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Enantioselective Construction of 2-Aryl-2,3-dihydrobenzofuran Scaffolds Using Cu/SPDO-Catalyzed [3 + 2] Cycloaddition

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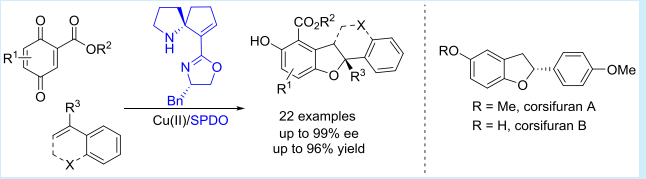
ABSTRACT: A new, efficient approach toward the preparation of 2-aryl-2,3-dihydrobenzofuran scaffolds through the Cu/SPDO-catalyzed [3 + 2] cycloaddition between quinone ester and styrene derivatives has been developed. The procedure features excellent enantioselectivities (up to 99% ee), high yields (up to 96%), and broad substrate tolerance. Additionally, asymmetric synthesis of natural corsifurans A and B from commercially available starting materials has also been achieved in two or three steps using this reaction as a key transformation.



Chiral 2-aryl-2,3-dihydrobenzofuran scaffolds are widely found in many bioactive natural products and drugs (Figure 1).[1] Due to their outstanding potential properties in

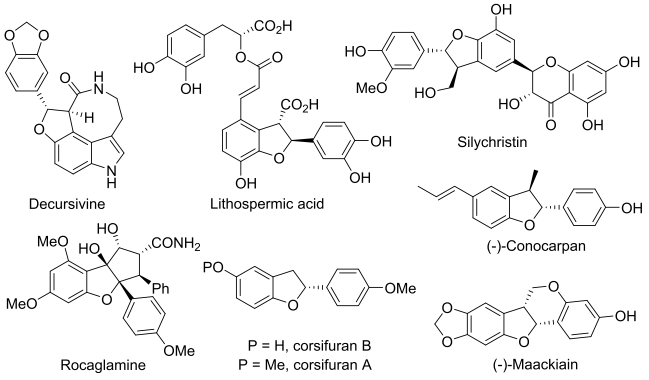
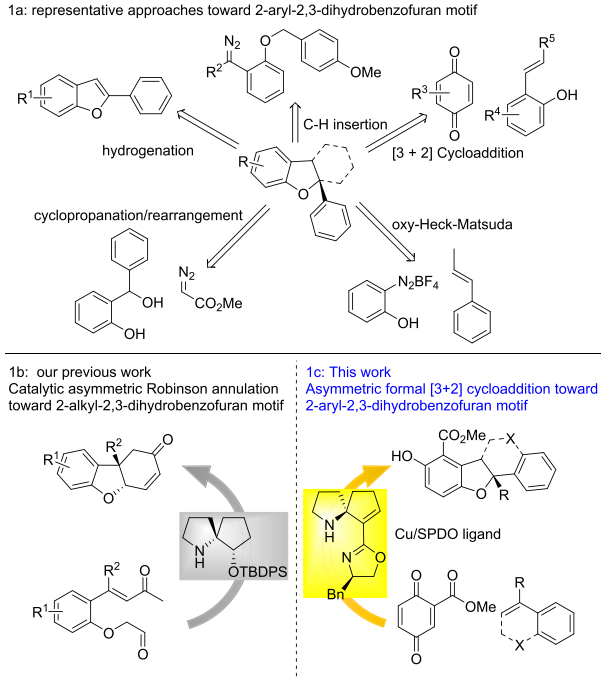


Figure 1. Selected biologically active compounds bearing 2-aryl-2,3-dihydrobenzofuran core.

functionalized molecules, the preparation of scaffolds in a diastereo- and enantioselective manner has attracted the attention of synthetic communities; consequently, some synthetic strategies have been developed in the past decade.[2] Representative approaches include Ru/NHC-catalyzed asymmetric hydrogenation developed by Glorius,[3] Rh/Davies's catalyst-catalyzed asymmetric C−H insertion reactions by Shaw and others,[4] Cu/BOX-catalyzed asymmetric O−H insertion/annulation by Wang,[5] a boron-catalyzed cyclopropanation/intramolecular rearrangement sequence by Ryu,[6] Pd/py-Box-catalyzed oxy-Heck−Matsuda arylations by Correia,[7] and chiral phosphoric acid catalyzed formal [3 + 2] cycloaddition by Zhou (Scheme 1a).[8] However, these developed synthetic methods have some disadvantages, such as multistep manipulation to prepare intramolecular reaction

Scheme 1. Outline of Asymmetric Construction of 2-Aryl-2,3-dihydrobenzofuran



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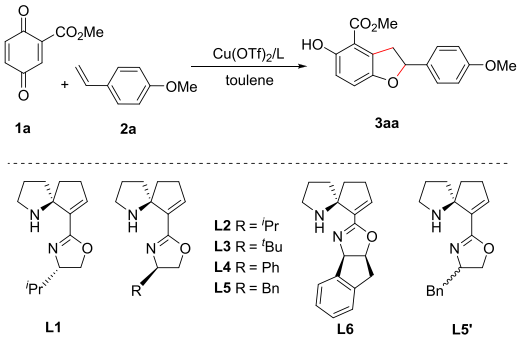
substrates, use of noble metal catalysts (Pd, Rh, etc.), narrow substrate scope, and unsatisfactory enantioselectivities.

At the same time, as one of the most valuable commodity chemicals in the chemical industry, styrene and its derivatives have served as important synthetic starting materials, and the functionalization of styrene has become a hot research topic in recent years, especially its asymmetric difunctionalization of double bonds to construct two vicinal stereocenters.[9] However, asymmetric [3 + 2] cycloadditions involving styrene to construct the above-mentioned 2-aryl-2,3-dihydrobenzofuran core have rarely been explored. To the best of our knowledge, only two relative formal transformations have been independently reported, namely, those by Correia[7] and Zhou.[8] Unfortunately, poor enantioselectivity was observed in the former report (up to 76% ee), and a narrow scope of substrates (i.e., only suitable for 1-styrylnaphthol and its derivatives) is a main limitation in the later transformation. Therefore, the exploration of a general and efficient asymmetric synthetic method for 2-aryl-2,3-dihydrobenzofuran scaffolds using [3 + 2] cyclization is highly demanded.

Recently, an SPD-organocatalyst-catalyzed enantioselective one-pot intramolecular Robison cyclization to construct 2-alkyl-2,3-dihydrobenzofuran scaffolds, unfortunately not efficient for 2-aryl-2,3-dihydrobenzofuran scaffolds, have been developed by our group (Scheme 1b).[10] Subsequently, another asymmetric intermolecular oxidative cross-coupling of 3-methyloxycarbonyl-2-naphthol with 2-naphthol for the preparation of *C1*-symmetric BINOLs through our well designed Cu/SPDO catalysis system also has been explored,[11] in which a proposed intermediate involving Cu/dioxygen of the quinone ester model plays a crucial role in the stereocontrol. Inspired by these previous studies and our continued research interest in the development of novel SPDO catalysts and their application in the asymmetric synthesis of bioactive natural products, herein, we envisioned that a [3 + 2] cyclization between quinone ester and styrene could be catalyzed by a suitable Cu/SDPO catalyst to provide alternative access to 2-aryl-2,3-dihydrobenzofuran derivatives with high enantioselectivities (Scheme 1c).

To test our assumptions, quinone ester (**1a**) and 4-methoxystyrene (**2a**) were selected as reaction partners. Actually, there are still some challenges in this designed asymmetric transformation. (1) Quinone esters formed by another competitive cycloaddition reaction such as [2 + 2] cyclization has been reported;[12] (2) excellent enantioselectivity of the transformation of styrene has rarely been reported due to the lack of a "holder" of efficient asymmetric [3 + 2] cycloaddition.[13] To address these problems, a series of new SPDO ligands (Table 1) were first synthesized according to our previously developed method.[11] With these new ligands in hand, various Cu salts with ligand (*R*,*S*)-**L1** as catalysts were first investigated to explore suitable reaction conditions, in which $Cu(OTf)_2$ could facilitate this transformation, affording desired adduct **3aa** in excellent yield (97%) with moderate enantioselectivity (62% ee) in toluene at room temperature for 6 h (entry 1, Table 1; for more details, see Supporting Information (SI)). Encouraged by these results, **L1** was replaced by other synthesized SPDO ligands (**L2**−**L6**) to further improve the enantioselectivity of the reaction. In detail, (*R*,*R*)-**L2** with C4-^{i}Pr gave a little higher ee than our previous corresponding (*R*,*S*)-**L1**, and (*R*,*R*)-**L5** with C4-Bn gave the best result in 95% isolated yield with 79% ee among **L2**−**L6** (entries 2−6). Then, reaction media were screened, and no

Table 1. Optimization of Reaction Conditions[a]



Entry	Ligand	T [°C]	t [h]	Yield [%][b]	ee [%][c]
1	**L1**	25	6	97	62
2	**L2**	25	6	85	63
3	**L3**	25	6	89	−49
4	**L4**	25	6	90	38
5	**L5**	25	6	95	79
6	**L6**	25	6	83	35
7	**L5**	0	12	94	85
8	**L5**	−40	24	91	88
9	**L5**	−80	36	89	90
10[d]	**L5**	−80	36	89	93
11[d]	**L5′**	−80	36	84	83

[a]The reactions were conducted with **1a** (0.10 mmol, 1.0 equiv), **2a** (1.2 equiv), $Cu(OTf)_2$ (10 mol %), and Ligand (10 mol %) in 2.0 mL toluene under Ar. [b]Isolated yields. [c]Determined by chiral UPC^2. [d]**2a** was added slowly with a syringe pump for 3 h.

better results were observed (for details, see the SI). Subsequently, lowering the reaction temperature can efficiently suppress the unexpected background reaction as we expected. And the enantioselectivity could be significantly increased to 90% ee when the reaction temperature was lowered to −80 °C (entries 7−9). Finally, the ee value of **3aa** was further increased to 93% by changing the addition of 4-methoxystyrene (**2a**) to the reaction system using a syringe pump for longer reaction times at −80 °C. (entry 10) As a comparison, **L5′** with racemic C4-Bn could not maintain efficiency like **L5**, which indicates that the enantioinduction depends on not only the main spirocenter but also the C4 site of oxazoline (entry 11). Therefore, the reaction parameters listed in entry 10 were selected as the optimal reaction conditions for subsequent investigations.

Having established the optimal reaction conditions, the scope of quinone esters **1** for asymmetric [3 + 2] cycloaddition was first explored. The results (Scheme 2) showed that most examples worked well to generate the expected **3aa**−**3ea** and **3ab**−**3ib** with good to high enantioselectivities (up to 99% ee) and high yields (up to 96%).[14] In detail, first, the substituents (Me, Et, ^{i}Pr, ^{t}Bu, and Ph) on the ester moiety of the quinone were investigated. The results showed that the ester group had an obvious influence on enantioselectivity but a slight influence on chemical yield, and a more sterically hindered alkyl group led to excellent enantioselectivities (**3aa**−**3da**) using **2a** (R^3 = H) as a reaction partner. For comparison, the reaction proceeded well without any decrease in the yield, and enantioselectivity, affording **3ab**−**3db** bearing two vicinal stereocenters when **2b** (R^3 = Me) was used. Fortunately, only (*R*,*R*)-products were isolated. Notably, the absolute configuration of the resulting products could be determined by

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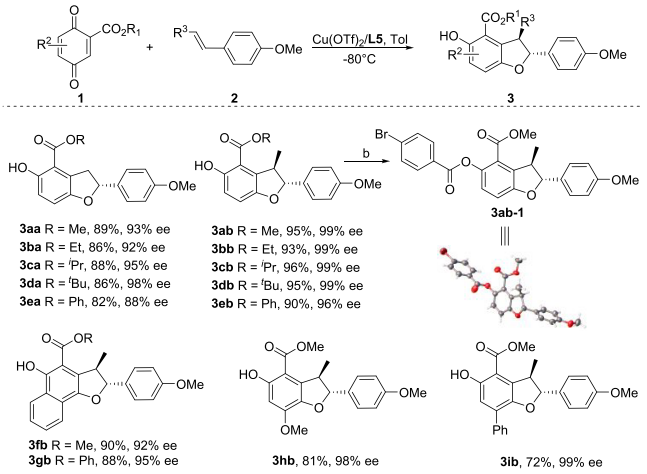
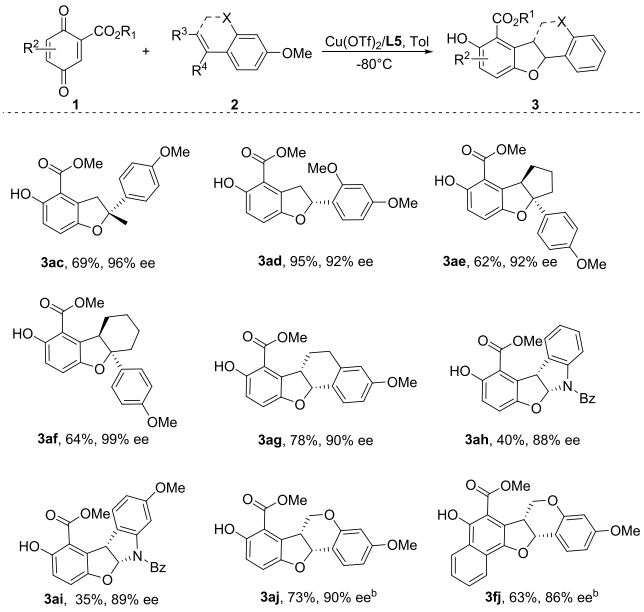
Scheme 2. Scope of Substrate Quinone Esters 1[b]



[a]Reaction conditions: Unless otherwise noted, the reactions were conducted with quinone ester (0.1 mmol 1.0 equiv), substituted styrene (1.2 equiv), $Cu(OTf)_2$ (10 mol %), and **L5** (10 mol %), in 2.0 mL of toluene at −80 °C under Ar for 36 h. [b]**3ab** (1.0 mmol, 1.0 equiv), 4-bromobenzoyl chloride (1.2 equiv), Et_3N (1.0 equiv), DMAP (1.0 equiv), DCM (10 mL).

Scheme 3. Scope of Substrate Styrene 2[b]



[a]Reaction conditions: Unless otherwise noted, the reactions were conducted with quinone ester (0.1 mmol, 1.0 equiv), substituted styrene (1.2 equiv), $Cu(OTf)_2$ (10 mol %), and **L5** (10 mol %), in 2 mL of toluene at −80 °C under Ar for 36 h. [b]**L4** used at rt.

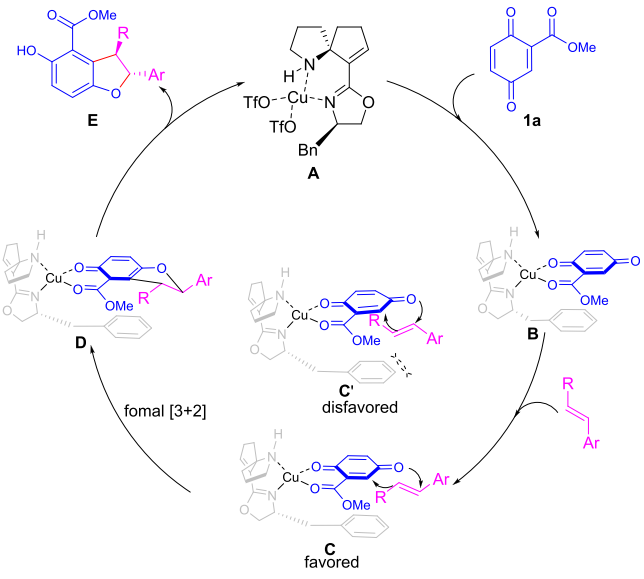


Figure 2. A possible mechanism for Cu/SPDO-catalyzed [3 + 2] cycloaddition.

X-ray analysis of derivative **3ab-1** of product **3ab**. However, when phenyl ester was used, the ee value of product **3ea** and **3eb** declined slightly to 88% and 96%. Second, the substituents on the quinone ester ring were investigated, and a variety of substrates **1f**−**1i** reacted with **2b** smoothly, generating the expected 2,3-dihydrobenzofuran derivatives **3fb**−**3ib** with high enantioselectivity in 92−99% ee, respectively.

Next, various styrene derivatives were further investigated, and all examples also worked well to give high enantioselectivities (up to 99% ee) and good to high yields (up to 96%)[15] (Scheme 3). First, 1-isopropenyl-4-methoxybenzene was proven to be an amenable substrate, yielding the product **3ac** bearing a challenging all-carbon quaternary stereocenter at the C-2 position, albeit with a slight decrease in the yield and an increase in ee value (69% yield and 96% ee). Second, when 2,4-dimethoxystyrene (**2d**) was used as a reaction partner, desired product **3ad** was isolated in 92% ee and 95% yield. Third, cyclic styrene substrates were also subjected to the optimal reaction conditions, affording the desired products with excellent diastereoselectivity (>20:1 dr) and enantioselectivity (86−99% ee), albeit with slightly decreased yields (**3ae**−**3ag**, 62−78%). Especially, two N-Bz-protected indoles were proven to be amenable substrates, providing important benzofuroindoline skeletons, which exist in many bioactive natural products and drugs.[1] Unfortunately, the chemical yield was lower. Subsquently, oxygen-heteroaromatic substrates were tested, and the results demonstrated that **L4** was a superior catalyst to **L5**. When 7-methoxy-2*H*-chromene was used as a substrate, the reaction afforded another important bioactive benzofuranyl-benzopyran moiety, either with quinone ester or with naphthoquinone ester. These reaction results from Schemes 2 and 3 demonstrated that the current asymmetric transformation provides a potential platform for the preparation of structurally diverse 2-aryl-2,3-dihydrobenzofuran compounds.

Based on our previous work with the SPDO system, a possible mechanism is proposed (Figure 2). When styrene attacks from the *Re* face of **B**, which formed from Cat **A** coordinated with **1a**, a favored transient state would be formed to give intermediate **D** via **C**, leading to the (*R*,*R*)-product **E**. However, when styrene attacks from the *Si* face of **B**, a bigger steric hindrance would exist to hinder the formation of (*S*,*S*)-product **E**.

To further showcase the practical utility of the asymmetric transformation we developed above, syntheses of corsifuran A and B[16] were carried out (Scheme 4). Starting from resulting product **3da**, subsequent hydrolysis and decarboxylation could yield the corsifuran B in 60% yield, and further methylation of the phenolic hydroxyl group afforded corsifuran A. Therefore,

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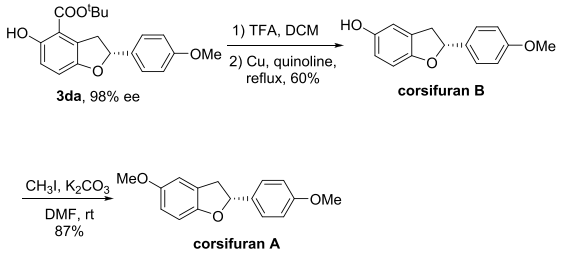
Scheme 4. Synthesis of (*R*)-Corsifuran A and (*R*)-Corsifuran B



a more straightforward approach to access two natural products has been developed.

In summary, we have accomplished the asymmetric [3 + 2] cyclization of quinone esters and styrene to produce a series of chiral 2-aryl-2,3-dihydrobenzofurans, featuring a broad substrate scope and high to excellent yield and enantioselectivity, by using our developed novel Cu-SPDO complex catalytic system. This approach enables the most straightforward synthesis of 2,3-dihydrobenzofuran bearing two contiguous stereocenters. Further investigations of the reaction mechanism of SPDO ligands in this catalytic system and other asymmetric reactions catalyzed by SPDO ligands/metal complexes are underway in our laboratory.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge at https://pubs.acs.org/doi/10.1021/acs.orglett.0c04241.

Experimental procedures, characterizations and analytical data of products, NMR and HPLC spectra (PDF)

Accession Codes

CCDC 2048013 contains the supplementary crystallographic data for this paper. These data can be obtained free of charge via www.ccdc.cam.ac.uk/data_request/cif, or by emailing data_request@ccdc.cam.ac.uk, or by contacting The Cambridge Crystallographic Data Centre, 12 Union Road, Cambridge CB2 1EZ, UK; fax: +44 1223 336033.

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Notes

The authors declare no competing financial interest.

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■ REFERENCES

(1) Chen, Z.; Pitchakuntla, M.; Jia, Y. Synthetic approaches to natural products containing 2,3-dihydrobenzofuran skeleton. *Nat. Prod. Rep.* **2019**, *36*, 666−690.

(2) (a) Sheppard, T. D. Strategies for the Synthesis of 2,3-Dihydrobenzofurans. *J. Chem. Res.* **2011**, *35*, 377−385. (b) Lupattelli, P.; Laurita, T.; D'Orsi, R.; Chiummiento, L.; Funicello, M. Recent Advances in Synthetic Strategies to 2,3-Dihydrobenzofurans. *Synthesis* **2020**, *52*, 1451−1477.

(3) Ortega, N.; Urban, S.; Beiring, B.; Glorius, F. Ruthenium NHC catalyzed highly asymmetric hydrogenation of benzofurans. *Angew. Chem., Int. Ed.* **2012**, *51*, 1710−1713.

(4) (a) Reddy, R. P.; Lee, G. H.; Davies, H. M. L. Dirhodium Tetracarboxylate Derived from Adamantylglycine as a Chiral Catalyst for Carbenoid Reactions. *Org. Lett.* **2006**, *8*, 3437−3440. (b) Soldi, C.; Lamb, K. N.; Squitieri, R. A.; Gonzalez-Lopez, M.; Di Maso, M. J.; Shaw, J. T. Enantioselective intramolecular C−H insertion reactions of donor-donor metal carbenoids. *J. Am. Chem. Soc.* **2014**, *136*, 15142−15145. (c) Zhu, D.; Ma, J.; Luo, K.; Fu, H.; Zhang, L.; Zhu, S. Enantioselective Intramolecular C-H Insertion of Donor and Donor/Donor Carbenes by a Nondiazo Approach. *Angew. Chem., Int. Ed.* **2016**, *55*, 8452−8456. (d) Lamb, K. N.; Squitieri, R. A.; Chintala, S. R.; Kwong, A. J.; Balmond, E. I.; Soldi, C.; Dmitrenko, O.; Castiñeira Reis, M.; Chung, R.; Addison, J. B.; Fettinger, J. C.; Hein, J. E.; Tantillo, D. J.; Fox, J. M.; Shaw, J. T. Synthesis of Benzodihydrofurans by Asymmetric C−H Insertion Reactions of Donor/Donor Rhodium Carbenes. *Chem. - Eur. J.* **2017**, *23*, 11843−11855.

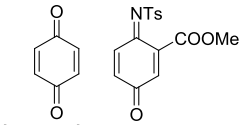
(5) Liang, X. S.; Li, R. D.; Wang, X. C. Copper-Catalyzed Asymmetric Annulation Reactions of Carbenes with 2-Iminyl- or 2-Acyl-Substituted Phenols: Convenient Access to Enantioenriched 2,3-Dihydrobenzofurans. *Angew. Chem., Int. Ed.* **2019**, *58*, 13885−13889.

(6) Pandit, R. P.; Kim, S. T.; Ryu, D. H. Asymmetric Synthesis of Enantioenriched 2-Aryl-2,3-Dihydrobenzofurans by a Lewis Acid Catalyzed Cyclopropanation/Intramolecular Rearrangement Sequence. *Angew. Chem., Int. Ed.* **2019**, *58*, 13427−13432.

(7) Silva, A. R.; Polo, E. C.; Martins, N. C.; Correia, C. R. D. Enantioselective Oxy-Heck-Matsuda Arylations: Expeditious Synthesis of Dihydrobenzofuran Systems and Total Synthesis of the Neolignan (−)-Conocarpan. *Adv. Synth. Catal.* **2018**, *360*, 346−365.

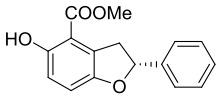
(8) Feng, W.; Yang, H.; Wang, Z.; Gou, B. B.; Chen, J.; Zhou, L. Enantioselective [3 + 2] Formal Cycloaddition of 1-Styrylnaphthols with Quinones Catalyzed by a Chiral Phosphoric Acid. *Org. Lett.* **2018**, *20*, 2929−2933.

(9) Li, Z.-L.; Fang, G.-C.; Gu, Q.-S.; Liu, X.-Y. Recent advances in copper-catalysed radical-involved asymmetric 1,2-difunctionalization of alkenes. *Chem. Soc. Rev.* **2020**, *49*, 32−48.
(10) (a) Zhang, Q.; Zhang, F.-M.; Zhang, C.-S.; Liu, S.-Z.; Tian, J.-M.; Wang, S.-H.; Zhang, X.-M.; Tu, Y.-Q. Enantioselective synthesis of cis-hydrobenzofurans bearing all-carbon quaternary stereocenters and application to total synthesis of (−)-morphine. *Nat. Commun.* **2019**, *10*, 2507. (b) Zhang, Q.; Zhang, F.-M.; Zhang, C.-S.; Liu, S.-Z.; Tian, J.-M.; Wang, S.-H.; Zhang, X.-M.; Tu, Y.-Q. Catalytic Asymmetric Total Syntheses of (−)-Galanthamine and (−)-Lycoramine. *J. Org. Chem.* **2019**, *84*, 12664−12671.
(11) (a) Tian, J.-M.; Wang, A.-F.; Yang, J.-S.; Zhao, X.-J.; Tu, Y.-Q.; Zhang, S.-Y.; Chen, Z.-M. Copper-Complex-Catalyzed Asymmetric Aerobic Oxidative Cross-Coupling of 2-Naphthols: Enantioselective Synthesis of 3,3′-Substituted C1-Symmetric BINOLs. *Angew. Chem., Int. Ed.* **2019**, *58*, 11023−11027. (b) Xi, C.-C.; Zhao, X.-J.; Tian, J.-M.; Chen, Z.-M.; Zhang, K.; Zhang, F.-M.; Tu, Y.-Q.; Dong, J.-W. Atroposelective Synthesis of Axially Chiral 3-Arylindoles by Copper-Catalyzed Asymmetric Cross-Coupling of Indoles with Quinones and Naphthoquinones. *Org. Lett.* **2020**, *22*, 4995−5000.
(12) Zheng, H.; Xu, C.; Wang, Y.; Kang, T.; Liu, X.; Lin, L.; Feng, X. Catalytic asymmetric [2 + 2] cycloaddition between quinones and fulvenes and a subsequent stereoselective isomerization to 2,3-dihydrobenzofurans. *Chem. Commun.* **2017**, *53*, 6585−6588.
(13) (a) Xiong, H.; Xu, H.; Liao, S.; Xie, Z.; Tang, Y. Copper-Catalyzed Highly Enantioselective Cyclopentannulation of Indoles with Donor−Acceptor Cyclopropanes. *J. Am. Chem. Soc.* **2013**, *135*, 7851−7854. (b) Nakamuro, T.; Hagiwara, K.; Miura, T.; Murakami, M. Enantioselective Denitrogenative Annulation of 1H-Tetrazoles with Styrenes Catalyzed by Rhodium. *Angew. Chem., Int. Ed.* **2018**, *57*, 5497−5500. (c) Huang, X.; Lin, J.; Shen, T.; Harms, K.; Marchini, M.; Ceroni, P.; Meggers, E. Asymmetric [3 + 2] Photocycloadditions of Cyclopropanes with Alkenes or Alkynes through Visible-Light Excitation of Catalyst-Bound Substrates. *Angew. Chem., Int. Ed.* **2018**, *57*, 5454−5458. (d) Hao, W.; Harenberg, J. H.; Wu, X.; MacMillan, S. N.; Lin, S. Diastereo- and Enantioselective Formal [3 + 2] Cycloaddition of Cyclopropyl Ketones and Alkenes via Ti-Catalyzed Radical Redox Relay. *J. Am. Chem. Soc.* **2018**, *140*, 3514−3517. (e) Hong, F.-L.; Chen, Y.-B.; Ye, S.-H.; Zhu, G.-Y.; Zhu, X.-Q.; Lu, X.; Liu, R.-S.; Ye, L.-W. Copper-Catalyzed Asymmetric Reaction of Alkenyl Diynes with Styrenes by Formal [3 + 2] Cycloaddition via Cu-Containing All-Carbon 1,3-Dipoles: Access to Chiral Pyrrole-Fused Bridged [2.2.1] Skeletons. *J. Am. Chem. Soc.* **2020**, *142*, 7618−7626.
(14) When benzoquinone and **1j** (as below) were used, no products were isolated under the optimal reaction conditions.

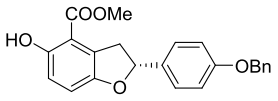


benzoquinone **1j**

(15) When styrene **2k** or 4-OBn- styrene **2l** was used, only moderate results were obtained as shown below.



3ak, 3%, 35% ee



3al, 86%, 74% ee

(16) (a) von Reuß, S. H.; König, W. A. Corsifurans A−C, 2-arylbenzofurans of presumed stilbenoid origin from Corsinia coriandrina (Hepaticae). *Phytochemistry* **2004**, *65*, 3113−3118. (b) Adams, H.; Gilmore, N. J.; Jones, S.; Muldowney, M. P.; von Reuss, S. H.; Vemula, R. Asymmetric Synthesis of Corsifuran A by an Enantioselective Oxazaborolidine Reduction. *Org. Lett.* **2008**, *10*, 1457−1460.

https://dx.doi.org/10.1021/acs.orglett.0c04241
Org. Lett. 2021, 23, 1258−1262