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[3 + 2]-Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles: A Rapid Entry to Oxazolines

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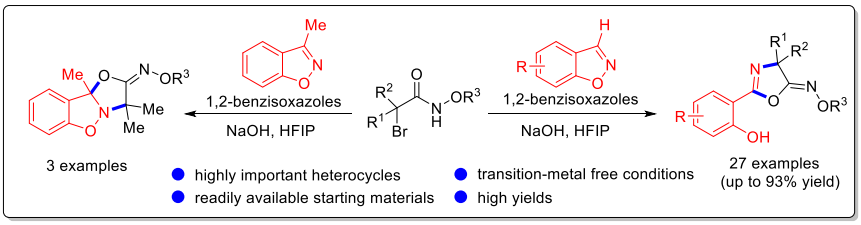


ABSTRACT: A novel and efficient [3+2] cycloaddition reaction of azaoxyallyl cations and 1,2-benzisoxazoles to give oxazoline derivatives has been developed. The transformation provides a rapid entry to functionalized oxazoline scaffolds under mild and transition-metal free conditions, which will greatly expand the reaction types of heterocycle chemistry and pave the way for syntheses of bioactive compounds.

INTRODUCTION

Oxazolines are privileged structural motifs widely distributed in natural products and pharmaceutics.[1] Development of novel and efficient methods for their synthesis has received considerable attention. Among the synthetic approaches, cycloaddition reactions display distinct advantages because they involve the formation of multiple bonds in a single step.[2]

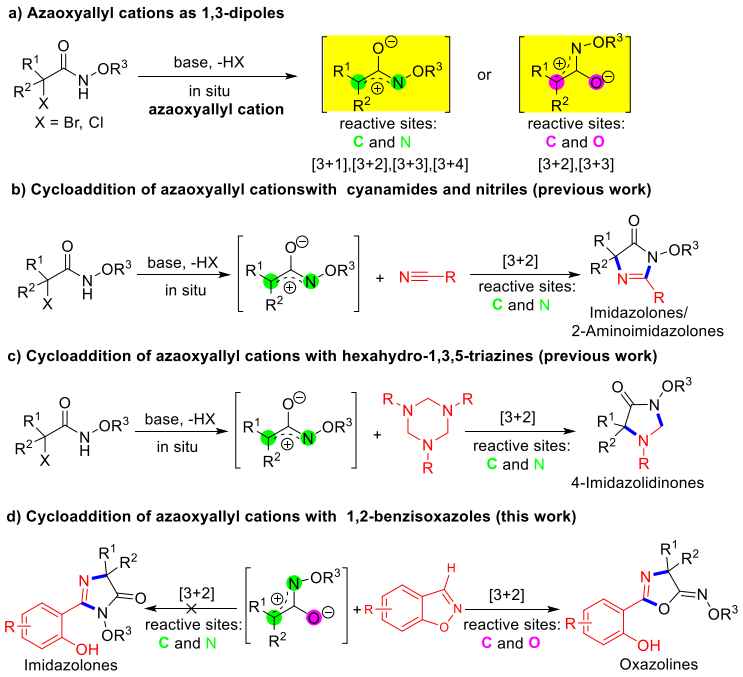
Azaoxyallyl cations, generated *in situ* from α-halo hydroxamates, have been extensively applied in cycloaddition reactions as highly efficient 3-atom units.[3] Recently, a series of azaoxyallyl cations involved [3+1]-,[4] [3+2]-,[5] [3+3]-[6] and [3+4]-[7] cycloaddition reactions have been well developed, which enable facile synthesis of four to seven-membered heterocyclic scafolds (Scheme 1a). It is important to note that azaoxyallyl cations could be coupled with different cycloaddition partners either via the C and O termini or via the C and N as reactive sites, affording the corresponding *O*-alkylated or *N*-alkylated products. In 2018, the annulation reactions between azaoxyallyl cations and nitriles or cyanamides to give imidazolones or 2-aminoimidazolones were reported by Wu and co-workers (Scheme 1b).[5f] Later, Sun and co-workers (Scheme 1c)[5g] established that 4-imidazolones could be prepared through a cycloaddition reaction of azaoxyallyl cations and hexahydro-1,3,5-triazines. While pioneer synthetic approaches mainly focused on exploration of *N*-alkylated frameworks, *O*-alkylated

cycloadditions occurred only in some special cases. In 2016, Jeffrey and co-workers disclosed that [3+2] cycloaddition reaction of azaoxyallyl cations with carbonyl compounds proceeded by initial *O*-alkylation followed by rearrangement to the 4-oxazolidinone.[5e] Moreover, the Zhao's research group reported cycloaddition reactions of the azaoxyallyl cations, in which C and O termini were involved for the bond formations.[8] Despite these elegant methods, further exploration of new *O*-alkylated approaches is still highly desirable.

On the other hand, benzisoxazole is a synthetically important and useful motif, characterized by the notable nucleophilicity of its nitrogen atom. For example, Tang[9] and others[10] reported that 1,2-benzisoxazoles usually served as a unique class of aza-[2C]-components in annulation reactions, generating highly valuable scaffolds through cleaving N-O bond.

Consequently, we envisioned that [3+2]-cycloaddition reaction of azaoxyallyl cations with 1,2-benzisoxazoles would deliver imidazolones derivatives (Scheme 1d). However, the originally proposed chemistry failed to work as expected. Instead, a novel cycloaddition was discovered in practice, affording *O*-alkylated oxazolines as products (Scheme 1d).

Scheme 1. [3+2] Cycloaddition of Azaoxyallyl Cation with Nitrogen Nucleophiles

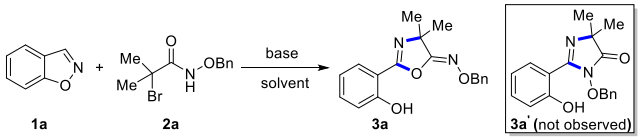


RESULTS AND DISCUSSION

We began our feasibility studies by examining the reaction between 1,2-benzisoxazole **1a** (1.0 equiv) and α-halo hydroxamate **2a** (1.0 equiv) with Na_2CO_3 in HFIP at room temperature (Table 1, entry 1). The results showed that the expected *N*-alkylated imidazolone derivative **3a'** was not observed. Herein, a new oxazoline derivative **3a** was detected in 32% yield by careful analysis of the NMR spectroscopic data. This discovery encouraged us to explore furtherly on this

subject, since azaoxyallyl cations underwent C-O annulation reactions to provide new nitrogen heterocycles. Moreover, the resulting *O*-alkylated oxazoline derivatives represent an important class of unique heterocycles because of their potential bioactivities.

Table 1. Optimization of Reaction Conditions [a]

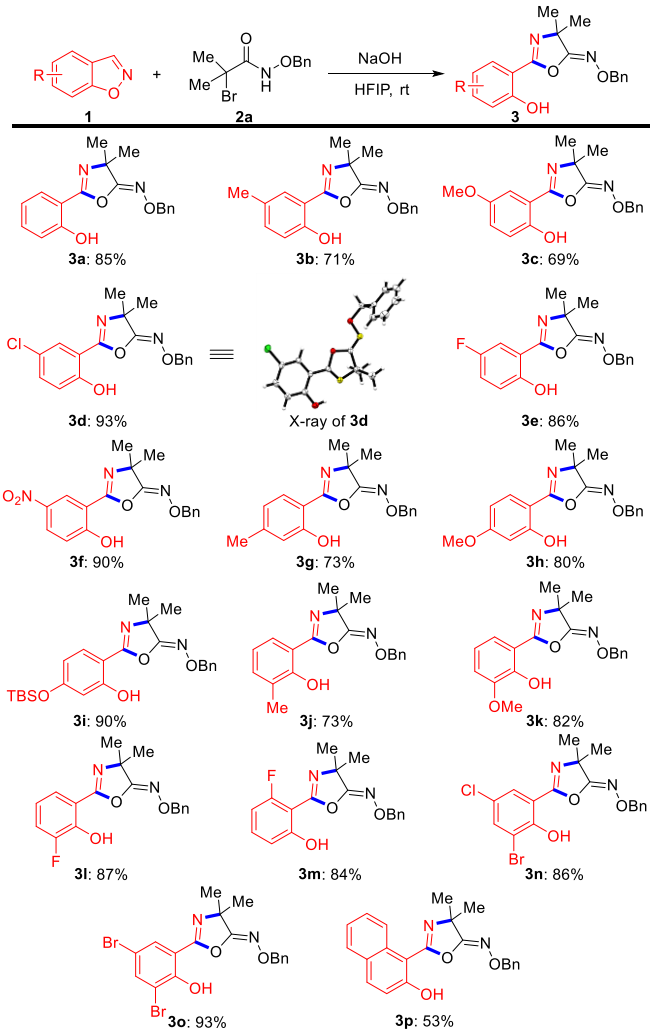


Entry	Base	Solvent	Time (h)	Yield [b] (%)
1	Na_2CO_3	HFIP	1	32 [c]
2	Na_2CO_3	HFIP	1	83
3	Na_2CO_3	THF	24	trace
4	Na_2CO_3	CH_2Cl_2	24	trace
5	Na_2CO_3	toluene	24	NR
6	Na_2CO_3	DMF	24	NR
7	Na_2CO_3	DCE	24	NR
8	Na_2CO_3	*i*-PrOH	24	NR
9	Na_2CO_3	MeOH	24	NR
10	Na_2CO_3	TFE	1	38
11	$NaHCO_3$	HFIP	24	21
12	K_2CO_3	HFIP	1	71
13	Cs_2CO_3	HFIP	1	68
14	**NaOH**	**HFIP**	**1**	**85**
15	*t*-BuOK	HFIP	1	70
16	DBU	HFIP	1	62
17	Et_3N	HFIP	1	60
18	DMAP	HFIP	1	75

[a]Reaction conditions: **1a** (0.20 mmol), **2a** (0.40 mmol), base (0.40 mmol) and solvent (1.5 mL). [b]Isolated yield. [c]**1a** (0.20 mmol), **2a** (0.20 mmol), base (0.20 mmol). NR = No Reaction. HFIP = 1,1,1,3,3,3-hexafluoroisopropanol, THF = tetrahydrofuran, DMF = N,N-dimethylformamide, DCE = dichloroethane, TFE = 2,2,2-trifluoroethanol, DBU = 1,8-diazabicyclo[5.4.0]undec-7-ene, DMAP = 4-dimethylaminopyridine.

To improve the efficiency of the above transformations, we conducted a systematic screening of the reaction conditions with **1a** and **2a** as model substrates (Table 1). To our gratification, a notable improvement was obtained by increasing the loading amount of **2a** and Na_2CO_3, affording **3a** in 83% yield (entry 2). Next, the effect of solvent was examined. Unfortunately, only a trace amount of **3a** was obtained by using THF and DCM as the reaction media (entries 3 and 4), while other solvents such as toluene, DMF, DCE, *i*-PrOH, MeOH and TFE were not suitable for this reaction and rendered no conversion (entries 5-10). It was found that the base had a notable influence on the outcomes. After screening a number of inorganic bases (entries 11-14), NaOH gave the best result, providing **3a** in 85% yield. Reactions carried out with organic bases (entries 15-18) failed to enhance the yields.

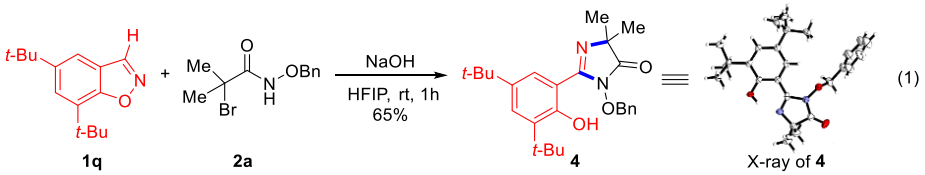
Scheme 2. Scope of 1,2-Benzisoxazoles [a,b]



[a]Reaction conditions: **1** (0.20 mmol), **2a** (0.40 mmol) and NaOH (0.40 mmol) in HFIP (1.5 mL) at rt for 1h. [b] Isolated yield.

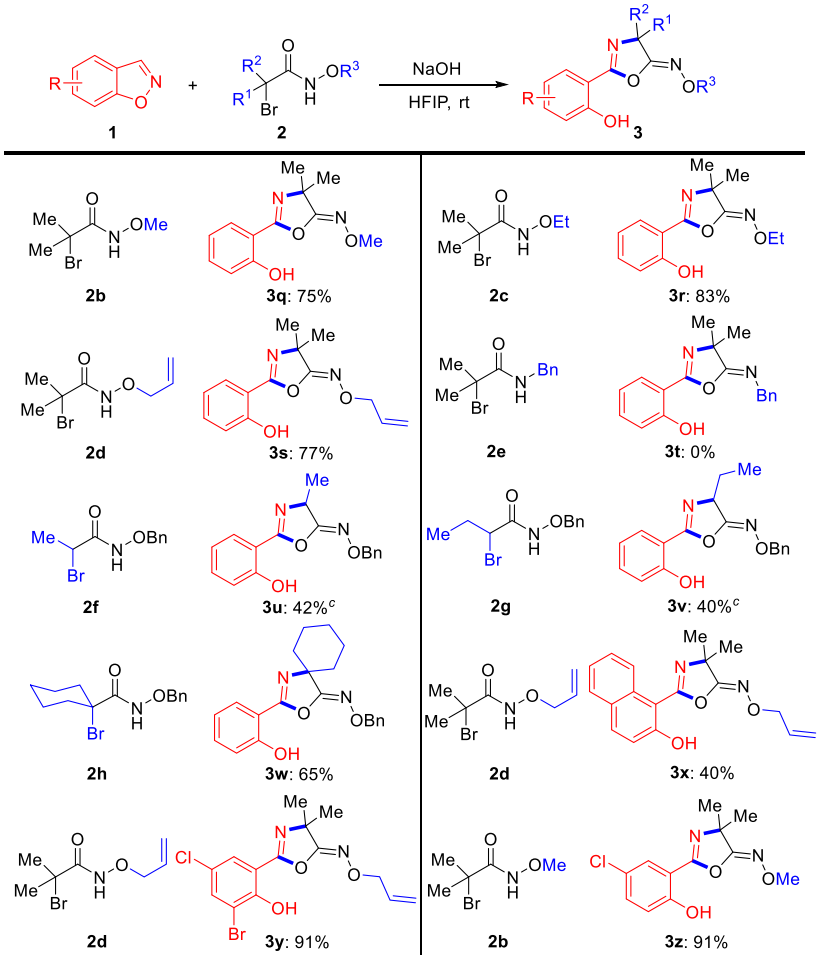
Having established the optimal reaction conditions, we sought to explore the scope of the reaction with different 1,2-benzisoxazoles. As shown in Scheme 2, the reactions of α-halo hydroxamate **2a** with a range of 1,2-benzisoxazoles were carried out, which provided corresponding products in good to excellent yields. The substituted 1,2-benzisoxazoles, either bearing electron-donating or -withdrawing substituents could undergo the transformations smoothly to afford the corresponding products (**3b-3f**) in 69-93% yields. The structure of **3d** was unambiguously determined by X-ray crystallography.[11] Additionally, 1,2-benzisoxazoles (**1g-m**) bearing various substitutes (6-Me, 6-OMe, 6-OTBS, 7-Me, 7-OMe, 7-F, 4-F) underwent the cycloaddition reaction to give products in good to excellent yields (73-90%). Also, we found that 5,7-disubstituted substrates were amenable to this reaction, affording oxazolines **3n** and **3o** in 86% and 93% yields, respectively. Moreover, this transformation could also be extended to the 1,2-benzisoxazole bearing aromatic ring substituent, as shown by the case of **3p**.

Figure 1. X-ray Structure of Product 4



Curiously, the reaction with *t*-butyl-disubstituted 1,2-benzisoxazole led to *N*-alkylated product **4** in 65% yield (Figure 1). The distinct reactivity will be discussed later. The structure of **4** was unambiguously confirmed by X-ray crystallography.[11]

Table 2. Scope of α-Halo Hydroxamates [a,b]

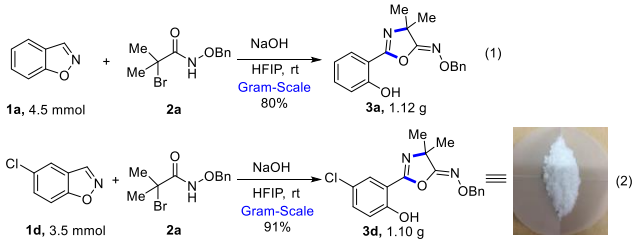


[a]Reaction conditions: **1** (0.20 mmol), **2** (0.40 mmol) and NaOH (0.40 mmol) in HFIP (1.5 mL) at rt for 1h. [b]Isolated yield. [c]at 60 °C for 10h.

Next, the scope of α-halohydroxamate partner was also systematically evaluated, as shown in Table 2. Hydroxamates with various *N*-protecting groups (**2b-d**) such as methoxy, ethoxy and allyloxy worked well in this reaction, delivering oxazolines (**3q**-**s**) in 75-83% yields. Unfortunately, no desired cycloaddition product was observed with *N*-benzyl-2-bromo-2-methylpropanamide (**2e**) as substrate. The plausible reason is that the *N*-benzyl substituent is not sufficient enough to stabilize the azaoxyallyl cation.[6g,7c,12] The reaction with α-halo hydroxamates bearing monoalkyl groups (-Me, -Et) displayed low reactivity, affording **3u** and **3v** in 42% and 40% yields at an elevated temperature and a longer reaction time.

Additionally, cyclohexyl-substituted hydroxamate **2h** was also compatible, giving **3w** in 65% yield. Moreover, some other combinations of 1,2-benzisoxazoles and α-halohydroxamates tolerated well in this transformation (**3x-3z**), providing functionalized oxazolines.

Scheme 3. Gram-Scale Experiments[a]

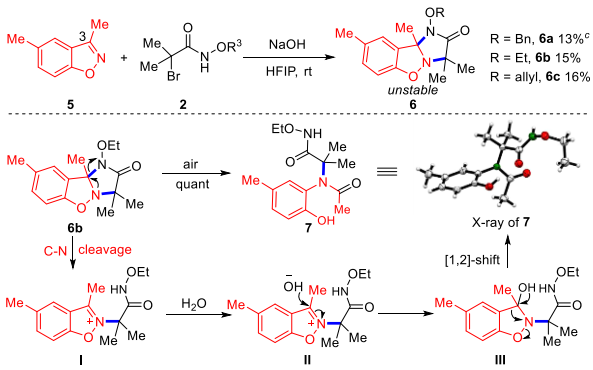


[a]The image in scheme 3 was photographed by Juan Feng.

In order to showcase the potential practicality of this method, two large-scale reaction of **1a** (4.5 mmol) and **1d** (3.5 mmol) with **2a** were performed, the desired products **3a** (1.12 g) and **3d** (1.10 g) were isolated in 80% and 91% yields under the optimized conditions (Scheme 3, eq 1 and eq 2).

As extension of our study, the cycloaddition of 3-methyl-substituted 1,2-benzoisoxazoles **5** with α-halo hydroxamates **2** was also investigated (Scheme 4). It was found that the reaction was sensitive to the R_3-substituent of 1,2-benzoisoxazole. Actually, substrates bearing a methyl group at the C-3 position gave inferior results and provided tricyclic imidazolones only in 13-16% yields.[5e,6e]

Scheme 4. Scope of α-Halo Hydroxamates [a,b]

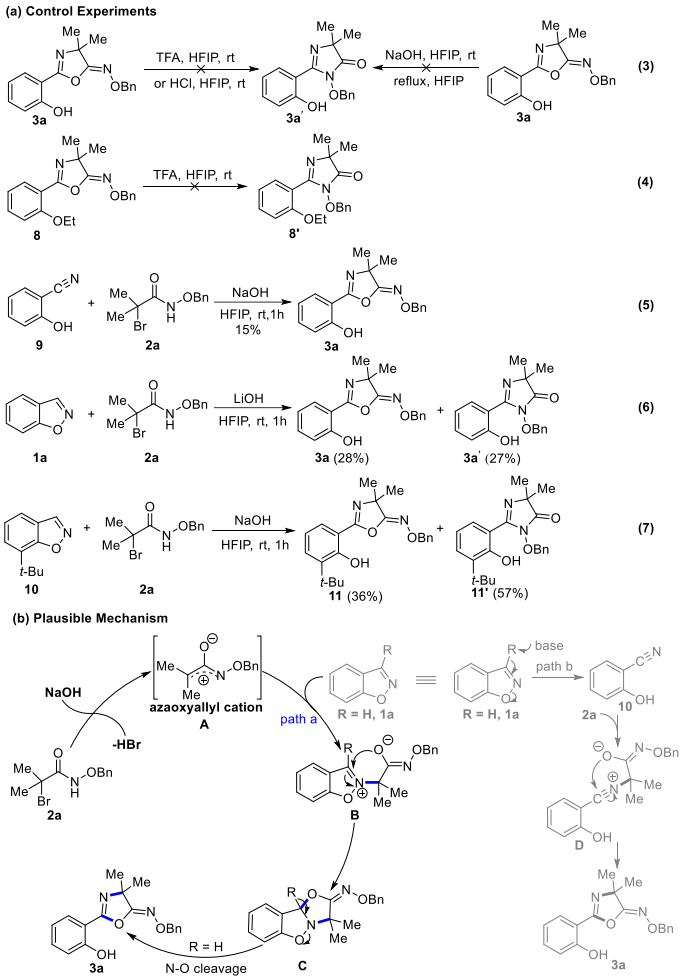


[a]Reaction conditions: **5** (0.20 mmol), **2** (0.40 mmol) and NaOH (0.40 mmol) in HFIP (1.5 mL) at rt for 1h. [b]Isolated yield. [c]at 60 °C for 2h.

However, we were surprised to find that the tricyclic imidazolone derivative **6b** could be converted to the amide **7** in nearly quant yield upon exposure to air, whereas **6a** and **6c** decomposed slowly in the same condition and afforded only trace amides (results not shown). The structure of **7** was characterized by X-ray diffraction (Scheme 4).[11] Mechanistically,

isolation of amide **7** suggested a mechanism involving cleavage of the C-N bond under condition of trace amount of water, followed by [1,2]-shift process.

Scheme 5. Control Experiments and Plausible Mechanisms



Since both oxazoline products and imidazolone products could be detected in our reaction processes, to further explore the mechanism of this reaction, several control experiments were carried out. At first, when **3a** was treated with acid (trifluoroacetic acid or hydrochloric acid) or base (NaOH) at room temperature, or refluxed in HFIP for a long time, no *N*-alkylated product **3a**′ was detected (Scheme 5a, eq 3). Others have also observed some *O*-cyclization products failed to rearrange to *N*-cyclization products,[5e, 5f] which suggested that the stability of the products dramatically slowed the rearrangement. We suspected that the failed rearrangement might arise from hydrogen bond between the hydroxyl and the N atom in the oxazoline products. Unfortunately, the protected oxazoline failed to rearrange via acid catalysis (Scheme 5a, eq 4). We proposed an alternative mechanism (Scheme 5b, path b) involving a Kemp isomerization of the benzisoxazole to 2-hydroxybenzonitrile **9**[13], which could then form cycloadduct **3a**. However, when 2-hydroxybenzonitrile **9** was tested under standard conditions, only 15% yield of **3a** was observed (Scheme 5a, eq 5). At this point, the process benzisoxazole

1a could convert to **3a** via intermediate benzonitrile **9** might be ruled out. It indicated that benzisoxazoles displayed unique reactivity in cycloadditon reactions. However, upon treatment with LiOH, oxazoline **3a** and imidazolone **3a'** were both obtained in 28% and 27% yields, respectively (Scheme 5a, eq 6). At the moment, it's unclear why oxazoline products were main products, the unexpected reactivity of benzisoxazole and effect of base might result in *O*-alkylation process. Finally, *t*-Butyl-substituted 1,2-benzisoxazole was prepared to further explore the reaction, a mixture of **11** and **11'** was obtained (Scheme 5a, eq 7). Based on our previous control experiments, we speculated that steric bulk of substrate and base used in this reaction both had effect on formation of *N*-alkylated product **4**.

On the basis of the above control experiments, a plausible mechanism was proposed as illustrated in Scheme 5b. Thus, the cycloaddition of α-halohydroxamate **2a** and 1,2-benzisoxazole **1a** could occur through path a. Azaoxyallyl cation intermediate **A**, once in situ generated from α-halohydroxamate **2a** under basic conditions could react with 1,2-benzisoxazole **1a** to form zwitterionic intermediate **B**. Next, intramolecular nucleophilic addition of **B** afforded oxygen-tricycle **C**, followed by cleavage of the N-O bond to give the final product **3a**.

CONCLUSION

In summary, a highly novel and effective [3+2] cycloaddition reaction between in situ generated azaoxyallyl cations and 1,2-benzisoxazoles has been developed, which provides a useful method for access of a series of new oxazoline derivatives in excellent yields. More significantly, this transformation was conducted under transition metal free conditions. The biological activity of these oxazolines and further application of these strategies are currently underway in our laboratory.

EXPERIMENTAL SECTION

General Information.

^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra were recorded on Bruker AV300 spectrometer. TMS was used as internal standard for ^{1}H NMR (7.26 ppm), and solvent signal was used as reference for ^{13}C NMR ($CDCl_3$, 77.16 ppm). Chemical shift values (δ) are expressed in ppm downfield relative to internal standard (tetramethylsilane at 0 ppm). Multiplicities are indicated as s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), brs (broad singlet), td (triple doublet) and qd (quarter doublet). Coupling constants are reported in hertz (Hz). Analytical thin layer chromatography (TLC) was performed on SILICYCLE pre-coated TLC plates (silica gel 60 F-254, 0.25 mm). Visualization was accomplished with UV light and/or KMnO4 staining solutions. For chromatographic purification, 200-300 mesh silica gel (Qingdao, China) was employed. Infrared spectra (IR) were recorded on a Thermo Scientific Nicolet iS5 FT-IR spectrophotometer and reported as wavelength numbers (cm^{-1}). Melting points were determined using a Stanford Research Systems DigiMelt MPA-160 capillary melting point apparatus. Solvent purification was conducted according to Purification of Laboratory Chemicals (Peerrin, D. D.; Armarego, W. L. and Perrins, D. R., Pergamon Press: Oxford, 1980). Yields refer to chromatographically and spectroscopically (^{1}H NMR)

homogeneous materials. The HRMS measurements were recorded on ICR (Fourier transform ion cyclotron resonance, FTICR) analyzer using an ESI source.

General Procedures for Synthesis of 1, 2-Benzisoxazoles.[9,10b,14] A mixture of Ph_3P (1.5 mmol, 1.5 equiv) and DDQ (1.5 mmol, 1.5 equiv) in dry CH_2Cl_2 (5 mL) was stirred at room temperature for 1 min. Salicylaldoxime (1.0 mmol, 1.0 equiv) was then added. The color of the reaction mixture changed from green to brown in 1 min. GC or TLC monitoring showed completion of the reaction, and the solvent was evaporated. Column chromatography of the crude mixture on silica gel using *n*-hexane and ethyl acetate (20:1) as eluent gave the desired 1,2-benzisoxazoles. All of the 1,2-benzisoxazoles compounds **1a-1p** were prepared according to literature procedures [14a] and the data were matched with reported values.[9,10b,14]

General Procedures for Synthesis of α-Halo Hydroxamates.[5b,5h,6b,7a] To a suspension of the O-benzyloxyamine hydrochloride or benzylamine (3.0 mmol, 1.0 equiv) and triethylamine (3.0 mmol, 1.0 equiv) in CH_2Cl_2 (0.25 M) was added dropwise the alpha-haloacid halide (3.0 mmol, 1.0 equiv) at 0 °C. The reaction mixture was stirred at this temperature until TLC analysis revealed complete consumption of starting material. The mixture was warmed to room temperature and quenched with water. The organic phase was washed 3x with water, dried over sodium sulfate, filtered and evaporated. Purification via flash column chromatography (CH_2Cl_2) provided the α-halohydroxamates as colorless solids. All of the α-halohydroxamates **2a-2h** were prepared according to literature procedures [7a] and the data were matched with reported values.[5b,7a,6b]

General Procedures for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles. A mixture of 1,2-benzisoxazole **1** (0.20 mmol, 1.0 equiv), α-bromoamide **2** (0.40 mmol, 2.0 equiv) and NaOH (16.0 mg, 0.40 mmol, 2.0 equiv) was added HFIP (1.5 mL) and stirred at room temperature for 1 h. After consumption of the 1,2-benzisoxazole **1** monitored by TLC analysis, the reaction mixture was filtered. Removal of the solvent under vacuum, the resulting residue submitted to flash chromatography (SiO_2, hexane/EtOAc) to obtain the corresponding oxazoline derivative **3**.

Experimental Procedure for Scaling Up Reaction. a) A mixture of 1,2-benzisoxazole **1a** (535.5 mg, 4.5 mmol, 1.0 equiv), α-bromoamide **2a** (2.439 g, 9.0 mmol, 2.0 equiv) and NaOH (360.0 mg, 9.0 mmol, 2.0 equiv) was added HFIP (33.0 mL) and stirred at room temperature for 1 h. After consumption of the 1,2-benzisoxazole **1a** monitored by TLC analysis, the reaction mixture was filtered. Removal of the solvent under vacuum, the resulting residue was submitted to flash chromatography (SiO_2, hexane/EtOAc) to obtain the corresponding oxazoline **3a** (1.12 g, 80%). **b)** A mixture of 1, 2-benzisoxazole **1d** (535.5 mg, 3.5 mmol, 1.0 equiv), α-bromoamide **2a** (1.897 g, 7.0 mmol, 2.0 equiv) and NaOH (280 mg, 7.0 mmol, 2.0 equiv) was added HFIP (26.0 mL) and stirred at room temperature for 1 h. After consumption of the 1,2-benzisoxazole **1d** monitored by TLC analysis, the reaction mixture was filtered. Removal of the solvent under vacuum, the

resulting residue was submitted to flash chromatography (SiO_2, hexane/EtOAc) to obtain the corresponding oxazoline **3d** (1.096 g, 91%).

Experimental Procedure for Synthesis of 7. The oxazoline derivate **6b** (10.0 mg, 0.036 mmol) was concentrated to remove the solvent under vacuum, which was upon exposure to air over 3 days, affording the amide **7** (10.6 mg, 0.036 mmol) in nearly quant yield.

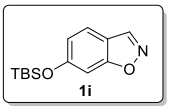
Experimental Procedure for Control Experiments.

A mixture of 2-hydroxybenzonitrile **9** (24.0 mg, 0.20mmol, 1.0 equiv), α-bromoamide **2a** (108.0 mg, 0.40 mmol, 2.0 equiv) and NaOH (16.0 mg, 0.4 mmol, 2.0 equiv) was added HFIP (1.5 mL) and stirred at room temperature for 1 h. After consumption of the 2-hydroxybenzonitrile **9** monitored by TLC analysis, the reaction mixture was filtered. Removal of the solvent under vacuum, the resulting residue was submitted to flash chromatography (SiO_2, hexane/EtOAc) to obtain the corresponding oxazoline **3a** (9.3 mg, 0.03 mmol, 15%).

A mixture of 1,2-benzisoxazole **1a** (24.0 mg, 0.20 mmol, 1.0 equiv), α-bromoamide **2a** (108.0 mg, 0.40 mmol, 2.0 equiv) and LiOH (9.6 mg, 0.4 mmol, 2.0 equiv) was added HFIP (1.5 mL) and stirred at room temperature for 1 h. After consumption of the 1,2-benzisoxazole **1a** monitored by TLC analysis, the reaction mixture was filtered. Removal of the solvent under vacuum, the resulting residue was submitted to flash chromatography (SiO_2, hexane/EtOAc) to obtain the corresponding oxazoline **3a** (17.1 mg, 28%) and imidazolone **3a**′ (16.7 mg, 27%).

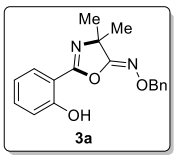
Characterization Data for the Products.

Note: 1,2-Benzisoxazoles **1a**,[14a] **1b**,[9] **1c**,[14b] **1d**,[9] **1e**,[9] **1f**,[14b] **1g**,[14c] **1h**,[14c] **1j**,[14d] **1k**,[14a] **1l**,[14b] **1m**,[14b] **1n**,[14b] **1o**,[10b] **1p**,[14a] and **1q**[14b] are known compounds and the data were matched with reported values. Thus, their ^{1}H-NMR, ^{13}C-NMR and GC-MS data are not provided. The 1,2-Benzisoxazoles **1i** is a new compound, and its spectroscopic data is provided below.



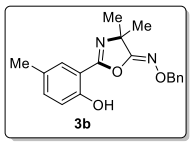
1i

6-((tert-butyldimethylsilyl)oxy)benzo[d]isoxazole (1i): The product was obtained as a colorless oil. IR νmax (film): 2929, 2858, 1615, 1481, 1301 cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 8.57 (s, 1H), 7.54 (d, J = 8.6 Hz, 1H), 7.02 (s, 1H), 6.85 (dd, J = 8.5, 1.7 Hz, 1H), 1.00 (s, 10H), 0.24 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 163.9, 158.5, 146.0, 122.1, 118.6, 115.6, 100.3, 25.7, 18.4, -4.32 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{13}H_{20}NO_2Si$ 250.1259; found: 250.1258.



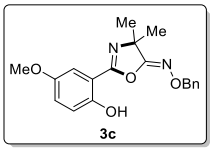
3a

(Z)-2-(2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3a). By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (24.0 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3a** as a yellow white solid (52.7 mg, 0.170 mmol, 85 %). mp 78-80 °C; IR ν_{max} (film): 2928, 1703, 1642, 1617, 1489, 1373, 1331, 1305, 1255, 1227, 1194 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.16 (s, 1H), 7.80 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.49-7.29 (m, 6H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.92 (t, *J* = 7.6 Hz, 1H), 5.13 (s, 2H), 1.53 (d, *J* = 1.1 Hz, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.5, 160.1, 157.8, 137.3, 134.4, 128.6, 128.5, 128.5, 128.2, 119.3, 117.1, 109.2, 77.2, 67.39, 28.11 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}N_2O_3$ 311.1392; found: 311.1390.



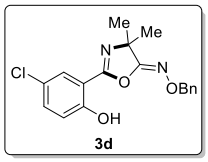
3b

(Z)-2-(2-hydroxy-5-methylphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3b). By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1b** (26.6 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3b** as a white solid (46.0 mg, 0.142 mmol, 71 %). mp 110-112 °C; IR νmax (film): 2921, 1696, 1646, 1620, 1494, 1450, 1290, 1258 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 10.96 (s, 1H), 7.56 (d, *J* = 2.2 Hz, 1H), 7.47-7.28 (m, 5H), 7.21 (dd, *J* = 8.4, 2.3 Hz, 1H), 6.92 (d, *J* = 8.5 Hz, 1H), 5.13 (s, 2H), 2.28 (s, 3H), 1.51 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.5, 157.9, 157.8, 137.3, 135.3, 128.5, 128.5, 128.5, 128.2, 128.1, 116.9, 108.7, 77.2, 67.3, 28.1, 20.4 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_3$ 325.1544; found: 325.1547.



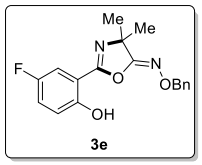
3c

(Z) -2-(2-hydroxy-5-methoxyphenyl)-4,4-dimethyloxazol-5(4H)-one O- benzyl oxime (3c). By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1c** (29.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3c** as a white solid (46.9 mg, 0.138 mmol, 69 %). mp 131-133 °C; IR νmax (film): 2940, 1700, 1643, 1614, 1493, 1447, 1381, 1295, 1232 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 10.83 (s, 1H), 7.49-7.32 (m, 5H), 7.24 (d, *J* = 3.0 Hz, 1H), 7.05 (dd, *J* = 9.0, 3.0 Hz, 1H), 6.98 (d, *J* = 9.1 Hz, 1H), 5.14 (s, 2H), 3.79 (s, 3H), 1.54 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.4, 157.7, 154.5, 152.3, 137.3, 128.6, 128.5, 128.2, 122.3, 118.1, 111.2, 108.7, 77.2, 67.4, 56.2, 28.12 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_4$ 341.1498; found: 341.1496.



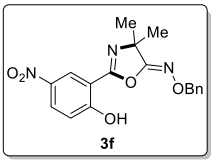
3d

(Z)-2-(5-chloro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3d): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1d** (30.6 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3d** as a white solid. (64.0 mg, 0.186 mmol, 93 %). mp 136-138 °C; IR νmax (film): 2985, 1696, 1651, 1616, 1480, 1452, 1333，1283, 1223 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.17 (s, 1H), 7.77 (d, *J* = 2.6 Hz, 1H), 7.49-7.32 (m, 6H), 6.99 (d, *J* = 8.9 Hz, 1H), 5.15 (s, 2H), 1.54 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 159.6, 158.6, 157.1, 137.1, 134.3, 128.6, 128.5, 128.2, 127.7, 124.1, 118.7, 110.1, 77.3, 67.5, 28.0 ppm. HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{18}ClN_2O_3$ 345.0998; found: 345.1000.



3e

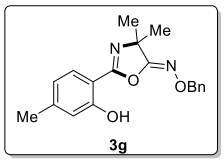
(Z)-2-(5-fluoro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3e): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1e** (27.4 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3e** as a white solid (56.4 mg, 0.172 mmol, 86%). mp 94-96 °C; IR νmax (film): 2980, 1694, 1649, 1627, 1489, 1342, 1279, 1223 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 10.97 (s, 1H), 7.52-7.32 (m, 6H), 7.15 (ddd, *J* = 9.0, 7.9, 3.2 Hz, 1H), 6.99 (dd, *J* = 9.1, 4.4 Hz, 1H), 5.14 (s, 2H), 1.55 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 159.8 (d, *J* = 3.0 Hz), 157.3, 155.4 (d, *J* = 237.0 Hz), 156.3 (d, *J* = 1.5 Hz), 137.2, 128.5, 128.5, 128. 2, 121.6 (d, *J* = 23.3 Hz), 118.4 (d, *J* = 7.5 Hz), 114.0 (d, *J* = 25.5 Hz), 109.1 (d, *J* = 8.3 Hz), 77.2, 67.6, 28.0 ppm; ^{19}F NMR ($CDCl_3$, 282 MHz): δ = -124.10--124.17 (m) ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{18}FN_2O_3$ 329.1291; found: 329.1296.



3f

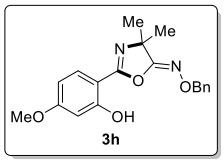
(Z)-2-(2-hydroxy-5-nitrophenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3f): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1f** (32.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5

mL) afforded product **3f** as a white solid (64.1 mg, 0.181 mmol, 90 %). mp 139-141 °C; IR νmax (film): 2979, 1700, 1650, 1578, 1524, 1477.01, 1339, 1296, 1265, 1221cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 12.09 (s, 1H), 8.72 (d, *J* = 2.8 Hz, 1H), 8.31 (dd, *J* = 9.2, 2.7 Hz, 1H), 7.50-7.29 (m, 5H), 7.13 (d, *J* = 9.3 Hz, 1H), 5.13 (s, 2H), 1.55 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 164.9, 159.6, 156.3, 140.2, 137.0, 129.6, 128.7, 128.6, 128.4, 125.2, 118.1, 109.1, 77.5, 67.7, 28.1 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{18}N_3O_5$ 356.1240; found: 356.1241.



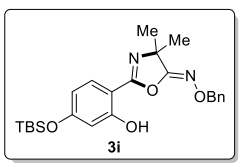
3g

(Z)-2-(2-hydroxy-4-methylphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3g). By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1g** (26.6 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3g** as a yellow oil (47.3 mg, 0.144 mmol, 73 %); IR νmax (film): 2929, 1695, 1641, 1573, 1508, 1337, 1306, 1263, 1193 cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ =11.12 (s, 1H), 7.70 (d, *J* = 8.0 Hz, 1H), 7.50-7.30 (m, 5H), 6.88 (s, 1H), 6.75 (s, 1H), 5.16 (s, 2H), 2.38 (s, 3H), 1.55 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 160.5, 160.0, 158.0, 145.6, 137.3, 128.5, 128.5, 128.3, 128.1, 120.5, 117.4, 106.5, 77.1, 67.2, 28.1, 22.0 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_3$ 325.1549; found: 325.1547.



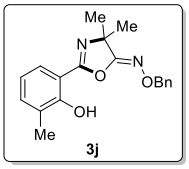
3h

(Z)-2-(2-hydroxy-4-methoxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3h): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1h** (29.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3h** as a white solid (54.5 mg, 0.160 mmol, 80 %). mp 116-118 °C; IR νmax (film): 2938, 1683, 1628, 1575, 1507, 1355, 1270, 1203, 1190cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 11.33 (s, 1H), 7.69 (d, *J* = 8.8 Hz, 1H), 7.52-7.29 (m, 5H), 6.54 (d, *J* = 2.4 Hz, 1H), 6.48 (dd, *J* = 8.8, 2.4 Hz, 1H), 5.13 (s, 2H), 3.82 (s, 3H), 1.52 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 164.7, 162.0, 160.3, 158.0, 137.3, 129.7, 128.5, 128.5, 128.1, 107.2, 102.3, 101.0, 77.1, 67.1, 55.6, 28.2 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_4$ 341.1498; found: 341.1496.



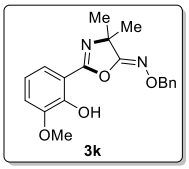
3i

(Z)-2-(4-((tert-butyldimethylsilyl)oxy)-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3i): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1i** (49.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3i** as a colorless oil (67.8 mg, 0.154 mmol, 77 %); IR νmax (film): 2929, 1695, 1640, 1498, 1339, 1275, 1175 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.23 (s, 1H), 7.67 (d, *J* = 8.6 Hz, 1H), 7.39 (ddd, *J* = 16.6, 10.5, 6.8 Hz, 5H), 6.51 (d, *J* = 2.0 Hz, 1H), 6.43 (dd, *J* = 8.6, 2.1 Hz, 1H), 5.13 (s, 2H), 1.52 (s, 6H), 1.01 (d, *J* = 9.2 Hz, 9H), 0.26 (d, *J* = 7.3 Hz, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 161.8, 161.3, 160.4, 158.0, 137.4, 129.7, 128.5, 128.1, 112.4, 108.0, 103.1, 77.1, 67.1, 28.2, 25.7, 18.4, -4.3 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{24}H_{33}N_2O_4Si$ 441.2202; found: 441.2204.



3j

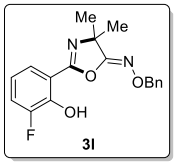
(Z)-2-(2-hydroxy-3-methylphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3j): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1j** (26.6 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3j** as a white solid (47.3 mg, 0.146 mmol, 73 %). mp 81-83 °C; IR νmax (film): 2929, 1690, 1638, 1454, 1364, 1334, 1298, 1256, 1193 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.42 (s, 1H), 7.67 (dd, *J* = 7.9, 1.7 Hz, 1H), 7.50-7.28 (m, 6H), 6.85 (t, *J* = 7.6 Hz, 1H), 5.15 (s, 2H), 2.32 (s, 3H), 1.55 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.9, 158.4, 158.0, 137.4, 135.4, 128.6, 128.5, 128.2, 126.3, 126.2, 118.8, 108.5, 77.2, 67.4, 28.2, 16.0 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_3$ 325.1543; found: 325.1547.



3k

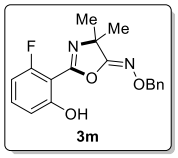
(Z)-2-(2-hydroxy-3-methoxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3k): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1k** (29.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3k** as a white solid (55.8 mg, 0.164 mmol, 82 %). mp 95-97 °C; IR νmax (film): 2948, 1687, 16468, 1470, 1358, 1303, 1250, 1191 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.41 (s, 1H), 7.47-7.28 (m, 6H), 7.02 (dd, *J* = 8.1, 1.6 Hz, 1H), 6.86 (t, *J* = 8.0 Hz, 1H), 5.12 (s, 2H), 3.91 (s, 3H), 1.53 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.7, 157.7, 150.3,

148.4, 137.2, 128.5, 128.5, 128.1, 119.9, 118.9, 115.8, 109.3, 77.1, 67.3, 56.3, 28.0 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{21}N_2O_4$ 341.1499; found: 341.1496.



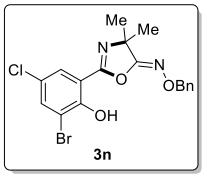
3l

(Z)-2-(3-fluoro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3l): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1l** (27.4 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3l** as a colorless oil (59.1 mg, 0.180 mmol, 90 %); IR νmax (film): 2980, 1695, 1649, 1472, 1338, 1300, 1262, 1194 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.27 (s, 1H), 7.48 (dt, *J* = 8.1, 1.5 Hz, 1H), 7.30 (m, 5H), 7.15 (ddd, *J* = 10.6, 7.2, 1.6 Hz, 1H), 6.77 (dd, *J* = 8.1, 4.5 Hz, 1H), 5.05 (s, 2H), 1.46 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.1 (d, *J* = 3.8 Hz), 157.2, 151.3 (d, *J* = 244.5 Hz), 148.6 (d, *J* = 13.4 Hz), 137.1, 128.5, 128.4, 128.2, 123.5 (d, *J* = 3.8 Hz), 120.4 (d, *J* = 17.3 Hz), 118.7 (d, *J* = 6.7 Hz), 111.1 (d, *J* = 3.8 Hz), 77.1, 67.4, 28.0 ppm; ^{19}F NMR ($CDCl_3$, 282 MHz): δ = -135.83--136.07 (m) ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{18}FN_2O_3$ 329.1293; found: 329.1296.



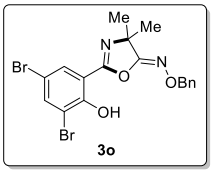
3m

(Z)-2-(2-fluoro-6-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3m): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1m** (27.4 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3m** as a white solid (55.1 mg, 0.168 mmol, 84 %). mp 78-80 °C; IR νmax (film): 2983, 1701, 1642, 1620, 1457, 1319, 1230, 1191 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.98 (s, 1H), 7.46-7.30 (m, 6H), 6.84 (dt, *J* = 8.5, 1.0 Hz, 1H), 6.65 (ddd, *J* = 10.7, 8.3, 1.1 Hz, 1H), 5.14 (s, 2H), 1.53 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 161.6 (d, *J* = 3.9 Hz), 161.3 (d, *J* = 263.2 Hz), 159.6 (d, *J* = 2.2 Hz), 157.5, 137.4, 134.5 (d, *J* = 12.0 Hz), 128.4, 128.3, 128.0, 113.1 (d, *J* = 3.8 Hz), 106.9 (d, *J* = 21.0 Hz), 99.3 (d, *J* = 12.8 Hz), 77.1, 65.7, 28.0 ppm; ^{19}F NMR ($CDCl_3$, 282 MHz): δ = -107.20--107.30 (m) ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{18}FN_2O_3$ 329.1300; found: 329.1296.



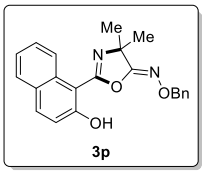
3n

(Z)-2-(3-bromo-5-chloro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3n): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1n** (46.4 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3n** as a white solid (72.6 mg, 0.172 mmol, 86 %). mp 137-139 °C; IR νmax (film): 3078, 1695, 1645, 1608, 1445, 1426, 1370, 1323, 1239, 1182cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 12.00 (s, 1H), 7.74 (d, *J* = 3.2 Hz, 1H), 7.66 (d, *J* = 3.2 Hz, 1H), 7.47-7.32 (m, 5H), 5.14 (s, 2H), 1.54 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 159.4, 156.6, 155.4, 137.0, 137.0, 128.6, 128.5, 128.3, 127.0, 124.3, 111.6, 110.6, 77.4, 67.5, 28.0 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{17}BrClN_2O_3$ 423.0102; found: 423.0106.



3o

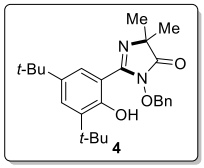
(Z)-2-(3,5-dibromo-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3o): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1o** (55.0 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3o** as a white solid. (87.1 mg, 0.187 mmol, 93 %). mp 149-151 °C; IR νmax (film): 2916, 1693, 1644, 1606, 1433, 1322, 1253, 1298, 1256, 1196 cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 12.03 (s, 1H), 7.87 (d, *J* = 2.4 Hz, 1H), 7.79 (d, *J* = 2.4 Hz, 1H), 7.50-7.32 (m, 5H), 5.14 (s, 2H), 1.54 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl^3$, 75 MHz): δ = 159.4, 156.6, 155.9, 139.6, 137.0, 129.9, 128.6, 128.5, 128.3, 112.0, 111.2, 110.9, 77.4, 67.5, 28.0 ppm; HRMS (ESI) m/z: $[M-H]^-$calcd for $C_{18}H_{15}Br_2N_2O_3$ 464.9455; found: 464.9455.



3p

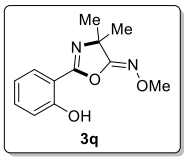
(Z)-2-(2-hydroxynaphthalen-1-yl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (3p): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1p** (33.8 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3p** as a white solid (38.2 mg, 0.106 mmol, 53 %). mp 144-146 °C; IR νmax (film): 2934, 1695, 1620, 1607, 1589, 1472, 1471, 1361, 1227, 1207 cm^{-1}; ^{1}H NMR ($CDCl_3$, 300 MHz): δ = 13.28 (s, 1H), 8.85 (dd, *J* = 9.0, 1.2 Hz, 1H), 7.88 (d, *J* = 9.0 Hz, 1H), 7.77 (dd, *J* = 7.9, 1.5 Hz, 1H), 7.57 (ddd, *J* = 8.7, 6.9, 1.5 Hz, 1H), 7.51-7.44 (m, 2H), 7.43-7.31 (m, 4H), 7.24 (d, *J* = 9.0 Hz, 1H), 5.20 (s, 2H), 1.59 (s, 6H) ppm; ^{13}C{^{1}H} NMR ($CDCl_3$, 75 MHz): δ = 163.0, 162.9, 158.2, 137.6, 135.7,

131.5, 129.1, 128.6, 128.5, 128.1, 128.0, 125.0, 123.8, 119.1, 101.0, 76.9, 65.1, 28.2 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{21}N_2O_3$ 361.1546; found: 361.1547.



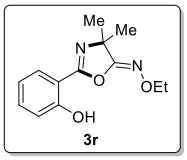
4

(Z)-2-(3,5-di-tert-butyl-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (4): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1q** (46.2 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **4** as a white solid. (54.9 mg, 0.130 mmol, 65 %). mp 145-146 °C; IR νmax (film): 2929, 1690, 1638, 1454, 1364, 1334, 1298, 1256, 1193 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 12.68 (s, 1H), 8.04 (d, *J* = 2.4 Hz, 1H), 7.49 (d, *J* = 2.4 Hz, 1H), 7.43-7.27 (m, 5H), 5.12 (s, 2H), 1.46 (s, 9H), 1.44 (s, 6H), 1.25 (s, 9H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 179.5, 158.9, 157.8, 140.3, 137.2, 132.7, 130.2, 129.7, 128.6, 128.6, 121.9, 109.3, 79.0, 62.7, 35.4, 34.5, 31.6, 29.6, 24.6 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{26}H_{35}N_2O_3$ 423.2641; found: 423.2642.



3q

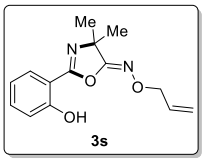
(Z)-2-(2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-methyl oxime (3q): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2b** (78.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3q** as a white solid (35.1 mg, 0.15 mmol, 75 %). mp 99-101 °C; IR νmax (film): 2935, 1701, 1642, 1493, 1332, 1307, 1255, 1197, 1111 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.13 (s, 1H), 7.78 (dd, *J* = 8.1, 1.8 Hz, 1H), 7.45-7.37 (m, 1H), 7.03 (d, *J* = 7.8 Hz, 1H), 6.95-6.89 (m, 1H), 3.92 (s, 3H), 1.54 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.4, 160.1, 157.4, 134.5, 128.5, 119.3, 117.2, 109.1, 67.3, 63.0, 28.1 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{12}H_{15}N_2O_3$ 235.1079; found: 235.1077.



3r

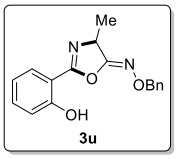
(Z)-2-(2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-ethyl oxime (3r): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2c** (83.6 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3r** as a

white solid (41.2 mg, 0.166 mmol, 83 %). mp 87-89 °C; IR νmax (film): 2983, 1703, 1642, 1620, 1484, 1335, 1306, 1252, 1230, 1148 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.19 (s, 1H), 7.81 (dd, *J* = 8.1, 1.8 Hz, 1H), 7.42 (ddd, *J* = 8.8, 7.3, 1.8 Hz, 1H), 7.03 (dd, *J* = 8.4, 1.2 Hz, 1H), 6.92 (ddd, *J* = 8.1, 7.3, 1.1 Hz, 1H), 4.15 (q, *J* = 7.2 Hz, 2H), 1.54 (s, 6H), 1.34 (t, *J* = 7.2 Hz, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.5, 160.1, 157.1, 134.4, 128.6, 119.3, 117.1, 109.2, 70.8, 67.2, 28.1, 14.5 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{13}H_{17}N_2O_3$ 249.1236; found: 249.1234.



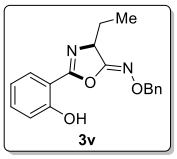
3s

(Z)-2-(2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-allyl oxime (3s): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2d** (88.4 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3s** as a white solid (40.0 mg, 0.154 mmol, 77 %). mp 98-100 °C; IR νmax (film): 2895, 1704, 1642, 1617, 1494, 1429, 1345, 1307, 1253, 1229, 1200, 1165, 1024, 969 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.15 (s, 1H), 7.80 (dd, *J* = 7.2, 1.8 Hz, 1H), 7.42 (ddd, *J* = 8.7, 7.2, 1.8 Hz, 1H), 7.03 (dd, *J* = 8.1, 1.2 Hz, 1H), 6.92 (ddd, *J* = 8.1, 7.2, 1.2 Hz, 1H), 6.13-5.98 (m, 1H), 5.42-5.23 (m, 2H), 4.59 (dt, *J* = 6.0, 1.2 Hz, 2H), 1.54 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 160.5, 160.1, 157.6, 134.4, 133.7, 128.6, 119.3, 118.4, 117.1, 109.1, 76.0, 67.4, 28.1 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{14}H_{17}N_2O_3$ 261.1234; found: 261.1234.



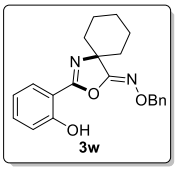
3u

(S,Z)-2-(2-hydroxyphenyl)-4-methyloxazol-5(4H)-one O-benzyl oxime (3u): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2f** (102.8 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3u** as a white solid (24.9 mg, 0.084 mmol, 42 %). mp 83-85 °C; IR νmax (film): 2974, 1698, 1647, 1613, 1582, 1487, 1352, 1258, 1157 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.13 (s, 1H), 7.80 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.49-7.29 (m, 6H), 7.04 (dd, *J* = 8.4, 1.2 Hz, 1H), 6.93 (td, *J* = 7.6, 1.2 Hz, 1H), 5.12 (d, *J* = 2.1 Hz, 2H), 4.82 (q, *J* = 7.1 Hz, 1H), 1.54 (d, *J* = 6.9 Hz, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 162.5, 160.1, 155.5, 137.4, 134.6, 128.6, 128.6, 128.5, 128.2, 119.3, 117.2, 109.1, 77.1, 61.1, 20.5 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{17}N_2O_3$ 297.1235; found: 297.1234.



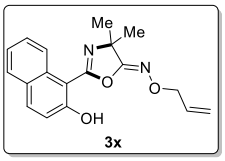
3v

(*S*,*Z*)-4-ethyl-2-(2-hydroxyphenyl)oxazol-5(4H)-one O-benzyl oxime (3v): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2g** (108.4 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3v** as a white solid (24.8 mg, 0.08 mmol, 40%). mp 84-86 °C; IR νmax (film): 2967, 1693, 1645, 1615, 1485, 1464, 1342, 1260, 1227, 1157 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.21 (s, 1H), 7.80 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.48-7.28 (m, 6H), 7.04 (dd, *J* = 8.4, 1.2 Hz, 1H), 6.93 (td, *J* = 7.5, 1.2 Hz, 1H), 5.13 (s, 2H), 4.74 (dd, *J* = 6.9, 5.1 Hz, 1H), 2.05-1.88 (m, 1H), 1.87-1.74 (m, 1H), 1.00 (t, *J* = 7.5 Hz, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 162.7, 160.2, 154.5, 137.5, 134.5, 128.6, 128.5, 128.5, 128.2, 119.3, 117.2, 109.0, 77.1, 66.4, 27.8, 9.3 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}N_2O_3$ 311.1389; found: 311.1390.



3w

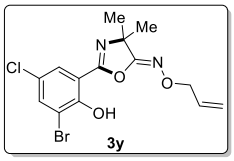
(Z)-2-(2-hydroxyphenyl)-3-oxa-1-azaspiro[4.5]dec-1-en-4-one O-benzyl oxime (3w): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1a** (23.8 mg, 0.20 mmol), haloamide **2h** (83.6 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3w** as a colorless oil (124.4 mg, 0.129 mmol, 65%); IR νmax (film): 2932, 1692, 1643, 1488, 1449, 1303, 1256, 1230, 1157, 1007, 751 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.38 (s, 1H), 7.80 (dd, *J* = 8.0, 1.7 Hz, 1H), 7.40 (m, 6H), 7.05 (d, *J* = 8.4 Hz, 1H), 6.92 (t, *J* = 7.6 Hz, 1H), 5.14 (s, 2H), 1.89-1.62 (m, 10H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): 160.3, 160.1, 157.8, 137.4, 134.3, 128.6, 128.5, 128.5, 128.1, 119.2, 117.1, 109.3, 77.1, 70.4, 37.0, 25.1, 21.7 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{23}N_2O_3$ 351.1701; found: 351.1703.



3x

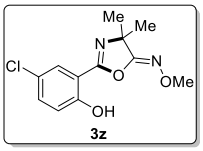
(Z)-2-(2-hydroxynaphthalen-1-yl)-4,4-dimethyloxazol-5(4H)-one O-allyl oxime (3x): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1p** (33.6 mg, 0.20 mmol), haloamide **2d** (88.4 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3x** as a yellow oil (24.8 mg, 0.08 mmol, 40 %). IR νmax (film): 2979, 1694, 1623, 1610, 1591, 1470, 1419, 1299,

1252, 1233, 1196, 1001, 976 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 13.29 (s, 1H), 8.83 (dd, *J* = 8.7, 1.2 Hz, 1H), 7.88 (d, *J* = 9.0 Hz, 1H), 7.77 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.60 (ddd, *J* = 8.7, 6.8, 1.5 Hz, 1H), 7.38 (ddd, *J* = 8.1, 6.9, 1.2 Hz, 1H), 7.23 (d, *J* = 9.0 Hz, 1H), 6.17-6.00 (m, 1H), 5.42 (dq, *J* = 17.3, 1.5 Hz, 1H), 5.29 (dq, *J* = 10.8, 1.2 Hz, 1H), 4.66 (dt, *J* = 5.7, 1.5 Hz, 2H), 1.61 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 163.0, 162.8, 157.8, 135.7, 133.9, 131.5, 129.1, 128.6, 128.5, 125.0, 123.8, 119.2, 117.8, 101.0, 75.8, 65.1, 28.3 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}N_2O_3$ 311.1387; found: 311.1390.



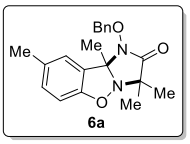
3y

(Z)-2-(3-bromo-5-chloro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-allyl oxime (3y): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1n** (46.0 mg, 0.20 mmol), haloamide **2d** (88.4 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3y** as a white solid (67.7 mg, 0.182 mmol, 91 %). mp 147-149 °C; IR νmax (film): 2942, 1698, 1647, 1609, 1425, 1321, 1240, 1181, 1033, 971 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.96 (s, 1H), 7.74 (d, *J* = 2.4 Hz, 1H), 7.65 (d, *J* = 2.4 Hz, 1H), 6.11-5.95 (m, 1H), 5.41-5.20 (m, 2H), 4.58 (dt, *J* = 5.7, 1.5 Hz, 2H), 1.54 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 159.4, 156.5, 155.5, 137.1, 133.5, 127.0, 124.4, 118.8, 111.6, 110.6, 76.2, 67.6, 28.0 ppm; HRMS (ESI) m/z: $[M-H]^-$ calcd for $C_{14}H_{13}BrClN_2O_3$ 370.9802; found: 370.9804.



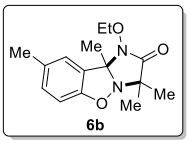
3z

(Z)-2-(5-chloro-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-methyl oxime (3z): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **1d** (30.6 mg, 0.20 mmol), haloamide **2b** (78.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **3z** as a white solid. (48.8 mg, 0.182 mmol, 91 %). mp 120-122 °C; IR νmax (film): 2939, 1691, 1651, 1615, 1575, 1479, 1331, 1282, 1192, 1037, 971 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 11.11 (s, 1H), 7.74 (d, *J* = 2.7 Hz, 1H), 7.35 (dd, *J* = 8.7, 2.7 Hz, 1H), 6.96 (d, *J* = 9.0 Hz, 1H), 3.92 (s, 3H), 1.53 (s, 6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 159.6, 158.6, 156.8, 134.4, 127.6, 124.2, 118.7, 110.1, 67.5, 63.1, 28.0 ppm; HRMS (ESI) m/z: $[M-H]^-$:calcd for $C_{12}H_{12}ClN_2O_3$ 267.0544; found: 267.0542.



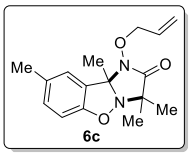
6a

(E)-3,3,8,9b-tetramethyl-9bH-benzo[d]oxazolo[3,2-b]isoxazol-2(3H)-one O-benzyl oxime (6a): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **5a** (29.4 mg, 0.20 mmol), haloamide **2a** (108.0 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **6a** as a colorless oil (8.8 mg, 0.023 mmol, 13%), with the recovery of 17.0 mg (58%) starting material; IR νmax (film): 2925, 1741, 1492, 1455, 1383, 1255, 1200, 1071, 977 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 7.55-7.45 (m, 2H), 7.41-7.32 (m, 3H), 6.73 (d, *J* = 8.1 Hz, 1H), 6.68-6.61 (m, 2H), 5.13 (d, *J* = 3.4 Hz, 2H), 2.29 (s, 3H), 1.75 (s, 3H), 1.48 (s, 3H), 1.19 (s, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 125 MHz): δ = 172.3, 149.2, 134.7, 134.4, 130.7, 129.9, 129.1, 128.6, 124.3, 117.7, 111.8, 108.6, 79.5, 61.6, 28.1, 24.7, 23.6, 21.3 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{23}N_2O_3$ 339.1705; found: 339.1703.



6b

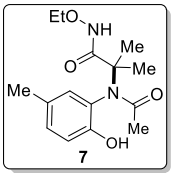
(Z)-3,3,8,9b-tetramethyl-9bH-benzo[d]oxazolo[3,2-b]isoxazol-2(3H)-one O-ethyl oxime (6b): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **5a** (29.4 mg, 0.20 mmol), haloamide **2c** (83.6 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **6b** as a colorless oil (8.3 mg, 0.03 mmol, 15%), with the recovery of 12.4 mg (42%) starting material; IR νmax (film): 2980, 1740, 1666, 1643, 1491, 1381, 1335, 1251, 1199, 1024, 800 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 6.72 (d, *J* = 7.8 Hz, 1H), 6.61-6.68 (m, 2H), 4.21 (q, *J* = 7.1 Hz, 2H), 2.28 (s, 3H), 1.75 (s, 3H), 1.49 (s, 3H), 1.36 (t, *J* = 7.1 Hz, 3H), 1.23 (s, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 172.4, 149.0, 134.2, 130.6, 124.1, 117.5, 111.7, 108.4, 73.1, 61.4, 28.0, 24.4, 23.4, 21.1, 13.7 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{15}H_{21}N_2O_3$ 277.1550; found: 277.1547.



6c

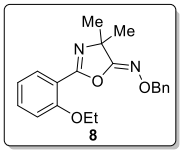
(Z)-3,3,8,9b-tetramethyl-9bH-benzo[d]oxazolo[3,2-b]isoxazol-2(3H)-one O-allyl oxime (6c): By following General Procedure for [3+2] Cycloaddition of Azaoxyallyl Cations with 1,2-Benzisoxazoles described above, a mixture of 1,2-benzisoxazole **5a** (29.4 mg, 0.20 mmol), haloamide **2d** (88.4 mg, 0.40 mmol), and NaOH (16.0 mg, 0.40 mmol) in HFIP (1.5 mL) afforded product **6c** as a colorless oil (9.2 mg, 0.028 mmol, 16 %), with the recovery of 18.9 mg (63%) starting material; IR νmax (film): 2926, 1741, 1491, 1382, 1289, 1252, 1199, 1069, 994, 800 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): δ = 6.72 (d, *J* =

8.1 Hz, 1H), 6.69-6.61 (m, 2H), 6.16-5.98 (m, 1H), 5.45-5.26 (m, 2H), 4.62 (d, *J* = 6.5 Hz, 2H), 2.28 (s, 3H), 1.75 (s, 3H), 1.48 (s, 3H), 1.22 (s, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 172.4, 149.1, 134.3, 131.7, 130.7, 124.2, 121.2, 117.6, 111.8, 108.5, 78.4, 61.6, 28.1, 24.7, 23.6, 21.3 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{21}N_2O_3$ 289.1546; found: 289.1547.



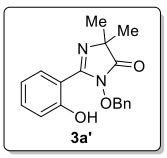
7

N-ethoxy-2-(N-(2-hydroxy-5-methylphenyl)acetamido)-2-methylpropanamide (7): By following Experimental Procedure for synthesis of **7**. The oxazoline derivate **6b** (10.0 mg, 0.036 mmol) was concentrated to remove the solvent under vacuum, which was upon exposure to air over 3 days, afforded product **7** as a colorless solid (10.6 mg, 0.036 mmol, 100 %). mp 150-152 °C; IR ν_{max} (film): 3024.60, 2918.56, 1657.26, 1500.86, 1376.21, 1338.57, 1299.30, 1245.16, 1044.53, 825.66; ^1H NMR ($CDCl_3$, 300 MHz): δ = 9.83 (s, 1H), 8.61 (s, 1H), 7.10 (d, *J* = 8.0 Hz, 1H), 6.94 (d, *J* = 8.3 Hz, 1H), 6.79 (s, 1H), 4.17-3.98 (m, 2H), 2.28 (s, 3H), 1.75 (s, 6H), 1.32 (t, *J* = 6.9 Hz, 3H), 1.09 (s, 3H) ; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 176.6, 172.5, 153.2, 131.6, 130.2, 129.3, 126.1, 118.0, 72.5, 62.0, 26.9, 23.3, 22.9, 20.4, 13.6; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{15}H_{23}N_2O_4$ 295.1651; found: 295.1652.



8

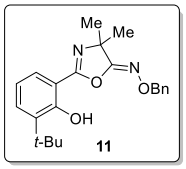
3-(benzyloxy)-2-(2-ethoxyphenyl)-5,5-dimethyl-3,5-dihydro-4H-imidazol-4-one (8): IR νmax (film): 2978, 2929, 1651, 1493, 1453,1192 cm^{-1}; ^1H NMR ($CDCl_3$, 400 MHz): *δ* = 7.77 (dd, *J* = 7.6, 1.3 Hz, 1H), 7.41 (q, *J* = 6.1 Hz, 3H), 7.37-7.28 (m, 3H), 6.96 (dd, *J* = 15.0, 7.9 Hz, 2H), 5.10 (s, 2H), 4.09 (q, *J* = 6.9 Hz, 2H), 1.50 (d, *J* = 6.6 Hz, 6H), 1.39 (t, *J* = 6.9 Hz, 3H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 100 MHz): δ = 160.7, 158.4, 137.7, 133.2, 131.3, 128.4, 128.4, 127.9, 120.5, 116.1, 113.4, 76.8, 67.9, 65.0, 27.8, 14.7 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{20}H_{23}N_2O_3$ 339.1708; found: 339.1703.



3a'

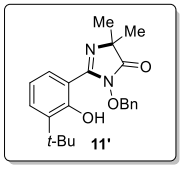
3-(benzyloxy)-2-(2-hydroxyphenyl)-5,5-dimethyl-3,5-dihydro-4H-imidazol-4-one (3a'): The product was obtained as a colorless oil (16.7 mg, 0.054 mmol, 27 %). IR νmax (film): 2976, 1744, 1625, 1602, 1491, 1353, 1258 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): *δ* = 8.21 (d, *J* = 7.5 Hz, 1H), 7.48-7.29 (m, 6H), 7.04 (d, *J* = 8.2 Hz, 1H), 6.90 (t, *J* = 7.5 Hz, 1H), 5.15 (s, 2H), 1.43 (s,

6H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 179.3, 161.1, 158.2, 133.9, 132.5, 130.5, 129.9, 128.8, 127.8, 118.9, 118.1, 79.1, 63.0, 24.5 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{19}N_2O_3$ 311.1391; found: 311.1390.



11

(Z)-2-(3-(tert-butyl)-2-hydroxyphenyl)-4,4-dimethyloxazol-5(4H)-one O-benzyl oxime (11): The product was obtained as a colorless oil (26.4 mg, 0.072 mmol, 36 %). IR νmax (film): 2959, 2926, 1638, 1456, 1333, 1211 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): *δ* = 11.75 (s, 1H), 7.70 (d, *J* = 7.7 Hz, 1H), 7.51-7.29 (m, 6H), 6.85 (t, *J* = 7.7 Hz, 1H), 5.10 (d, *J* = 19.3 Hz, 2H), 1.49 (d, *J* = 28.2 Hz, 15H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 161.2, 159.3, 157.9, 137.6, 137.4, 131.6, 128.5, 128.1, 126.6, 118.6, 109.2, 77.1, 67.4, 35.1, 29.5, 28.2 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}N_2O_3$ 367.2017; found: 367.2016.



11'

3-(benzyloxy)-2-(3-(tert-butyl)-2-hydroxyphenyl)-5,5-dimethyl-3,5-dihydro-4H-imidazol-4-one (11'): The product was obtained as a colorless oil (41.7 mg, 0.114 mmol, 57 %). IR νmax (film): 2956, 1746, 1602, 1425, 1252, 1208 cm^{-1}; ^1H NMR ($CDCl_3$, 300 MHz): *δ* = ^1H NMR (300 MHz, $CDCl_3$) δ 12.96 (s, 1H), 8.17-7.96 (m, 1H), 7.48-7.29 (m, 6H), 6.86 (t, *J* = 7.9 Hz, 1H), 5.06 (d, *J* = 37.0 Hz, 2H), 1.46 (d, *J* = 3.9 Hz, 15H) ppm; $^{13}C\{^1H\}$ NMR ($CDCl_3$, 75 MHz): δ = 179.3, 160.2, 158.7, 138.1, 132.6, 131.0, 130.4, 129.7, 128.7, 125.8, 118.1, 110.0, 79.0, 62.7, 35.2, 29.5, 24.5 ppm; HRMS (ESI) m/z: $[M+H]^+$ calcd for $C_{22}H_{27}N_2O_3$ 367.2012; found: 367.2016.

ASSOCIATED CONTENT

Supporting Information

Spectra data, copies of all new compounds, X-ray crystallography data and CIF files. 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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(11) X-ray CCDC 1906323 (**3d**), CCDC 1906324 (**4**) and CCDC 1906325 (**7**) contain the supplementary crystallographic data for this paper. These data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif.

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