Supporting information

Microwave-Promoted Deprenylation: Prenyl Ether as a Thermolabile Phenol Protecting Group

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A General experimental remarks

All experiments were conducted in dry reaction vessels under an atmosphere of dry nitrogen. Solvents were purified by standard procedures. $^1$H NMR spectra were obtained at 300 MHz with a Bruker ARX-300 spectrometer in CDCl$_3$ with CHCl$_3$ ($\delta = 7.26$ ppm) as an internal standard, or in C$_6$D$_6$ with C$_6$D$_5$H ($\delta = 7.18$ ppm) as an internal standard. Coupling constants are given in Hz. $^{13}$C NMR spectra were recorded at 75 MHz with a Bruker ARX-300 in CDCl$_3$ with CDCl$_3$ ($\delta = 77.0$ ppm) as an internal standard or in C$_6$D$_6$ with C$_6$D$_5$H ($\delta = 128.0$ ppm) as an internal standard. IR spectra were recorded as ATR-FTIR spectra on a Perkin-Elmer UART-two spectrometer. Wavenumbers ($\nu$) are given in cm$^{-1}$. The peak intensities are defined as strong (s), medium (m) or weak (w). Low- and high resolution mass spectra were obtained by EI-TOF (Micromass Manchester Waters Inc.) or ESI-TOF (Micromass Manchester Waters Inc.). Microanalyses were obtained with an Elementar-Vario EL-III apparatus. Microwave reactions were carried out in an Anton-Paar-monowave-300 reactor at 250°C (monowave, maximum power 850 W, temperature control via IR-sensor, vial volume 20 mL). References for starting materials synthesized according to literature procedures are provided in the appropriate sections.
Microwave-promoted Claisen rearrangement of ortho-disubstituted aromatic allyl-, crotyl- and prenyl ethers (Scheme 3)

B1 Procedures, references and analytical data for ethers 9a-c

2-(Allyloxy)-3-methoxybenzaldehyde (9a)

Procedure for the synthesis, characterization data and copies of NMR-spectra were published previously.¹

2-(But-2-en-1-yloxy)-3-methoxybenzaldehyde (9b)

Procedure for the synthesis, characterization data and copies of NMR-spectra were published previously.¹

3-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)benzaldehyde (9c)

Procedure for the synthesis, characterization data and copies of NMR-spectra were published previously.¹

B2 Procedures, references and analytical data for Claisen rearrangement products 10a-c and 11a

General procedure

The corresponding ether 9 (1.0 mmol) was dissolved in N,N-diethyl aniline (5 mL) in a vessel suited for microwave irradiation. The vessel was sealed, placed in a dedicated microwave reactor, and irradiated at 250°C for 1 hour. After cooling to ambient temperature the mixture was diluted with ethyl acetate (20 mL) and washed three times with diluted hydrochloric acid (1 M, 30 mL each). The organic extract was dried with MgSO₄, filtered and evaporated. The crude product was purified by column chromatography on silica, using hexane-MTBE mixtures of increasing polarity as eluent.

5-Allyl-2-hydroxy-3-methoxybenzaldehyde (10a) and 2-allyl-6-methoxyphenol (11a)

Following the general procedure, 9a (153 mg, 0.80 mmol) was converted to a mixture of 11a (50 mg, 0.30 mmol, 38%) and 10a (14 mg, 0.07 mmol, 9%); separable by chromatography.
Data for **11a**:\(^2\) colourless oil.

IR (ATR): 3525 (bw), 1619 (w), 1478 (s), 1270 (s), 1219 cm\(^{-1}\) (m).

\(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 6.85 - 6.74\) (m, 3H), 6.06 (ddt, \(J = 16.8, 10.1, 6.6\) Hz, 1H), 5.78 (s, 1H), 5.20 – 5.03 (m, 2H), 3.90 (s, 3H), 3.47 (d, \(J = 6.6\) Hz, 2H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 146.5, 143.5, 136.8, 126.0, 122.4, 119.5, 115.5, 108.8, 56.1, 33.9\).

HRMS (EI): \(m/z [M]^+\) calcd for C\(_{10}\)H\(_{12}\)O\(_2\): 164.0837; found: 164.0823.

Data for **10a**:\(^3\) colourless oil.

IR (ATR): 2919 (w), 1654 (m), 1466 (m), 1389 (m), 1266 cm\(^{-1}\) (s)

\(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 10.96\) (s, 1H), 9.88 (s, 1H), 6.98 (d, \(J = 1.7\) Hz, 1H), 6.94 (d, \(J = 1.7\) Hz, 1H), 6.95 (ddt, \(J = 16.3, 10.7, 6.6\) Hz, 1H), 5.13 (dm, \(J = 10.7\) Hz, 1H), 5.10 (dm, \(J = 16.6\) Hz, 1H), 3.91 (s, 3H), 3.37 (d, \(J = 6.6\) Hz, 2H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 196.7, 150.2, 148.4, 136.9, 131.6, 123.8, 120.6, 118.9, 116.7, 56.4, 39.5\).

HRMS (EI): \(m/z [M]^+\) calcd for C\(_{11}\)H\(_{12}\)O\(_3\): 192.0786; found: 192.0768.

**(E)**-5-(But-2-en-1-yl)-2-hydroxy-3-methoxybenzaldehyde (**10b**)

Following the general procedure, **9b** (121 mg, 0.59 mmol) was converted to **10b** (63 mg, 0.25 mmol, 52%); colourless oil.

IR (ATR): 1654 (m), 1466 (m), 1389 (w), 1264 (s), 974 cm\(^{-1}\) (m).

\(^1\)H-NMR (300 MHz, CDCl\(_3\)): \(\delta = 10.93\) (s, 1H), 9.88 (s, 1H), 6.98 (d, \(J = 1.8\) Hz, 1H), 6.92 (d, \(J = 1.7\) Hz, 1H), 5.57 – 5.51 (m, 2H), 3.89 (s, 3H), 3.27 (d, \(J = 4.0\) Hz, 2H), 1.69 (d, \(J = 4.0\) Hz, 3H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 196.7, 150.0, 148.2, 132.6, 129.4, 127.2, 123.6, 120.5, 118.8, 56.3, 38.3, 17.9\).

HRMS (EI): \(m/z [M]^+\) calcd for C\(_{12}\)H\(_{14}\)O\(_3\): 206.0943; found: 206.0957.
2-Hydroxy-3-methoxy-5-(3-methylbut-2-en-1-yl)benzaldehyde (10c)

Following the general procedure, 9c (66 mg, 0.30 mmol) was converted to 10c (40 mg, 0.18 mmol, 61%); colourless oil.

IR (ATR): 2931 (w), 1654 (m), 1464 (m), 1264 (s), 1153 cm$^{-1}$ (w).

$^1$H NMR (300 MHz, CDCl$_3$): $\delta = 10.92$ (s, 1H), 9.86 (s, 1H), 6.94 (m, 1H), 6.93 (m, 1H), 5.29 (t, $J = 7.3$ Hz, 1H), 3.90 (s, 3H), 3.31 (d, $J = 7.3$ Hz, 2H), 1.77 (s, 3H), 1.72 (s, 3H).

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta = 196.7, 149.9, 148.2, 133.6, 133.4, 123.4, 122.5, 120.6, 118.8, 56.4, 33.7, 25.8, 18.0$.

HRMS (EI): $m/z$ [M]$^+$ calcd for C$_{13}$H$_{16}$O$_3$: 220.1099; found: 220.1085.
B3  Copies of spectra for rearrangement products 11a and 10a-c

$^1$H NMR (300 MHz, CDCl$_3$) of 11a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 11a
$^1$H NMR (300 MHz, CDCl$_3$) of 10a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 10a
\( ^1\text{H NMR (300 MHz, CDCl}_3 \text{)} \) of 10b

\[ \begin{align*}
\text{13C NMR (75 MHz, CDCl}_3 \text{)} \text{ of 10b} & \\
\end{align*} \]
$^1$H NMR (300 MHz, CDCl$_3$) of 10c

$^{13}$C NMR (75 MHz, CDCl$_3$) of 10c
C Synthesis of para-substituted prenyloxy benzenes 13 and 14a-e (Table 1 and Scheme 4)

C1 Procedures, references and analytical data

4-((3-Methylbut-2-en-1-yl)oxy)phenol (13)

To a solution of 12 (5.51 g, 50.0 mmol) in acetone (50 mL) were added prenylbromide (1.17 mL, 10.0 mmol) and K$_2$CO$_3$ (2.76 g, 20.0 mmol). The mixture was heated at 50°C until the phenol was completely converted (TLC), then cooled to ambient temperature, hydrolysed with brine (100 mL) and extracted with ethyl acetate (100 mL). The aqueous layer was separated and extracted twice with ethyl acetate, the combined organic layers were dried with MgSO$_4$, filtered and evaporated. The residue was purified by column chromatography on silica, using hexane-MTBE mixtures of increasing polarity, to give 13 (1.04 g, 5.8 mmol, 58%); colourless liquid.

IR (ATR): 3351 (bw), 1507 (s), 1448 (m), 1196 (s), 982 cm$^{-1}$ (w).

$^1$H NMR (300 MHz, CDCl$_3$): δ = 6.81 (dm, $J = 9.1$ Hz, 2H), 6.75 (dm, $J = 9.1$ Hz, 2H), 5.48 (t, $J = 6.7$ Hz, 1H), 4.76 (s, 1H), 4.45 (d, $J = 6.7$ Hz, 2H), 1.79 (s, 3H), 1.73 (s, 3H).

$^{13}$C NMR (75 MHz, CDCl$_3$): δ = 153.1, 149.6, 138.2, 120.0, 116.1, 116.0, 65.6, 26.0, 18.3.

HRMS (EI): m/z [M$^+$] calcd for C$_{11}$H$_{14}$O$_2$: 178.0994; found: 178.1013.

4-((3-Methylbut-2-en-1-yl)oxy)phenyl acetate (14a)

To a solution of 13 (307 mg, 1.72 mmol) in CH$_2$Cl$_2$ (5 mL) was added NEt$_3$ (713 μL, 5.16 mmol) and DMAP (4 mg, 0.04 mmol, 5 mol%). The solution was cooled to 0°C, and a solution of acetic anhydride (325 μL, 3.44 mmol) in CH$_2$Cl$_2$ (5 mL) was added dropwise. The mixture was allowed to warm to ambient temperature, and stirring was continued for 10 h. The mixture was then acidified by addition of hydrochloric acid (1 M) and the aqueous layer was extracted with MTBE. The combined extracts were dried with MgSO$_4$, filtered and evaporated. The residue was purified by chromatography on silica to furnish 14a (340 mg, 1.55 mmol, 90%); colourless oil.
IR (ATR): 1759 (m), 1503 (s), 1369 (w), 1181 (s), 1009 cm\(^{-1}\) (m).

\(^{1}\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 6.99\) (d, \(J = 9.1\) Hz, 2H), 6.89 (d, \(J = 9.1\) Hz, 2H), 5.49 (t, \(J = 6.7\) Hz, 1H), 4.49 (d, \(J = 6.7\) Hz, 2H), 2.27 (s, 3H), 1.80 (s, 3H), 1.74 (s, 3H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 170.0, 156.7, 144.2, 138.4, 122.4, 119.7, 115.3, 65.2, 25.9, 21.2, 18.3\).

HRMS (EI): \(m/z\) [M]\(^+\) calcd for \(C_{13}H_{16}O_3\): 220.1099; found: 220.1093.

tert-Butyldimethyl(4-((3-methylbut-2-en-1-yl)oxy)phenoxy)silane (14b)

A solution of \(\text{13} (356\) mg, 2.00 mmol) and NEt\(_3\) (553 \(\mu\)L, 4.00 mmol) in CH\(_2\)Cl\(_2\) (5 mL) was cooled to 0°C, and a solution of tert-BuMe\(_2\)SiCl (453 mg, 3.00 mmol) in CH\(_2\)Cl\(_2\) (5 mL) was added dropwise. The solution was allowed to warm to ambient temperature, and stirring was continued for 10 h. The mixture was carefully acidified by addition of hydrochloric acid (1 M), and the aqueous layer was extracted with MTBE. The combined organic extracts were dried with MgSO\(_4\), filtered and evaporated. The residue was purified by chromatography on silica to furnish \(\text{14b} (465\) mg, 1.59 mmol, 80%).

IR (ATR): 1503 (s), 1252 (m), 1214 (s), 1007 (w), 908 cm\(^{-1}\) (m).

\(^{1}\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 6.84 – 6.71\) (m, 4H), 5.51 (t, \(J = 6.7\) Hz, 1H), 4.46 (d, \(J = 6.7\) Hz, 2H), 1.81 (s, 3H), 1.74 (s, 3H), 1.00 (s, 9H), 0.19 (s, 6H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 153.5, 149.4, 137.9, 120.7, 120.2, 115.5, 65.3, 25.9, 25.9, 18.3, 18.3, –4.4\).

HRMS (EI): \(m/z\) [M]\(^+\) calcd for \(C_{17}H_{38}O_2Si\): 292.1859; found: 292.1850.

1-Methoxy-4-((3-methylbut-2-en-1-yl)oxy)benzene (14c)

To a solution of \(\text{13} (178\) mg, 1.00 mmol) in acetone (10 mL) were added K\(_2\)CO\(_3\) (276 mg, 2.00 mmol) and CH\(_3\)I (622 \(\mu\)L, 10.0 mmol). The mixture was stirred at ambient temperature for 10 h. The reaction was quenched by addition of water (10 mL), and the aqueous layer was extracted three times with MTBE. The combined organic layers were dried with MgSO\(_4\), filtered and...
evaporated. The crude product was purified by chromatography on silica to furnish 14c (102 mg, 0.53 mmol, 53%); colourless oil.

IR (ATR): 1505 (s), 1224 (s), 1034 (m), 822 (s), 735 cm−1 (m).

1H NMR (300 MHz, CDCl3): δ = 6.94 – 6.83 (m, 4H), 5.53 (t, J = 6.7 Hz, 1H), 4.49 (d, J = 6.7 Hz, 2H), 3.79 (s, 3H), 1.83 (s, 3H), 1.77 (s, 3H).

13C NMR (75 MHz, CDCl3): δ = 153.8, 153.1, 137.9, 120.1, 115.7, 114.7, 65.4, 55.8, 25.9, 18.2.


1-(Benzyloxy)-4-((3-methylbut-2-en-1-yl)oxy)benzene (14d)

To a solution of 13 (178 mg, 1.00 mmol) in dry and degassed THF (20 mL) was added KO(t–Bu) (224 mg, 2.00 mmol). A solution of benzyl bromide (183 μL, 1.50 mmol) in THF (10 mL) was added dropwise. The mixture was then heated to reflux for 14 h. After cooling to ambient temperature, the solvent was evaporated. The residue was mixed with MTBE (30 mL) and the solution was carefully acidified with hydrochloric acid (1 M). The aqueous layer was separated and extracted twice with MTBE. The combined organic extracts were dried with MgSO4, filtered and evaporated. The residue was purified by chromatography on silica to furnish 14d (257 mg, 0.96 mmol, 96%); colourless oil.

IR (ATR): 1506 (s), 1224 (s), 1019 (m), 824 (s), 733 cm−1 (s).

1H NMR (300 MHz, CDCl3): δ = 7.50 – 7.27 (m, 5H), 6.92 (dm, J = 9.2 Hz, 2H), 6.86 (dm, J = 9.2 Hz, 2H), 5.51 (t, J = 6.7 Hz, 1H), 5.03 (s, 2H), 4.47 (d, J = 6.7 Hz, 2H), 1.81 (s, 3H), 1.75 (s, 3H).

13C NMR (75 MHz, CDCl3): δ = 153.4, 153.1, 138.1, 137.5, 128.7, 128.0, 127.6, 120.1, 115.9, 115.7, 70.8, 65.5, 26.0, 18.3.


4-((3-Methylbut-2-en-1-yl)oxy)-1,1'-biphenyl (14e)5
Following the procedure for compound 13, phenol 15 (340 mg, 2.0 mmol) was converted to 14e (481 mg, 2.0 mmol, quant.). Prenylbromide (0.35 mL, 3.0 mmol) and K$_2$CO$_3$ (0.55 g, 4.0 mmol) were used in excess; colourless solid; mp 79 – 82°C.

IR (ATR): 2921 (bw), 1488 (m), 1249 (m), 1199 (m), 1003 cm$^{-1}$ (m).

$^1$H NMR (300 MHz, CDCl$_3$): $\delta = 7.62 – 7.50$ (m, 4H), 7.43 (t, $J = 7.5$ Hz, 2H), 7.31 (t, $J = 7.3$ Hz, 1H), 7.01 (d, $J = 8.7$ Hz, 2H), 5.55 (t, $J = 6.7$ Hz, 1H), 4.57 (d, $J = 6.6$ Hz, 2H), 1.83 (s, 3H), 1.78 (s, 3H).

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta = 158.6, 141.0, 138.4, 133.8, 128.8, 128.2, 126.8, 126.7, 119.8, 115.1, 65.0, 26.0, 18.4$.

HRMS (EI) $m/z$ [M]$^+$ calcd for C$_{17}$H$_{18}$O: 238.1358; found: 238.1362.
C2  Copies of spectra

$^1$H NMR (300 MHz, CDCl$_3$) of 13

$^{13}$C NMR (75 MHz, CDCl$_3$) of 13
$^1$H NMR (300 MHz, CDCl$_3$) of 14a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 14a
$^1$H NMR (300 MHz, CDCl$_3$) of 14b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 14b
$^1$H NMR (300 MHz, CDCl$_3$) of 14c

$^{13}$C NMR (75 MHz, CDCl$_3$) of 14c
$^1$H NMR (300 MHz, CDCl$_3$) of 14d

$^{13}$C NMR (75 MHz, CDCl$_3$) of 14d
$^1$H NMR (300 MHz, CDCl$_3$) of 14e

$^{13}$C NMR (75 MHz, CDCl$_3$) of 14e
**D** Microwave-promoted deprenylation (Table 2)

**D1** References and analytical data for deprotected phenols 16

4-Hydroxyphenyl acetate (16a)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 14a (123 mg, 0.56 mmol) was converted to 16a (43 mg, 0.28 mmol, 51%); colourless oil.

IR (ATR): 3448 (bw), 1729 (m), 1503 (m), 1370 (m), 1175 cm⁻¹ (s).

¹H NMR (300 MHz, CDCl₃): δ = 6.83 (d, J = 8.0 Hz, 2H), 6.74 (d, J = 8.1 Hz, 2H), 5.71 (s, 1H), 2.29 (s, 3H).

¹³C NMR (75 MHz, CDCl₃): δ = 170.4, 152.1, 144.2, 121.0, 116.7, 21.2.

HRMS: no [M]+ signal observed with all standard ionization techniques.

4-((tert-Butyldimethylsilyloxy)phenol (16b)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 14b (197 mg, 0.67 mmol) was converted to 16b (92 mg, 0.41 mmol, 61%); colourless oil.

IR (ATR): 3326 (bw), 1505 (s), 1210 (m), 909 (m), 826 cm⁻¹ (s).

¹H NMR (300 MHz, CDCl₃): δ = 6.77 – 6.69 (m, 4H), 5.76 (s, 1H), 0.99 (s, 9H), 0.18 (s, 6H).

¹³C NMR (75 MHz, CDCl₃): δ = 149.9, 149.4, 121.0, 116.2, 25.9, 18.3, −4.4.

HRMS (EI): m/z [M]+ calcd for C₁₂H₂₀O₂Si: 224.1233; found: 224.1231.

4-Methoxyphenol (16c)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 14c (81 mg, 0.42 mmol) was converted to 16c (28 mg, 0.23 mmol, 55%); colourless oil.

IR (ATR): 3392 (bs), 1504 (m), 1452 (m), 1229 (m), 1032 cm⁻¹ (s).

¹H NMR (300 MHz, CDCl₃): δ = 6.80 (dm, J = 9.3 Hz, 2H), 6.76 (dm, J = 9.3 Hz, 2H), 5.33 (s, 1H), 3.77 (s, 3H).

¹³C NMR (75 MHz, CDCl₃): δ = 153.7, 149.6, 116.2, 115.0, 56.0.

4-(Benzyloxy)phenol (16d)$^9$

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 14d (81 mg, 0.30 mmol) was converted to 16d (31 mg, 0.16 mmol, 52%); colourless oil.

IR (ATR): 3422 (bw), 1500 (m), 1219 (m), 1015 (m), 819 cm$^{-1}$ (s).

$^1$H NMR (300 MHz, CDCl$_3$): δ = 7.47 – 7.29 (m, 5H), 6.87 (d, $J$ = 9.0 Hz, 2H), 6.76 (d, $J$ = 9.0 Hz, 2H), 5.02 (s, 2H), 4.85 (s, 1H).

$^{13}$C NMR (75 MHz, CDCl$_3$): δ = 153.1, 149.8, 137.3, 128.7, 128.0, 127.64, 116.2, 116.2, 70.9;

HRMS (EI): $m/z$ [M]$^+$ calcd for C$_{13}$H$_{12}$O$_2$: 200.0837; found: 200.0845.

Biphenyl-4-ol (15)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 14e (99 mg, 0.42 mmol) was converted to 15 (36 mg, 0.21 mmol, 50%); colourless solid; mp 168 – 170°C. Analytical data and copies of spectra have previously been reported by us in different context.$^{10}$
Copies of spectra for deprenylated phenols 16

$^1$H NMR (300 MHz, CDCl$_3$) of 16a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 16a
$^1$H NMR (300 MHz, CDCl$_3$) of 16b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 16b
\( ^1H \) NMR (300 MHz, CDCl\textsubscript{3}) of 16c

\[ \begin{align*}
\text{MeO} & \quad \text{OH} \\
\end{align*} \]

\( ^13C \) NMR (75 MHz, CDCl\textsubscript{3}) of 16c

\[ \begin{align*}
\text{MeO} & \quad \text{OH} \\
\end{align*} \]
$^1$H NMR (300 MHz, CDCl$_3$) of 16d

$^{13}$C NMR (75 MHz, CDCl$_3$) of 16d
D3 Orthogonality of protecting groups in 14a and 14b

Synthesis of 13 via deacetylation of 14a

A solution of 14a (110 mg, 0.50 mmol) in methanol (2 mL) was cooled to 0°C. A solution of KOH (56 mg, 1.00 mmol) in methanol (3 mL) was added and the solution was stirred until the starting material was completely consumed. Hydrochloric acid (1 M, 3.0 mL), brine (10 mL) and ethyl acetate (30 mL) were added. The organic layer was separated, extracted with ethyl acetate, dried with MgSO₄, filtered and evaporated. The crude product was purified by chromatography on silica to furnish 13 (78 mg, 0.44 mmol, 88%).

Synthesis of 13 via desilylation of 14b

A solution of 14b (156 mg, 0.53 mmol) in THF (2 mL) was cooled to 0°C. TBAF-trihydrate (184 mg, 0.58 mmol) was added, and the solution was stirred for 0.5 h. Workup of the reaction mixture was accomplished as described above for the deacetylation to furnish 13 (60 mg, 0.34 mmol, 64%). Analytical data and copies of spectra for compound 13 are reported in section C.
Syntheses of flavones 17 and 18 via traceless cyclizing deprenylation (Scheme 5)

E1 Synthesis and analytical data of flavone 17 and all precursors

5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)benzaldehyde (22)

To a solution of 21 (500 mg, 3.3 mmol) in acetone (5 mL) were added prenylbromide (0.59 mL, 5.0 mmol) and K₂CO₃ (912 mg, 6.6 mmol). The mixture was heated at 50°C until 21 was completely converted (TLC), then cooled to ambient temperature, hydrolysed with brine (10 mL) and extracted with ethyl acetate (20 mL). The aqueous layer was separated and extracted twice with ethyl acetate, the combined organic layers were dried with MgSO₄, filtered and evaporated. The residue was purified by column chromatography on silica, using hexane-MTBE mixtures of increasing polarity, to give 22 (568 mg, 2.6 mmol, 79%); colourless oil.

IR (ATR): 1680 (m), 1490 (s), 1276 (s), 1212 (s), 992 cm⁻¹ (m).

¹H NMR (300 MHz, CDCl₃): δ = 10.45 (s, 1H), 7.32 (d, J = 3.2 Hz, 1H), 7.11 (dd, J = 9.0, 3.2 Hz, 1H), 6.95 (d, J = 9.1 Hz, 1H), 5.48 (tm, J = 6.7 Hz, 1H), 4.59 (d, J = 6.7 Hz, 2H), 3.80 (s, 3H), 1.79 (s, 3H), 1.73 (s, 3H).

¹³C NMR (75 MHz, CDCl₃): δ = 189.9, 156.3, 153.8, 138.8, 125.7, 123.6, 119.3, 115.4, 110.2, 66.4, 55.9, 25.9, 18.4.


1-(5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-phenylprop-2-yn-1-ol (24a)

To a solution of phenylacetylene (23a, 88 mg, 0.86 mmol) in THF (2 mL) was added BuLi (2.5 M solution in hexanes, 0.34 mL, 0.86 mmol) at 0°C. The solution was warmed to ambient temperature and stirred for 0.5 h. A solution of 22 (159 mg, 0.72 mmol) in THF (2 mL) was added dropwise. The reaction was quenched by addition of brine (2 mL), the aqueous layer was separated and extracted three times with ethyl acetate (20 mL each). The combined organic extracts were dried with MgSO₄, filtered and evaporated. The residue was purified by chromatography on silica to furnish 24a (206 mg, 0.64 mmol, 91%); colourless oil.

IR (ATR): 3432 (bw), 1491 (s), 1207 (s), 1033 (m), 692 cm⁻¹ (m).
1H NMR (300 MHz, CDCl3): δ = 7.50 – 7.44 (m, 2H), 7.35 – 7.28 (m, 3H), 7.21 (d, J = 2.7 Hz, 1H), 6.88 (d, J = 8.8 Hz, 1H), 6.82 (dd, J = 8.9, 2.8 Hz, 1H), 5.88 (d, J = 5.2 Hz, 1H), 5.51 (t, J = 6.5 Hz, 1H), 4.58 (d, J = 6.5 Hz, 2H), 3.80 (s, 3H), 3.32 (d, J = 5.7 Hz, 1H), 1.78 (s, 3H), 1.73 (s, 3H).

13C NMR (75 MHz, CDCl3): δ = 153.8, 150.3, 138.3, 131.8, 130.4, 128.4, 128.2, 122.8, 119.7, 114.0, 114.0, 113.7, 88.3, 86.1, 66.2, 62.1, 55.8, 25.8, 18.3.


1-(5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-phenylprop-2-yn-1-one (25a)

To a solution of 24a (187 mg, 0.58 mmol) in CH2Cl2 (5 mL) was added MnO2 (780 mg, 8.7 mmol). The mixture was stirred for 12 h at ambient temperature. It was then filtered through a pad of celite, evaporated, and the residue was chromatographed on silica using hexane-MTBE mixtures of increasing polarity to furnish 25a (185 mg, 0.58 mmol, quant.); colourless solid; mp 66 – 68°C.

IR (ATR): 2203 (m), 1600 (m), 1491 (s), 1417 (m), 1276 cm⁻¹ (s).

1H NMR (300 MHz, CDCl3): δ = 7.62 (d, J = 7.3 Hz, 2H), 7.52 (d, J = 3.1 Hz, 1H), 7.47 – 7.32 (m, 3H), 7.09 (dd, J = 9.0, 3.2 Hz, 1H), 6.97 (d, J = 9.0 Hz, 1H), 5.51 (t, J = 6.4 Hz, 1H), 4.63 (d, J = 6.5 Hz, 2H), 3.82 (s, 3H), 1.70 (s, 3H), 1.67 (s, 3H).

13C NMR (75 MHz, CDCl3): δ = 176.4, 154.0, 153.5, 137.8, 133.0, 130.4, 128.6, 127.8, 122.1, 121.1, 120.0, 116.0, 114.6, 92.1, 90.0, 67.1, 56.0, 25.8, 18.4.

HRMS: no [M]+ signal observed with all standard ionization techniques.

6-Methoxy-2-phenyl-4H-chromen-4-one (17)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 25a (112 mg, 0.35 mmol) was converted to 17 (49 mg, 0.19 mmol, 56%); colourless oil. The compound has previously been described by others as a solid and melting points of 160°C – 165°C11 and 190°C – 192°C12 have been reported. All other analytical data match those previously reported.11,12
IR (ATR): 1636 (s), 1483 (s), 1357 (s), 1206 (m), 1029 cm$^{-1}$ (m).

$^1$H NMR (300 MHz, CDCl$_3$): $\delta$ = 7.92 – 7.85 (m, 2H), 7.57 (d, $J$ = 3.0 Hz, 1H), 7.53 – 7.44 (m, 4H), 7.26 (d, $J$ = 9.1, 3.1 Hz, 1H), 6.80 (s, 1H), 3.87 (s, 3H)

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ = 178.4, 163.2, 157.1, 151.1, 131.9, 131.6, 129.1, 126.3, 124.6, 123.9, 119.6, 106.9, 104.9, 56.0.

HRMS (EI): $m/z$ [M]$^+$ calcd for C$_{16}$H$_{12}$O$_3$: 252.0786; found: 252.0750.

E2 Synthesis and analytical data of flavone 18 and all precursors

1-Ethynyl-3-methoxybenzene (23b)

To a solution of 3-methoxybenzaldehyde (364 µL, 3.00 mmol) in methanol (30 mL) was added K$_2$CO$_3$ (830 mg, 6.00 mmol), followed by dimethyl-(1-diazo-2-oxopropyl)phosphonate (Bestmann-Ohira-reagent, 920 mg, 4.80 mmol). The mixture was stirred until the starting material was fully consumed (TLC) and all volatiles were evaporated. The residue was mixed with brine (30 mL) and ethyl acetate (30 mL). The aqueous layer was separated and extracted twice with ethyl acetate (30 mL), the combined organic extracts were dried with MgSO$_4$, filtered and evaporated. The residue was purified by column chromatography on silica using hexane-MTBE mixtures of increasing polarity to furnish 23b (301 mg, 2.28 mmol, 77%); colourless oil.

IR (ATR): 3289 (m), 1575 (s), 1480 (m), 1257 (s), 1142 cm$^{-1}$ (s).

$^1$H NMR (300 MHz, CDCl$_3$): $\delta$ = 7.22 (dd, $J$ = 8.3, 7.6 Hz, 1H), 7.10 (d, $J$ = 7.6 Hz, 1H), 7.03 (s, 1H), 6.91 (dd, $J$ = 8.3, 1.6 Hz, 1H), 3.80 (s, 3H), 3.07 (s, 1H).

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta$ = 159.4, 129.5, 124.8, 123.2, 117.1, 115.5, 83.7, 77.1, 55.4.


1-(5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-(3-methoxyphenyl)prop-2-yn-1-ol (24b)

Following the procedure for 24a, aldehyde 22 (154 mg, 0.72 mmol) and alkyne 23b (114 mg, S30
0.86 mmol) were converted to 24b (241 mg, 0.68 mmol, 98%); colourless oil.

IR (ATR): 3434 (bw), 1492 (s), 1285 (m), 1203 (s), 1039 cm⁻¹ (m).

¹H NMR (300 MHz, CDCl₃): δ = 7.27 – 7.18 (m, 2H), 7.06 (d, J = 7.6 Hz, 1H), 7.00 (s, 1H), 6.92 – 6.85 (m, 2H), 6.82 (dd, J = 9.0, 2.9 Hz, 1H), 5.87 (d, J = 5.4 Hz, 1H), 5.51 (tm, J = 6.7 Hz, 1H), 4.58 (d, J = 6.7 Hz, 2H), 3.79 (s, 3H), 3.35 (d, J = 5.5 Hz, 1H), 1.78 (s, 3H), 1.73 (s, 3H).

¹³C NMR (75 MHz, CDCl₃): δ = 159.4, 153.9, 150.4, 138.4, 130.5, 129.4, 124.4, 123.9, 119.8, 116.7, 115.1, 114.1, 113.9, 88.3, 86.1, 66.3, 62.1, 55.9, 55.4, 27.1, 25.9, 18.4.


1-(5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-(3-methoxyphenyl)prop-2-yn-1-one (25b)

Following the procedure for 25a, alkynol 24b (212 mg, 0.60 mmol) was converted to 25b (199 mg, 0.57 mmol, 94%); colourless oil.

IR (ATR): 2194 (m), 1595 (s), 1490 (s), 1417 (m), 1214 cm⁻¹ (s).

¹H NMR (300 MHz, CDCl₃): δ = 7.51 (d, J = 3.1 Hz, 1H), 7.28 (dd, J = 7.9, 7.9 Hz, 1H), 7.22 (d, J = 7.6 Hz, 1H), 7.14 (s, 1H), 7.09 (dd, J = 9.1, 3.2 Hz, 1H), 7.03 – 6.94 (m, 2H), 5.50 (t, J = 6.3 Hz, 1H), 4.63 (d, J = 6.4 Hz, 2H), 3.82 (s, 3H), 3.82 (s, 3H), 1.70 (s, 3H), 1.68 (s, 3H).

¹³C NMR (75 MHz, CDCl₃): δ = 176.4, 159.5, 154.0, 153.5, 153.5, 137.8, 129.7, 127.8, 125.5, 122.1, 122.0, 119.9, 117.7, 117.1, 116.1, 114.6, 92.0, 89.7, 67.1, 56.0, 55.5, 25.8, 18.4.


6-Methoxy-2-(3-methoxyphenyl)-4H-chromen-4-one (18)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 25b (110 mg, 0.31 mmol) was converted to 18 (48 mg, 0.17 mmol, 54%); colourless oil.

The compound has previously been described by others as a solid and a melting point of 153°C – 154°C¹³ has been reported. All other analytical data match those previously reported.¹³
IR (ATR): 1641 (s), 1485 (s), 1352 (s), 1204 (m), 782 cm\(^{-1}\) (m).

\(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 7.56\) (d, \(J = 3.0\) Hz, 1H), 7.49 – 7.36 (m, 4H), 7.26 (dd, \(J = 9.1, 3.1\) Hz, 1H), 7.03 (dm, \(J = 7.9\) Hz, 1H), 6.77 (s, 1H), 3.88 (s, 3H), 3.86 (s, 3H).

\(^{13}\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 178.4, 163.0, 160.1, 157.1, 151.1, 133.3, 130.2, 124.6, 123.9, 119.6, 118.7, 117.2, 111.7, 107.1, 104.9, 56.0, 55.5\).

HRMS (EI): \(m/z [M]^+\) calcd for \(\text{C}_{17}\text{H}_{14}\text{O}_4\): 282.0892; found: 282.0884.
E3  Copies of spectra for flavones 17, 18 and precursors

$^1$H NMR (300 MHz, CDCl$_3$) of 22

$^{13}$C NMR (75 MHz, CDCl$_3$) of 22
$^1$H NMR (300 MHz, CDCl$_3$) of 24a

![NMR Spectrogram of 24a](image)

$^{13}$C NMR (75 MHz, CDCl$_3$) of 24a

![NMR Spectrogram of 24a](image)
$^1$H NMR (300 MHz, CDCl$_3$) of 25a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 25a
$^1$H NMR (300 MHz, CDCl$_3$) of 17

$^{13}$C NMR (75 MHz, CDCl$_3$) of 17
$^1$H NMR (300 MHz, CDCl$_3$) of 23b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 23b
$^1$H NMR (300 MHz, CDCl$_3$) of 24b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 24b
$^1$H NMR (300 MHz, CDCl$_3$) of 25b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 25b
$^1$H NMR (300 MHz, CDCl$_3$) of 18

13C NMR (75 MHz, CDCl$_3$) of 18
Syntheses of chromanones 19, 20 via traceless cyclizing deprenylation (Scheme 6)

F1 Synthesis and analytical data of chromanone 19 and all precursors

5-(Methoxymethoxy)-2-((3-methylbut-2-en-1-yl)oxy)benzaldehyde (27)

Following the procedure for the synthesis of 22 stated in section E1, MOM-protected aldehyde 2614 (791 mg, 4.34 mmol) was converted to 27 (650 mg, 2.60 mmol, 60%); colourless oil.

IR (ATR): 2933 (bw), 1682 (s), 1489 (s), 1273 (m), 1001 cm\(^{-1}\) (m).

\(^1\)H NMR (300 MHz, CDCl\(_3\)): \(\delta = 10.44\) (s, 1H), 7.48 (d, \(J = 3.1\) Hz, 1H), 7.22 (dd, \(J = 9.0, 3.2\) Hz, 1H), 6.94 (d, \(J = 9.0\) Hz, 1H), 5.48 (tm, \(J = 6.8\) Hz, 1H), 5.13 (s, 2H), 4.59 (d, \(J = 6.7\) Hz, 2H), 3.47 (s, 3H), 1.81 (s, 3H), 1.74 (s, 3H).

\(^1^3\)C NMR (75 MHz, CDCl\(_3\)): \(\delta = 189.7, 156.9, 151.2, 138.8, 125.9, 124.9, 119.3, 115.0, 114.9, 95.3, 66.3, 56.2, 25.9, 18.4\).

HRMS (EI) \(m/z\) [M]+ calcd for C\(_{14}\)H\(_{18}\)O\(_4\): 250.1205; found: 250.1216.

1-(5-(Methoxymethoxy)-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-methylbut-2-en-1-ol (28a)

Mg-turnings (182 mg, 7.5 mmol) were suspended in dry and degassed THF (30 mL). 1-Bromo-2-methylpropene (1.01 g, 7.5 mmol) was added, and the mixture was heated to reflux for 5 h. It was then cooled to 0°C, and a solution of aldehyde 27 (636 mg, 2.54 mmol) in THF (10 mL) was added dropwise. The reaction mixture was allowed to warm to ambient temperature and stirred for an additional 0.5 h. The reaction was quenched by addition of a saturated solution of NH\(_4\)Cl, the aqueous layer was separated and extracted three times with ethyl acetate (50 mL each). The combined organic extracts were dried with MgSO\(_4\), filtered and evaporated. The residue was purified by column chromatography on silica to furnish 28a (568 mg, 1.86 mmol, 73%); colourless oil.

IR (ATR): 3443 (bw), 2913 (s), 1492 (s), 1151 (m), 1004 cm\(^{-1}\) (m).

\(^1\)H-NMR (300 MHz, C\(_6\)D\(_6\)): \(\delta = 7.59\) (d, \(J = 3.0\) Hz, 1H), 7.11 (dd, \(J = 8.8, 3.0\) Hz, 1H), 6.70 (d, \(J = 8.8\) Hz, 1H), 5.95 (dd, \(J = 8.5, 4.4\) Hz, 1H), 5.71 (dm, \(J = 8.5\) Hz, 1H), 5.50 (tm, \(J = 6.7\) Hz, 1H).
Hz, 1H), 5.03 (d, J = 6.9 Hz, 1H), 5.00 (d, J = 6.9 Hz, 1H), 4.34 (d, J = 6.6 Hz, 2H), 3.30 (s, 3H), 2.57 (d, J = 4.5 Hz, 1H), 1.78 (d, J = 1.2 Hz, 3H), 1.67 (d, J = 1.1 Hz, 3H), 1.63 (s, 3H), 1.51 (s, 3H).

13C NMR (75 MHz, C6D6): δ = 152.4, 151.5, 137.3, 135.2, 133.7, 120.8, 116.4, 115.5, 113.1, 95.3, 67.6, 65.6, 55.5, 25.8, 25.6, 18.4, 18.0; one signal could not be located due to signal overlap.


1-(5-(Methoxymethoxy)-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-methylbut-2-en-1-one (29a)

To a solution of 28a (153 mg, 0.50 mmol) in CH2Cl2 (2 mL) was added molecular sieves (4Å, 0.50 g), followed by N-methylmorpholine-N-oxide (147 mg, 1.25 mmol) and NPr4RuO4 (9 mg, 5 mol%). The mixture was stirred at ambient temperature until the starting material was fully consumed (TLC). The solvent was evaporated and the residue was purified by chromatography on silica without further workup, using hexane-MTBE mixtures of increasing polarity as eluent, to furnish 29a (118 mg, 0.39 mmol, 78%); colourless oil.

IR (ATR): 2911 (bw), 1657 (m), 1489 (m), 1152 (s), 996 cm⁻¹ (s).

1H NMR (300 MHz, CDCl3): δ = 7.28 (d, J = 3.1 Hz, 1H), 7.07 (dd, J = 8.9, 3.1 Hz, 1H), 6.87 (d, J = 8.9 Hz, 1H), 6.70 – 6.65 (m, 1H), 5.52 – 5.42 (m, 1H), 5.12 (s, 2H), 4.52 (d, J = 6.6 Hz, 2H), 3.47 (s, 3H), 2.20 (d, J = 1.0 Hz, 3H), 1.94 (d, J = 1.0 Hz, 3H), 1.77 (s, 3H), 1.71 (s, 3H).

13C NMR (75 MHz, CDCl3): δ = 192.7, 154.8, 152.7, 151.6, 138.2, 132.6, 126.1, 121.0, 120.1, 118.4, 115.6, 95.6, 67.1, 56.3, 28.2, 26.1, 21.6, 18.6.

HRMS (EI): m/z [M]+ calcd. for C18H24O4: 304.1675; found: 304.1673.

6-(Methoxymethoxy)-2,2-dimethylchroman-4-one (30)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 29a (39 mg, 0.13 mmol) was converted to 30 (28 mg, 0.12 mmol, 93%); colourless oil.

IR (ATR): 2973 (bw), 1687 (m), 1484 (s), 1283 (m), 1000 cm⁻¹ (s).
$^1$H NMR (300 MHz, CDCl$_3$): $\delta = 7.48$ (d, $J = 3.1$ Hz, 1H), 7.17 (dd, $J = 9.0, 3.1$ Hz, 1H), 6.86 (d, $J = 9.0$ Hz, 1H), 5.12 (s, 2H), 3.47 (s, 3H), 2.69 (s, 2H), 1.43 (s, 6H).

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta = 192.5$, 155.4, 151.2, 126.4, 120.4, 119.6, 112.2, 95.3, 79.2, 56.2, 49.0, 26.7.

HRMS (EI): $m/z$ [M]$^+$ calcd for C$_{13}$H$_{16}$O$_4$: 236.1049; found: 236.1045.

6-Hydroxy-2,2-dimethylchroman-4-one (19)

The MOM-protected chromanone 30 (20 mg, 0.08 mmol) was dissolved in methanol (10 mL) and $p$-toluenesulfonic acid (190 mg, 1.00 mmol) was added. The solution was stirred at ambient temperature for 12 h, diluted with ethyl acetate (20 mL) and washed with brine (10 mL) and water (10 mL). The organic layer was dried with MgSO$_4$, filtered and evaporated. The crude product was purified by column chromatography on silica using hexane-MTBE mixtures of increasing polarity to furnish 19 (16 mg, 0.08 mmol, quant.); colourless oil. The compound has previously been described by others as a solid and melting points of 140°C – 141°C$^{15}$ and 161°C$^{16}$ have been reported. Spectroscopical data match those previously reported.$^{17}$

IR (ATR): 3358 (bw), 2976 (w), 1669 (m), 1460 (s), 1229 cm$^{-1}$ (m).

$^1$H NMR (300 MHz, CDCl$_3$): $\delta = 7.31$ (d, $J = 3.1$ Hz, 1H), 7.05 (dd, $J = 8.9, 3.1$ Hz, 1H), 6.84 (d, $J = 8.9$ Hz, 1H), 2.70 (s, 2H), 1.44 (s, 6H).

$^{13}$C NMR (75 MHz, CDCl$_3$): $\delta = 193.1$, 154.6, 149.7, 125.0, 120.3, 119.8, 110.9, 79.1, 49.0, 26.7.

HRMS (EI): $m/z$ [M]$^+$ calcd for C$_{11}$H$_{12}$O$_3$: 192.0786; found: 192.0776.

**F2** Synthesis and analytical data of chromanone 20 and all precursors

1-(5-Methoxy-2-(((3-methylbut-2-en-1-yl)oxy)phenyl)-3-methylbut-2-en-1-ol (28b)

Following the procedure for the synthesis of 28a, aldehyde 22 (186 mg, 0.85 mmol) was converted to 28b (164 mg, 0.59 mmol, 70%); colourless oil.

IR (ATR): 3450 (bw), 2971 (w), 1494 (s), 1211 (s), 1044 cm$^{-1}$ (m).

S43
$^1$H NMR (300 MHz, C$_6$D$_6$): δ = 7.29 (d, $J$ = 3.0 Hz, 1H), 6.72 (dd, $J$ = 8.8, 3.0 Hz, 1H), 6.62 (d, $J$ = 8.8 Hz, 1H), 5.87 (dd, $J$ = 8.3, 2.9 Hz, 1H), 5.63 (d, $J$ = 8.7 Hz, 1H), 5.43 (t, $J$ = 6.6 Hz, 1H), 4.26 (d, $J$ = 6.6 Hz, 2H), 3.41 (s, 3H), 2.44 (d, $J$ = 3.6 Hz, 1H), 1.70 (s, 3H), 1.58 (s, 3H), 1.54 (s, 3H), 1.43 (s, 3H).

$^{13}$C NMR (75 MHz, C$_6$D$_6$): δ = 154.7, 150.6, 137.2, 135.1, 133.6, 128.5, 120.9, 113.6, 113.3, 112.8, 67.7, 65.7, 55.3, 25.9, 25.6, 18.4, 18.0

HRMS (EI): $m/z$ [M]$^+$ calcd. for C$_{17}$H$_{24}$O$_3$: 276.1725; found: 276.1730.

1-(5-Methoxy-2-((3-methylbut-2-en-1-yl)oxy)phenyl)-3-methylbut-2-en-1-one (29b)

Following the procedure for the synthesis of 29a, alcohol 28b (149 mg, 0.54 mmol) was converted to 29b (103 mg, 0.38 mmol, 70%); colourless oil.

IR (ATR): 1656 (m), 1491 (s), 1279 (s), 1213 (s), 1044 cm$^{-1}$ (m).

$^1$H NMR (300 MHz, CDCl$_3$): δ = 7.16 (d, $J$ = 3.0 Hz, 1H), 6.95 (dd, $J$ = 9.0, 3.0 Hz, 1H), 6.89 (d, $J$ = 9.0 Hz, 1H), 6.72 (s, 1H), 5.45 (t, $J$ = 6.6 Hz, 1H), 4.51 (d, $J$ = 6.7 Hz, 2H), 3.79 (s, 3H), 2.21 (s, 3H), 1.94 (s, 3H), 1.77 (s, 3H), 1.70 (s, 3H).

$^{13}$C NMR (75 MHz, CDCl$_3$): δ = 192.6, 154.5, 153.9, 151.7, 138.0, 132.0, 125.9, 119.9, 119.1, 115.9, 114.2, 67.1, 55.9, 28.0, 25.9, 21.4, 18.3.

HRMS: no [M]$^+$ signal observed with all standard ionization techniques.

6-Methoxy-2,2-dimethylchroman-4-one (20)

Following the general procedure for microwave irradiation of prenyl ethers stated in section B2, 29b (91 mg, 0.33 mmol) was converted to 20 (61 mg, 0.30 mmol, 89%); colourless oil. The compound has previously been described by others as a solid and a melting point of 72°C – 74°C$^{18}$ has been reported. Spectroscopical data match those previously reported.$^{19}$

IR (ATR): 1684 (m), 1485 (s), 1430 (m), 1284 (m), 1232 cm$^{-1}$ (m).

$^1$H NMR (300 MHz, CDCl$_3$): δ = 7.29 (d, $J$ = 3.2 Hz, 1H), 7.08 (dd, $J$ = 9.0, 3.2 Hz, 1H), 6.85 (d, $J$ = 9.0 Hz, 1H), 3.79 (s, 3H), 2.70 (s, 2H), 1.44 (s, 6H).
\[ ^{13}\text{C} \text{ NMR (75 MHz, CDCl}_3\]: } \delta = 192.7, 154.7, 153.7, 125.4, 120.0, 119.7, 107.1, 79.1, 55.8, 48.9, 26.6. \\
\text{HRMS (EI): } m/z [M]^+ \text{ calcld for C}_{12}\text{H}_{14}\text{O}_3: 206.0943, \text{ found: 206.0952.}

\textbf{Attempted oxidation of 28a with MnO}_2 (\text{Scheme 7})

In analogy to the procedure for the synthesis of 25a stated in section E1, allylic alcohol 28a (153 mg, 0.50 mmol) was treated with MnO\(_2\) (650 mg, 7.5 mmol). Column chromatography on silica furnished 29a (43 mg, 0.14 mmol, 28%), 31 (39 mg, 0.14 mmol, 27%) and 32 (20 mg, 0.07 mmol, 13%).

\((E)-4-(\text{Methoxymethoxy})-1-((3\text{-methylbut-2-en-1-yl})\text{oxy})-2-(3\text{-methylbuta-1,3-dien-1-yl})\text{benzene (31)}\)

Colourless oil.

\text{IR (ATR): } 2931 \text{ (bw)}, 1489 \text{ (s)}, 1215 \text{ (m)}, 1151 \text{ (s)}, 1004 \text{ cm}^{-1} \text{ (s).}

\[ ^1\text{H} \text{ NMR (300 MHz, C}_6\text{D}_6\]: } \delta = 7.53 \text{ (d, } J = 2.9 \text{ Hz, 1H}), 7.27 \text{ (d, } J = 16.3 \text{ Hz, 1H}), 7.06 \text{ (d, } J = 16.9 \text{ Hz, 1H}), 7.01 \text{ (dd, } J = 9.2, 3.3 \text{ Hz, 1H}), 6.68 \text{ (d, } J = 8.9 \text{ Hz, 1H}), 5.50 \text{ (tm, } J = 6.6 \text{ Hz, 1H}), 5.03 \text{ (s, 1H)}, 4.96 \text{ (s, 1H)}, 4.91 \text{ (s, 2H)}, 4.34 \text{ (d, } J = 6.5 \text{ Hz, 2H}), 3.20 \text{ (s, 3H)}, 1.87 \text{ (s, 3H)}, 1.54 \text{ (s, 3H)}, 1.43 \text{ (s, 3H).}

\[ ^{13}\text{C} \text{ NMR (75 MHz, C}_6\text{D}_6\]: } \delta = 152.4, 152.2, 142.9, 136.8, 132.7, 128.6, 124.2, 121.1, 117.3, 116.7, 114.9, 114.4, 95.3, 66.3, 55.5, 25.7, 18.7, 18.0. \\
\text{HRMS (EI): } m/z [M]^+ \text{ calcld for C}_{18}\text{H}_{24}\text{O}_3: 288.1725; \text{ found: 288.1722.}

\((E)-4-(5-(\text{Methoxymethoxy})-2-((3\text{-methylbut-2-en-1-yl})\text{oxy})\text{phenyl})-2\text{-methylbut-3-en-2-ol (32)}\)

Colourless oil.

\text{IR (ATR): } 3434 \text{ (bw)}, 1491 \text{ (s)}, 1216 \text{ (m)}, 1076 \text{ (m)}, 1016 \text{ cm}^{-1} \text{ (s).}

\[ ^1\text{H} \text{ NMR (300 MHz, C}_6\text{D}_6\]: } \delta = 7.49 \text{ (d, } J = 2.9 \text{ Hz, 1H}), 7.28 \text{ (d, } J = 16.2 \text{ Hz, 1H}), 7.02 \text{ (dd, } J = 8.9, 3.0 \text{ Hz, 1H}), 6.69 \text{ (d, } J = 8.9 \text{ Hz, 1H}), 6.39 \text{ (d, } J = 16.2 \text{ Hz, 1H}), 5.50 \text{ (tm, } J = 6.6 \text{ Hz, 1H}), 4.93 \text{ (s, 2H)}, 4.34 \text{ (d, } J = 6.5 \text{ Hz, 2H}), 3.21 \text{ (s, 3H)}, 1.53 \text{ (s, 3H)}, 1.44 \text{ (s, 3H)}, 1.21 \text{ (s, 6H).}
$^{13}$C NMR (75 MHz, C$_6$D$_6$): $\delta = 152.3, 152.0, 139.1, 136.8, 121.4, 121.1, 116.4, 115.2, 114.3, 95.3, 70.8, 66.3, 55.5, 30.1, 25.7, 18.0; one signal could not be located due to signal overlap.

HRMS: no [M]$^+$ signal observed with all standard ionization techniques.
F3  Copies of spectra for chromanones 19, 20 and precursors

$^1$H NMR (300 MHz, CDCl$_3$) of 27

$^{13}$C NMR (75 MHz, CDCl$_3$) of 27
$^1$H NMR (300 MHz, C$_6$D$_6$) of 28a

$^{13}$C NMR (75 MHz, C$_6$D$_6$) of 28a
$^1$H NMR (300 MHz, CDCl$_3$) of 29a

$^{13}$C NMR (75 MHz, CDCl$_3$) of 29a
$^1$H NMR (300 MHz, CDCl$_3$) of 30

$^{13}$C NMR (75 MHz, CDCl$_3$) of 30
$^1$H NMR (300 MHz, CDCl$_3$) of 19

$^{13}$C NMR (75 MHz, CDCl$_3$) of 19
$^{1}$H NMR (300 MHz, C$_6$D$_6$) of 28b

$^{13}$C NMR (75 MHz, C$_6$D$_6$) of 28b
$^1$H NMR (300 MHz, CDCl$_3$) of 29b

$^{13}$C NMR (75 MHz, CDCl$_3$) of 29b
$^1$H NMR (300 MHz, CDCl$_3$) of 20

$^{13}$C NMR (75 MHz, CDCl$_3$) of 20
$^1$H NMR (300 MHz, C$_6$D$_6$) of 31

$^{13}$C NMR (75 MHz, C$_6$D$_6$) of 31
$^1$H NMR (300 MHz, C$_6$D$_6$) of 32

$^{13}$C NMR (75 MHz, C$_6$D$_6$) of 32
References

(1) Schmidt, B.; Riemer, M. Synthesis 2016, 48, 141-149.