Supporting Information

for

Activation of C-H Activation: The Beneficial Effect of Catalytic Amount of Triaryl Boranes on Palladium Catalyzed C-H Activation

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Materials and methods

Analytical thin-layer chromatography was performed on Merck DC pre-coated TLC plates with 0.25 mm Kieselgel 60 F254. Visualization was performed with a 254 nm UV lamp. The $^1$H, $^{13}$C and $^{19}$F NMR spectra were recorded on a Bruker Avance-250 spectrometer in DMSO-d6, CDCl$_3$ and CD$_2$Cl$_2$. Chemical shifts are expressed in parts per million (δ) using residual solvent protons as internal standards. Coupling constants (J) are reported in Hertz (Hz). Splitting patterns are designated as s (singlet), bs (broad singlet), d (doublet), t (triplet), q (quartet), m (multiplet). Conversions determined by gas chromatography: Agilent 5890 Gas Chromatograph (30 m x 0.25 mm column with 0.25 µm HP-5MS coating, He carrier gas) with FID detector and low resolution mass spectrometry was obtained on an Agilent 6890N Gas Chromatograph (30 m x 0.25 mm column with 0.25 µm HP-5MS coating, He carrier gas) and Agilent HP 5973N Mass Spectrometer (Ion source: EI+, 70eV, 230 °C interface 300 °C). IR spectra were obtained on a Mettler Toledo ReactIR™ 15, AgX DiComp probe, 6 mm x 1.5 m Fiber (Silver Halide), MCT detector. The in-situ reactions were followed with the following setup: sampling interval: 15 sec., 2500-650 cm$^{-1}$ (resolution 8 cm$^{-1}$) Scan option: AutoSelect; Gain: 1x. Data were processed by Mettler Toledo iC IR™. All melting points were measured on Büchi 501 apparatus and are uncorrected. Anhydrous dichloromethane was distilled from sodium under N$_2$ and stored on molecular sieves, 4Å. BBr$_3$ was applied in the form of a stock solution: 0.25 M in anhydrous dichloromethane. BCl$_3$ was applied in the form of a stock solution: 1 M in anhydrous dichloromethane. Although tris(pentafluoro)phenyl borane has been reported to be robust$^1$, compounds were stored and handled inside a glove box. B(C$_6$F$_3$)$_3$ was purchased from commercial sources and used without any further purification, MesB(C$_6$F$_3$)$_2$ and MesB(C$_6$F$_4$)$_2$ were synthesized according to relevant literature$^2$. 
1. Study of the influence of different boron based Lewis acids on the Palladium catalyzed C-H activation

General procedure for the test reactions

Under nitrogen atmosphere (in glove-box) a flame dried screw capped 4 mL vial with a stirring bar was charged with acetanilide (0.1 mmol, 1 equiv.) and Pd(OAc)$_2$ (0.005 mmol, 1.1 mg, 5 mol%) and the mixture was dissolved in anhydrous dichloromethane (0.2 mL). Tris(pentafluoro)phenyl borane (0.0072 mmol, 3.7 mg, 7.2 mol%), 4-fluoro-benzaldehyde (0.2 mmol, 21 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (0.2 mmol, 40 µL, 2 equiv.) were added and the vial was closed with septum screw cap. The assembling was repeated. One reaction mixture was removed from the glove-box and magnetically stirred at 30°C for 24 hours under inert atmosphere, the other was left inside the glove box to stir at 30°C. Samples for GC analysis were taken (not loosening the cap of the vial in the fume hood).

Figure S1. Monitoring of the reactions by GC FID: (up) reaction was assembled inside the glove-box but taken into fume hood (down) reaction was assembled and run inside the glove-box
Considering that no significant difference in conversions was experienced, all other reactions were assembled inside the glove-box and taken into fume hood.

BBr$_3$ was applied in the form of a stock solution: 0.25 M in anhydrous dichloromethane.

BCl$_3$ was applied in the form of a stock solution: 1 M in anhydrous dichloromethane.

All boron compounds were stored and handled inside a glove box.
2. Optimization of the $\text{B}(\text{C}_6\text{F}_5)_3$ amount and Pd/Borane ratio

General procedure for the test reactions

Under nitrogen atmosphere (in glove-box) a flame dried screw capped 4 mL vial with a stirring bar was charged with acetonilide (0.1 mmol, 1 equiv.) and $\text{Pd(OAc)}_2$ (0.005 mmol, 1.1 mg, 5 mol%) and the mixture was dissolved in anhydrous dichloromethane (0.2 mL). Tris(pentafluoro)phenyl borane (0.0072 mmol, 3.7 mg, 7.2 mol%), 4-fluoro-benzaldehyde (0.2 mmol, 21 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (0.2 mmol, 40 µL, 2 equiv.) were added and the vial was closed with septum screw cap. The reaction mixture removed from the glove-box and was magnetically stirred at 30°C for 24 hours under inert atmosphere. After 24 hours samples for GC analysis were taken.
3. IR spectroscopy

Hardware: Mettler Toledo ReactIR™ 15, AgX DiComp probe, 6 mm x 1.5 m Fiber, MCT detector
Software: Mettler Toledo iC IR™
Sampling interval: 1-2 minutes, 2500-650 cm⁻¹ (resolution 8 cm⁻¹)

3.1 Monitoring of the palladium catalyzed coupling reaction

General procedure for the test reactions

A flame dried screw cap 4 mL vial with a stirring bar was charged with acetanilide (0.2 mmol, 27 mg, 1 equiv.) and Pd(OAc)₂ (0.01 mmol, 1.1 mg, 5 mol%) and the mixture was dissolved in anhydrous dichloromethane (0.4 mL). Tris(pentafluoro)phenyl borane (0.0148 mmol, 7.9 mg, 7.2 mol%), 4-fluoro-benzaldehyde (0.4 mmol, 42 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (0.4 mmol, 80 µL, 2 equiv.) were added and the vial was closed with septum screw cap. The probe was inserted through the septum and the reaction mixture was magnetically stirred and monitored at 30°C for 24 hours.

Progression on relative intensity of a defined characteristic peak of the product at 925 cm⁻¹ was monitored.

3.2 Study of the initiation period

Monitoring the coupling of the anilide and the aldehyde in the presence of 5 mol% Pd(OAc)₂ and 7 mol% borane with GCMS studies revealed delayed product formation. In order to gain insight into the reaction, in situ IR measurements were also carried out to follow the product formation and determine the specific initiation period of the reaction.
Figure S2. Delayed formation of product 3a in the reaction (peaks at 1637 and 925 cm⁻¹). Formation and decomposition of a transient species.

Although, we have no information of the exact structure of this species, we suppose that this intermediate could be responsible for the unexpectedly long initial period of this catalytic transformation. As a result of data analysis the computed IR spectrum is presented (Figure S3).

Figure S3. Predicted IR spectrum of the transient species
3.3 Interaction of trispentafluorophenyl borane and benzaldehyde

It was reported\(^3\) earlier, that benzaldehyde and tris-pentafluorophenyl borane formed Lewis acid-base adduct. A 82 cm\(^{-1}\) red shift was measured in case of the isolated Lewis pair of the aldehyde and the borane (1620 cm\(^{-1}\)) compared to the ‘free’ νC=O stretching frequency (1702 cm\(^{-1}\)) of benzaldehyde.

The comparative study below demonstrates that the carbonyl shift is dependent on the matrix and is not observable in solution.

Method A)

20mg/mL (36mM) stock solution of trispentafluorophenyl borane was freshly prepared in glove-box. Benzaldehyde (0.02 mmol, 2 µL, 1 equiv.) was weighed into a 4 mL septum sealed screw capped vial and the atmosphere was evacuated and backfilled with Argon 3 times.0.5 mL of the stock solution was injected and the IR spectra of the mixture was measured in situ. Reference spectra of the individual components were also measured, separately, in the form of DCM solution (Figure S4).

Figure S4. IR spectrum of solid \(\text{B(C}_6\text{F}_5\text{)}_3\) (top), neat benzaldehyde (2\(^{nd}\)), 1:1 mixture of benzaldehyde and \(\text{B(C}_6\text{F}_5\text{)}_3\) in CH\(_2\)Cl\(_2\) solution (3\(^{rd}\)), 1:1 mixture of benzaldehyde and \(\text{B(C}_6\text{F}_5\text{)}_3\) in toluene solution (bottom)
Method B)

Under nitrogen atmosphere (in glove-box) a flame dried round bottom flask with a stirring bar was charged with tris(pentafluoro)phenyl borane (0.23 mmol, 119 mg). Anhydrous toluene (5 mL) was added, benzaldehyde (0.23 mmol, 23 µL) was injected and the mixture was stirred for 5 minutes. Outside the glove box the solvent was removed by short-path vacuum distillation, and the remaining yellow oil was diluted with 5 mL anhydrous hexane. 5 minutes of ultrasound treatment resulted white precipitate in the hexane solution which was filtered under Ar and dried in vacuum. White solid (m= 61 mg, 43%) IR $\nu_{\text{max}} = 1648, 1620, 1600, 1573, 1518, 1458, 1379, 1327, 1286, 1241, 1182, 1103, 984, 969, 861, 790, 775, 721, 678 \text{ cm}^{-1}$.

IR spectrum of the isolated borane-aldehyde Lewis pair was measured in solid form, and in solutions: DCM and toluene (Figure S5).
**Figure S5.** IR spectrum of the isolated adduct of B(C₆F₅)₃ and benzaldehyde in solid form (top), in CH₂Cl₂ solution (middle), in toluene solution (bottom)
4. $^{19}$F NMR studies

Sample preparation: the appropriate components of the given experiment are dissolved in dry CD$_2$Cl$_2$ under N$_2$ atmosphere (in glove box) in a flame dried screw capped septum sealed NMR tube.

Samples were measured at room temperature immediately after their preparation. The reaction mixture was stored at 30°C without stirring and measured after 24 h.

Composition of the samples with regard to the proportion of the substances in a reaction is the following:

- Pd(OAc)$_2$/B(C$_6$F$_5$)$_3$ = 0.69 equiv / 1 equiv
- NH$_4$OAc/B(C$_6$F$_5$)$_3$ = 0.69 equiv / 1 equiv
- amide/B(C$_6$F$_5$)$_3$ = 13.9 equiv / 1 equiv
- aldehyde/B(C$_6$F$_5$)$_3$ = 27.8 equiv / 1 equiv
- $^t$BuOOH/B(C$_6$F$_5$)$_3$ = 27.8 equiv / 1 equiv
- $^t$BuOH/B(C$_6$F$_5$)$_3$ = 27.8 equiv / 1 equiv

Reaction mixture:

- 4-F-acetanilide (0.5 mmol, 1 equiv)
- Pd(OAc)$_2$ (0.025 mmol, 5 mol%)
- tris(pentafluoro)phenyl borane (0.036 mmol, 7.2 mol%),
- 4-fluoro-benzaldehyde (1 mmol, 2 equiv) and
- TBHP solution (5.5M in decane, 4Å M.S.) (1 mmol, 2 equiv)
- CD$_2$Cl$_2$ (0.75µL)
Figure S6. $^{19}$F NMR spectrum in CD$_2$Cl$_2$ of: the reaction mixture to yield 3i (top), borane-Pd(OAc)$_2$ mixture (2$^{nd}$), mixture of 1i and B(C$_6$F$_5$)$_3$ (3$^{rd}$), mixture of 2a and B(C$_6$F$_5$)$_3$ (4$^{th}$), mixture of tBuOOH and B(C$_6$F$_5$)$_3$ (5$^{th}$), mixture of tBuOH and B(C$_6$F$_5$)$_3$ (bottom)
5. Study of the effect of tris(pentafluoro)phenyl borane on the C-H activation

5.1 Preparation and characterization of complex 4

![Complex 4](image)

In a 4 mL screw cap vial, palladium acetate (112 mg, 0.5 mmol) and acetanilide (67.5 mg, 0.5 mmol) was dissolved in 0.5 mL DCM. Trifluoroacetic acid (39µL, 0.5 mmol) was added. The solution was magnetically stirred for 3 hours at room temperature. The formed yellow precipitate was filtered and washed with DCM and hexane and dried in vacuum. Isolation of the corresponding acetate-bridged complex was unsuccessful due to instability of the compound. Pd(CF₃COO)₂ is also a suitable catalyst in the oxidative coupling reaction.

Yellow solid (m=128 mg, 0.18 mmol, 72%), mp.: 212°C, ¹H NMR (250 MHz, DMSO-d₆) δ 12.01 (s, 2H), 7.55 (bs, 2H), 7.15 (d, J = 7.2 Hz, 2H), 7.00 (t, J = 7.0 Hz, 4H), 2.34 (s, 6H). ¹³C NMR (63 MHz, CDCl₃) δ 168.4, 158.0, 134.8, 132.3, 126.7, 124.8, 120.7, 117.6, 117.4, 21.6. ¹⁹F NMR (235 MHz, DMSO-d₆) δ -73.64. IR νmax = 731, 740, 791, 854, 980, 1036, 1089, 1152, 1200, 1361, 1424, 1465, 1548, 1607, 1678, 1700. Elemental analysis for compound C₂₀H₁₆F₆N₂O₆Pd₂: Calculated: C, 33.97; H, 2.28; N, 3.96; Found: C, 35.19; H, 2.52; N, 3.48.

5.2 Coupling reactions with complex 4

A 4 mL screw cap vial with a stirring bar was charged with complex 4 (0.05 mmol, 35 mg, 1 equiv.) in dichloromethane (0.2 mL). Tris(pentafluoro)phenyl borane (0.05 mmol, 25.6 mg, 1 equiv.), 4-fluoro-benzaldehyde (0.1 mmol, 10.5 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (0.1 mmol, 20 µL, 2 equiv.) were added afterwards and the vial was capped with septum screw cap. The reaction mixture was magnetically stirred at 30°C for 24 hours under inert atmosphere. Samples for GC analysis were taken.
Figure S7. Reaction of complex 4 with 4-fluorobenzaldehyde in the presence and absence of Lewis acid

Syntheses of 3a each started from (0.28 mmol, 200 mg) freshly prepared 4. Characterization of 3a: see pages S14, S29.
5.3 Study of the effect of borane on Pd(TFA)$_2$ catalyzed reaction

General procedure for the test reactions

Under nitrogen atmosphere (in glove-box) a flame dried screw cap 4 mL vial with a stirring bar was charged with acetanilide (0.1 mmol, 1 equiv.) and Pd(TFA)$_2$ (0.005 mmol, 1.7 mg, 5 mol%) and the mixture was dissolved in anhydrous dichloromethane (0.2 mL). Tris(pentafluoro)phenyl borane (0.0072 mmol, 3.7 mg, 7.2 mol%), 4-fluoro-benzaldehyde (0.2 mmol, 21 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (0.2 mmol, 40 µL, 2 equiv.) were added and the vial was capped with septum screw cap. The reaction mixture was removed from the glove-box and was magnetically stirred at 30°C for 24 hours under inert atmosphere. After 24 hours samples for GC analysis were taken.

Table S1. Conversions of the couplings in the presence and absence of B(C$_6$F$_5$)$_3$

<table>
<thead>
<tr>
<th>B(C$_6$F$_5$)$_3$</th>
<th>Pd(TFA)$_2$</th>
<th>conversion (24h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 mol%</td>
<td>5 mol%</td>
<td>65%</td>
</tr>
<tr>
<td>-</td>
<td>5 mol%</td>
<td>29%</td>
</tr>
</tbody>
</table>
6 Synthesis of ortho-acyl-acetanilides

6.1 General synthetic procedure

Under nitrogen atmosphere (in glove-box) a flame dried screw cap 4 mL vial with a stirring bar was charged with amide (0.5 mmol, 1 equiv.) and Pd(OAc)$_2$ (0.025 mmol, 5.6 mg, 5 mol%) and the mixture was dissolved in anhydrous dichloromethane (1 mL). Tris(pentafluoro)phenyl borane (0.036 mmol, 18 mg, 7.2 mol%), 4-fluoro-benzaldehyde (1 mmol, 105 µL, 2 equiv.) and TBHP solution (5.5M in decane, 4Å M.S.) (1 mmol, 200 µL, 2 equiv.) were added and the vial was capped with septum screw cap. The reaction mixture was removed from the glove-box and was magnetically stirred at 30°C for 18 hours under inert atmosphere. The mixture was diluted with DCM, washed with 1N HCl solution and water. The unified organic phases were dried with anhydrous sodium sulfate and solvent was removed in vacuum. The product was purified by column chromatography and dried in vacuum.

6.1 Characterization of the products

\[ N-(2-(4-fluorobenzoyl)phenyl)acetamide \]

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 117 mg, 0.46 mmol, 92% ) Mp.: 95-104°C (lit.: 102°C), R$_f$=0.39 (hexene: EtOAc 2:1), $^1$H NMR (250 MHz, CDCl$_3$) δ 10.61 (s, 1H), 8.59 (d, J = 8.4 Hz, 1H), 7.74 (dd, J = 8.7, 5.4 Hz, 2H), 7.54 (dd, J = 18.1, 7.7 Hz, 2H), 7.22 – 7.03 (m, 3H), 2.20 (s, 3H), $^{19}$F NMR (235 MHz, CDCl$_3$) δ -105.47 (s), $^{13}$C NMR (63 MHz, CDCl$_3$) δ 197.94, 169.07, 167.40, 163.35, 140.28, 134.73 (d, J = 3.1 Hz), 134.23, 133.00, 132.56 (d, J = 9.2 Hz), 123.34, 122.12, 121.74, 115.70, 115.36, 25.18., MS (EI, 70eV): m/z(%): 257(62, [M$^+$]),
215(100), 198(24), 185(44), 170(6), 157(6), 134(18), 120(25), 95(33), 75(11), 65(7), IR
ν<sub>max</sub> = 854; 925; 1156; 1238; 1260; 1294; 1447; 1521; 1581; 1600; 1637; 1700.

**N-(2-(4-fluorobenzoyl)-6-methylphenyl)acetamide (3b)**

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Light brown solid (m= 29 mg, 0.11 mmol, 21 %) Mp.: 146°C, R<sub>f</sub>=0.70 (hexene: EtOAc 2:1),

<sup>1</sup>H NMR (250 MHz, CDCl<sub>3</sub>) δ 8.68 (s, 1H), 7.88 (dd, <i>J</i> = 8.6, 5.6 Hz, 2H), 7.49 – 7.29
(m, 1H), 7.28 – 6.98 (m, 4H), 2.26 (s, 3H), 2.01 (s, 3H),

<sup>13</sup>C NMR (63 MHz, CDCl<sub>3</sub>) δ 196.28, 168.92, 136.03, 134.36, 134.11, 133.88, 133.57 (d, <i>J</i> = 3.2 Hz), 133.36, 133.21,
127.73, 125.49, 115.74, 115.39, 23.47, 18.76.,

<sup>19</sup>F NMR (235 MHz, CDCl<sub>3</sub>) δ -104.80., MS (EI, 70eV): m/z(%): 271(13, [M<sup>+</sup>]), 228 (100), 212 (8), 198 (9), 148(20), 123(16), 106(8), 95(22), 75(6), IR ν<sub>max</sub> = 705; 1152; 1242; 1264; 1421; 1436; 1458; 1473; 1492; 1507; 1521;
1540; 1559; 1600; 1652; 1671; 1686; 1700; 1719; 1734; HRMS m/z [M+H]<sup>+</sup> Calculated for
C<sub>16</sub>H<sub>15</sub>FNO<sub>2</sub>: 272.1087; found 272.1086.

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**N-(2-(4-fluorobenzoyl)-5-methylphenyl)acetamide (3c)**

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 98 mg, 0.36 mmol, 72 %) Mp.:118 °C, R<sub>f</sub>=0.70 (hexene: EtOAc 2:1),

<sup>1</sup>H NMR (250 MHz, CDCl<sub>3</sub>) δ 10.83 (s, 1H), 8.45 (s, 1H), 7.76 – 7.59 (m, 2H), 7.39 (d, <i>J</i> =
8.0 Hz, 1H), 7.14 (t, J = 8.6 Hz, 2H), 6.88 (d, J = 7.9 Hz, 1H), 2.41 (s, 3H), 2.21 (s, 3H), $^{13}$C NMR (63 MHz, CDCl$_3$) δ 198.00, 169.35, 145.94, 140.68, 135.19, 135.14, 133.52, 132.55, 132.40, 123.13, 122.01, 120.70, 115.73, 115.38, 25.39, 22.23., $^{19}$F NMR (235 MHz, CDCl$_3$) δ -106.00., MS (EI, 70eV): m/z(%): 271(17, [M$^+$]), 228 (100), 221(6), 198 (9), 148(12), 134(21), 123(12), 106(8), 95(20), 75(5),, IR $\nu_{\text{max}}$= 735; 780; 854; 918; 1157; 1242; 1261; 1273; 1295; 1317; 1418; 1458; 1506; 1528; 1574; 1602; 1634; 1697, HRMS m/z [M+H]$^+$
Calculated for C$_{16}$H$_{15}$FNO$_2$: 272.1108; found 272.1085.

\[ \text{N-(2-(4-fluorobenzoyl)-4-methylphenyl)acetamide (3d)} \]

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 135 mg, 0.49 mmol, 99 %) Mp.: 134°C , $R_f$=0.71 (hexene: EtOAc 2:1), $^1$H NMR (250 MHz, CDCl$_3$) δ 10.38 (s, 1H), 8.37 (d, J = 8.4 Hz, 1H), 7.73 – 7.58 (m, 2H), 7.30 (d, J = 8.5 Hz, 1H), 7.20 (s, 1H), 7.14 – 6.99 (m, 2H), 2.22 (s, 3H), 2.12 (s, 3H). $^{13}$C NMR (63 MHz, CDCl$_3$) δ 197.95, 169.12, 137.64, 134.85, 133.02, 132.64, 132.49, 131.88, 123.68, 121.90, 115.71, 115.36, 25.09, 20.74., $^{19}$F NMR (235 MHz, CDCl$_3$) δ -105.51., MS (EI, 70eV): m/z(%): 271(17, [M$^+$]), 228 (100), 221(6), 198 (9), 148(12), 134(21), 123(12), 106(8), 95(20), 75(5),, IR $\nu_{\text{max}}$= 1156; 1234; 1268; 1298; 1316; 1518; 1600; 1637; 1697; 1719; HRMS m/z [M+H]$^+$
Calculated for C$_{16}$H$_{15}$FNO$_2$: 272.11087; found 272.1082.
**N-(2-(4-fluorobenzoyl)-6-methoxyphenyl)acetamide (3e)**

The product was purified by column chromatography (hexene: EtOAc 1:1) and dried in vacuum.

Off-white solid (m= 46 mg, 0.16 mmol, 32% ) Mp.: 163°C , Rf=0.46 (hexene: EtOAc 1:1),

$^1$H NMR (250 MHz, CDCl$_3$) δ 8.01 (s, 1H), 7.92 (dd, $J = 8.7, 5.6$ Hz, 2H), 7.12 (dt, $J = 15.0$, 8.3 Hz, 3H), 6.97 (d, $J = 8.2$ Hz, 1H), 6.89 (d, $J = 7.7$ Hz, 1H), 3.81 (s, 3H), 2.02 (s, 3H),

$^{13}$C NMR (63 MHz, CDCl$_3$) δ 193.70, 163.44, 151.65, 145.53, 133.76, 133.31 (d, $J = 2.8$ Hz), 133.00, 132.86, 124.89, 123.78, 120.94, 115.33, 114.98, 112.77, 55.89, 23.53,..,

$^{19}$F NMR (235 MHz, CDCl$_3$) δ -106.19,.., MS (EI, 70eV): m/z(%): 287(26, [M$^+$]), 245 (100), 244 (97), 230 (41), 207(34), 123(41), 95(51),.., IR $\nu_{\text{max}}$= 735; 1152; 1242; 1264; 1283; 1305; 1462; 1503; 1600; 1671; 1700; 1719; 1734,.., HRMS m/z [M+H$^+$] Calculated for C$_{16}$H$_{15}$FNO$_3$: 288.1036; found 288.1037.

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**N-(2-(4-fluorobenzoyl)-5-methoxyphenyl)acetamide (3f)**

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Light brown solid (m= 57 mg, 0.2 mmol, 40% ) Mp.: 152°C , Rf=0.65 (hexene: EtOAc 2:1),

$^1$H NMR (250 MHz, CDCl$_3$) δ 8.10 (s, 1H), 7.91 (dd, $J = 8.7, 5.6$ Hz, 2H), 7.20 – 7.00 (m, 3H), 6.91 (dd, $J = 15.5$, 8.0 Hz, 2H), 3.78 (s, 3H), 2.00 (s, 3H),.., $^{13}$C NMR (63 MHz, CDCl$_3$) δ 193.75, 167.48, 151.72, 143.25, 133.76, 133.29 (d, $J = 2.9$ Hz), 133.02, 132.87, 124.88, 123.74, 120.88, 115.32, 114.97, 112.76, 55.85, 23.49,.., $^{19}$F NMR (235 MHz, CDCl$_3$) δ -
106.58., MS (EI, 70eV): m/z(%): 287(16, [M⁺]), 245 (100), 230 (44), 202(15),172(13), 123(43), 106(14), 95(472), 75(12), IR ν_max=705; 735; 1152; 1242; 1283; 1421; 1436; 1462; 1507; 1600; 1671; 1700; 1719; 1734., HRMS m/z [M+H]^+ Calculated for C_{16}H_{15}FNO_3: 288.1036; found 288.1025.

\[
\begin{align*}
\text{N-(5-chloro-2-(4-fluorobenzoyl)phenyl)acetamide} & \quad (3g) \\
\text{The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.} \\
\text{Light brown solid (m= 45 mg, 0.16 mmol, 31 %) } Mp.: 72-76°C, R_f=0.83 (hexene: EtOAc 2:1), ^1\text{H NMR (250 MHz, CDCl}_3\text{) } \delta 10.80 (s, 1H), 8.72 (s, 1H), 7.70 (dd, } J = 8.8, 5.3 \text{ Hz, 2H), 7.45 (d, } J = 8.5 \text{ Hz, 1H), 7.17 (t, } J = 8.6 \text{ Hz, 2H), 7.06 (d, } J = 8.5 \text{ Hz, 1H), 2.23 (s, 3H),} \\
\text{13C NMR (63 MHz, CDCl}_3\text{) } \delta 197.37, 169.46, 141.52, 140.86, 134.28, 132.63, 132.48, 122.47, 121.58, 121.22, 115.99, 115.64, 25.36., ^{19}\text{F NMR (235 MHz, CDCl}_3\text{) } \delta -104.97., \text{ MS (EI, 70eV): m/z(%): 291(13, [M^+]), 248 (100), 232 (7), 219 (6), 212(6), 184 (11), 154(21), 123(27), 95(37), 75(14), 63(6)., IR } \nu_{\text{max}} =, 656; 705; 735; 1089; 1119; 1156; 1238; 1253; 1410; 1510; 1574; 1600; 1641; 1700., \text{ HRMS m/z [M+H]^+ Calculated for C}_{15}H_{12}ClFNO_2: 292.0541; found 292.0540.}
\end{align*}
\]

\[
\begin{align*}
\text{N-(2-(4-fluorobenzoyl)-4-chlorophenyl)acetamide} & \quad (3h) \\
\text{The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.} \\
\text{Brown solid (m= 56 mg, 0.33 mmol, 39 %) } Mp.: 114-119°C, R_f=0.43 (hexene: EtOAc 2:1), ^1\text{H NMR (250 MHz, CDCl}_3\text{) } \delta 10.43 (s, 1H), 8.54 (d, } J = 8.9 \text{ Hz, 1H), 7.74 (dd, } J = 8.7, 5.4
\end{align*}
\]
N-(4-fluoro-2-(4-fluorobenzoyl)phenyl)acetamide  (3i)
The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.
Brown solid (m= 55 mg, 0.2 mmol, 40% ) Mp.: 132°C , Rf=0.5 (hexene: EtOAc 2:1), $^1$H NMR (250 MHz, CDCl$_3$) δ 10.23 (s, 1H), 8.45 (dd, $J$ = 9.2, 5.0 Hz, 1H), 7.69 (dd, $J$ = 8.7, 5.5 Hz, 2H), 7.32 – 7.03 (m, 4H), 2.12 (s, 3H), $^{13}$C NMR (63 MHz, CDCl$_3$) δ 196.44, 169.07, 136.09 (d, $J$ = 2.4 Hz), 133.87 (d, $J$ = 3.2 Hz), 132.71, 132.57, 124.04 (d, $J$ = 7.1 Hz), 123.99, 121.07, 120.73, 118.85, 118.47, 115.96, 115.61, 24.97., $^{19}$F NMR (235 MHz, CDCl$_3$) δ -104.40, -118.19., MS (EI, 70eV): m/z(%): 275(12, [M+]), 232 (100), 216 (8), 203 (12), 138 (13), 123 (25), 110 (9), 95 (33)., IR $\nu_{max}$= 698; 735; 1157; 1238; 1267; 1287; 1317; 1412; 1518; 1600; 1648; 1697., HRMS m/z [M+H]$^+$ Calculated for C$_{15}$H$_{13}$F$_2$NO$_2$: 276.0836; found 276.0832.

N-(2-(4-fluorobenzoyl)naphthalen-1-yl)acetamide  (3j)
The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Orange solid (m= 199 mg, 0.65 mmol, 65%) Mp.:178 °C , Rf=0.2 (hexene: EtOAc 2:1), \(^{1}\)H NMR (250 MHz, CDCl\(_3\)+CD\(_2\)Cl\(_2\)) \(\delta\) 9.17 (s, 1H), 8.04 – 7.77 (m, 3H), 7.78 (d, \(J = 7.8\) Hz, 1H), 7.65 – 7.41 (m, 3H), 7.17 (q, \(J = 8.7\) Hz, 3H), 2.15 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)+CD\(_2\)Cl\(_2\)) \(\delta\) 193.79, 167.14, 132.21, 130.82 (d, \(J = 2.9\) Hz), 130.62, 130.47, 129.55, 128.20, 126.35, 125.49, 125.13, 124.27, 123.24, 122.41, 121.58, 113.02, 112.67, 20.84., \(^{19}\)F NMR (235 MHz, CDCl\(_3\)+CD\(_2\)Cl\(_2\)) \(\delta\) -108.10., MS (EI, 70eV): m/z(%): 307(12, [M\(^+\)]), 264(100), 248(6), 235(17), 184(10), 170(11), 140(9), 95(22), 123(11), 115(21), 95(22), 75(7),. IR \(\nu_{\text{max}}\)\(=701; 727; 1112; 1152; 1242; 1372; 1484; 1507; 1578; 1600; 1647; 1701., HRMS m/z [M+H\(^+\)] Calculated for C\(_{19}\)H\(_{15}\)FNO\(_2\): 308.1087; found: 308.1070.

\[
\begin{align*}
\text{O} & \\
\text{NH} \quad \text{O} & \\
\text{N-(2-benzoylphenyl)acetamide}^2 \quad (3k)
\end{align*}
\]

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 82 mg, 0.34 mmol, 69%) Mp.: 64-70°C (lit.: 73-82°C), Rf=0.52 (hexene: EtOAc 1:1), \(^{1}\)H NMR (250 MHz, CDCl\(_3\)) \(\delta\) 10.73 (s, 1H), 8.54 (d, \(J = 8.5\) Hz, 1H), 7.61 (d, \(J = 7.1\) Hz, 2H), 7.56 – 7.30 (m, 5H), 6.99 (t, \(J = 7.6\) Hz, 1H), 2.14 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) 199.70, 169.26, 140.43, 138.60, 134.25, 133.50, 132.51, 129.88, 128.32, 123.27, 122.08, 121.54, 25.25., MS (EI, 70eV): m/z(%): 239(11, [M\(^+\)]), 196(100), 198(24), 180(74), 167(14), 134(15), 120(31), 105(14), 92(17), 77(34), 65(11), 51(13),. IR \(\nu_{\text{max}}\)\(=702; 925; 1257; 1294; 1316; 1447; 1518; 1637; 1693.

\[
\begin{align*}
\text{O} & \\
\text{NH} \quad \text{O} & \\
\end{align*}
\]
\textit{N-}(2-(2-methylbenzoyl)phenyl)acetamide$^7$ \hspace{1cm} (3l)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 77 mg, 0.30 mmol, 61\%) Mp.: 95-98°C (lit.: 104°C), \(R_f\)=0.66 (hexene: EtOAc 1:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \(\delta\) 11.48 (s, 1H), 8.67 (d, \(J = 8.4\) Hz, 1H), 7.47 (t, \(J = 7.9\) Hz, 1H), 7.38 – 7.08 (m, 5H), 6.92 (d, \(J = 7.6\) Hz, 1H), 2.20 (d, \(J = 2.6\) Hz, 6H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) 202.95, 169.65, 141.60, 139.36, 135.97, 135.37, 134.57, 131.00, 130.32, 127.95, 125.44, 122.52, 120.82, 77.16, 25.59, 19.80., MS (EI, 70eV): m/z(%): 253([M\(^+\)]), 210(100), 196(19), 180(8), 167(8), 134(11), 120(19), 91(24), 65(15)., IR \(\nu_{max}\)= 925; 1257; 1294; 1316; 1421; 1451; 1525; 1585; 1607; 1637; 1700.

\begin{center}
\includegraphics[width=0.5\textwidth]{amid.png}
\end{center}

\textit{N-}(2-(3-methylbenzoyl)phenyl)acetamide$^8$ \hspace{1cm} (3m)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Brown solid (m= 100 mg, 0.39 mmol, 79 \%) Mp.: 73°C (lit.: 75-76°C), \(R_f\)=0.75 (hexene: EtOAc 2:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \(\delta\) 10.77 (s, 1H), 8.56 (d, \(J = 8.6\) Hz, 1H), 7.55 – 7.38 (m, 4H), 7.37 – 7.21 (m, 2H), 7.02 (t, \(J = 7.6\) Hz, 1H), 2.35 (s, 3H), 2.16 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) \(\delta\) 200.26, 169.67, 140.72, 138.99, 138.62, 134.51, 133.86, 133.69, 130.68, 128.53, 127.58, 123.86, 122.48, 121.91, 25.60, 21.72., MS (EI, 70eV): m/z(%): 253([M\(^+\)]), 210(100), 196(88), 180(15), 167(12), 134(22), 120(32), 119(14), 91(28), 65(18)., IR \(\nu_{max}\)=735; 1096; 1119; 1163; 1208; 1272; 1294; 1316; 1447; 1521; 1585; 1604; 1637; 1697.
**N-(2-(4-methylbenzoyl)phenyl)acetamide**\(^2\)  (3n)

The solvent was removed in vacuum. The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 57 mg, 0.23 mmol, 45%) Mp.: 108-112°C (lit.: 106-115°C), \(R_f\)=0.58 (hexene: EtOAc 1:1), \(^1H\) NMR (250 MHz, CDCl\(_3\)) \(\delta 10.64 (s, 1H), 8.52 (d, J = 8.4 Hz, 1H), 7.50 (dd, J = 19.1, 8.0 Hz, 4H), 7.20 (d, J = 8.0 Hz, 2H), 6.99 (t, J = 7.6 Hz, 1H), 2.36 (s, 3H), 2.13 (s, 3H). \(^{13}C\) NMR (63 MHz, CDCl\(_3\)) \(\delta 199.28, 169.14, 143.47, 140.19, 135.81, 133.92, 133.24, 130.19, 129.00, 123.66, 122.01, 121.54, 25.23, 21.64.\) MS (EI, 70eV): m/z(%): 253(20, [M\(^+\)]), 210(100), 196(38), 180(12), 167(8), 134(19), 120(23), 91(27), 65(17). IR \(\nu_{\text{max}}\)=925; 1272; 1294; 1316; 1447; 1521; 1581; 1604; 1637; 1697.

**N-(2-(2-fluorobenzoyl)phenyl)acetamide**\(^2\)  (3o)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Light brown solid (m= 70 mg, 0.27 mmol, 54%) Mp.: 100°C (lit.: 81-93°C), \(R_f\)=0.30 (hexene: EtOAc 2:1), \(^1H\) NMR (250 MHz, CDCl\(_3\)) \(\delta 11.21 (s, 1H), 8.60 (d, J = 8.5 Hz, 1H), 7.49 – 7.26 (m, 4H), 7.17 – 6.98 (m, 2H), 6.91 (t, J = 7.6 Hz, 1H), 2.13 (s, 3H). \(^{13}C\) NMR (63 MHz, CDCl\(_3\)) \(\delta 197.25, 169.85, 141.45, 135.73, 134.32 (d, J = 1.8 Hz), 133.32, 133.19, 130.40 (d, J = 2.6 Hz), 127.93, 127.69, 124.49 (d, J = 3.6 Hz), 122.55, 121.06, 116.73, 116.39, 25.63.\) MS (EI, 70eV): m/z(%): 257(28, [M\(^+\)]), 214 (100), 195 (20), 185 (11), 134(18), 120(34), 92(16), 75(7), 65(8). IR \(\nu_{\text{max}}\)=929; 1223; 1253; 1279; 1320; 1451; 1488; 1525; 1585; 1611; 1641; 1700.

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*Images of chemical structures and NMR spectra are not included in this text.*
\[
\begin{align*}
N-(2-(3-fluorobenzoyl)phenyl)acetamide \quad (3p) \\
\text{The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.} \\
\text{Yellow solid (m= 78 mg, 0.3 mmol, 61 %) Mp.: 96 °C (lit.: yellow oil), R}_f = 0.27 \text{ (hexene: EtOAc 2:1), } \\
^1\text{H NMR (250 MHz, CDCl}_3\text{) } \delta 10.65 \text{ (s, 1H), 8.53 (d, } J = 8.3 \text{ Hz, 1H), 7.56 – 7.28 (m, 5H), 7.25 – 7.16 (m, 1H), 7.00 (t, } J = 7.6 \text{ Hz, 1H), 2.13 (s, 3H), } \\
^{13}\text{C NMR (63 MHz, CDCl}_3\text{) } \delta 198.05, 169.20, 164.36, 160.41, 140.55, 134.57, 133.28, 130.07, 129.95, \\
125.66, 125.61, 122.85, 122.18, 121.66, 119.59, 119.25, 116.75, 116.39, 77.16, 25.16, \text{ MS (EI, 70eV): m/z(%) : 257(28, [M}^+\text{]), 214 (100), 195 (10), 185 (13), 134(13), 120(33), 92(15), 75(7), 65(8)., IR } \nu_{\text{max}} = 1272; 1294; 1313; 1447; 1521; 1585; 1641; 1700. \\
\end{align*}
\]

\[
\begin{align*}
N-(2-(2-chlorobenzoyl)phenyl)acetamide \quad (3q) \\
\text{The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.} \\
\text{Off-white solid (m= 60 mg, 0.22 mmol, 44 %) Mp.: 80°C (lit.: 160°C), } R_f=0.64 \text{ (hexene: EtOAc 2:1), } \\
^1\text{H NMR (250 MHz, CDCl}_3\text{) } \delta 10.66 \text{ (s, 1H), 8.54 (d, } J = 8.4 \text{ Hz, 1H), 7.64 – 7.27 (m, 6H), 7.01 (t, } J = 7.6 \text{ Hz, 1H), 2.14 (s, 3H), } \\
^{13}\text{C NMR (63 MHz, CDCl}_3\text{) } \delta 198.13, 169.37, 140.61, 140.30, 134.72, 133.35, 132.42, 129.70, 127.98, 122.84, 122.33, 121.76, \\
77.16, 25.24, \text{ MS (EI, 70eV): m/z(%) : 273(20, [M}^+\text{]), 233 (17), 167 (15), 134(23), 120(45), 92(22), 75(12), 65(12)., IR } \nu_{\text{max}} = 690; 1257; 1298; 1420; 1449; 1521; 1581; 1640; 1700. \\
\end{align*}
\]
N-(2-(3-chlorobenzoyl)phenyl)acetamide\(^2\) \( (3r)\)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Yellow oil (m= 87 mg, 0.32 mmol, 63 %), Mp: (lit.: 76-82°C), R\(_f\)=0.54 (hexene: EtOAc 2:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \( \delta \) 10.65 (s, 1H), 8.51 (d, \( J = 8.4 \) Hz, 1H), 7.57 (t, \( J = 1.7 \) Hz, 1H), 7.52 – 7.26 (m, 5H), 6.99 (t, \( J = 7.6 \) Hz, 1H), 2.12 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) \( \delta \) 197.87, 169.19, 140.33, 140.04, 134.46 (d, \( J = 2.2 \) Hz), 133.12, 132.20, 129.46 (d, \( J = 1.2 \) Hz), 127.77, 122.64, 122.12, 121.54, 25.01., MS (EI, 70eV): m/z(%): 273(21, [M\(^+\)]), 233 (18), 214(6), 196 (47), 167 (15), 139 (15), 134(23), 120(45), 111 (20), 92(22), 75(11), 6S(10)., IR \( \nu_{max} = \) 687; 1257; 1294; 1420; 1447; 1521; 1581; 1641; 1700.

N-(2-(4-chlorobenzoyl)phenyl)acetamide\(^2\) \( (3s)\)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 65 mg, 0.24 mmol, 47 %), Mp.: 121°C (lit.:122-126°C), R\(_f\)=0.54 (hexene: EtOAc 2:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \( \delta \) 10.67 (s, 1H), 8.58 (d, \( J = 8.3 \) Hz, 1H), 7.67 – 7.39 (m, 6H), 7.07 (t, \( J = 7.6 \) Hz, 0H), 2.20 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) \( \delta \) 198.25, 169.26, 140.43, 139.05, 136.88, 134.47, 133.14, 131.35, 128.71, 123.14, 122.23, 121.79, 77.16, 25.23., MS (EI, 70eV): m/z(%): 273(21, [M\(^+\)]), 230 (100), 214(7), 196 (50), 167 (14), 139 (16), 134(21), 120(46), 111 (22), 92(21), 75(12), 65(12)., IR \( \nu_{max} = \) 928; 1246; 1262; 1297; 1316; 1449; 1525; 1585; 1642; 1699.
N-(2-(2-bromobenzoyl)phenyl)acetamide (3t)

The solvent was removed in vacuum. The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Brown solid (m= 134 mg, 0.42 mmol, 84% ) Mp.:125°C, Rf=0.56 (hexene: EtOAc 2:1), $^1$H NMR (250 MHz, CDCl$_3$) δ 11.48 (s, 1H), 8.72 (d, $J = 8.5$ Hz, 1H), 7.62 – 7.45 (m, 2H), 7.38 – 7.17 (m, 4H), 6.93 (t, $J = 7.6$ Hz, 1H), 2.23 (s, 3H)., $^{13}$C NMR (63 MHz, CDCl$_3$) δ 200.26, 170.18, 142.33, 141.17, 136.32, 135.06, 133.61, 131.62, 128.94, 127.66, 122.71, 121.39, 121.07, 119.62, 25.99., MS (EI, 70eV): m/z(%): 317(16, [M$^+$]), 277(12), 196(100), 167(16), 157(5), 139(7), 134(11), 120(14), 92(8), 65(4)., IR $\nu_{\text{max}}$= 655; 704; 742; 1250; 1433; 1454; 1525; 1584; 1644; 1701.

N-(2-(3-bromobenzoyl)phenyl)acetamide (3u)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 134 mg, 0.42 mmol, 84% ) Mp.:75 °C (lit.:yellow oil), Rf=0.57 (hexene: EtOAc 2:1), $^1$H NMR (250 MHz, CDCl$_3$) δ 10.75 (s, 1H), 8.63 (d, $J = 8.5$ Hz, 1H), 7.83 (t, $J = 1.8$ Hz, 1H), 7.72 (d, $J = 8.0$ Hz, 1H), 7.59 (t, $J = 6.8$ Hz, 2H), 7.52 (d, $J = 7.9$ Hz, 1H), 7.36 (t, $J = 7.8$ Hz, 1H), 7.15 – 7.05 (m, 1H), 2.23 (s, 3H)., $^{13}$C NMR (63 MHz, CDCl$_3$) δ 198.18, 169.33, 140.76, 140.59, 135.42, 134.87, 133.49, 132.66, 129.98, 128.49, 122.74, 122.35, 121.76, 25.42., MS (EI, 70eV): m/z(%): 317(19, [M$^+$]), 276 (81), 196(100), 167 (40), 155 (21), 134(48), 120(87), 92(44), 75(17), 65(26)., IR $\nu_{\text{max}}$=656; 673; 705; 735; 1160; 1249; 1279; 1298; 1316; 1372; 1414; 1451; 1525; 1559; 1585; 1607; 1645; 1700.
**N-(2-(3-bromobenzoyl)phenyl)acetamide**  
(3v)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Off-white solid (m= 83 mg, 0.26 mmol, 52%) Mp.: 142 °C (lit.: 142°C), R_f = 0.63 (hexene: EtOAc 2:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \(\delta\) 10.68 (s, 1H), 8.59 (d, \(J = 8.4\) Hz, 1H), 7.54 (dt, \(J = 24.7, 8.2\) Hz, 6H), 7.06 (t, \(J = 7.6\) Hz, 1H), 2.20 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) \(\delta\) 193.11, 163.88, 135.20, 132.05, 129.21, 127.85, 126.37, 126.11, 122.31, 117.72, 116.89, 116.45, 19.94, MS (EI, 70eV): m/z(%): 317 (19, [M\(^+\)]), 276 (100), 196 (50), 167 (41), 155 (24), 134 (40), 120 (58), 92 (33), 76 (19), 65 (18), IR \(\nu\) max = 739; 923; 1234; 1258; 1272; 1447; 1523; 1582; 1639; 1700.

**N-(2-(2-naphthoyl)phenyl)acetamide**  
(3w)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Yellow solid (m= 91 mg, 0.32 mmol, 63%) Mp.: 86-91°C (lit.: 118-119°C), R_f = 0.57 (hexene: EtOAc 1:1), \(^1\)H NMR (250 MHz, CDCl\(_3\)) \(\delta\) 10.78 (s, 1H), 8.65 (d, \(J = 8.3\) Hz, 1H), 8.17 (s, 1H), 8.05 – 7.73 (m, 4H), 7.61 (q, \(J = 8.5, 7.4\) Hz, 4H), 7.10 (t, \(J = 7.6\) Hz, 1H), 2.23 (s, 3H), \(^{13}\)C NMR (63 MHz, CDCl\(_3\)) \(\delta\) 199.59, 169.24, 140.47, 135.85, 135.27, 134.24, 133.54, 132.19, 131.83, 129.49, 128.61, 128.45, 127.91, 127.10, 125.62, 123.77, 122.22, 121.73, 25.36, MS (EI, 70eV): m/z(%): 289 (14, [M\(^+\)]), 246 (100), 230 (7), 217 (13), 155 (6), 134 (11), 127 (28), 120 (11), 92 (8), 77 (4), 65 (4), IR \(\nu\) max = 656; 697; 742; 1201; 1234; 1275; 1294; 1421; 1447; 1521; 1581; 1637; 1697.
\(N-(2-(2\text{-phenylacetyl})\text{phenyl})\text{acetamide}\) (3x)

The product was purified by column chromatography (hexene: EtOAc 2:1 and further DCM: EtOAc 8:1) and dried in vacuum.

Off-white solid (m= 40 mg, 0.16 mmol, 16% ) Mp.: 97°C (lit: 99-100°C), \(R_f=0.81\) (DCM:EtOAc= 8:1), \(^1\text{H} \text{NMR} (250 \text{ MHz, CDCl}_3) \delta 11.63 \text{ (s, 1H)}, 8.73 \text{ (d, } J = 8.4 \text{ Hz, 1H)}, 8.00 \text{ (d, } J = 7.3 \text{ Hz, 1H)}, 7.52 \text{ (t, } J = 7.4 \text{ Hz, 1H)}, 7.40 – 7.17 \text{ (m, 5H)}, 7.08 \text{ (t, } J = 7.5 \text{ Hz, 1H)}, 4.31 \text{ (s, 2H)}, 2.15 \text{ (s, 3H)}, \ ^{13}\text{C} \text{NMR} (63 \text{ MHz, CDCl}_3) \delta 202.23, 169.68, 141.55, 135.36, 134.24, 131.24, 129.62, 128.85, 127.29, 122.42, 121.09, 120.97, 46.79, 25.70., MS (EI, 70eV): \text{m/z(\%):253(1, [M]+), 196(1), 162(100), 144(7), 120(40), 92(18), 65(11.)}, \text{IR } \nu_{\text{max}}=697; 1238; 1268; 1420; 1454; 1510; 1521; 1540; 1559; 1700; 1719; 1734; 1771.

\(N-(2\text{-butyrylphenyl})\text{acetamide}\) (3y)

The product was purified by column chromatography (hexene: EtOAc 2:1) and dried in vacuum.

Brown solid (m= 36 mg, 0.18 mmol, 35% ) Mp.: 40-42°C (lit: 43-46 °C), \(R_f=0.73\) (hexene: EtOAc 2:1), \(^1\text{H} \text{NMR} (250 \text{ MHz, CDCl}_3) \delta 11.73 \text{ (s, 1H)}, 8.70 \text{ (d, } J = 8.4 \text{ Hz, 1H)}, 7.89 \text{ (d, } J = 8.0 \text{ Hz, 1H)}, 7.60 – 7.40 \text{ (m, 1H)}, 7.09 \text{ (d, } J = 7.6 \text{ Hz, 1H)}, 2.97 \text{ (t, } J = 7.3 \text{ Hz, 2H)}, 2.21 \text{ (s, 3H)}, 1.74 \text{ (q, } J = 7.3 \text{ Hz, 2H)}, 0.99 \text{ (t, } J = 7.4 \text{ Hz, 3H)}, \ ^{13}\text{C} \text{NMR} (63 \text{ MHz, CDCl}_3) \delta 205.13, 169.60, 141.05, 134.88, 130.80, 122.35, 121.67, 120.91, 41.95, 25.60, 18.07, 13.86., \text{MS (EI, 70eV): m/z(\%): 205(2, [M]+), 162 (96), 148 (5), 144 (9), 135(7), 120(100), 92(20), 76(6), 65(15.)}, \text{IR } \nu_{\text{max}}=661; 705; 741; 974; 1205; 1242; 1301; 1372; 1454; 1525; 1585; 1656; 1697.
N-(2-propionylphenyl)acetamide\textsuperscript{11} (3z)

The product was purified by column chromatography (DCM: EtOAc 2:1) and dried in vacuum.

Yellow solid (m= 96 mg, 0.5 mmol, 50 % ) Mp.: 62° C , R\textsubscript{f}=0.52 (DCM:EtOAc), \textsuperscript{1}H NMR (250 MHz, CDCl\textsubscript{3}) \( \delta \) 11.66 (s, 1H), 8.63 (d, \( J = 8.4 \) Hz, 1H), 7.81 (d, \( J = 7.3 \) Hz, 1H), 7.42 (t, \( J = 7.9 \) Hz, 1H), 2.96 (q, \( J = 7.2 \) Hz, 2H), 2.13 (s, 3H), 1.11 (t, \( J = 7.2 \) Hz, 3H), \textsuperscript{13}C NMR (63 MHz, CDCl\textsubscript{3}) \( \delta \) 205.32, 169.44, 140.85, 134.73, 130.55, 122.24, 121.33, 120.68, 33.09, 25.51, 8.36., MS (EI, 70eV): m/z(%): 191(9, [M\textsuperscript{+}]), 162 (56), 149 (7), 144(5),134(7), 120(100), 92(20)., IR \( \nu_{\text{max}} \) =697; 725; 735; 1085; 1134; 1208; 1299; 1451; 1521; 1585; 1656; 1697.
NMR spectra of the products
$N$-(2-(4-fluorobenzoyl)phenyl)acetamide (3a)

$N$-(2-(4-fluorobenzoyl)-6-methylphenyl)acetamide (3b)
N-(2-(4-fluorobenzoyl)-5-methylphenyl)acetamide  (3c)
$N$-(2-(4-fluorobenzoyl)-4-methylphenyl)acetamide  (3d)
$N$-(2-(4-fluorobenzoyl)-6-methoxyphenyl)acetamide  (3e)
$N$-(2-(4-fluorobenzoyl)-5-methoxyphenyl)acetamide  (3f)
N-(5-chloro-2-(4-fluorobenzoyl)phenyl)acetamide  (3g)
N-(2-(4-fluorobenzoyl)-4-chlorophenyl)acetamide (3h)
$N$-(4-fluoro-2-(4-fluorobenzoyl)phenyl)acetamide  \quad (3i)$
N-(2-(4-fluorobenzoyl)naphthalen-1-yl)acetamide (3j)
\[ N-(2\text{-benzoylphenyl})\text{acetamide} \quad (3k) \]
N-(2-(2-methylbenzoyl)phenyl)acetamide (3l)
$N\text{-}(2\text{-}(3\text{-}methylbenzoyl)phenyl)acetamide}$ (3m)
\[ \text{N-(2-(4-methylbenzoyl)phenyl)acetamide (3n)} \]
$N$-(2-(2-fluorobenzoyl)phenyl)acetamide  (3o)
N-(2-(3-fluorobenzoyl)phenyl)acetamide (3p)
N-(2-(2-chlorobenzoyl)phenyl)acetamide (3q)
N-(2-(3-chlorobenzoyl)phenyl)acetamide (3r)
N-(2-(4-chlorobenzoyl)phenyl)acetamide (3s)
$N$-(2-(2-bromobenzoyl)phenyl)acetamide  \quad (3t)$
N-(2-(3-bromobenzoyl)phenyl)acetamide (3u)
\[ N-(2-(3\text{-bromobenzoyl})\text{phenyl})\text{acetamide} \]
N-(2-(2-naphthoyl)phenyl)acetamide (3w)
$N$-(2-(2-phenylacetyl)phenyl)acetamide  (3x)
N-(2-butyrylphenyl)acetamide (3y)
N-(2-propionylphenyl)acetamide (3z)
7 References