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Copper-Catalyzed Tandem Decyclization-Cyclization Reaction of *N*-Alkynyl-3-hydroxyisoindolin-1-ones Generated from *N*-Alkynyl Phthalimides: Selective Synthesis of *ortho*-(2-Oxazolyl)phenyl Ketones

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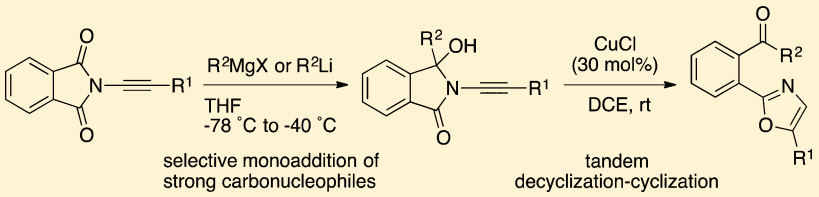
Supporting Information

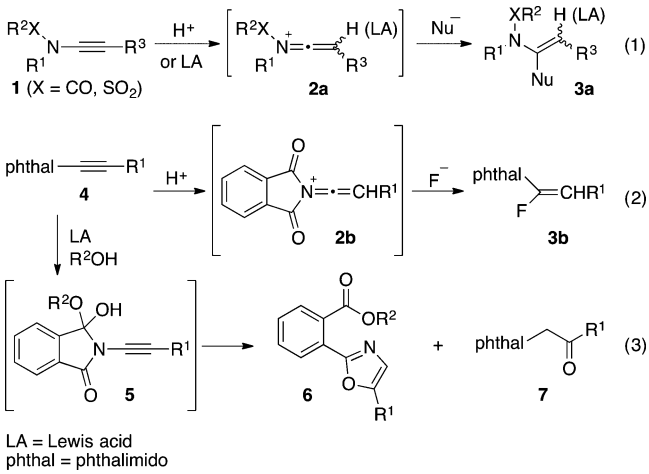


ABSTRACT: Selective carbophilic monoaddition on *N*-alkynyl phthalimides was performed with organometallic reagents to afford 3-substituted *N*-alkynyl-3-hydroxyisoindolin-1-ones (*α*-hydroxy ynamides) as a new subgroup of ynamides. Owing to the alkynyl motif on the nitrogen atom, *α*-hydroxy ynamides were easily isomerized to the corresponding *ortho*-(2-oxazolyl)phenyl ketones in a CuCl-catalyzed tandem decyclization−cyclization reaction under mild conditions.

N-Alkynyl phthalimides **4**,[1] a new subgroup of *N*-alkynyl amines, have certain advantages over ynamides **1**,[2] which are recognized as useful *N*-alkynyl amine species for building blocks in organic synthesis. Because of the higher reactivity of imide carbonyls over their amide counterparts, conversion of the imide functional group into a free amino group can be easily achieved by treatment with hydrazine under mild conditions, as in the Gabriel synthesis of primary alkyl amines. *N*-Ethynylphthalimide can be used as the synthetic equivalent of the highly labile ethynamine.[1]

It is also of interest to consider the reactivity of the carbonyl vs the alkynyl group toward heteronucleophiles (Scheme 1). A highly regioselective *α*-fluorination was performed by Evano and Thibaudeau on both ynamides **1** and *N*-alkynyl phthalimides **4** under protic conditions via the keteniminium ion intermediates **2a** and **2b** (Scheme 1, eqs 1 and 2).[3] The *α*-regioselective addition of heteronucleophiles to the alkynyl group was also observed for the various Lewis acid catalyzed reactions of ynamides **1**,[2] which is most probably due to the sufficient electron donation from nitrogen to the neighboring alkynyl group. In contrast, we found that the reaction of *N*-alkynyl phthalimides **4** with alcohols can lead to *ortho*-(2-oxazolyl)benzoates **6** and *β*-ketoimides **7** (Scheme 1, eq 3), but not as simple adducts to the alkynyl group based on the inherent electronic bias.[4,5] The reaction is extremely sensitive to the Lewis acid character. The use of *σ*-electrophilic Lewis acids, such as $CeCl_3$ and $MgCl_2$, gave oxazoles **6**, and increasing the *π*-electrophilic Lewis acidity tended to decrease the yields of the oxazoles **6** and increase the production of *β*-ketoimides **7**. We speculated that *N*-alkynyl-3-alkoxy-3-hydroxyisoindolin-1-one **5** generated from the nucleophilic addition of an alcohol to

Scheme 1. Proton/Lewis Acid Mediated Nucleophilic Addition toward Ynamides (1) and *N*-Alkynyl Phthalimides (4)



imide carbonyl is a common intermediate involved in these types of transformations, although direct attempts to identify intermediates **5** were not successful.

Herein, we disclose our studies of the isolation of 3-substituted *N*-alkynyl-3-hydroxyisoindolin-1-ones (*α*-hydroxy ynamides) **8** from the monoaddition of organometallic reagents on the imide functionality of *N*-alkynyl phthalimide **4**, which

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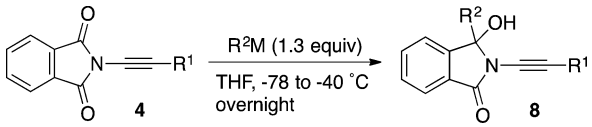
led to the efficient synthesis of *ortho*-(2-oxazoyl)phenyl ketones **17** by a Lewis acid catalyzed tandem decyclization−cyclization reaction under mild conditions. 3-Substituted 3-hydroxyisoindolin-1-ones are pharmaceutically important structural units because they are found in numerous natural products and bioactive compounds.[6] In addition, no α-hydroxy ynamides **8** have been reported to our knowledge. Moreover, oxazoles are of great interest because they are common fragments of many biologically active molecules,[7] and the strategies for the construction of the *ortho*-(2-oxazoyl)benzoyl unit are quite insufficient.[8]

Following the well-studied precedent for the reaction of strongly nucleophilic organometallic reagents with phthalimide and its *N*-alkyl, *N*-aryl, and *N*-alkenyl derivatives,[9] the selective carbophilic monoaddition onto the *N*-(1-hexyn-1-yl)-phthalimide **4a** was performed with 1.3 equiv of PhMgCl at low temperature and afforded α-hydroxy ynamide **8a** in an 81% isolated yield (Table 1, entry 1). Alkyllithium reagents could

Table 1. Preparation of α-Hydroxy Ynamides (8) from the Reaction of *N*-Alkynyl Phthalimides (4) with Carbonucleophiles[a]



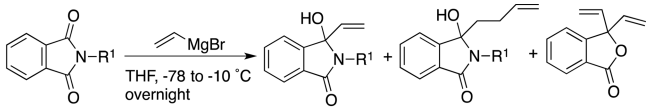
entry	R^1	4	R^2 M	product	yield,[b] %
1	Bu	**4a**	PhMgCl	**8a**	81
2	Bu	**4a**	MeLi	**8b**	62
3	Bu	**4a**	BuLi	**8c**	54
4	Bu	**4a**	*i*-PrMgBr	**8d**	66
5	Bu	**4a**	*tert*-BuLi	**8e**	52
6	*cyclo*-Pr	**4b**	MeLi	**8f**	34
7	*cyclo*-Hex	**4c**	MeLi	**8g**	58
8	*tert*-Bu	**4d**	MeLi	**8h**	59
9	Ph	**4e**	MeLi	**8i**	42
10	TMS	**4f**	MeLi	**8j**	62

[a]Conditions: *N*-alkynyl phthalimide **4** (0.3 mmol) in THF (6 mL) under N_2. [b]Isolated yield.

also be used, and the sterically hindered *tert*-butyl group was added in moderate yield (Table 1, entry 5).[10] As summarized in Table 1, various *N*-alkynyl phthalimides **4b−f** were converted to the corresponding α-hydroxy ynamide **8f−j** in moderate yields (Table 1, entries 6−10). Attempts to use *N*-(1-hexyn-1-yl)succinimide and maleimide, however, resulted in a complex mixture.

Along with this line, we envisioned that a vinyl functionality could be readily introduced when vinylmagnesium bromide is employed as a carbonucleophile. No trace of vinyl adduct **8k**, however, was obtained. Treatment of *N*-(1-hexyn-1-yl)-phthalimide **4a** with 1.5 equiv of vinylmagnesium bromide gave a 1:2 mixture of 3-homoallyl-3-hydroxyisoindolin-1-one **8l** and 3,3-divinylphthalide **12** in 29% yield accompanied by 8% of the starting ynimide **4a** (Table 2, entry 1). For reasons that are not yet clear, the ratio and yield of **8l** increased with increasing amounts of vinylmagnesium bromide (Table 2, entries 2 and 3). As shown in Scheme 2, the formation of these products certainly result from the ring opening of the monoalkoxy intermediate **13**, leading to the α,β-unsaturated ketone **14**. The further 1,4- and 1,2-addition of vinylmagnesium bromide to **14**

Table 2. Reaction with *N*-Substituted Phthalimides with Vinylmagnesium Bromide[a]



4a: R^1 = 1-hexyn-1-yl; **9**: R^1 = Ph
8k: R^1 = 1-hexyn-1-yl; **10**: R^1 = Ph
8l: R^1 = 1-hexyn-1-yl; **11**: R^1 = Ph
12

			products (yields,[b] %)		
entry	phthalimide	CH_2=CHMgBr (equiv)	vinyl adduct	homoallyl adduct	**12**
1	**4a**	1.5	**8k** (0)	**8l** (10)	29
2	**4a**	3.0	**8k** (0)	**8l** (40)	27
3	**4a**	5.0	**8k** (0)	**8l** (48)	16
4	**9**	1.5	**10** (53)	**11** (0)	0
5	**9**	3.0	**10** (43)	**11** (9)	0

[a]Conditions: *N*-substituted phthalimides (0.1 mmol) in THF (2 mL) under N_2. [b]Yields were determined by ^{1}H NMR on the crude reaction mixture using 1,2-dichloroethane as an internal standard.

gives the corresponding dialkoxides **15** and **16**, which remain uncyclized *in situ* but cyclize upon treatment with saturated aqueous NH_4Cl. Lactamization from the addition of an amide nitrogen to the regenerated carbonyl group leads to 3-homoallyl-3-hydroxyisoindolin-1-one **8l**,[11,12] and lactonization from the addition of a hydroxyl group to the regenerated amide carbonyl gives phthalide **12** with the concomitant release of the primary amine.[13]

Because of the facile ring opening of the carbonyl addition intermediates, the bis-addition of organometallic reagents to phthalic anhydride has been frequently observed.[13,14] In contrast, *N*-substituted phthalimides usually afford a mono-adduct.[9] Nagao has reported that *N*-alkyl-3-hydroxy-3-vinyl-isoindolin-1-ones were obtained in good yields from the treatment of *N*-alkyl phthalimides with 1.5 equiv of vinyl-magnesium bromide.[15] In addition, the use of *N*-phenyl-phthalimide **9** gave the corresponding *N*-phenyl-3-hydroxy-3-vinylisoindolin-1-ones **10** as a major product (Table 2, entries 4 and 5), and only 9% of the homoallyl adduct **11** was obtained in the presence of 3.0 equiv of vinylmagnesium bromide. The product distribution of the addition of vinylmagnesium bromide to *N*-substituted phthalimides in this way depends on the *s*-character of the carbon atom on the nitrogen atom. Again, *N*-alkynyl phthalimide **4a** exclusively led to a product derived from ring-opened intermediate **14**, which appears to be caused by the stability of ring-opened **14** against the carbonyl addition intermediate **13**. B3LYP calculations[16] of the relative free energies of intermediates **13** and **14** support this hypothesis. In the case of R^1 = Me (M = Li), the carbonyl addition intermediate **13** is favored over **14** by 1.2 kcal/mol. In other cases of R^1 = Ph or 1-propyn-1-yl (M = Li), the ring-opened intermediate **14** is favored over **13** by 4.5 and 5.9 kcal/mol, respectively, owing to the delocalization of the negative charge by cross-conjugation.

N-Alkynyl phthalimides **4a** reacted with methanol in the presence of $MgCl_2$ to afford methyl *o*-(2-oxazolyl)benzoates **6** (R^1 = Bu, R^2 = Me) in good yield.[4] The reaction with PhMgCl, however, led to the isolation of α-hydroxy ynamide **8a**, and oxazole **17** was not obtained even at a higher reaction temperature. These product compositions might be based on the nature of 3-hydroxyisoindolin-1-ones. The highly reactive *ortho*-amide **5** can be cleaved to isomerize to oxazole easily, while the less reactive amidoacetal **8** can be isolated and

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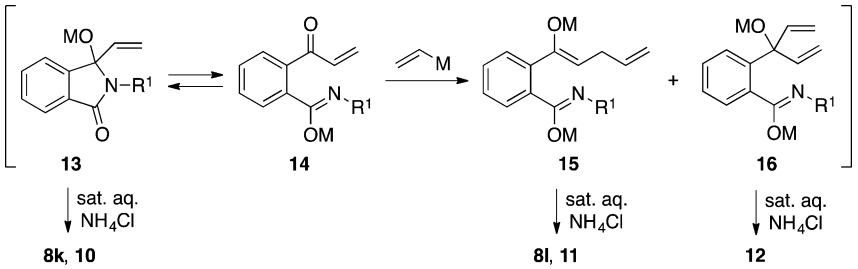
Scheme 2. Plausible Reaction Mechanism for the Production of Homoallyl Adducts (8l, 11) and 3,3-Divinylphthalide (12)



purified. In general, it is possible that the acid-catalyzed ring opening of 3-substituted 3-hydroxyisoindolin-1-one derivatives is difficult. Through protonation and complexation, Brønsted and Lewis acids, respectively, convert the hydroxy group to a better leaving group, which then undergoes facile elimination[9c,17] or nucleophilic substitution.[9a,b,18] In a series of intramolecular ring expansion studies by Nagao's research group using 3-substituted 3-hydroxyisoindolin-1-one derivatives, successful Lewis acid catalyzed cleavage of the C−N bond was observed only in 3-allenyl derivatives.[10] Attempts to use 3-propargyl or 3-vinyl derivatives resulted in dehydration.[15,20] These authors also reported that thermal conditions with a strong base are necessary for the ring opening of 3-propargyl derivatives.[20] In contrast, we found that Lewis acids promote the facile ring opening of the α-hydroxy ynamide **8a** to give the oxazole **17a**.[21] An examination of the catalytic activity of various Lewis acids revealed that isomerization of the α-hydroxy ynamide **8** to oxazole **17** required some π-electrophilicity of the Lewis acids.[22] CuCl, AgF, and AuCl were especially effective in producing oxazole **17a** in 84% to quantitative ^{1}H NMR yields. The strong π-electrophilic $Ph_3PAuNTf_2$−$AgBF_4$ catalytic system also resulted in the production of **17a**, although the $Ph_3PAuNTf_2$−$AgBF_4$-catalyzed reaction of *N*-alkynyl phthalimides **4** with alcohols led to β-ketoimides **7**.[4] On the other hand, BF_3−OEt_2 and $MgCl_2$ gave *N*-(1-oxohexyl)-3-hydroxy-3-phenylisoindolin-1-one which was generated from the hydrolysis of **8a**.

The CuCl-catalyzed isomerization of α-hydroxy ynamides **8** to oxazoles **17** is summarized in Table 3. The steric demand of alkyl substituents on the terminal alkynyl carbon atom or the α-carbon atom of the hydroxy group did not influence the yield of oxazole **17**. An aromatic group at the R^1 or R^2 of **8** also successfully led to the corresponding oxazole **17** (Table 3, entries 1−9); however, a TMS substituent disturbed the desired isomerization, and 61% of the starting **8j** was recovered. A prolonged reaction time also resulted in a similar recovery of **8j**.

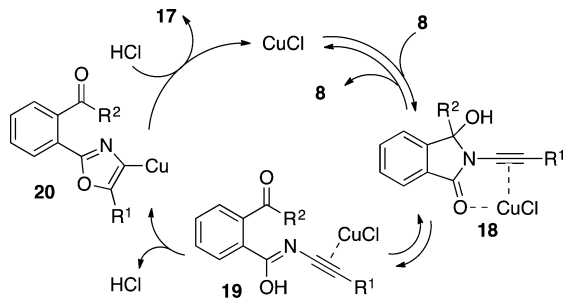
A plausible mechanism for the isomerization reaction is shown in Scheme 3. Coordination of the Cu salt with the carbonyl oxygen and electron-rich C−C triple bond of the α-hydroxy ynamide **8** promotes the cleavage of the five-membered ring to give intermediate **19**. We suppose that the driving force for the cleavage of the C−N bond is the formation of the fully conjugated ynimine scaffold of **19**. The existence of the equilibrium between **18** and **19** is also speculated because the lactamization of intermediate **15** to α-hydroxy amide **8l** proceeded with protic acid (Scheme 2). The subsequent Cu salt-mediated 5-*endo-dig* cyclization leads to the construction of the oxazole skeleton (**19** to **17**).[23] When **8a** was treated with 30 mol % $CuCl_2$, 2-(5-butyl-4-chloro-2-oxazolyl)phenyl ketone was obtained in 23% yield (see Supporting Information), which most likely implies the existence of the organocopper

Table 3. CuCl-Catalyzed Isomerization of α-Hydroxy Ynamides (8) to Oxazoles (17)[a]

entry	R^1	R^2	8	17 (yield,[b] %)
1	Bu	Ph	**8a**	**17a** (81)
2	Bu	Me	**8b**	**17b** (80)
3	Bu	Bu	**8c**	**17c** (92)
4	Bu	*i*-Pr	**8d**	**17d** (77)
5	Bu	*tert*-Bu	**8e**	**17e** (83)
6	*cyclo*-Pr	Me	**8f**	**17f** (81)
7	*cyclo*-Hex	Me	**8g**	**17g** (92)
8	*tert*-Bu	Me	**8h**	**17h** (95)
9	Ph	Me	**8i**	**17i** (98)
10	TMS	Me	**8j**[c]	**17j** (0)
11	Bu	$(CH_2)_2CH{=}CH_2$	**8l**	**17l** (80)

[a]Conditions: α-Hydroxy ynamide **8** (0.1 mmol) in DCE (2 mL) under N_2. [b]Isolated yield. [c]61% of **8j** was recovered.

Scheme 3. Plausible Isomerization Mechanism for the Production of Oxazole (17) via Copper-Catalyzed Tandem Decyclization−Cyclization of α-Hydroxy Ynamide (8)



intermediate **20**. As mentioned above, the α-hydroxy ynamide **8j** did not afford the oxazole **17j**.[24] Clearly, this result is due to the α-electronic effect of the TMS substituent because bulky **8h** successfully produced **17h**. Compared to the NBO charges at C(β) of model compounds **21a**, **21b** has a considerable negative charge (Figure 1),[25] which likely disturbs the nucleophilic attack of the hydroxy group on the C(β) atom.

In conclusion, we developed the synthesis of 3-substituted *N*-alkynyl-3-hydroxyisoindolin-1-ones from the selective carbophilic monoaddition of organometallic reagents with *N*-alkynyl phthalimides. α-Hydroxy ynamides are a new subgroup of ynamides and were successfully isomerized to the corresponding oxazoles via a CuCl-catalyzed tandem decyclization−

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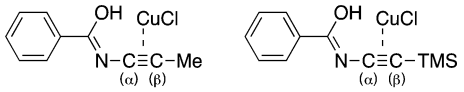

21a C(α): 0.12 C(β): -0.14 **21b** C(α): 0.17 C(β): -0.63

Figure 1. Selected NBO charges of model compound **21** in the gas-phase for optimized minima.[25]

cyclization reaction under mild conditions. Ynimides can efficiently take advantage of both the carbonyl and alkynyl groups bound to the nitrogen atom, and we generalize that *N*-alkynyl phthalimides are a novel building block for the construction of the *ortho*-(2-oxazolyl)benzoyl motif.

EXPERIMENTAL SECTION

General. *N*-Alkynyl phthalimides (**4**) were prepared according to a previously reported procedure.[4] Dry THF was commercially available. DCE was dried with CaH_2 and distilled under nitrogen. Organometallic reagents such as alkyl lithiums and Grignard reagents were obtained from commercial sources. The commercially available CuCl was used as received without further purification. All reactions were performed under a nitrogen atmosphere. Column chromatography was performed with silica gel 60N (63−210 μm). Preparative thin-layer chromatography (TLC) was carried out on precoated plates of silica gel (MERCK, silica gel F-254). ^{1}H NMR and ^{13}C NMR spectra were recorded with 600 and 150 MHz, respectively. Chemical shifts are reported in ppm unit. For ^{1}H NMR spectra, data are reported as follows: chemical shift (multiplicity, coupling constants, and number of protons). The abbreviations for multiplicity are s = singlet, d = doublet, t = triplet, q = quartet, qu = quintet, m = multiplet, br = broad. Infrared spectra were obtained using an FT spectrometer and are reported in wave numbers (cm^{-1}). Mass spectroscopy experiments were performed on a double-focusing mass spectrometer by using EI as the ionization mode. Melting points were obtained from a melt-temp apparatus and were uncorrected.

General Procedure for the Preparation of α-Hydroxy Ynamides (8). To a stirring solution of *N*-alkynyl phthalimide **4** (0.3 mmol) in anhydrous THF (6 mL) was added a solution of an organometallic reagent (0.39 mmol) at −78 °C. The reaction mixture was slowly warmed to −40 °C overnight. The reaction was quenched with saturated aqueous NH_4Cl solution at −40 °C and extracted with CH_2Cl_2 (three times). The combined organic solution was washed with water, dried over anhydrous Na_2SO_4, and concentrated at the reduced pressure. Column chromatography on neutral silica gel using hexane/ethyl acetate as an eluent afforded α-hydroxy ynamide **8**.

N-(1-Hexyn-1-yl)-3-hydroxy-3-phenylisoindolin-1-one (***8a***). Yellow solid, 74.1 mg, 81% yield; mp = 102−105 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.88 (d, *J* = 7.5 Hz, 1 H), 7.58 (t, *J* = 7.5 Hz, 1 H), 7.53 (d, *J* = 7.5 Hz, 1 H), 7.51−7.48 (m, 2 H), 7.41−7.34 (m, 2 H), 3.27 (s, 1 H), 2.29 (t, *J* = 7.2 Hz, 2 H), 1.41 (qu, *J* = 7.2 Hz, 2 H), 1.23 (sextet, *J* = 7.2 Hz, 2 H), 0.80 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 167.5, 147.5, 137.8, 133.8, 129.9, 128.8, 128.5, 128.1, 126.0, 124.2, 123.2, 92.5, 77.7, 68.0, 30.6, 21.5, 18.4, 13.5; FT-IR ($CHCl_3$): 3300 (br), 2360, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{20}H_{19}O_2N$: 305.1422. Found: 305.1419.

N-(1-Hexyn-1-yl)-3-hydroxy-3-methylisoindolin-1-one (***8b***). Pale brown solid, 45.4 mg, 62% yield; mp = 64−65 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.82 (d, *J* 7.8 Hz, 1 H), 7.66 (t, *J* = 7.8 Hz, 1 H), 7.60 (d, *J* = 7.8 Hz, 1 H), 7.53 (*t*, 7.8 Hz, 1 H), 2.93 (brs, 1 H), 2.46 (t, *J* = 7.3 Hz, 2 H), 1.84 (s, 3 H), 1.60 (qu, *J* = 7.3 Hz, 2 H), 1.48 (sextet, *J* = 7.3 Hz, 2 H), 0.95 (t, *J* = 7.3 Hz, 3 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 166.9, 147.1, 133.4, 130.0, 128.2, 124.0, 122.0, 89.7, 77.1, 67.5, 30.9, 24.1, 21.9, 18.5, 13.5; FT-IR ($CHCl_3$): 3300 (br), 2360, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{15}H_{17}O_2N$: 243.1272. Found: 243.1266.

N-(1-Hexyn-1-yl)-3-butyl-3-hydroxyisoindolin-1-one (***8c***). Pale yellow solid, 46.6 mg, 54% yield; mp = 75−79 °C; ^{1}H NMR (600 MHz, $CDCl_3$. Because of the apparition of a stereogenic center adjacent to the nitrogen atom, the ^{1}H NMR spectra showed the magnetically nonequivalence of the methylene protons of the butyl group, which appears as a classical AB system.): δ 7.85 (dd, *J* = 6.6, 1.8 Hz, 1 H), 7.66 (td, *J* = 6.6, 1.8 Hz, 1 H), 7.56−7.53 (m, 2 H), 2.74 (s, 1 H), 2.49−2.44 (m, 2 H), 2.31−2.25 (m, 1 H), 2.20−2.14 (m, 1 H), 1.63−1.55 (m, 2 H), 1.52−1.45 (m, 2 H), 1.31−1.21 (m, 2 H), 1.13−1.03 (m, 1 H), 0.94 (t, *J* = 7.2 Hz, 3 H), 0.81 (t, *J* = 7.2 Hz, 3 H), 0.77−0.68 (m, 1 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 167.3, 145.7, 133.4, 129.7, 129.1, 124.0, 122.1, 92.3, 77.0, 67.5, 36.0, 30.9, 25.3, 22.2, 21.8, 18.5, 13.6, 13.5; FT-IR ($CHCl_3$): 3320 (br), 2260, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{23}O_2N$: 285.1733. Found: 285.1731.

N-(1-Hexyn-1-yl)-3-hydroxy-3-(1-methylethyl)isoindolin-1-one (***8d***). Pale yellow solid, 54.0 mg, 66% yield; mp = 102−105 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.82 (d, *J* = 7.2 Hz, 1 H), 7.62 (t, *J* = 7.2 Hz, 1 H), 7.57 (d, *J* = 7.2 Hz, 1 H), 7.53 (t, *J* = 7.2 Hz, 1 H), 3.05 (s, 1 H), 2.63 (septet, *J* = 7.0 Hz, 1 H), 2.44 (t, *J* = 7.5 Hz, 2 H), 1.59 (qu, *J* = 7.5 Hz, 2 H), 1.46 (sextet, *J* = 7.5 Hz, 2 H), 1.23 (d, *J* = 7.0 Hz, 3 H), 0.94 (t, *J* = 7.5 Hz, 3 H), 0.68 (d, *J* = 7.0 Hz, 3 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 167.1, 144.1, 133.0, 130.2, 130.0, 124.1, 123.3, 94.9, 77.3, 67.9, 34.9, 31.0, 22.0, 18.8, 17.0, 16.6, 13.6; FT-IR ($CHCl_3$): 3340 (br), 2259, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{21}O_2N$: 271.1567. Found: 271.1570.

N-(1-Hexyn-1-yl)-3-hydroxy-3-(1,1-dimethylethyl)isoindolin-1-one (***8e***). Yellow oil, 44.7 mg, 52% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.81 (d, *J* = 7.2 Hz, 1 H), 7.60 (d, *J* = 7.2 Hz, 1 H), 7.58 (t, *J* = 7.2 Hz, 1 H), 7.51 (t, *J* = 7.2 Hz, 1 H), 2.99 (s, 1 H), 2.44 (t, *J* = 7.4 Hz, 2 H), 1.58 (qu, *J* = 7.4 Hz, 2 H), 1.46 (sextet, *J* = 7.4 Hz, 2 H), 1.14 (s, 9 H), 0.93 (t, *J* = 7.4 Hz, 3 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 167.9, 145.8, 132.4, 130.3, 129.8, 124.3, 123.8, 96.0, 77.8, 70.0, 40.3, 30.8, 25.7, 22.0, 18.7, 13.6; FT-IR ($CHCl_3$): 3360 (br), 2362, 1734, 1684 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{23}O_2N$: 285.1730. Found: 285.1729.

N-(2-Cyclopropylethynyl)-3-hydroxy-3-methylisoindolin-1-one (***8f***). Yellow solid, 23.1 mg, 34% yield; mp = 98−102 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.84 (d, *J* = 7.5 Hz, 1 H), 7.66 (t, *J* = 7.5 Hz, 1 H), 7.59 (d, *J* = 7.5 Hz, 1 H), 7.54 (t, *J* = 7.5 Hz, 1 H), 2.71 (s, 1 H), 1.83 (s, 3 H), 1.52−1.47 (m, 1 H), 0.91−0.80 (m, 4 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 166.9, 146.9, 133.6, 130.0, 128.4, 124.1, 122.1, 89.7, 81.2, 62.9, 24.3, 9.0, 7.0; FT-IR ($CHCl_3$): 3340 (br), 2258, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{14}H_{13}O_2N$: 227.0952. Found: 227.0949.

N-(2-Cyclohexylethynyl)-3-hydroxy-3-methylisoindolin-1-one (***8g***). Brown solid, 47.1 mg, 58% yield; mp = 69−72 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.83 (d, *J* = 7.4 Hz, 1 H), 7.66 (t, *J* = 7.4 Hz, 1 H), 7.60 (d, *J* = 7.4 Hz, 1 H), 7.54 (t, *J* = 7.4 Hz, 1 H), 2.77 (br.s, 1 H), 2.70−2.63 (m, 1 H), 1.94−1.86 (m, 2 H), 1.89 (s, 3 H), 1.81−1.72 (m, 2 H), 1.62−1.51 (m, 3 H), 1.41−1.31 (m, 3 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 166.6, 147.0, 133.4, 129.8, 128.4, 124.0, 122.0, 89.7, 81.1, 67.8, 32.8, 29.1, 25.8, 24.8, 24.1; FT-IR ($CHCl_3$): 3360 (br), 2262, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{19}O_2N$: 269.1431. Found: 269.1423.

N-(3,3-Dimethyl-1-butyn-1-yl)-3-hydroxy-3-methylisoindolin-1-one (***8h***). Pale brown solid, 43.4 mg, 59% yield; mp = 134−137 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.80 (d, *J* = 7.4 Hz, 1 H), 7.65 (t, *J* = 7.4 Hz, 1 H), 7.59 (d, *J* = 7.4 Hz, 1 H), 7.53 (t, *J* - 7.4 Hz, 1 H), 2.97 (br.s, 1 H), 1.82 (s, 3 H), 1.34 (s, 9 H); ^{13}C NMR (150 MHz, $CDCl_3$): δ 166.2, 146.9, 133.5, 130.0, 128.6, 124.1, 122.1, 89.5, 85.2, 66.6, 31.3, 27.8, 24.1; FT-IR ($CHCl_3$): 3320 (br), 2258, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{15}H_{17}O_2N$: 243.1264. Found: 243.1262.

N-(2-Phenylethynyl)-3-hydroxy-3-methylisoindolin-1-one (***8i***). White solid, 33.2 mg, 42% yield; mp = 131−134 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.88 (d, *J* = 7.4 Hz, 1 H), 7.70 (t, *J* = 7.4 Hz, 1 H), 7.64 (d, *J* = 7.4 Hz, 1 H), 7.57 (t, *J* = 7.4 Hz, 1 H), 7.57−7.53 (m, 2 H), 7.36−7.31 (m, 3 H), 2.89 (s, 1 H), 1.94 (s, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 166.5, 149.2, 134.7, 131.9, 130.8, 129.4, 128.7, 124.3, 123.5, 91.0, 79.4, 76.7, 25.1; FT-IR ($CHCl_3$): 3300 (br), 2246, 1734, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{13}O_2N$: 263.0952. Found: 263.0949.

N-[2-(Trimethylsilyl)ethynyl]-3-hydroxy-3-methylisoindolin-1-one (***8j***). White solid, 48.5 mg, 62% yield; mp = 111−113 °C; ^{1}H NMR

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(600 MHz, $CDCl_3$): δ 7.84 (d, J = 7.5 Hz, 1 H), 7.68 (t, J = 7.5 Hz, 1 H), 7.60 (d, J = 7.5 Hz, 1 H), 7.55 (t, J = 7.5 Hz, 1 H), 2.90 (br.s, 1 H), 1.86 (s, 3 H), 0.27 (s, 9 H); ^{13}C NMR (150 MHz, CD_3CN): δ 166.0, 146.7, 133.7, 130.0, 127.9, 124.1, 122.0, 89.6, 89.0, 79.6, 24.1; FT-IR ($CHCl_3$): 3300 (br), 2176, 1727, 1718 cm^{-1}; HRMS (EI) Calcd for $C_{14}H_{17}O_2NSi$: 259.1035. Found: 259.1032.

Reaction with *N*-Alkynyl Phthalimide (4a) with Vinylmagnesium Bromide. To a stirring solution of *N*-alkynyl phthalimide **4a** (0.3 mmol) in anhydrous THF (6 mL) was added solution of vinylmagnesium bromide (1.5 mmol) at −78 °C. The reaction mixture was slowly warmed to −10 °C overnight. The reaction was quenched with saturated aqueous NH_4Cl solution at −10 °C and extracted with CH_2Cl_2 (three times). The combined organic solution was washed with water, dried over anhydrous Na_2SO_4, and concentrated at the reduced pressure. Column chromatography on neutral silica gel using hexane/ethyl acetate as an eluent afforded α-hydroxy ynamide **8l** and **12**.

*N-(1-Hexyn-1-yl)-3-hydroxy-3-(3-buen-1-yl)isoindolin-1-one (**8l**).* Pale brown solid, 37.4 mg, 44% yield; mp = 89−91 °C; ^{1}H NMR (600 MHz, CDCl $_3$. Because of the apparition of a stereogenic center adjacent to the nitrogen atom, the ^{1}H NMR spectra showed the magnetically nonequivalence of the methylene protons of the homoallyl group, which appears as a classical AB system.): δ 7.78 (d, J = 7.2 Hz, 1 H), 7.65 (d, J = 7.2 Hz, 1 H), 7.55 (d, J = 7.2 Hz, 1 H), 7.52 (t, J = 7.2 Hz, 1 H), 7.51−7.62 (m, 1 H), 4.92−4.85 (m, 2 H), 3.38 (s, 1 H), 2.43 (t, J = 7.2 Hz, 2 H), 2.41−2.33 (m, 1 H), 2.31−2.23 (m, 1 H), 1.90−1.81 (m, 1 H), 1.58 (qu, J = 7.2 Hz, 2 H), 1.73−1.61 (m, 1 H), 1.47 (sextet, J = 7.2 Hz, 2 H), 0.94 (t, J = 7.2 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 166.8, 145.2, 136.5, 133.6, 130.2, 129.5, 124.2, 122.3, 115.2, 91.8, 77.3, 67.5, 35.6, 31.0, 27.9, 21.9, 18.6, 13.6; FT-IR ($CHCl_3$): 3300 (br), 2262, 1700 m^{-1}; HRMS (EI) Calcd for $C_{18}H_{21}O_2N$: 283.1568. Found: 283.1570.

*3,3-Diethenylisobenzofuran-1-one (**12**).* This product is a known compound[26] and was identified by comparison of its ^{1}H and ^{13}C NMR with that prepared according to a previously reported procedure.[27] Yellow oil, 6.1 mg, 11% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.91 (d, J = 7.4 Hz, 1 H), 7.70 (t, J = 7.4 Hz, 1 H), 7.55 (t, J = 7.4 Hz, 1 H), 7.41 (d, J = 7.4, 1 H), 6.11 (dd, J = 7.4, 11 Hz, 2 H), 5.44 (d, J = 17 Hz, 2 H), 5.32 (d, J = 11 Hz, 2 H); ^{13}C NMR (150 MHz, CD_3CN): δ 169.4, 150.1, 135.8, 134.0, 129.4, 126.1, 125.4, 122.8, 117.2, 88.4; FT-IR ($CHCl_3$): 1763, 1612, 1467 cm^{-1}.

Reaction with *N*-Phenyl Phthalimide with Vinyl Magnesium Bromide. To a stirring solution of *N*-phenyl phthalimide **9** (0.1 mmol) in anhydrous THF (2 mL) was added THF solution of vinylmagnesium bromide (0.3 mmol) at −78 °C. The reaction mixture was slowly warmed to −10 °C overnight. The reaction was quenched with saturated aqueous NH_4Cl solution at −10 °C and extracted with CH_2Cl_2 (three times). The combined organic solution was washed with water, dried over anhydrous Na_2SO_4, and concentrated at the reduced pressure. The crude product was purified by preparative TLC to afford **10** and **11**.

*N-Phenyl-3-ethenyl-3-hydroxyisoindolin-1-one (**10**).* White solid, 11.4 mg, 45% yield; mp = 158−160 °C; ^{1}H NMR (600 MHz, CDCl $_3$): δ 7.66 (d, J = 7.6 Hz, 1 H), 7.56 (t, J = 7.6 Hz, 1 H), 7.55 (d, J = 7.8 Hz, 2 H), 7.48 (d, J = 7.6 Hz, 1 H), 7.42 (d, J = 7.6 Hz, 1 H), 7.34 (t, J = 7.8 Hz, 2 H), 7.25 (t, J = 7.8 Hz, 1 H), 5.76 (dd, J = 17, 10 Hz, 1 H), 5.68 (d, J = 17 Hz, 1 H), 5.32 (d, J = 10 Hz, 1 H); ^{13}C NMR (150 MHz, CD_3CN): δ 166.9, 146.2, 136.0, 135.7, 132.9, 130.3, 129.9, 128.7, 126.6, 125.8, 123.8, 122.7, 118.4, 91.4; FT-IR ($CHCl_3$): 3320 (br), 1697 cm^{-1}; HRMS (EI) Calcd for $C_{16}H_{13}O_2N$: 251.0950. Found: 251.0948.

*N-Phenyl-3-(3-buen-1-yl)-3-hydroxyisoindolin-1-one (**11**).* White solid, 1.7 mg, 6% yield; mp = 114−116 °C; ^{1}H NMR (600 MHz, $CDCl_3$. Because of the apparition of a stereogenic center adjacent to the nitrogen atom, the ^{1}H NMR spectra showed the magnetically nonequivalence of the methylene protons of the homoallyl group, which appears as a classical AB system.): δ 7.71 (d, J = 7.3 Hz, 1 H), 7.63 (t, J = 7.3 Hz, 1 H), 7.61−7.55 (m, 3 H), 7.48 (t, J = 7.3 Hz, 1 H), 7.40 (t, J = 7.4 Hz, 2 H), 7.30 (t, J = 7.4 Hz, 1 H), 5.54−5.46 (m, 1 H), 4.81−4.73 (m, 2 H), 3.34 (s, 1 H), 2.22−2.15 (m, 1 H), 2.12−2.05 (m, 1 H), 1.82−1.74 (m, 1 H), 1.54−1.45 (m, 1 H); ^{13}C NMR (150 MHz, CD_3CN): δ 166.98, 145.9, 136.6, 135.4, 132.9, 131.0, 129.9, 129.0, 127.0, 126.4, 123.9, 121.8, 115.0, 92.9, 34.9, 27.8; FT-IR ($CHCl_3$): 3340 (br), 1698, 1683 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{17}O_2N$: 279.1263. Found: 279.1261.

General Procedure for the CuCl-Catalyzed Isomerization of α-Hydroxy Ynamides (8) to Oxazoles (17). In a dry two-necked round-bottom flask were added α-hydroxy ynamide **8** (0.1 mmol) and CuCl (3.0 mg, 0.03 mmol). The reaction was purged with N_2. Anhydrous DCE (2.0 mL) was added via a syringe. After an hour, the reaction mixture was filtered through a short pad of silica gel with AcOEt as eluent. The filtrate was concentrated in vacuo. The crude product was purified by preparative TLC to afford **17**.

*[2-(5-Butyl-2-oxazolyl)phenyl]-phenylmethanone (**17a**).* Pale yellow oil, 24.7 mg, 81% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.08 (d, J = 7.4 Hz, 1 H), 7.76 (d, J = 7.4 Hz, 2 H), 7.59 (t, J = 7.4 Hz, 1 H), 7.54 (t, J = 7.4 Hz, 1 H), 7.50 (t, J = 7.4 Hz, 1 H), 7.45 (d, J = 7.4 Hz, 1 H), 7.37 (t, J = 7.4 Hz, 2 H), 6.64 (s, 1 H), 2.42 (t, J = 7.5 Hz, 2 H), 1.33 (qu, J = 7.5 Hz, 2 H), 1.19 (sextet, J = 7.5 Hz, 2 H), 0.83 (t, J = 7.5 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 197.3, 158.8, 153.7, 138.4, 137.1, 132.9, 129.9, 129.7, 129.5, 128.3, 128.2, 127.7, 125.7, 123.6, 29.3, 24.9, 21.9, 13.6; FT-IR ($CHCl_3$): 1669, 1598, 1450 cm^{-1}; HRMS (EI) Calcd for $C_{20}H_{19}O_2N$: 305.1421. Found: 305.1418.

*1-[2-(5-Butyl-2-oxazolyl)phenyl]ethanone (**17b**).* Pale yellow oil, 19.5 mg, 80% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.93 (d, J = 7.5 Hz, 1 H), 7.51 (t, J = 7.5 Hz, 1 H), 7.48 (t, J = 7.5 Hz, 1 H), 7.39 (d, J = 7.5 Hz, 1 H), 6.87 (s, 1 H), 2.71 (t, J = 7.7 Hz, 2 H), 1.67 (qu, J = 7.7 Hz, 2 H), 1.41 (sextet, J = 7.7 Hz, 2 H), 0.95 (t, J = 7.7 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 204.2, 158.8, 153.9, 141.1, 130.0, 129.8, 128.1, 126.6, 124.5, 123.9, 30.6, 29.7, 25.2, 22.1, 13.7; FT-IR ($CHCl_3$): 1701, 1696, 1599, 1468 cm^{-1}; HRMS (EI) Calcd for $C_{15}H_{17}O_2N$: 243.1269. Found: 243.1264.

*1-[2-(5-Butyl-2-oxazolyl)phenyl]pentanone (**17c**).* Pale yellow oil, 26.3 mg, 92% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.94 (d, J = 7.7 Hz, 1 H), 7.49 (t, J = 7.7 Hz, 1 H), 7.46 (t, J = 7.7 Hz, 1 H), 7.32 (d, J = 7.7 Hz, 1 H), 6.86 (br.s, 1 H), 2.73−2.66 (m, 4 H), 1.73−1.62 (m, 4 H), 1.44−1.31 (m, 4 H), 0.95 (t, J = 7.2 Hz, 3 H), 0.90 (t, J = 7.5 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 207.0, 141.2, 129.7, 129.6, 127.9, 126.5, 124.4, 123.9, 43.0, 30.0, 26.4, 25.2, 22.3, 22.1, 13.8, 13.7; FT-IR ($CHCl_3$): 1696, 1590, 1467, 1456 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{23}O_2N$: 285.1722. Found: 285.1725.

*1-[2-(5-Butyl-2-oxazolyl)phenyl]-2-methylpropanone (**17d**).* Pale yellow oil, 21.0 mg, 77% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.96 (d, J = 7.5 Hz, 1 H), 7.50 (t, J = 7.5 Hz, 1 H), 7.46 (t, J = 7.5 Hz, 1 H), 7.30 (d, J = 7.5 Hz, 1 H), 6.84 (s, 1 H), 2.92 (septet, J = 7.1 Hz, 1 H), 2.69 (t, J = 7.0 Hz, 2 H), 1.66 (qu, J = 7.0 Hz, 2 H), 1.40 (sextet, J = 7.0 Hz, 2 H), 1.17 (d, J = 7.1 Hz, 6 H), 0.95 (t, J 7.0 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 211.0, 159.0, 153.8, 140.3, 129.5, 127.8, 127.2, 124.5, 123.9, 40.8, 29.6, 25.2, 22.1, 18.6, 13.7; FT-IR ($CHCl_3$): 1696, 1595, 1467 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{21}O_2N$: 271.1566. Found: 271.1569.

*1-[2-(5-Butyl-2-oxazolyl)phenyl]-2,2-dimethylpropanone (**17e**).* Pale yellow oil, 23.6 mg, 83% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.01 (d, J = 7.6 Hz, 1 H), 7.46 (t, J = 7.6 Hz, 1 H), 7.43 (t, J = 7.6 Hz, 1 H), 7.18 (d, J = 7.6 Hz, 1 H), 6.82 (s, 1 H), 2.69 (t, J = 7.4 Hz, 2 H), 1.66 (qu, J = 7.4 Hz, 2 H), 1.40 (sextet, J = 7.4 Hz, 2 H), 1.21 (s, 9 H), 0.95 (t, J = 7.4 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 214.4, 159.0, 153.5, 139.9, 129.3, 128.6, 127.1, 125.8, 124.0, 123.8, 45.1, 29.6, 27.3, 25.3, 22.1, 13.7; FT-IR ($CHCl_3$): 1700, 1687, 1580 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{23}O_2N$: 285.1727. Found: 285.1728.

*1-[2-(5-Cyclopropyl-2-oxazolyl)phenyl]ethanone (**17f**).* Pale yellow solid, 18.4 mg, 81% yield; mp = 64−65 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.91 (d, J = 7.3 Hz, 1 H), 7.50 (t, J = 7.3 Hz, 1 H), 7.47 (t, J = 7.3 Hz, 1 H), 7.38 (d, J = 7.3 Hz, 1 H), 6.85 (s, 1 H), 2.45 (s, 3 H), 1.97−1.91 (m, 1 H), 1.02−0.97 (m, 2 H), 0.86−0.82 (m, 2 H); ^{13}C NMR (150 MHz, CD_3CN): δ 204.2, 158.2, 155.2, 141.0, 129.9, 129.8, 128.0, 126.5, 124.4, 123.0, 30.6, 7.0, 6.5; FT-IR ($CHCl_3$): 1696, 1595, 1350 cm^{-1}; HRMS (EI) Calcd for $C_{14}H_{13}O_2N$: 227.0943. Found: 227.0945.

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*1-[2-(5-Cyclohexyl-2-oxazolyl)phenyl]ethanone (**17g**).* Pale yellow oil, 24.9 mg, 92% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.94 (d, J = 7.7 Hz, 1 H), 7.51 (t, J = 7.7 Hz, 1 H), 7.48 (t, J = 7.7 Hz, 1 H), 7.39 (d, J = 7.7 Hz, 1 H), 6.84 (s, 1 H), 2.75−2.68 (m, 1 H), 2.44 (s, 3 H), 2.07−2.02 (m, 2 H), 1.85−1.79 (m, 2 H), 1.76−1.70 (m, 1 H), 1.47−1.34 (m, 4 H), 1.31−1.23 (m, 1 H); ^{13}C NMR (150 MHz, CD_3CN): δ 204.2, 158.6, 158.3, 141.0, 130.0, 129.8, 128.1, 126.5, 124.6, 122.3, 35.2, 31.1, 30.6, 25.8, 25.6; FT-IR ($CHCl_3$): 1730, 1700, 1696, 1374 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{19}O_2N$: 269.1402. Found: 269.1409.

*1-[2-[5-(1,1-Dimethylethyl)-2-oxazolyl]phenyl]ethanone (**17h**).* Pale yellow oil, 23.2 mg, 95% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (d, J = 7.4 Hz, 1 H), 7.52 (t, J = 7.4 Hz, 1 H), 7.48 (t, J = 7.4 Hz, 1 H), 7.39 (d, J = 7.4 Hz, 1 H), 6.83 (s, 1 H), 2.45 (s, 3 H), 1.33 (s, 9 H); ^{13}C NMR (150 MHz, CD_3CN): δ 204.0, 161.8, 158.8, 141.0, 130.0, 129.9, 128.2, 126.5, 124.6, 121.3, 31.5, 30.6, 28.7; FT-IR ($CHCl_3$): 1699, 1585, 1464 cm^{-1}; HRMS (EI) Calcd for $C_{15}H_{17}O_2N$: 243.1247. Found: 243.1253.

*1-[2-(5-Phenyl-2-oxazolyl)phenyl]ethanone (**17i**).* White solid, 25.9 mg, 98% yield; mp = 87−88 °C; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.06 (d, J = 7.7 Hz, 1 H), 7.68 (d, J = 7.2 Hz, 2 H), 7.56 (t, J = 7.7 Hz, 1 H), 7.53 (t, J = 7.7 Hz, 1 H), 7.49−7.41 (m, 4 H), 7.36 (t, J = 7.2 Hz, 1 H), 2.52 (s, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 204.2, 159.4, 152.0, 141.3, 130.3, 130.1, 129.0, 128.7, 128.3, 127.6, 126.6, 124.2, 124.0, 123.6, 30.8; FT-IR ($CHCl_3$): 1696, 1490, 1360 cm^{-1}; HRMS (EI) Calcd for $C_{17}H_{13}O_2N$: 263.0950. Found: 263.0948.

*1-[2-[5-(3-Buten-1-yl)-2-oxazolyl]phenyl]ethanone (**17l**).* White brown oil, 22.7 mg, 80% yield; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (dd, J = 7.6, 1.2 Hz, 1 H), 7.50 (td, J = 7.6, 1.2 Hz, 1 H), 7.46 (td, J = 7.6, 1.2 Hz, 1 H), 7.32 (dd, J = 7.6, 1.2 Hz, 1 H), 6.84 (s, 1 H), 5.90−5.81 (m, 1 H), 5.06−5.01 (m, 1 H), 4.99−4.96 (m, 1 H), 2.83−2.79 (m, 2 H), 2.69 (t, J = 7.4 Hz, 2 H), 2.52−2.46 (m, 2 H), 1.66 (qu, J = 7.4 Hz, 2 H), 1.41 (sextet, J = 7.4 Hz, 2 H), 0.95 (t, J = 7.4 Hz, 3 H); ^{13}C NMR (150 MHz, CD_3CN): δ 206.0, 158.8, 153.8, 140.9, 137.2, 129.7, 127.8, 126.5, 124.3, 123.9, 115.1, 42.4, 29.6, 28.4, 25.2, 22.1, 13.7; FT-IR ($CHCl_3$): 1700, 1595 cm^{-1}; HRMS (EI) Calcd for $C_{18}H_{21}O_2N$: 283.1579. Found: 283.1576.

■ ASSOCIATED CONTENT

Supporting Information

The Supporting Information is available free of charge on the ACS Publications website at DOI: 10.1021/acs.joc.6b00888.

Optimization conditions for the formation of Oxazole **17a**; ^{1}H and ^{13}C NMR spectra for all new compounds; Cartesian coordinates, energies, and NBO charges for computational studies (PDF)

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Notes

The authors declare no competing financial interest.

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