

SUPPORTING INFORMATION

SYNTHESIS OF 2,3-DIHYDROBENZO[1,4]DIOXINS AND -OXAZINS VIA A
DOMINO WACKER-HECK REACTION

Lutz F. Tietze^{*[a]}, **Kristina F. Wilckens**^[a], **Sinem Yilmaz**^[a], **Florian Stecker**^[a],
and **Julia Zinngrebe**^[a]

^[a] Institute of Organic and Biomolecular Chemistry, Georg-August-University
Göttingen, Tammannstraße 2, D-37077 Göttingen (Germany), ltietze@gwdg.de

TABLE OF CONTENTS

<u>GENERAL EXPERIMENTAL METHODS</u>	<u>2</u>
<u>GENERAL PROCEDURES</u>	<u>2</u>
<u>SYNTHESIS OF THE MONOALLYL ETHERS 10–25</u>	<u>3</u>
<u>SYNTHESIS OF PHENOL 65</u>	<u>7</u>
<u>DOMINO WACKER-HECK REACTION.....</u>	<u>9</u>

GENERAL EXPERIMENTAL METHODS

All reactions were performed under argon in flame-dried flasks. All solvents were dried and distilled prior to use by usual laboratory methods. All reagents obtained from commercial sources were used without further purification. Thin-layer chromatography (TLC) was performed on precoated silica gel SIL G/UV₂₅₄ plates (Macherey–Nagel GmbH & Co. KG) and silica gel 60 (0.032–0.063 mm, Merck) was used for column chromatography. Phosphomolybdic acid in methanol (PMA) or vanillin in methanolic sulfuric acid were used as staining reagents for TLC. UV spectra were taken in CH₃CN or MeOH with a Perkin–Elmer Lambda 2 spectrometer. IR spectra were recorded as KBr pellets or as films with a Bruker IFS 25 spectrometer. ¹H- and ¹³C-NMR spectra were recorded with Mercury–200, VXR–200, Unity–300, Inova–500, Unity Inova–600 (Varian) or AMX 300 (Bruker) spectrometer. Chemical shifts are reported in ppm with tetramethylsilane (TMS) as internal standard. Multiplicities of ¹³C-NMR peaks were determined with the APT pulse sequence. Mass spectra were measured with a Finnigan MAT 95, TSQ 7000 or LCQ instrument.

GENERAL PROCEDURES

General Procedure A: Allylation using K₂CO₃: A suspension of anhydrous K₂CO₃ (0.95–1.1 eq.) and KI (1.1 eq.), or alternatively TBAI (cat.), in acetone (2 mL/mmol substrate) was treated with the respective substrate and stirred at room temperature until the end of gas release. Afterwards the allyl halide (1.1–2.0 eq.) was added and the resulting mixture stirred for 0.5–6 h at 25–60 °C. (TLC-Control). Then H₂O (5 mL/mmol) was added, the solution was neutralised with 1 N HCl and the aqueous phase was extracted with Et₂O (3 × 5 mL/mmol). The combined organic layers were dried over MgSO₄, the solvent removed under vacuum and the crude product purified by column chromatography on silica.

General Procedure B: Allylation using NaH: The substrate, dissolved in dry DMF (3 mL/mmol), was carefully treated with NaH (0.95 eq.) at 0 °C. After warming up to room temperature and the end of gas release, the respective allyl halide as well as TBAI (cat.) were added and the reaction mixture stirred for 2–24 h at 25–80 °C (TLC-Control). Then H₂O (5 mL/mmol) was added, the solution neutralised with 1 N HCl and the aqueous phase extracted with Et₂O (3 × 5 mL/mmol). The combined organic layers were

washed with H₂O (15 mL/mmol) and saturated NaCl-solution, dried over MgSO₄ and the solvent removed under reduced pressure. The crude product was purified by column chromatography on silica.

General Procedure C: Domino Wacker-Heck Reaction: A mixture of palladium trifluoroacetate (0.1 eq.) and *p*-benzoquinone (4.0 eq.) in CH₂Cl₂ (0.4–0.5 mL/mmol substrate) was stirred for 10 min at room temperature. Then a solution of the phenol (1.0 eq.) and the respective coupling partner (2.0–5.0 eq.) in CH₂Cl₂ (0.4–0.5 mL/mmol) was added to the suspension and the mixture was stirred for 5 h–4 d at 25–60 °C. (TLC-Control). At the end of the reaction the mixture was treated with 1N HCl (50 mL/mmol) and the aqueous phase extracted with Et₂O (3 x 50 mL/mmol). The combined organic phases were washed with 1N NaOH (3 x 50 mL/mmol), dried over MgSO₄ and the solvent was removed under reduced pressure. The crude product was purified by column chromatography on silica.

SYNTHESIS OF THE MONOALLYL ETHERS 10–25

2-(2-Methylallyloxy)-phenol (10): According to general procedure A, catechol (**1**) (5.01 g, 45.5 mmol) was treated with K₂CO₃ (6.92 g, 50.1 mmol, 1.1 eq.), KI and 3-chloro-2-methylpropene (**26**) (4.94 g, 54.6 mmol, 5.34 mL, 1.2 eq.) under reflux for 4 h. After column chromatography on silica (P/EtOAc = 50:1 → 10:1) the desired compound **10** (3.90 g, 23.8 mmol, 52 %) was obtained as a colorless liquid. ¹H-NMR (300 MHz, CDCl₃): δ = 1.85 (s, 3 H, 2'-CH₃), 4.51 (s, 2 H, 1'-H₂), 5.03 (m_c, 1 H, 3'-H), 5.10 (m_c, 1 H, 3'-H), 5.70 (s, 1 H, OH), 6.79–6.99 (m, 4 H, Ar-H) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 19.37 (2'-CH₃), 72.59 (C-1'), 113.30 (C-3'), 112.11, 114.62 (C-3, C-6), 120.02, 121.63 (C-4, C-5), 140.38 (C-2') 145.60, 145.78 (C-1, C-2) ppm. IR (Film): $\tilde{\nu}$ = 3536, 2919, 1597, 1501, 1454, 1373, 1259, 1219 cm⁻¹. UV (CH₃CN): λ_{max} (lg ε) = 197.0 (4.582), 199.5 (4.582), 215.5 (3.798), 276.0 (3.424) nm. MS (EI, 70 eV): m/z (%) = 164 (57) [M]⁺, 109 (30) [M-C₄H₇]⁺, 55 (100) [C₄H₇]⁺. Calcd for C₁₀H₁₂O₂: 164.0837, Found: 164.0837 (EI-HRMS).

5-Methyl-2-(2-methylallyloxy)-phenol (11), 4-Methyl-2-(2-methylallyloxy)-phenol (19): According to general procedure A, 4-methoxycatechol (**2**) (6.24 g, 50.3 mmol) was treated with K₂CO₃ (6.95 g, 50.3 mmol, 1.0 eq.), KI and 3-chloro-2-methylpropene (**26**) (5.01 g, 55.3 mmol, 5.41 mL, 1.1 eq.) under reflux for 4 h. After purification by column chromatography on silica (P/EtOAc = 60:1) a 1:1 mixture of the two regioisomers **11** and **19** (5.68 g, 31.9 mmol, 63 %) was obtained as a colorless liquid. ¹H-NMR

(300 MHz, CDCl₃): δ = 1.84, 1.86 (s, 3 H, 2'-CH₃), 2.27, 2.28 (s, 3 H, Ar-CH₃), 4.48, 4.49 (s, 2 H, 1'-H₂), 5.03 (m_c, 1 H, 3'-H_a), 5.10 (m_c, 1 H, 3'-H_b), 5.54, 5.65 (s, 1 H, OH), 6.59–6.88 (m, 3 H, Ar-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 19.31, 19.35 (2'-CH₃), 20.72, 20.97 (Ar-CH₃), 72.51, 72.75 (C-1'), 112.08, 112.98, 114.21, 115.42 (C-3, C-6), 113.09, 113.10 (C-3'), 120.15, 121.71 (C-4¹¹, C-5¹⁹), 129.44, 131.31 (C-4¹⁹, C-5¹¹), 140.46, 140.56 (C-2'), 143.42 (C-1), 145.31, 145.59 (C-2') ppm. **IR** (Film): $\tilde{\nu}$ = 3543, 2920, 1594, 1512, 1454, 1377, 1272, 1232 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 199.0 (4.623), 281.5 (3.469) nm. **MS** (EI, 70 eV): m/z (%) = 178 (38) [M]⁺, 123 (100) [M-C₄H₇]⁺, 55 (77) [C₄H₇]⁺. Calcd for C₁₁H₁₄O₂: 178.0994, Found: 178.0994 (EI-HRMS).

2-Methoxy-6-(2-methylallyloxy)-phenol (12), 3-Methoxy-2-(2-methylallyloxy)-phenol (20): According to general procedure A, 3-methoxycatechol (**3**) (7.04 g, 50.2 mmol) was treated with K₂CO₃ (6.94 g, 50.2 mmol, 1.0 eq.), KI and 3-chloro-2-methylpropene (**26**) (4.94 g, 55.3 mmol, 5.34 mL, 1.1 eq.) under reflux for 4 h. The two regioisomers **12** (5.11 g, 26.3 mmol, 52 %) and **20** (1.50 g, 7.72 mmol, 15 %) were obtained as colorless liquids after column chromatography on silica (P/EtOAc = 30:1 → 5:1). **12: ¹H-NMR** (300 MHz, CDCl₃): δ = 1.87 (s, 3 H, 2'-CH₃), 3.85 (s, 3 H, OMe), 4.47 (s, 2 H, 1'-H₂), 4.99 (m_c, 1 H, 3'-H), 5.11 (m_c, 1 H, 3'-H), 5.83 (s, 1 H, OH), 6.47 (dd, J = 8.3, 1.1 Hz, 1 H, 3-H), 6.60 (dd, J = 8.3, 1.2 Hz, 1 H, 5-H), 6.92 (t, J = 8.3 Hz, 1 H, 4-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 19.66 (2'-CH₃), 55.77 (OMe), 76.84 (C-1'), 104.03, 108.00 (C-3, C-5), 113.36 (C-3'), 124.00 (C-4), 134.56 (C-1), 141.55 (C-2'), 149.57, 152.47 (C-6, C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 3518, 2943, 1596, 1480, 1310, 1268, 1200 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 200.5 (4.613), 267.5 (2.885) nm. **MS** (EI, 70 eV): m/z (%) = 194 (54) [M]⁺, 139 (100) [M-C₄H₇]⁺. Calcd for C₁₁H₁₄O₃: 194.0943, Found: 194.0943 (EI-HRMS). **20: ¹H-NMR** (300 MHz, CDCl₃): δ = 1.83 (s, 3 H, 2'-CH₃), 3.89 (s, 3 H, OMe), 4.52 (s, 2 H, 1'-H₂), 4.99 (m_c, 1 H, 3'-H), 5.08 (m_c, 1 H, 3'-H), 5.56 (s, 1 H, OH), 6.54–6.61 (m, 2 H, 4-H, 5-H), 6.76 (t, J = 8.3 Hz, 1 H, 6-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 19.32 (2'-CH₃), 56.18 (OMe), 60.37 (C-1'), 105.06, 106.47 (C-4, C-6), 113.03 (C-3'), 118.88 (C-5), 135.16 (C-2), 140.66 (C-2'), 146.21, 147.35 (C-1, C-3) ppm. **IR** (Film): $\tilde{\nu}$ = 3517, 2939, 1619, 1507, 1480, 1363, 1284, 1214 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 202.0 (4.658), 269.5 (3.066) nm. **MS** (EI, 70 eV): m/z (%) = 194 (67) [M]⁺, 139 (100) [M-C₄H₇]⁺. Calcd for C₁₁H₁₄O₃: 194.0943, Found: 194.0943 (EI-HRMS).

2-Fluoro-6-(2-methylallyloxy)-phenol (13), 3-Fluoro-2-(2-methylallyloxy)-phenol (21): According to general procedure A, 3-fluorocatechol (**4**) (1.00 g, 7.81 mmol) was treated with K₂CO₃ (1.08 g, 7.81 mmol, 1.0 eq.), KI and 3-Chloro-2-methylpropene (**26**) (778 mg, 8.29 mmol, 841 μ L, 1.1 eq.) under reflux for 6 h

to obtain the two regioisomers **13** (**21**) (688 mg, 3.77 mmol, 48 %) and **21** (**13**) (103 mg, 0.57 mmol, 8 %) as colorless liquids after column chromatography on silica (P/EtOAc = 100:1 → 50:1). **13** or **21**: ¹H-NMR (300 MHz, CDCl₃): δ = 1.86 (s, 3 H, 2'-CH₃), 4.56 (s, 2 H, 1'-H₂), 5.01 (m_c, 1 H, 3'-H_a), 5.11 (m_c, 1 H, 3'-H_b), 5.81 (s, 1 H, OH), 6.63 (ddd, *J* = 11.3, 8.4, 1.5 Hz, 1 H, 4-H), 6.74 (dt, *J* = 8.2, 1.5 Hz, 1 H, 6-H), 6.89 (dt, *J* = 8.2, 6.0 Hz, 1 H, 5-H) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 19.46 (2'-CH₃), 77.55, 77.63 (C-1'), 108.02, 108.28 (C-3), 110.81, 110.85 (C-5), 114.30 (C-3'), 123.39, 123.51 (C-4), 133.41, 133.58 (C-1), 140.79 (C-2'), 149.77, 149.84 (C-6), 153.36, 156.62 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 3528, 2946, 1597, 1497, 1350, 1295, 1225 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 194.5 (4.567), 267.5 (3.004) nm. **MS** (EI, 70 eV): *m/z* (%) = 182 (29) [M]⁺, 55 (100) [C₄H₇]⁺. Calcd for C₁₀H₁₁FO₂: 182.0743. Found: 182.0743 (EI-HRMS).

3-Hydroxy-4-(2-methyl-allyloxy)-benzoic acid ethyl ester (14), 4-Hydroxy-3-(2-methyl-allyloxy)-benzoic acid ethyl ester (22): According to general procedure A, 3,4-dihydroxy-benzoic acid ethyl ester (**5**) (1.50 g, 8.23 mmol) was reacted with K₂CO₃ (1.25 g, 9.05 mmol, 1.1 eq.), TBAI and 3-chloro-2-methylpropene (**26**) (820 mg, 9.06 mmol, 887 μ L, 1.1 eq.) under reflux for 6 h to provide a 4.1:1 mixture of regioisomers **14** and **22** (933 mg, 3.95 mmol, 48 %) as a white solid after column chromatography on silica (P/EtOAc = 50:1 → 10:1). Via a second column chromatography regioisomer **14** (556 mg, 2.35 mmol, 29 %) could partially be isolated from the mixture. **14**: ¹H-NMR (300 MHz, CDCl₃): δ = 1.37 (t, *J* = 7.2 Hz, 3 H, OCH₂CH₃), 1.83 (s, 3 H, 2'-CH₃), 4.33 (q, *J* = 7.1 Hz, 2 H, OCH₂CH₃), 4.56 (s, 2 H, 1'-H₂), 5.04 (m_c, 1 H, 3'-H_a), 5.08 (m_c, 1 H, 3'-H_b), 5.73 (s, 1 H, OH), 6.86 (d, *J* = 8.4 Hz, 1 H, 5-H), 7.58 (dd, *J* = 8.3, 2.2 Hz, 1 H, 6-H), 7.61 (d, *J* = 2.0 Hz, 1 H, 2-H) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 14.31 (OCH₂CH₃), 19.31 (2'-CH₃), 60.73 (OCH₂CH₃), 72.58 (C-1'), 113.85 (C-3'), 111.07, 115.68, 122.55 (C-2, C-5, C-6), 123.80 (C-1), 139.65 (C-2'), 145.26 (C-3), 149.31 (C-4), 166.27 (CO₂Et) ppm. **IR** (Pellet): $\tilde{\nu}$ = 3489, 2980, 1692, 1614, 1514, 1448, 1371, 1267 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 206.0 (4.393), 216.0 (4.339), 256.5 (4.084), 292.5 (3.775) nm. **MS** (ESI): *m/z* (%) = 495.2 (36) [2 × M+Na]⁺, 275.1 (16) [M+K]⁺, 259.1 (19) [M+Na]⁺, 237.1 (100) [M+H]⁺. Calcd for C₁₃H₁₆O₄: 237.11214 [M+H]⁺. Found 237.11209 [M+H]⁺ (ESI-HRMS).

3-Hydroxy-4-(2-methylallyloxy)-benzonitrile (15), 4-Hydroxy-3-(2-methylallyloxy)-benzonitrile (23): According to general procedure B, 3,4-dihydroxybenzonitrile (**6**) (500 mg, 3.70 mmol) was reacted with 3-bromo-2-methylpropene (**26**) (550 mg, 4.07 mmol, 410 μ L, 1.1 eq.) within 3 h at 60 °C and a 3.2:1 mixture of the two product regioisomers (376 mg, 1.99 mmol, 54 %) was obtained as a white solid after column chromatography on silica (P/EtOAc = 30:1 → 10:1). ¹H-NMR (300 MHz, CDCl₃): δ = 1.83 (s,

3 H, 2'-CH₃), 4.53 (s, 2 H, 1'-H₂²³), 4.56 (s, 2 H, 1'-H₂¹⁵), 5.02–5.11 (m, 2 H, 3'-H), 5.98 (s, 1 H, OH¹⁵), 6.30 (s, 1 H, OH²³), 6.87 (m_c, 1 H, 5-H¹⁵), 6.96 (d, *J* = 8.4 Hz, 1 H, 5-H²³), 7.07 (d, *J* = 1.9 Hz, 1 H, 2-H²³), 7.12–7.18 (m, 2 H, 6-H¹⁵, 2-H²³), 7.20 (dd, *J* = 8.3, 1.9 Hz, 1 H, 6-H²³) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 19.20 (2'-CH₃), 72.72 (C-1¹⁵), 72.94 (C-1²³), 103.04 (C-1²³), 104.47 (C-1¹⁵), 112.09 (C-5¹⁵), 114.20 (C-3²³), 114.24 (C-3¹⁵), 115.17 (C-5²³), 115.34 (C-2²³), 117.74 (C-2¹⁵), 118.94 (CN¹⁵), 119.19 (CN²³), 125.39 (C-6¹⁵), 126.98 (C-6²³), 139.13 (C-2¹⁵), 139.17 (C-2²³), 145.60 (C-3¹⁵), 145.96 (C-4²³), 149.30 (C-4¹⁵), 150.00 (C-3²³) ppm. IR (Pellet): $\tilde{\nu}$ = 3349, 2229, 1580, 1510, 1290 cm⁻¹. UV (CH₃CN): λ_{\max} (lg ϵ) = 212.0 (4.472), 251.5 (4.119), 287.5 (3.664), 292.0 (3.653) nm. MS (EI, 70 eV): *m/z* (%) = 189 (27) [M]⁺, 55 (100) [C₄H₇]⁺. Calcd for C₁₁H₁₁NO₂: 189.0790. Found: 189.0790 (EI-HRMS).

2-(2-Methylallyloxy)-5-nitro-phenol (16), 2-(2-Methylallyloxy)-4-nitro-phenol (24): According to general procedure B, 4-Nitrocatechol (7) (500 mg, 3.22 mmol) was reacted with 3-Bromo-2-methylpropene (26) (479 mg, 3.55 mmol, 358 μ L, 1.1 eq.) within 4 h at 80 °C and a 14.5:1 mixture of the two product regioisomers (396 mg, 1.89 mmol, 58 %) was obtained as a yellow solid after column chromatography on silica (P/EtOAc = 30:1 → 5:1). Main isomer **16**: ¹H-NMR (300 MHz, CDCl₃): δ = 1.83 (s, 3 H, 2'-CH₃), 4.63 (s, 2 H, 1'-H₂), 5.07–5.11 (m, 2 H, 3'-H₂), 5.83 (s, 1 H, OH), 6.90 (m_c, 1 H, 5-H), 7.75–7.83 (m, 2 H, 2-H, 6-H) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 19.22 (2'-CH₃), 73.09 (C-1'), 110.20, 110.78 (C-2, C-5), 114.50 (C-3'), 116.76 (C-6), 138.97 (C-2'), 141.91 (C-1), 145.63 (C-3), 150.80 (C-4) ppm. IR (Pellet): $\tilde{\nu}$ = 3355, 1606, 1508, 1448, 1340, 1276 cm⁻¹. UV (CH₃CN): λ_{\max} (lg ϵ) = 209.5 (4.054), 241.0 (3.907), 301.0 (3.754), 337.0 (3.830), 451.5 (2.435) nm. MS (EI, 70 eV): *m/z* (%) = 439.0 (59) [2 × M–2 H+Na]⁻, 207.9 (98) [M–H]⁻, 153.0 (100) [M–C₄H₈]⁻. Calcd for C₁₀H₁₁NO₄: 208.06153 [M–H]⁻. Found: 208.06160 [M–H]⁻.

4-tert-Butyl-2-(2-methylallyloxy)-phenol (17), 5-tert-Butyl-2-(2-methylallyloxy)-phenol (25): According to general procedure B, 4-tert-butylcatechol (8) (1.50 g, 9.03 mmol) was treated with 3-bromo-2-methylpropene (26) (1.34 mg, 9.93 mmol, 1.00 mL, 1.1 eq.) for 2 h at room temperature to obtain a 1:1 mixture of regioisomers **17** and **25** (934 mg, 4.24 mmol, 47 %) as a colorless liquid after column chromatography on silica (P/EtOAc = 100:1 → 10:1). ¹H-NMR (300 MHz, CDCl₃): δ = 1.31, 1.32 (s, 9 H, C(CH₃)₃), 1.86, 1.87 (m_c, 3 H, 2'-CH₃), 4.50, 4.54 (s, 2 H, 1'-H₂), 5.04, 5.06, 5.12, 5.14 (m_c, 2 H, 3'-H₂), 5.60, 5.69 (s, 1 H, OH), 6.81 (d, *J* = 8.4 Hz, 1 H, 3-H²⁵, 6-H¹⁷), 6.86 (dd, *J* = 8.5, 2.2 Hz, 1 H, 4-H²⁵/5-H¹⁷), 6.89–6.96 (m, 3 H, Ar-H), 7.04 (d, *J* = 2.2 Hz, 6-H²⁵/3-H¹⁷) ppm. ¹³C-NMR (75.6 MHz, CDCl₃): δ = 19.36, 19.41 (2'-CH₃), 31.40, 31.51 (C(CH₃)₃), 34.17, 34.32 (C(CH₃)₃), 72.70, 72.74 (C-1'), 109.81, 111.53, 112.22, 113.86, 116.40, 118.08 (C-3, C-6, C-4²⁵, C-5¹⁷), 113.12, 113.34 (C-3'), 140.62,

140.70, 143.18, 143.36, 143.42, 144.90, 145.05, 145.13 (C-2', C-1, C-2, C-5²⁵, C-4²⁵) ppm. **IR** (Film): $\tilde{\nu}$ = 3550, 2963, 1592, 1518, 1454, 1365, 1279, 1215 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 199.0 (4.691), 279.0 (3.500) nm. **MS** (DCI): m/z (%) = 255 (63) [M+NH₃+NH₄]⁺, 238 (100) [M+NH₄]⁺. Calcd for C₁₄H₂₀O₂: 243.13555 [M+Na]⁺. Found: 243.13554 [M+Na]⁺ (ESI-HRMS).

2,4-Di-*tert*-butyl-6-(2-methylallyloxy)-phenol (18): According to general procedure **B**, 3,5-di-*tert*-butylcatechol (**9**) (500 mg, 2.25 mmol) was reacted with 3-chloro-2-methylpropene (**26**) (224 mg, 2.47 mmol, 242 μ L, 1.1 eq.) within 24 h at room temperature to provide the desired product **18** (317 mg, 1.15 mmol, 51 %) as a colorless crystalline solid after column chromatography on silica (P/EtOAc = 150:1 \rightarrow 50:1). **¹H-NMR** (300 MHz, CDCl₃): δ = 1.30 (s, 9 H, 2-C(CH₃)₃), 1.43 (s, 9 H, 4-C(CH₃)₃), 1.87 (s, 3 H, 2'-CH₃), 4.50 (s, 2 H, 1'-H₂), 5.03 (m_c, 1 H, 3'-H_a), 5.12 (m_c, 1 H, 3'-H_b), 5.93 (s, 1 H, OH), 6.82 (d, J = 2.3 Hz, 1 H, 5-H), 6.93 (d, J = 2.3 Hz, 1 H, 3-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 19.51 (2'-CH₃), 29.47 (4-C(CH₃)₃), 31.63 (2-C(CH₃)₃), 34.56 (4-C(CH₃)₃), 34.88 (2-C(CH₃)₃), 73.06 (C-1'), 107.36 (C-5), 113.20 (C-3'), 115.89 (C-3), 134.58, 140.86, 141.25, 142.00, 145.20 (C-2', C-1, C-2, C-4, C-6) ppm. **IR** (Pellet): $\tilde{\nu}$ = 3455, 2958, 1595, 1421, 1362, 1302, 1252, 1219 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 201.5 (4.682), 278.5 (3.387) nm. **MS** (EI, 70 eV): m/z (%) = 276 (30) [M]⁺, 173 (29) [M-C₈H₁₆]⁺, 57 (46) [C₄H₉]. Calcd for C₁₈H₂₈O₂: 299.19815 [M+Na]⁺. Found: 299.19826 [M+Na]⁺ (ESI-HRMS).

SYNTHESIS OF PHENOL 65

(2-Hydroxy-phenyl)-carbamic acid *tert*-butyl ester (62): 2-Aminophenol (**61**) (2.00 g, 18.3 mmol) in THF (20 mL) was treated with di-*tert*-butyldicarbonate (4.20 g, 19.2 mmol, 4.42 mL, 1.05 eq.) and stirred for 13 h at room temperature. Then the solvent was removed in vacuum and the residue dissolved in H₂O (50 mL). The aqueous phase was extracted with EtOAc (3 \times 50 mL) and the solvent removed in vacuum. The remaining solid was washed with CCl₄ to yield the protected phenol **62** (3.60 g, 17.2 mmol, 94 %) as colorless crystals. **¹H-NMR** (300 MHz, CDCl₃): δ = 1.53 (s, 9 H, C(CH₃)₃), 6.68 (s, 1 H, NH), 6.86 (dt, J = 7.7, 1.8 Hz, 1 H, 5-H), 6.96 (dd, J = 8.1, 1.6 Hz, 1 H, 3-H), 7.00–7.11 (m, 2 H, 4-H, 6-H), 8.17 (s, 1 H, OH) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 28.22 (C(CH₃)₃), 82.03 (C(CH₃)₃), 118.66, 120.74, 121.27, 125.47, 125.57 (C-1, C-3, C-4, C-5, C-6), 147.26 (C-2), 154.98 (CO₂C(CH₃)₃) ppm. **IR** (Pellet): $\tilde{\nu}$ = 3427, 3292, 1691, 1614, 1522, 1456, 1326, 1227 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 204.5 (4.576), 235.0 (4.026),

281.0 (3.550) nm. **MS** (ESI): m/z (%) = 441 (55) $[2 M+Na]^+$, 232 (100) $[M+Na]^+$. Calcd for $C_{11}H_{15}NO_3$: 232.09441 $[M+Na]^+$. Found: 232.09447 $[M+Na]^+$ (ESI-HRMS).

(2-Triisopropylsilyloxyphenyl)-carbamic acid *tert*-butyl ester (63): A solution of **62** (1.29 g, 6.17 mmol) and imidazole (1.5 Äq, 630 mg, 9.25 mmol) in CH_2Cl_2 (20 mL) was treated with TIPS-Cl (1.78 g, 9.25 mmol, 1.98 mL, 1.5 eq.) and stirred for 20 h at room temperature. Afterwards H_2O (50 mL) was added and the reaction mixture extracted with CH_2Cl_2 (3×50 mL). The combined organic phases were washed with saturated aqueous NaCl, dried over $MgSO_4$ and the solvent was removed under reduced pressure. After purification via column chromatography on silica (P/EtOAc = 100:1) the double protected phenol **63** (2.13 g, 5.83 mmol, 95 %) was received as a colorless oil. **1H -NMR** (300 MHz, $CDCl_3$): δ = 1.12 (d, J = 7.3 Hz, 18 H, $CH(CH_3)_2$), 1.24–1.41 (m, 3 H, $CH(CH_3)_2$), 1.51 (s, 9 H, $C(CH_3)_3$), 6.78–6.89 (m, 2 H, 3-H, 5-H), 6.93 (dt, J = 6.9, 2.2 Hz, 1 H, 4-H), 7.11 (s, 1 H, OH), 7.99 (d, J = 8.0 Hz, 1 H, 6-H) ppm. **^{13}C -NMR** (75.6 MHz, $CDCl_3$): δ = 12.68 ($CH(CH_3)_2$), 17.89 ($CH(CH_3)_2$), 28.29 ($C(CH_3)_3$), 80.00 ($C(CH_3)_3$), 117.29 (C-3), 118.48 (C-6), 121.52 (C-5), 122.16 (C-4), 129.81 (C-1), 143.88 (C-2), 152.75 ($CO_2C(CH_3)_3$) ppm. **IR** (Film): $\tilde{\nu}$ = 3438, 2946, 2869, 1735, 1598, 1450, 1367, 1328, 1265, 1234 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 206.5 (4.609), 237.0 (4.152), 280.0 (3.480) nm. **MS** (DCI): m/z (%) = 749 (100) $[2 M+NH_4]^+$, 383 (95) $[M+NH_4]^+$, 366 (13) $[M+H]^+$. Calcd for $C_{20}H_{35}NO_3Si$: 366.24590 $[M+H]^+$. Found: 366.24593 $[M+H]^+$ (ESI-HRMS).

(2-Methylallyl)-(2-triisopropylsilyloxyphenyl)-carbamic acid *tert*-butyl ester (64): A solution of **63** (2.03 g, 5.55 mmol) in dry DMF (60 mL) was treated with 3-Brom-2-methylpropene (**26**) (2.25 g, 16.7 mmol, 1.68 mL, 3.0 eq.) and the resulting reaction mixture cooled to 0 °C before NaH (60 % in mineral oil, 244 mg, 6.11 mmol, 1.1 eq.) was added in small portions. After slow warming up to room temperature the mixture was stirred for further 3 h. Afterwards aqueous NH_4Cl solution (15 mL) and Et_2O (60 mL) were added carefully. The organic phase was washed with saturated aqueous NH_4Cl solution (2×60 mL), dried over Na_2SO_4 and the solvent was removed in vacuum. After column chromatography on silica (P/EtOAc = 100:1 \rightarrow 95:5) alkene **64** (2.31 g, 5.50 mmol, 99 %) could be obtained as colorless crystals. **1H -NMR** (300 MHz, $DMSO-d_6$, 100 °C): δ = 1.15 (d, 18 H, $CH(CH_3)_2$), 1.29–1.47 (m, 3 H, $CH(CH_3)_2$), 1.38 (s, 9 H, $C(CH_3)_3$), 1.75 (s, 3 H, 2'- CH_3), 2.98 (s, 2 H, 1'- H_2), 4.74 (m_c, 1 H, 3'- H_a), 4.80 (m_c, 1 H, 3'- H_b), 6.88–6.96 (m, 2 H, 3-H, 5-H), 7.11 (dd, J = 7.8, 1.7 Hz, 1 H, 6-H), 7.18 (ddd, J = 8.3, 7.3, 1.8 Hz, 1 H, 4-H) ppm. **^{13}C -NMR** (75.6 MHz, $DMSO-d_6$, 100 °C): δ = 11.84 ($CH(CH_3)_2$), 17.14 ($CH(CH_3)_2$), 19.31 (2'- CH_3), 27.35 ($C(CH_3)_3$), 53.80 (C-1'), 78.25 ($C(CH_3)_3$), 111.5 (C-3'), 118.2, 119.8, 127.2, 130.2 (C-3, C-6, C-5, C-4), 131.6 (C-1), 141.1 (C-2'), 150.6, 153.5 (C-2, $CO_2C(CH_3)_3$) ppm. **IR**

(Pellet): $\tilde{\nu}$ = , 2946, 2867, 1693, 1499, 1381, 1300 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 192.0 (4.559), 273.0 (3.284), 278.0 (3.250) nm. **MS** (EI, 70 eV): m/z (%) = 419 (47) $[\text{M}]^+$, 346 (100) $[\text{M}-\text{C}_4\text{H}_9\text{O}]^+$. Calcd for $\text{C}_{24}\text{H}_{41}\text{NO}_3\text{Si}$: 420.29285 $[\text{M}+\text{H}]^+$. Found: 420.29299 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(2-Hydroxyphenyl)-(2-methylallyl)- carbamic acid tert-butyl ester (65): TBAF·3 H_2O (1.91 g, 6.05 mmol, 1.25 eq.) was added to a solution of **64** (2.03 g, 4.84 mmol) in THF (50 mL) and the resulting mixture was stirred for 15 min at room temperature (TLC-Control). Afterwards the solvent was removed in vacuum and the crude product filtered over silica (P/EtOAc = 30:1 \rightarrow 5:1) to yield alkene **65** (1.17 g, 4.44 mmol, 92 %) as a colorless crystalline solid. **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.49 (s, 9 H, $\text{C}(\text{CH}_3)_3$), 1.72 (s, 3 H, 2'- CH_3), 4.16 (s, 2 H, 1'- H_2), 4.84–4.90 (m_c , 2 H, 3'- H_2), 6.90 (dt, J = 7.4, 1.5 Hz, 1 H, 5-H), 7.01 (dd, J = 8.2, 1.2 Hz, 1 H, 3-H), 7.10–7.19 (m, 2 H, 4-H, 6-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 20.09 (2'- CH_3), 28.11 ($\text{C}(\text{CH}_3)_3$), 56.63 (C-1'), 81.90 ($\text{C}(\text{CH}_3)_3$), 111.49 (C-3'), 119.47 (C-3), 120.94 (C-5), 125.51, 127.65 (C-4, C-6), 130.90 (C-1), 141.20 (C-2'), 150.95 (C-2), 155.53 ($\text{CO}_2\text{C}(\text{CH}_3)_3$) ppm. **IR** (Pellet): $\tilde{\nu}$ = 3248, 2973, 1651, 1597, 1513, 1403, 1294 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 274.0 (3.395) nm. **MS** (ESI): m/z (%) = 549.3 (27) $[2 \text{M}+\text{Na}]^+$, 302.12 (100) $[\text{M}+\text{K}]^+$, 286.14 (37) $[\text{M}+\text{Na}]^+$. Calcd for $\text{C}_{15}\text{H}_{21}\text{NO}_3$: 286.14136 $[\text{M}+\text{Na}]^+$. Found: 286.14146 $[\text{M}+\text{Na}]^+$ (ESI-HRMS).

DOMINO WACKER-HECK REACTION

(rac)-(E)-5-(2-Methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-31) : According to general procedure **C**, phenol **10** (53.1 mg, 323 μmol) was reacted with methyl vinyl ketone (**27**) (45.3 mg, 647 μmol , 52.7 μL , 2.0 eq.), *p*-benzoquinone (140 mg, 1.29 mmol, 4.0 eq.) and palladium trifluoroacetate (10.8 mg, 32.3 μmol , 0.1 eq.) in CH_2Cl_2 (0.35 mL) at room temperature for 10 h. Purification by column chromatography on silica (P/EtOAc = 5:1) yielded **(rac)-31** (66.2 mg, 285 μmol , 88 %) as a yellow oil. **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.32 (s, 3 H, 2'- CH_3), 2.26 (s, 3 H, 1- H_3), 2.48 (ddd, J = 14.4, 8.3, 1.2 Hz, 1 H, 5- H_a), 2.65 (ddd, J = 14.5, 7.1, 1.5 Hz, 1 H, 5- H_b), 3.87 (d, J = 11.3 Hz, 1 H, 3'- H_a), 3.96 (d, J = 11.3 Hz, 1 H, 3'- H_b), 6.14 (dt, J = 15.9, 1.4 Hz, 1 H, 3-H), 6.76–6.93 (m, 5 H, 4-H, Ar-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 21.37 (2'- CH_3), 27.08 (C-1), 38.81 (C-5), 70.43 (C-2'), 73.63 (C-3'), 117.00, 117.57 (C-5', C-8'), 121.22, 122.02 (C-6', C-7'), 134.64 (C-3), 141.26 (C-4), 141.97, 142.08 (C-4'a, C-8'a), 198.05 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2980 (C-H), 1674 (C=O), 1630, 1593 (C=C), 1494, 1362 (CH_3), 1264, 1201 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 200.0 (4.719), 217.5 (4.329), 278.0 (3.507), 331.0 (2.419)

nm. **MS** (EI, 70 eV): m/z (%) = 232 (30) $[M]^+$, 149 (100) $[M-C_5H_7O]^+$. Calcd for $C_{14}H_{16}O_3$: 233.11722 $[M+H]^+$. Found: 233.11711 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(2-Methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-32):

Phenol **10** (49.8 mg, 303 μ mol) was reacted with methyl acrylate (**28**) (52.2 mg, 607 μ mol, 55.0 μ L, 2.0 eq.), *p*-benzoquinone (131 mg, 1.21 mmol, 4.0 eq.) and palladium trifluoroacetate (10.1 mg, 30.3 μ mol, 0.1 eq.) in CH_2Cl_2 (0.35 mL) at room temperature for 12 h following general procedure **C**. Purification by column chromatography on silica (P/EtOAc = 6:1) yielded (*rac*)-**32** (66.1 mg, 266 μ mol, 88 %) as a colorless oil. **¹H-NMR** (300 MHz, $CDCl_3$): δ = 1.32 (s, 3 H, 2'-CH₃), 2.48 (ddd, J = 14.4, 8.3, 1.3 Hz, 1 H, 4-H_a), 2.60 (ddd, J = 14.2, 7.2, 1.6 Hz, 1 H, 4-H_b), 3.74 (s, 3 H, OMe), 3.85 (d, J = 11.3 Hz, 1 H, 3'-H_a), 3.96 (d, J = 11.3 Hz, 1 H, 3'-H_b), 5.92 (dt, J = 15.7, 1.4 Hz, 1 H, 2-H), 6.79–6.92 (m, 4 H, Ar-H), 7.00 (ddd, J = 15.6, 8.2, 7.2 Hz, 1 H, 3-H) ppm. **¹³C-NMR** (75.6 MHz, $CDCl_3$): δ = 21.23 (2'-CH₃), 38.48 (C-4), 51.54 (OMe), 70.28 (C-2'), 73.58 (C-3'), 116.95, 117.64 (C-5', C-8'), 121.13, 121.98 (C-6', C-7'), 124.81 (C-2), 141.98, 142.07 (C-4'a, C-8'a), 142.61 (C-3), 166.38 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2981, 1724, 1659, 1594, 1494, 1436, 1264 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 201.0 (4.720), 277.5 (3.472) nm. **MS** (EI, 70 eV): m/z (%) = 248 (24) $[M]^+$, 149 (100) $[M-C_5H_7O_2]^+$. Calcd for $C_{14}H_{16}O_4$: 249.11214 $[M+H]^+$. Found: 249.11214 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(2-Methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid ethyl ester ((rac)-33):

Phenol **10** (70.0 mg, 426 μ mol) was reacted with ethyl acrylate (**29**) (85.4 mg, 853 μ mol, 92.7 μ L, 2.0 eq.), *p*-benzoquinone (184 mg, 1.71 mmol, 4.0 eq.) and palladium trifluoroacetate (14.2 mg, 42.6 μ mol, 0.1 eq.) in CH_2Cl_2 (0.45 mL) at 40 °C for 20 h following general procedure **C**. Purification by column chromatography on silica (P/EtOAc = 10:1) yielded (*rac*)-**33** (80.2 mg, 306 μ mol, 72 %) as a colorless oil. **¹H-NMR** (300 MHz, $CDCl_3$): δ = 1.30 (t, J = 7.3 Hz, 3 H, CH_2CH_3), 1.33 (s, 3 H, 2'-CH₃), 2.48 (ddd, J = 14.2, 8.2, 1.2 Hz, 1 H, 4-H_a), 2.60 (ddd, J = 14.5, 7.3, 1.5 Hz, 1 H, 4-H_b), 3.85 (d, J = 11.3 Hz, 1 H, 3'-H_a), 3.97 (d, J = 11.3 Hz, 1 H, 3'-H_b), 4.20 (q, J = 7.2 Hz, 2 H, CH_2CH_3), 5.91 (dt, J = 15.6, 1.4 Hz, 1 H, 2-H), 6.79–6.92 (m, 4 H, Ar-H), 6.98 (ddd, J = 15.6, 8.1, 7.3 Hz, 1 H, 3-H) ppm. **¹³C-NMR** (75.6 MHz, $CDCl_3$): δ = 14.22 (OCH_2CH_3), 21.25 (2'-CH₃), 38.50 (C-4), 60.39 (OCH_2CH_3), 70.28 (C-2'), 73.63 (C-3'), 116.96, 117.65 (C-5', C-8'), 121.13, 121.98 (C-6', C-7'), 125.28 (C-2), 142.01, 142.09 (C-4'a, C-8'a), 142.24 (C-3), 165.99 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2981, 1719, 1656, 1594, 1369, 1264 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 200.5 (4.727), 278.0 (3.486) nm. **MS** (EI, 70 eV): m/z (%) = 262.2 (17) $[M]^+$, 149.1 (100) $[M-C_6H_9O_2]^+$. Calcd for $C_{15}H_{18}O_4$: 263.12779 $[M+H]^+$. Found: 263.12771 $[M+H]^+$ (ESI-HRMS).

(rac)-(E/Z)-4-(2-Methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enitrile ((rac)-34): Phenol **10** (70.0 mg, 426 μmol) was reacted with acryl nitrile (**30**) (45.2 mg, 853 μmol , 92.7 μL , 2.0 eq.), *p*-benzoquinone (184 mg, 1.71 mmol, 4.0 eq.) and palladium trifluoroacetate (14.2 mg, 42.6 μmol , 0.1 eq.) in CH_2Cl_2 (0.45 mL) at 60 °C for 3 d following general procedure **C**. Purification by column chromatography on silica (P/EtOAc = 10:1) yielded **34** (*E/Z* = 5:1, 48.7 mg, 226 μmol , 44 %) as a mixture of the doublebond isomers as a yellow oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.32, 1.34 (s, 3 H, 2'- CH_3), 2.44 (ddd, *J* = 14.5, 8.3, 1.2 Hz, 1 H, 4- $\text{H}_{a(E)}$), 2.59–2.76 (m, 1 H, 4- $\text{H}_{b(E)}$, 4- $\text{H}_{a(Z)}$), 2.84 (ddd, *J* = 14.9, 6.7, 1.2 Hz, 1 H, 4- $\text{H}_{b(Z)}$) 3.81–4.01 (m, 2 H, 3'- H_2), 5.42 (dt, *J* = 16.3, 1.5 Hz, 1 H, 2- $\text{H}_{(E)}$), 5.51 (dt, *J* = 11.0, 1.4 Hz, 1 H, 2- $\text{H}_{(Z)}$), 6.64 (ddd, *J* = 11.2, 8.6, 6.8, 1 H, 3- $\text{H}_{(Z)}$), 6.78 (*m_c*, 1 H, 3- $\text{H}_{(E)}$), 6.82–6.94 (m, 4 H, Ar-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.16 (2'- CH_3), 39.15 (C-4), 70.18 (C-2'), 73.20 (C-3'), 103.41 (C-2), 116.82 (CN), 116.98, 117.51 (C-5', C-8'), 121.34, 122.09 (C-6', C-7'), 141.59, 141.85 (C-4'a, C-8'a), 149.46 (C-3) ppm. **IR** (Film): $\tilde{\nu}$ = 2981, 2225, 1636, 1594, 1494, 1464, 1386, 1264, 1205 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 200.5 (4.732), 277.5 (3.484) nm. **MS** (EI, 70 eV): *m/z* (%) = 215.1 (33) $[\text{M}]^+$, 149.1 (100) $[\text{M}-\text{C}_4\text{H}_4\text{N}]^+$. Calcd for $\text{C}_{13}\text{H}_{13}\text{NO}_2$: 238.08385 $[\text{M}+\text{Na}]^+$. Found: 238.08387 $[\text{M}+\text{Na}]^+$ (ESI-HRMS).

(rac)-(E)-5-(8-Methoxy-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-35): Following general procedure **C**, phenol **12** (75.1 mg, 387 μmol) was reacted with methyl vinyl ketone (**27**) (54.2 mg, 773 μmol , 54.2 μL , 2.0 eq.), *p*-benzoquinone (167 mg, 1.55 mmol, 4.0 eq.) and palladium trifluoroacetate (10.8 mg, 38.7 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) at room temperature within 5 h. After purification by column chromatography on silica (P/EtOAc = 8:3) the desired compound (*rac*)-**35** (79.5 mg, 303 μmol , 78 %) was obtained as a colorless oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.33 (s, 3 H, 2'- CH_3), 2.26 (s, 3 H, 1- H_3), 2.48 (ddd, *J* = 14.4, 8.0, 1.2 Hz, 1 H, 5- H_a), 2.65 (ddd, *J* = 14.5, 7.0, 1.3 Hz, 1 H, 5- H_b), 3.87–3.94 (m, 4 H, OMe, 3'- H_a), 4.04 (d, *J* = 11.2 Hz, 1 H, 3'- H_b), 6.15 (dt, *J* = 15.9, 1.2 Hz, 1 H, 3-H), 6.52 (m, 2 H, Ar-H), 6.82 (m, 2 H, Ar-H, 4-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.34 (2'- CH_3), 27.13 (C-1), 38.66 (C-5), 56.07 (OMe), 70.62 (C-2'), 73.67 (C-3'), 103.80, 110.30 (C-5', C-7'), 121.00 (C-6'), 131.64 (C-8'a), 134.73 (C-3), 141.21 (C-4), 142.64 (C-4'a), 148.83 (C-8'), 198.09 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2934, 1673, 1597, 1474, 1363, 1332, 1257, 1201, 1132, 1102, 983, 909, 768, 718 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 206.0 (4.703). **MS** (EI, 70 eV): *m/z* (%) = 262 (17) $[\text{M}]^+$, 179 (34) $[\text{M}-\text{C}_3\text{H}_7\text{O}]^+$. Calcd for $\text{C}_{15}\text{H}_{18}\text{O}_4$: 263.12779 $[\text{M}+\text{H}]^+$. Found: 263.12766 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-5-(5-Methoxy-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)pent-3-en-2-one ((rac)-36): Following general procedure **C**, phenol **20** (77.6 mg, 401 μmol) was reacted with methyl vinyl ketone (**27**)

(56.1 mg, 801 μmol , 65.3 μL , 2.0 eq.), *p*-benzoquinone (173 mg, 1.60 mmol, 4.0 eq.) and palladium trifluoroacetate (13.2 mg, 40.1 μmol , 0.1 eq.) in CH_2Cl_2 (0.45 mL) at room temperature for 6 h. Purification by column chromatography on silica (P/EtOAc = 8:3) provided the desired compound (*rac*)-**36** (77.2 mg, 294 μmol , 74 %) as a yellow oil. **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.33 (s, 3 H, 2'- CH_3), 2.26 (s, 3 H, 1- H_3), 2.48 (ddd, J = 14.4, 8.0, 1.2 Hz, 1 H, 5- H_a), 2.65 (ddd, J = 14.5, 7.0, 1.3 Hz, 1 H, 5- H_b), 3.87–3.94 (m, 4 H, OMe, 3'- H_a), 4.04 (d, J = 11.2 Hz, 1 H, 3'- H_b), 6.15 (dt, J = 15.9, 1.2 Hz, 1 H, 3-H), 6.52 (m, 2 H, Ar-H), 6.82 (m, 2 H, Ar-H, 4-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 21.49 (2'- CH_3), 26.98 (C-1), 38.56 (C-5), 56.07 (OMe), 70.12 (C-2'), 73.67 (C-3'), 104.65 (C-6'), 109.66 (C-8'), 120.07 (C-7'), 131.60 (C-4'a), 134.68 (C-3), 141.31 (C-4), 142.79 (C-8'a), 149.31 (C-5'), 198.04 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2936, 1673, 1596, 1478, 1255, 1218 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 207.0 (4.701) nm. **MS** (ESI): m/z (%) = 285 $[\text{M}+\text{Na}]^+$, 236 $[\text{M}+\text{H}]^+$. Calcd for $\text{C}_{15}\text{H}_{18}\text{O}_4$: 263.12779 $[\text{M}+\text{H}]^+$. Found: 263.12779 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(*rac*)-(E)-5-(8-Fluoro-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((*rac*)-37**)**: According to general procedure C, phenol **13** (74.0 mg, 406 μmol) was reacted with methyl vinyl ketone (**27**) (56.9 mg, 812 μmol , 66.2 μL , 2.0 eq.), *p*-benzoquinone (176 mg, 1.62 mmol, 4.0 eq.) and palladium trifluoroacetate (13.5 mg, 40.6 μmol , 0.1 eq.) in CH_2Cl_2 (0.45 mL) for 5 h at room temperature. Purification by column chromatography on silica (P/EtOAc = 5:1) yielded the desired product (*rac*)-**37** (75.3 mg, 299 μmol , 74 %) as a yellow oil. **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.33 (s, 3 H, 2'- CH_3), 2.25 (s, 3 H, 1- H_3), 2.47 (dd, J = 14.6, 8.1 Hz, 1 H, 5- H_a), 2.63 (dd, J = 14.6, 7.0 Hz, 1 H, 5- H_b), 3.89 (d, J = 11.3 Hz, 1 H, 3'- H_a), 4.01 (d, J = 11.3 Hz, 1 H, 3'- H_b), 6.14 (d, J = 16.0 Hz, 1 H, 3-H), 6.60–6.71 (m, 2 H, Ar-H), 6.72–6.87 (m, 2 H, Ar-H, 4-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 21.18 (2'- CH_3), 27.13 (C-1), 38.62 (C-5), 70.34 (C-2'), 73.98 (C-3'), 108.04, 108.27 (C-7'), 112.82, 112.86 (C-5'), 120.57, 120.68 (C-6'), 130.94, 131.13 (C-8'a), 134.73 (C-3), 140.57 (C-4), 143.52, 143.56 (C-4'a), 149.99, 153.23 (C-8'), 197.87 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2983, 1674, 1597, 1497, 1476, 1363, 1314, 1253 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 198.5 (4.609), 214.5 (4.327), 269.0 (3.129), 275.0 (3.078) nm. **MS** (EI, 70 eV): m/z (%) = 250.1 (27) $[\text{M}]^+$, 167.0 (99) $[\text{M}-\text{C}_5\text{H}_7\text{O}]^+$, 43.0 (100) $[\text{C}_2\text{H}_3\text{O}]^+$. Calcd for $\text{C}_{14}\text{H}_{15}\text{FO}_3$: 251.10780 $[\text{M}+\text{H}]^+$. Found: 251.10788 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(*rac*)-(E)-3-Methyl-3-(4-oxo-pent-2-enyl)-2,3-dihydrobenzo[*b*][1,4]dioxin-6-carboxylic acid ethyl ester ((*rac*)-38**)**: According to general procedure C, phenol **14** (100 mg, 423 μmol) was reacted with methyl vinyl ketone (**27**) (59.3 mg, 847 μmol , 69.0 μL , 2.0 eq.), *p*-benzoquinone (183 mg, 1.69 mmol, 4.0 eq.) and palladium trifluoroacetate (14.1 mg, 42.3 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) for 5 h at 60 $^\circ\text{C}$.

Purification by column chromatography on silica (P/EtOAc = 4:1) yielded the desired product (*rac*)-**38** (114.9 mg, 378 μ mol, 89 %) as a yellow oil. **¹H-NMR** (300 MHz, CDCl₃): δ = 1.33 (s, 3 H, 3-CH₃), 1.36 (t, J = 7.3 Hz, 3 H, CO₂CH₂CH₃), 2.27 (s, 3 H, 5'-H₃), 2.47 (ddd, J = 14.4, 8.3, 1.1 Hz, 1 H, 1'-H_a), 2.62 (ddd, J = 14.3, 7.0, 1.4 Hz, 1 H, 1'-H_b), 3.91 (d, J = 11.4 Hz, 1 H, 2-H_a), 4.01 (d, J = 11.4 Hz, 1 H, 2-H_b), 4.33 (q, J = 7.3 Hz, 2 H, CO₂CH₂CH₃), 6.15 (m_c, 1 H, 3'-H), 6.80 (ddd, J = 15.5, 8.0, 7.0 Hz, 1 H, 2'-H), 6.91 (m_c, 1 H, 8-H), 7.55–7.66 (m, 2 H, 5-H, 7-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 14.31 (CO₂CH₂CH₃), 21.26 (3-CH₃), 27.16 (C-5'), 38.80 (C-1'), 60.76 (CO₂CH₂CH₃), 70.63 (C-3), 73.71 (C-2), 116.78, 119.25, 123.19 (C-5, C-7, C-8), 124.45 (C-6), 134.82 (C-3'), 140.61 (C-2'), 141.46 (C-3), 146.12 (C-2), 166.00 (CO₂Et), 197.93 (C-4') ppm. **IR** (Film): $\tilde{\nu}$ = 2982, 1714, 1588, 1508, 1433, 1366, 1293, 1205 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 209.0 (4.556), 222.0 (4.558), 254.5 (4.067), 295.0 (3.680) nm. **MS** (ESI): m/z (%) = 327.1 (50) [M+Na]⁺, 322.2 (63) [M+NH₄]⁺, 305.2 (22) [M+H]⁺. Calcd for C₁₇H₂₀O₅: 305.13835 [M+H]⁺. Found: 305.13820 [M+H]⁺ (ESI-HRMS).

(rac)-(E)-5-(6,8-Di-tert-butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one

(rac)-39: Following general procedure C, phenol **18** (100 mg, 362 μ mol) was converted with methyl vinyl ketone (**27**) (50.8 mg, 724 μ mol, 59.0 μ L, 2.0 eq.), *p*-benzoquinone (156 mg, 1.45 mmol, 4.0 eq.) and palladium trifluoroacetate (12.0 mg, 36.2 μ mol, 0.1 eq.) in CH₂Cl₂ (0.40 mL) at 40 °C for 4 d. Purification by column chromatography on silica (P/EtOAc = 10:1) provided **(rac)-39** (84.8 mg, 246 μ mol, 68 %) as a yellow oil. **¹H-NMR** (300 MHz, CDCl₃): δ = 1.28 (s, 9 H, C(CH₃)₃), 1.36 (s, 3 H, 2'-CH₃), 1.39 (s, 9 H, C(CH₃)₃), 2.25 (s, 3 H, 1-H₃), 2.55 (ddd, J = 14.1, 7.9, 1.2 Hz, 1 H, 5-H_a), 2.65 (ddd, J = 14.1, 7.3, 1.3 Hz, 1 H, 5-H_b), 3.86 (d, J = 11.1 Hz, 1 H, 3'-H_a), 3.94 (d, J = 10.9 Hz, 1 H, 3'-H_b), 6.17 (dt, J = 16.1, 1.3 Hz, 1 H, 3-H), 6.81 (d, J = 2.3 Hz, 1 H, 5'-H), 6.92 (m_c, J = 15.9, 7.5 Hz, 1 H, 4-H), 6.92 (d, J = 2.3 Hz, 1 H, 7'-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl₃): δ = 21.26 (2'-CH₃), 26.75 (C-1), 29.76, 31.48 (C(CH₃)₃), 34.32, 35.11 (C(CH₃)₃), 39.59 (C-5), 70.18 (C-2'), 73.46 (C-3'), 112.21 (C-5'), 116.50 (C-7'), 134.82 (C-3), 137.67, 138.00, 141.36, 142.84 (C-6', C-8', C-4'a, C-8'a), 141.95 (C-4), 198.13 (C-2) ppm. **IR** (Pellet): $\tilde{\nu}$ = 2962, 1678, 1587, 1483, 1420, 1363, 1308, 1242 cm⁻¹. **UV** (CH₃CN): λ_{\max} (lg ϵ) = 204.5 (4.763), 279.5 (3.474), 383.5 (3.476) nm. **MS** (ESI): m/z (%) = 367.2 (71) [M+Na]⁺, 362.3 (100) [M+NH₄]⁺, 345.2 (90) [M+H]⁺. Calcd for C₂₂H₃₂O₃: 345.24242 [M+H]⁺. Found: 345.24232 [M+H]⁺ (ESI-HRMS).

(rac)-(E)-5-(2,7-Dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-40), (rac)-(E)-5-(2,6-Dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-41): Following general procedure C, the mixture of regioisomers **11** and **19** (100 mg, 561 μ mol) was reacted with methyl vinyl

ketone (**27**) (78.7 mg, 1.12 μmol , 91.5 μL , 2.0 eq.), *p*-benzoquinone (243 mg, 2.24 mmol, 4.0 eq.) and palladium trifluoroacetate (18.7 mg, 56.1 μmol , 0.1 eq.) in CH_2Cl_2 (0.55 mL) for 6 h at room temperature. Purification by column chromatography on silica (P/EtOAc = 8:1) yielded a mixture of the isomers (*rac*)-**40** and (*rac*)-**41** (110.4 mg, 448 μmol , 80 %) as a yellow oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.31 (s, 3 H, 2'- CH_3), 2.23–2.28 (m, 6 H, 1- H_3 , Ar- CH_3), 2.40–2.51 (m, 1 H, 5- H_a), 2.58–2.69 (m, 1 H, 5- H_b), 3.80–3.87 (m, 1 H, 3'- H_a), 3.90–3.97 (m, 1 H, 3'- H_b), 6.08–6.18 (m_c, 1 H, 3-H), 6.60–6.90 (m, 4 H, 4-H, Ar-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 20.60, 20.67 (Ar- CH_3), 21.34, 21.37 (2'- CH_3), 27.05 (C-1), 38.71, 38.83 (C-5), 70.46, 70.50 (C-2'), 73.42, 73.63 (C-3'), 116.61, 117.19, 117.31, 117.89, 121.78, 122.58 (C-5'⁴⁰, C-6'⁴⁰, C-8'⁴⁰, C-5'⁴¹, C-7'⁴¹, C-8'⁴¹), 130.91, 131.70 (C-7'⁴⁰, C-6'⁴¹), 134.62 (C-3), 139.58, 139.75 (C-4'a⁴⁰, C-8'a⁴¹), 141.42 (C-4), 141.56, 141.65 (C-8'a⁴⁰, C-4'a⁴¹), 198.06 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2979, 1674, 1593, 1506, 1426, 1362, 1279, 1215 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 202.5 (4.650), 283.5 (3.528) nm. **MS** (EI, 70 eV): m/z (%) = 246.2 (66) $[\text{M}]^+$, 163.1 (100) $[\text{M}-\text{C}_5\text{H}_7\text{O}]^+$. Calcd for $\text{C}_{15}\text{H}_{18}\text{O}_3$: 247.13287 $[\text{M}+\text{H}]^+$. Found: 247.13275 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-3-Methyl-3-(4-oxo-pent-2-enyl)-2,3-dihydrobenzo[*b*][1,4]dioxin-6-carbonitrile ((rac)-42),

(rac)-(E)-2-Methyl-2-(4-oxopent-2-enyl)-2,3-dihydrobenzo[*b*][1,4]dioxin-6-carbonitrile ((rac)-43):

The mixture of regioisomers **15** and **23** (70.0 mg, 370 μmol) was reacted with methyl vinyl ketone (**27**) (51.9 mg, 740 μmol , 60.3 μL , 2.0 eq.), *p*-benzoquinone (160 mg, 1.48 mmol, 4.0 eq.) and palladium trifluoroacetate (13.5 mg, 37.0 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) at 40 °C for 38 h following general procedure C. Purification by column chromatography on silica (P/EtOAc = 4:1) provided a mixture of the isomers (*rac*)-**42** and (*rac*)-**43** (86.9 mg, 338 μmol , 91 %) as a colorless oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.33, 1.35 (s, 3 H, 3'⁴²- CH_3 /2'⁴³- CH_3), 2.26, 2.27 (s, 3 H, 5'- H_3), 2.43–2.54 (m, 1 H, 1'- H_a), 2.55–2.66 (m, 1 H, 1'- H_b), 3.86–4.05 (m, 2 H, 2'⁴²-H/3'⁴³-H), 6.11 (m_c, 1 H, 3'-H), 6.70–6.83 (m, 1 H, 2'-H), 6.88–6.97 (m, 1 H, Ar-H), 7.12–7.21 (m, 2 H, Ar-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.18, 21.24 (3- CH_3), 27.32, 27.39 (C-5'), 38.76, 38.85 (C-1'), 70.29, 70.57 (C-3'⁴², C-2'⁴³), 74.25, 74.99 (C-2'⁴², C-3'⁴³), 104.35, 105.19 (C-6), 118.00, 118.56 (C-8), 118.75, 118.80 (CN), 121.01, 121.54 (C-5'⁴², C-7'⁴³), 125.75, 126.52 (C-7'⁴², C-5'⁴³), 134.91, 134.95 (C-3'), 139.85, 139.90 (C-4a⁴², C-8a⁴³), 142.26, 142.34 (C-8a⁴², C-4a^B), 197.74, 197.77 (C-4') ppm. **IR** (Film): $\tilde{\nu}$ = 2983, 2225, 1674, 1581, 1506, 1424, 1363, 1286 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 212.5 (4.637), 219.0 (4.632), 250.0 (4.102), 296.0 (3.648) nm. **MS** (ESI): m/z (%) = 280 (100) $[\text{M}+\text{Na}]^+$, 258 (56) $[\text{M}+\text{H}]^+$. Calcd for $\text{C}_{15}\text{H}_{15}\text{NO}_3$: 258.11247 $[\text{M}+\text{H}]^+$. Found: 258.11262 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-5-(2-Methyl-7-nitro-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-44), (rac)-(E)-5-(2-Methyl-6-nitro-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-45): According to general procedure C, the mixture of regioisomers **16** and **24** (70.0 mg, 335 μmol) was treated with methyl vinyl ketone (**27**) (46.9 mg, 669 μmol , 54.5 μL , 2.0 eq.), *p*-benzoquinone (145 mg, 1.34 mmol, 4.0 eq.) and palladium trifluoroacetate (11.1 mg, 33.5 μmol , 0.1 eq.) in CH_2Cl_2 (0.35 mL) at 40 $^\circ\text{C}$ for 18 h. Purification by column chromatography on silica (P/EtOAc = 8:3) yielded a mixture of the isomers **(rac)-44** and **(rac)-45** (86.7 mg, 313 μmol , 93 %) as a yellow oil. Main isomer **rac-44**: **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.36 (s, 3 H, 2'- CH_3), 2.28 (s, 3 H, 1- H_3), 22.53 (ddd, J = 14.4, 8.0, 1.3 Hz, 1 H, 5- H_a), 2.63 (ddd, J = 14.5, 7.1, 1.5 Hz, 1 H, 5- H_b), 3.97 (d, J = 11.5 Hz, 1 H, 3'- H_a), 4.06 (d, J = 11.5 Hz, 1 H, 3'- H_b), 6.17 (dt, J = 15.9, 1.4 Hz, 1 H, 3-H), 6.78 (m_c, J = 15.9, 7.1 Hz, 1 H, 4-H), 6.91–7.00 (m, 1 H, Ar-H), 7.73–7.85 (m, 2 H, Ar-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 21.15 (2'- CH_3), 27.32 (C-1), 38.78 (C-5), 70.68 (C-2'), 74.33 (C-3'), 113.77 (C-8'), 117.06, 117.45 (C-5', C-6'), 135.04 (C-3), 139.74 (C-4), 141.72 (C-8'a), 142.34 (C-7'), 147.84 (C-4'a), 197.77 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2935, 1674, 1593, 1521, 1345, 1276 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 216.0 (3.403), 301.0 (2.797), 332.5 (2.798) nm. **MS** (EI, 70 eV): m/z (%) = 277.1 (52) $[\text{M}]^+$, 194.0 (100) $[\text{M}-\text{C}_5\text{H}_7\text{O}]^+$. Calcd for $\text{C}_{14}\text{H}_{15}\text{NO}_5$: 278.10230 $[\text{M}+\text{H}]^+$. Found: 278.10233 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-5-(7-tert-Butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-46), (rac)-(E)-5-(6-tert-Butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-pent-3-en-2-one ((rac)-47): The mixture of regioisomers **17** and **25** (80.0 mg, 363 μmol) was reacted with methyl vinyl ketone (**27**) (50.9 mg, 726 μmol , 59.2 μL , 2.0 eq.), *p*-benzoquinone (157 mg, 1.45 mmol, 4.0 eq.) and palladium trifluoroacetate (11.1 mg, 36.3 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) for 6 h at room temperature following general procedure C. A mixture of the isomers **(rac)-46** and **(rac)-47** (88.7 mg, 308 μmol , 85 %) was obtained after purification by column chromatography on silica (P/EtOAc = 5:1) as a yellow oil. **$^1\text{H-NMR}$** (300 MHz, CDCl_3): δ = 1.28 (s, 9 H, $\text{C}(\text{CH}_3)_3$), 1.32, 1.33 (s, 3 H, 2'- CH_3), 2.26, 2.27 (s, 3 H, 1- H_3), 2.43–2.54 (m, 1 H, 5- H_a), 2.60–2.70 (m, 1 H, 5- H_b), 3.81–3.89 (m, 1 H, 3'- H_a), 3.91–3.99 (m, 1 H, 3'- H_b), 6.11–6.19 (m, 1 H, 3-H), 6.77–6.93 (m, 4 H, 4-H, Ar-H) ppm. **$^{13}\text{C-NMR}$** (75.6 MHz, CDCl_3): δ = 21.43, 21.47 (2'- CH_3), 27.02, 27.14 (C-1), 31.42 ($\text{C}(\text{CH}_3)_3$), 34.15, 34.21 ($\text{C}(\text{CH}_3)_3$), 38.87, 38.99 (C-5), 70.45, 70.55 (C-2'), 73.56, 73.73 (C-3'), 114.02, 114.52, 116.32, 116.82, 118.16, 118.96 (C-5'⁴⁶, C-6'⁴⁶, C-8'⁴⁶, C-5'⁴⁷, C-7'⁴⁷, C-8'⁴⁷), 134.61, 134.64 (C-3), 139.51, 139.60, 141.25, 141.29, 144.59, 145.42 (C-4'a, C-8'a, C-7'⁴⁶, C-6'⁴⁷), 141.42, 141.55 (C-4), 198.09, 198.12 (C-2) ppm. **IR** (Film): $\tilde{\nu}$ = 2964, 1675, 1590, 1504, 1421, 1362, 1275, 1201 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 202.0 (4.740), 281.0 (3.562) nm. **MS** (ESI): m/z

(%) = 311.2 (100), $[M+Na]^+$, 289.2 (71) $[M+H]^+$. Calcd for $C_{18}H_{24}O_3$: 289.17982 $[M+H]^+$. Found: 289.17993 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(8-Methoxy-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-48): According to general procedure C, phenol **12** (76.3 mg, 393 μ mol) was reacted with methyl acrylate (**28**) (67.6 mg, 786 μ mol, 71.1 μ L, 2.0 eq.), *p*-benzoquinone (170 mg, 1.57 mmol, 4.0 eq.) and palladium trifluoroacetate (13.1 mg, 39.3 μ mol, 0.1 eq.) in CH_2Cl_2 (0.45 mL) at room temperature within 7 h. Purification by column chromatography on silica (P/EtOAc = 8:3) yielded the desired compound (*rac*)-**48** (75.3 mg, 271 μ mol, 69 %) as a colorless oil. **1H -NMR** (300 MHz, $CDCl_3$): δ = 1.33 (s, 3 H, 2'-CH₃), 2.48 (ddd, J = 14.4, 8.3, 1.3 Hz, 1 H, 4-H_a), 2.62 (ddd, J = 14.3, 7.2, 1.4 Hz, 1 H, 4-H_b), 3.74 (s, 1 H, CO₂Me), 3.88 (s, 1 H, OMe), 3.90 (d, J = 11.2 Hz, 1 H, 3'-H_a), 4.03 (d, J = 11.2 Hz, 1 H, 3'-H_b), 5.92 (ddd, J = 15.7, 1.4 Hz, 1 H, 3-H), 6.47–6.56 (m, 2 H, 5'-H, 7'-H), 6.81 (dd, J = 8.4, 8.1 Hz, 1 H, 6'-H), 6.99 (ddd, J = 15.5, 8.0, 7.2 Hz, 1 H, 3-H) ppm. **^{13}C -NMR** (75.6 MHz, $CDCl_3$): δ = 21.16 (2'-CH₃), 38.33 (C-4), 51.52 (CO₂CH₃), 56.02 (OMe), 70.48 (C-2'), 73.57 (C-3'), 103.71, 110.34 (C-5', C-7'), 120.89 (C-6'), 124.85 (C-2), 131.60 (C-8'a), 142.51 (C-3), 142.62 (C-4'a), 148.77 (C-8'), 166.36 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2950, 1723, 1659, 1597, 1499, 1474, 1332, 1284, 1201 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 206.0 (4.734), 262.0 (3.017) nm. **MS** (EI, 70 eV): m/z (%) = 278.2 (43) $[M]^+$, 179.1 (100) $[M-C_5H_7O_2]^+$. Calcd for $C_{15}H_{18}O_5$: 279.12270 $[M+H]^+$. Found: 279.12265 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(5-Methoxy-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-49): Phenol **20** (100.0 mg, 515 μ mol) was reacted with methyl acrylate (**28**) (88.6 mg, 1.03 mmol, 93.3 μ L, 2.0 eq.), *p*-benzoquinone (223 mg, 2.06 mmol, 4.0 eq.) and palladium trifluoroacetate (17.1 mg, 51.5 μ mol, 0.1 eq.) in CH_2Cl_2 (0.40 mL) at room temperature within 36 h following general procedure C. After purification by column chromatography on silica (P/EtOAc = 4:1) the desired product (*rac*)-**49** (69.3 mg, 249 μ mol, 48 %) was yielded as a colorless oil. **1H -NMR** (300 MHz, $CDCl_3$): δ = 1.38 (s, 3 H, 2'-CH₃), 2.50–2.67 (m_c, 2 H, 4-H₂), 3.73 (s, 3 H, CO₂Me), 3.81–3.88 (m, 4 H, OMe, 3'-H_a), 3.97 (d, J = 11.3 Hz, 1 H, 3'-H_b), 5.91 (dt, J = 15.6, 1.4 Hz, 1 H, 2-H), 6.53 (m, 2 H, 6'-H, 8'-H), 6.78 (t, J = 8.3 Hz, 1 H, 7'-H), 6.98 (ddd, J = 15.6, 8.0 Hz, 1 H, 3-H) ppm. **^{13}C -NMR** (75.6 MHz, $CDCl_3$): δ = 21.32 (2'-CH₃), 38.32 (C-4), 51.51 (CO₂CH₃), 56.11 (OMe), 69.92 (C-2'), 73.75 (C-3'), 104.68, 109.67 (C-6', C-8'), 119.97 (C-7'), 124.91 (C-2), 131.67 (C-8'a), 142.58 (C-3), 142.80 (C-4'a), 149.35 (C-5'), 166.35 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2950, 1723, 1659, 1597, 1478, 1384, 1281, 1200 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 205.5 (4.755) nm. **MS** (EI, 70 eV): m/z (%) = 278.1 (40) $[M]^+$, 179.1 (100) $[M-C_5H_7O_2]^+$. Calcd for $C_{15}H_{18}O_5$: 279.12270 $[M+H]^+$. Found: 279.12269 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(8-fluoro-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-50): Following general procedure C, phenol **13** (100 mg, 549 μmol) was treated with methyl acrylate (**28**) (94.5 mg, 1.10 mmol, 99.5 μL , 2.0 eq.), *p*-benzoquinone (237 mg, 2.20 mmol, 4.0 eq.) and palladium trifluoroacetate (18.2 mg, 54.9 μmol , 0.1 eq.) in CH_2Cl_2 (0.55 mL) for 20 h at room temperature. Purification by column chromatography on silica (P/EtOAc = 10:1) yielded **(rac)-50** (107 mg, 401 μmol , 73 %) as a colorless oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.33 (s, 3 H, 2'-CH₃), 2.47 (ddd, J = 14.3, 8.1 Hz, 1.2 Hz, 1 H, 4-H_a), 2.60 (ddd, J = 14.5, 7.2, 1.4 Hz, 1 H, 4-H_b), 3.73 (s, 3 H, OMe), 3.88 (d, J = 11.3 Hz, 1 H, 3'-H_a), 4.01 (d, J = 11.3 Hz, 1 H, 3'-H_b), 5.91 (dt, J = 15.7, 1.4 Hz, 1 H, 2-H), 6.61–6.81 (m, 3 H, Ar-H), 6.97 (m_c, J = 15.5, 8.1, 7.2 Hz, 1 H, 3-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.07 (2'-CH₃), 38.33 (C-4), 51.52 (OMe), 70.24 (C-2'), 73.94 (C-3'), 107.98, 108.22 (C-7'), 112.87, 112.92 (C-5'), 120.52, 120.64 (C-6'), 125.03 (C-2), 130.96, 131.14 (C-8'a), 142.03 (C-3), 143.54, 143.59 (C-4'a), 150.00, 153.24 (C-8'), 166.25 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2951, 1724, 1660, 1597, 1497, 1476, 1314 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 199.0 (4.700), 269.0 (3.086), 275.0 (3.040) nm. **MS** (ESI): m/z (%) = 305.1 (100) $[\text{M}+\text{K}]^+$, 289.1 (57) $[\text{M}+\text{Na}]^+$, 267.1 (67) $[\text{M}+\text{H}]^+$. Calcd for $\text{C}_{14}\text{H}_{15}\text{FO}_4$: 267.10271 $[\text{M}+\text{H}]^+$. Found: 267.10262 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-3-(4-Methoxy-4-oxobut-2-enyl)-3-methyl-2,3-dihydrobenzo[*b*][1,4]-dioxin-6-carboxylic acid ethyl ester ((rac)-51): Phenol **14** (100 mg, 423 μmol) was treated with methyl acrylate (**28**) (72.9 mg, 847 μmol , 76.7 μL , 2.0 eq.), *p*-benzoquinone (183 mg, 1.69 mmol, 4.0 eq.) and palladium trifluoroacetate (14.1 mg, 42.3 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) at 40 °C within 18 h according to general procedure C. Purification by column chromatography on silica (P/EtOAc = 7:1) provided **(rac)-51** (114.5 mg, 357 μmol , 84 %) as a colorless oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.33 (s, 3 H, 3-CH₃), 1.36 (t, J = 7.3 Hz, 3 H, $\text{CO}_2\text{CH}_2\text{CH}_3$), 2.47 (ddd, J = 14.4, 8.3, 1.2 Hz, 1 H, 1'-H_a), 2.58 (ddd, J = 14.4, 7.3, 1.5 Hz, 1 H, 1'-H_b), 3.74 (s, 3 H, OMe), 3.90 (d, J = 11.4 Hz, 1 H, 2-H_a), 4.00 (d, J = 11.3 Hz, 1 H, 2-H_b), 4.32 (q, J = 7.2 Hz, 2 H, $\text{CO}_2\text{CH}_2\text{CH}_3$), 5.92 (dt, J = 15.8, 1.4 Hz, 1 H, 3'-H_a), 6.88–7.03 (m, 2 H, 3'-H_b, 7-H), 6.91 (m_c, 1 H, 8-H), 7.54–7.60 (m, 2 H, 5-H, 7-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 14.31 ($\text{CO}_2\text{CH}_2\text{CH}_3$), 21.15 (3-CH₃), 38.48 (C-1'), 51.60 (OMe), 60.74 ($\text{CO}_2\text{CH}_2\text{CH}_3$), 70.49 (C-3), 73.68 (C-2), 116.74, 119.31, 123.15 (C-5, C-7, C-8), 124.42 (C-6), 125.10 (C-3'), 141.48 (C-3), 142.04 (C-2'), 146.13 (C-2), 166.04 (CO_2Et), 166.29 (C-4') ppm. **IR** (Film): $\tilde{\nu}$ = 2983, 1717, 1660, 1588, 1507, 1434, 1286, 1206 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 211.0 (3.549), 217.5 (3.521), 255.5 (3.051), 295.0 (2.684) nm. **MS** (EI, 70 eV): m/z (%) = 320.2 (23) $[\text{M}+\text{H}]^+$, 221.1 (100) $[\text{M}-\text{C}_5\text{H}_7\text{O}_2]^+$. Calcd for $\text{C}_{17}\text{H}_{20}\text{O}_6$: 321.13326 $[\text{M}+\text{H}]^+$. Found: 321.13332 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-4-(6,8-Di-tert-butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]-dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-52): According to general procedure C, phenol **18** (100 mg, 362 μmol) was reacted with methyl acrylate (**28**) (62.3 mg, 724 μmol , 65.6 μL , 2.0 eq.), *p*-benzoquinone (156 mg, 1.45 mmol, 4.0 eq.) and palladium trifluoroacetate (12.0 mg, 36.2 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) at 40 °C within 3 d. After purification by column chromatography on silica (P/EtOAc = 15:1) (*rac*)-**52** (112.8 mg, 313 μmol , 86 %) was provided as a white solid. ¹H-NMR (300 MHz, CDCl_3): δ = 1.28 (s, 9 H, C(CH₃)₃), 1.35 (s, 3 H, 2'-CH₃), 1.38 (s, 9 H, C(CH₃)₃), 2.58 (dd, *J* = 7.8, 1.2 Hz, 1 H, 4-H), 3.74 (s, 3 H, OMe), 3.83 (d, *J* = 11.1 Hz, 1 H, 3'-H_a), 3.93 (d, *J* = 11.1 Hz, 1 H, 3'-H_b), 5.90–5.98 (m, 1 H, 2-H), 6.79 (d, *J* = 2.4 Hz, 1 H, 5'-H), 6.91 (d, *J* = 2.4 Hz, 1 H, 7'-H), 7.05 (m_c, *J* = 15.5, 7.7 Hz, 1 H, 3-H) ppm. ¹³C-NMR (75.6 MHz, CDCl_3): δ = 21.22 (2'-CH₃), 29.78, 31.49 (C(CH₃)₃), 34.31, 35.11 (C(CH₃)₃), 39.28 (C-4), 51.55 (OMe), 69.88 (C-2'), 73.38 (C-3'), 112.15 (C-5'), 116.46 (C-7'), 124.81 (C-2), 137.81, 138.03, 141.35, 142.74 (C-6', C-8', C-4'a, C-8'a), 142.99 (C-3), 166.40 (C-1) ppm. IR (Film): $\tilde{\nu}$ = 2955, 1728, 1660, 1588, 1419, 1310, 1241 cm^{-1} . UV (CH_3CN): λ_{max} (lg ϵ) = 205.0 (4.812), 284.0 (3.438), 280.0 (3.427) nm. MS (ESI): *m/z* (%) = 383.2 (24) [M+Na]⁺, 378.3 (100) [M+NH₄]⁺, 361.2 (45) [M+H]⁺. Calcd for C₂₂H₃₂O₄: 361.23734 [M+H]⁺. Found: 361.23715 [M+H]⁺ (ESI-HRMS).

(rac)-(E)-4-(2,7-Dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-53), (rac)-(E)-4-(2,6-Dimethyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-54): A mixture of regioisomers **11** and **19** (100 mg, 561 μmol) was reacted with methyl acrylate (**28**) (96.6 mg, 1.12 mmol, 102 μL , 2.0 eq.), *p*-benzoquinone (243 mg, 2.24 mmol, 4.0 eq.) and palladium trifluoroacetate (18.7 mg, 56.1 μmol , 0.1 eq.) in CH_2Cl_2 (0.55 mL) for 9 h at room temperature following general procedure C. After purification by column chromatography on silica (P/EtOAc = 10:1) a mixture of the isomers (*rac*)-**53** and (*rac*)-**54** (114.6 mg, 437 μmol , 78 %) was obtained as a colorless oil. ¹H-NMR (300 MHz, CDCl_3): δ = 1.30 (s, 3 H, 2'-CH₃), 2.25 (s, 3 H, Ar-CH₃), 2.41–2.51 (m, 1 H, 4-H_a), 2.54–2.64 (m, 1 H, 4-H_b), 3.74 (m, 3 H, OMe), 3.79–3.85 (m, 1 H, 3'-H_a), 3.90–3.96 (m, 1 H, 3'-H_b), 6.87–6.96 (m_c, 1 H, 2-H), 6.61–6.81 (m, 3 H, Ar-H), 6.93–7.06 (m, 1 H, 3-H) ppm. ¹³C-NMR (75.6 MHz, CDCl_3): δ = 20.60, 20.66 (Ar-CH₃), 21.20, 21.23 (2'-CH₃), 38.39, 38.50 (C-4), 51.53 (OMe), 70.32, 70.36 (C-2'), 73.38, 73.58 (C-3'), 116.56, 117.25, 117.27, 117.95, 121.69, 122.54 (C-5'⁵³, C-6'⁵³, C-8'⁵³, C-5'⁵⁴, C-7'⁵⁴, C-8'⁵⁴), 124.75 (C-2) 130.80, 131.65 (C-7'⁵³, C-6'⁵⁴), 139.60, 139.76 (C-4'a⁵³, C-8'a⁵⁴), 141.58, 141.66 (C-8'a⁵³, C-4'a⁵⁴), 142.74 (C-3), 166.40 (C-1) ppm. IR (Film): $\tilde{\nu}$ = 2950, 1725, 1660, 1593, 1506, 1436, 1278 cm^{-1} . UV (CH_3CN): λ_{max} (lg ϵ) = 202.5 (4.354), 283.5 (3.160) nm. MS (EI, 70 eV): *m/z* (%) = 262.1 (46) [M]⁺, 163.1 (100) [M-C₅H₇O₂]⁺. Calcd for C₁₅H₁₈O₄: 263.12779 [M+H]⁺. Found: 263.12777 [M+H]⁺ (ESI-HRMS).

(rac)-(E)-4-(7-Cyano-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-55), (rac)-(E)-4-(6-Cyano-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-56): Following general procedure **C**, the mixture of regioisomers **15** and **23** (70.0 mg, 370 μmol) was converted with methyl acrylate (**28**) (63.7 mg, 740 μmol , 67.1 μL , 2.0 eq.), *p*-benzoquinone (160 mg, 1.48 mmol, 4.0 eq.) and palladium trifluoroacetate (13.5 mg, 37.0 μmol , 0.1 eq.) in CH_2Cl_2 (0.40 mL) at 40 °C for 38 h. Purification by column chromatography on silica (P/EtOAc = 5:1) provided a mixture of the isomers *(rac)*-**55** and *(rac)*-**56** (94.0 mg, 344 μmol , 93 %) as a colorless oil. **¹H-NMR** (300 MHz, CDCl_3): δ = 1.33, 1.34 (s, 3 H, 2'- CH_3), 2.42–2.64 (m, 2 H, 4- H_2), 3.74, 3.74 (s, 3 H, OMe), 3.84–4.05 (m, 2 H, 3'- H_2), 5.87–5.96 (m, 1 H, 2-H), 6.85–7.00 (m, 2 H, 3-H, 8⁵⁵-H/5⁵⁶-H), 7.10–7.20 (m, 2 H, 5⁵⁵-H/8⁵⁶-H, 6⁵⁵-H/7⁵⁶-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.07, 21.12 (2'- CH_3), 38.43, 38.55 (C-4), 51.63 (OMe), 70.16, 70.43 (C-2'), 74.17, 74.91 (C-3'), 104.27, 105.13 (C-7⁵⁵/C-6⁵⁶), 117.93, 118.57 (C-5⁵⁵, C-8⁵⁶), 118.81 (CN), 120.96, 121.56 (C-8⁵⁵, C-5⁵⁶), 125.35, (C-2) 125.68, 126.47 (C-6⁵⁵, C-7⁵⁶), 141.41 (C-3), 142.26, 142.32 (C-8^{a55}, C-4^{a56}), 146.22, 146.29 (C-4^{a55}, C-8^{a56}), 166.17 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2951, 2226, 1723, 1660, 1581, 1504, 1436, 1286 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 212.5 (4.632), 218.0 (4.610), 251.0 (4.059), 296.0 (3.625) nm. **MS** (EI, 70 eV): m/z (%) = 273.1 (16) $[\text{M}]^+$, 174 (100) $[\text{M}-\text{C}_5\text{H}_7\text{O}_2]^+$. Calcd for $\text{C}_{15}\text{H}_{15}\text{NO}_4$: 274.10738 $[\text{M}+\text{H}]^+$. Found: 274.10721 $[\text{M}+\text{H}]^+$ (ESI-HRMS).

(rac)-(E)-4-(2-Methyl-7-nitro-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-57), (rac)-(E)-4-(2-methyl-6-nitro-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-58): The mixture of regioisomers **16** and **24** (70.0 mg, 335 μmol) was converted with methyl acrylate (**28**) (57.6 mg, 57 μmol , 60.6 μL , 2.0 eq.), *p*-benzoquinone (145 mg, 1.34 mmol, 4.0 eq.) and palladium trifluoroacetate (11.1 mg, 33.5 μmol , 0.1 eq.) in CH_2Cl_2 (0.35 mL) for 24 h at 40 °C according to general procedure **C**. Purification by column chromatography on silica (P/EtOAc = 5:1) yielded a mixture of the isomers *(rac)*-**57** and *(rac)*-**58** (87.2 mg, 297 μmol , 89 %) as a yellow oil. **57**: **¹H-NMR** (300 MHz, CDCl_3): δ = 1.35 (s, 3 H, 2'- CH_3), 2.50 (ddd, J = 14.3, 7.9, 1.2 Hz, 1 H, 4- H_a), 2.59 (ddd, J = 14.4, 7.4, 1.3 Hz, 1 H, 4- H_b), 3.75 (s, 3 H, OMe), 3.95 (d, J = 11.5 Hz, 1 H, 3'- H_a), 4.06 (d, J = 11.5 Hz, 1 H, 3'- H_b), 5.93 (dt, J = 15.7, 1.3 Hz, 1 H, 2-H), 6.88–7.01 (m, 2 H, 3-H, Ar-H), 7.75–7.80 (m, 2 H, Ar-H) ppm. **¹³C-NMR** (75.6 MHz, CDCl_3): δ = 21.05 (2'- CH_3), 38.46 (C-4), 51.66 (OMe), 70.54 (C-2'), 74.27 (C-3'), 113.80 (C-8'), 116.99, 117.38 (C-5', C-6'), 125.47 (C-2), 141.27 (C-3), 141.73 (C-8'a), 142.31 (C-7'), 147.85 (C-4'a), 166.16 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2951, 1724, 1660, 1593, 1521, 1435, 1345, 1275 cm^{-1} . **UV** (CH_3CN): λ_{max} ($\lg \epsilon$) = 209.0 (4.373), 243.5 (4.019), 301.0 (6.878) 296.0 (3.805) nm.

MS (EI, 70 eV): m/z (%) = 293.1 (28) $[M]^+$, 194.0 (100) $[M-C_5H_7O_2]^+$. Calcd for $C_{14}H_{15}NO_6$: 294.09721 $[M+H]^+$. Found: 294.09721 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-4-(7-tert-Butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-59), (rac)-(E)-4-(6-tert-Butyl-2-methyl-2,3-dihydrobenzo[*b*][1,4]dioxin-2-yl)-but-2-enoic acid methyl ester ((rac)-60): A mixture of regioisomers **17** and **25** (80.0 mg, 363 μ mol) was treated with methyl acrylate (**28**) (62.5 mg, 726 μ mol, 65.8 μ L, 2.0 eq.), *p*-benzoquinone (157 mg, 1.45 mmol, 4.0 eq.) and palladium trifluoroacetate (11.1 mg, 36.3 μ mol, 0.1 eq.) in CH_2Cl_2 (0.40 mL) for 24 h at room temperature according to general procedure **C**. The mixture of the isomers **(rac)-115** and **(rac)-116** (92.8 mg, 305 μ mol, 84 %) was obtained after purification by column chromatography on silica (P/EtOAc = 5:1) as a colorless oil. **¹H-NMR** (300 MHz, $CDCl_3$): δ = 1.28 (s, 9 H, $C(CH_3)_3$), 1.31, 1.32 (s, 3 H, 2'- CH_3), 2.26, 2.44–2.54 (m, 1 H, 4- H_a), 2.55–2.65 (m, 1 H, 4- H_b), 3.74, 3.75 (s, 3 H, OMe), 3.80–3.87 (m, 1 H, 3'- H_a), 3.91–3.98 (m, 1 H, 3'- H_b), 5.88–5.97 (m, 1 H, 2-H), 6.77–6.93 (m, 3 H, Ar-H), 6.94–7.07 (m, 1 H, 3-H) ppm. **¹³C-NMR** (75.6 MHz, $CDCl_3$): δ = 21.31 (2'- CH_3), 31.42, 31.43 ($C(CH_3)_3$), 34.14, 34.21 ($C(CH_3)_3$), 38.53, 38.63 (C-4), 51.55 (OMe), 70.30, 70.38 (C-2'), 73.52, 73.69 (C-3'), 113.98, 114.59, 116.27, 116.87, 118.06, 118.91 (C-5'⁵⁹, C-6'⁵⁹, C-8'⁵⁹, C-5'⁶⁰, C-7'⁶⁰, C-8'⁶⁰), 124.73, 142.78 (C-2), 139.52, 139.60, 141.26, 141.28, 144.48, 145.37 (C-4'a, C-8'a, C-7'⁵⁹, C-6'⁶⁰), 142.79, 142.82 (C-3), 166.41, 166.43 (C-1) ppm. **IR** (Film): $\tilde{\nu}$ = 2963, 1726, 1659, 1590, 1503, 1436, 1275 cm^{-1} . **UV** (CH_3CN): λ_{max} (lg ϵ) = 202.5 (4.743), 281.5 (3.534) nm. **MS** (ESI, 70 eV): m/z (%) = 327.2 (100) $[M+Na]^+$, 305.2 (15) $[M+H]^+$. Calcd for $C_{18}H_{24}O_4$: 305.17474 $[M+H]^+$. Found: 305.17495 $[M+H]^+$ (ESI-HRMS).

(rac)-(E)-2-Methyl-2-(4-oxopent-2-enyl)-2,3-dihydrobenzo[*b*][1,4]oxazin-4-carboxylic acid-tert-butyl ester ((rac)-66): Following general procedure **C**, phenol **65** (100 mg, 380 μ mol) was converted with methyl vinyl ketone (**27**) (53.2 mg, 759 μ mol, 61.9 μ L, 2.0 eq.), *p*-benzoquinone (164 mg, 1.52 mmol, 4.0 eq.) and palladium trifluoroacetate (12.6 mg, 38.0 μ mol, 0.1 eq.) in CH_2Cl_2 (0.40 mL) at 40 °C within 12 h. Purification by column chromatography on silica (P/EtOAc = 10:1) yielded **(rac)-66** (103.9 mg, 314 μ mol, 83 %) as a yellow oil. **¹H-NMR** (300 MHz, $CDCl_3$): δ = 1.30 (s, 3 H, 2- CH_3), 1.54 (s, 9 H, $C(CH_3)_3$), 2.26 (s, 3 H, 5'- H_3), 2.47 (ddd, J = 14.3, 7.8, 1.3 Hz, 1 H, 1'- H_a), 2.55 (ddd, J = 14.3, 7.4, 1.3 Hz, 1 H, 1'- H_b), 3.57 (d, J = 13.6 Hz, 1 H, 3- H_a), 3.73 (d, J = 13.6 Hz, 1 H, 3- H_b), 6.14 (dm_c, J = 16.0 Hz, 1 H, 3'-H), 6.76–6.92 (m, 3 H, 2'-H, 6-H, 8-H), 7.00 (ddd, J = 7.6, 6.9, 1.5 Hz, 1 H, 7-H), 7.71 (s, 1 H, 5-H) ppm. **¹³C-NMR** (75.6 MHz, $CDCl_3$): δ = 22.44 (2- CH_3), 26.91 (C-5'), 28.13 ($C(CH_3)_3$), 40.20 (C-1'), 49.15 (C-3), 75.51 (C-2), 81.68 ($C(CH_3)_3$), 117.19, 119.91 (C-6, C-8), 123.40 (C-5), 124.61 (C-7), 124.69 (C-4a), 134.48 (C-3'), 141.53 (C-2'), 144.95 (C-8a), 152.76 ($CO_2C(CH_3)_3$), 197.96 (C-4') ppm. **IR**

(Film): $\tilde{\nu} = 2974, 1696, 1674, 1377, 1252 \text{ cm}^{-1}$. **UV** (CH₃CN): $\lambda_{\text{max}} (\lg \epsilon) = 211.5 (4.666), 282.5 (3.556)$ nm. **MS** (EI, 70 eV): $m/z (\%) = 331.2 (22) [\text{M}]^+, 231.2 (78) [\text{M}-\text{C}_5\text{H}_9\text{O}_2]^+, 148.1 (44) [\text{M}-\text{C}_{10}\text{H}_{16}\text{O}_3]^+$. Calcd for **C₁₉H₂₅NO₄**: 370.14152 [M+K]⁺. Found: 370.14146 [M+K]⁺ (ESI-HRMS).