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One-pot three component regioselective synthesis of C1-functionalised 3-arylbenzo[*f*]quinoline

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An efficient method for C1-functionalised regioselective synthesis of 3-arylbenzo[*f*]quinoline has been demonstrated *via* δ-selective inferred aromatization using *β*-ketoester, 2-naphthylamine and aromatic aldehyde by employing 10 mol% camphorsulfonic acid as catalyst in acetonitrile at 70 °C. In this approach, two *C-C* bond formation will attain functionalised benzo[*f*]quinoline in one-pot three component reaction. In addition, the present protocol access a diverse substrate scope tolerance with good yields. Furthermore, the protocol was directly utilised for the synthesis of alkyl 2-(3-(naphthalen-2-yl)benzo[*f*]quinolin-1-yl)acetate, allyl 2-(3-(heteroaromatic)benzo[*f*]quinolin-1-yl)acetate and functionalised 1,2,3-tri substituted benzo[*f*]quinoline.

Introduction

A C4-functionalized quinoline are recognized as one of the forefront of heterocycles[1a] that found in many alkaloid natural products, bioactive scaffolds and in potent marketed drugs (Figure 1).[1b-e] Around the active quinoline equip skeleton,[2,1e] its integral core derive unit of benzoquinoline feature as eminent biological probe in pharmaceuticals which viewed as selective 5-HT_3 receptor ligands,[3] CFTR activators,[4] D_3 dopamine agonists,[5] vesicular glutamate transporter inhibitors,[6] dopaminergic activity in nerve assay,[7] α_1-receptors agonistic activity[8] and *in vitro* human type 1 & 2 steroid 5α-reductase inhibitors.[9] Certainly, few of them are found to possess antibacterial,[10] antimicrobial,[11] antipsychotic,[12] and antimalarial[13] activities. These emerging wide avenue of applications demand the future bioactive scaffold of functionalised benzoquinoline on development of facile synthetic method. The design and synthesize of functionalised benzoquinoline using *β*-ketoester **1**, 2-naphthylamine **2** and an aldehyde **3** favours the possible reaction site-pathways as shown in Scheme 1.

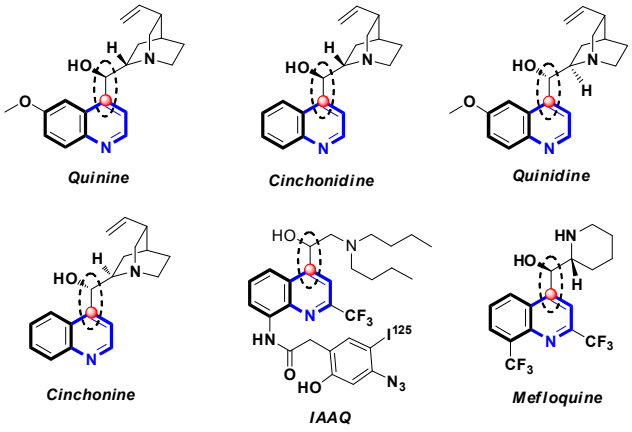
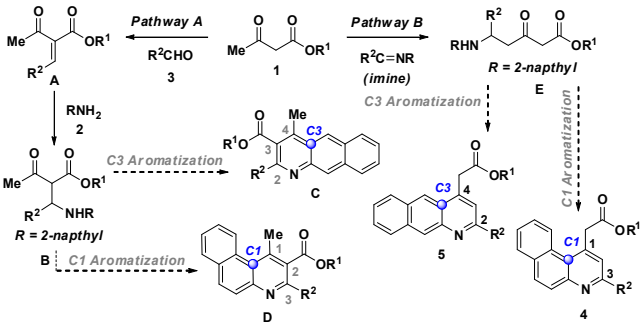


Figure 1. Biologically active molecules containing C4-functionalized quinoline skeleton.



Scheme 1. Possible reaction site-pathways.

In pathway **A**, *β*-ketoester with aldehyde prefer to attain species **A** which react with amine *via* Michael addition desires to **B** and it may aromatize either at C3 or C1 position of the napthylamine to form alkyl 4-methyl-2-arylbenzo[*g*]quinoline-3-carboxylate **C** and alkyl 1-methyl-3-arylbenzo[*f*]quinoline-2-carboxylate **D**. On the other hand in pathway **B**, alkyl-5-(naphthalen-2-ylamino)-3-oxo-5-arylpentanoate **E** prefer to form alkyl 2-(3-arylbenzo[*f*] quinolin-1-yl)acetate **4** and alkyl 2-(2-arylbenzo[*g*]quinolin-4-yl)acetate **5**. Among the possible reaction site-pathways, the regioselective synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate **4** are highly desirable, which may act as a scaffold in drug discovery unit. Since the reported methods in literature[14] are limited, we were interested to find out an elegant method for the synthesis of functionalised benzo[*f*]quinoline **4**. The insight schematic route leading to the synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate **4** is shown in Scheme 2.

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Electronic Supplementary Information (ESI) available: [XRD of **4g** CCDC no is 1434638. ^{1}H & ^{13}C NMR copies]. See DOI: 10.1039/x0xx00000x

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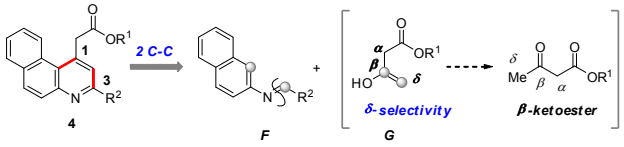


Scheme 2. Synthetic route and its pre-centre of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate.

The role of *δ*-selectivity in synthetic precursor plays a vital key transformation to obtain complex heterocycles[15] in pharmaceuticals.[16] In particular, the *δ*-selective of *β*-ketoester[17a,b] through multicomponent reactions[17c-f] remains a challenge puzzle to synthetic chemists. Multicomponent reactions are often considered as sheer growing molecular diversity[18] to assemble complex molecules having diverse range of biomedical applications.[19] The existing demand in these reactions is to achieve the significant biomolecular scaffolds which widely access through intermolecular *C-C* bond formation.[20] We envisaged that functionalised benzo[*f*]quinoline may pursuit through progressive MCRs intermolecular *C-C* bond formation.

The expedient cheap and readily available camphorsulfonic acid has well-defined versatile application in organic tranformations[21] and it is used extensively in cyclisation reactions,[22] alkylation of anilines,[23] asymmetric[24] and in natural product synthesis.[25,22] We believed that driven camphorsulfonic acid might be suitable for demanded δ-selectivity in the regioselective synthesis of functionalised benzo[*f*]quinoline.

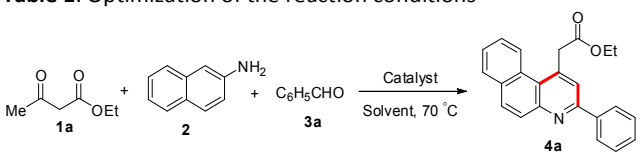
Over all, herein we wish to report the efficient synthesis of C1-functionalised 3-arylbenzo[*f*]quinoline from *β*-ketoester, 2-naphthylamine and aromatic aldehyde using 10 mol% camphorsulfonic acid as catalyst in acetonitrile at 70 °C as shown in Scheme 3.

Scheme 3. Synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate.

Results and discussion

In attempt to optimise the reaction conditions, we had tested a series of reactions with ethyl acetoacetate **1a**, 2-napthylamine **2** and benzaldehyde **3a** as depicted in Table 1. It is to be noted that the 10 mol% camphorsulfonic acid catalyst in acetonitrile at 70 °C which gave best yield (Table 1, entry 5). However, different solvents such as DCE, THF and *n*-BuOH affords lower yield. (Table 1, entries 8-10). It is also noteworthy that in our present protocol we have not observed any other byproducts such as **C**, **D** and **5** in the reaction medium. After optimisation, we conducted reactions with 2-naphthylamine (**2**), methyl acetoacetate (**1b**) and with a diverse para-substituted benzaldehyde such as 4-methyl (**3b**), 4-chloro (**3c**), 4-bromo (**3d**), 4-methoxy (**3e**) and 4-hydroxy (**3f**) moiety which afforded the desired product **4b-f** in 86-96% yield. Subsequent reaction with *tert*-butyl acetoacetate (**1c**), 4-fluorobenzaldehyde (**3g**)/furfural (**3h**) delivered the required product **4g** and **4h** in 88% and 76% yield.

Table 1. Optimization of the reaction conditions[a]



Entry	Catalyst (mol%)	Solvent	Time (h)	Yield (%)[b]
01	AcOH (10)	CH_3CN	8.0	55
02	*p*-TSA (10)	CH_3CN	12	NR
03	Iodine (10)	CH_3CN	2.5	60
04	L-Proline (10)	CH_3CN	12	NR
05	(±)-CSA (10)	CH_3CN	2.0	92
06	(±)-CSA (05)	CH_3CN	3.0	80
07	(±)-CSA (15)	CH_3CN	2.5	89
08	(±)-CSA (10)	DCE	12	35
09	(±)-CSA (10)	THF[c]	06	65
10	(±)-CSA (10)	*n*-BuOH	12	25

[a]All the reactions were carried out using ethyl acetoacetate (**1a**, 0.5 equiv), 2-naphthylamine (**2**, 0.5 equiv) and benzaldehyde (**3a**, 0.5 equiv). [b]Isolated yield. [c]Reaction temperature at 55°C. NR = no reaction.

Further, the reaction was examined with 2/3-halobenzaldehyde (**3i/3j**)/2,4-dimethoxy benzaldehyde (**3k**), 2-naphthylamine and methyl acetoacetate (**1b**) and the resultant product **4i-k** were obtained in 78-88% yield. In addition, 2/3-(allyloxy) benzaldehyde (**3l/3m**) underwent reactions with allyl acetoacetate (**1d**) and 2-naphthylamine which gave the corresponding product **4l** and **4m** in 74% and 76% yield respectively. Reactions with different substituted benzaldehyde, ethyl acetoacetate (**1a**) and 2-naphthylamine resulted in **4n-r** in 72-90% yield.

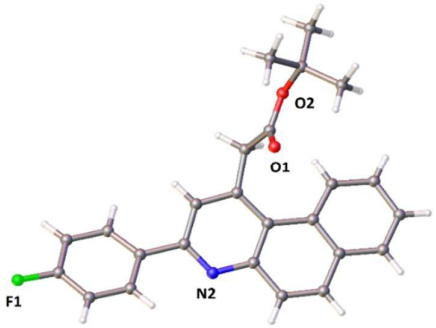


Figure 2. X-ray crystal of **4g**.

Inspired by these results, we performed reactions of allyl acetoacetate (**1d**), 2-naphthylamine and with a variety of para-substituted benzaldehyde such as 4-methyl (**3b**), 4-fluoro (**3g**) and 4-methoxy (**3e**) under the optimized reaction condition which afford the required benzo[*f*]quinolines **4s-u** in 78-86% yield as shown in Table 2. The crystal structure of **4g** was determined through single XRD analysis which is shown in Figure 2.

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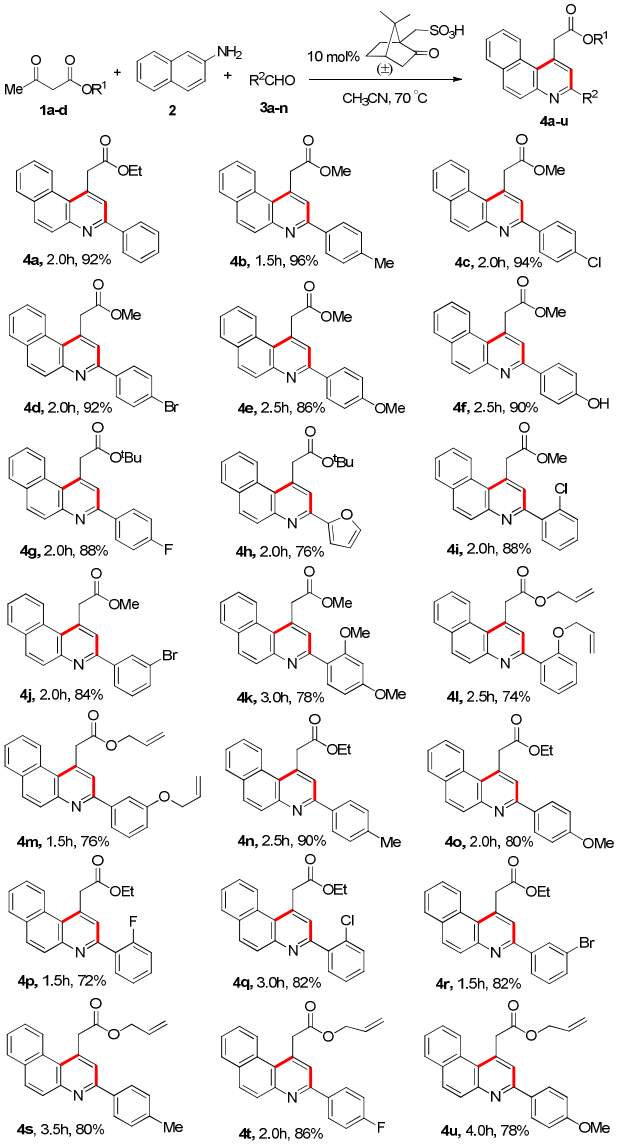
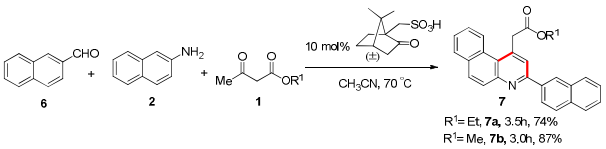
Table 2. Synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate using (±)-camphorsulfonic acid as catalyst[a,b]



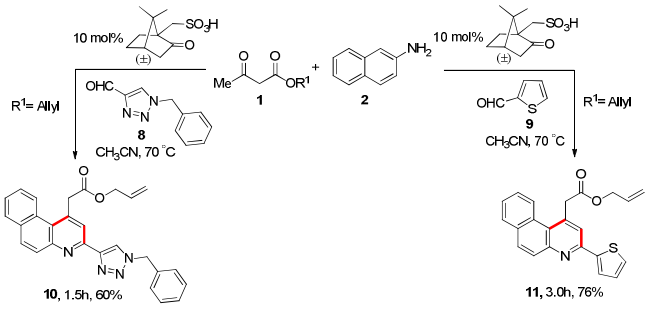
[a]All the reactions were carried out using *β*-ketoester (0.5 equiv), 2-naphthylamine (0.5 equiv), and aromatic aldehyde (0.5 equiv). [b]Isolated yield.

We have also performed reaction with fused aromatic aldehyde such as 2-napthaldehyde (**6**), 2-napthylamine (**2**) and with different *β*-ketoesters in the presence of 10 mol% camphorsulfonic acid as catalyst in acetonitrile at 70 °C and the desired product alkyl 2-(3-(naphthalen-2-yl)benzo[*f*]quinolin-1-yl)acetate **7** was obtained in good yield as shown in Scheme 4.



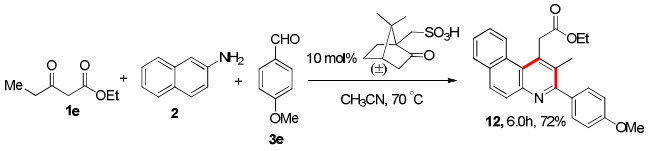
Scheme 4. Synthesis of alkyl 2-(3-(naphthalen-2-yl)benzo[*f*]quinolin-1-yl)acetate.

The protocol in hand was further investigated with heteroaromatic aldehyde such as 1-benzyl-1,2,3-triazole-4-carbaldehyde (**8**)/2-thiophenecarboxaldehyde (**9**) with 2-napthylamine (**2**) and allyl acetoacetate (**1d**) using catalytic amount of camphorsulfonic acid and the expected product allyl 2-(3-(heteroaromatic)benzo[*f*]quinolin-1-yl)acetate **10** and **11** were obtained in 60% and 76% yield as shown in Scheme 5.



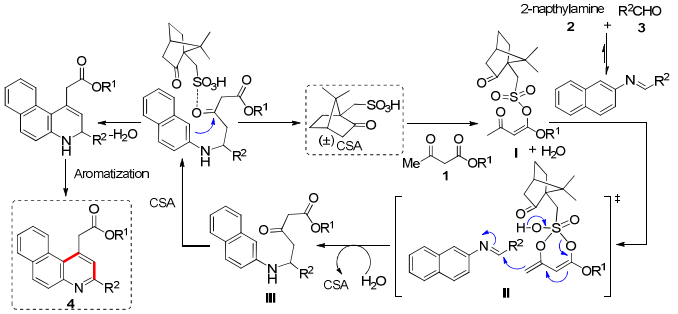
Scheme 5. Synthesis of allyl 2-(3-(heteroaromatic)benzo[*f*]quinolin-1-yl)acetate.

Furthermore, we have synthesized the functionalised 1,2,3-trisubstituted benzo[*f*]quinoline from ethyl 3-oxopentanoate (**1e**), 2-napthylamine (**2**) and 4-methoxybenzaldehyde (**3e**) using 10 mol% camphorsulfonic acid in acetonitrile at 70 °C which afford the resultant product **12** in 72% yield as shown in Scheme 6.



Scheme 6. Synthesis of 1,2,3-trisubstituted benzo[*f*]quinoline.

A plausible mechanism is described as follows: The *β*-ketoester **1** most likely to react with camphorsulfonic acid to form an intermediate **I**, which subsequently undergoes rearrangement and reacts with the generated imine to form a Michael type addition product from *δ*-selective of *β*-ketoester with imine *via* **II**[17a] to attain **III**. Further, **III** favors to prefer aromatization to form the desired product **4** as shown in Scheme 7. It is to be



Scheme 7. Proposed mechanism for the formation of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate.

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highlighted here, that we have observed the HRMS of the intermediate **III** of **4p** after 10 min under reflux condition which indirectly support the proposed mechanism (see supporting information).

Conclusions

In summary, the regioselective synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate has been achieved using camphorsulfonic acid through δ-selective of β-ketoester. It is a straight forward methodology which provide flexible access to diverse range of substrates. The prominent aspect of this present method was that two new *C-C* bonds were formed in a one-pot fashion under mild reaction conditions. In addition, the protocol enables the synthesis of naphthalen-2-yl, hetero aromatic and trisubstituted benzo[*f*]quinoline analogues in good yields.

General Procedure

Synthesis of alkyl 2-(3-arylbenzo[*f*]quinolin-1-yl)acetate (4)

A mixture of β-ketoester (**1**, 0.5 mmol), 2-naphthylamine (**2**, 0.5 mmol) and aromatic aldehyde (**3**, 0.5 mmol) was taken in 5 ml acetonitrile. To that camphorsulfonic acid (0.011g, 0.05 mmol) was added in to it and it allow to stir at 70 °C. After completion of the reaction, the solvent was removed under reduced pressure and it was extract with DCM, washed with water, dried over sodium sulphate and concentrate under reduced pressure. Then, the residue was purified through column chromatography to obtain the pure product **4**. Similarly, the compound **7** and **10**-**12** were synthesized by following the above reaction procedure.

Ethyl 2-(3-phenylbenzo[f]quinolin-1-yl)acetate (4a): Yield 92%, white solid, mp 131-132 ˚C,^{1}H NMR (400 MHz, $CDCl_3$): δ 8.54 (d, *J* = 8.8 Hz, 1H), 8.22 (d, *J* = 8.8 Hz, 2H), 8.09 (d, *J* = 9.2 Hz, 1H), 7.99- 7.97 (m, 2H), 7.87 (s, 1H), 7.67-7.64 (m, 2H), 7.56 (t, *J* = 7.2 Hz, 2H), 7.49 (t, *J* = 6.8 Hz, 1H), 4.49 (s, 2H), 4.25 (q, *J* = 7.2 Hz, 2H), 1.23 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.8, 155.9, 150.3, 141.1, 139.2, 133.2, 131.5, 130.0, 129.8, 129.5, 129.4, 129.1, 127.6, 127.0, 126.9, 126.8, 124.6, 123.2, 61.7, 44.0, 14.4; IR (KBr)ν_{max} 3056, 2980, 2902, 1735, 1584, 1552, 1484, 1455, 1391, 1367, 1322, 1255, 1194, 1156, 1029 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{20}NO_2$ 342.1489 (M + H$^+$); Found 342.1489.

Methyl 2-(3-(p-tolyl)benzo[f]quinolin-1-yl)acetate (4b):[14a] Yield 96%, light yellow, mp 168-169 ˚C,^{1}H NMR (400 MHz, $CDCl_3$): δ 8.49 (d, *J* = 7.6 Hz, 1H), 8.12 (t, *J* = 8.0 Hz, 2H), 8.08 (s, 1H), 7.97-7.93 (m, 2H), 7.83 (s, 1H), 7.68-7.61 (m, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 4.47 (s, 2H), 3.77 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.3, 155.8, 150.2, 140.8, 139.6, 136.2, 133.1, 131.4, 129.9, 129.7, 129.6, 129.4, 128.2, 127.5, 126.8, 126.7, 124.3, 122.9, 52.7, 43.7, 21.5; IR (KBr)ν_{max} 3029, 2952, 2922, 2853, 1737, 1579, 1548, 1481, 1452, 1437, 1392, 1353, 1259, 1184, 1132, 1057 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{20}NO_2$ 342.1489 (M + H$^+$); Found 342.1505.

Methyl 2-(3-(4-chlorophenyl)benzo[f]quinolin-1-yl)acetate (4c):[14a] Yield 94%, white solid, mp 138-139 ˚C,^{1}H NMR (400 MHz, $CDCl_3$): δ 8.49 (d, *J* = 7.2 Hz, 1H), 8.17 (d, *J* = 8.8 Hz, 2H), 8.12 (d, *J* = 8.8 Hz, 1H), 8.00-7.96 (m, 2H), 7.83 (s, 1H), 7.69-7.66 (m, 2H), 7.51 (d, *J* = 8.8 Hz, 2H), 4.51 (s, 2H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.1, 154.3, 149.9, 141.4, 137.0, 135.9, 133.2, 131.9, 129.7, 129.5, 129.2, 128.9, 127.2, 127.0, 126.8, 124.7, 122.9, 52.8, 43.7; IR (KBr)ν_{max} 3056, 2942, 2924, 2852, 1741, 1585, 1550, 1481, 1435, 1390, 1328, 1257, 1198, 1157, 1091, 1012 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{17}ClNO_2$ 362.0943 (M + H$^+$); Found 362.0942.

Methyl 2-(3-(4-bromophenyl)benzo[f]quinolin-1-yl)acetate (4d):[14a] Yield 92%, light yellow solid, mp 143-144 ˚C,^{1}H NMR (400 MHz, $CDCl_3$): δ 8.51 (d, *J* = 9.0 Hz, 1H), 8.11 (d, *J* = 8.4 Hz, 2H), 8.06 (d, *J* = 9.0 Hz, 1H), 7.99- 7.96 (m, 2H), 7.83 (s, 1H), 7.68-7.66 (m, 4H), 4.51 (s, 2H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.2, 154.5, 150.3, 141.1, 137.9, 133.2, 132.2, 131.7, 129.8, 129.6, 129.5, 129.1, 127.1, 126.9, 126.8, 124.7, 124.1, 122.7, 52.8, 43.6; IR (KBr)ν_{max} 3051, 2951, 2915, 2854, 1736, 1584, 1549, 1481, 1455, 1434, 1387, 1356, 1328, 1257, 1199, 1159, 1087, 1008 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{17}BrNO_2$ 406.0437 (M + H$^+$); Found 406.0437.

Methyl 2-(3-(4-methoxyphenyl)benzo[f]quinolin-1-yl)acetate (4e): Yield 86%, light yellow solid, mp 149-150 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.47 (d, *J* = 8.4 Hz, 1H), 8.18 (d, *J* = 8.4 Hz, 2H), 8.09 (d, *J* = 9.0 Hz, 1H), 7.93 (t, *J* = 9.0 Hz, 2H), 7.78 (s, 1H), 7.65-7.56 (m, 2H), 7.04 (d, *J* = 8.4 Hz, 2H), 4.46 (s, 2H), 3.87 (s, 3H), 3.76 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 171.2, 161.1, 155.3, 149.9, 140.9, 132.9, 131.8, 131.5, 131.2, 129.9, 129.4, 128.9, 126.8, 126.7, 126.6, 124.1, 122.7, 114.4, 55.5, 52.7, 43.6; IR (KBr)ν_{max} 3068, 2995, 2948, 2937, 2830, 1737, 1604, 1544, 1503, 1434, 1354, 1337, 1252, 1202, 1183, 1161, 1028 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{20}NO_3$ 358.1438 (M + H$^+$); Found 358.1430.

Methyl 2-(3-(4-hydroxyphenyl)benzo[f]quinolin-1-yl)acetate (4f): Yield 90%, white solid, mp 141-142 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 9.30 (s, 1H), 8.40 (d, *J* = 6.0 Hz, 1H), 8.02 (d, *J* = 6.6 Hz, 2H), 7.93 (d, *J* = 2.4, 1H), 7.92 (d, *J* = 1.8 Hz, 2H), 7.75 (s, 1H), 7.56-7.53 (m, 2H), 6.91 (d, *J* = 6.0 Hz, 2H), 4.44 (s, 2H), 3.69 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.4, 158.5, 154.8, 149.2, 140.1, 132.0, 129.1, 129.0, 128.6, 128.5, 128.1, 128.0, 126.1, 125.9, 125.7, 122.9, 121.8, 121.7, 115.4, 115.3, 51.8, 42.8; IR (KBr)ν_{max} 3058, 2995, 2953, 2838, 1738, 1608, 1588, 1549, 1514, 1484, 1451, 1353, 1258, 1171, 1130, 1058 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{18}NO_3$ 344.1281 (M + H$^+$); Found 344.1286.

Tert-butyl 2-(3-(4-fluorophenyl)benzo[f]quinolin-1-yl)acetate (4g): Yield 88%, white solid, mp 140-141 ˚C,^{1}H NMR (600 MHz, $CDCl_3$): δ 8.58 (d, *J* = 7.8 Hz, 1H), 8.23-8.21 (m, 2H), 8.06 (d, *J* = 8.4 Hz, 1H), 7.98-7.95 (m, 2H), 7.81 (s, 1H), 7.67-7.64 (m, 2H), 7.23-7.20 (m, 2H), 4.41 (s, 2H), 1.44 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 169.5, 165.2, 163.5, 154.1, 133.5, 133.1, 131.2, 131.1, 130.3, 130.1, 129.7, 129.6, 129.3, 128.3, 127.3, 127.2, 127.1, 127.0, 126.6, 124.8, 123.6, 116.3, 116.1, 115.6, 115.5, 82.6, 45.6, 28.2; IR (KBr)ν_{max} 3057, 2976, 2927, 2850, 1727, 1602,

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1585, 1553, 1532, 1510, 1483, 1455, 1392, 1368, 1329, 1226, 1149, 1073, 1014 cm^{-1}; HRMS (ESI) Calcd For $C_{25}H_{23}FNO_2$ 388.1708 (M + H^+); Found 388.1707.

Tert-butyl 2-(3-(furan-2-yl)benzo[f]quinolin-1-yl)acetate (4h): Yield 76%, brown solid, mp 94-95 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.56 (d, *J* = 8.4 Hz, 1H), 8.04 (d, *J* = 9.2 Hz, 1H), 7.96-7.95 (m, 3H), 7.84 (s, 1H), 7.66-7.64 (m, 2H), 7.27 (d, *J* = 3.2 Hz, 1H), 6.62-6.61 (m, 1H), 4.41 (s, 2H), 1.43 (s, 9H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 169.8, 153.6, 150.2, 147.8, 144.1, 141.7, 133.1, 131.6, 129.4, 129.4, 126.9, 126.8, 126.7, 124.6, 121.6, 112.4, 110.0, 82.2, 45.3, 28.2; IR (KBr)ν_{max} 3029, 2974, 2926, 1728, 1601, 1551, 1491, 1454, 1393, 1368, 1325, 1254, 1224, 1072 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{22}NO_3$ 360.1594 (M + H^+); Found 360.1609.

Methyl 2-(3-(2-chlorophenyl)benzo[f]quinolin-1-yl)acetate (4i): Yield 88%, brown solid, mp 79-80 ˚C,^{1}H NMR (400 MHz, $CDCl_3$): δ 8.56 (d, *J* = 8.0 Hz, 1H), 8.19 (d, *J* = 8.0 Hz, 1H), 8.00 (t, *J* = 8.4 Hz, 2H), 7.84 (s, 2H), 7.69 (s, 2H), 7.53 (d, *J* = 7.2 Hz, 1H), 7.42 (t, *J* = 8.4 Hz, 2H), 4.52 (s, 2H), 3.77 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.9, 155.0, 149.4, 133.3, 132.7, 132.3, 132.2, 130.4, 129.6, 128.6, 127.5, 127.4, 127.2, 127.1, 126.9, 124.8, 52.8, 43.6; IR (KBr)ν_{max} 3059, 2987, 2953, 2850, 1738, 1596, 1580, 1550, 1476, 1435, 1395, 1351, 1330, 1258, 1201, 1160, 1094, 1057 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{17}ClNO_2$ 362.0943 (M + H^+); Found 362.0943.

Methyl 2-(3-(3-bromophenyl)benzo[f]quinolin-1-yl)acetate (4j): Yield 84%, white solid, mp 130-131 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.50 (d, *J* = 12.0 Hz, 1H), 8.40 (s, 1H), 8.12 (d, *J* = 12.0 Hz, 1H), 8.06 (d, *J* = 12.0 Hz, 1H), 7.97 (d, *J* = 12.0 Hz, 2H), 7.81(s, 1H), 7.69-7.65 (m, 2H), 7.59 (d, *J* = 12.0 Hz, 1H), 7.39 (t, *J* = 12.0 Hz, 1H), 4.49 (s, 2H), 3.78 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.4, 154.1, 150.3, 141.1, 141.0, 133.3, 132.4, 131.8, 130.6, 130.5, 129.8, 129.6, 129.5, 127.1, 126.9, 126.8, 126.1, 124.9, 123.3, 122.9, 52.8, 43.7; IR (KBr)ν_{max} 3031, 2950, 2916, 2848, 1724, 1605, 1582, 1549, 1488, 1454, 1424, 1383, 1357, 1323, 1306, 1247, 1161, 1053 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{17}BrNO_2$ 406.0437 (M + H^+); Found 406.0435.

Methyl 2-(3-(2,4-dimethoxyphenyl)benzo[f]quinolin-1-yl)acetate (4k): Yield 78%, brown solid, mp 111-112 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.52 (d, *J* = 7.6 Hz, 1H), 8.12 (d, *J* = 8.0 Hz, 1H), 8.02-7.94 (m, 4H), 7.64 (s, 2H), 6.69 (d, *J* = 6.8 Hz, 1H), 6.60 (s, 1H), 4.49 (s, 2H), 3.87 (s, 6H), 3.75 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.3, 162.1, 158.8, 154.6, 149.7, 139.8, 133.0, 132.7, 131.2, 129.9, 129.4, 129.2, 127.3, 126.7, 123.9, 105.7, 99.2, 55.9, 55.7, 52.6, 43.7; IR (KBr)ν_{max} 3059, 3003, 2950, 2837, 1736, 1608, 1579, 1547, 1505, 1455, 1437, 1300, 1283, 1209, 1160, 1030 cm^{-1}; HRMS (ESI) Calcd For $C_{24}H_{22}NO_4$ 388.1544 (M + H^+); Found 388.1542.

allyl 2-(3-(2-(allyloxy)phenyl)benzo[f]quinolin-1-yl)acetate (4l): Yield 74%, light yellow solid, mp 169-170 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.55 (d, *J* = 8.0 Hz, 1H), 8.17 (s, 1H), 8.07 (s, 1H), 8.04 (d, *J* = 7.6 Hz, 1H), 7.98 (d, *J* = 8.4 Hz, 2H), 7.66-7.64 (m, 2H), 7.42 (t, *J* = 7.6 Hz, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.09-6.00 (m, 1H), 5.91-5.81 (m, 1H), 5.38 (d, *J* = 17.2 Hz, 1H), 5.26 (d, *J* = 13.6 Hz, 2H), 5.22-5.18 (m 1H), 4.67-4.63 (m, 4H), 4.51 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.5, 156.5, 155.1, 150.1, 139.3, 133.3, 133.1, 131.8, 131.7, 131.0, 130.5, 129.9, 129.7, 129.3, 129.2, 127.8, 126.8, 126.7, 126.6, 124.2, 121.7, 118.9, 117.2, 113.3, 69.5, 66.1, 43.8; IR (KBr)ν_{max} 3055, 2969, 2948, 2930, 2835, 1741, 1687, 1624, 1577, 1544, 1480, 1451, 1352, 1316, 1257, 1224, 1182, 1148, 1059 cm^{-1}; HRMS (ESI) Calcd For $C_{27}H_{24}NO_3$ 410.1751 (M + H^+); Found 410.1755.

allyl 2-(3-(3-(allyloxy)phenyl)benzo[f]quinolin-1-yl)acetate (4m): Yield 76%, white solid, mp 81-82 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.53 (d, *J* = 6.0 Hz, 1H), 8.08 (d, *J* = 6.0 Hz, 1H), 7.98-7.95 (m, 2H), 7.86-7.84 (m, 2H), 7.76 (d, *J* = 6.0 Hz, 1H), 7.66-7.63 (m, 2H), 7.44 (t, *J* = 6.0 Hz, 1H), 7.04 (d, *J* = 6.0 Hz, 1H), 6.17-6.10 (m, 1H), 5.92-5.85 (m, 1H), 5.49 (d, *J* = 18.0 Hz, 1H), 5.33 (d, *J* = 6.0 Hz, 1H), 5.28 (d, *J* = 18.0 Hz, 1H), 5.22 (d, *J* = 12.0 Hz, 1H), 4.68 (d, *J* = 6.0 Hz, 4H), 4.52 (s, 2H)); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.4, 159.4, 155.6, 150.2, 140.8, 140.5, 133.5, 133.2, 131.8, 131.5, 130.0, 129.9, 129.7, 129.4, 126.9, 126.8, 126.8, 124.7, 123.3, 120.2, 119.1, 117.9, 116.3, 113.7, 69.2, 66.3, 43.8; IR (KBr)ν_{max} 3056, 2924, 2896, 1733, 1647, 1583, 1552, 1488, 1455, 1423, 1358, 1319, 1281, 1231, 1195, 1154, 1024, 991 cm^{-1}; HRMS (ESI) Calcd For $C_{27}H_{24}NO_3$ 410.1756 (M + H^+); Found 410.1754.

Ethyl 2-(3-(p-tolyl)benzo[f]quinolin-1-yl)acetate (4n): Yield 90%, brown solid, mp 102-103 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.53 (d, *J* = 8.0 Hz, 1H), 8.13 (d, *J* = 8.4 Hz, 2H), 8.08 (s, 1H), 7.96 (d, *J* = 9.6 Hz, 2H), 7.85 (s, 1H), 7.67-7.63 (m, 2H), 7.34 (d, *J* = 7.6 Hz, 2H), 4.48 (s, 2H), 4.24 (q, *J* = 6.8 Hz, 2H), 2.45 (s, 3H), 1.23 (t, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.8, 155.8, 150.2, 141.1, 139.7, 136.2, 133.1, 131.4, 130.0, 129.8, 129.7, 129.4, 127.5, 126.9, 126.8, 126.7, 124.4, 123.0, 61.7, 43.9, 21.6, 14.4; IR (KBr)ν_{max} 3053, 3025, 2980, 2923, 2855, 1734, 1606, 1585, 1550, 1512, 1482, 1455, 1391, 1366, 1322, 1248, 1217, 1184, 1156, 1094, 1054 cm^{-1}; HRMS (ESI) Calcd For $C_{24}H_{22}NO_2$ 356.1645 (M + H^+); Found 356.1646.

Ethyl 2-(3-(4-methoxyphenyl)benzo[f]quinolin-1-yl)acetate (4o): Yield 80%, white solid, mp 120-121 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.53 (d, *J* = 6.0 Hz, 1H), 8.19 (d, *J* = 6.0 Hz, 2H), 8.06 (d, *J* = 12.0 Hz, 1H), 7.96 (d, *J* = 6.0 Hz, 1H), 7.95-7.94 (m, 1H), 7.81 (s, 1H), 7.66-7.63 (m, 2H), 7.07 (d, *J* = 6.0 Hz, 2H), 4.48 (s, 2H), 4.24 (q, *J* = 6.0 Hz, 2H), 3.90, (s, 3H), 1.23 (t, *J* = 6.0 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.8, 161.0, 155.5, 150.2, 140.9, 133.0, 131.7, 131.3, 130.1, 129.7, 129.4, 128.9, 126.8, 126.7, 126.7, 124.1, 122.6, 114.4, 61.7, 55.6, 44.0, 14.4; IR (KBr)ν_{max} 3027, 2957, 2924, 2852, 1732, 1631, 1606, 1583, 1550, 1531, 1512, 1482, 1455, 1392, 1364, 1324, 1248, 1224, 1175, 1145, 1030 cm^{-1}; HRMS (ESI) Calcd For $C_{24}H_{22}NO_3$ 372.1594 (M + H^+); Found 372.1594.

Ethyl 2-(3-(2-fluorophenyl)benzo[f]quinolin-1-yl)acetate (4p): Yield 72%, semisolid, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.57 (d, *J* = 6.0 Hz, 1H), 8.24-8.21 (m, 1H), 8.08 (d, *J* = 6.0 Hz, 1H), 7.98 (d, *J* = 6.0Hz, 2H), 7.97-7.95 (m, 1H), 7.68-7.66 (m, 2H), 7.43 (t, *J* = 6.0 Hz, 1H), 7.34 (t, *J* = 6.0 Hz, 1H), 7.23-7.20, (m, 1H), 4.50 (s, 2H), 4.24 (q, *J* = 6.0Hz, 2H), 1.23 (t, *J* = 6.0 Hz, 3H); ^{13}C NMR

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(150 MHz, $CDCl_3$): δ 170.7, 161.9, 160.2, 152.2, 150.2, 140.7, 133.3, 131.6, 131.6, 131.5, 131.1, 131.0, 129.9, 129.6, 129.4, 127.1, 127.0, 126.8, 124.9, 124.9, 124.7, 116.6, 116.4, 61.7, 44.0, 14.3; IR (KBr)ν_{max} 3028, 2956, 2923, 2852, 1733, 1586, 1582, 1550, 1484, 1452, 1371, 1364, 1320, 1249, 1215, 1155, 1080, 1030 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{19}FNO_2$ 360.1395 ($M + H^+$); Found 360.1396.

Ethyl 2-(3-(2-chlorophenyl)benzo[f]quinolin-1-yl)acetate (4q): Yield 82%, white solid, mp 151-152 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.60 (d, *J* = 8.4 Hz, 1H), 8.12 (d, *J* = 7.2 Hz, 1H), 8.01-7.97 (m, 2H), 7.83-7.81 (m, 2H), 7.70-7.67 (m, 2H), 7.53 (d, *J* = 7.8 Hz, 1H), 7.45-7.31 (m, 1H), 7.43-7.38 (m, 1H), 4.49 (s, 2H), 4.24 (q, *J* = 7.2 Hz, 2H), 1.23 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.4, 155.9, 149.3, 133.2, 132.7, 132.3, 132.1, 130.5, 130.4, 129.7, 129.6, 129.5, 128.6, 127.5, 127.4, 127.3, 127.1, 124.9, 61.8, 43.9, 14.3; IR (KBr)ν_{max} 3060, 2982, 2933, 2849, 1734, 1627, 1596, 1578, 1550, 1475, 1442, 1394, 1369, 1350, 1330, 1244, 1210, 1160, 1133, 1094, 1055, 1038 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{19}ClNO_2$ 376.1099 ($M + H^+$); Found 376.1099.

Ethyl 2-(3-(3-bromophenyl)benzo[f]quinolin-1-yl)acetate (4r): Yield 82%, white solid, mp 125-126 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.54 (d, *J* = 12.0 Hz, 1H), 8.40 (s, 1H), 8.13 (d, *J* = 6.0 Hz, 1H), 8.07 (d, *J* = 6.0 Hz, 1H), 8.00-7.97, (m, 2H), 7.84 (s, 1H), 7.68-7.66 (m, 2H), 7.60 (d, *J* = 6.0 Hz, 1H), 7.41 (t, *J* = 12.0 Hz, 1H), 4.50 (s, 2H), 4.25 (q, *J* = 6.0 Hz, 2H), 1.25 (t, *J* = 6.0 Hz, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.7, 154.2, 150.2, 141.4, 141.1, 133.3, 132.5, 131.7, 130.7, 130.6, 129.9, 129.6, 129.4, 126.9, 126.2, 126.1, 124.9, 123.4, 123.1, 123.0, 61.5, 43.9, 13.9; IR (KBr)ν_{max} 3025, 2922, 2852, 1733, 1586, 1572, 1550, 1480, 1452, 1442, 1428, 1371, 1322, 1213, 1197, 1158, 1019 cm^{-1}; HRMS (ESI) Calcd For $C_{23}H_{19}BrNO_2$ 420.0594 ($M + H^+$); Found 420.0623.

Allyl 2-(3-(p-tolyl)benzo[f]quinolin-1-yl)acetate (4s): Yield 80%, brown solid, mp 83-84 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.52 (d, *J* = 8.8 Hz, 1H), 8.12 (d, *J* = 8.0 Hz, 2H), 8.08 (d, *J* = 9.2 Hz, 1H), 7.99-7.95 (m, 2H), 7.86 (s, 1H), 7.69-7.63 (m, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 5.92-5.83 (m, 1H), 5.30-5.17 (m, 2H), 4.68 (d, *J* = 5.2 Hz, 2H), 4.52 (s, 2H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.4, 155.8, 150.2, 140.7, 139.6, 136.2, 133.1, 131.8, 131.4, 130.0, 129.8, 129.4, 128.7, 127.5, 126.8, 124.4, 122.9, 119.0, 66.2, 43.8, 21.5; IR (KBr)ν_{max} 3062, 3035, 2923, 2853, 1735, 1653, 1605, 1582, 1548, 1479, 1451, 1352, 1330, 1274, 1216, 1185, 1154, 1130, 1054 cm^{-1}; HRMS (ESI) Calcd For $C_{25}H_{22}NO_2$ 368.1645 ($M + H^+$); Found 368.1649.

Allyl 2-(3-(4-fluorophenyl)benzo[f]quinolin-1-yl)acetate (4t): Yield 86%, white solid, mp 154-155 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.52-8.51 (m, 1H), 8.22-8.20 (m, 2H), 8.09 (d, *J* = 8.4 Hz, 1H), 7.98-7.95 (m, 2H), 7.83 (s, 1H), 7.67-7.63 (m, 2H), 7.22 (t, *J* = 8.4 Hz , 2H), 5.92-5.85 (m, 1H), 5.29 (t, *J* = 8.4 Hz, 1H), 5.23 (d, *J* = 11.4 Hz, 1H), 4.69 (d, *J* = 6.0 Hz, 2H), 4.52 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.3, 164.9, 163.3, 154.6, 150.0, 141.2, 133.2, 131.8, 131.7, 129.8, 129.6, 129.5, 129.5, 129.3, 127.0, 126.9, 126.8, 124.5, 122.9, 119.2, 116.1, 115.9, 66.3, 43.8; IR (KBr)ν_{max} 3059, 2954, 2924, 2848, 1735, 1653, 1601, 1585, 1552, 1508, 1483, 1454, 1390, 1358, 1322, 1228, 1191, 1156, 1014 cm^{-1}; HRMS (ESI) Calcd For $C_{24}H_{19}FNO_2$ 372.1395 ($M + H^+$); Found 372.1384.

Allyl 2-(3-(4-methoxyphenyl)benzo[f]quinolin-1-yl)acetate (4u): Yield 78%, pale yellow solid, mp 92-95 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.50 (d, *J* = 6.4 Hz, 1H) 8.18 (d, *J* = 8.0 Hz, 2H), 8.05 (d, *J* = 9.2 Hz, 1H), 7.95 (d, *J* = 7.6 Hz, 2H), 7.81 (s, 1H), 7.62 (d, *J* = 3.2 Hz, 2H), 7.05 (d, *J* = 8.0 Hz, 2H), 5.89-5.85 (m, 1H), 5.31-5.21 (m, 2H), 4.68 (s, 2H), 4.49 (s, 2H), 3.89 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.5, 161.0, 155.4, 150.2, 140.6, 133.0, 131.8, 131.6, 131.3, 129.9, 129.6, 129.3, 128.9, 126.7, 126.6, 124.1, 122.6, 119.0, 114.4, 66.1, 55.5, 43.8; IR (KBr)ν_{max} 3051, 2959, 2933, 2836, 1735, 1675, 1653, 1606, 1583, 1550, 1530, 1511, 1482, 1455, 4140, 1358, 1323, 1306, 1176, 1155, 1111, 1030 cm^{-1}; HRMS (ESI) Calcd For $C_{25}H_{22}NO_3$ 384.1594 ($M + H^+$); Found 384.1612.

Ethyl 2-(3-(naphthalen-2-yl)benzo[f]quinolin-1-yl)acetate (7a): Yield 74%, pale yellow solid, mp 76-77 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.69 (s, 1H), 8.56 (d, *J* = 8.8 Hz, 1H), 8.41 (d, *J* = 8.4 Hz, 1H), 8.18 (d, *J* = 8.8 Hz, 1H), 8.03-8.02 (m, 3H), 8.00-7.96 (m, 2H), 7.92-7.89 (m, 1H), 7.69-7.64 (m, 2H), 7.55-7.53 (m, 2H), 4.54 (s, 2H), 4.27 (q, *J* = 7.2 Hz, 2H), 1.25 (t, *J* =7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 170.8, 155.6, 150.2, 141.4, 136.2, 134.1, 133.7, 133.2, 131.7, 130.0, 129.5, 129.4, 129.1, 128.8, 127.9, 127.3, 127.0, 126.9, 126.9, 126.8, 126.5, 125.1, 124.7, 123.5, 61.7, 44.1, 14.4; IR (KBr)ν_{max} 3056, 2978, 2923, 2851, 1734, 1583, 1552, 1509, 1482, 1452, 1389, 1367, 1321, 1256, 1215, 1195, 1156, 1029; cm^{-1}; HRMS (ESI) Calcd For $C_{27}H_{22}NO_2$ 392.1645 ($M + H^+$); Found 392.1648.

Methyl 2-(3-(naphthalen-2-yl)benzo[f]quinolin-1-yl)acetate (7b): Yield 87%, white solid, mp 80-81 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.68 (s, 1H), 8.52 (d, *J* = 6.0 Hz, 1H), 8.41-8.39 (m, 1H), 8.14 (d, *J* = 6.0 Hz, 1H), 8.02-8.01 (m, 4H), 7.99-7.96 (m, 1H), 7.90 (t, *J* = 6 Hz, 1H), 7.68-7.65 (m, 2H), 7.55-7.53 (m, 2H), 4.54 (s, 2H), 3.79 (s, 3H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 171.3, 155.6, 150.3, 141.0, 136.3, 134.1, 133.7, 133.2, 131.6, 129.9, 129.6, 129.4, 129.0, 128.8, 127.9, 127.2, 127.0, 126.9, 126.8, 126.8, 126.6, 125.1, 124.6, 123.4, 52.8, 43.7; IR (KBr)ν_{max} 3057, 2986, 2952, 2848, 1736, 1595, 1549, 1472, 1432, 1391, 1347, 1198, 1158, 1088, 1055 cm^{-1}; HRMS (ESI) Calcd For $C_{26}H_{20}NO_2$ 378.1489 ($M + H^+$); Found 378.1486.

Allyl 2-(3-(1-benzyl-1H-1,2,3-triazol-4-yl)benzo[f]quinolin-1-yl)acetate (10): Yield 60%, brown solid, mp 124-125 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.53 (d, *J* = 8.1 Hz, 1H), 8.45 (s, 1H), 8.02-7.97 (m, 2H), 7.69 (s, 2H), 7.40-7.39 (m, 6H), 7.28 (s, 1H), 5.86-5.83 (m, 1H), 5.65 (s, 2H), 5.26 (d, *J* = 17.4 Hz, 1H), 5.20 (d, *J* = 10.8 Hz, 1H), 4.66 (d, *J* = 5.6 Hz, 2H), 4.57 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.3, 150.2, 148.9, 148.7, 141.3, 134.7, 133.2, 131.8, 131.7, 130.1, 129.4, 129.1, 129.0, 128.5, 128.1, 127.0, 126.8, 125.3, 123.4, 123.1, 122.9, 119.1, 66.3, 54.7, 43.9; IR (KBr)ν_{max} 3148, 3062, 2924, 2853, 1736, 1647, 1597, 1557, 1497, 1454, 1430, 1362, 1338, 1296, 1232, 1187, 1156, 1092, 1043, 1017 cm^{-1}; HRMS (ESI) Calcd For $C_{27}H_{23}N_4O_2$ 435.1821 ($M + H^+$); Found 435.1813.

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Allyl 2-(3-(thiophen-2-yl)benzo[f]quinolin-1-yl)acetate (11): Yield 76%, brown solid, mp 114-115 ˚C, ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.48 (d, *J* = 9.6 Hz, 1H), 8.01 (d, *J* = 9.0 Hz, 1H), 7.95-7.93 (m, 2H), 7.78 (s, 1H), 7.76 (d, *J* = 3.4 Hz, 1H), 7.65-7.61 (m, 2H), 7.47 (d, *J* = 5.4 Hz, 1H), 7.18-7.16 (m, 1H), 5.91-5.84 (m, 1H), 5.29-5.26 (m, 1H), 5.22 (d, *J* = 9.6 Hz, 1H), 4.68 (d, *J* = 6.0 Hz, 2H), 4.48 (s, 2H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 170.3, 151.1, 150.2, 144.7, 140.8, 133.1, 131.8, 131.7, 129.9, 129.5, 129.3, 128.6, 128.3, 126.9, 126.8, 126.7, 125.9, 124.9, 121.7, 119.1, 66.2, 43.7; IR (KBr)ν_{max} 3071, 2958, 2930, 2857, 1739, 1584, 1552, 1523, 1482, 1455, 1423, 1365, 1326, 1259, 1155, 1071, 1015 cm^{-1}; HRMS (ESI) Calcd For $C_{22}H_{18}NO_2S$ 360.1053 (M + H$^+$); Found 360.1052.

Ethyl 2-(3-(4-methoxyphenyl)-2-methylbenzo[f]quinolin-1-yl)acetate (12): Yield 72%, white solid, mp 76-77 ˚C, ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.37 (d, *J* = 6.8 Hz, 1H), 7.94 (d, *J* = 8.8 Hz, 2H), 7.88 (d, *J* = 8.8 Hz, 1H), 7.63-7.62 (m, 3H), 7.58 (s, 1H), 7.03 (d, *J* = 8.4 Hz, 2H), 4.42 (s, 2H), 4.38 (q, *J* = 7.6 Hz, 2H), 3.89 (s, 3H), 2.47 (s, 3H), 1.38 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 171.2, 159.9, 158.9, 147.1, 139.4, 133.9, 133.4, 130.9, 130.4, 129.8, 129.6, 129.2, 129.1, 128.9, 127.2, 126.9, 126.3, 125.0, 122.1, 114.0, 61.7, 55.6, 40.1, 17.7, 14.6; IR (KBr)ν_{max} 3055, 2957, 2932, 2836, 1738, 1607, 1577, 1516, 1549, 1510, 1477, 1451, 1427, 1368, 1301, 1178, 1109, 1019 cm^{-1}; HRMS (ESI) Calcd For $C_{25}H_{24}NO_3$ 386.1751 (M + H$^+$); Found 386.1753.

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Graphical Abstract

One-pot three component regioselective synthesis of C1-functionalised 3-arylbenzo[f]quinoline

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