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Rh(II)/Brønsted Acid Cocatalyzed Intramolecular Trapping of Ammonium Ylides with Enones: Diastereoselective Synthesis of 2,2,3-Trisubstituted Indolines

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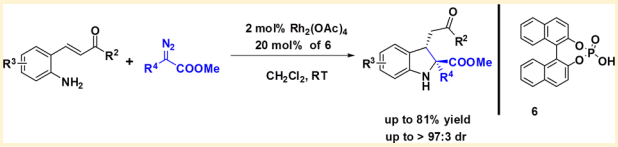
Supporting Information

ABSTRACT: Highly diastereoselective intramolecular trapping of ammonium ylides with enones has been developed through a Rh(II)/Brønsted acid cocatalytic strategy. This process allows rapid and efficient construction of *N*-unprotected polyfunctional 2,2,3-trisubstituted indolines in moderate to good yields with excellent diastereoselectivity.



Transition-metal carbenes as active intermediates play an important role in modern organic chemistry.[1] They undergo numerous transformations such as X−H insertions,[1,2a] cyclopropanations,[1,2b] cycloaddition reactions,[1,2c,d] as well as coupling reactions involving carbene migratory insertion.[1,2e] They have proven to be particular useful in construction of complex compounds.[2d,3] Ylides generated from carbene and nucleophiles such as alcohols and amines are proposed as active intermediates of X−H insertion reactions.[4] Recently, the Hu group has demonstrated that the interception of the in situ generated active oxonium/ammonium ylides with appropriate electrophiles is feasible.[5] These new transformations form multiple bonds to create adjacent two stereogenic centers.[5] One challenge of these transformations is to expand the scope of the suitable electrophile partners. For instance, only a few enones bearing electron-withdrawing activated groups realized successful trapping of the ammonium ylides in a Michael addition way.[6] Enones without additional activated functionality have not yet been developed for this trapping process.

2,3-Multisubstituted indolines are found in many biologically active natural products and some drugs,[7] such as strempeliopine,[8a] hinckdentine A,[8b,c] and vallesamidine (as shown in Figure 1).[8d−f] Although much attention has been attracted to develop numerous methods to synthesize indolines, approaches for the synthesis of 2,3-multisubstituted indolines are relatively rare. These methods include oxidative functionalization of C2 and/or C3 of indoles,[9a−c] cycloaddition of the indole C2−C3 double bond,[9d,e] functionalization at the C2 position of substituted oxindoles,[9f] as well as access to the indoline skeleton by C−C and/or C−N bond-forming reactions.[9g−i] Given the importance of the 2,3-multisubstituted indolines in both natural product synthesis and biological study, rapid and efficient methods for the stereoselective construction of them are still highly demanded. Recently, the Hu group utilized the reactions of intramolecular trapping of ammonium ylides with ketones to afford 3-hydroxy-2,2,3-trisubstituted indolines via a $Rh_2(OAc)_4$ catalysis (Scheme 1, previous work).[9i] We envision that a novel process based on the trapping of ammonium ylides with enones without additional activated groups in a Michael addition fashion could be achieved intramolecularly, which enables constructing new types of 2,2,3-trisubstituted indoline scaffolds through formation of both C−N and C−C bonds in one step. The desired indoline products contain polyfunctional groups, such as the carbonyl group that can be transformed into a wide range of functional groups, such as alcohols, amines, alkyl groups, and esters. However, under a $Rh_2(OAc)_4$ catalysis, this designed trapping process cannot be achieved. Only N−H insertion product **5** was observed (Scheme 1, this work, path B), and no desired indoline skeleton product was obtained whether the amine of **1** was a primary amine or secondary amine. Herein, we disclose that the Rh(II) and Brønsted acid cocatalytic system enables successful intramolecular trapping of ammonium ylides with enones, affording polyfunctional 2,2,3-trisubstituted indoline motifs in moderate to good yields with

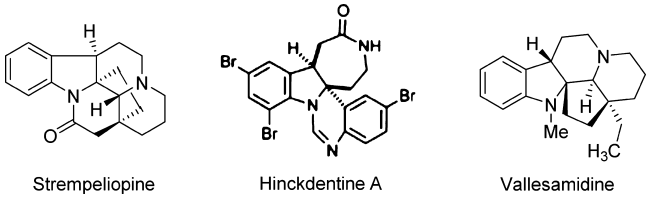


Figure 1. Examples of biologically active 2,3-multisubstituted indolines.

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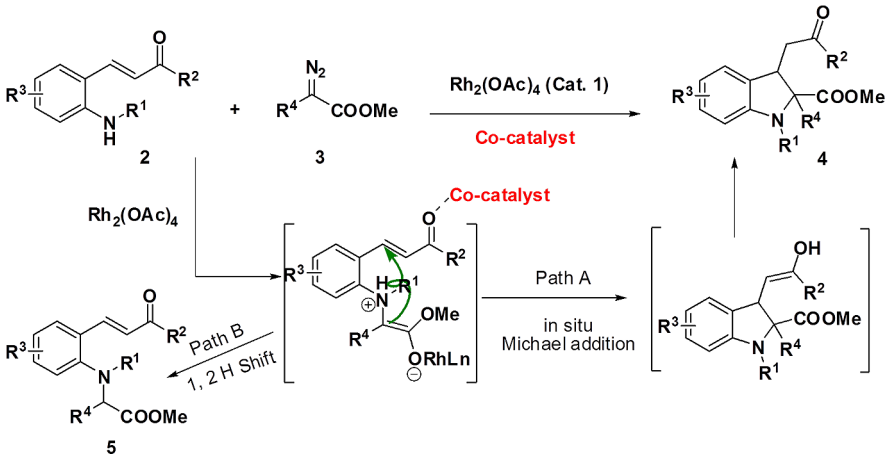
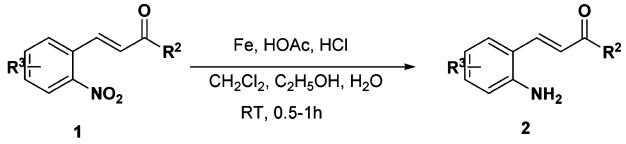
Scheme 1. Intramolecular Trapping of Ammonium Ylides for the Construction of 2,3-Multisubstituted Indolines



excellent diastereoselectivity under mild conditions (Scheme 1, this work, path A).

After some attempts, we prepared a series of starting materials **2** in good yields through a modified procedure by reduction of **1** using Fe/HOAc/HCl in CH_2Cl_2/C_2H_5OH/water (1:1:0.5) at room temperature for 0.5−1 h (Scheme 2).[10a−c]

Scheme 2. Preparing Starting Materials 2a−2h through a Modified Procedure



1a: $R^2 = C_6H_5$, R^3 = H	**2a**, 76% yield
1c: R^2 = *p*-ClC_6H_4, R^3 = H	**2c**, 75% yield
1d: R^2 = *p*-MeC_6H_4, R^3 = H	**2d**, 70% yield
1e: R^2 = 2-furyl, R^3 = H	**2e**, 72% yield
1f: R^2 = 2-thiophenyl, R^3 = H	**2f**, 65% yield
1g: $R^2 = C_6H_5$, R^3 =5-Br	**2g**, 56% yield
1h: $R^2 = C_6H_5$, R^3 = 4-Br	**2h**, 70% yield

We began our investigation by testing a model reaction of **2a** and diazo compound **3a** catalyzed by $Rh_2(OAc)_4$ alone in CH_2Cl_2 at room temperature (Table 1, entry 1). Only traditional N−H insertion of diazo compound **3a** with amine **2a** took place, and no desired trapping product **4a** was obtained (Table 1, entry 1). No improvement was obtained by using *N*-methyl substituted aminochalcone **2b** (Table 1, entry 2).[9i] We envisioned that Lewis acid or Brønsted acid as cocatalysts could activate the enone **2a** to facilitate the trapping process. Thus, we attempted to screen a number of Lewis acids as cocatalysts. $ZnCl_2$, $Mg(OTf)_2$, $Yb(OTf)_3$, $Sc(OTf)_3$, $Cu(OTf)_2$, and AgOTf gave traces or none of the desired product **4a** (Table 1, entries 3−8). To our delight, $InCl_3$ was found to be effective, and the trapping product was isolated in 32% yield with only one diastereoisomer (Table 1, entry 9), demonstrating that the introduction of a Lewis acid cocatalyst indeed facilitated changing the reaction pathway. $In(OTf)_3$ and $InBr_3$ were also tested and gave lower yields (Table 1, entries 10 and 11). Encouraged by the initial results, we continued to screen Brønsted acids as cocatalyst to further improve the yield of **4a** (Table 1, entries 12−15). Acetic acid gave 12% yield of the desired product **4a**. *p*-Toluenesulfonic acid gave 35% yield of **4a**. Trifluoroacetic acid afforded the desired product in 47% yield. To our delight, when racemic BINOL phosphoric acid **6** served as a cocatalyst, a 71% yield of the desired product **4a** was achieved and only one diastereoisomer was observed and isolated. Decreasing the amount of **6** to 10 mol % led to the decrease of the yield to 40% (Table 1, entry 16). The effects of solvent and temperature were investigated (Table 1, entries 17−22). The optimal condition was identified as 2 mol % $Rh_2(OAc)_4$ and 20 mol % **6** at room temperature in CH_2Cl_2.

With the optimized reaction conditions in hand, the scope of this novel reaction was evaluated, and the results are summarized in Table 2. Although **2b** as substrate gave a slightly higher yield of the trapping product compared with **2a** (Table 2, entries 2 and 3), concerning the more step economy to prepare **2a** compared with **2b** as well as easier functionalization of the unprotected-*N* of the corresponding indoline products for structure−activity study in medical chemistry, **2a** was chosen as the substrate to investigate the scope of the diazo compounds **3**. A range of diazo compounds **3** with different electronic and steric aryl substituents underwent high diastereoselective reactions with **2a** (Table 2, entries 1, 3−10). In all of these cases, only one diastereoisomer of **4** was observed and isolated in moderate to good yields (Table 2, entries 1, 3−10). The electronic features of the aryl substituents of **3** have significant influence on the yields of **4**. Diazo compounds **3** with more electron-deficient aryl substituents gave higher yields than electron-rich substituted ones (Table 2, entries 1, 3−8), presumably due to the higher stability of the active ammonium ylide intermediates with electron-withdrawing groups (Scheme 1). Of these, *ortho*-Cl substituted diazoester **3e** still gave 59% yield of the trapping product **4f** (Table 2, entry 6). Aromatic heterocyclic diazo esters **3h** and **3i** bearing 2-thiophenyl and 3-(*N*-Boc)-indolyl, respectively, led to the desired products **4i** and **4j** in moderate to lower yields, but still maintaining excellent diastereoselectivity (Table 2, entries 9 and 10). The reaction was further extended to other substituted *ortho*-amino chalcones (Table 2, entries 11−16). **2c** bearing a *p*-Cl substituted phenyl group gave higher yield than **2d** bearing *p*-Me sustitution owing to higher electrophilicity. Both of them led to a slight decrease in

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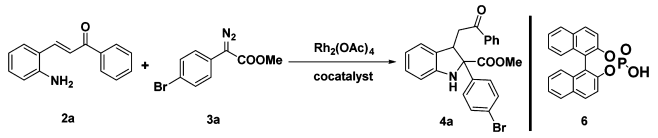
Table 1. Optimization of Reaction Conditions for the Synthesis of Indoline 4 Based on Intramolecular Trapping of Ammonium Ylides with Enones[a]



entry	cocatalyst	solvent	T (°C)	yield (%)[b]	dr[c] *anti*:*syn*
1		CH_2Cl_2	20	0	
2		CH_2Cl_2	20	0[d]	
3	$ZnCl_2$	CH_2Cl_2	20	<5	
4	$Mg(OTf)_2$	CH_2Cl_2	20	0	
5	$Sc(OTf)_3$	CH_2Cl_2	20	0	
6	$Yb(OTf)_3$	CH_2Cl_2	20	0	
7	$Cu(OTf)_2$	CH_2Cl_2	20	0	
8	AgOTf	CH_2Cl_2	20	0	
9	$InCl_3$	CH_2Cl_2	20	32	>97:3
10	$In(OTf)_3$	CH_2Cl_2	20	12	
11	$InBr_3$	CH_2Cl_2	20	8	
12	acetic acid	CH_2Cl_2	20	12	>97:3
13	*p*-methylbenzenesulfonic acid	CH_2Cl_2	20	35	>97:3
14	trifluoroacetic acid	CH_2Cl_2	20	47	>97:3
15	**6**	CH_2Cl_2	20	71	>97:3
16	**6**	CH_2Cl_2	20	40[e]	>97:3
17	**6**	toluene	20	48	>97:3
18	**6**	$(CH_2Cl)_2$	20	49	>97:3
19	**6**	THF	20	33	>97:3
20	**6**	1,4-dioxane	20	30	>97:3
21	**6**	CH_2Cl_2	0	39	>97:3
22	**6**	CH_2Cl_2	40	50	>97:3

[a]All reactions were carried out by addition of **3a** (0.20 mmol, 2.0 equiv) in solvent (1 mL) via a syringe pump to a mixture of 2 mol % $Rh_2(OAc)_4$, **2a** (0.10 mmol, 1.0 equiv), 4 Å MS (120 mg), and 20 mol % cocatalyst in 1 mL of solvent for 2 h at room temperature (20 °C). [b]Isolated yield of *anti* isomers. [c]The ratio of *anti* and *syn* was determined by ^{1}H NMR spectroscopy of the crude reaction mixture. [d]*N*-Methyl substituted aminochalcone **2b** as substrate. [e]10 mol % cocatalyst **6**.

dr. (Table 2, entries 11 and 12). It is noteworthy that the R^2 could be extended to aromatic heterocycles. For example, **2e** bearing a furyl and **2f** bearing a thiophenyl were well-tolerated, affording the desired corresponding products in good yields as only one diastereoisomer (Table 2, entries 13 and 14). 5-Bromo substituted *ortho*-amino chalcone **2g** worked well, affording the trapping product in moderate yield with excellent diastereoselectivity (Table 2, entry 15). 4-Bromo substituted *ortho*-amino chalcone **2h** proceeded smoothly to give the desired product in 72% yield as one diastereoisomer (Table 2, entry 16). Other types of diazo compounds, such as diazoacetophenone **3′j** and α-diazophosphonates **3′k** instead of phenyl diazoester as substrates, were also tested, but no Michael-type trapping product was obtained in the current reaction conditions (Table 2, entries 17 and 18). The Michael acceptor **7** as substrate was tried to react with diazo compound **3a** under the optimized cocatalytic conditions. No Michael-type trapping product was obtained, and only the traditional N−H insertion reaction occurred (Table 2, entry 18). These reactions (Table 2, entries 17−19) demonstrated that the match of the components is crucial for this process of trapping of ammonium ylides in a 1,4-addition way.

The relative stereochemistry of **4a** was determined to be *anti* by single-crystal X-ray analysis (as shown in Figure 2), and those of other products were tentatively assigned by analogy.

To rationalize the observed stereochemistry of this process, plausible transition states TS-I and TS-II were proposed in Scheme 3. Bifunctional **6** is proposed as a "proton shuttle" in the reaction.[11] Sterically less encumbered transition state TS-I is favored than steric crowding TS-II. The diastereoselectivity of the obtained product **4** is in agreement with this proposed model.

Asymmetric synthesis of **4a** through $Rh_2(OAc)_4$ and chiral BINOL phosphoric acid cocatalysis was studied, and the primary best result was 47% ee as a single diastereoisomer in 41% yield using 10 mol % (*R*)-**8f** as cocatalyst (Scheme 4). The $[PdCl(\eta^3\text{-}C_3H_5)]_2$/chiral phosphoric acid system was also attempted for this reaction. Only 3,3′-strong electron-withdrawing substituted chiral phosphoric acid (*R*)-**8c** (R = 3,5-$CF_3C_6H_3$) gave 61% yield and 20% ee as one diastereoisomer, and other chiral phosphoric acids led to low yields (<10%) of **4a**. Further investigation of asymmetric catalysis of this reaction with other catalytic/cocatalytic systems to achieve high enantioselectivity control is currently underway in our laboratory.

In conclusion, a novel process of successful trapping of the ammonium ylides with enones without additional activated groups in a Michael addition fashion was developed through a Rh(II) and bifunctional BINOL phosphoric acid cocatalytic strategy. This process afforded new types of *N*-unprotected polyfunctional 2,2,3-trisubstituted indolines in moderate to good yields with excellent diastereoselectivity. A wide range of functional groups can be tolerated. The synthetic accessibility of 2-amino chalcones **2** and no requirement of prefunctional-

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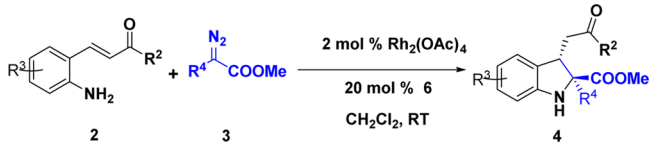
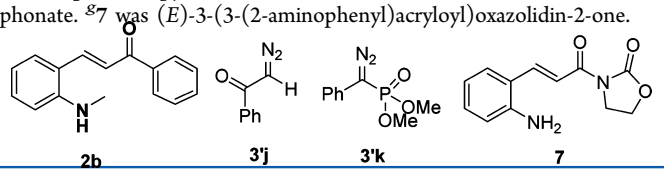
Table 2. Highly Diastereoselective Intramolecular Trapping of Ammonium Ylides with Enones to Synthesize Indolines 4[a]



2 3 4

entry	3: R^4	2: R^2/R^3	4: yield (%)[b]	dr[c] *anti*:*syn*
1	**3a**: *p*-BrC_6H_4	**2a**: C_6H_5/H	**4a**: 71	>97:3
2	**3b**: C_6H_5	**2b**: C_6H_5/H[d]	**4b**: 70	>97:3
3	**3b**: C_6H_5	**2a**: C_6H_5/H	**4c**: 64	>97:3
4	**3c**: *p*-FC_6H_4	**2a**: C_6H_5/H	**4d**: 81	>97:3
5	**3d**: *m*-BrC_6H_4	**2a**: C_6H_5/H	**4e**: 66	>97:3
6	**3e**: *o*-ClC_6H_4	**2a**: C_6H_5/H	**4f**: 59	>97:3
7	**3f**: *p*-MeC_6H_4	**2a**: C_6H_5/H	**4g**: 53	>97:3
8	**3g**: *m*-$MeOC_6H_4$	**2a**: C_6H_5/H	**4h**: 49	>97:3
9	**3h**: 2-thiophenyl	**2a**: C_6H_5/H	**4i**: 46	>97:3
10	**3i**: 3-(*N*-Boc) indolyl	**2a**: C_6H_5/H	**4j**: 30	>97:3
11	**3a**: *p*-BrC_6H_4	**2c**: *p*-ClC_6H_4/H	**4k**: 67	90:10
12	**3a**: *p*-BrC_6H_4	**2d**: *p*-MeC_6H_4/H	**4l**: 52	95:5
13	**3b**: C_6H_5	**2e**: 2-furyl/H	**4m**: 70	>97:3
14	**3a**: *p*-BrC_6H_4	**2f**: 2-thiophenyl/H	**4n**: 66	>97:3
15	**3b**: C_6H_5	**2g**: C_6H_5/5-Br	**4o**: 51	>97:3
16	**3b**: C_6H_5	**2h**: C_6H_5/4-Br	**4p**: 72	>97:3
17	**3′j**[e]	**2a**: C_6H_5/H	**4q**: 0	
18	**3′k**[f]	**2a**: C_6H_5/H	**4r**: 0	
19	**3a**: *p*-BrC_6H_4	**7**[g]	**4s**: 0	

[a]All reactions were carried out by addition of **3** (0.20 mmol, 2.0 equiv) in CH_2Cl_2 (1 mL) via a syringe pump to a mixture of 2 mol % $Rh_2(OAc)_4$, **2** (0.10 mmol, 1.0 equiv), 4 Å MS (120 mg), and 20 mol % **6** in 1 mL of CH_2Cl_2 for 2 h at room temperature (20 °C). [b]Isolated yield. [c]The ratio of *anti* and *syn* was determined by ^{1}H NMR spectroscopy of the crude reaction mixture. [d]**2b** as substrate. [e]**3′j** was diazoacetophenone. [f]**3′k** was dimethyl (diazo(phenyl)methyl)phosphonate. [g]**7** was (*E*)-3-(3-(2-aminophenyl)acryloyl)oxazolidin-2-one.



2b 3'j 3'k 7

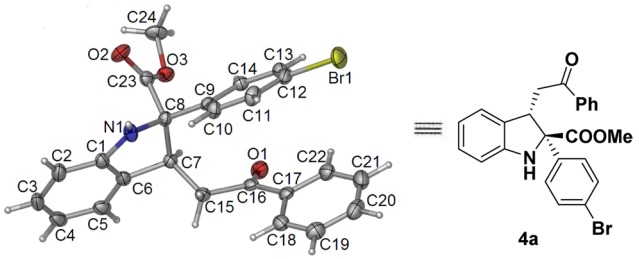
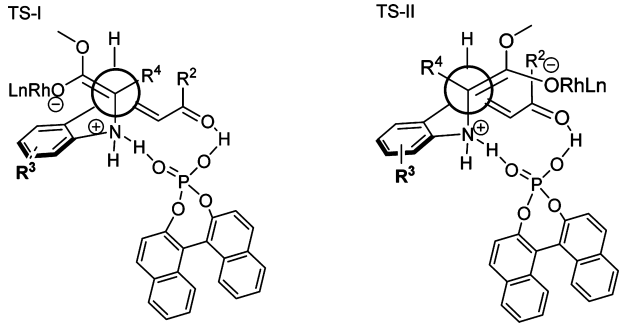


Figure 2. Single-crystal X-ray of **4a**.

Scheme 3. Proposed Transition States for Rationalizing the Diastereoselectivity of Product 4



ization or protection strategy further illustrate the utility of this methodology.

EXPERIMENTAL SECTION

General. All moisture-sensitive reactions were performed under an argon atmosphere in a well-dried reaction flask. Dichloromethane (CH_2Cl_2) and 1,2-dichloroethane ($ClCH_2CH_2Cl$) were freshly distilled over calcium hydride, toluene, THF, and dioxane from sodium benzophenone ketyl, respectively, prior to use. All commercially available reagents were directly used as received from vendors, unless otherwise stated. ^{1}H and ^{13}C NMR spectra were recorded on a 500 MHz or a 400 MHz spectrometer. Chemical shifts are reported in parts per million (ppm) relative to the internal standard tetramethylsilane (δ = 0 ppm) for ^{1}H NMR and deuteriochloroform (δ = 77.00 ppm) for ^{13}C NMR spectroscopy. HRMS spectra were recorded with electrospray ionization and TOF mass analyzers. Normal phase HPLC was used to determine enantiomeric excess of chiral compounds with eluents of hexane/*i*-PrOH. The racemic standards used in HPLC studies were prepared according to the general procedure by using racemic BINOL derivatived phosphoric acid catalyst.

General Procedure for the Preparation of 2′-Amino Chalcone 2. To a solution of 2′-nitrochalcone **1** (0.4 mmol) in 2 mL of CH_2Cl_2/C_2H_5OH (1:1) was added Fe (157 mg, 2.8 mmol), followed by HOAc (1.2 mL), H_2O (0.6 mL), and a drop of concentrated HCl. The reaction mixture was stirred at room temperature until complete consumption of the **1** was monitored by TLC. Then, the mixture was filtered and saturated aqueous $NaHCO_3$

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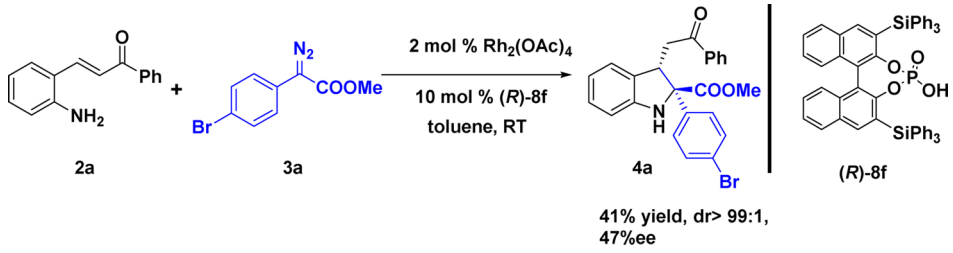
Scheme 4. Asymmetric Synthesis of 4a Using Rh(II)/(*R*)-8f Cocatalyst



was added to the filtrate. The aqueous layer was extracted with CH_2Cl_2 (3 × 15 mL). The combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated in vacuo to provide the crude product, which was purified by flash column chromatography on silica gel (petroleum ether:EtOAc = 10:1−5:1) to give the product **2**.

General Procedure for Intramolecular Trapping of Ammonium Ylides with Enones. A suspension of $Rh_2(OAc)_4$ (2.0 mol %), racemic BINOL phosphoric acid **6** (20 mol %), 2′-amino chalcone **2** (0.1 mmol, 1.0 equiv), and 4 Å molecular sieve (0.1 g) in 1.0 mL of CH_2Cl_2 was stirred at room temperature (20 °C) under an argon atmosphere. The diazo compound **3** (0.2 mmol, 2.0 equiv) in 1.0 mL of CH_2Cl_2 was added to the suspension over 2 h via a syringe pump. After completion of the addition, the reaction mixture was stirred for an additional 20 min. Then, the mixture was filtered through Celite and the filtrate was concentrated to give a residue, which was analyzed by ^{1}H NMR spectroscopy for the determination of diastereoselectivity. The residue was further purified by flash chromatography on silica gel (eluent:EtOAc/light petroleum ether = 1/80−1/10) to give the desired products **4**.

(*E*)-3-(2-Aminophenyl)-1-phenylprop-2-en-1-one (2a). Crystalline solid, mp 115.2−117.2 °C (68 mg, 76%). ^{1}H NMR (500 MHz, CDCl3) δ 7.97−8.03 (m, 3H), 7.47−7.60 (m, 5H), 7.20 (t, J = 8.0 Hz, 1H), 6.80 (t, J = 8.0 Hz, 1H), 6.73(d, J = 8.0 Hz, 1H), 4.06 (broad s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 190.3, 146.3, 140.1, 138.4, 132.7, 131.7, 128.6, 128.5, 128.2, 121.8, 120.3, 118.9, 116.8. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{15}H_{13}NONa$ 246.0895; found 246.0905.

(*E*)-3-(2-(Methylamino)phenyl)-1-phenylprop-2-en-1-one (2b). Crystalline solid, mp 120.1−122.2 °C (53 mg, 78%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97−8.01 (m, 3H), 7.44−7.56 (m, 5H), 7.24−7.32 (m, 1H), 6.67−6.74 (m, 2H), 4.29 (s, 1H), 2.89 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 190.2, 148.4, 140.1, 138.4, 132.7, 132.1, 128.6, 128.5, 128.1, 121.8, 120.2, 117.1, 111.0, 30.6. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{16}H_{15}NONa$ 260.1051; found 260.1052.

(*E*)-3-(2-Aminophenyl)-1-(4-chlorophenyl)prop-2-en-1-one (2c). Crystalline solid, mp 112.4−115.6 °C (77 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96−8.01 (m, 3H), 7.42−7.53 (m, 4H), 7.19−7.21 (m, 1H), 6.80 (t, J = 8.0 Hz, 1H), 6.73 (d, J = 8.0 Hz, 1H), 4.06 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 188.9, 146.4, 140.6, 139.2, 136.7, 131.9, 129.9, 128.9, 128.2, 121.1, 120.1, 119.0, 116.9. HRMS (ESI-TOF) m/z: [M + H]$^+$ calcd for $C_{15}H_{12}ClNO$ 258.0686; found 258.0693.

(*E*)-3-(2-Aminophenyl)-1-(*p*-tolyl)prop-2-en-1-one (2d). Crystalline solid, mp 135.2−137.3 °C (71 mg, 70%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93−7.99 (m, 3H), 7.47−7.53 (m, 2H), 7.26−7.31 (m, 2H), 7.18−7.20 (m, 1H), 6.80 (t, J = 8.0 Hz, 1H), 6.72 (d, J = 8.0 Hz, 1H), 4.05 (s, 2H), 2.44 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 189.8, 146.2, 143.6, 139.7, 135.8, 131.5, 129.3, 128.6, 128.1, 122.0, 120.5, 118.9, 116.8, 21.7. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{16}H_{15}NONa$ 260.1051; found 260.1044.

(*E*)-1-(Furan-2-yl)-3-(2-nitrophenyl)prop-2-en-1-one (1e). [12a] Amorphous solid (450 mg, 74%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.25 (d, J = 16.0 Hz, 1H), 8.07 (d, J = 8.0 Hz, 1H), 7.76 (m, 1H), 7.65−7.67 (m, 2H), 7.65−7.69 (m, 1H), 7.38 (d, J = 4.0 Hz, 1H), 7.30 (d, J = 16.0 Hz, 1H), 6.61 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.4, 153.1, 148.6, 146.9, 139.0, 139.0, 131.1, 130.2, 129.2, 126.4, 124.9, 118.3, 112.8. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{13}H_9NO_4Na$ 266.0424; found 266.0438.

(*E*)-3-(2-Aminophenyl)-1-(furan-2-yl)prop-2-en-1-one (2e). Amorphous solid (61 mg, 72%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, J = 16.0 Hz, 1H), 7.65 (s, 1H), 7.53 (d, J = 8.0 Hz, 1H), 7.38 (d, J = 12.0 Hz, 1H), 7.32 (d, J = 4.0 Hz, 1H), 7.20 (t, 1H), 6.80 (m, 1H), 6.72 (d, J = 8.0 Hz, 1H), 6.59 (m, 1H), 4.03(s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 178.0, 146.4, 146.3, 141.7, 139.2, 131.8, 128.2, 121.0, 120.0, 118.8, 117.3, 116.8, 112.5. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{13}H_{11}NO_2Na$ 236.0682; found 236.0699.

(*E*)-3-(2-Nitrophenyl)-1-(thiophen-2-yl)prop-2-en-1-one (1f). [12a] Amorphous solid (459 mg, 71%).^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (d, J = 16.0 Hz, 1H), 8.08 (d, J = 8.0 Hz, 1H), 7.89 (d, J = 4.0 Hz, 1H), 7.67−7.73 (m, 3H), 7.58 (m, 1H), 7.19−7.25 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 181.8, 148.7, 144.6, 139.3, 134.5, 133.5, 132.5, 131.2, 130.4, 129.2, 128.3, 127.0, 125.0. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{13}H_9NO_3SNa$ 282.0195; found 282.0188.

(*E*)-3-(2-Aminophenyl)-1-(thiophen-2-yl)prop-2-en-1-one (2f). Amorphous solid (60 mg, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, J = 16.0 Hz, 1H), 7.86 (d, J = 4.0 Hz, 1H), 7.68 (d, J = 4.0 Hz, 1H), 7.52 (d, J = 8.0 Hz, 1H), 7.36 (d, J = 16.0 Hz, 1H), 7.17−7.21 (m, 2H), 6.80 (t, J = 8.0 Hz, 1H), 6.73 (d, J = 8.0 Hz, 1H), 4.08 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 182.0, 146.3, 145.7, 139.8, 131.9, 131.7, 131.6, 128.2, 128.1, 121.5, 120.0, 118.9, 116.8. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{13}H_{11}NOSNa$ 252.0454; found 252.0461.

(*E*)-3-(5-Bromo-2-nitrophenyl)-1-phenylprop-2-en-1-one (1g). [12b] A solution of 5-bromo-2-nitrobenzaldehyde (575 mg, 2.5 mmol) and (benzoylmethylene)triphenylphosphorane (1.4 g, 3.7 mmol) in 25 mL of CH_3CN was stirred at 60 °C until the reaction was complete, as indicated by TLC. After evaporation of CH_3CN in vacuo, the crude residue was purified by chromatography with petroleum ether/EtOAc (3:1) to give **1g** (714 mg, 86% yield). Solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.10 (d, J = 15.6 Hz, 1H), 8.06−7.96 (m, 3H), 7.87 (d, J = 1.9 Hz, 1H), 7.69 (dd, J = 8.7, 2.0 Hz, 1H), 7.62 (t, J = 7.4 Hz, 1H), 7.53 (t, J = 7.5 Hz, 2H), 7.33 (d, J = 15.6 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 189.9, 147.1, 138.9, 137.2, 133.39, 133.36, 133.2, 132.2, 128.9, 128.8, 128.6, 128.1, 126.6. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{15}H_{10}BrNO_3Na$ 353.9742; found 353.9737.

(*E*)-3-(2-Amino-5-bromophenyl)-1-phenylprop-2-en-1-one (2g). Crystalline solid, mp 136.8−140.2 °C (68 mg, 56%).^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02−8.04 (m, 2H), 7.88 (d, J = 15.3 Hz, 1H), 7.67−7.56 (m, 2H), 7.53−7.45 (m, 3H), 7.32−7.23 (m, 1H), 6.62 (d, J = 8.6 Hz, 1H), 4.09 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 189.8, 145.1, 138.3, 138.0, 134.1, 133.0, 130.1, 128.7, 128.5, 122.7, 122.0, 118.3, 110.6. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{15}H_{12}BrNONa$ 324.0000; found 323.9995.

(*E*)-3-(4-Bromo-2-nitrophenyl)-1-phenylprop-2-en-1-one (1h). [12b] A solution of 4-bromo-2-nitrobenzaldehyde (575 mg, 2.5 mmol) and (benzoylmethylene)triphenylphosphorane (1.4 g, 3.7 mmol) in 25 mL of CH_3CN was stirred at 60 °C until the reaction was complete, as indicated by TLC. After evaporation of CH_3CN in vacuo, the crude residue was purified by chromatography with petroleum ether/EtOAc (3:1) to give **1g** (690 mg, 83% yield). White solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11−8.07 (m, 2H), 8.04−8.02 (m, 2H), 7.74−7.56 (m, 3H), 7.54 (t, J = 7.6 Hz, 2H), 7.28−7.37 (d, J = 15.7 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.1, 148.8, 138.9,

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137.3, 136.3, 133.7, 133.3, 130.3, 129.7, 128.8, 127.7, 125.2. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{15}H_{10}BrNO_3Na$ 353.9742; found 353.9737.

(*E*)-3-(2-Amino-4-bromophenyl)-1-phenylprop-2-en-1-one (2h). Crystalline solid, mp 100.3−102.2 °C (85 mg, 70%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, J = 7.7 Hz, 2H), 7.90 (d, J = 15.3 Hz, 1H), 7.59 (t, J = 7.3 Hz, 1H), 7.55−7.41 (m, 4H), 6.90−6.63 (m, 2H), 4.13 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 190.0, 147.0, 138.8, 138.2, 137.3, 132.9, 129.2, 128.7, 128.5, 122.0, 119.2, 118.7, 116.3. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{15}H_{12}BrNONa$ 324.0000; found 323.9984.

(*E*)-3-(3-(2-Aminophenyl)acryloyl)oxazolidin-2-one (7). Amorphous solid (63 mg, 68%).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, J = 15.6 Hz, 1H), 7.78 (d, J = 15.6 Hz, 1H), 7.49 (d, J = 7.8 Hz, 1H), 7.18 (t, J = 7.6 Hz, 1H), 6.89−6.63 (m, 2H), 4.45 (t, J = 8.0 Hz, 2H), 4.12 (dd, J = 16.0, 7.9 Hz, 4H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.7, 153.7, 146.2, 141.8, 131.8, 129.1, 119.8, 118.9, 116.8, 116.2, 62.1, 42.9. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{12}H_{12}N_2O_3Na$ 255.0740; found 255.0754.

***anti*-Methyl 2-(4-Bromophenyl)-3-(1-phenylethanone-2-yl)-indoline-2-carboxylate (4a).** Amorphous solid (32 mg, 71%). ^{1}H NMR (CDCl3, 500 MHz) δ 7.47 (d, J = 8.0 Hz, 2H), 7.39 (d, J = 8.3 Hz, 2H), 7.28−7.33 (m, 3H), 7.12−7.20 (m, 2H), 7.01 (d, J = 7.4 Hz, 1H), 6.94 (m, 1H), 6.69 (d, J = 7.7 Hz, 1H), 6.60 (m, 1H), 4.86 (s, 1H), 4.75 (m, 1H), 3.58 (s, 3H), 2.57 (d, J = 6.8 Hz, 2H). ^{13}C NMR (125 MHz, CDCl3) δ 198.3, 174.9, 148.1, 136.3, 132.9, 131.7, 131.0, 128.6, 128.30, 128.26, 127.8, 125.5, 122.4, 120.3, 110.3, 53.3, 44.5, 40.9; HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{24}H_{20}BrNO_3Na$ 472.0519; found 472.0529.

***anti*-Methyl 1-Methyl-3-(2-oxo-2-phenylethyl)-2-phenyl-indoline-2-carboxylate (4b).** Oil (27 mg, 70%). ^{1}H NMR (400 MHz, CDCl3) δ 7.60 (d, J = 7.6 Hz, 2H), 7.45 (t, J = 7.2 Hz, 1H), 7.35−7.23 (m, 6H), 7.22−7.10 (m, 2H), 7.03 (d, J = 7.2 Hz, 1H), 6.66 (t, J = 7.4 Hz, 1H), 6.49 (d, J = 7.8 Hz, 1H), 4.85 (t, J = 6.8 Hz, 1H), 3.77 (s, 3H), 2.86 (s, 3H), 2.73 (dd, J = 16.1, 9.5 Hz, 2H). ^{13}C NMR (100 MHz, CDCl3) δ 198.2, 173.1, 150.4, 136.9, 136.0, 132.8, 130.8, 128.4, 128.3, 128.2, 128.1, 127.9, 127.7, 124.2, 118.2, 106.0, 81.6, 52.2, 45.4, 41.9, 32.2. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{25}H_{23}NO_3Na$ 408.1570; found 408.1562.

***anti*-Methyl 3-(1-Phenylethanone-2-yl)-2-phenylindoline-2-carboxylate (4c).** Amorphous solid (24 mg, 64%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.60−7.65 (m, 4H), 7.42 (m, 1H), 7.284−7.34 (m, 4H), 7.24−7.26 (m, 1H), 7.14 (d, J = 7.4, 1H), 7.08 (m, 1H), 6.82 (d, J = 7.7, 1H), 6.71 (m, 1H), 5.03 (s, 1H), 4.88 (m, 1H), 3.71 (s, 3H), 2.64−2.76 (m, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ198.5, 175.2, 148.3, 137.2, 137.0, 132.8, 131.3, 128.6, 128.2, 128.1, 127.8, 126.7, 125.6, 120.0, 110.2, 53.1, 44.3, 40.9. HRMS (ESI-TOF) m/z: [M + Na]+ calcd for $C_{24}H_{21}NO_3Na$ 394.1414; found 394.1422.

***anti*-Methyl 2-(4-Fluorophenyl)-3-(1-phenylethanone-2-yl)-indoline-2-carboxylate (4d).** Amorphous solid (32 mg, 81%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.60−7.65 (m, 4H), 7.45 (m, 1H), 7.30−7.33 (m, 2H), 7.15 (d, J = 7.3, 1H), 7.08−7.10 (m, 1H), 6.99 (t, J = 8.6, 2H), 6.82 (d, J = 7.8, 1H), 6.73 (m, 1H), 5.02 (s, 1H), 4.88 (t, J = 6.7, 1H), 3.72 (s, 3H), 2.70 (d, J = 7.5, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ198.3, 175.1, 163.4, 161.5,148.2, 136.9, 133.0, 132.9, 131.2, 128.7, 128.6, 128.3, 128.2, 127.8, 125.5, 120.3, 115.6, 115.4, 110.3, 53.2, 44.5, 40.9, 29.7. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{24}H_{20}FNO_3Na$ 412.1319; found 412.1322.

***anti*-Methyl 2-(3-Bromophenyl)-3-(1-phenylethanone-2-yl)-indoline-2-carboxylate (4e).** Amorphous solid (30 mg, 66%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.87 (s, 1H), 7.62 (d, J = 8.0, 2H), 7.55 (d, J = 7.5, 1H), 7.45 (m, 1H), 7.32 (m, 3H), 7.15 (t, J = 7.5, 2H), 7.08 (m, 1H), 6.83 (d, J = 8.0, 1H), 6.74 (t, J = 7.0, 1H), 5.01 (s, 1H), 4.90 (m, 1H), 3.73 (s, 3H), 2.72 (d, J = 6.5, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 198.2, 174.7, 148.0, 139.5, 136.8, 132.9, 131.3, 131.0, 130.1, 129.9, 128.3, 127.9, 125.6, 125.5, 123.0, 120.4, 110.4, 53.4, 44.6, 40.8. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{24}H_{20}BrNO_3Na$ 472.0519; found 472.0534.

***anti*-Methyl 2-(2-Chlorophenyl)-3-(1-phenylethanone-2-yl)-indoline-2-carboxylate (4f).** Amorphous solid (24 mg, 59%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 8.07 (d, J = 7.8, 1H), 7.68 (d, J = 7.7, 2H), 7.46 (m, 1H), 7.28−7.38 (m, 4H), 7.26−7.29 (m, 1H), 7.12 (d, J = 7.3, 1H), 7.03 (m, 1H), 6.68−6.73 (m, 2H), 5.10−5.13 (m, 1H), 4.48 (s, 1H), 3.67 (m, 3H), 2.70−2.75 (m, 1H), 2.40−2.45 (m, 1H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 197.9, 172.7, 146.3, 137.1, 137.0, 132.8, 132.6, 131.8, 130.2, 129.6, 128.9, 128.6, 128.3, 128.0, 127.8, 127.0, 125.6, 120.1, 109.4, 52.9, 42.1, 41.5. HRMS (ESI-TOF) m/z: [M + H]$^+$ calcd for $C_{24}H_{21}ClNO_3$ 406.1210; found 406.1206.

***anti*-Methyl 3-(1-Phenylethanone-2-yl)-2-*p*-tolylindoline-2-carboxylate (4g).** Amorphous solid (20 mg, 53%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.61 (d, J = 7.4, 2H), 7.51 (d, J = 8.0, 2H), 7.42−7.44 (m, 1H), 7.30 (t, J = 7.7, 1H), 7.07−7.15 (m, 4H), 6.81 (d, J = 7.0, 1H), 6.71 (m, 1H), 5.01 (s, 1H), 4.87 (t, J = 7.0, 1H), 3.70 (s, 3H), 2.71 (d, J = 7.0, 2H), 2.26 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 198.6, 175.4, 148.3, 137.9, 137.0, 134.2, 132.7, 131.3, 129.3, 128.2,. 128.1, 127.9, 126.6, 125.5, 120.0, 110.1, 53.1, 44.5, 40.9, 21.0. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{25}H_{23}NO_3Na$ 408.1570; found 408.1577.

***anti*-Methyl 2-(3-Methoxyphenyl)-3-(1-phenylethanone-2-yl)indoline-2-carboxylate (4h).** Amorphous solid (20 mg, 49%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.62 (d, J = 8.0, 2H), 7.42−7.44 (m, 1H), 7.30−7.32 (m, 2H), 7.21−7.22 (m, 3H), 7.14 (d, J = 7.5, 1H), 7.06−7.07 (m, 1H), 6.81 (d, J = 7.8, 1H), 6.71−6.75 (m, 2H), 5.01 (s, 1H), 4.88 (t, J = 6.9, 1H), 3.78 (s, 3H), 3.71 (s, 3H), 2.73 (d, J = 6.9, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 198.3, 175.1, 159.7, 148.2, 138.8, 132.8, 131.3, 129.7, 128.2, 128.1, 127.9, 125.5, 120.1, 119.0, 113.5, 112.6, 110.2, 55.2, 53.2, 44.4, 40.8. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{25}H_{23}NO_4Na$ 424.1519; found 424.1521.

***anti*-Methyl 3-(2-Oxo-2-phenylethyl)-2-(thiophen-2-yl)-indoline-2-carboxylate (4i).** Amorphous solid (17 mg, 46%). ^{1}H NMR (500 MHz, CDCl3) δ 7.61−7.67 (m, 2H), 7.30−7.42 (m, 1H), 7.26−7.28 (m, 2H), 7.02−7.07 (m, 4H), 6.83 (m, 1H), 6.74−6.76 (m, 1H), 6.66 (m, 1H), 5.22 (s, 1H), 4.73 (m, 1H), 3.72 (s, 3H), 2.76−2.88 (m, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 197.4, 173.4, 147.0, 140.9, 136.5, 131.9, 130.0, 127.3, 127.3, 126.9, 126.7, 125.2, 124.5, 124.3, 119.4, 109.4, 73.6, 52.4, 44.5, 40.1. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{22}H_{19}NNaO_3S$ 400.0978; found 400.0999.

***anti*-*tert*-Butyl 3-(2-(Methoxycarbonyl)-3-(2-oxo-2-phenyl-ethyl)indolin-2-yl)-1*H*-indole-1-carboxylate (4j).** Amorphous solid (15 mg, 30%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.99 (m, 1H), 7.80 (m, 1H), 7.72(s, 1H), 7.40−7.49 (m, 2H), 7.32 (m, 1H), 7.12−7.30 (m, 5H), 7.02 (m, 1H), 6.80 (m, 1H), 6.66 (m, 1H), 5.09 (s, 1H), 5.01(m, 1H), 3.60 (s, 3H), 2.80 (m, 2H), 1.60 (s, 9H). ^{13}C NMR ($CDCl_3$, 100 MHz) 197.4, 173.5, 148.3, 146.7, 135.8, 131.7, 130.4, 127.2, 127.1, 126.7, 124.7, 124.2, 123.7, 122.1, 119.9, 119.2, 116.9, 114.2, 109.2, 83.0, 72.4., 52.1, 42.7, 39.6, 27.1. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{31}H_{30}N_2O_5Na$ 533.2060; found 533.2075.

***anti*-Methyl 2-(4-Bromophenyl)-3-(1-(4-chlorophenyl)-ethanone-2-yl)indoline-2-carboxylate (4k).** Amorphous solid (32 mg, 67%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.52 (m, 4H), 7.40 (d, J = 8.7, 2H), 7.29 (d, J = 8.5, 2H), 7.08−7.13 (m, 2H), 6.82 (d, J = 7.7, 1H), 6.74 (t, J = 7.5, 1H), 4.99 (s, 1H), 4.86 (t, J = 7.7, 1H), 3.71 (s, 3H), 2.67 (m, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 197.1, 175.4, 148.0, 136.2, 135.1, 131.8, 129.3, 128.64, 128.60, 128.4, 125.4, 122.5, 120.4, 110.4, 53.3, 44.7, 40.7. (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{24}H_{19}BrClNO_3Na$ 506.0129; found 506.0122.

***anti*-Methyl 2-(4-Bromophenyl)-3-(2-oxo-2-(*p*-tolyl)ethyl)-indoline-2-carboxylate (4l).** Amorphous solid (25 mg, 52%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.49−7.52 (m, 4H), 7.40 (d, J = 8.6, 2H), 7.06−7.14 (m, 4H), 6.81 (d, J = 7.7, 1H), 6.72 (t, J = 7.4, 1H), 4.98 (s, 1H), 4.87 (t, J = 7.2, 1H), 2.91(s, 3H), 2.66 (d, J = 6.8, 2H), 2.34 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 197.9, 174.9, 148.1, 143.8, 136.3, 134.4, 131.7, 131.2, 129.0, 128.6, 128.2, 128.0, 125.5, 122.4, 120.3, 110.3, 53.3, 44.6, 40.7, 21.6. HRMS (ESI-TOF) m/z: [M + Na]$^+$ calcd for $C_{25}H_{22}BrNO_3Na$ 486.0681; found 486.0674.

***anti*-Methyl-3-(2-(furan-2-yl)-2-oxoethyl)-2-phenylindoline-2-carboxylate (4m).** Amorphous solid (25 mg, 70%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.64 (d, J = 7.6, 2H), 7.40 (s, 1H), 7.32 (m, 2H), 7.24−7.26 (m, 1H), 7.08 (m, 2H), 6.82 (m, 2H), 6.70 (t, J = 8.0, 1H), 6.34 (d, J = 2.0, 1H), 5.01 (s, 1H), 4.83 (t, J = 8.0, 1H), 3.70 (s,

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3H), 2.54 (m, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 187.4, 175.2, 152.6, 148.3, 146.2, 137.0, 130.9, 128.6, 128.22, 128.15, 126.8, 125.4, 120.1, 117.2, 111.9, 110.2, 53.2, 44.3, 40.7. HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $C_{22}H_{19}NO_4Na$ 384.1206; found 384.1225.

***anti*-Methyl 2-(4-Bromophenyl)-3-(2-oxo-2-(thiophen-2-yl)-ethyl)indoline-2-carboxylate (4n).** Amorphous solid (30 mg, 66%). ^{1}H NMR ($CDCl_3$, 500 MHz) δ 7.51−7.54 (m, 3H), 7.40 (d, J = 8.4, 2H), 7.21 (m, 1H), 7.13 (d, J = 7.4, 1H), 7.07−7.09 (m, 1H), 6.94 (m, 1H), 6.82 (d, J = 8.2, 1H), 6.74 (t, J = 7.4, 1H), 5.00 (s, 1H), 4.87 (t, J = 6.5, 1H), 3.71 (s, 3H), 2.656−2.70 (m, 2H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ 191.0, 174.7, 148.0, 136.2, 133.7, 131.9, 131.7. 130.7, 128.7, 128.3, 127.8, 125.4, 122.4, 120.3, 110.3, 53.3, 44.8, 41.6. HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $C_{22}H_{18}BrNO_3SNa$ 478.0083; found 478.0078.

***anti*-Methyl 2-Phenyl-3-(phenylethanone-2-yl)-5-bromo-indoline-2-carboxylate (4o).** Amorphous solid (23 mg, 51%). ^{1}H NMR (400 MHz, CDCl3) δ 7.61 (t, J = 7.5 Hz, 4H), 7.45 (s, 1H), 7.35−7.26 (m, 5H), 7.21−7.15 (m, 1H), 6.69 (d, J = 8.3 Hz, 1H), 5.01 (s, 1H), 4.85 (dd, J = 8.9, 4.9 Hz, 1H), 3.72 (s, 3H), 2.72−2.68 (m, 2H). ^{13}C NMR (100 MHz, CDCl3) δ 197.9, 174.9, 147.4, 136.8, 136.7, 133.7, 133.0, 131.0, 129.0, 128.7, 128.4, 127.9, 126.6, 111.9, 111.6, 77.9, 53.3, 44.1, 40.8, 29.7. HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $C_{24}H_{20}BrNO_3Na$ 472.0524; found 472.0534.

***anti*-Methyl 2-Phenyl-3-(phenylethanone-2-yl)-6-bromo-indoline-2-carboxylate (4p).** Amorphous solid (32 mg, 72%). ^{1}H NMR ($CDCl_3$, 400 MHz) δ 7.61 (d, J = 8.0 Hz, 4H), 7.45 (m, 1H), 7.40−7.26 (m, 5H), 7.06 (d, J = 7.9 Hz, 1H), 6.80 (d, J = 1.2 Hz, 1H), 6.67 (dd, J = 7.9, 1.6 Hz, 1H), 5.04 (s, 1H), 4.82−4.80 (m, 1H), 3.72 (s, 3H), 2.63−2.70 (m, 2H). ^{13}C NMR (100 MHz, CDCl3) δ 198.2, 174.8, 149.5, 136.9, 136.7, 133.8, 133.0, 130.0, 128.8, 128.4, 127.9, 126.54, 126.51, 120.0, 110.5, 77.9, 53.3, 43.8, 40.8. HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $C_{24}H_{20}BrNO_3Na$ 472.0524; found 472.0504.

■ ASSOCIATED CONTENT

Ⓢ Supporting Information

^{1}H NMR and ^{13}C NMR spectra, HRMS data for all new compounds, and HPLC spectroscopy data. This material is available free of charge via the Internet at http://pubs.acs.org.

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Notes

The authors declare no competing financial interest.

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