

## Supplementary Information

### Decarboxylative Photoinduced Ligand-to-Metal Charge Transfer Reaction: Synthesis of 2-Substituted Chroman-4-ones

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## 1. General information

NMR spectra were acquired on a Bruker Ultra Shield 700 instrument, running at 700 MHz for  $^1\text{H}$  and 176 MHz for  $^{13}\text{C}$ , respectively. Chemical shifts ( $\delta$ ) are reported in ppm relative to residual solvent signals ( $\text{CDCl}_3$ : 7.26 ppm for  $^1\text{H}$  NMR, 77.16 ppm for  $^{13}\text{C}$  NMR). Mass spectra were recorded on a Bruker Maxis Impact spectrometer using electrospray (ES+) ionization (referenced to the mass of the charged species). Analytical thin layer chromatography (TLC) was performed using pre-coated aluminum-backed plates (Merck Kieselgel 60 F254) and visualized by ultraviolet irradiation. Unless otherwise noted, analytical grade solvents and commercially available reagents were used without further purification. For flash chromatography (FC) silica gel (Silica gel 60, 230-400 mesh, Fluka). Blue LED (50 W,  $\lambda = 390$  nm), were purchased from commercial supplier Kessil LED photoreactor lightning. Chromone-3-carboxylic acids **1** were synthesized according to the literature procedure.<sup>1</sup> Figure S1 shows the 50W 390nm photochemical reaction setup. The reaction vials in front of the 50W 390 nm bulb at approximately 7 cm distance.

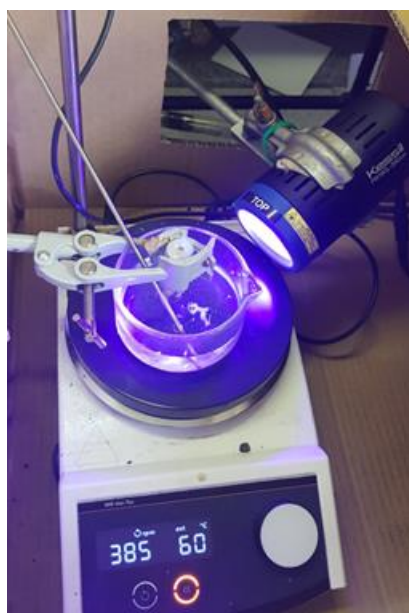
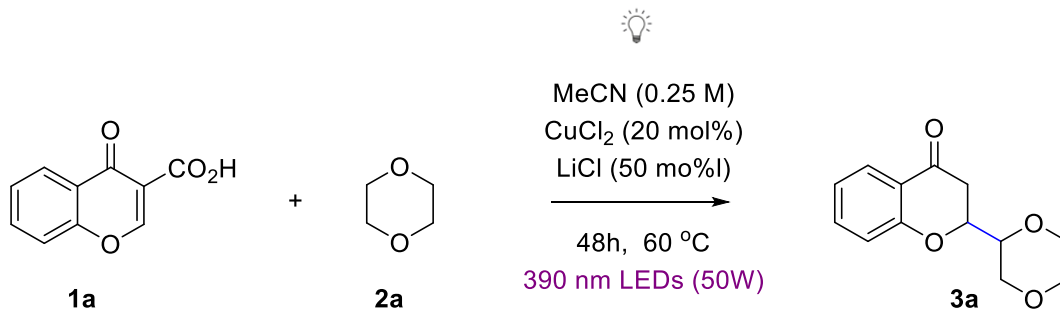


Figure S1 shows the 50W 390nm photochemical reaction setup. The reaction vials in front of the 50W 390 nm bulb at approximately 7 cm distance.

<sup>1</sup> Ishizuka, N.; Matsumura, K.; Sakai, K.; Fujimoto, M.; Mihara, S.; Yamamori, T. *J. Med. Chem.*, **2002**, *45*, 2041.

## 2. Optimization studies and control experiments

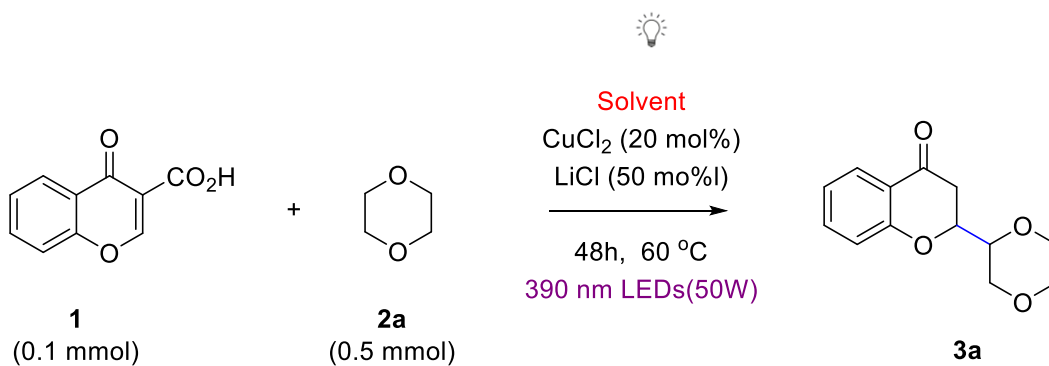
Table S1. Initial reaction optimization by screening of the ratio of **1a**:**2a** used



Entry	1(equiv)	2a(equiv)	Yield (%)	d.r.
<b>1</b>	1.0	3.0	33	1:1
<b>2</b>	1.1	1.0	28	1:1
<b>3</b>	1.0	10.0	21	1:1
<b>4</b>	1.0	5.0	83	1:1
<b>5<sup>a</sup></b>	1.0	5.0	91	1:1

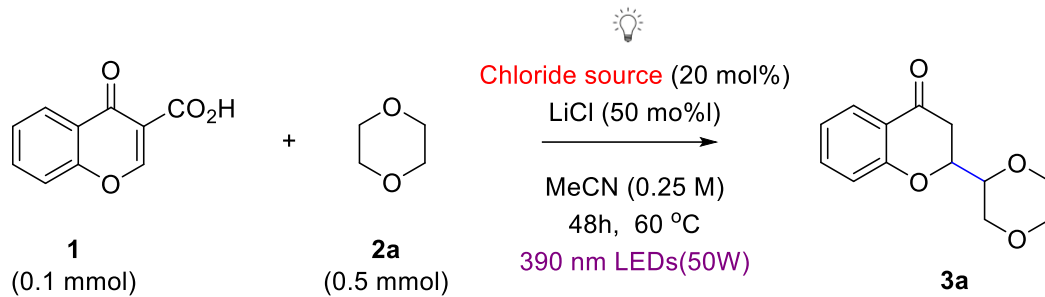
<sup>a</sup>Reaction performed in crimp vial

Table S2. Screening of the solvent



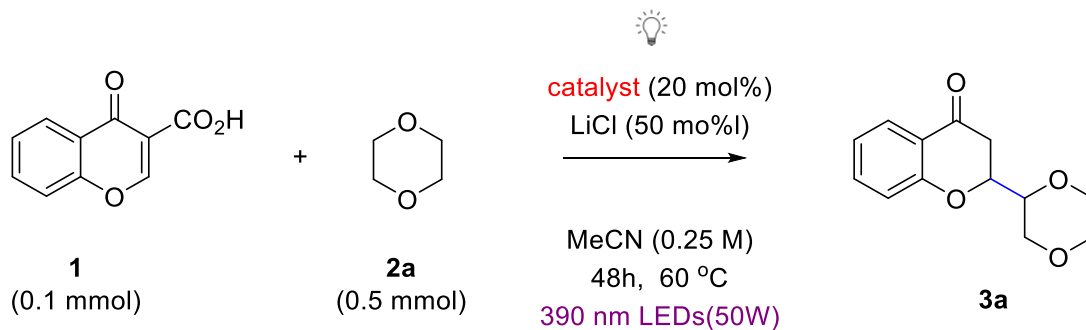
Entry	Solvent (c 0.25 M)	Yield (%)	d.r.
<b>1</b>	Aceton	65	1:1
<b>2</b>	DMF	16	1:1
<b>3</b>	CH <sub>2</sub> Cl <sub>2</sub>	13	1:1
<b>4</b>	CHCl <sub>3</sub>	9	1:1

Table S3. Screening of the chloride source.



Entry	"Cl" source	Yield (%)	d.r.
<b>1</b>	TMSCl	60	1:1
<b>2</b>	TBACl	53	1:1
<b>3</b>	HCl	-	-

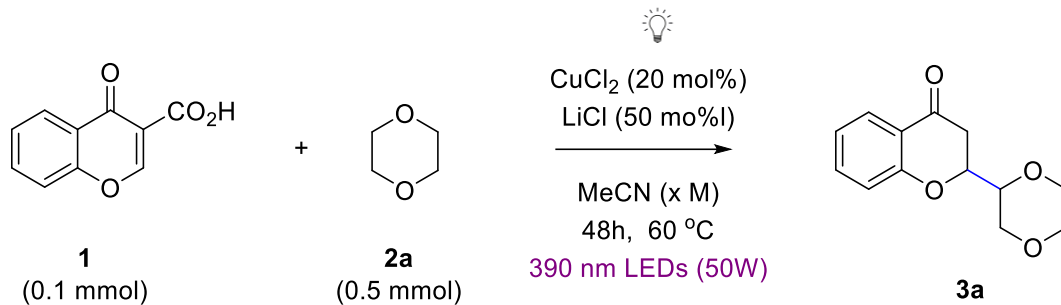
Table S4. Screening of the catalysts.



Entry	Catalyst	Yield (%)	d.r.
<b>1</b>	FeCl <sub>3</sub>	70	1:1
<b>2</b>	RuCl <sub>3</sub>	79	1:1
<b>3</b>	TiCl <sub>4</sub>	30	1:1
<b>4</b>	BiCl <sub>3</sub>	39	1:1

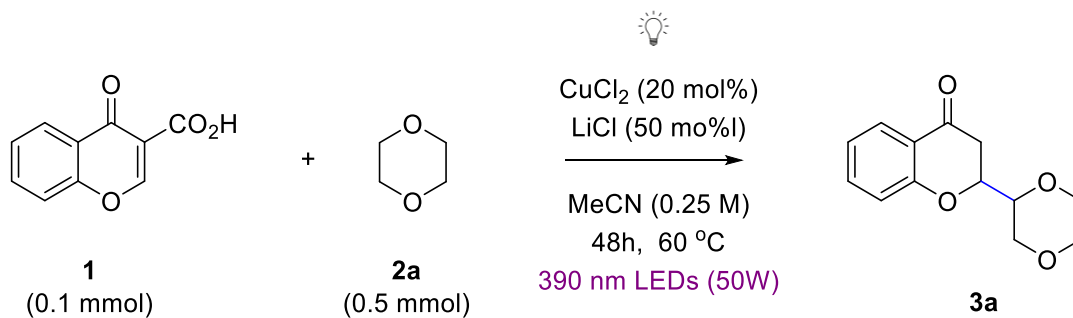


Table S5. Evaluation of solvent concentration



Entry	Solvent (c = xM)	Yield (%)	d.r.
<b>1</b>	CH <sub>3</sub> CN (0.3M)	57	1:1

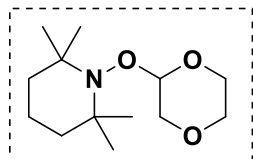
Table S6. Control experiment.



Entry	Deviation from standard conditions	Yield (%)	d.r.
<b>1</b>	Kessil(440nm)	37	1:1
<b>2</b>	Kessil(370nm)	58	1:1
<b>3</b>	0% CuCl <sub>2</sub>	-	-
<b>4</b>	0% LiCl	49	1:1
<b>5</b>	30 °C	38	1:1
<b>6</b>	In the dark	-	-
<b>7</b>	1.0 mmol scale	27	1:1
<b>8</b>	Chromone instead of <b>1</b>	-	-

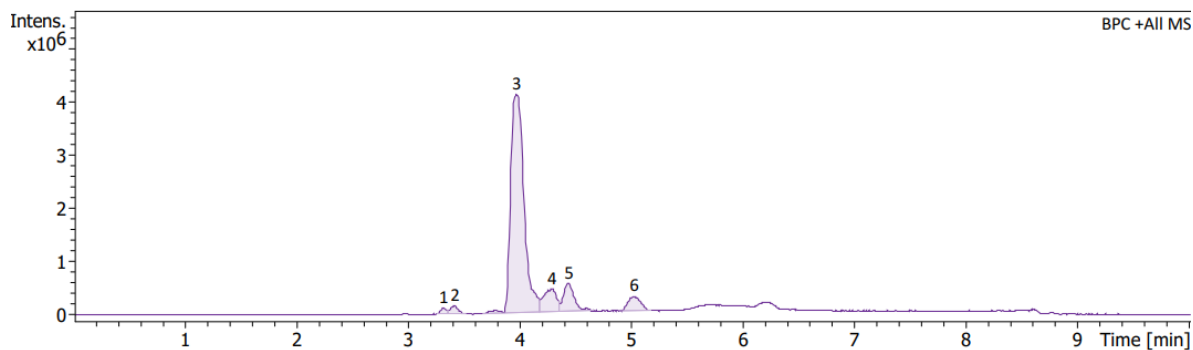
# Radical captured experiment by TEMPO

Detected by LC-HRMS



## Acquisition Parameter

Source Type	VIP-HESI	Ion Polarity	Positive	Set Nebulizer	3.0 Bar
Focus	Not active	Set Capillary	4500 V	Set Dry Heater	220 °C
Scan Begin	80 m/z	Set End Plate Offset	-500 V	Set Dry Gas	9.0 l/min
Scan End	2000 m/z	Set Collision Cell RF	900.0 Vpp	Set Divert Valve	Source

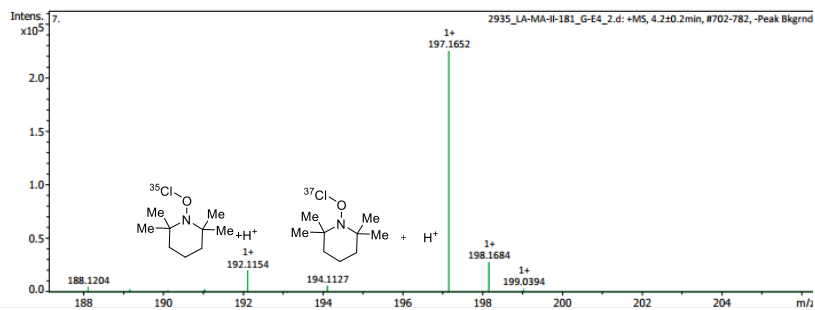
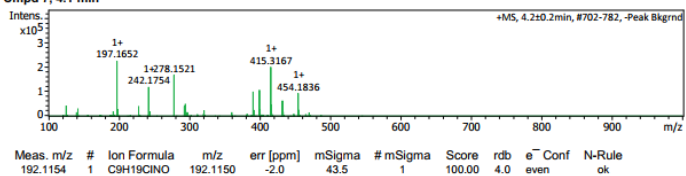


## Compound Spectrum List Report

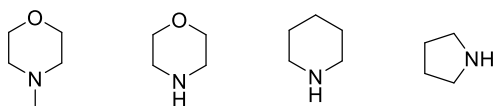
#	RT [min]	Area	Int. Type	I	S/N	Trace	Max. m/z	FWHM [min]
1	3.3	391499	Manual	135582	21.5	BPC +All MS	235.0964	0.1
2	3.4	794484	Chromatogram	184611	43.2	BPC +All MS	235.0963	0.1
3	4.0	34019280	Chromatogram	4130520	1132.8	BPC +All MS	<u>244.1905</u>	0.1
4	4.3	3547972	Chromatogram	493631	118.3	BPC +All MS	301.1401	0.2
5	4.4	3741507	Chromatogram	598776	145.0	BPC +All MS	390.2266	0.1
6	5.0	2103850	Chromatogram	352374	72.7	BPC +All MS	399.3210	0.1

## Compound Spectrum List Report

### Cmpd 7, 4.1 min



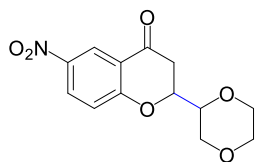
### 3. Unsuccessful substrates



no product was observed in the reaction with this amines



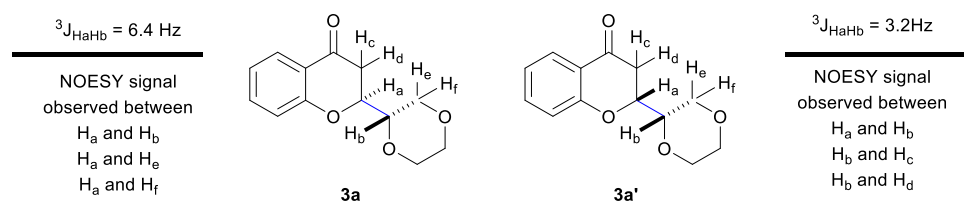
products obtained in less than 10% yield



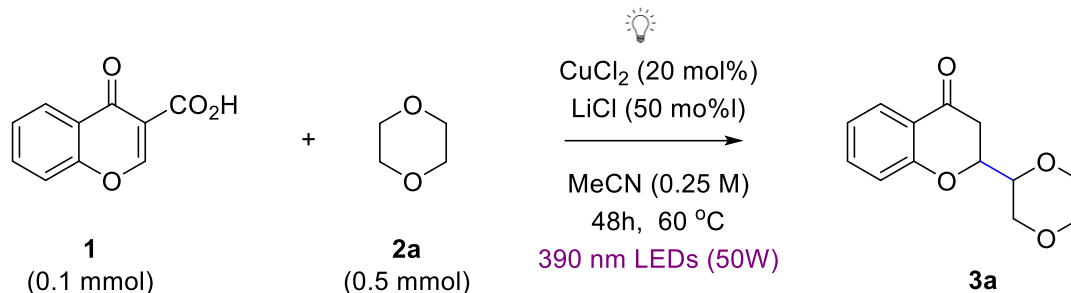
#### 4. Relative configuration assignment

During our studies problem dealt with the assignment of relative configuration of the stereogenic center present in two diastereoisomers of **3** was solved. The analysis of values of coupling constants between  $H_a$  and  $H_b$  in  $^1H$  NMR spectra of **3a'** indicated the *cis*-alignment of these protons. This observation was further confirmed by the NOESY experiments where correlation signals between  $H_a$  and  $H_b$  were observed. Notably, additional NOESY correlations between  $H_a$  and  $H_e$ ,  $H_f$  as well as  $H_b$  and  $H_c$ ,  $H_d$  further confirmed the relative configuration of the both diastereoisomers of **3**.

Relative configuration of the stereogenic center present in **3a** and **3a'**

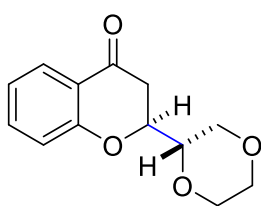


## 5. General procedure for the synthesis of 2- substituted-chroman-4-ones



To a 4 mL argon-purged crimp capped vial equipped with a stir bar, anhydrous CuCl<sub>2</sub> 20 mol% (0.02 mmol) and LiCl 50 mol% (0.05 mmol) were added. Subsequently, the corresponding chromone-3-carboxylic acid **1** (0.1 mmol, 1.0 equiv) was introduced. The mixture was degassed through vacuum evacuation and backfilled with argon (Ar) gas using a Schlenk line, repeating the process three times. Anhydrous acetonitrile (0.4 mL, c = 0.25 M) was then added via syringe, and the reaction solution was stirred, then corresponding alkane **2** (0.5 mmol, 5.0 equiv) was added in one portion and the reaction mixture was exposed to irradiation using 390 nm LED modules at 100% light intensity, maintaining a distance of 7 cm between the reaction vessel and the light source. Simultaneously, the reaction mixture was heated at 60°C for 48 hours. Upon completion of irradiation, the reaction was quenched by adding 10 mL of H<sub>2</sub>O, followed by extraction with ethyl acetate (3 x 15 mL). The combined organic layers were washed with brine (1 x 15 mL), dried over anhydrous Mg<sub>2</sub>SO<sub>4</sub>, filtered, and concentrated under vacuum. The resulting residue was subjected to column chromatography on silica gel using a petroleum ether/ethyl acetate eluent 4:1, yielding the corresponding products **3**.

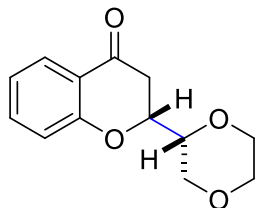
### Characterization Data of Products



**(S\*)-2-((S\*)-1,4-dioxan-2-yl)chroman-4-one (3a):** Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 48% (11 mg) and 43% (10 mg), resulting in an overall yield of 92%.

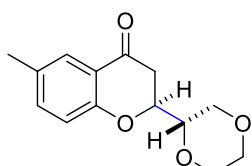
<sup>1</sup>H NMR (**Isomer 1**, 700 MHz, MeOD) δ 7.81 (dd, J = 7.9, 1.7 Hz, 1H), 7.52 (ddd, J = 8.4, 7.2, 1.8 Hz, 1H), 7.04 (ddd, J = 8.0, 7.2, 1.0 Hz, 1H), 7.00 (dd, J = 8.6, 1.1 Hz, 1H), 4.43 (ddd, J = 12.1, 6.4, 3.5 Hz, 1H), 4.02 (dd, J = 11.5, 2.7 Hz, 1H), 3.79 – 3.86 (m, 2H), 3.68 – 3.76 (m, 2H), 3.58 – 3.63 (m, 1H), 3.52 (dd, J = 11.5, 9.9 Hz, 1H), 2.85 (dd, J = 16.9, 12.1 Hz, 1H), 2.78 (dd, J = 16.9, 3.5 Hz, 1H). <sup>13</sup>C NMR (**Isomer 1**, 176 MHz, MeOD) δ 193.68, 162.45, 137.46, 127.64, 122.69, 122.23, 118.98, 78.37, 77.04, 69.13, 67.84, 67.58, 39.88.

HRMS (**Isomer 1**, ESI+) m/z calcd. for C<sub>13</sub>H<sub>15</sub>O<sub>4</sub><sup>+</sup> [M+H]<sup>+</sup> 235.09647 found 235.0972.



**(*R*<sup>\*</sup>)-2-((*R*<sup>\*</sup>)-1,4-dioxan-2-yl)chroman-4-one (3a')**: <sup>1</sup>H NMR (**Isomer 2**, 700 MHz, MeOD) δ 7.80 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.52 (ddd, *J* = 8.3, 7.2, 1.8 Hz, 1H), 6.99–7.05 (m, 2H), 4.53 (dt, *J* = 12.9, 3.2 Hz, 1H), 3.82–3.86 (m, 2H), 3.77–3.81 (m, 2H), 3.74 (td, *J* = 11.5, 2.7 Hz, 1H), 3.70 (dd, *J* = 11.7, 2.8 Hz, 1H), 3.61 (td, *J* = 11.7, 2.8 Hz, 1H), 3.00 (dd, *J* = 16.9, 12.9 Hz, 1H), 2.60 (dd, *J* = 16.9, 3.2 Hz, 1H). <sup>13</sup>C NMR (**Isomer 2**, 176 MHz, MeOD) δ 194.12, 162.73, 137.37, 127.55, 122.52, 122.11, 118.95, 78.11, 77.31, 68.41, 68.33, 67.51, 39.60.

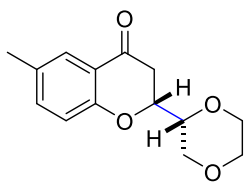
HRMS (**Isomer 2**, ESI+) *m/z* calcd. for C<sub>13</sub>H<sub>15</sub>O<sub>4</sub><sup>+</sup> [M+H]<sup>+</sup> 235.09647 found 235.0970.



**(*S*<sup>\*</sup>)-2-((*S*<sup>\*</sup>)-1,4-dioxan-2-yl)-6-methylchroman-4-one (3b)**: Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 2:1) as a yellow oil. The individual diastereomers were obtained with yields of 54% (13 mg) and 25% (6 mg), resulting in an overall yield of 79%.

<sup>1</sup>H NMR (**Isomer 1**, 700 MHz, MeOD) δ 7.61 (dd, *J* = 1.7, 0.7 Hz, 1H), 7.36 (ddd, *J* = 8.4, 2.4, 0.7 Hz, 1H), 6.90 (d, *J* = 8.5 Hz, 1H), 4.40 (ddd, *J* = 12.1, 6.5, 3.6 Hz, 1H), 4.02 (dd, *J* = 11.5, 2.7 Hz, 1H), 3.80–3.85 (m, 2H), 3.69–3.76 (m, 2H), 3.59–3.63 (m, 1H), 3.52 (dd, *J* = 11.5, 9.9 Hz, 1H), 2.82 (dd, *J* = 17.0, 12.1 Hz, 1H), 2.76 (dd, *J* = 17.0, 3.5 Hz, 1H), 2.29 (s, 3H). <sup>13</sup>C NMR (**Isomer 1**, 176 MHz, MeOD) δ 193.89, 160.56, 138.45, 132.40, 127.16, 121.86, 118.81, 78.34, 77.08, 69.20, 67.85, 67.60, 39.95, 20.40.

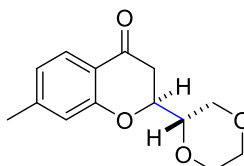
HRMS (**Isomer 1**, ESI+) *m/z* calcd. for C<sub>14</sub>H<sub>17</sub>O<sub>4</sub><sup>+</sup> [M+H]<sup>+</sup> 249.11212 found 249.1174.



**(*R*<sup>\*</sup>)-2-((*R*<sup>\*</sup>)-1,4-dioxan-2-yl)-6-methylchroman-4-one (3b')**: <sup>1</sup>H NMR (**Isomer 2**, 700 MHz, MeOD) δ 7.60 (d, *J* = 1.0 Hz, 1H), 7.36 (dd, *J* = 8.7, 2.7 Hz, 1H), 6.92 (d, *J* = 8.5 Hz, 1H), 4.48–4.52 (m, 1H), 3.83–3.86 (m, 2H), 3.77–3.81 (m, 2H), 3.74 (td, *J* = 11.6, 2.7 Hz, 1H), 3.71 (dd, *J* = 11.7, 2.8 Hz, 1H), 3.62 (td, *J* = 11.6, 2.8 Hz, 1H), 2.98 (dd, *J* = 17.0, 12.9 Hz, 1H),

2.58 (dd, *J* = 17.0, 3.2 Hz, 1H), 2.30 (s, 3H). <sup>13</sup>C NMR (**Isomer 2**, 176 MHz, MeOD) δ 194.37, 160.86, 138.39, 132.23, 127.08, 121.72, 118.79, 78.08, 77.34, 68.45, 68.35, 67.53, 39.64, 20.40.

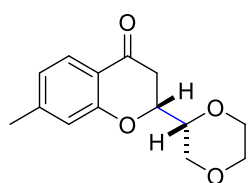
HRMS (**Isomer 2**, ESI+) *m/z* calcd. for C<sub>14</sub>H<sub>17</sub>O<sub>4</sub><sup>+</sup> [M+H]<sup>+</sup> 249.11212 found 249.1176.



**(*S*<sup>\*</sup>)-2-((*S*<sup>\*</sup>)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3c)**: Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 2:1) as a yellow oil. The individual diastereomers were obtained with yields of 58% (14 mg) and 29% (7 mg), resulting in an overall yield of 87%.

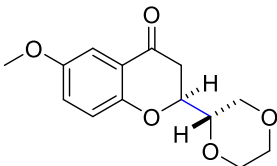
$^1\text{H}$  NMR (**Isomer 1**, 700 MHz, MeOD)  $\delta$  7.70 (d,  $J = 8.0$  Hz, 1H), 6.88 (ddd,  $J = 8.0, 1.5, 0.8$  Hz, 1H), 6.82 (bs, 1H), 4.40 (ddd,  $J = 12.0, 6.5, 3.5$  Hz, 1H), 4.02 (dd,  $J = 11.4, 2.6$  Hz, 1H), 3.80 – 3.84 (m, 2H), 3.70 – 3.75 (m, 2H), 3.61 (td,  $J = 11.6, 2.9$  Hz, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.81 (dd,  $J = 17.0, 12.0$  Hz, 1H), 2.75 (dd,  $J = 17.0, 3.6$  Hz, 1H), 2.35 (s, 3H).  $^{13}\text{C}$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  193.50, 162.53, 149.43, 127.58, 124.01, 119.98, 118.91, 78.38, 77.05, 69.21, 67.85, 67.59, 39.81, 21.87.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{17}\text{O}_4^+$   $[\text{M}+\text{H}]^+$  249.11212 found 249.1123.



**( $R^*$ )-2-(( $R^*$ )-1,4-dioxan-2-yl)-7-methylchroman-4-one (3c')**:  $^1\text{H}$  NMR (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.69 (d,  $J = 8.0$  Hz, 1H), 6.86 (ddd,  $J = 8.0, 1.5, 0.7$  Hz, 1H), 6.84 (bs, 1H), 4.50 (dt,  $J = 12.9, 3.2$  Hz, 1H), 3.83 – 3.86 (m, 2H), 3.77 – 3.81 (m, 2H), 3.74 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.70 (dd,  $J = 11.7, 2.8$  Hz, 1H), 3.62 (td,  $J = 11.6, 2.7$  Hz, 1H), 2.96 (dd,  $J = 16.9, 12.9$  Hz, 1H), 2.56 (dd,  $J = 17.0, 3.2$  Hz, 1H), 2.35 (s, 3H).  $^{13}\text{C}$  NMR (**Isomer 2**, 176 MHz, MeOD)  $\delta$  193.97, 162.83, 149.32, 127.50, 123.86, 119.84, 118.88, 78.12, 77.31, 68.44, 68.35, 67.53, 39.51, 21.87.

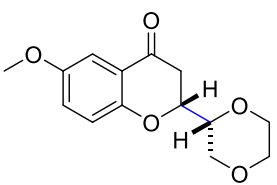
HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{17}\text{O}_4^+$   $[\text{M}+\text{H}]^+$  249.11212 found 249.1121.



**( $S^*$ )-2-(( $S^*$ )-1,4-dioxan-2-yl)-6-methoxychroman-4-one (3d)**: Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 2:1) as a yellow oil. The individual diastereomers were obtained with yields of 30% (8 mg) and 12% (3 mg), resulting in an overall yield of 42%.

$^1\text{H}$  NMR (**Isomer 1**, 700 MHz, MeOD)  $\delta$  7.28 (d,  $J = 3.2$  Hz, 1H), 7.14 (dd,  $J = 9.0, 3.2$  Hz, 1H), 6.95 (d,  $J = 9.1$  Hz, 1H), 4.39 (ddd,  $J = 12.1, 6.5, 3.6$  Hz, 1H), 4.02 (dd,  $J = 11.4, 2.6$  Hz, 1H), 3.80 – 3.85 (m, 2H), 3.78 (s, 3H), 3.69 – 3.75 (m, 2H), 3.59 – 3.63 (m, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.83 (dd,  $J = 17.1, 12.1$  Hz, 1H), 2.77 (dd,  $J = 17.1, 3.6$  Hz, 1H).  $^{13}\text{C}$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  193.70, 157.04, 155.80, 125.99, 122.16, 120.25, 108.57, 78.49, 77.09, 69.21, 67.86, 67.60, 56.18, 39.89.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{17}\text{O}_5^+$   $[\text{M}+\text{H}]^+$  265.10704 found 265.1072.

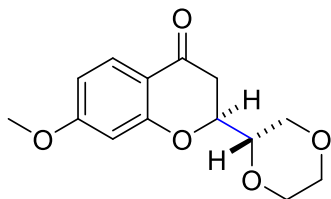


**( $R^*$ )-2-(( $R^*$ )-1,4-dioxan-2-yl)-6-methoxychroman-4-one (3d')**:  $^1\text{H}$  NMR (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.27 (d,  $J = 3.2$  Hz, 1H), 7.14 (dd,  $J = 9.0, 3.2$  Hz, 1H), 6.96 (dd,  $J = 9.0, 0.4$  Hz, 1H), 4.48 (dt,  $J = 13.1, 3.2$  Hz, 1H), 3.83 – 3.87 (m, 2H), 3.77 – 3.82 (m, 5H), 3.74 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.71 (dd,  $J = 11.8, 2.8$  Hz, 1H), 3.62 (td,  $J = 11.6, 2.8$  Hz, 1H), 2.98 (dd,  $J = 17.0, 13.1$  Hz, 1H), 2.58 (dd,  $J = 17.1, 3.1$  Hz, 1H).  $^{13}\text{C}$  NMR (**Isomer 2**, 176 MHz,



MeOD)  $\delta$  194.15, 157.32, 155.70, 125.95, 122.00, 120.23, 108.49, 78.22, 77.30, 68.45, 68.35, 67.53, 56.17, 39.54.

HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $C_{14}H_{17}O_5^+$   $[M+H]^+$  265.10704 found 265.1069.

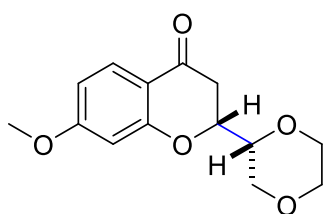


**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-7-methoxychroman-4-one (3e):**

Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 19% (5 mg) and 12% (3 mg), resulting in an overall yield of 31%.

$^1H$  NMR (**Isomer 1**, 700 MHz, MeOD)  $\delta$  7.75 (d,  $J$  = 8.8 Hz, 1H), 6.62 (dd,  $J$  = 8.8, 2.4 Hz, 1H), 6.51 (d,  $J$  = 2.4 Hz, 1H), 4.43 (ddd,  $J$  = 12.1, 6.4, 3.4 Hz, 1H), 4.03 (dd,  $J$  = 11.5, 2.7 Hz, 1H), 3.84 (s, 3H), 3.81 – 3.84 (m, 2H), 3.70 – 3.76 (m, 2H), 3.59 – 3.64 (m, 1H), 3.53 (dd,  $J$  = 11.5, 9.9 Hz, 1H), 2.80 (dd,  $J$  = 17.0, 12.1 Hz, 1H), 2.72 (dd,  $J$  = 17.0, 3.5 Hz, 1H).  $^{13}C$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  192.64, 168.07, 164.60, 129.42, 115.91, 111.27, 101.88, 78.71, 77.03, 69.18, 67.86, 67.60, 56.32, 39.48.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $C_{14}H_{17}O_5^+$   $[M+H]^+$  265.10704 found 265.1067.

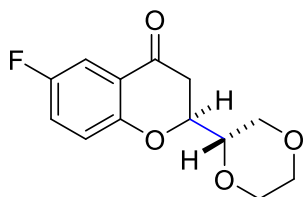


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-7-methoxychroman-4-one (3e'):**

$^1H$  NMR (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.74 (d,  $J$  = 8.8 Hz, 1H), 6.61 (dd,  $J$  = 8.8, 2.4 Hz, 1H), 6.52 (d,  $J$  = 2.4 Hz, 1H), 4.51 (dt,  $J$  = 13.0, 3.2 Hz, 1H), 3.83 – 3.86 (m, 5H), 3.77 – 3.81 (m, 2H), 3.75 (td,  $J$  = 11.6, 2.8 Hz, 1H), 3.71 (dd,  $J$  = 11.8, 2.8 Hz, 1H), 3.62 (td,  $J$  = 11.6, 2.8 Hz, 1H), 2.95 (dd,  $J$  = 17.0, 13.0 Hz, 1H), 2.52 (dd,  $J$  = 17.0, 3.2

Hz, 1H).  $^{13}C$  NMR (**Isomer 2**, 176 MHz, MeOD)  $\delta$  193.09, 168.02, 164.89, 129.34, 115.78, 111.16, 101.84, 78.46, 77.23, 68.43, 68.34, 67.54, 56.30, 39.17.

HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $C_{14}H_{17}O_5^+$   $[M+H]^+$  265.10704 found 265.1072.



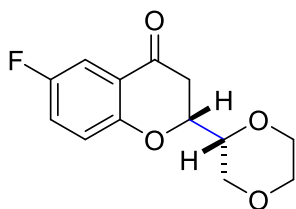
**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-6-fluorochroman-4-one (3f):**

Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 28% (7 mg) and 20% (5 mg), resulting in an overall yield of 48%.

$^1H$  NMR (**Isomer 1**, 700 MHz, MeOD)  $\delta$  7.46 (dd,  $J$  = 8.3, 3.2 Hz, 1H), 7.31 (ddd,  $J$  = 9.1, 8.0, 3.3 Hz, 1H), 7.04 (dd,  $J$  = 9.1, 4.2 Hz, 1H), 4.45 (ddd,  $J$  = 12.0, 6.3, 3.6 Hz, 1H), 4.02 (dd,  $J$  = 11.5, 2.6 Hz, 1H), 3.85 (ddd,  $J$  = 9.9, 6.3, 2.7 Hz, 1H), 3.82 (ddt,  $J$  = 11.6, 2.7, 1.1 Hz, 1H), 3.68 – 3.78 (m, 2H), 3.61 (td,  $J$  = 11.6, 2.8 Hz, 1H), 3.53 (dd,  $J$  = 11.6, 9.9 Hz, 1H), 2.86 (dd,  $J$  = 17.1, 12.0 Hz, 1H), 2.80 (dd,  $J$  = 17.1, 3.6 Hz, 1H).  $^{13}C$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  192.70 (d,  $J$  = 2.0 Hz), 158.75 (d,  $J$  = 1.9 Hz), 158.74 (d,  $J$  = 241.0 Hz), 124.64 (d,  $J$  = 24.8 Hz), 122.79 (d,  $J$  = 6.6 Hz), 120.98 (d,  $J$  = 7.5 Hz), 112.31 (d,  $J$  = 23.7 Hz), 78.66, 77.03, 69.09, 67.85, 67.59, 39.62.

$^{19}F$  NMR (**Isomer 1**, 376 MHz, METHANOL-D4)  $\delta$  -123.48.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $C_{13}H_{14}FO_4^+$   $[M+H]^+$  253.08705 found 253.0872.

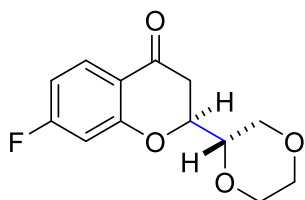


**(*R*<sup>\*</sup>)-2-((*R*<sup>\*</sup>)-1,4-dioxan-2-yl)-6-fluorochroman-4-one (**3f'**):**  $^1H$  NMR (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.45 (dd,  $J = 8.3, 3.2$  Hz, 1H), 7.30 (ddd,  $J = 9.1, 8.0, 3.2$  Hz, 1H), 7.05 (dd,  $J = 9.1, 4.2$  Hz, 1H), 4.55 (dt,  $J = 12.7, 3.2$  Hz, 1H), 3.82 – 3.86 (m, 2H), 3.77 – 3.81 (m, 2H), 3.74 (td,  $J = 11.5, 2.7$  Hz, 1H), 3.70 (dd,  $J = 11.8, 2.8$  Hz, 1H), 3.61 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.00 (dd,  $J = 17.1, 12.7$  Hz, 1H), 2.64 (dd,  $J = 17.1, 3.3$  Hz, 1H).  $^{13}C$

NMR (**Isomer 2**, 176 MHz, MeOD)  $\delta$  193.13 (d,  $J = 1.9$  Hz), 159.01 (d,  $J = 1.9$  Hz), 158.65 (d,  $J = 240.3$  Hz), 124.56 (d,  $J = 24.8$  Hz), 122.67 (d,  $J = 6.4$  Hz), 120.91 (d,  $J = 7.5$  Hz), 112.20 (d,  $J = 23.6$  Hz), 78.37, 77.34, 68.41, 68.36, 67.53, 39.35.

$^{19}F$  NMR (**Isomer 2**, 376 MHz, METHANOL-D<sub>4</sub>)  $\delta$  -123.79 – -123.70 (m).

HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $C_{13}H_{14}FO_4^+$   $[M+H]^+$  253.08705 found 253.0869.



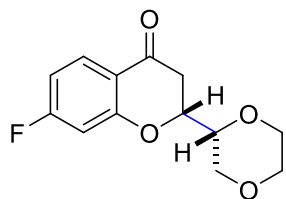
**(*S*<sup>\*</sup>)-2-((*S*<sup>\*</sup>)-1,4-dioxan-2-yl)-7-fluorochroman-4-one (**3g**):**

Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 32% (8 mg) and 24% (6 mg), resulting in an overall yield of 56%.

$^1H$  NMR (**Isomer 1**, 700 MHz, MeOD):  $\delta$  7.88 (dd,  $J = 8.8, 6.6$  Hz, 1H), 6.82 (td,  $J = 8.5, 2.4$  Hz, 1H), 6.77 (dd,  $J = 10.0, 2.4$  Hz, 1H), 4.50 (ddd,  $J = 12.1, 6.2, 3.4$  Hz, 1H), 4.01 (dd,  $J = 11.6, 2.7$  Hz, 1H), 3.86 (ddd,  $J = 9.8, 6.2, 2.7$  Hz, 1H), 3.82 (dd,  $J = 11.0, 3.1$  Hz, 1H), 3.70 – 3.76 (m, 2H), 3.61 (td,  $J = 11.7, 2.9$  Hz, 1H), 3.53 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.87 (dd,  $J = 17.0, 12.2$  Hz, 1H), 2.78 (dd,  $J = 17.0, 3.4$  Hz, 1H).  $^{13}C$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  192.17, 168.97 (d,  $J = 254.9$  Hz), 164.19 (d,  $J = 13.9$  Hz), 130.48 (d,  $J = 11.5$  Hz), 119.36 (d,  $J = 2.5$  Hz), 110.82 (d,  $J = 23.0$  Hz), 105.57 (d,  $J = 24.8$  Hz), 79.04, 76.97, 69.02, 67.86, 67.58, 39.48.

$^{19}F$  NMR (**Isomer 1**, 376 MHz, METHANOL-D<sub>4</sub>)  $\delta$  -102.71 (ddd,  $J = 10.1, 8.3, 6.6$  Hz).

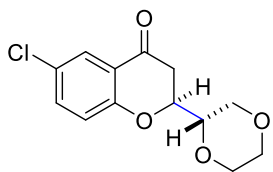
HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $C_{13}H_{14}FO_4^+$   $[M+H]^+$  253.08705 found 253.0868.



**(*R*<sup>\*</sup>)-2-((*R*<sup>\*</sup>)-1,4-dioxan-2-yl)-7-fluorochroman-4-one (**3g'**):**  $^1H$  NMR (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.87 (dd,  $J = 8.7, 6.6$  Hz, 1H), 6.80 (td,  $J = 8.5, 2.4$  Hz, 1H), 6.77 (dd,  $J = 10.1, 2.4$  Hz, 1H), 4.59 (dt,  $J = 12.2, 3.2$  Hz, 1H), 3.82 – 3.86 (m, 2H), 3.77 – 3.81 (m, 2H), 3.74 (td,  $J = 11.5, 2.8$  Hz, 1H), 3.70 (dd,  $J = 11.7, 2.7$  Hz, 1H), 3.61 (td,  $J = 11.6, 2.7$  Hz, 1H),

2.99 (dd,  $J = 17.0, 12.5$  Hz, 1H), 2.62 (dd,  $J = 17.0, 3.3$  Hz, 1H).  $^{13}C$  NMR (**Isomer 2**, 176 MHz, MeOD)  $\delta$  192.58, 168.94 (d,  $J = 254.4$  Hz), 164.44 (d,  $J = 13.5$  Hz), 130.35 (d,  $J = 11.5$  Hz), 119.26 (d,  $J = 2.4$  Hz), 110.63 (d,  $J = 23.0$  Hz), 105.49 (d,  $J = 24.8$  Hz), 78.75, 77.28, 68.37, 68.35, 67.51, 39.27.

$^{19}\text{F}$  NMR (**Isomer 2**, 376 MHz, METHANOL-D<sub>4</sub>)  $\delta$  -102.92 (ddd,  $J = 10.1, 8.4, 6.7$  Hz).  
HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{14}\text{FO}_4^+$   $[\text{M}+\text{H}]^+$  253.08705 found 253.0870.



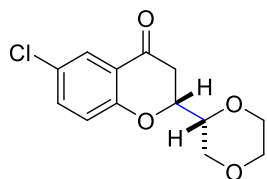
**(S\*)-6-chloro-2-((S\*)-1,4-dioxan-2-yl)chroman-4-one (3h):**

Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 19% (5 mg) and 15% (4 mg), resulting in an

overall yield of 34%.

$^1\text{H}$  NMR (**Isomer 1**, 700 MHz, MeOD)  $\delta$  7.75 (d,  $J = 2.7$  Hz, 1H), 7.50 (dd,  $J = 8.8, 2.7$  Hz, 1H), 7.03 (d,  $J = 8.8$  Hz, 1H), 4.48 (ddd,  $J = 12.1, 6.2, 3.5$  Hz, 1H), 4.01 (dd,  $J = 11.5, 2.7$  Hz, 1H), 3.85 (ddd,  $J = 9.9, 6.2, 2.7$  Hz, 1H), 3.81 – 3.83 (m, 1H), 3.70 – 3.76 (m, 2H), 3.61 (td,  $J = 11.7, 2.8$  Hz, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.87 (dd,  $J = 17.1, 12.1$  Hz, 1H), 2.81 (dd,  $J = 17.1, 3.5$  Hz, 1H).  $^{13}\text{C}$  NMR (**Isomer 1**, 176 MHz, MeOD)  $\delta$  192.30, 160.97, 136.99, 128.05, 126.78, 123.18, 121.03, 78.65, 77.01, 69.03, 67.85, 67.58, 39.52.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{14}\text{ClO}_4^+$   $[\text{M}+\text{H}]^+$  269.05750 found 269.0573.

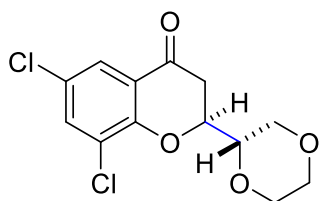


**(R)-6-chloro-2-((R)-1,4-dioxan-2-yl)chroman-4-one (3h')**  $^1\text{H}$  NMR

(**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.73 (d,  $J = 2.7$  Hz, 1H), 7.49 (dd,  $J = 8.8, 2.7$  Hz, 1H), 7.04 (d,  $J = 8.9$  Hz, 1H), 4.57 (dt,  $J = 12.3, 3.1$  Hz, 1H), 3.82 – 3.86 (m, 2H), 3.77 – 3.81 (m, 2H), 3.73 (td,  $J = 11.5, 2.8$  Hz, 1H), 3.70 (dd,  $J = 11.8, 2.8$  Hz, 1H), 3.60 (td,  $J = 11.5, 2.8$  Hz, 1H), 3.00 (dd,  $J = 17.0,$

12.3 Hz, 1H), 2.66 (dd,  $J = 17.0, 3.4$  Hz, 1H).  $^{13}\text{C}$  NMR (**Isomer 2**, 176 MHz, MeOD)  $\delta$  192.69, 161.22, 136.89, 127.84, 126.65, 123.11, 120.96, 78.34, 77.39, 68.40, 68.36, 67.52, 39.30.

HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{14}\text{ClO}_4^+$   $[\text{M}+\text{H}]^+$  269.05750 found 269.0573.

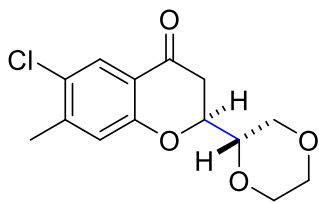


**(S\*)-6,8-dichloro-2-((S\*)-1,4-dioxan-2-yl)chroman-4-one (3i):**

Synthesized according to general procedure, resulting in the formation of a single diastereomer as a yellow oil. The single diastereomer was obtained with a yield of 40% (12 mg).

$^1\text{H}$  NMR (700 MHz, MeOD)  $\delta$  7.69 (d,  $J = 2.6$  Hz, 1H), 7.66 (d,  $J = 2.6$  Hz, 1H), 4.70 (ddd,  $J = 11.3, 3.8, 2.7$  Hz, 1H), 3.85 – 3.90 (m, 2H), 3.82 (dd,  $J = 11.3, 3.1$  Hz, 1H), 3.79 (ddd,  $J = 7.7, 5.0, 2.8$  Hz, 1H), 3.68 – 3.74 (m, 2H), 3.56 – 3.60 (m, 1H), 3.06 (dd,  $J = 17.1, 11.3$  Hz, 1H), 2.76 (dd,  $J = 17.2, 3.8$  Hz, 1H).  $^{13}\text{C}$  NMR (176 MHz, MeOD)  $\delta$  191.68, 156.87, 136.20, 127.35, 125.51, 125.04, 124.15, 78.94, 77.50, 68.54, 68.44, 67.54, 39.08.

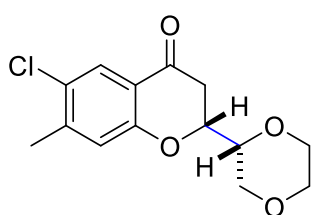
HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{13}\text{Cl}_2\text{O}_4^+$   $[\text{M}+\text{H}]^+$  303.01853 found 303.0183.



**(S\*)-6-chloro-2-((S\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3j):** Synthesized according to general procedure, yielding a separable mixture of diastereomers (~ d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 21% (6 mg) and 18% (5 mg), resulting in an overall yield of 39%.

$^1\text{H NMR}$  (**Isomer 1**, 700 MHz, MeOD) :  $^1\text{H NMR}$  (700 MHz, MeOD)  $\delta$  7.73 (s, 1H), 6.98 (d,  $J = 0.9$  Hz, 1H), 4.44 (ddd,  $J = 12.0, 6.3, 3.6$  Hz, 1H), 4.01 (dd,  $J = 11.5, 2.7$  Hz, 1H), 3.78 – 3.86 (m, 2H), 3.69 – 3.76 (m, 2H), 3.59 – 3.64 (m, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.84 (dd,  $J = 17.1, 12.0$  Hz, 1H), 2.77 (dd,  $J = 17.1, 3.6$  Hz, 1H), 2.37 (s, 3H).  $^{13}\text{C NMR}$  (**Isomer 1**, 176 MHz, MeOD)  $\delta$  192.27, 160.84, 146.48, 128.65, 127.18, 121.40, 121.23, 78.62, 77.01, 69.09, 67.85, 67.59, 39.52, 20.71.

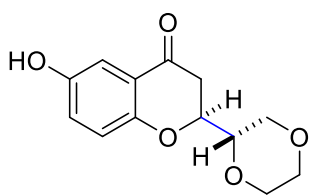
HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{16}\text{ClO}_4^+[\text{M}+\text{H}]^+$  283.07315 found 283.0737.



**(R\*)-6-chloro-2-((R\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3j')**:  $^1\text{H NMR}$  (**Isomer 2**, 700 MHz, MeOD)  $\delta$  7.71 (s, 1H), 6.98 (d,  $J = 0.9$  Hz, 1H), 4.54 (dt,  $J = 12.4, 3.3$  Hz, 1H), 3.81 – 3.86 (m, 2H), 3.75 – 3.80 (m, 2H), 3.73 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.70 (dd,  $J = 11.7, 2.7$  Hz, 1H), 3.60 (td,  $J = 11.5, 2.8$  Hz, 1H), 2.97 (dd,  $J = 17.0, 12.4$  Hz, 1H), 2.61 (dd,  $J = 17.0, 3.3$  Hz, 1H), 2.37 (s, 3H).  $^{13}\text{C NMR}$  (**Isomer 2**, 176 MHz, MeOD)  $\delta$  192.66, 161.10, 146.33, 128.45, 127.07, 121.31, 121.16, 78.32, 77.36, 68.41, 68.35, 67.52, 39.27, 20.72.

$^{13}\text{C NMR}$  (**Isomer 2**, 176 MHz, MeOD)  $\delta$  192.66, 161.10, 146.33, 128.45, 127.07, 121.31, 121.16, 78.32, 77.36, 68.41, 68.35, 67.52, 39.27, 20.72.

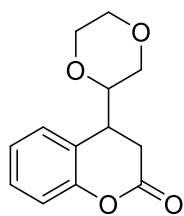
HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{16}\text{ClO}_4^+[\text{M}+\text{H}]^+$  283.0731 found 283.0730.



**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-6-hydroxychroman-4-one (3k):** Synthesized according to general procedure, resulting in the formation of a mixture of diastereomers (10:1) as a light yellow oil. Yield of 65% (16.2 mg). Elutes with 35% EtOAc in petroleum ether.  $^1\text{H NMR}$  (700 MHz, MeOD)  $\delta$  7.16 (d,  $J = 3.1$  Hz, 1H), 7.01 (dd,  $J = 8.9, 3.1$  Hz, 1H), 6.87 (d,  $J = 8.9$  Hz, 1H), 4.35 (ddd,  $J = 12.0, 6.5, 3.6$  Hz, 1H), 4.02 (dd,  $J = 11.6, 2.7$  Hz, 1H), 3.89 – 3.95 (m, 1H), 3.79 – 3.84 (m, 2H), 3.69 – 3.76 (m, 2H), 3.61 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.80 (dd,  $J = 17.1, 12.0$  Hz, 1H), 2.74 (dd,  $J = 17.1, 3.6$  Hz, 1H).  $^{13}\text{C NMR}$  (176 MHz, MeOD)  $\delta$  193.96, 156.06, 153.15, 125.84, 122.44, 119.90, 111.35, 78.38, 77.12, 69.25, 67.85, 67.61, 40.05.

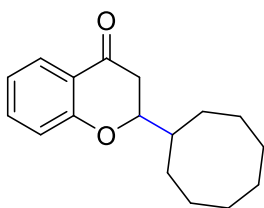
$^1\text{H NMR}$  (700 MHz, MeOD)  $\delta$  7.16 (d,  $J = 3.1$  Hz, 1H), 7.01 (dd,  $J = 8.9, 3.1$  Hz, 1H), 6.87 (d,  $J = 8.9$  Hz, 1H), 4.35 (ddd,  $J = 12.0, 6.5, 3.6$  Hz, 1H), 4.02 (dd,  $J = 11.6, 2.7$  Hz, 1H), 3.89 – 3.95 (m, 1H), 3.79 – 3.84 (m, 2H), 3.69 – 3.76 (m, 2H), 3.61 (td,  $J = 11.6, 2.8$  Hz, 1H), 3.52 (dd,  $J = 11.5, 9.9$  Hz, 1H), 2.80 (dd,  $J = 17.1, 12.0$  Hz, 1H), 2.74 (dd,  $J = 17.1, 3.6$  Hz, 1H).  $^{13}\text{C NMR}$  (176 MHz, MeOD)  $\delta$  193.96, 156.06, 153.15, 125.84, 122.44, 119.90, 111.35, 78.38, 77.12, 69.25, 67.85, 67.61, 40.05.

HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{15}\text{O}_5^+[\text{M}+\text{H}]^+$  251.0914 found 251.0913.



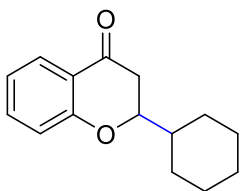
**(4-(1,4-dioxan-2-yl)chroman-2-one (3l):** Synthesized according to general procedure, resulting in the formation of an inseparable mixture of diastereomers (d.r  $\approx$  1:1) in a light yellow oil form . 17 mg, yield: 74 %; Elutes with 25% EtOAc in petroleum ether.  $^1\text{H NMR}$ (400 MHz, METHANOL- $\text{D}_4$ )  $\delta$  7.24 – 7.34 (m,  $2\text{H}_{\text{A+B}}$ ), 7.10 – 7.19 (m,  $1\text{H}_{\text{A+B}}$ ,  $1\text{H}_{\text{A}}$ ), 7.02 (ddd,  $J = 8.1, 6.7, 1.2$  Hz,  $1\text{H}_{\text{B}}$ ), 3.82 (ddd,  $J = 11.2, 2.3, 0.8$  Hz,  $1\text{H}_{\text{B}}$ ), 3.70 – 3.77 (m,  $1\text{H}_{\text{A+B}}$ ), 3.60 – 3.68 (m,  $2\text{H}_{\text{A+B}}$ ), 3.49 – 3.60 (m,  $2\text{H}_{\text{A+B}}$ ), 3.35-3.32 (m,  $1\text{H}_{\text{A}}$ ), 3.30-3.26 (m,  $1\text{H}_{\text{B}}$ ), 3.24 (dd,  $J = 11.3, 10.3$  Hz,  $1\text{H}_{\text{B}}$ ), 3.18 (ddd,  $J = 7.2, 3.5, 1.8$  Hz,  $1\text{H}_{\text{B}}$ ), 3.10 (td,  $J = 6.1, 2.0$  Hz,  $1\text{H}_{\text{A}}$ ), 3.04 (dd,  $J = 16.2, 2.1$  Hz,  $1\text{H}_{\text{A}}$ ), 2.92 (dd,  $J = 16.2, 7.2$  Hz,  $1\text{H}_{\text{A}}$ ), 2.73 – 2.82 (m,  $1\text{H}_{\text{A+B}}$ ).  $^{13}\text{C NMR}$  (101 MHz, METHANOL- $\text{D}_4$ )  $\delta$  170.49, 170.07, 153.81, 153.45, 130.75, 130.04, 129.95, 129.89, 125.63, 125.00, 124.65, 122.87, 117.84, 117.78, 79.84, 78.25, 69.97, 69.75, 68.23, 68.04, 67.36, 67.34, 38.66, 38.54, 33.65, 30.98.

HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{15}\text{O}_4^+$   $[\text{M}+\text{H}]^+$  235.0965 found 235.0964 .



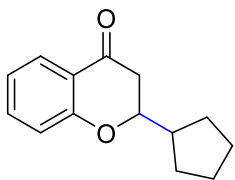
**2-cyclooctylchroman-4-one (3m):** Synthesized according to general procedure, yielding the desired product as yellow oil, 8 mg, yield:32%; Elutes with 5% EtOAc in petroleum ether.  $^1\text{H NMR}$  (700 MHz, MeOD)  $\delta$  7.80 (dd,  $J=7.9, 1.7$  Hz, 1H), 7.51 (ddd,  $J = 8.3, 7.2, 1.8$  Hz, 1H), 6.97 – 7.02 (m, 2H), 4.28 (ddd,  $J = 13.3, 5.5, 2.7$  Hz, 1H), 2.78 (dd,  $J = 16.7, 13.3$  Hz, 1H), 2.62 (dd,  $J = 16.7, 2.6$  Hz, 1H), 1.97 – 2.01 (m, 1H), 1.75–1.89 (m, 4H), 1.63 – 1.67 (m, 3H), 1.46 – 1.59 (m, 7H).  $^{13}\text{C NMR}$  (176 MHz, MeOD)  $\delta$  195.26, 163.58, 137.33, 127.60, 122.14, 122.09, 119.04, 84.15, 42.34, 40.95, 29.81, 28.81, 28.00, 27.72, 27.72, 27.12, 26.75.

HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{17}\text{H}_{23}\text{O}_2^+$   $[\text{M}+\text{H}]^+$  259.16924 found 259.1693.

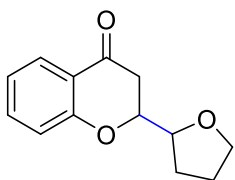


**2-cyclohexylchroman-4-one (3n):** Synthesized according to general procedure, yielding the desired product as yellow oil, 9 mg, yield: 39%; Elutes with 5% EtOAc in petroleum ether.  $^1\text{H NMR}$  (700 MHz, MeOD)  $\delta$  7.79 (dd,  $J = 7.8, 1.7$  Hz, 1H), 7.51 (ddd,  $J = 8.4, 7.1, 1.8$  Hz, 1H), 6.97–7.02 (m, 2H), 4.22 (ddd,  $J = 13.1, 6.0, 2.8$  Hz, 1H), 2.76 (dd,  $J = 16.7, 13.1$  Hz, 1H), 2.64 (dd,  $J = 16.7, 2.8$  Hz, 1H), 2.02 (d,  $J = 12.9$  Hz, 1H), 1.69–1.85 (m, 5H), 1.17–1.36 (m, 5H).  $^{13}\text{C NMR}$  (176 MHz, MeOD)  $\delta$  195.16, 163.49, 137.33, 127.58, 122.14, 122.11, 119.02, 83.32, 43.10, 41.13, 29.37, 29.18, 27.49, 27.13, 27.05.

HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{15}\text{H}_{19}\text{O}_2^+$   $[\text{M}+\text{H}]^+$  231.13794 found 231.1381.



**2-cyclopentylchroman-4-one (3o):** Synthesized according to general procedure, yielding the desired product as yellow oil, 7 mg, yield: 33 %; Elutes with 5% EtOAc in petroleum ether.  $^1\text{H NMR}$  (700 MHz,  $\text{CDCl}_3$ )  $\delta$  7.87 (ddd,  $J = 7.9, 1.8, 0.5$  Hz, 1H), 7.46 (ddd,  $J = 8.3, 7.1, 1.8$  Hz, 1H), 6.95 – 7.01 (m, 2H), 4.23 (ddd,  $J = 10.9, 7.9, 4.8$  Hz, 1H), 2.67 – 2.74 (m, 2H), 2.24 (h,  $J = 8.1$  Hz, 1H), 1.90 – 1.98 (m, 1H), 1.75 – 1.82 (m, 1H), 1.65 – 1.72 (m, 2H), 1.53 – 1.64 (m, 3H), 1.29 – 1.38 (m, 1H).  $^{13}\text{C NMR}$  (176 MHz,  $\text{CDCl}_3$ )  $\delta$  192.98, 161.99, 136.05, 127.04, 121.23, 121.18, 118.10, 81.87, 44.23, 42.33, 28.94, 28.55, 25.68, 25.56. HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{14}\text{H}_{17}\text{O}_2^+$   $[\text{M}+\text{H}]^+$  217.12229 found 217.1221.



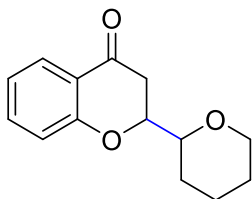
**2-(tetrahydrofuran-2-yl)chroman-4-one (3p):** Synthesized according to general procedure, yielding a separable mixture of diastereomers (~d.r. 1:1) as a yellow oil. The individual diastereomers were obtained with yields of 33% (7 mg) and 24% (5 mg), resulting in an overall yield of 57%. Elutes with 5% EtOAc in petroleum ether.

$^1\text{H NMR}$  (**Isomer 1**, 700 MHz,  $\text{CDCl}_3$ )  $\delta$  7.88 (ddd,  $J = 7.8, 1.8, 0.5$  Hz, 1H), 7.47 (ddd,  $J = 8.3, 7.2, 1.8$  Hz, 1H), 6.98 – 7.03 (m, 2H), 4.39 (ddd,  $J = 12.2, 5.1, 3.7$  Hz, 1H), 4.17 (ddd,  $J = 7.3, 6.5, 5.1$  Hz, 1H), 3.93 (dt,  $J = 8.2, 6.5$  Hz, 1H), 3.84 (dt,  $J = 8.3, 6.7$  Hz, 1H), 2.82 (dd,  $J = 16.8, 12.3$  Hz, 1H), 2.78 (dd,  $J = 16.8, 3.7$  Hz, 1H), 2.09 – 2.14 (m, 1H), 1.88 – 1.89 (m, 3H).  $^{13}\text{C NMR}$  (**Isomer 1**, 176 MHz,  $\text{CDCl}_3$ )  $\delta$  192.29, 161.53, 136.10, 127.06, 121.51, 121.25, 118.11, 79.83, 79.62, 69.14, 39.23, 27.75, 25.82.

$^1\text{H NMR}$  (**Isomer 2**, 700 MHz,  $\text{CDCl}_3$ )  $\delta$  7.88 (dd,  $J = 7.6, 2.0$  Hz, 1H), 7.47 (ddd,  $J = 8.4, 7.1, 1.8$  Hz, 1H), 7.04 (dd,  $J = 8.4, 0.8$  Hz, 1H), 7.01 (ddd,  $J = 8.0, 7.1, 1.1$  Hz, 1H), 4.41 (ddd,  $J = 13.1, 5.2, 2.9$  Hz, 1H), 4.11 (td,  $J = 7.2, 5.2$  Hz, 1H), 3.93 (dt,  $J = 8.3, 6.8$  Hz, 1H), 3.87 (ddd,  $J = 8.4, 7.5, 5.6$  Hz, 1H), 2.91 (dd,  $J = 16.7, 13.1$  Hz, 1H), 2.66 (dd,  $J = 16.7, 2.9$  Hz, 1H), 2.00 2.09 (m, 2H), 1.93 – 2.00 (m, 1H), 1.85 – 1.91 (m, 1H).  $^{13}\text{C NMR}$  (**Isomer 2**, 176 MHz,  $\text{CDCl}_3$ )  $\delta$  192.23, 161.51, 136.18, 127.00, 121.51, 121.11, 118.23, 79.93, 79.82, 69.06, 39.97, 27.64, 26.07.

HRMS (**Isomer 1**, ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{15}\text{O}_3^+$   $[\text{M}+\text{H}]^+$  219.10156 found 219.1016

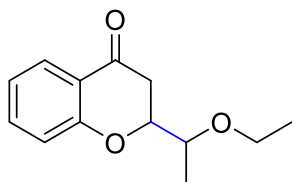
HRMS (**Isomer 2**, ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{15}\text{O}_3^+$   $[\text{M}+\text{H}]^+$  219.10156 found 219.1015



**2-(tetrahydro-2H-pyran-2-yl)chroman-4-one (3q):** Synthesized according to general procedure, resulting in the formation of an inseparable mixture of diastereomers (d.r. 1:1) in a colorless oil form. 15 mg, yield: 65 %; Elutes with 5% EtOAc in petroleum ether.  $^1\text{H NMR}$  (700 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86 (dt,  $J = 7.8, 1.8$  Hz, 2H), 7.45 (ddt,  $J = 8.3, 7.2, 1.9$  Hz, 2H), 7.03 (dd,  $J = 8.3, 1.0$  Hz, 1H), 7.01 – 6.96 (m, 3H), 4.35 (dddd,  $J = 32.3, 12.8, 4.4, 2.9$  Hz, 2H), 4.16 – 3.95 (m, 2H), 3.62 (ddd,  $J = 11.3, 4.7, 2.2$  Hz, 1H), 3.55 –

3.43 (m, 4H), 2.99 (dd, J = 16.9, 13.5 Hz, 1H), 2.89 (dd, J = 16.9, 12.8 Hz, 1H), 2.76 (dd, J = 16.9, 3.0 Hz, 1H), 2.60 (dd, J = 16.9, 2.8 Hz, 1H), 2.00 – 1.90 (m, 2H), 1.78 (ddt, J = 13.8, 3.8, 1.6 Hz, 1H), 1.75 – 1.70 (m, 1H), 1.69 – 1.58 (m, 3H), 1.57 – 1.50 (m, 3H), 1.42 (tdd, J = 12.7, 11.4, 3.9 Hz, 1H). <sup>13</sup>C (176 MHz, CDCl<sub>3</sub>) δ 192.77, 192.59, 161.59, 161.49, 136.00, 135.99, 126.99, 126.92, 121.44, 121.43, 121.23, 121.13, 118.32, 118.14, 80.21, 79.76, 78.38, 78.27, 69.20, 68.87, 39.45, 38.73, 27.48, 27.08, 26.03, 25.95, 23.30, 23.12.

HRMS (ESI+) m/z calcd. for C<sub>14</sub>H<sub>17</sub>O<sub>3</sub><sup>+</sup>[M+H]<sup>+</sup> 233.11721 found 233.1171 .

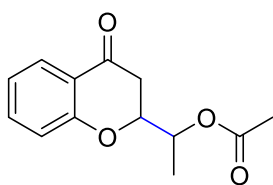


**2-(1-ethoxyethyl)chroman-4-one (3r):** Synthesized according to general procedure, resulting in the formation of an inseparable mixture of diastereomers (d.r 1:1) in a yellow oil form . 16 mg, yield: 72 %; Elutes with 25% EtOAc in petroleum ether.

<sup>1</sup>H NMR (700 MHz, CDCl<sub>3</sub>): 7.91 – 7.79 (m, 2H), 7.46 (ddt, J = 8.3, 7.1, 2.0 Hz, 2H), 7.05 – 6.88 (m, 4H), 4.43 (ddd, J = 13.3, 4.0, 2.8 Hz, 1H), 4.33 (ddd, J = 12.4, 4.7, 3.3 Hz, 1H), 3.77 – 3.71 (m, 1H), 3.71 – 3.64 (m, 3H), 3.54 (ddq, J = 27.5, 9.3, 7.0 Hz, 2H), 2.97 – 2.83 (m, 2H), 2.79 (dd, J = 16.9, 3.3 Hz, 1H), 2.64 (dd, J = 16.8, 2.8 Hz, 1H), 1.32 (d, J = 6.4 Hz, 3H), 1.27 (d, J = 6.4 Hz, 3H), 1.21 (dt, J = 11.9, 7.0 Hz, 6H).

<sup>13</sup>C NMR (176 MHz, CDCl<sub>3</sub>): δ 192.86, 192.71, 161.64, 161.48, 136.04, 135.99, 127.03, 126.97, 121.41, 121.40, , 121.25, 118.20, 118.07, 80.85, 79.95, 76.13, 75.70, 65.51, 65.38, 39.12, 38.63, 16.36, 15.63, 15.60, 15.52.

HRMS (ESI+) m/z calcd. for C<sub>13</sub>H<sub>17</sub>O<sub>3</sub><sup>+</sup> [M+H]<sup>+</sup> 221.11721 found 221.1173 .



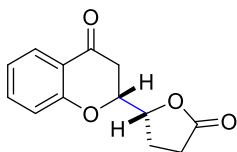
**1-(4-oxochroman-2-yl)ethyl acetate (3s):** Synthesized according to general procedure, resulting in the formation of an inseparable mixture of diastereomers (d.r 1:1) in a yellow oil form, 17 mg, yield: 74 %; Elutes with 30% EtOAc in petroleum ether.

<sup>1</sup>H NMR (700 MHz, CDCl<sub>3</sub>): δ

<sup>1</sup>H NMR (700 MHz, Chloroform-d) δ 7.91 – 7.83 (m, 2H), 7.52 – 7.43 (m, 2H), 7.06 – 6.94 (m, 4H), 5.24 (td, J = 6.5, 4.3 Hz, 1H), 5.20 (qd, J = 6.6, 4.3 Hz, 1H), 4.50 – 4.43 (m, 2H), 2.82 (td, J = 16.6, 13.0 Hz, 2H), 2.76 – 2.70 (m, 1H), 2.65 (dd, J = 16.6, 3.0 Hz, 1H), 2.09 (s, 3H), 2.08 (s, 3H), 1.41 (d, J = 6.6 Hz, 3H), 1.37 (d, J = 6.5 Hz, 3H). <sup>13</sup>C NMR (176 MHz, CDCl<sub>3</sub>): δ 191.74, 191.65, 170.35, 170.27, 161.27, 161.21, 136.29, 136.25, 127.09, 127.06, 121.77, 121.09, 121.07, 118.11, 79.12, 78.62, 70.88, 70.47, 39.16, 38.54, 21.24, 21.17, 15.74, 15.73.

HRMS (ESI+) m/z calcd. for C<sub>13</sub>H<sub>15</sub>O<sub>4</sub><sup>+</sup>[M+H]<sup>+</sup> 235.09647 found 235.0965.



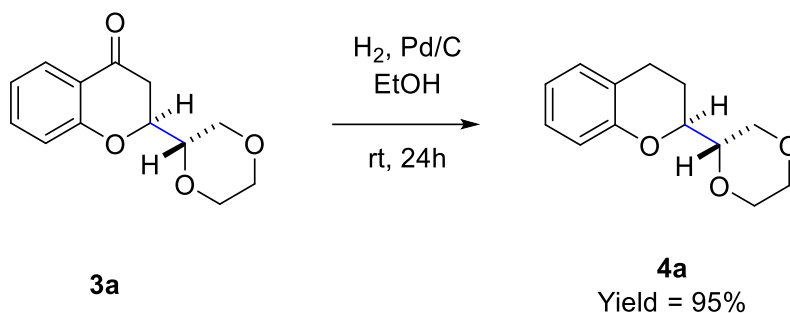


**(R)-2-((R)-5-oxotetrahydrofuran-2-yl)chroman-4-one (3t):** Synthesized according to general procedure, yielding the desired product as yellow oil, 14.7 mg, yield: 63 %; Elutes with 25% EtOAc in petroleum ether.  $^1\text{H}$  NMR (700 MHz, MeOD)  $\delta$  7.84 (dd,  $J = 8.1, 1.7$  Hz, 1H), 7.55 (ddd,  $J = 8.3, 7.2, 1.8$  Hz, 1H), 7.03 – 7.12 (m, 2H), 4.79 (ddd,  $J = 8.0, 6.0, 3.4$  Hz, 1H), 4.62 (dt,  $J = 13.4, 3.1$  Hz, 1H), 3.00 (dd,  $J = 16.8, 13.4$  Hz, 1H), 2.69 – 2.79 (m, 2H), 2.60 – 2.67 (m, 1H), 2.43 – 2.49 (m, 1H), 2.36 – 2.41 (m, 1H).  $^{13}\text{C}$  NMR (176 MHz, MeOD)  $\delta$  193.37, 179.53, 162.50, 137.57, 127.72, 122.88, 122.01, 119.03, 81.80, 80.09, 40.08, 29.03, 24.37.

HRMS (ESI+)  $m/z$  calcd. for  $\text{C}_{13}\text{H}_{13}\text{O}_4^+$   $[\text{M}+\text{H}]^+$  233.08082 found 233.0803.

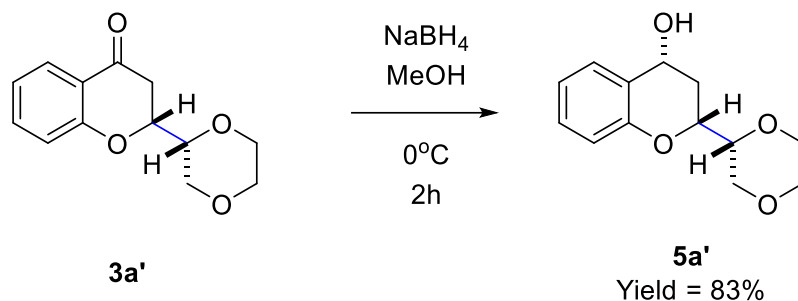


6. General procedure for the synthesis of (*S*\*)-2-((*S*\*)-1,4-dioxan-2-yl)chromane **4a**



In the 4 mL vial 1,4-dioxan-2-ylchroman-4-one **3a** (33.2 mg, 0.14 mmol, 1.0 equiv) was dissolved in EtOH (2.0 mL) and Pd/C (1.5 mg, 0.014 mmol, 0.1 equiv.) at room temperature was added in the atmosphere of hydrogen. Reaction mixture was stirred for 24h. Next, the reaction was filtered by celite and the crude product was purified by silica gel chromatography (CH<sub>2</sub>Cl<sub>2</sub>:MeOH 85:15) to provide the desired product **4a**. Pure product **4a** was isolated as white oil in 95% (31.8 mg), as a single diastereoisomer. <sup>1</sup>H NMR (700 MHz, CDCl<sub>3</sub>) δ 7.10 – 7.06 (m, 1H), 7.04 (dd, J = 7.5, 1.5 Hz, 1H), 6.84 (td, J = 7.4, 1.3 Hz, 1H), 6.80 (dd, J = 8.1, 1.2 Hz, 1H), 4.11 (dd, J = 11.5, 2.6 Hz, 1H), 3.95 (ddd, J = 9.7, 7.2, 2.4 Hz, 1H), 3.84 (dd, J = 11.6, 2.8 Hz, 1H), 3.80 – 3.72 (m, 2H), 3.70 – 3.62 (m, 2H), 3.58 – 3.53 (m, 1H), 2.86 – 2.74 (m, 2H), 2.18 (dddd, J = 13.6, 6.1, 4.0, 2.4 Hz, 1H), 1.88 – 1.78 (m, 1H). <sup>13</sup>CNMR (176 MHz, CDCl<sub>3</sub>) δ 154.13, 129.55, 127.25, 122.04, 120.42, 116.81, 76.20, 75.43, 68.98, 66.89, 66.58, 24.01, 23.60. HRMS calculated for [C<sub>13</sub>H<sub>16</sub>O<sub>3</sub>H<sup>+</sup>]: 221.1172; found: 221.1173.

7. General procedure for the synthesis of (2*R*\*,4*R*\*)-2-((*R*\*)-1,4-dioxan-2-yl)chroman-4-ol **5a'**

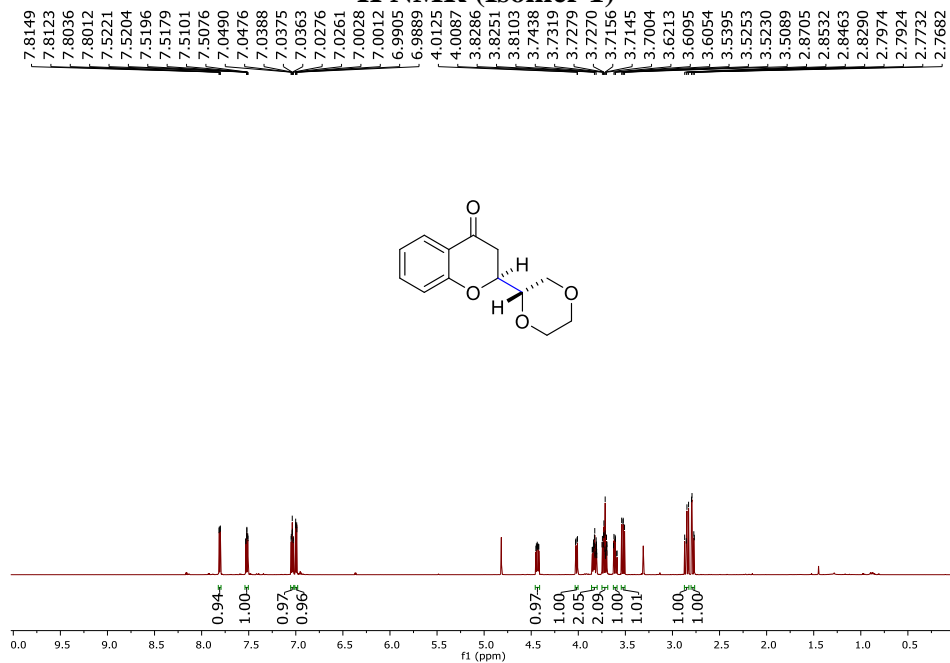


In the 4 mL vial 1,4-dioxan-2-ylchroman-4-one **3a'** (18.7 mg, 0.08 mmol, 1.0 equiv) was dissolved in MeOH (1.0 mL) and NaBH<sub>4</sub> (4.5 mg, 0.12 mmol, 1.5 equiv.) at 0°C was added. Reaction mixture was stirred for 2h. Next, the reaction was quenched with water (5 mL), extracted with ethyl acetate (3x10 mL) and washed with brine (5 mL). The organic phase was dried over MgSO<sub>4</sub> and concentrated under reduced pressure. The crude product was purified by silica gel chromatography (CH<sub>2</sub>Cl<sub>2</sub>:MeOH 85:15) to provide the desired product **5a'**. Pure product **5a'** was isolated as white oil in 83% (15.6 mg), as a single diastereoisomer. <sup>1</sup>H NMR (700 MHz, CDCl<sub>3</sub>) δ 7.44 (dt, J = 7.6, 1.3 Hz, 1H), 7.21 – 7.12 (m, 1H), 6.95 (td, J = 7.5, 1.2 Hz, 1H), 6.80 (dd, J = 8.2, 1.1 Hz, 1H), 4.90 (t, J = 7.7 Hz, 1H), 4.14 – 4.01 (m, 2H), 3.85 – 3.81 (m, 1H), 3.79 – 3.71 (m, 3H), 3.64 (td, J = 11.4, 2.9 Hz, 1H), 3.53 (dd, J = 11.6, 9.8 Hz, 1H), 2.48 (ddd, J = 13.3, 6.1, 2.4 Hz, 1H), 2.10 (s, 1H), 1.87 (ddd, J = 13.3, 10.3, 9.5 Hz, 1H). <sup>13</sup>C NMR (176 MHz, CDCl<sub>3</sub>) δ 153.47, 129.10, 127.33, 125.80, 121.04, 116.63, 76.14, 74.15, 68.70, 66.79, 66.51, 64.61, 33.69. HRMS calculated for [C<sub>13</sub>H<sub>16</sub>O<sub>4</sub>Na<sup>+</sup>]: 259.0941; found: 259.0939.

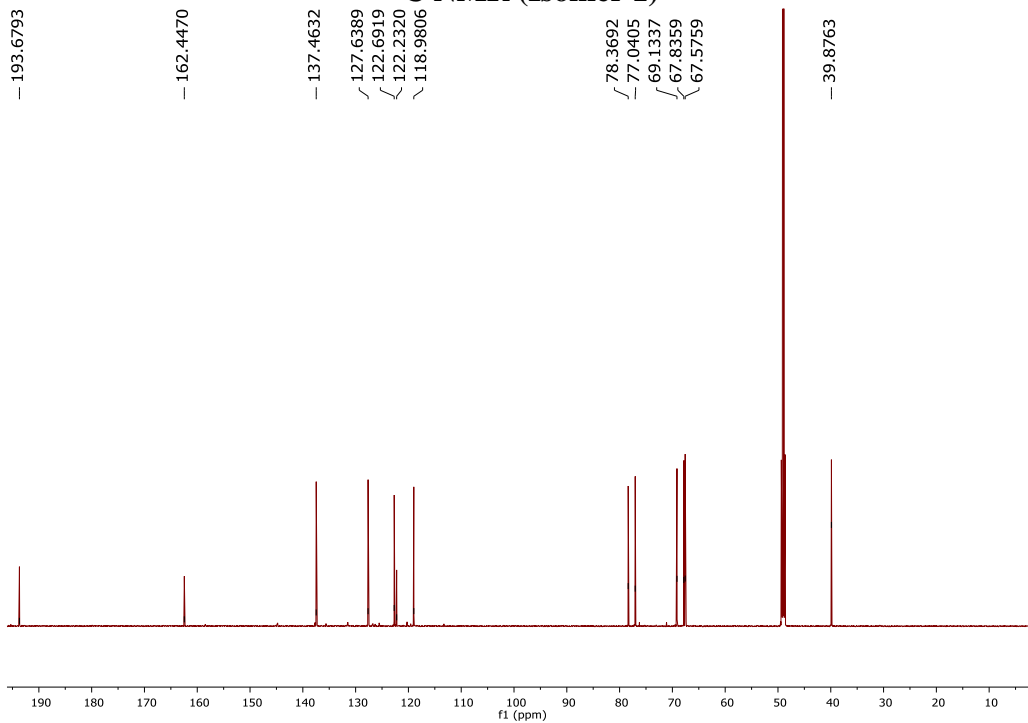
## 4. NMR Data

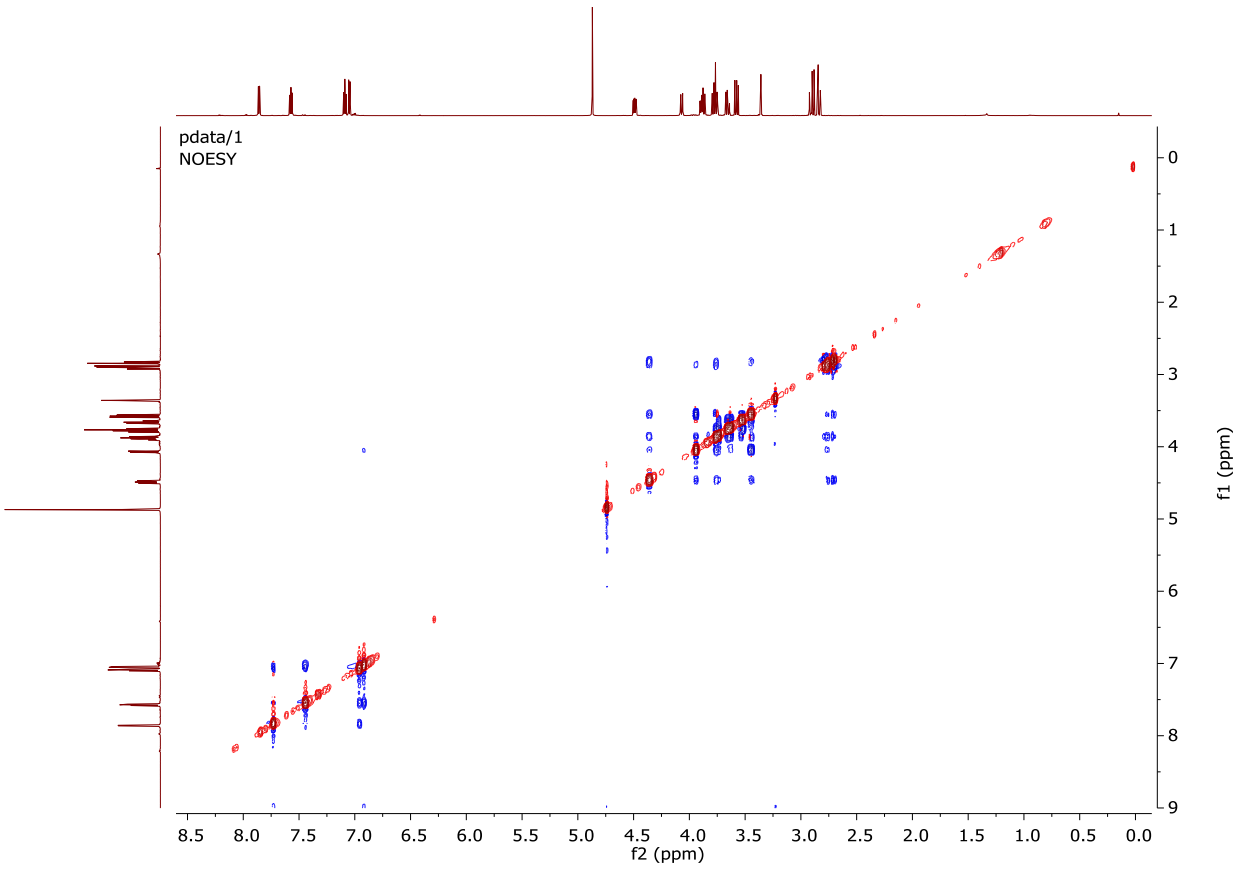
### (*R*\*)-2-((*R*\*)-1,4-dioxan-2-yl)chroman-4-one (3a)

#### <sup>1</sup>H NMR (Isomer 1)



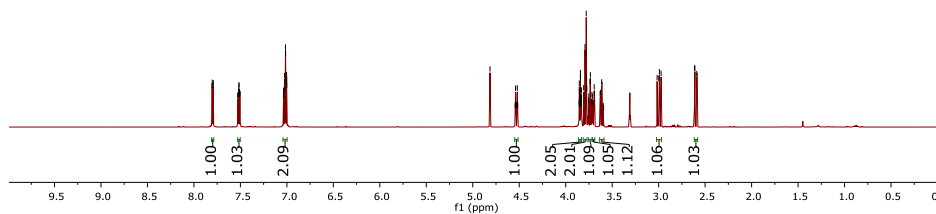
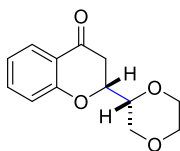
#### <sup>13</sup>C NMR (Isomer 1)





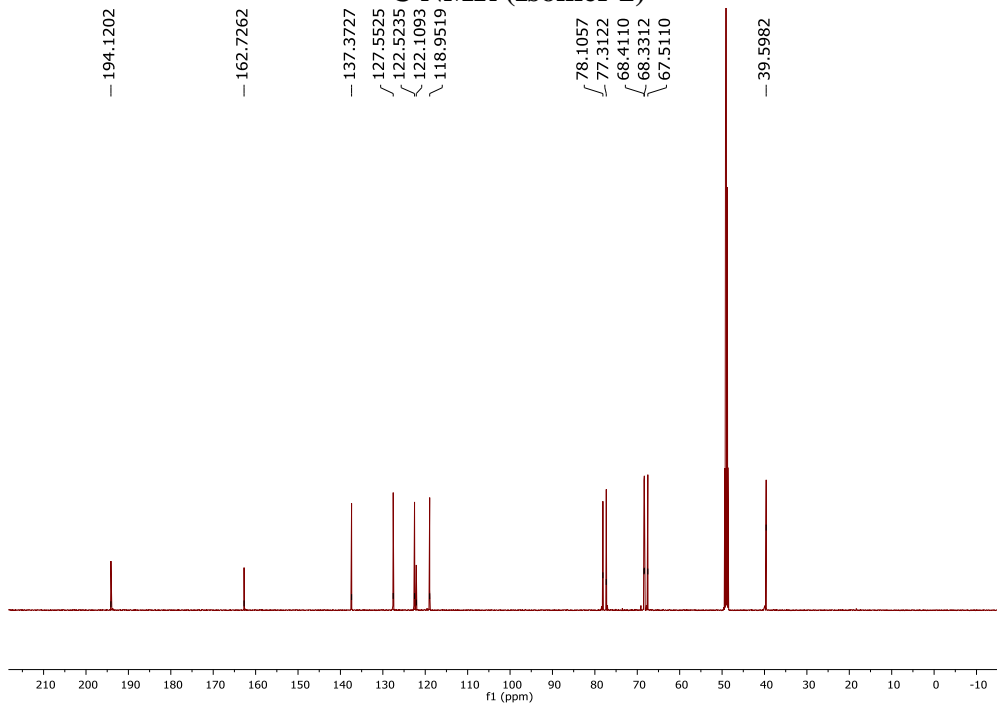
**(R\*)-2-((R\*)-1,4-dioxan-2-yl)chroman-4-one (3a')**  
<sup>1</sup>H NMR (Isomer 2)

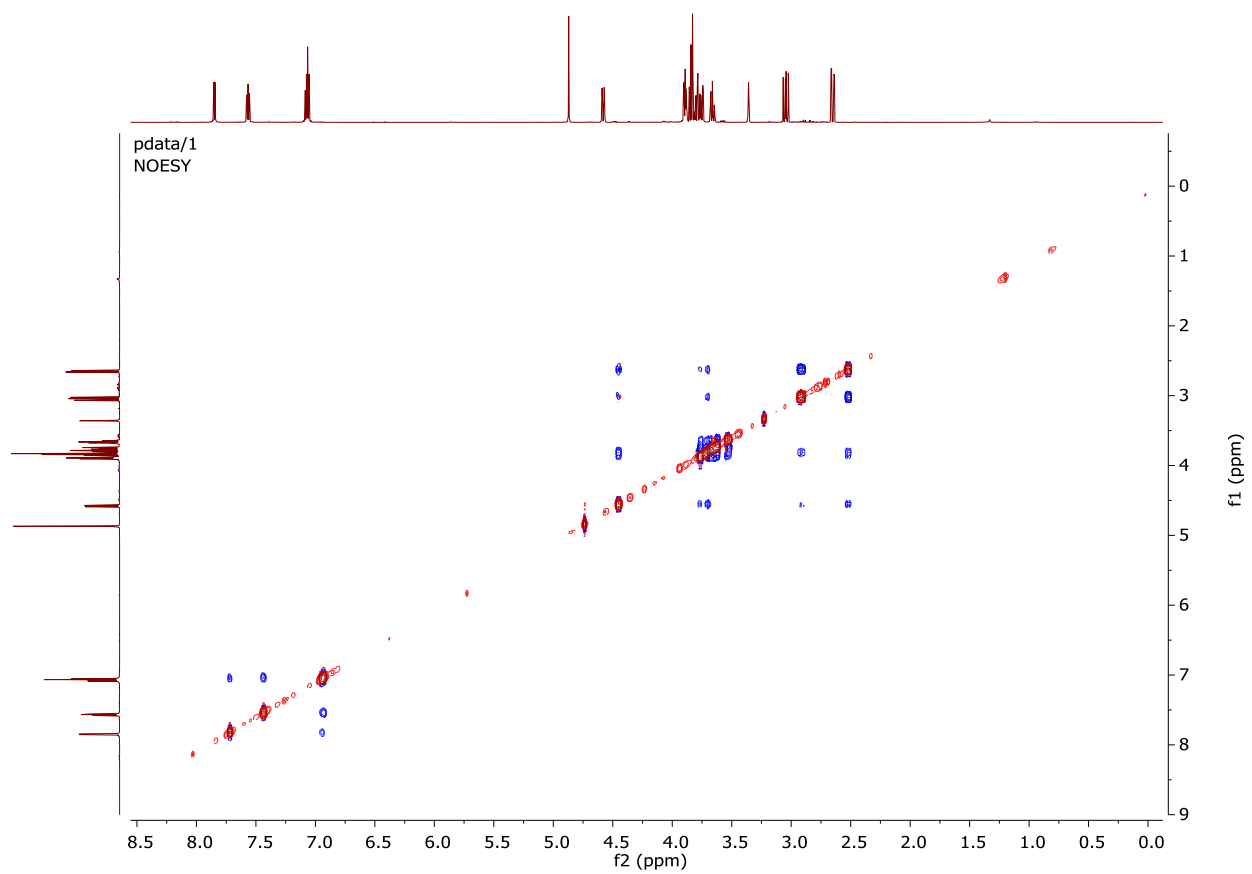
7.8053  
 7.8029  
 7.7942  
 7.7917  
 7.5176  
 7.5158  
 7.5150  
 7.5133  
 7.5056  
 7.0350  
 7.0263  
 7.0250  
 7.0238  
 7.0150  
 7.0136  
 7.0037  
 7.0031  
 7.0021  
 7.0015  
 4.8145  
 4.5592  
 4.5209  
 3.8540  
 3.8522  
 3.8418  
 3.8405  
 3.8355  
 3.8316  
 3.8067  
 3.7925  
 3.7794  
 3.7781  
 3.7761  
 3.7742  
 3.7385  
 3.7346  
 3.6934  
 3.6257  
 3.6131  
 3.6092  
 3.0165  
 2.9981  
 2.9739  
 2.6144  
 2.6099  
 2.5902  
 2.5857



<sup>13</sup>C NMR (Isomer 2)

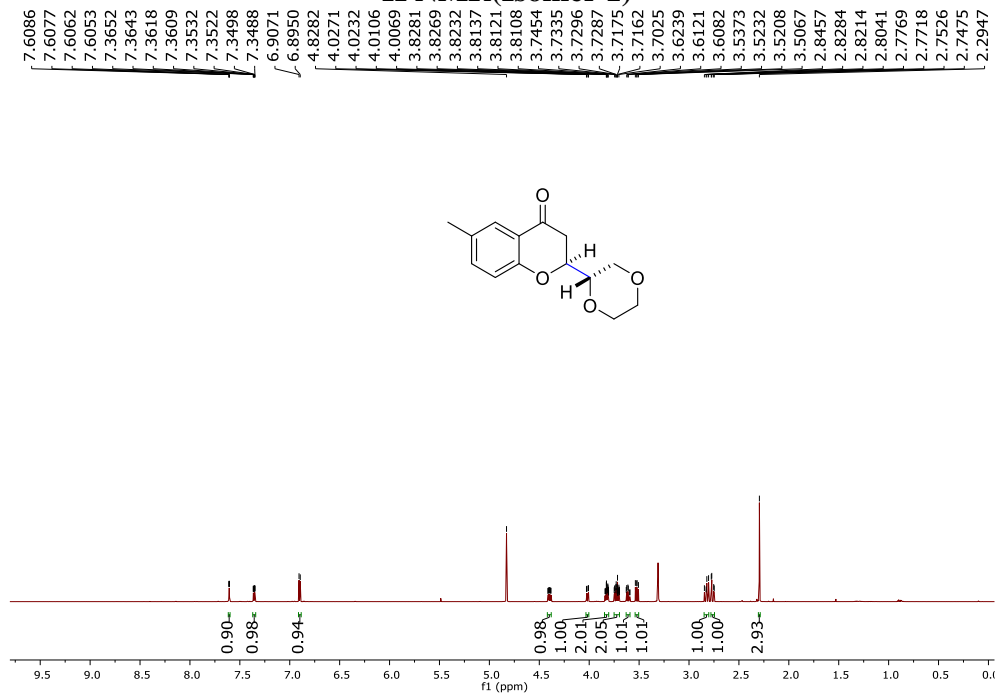
-194.1202  
 -162.7262  
 -137.3727  
 127.5525  
 122.5235  
 122.1093  
 118.9519  
 78.1057  
 77.3122  
 68.4110  
 68.3312  
 67.5110  
 -39.5982



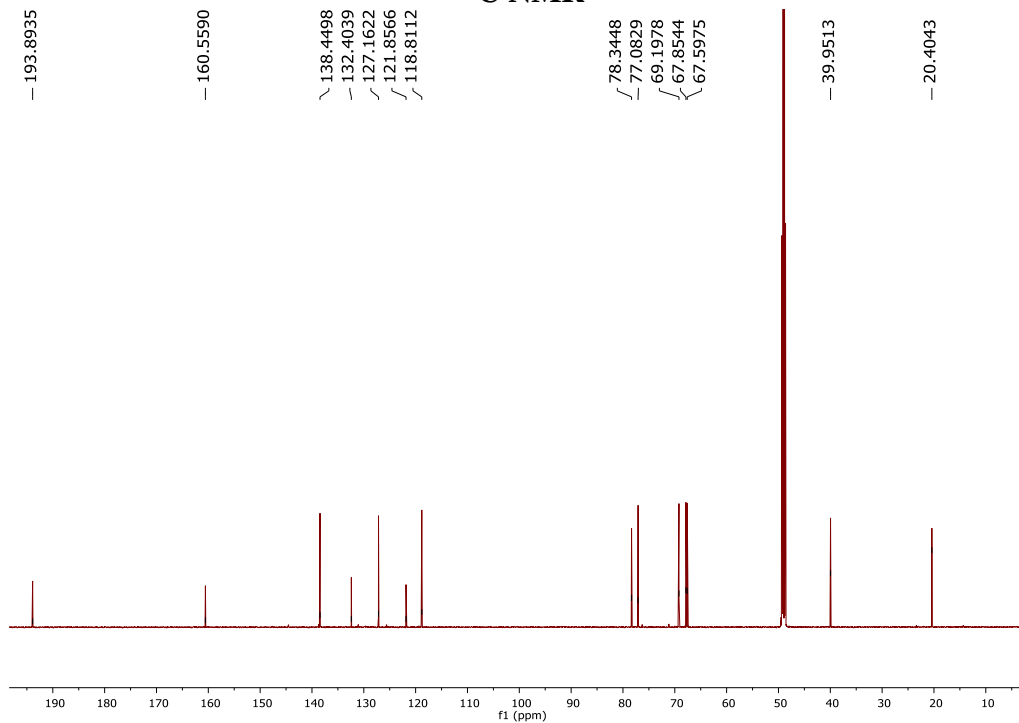


**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-6-methylchroman-4-one (3b)**

**<sup>1</sup>H NMR (Isomer 1)**

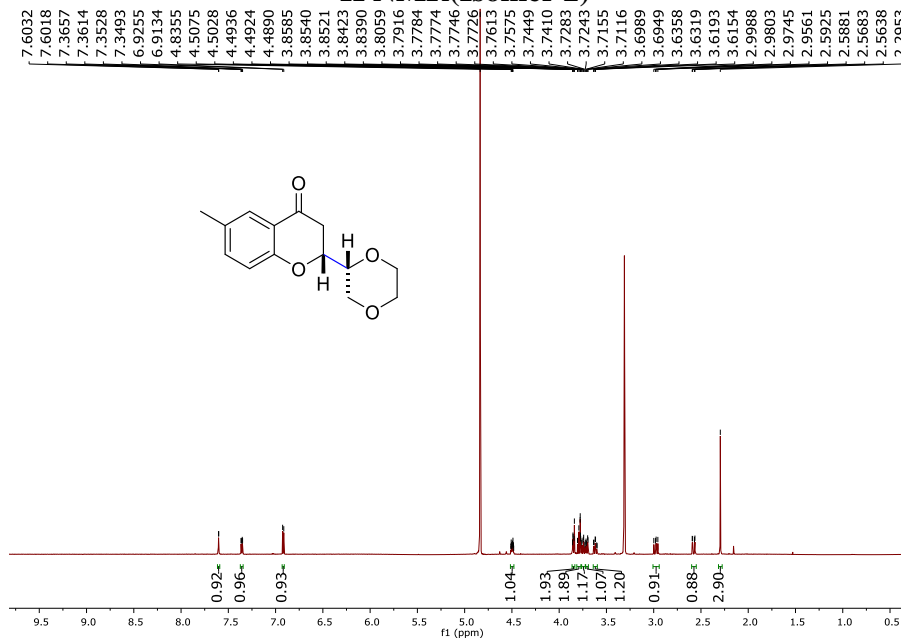


**<sup>13</sup>C NMR**

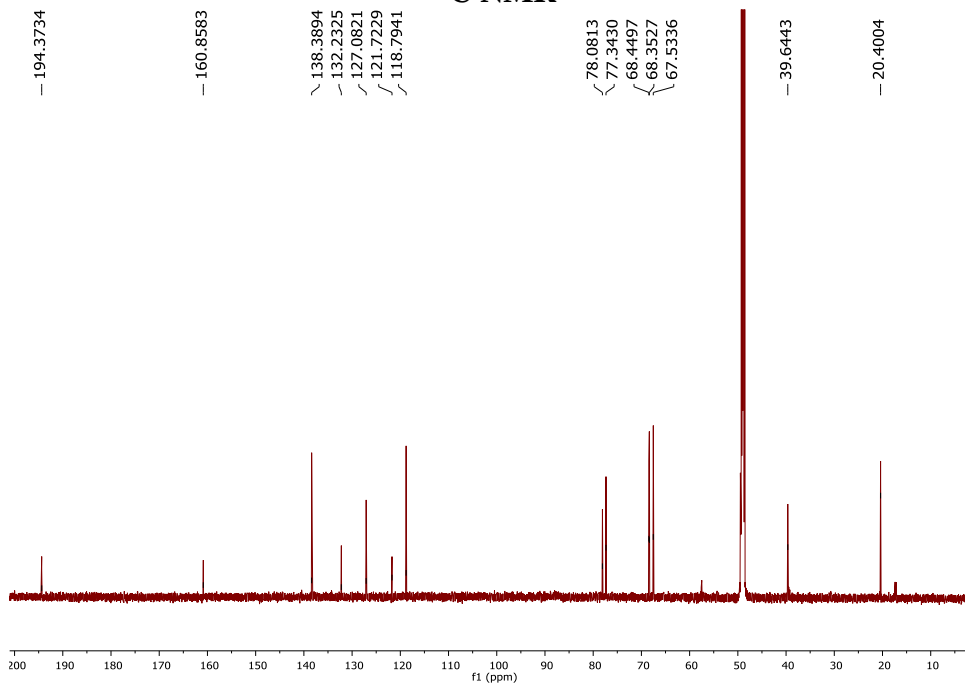


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-6-methylchroman-4-one (3b')**

**<sup>1</sup>H NMR (Isomer 2)**



**<sup>13</sup>C NMR**

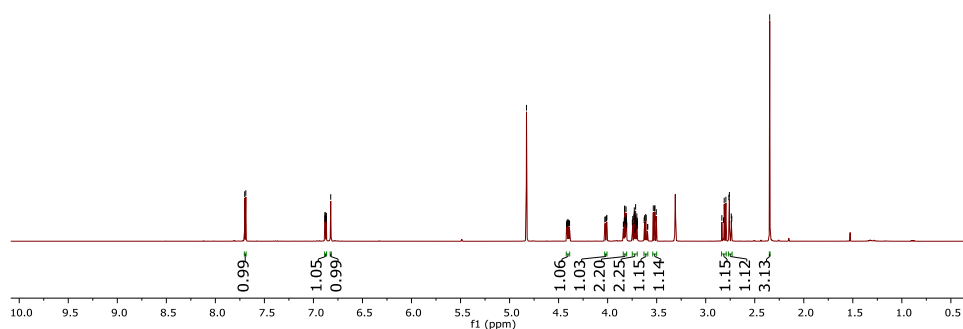
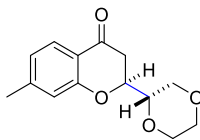




**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3c)**

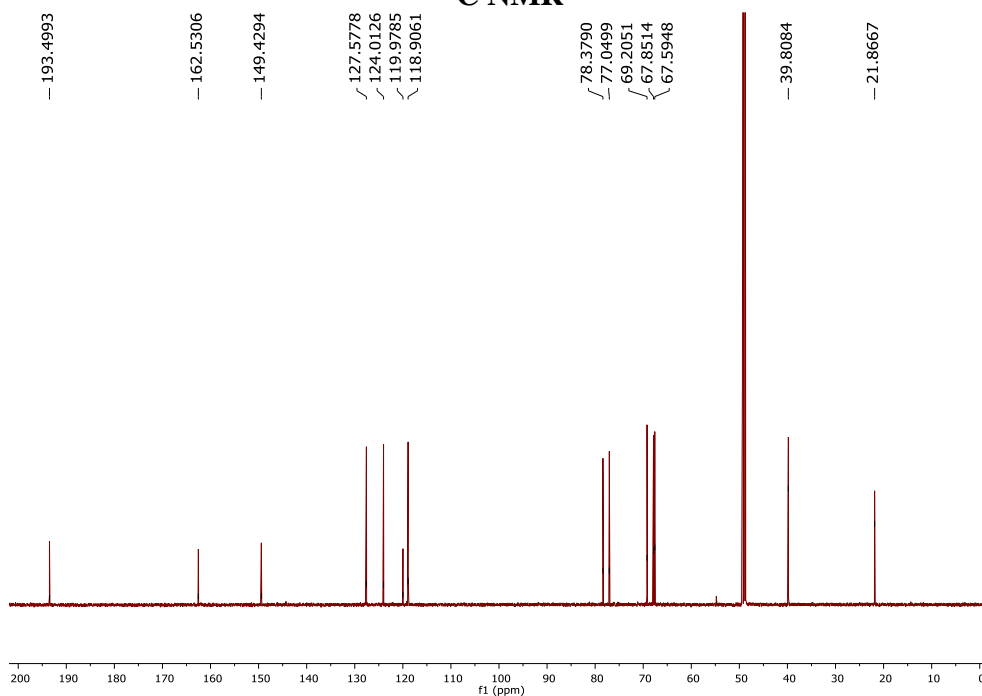
**<sup>1</sup>H NMR (Isomer 1)**

7.7009  
7.6894  
6.8830  
6.8819  
6.8808  
6.8797  
6.8715  
6.8704  
6.8693  
6.8682  
6.8237  
4.8274  
4.0279  
4.0241  
4.0116  
4.0078  
3.8300  
3.8280  
3.8264  
3.8253  
3.8122  
3.8103  
3.7439  
3.7321  
3.7282  
3.7273  
3.7176  
3.7164  
3.7148  
3.7027  
3.7013  
3.6277  
3.6231  
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3.5345  
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3.5181  
3.5039  
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2.8185  
2.8113  
2.7942  
2.7635  
2.7584  
2.7392  
2.7341  
2.3473



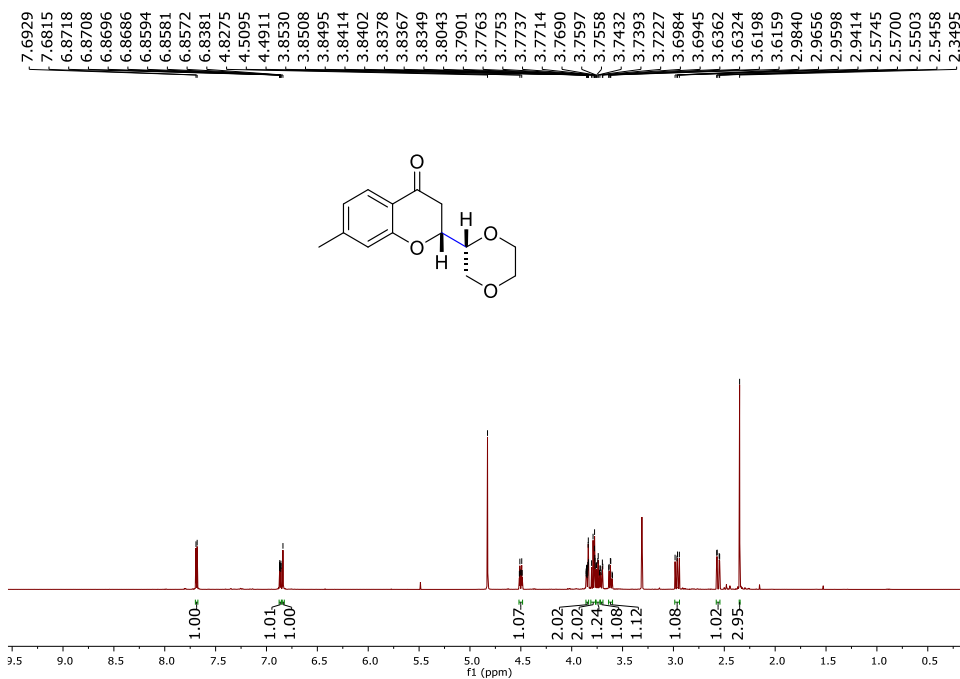
**<sup>13</sup>C NMR**

- 193.4993  
- 162.5306  
- 149.4294  
/ 127.5778  
/ 124.0126  
/ 119.9785  
/ 118.9061  
/ 78.3790  
/ 77.0499  
/ 69.2051  
/ 67.8514  
/ 67.5948  
- 39.8084  
- 21.8667

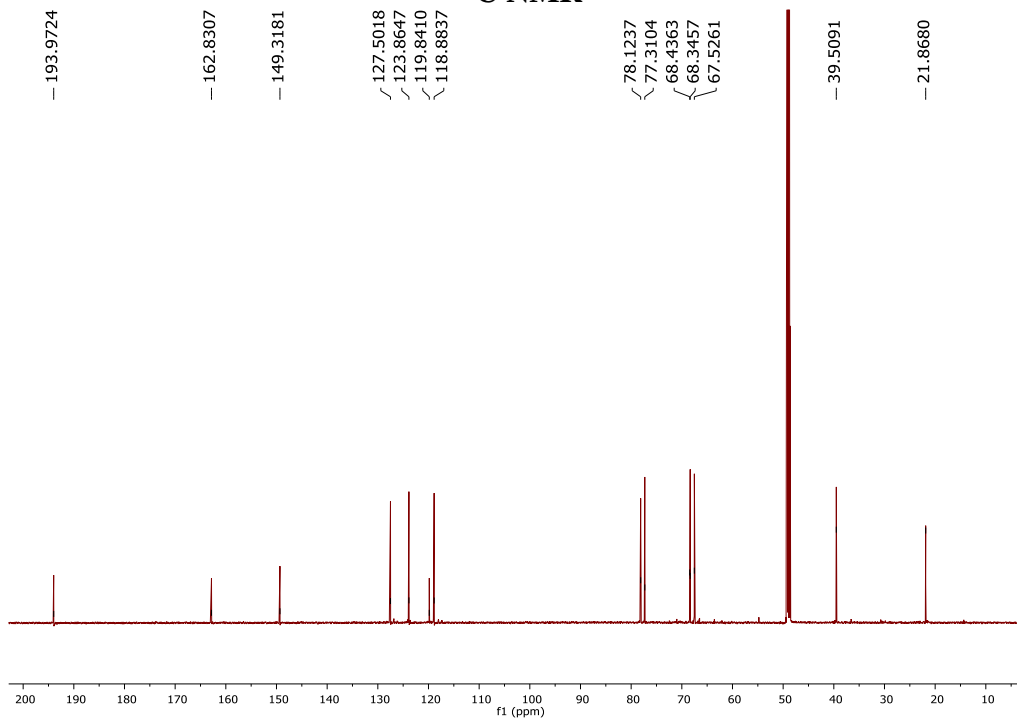


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3c')**

**<sup>1</sup>H NMR (Isomer 2)**

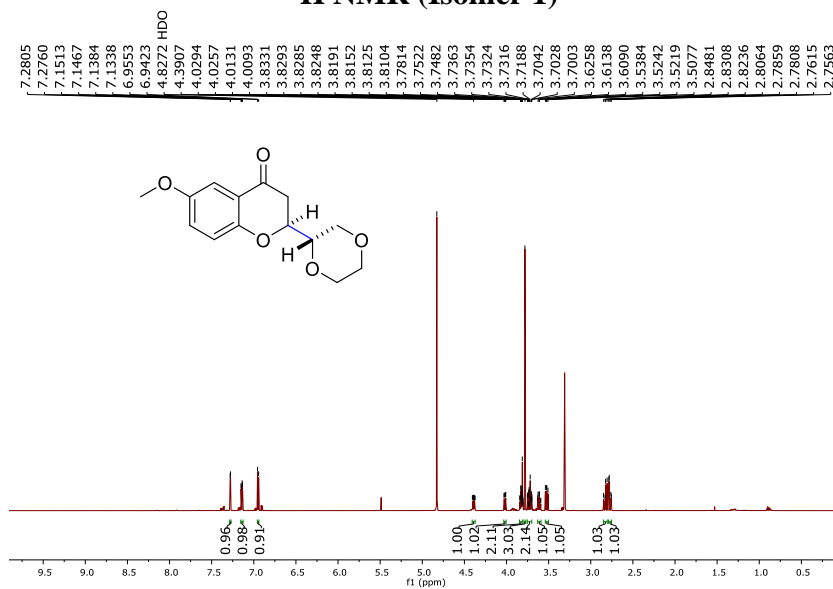


**<sup>13</sup>C NMR**

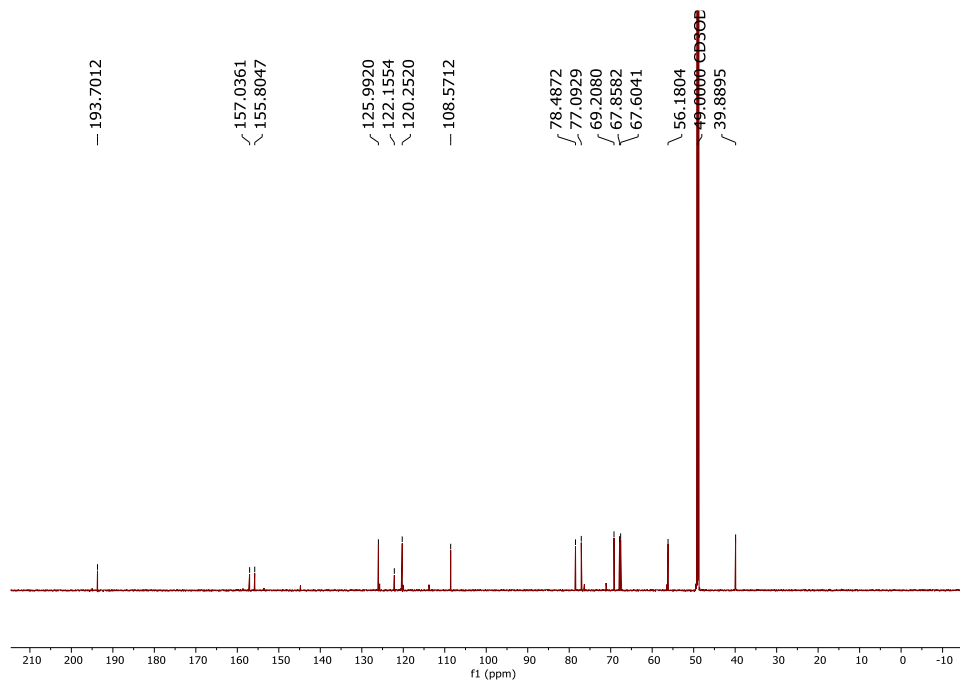


**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-6-methoxychroman-4-one (3d)**

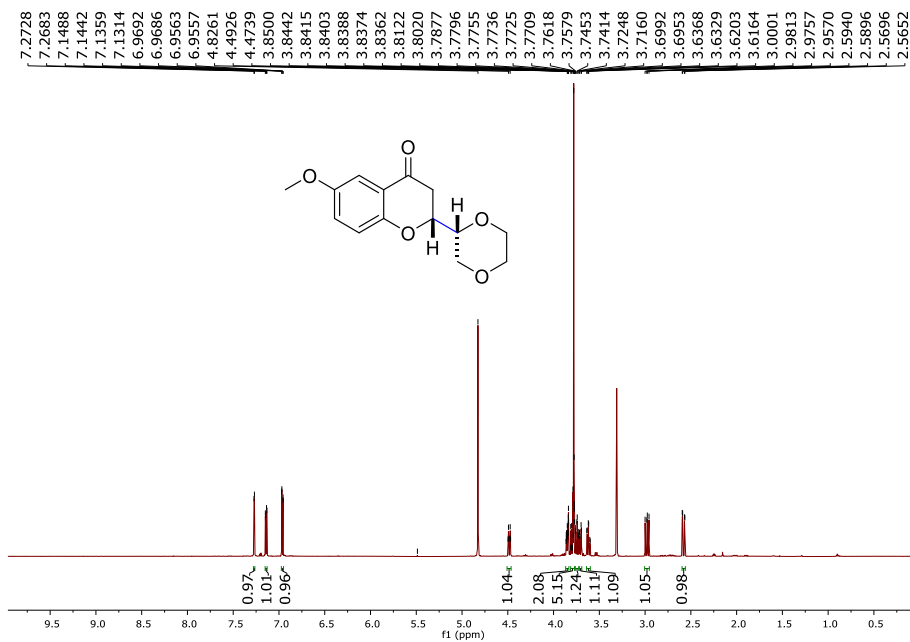
**<sup>1</sup>H NMR (Isomer 1)**



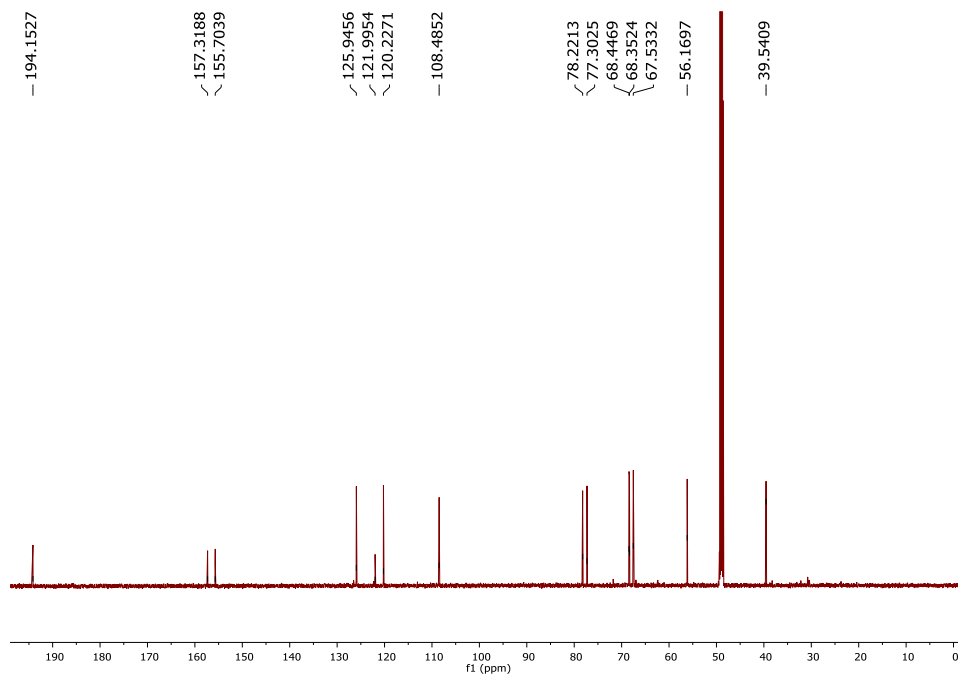
**<sup>13</sup>C NMR**



**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-6-methoxychroman-4-one (3d')**  
**<sup>1</sup>H NMR (Isomer 2)**

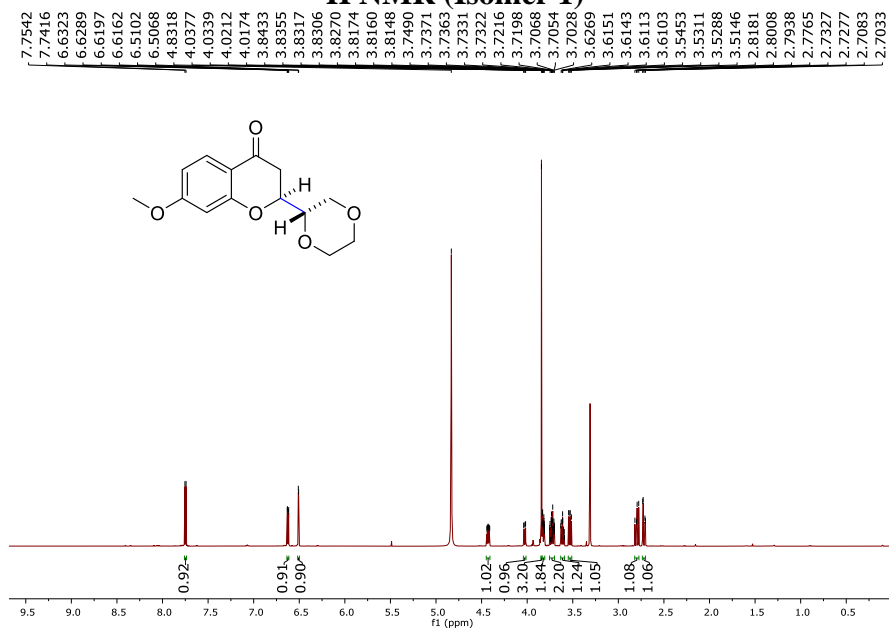


**<sup>13</sup>C NMR (Isomer 2)**

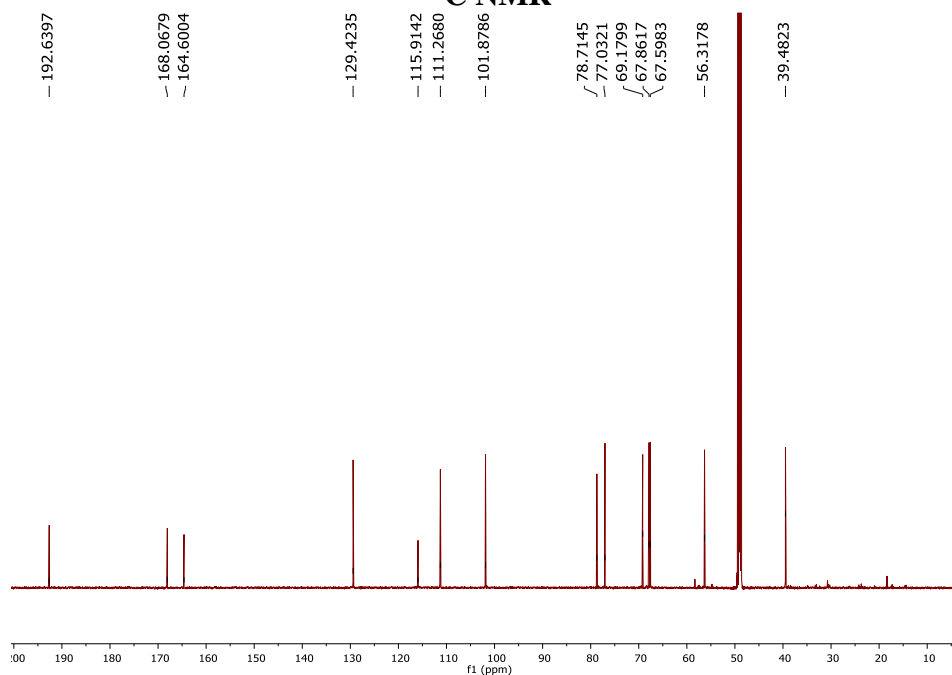


**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-7-methoxychroman-4-one (3e)**

**<sup>1</sup>H NMR (Isomer 1)**

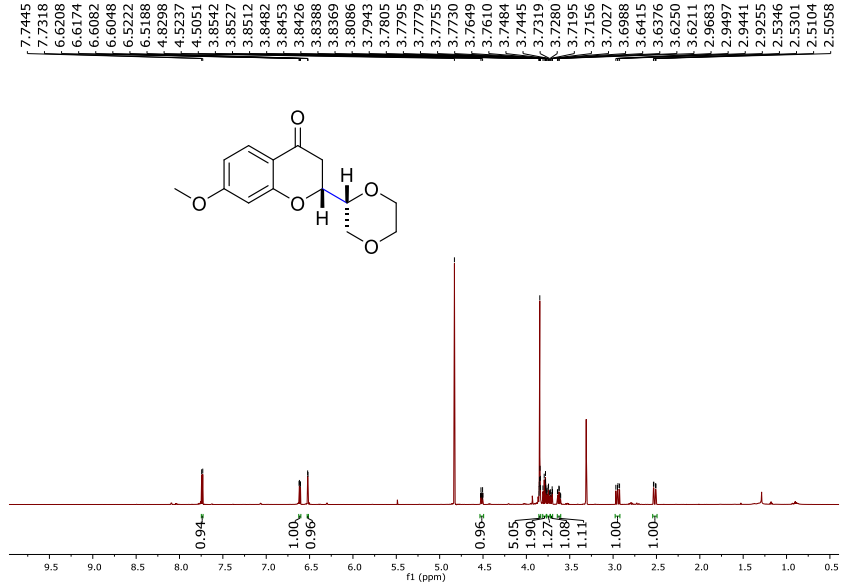


**<sup>13</sup>C NMR**

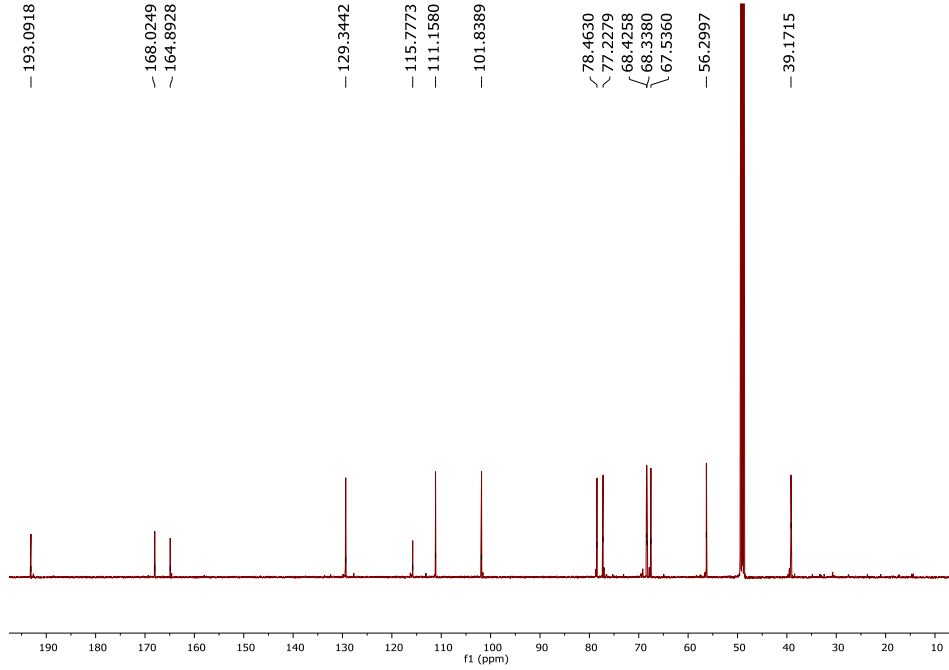


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-7-methoxychroman-4-one (3e')**

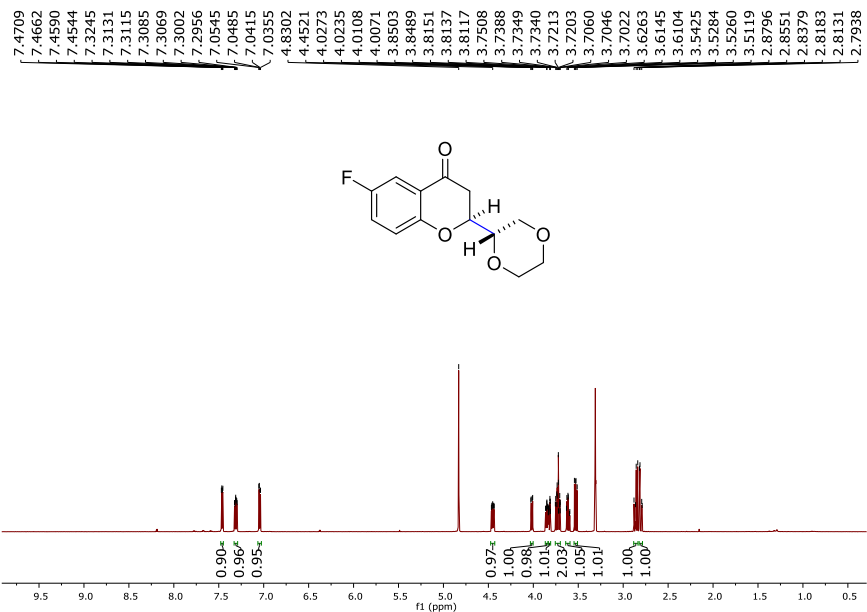
**<sup>1</sup>H NMR (Isomer 2)**



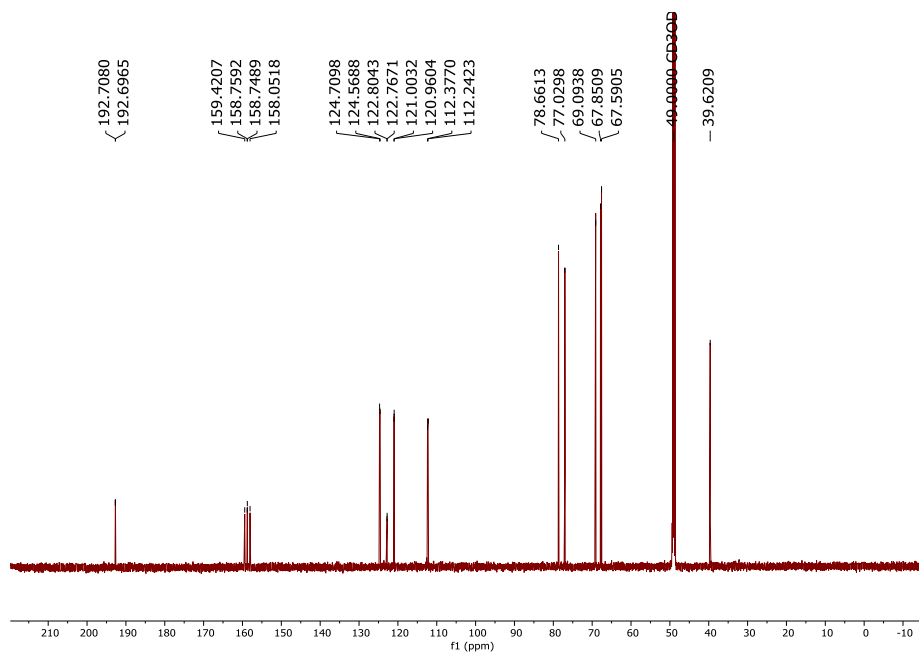
**<sup>13</sup>C NMR**



**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-6-fluorochroman-4-one (3f)**  
**<sup>1</sup>H NMR (Isomer 1)**

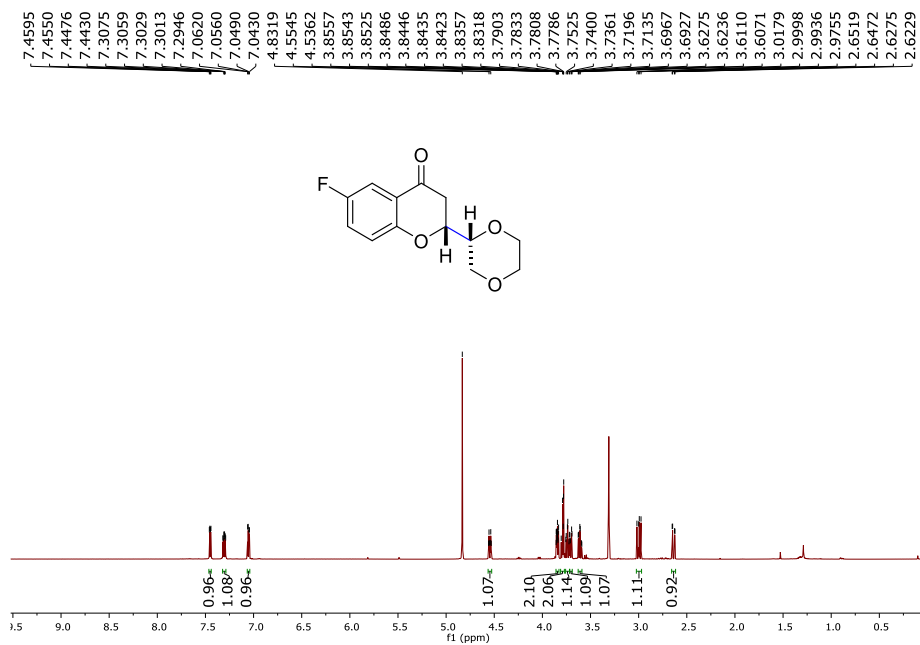


**<sup>13</sup>C NMR (Isomer 1)**

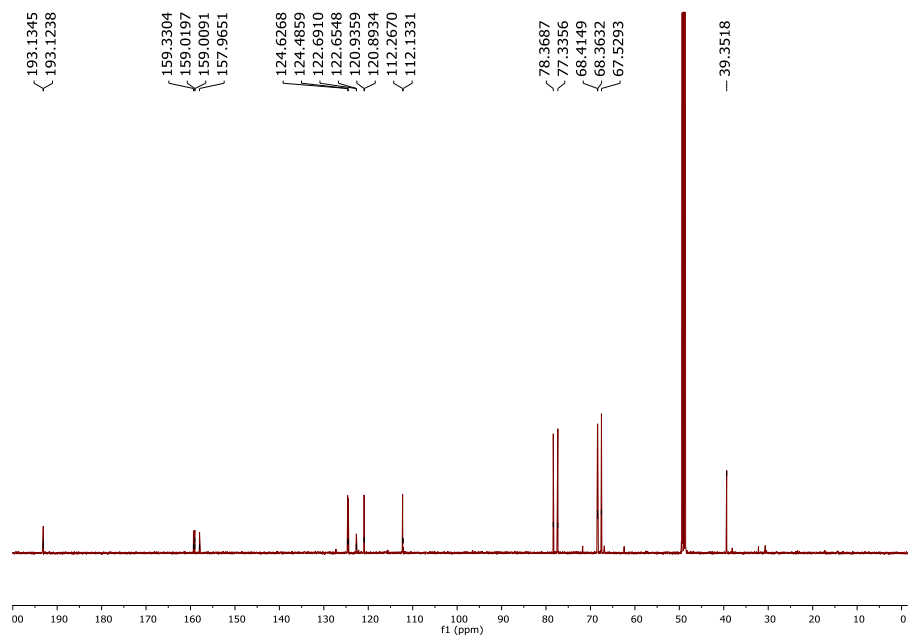


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-6-fluorochroman-4-one (3f')**

**<sup>1</sup>H NMR (Isomer 2)**

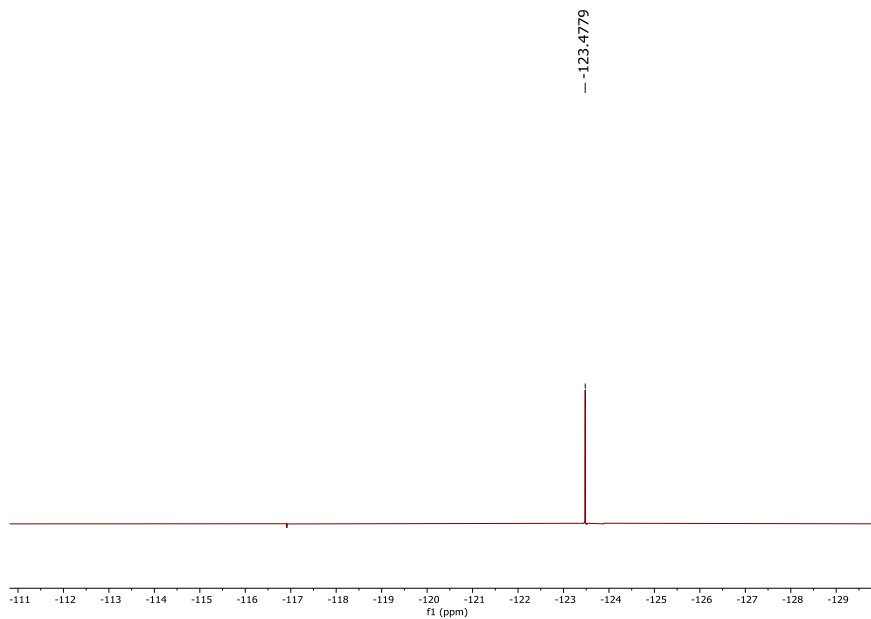


**<sup>13</sup>C NMR (Isomer 2)**

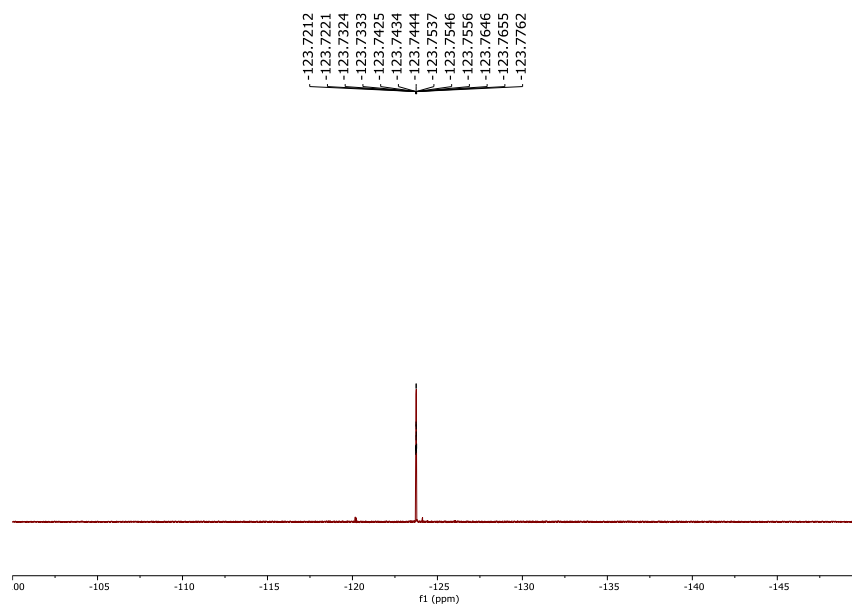




**<sup>19</sup>F NMR  
(Isomer 1)**

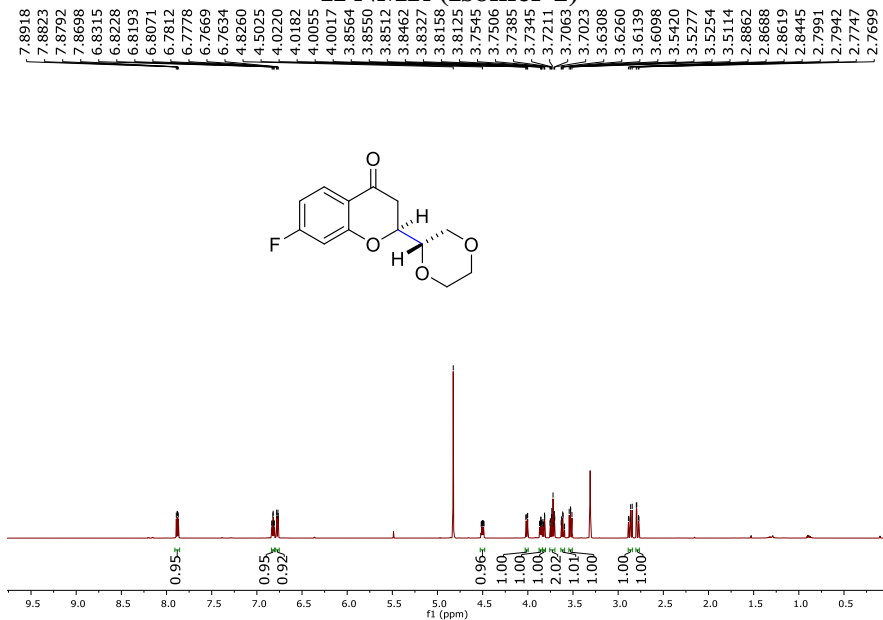


**<sup>19</sup>F NMR  
(Isomer 2)**

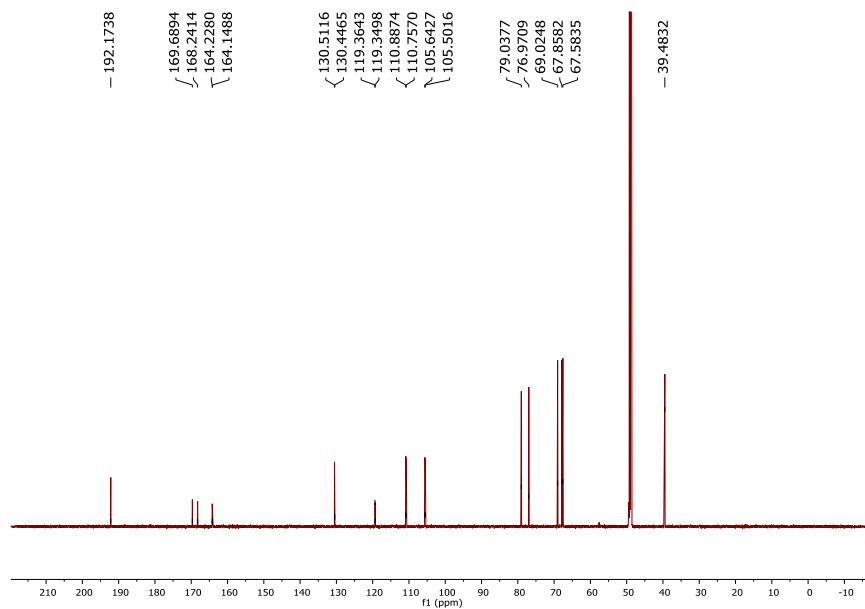


**(S\*)-2-((S\*)-1,4-dioxan-2-yl)-7-fluorochroman-4-one (3g):**

**<sup>1</sup>H NMR (Isomer 1)**

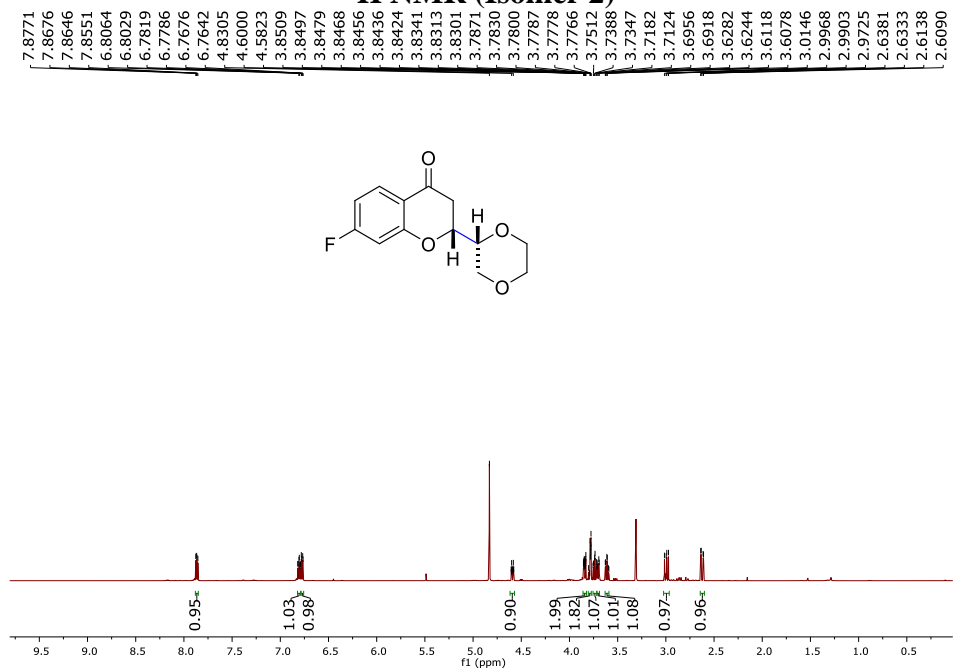


**<sup>13</sup>C NMR (Isomer 1)**

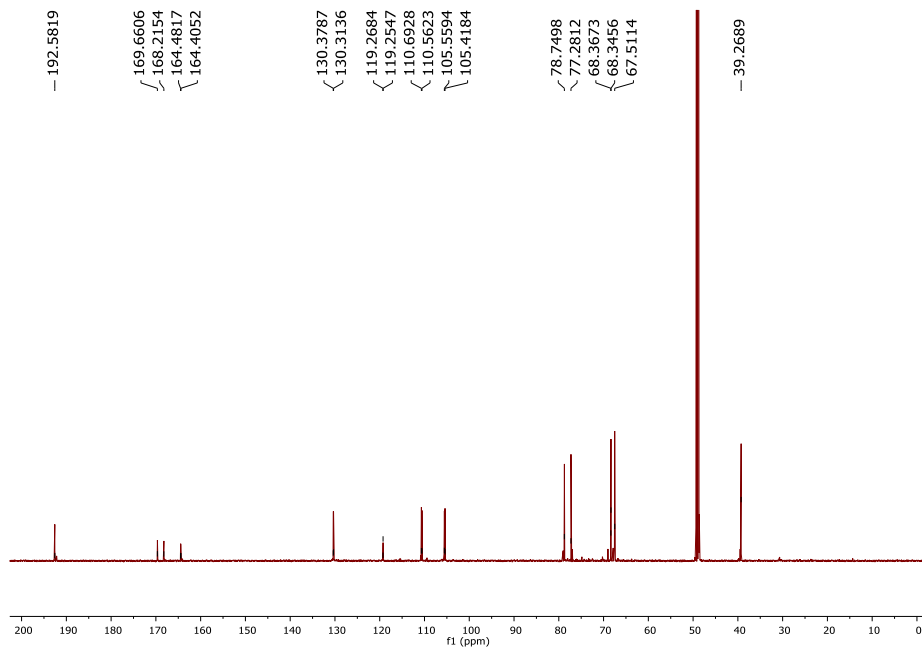


**(R\*)-2-((R\*)-1,4-dioxan-2-yl)-7-fluorochroman-4-one (3g')**

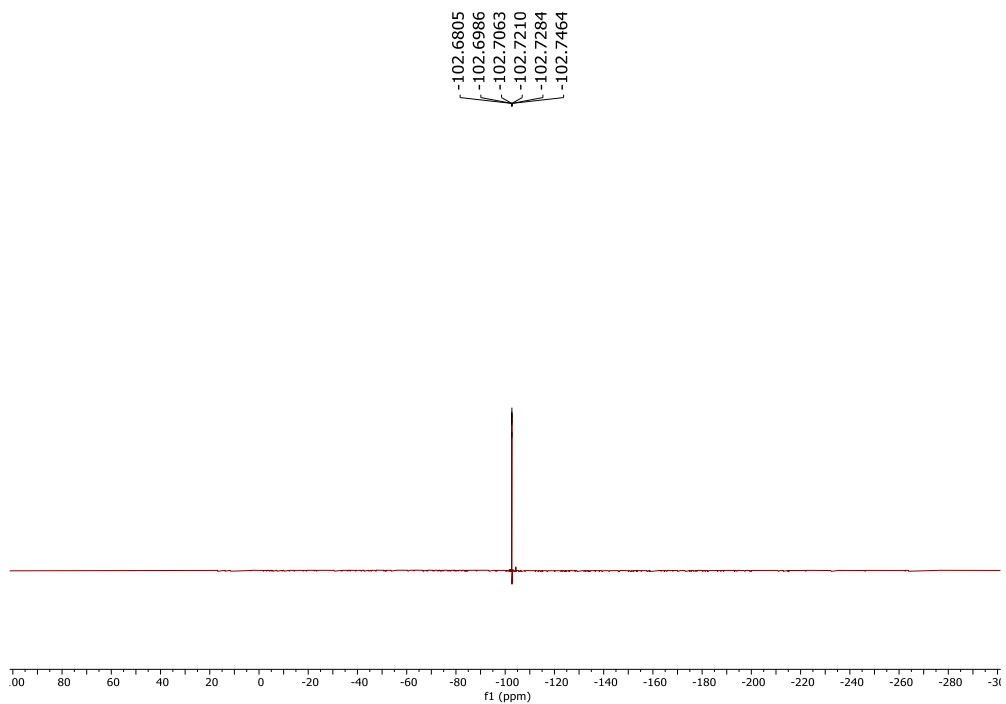
**<sup>1</sup>H NMR (Isomer 2)**



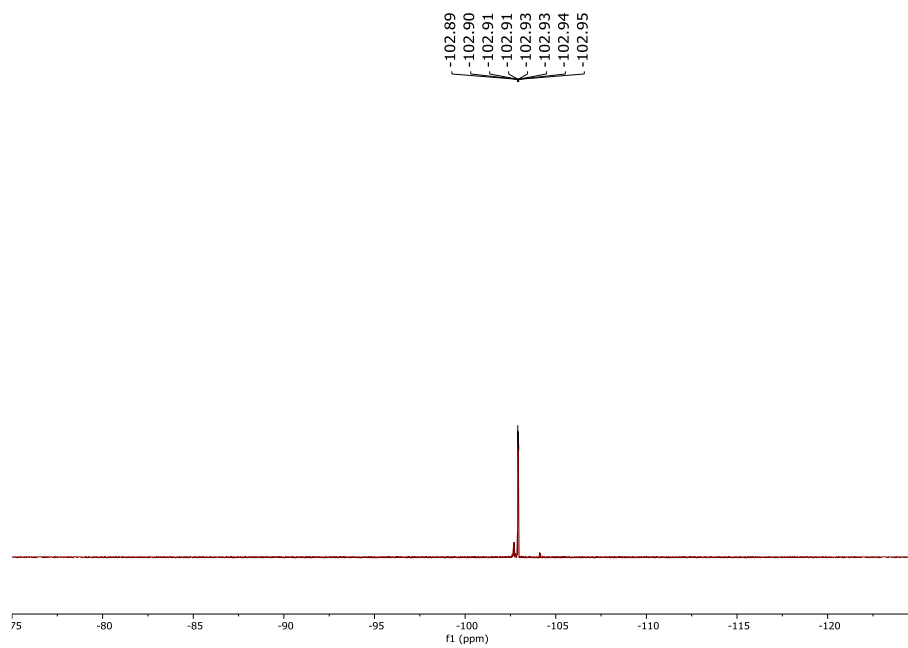
**<sup>13</sup>C NMR (Isomer 2)**



### <sup>19</sup>F NMR (Isomer 1)

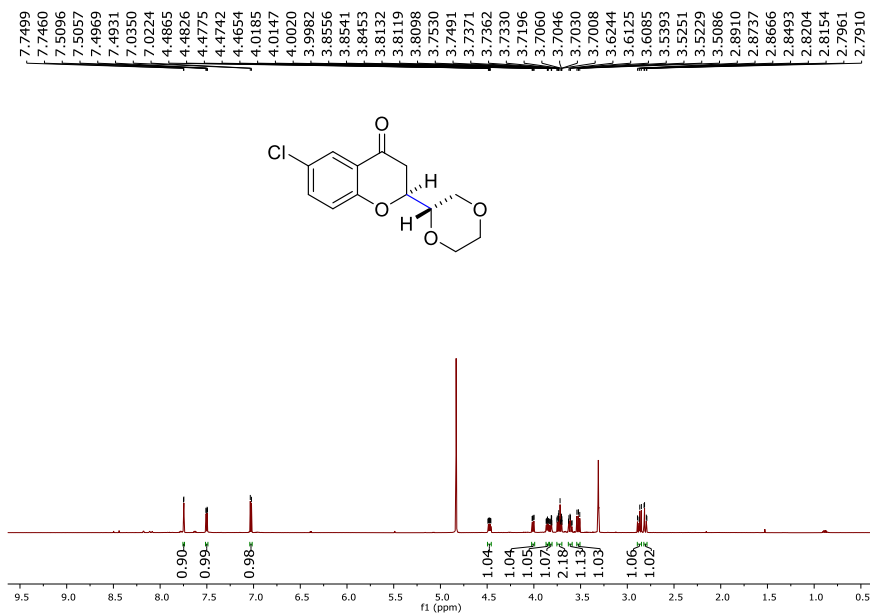


### <sup>19</sup>F NMR (Isomer 2)

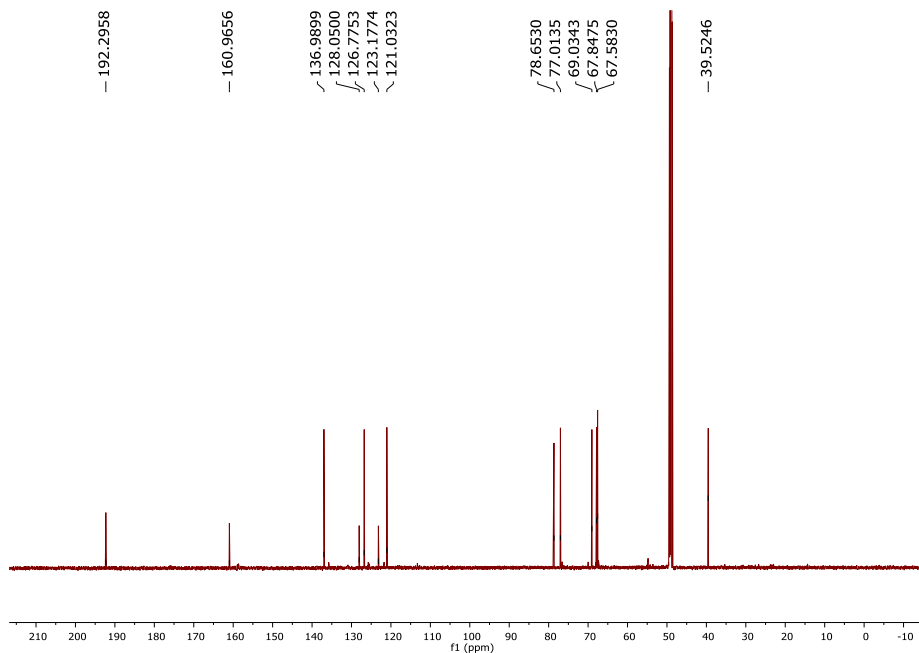


**(S\*)-6,8-dichloro-2-((S\*)1,4-dioxan-2-yl)chroman-4-one (3h):**

**<sup>1</sup>H NMR (Isomer 1)**

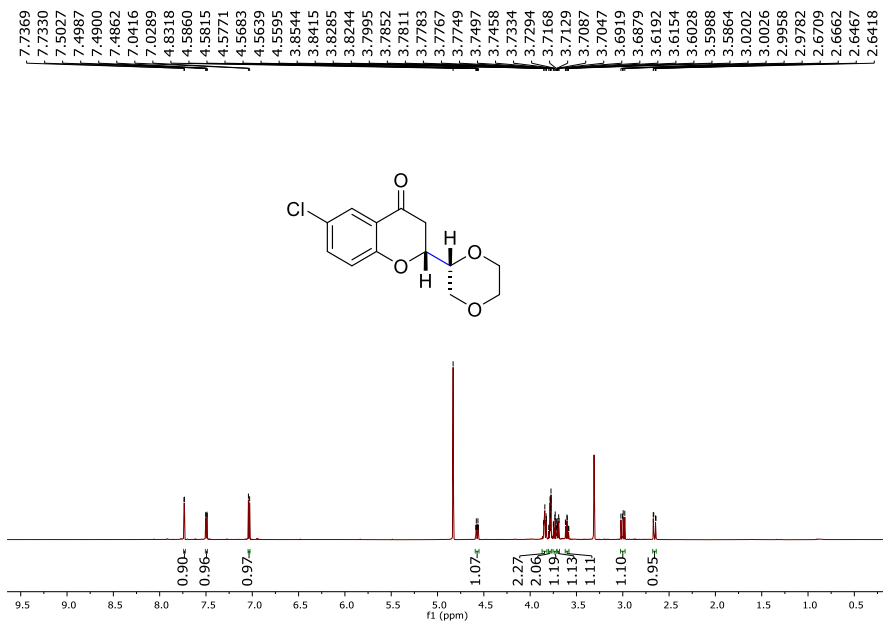


**<sup>13</sup>C NMR (Isomer 1)**

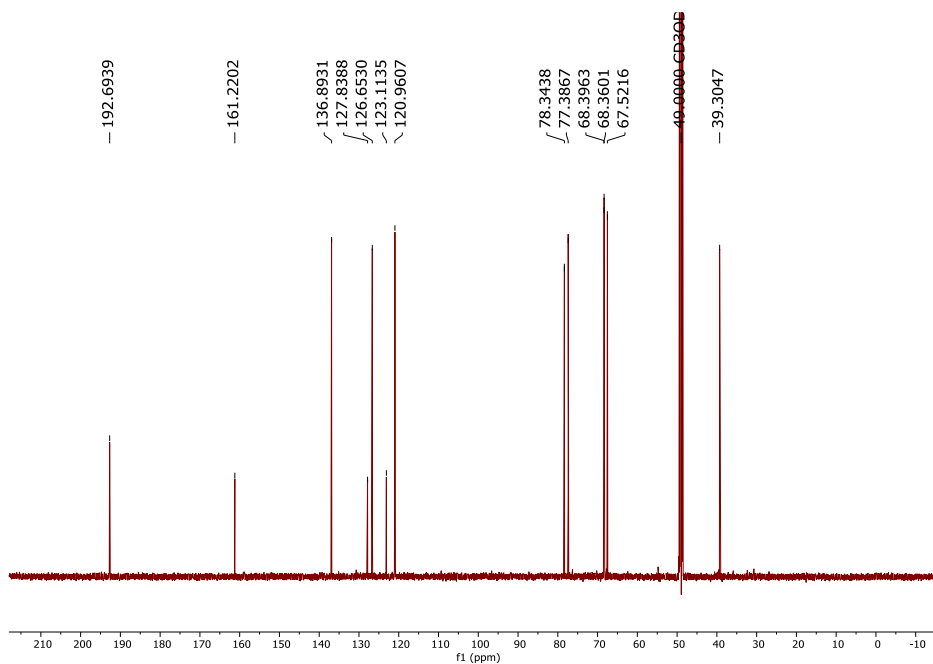


**(R\*)-6,8-dichloro-2-((R\*)1,4-dioxan-2-yl)chroman-4-one (3h')**:

**<sup>1</sup>H NMR (Isomer 2)**

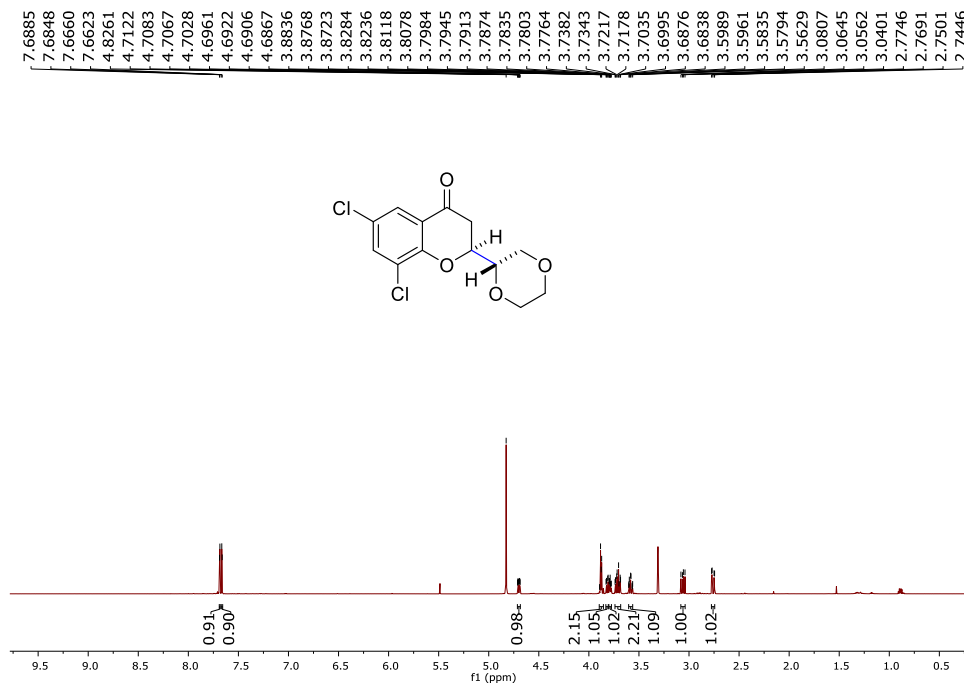


**<sup>13</sup>C NMR (Isomer 2)**

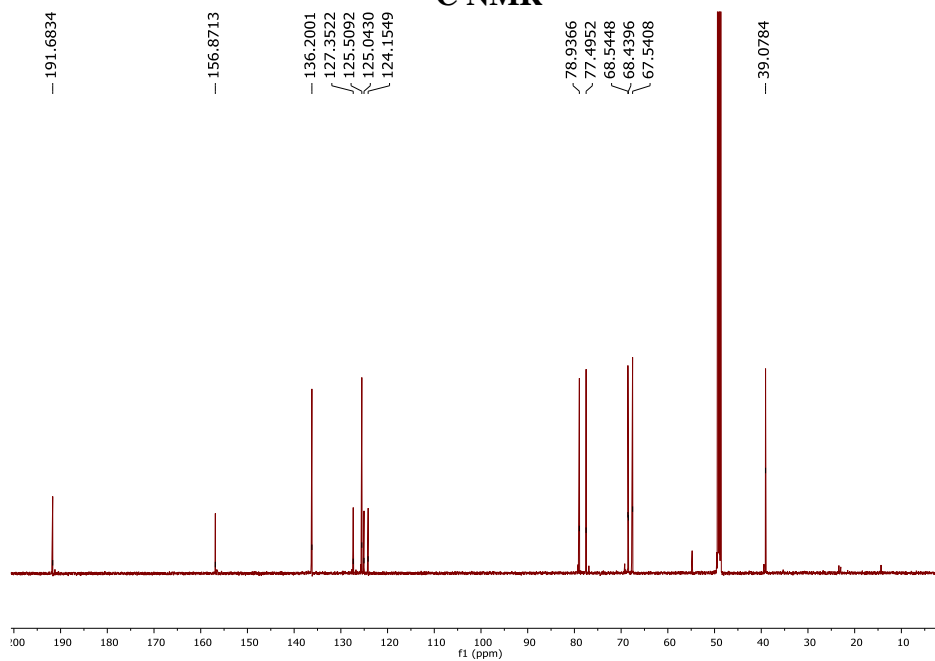


**(S\*)-6,8-dichloro-2-((S\*)1,4-dioxan-2-yl)chroman-4-one (3i):**

**<sup>1</sup>H NMR**

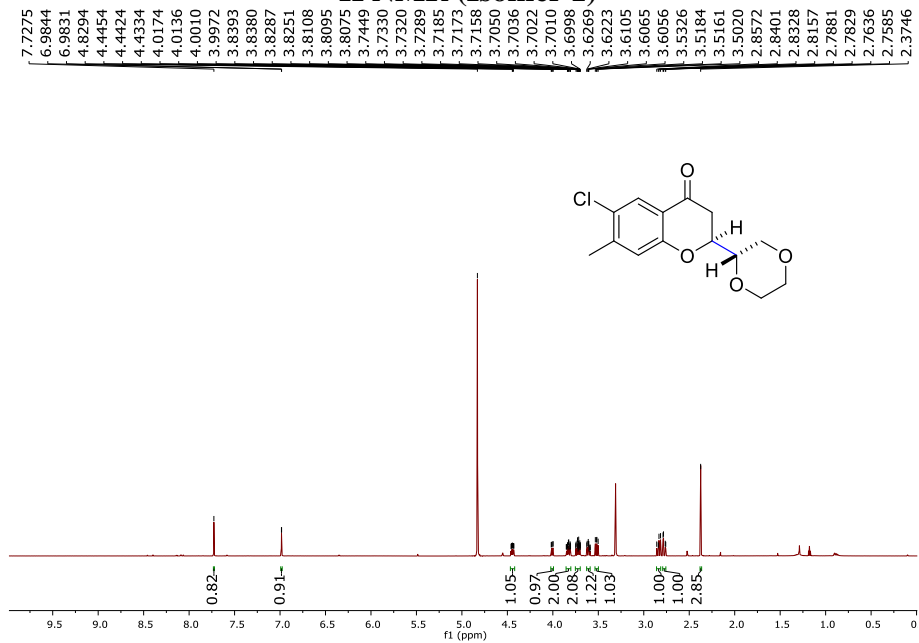


**<sup>13</sup>C NMR**

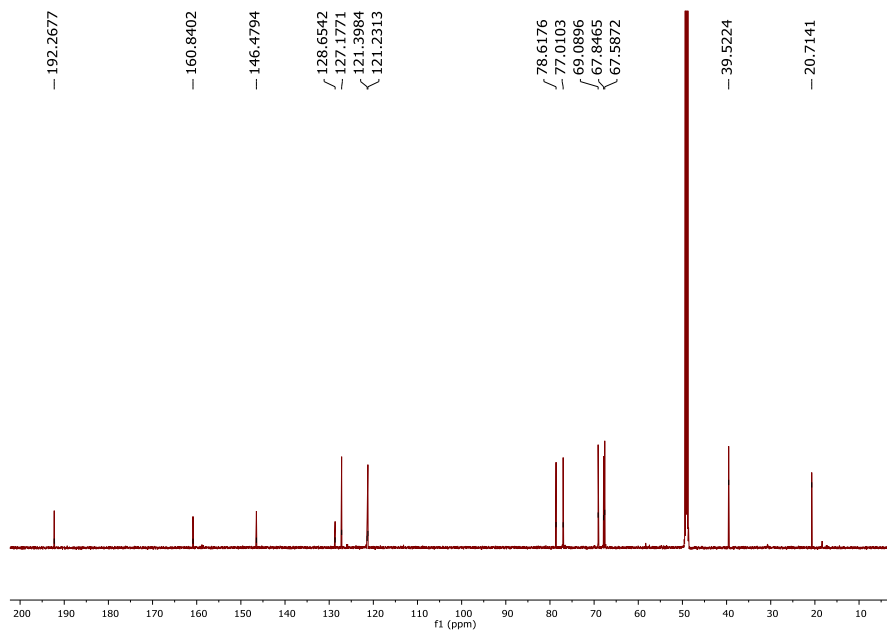


**(S\*)-6-chloro-2-((S\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3j):**

**<sup>1</sup>H NMR (Isomer 1)**

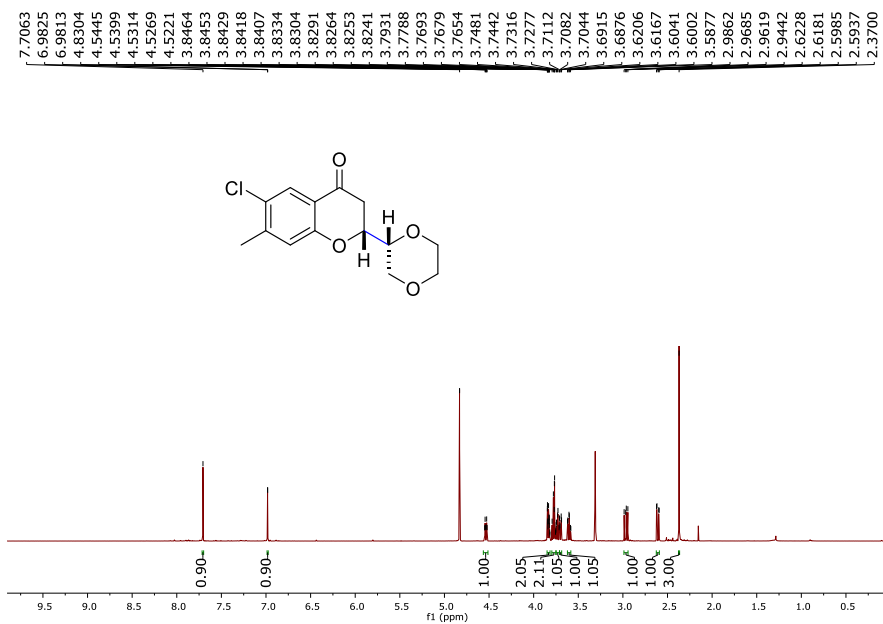


**<sup>13</sup>C NMR (Isomer 1)**

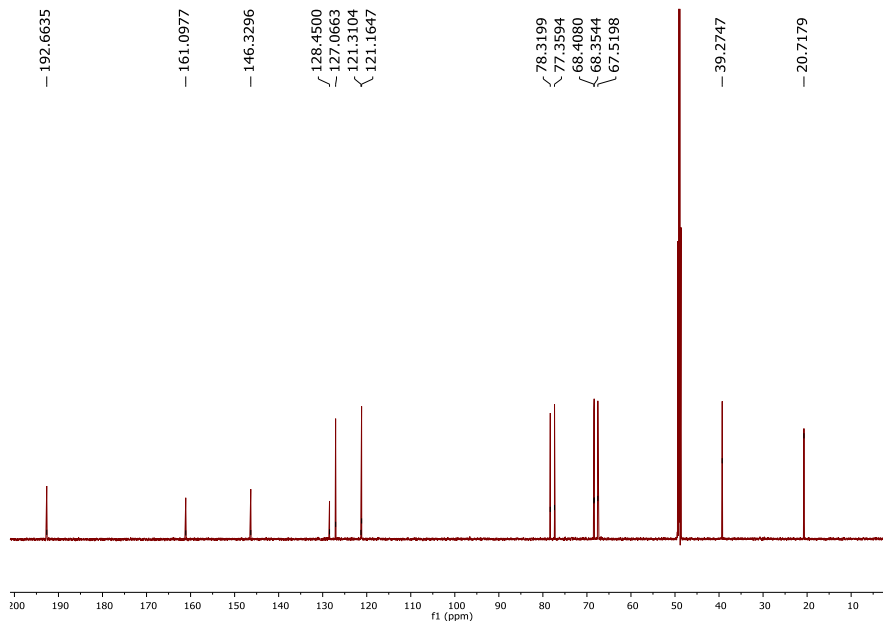




**(R\*)-6-chloro-2-((R\*)-1,4-dioxan-2-yl)-7-methylchroman-4-one (3j'):**  
**<sup>1</sup>H NMR (Isomer 2)**

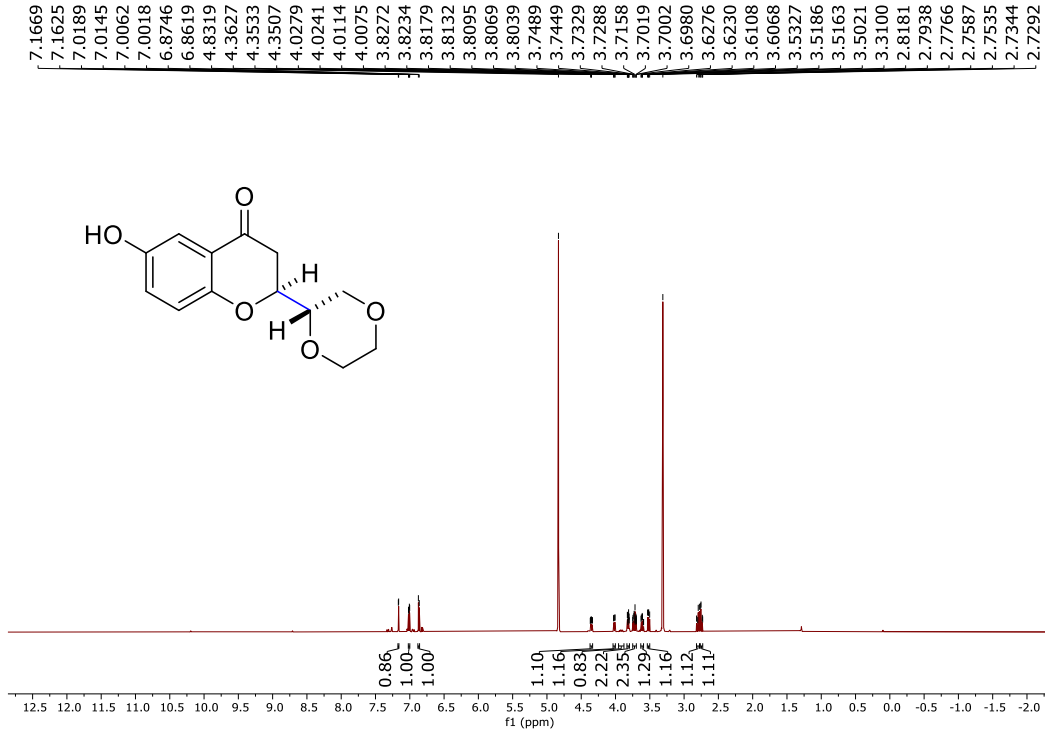


**<sup>13</sup>C NMR (Isomer 2)**

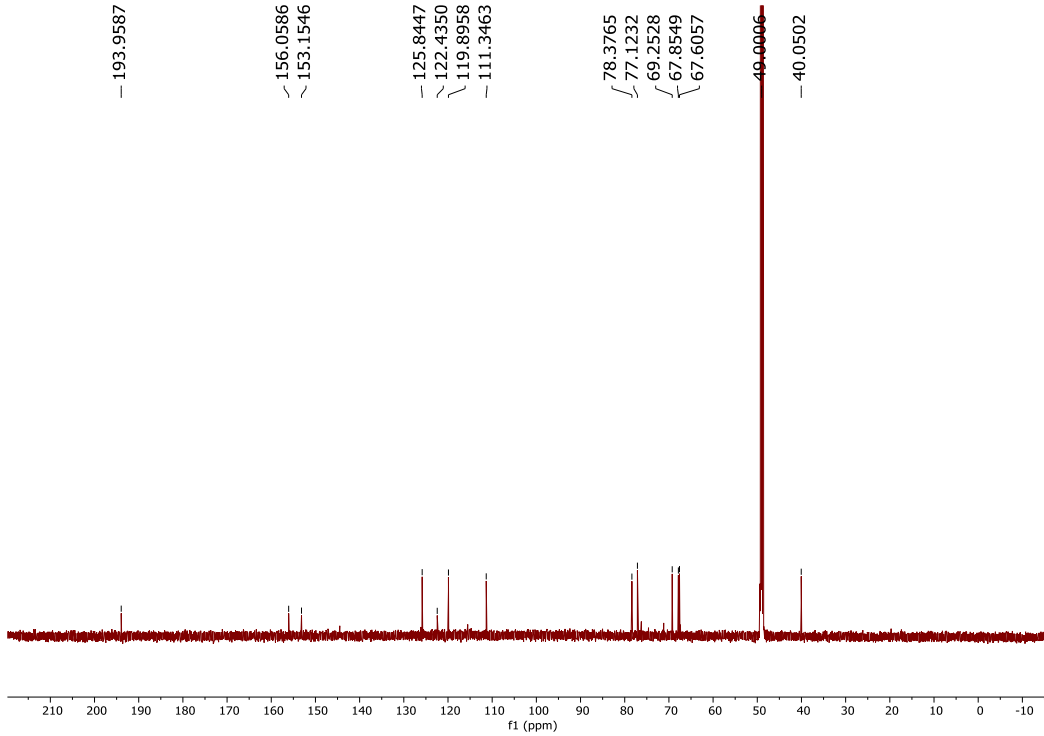


# 2-(1,4-dioxan-2-yl)-6-hydroxychroman-4-one (3k)

## <sup>1</sup>H NMR (CD<sub>3</sub>OD)

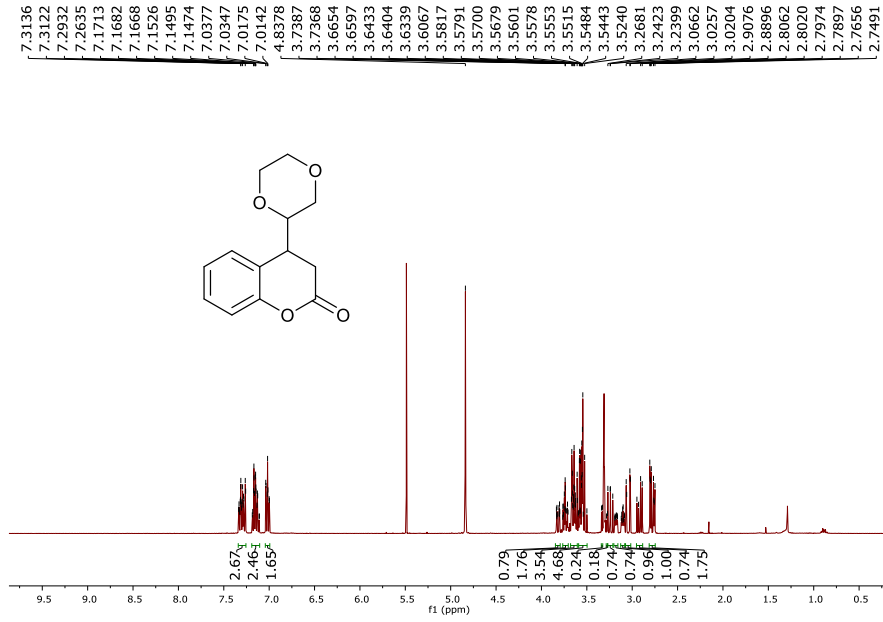


## <sup>13</sup>C NMR (CD<sub>3</sub>OD)

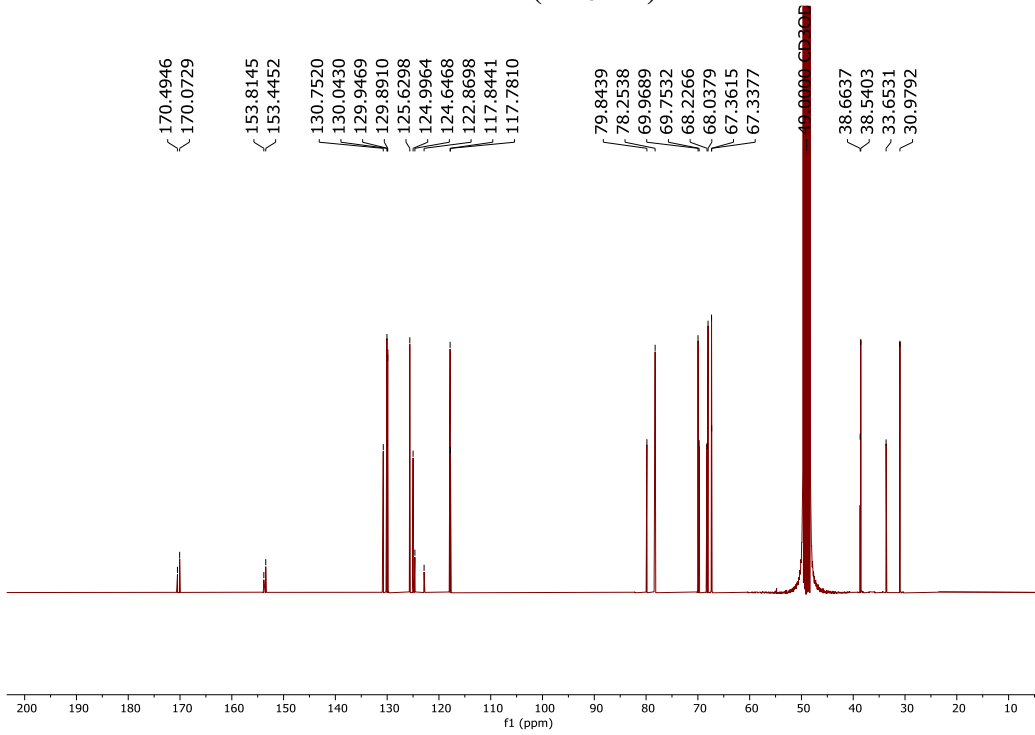


# 4-(1,4-dioxan-2-yl)chroman-2-one (31)

## <sup>1</sup>H NMR (CD<sub>3</sub>OD)

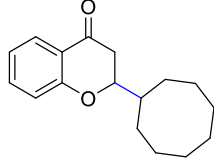
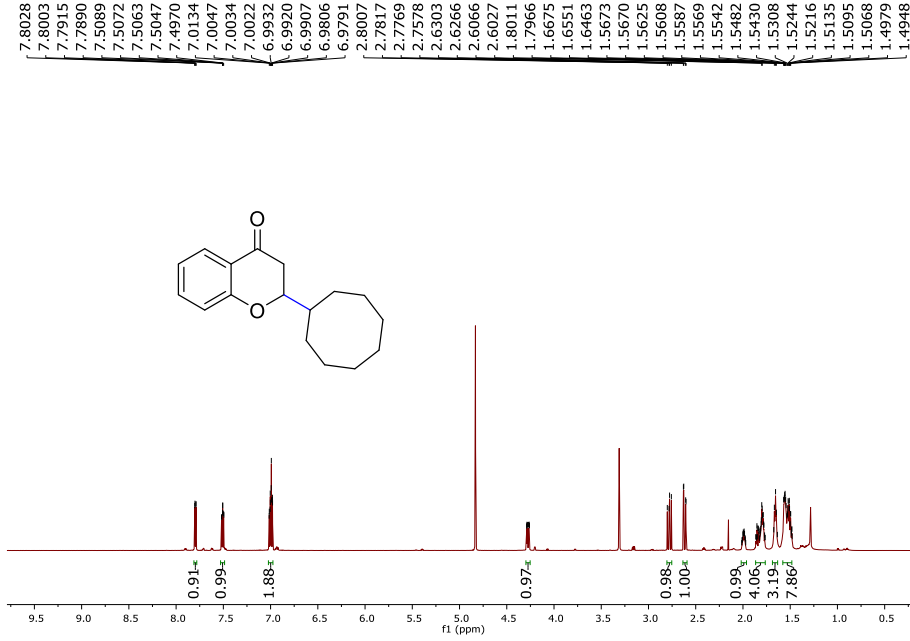


## <sup>13</sup>C NMR (CD<sub>3</sub>OD)

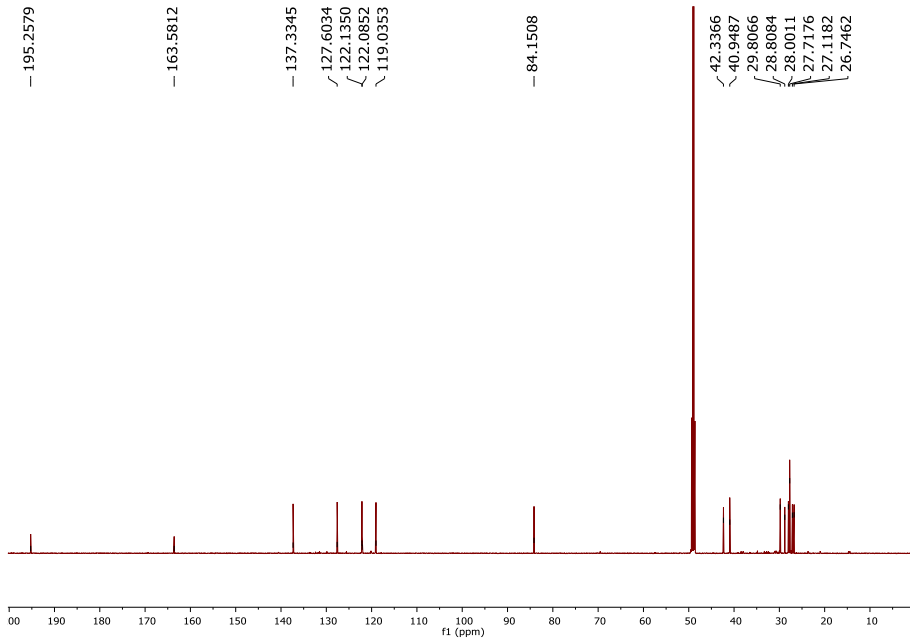


## 2-cyclooctylchroman-4-one (3m):

### <sup>1</sup>H NMR

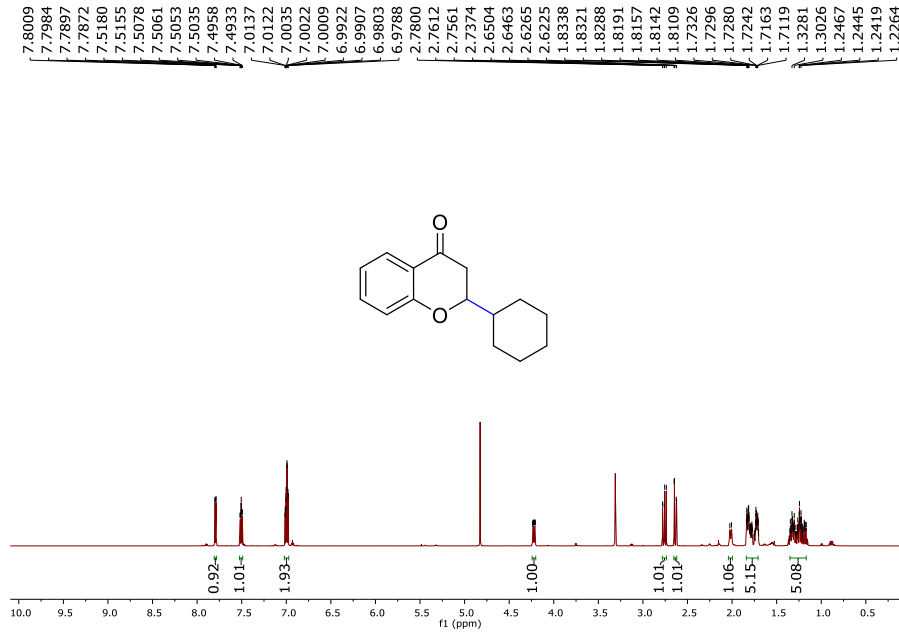


### <sup>13</sup>C NMR

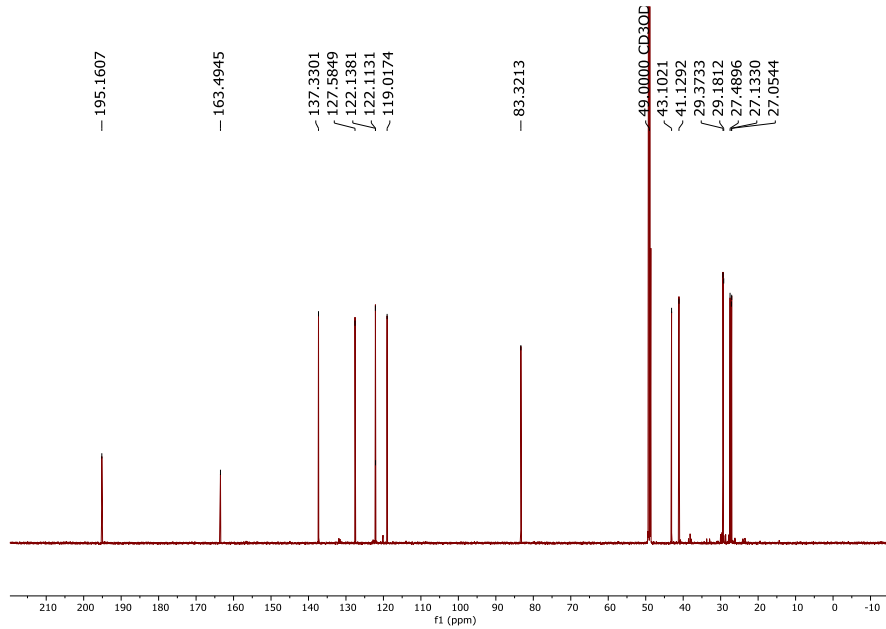


## 2-cyclohexylchroman-4-one (3n):

### <sup>1</sup>H NMR

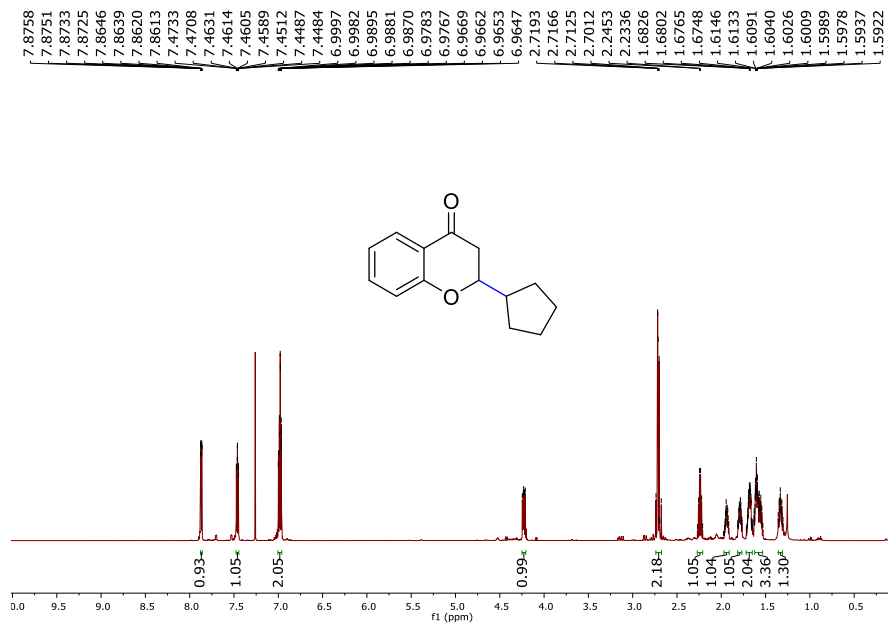


### <sup>13</sup>C NMR

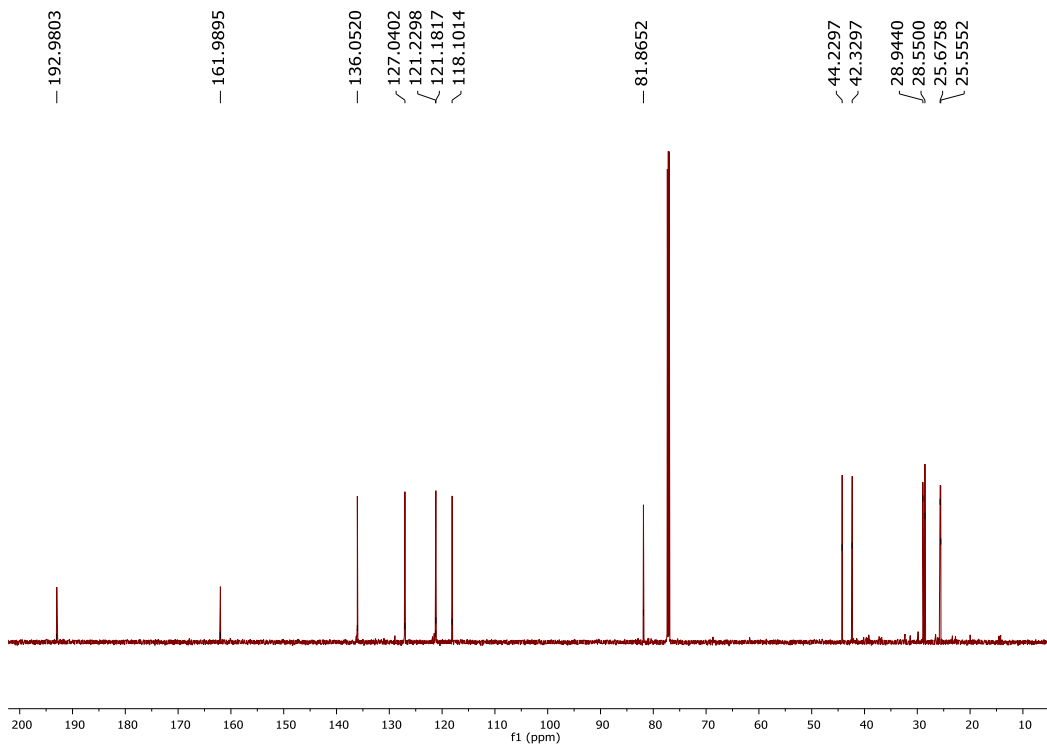


## 2-cyclopentylchroman-4-one (3o):

### <sup>1</sup>H NMR

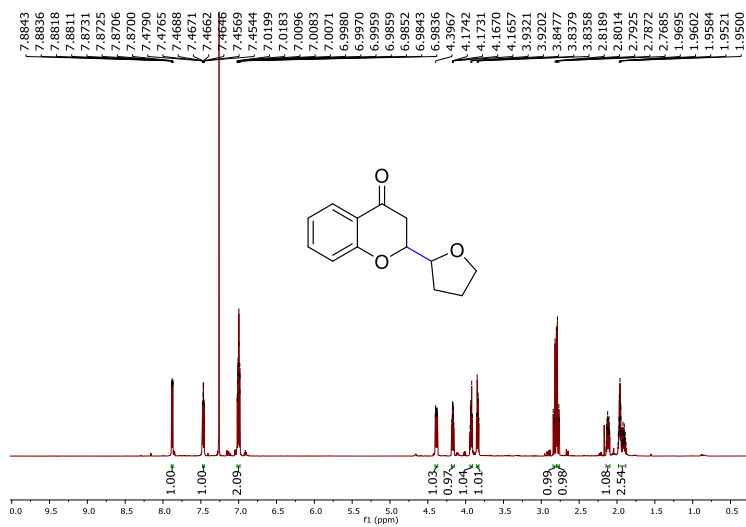


### <sup>13</sup>C NMR

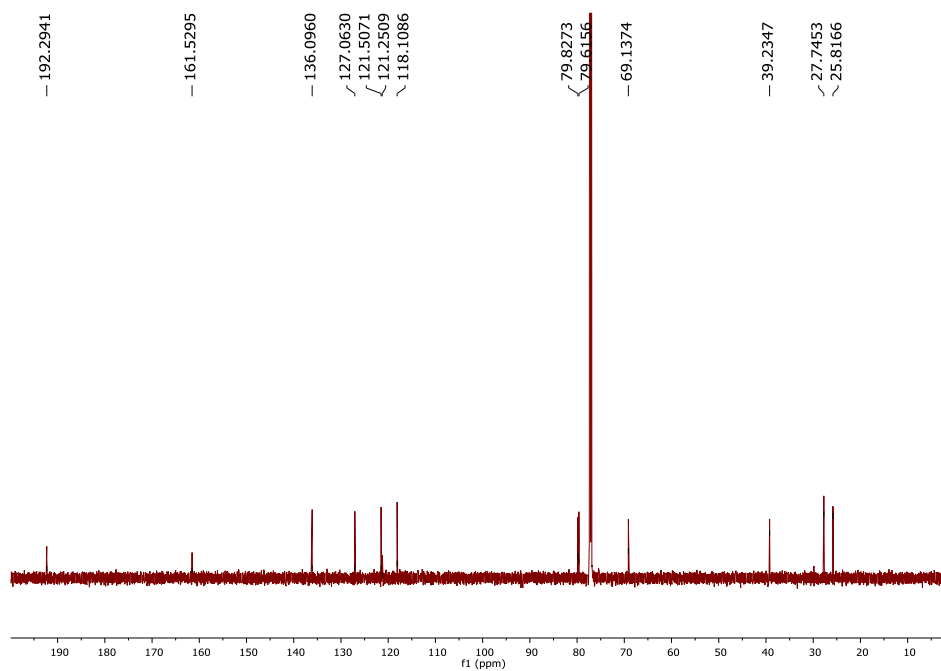


## 2-(tetrahydrofuran-2-yl)chroman-4-one (3p):

### <sup>1</sup>H NMR (Isomer 1)

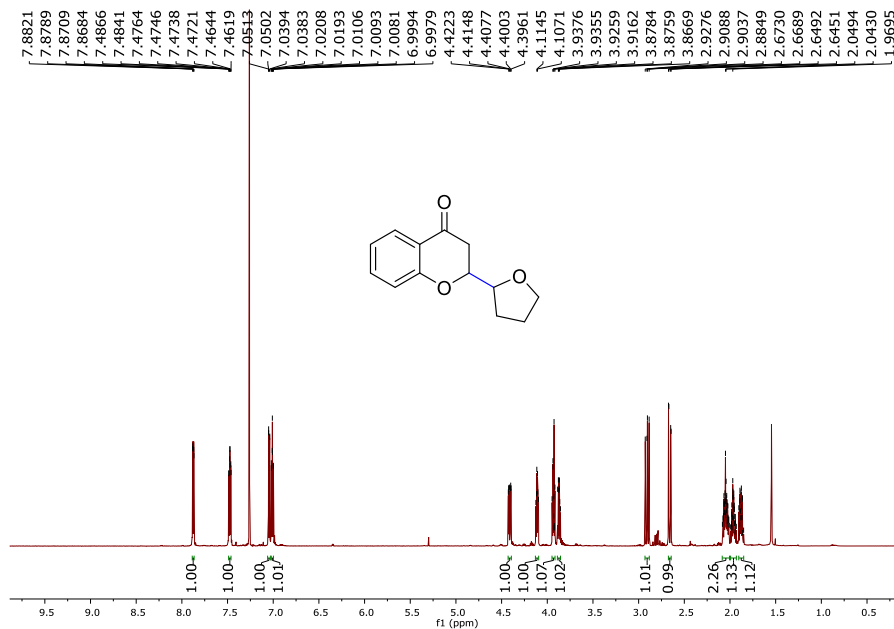


### <sup>13</sup>C NMR (Isomer 1)

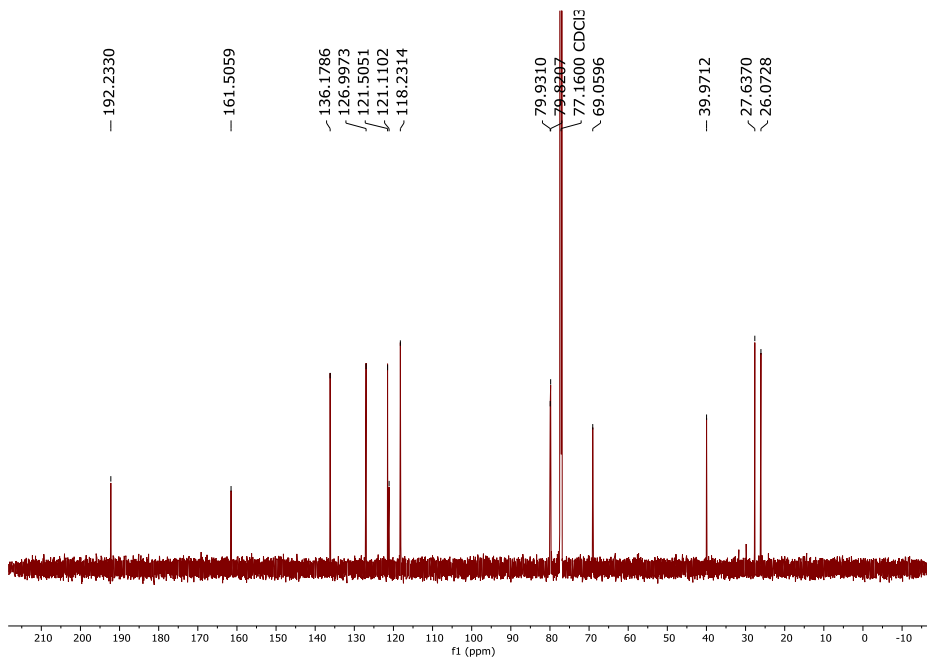


## 2-(tetrahydrofuran-2-yl)chroman-4-one (3p')

### <sup>1</sup>H NMR (Isomer 2)



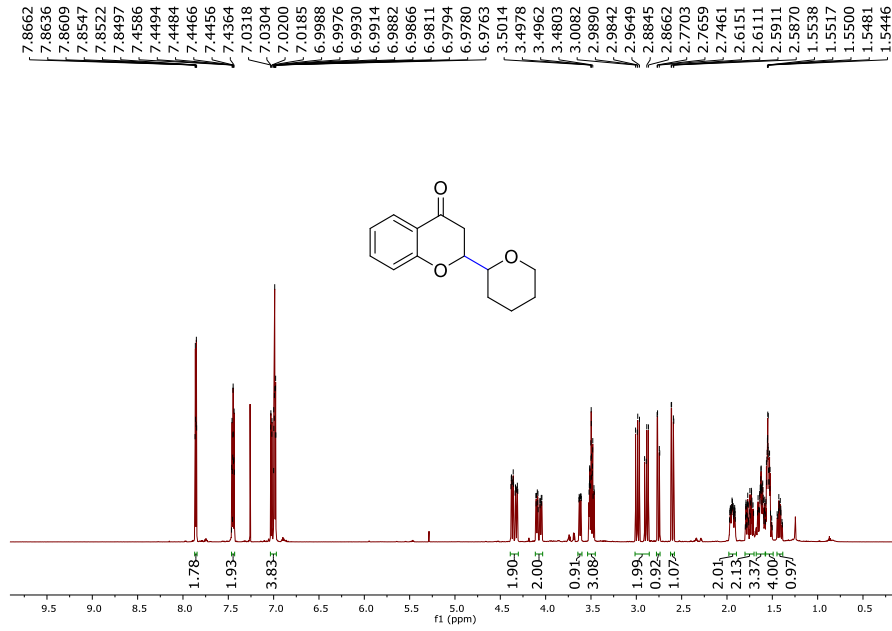
### <sup>13</sup>C NMR (Isomer 2)



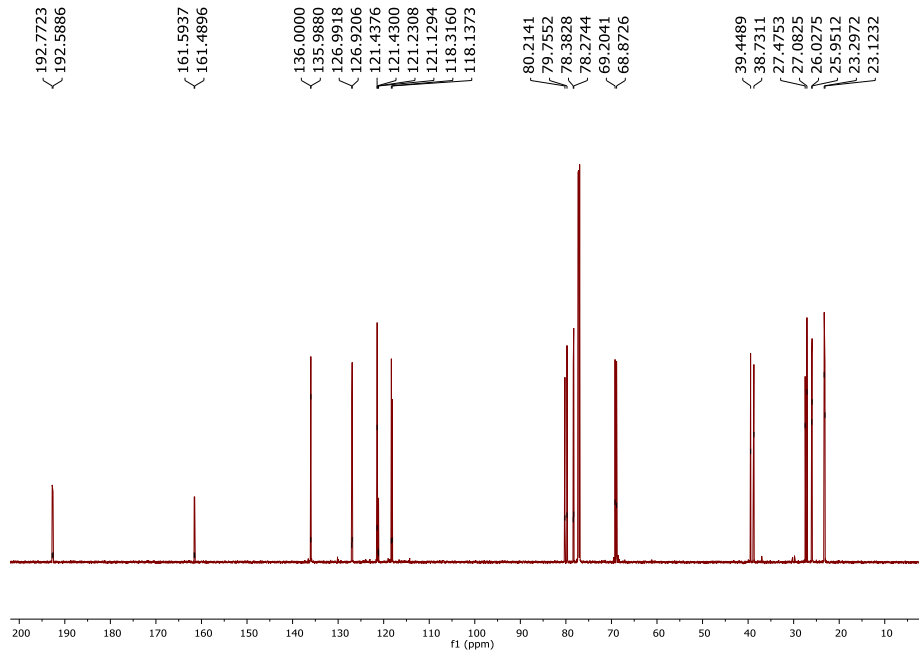


## 2-(tetrahydro-2H-pyran-2-yl)chroman-4-one (3q):

### <sup>1</sup>H NMR

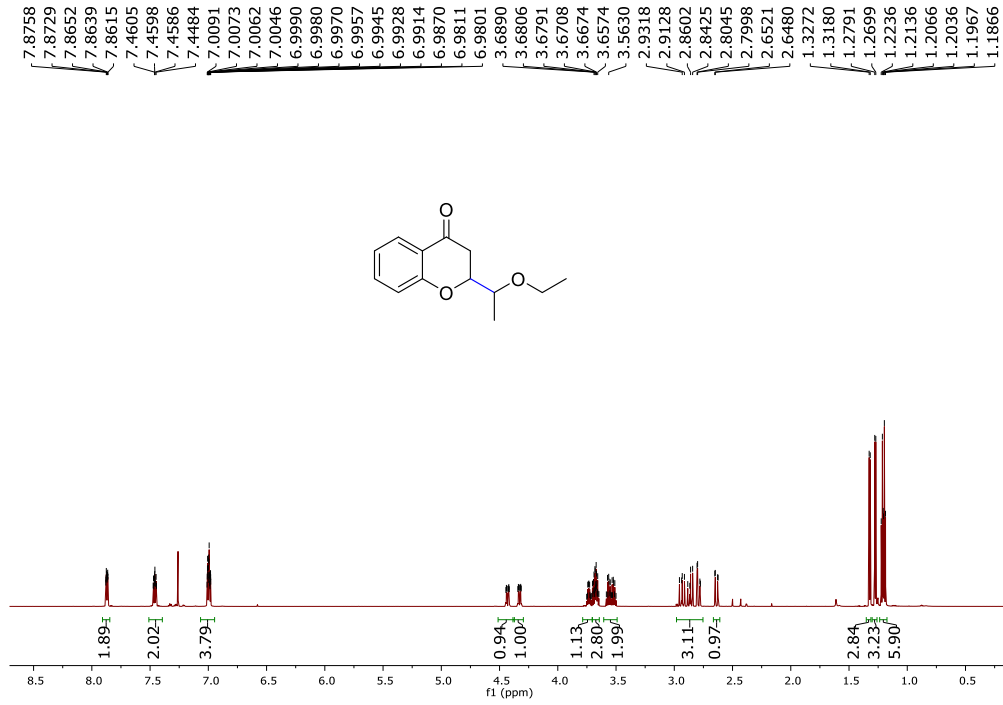


### <sup>13</sup>C NMR

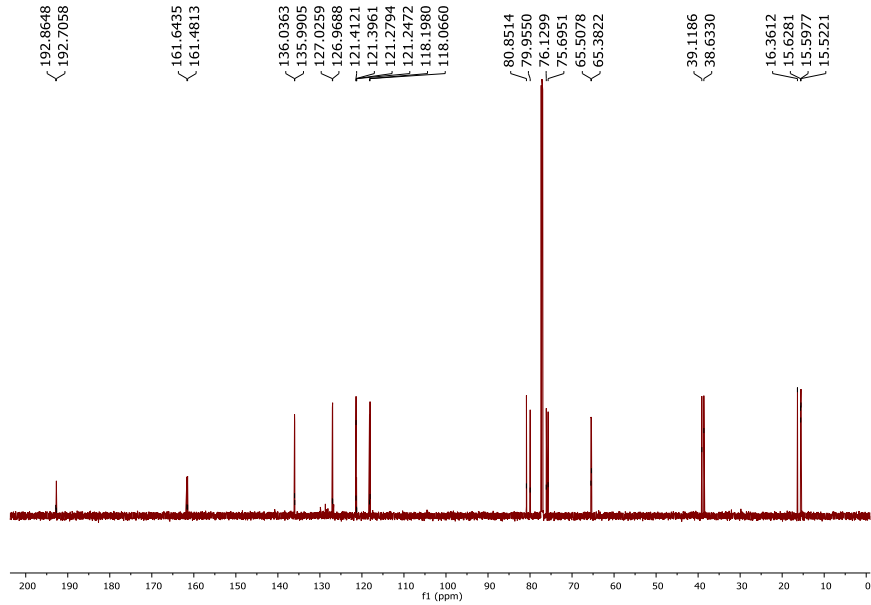


## 2-(1-ethoxyethyl)chroman-4-one (3r):

### <sup>1</sup>H NMR

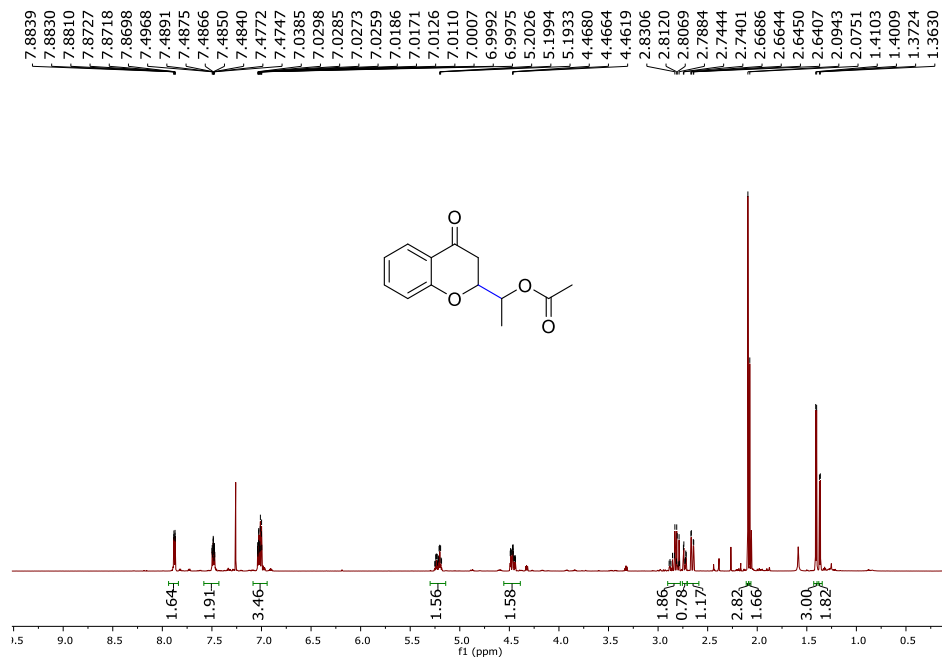


### <sup>13</sup>C NMR

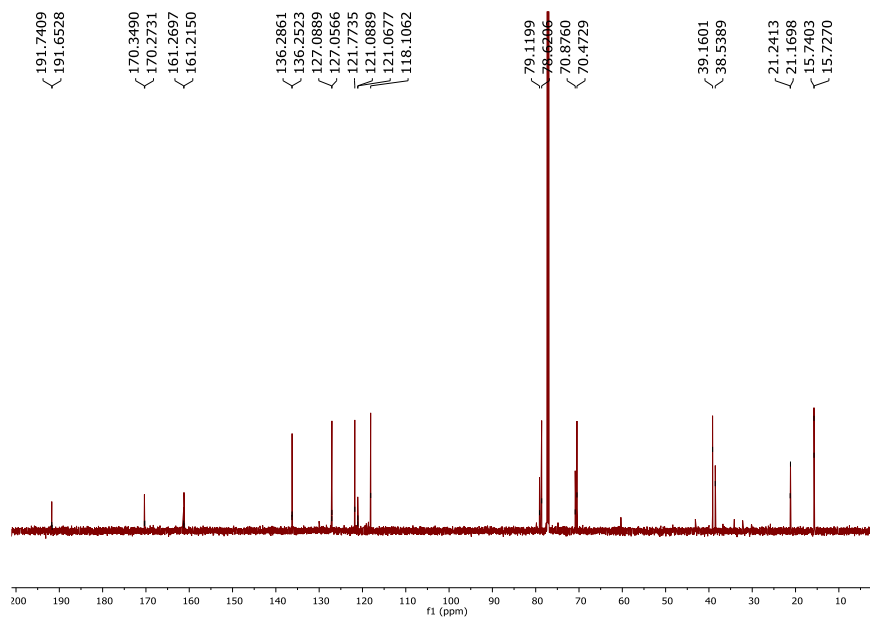


# 1-(4-oxochroman-2-yl)ethyl acetate (3s)

## <sup>1</sup>H NMR

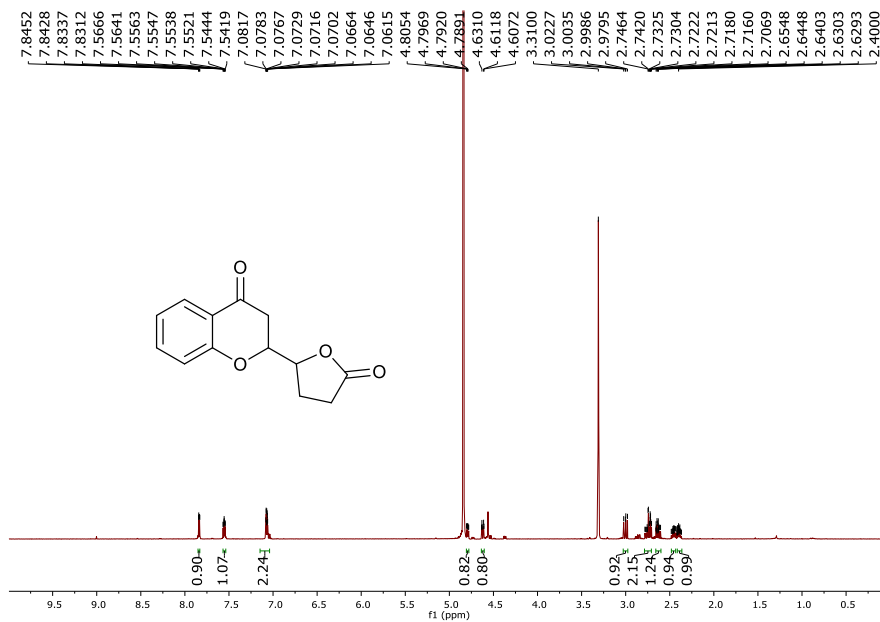


## <sup>13</sup>C NMR

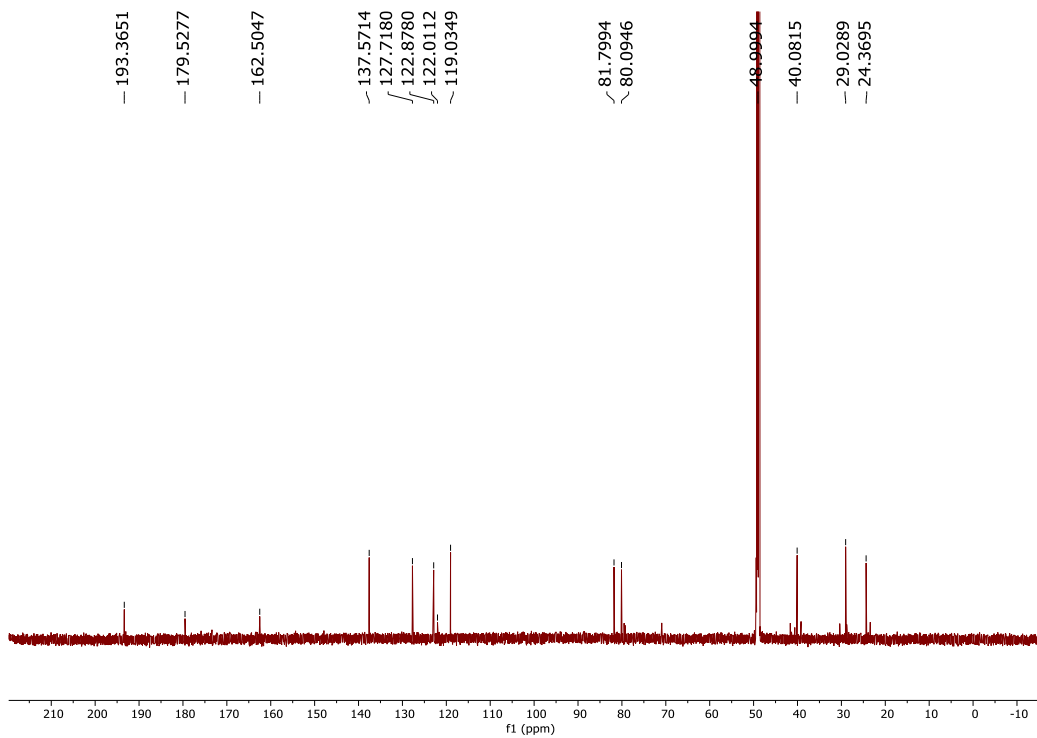


# 2-(5-oxotetrahydrofuran-2-yl)chroman-4-one (3t)

## <sup>1</sup>H NMR (CD<sub>3</sub>OD)

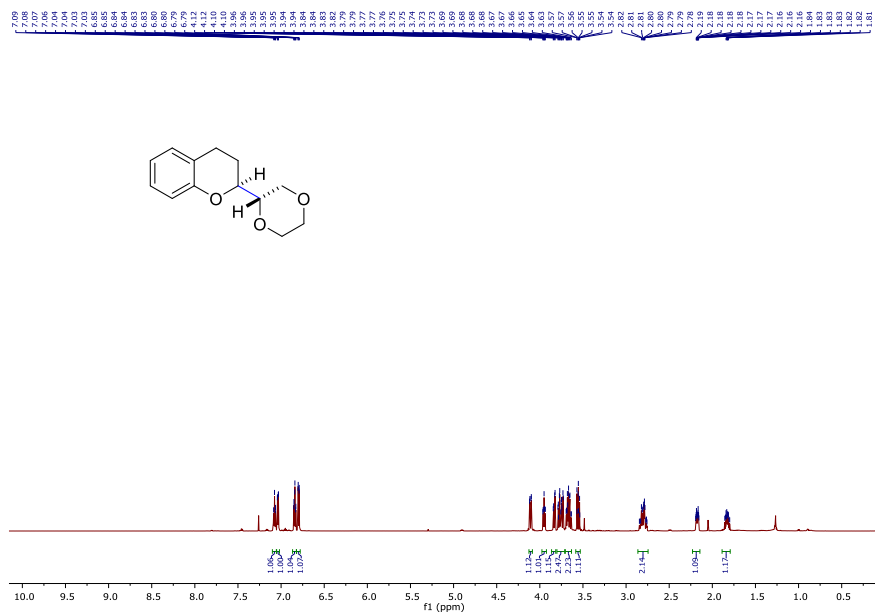


## <sup>13</sup>C NMR (CD<sub>3</sub>OD)

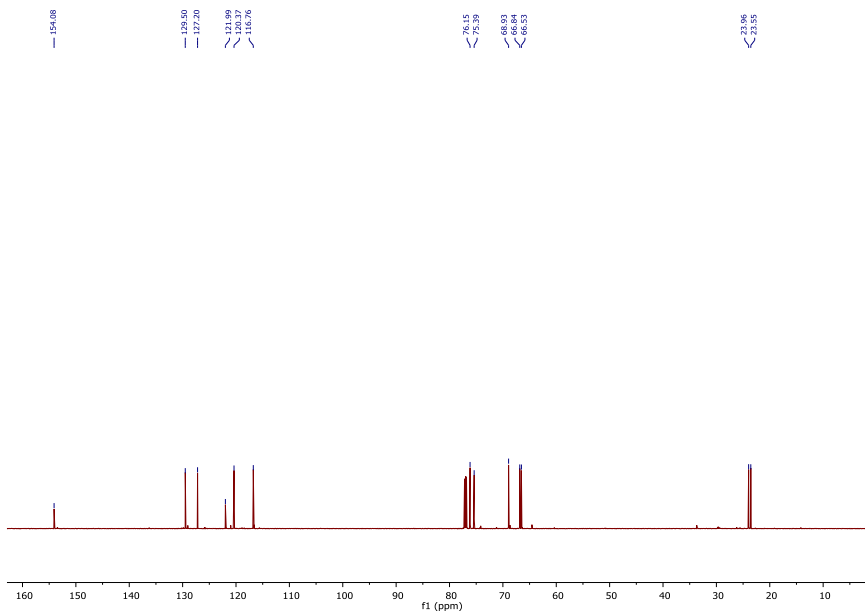


# (S\*)-2-((S\*)-1,4-dioxan-2-yl)chromane 4a

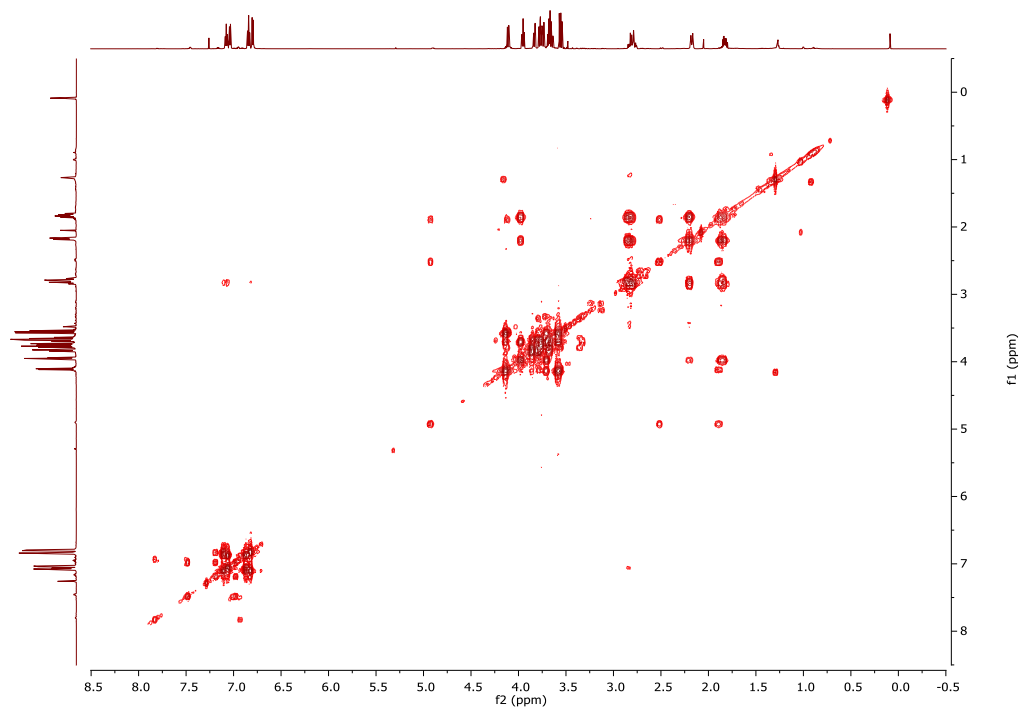
## <sup>1</sup>H NMR



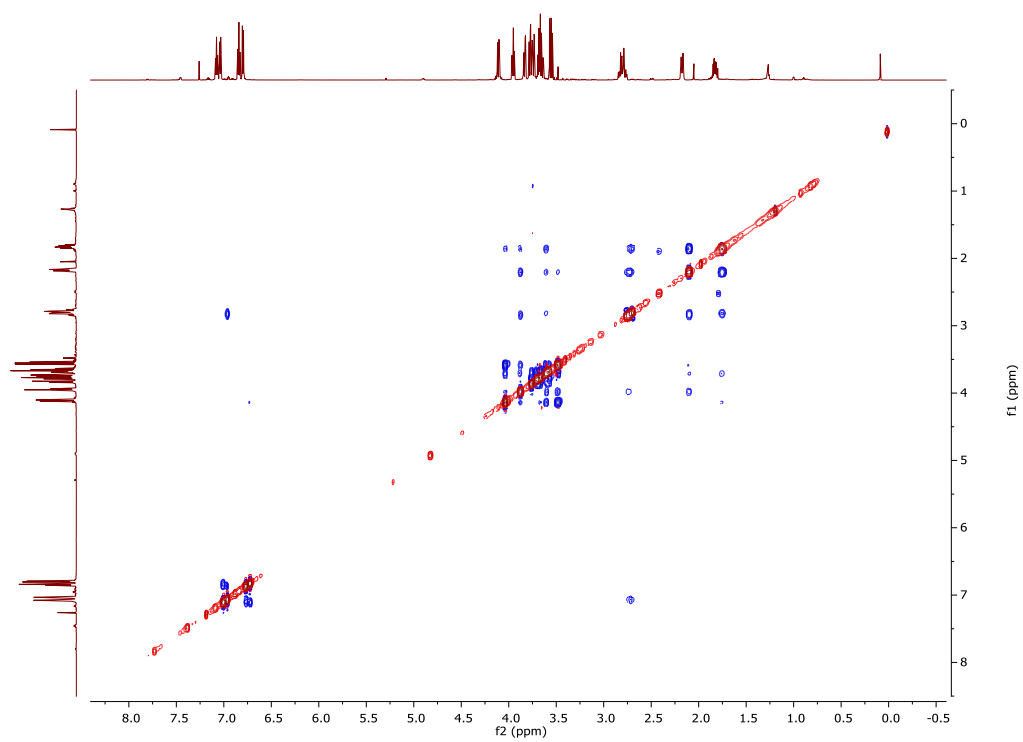
## <sup>13</sup>C NMR



**COSY NMR of (*S*<sup>\*</sup>)-2-((*S*<sup>\*</sup>)-1,4-dioxan-2-yl)chromane 4a**

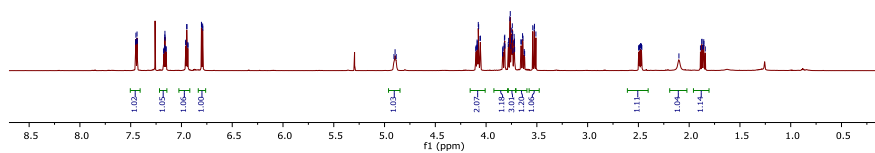
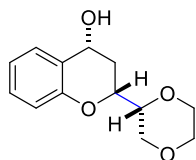


**NOESY NMR of (*S*<sup>\*</sup>)-2-((*S*<sup>\*</sup>)-1,4-dioxan-2-yl)chromane 4a**

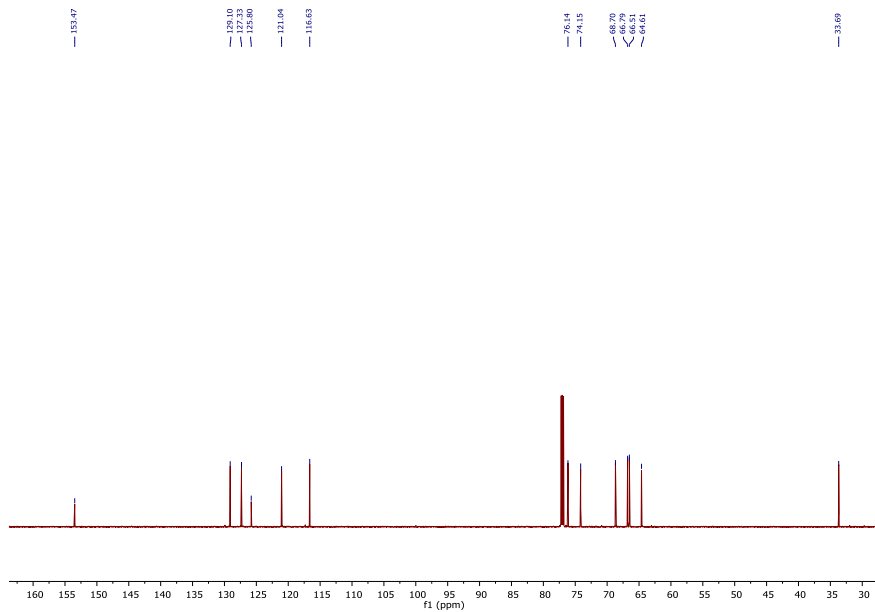


(2*R*\*,4*R*\*)-2-((*R*\*)-1,4-dioxan-2-yl)chroman-4-ol 5a'

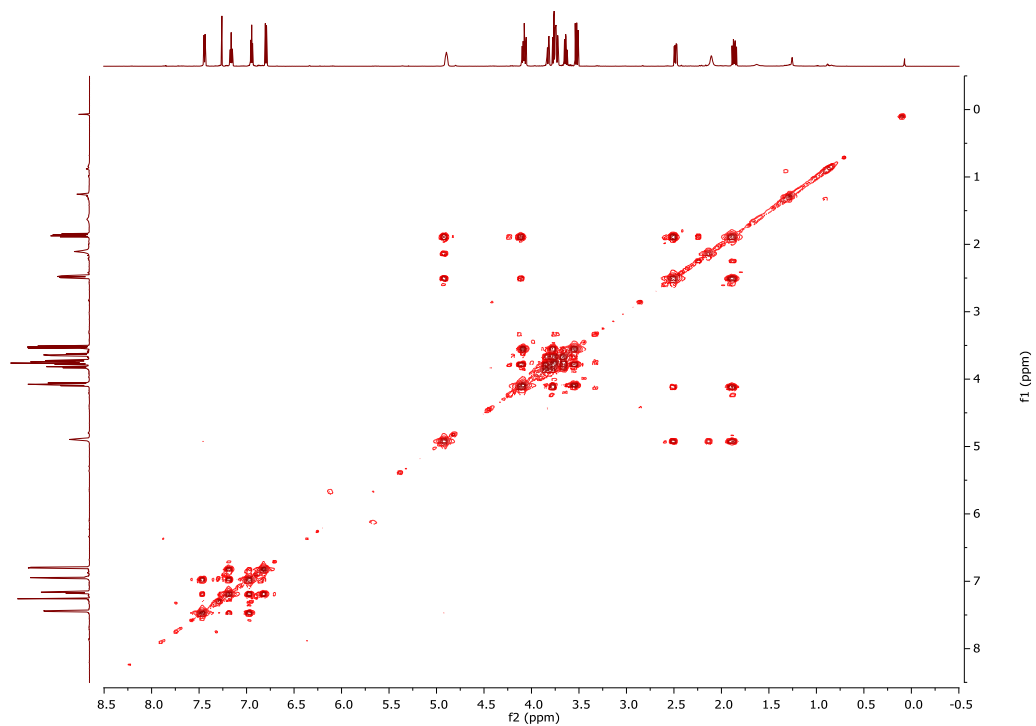
<sup>1</sup>H NMR



<sup>13</sup>C NMR



**COSY NMR of (2*R*\*,4*R*\*)-2-((*R*\*)-1,4-dioxan-2-yl)chroman-4-ol 5a'**



**NOESY NMR of (2*R*\*,4*R*\*)-2-((*R*\*)-1,4-dioxan-2-yl)chroman-4-ol 5a'**

