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Article

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Copper-Catalyzed Selective 1,2-Dialkylation of N‑Heteroarenes via a Radical Addition/Reduction Process: Application for the Construction of Alkylated Dihydroazaarenes Derivatives

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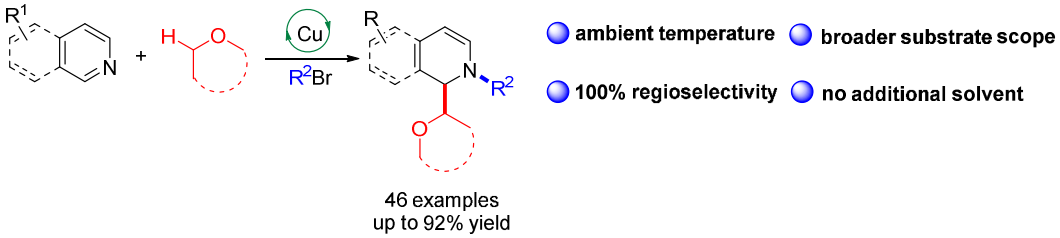


Abstract: A highly efficient Cu-catalyzed 1,2-difunctionalization of various N-heteroarenes were developed with ether and alkyl hal-ide at ambient temperature. This transformation involves the combination of oxidative coupling by Cu/TBHP and reduc-tion process by DBU (1,8-diazabicyclo[5.4.0]undec-7-ene). This method provides an efficient way to prepare various substituted dihydroazaarenes derivatives via a free-radical process.

Keywords: copper catalysis; N‑heteroarenes; 1,2-alkylation; radical addition/reduction process; dihydroquinoline/isoquinoline.

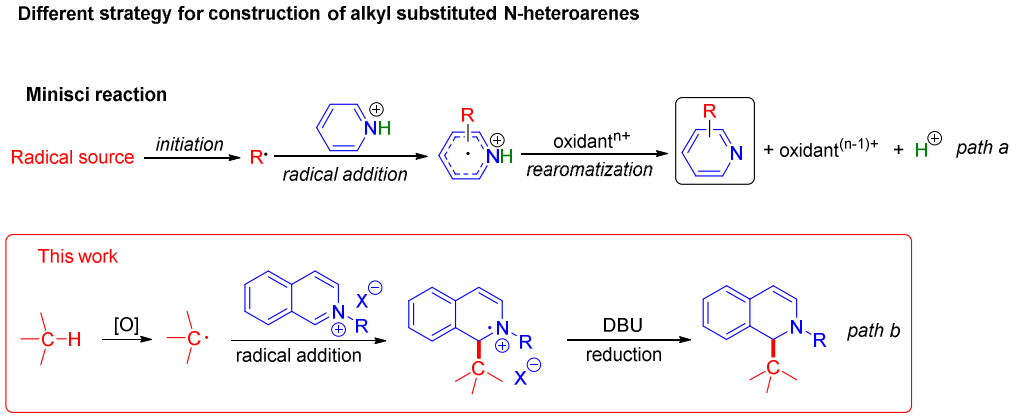
Introduction

1,2-Dihydroquinolines/1,2-dihydroisoquinolines (1,2-DHQs/1,2-DHIQs) with various substituents around their core structure have increasingly gained much attention due to their intri-guing pharmacological and biological properties.[1-5] For example, 1,2-DHQs were widely used as antibacterial,[2] antitrypanosomal,[3] antioxidant and antidiabetic agents,[4] as well as anti-juvenile hor-mone insecticides.[5] Moreover, 1,2-DHQs/1,2-DHIQs were also employed as important building blocks in organic synthesis.[6] Numerous methods for the preparation of these useful motifs have been developed. Catalytic hydrogenation of quinoline/isoquinoline was considered to be a straightforward strategy for the synthesis of 1,2-DHQs/1,2-DHIQs.[7-10] However, the reactions were usually carried out under harsh conditions and sometimes suffered from poor chemo- or regioselectivity. Another approach involved the addition of a carbon nucleophile to an activated pyridinium salt, which was typically formed in situ from the corresponding N-heteroarenes and an acylating agent.[11] This approach is particularly attractive, as it employs readily available starting materials and provides 1/2-substituted 1,2-DHQs/1,2-DHIQs in a single step. However, the examples via a free-radical process remained limited. Con-sequently, exploration of alternative methods for the synthesis 1,2-DHQs/1,2-DHIQs is highly desirable.

The direct C–H functionalization of the π-electron-deficient pyridine skeleton has always been a great challenge.[12] Minisci reaction offers various possibilities for the construction of substituted elec-tron-deficient N-heteroarenes.[13-15] As we know, traditional Minisci reaction was carried out under acid conditions, and the mechanism involved the addition of different radicals to the protonated ring, followed by the rearomatization of the radical adduct by oxidation (Scheme 1, path a). Consequently, based on this process, no

dearomatized products are observed. We noticed that if the final oxidation process is replaced by reduction, the dearomatization will be realized with the N-alkylation of N-heteroarenes by halide instead of Brønsted acid (Scheme 1, path b). Very recently, our group has reported the Cu-catalyzed 1,4-difunctionalization of isoquinolinium salts through an atom-transfer radical process, and we proposed an electrophilic radial cation intermediate generated in this process.[16] It is thus hypothesized that such a radial cation could capture an elec-tron from tertiary amine such as DBU under relative mild condi-tions.[17] Herein, we report the first example of Minisci reactions under alkaline conditions. This method allows convenient access to a variety of 1,2-DHQs/1,2-DHIQs.

Scheme 1. Introduction

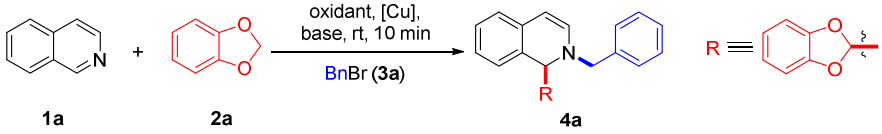


Results and Discussion

To test the above hypothesis, we focused the initial studies on the reaction of isoquinoline (**1a**), benzo[*d*][1,3]dioxole (**2a**) and benzyl bromide (**3a**) with 1 equiv of *tert*-butyl hydroperoxide (TBHP), 1 equiv of 1,8-diazabicyclo[5.4.0]undec-7-ene (DBU) and 5 mol % $Cu(acac)_2$ at ambient temperature for 1 h (Table 1, entry 1). The desired 1,2-alkylation product **4a** was obtained in 29% yield. Further screening results are listed in Table 1. For example, excess oxidant (3 equiv) was beneficial to obtain a better yield of **4a**

(53%, entry 2). The best result (91%) was obtained upon increasing the catalyst loading to 10 mol % (entry 3). Notably, the reaction was quite sensitive to oxidants, and only trace product was detected when other radical initiators, such as di-*tert*-butyl peroxide (DTBP) and dicumyl peroxide (DCP) were chosen (entries 4-5). Among the tested catalysts, $Cu(acac)_2$ was superior to $CuCl_2$ (43%), and Cu_2O (10%) (entries 6-7). Different tertiary amines were also screened. DBU was more efficient than others (entries 8-9). In addition, additional solvents, i.e., CH_2Cl_2 and dimethylformamide (DMF) were not beneficial to obtain satisfactory results (entries 10-11). The rise in temperature is not advantageous to the reaction (entry 12). Control experiments showed that the catalyst and oxidant critically affected the reaction efficiency. Only trace yield was obtained in the absence of oxidant or catalyst (entries 13-14). The C-1 alkylation and C-4 halogenation result could been obtained without DBU.[16] For more details of the screening experiments, see Table S1 of the Supporting Information.

Table 1. Modification of the Typical Reaction Conditions[a]



1a **2a** **4a**

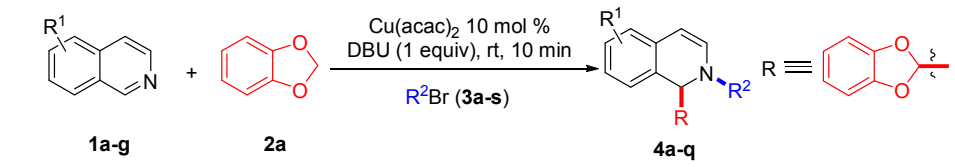
entry	oxidant	catalyst	base	solvent	temp (°C)	yield (%)[b]
1[c]	TBHP	$Cu(acac)_2$	DBU	free	rt	29
2	TBHP	$Cu(acac)_2$	DBU	free	rt	53
3[d]	TBHP	$Cu(acac)_2$	DBU	free	rt	91
4[d]	DCP	$Cu(acac)_2$	DBU	free	rt	trace
5[d]	DTBP	$Cu(acac)_2$	DBU	free	rt	trace
6[d]	TBHP	$CuCl_2$	DBU	free	rt	43
7[d]	TBHP	Cu_2O	DBU	free	rt	10
8[d]	TBHP	$Cu(acac)_2$	DABCO	free	rt	79
9[d]	TBHP	$Cu(acac)_2$	Et_3N	free	rt	23
10[d,e]	TBHP	$Cu(acac)_2$	DBU	CH_2Cl_2	rt	62
11[d,e]	TBHP	$Cu(acac)_2$	DBU	DMF	rt	58
12[d]	TBHP	$Cu(acac)_2$	DBU	free	45	80
13[d]	-	$Cu(acac)_2$	DBU	free	rt	trace
14	TBHP	-	DBU	free	rt	trace

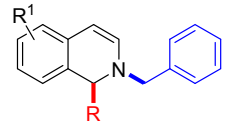
15[d]	TBHP	$Cu(acac)_2$	-	free	rt	trace

[a]Reaction conditions: **1a** (0.3 mmol) and **3a** (0.3 mmol) were added successively into **2a** (3 mmol, 10 equiv), and the mixture was stirred at ambient temperature for 10 mins, 70% TBHP in water (3 equiv), catalyst (5 mol %), DBU (0.3 mmol, 1 equiv) for another 10 min. [b]Isolated yield. [c]1 equiv of TBHP. [d]10 mol % of catalyst loading. [e]2 mL of solvent.

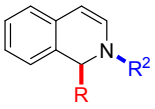
With the optimized reaction conditions in hand, the scope and limitation of the N-heteroarenes and halides were studied, as shown in Scheme 2. Generally, for the various isoquinolines, the reaction efficiency was not sensitive to the electronic properties of the substituents on the isoquinoline ring, as substrates bearing both electron-donating (**4b**, 82%) and electron-withdrawing groups (**4c**, **4f-g**, 83%-88%) gave good to excellent yields. Notably, the bulky phenyl (**4d**, 90%), 4-methoxyphenyl (**4e**, 92%) derivatives could be tolerated in this reaction. As to different halides, various substituents on the benzene core worked well to generate **4h-n** in 70-87% yields. Importantly, the diversity of the products were further increased as this procedure allows access to the reaction of isoquinolines with diverse alkyls (**4o-p**, 89-91%), phenyl ethyl (**4q**, 90%), hydrocinnamyl (**4r**, 97%) and 2-(1-Menaphthyl) (**4y**, 71%) and (2-Menaphthyl) (**4z**, 73%) halides. Some functional group tolerance was also observed including C-Cl (**4s**, 79%), C-Br (**4t**, 80%) bonds, esters (**4u-w**, 71-88%) and cyano (**4x,** 87%) groups.

Scheme 2. Scope of Isoquinoline and Halide[a]

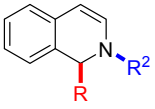




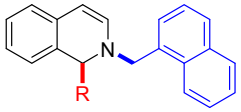
R^1 = H, **4a**, 91%
R^1 = 3-Me, **4b**, 82%
R^1 = 4-Br, **4c**, 83%
R^1 = 4-Ph, **4d**, 90%
R^1 = 4-(4-$MeOC_6H_4$), **4e**, 92%
R^1 = 5-Br, **4f**, 87%
R^1 = 6-Br, **4g**, 88%



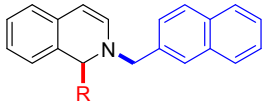
R^2 = $CH_2$4-MeC_6H_4, **4h**, 79%
R^2 = $CH_2$4-$MeOC_6H_4$, **4i**,86%
R^2 = $CH_2$3,5-$(MeO)_2C_6H_3$, **4j**, 81%
R^2 = $CH_2$4-FC_6H_4, **4k** 77%
R^2 = $CH_2$4-ClC_6H_4, **4l**, 87%
R^2 = $CH_2$4-$CF_3C_6H_4$, **4m** 69%
R^2 = $CH_2$4-$NO_2C_6H_4$, **4n**, 70%



R^2 = $CH(CH_3)_2$, **4o**, 89%
R^2 = $CH_2CH_2CH_2CH_3$, **4p**, 91%
R^2 = CH_2CH_2Ph, **4q**, 90%
R^2 = $CH_2CH_2CH_2Ph$, **4r**, 87%
R^2 = $CH_2CH_2CH_2Cl$, **4s**, 79%
R^2 = $CH_2CH_2CH_2Br$, **4t**, 80%
R^2 = $CH_2CO_2CH_3$, **4u**, 71%
R^2 = $CH_2CO_2CH_2CH_3$, **4v**, 74%
R^2 = $CH_2CH_2CH_2COOCH_3$, **4w**, 88%
R^2 = $CH_2CH_2CH_2CN$, **4x**, 87%



4y, 71%



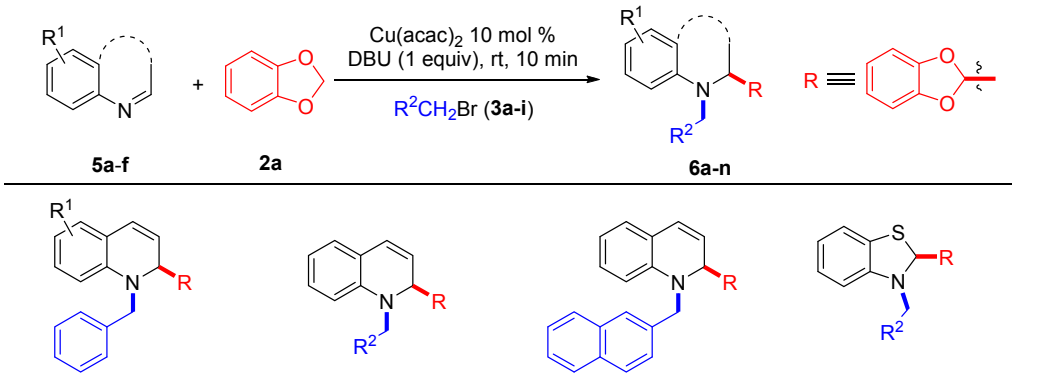
4z, 73%

[a]Reaction conditions: **1** (0.3 mmol) and **3** (0.3 mmol) were added successively into **2a** (3 mmol, 10 equiv), and the mixture was stirred at ambient temperature for 10 min, 70% TBHP in water (3 equiv), $Cu(acac)_2$ (10 mol %) and DBU (0.3 mmol, 1 equiv) at room temperature for another 10 min; neat, isolated yield.

In order to develop the scope of the reaction, various N-heteroarenes were also investigated. The results were summarized in Scheme 3. Generally, in the presence of 10 mol % $Cu(acac)_2$, 3 equiv TBHP and 1 equiv DBU, the reaction efficiency was not sensitive to the electronic property of the groups on the quinoline ring, as substrates bearing both electron-donating (**6b-c**, 82-83%) and electron-withdrawing groups (**6d**, 90%) worked well with good to excellent yields. Meanwhile, halide derivatives bearing either electron-donating or electro-withdrawing substituents reacted smoothly, and afforded the corresponding 1,2-dialkylation DHQ products **6e-k** in good yields of 69–90%. Additionally, this procedure could also utilize 2-bromomethyl-naphthalene, as the primary analogue ran smoothly under the standard conditions, affording **6l** in 77% yield. In particular, benzothiazole also gave good yields (87-88%) of the products **6m-n**, which

indicated that the scope of N-heteroarenes were not restricted to isoquinolines and quinolines. A variety types of pyridines were also studied, and it is regrettable that no positive result was observed.

Scheme 3. Scope of Other N-Heteroarenes[a]



R^1 = H, **6a**, 81%
R^1 = 4-Me, **6b**, 82%
R^1 = 6-Me, **6c**, 83%
R^1 = 6-Br, **6d**, 90%

R^2 = 4-MeC_6H_4, **6e**, 82%
R^2 = 4-$MeOC_6H_4$, **6f**, 77%
R^2 = 3,5-$(MeO)_2C_6H_3$, **6g**, 83%
R^2 = 4-FC_6H_4, **6h**, 90%
R^2 = 4-ClC_6H_4, **6i**, 82%
R^2 = 4-$CF_3C_6H_4$, **6j**, 69%
R^2 = 4-$NO_2C_6H_4$, **6k**, 73%

6l, 77%

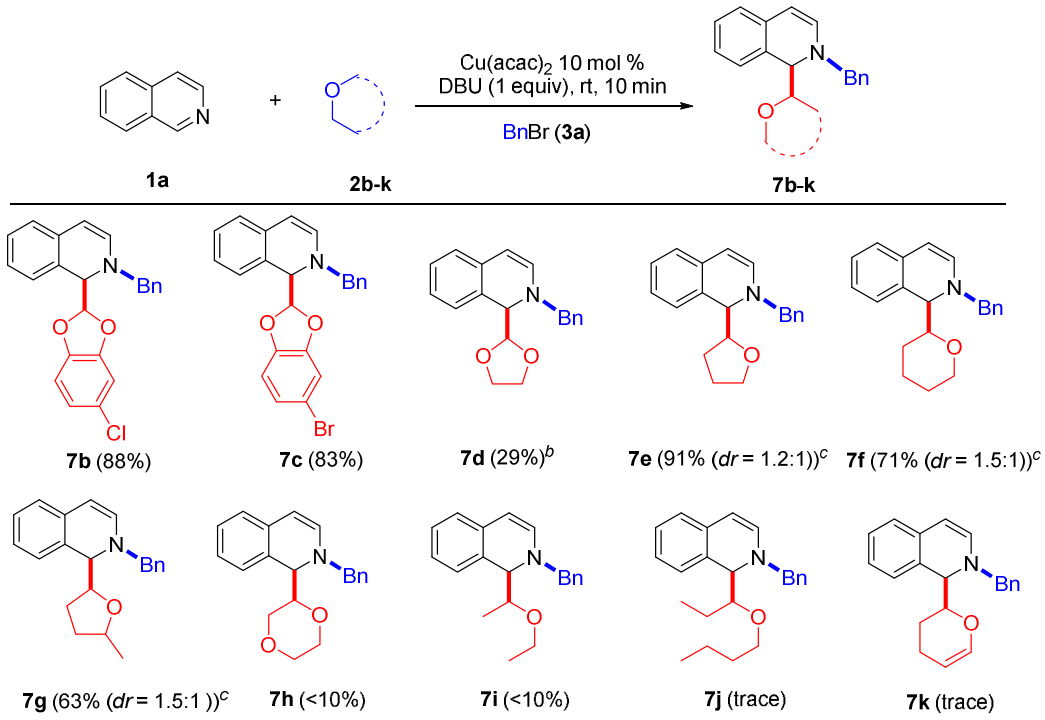
R^2 = Ph, **6m**, 88%
R^2 = 4-$MeOC_6H_4$, **6n**, 87%

[a]Reaction conditions: **5** (0.3 mmol) and **3** (0.3 mmol) were added successively into **2a** (3 mmol, 10 equiv), and the mixture was stirred at ambient temperature for 10 min, 70% TBHP in water (3 equiv), $Cu(acac)_2$ (10 mol %) and DBU (0.3 mmol, 1 equiv) at room temperature for another 10 min; neat, isolated yield.

The scope of the ether component of this reaction was also evaluated, and the results are shown in Scheme 4. As anticipated, 5-chloro and 5-bromo-substituted benzo[*d*][1,3]dioxoles reacted smoothly under the standard conditions to give the corresponding products **7b** and **7c** in 88% and 83% yields, respectively. Notably, both **7b** and **7c** have no other diastereoisomers. 1,3-Dioxolane also reacted with **1a** and **3a** to give **7d** in 29% yield with a prolonged reaction time of 1 h. However, the reaction temperature had to be lowered to 0 °C because of the higher reactivity and instability of the 1,3-dioxole radical intermediate. Subsequently, some other ethers, such as tetrahydrofuran, tetrahydropyran and 2-methyltetrahydrofuran, also underwent the reaction smoothly under

the optimized conditions with a prolonged reaction time of 1 h, leading to the desired products **4d-4f** in good yields (63-91%) and diastereoselectivities ranging from 1.2 to 1.5:1. Unfortunately, the reaction was not compatible with dioxane, diethyl ether, 1-butoxybutane and dihydropyran.

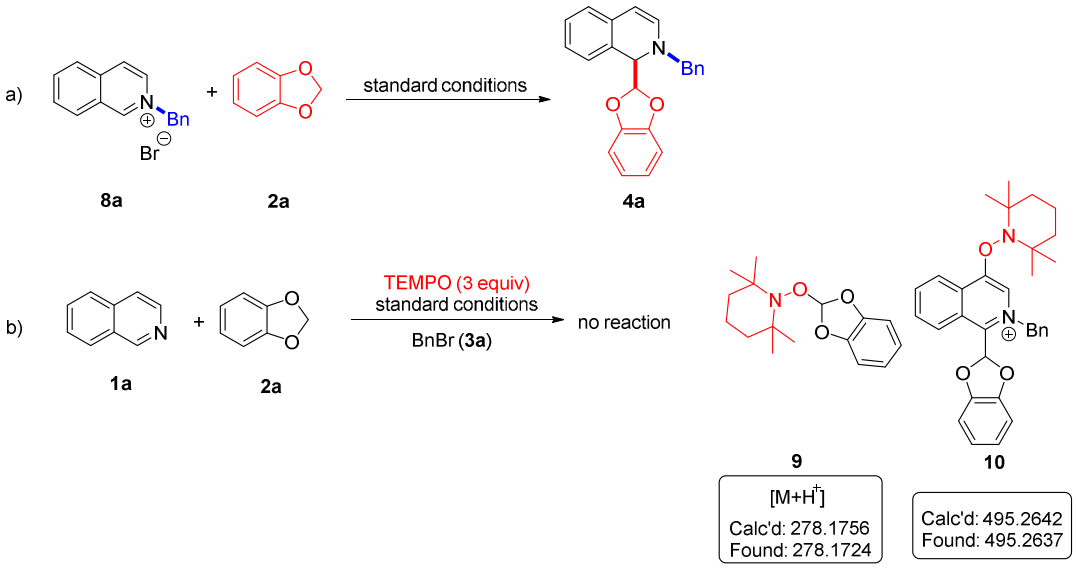
Scheme 4. Scope of Ethers[a]



[a]Reaction conditions: **1a** (0.3 mmol) and **3a** (0.3 mmol) were added successively into **2** (3 mmol, 10 equiv), and the mixture was stirred at ambient temperature for 10 min, 70% TBHP in water (3 equiv) and $Cu(acac)_2$ (10 mol %) at room temperature for another 10 min; neat, isolated yield. [b]0 °C for 1 h. [c]The reaction time was 1 h.

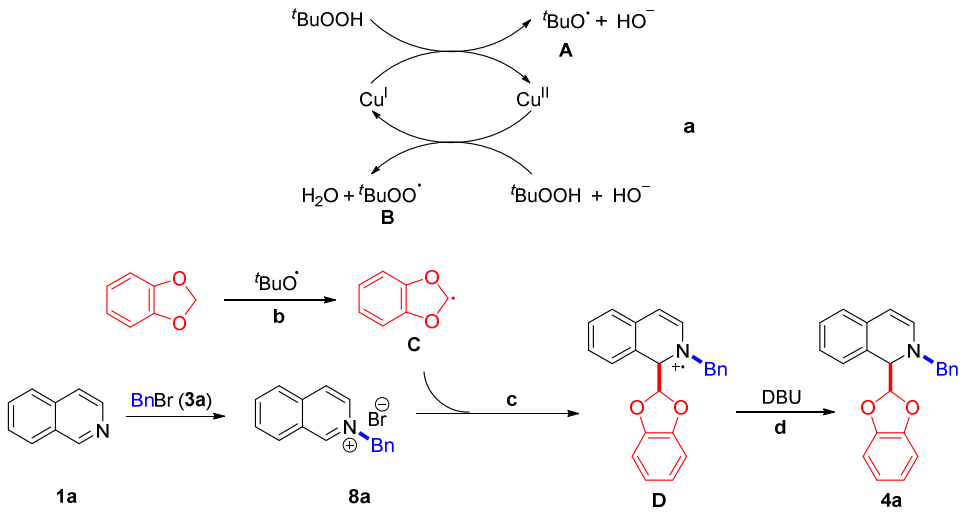
Several control experiments were conducted to gain insight into this transformation, and the results are compiled in Scheme 5. Initially, the *in situ* produced 2-benzylisoquinolinium bromide (**8a**) was used to react with benzo[*d*][1,3]dioxole (**2a**) under the standard conditions; **4a** was successfully generated in 92% yield, which strongly implied the isoquinolinium salt was the intermediate for this transformation (Scheme 5a). Next, under the standard conditions, 3 equiv of 2,2,6,6-tetramethyl-1-piperidinyloxyl

(TEMPO) were added into the reaction mixture. The reaction was totally inhibited, and no desired product **4a** was detected. The radical adducts **9** and **10** were determined by HRMS [m/z 278.1724 (calcd. for $[C_{14}H_{25}NO_2+H]^+$, 278.1756)] and [m/z 495.2637 (calcd. for $[C_{29}H_{37}N_2O_2]^+$, 495.2642)] (Scheme 5b), which implied that a radical process was involved in this transformation.



Scheme 5 Control Experiments

Based on the above results and previously reported reactions,[15,16] a plausible reaction mechanism was proposed (Scheme 6). First, the initial copper-catalyzed homolytic decomposition of TBHP generates radical intermediates **A** and **B**.[18] Both of the radical species then abstract a hydrogen from the 2-position of benzo[*d*][1,3]dioxole (**2a**) to give the nucleophilic radical **C**, which preferentially adds to the C-1 position of 2-benzylisoquinolinium bromide, leading to the electrophilic radial cation **D**. Finally, intermediate **D** captured one electron from DBU to give the final product **4a**.[17]



Scheme 6 Plausible Reaction Mechanism

Conclusion

In summary, we developed an efficient and practical Cu-catalyzed 1,2-difunctionalization of different N-heteroarenes involving the combination of oxidative coupling and reduction process by DBU under fairly mild conditions. This method provides an efficient way to prepare various substituted dihydroazaarenes derivatives via a free-radical process. Further investigation of this strategy, focusing on the functionalization of other azaarene compounds via a free-radical process, is underway in our laboratory.

Experimental section

General Information:

Unless otherwise noted, all reactants or reagents including dry solvents were obtained from commercial suppliers and used as received. Analytical thin-layer chromatography (TLC) was carried out using 0.25 mm commercial silica gel plates (Merck silica gel 60 F254). The developed chromatogram was analyzed by UV lamp (254 nm). ^{1}H NMR and ^{13}C NMR spectra were obtained on a Variance 400 M. Chemical shifts (δ) are expressed in parts per million and are internally referenced. High-resolution mass spectra (HRMS) were obtained on AB 5800 MALDI-TOF/TOF

and are reported as m/z (relative intensity). Melting points were measured on a Yanaco Micro Melting Point Apparatus and are uncorrected. All chemicals, solvents, and deuterated solvents were purchased from Aldrich, Alfa Aesar, Apollo Scientific, TCI, Acros and Deutero companies.

Experiment section:

General Procedure for the Preparation of 4, 6 and 7.

N‑heteroarenes (0.3 mmol) and halides (0.3 mmol) were added successively into ethers (3 mmol), and the mixture was stirred at ambient temperature for 10 mins, $Cu(acac)_2$ (0.030 mmol), TBHP (3 equiv., 70% aqueous solution) were added to the mixture of substrates under air. The mixture was stirred RT for another 10 mins. The reaction mixture was quenched with saturated $Na_2S_3O_3$ solution, extracted repeatedly with ethyl acetate, dried over $MgSO_4$. It was then removal of the organic solvent in vacuum and followed by flash silica gel column chromatographic purification afforded products **4a-r** (69-92%), **6a-n** (69-90%) and **7b-g** (29-91%) with 15−30% ethyl acetate in petroleum as the eluent.

General Procedure for the Preparation of 8.

1a (10 mmol), benzyl bromide (10 mmol) were added to dry CH_3CN (10 mL) in a sealed tube. The mixture was stirred at RT for 12 h. Filtrate was obtained by filtration under reduced pressure. It was then removal of the organic solvent in vacuum afforded product **1** (yield: 95%).

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-1,2-dihydroisoquinoline (4a): colorless oil, 0.0932 g, 91%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.28 (t, J = 4.0 Hz, 2H, ArH), 7.21 (t, J = 8.0 Hz, 3H, ArH), 7.12 (t, J = 8.0 Hz, 1H, ArH), 6.99 (t, J = 4.0 Hz, 2H, ArH), 6.91-6.86 (m, 3H, ArH), 6.80 (t, J = 4.0 Hz, 2H, ArH), 6.38 (d, J = 8.0 Hz, 1H, CH), 6.23 (d, J = 4.0 Hz, 1H, CH), 5.27 (d, J = 8.0 Hz, 1H, CH), 4.74 (d, J = 4.0 Hz, 1H, CH), 4.55-4.44 (m, 2H, CH_2); ^{13}C NMR (100 MHz,

d_6-DMSO) δ: 147.5, 147.4, 139.3, 137.1, 134.4, 129.0, 128.4, 128.1, 127.6, 127.6, 124.8, 123.2, 122.8, 122.0, 121.8, 110.8, 108.6, 108.5, 97.2, 61.1, 58.0. HRMS (ESI) Calcd. for $C_{23}H_{20}NO_2$ ($[M+H]^+$): 342.1494, found: 342.1499.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-3-methyl-1,2-dihydroisoquinoline (4b): colorless oil, 0.0874 g, 82%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.22 (d, J = 8.0 Hz, 2H, ArH), 7.18-7.12 (m, 2H, ArH), 7.08 (d, J = 8.0 Hz, 2H, ArH), 7.03-6.97 (m, 2H, ArH), 6.88 (d, J = 8.0 Hz, 3H, ArH), 6.81 (s, 2H, ArH), 6.21 (s, 1H, CH), 5.29 (s, 1H, CH), 4.73-4.64 (m, 2H, CH_2), 4.41 (d, J = 16.0 Hz, 1H, CH), 1.67 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ147.7, 147.5, 142.6, 140.1, 135.2, 128.9, 128.3, 127.4, 127.2, 126.5, 124.2, 123.8, 122.1, 121.8, 121.7, 110.9, 108.3, 108.2, 99.1, 64.0, 54.5, 19.8. HRMS (ESI) Calcd. for $C_{24}H_{22}NO_2$ ($[M+H]^+$): 356.1651, found: 356.1650.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-4-bromo-1,2-dihydroisoquinoline (4c): colorless oil, 0.1047 g, 83%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.31-7.25 (m, 3H, ArH), 7.23-7.20 (m, 3H, ArH), 7.16 (d, J = 8.0 Hz, 1H, ArH), 7.12-7.05 (m, 2H, ArH), 6.88-6.85 (m, 2H, ArH), 6.83 (s, 1H, CH), 6.80 (t, J = 4.0 Hz, 2H, ArH), 6.26 (d, J = 4.0 Hz, 1H, CH), 4.85 (d, J = 4.0 Hz, 1H, CH), 4.52 (s, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.3, 138.7, 138.0, 137.9, 132.6, 129.2, 128.9, 128.1, 127.9, 127.6, 126.5, 123.7, 122.0, 121.9, 121.7, 110.9, 110.6, 108.6, 108.5, 89.7, 61.4, 61.1, 57.9; HRMS (ESI) Calcd. for $C_{23}H_{19}BrNO_2$ ($[M+H]^+$): 420.0599, found: 420.0592, 422.0570.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-4-phenyl-1,2-dihydroisoquinoline (4d): colorless oil, 0.1127 g, 90%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.36 (t, J = 8.0 Hz, 2H, ArH), 7.28-7.20 (m, 8H, ArH), 7.14-7.00 (m, 4H, ArH), 6.88-6.85 (m, 2H, ArH), 6.81-6.78 (m, 2H, ArH), 6.58 (s, 1H, CH), 6.35 (t, J = 4.0 Hz, 1H, CH), 4.76 (d, J = 4.0 Hz, 1H, CH), 4.66-4.55 (m, 2H, CH_2); ^{13}C NMR

(100 MHz, d_6-DMSO) δ: 147.5, 147.4, 139.1, 138.8, 136.3, 134.0, 129.0, 128.9, 128.8, 128.6, 128.3, 127.8, 127.8, 126.1, 125.4, 124.2, 122.0, 121.9, 120.9, 111.0, 110.4, 108.6, 108.5, 61.4, 57.9. HRMS (ESI) Calcd. for $C_{29}H_{24}NO_2$ ($[M+H]^+$): 418.1807, found: 418.1800.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-4-(4-methoxyphenyl)-1,2-dihydroisoquinoline (4e): white solid, 0.1235 g, 92%, ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.32-7.23 (m, 5H, ArH), 7.21-7.19 (m, 2H, ArH), 7.13-7.02 (m, 3H, ArH), 6.94 (d, J = 8.1 Hz, 3H, ArH), 6.89-6.86 (m, 2H, ArH), 6.81-6.78 (m, 2H, ArH), 6.45 (s, 1H, CH), 6.33 (d, J = 3.8 Hz, 1H, CH), 4.73 (d, J = 4.1 Hz, 1H, CH), 4.57 (dd, J = 15.3 Hz, 2H CH_2), 3.76 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 157.4, 147.1, 146.9, 138.7, 135.1, 134.0, 130.6, 129.7, 128.5, 128.1, 127.8, 127.4, 127.3, 124.8, 123.7, 121.5, 121.4, 120.5, 113.9, 110.1, 110.0, 108.1, 108.0, 60.9, 57.4, 55.0. HRMS (ESI) Calcd. for $C_{30}H_{26}NO_3$ ($[M+H]^+$): 448.1913, found: 448.1901. m.p. 150-152 °C.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-benzyl-5-bromo-1,2-dihydroisoquinoline (4f): colorless oil, 0.1097 g, 87%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.28 (d, J = 4.0 Hz, 2H, ArH), 7.24-7.18 (m, 3H, ArH), 7.11 (s, 2H, ArH), 6.95 (d, J = 8.0 Hz, 1H, ArH), 6.88 (d, J = 4.0 Hz, 2H, ArH), 6.81 (s, 2H, ArH), 6.48 (d, J = 8.0 Hz, 1H, CH), 6.22 (s, 1H, CH), 5.25 (d, J = 8.0 Hz, 1H, CH), 4.78 (s, 1H, CH), 4.56-4.46 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 147.3, 139.1, 138.6, 137.1, 130.1, 129.0, 127.7, 127.5, 127.0, 124.8, 122.0, 121.9, 110.5, 108.6, 108.5, 95.9, 60.6, 58.0.; HRMS (ESI) Calcd. for $C_{23}H_{19}BrNO_2$ ($[M+H]^+$): 420.0599, found: 420.0594, 422.0572.

1-(Benzo[*d*][1,3]dioxol-2-yl)-4-bromo-2-(4-methoxybenzyl)-1,2-dihydroisoquinoline (4g): colorless oil, 0.1110 g, 88%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.25 (t, J = 8.0 Hz, 1H, ArH), 7.16-7.13 (m, 3H, ArH), 7.11-7.03 (m, 2H, ArH), 6.83-6.84 (m, 4H, ArH), 6.82-6.79 (m, 3H, ArH), 6.24 (d, J = 4.0 Hz, 1H, CH), 4.84 (d, J = 4.0 Hz, 1H, CH), 4.43 (s, 2H, CH_2), 3.69 (s, 3H,

OCH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 147.2, 139.6, 138.9, 133.7, 132.3, 129.0, 127.8, 127.8, 127.6, 125.8, 124.9, 122.1, 122.0, 117.5, 110.4, 108.7, 108.6, 95.0, 61.1, 57.9.; HRMS (ESI) Calcd. for $C_{23}H_{19}BrNO_2$ ($[M+H]^+$): 420.0599, found: 420.0597, 422.0569.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(4-methylbenzyl)-1,2-dihydroisoquinoline (4h): colorless oil, 0.0842 g, 79%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.08 (s, 5H, ArH), 6.97 (s, 2H, ArH), 6.90 (d, J = 4.0 Hz, 3H, ArH), 6.80 (d, J = 4.0 Hz, 2H, ArH), 6.37 (d, J = 4.0 Hz, 1H, CH), 6.21 (d, J = 4.0 Hz, 1H, CH), 5.24 (t, J = 4.0 Hz, 1H, CH), 4.71 (s, 1H, CH), 4.49-4.37 (m, 2H, CH_2), 2.22 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.3, 137.1, 136.8, 136.1, 134.4, 129.5, 128.4, 128.1, 127.7, 124.7, 123.2, 122.7, 122.0, 121.8, 110.8, 108.6, 108.5, 97.0, 61.0, 57.8, 21.1; HRMS (ESI) Calcd. for $C_{24}H_{22}NO_2$ ($[M+H]^+$): 356.1651, found: 356.1656.

1-(Benzo[d][1,3]dioxol-2-yl)-2-(4-methoxybenzyl)-1,2-dihydroisoquinoline (4i): colorless oil, 0.0958 g, 86%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.13-7.12 (m, 2H, ArH), 6.97 (s, 1H, ArH), 6.89-6.87 (m, 3H, ArH), 6.85-6.83 (m, 3H, ArH), 6.80-6.79 (m, 2H, ArH), 6.37 (d, J = 4.0 Hz, 1H, CH), 6.21 (d, J = 4.0 Hz, 1H, CH), 5.24 (t, J = 4.0 Hz, 1H, CH), 4.71 (s, 1H, CH), 4.46-4.35 (m, 2H, CH_2), 3.69 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 159.0, 147.5, 147.3, 137.0, 134.4, 130.9, 129.1, 128.4, 128.1, 124.6, 123.2, 122.7, 122.0, 121.8, 114.4, 110.7, 108.6, 108.5, 97.0, 60.9, 57.5, 55.4.; HRMS (ESI) Calcd. for $C_{24}H_{22}NO_3$ ($[M+H]^+$): 372.1600, found: 372.1603.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(3,5-dimethoxybenzyl)-1,2-dihydroisoquinoline (4j): colorless oil, 0.0976 g, 81%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.13 (d, J = 8.0 Hz, 1H, ArH), 7.01 (d, J = 8.0 Hz, 2H, ArH), 6.93 (d, J = 8.0 Hz, 1H, ArH), 6.87 (d, J = 4.0 Hz, 2H, ArH), 6.80 (s, 2H, ArH), 6.36 (s, 3H, ArH), 6.33 (s, 1H, CH), 6.21 (s, 1H, CH), 5.30 (d, J = 8.0 Hz, 1H, CH), 4.75 (s, 1H, CH), 4.48-4.37 (m, 2H, CH_2), 3.58 (s, 2H, OCH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 161.0,

147.5, 147.4, 142.0, 137.1, 134.3, 128.4, 128.1, 124.8, 123.2, 122.8, 121.9, 121.8, 110.7, 108.6, 108.5, 105.2, 99.2, 97.5, 61.3, 58.1, 55.3.; HRMS (ESI) Calcd. for $C_{25}H_{24}NO_4$ ($[M+H]^+$): 402.1705, found: 402.1700.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(4-fluorobenzyl)-1,2-dihydroisoquinoline (4k): colorless oil, 0.0830 g, 77%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.65 (d, J = 8.0 Hz, 2H, ArH), 7.41 (d, J = 8.0 Hz, 2H, ArH), 7.13 (d, J = 8.0 Hz, 1H, ArH), 7.01 (d, J = 8.0 Hz, 2H, ArH), 6.93 (d, J = 8.0 Hz, 1H, ArH), 6.86 (d, J = 8.0 Hz, 2H, ArH), 6.80 (d, J = 4.0 Hz, 2H, ArH), 6.39 (d, J = 8.0 Hz, 1H, CH), 6.24 (d, J = 4.0 Hz, 1H, CH), 5.32 (d, J = 4.0 Hz, 1H, CH), 4.78 (s, 1H, CH), 4.66-4.54 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 163.0, 160.6, 147.5, 147.3, 136.9, 135.5, 135.5, 134.3, 129.6, 129.6, 128.4, 128.1, 124.8, 123.3, 122.8, 122.0, 121.8, 115.8, 115.6, 110.7, 108.6, 108.5, 97.5, 61.1, 57.2.; HRMS (ESI) Calcd. for $C_{23}H_{19}FNO_2$ ($[M+H]^+$): 360.1400, found: 360.1401.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(4-chlorobenzyl)-1,2-dihydroisoquinoline (4l): colorless oil, 0.0981 g, 87%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.33 (d, J = 8.0 Hz, 2H, ArH), 7.22 (d, J = 8.0 Hz, 2H, ArH), 7.12 (d, J = 8.0 Hz, 1H, ArH), 6.99 (d, J = 8.0 Hz, 2H, ArH), 6.92-6.86 (m, 3H, ArH), 6.80 (s, 2H, ArH), 6.37 (d, J = 8.0 Hz, 1H, CH), 6.22 (s, 1H, CH), 5.29 (s, 1H, CH), 4.74 (s, 1H, CH), 4.54-4.42 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.3, 138.4, 136.8, 134.2, 132.2, 129.5, 128.9, 128.5, 128.1, 124.9, 123.3, 122.8, 122.0, 121.8, 110.7, 108.6, 108.5, 97.6, 61.1, 57.2. HRMS (ESI) Calcd. for $C_{23}H_{19}ClNO_2$ ($[M+H]^+$): 376.1104, found: 376.1100.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(4-(trifluoromethyl)benzyl)-1,2-dihydroisoquinoline (4m): colorless oil, 0.0847 g, 69%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.65 (d, J = 8.0 Hz, 2H, ArH), 7.41 (d, J = 8.0 Hz, 2H, ArH), 7.13 (d, J = 8.0 Hz, 1H, ArH), 7.01 (d, J = 8.0 Hz, 2H, ArH), 6.93

(d, J = 8.0 Hz, 1H, ArH), 6.87 (d, J = 12.0 Hz, 2H, ArH), 6.80 (d, J = 4.0 Hz, 2H, ArH), 6.39 (d, J = 8.0 Hz, 1H, CH), 6.24 (d, J = 4.0 Hz, 1H, CH), 5.32 (d, J = 8.0 Hz, 1H, CH), 4.78 (s, 1H, CH), 4.66-4.54 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.3, 144.5, 136.8, 134.2, 128.5, 128.2, 128.2, 125.8, 125.8, 125.0, 123.4, 122.9, 122.0, 121.8, 110.7, 108.6, 108.5, 97.9, 61.3, 57.4; HRMS (ESI) Calcd. for $C_{24}H_{19}F_3NO_2$ ($[M+H]^+$): 410.1368, found: 410.1366.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(4-nitrobenzyl)-1,2-dihydroisoquinoline (4n): colorless oil, 0.8115 g, 70%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 8.15 (d, J = 8.0 Hz, 2H, ArH), 7.47 (d, J = 8.0 Hz, 2H, ArH), 7.15 (t, J = 8.0 Hz, 1H, ArH), 7.02 (t, J = 8.0 Hz, 2H, ArH), 6.93 (d, J = 8.0 Hz, 1H, ArH), 6.87 (t, J = 8.0 Hz, 2H, ArH), 6.79 (t, J = 4.0 Hz, 2H, ArH), 6.40 (d, J = 8.0 Hz, 1H, CH), 6.23 (d, J = 4.0 Hz, 1H, CH), 5.34 (d, J = 4.0 Hz, 1H, CH), 4.80 (d, J = 4.0 Hz, 1H, CH), 4.70-4.58 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.7, 147.5, 147.3, 147.2, 136.6, 134.1, 128.7, 128.5, 128.2, 125.0, 124.1, 123.4, 123.0, 122.0, 121.9, 110.7, 108.6, 108.5, 98.2, 61.3, 57.3; HRMS (ESI) Calcd. for $C_{23}H_{19}N_2O_4$ ($[M+H]^+$): 387.1345, found: 387.1340.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-isopropyl-1,2-dihydroisoquinoline (4o): colorless oil, 0.0783 g, 89%, ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.12-7.07 (m, 2H, ArH), 6.99 (t, J = 8.0 Hz, 1H, ArH), 6.88 (d, J = 4.0 Hz, 1H, ArH), 6.82-6.81 (m, 2H, ArH), 6.78-6.76 (m, 2H, ArH), 6.34 (d, J = 4.0 Hz, 1H, CH), 6.07 (d, J = 4.0 Hz, 1H, CH), 5.31 (d, J = 4.0 Hz, 1H, CH), 4.84 (d, J = 4.0 Hz, 1H, CH), 3.47-3.43 (m, 1H, CH), 1.09-1.07 (m, 6H, CH3); ^{13}C NMR (100 MHz, DMSO) δ 147.2, 147.1, 134.3, 132.1, 127.8, 127.6, 124.1, 123.0, 121.9, 121.3, 121.2, 110.2, 108.0, 107.9, 97.8, 61.2, 54.4, 22.6, 20.5; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{19}H_{20}NO_2$ ($[M+H]^+$): 294.1494, found: 294.1493.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-butyl-1,2-dihydroisoquinoline (4p): colorless oil, 0.0839 g, 91%, ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.14-7.06 (m, 2H, ArH), 6.99 (t, *J* = 8.0 Hz, 1H, ArH), 6.89-6.82 (m, 3H, ArH), 6.80-6.77 (m, 2H, ArH), 6.27 (d, *J* = 8.0 Hz, 1H, CH), 6.14 (d, *J* = 4.0 Hz, 1H, CH), 5.21 (d, *J* = 8.0 Hz, 1H, CH), 4.75 (d, *J* = 8.0 Hz, 1H, CH), 3.29 (t, *J* = 8.0 Hz, 1H, CH), 3.21-3.14 (m, 1H, CH_2), 1.48-1.40 (m, 2H, CH_2) 1.22-1.16 (m, 2H, CH2), 0.82 (t, J = 8.0 Hz, 3H, CH3);δ: ^{13}C NMR (100 MHz, d_6-DMSO) δ 147.5, 147.4, 136.8, 134.6, 128.3, 128.2, 124.5, 123.2, 122.4, 121.9, 121.8, 110.4, 108.5, 108.5, 96.6, 61.4, 54.1, 31.8, 19.6, 14.1; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{20}H_{21}NO_2$ ([M+H]$^+$): 307.1572, found: 307.1575.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-phenethyl-1,2-dihydroisoquinoline (4q): colorless oil, 0.0960 g, 90%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.19 (t, *J* = 8.0 Hz, 2H, ArH), 7.16-7.11 (m, 4H, ArH), 7.00 (d, *J* = 2.8 Hz, 2H, ArH), 6.89 (d, *J* = 4.0 Hz, 1H, ArH), 6.85-6.81 (m, 2H, ArH), 6.79-6.76 (m, 2H, ArH), 6.30 (d, *J* = 4.0 Hz, 1H, CH), 6.14 (d, *J* = 4.0 Hz, 1H, CH), 5.23 (d, *J* = 4.0 Hz, 1H, CH), 4.77 (d, *J* = 4.0 Hz, 1H, CH), 3.52-3.47 (m, 1H, CH_2), 3.42-3.39 (m, 1H, CH_2) 2.82-2.77 (m, 1H, CH_2), 2.74-2.69 (m, 1H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ 147.1, 146.9, 139.0, 135.9, 134.0, 128.7, 128.2, 127.8, 127.7, 126.0, 124.0, 122.9, 122.1, 121.4, 121.3, 110.0, 108.1, 108.0, 96.6, 61.1, 56.0, 35.7; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{24}H_{21}NO_2$ ([M+H]$^+$): 355.1572, found: 355.1572.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(3-phenylpropyl)-1,2-dihydroisoquinoline (4r): colorless oil, 0.0964 g, 87%, ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.23 (t, *J* = 4.0 Hz, 2H, ArH), 7.15-7.13 (m, 2H, ArH), 7.10 (t, *J* = 4.0 Hz, 3H, ArH), 7.02 (t, *J* = 8.0 Hz, 1H, ArH), 6.91 (t, *J* = 4.0 Hz, 1H, ArH), 6.84-6.81 (m, 2H, ArH), 6.80-6.77 (m, 2H, ArH), 6.28 (d, *J* = 8.0 Hz, 1H, CH), 6.15 (d, *J* = 4.0 Hz, 1H, CH), 5.27 (d, *J* = 8.0 Hz, 1H, CH), 4.76 (d, *J* = 4.0 Hz, 1H, CH), 3.34-3.30 (m, 1H, CH_2),

3.22-3.18 (m, 1H, CH_2), 2.48 (t, J = 8.0 Hz, 2H, CH_2), 1.84-1.71(m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ 147.0, 146.9, 141.4, 136.1, 134.0, 128.2, 128.1, 127.9, 127.7, 125.7, 124.1, 122.8, 122.1, 121.6, 121.5, 121.3, 109.8, 108.6, 108.1, 108.0, 96.6, 61.1, 53.56, 32.0, 30.9; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{25}H_{23}NO_2$ ($[M+H]^+$): 369.1729, found: 369.1728.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(3-chloropropyl)-1,2-dihydroisoquinoline (4s): colorless oil, 0.0777 g, 79%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.15-7.09 (m, 1H, ArH), 7.04-6.98 (m, 2H, ArH), 6.89-6.84 (m, 1H, ArH), 6.79-6.73 (m, 4H, ArH), 6.20-6.16 (m, 1H, CH), 6.09 (t, J = 4.0 Hz, 1H, CH), 5.23-5.20 (m, 1H, CH), 4.66-4.61 (m, 1H, CH), 3.27-3.19 (m, 1H, CH_2), 3.16-3.07 (m, 1H, CH_2), 1.80-1.60 (m, 2H, CH_2), 1.37-1.21 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 146.9, 146.9, 146.8, 146.8, 135.9, 135.8, 133.9, 127.9, 127.7, 127.7, 124.2, 124.1, 122.8, 122.1, 122.1, 121.4, 121.3, 109.7, 108.1, 108.0, 96.9, 96.8, 61.0, 61.0, 51.2, 51.2, 29.4, 29.1; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{19}H_{19}ClNO_2$ ($[M+H]^+$): 328.1104, found: 328.1104.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(3-bromopropyl)-1,2-dihydroisoquinoline (4t): colorless oil, 0.8934 g, 80%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.12-7.08 (m, 1H, ArH), 6.98-6.94 (m, 2H, ArH), 6.87-6.75 (m, 5H, ArH), 6.19 (t, J = 8.0 Hz, 1H, CH), 6.09-6.08 (m, 1H, CH), 5.19-5.11 (m, 1H, CH), 4.62 (t, J = 4.0 Hz, 1H, CH), 3.28-3.21 (m, 1H, CH), 3.16-3.10 (m, 1H, CH_2), 1.37 (d, J = 4.0 Hz, 2H, CH2), 1.21 (t, J = 8.0 Hz, 2H, CH2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 147.3, 136.7, 136.5, 134.4, 128.3, 128.1, 124.5, 123.1, 123.1, 122.5, 121.9, 121.8, 110.1, 108.5, 108.5, 96.9, 96.7, 61.5, 61.2, 53.9, 26.4, 26.2; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{19}H_{19}BrNO_2$ ($[M+H]^+$): 372.0599, found: 372.0598, 374.0579.

Methyl 2-(1-(benzo[*d*][1,3]dioxol-2-yl)isoquinolin-2(1*H*)-yl)acetate (4u): colorless oil, 0.0689 g, 71%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.14 (s, 1H, ArH), 7.03 (s, 2H, ArH), 6.91 (d, J = 4.0 Hz,

1H, ArH), 6.84 (s, 2H, ArH), 6.79 (s, 2H, ArH), 6.22 (d, J = 8.0 Hz, 1H, CH), 6.16 (s, 1H, CH), 5.23 (d, J = 8.0 Hz, 1H, CH), 4.81 (s, 1H, CH), 4.19-4.04 (m, 4H, CH_2), 3.59 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 171.4, 147.5, 147.3, 136.8, 134.0, 128.4, 128.1, 124.8, 123.7, 122.9, 122.0, 121.8, 110.7, 108.6, 108.5, 97.6, 61.9, 55.4, 52.1; HRMS (ESI) Calcd. for $C_{19}H_{18}NO_4$ ($[M+H]^+$): 324.1236, found: 324.1227.

Ethyl 2-(1-(benzo[*d*][1,3]dioxol-2-yl)isoquinolin-2(1*H*)-yl)acetate (4v): colorless oil, 0.0749 g, 74%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.14 (s, 1H, ArH), 7.03 (s, 2H, ArH), 6.91 (d, J = 4.0 Hz, 1H, ArH), 6.83 (s, 2H, ArH), 6.79 (s, 2H, ArH), 6.21 (s, 1H, CH), 6.16 (s, 1H, CH), 5.25 (d, J = 4.0 Hz, 1H, CH), 4.81 (s, 1H, CH), 4.16-4.02 (m, 4H, CH_2), 1.13 (d, J = 4.0 Hz, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 170.9, 147.5, 147.3, 136.8, 134.0, 128.3, 128.1, 124.8, 123.7, 122.8, 122.0, 121.8, 110.6, 108.6, 108.5, 97.7, 62.0, 60.8, 55.6, 14.4; HRMS (ESI) Calcd. for $C_{20}H_{20}NO_4$ ($[M+H]^+$): 338.1392, found: 338.1388.

Methyl 4-(1-(benzo[*d*][1,3]dioxol-2-yl)isoquinolin-2(1*H*)-yl)butanoate (4w): colorless oil, 0.0928 g, 88%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.13 (t, J = 8.0 Hz, 1H, ArH), 7.08 (d, J = 4.0 Hz, 1H, ArH), 7.02 (d, J = 8.0 Hz, 1H, ArH), 6.90 (d, J = 4.0 Hz, 1H, ArH), 6.85-6.83 (m, 2H, ArH), 6.78 (t, J = 4.0 Hz, 2H, ArH), 6.26 (d, J = 4.0 Hz, 1H, CH), 6.14 (d, J = 4.0 Hz, 1H, CH), 5.25 (d, J = 4.0 Hz, 1H, CH), 4.74 (d, J = 4.0 Hz, 1H, CH), 3.49 (s, 3H, OCH_3), 3.35-3.30 (m, 1H, CH_2), 3.23-3.18 (m, 1H, CH_2), 2.23 (t, J = 4.0 Hz, 2H, CH_2), 1.75-1.69(m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 173.4, 147.4, 147.3, 136.5, 134.4, 128.4, 128.2, 124.6, 123.3, 122.6, 121.9, 121.8, 110.2, 108.6, 108.5, 97.2, 61.4, 53.5, 51.6, 30.7, 25.1; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{21}H_{22}NO_4$ ($[M+H]^+$): 352.1549, found: 352.1544.

4-(1-(Benzo[*d*][1,3]dioxol-2-yl)isoquinolin-2(1H)-yl)butanenitrile (4x): colorless oil, 0.0831 g, 87%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.15 (t, J = 4.0 Hz, 1H, ArH), 7.09 (d, J = 4.0 Hz, 1H, ArH), 7.03 (t, J = 4.0 Hz, 1H, ArH), 6.92 (d, J = 4.0 Hz, 1H, ArH), 6.87-6.84 (m, 2H, ArH), 6.81-6.79 (m, 2H, ArH), 6.28 (d, J = 8.0 Hz, 1H, CH), 6.16 (d, J = 4.0 Hz, 1H, CH), 5.30 (d, J = 4.0 Hz, 1H, CH), 4.79 (d, J = 4.0 Hz, 1H, CH), 3.39-3.35 (m, 1H, CH_2), 3.28-3.23 (m, 1H, CH_2), 2.42-2.35 (m, 2H, CH_2), 1.83-1.74 (m, 2H, CH_2); 13C NMR (100 MHz, d_6-DMSO) δ: 147.4, 147.3, 136.2, 134.2, 128.4, 128.3, 124.8, 123.4, 122.7, 122.0, 121.8, 120.6, 110.1, 108.6, 108.5, 97.9, 61.4, 53.0, 25.4, 13.9; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{20}H_{19}N_2O_2$ ($[M+H]^+$): 319.1447, found: 319.1444.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(naphthalen-1-ylmethyl)-1,2-dihydroisoquinoline (4y): colorless oil, 0.0834 g, 71%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 8.00-7.82 (m, 3H, ArH), 7.50 (s, 2H, ArH), 7.42-7.33 (m, 2H, ArH), 7.12 (s, 1H, ArH), 6.98-6.82 (m, 7H, ArH), 6.46 (d, J = 8.0 Hz, 1H, CH), 6.29 (s, 1H, CH), 5.30 (d, J = 8.0 Hz, 1H, CH), 5.05-4.94 (m, 2H, CH_2), 4.78 (s, 1H, CH); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.3, 136.8, 134.3, 134.1, 133.8, 131.4, 129.0, 128.5, 128.4, 128.2, 126.8, 126.3, 125.9, 125.8, 124.8, 123.6, 123.3, 122.8, 122.1, 122.0, 121.9, 110.6, 109.0, 108.7, 108.6, 97.5, 61.1, 55.6; MS HRMS (ESI) Calcd. for $C_{27}H_{22}NO_2$ ($[M+H]^+$): 392.1651, found: 392.1644.

1-(Benzo[*d*][1,3]dioxol-2-yl)-2-(naphthalen-2-ylmethyl)-1,2-dihydroisoquinoline (4z): colorless oil, 0.0857 g, 73%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.83-7.72 (m, 4H, ArH), 7.47 (d, J = 4.0 Hz, 2H, ArH), 7.35 (d, J = 8.0 Hz, 1H, ArH), 7.12 (s, 1H, ArH), 6.96-6.80 (m, 7H, ArH), 6.46 (d, J = 8.0 Hz, 1H, CH), 6.25 (d, J = 4.0 Hz, 1H, CH), 5.31-5.28 (m, 1H, CH), 4.78 (s, 1H, CH), 4.63 (t, J = 16.0 Hz, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.4, 137.0,

136.7, 134.3, 133.2, 132.8, 128.7, 128.4, 128.1, 128.0, 126.7, 126.5, 126.3, 126.1, 124.8, 123.3, 122.8, 122.0, 121.9, 110.8, 108.6, 108.5, 97.4, 61.0, 58.2; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{27}H_{22}NO_2$ ($[M+H]^+$): 392.1651, found: 392.1645.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-benzyl-1,2-dihydroquinoline (6a): colorless oil, 0.0830 g, 81%; 1H NMR (400 MHz, d_6-DMSO) δ: 7.26 (s, 4H, ArH), 7.19 (s, 1H, ArH), 6.89 (d, *J* =28.0 Hz, 3H, ArH), 6.75(d, *J* =12.0 Hz, 3H, ArH), 6.62 (d, *J* = 12.0 Hz, 1H, ArH), 6.51 (s, 1H, ArH), 6.36 (d, *J* = 8.0 Hz, 1H, CH), 6.13 (s, 1H, CH), 5.69 (s, 1H, CH), 4.71 (d, *J* =16.0 Hz, 1H, CH), 4.53 (d, *J* = 16.0 Hz, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.4, 143.8, 138.7, 129.6, 129.2, 128.8, 127.5, 127.3, 127.2, 122.2, 121.9, 121.8, 118.4, 117.0, 112.2, 110.8, 108.5, 61.2, 54.0. MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{23}H_{20}NO_2$ ($[M+H]^+$): 342.1494, found: 342.1490.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-benzyl-4-methyl-1,2-dihydroquinoline (6b): colorless oil, 0.0874 g, 82%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.26 (s, 3H, ArH), 7.18 (s, 1H, ArH), 7.14-7.11 (m, 1H, ArH), 7.08 (d, *J* = 8.0 Hz, 1H, ArH), 6.90 (t, *J* = 8.0 Hz, 1H, ArH), 6.85 (d, *J* = 4.0 Hz, 1H, ArH), 6.77 (s, 2H, ArH), 6.72 (d, *J* = 8.0 Hz, 1H, ArH), 6.56 (d, *J* = 8.0 Hz, 1H, ArH), 6.37 (d, *J* = 8.0 Hz, 1H, ArH), 6.08(d, *J* = 4.0 Hz, 1H, CH), 5.57 (d, *J* = 8.0 Hz, 1H, CH), 4.69 (d, *J* = 20.0 Hz, 1H, CH_2), 4.51 (d, *J* = 16.0 Hz, 1H, CH_2), 1.99 (s, 1H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 143.7, 143.6, 138.7, 134.0, 129.0, 128.8, 127.3, 127.3, 124.2, 123.9, 123.4, 121.8, 116.8, 116.2, 112.3, 111.0, 109.6, 108.5, 108.4, 60.8, 54.0, 19.1; MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{24}H_{22}NO_2$ ($[M+H]^+$): 356.1651, found: 356.1644.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-benzyl-6-methyl-1,2-dihydroquinoline (6c): colorless oil, 0.0885 g, 83%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.25 (s, 4H, ArH), 7.18 (s, 1H, ArH), 6.84 (s, 1H, ArH), 6.77 (d, *J* = 8.0 Hz, 4H, ArH), 6.69 (d, *J* = 8.0 Hz, 1H, ArH), 6.58 (d, *J* = 12.0 Hz, 1H,

ArH), 6.28 (d, *J* = 4.0 Hz,1H, CH), 6.10 (s, 1H, CH), 5.67 (s, 1H, CH), 4.68 (d, *J* = 16.0 Hz, 1H, CH), 4.50 (d, *J* = 8.0 Hz, 2H, CH_2), 2.10 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ147.5, 147.4, 141.5, 138.9, 129.6, 128.8, 128.0, 127.2, 125.3, 122.1, 121.8, 121.8, 118.6, 112.3, 110.8, 108.5, 61.3, 54.1, 20.3; MS (m/z) HRMS (ESI) Calcd. for $C_{24}H_{22}NO_2$ ([M+H]+): 356.1651, found: 356.1650.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-benzyl-6-bromo-1,2-dihydroquinoline (6d): colorless oil, 0.1135 g, 90%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.28-7.20 (m, 5H, ArH), 7.12 (s, 1H, ArH), 6.98 (d, *J* = 8.0 Hz, 1H, ArH), 6.86 (s, 1H, ArH), 6.77-6.72 (m, 3H, ArH), 6.62 (d, *J* = 8.0 Hz, 1H, ArH), 6.26 (d, *J* = 8.0 Hz, 1H, CH), 6.17 (s, 1H, CH), 5.75 (d, *J* = 4.0 Hz, 1H, CH), 4.64 (d, *J* = 16.0 Hz, 2H, CH_2), 4.52 (d, *J* = 16.0 Hz, 1H, CH); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 143.0, 138.2, 131.2, 129.4, 128.9, 128.5, 127.4, 127.1, 124.5, 121.9, 120.0, 114.3, 110.7, 108.5, 108.0, 61.3, 54.0; MS (m/z) HRMS (ESI) Calcd. for $C_{23}H_{19}BrNO_2$ ($[M+H]^+$): 420.0599, found: 420.0591, 422.0577.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-methylbenzyl)-1,2-dihydroquinoline (6e): colorless oil, 0.0874 g, 82%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.14 (s, 2H, ArH), 7.07 (d, *J* = 8.0 Hz, 2H, ArH), 6.93-6.83 (m, 3H, ArH), 6.77-6.72 (m, 3H, ArH), 6.60 (d, *J* = 8.0 Hz, 1H, ArH), 6.49 (d, *J* = 8.0 Hz, 1H, ArH), 6.36 (d, *J* = 8.0 Hz, 1H, CH), 6.12 (d, *J* = 4.0 Hz, 1H, CH), 5.66 (t, *J* = 4.0 Hz,1H, CH), 4.64 (d, *J* = 16.0 Hz, 1H, CH), 4.48 (t, *J* = 12.0 Hz, 2H, CH_2), 2.23 (s, 3H, CH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.4, 143.9, 136.3, 135.6, 129.6, 129.4, 129.2, 127.4, 127.2, 122.2, 121.8, 121.8, 118.4, 116.9, 112.3, 110.7, 108.5, 61.1, 53.8, 21.1; MS (m/z) HRMS (ESI) Calcd. for $C_{24}H_{22}NO_2$ ([M+H]+): 356.1651, found: 356.1647.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-methoxybenzyl)-1,2-dihydroquinoline (6f): colorless oil, 0.0858 g, 77%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.18 (d, *J* = 8.0 Hz, 2H, ArH), 6.93-6.72 (m, 8H, ArH), 6.60 (d, *J* = 8.0 Hz, 1H, ArH), 6.51(t, *J* = 8.0 Hz, 1H, ArH), 6.39 (d, *J* = 8.0 Hz, 1H, CH), 6.11 (s, 1H, CH), 5.66 (d, *J* = 4.0 Hz, 1H, CH), 4.62 (d, *J* = 16.0 Hz, 1H, CH), 4.45 (t, *J* = 16.0 Hz, 2H, CH_2), 3.69 (s, 3H, OCH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 158.6, 147.5, 147.4, 143.9, 130.3, 129.6, 129.2, 128.6, 127.4, 122.2, 121.8, 121.8, 118.4, 116.9, 114.3, 112.3, 110.8, 108.5, 60.8, 55.4, 53.4; MS (m/z) HRMS (ESI) Calcd. for $C_{24}H_{22}NO_3$ ($[M+H]^+$): 372.1600, found:372.1599.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(3,5-dimethoxybenzyl)-1,2-dihydroquinoline (6g): colorless oil, 0.1000 g, 83%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 6.92-6.84 (m, 3H, ArH), 6.78-6.72 (m, 3H, ArH), 6.62 (d, *J* = 8.0 Hz, 1H, ArH), 6.52(t, *J* = 8.0 Hz, 1H, ArH), 6.43 (s, 2H, ArH), 6.37 (d, *J* = 8.0 Hz, 1H, ArH), 6.33 (s, 1H, CH), 6.13 (d, *J* = 4.0 Hz, 1H, CH), 5.70-5.66 (m, 1H, CH), 4.64 (d, *J* = 16.0 Hz, 1H, CH), 4.47 (t, *J* = 16.0 Hz, 2H, CH_2), 3.65 (s, 6H, OCH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 161.0, 147.5, 147.4, 143.8, 141.4, 129.6, 129.2, 127.5, 122.0, 121.9, 121.8, 118.2, 117.0, 112.2, 110.7, 108.5, 105.1, 98.6, 61.4, 55.4, 54.2; MS (m/z) HRMS (ESI) Calcd. for $C_{25}H_{24}NO_4$ ($[M+H]^+$): 402.1705, found: 402.1701.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-fluorobenzyl)-1,2-dihydroquinoline (6h): colorless oil, 0.0970 g, 90%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.28 (s, 2H, ArH), 7.10 (t, *J* = 8.0 Hz, 2H, ArH), 6.94-6.84 (m, 3H, ArH), 6.78-6.72 (m, 3H, ArH), 6.61 (d, *J* = 8.0 Hz, 1H, ArH), 6.51 (s, 1H, ArH), 6.35 (d, *J* = 8.0 Hz, 1H, CH), 6.13 (s, 1H, CH), 5.69 (s, 1H, CH), 4.69 (d, *J* = 16.0 Hz, 1H, CH), 4.52 (t, *J* = 12.0 Hz, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 143.6, 134.8, 129.6, 129.2, 129.1, 129.0, 127.5, 122.3, 121.9, 121.8, 118.5, 117.1, 115.7, 115.5, 112.3, 110.8, 108.5,

61.2, 53.3; MS (m/z) HRMS (ESI) Calcd. for $C_{23}H_{19}FNO_2$ ($[M+H]^+$): 360.1400, found: 360.1400.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-chlorobenzyl)-1,2-dihydroquinoline (6i): colorless oil, 0.0925 g, 82%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.33-7.26 (m, 4H, ArH), 6.93 (d, *J* = 8.0 Hz, 1H, ArH), 6.85 (t, *J* = 8.0 Hz, 2H, ArH), 6.77-6.71(m, 3H, ArH), 6.62 (d, *J* = 12.0 Hz, 1H, ArH), 6.51 (d, *J* = 4.0 Hz, 1H, ArH), 6.31 (d, *J* = 8.0 Hz, 1H, CH), 6.12 (s, 1H, CH), 5.71-5.68 (m, 1H, CH), 4.69 (d, *J* = 20.0 Hz, 1H, CH), 4.54 (t, *J* = 12.0 Hz, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 143.5, 137.9, 131.7, 129.6, 129.2, 129.0, 128.8, 127.5, 122.2, 121.9, 121.8, 118.6, 117.2, 112.3, 110.8, 108.5, 61.4, 53.4.; MS (m/z) HRMS (ESI) Calcd. for $C_{23}H_{19}ClNO_2$ ($[M+H]^+$): 376.1104, found: 376.1101.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-(trifluoromethyl)benzyl)-1,2-dihydroquinoline (6j): colorless oil, 0.0847 g, 69%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.63 (d, *J* = 8.0 Hz, 2H, ArH), 7.46 (d, *J* = 8.0 Hz, 2H, ArH), 6.95 (d, *J* = 4.0 Hz, 1H, ArH), 6.84(t, *J* = 8.0 Hz, 2H, ArH), 6.75 (d, *J* = 16.0 Hz, 3H, ArH), 6.64 (d, *J* = 8.0 Hz, 1H, ArH), 6.52 (s, 1H, ArH), 6.29 (d, *J* = 8.0 Hz, 1H, CH), 6.14 (s, 1H, CH), 5.73 (s, 1H, CH), 4.79 (d, J = 16.0 Hz, 1H, CH), 4.64 (d, J = 16.0 Hz, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.4, 144.0, 143.4, 129.6, 129.2, 127.8, 127.6, 125.6, 122.2, 121.9, 121.8, 118.6, 117.3, 112.2, 110.8, 110.7, 108.5, 61.6, 53.8; MS (*m*/*z*): HRMS (ESI) Calcd. for $C_{24}H_{19}F_3NO_2$ ($[M+H]^+$): 410.1368, found: 410.1365.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(4-nitrobenzyl)-1,2-dihydroquinoline (6k): colorless oil, 0.0846 g, 73%; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 8.13 (d, *J* = 8.0 Hz, 2H, ArH), 7.50 (d, *J* = 8.0 Hz, 2H, ArH), 6.95 (d, *J* = 8.0 Hz, 1H, ArH), 6.88-6.82(m, 2H, ArH), 6.75 (t, *J* = 8.0 Hz, 3H, ArH), 6.65 (d, J = 12.0 Hz, 1H, ArH), 6.53 (t, *J* = 8.0 Hz, 1H, ArH), 6.26 (d, *J* = 8.0 Hz, 1H, CH), 6.15 (d, *J* = 4.0 Hz, 1H, CH), 5.75-5.72 (m, 1H, CH), 4.84 (d, *J* = 16.0 Hz, 1H, CH), 4.69 (d, *J* = 16.0 Hz, 2H,

CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.5, 147.5, 147.0, 143.3, 129.6, 129.3, 128.3, 127.7, 124.0, 122.3, 121.9, 121.9, 118.8, 117.5, 112.2, 110.8, 108.6, 108.6, 61.7, 53.9, 46.0. MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{23}H_{19}N_2O_4$ ($[M+H]^+$): 387.1345, found: 387.1340.

2-(Benzo[*d*][1,3]dioxol-2-yl)-1-(naphthalen-2-ylmethyl)-1,2-dihydroquinoline (6l): colorless oil, 0.0904 g, 77%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.82 (t, *J* = 16.0 Hz, 4H, ArH), 7.46-7.40 (m, 3H, ArH), 6.95 (d, *J* = 4.0 Hz, 1H, ArH), 6.86 (s, 2H, ArH), 6.76 (d, *J* = 4.0 Hz, 3H, ArH), 6.65 (d, *J* = 12.0 Hz, 1H, ArH), 6.51 (s, 1H, ArH), 6.43 (d, *J* = 8.0 Hz, 1H, CH), 6.17 (s, 1H, CH), 5.71 (s, 1H, CH), 4.84 (d, *J* = 16.0 Hz, 1H, CH_2), 4.69 (d, *J* = 16.0 Hz, 1H, CH_2), 4.60 (s, 1H, CH); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.5, 147.4, 143.9, 136.4, 133.3, 132.7, 129.6, 129.2, 128.5, 127.9, 127.5, 126.6, 126.1, 125.8, 125.7, 122.3, 121.9, 118.6, 117.1, 112.3, 110.8, 110.8, 108.5, 61.2, 54.3, 46.0; MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{27}H_{22}NO_2$ ($[M+H]^+$): 392.1651, found: 392.1648.

2-(Benzo[d][1,3]dioxol-2-yl)-3-benzyl-2,3-dihydrobenzo[d]thiazole (6m): colorless oil, 0.0917 g, 88%; 1H NMR (400 MHz, d_6-DMSO) δ: 7.33-7.24 (m, 5H, ArH), 7.06 (d, *J* =8.0 Hz, 2H, ArH), 6.87 (d, *J* =8.0 Hz, 1H, ArH), 6.81-6.79 (m, 3H, ArH), 6.63 (t, *J* = 8.0 Hz, 1H, ArH), 6.47 (d, *J* =8.0 Hz, 1H, ArH), 6.29 (d, *J* =4.0 Hz, 1H, CH), 5.69 (d, *J* =4.0 Hz, 1H, CH), 4.71 (d, *J* =16.0 Hz, 1H, CH_2), 4.47 (d, *J* =16.0 Hz, 1H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.7, 147.4, 147.3, 138.0, 128.9, 127.7, 127.6, 126.1, 125.8, 122.0, 121.7, 119.8, 109.8, 109.7, 108.6, 108.6, 71.4, 53.7; MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{21}H_{18}NO_2S$ ($[M+H]^+$): 348.1058, found: 348.1052.

2-(Benzo[d][1,3]dioxol-2-yl)-3-(4-methylbenzyl)-2,3-dihydrobenzo[d]thiazole (6n): colorless oil, 0.0985 g, 87%; 1H NMR (400 MHz, d_6-DMSO) δ: 7.17 (d, *J* =8.0 Hz, 2H, ArH), 7.11 (d, *J* =8.0 Hz, 2H, ArH), 7.05 (d, *J* =8.0 Hz, 1H, ArH), 6.88-6.81(m, 5H, ArH), 6.62 (t, *J* = 8.0 Hz, 1H,

ArH), 6.48 (d, *J* =8.0 Hz, 1H, ArH), 6.28 (s, 1H, CH), 5.57 (d, *J* =4.0 Hz, 1H, CH), 4.65 (d, *J* =20.0 Hz, 1H, CH_2), 4.41 (d, *J* =16.0 Hz, 1H, CH_2), 2.25 (s, 3H, OCH_3); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 147.8, 147.4, 147.3, 136.8, 134.9, 129.5, 127.8, 126.1, 125.8, 122.0, 121.6, 119.8, 109.9, 109.7, 108.6, 108.5, 71.3, 53.5, 21.1. MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{22}H_{20}NO_2S$ ($[M+H]^+$): 362.1215, found: 362.1210.

2-Benzyl-1-(5-chlorobenzo[*d*][1,3]dioxol-2-yl)-1,2-dihydroisoquinoline (7b): colorless oil, 0.0992 g, 88%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.28-7.19 (m, 5H, ArH), 7.12 (t, *J* = 8.0 Hz, 1H, ArH), 6.97 (t, *J* = 8.0 Hz, 3H, ArH), 6.91-6.82 (m, 3H, ArH), 6.37 (d, *J* = 8.0 Hz, 1H, CH), 6.32 (d, *J* = 4.0 Hz, 1H, CH), 5.27 (d, *J* = 4.0 Hz, 1H, CH), 4.79 (s, 1H, CH), 4.52-4.41 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 148.8, 148.6, 147.0, 146.8, 139.3, 137.0, 134.4, 129.0, 128.5, 128.0, 127.7, 127.6, 125.2, 125.1, 124.8, 122.9, 122.9, 121.4, 121.3, 112.6, 112.5, 109.1, 109.0, 97.3, 61.1, 61.0, 57.9; MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{23}H_{19}ClNO_2$ ($[M+H]^+$): 376.1104, found: 376.1099.

1-Benzyl-1-(5-bromobenzo[*d*][1,3]dioxol-2-yl)-1,2-dihydroisoquinoline (7c): colorless oil, 0.1047 g, 83%; ^1H NMR (400 MHz, d_6-DMSO) δ: 7.27 (t, *J* = 8.0 Hz, 2H, ArH), 7.21 (t, *J* = 8.0 Hz, 3H, ArH), 7.12 (t, *J* = 8.0 Hz, 2H, ArH), 7.02-6.95 (m, 3H, ArH), 6.90 (d, *J* = 8.0 Hz, 1H, ArH), 6.85-6.82 (m, 1H, ArH), 6.37 (d, *J* = 8.0 Hz, 1H, CH), 6.32 (d, *J* = 4.0 Hz, 1H, CH), 5.27 (d, *J* = 8.0 Hz, 1H, CH), 4.79 (s, 1H, CH), 4.52-4.41 (m, 2H, CH_2); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 149.1, 148.8, 147.5, 147.3, 139.3, 137.0, 134.4, 129.0, 128.5, 128.0, 128.0, 127.7, 127.6, 124.8, 124.4, 124.3, 122.9, 122.9, 112.5, 112.4, 111.7, 111.6, 109.8, 109.7, 97.3, 61.1, 58.0; MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{23}H_{19}BrNO_2$ ($[M+H]^+$): 420.0599, found: 420.0591, 422.0579.

1-Benzyl-1-(tetrahydrofuran-2-yl)-1,2-dihydroisoquinoline (7e): colorless oil, 0.0795 g, 91%, dr = 1.2:1; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.29 (t, J = 8.0 Hz, 4H, ArH), 7.21 (d, J = 8.0 Hz, 6H, ArH), 7.07-7.01 (m, 2H, ArH), 6.93-6.79 (m, 6H, ArH), 6.45 (d, J = 8.0 Hz, 1H, CH), 6.40 (d, J = 4.0 Hz, 1H, CH), 5.19 (d, J = 8.0 Hz, 1H, CH), 5.09 (d, J = 8.0 Hz, 1H, CH), 4.64 (d, J = 16.0 Hz, 2H, CH), 4.58-4.44 (m, 3H, CH), 4.26 (d, J = 8.0 Hz, 1H, CH), 4.13 (t, J = 8.0 Hz, 1H, CH), 3.86-3.62 (m, 6H, CH), 2.04-1.97 (m, 1H, CH), 1.86 (d, J = 8.0 Hz, 1H, CH), 1.78-1.69 (m, 1H, CH), 1.64-1.53 (m, 4H, CH), 1.46-1.41 (m, 1H, CH); ^{13}C NMR (100 MHz, $CDCl_3$) δ: 13C NMR (101 MHz, d_6-DMSO) δ 140.0, 139.8, 138.3, 137.0, 134.4, 133.9, 128.9, 128.9, 127.8, 127.6, 127.5, 127.5, 127.4, 127.3, 127.0, 125.8, 124.4, 124.2, 122.4, 122.2, 96.0, 95.6, 85.4, 78.7, 67.8, 62.8, 61.5, 58.2, 58.0, 28.2, 26.6, 26.1, 25.5. MS (m/z) HRMS (ESI) Calcd. for $C_{20}H_{22}NO$ ($[M+H]^+$): 292.1701, found: 292.1689.

2-Benzyl-1-(tetrahydro-2*H*-pyran-2-yl)-1,2-dihydroisoquinoline (7f): colorless oil, 0.0651 g, 71%, dr = 1.5:1; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.30-7.25 (m, 4.1H, ArH), 7.23-7.15 (m, 5.5H, ArH), 7.09-7.06 (m, 0.98H, ArH), 7.04-7.02 (m, 1.14H, ArH), 6.93-6.85 (m, 4.32H, ArH), 6.79 (d, J = 4.0 Hz, 1.03H, ArH), 6.45 (d, J = 4.0 Hz, 1H, CH), 6.42 (d, J = 4.0 Hz, 0.66H, CH), 5.21 (d, J = 4.0 Hz, 0.79H, CH), 5.06 (d, J = 4.0 Hz, 1H, CH), 4.62-4.54 (m, 2.95H, CH), 4.51-4.43 (m, 1.82H, CH), 4.27 (d, J = 4.0 Hz, 0.68H, CH), 3.95-3.90 (m, 1.87H, CH), 3.55 (t, J = 8.0 Hz, 1H, CH), 3.31-3.21 (m, 3.91H, CH), 1.75 (d, J = 8.0 Hz, 1.15H, CH), 1.65 (t, J = 4.0 Hz, 2H, CH) 1.56-1.34 (m, 10H, CH), 1.32-1.30 (m, 3.28H, CH), 1.27-1.26 (m, 3.13H, CH), 1.23-1.21 (m, 3.32H, CH_2), 1.14-1.10 (m, 1.43, CH_2) ; ^{13}C NMR (100 MHz, d_6-DMSO) δ: 139.6, 139.3, 137.8, 136.5, 133.8, 133.7, 128.4, 127.5, 127.2, 127.1, 127.1, 127.0, 126.2, 124.6, 123.8, 123.4, 121.8,

121.8, 95.7, 94.8, 85.0, 77.1, 68.0, 67.6, 63.5, 62.6, 58.0, 57.8, 31.1, 29.8, 27.0, 25.7, 25.5, 25.4, 22.8, 22.5. MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{21}H_{24}NO$ ($[M+H]^+$): 306.1858, found: 306.1861.

2-Benzyl-1-(5-methyltetrahydrofuran-2-yl)-1,2-dihydroisoquinoline (7g): colorless oil, 0.0779 g, 85%, 1.5;1; ^{1}H NMR (400 MHz, d_6-DMSO) δ: 7.28-7.02 (m, 14H, ArH), 6.93-6.78 (m, 6H, ArH), 6.48-6.39 (m, 2H, CH), 5.17 (t, *J* = 8.0 Hz, 2H, CH), 4.65-4.38 (m, 6H, CH), 3.88-3.72 (m, 3H, CH), 3.58 (d, *J* = 8.0 Hz, 1H, CH), 3.06 (d, *J* = 8.0 Hz, 1H, CH), 2.39-2.32 (m, 1H, CH), 2.01-1.56 (m, 8H, CH), 1.34-1.11 (m, 13H, CH), 0.98 (s, 3H, CH); ^{13}C NMR (100 MHz, d_6-DMSO) δ: 140.2, 138.2, 134.9, 134.6, 128.9, 128.3, 127.6, 127.4, 127.3, 127.1, 125.5, 124.2, 124.2, 122.5, 122.4, 96.8, 90.1, 89.7, 67.5, 67.1, 66.1, 66.1, 59.2, 45.9, 34.3, 33.2, 26.8, 25.6, 24.4, 22.5, 9.0. MS (*m*/*z*) HRMS (ESI) Calcd. for $C_{21}H_{24}NO$ ($[M+H]^+$): 306.1858, found: 306.1850.

***S Supporting Information**

The Supporting Information is available free of charge on the ACS Publications website at DOI:

The copies of the ^{1}H, and ^{13}C NMR spectra for all new products (PDF).

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Notes

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