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Facile Construction of [6,6]-, [6,7]-, [6,8]-, and [6,9]Ring-Fused Triazole Frameworks by Copper-Catalyzed, Tandem, One-Pot, Click and Intramolecular Arylation Reactions: Elaboration to Fused Pentacyclic Derivatives

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A sequential copper-catalyzed, one-pot, click reaction–intramolecular direct arylation, which involves two mechanistically distinct reactions (atom-economical click reaction and direct arylation of 1,2,3-triazole), to generate [6,6]-, [6,7]-, [6,8]-, and [6,9]ring-fused triazoles is reported. Furthermore, a unique divergence of reactivity between the fused triazoles prepared from 2-bromobenzyl azide and 2-bromophenyl azide that leads to a fused pentacyclic heterocycle for the former and a C–C-coupled, biphenyl-fused, tricyclic product for the latter is observed under Pd catalysis. All of the key products have been characterized by single-crystal X-ray crystallography.

Introduction

Transition-metal-catalyzed sequential reactions and direct functionalization of C–H bonds in aromatic compounds have undergone rapid development in recent years.[1,2] The former methodology permits the creation of molecular complexity and diversity by the facile formation of multiple covalent bonds in a one-pot transformation and hence, minimizes the requisite reagents, separation processes, and waste. Direct functionalization eliminates the necessity to prefunctionalize the aryl group for cross-coupling reactions and thus allows time and material economy. Because of the relatively high cost and toxicity of palladium catalysts used in the construction of C–C and C–N bonds,[3,4] attention has also been paid to copper-catalyzed reactions.[5–6] One of the most intensely investigated, relevant C–N bond forming reactions is the click reaction between alkynes and organic azides that leads to 1,2,3-triazoles because of the potential uses of the products, which range from medicinal chemistry to materials science.[7–9] A recent report has demonstrated tandem cycloaddition and *N*-arylation to synthesize triazolothiadiazepine 1,1-dioxide derivatives.[10] Other groups have reported the transition-metal-catalyzed arylation of 1,2,3-triazole with aryl halides.[11] As part of our ongoing research into transition-metal-catalyzed C–C and C–N bond forming reactions,[13–15] we investigated the construction of a triazole and a C–C bond in one pot using copper catalysis. A number of approaches for the synthesis of 1,2,3-triazoles[8] and benzopyrans/benzooxepines[16] are available, but compounds that possess fused 1,2,3-triazole and benzopyran/benzooxepine units are scarce.[11d,12] In this paper, we disclose a straightforward route to the construction of [6,6]-, [6,7]-, [6,8]-, and [6,9]ring-fused triazole frameworks by copper-catalyzed, tandem, one-pot click and intramolecular arylation reactions. We also reveal an unusual divergence of reactivity between the fused triazoles prepared from 2-bromobenzyl azide and 2-bromophenyl azide; the former yields a fused pentacyclic heterocycle, whereas the latter affords a coupled product.

Results and Discussion

The precursors **1a**–**i** and **2a**–**m** used in this work are shown in Scheme 1. Initially, we performed the click reaction between *O*-propargyl iodophenol (**1a**) and benzyl azide (**2a**) in the presence of copper(I) iodide (10 mol-%), tetramethylethylenediamine (TMEDA, 20 mol-%), and *N*,*N*-dimethylformamide (DMF) at room temperature for 1 h and then treated the resulting mixture with an excess of KO*t*Bu (3 equiv.) at 140 °C for 4 h to effect intramolecular arylation. This procedure afforded the fused tricyclic compound **3**[11e] in 48% overall yield (Scheme 2). We then screened various reaction parameters to identify the optimal reaction conditions (Table 1). Although the ligands L-proline, bipyridine, sarcosine, and *N*,*N*′-dimethylethylenediamine (DMEDA) provided **3** in 60–64% yield (Table 1, Entries 2–5), simple TMEDA provided a better yield (75%, Entry 6).

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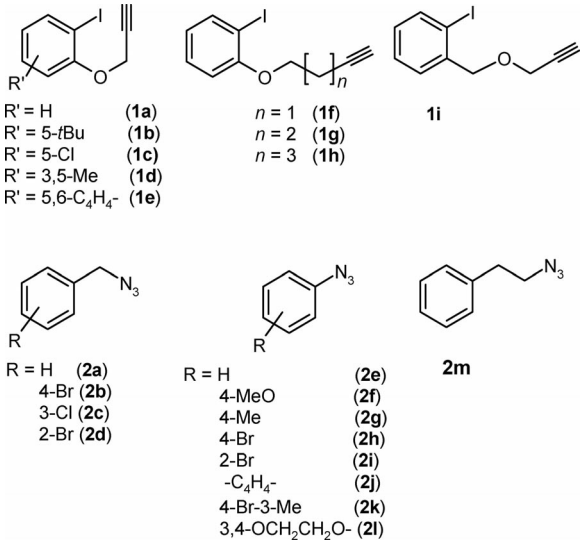
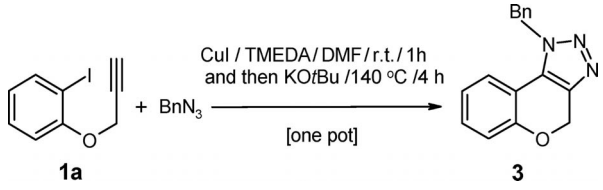
Other N-substituted diamine ligands afforded only moderate yields (Entries 7–9). Keeping the catalyst loading to 5 mol-% CuI/10 mol-% TMEDA provided a lower yield (Entry 10), whereas a higher loading (20 and 40 mol-% CuI/TMEDA) only marginally increased the yield (77%, Entry 11). Other copper salts or KO*t*Bu instead of LiO*t*Bu afforded lower yields. Cesium carbonate failed (triazole remained). LiO*t*Bu was the best base (Entries 6–11).



Scheme 1. Precursors used in this work.



Scheme 2. One-pot, copper-catalyzed click reaction and direct arylation that led to **3**.

With the optimized conditions in hand, the scope of this copper-catalyzed, sequential click reaction–direct arylation was examined by employing **1a** and various benzyl and aryl azides (Table 2). Both benzyl- (Entries 1–4) and phenyl azides (Entries 5–9) afforded the fused chromene triazoles (**3**–**11**) in good yields. The method was also applicable to naphthyl- (Entry 10) and aliphatic azides (Entry 11). The structure of **8** was confirmed by X-ray crystallography (Supporting Information, Figure S1). To further explore the generality and scope of this approach, reactions that used different propargyl iodophenyl ethers **1b**–**e** were investigated for this sequential process, and the results of the synthesis of **14**–**22** along with isolated yields are summarized in Scheme 3. Despite being a one-pot process, the isolated yields are good in most cases.

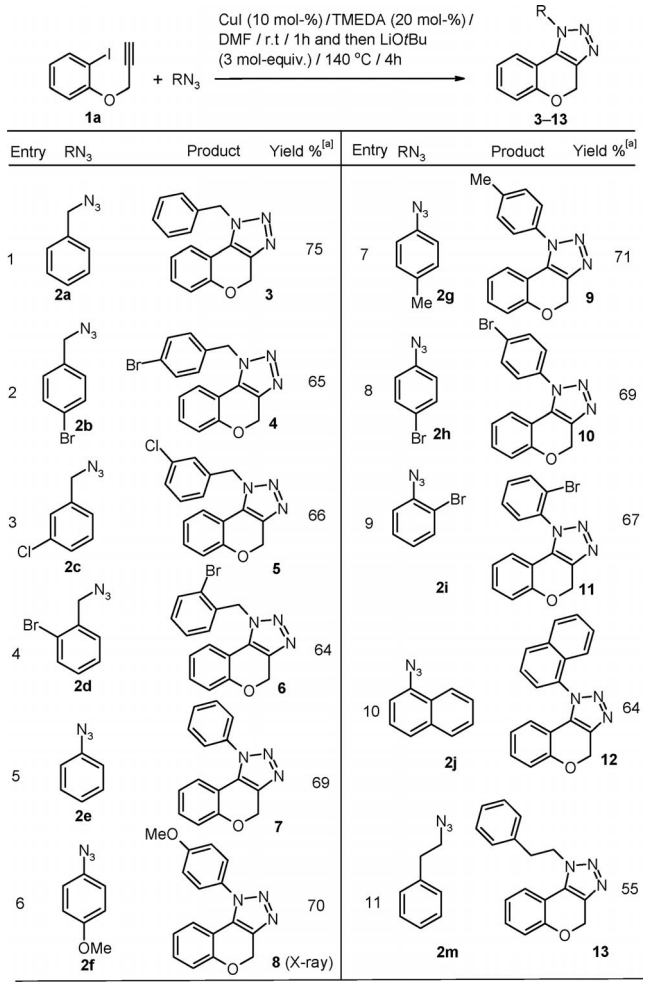
We also isolated the triazole intermediates **23** and **24**, which were obtained in ca. 90% yield without adding LiO*t*Bu. We found that for the subsequent arylation of **23**,

Table 1. Optimization of the catalytic system for the synthesis of **3** (Scheme 2).[a]

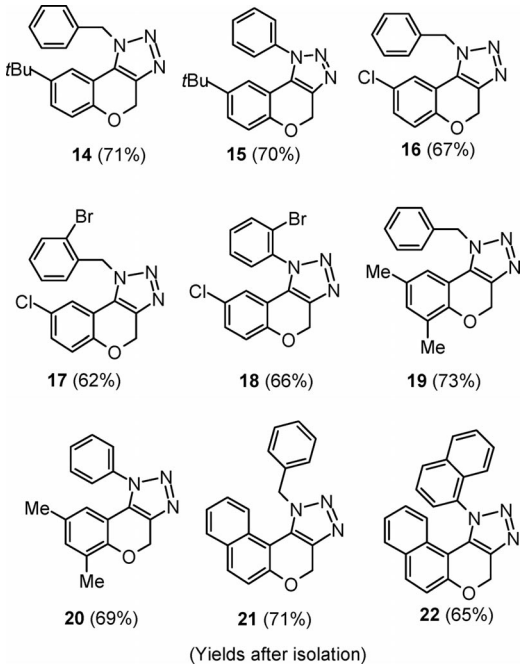
Entry	CuX	Ligand	Base	Isolated yield [%]
1	CuI	TMEDA	KO*t*Bu	48
2	CuI	L-Proline	LiO*t*Bu	60
3	CuI	Bipyridine	LiO*t*Bu	56
4	CuI	Sarcosine	LiO*t*Bu	64
5	CuI	DMEDA	LiO*t*Bu	62
6	**CuI**	**TMEDA**	**LiO*t*Bu**	**75**
7	CuI	DIPEDA	LiO*t*Bu	60
8	CuI	DTBEDA	LiO*t*Bu	58
9	CuI	DIPEA[b]	LiO*t*Bu	62
10[c]	CuI	TMEDA	LiO*t*Bu	61
11[d]	**CuI**	**TMEDA**	**LiO*t*Bu**	**77**
12	CuBr	TMEDA	LiO*t*Bu	58
13	CuCl	TMEDA	LiO*t*Bu	62
14	$CuSO_4$	Na ascorbate	LiO*t*Bu	36[e]
15	CuI	TMEDA	Cs_2CO_3	no reaction[f]

[a] Quantities used (except for Entries 10–11): **1a** (0.5 mmol), **2a** (0.5 mmol), CuX (10 mol-%), ligand (20 mol-%), base (3.0 equiv.), DMF (1 mL). [b] DIPEA = *N*,*N*-Diisopropylethylamine. [c] CuI (5 mol-%), TMEDA (10 mol-%). [d] CuI (20 mol-%), TMEDA (40 mol-%). [e] Triazole **23** (41%) was recovered. [f] Triazole **23** remained as such.

Table 2. Scope of one-pot, copper-catalyzed click–intramolecular arylation in the synthesis of **3**–**13**.

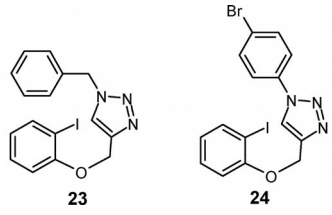


[a] Yield of the isolated product.



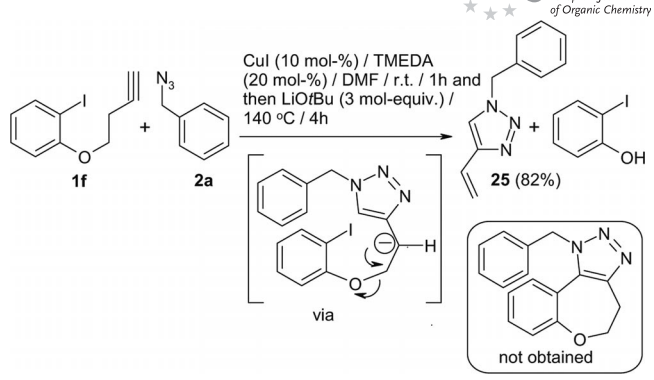
Scheme 3. Structures of [6,6]ring-fused compounds **14**–**22**.

CuI also acts as a catalyst; in its absence, only traces of **3** were obtained. Interestingly, for the latter intramolecular arylation, CuI/$PdCl_2(PPh_3)_2$ in place of CuI/Li*O*t*Bu* afforded a lower yield (ca. 45%). As a solvent, DMF was better than toluene; polyethylene glycol (PEG)-400 or water worked well for the first step (click reaction) but not for the intramolecular arylation.

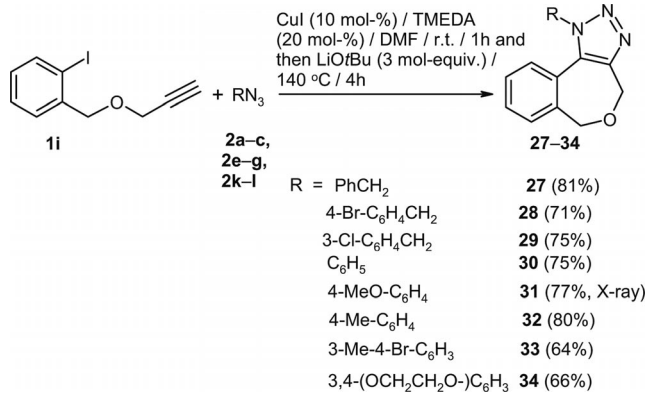


In an effort to elaborate this method to generate a seven-membered oxepin ring (in place of the six-membered pyran ring), **1f**, prepared by a Mitsunobu reaction,[17] was treated with **2a** under the optimized reaction conditions. This reaction, however, led to the elimination product **25** (Scheme 4), which arises from the abstraction of a proton from the CH_2 moiety connected to triazole and subsequent migration of the carbanion, which eliminates the iodophenoxide moiety (a good leaving group). Compound **25** can also be synthesized from $TsOCH_2CH_2C{\equiv}CH$ (**26**) in 79% yield (TsOH was the eliminated side product).

This problem was circumvented by choosing **1i** as the substrate as it does not have a $–OCH_2–CH_2–$ moiety, which is prone to elimination. Substrate **1i** was readily synthesized from 2-iodobenzyl alcohol and propargyl bromide in the presence of a base. Following the experimental conditions above, we conducted the reaction between **1i** and various substituted azides, and, to our delight, fused oxepin triazoles **27**–**34** were obtained in good yields (Scheme 5). Various benzyl- and phenyl-substituted azides reacted readily. Both electron-donating and -withdrawing groups, such as methoxy, methyl, and halogens, on the azide component afforded decent yields of the products. Compound **31** was characterized by X-ray crystallography (Figure S2).

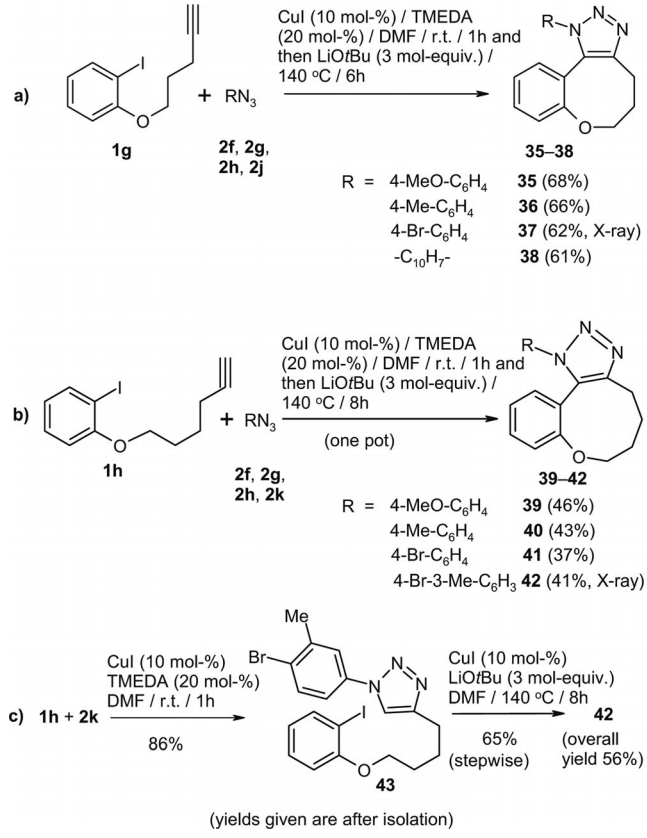


Scheme 4. Synthesis of **25** by the copper-catalyzed reaction of **1f** with **2a**.



Scheme 5. Copper-catalyzed, one-pot synthesis of **27**–**34**.

We then wondered whether our methodology could be applied to the synthesis of analogous [6,8]- and [6,9]ring-fused triazoles. Substrates **1g** and **1h** were prepared from 2-iodophenol, pentyn-1-ol or hexyn-1-ol following a Mitsunobu protocol. With the optimized conditions in hand, we performed the click reaction and direct arylation on these substrates with various aryl azides to generate fused triazoles with large rings. For effective intramolecular arylation, slightly longer reaction times (6–8 h) were required (Scheme 6). In both cases, the starting materials were completely consumed. The yields of the [6,8]ring-fused products **35**–**38** were superior to those of the [6,9] systems **39**–**42**, likely due to the possibility of formation of oligomeric/polymeric entities because of intermolecular arylation. In order to eliminate this potential side reaction, the concentration of the reaction medium was changed from 0.5 to 0.25 M for the preparation of **39**–**42**. However, in the stepwise route, by isolating the intermediate triazole **43**, the overall yield of **42** was 56%. We have not investigated this result further. The solid-state structures of **37** (Figure S3) and **42** (Figures 1 and S4) were determined by X-ray crystallography.



Scheme 6. Copper-catalyzed synthesis of **35**–**42** and the intermediate **43**.

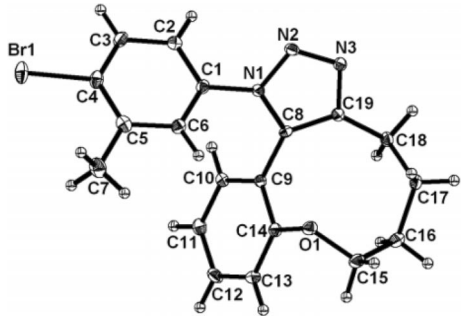
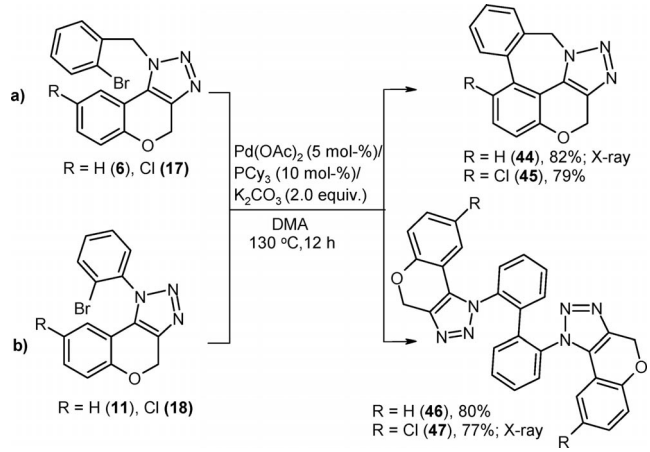


Figure 1. Molecular structure of **42** (only one of the two molecules in the asymmetric unit is shown). N1–N2 1.361(3) and N2–N3 1.308(3) Å.

In an effort to explore the utility of the compounds thus synthesized, we chose the *ortho*-substituted bromo compounds **6** and **17** (benzyl derivatives) and **11** and **18** (phenyl derivatives) for subsequent cyclization. These compounds were subjected to palladium-catalyzed intramolecular cyclization following a Fagnou protocol.[18] Precursors **6** and **17** afforded the new fused pentacyclic compounds **44** and **45** with a new seven-membered ring, whereas **11** and **18** underwent Ullmann coupling[19] to afford **46** and **47** under the same protocol (Scheme 7). Both are essentially clean reactions, and no other products were detected. We have determined the X-ray structures of **44** and **47** (Figures 2, S5, and S6). It is possible that the rigidity of the N–Ar bond in **11** and **18** relative to that of the N–CH_2Ph bond in **6** and **17** plays a role in the difference in reactivity. Reactions such as these are currently being investigated further in our laboratory.



Scheme 7. Palladium-catalyzed synthesis of **44**–**45** and **46**–**47**.

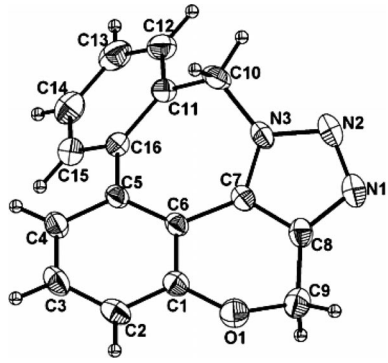


Figure 2. Molecular structure of **44**. Selected bond lengths [Å]: N(1)–N(2) 1.326(4), N(2)–N(2) 1.3544 (19).

Conclusions

We have developed a simple method for the one-pot sequential, copper-catalyzed click reaction and intramolecular direct arylation of the triazoles thus formed. A new class of heterocycles with [6,6]-, [6,7]-, [6,8]- and [6,9]ring-fused systems has been synthesized. The generality and ready availability of the starting materials should make this method an attractive synthetic tool for chemists. The synthesis of pentacyclic derivatives **44** and **45** and the Ullmann-type products **46** and **47** obtained under exactly the same Pd-catalyzed conditions has opened up new chemistry for further exploration.

Experimental Section

The general experimental conditions and synthesis of the precursors are described in the Supporting Information.

(A) General Procedure for the Synthesis of Compounds 3–22 and 25–42: An oven-dried Schlenk tube with a magnetic stirrer bar was

charged with CuI (10 mol-%), TMEDA (20 mol-%), and DMF (1 mL) under a nitrogen atmosphere. *O*-Alkynyliodophenol **1** (0.5 mmol) and azide **2** (0.5 mmol) were added by syringe. The mixture was stirred for 1 h at room temperature, and the formation of triazole was monitored by TLC. After the complete formation of **23**, lithium *tert*-butoxide (3.0 equiv.) was added, and the mixture was heated at 140 °C for 4 h. The mixture was then cooled to ambient temperature, diluted with ethyl acetate (2–3 mL), passed through a plug of celite, and washed with ethyl acetate (10–20 mL). The filtrate was washed with water (10 mL) and brine (10 mL). The organic layer was evaporated and the residue purified by column chromatography on silica gel by using hexane/ethyl acetate (75:25) as eluent to afford the desired product. Compounds **3**–**22** and **25**–**42** were obtained using the same molar quantities.

Compound 3: Yield 0.098 g (75%); m.p. 139–141 °C (ref.[11e] 143–144 °C). IR (KBr): $\tilde{\nu}$ = 2926, 2870, 1746, 1618, 1518, 1443, 1335, 1260, 1198, 1111, 1022, 768 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.29–7.38 (m, 3 H, Ar-*H*), 7.18–7.23 (m, 4 H, Ar-*H*), 7.02 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.90 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 5.82 (s, 2 H, NCH_2), 5.49 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 139.8, 134.7, 130.7, 129.2, 128.5, 127.8, 126.6, 122.7, 122.1, 118.0, 113.9, 64.5, 53.1 ppm. LC–MS: *m*/*z* = 264 [M + 1]$^+$. $C_{16}H_{13}N_3O$ (263.30): calcd. C 72.99, H 4.98, N 15.96; found C 73.12, H 4.93, N 16.20.

Compound 4: Yield 0.111 g (65%); m.p. 134–136 °C. IR (KBr): $\tilde{\nu}$ = 2924, 2855, 1748, 1618, 1520, 1489, 1447, 1406, 1339, 1196, 1115, 1071, 1011, 762 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.48 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.16–7.25 (m, 2 H, Ar-*H*), 7.06 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.01 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.92 (m, 1 H, Ar-*H*), 5.76 (s, 2 H, NCH_2), 5.48 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 139.9, 133.7, 132.4, 130.8, 128.3, 127.8, 122.6, 122.4, 122.2, 118.2, 113.7, 64.5, 52.5 ppm. LC–MS: *m*/*z* = 342, 344 [M]$^+$. $C_{16}H_{12}BrN_3O$ (342.19): calcd. C 56.16, H 3.53, N 12.28; found C 56.32, H 3.48, N 12.15.

Compound 5: Yield 0.099 g (66%); m.p. 100–102 °C. IR (KBr): $\tilde{\nu}$ = 3075, 2930, 1599, 1576, 1520, 1435, 1341, 1211, 1119, 1076, 1022, 843 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.17–7.30 (m, 5 H, Ar-*H*), 7.01–7.06 (m, 2 H, Ar-*H*), 6.93 (t, *J* = 8.0 Hz, 1 H, Ar-*H*), 5.79 (s, 2 H, NCH_2), 5.49 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 139.9, 136.7, 135.3, 130.9, 130.6, 128.8, 127.9, 126.8, 124.7, 122.4, 122.3, 118.2, 113.7, 64.5, 52.5 ppm. LC–MS: *m*/*z* = 298, 300 [M]$^+$. $C_{16}H_{12}ClN_3O$ (297.74): calcd. C 64.54, H 4.06, N 14.11; found C 64.41, H 4.12, N 14.21.

Compound 6: Yield 0.110 g (64%); m.p. 120–122 °C. IR (KBr): $\tilde{\nu}$ = 2924, 2855, 1520, 1464, 1439, 1341, 1202, 1124, 752 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.66–7.68 (m, 1 H, Ar-*H*), 7.20–7.24 (m, 3 H, Ar-*H*), 7.01–7.06 (m, 2 H, Ar-*H*), 6.90 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.61–6.64 (m, 1 H, Ar-*H*), 5.89 (s, 2 H, NCH_2), 5.53 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.7, 139.8, 134.0, 133.1, 130.8, 129.9, 128.4, 128.1, 127.5, 122.4, 122.3, 121.8, 118.0, 113.6, 64.5, 53.1 ppm. LC–MS: *m*/*z* = 342, 344 [M]$^+$. $C_{16}H_{12}BrN_3O$ (342.19): calcd. C 56.16, H 3.53, N 12.28; found C 56.09, H 3.54, N 12.41.

Compound 7: Yield 0.086 g (69%); m.p. 110–112 °C. IR (KBr): $\tilde{\nu}$ = 3067, 2932, 2863, 1688, 1597, 1522, 1447, 1196, 1022, 980, 758 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.55–7.61 (m, 5 H, Ar-*H*), 7.19–7.24 (m, 1 H, Ar-*H*), 7.04 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.89 (dd, *J* = 7.6, 1.2 Hz, 1 H, Ar-*H*), 6.79 (m, 1 H, Ar-*H*), 5.53 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.9, 139.5, 136.9, 130.8, 130.3, 129.8, 128.3, 125.7, 122.6, 121.9, 118.1, 113.9, 64.5 ppm. LC–MS: *m*/*z* = 250 [M + 1]$^+$. $C_{15}H_{11}N_3O$ (249.27): calcd. C 72.28, H 4.45, N 16.86; found C 72.35, H 4.41, N 16.75.

Compound 8: Yield 0.098 g (70%); m.p. 150–153 °C. IR (KBr): $\tilde{\nu}$ = 2924, 1616, 1561, 1526, 1443, 1254, 1204, 1175, 1100, 1017, 831, 756 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.46 (d, *J* = 8.8 Hz, 2 H, Ar-*H*), 7.21 (t, *J* ≈ 7.8 Hz, 1 H, Ar-*H*), 7.08 (d, *J* = 8.8 Hz, 2 H, Ar-*H*), 7.03 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.89 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.81 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 5.53 (s, 2 H, OCH_2), 3.93 (s, 3 H, OCH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.9, 153.8, 139.2, 130.7, 129.6, 128.4, 127.9, 127.1, 122.4, 118.0, 114.8, 114.0, 64.5, 55.7 ppm. LC–MS: *m*/*z* = 280 [M + 1]$^+$. $C_{16}H_{13}N_3O_2$ (279.30): calcd. C 68.81, H 4.69, N 15.04; found C 68.72, H 4.61, N 15.12. This compound was crystallized from dichloromethane/hexane (2:1) mixture at 25 °C and its X-ray structure was determined.

Compound 9: Yield 0.093 g (71%); m.p. 82–84 °C. IR (KBr): $\tilde{\nu}$ = 2919, 2853, 1613, 1520, 1443, 1343, 1219, 1198, 1148, 816, 758 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.44 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.38 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.19–7.21 (m, 1 H, Ar-*H*), 7.03 (dd, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.91 (dd, *J* = 7.6, 1.6 Hz, 1 H, Ar-*H*), 6.78–6.82 (m, 1 H, Ar-*H*), 5.53 (s, 2 H, OCH_2), 2.50 (s, 3 H, CH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.8, 140.6, 139.4, 134.3, 130.7, 130.3, 128.3, 125.5, 122.6, 121.9, 118.0, 114.0, 64.5, 21.4 ppm. LC–MS: *m*/*z* = 264 [M + 1]$^+$. $C_{16}H_{13}N_3O$ (263.30): calcd. C 72.99, H 4.98, N 15.96; found C 72.91, H 4.93, N 15.85.

Compound 10: Yield 0.114 g (69%); m.p. 153–156 °C. IR (KBr): $\tilde{\nu}$ = 3067, 2928, 1740, 1615, 1514, 1445, 1346, 1225, 1017, 828, 764 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.74 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.47 (d, *J* ≈ 8.2 Hz, 2 H, Ar-*H*), 7.24 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 7.05 (d, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.93 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.85 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 5.52 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.9, 139.8, 135.8, 133.1, 131.1, 128.3, 127.2, 124.4, 122.5, 122.1, 118.2, 113.7, 64.4 ppm. LC–MS: *m*/*z* = 328, 330 [M]$^+$. $C_{15}H_{10}BrN_3O$ (328.17): calcd. C 54.90, H 3.07, N 12.80; found C 54.82, H 3.15, N 12.71.

Compound 11: Yield 0.110 g (67%); m.p. 110–112 °C. IR (KBr): $\tilde{\nu}$ = 2926, 2876, 1611, 1518, 1445, 1200, 1019, 760 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.84–7.86 (m, 1 H, Ar-*H*), 7.53–7.58 (m, 3 H, Ar-*H*), 7.19–7.24 (m, 1 H, Ar-*H*), 7.02 (d, *J* = 8.4 Hz, 1 H, Ar-*H*), 6.77 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.57 (dd, *J* = 7.6, 1.2 Hz, 1 H, Ar-*H*), 5.61 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.7, 138.3, 136.4, 134.0, 132.3, 131.0, 129.3, 128.8, 122.0$_3$, 122.0$_1$, 121.8, 117.8, 113.5, 64.6 ppm. LC–MS: *m*/*z* = 328, 330 [M]$^+$. $C_{15}H_{10}BrN_3O$ (328.17): calcd. C 54.90, H 3.07, N 12.80; found C 54.81, H 3.15, N 12.68.

Compound 12: Yield 0.095 g (64%); m.p. 141–144 °C. IR (KBr): $\tilde{\nu}$ = 3059, 2922, 2861, 1618, 1559, 1508, 1447, 1385, 1200, 1017, 804, 774, 754 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.13 (m, 1 H, Ar-*H*), 8.00 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 7.64–7.65 (m, 2 H, Ar-*H*), 7.58 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.48 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.32 (d, *J* = 8.4 Hz, 1 H, Ar-*H*), 7.12 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.99 (d, *J* = 8.4 Hz, 1 H, Ar-*H*), 6.55 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.30 (dd, *J* = 8.0 Hz, *J* = 1.2 Hz, 1 H, Ar-*H*), 5.66 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.7, 138.5, 134.2, 133.1, 131.2, 130.8, 129.8, 129.5, 128.4, 128.2, 127.4, 125.2, 122.4, 121.9, 117.7, 113.5, 64.7 ppm. LC–MS: *m*/*z* = 300 [M + 1]$^+$. $C_{19}H_{13}N_3O$ (299.33): calcd. C 76.24, H 4.38, N 14.04; found C 76.08, H 4.31, N 14.15.

Compound 13: Yield 0.076 g (55%); m.p. 88–90 °C. IR (KBr): $\tilde{\nu}$ = 3061, 2926, 2855, 1746, 1616, 1557, 1518, 1449, 1339, 1196, 1123, 1024, 856, 754 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.35 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 7.19–7.32 (m, 6 H, Ar-*H*), 6.99–7.04 (m, 2 H, Ar-*H*), 5.43 (s, 2 H, OCH_2), 4.80 (t, *J* ≈ 7.8 Hz, 2 H, NCH_2), 3.27 (t, *J* ≈ 7.8 Hz, 2 H, Ph-CH_2) ppm. ^{13}C NMR (100 MHz,

$CDCl_3$): δ = 153.7, 139.5, 136.7, 130.6, 129.0, 128.7, 127.3, 122.2, 121.9, 118.2, 114.2, 64.5, 51.0, 36.3 ppm. LC–MS: *m/z* = 278 [M + 1]$^+$. $C_{17}H_{15}N_3O$ (277.32): calcd. C 73.63, H 5.45, N 15.15; found C 73.55, H 5.51, N 14.98.

Compound 14: Yield 0.113 g (71%); m.p. 112–114 °C. IR (KBr): $\tilde{\nu}$ = 2957, 2920, 2853, 1699, 1647, 1524, 1458, 1447, 1198, 992, 729 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.32–7.39 (m, 3 H, Ar-*H*), 7.19–7.23 (m, 3 H, Ar-*H*), 7.14 (s, 1 H, Ar-*H*), 6.93 (d, *J* = 8.4 Hz, 1 H, Ar-*H*), 5.85 (s, 2 H, NCH_2), 5.46 (s, 2 H, OCH_2), 1.16 [s, 9 H, C(CH_3)$_3$] ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 151.5, 145.0, 140.0, 134.9, 129.3, 128.5, 128.2, 127.6, 126.4, 120.0, 117.3, 113.3, 64.5, 53.3, 34.4, 31.3 ppm. LC–MS: *m/z* = 320 [M + 1]$^+$. $C_{20}H_{21}N_3O$ (319.41): calcd. C 75.21, H 6.63, N 13.16; found C 75.06, H 6.68, N 13.23.

Compound 15: Yield 0.107 g (70%); m.p. 158–160 °C. IR (KBr): $\tilde{\nu}$ = 2961, 2926, 2855, 1699, 1524, 1456, 1262, 1208, 1101, 1030, 802 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.61 (m, 5 H, Ar-*H*), 7.25 (m, 1 H, Ar-*H*), 6.97 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 6.89 (d, *J* = 2.4 Hz, 1 H, Ar-*H*), 5.51 (s, 2 H, OCH_2), 1.08 [s, 9 H, C(CH_3)$_3$] ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 151.6, 144.8, 139.5, 137.0, 130.3, 129.7, 128.8, 127.8, 125.9, 119.6, 117.4, 113.2, 64.5, 34.2, 31.1 ppm. LC–MS: *m/z* = 306 [M + 1]$^+$. $C_{19}H_{19}N_3O$ (305.38): calcd. C 74.73, H 6.27, N 13.76; found C 74.85, H 6.21, N 13.64.

Compound 16: Yield 0.099 g (67%); m.p. 119–121 °C. IR (KBr): $\tilde{\nu}$ = 3079, 2924, 2865, 1518, 1454, 1412, 1329, 1198, 1030, 1003, 986, 816, 721 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.31–7.40 (m, 3 H, Ar-*H*), 7.12–7.22 (m, 4 H, Ar-*H*), 6.92 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 5.80 (s, 2 H, NCH_2), 5.47 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.1, 140.0, 134.3, 130.2, 129.3, 128.7, 127.0, 126.9, 122.7, 122.6, 119.2, 115.0, 64.6, 53.2 ppm. LC–MS: *m/z* = 298 [M]$^+$. $C_{16}H_{12}ClN_3O$ (297.74): calcd. C 64.54, H 4.06, N 14.11; found C 64.32, H 4.15, N 14.25.

Compound 17: Yield 0.117 g (62%); m.p. 161–163 °C. IR (KBr): $\tilde{\nu}$ = 2919, 1615, 1516, 1447, 1406, 1204, 1092, 1055, 756 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.68–7.69 (m, 1 H, Ar-*H*), 7.21–7.24 (m, 2 H, Ar-*H*), 7.15 (dd, *J* = 8.8, 2.4 Hz, 1 H, Ar-*H*), 7.05–7.06 (m, 1 H, Ar-*H*), 6.93 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 6.68–6.70 (m, 1 H, Ar-*H*), 5.89 (s, 2 H, NCH_2), 5.50 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.1, 140.1, 133.6, 133.3, 130.5, 130.2, 128.4, 127.9, 127.3, 127.2, 122.3, 122.0, 119.2, 114.8, 64.7, 53.0 ppm. LC–MS: *m/z* = (main peaks) 377, 379 [M]$^+$. $C_{16}H_{11}BrClN_3O$ (376.64): calcd. C 51.02, H 2.94, N 11.16; found C 51.18, H 2.85, N 10.95.

Compound 18: Yield 0.120 g (66%); m.p. 152–154 °C. IR (KBr): $\tilde{\nu}$ = 3075, 2922, 1644, 1518, 1431, 1202, 1022, 984, 774 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.87–7.89 (m, 1 H, Ar-*H*), 7.54–7.63 (m, 3 H, Ar-*H*), 7.16 (dd, *J* = 8.4, 2.4 Hz, 1 H, Ar-*H*), 6.96 (d, *J* ≈ 8.4 Hz, 1 H, Ar-*H*), 6.47–6.48 (m, 1 H, Ar-*H*), 5.60 (d, *J* = 4.4 Hz, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 152.2, 138.7, 135.8, 134.2, 132.6, 130.7, 129.2, 129.0, 128.3, 127.0, 121.7, 121.6, 119.1, 114.8, 64.7 ppm. LC–MS: *m/z* = 363 [M]$^+$. $C_{15}H_9BrClN_3O$ (362.61): calcd. C 49.69, H 2.50, N 11.59; found C 49.51, H 2.56, N 11.45.

Compound 19: Yield 0.106 g (73%); m.p. 134–137 °C. IR (KBr): $\tilde{\nu}$ = 2963, 2917, 2866, 1516, 1435, 1329, 1198, 1015, 853, 710 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.31–7.38 (m, 3 H, Ar-*H*), 7.19–7.21 (m, 2 H, Ar-*H*), 6.89–6.90 (m, 2 H, Ar-*H*), 5.81 (s, 2 H, NCH_2), 5.45 (s, 2 H, OCH_2), 2.17 and 2.20 (2s, 6 H, 2 CH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.6, 140.0, 134.9, 132.8, 130.7, 129.2, 128.4, 127.2, 126.7, 120.8, 113.2, 64.3, 53.1, 20.7, 16.4 ppm. LC–MS: *m/z* = 292 [M + 1]$^+$. $C_{18}H_{17}N_3O$ (291.35): calcd. C 74.21, H 5.88, N 14.42; found C 74.33, H 5.80, N 14.31.

Compound 20: Yield 0.095 g (69%); m.p. 136–138 °C. IR (KBr): $\tilde{\nu}$ = 3075, 2918, 2851, 1647, 1597, 1514, 1456, 1217, 1192, 1063, 1007, 860 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.58–7.61 (m, 5 H, Ar-*H*), 6.91 (s, 1 H, Ar-*H*), 6.53 (s, 1 H, Ar-*H*), 5.50 (s, 2 H, OCH_2), 2.07 and 2.24 (2s, 6 H, 2 CH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 149.8, 139.9, 136.9, 133.0, 130.6, 130.2, 129.7, 128.8, 127.3, 125.7, 120.6, 113.2, 64.2, 20.7, 16.4 ppm. LC–MS: *m/z* = 278 [M + 1]$^+$. $C_{17}H_{15}N_3O$ (277.32): calcd. C 73.63, H 5.45, N 15.15; found C 73.45, H 5.51, N 15.07.

Compound 21: Yield 0.111 g (71%); m.p. 118–120 °C. IR (KBr): $\tilde{\nu}$ = 2961, 2916, 2855, 1738, 1458, 1260, 1090, 1017, 804 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.78–7.80 (m, 3 H, Ar-*H*), 7.40–7.44 (m, 2 H, Ar-*H*), 7.24–7.26 (m, 4 H, Ar-*H*), 7.07–7.09 (m, 2 H, Ar-*H*), 5.78 (s, 2 H, NCH_2), 5.38 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 154.1, 140.4, 134.9, 131.6, 129.9, 129.6, 128.9, 128.8, 128.3, 128.1, 127.2, 127.1, 124.8, 124.7, 118.7, 109.2, 64.6, 54.1 ppm. LC–MS: *m/z* = 314 [M + 1]$^+$. $C_{20}H_{15}N_3O$ (313.36): calcd. C 76.66, H 4.82, N 13.41; found C 76.55, H 4.85, N 13.36.

Compound 22: Yield 0.113 g (65%); m.p. 200–202 °C. IR (KBr): $\tilde{\nu}$ = 3057, 2915, 2857, 1618, 1593, 1510, 1368, 1346, 1219, 1013, 995, 812 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.93–7.97 (t, *J* ≈ 7.6 Hz, 2 H, Ar-*H*), 7.72–7.78 (m, 2 H, Ar-*H*), 7.21–7.61 (many lines, 6 H, Ar-*H*), 7.05 (t, *J* ≈ 7.4 Hz, 1 H, Ar-*H*), 6.83 (d, *J* ≈ 8.8 Hz, 1 H, Ar-*H*), 6.50 (t, *J* ≈ 7.4 Hz, 1 H, Ar-*H*), 5.64 (d, *J* ≈ 12.6 Hz, 1 H, OCH$_a$$H_b$), 5.48 (d, *J* ≈ 12.6 Hz, 1 H, OCH_aH$_b$) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 154.2, 140.2, 134.5, 134.4, 132.0, 131.0, 130.3, 129.8, 128.7, 128.2$_4$, 128.1$_8$, 128.0, 127.7, 126.0, 125.0, 124.4, 124.2, 124.1, 122.8, 118.6, 109.1, 64.5 ppm. LC–MS: *m/z* = 350 [M + 1]$^+$. $C_{23}H_{15}N_3O$ (349.39): calcd. C 79.07, H 4.33, N 12.03; found C 79.18, H 4.26, N 12.15.

Compound 25: This compound was synthesized according to the general procedure described above using [(1-iodo-2-prop-2-ynyl)-oxymethyl]benzene (**1f**, 0.136 g, 0.5 mmol) and benzyl azide **2a** (0.066 g, 0.5 mmol). Yield 0.075 g (82%); m.p. 36–39 °C. IR (KBr): $\tilde{\nu}$ = 3117, 2922, 2859, 1736, 1636, 1537, 1495, 1456, 1225, 1051, 912, 729 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.45 (s, 1 H, triazole-*H*), 7.37–7.43 (m, 3 H, Ar-*H*), 7.27–7.29 (m, 2 H, Ar-*H*), 6.70 (dd, *J* = 11.2 Hz, *J* = 6.8 Hz, 1 H, C*H*=CH$_2$), 5.86 (d, *J* = 17.6 Hz, 1 H, =CH$_{cis}$$H_{trans}$), 5.52 (s, 2 H, NC$H_2$), 5.32 (d, *J* = 11.2 Hz, 1 H, =CH_{cis}H$_{trans}$) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 146.8, 134.6, 129.1, 128.8, 128.0, 125.6, 120.2, 116.2, 54.1 ppm. LC–MS: *m/z* = 186 [M + 1]$^+$. $C_{11}H_{11}N_3$ (185.23): calcd. C 71.33, H 5.99, N 22.69; found C 71.16, H 6.05, N 22.85.

Compound 27: Yield 0.112 g (81%); m.p. 133–135 °C. IR (KBr): $\tilde{\nu}$ = 3030, 2938, 2861, 1605, 1495, 1453, 1360, 1327, 1235, 1101, 912, 770, 721 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.33–7.42 (m, 7 H, Ar-*H*), 7.19 (d, *J* = 7.2 Hz, 2 H, Ar-*H*), 5.77 (s, 2 H, NCH_2), 4.56 and 5.21 (2s, 4 H, 2 OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 145.0, 139.6, 135.7, 132.5, 129.8, 129.2, 129.0, 128.6, 128.3, 127.1, 126.5, 126.0, 70.9, 67.5, 52.6 ppm. LC–MS: *m/z* = 278 [M + 1]$^+$. $C_{17}H_{15}N_3O$ (277.32): calcd. C 73.63, H 5.45, N 15.15; found C 73.55, H 5.48, N 15.21.

Compound 28: Yield 0.126 g (71%); m.p. 139–141 °C. IR (KBr): $\tilde{\nu}$ = 3057, 2946, 2855, 1491, 1447, 1408, 1356, 1227, 1100, 1009, 916, 808, 774 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50 (d, *J* = 7.6 Hz, 2 H, Ar-*H*), 7.36 (m, 4 H, Ar-*H*), 7.07 (d, *J* = 7.6 Hz, 2 H, Ar-*H*), 5.71 (s, 2 H, NCH_2), 4.56 and 5.20 (2s, 4 H, 2 OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 145.1, 139.6, 134.7, 132.3, 129.9, 129.1, 128.6, 128.3, 126.9, 125.8, 122.4, 70.9, 67.5, 52.1 ppm. LC–MS: *m/z* = 356, 358 [M]$^+$. $C_{17}H_{14}BrN_3O$ (356.22): calcd. C 57.32, H 3.96, N 11.80; found C 57.25, H 3.91, N 11.91.

Compound 29: Yield 0.117 g (75%); m.p. 106–108 °C. IR (KBr): ṽ = 2934, 2852, 1734, 1601, 1574, 1435, 1235, 1101, 912, 766 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.30–7.35 (m, 6 H, Ar-*H*), 7.19 (s, 1 H, Ar-*H*), 7.06 (br., 1 H, Ar-*H*), 5.73 (s, 2 H, NCH_2), 4.56 and 5.21 (2s, 4 H, 2 OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 145.1, 139.6, 137.6, 135.2, 132.5, 130.5, 129.9, 129.1, 128.6$_4$, 128.5$_8$, 126.8, 126.7, 125.7, 124.7, 70.9, 67.5, 52.0 ppm. LC–MS: *m*/*z* = 312 [M]$^+$. $C_{17}H_{14}ClN_3O$ (311.77): calcd. C 65.49, H 4.53, N 13.48; found C 65.56, H 4.47, N 13.36.

Compound 30: Yield 0.099 g (75%); m.p. 164–166 °C. IR (KBr): ṽ = 2928, 2845, 1593, 1501, 1451, 1235, 1113, 1090, 995, 924, 760 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.51–7.53 (m, 3 H, Ar-*H*), 7.40–7.42 (m, 2 H, Ar-*H*), 7.28–7.36 (m, 2 H, Ar-*H*), 7.11 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.90 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 4.72 and 5.28 (2s, 4 H, 2 OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.9, 139.3, 137.3, 131.8, 129.8, 129.7, 129.5, 128.8, 128.3, 128.0, 126.0, 125.5, 71.5, 67.8 ppm. LC–MS: *m*/*z* = 264 [M + 1]$^+$. $C_{16}H_{13}N_3O$ (263.30): calcd. C 72.99, H 4.98, N 15.96; found C 73.12, H 4.92, N 16.07.

Compound 31: Yield 0.112 g (77%); m.p. 160–162 °C. IR (KBr): ṽ = 2917, 2855, 1607, 1514, 1451, 1300, 1258, 1115, 1090, 993, 835, 765 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.25–7.34 (m, 4 H, Ar-*H*), 7.12 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.99–7.02 (m, 2 H, Ar-*H*), 6.94 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 4.70 and 5.26 (2s, 4 H, 2 OCH_2), 3.86 (s, 3 H, OCH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 160.4, 144.7, 139.3, 131.7, 130.2, 129.5, 128.6, 128.0, 127.9, 127.3, 125.6, 114.8, 71.5, 67.8, 55.6 ppm. LC–MS: *m*/*z* = 294 [M + 1]$^+$. $C_{17}H_{15}N_3O_2$ (293.32): calcd. C 69.61, H 5.15, N 14.33; found C 69.55, H 5.21, N 14.28. This compound was crystallized from a dichloromethane/hexane (2:1) mixture at 25 °C and its X-ray structure was determined.

Compound 32: Yield 0.110 g (80%); m.p. 169–171 °C. IR (KBr): ṽ = 2926, 2857, 1717, 1516, 1453, 1238, 1115, 1088, 995, 922, 766 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.28–7.34 (m, 6 H, Ar-*H*), 7.11 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.93 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 4.71 and 5.26 (2s, 4 H, 2 OCH_2), 2.45 (s, 3 H, CH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.8, 140.0, 139.2, 134.8, 131.7, 130.3, 129.5, 128.7, 128.2, 128.0, 125.8, 125.6, 71.5, 67.8, 21.4 ppm. LC–MS: *m*/*z* = 278 [M + 1]$^+$. $C_{17}H_{15}N_3O$ (277.32): calcd. C 73.63, H 5.45, N 15.15; found C 73.55, H 5.41, N 15.27.

Compound 33: Yield 0.113 g (64%); m.p. 178–180 °C. IR (KBr): ṽ = 2957, 2859, 1599, 1485, 1447, 1233, 1092, 1030, 916, 768 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.64 (d, *J* ≈ 8.2 Hz, 1 H, Ar-*H*), 7.30–7.38 (m, 3 H, Ar-*H*), 7.17 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.02 (dd, *J* = 7.6 Hz, *J* ≈ 2.2 Hz, 1 H, Ar-*H*), 6.94 (d, *J* ≈ 8.2 Hz, 1 H, Ar-*H*), 5.26 (s, 2 H, OCH_2), 4.72 (s, 2 H, OCH_2), 2.46 (s, 3 H, CH_3) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 145.0, 140.1, 139.3, 136.4, 133.5, 131.7, 129.7, 128.9, 128.2, 128.1, 127.9, 126.2, 125.3, 124.6, 71.5, 67.8, 23.1 ppm. LC–MS: *m*/*z* = 356, 358 [M]$^+$. $C_{17}H_{14}BrN_3O$ (356.22): calcd. C 57.32, H 3.96, N 11.80; found C 57.25, H 3.88, N 11.91.

Compound 34: Yield 0.106 g (66%); m.p. 201–204 °C. IR (KBr): ṽ = 2978, 2868, 1595, 1512, 1458, 1285, 1252, 1086, 1063, 895, 762 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.25–7.33 (m, 2 H, Ar-*H*), 7.15 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.93–7.01 (m, 3 H, Ar-*H*), 6.80 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 5.24 (s, 2 H, OCH_2), 4.69 (s, 2 H, OCH_2), 4.31 (m, 4 H, OCH_2CH_2O) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 144.8, 144.6, 144.1, 139.2, 131.7, 130.5, 129.4, 128.7, 128.1, 128.0, 125.6, 119.2, 118.0, 115.4, 71.5, 67.8, 64.4, 64.3 ppm. LC–MS: *m*/*z* = 322 [M + 1]$^+$. $C_{18}H_{15}N_3O_3$ (321.33): calcd. C 67.28, H 4.71, N 13.08; found C 67.21, H 4.75, N 13.18.

Compound 35: Yield 0.105 g (68%); m.p. 157–159 °C. IR (KBr): ṽ = 3065, 2919, 1555, 1514, 1439, 1221, 1101, 999, 826, 772 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.33–7.35 (m, 1 H, Ar-*H*), 7.19–7.25 (m, 3 H, Ar-*H*), 6.93–6.97 (m, 1 H, Ar-*H*), 6.89 (dd, *J* = 6.8, 2.4 Hz, 2 H, Ar-*H*), 6.78 (dd, *J* = 7.6, 1.6 Hz, 1 H, Ar-*H*), 4.31 (br. s, 2 H, OCH_2), 3.83 (s, 3 H, OCH_3), 3.08 (br. s, 2 H, CH_2), 1.91–1.96 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 159.9, 157.4, 146.0, 131.0, 130.4, 130.2, 130.0, 126.6, 124.0, 123.4, 121.9, 114.4, 76.8, 55.6, 25.4, 25.3 ppm. LC–MS: *m*/*z* = 308 [M + 1]$^+$. $C_{18}H_{17}N_3O_2$ (307.35): calcd. C 70.34, H 5.58, N 13.67; found C 70.19, H 5.49, N 13.81.

Compound 36: Yield 0.096 g (66%); m.p. 176–178 °C. IR (KBr): ṽ = 3057, 2920, 1514, 1435, 1221, 1101, 999, 826, 772 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.32–7.36 (m, 1 H, Ar-*H*), 7.18–7.21 (m, 5 H, Ar-*H*), 6.94 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.76 (dd, *J* ≈ 7.6, 1.6 Hz, 1 H, Ar-*H*), 4.31 (br., 2 H, OCH_2), 3.07 (br., 2 H, CH_2), 2.37 (s, 3 H, CH_3), 1.91–1.95 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.3, 146.0, 139.0, 134.4, 131.0, 130.3, 130.2, 129.8, 125.0, 123.9, 123.3, 121.9, 76.8, 25.4, 25.3, 21.2 ppm. LC–MS: *m*/*z* = 292 [M + 1]$^+$. $C_{18}H_{17}N_3O$ (291.35): calcd. C 74.21, H 5.88, N 14.42; found C 74.35, H 5.82, N 14.31.

Compound 37: Yield 0.110 g (62%); m.p. 156–158 °C. IR (KBr): ṽ = 3090, 2922, 1497, 1439, 1321, 1223, 1152, 997, 843 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.53 (d, *J* = 8.8 Hz, 2 H, Ar-*H*), 7.39 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.20–7.27 (m, 3 H, Ar-*H*), 7.00 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.77 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 4.32 (br., 2 H, OCH_2), 3.08 (br. s, 2 H, CH_2), 1.93–1.95 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.4, 146.5, 135.8, 132.5, 131.4, 130.4, 130.1, 126.6, 124.2, 123.6, 122.9, 121.5, 76.9, 25.3, 25.2 ppm. LC–MS: *m*/*z* = 356, 358 [M]$^+$. $C_{17}H_{14}BrN_3O$ (356.22): calcd. C 57.32, H 3.96, N 11.80; found C 57.48, H 3.85, N 11.69. This compound was crystallized from a dichloromethane/hexane (2:1) mixture at 25 °C and its X-ray structure was determined.

Compound 38: Yield 0.101 g (61%); m.p. 172–175 °C. IR (KBr): ṽ = 3057, 2920, 1597, 1493, 1429, 1223, 993, 770 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.96 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 7.90 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 7.42–7.53 (m, 5 H, Ar-*H*), 7.19–7.23. (m, 1 H, Ar-*H*), 7.12–7.14 (m, 1 H, Ar-*H*), 6.67–6.71 (m, 1 H, Ar-*H*), 6.60 (dd, *J* = 8.0, 1.6 Hz, 1 H, Ar-*H*), 4.35 (br., 2 H, OCH_2), 3.19 (br., 2 H, CH_2), 1.98–2.03 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.1, 145.6, 134.1, 133.3, 132.5, 131.1, 130.3, 129.8, 129.0, 128.2, 127.8, 126.9, 125.5, 125.0, 123.9, 123.2, 122.7, 122.0, 77.3, 25.6, 25.2 ppm. LC–MS: *m*/*z* = 328 [M + 1]$^+$. $C_{21}H_{17}N_3O$ (327.38): calcd. C 77.04, H 5.23, N 12.83; found C 77.22, H 5.18, N 12.75.

Compound 39: Yield 0.075 g (46%); gummy solid. IR (neat): ṽ = 3059, 2932, 1516, 1445, 1254, 1113, 1030, 993, 835 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.37 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.19–7.27 (m, 3 H, Ar-*H*), 6.94 (t, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 6.82–6.86 (m, 3 H, Ar-*H*), 4.26 (t, *J* = 5.2 Hz, 2 H, OCH_2), 3.79 (s, 3 H, OCH_3), 2.70–2.73 (m, 2 H, CH_2), 1.93–1.96 (m, 2 H, CH_2), 1.80–1.84 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 159.7, 157.4, 147.2, 131.7, 130.9, 130.8, 130.0, 126.0, 122.8, 121.3, 118.8, 114.2, 72.7, 55.5, 30.2, 26.7, 26.0 ppm. LC–MS: *m*/*z* = 322 [M + 1]$^+$. $C_{19}H_{19}N_3O_2$ (321.38): calcd. C 71.01, H 5.96, N 13.07; found C 71.15, H 5.88, N 13.12.

Compound 40: Yield 0.065 g (43%); m.p. 100–102 °C. IR (KBr): ṽ = 3052, 2924, 1580, 1489, 1443, 1285, 1225, 1101, 993 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.36–7.40 (m, 1 H, Ar-*H*), 7.21–7.23 (m, 3 H, Ar-*H*), 7.13–7.15 (m, 2 H, Ar-*H*), 6.95 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.83 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 4.27 (t, *J* ≈ 5.2 Hz, 2 H, OCH_2), 2.71–2.74 (m, 2 H, CH_2), 2.34 (s, 3 H, CH_3), 1.94–1.95

(m, 2 H, CH_2), 1.82–1.84 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.3, 147.4, 138.7, 134.3, 131.6, 130.9, 130.8, 129.7, 124.4, 122.8, 121.3, 118.8, 72.6, 30.2, 26.7, 26.0, 21.2 ppm. LC–MS: *m*/*z* = 306 $[M + 1]^+$. $C_{19}H_{19}N_3O$ (305.38): calcd. C 74.73, H 6.27, N 13.76; found C 74.86, H 6.17, N 13.65.

Compound 41: Yield 0.069 g (37%); m.p. 125–127 °C. IR (KBr): $\tilde{\nu}$ = 3069, 2922, 1570, 1493, 1443, 1221, 992, 770 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.50 (d, *J* = 8.8 Hz, 2 H, Ar-*H*), 7.40–7.45 (m, 1 H, Ar-*H*), 7.28 (m, 1 H, Ar-*H*), 7.24 (d, *J* = 8.8 Hz, 2 H, Ar-*H*), 6.98–7.02 (m, 1 H, Ar-*H*), 6.85 (dd, *J* = 7.6, 1.6 Hz, 1 H, Ar-*H*), 4.28 (t, *J* = 5.2 Hz, 2 H, OCH_2), 2.72–2.75 (m, 2 H, CH_2), 1.81–1.99 (m, 4 H, 2 CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.3, 147.8, 135.8, 132.4, 131.6, 131.2, 130.7, 125.9, 123.0, 122.6, 120.9, 119.0, 72.7, 30.2, 26.6, 26.0 ppm. LC–MS: *m*/*z* = 370, 372 $[M]^+$. $C_{18}H_{16}BrN_3O$ (370.25): calcd. C 58.39, H 4.36, N 11.35; found C 58.29, H 4.31, N 11.48.

Compound 42: Yield 0.080 g (41%); m.p. 120–122 °C. IR (KBr): $\tilde{\nu}$ = 3059, 2920, 1578, 1489, 1441, 1221, 1109, 1032, 939, 766 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.46 (d, *J* ≈ 8.0 Hz, 1 H, Ar-*H*), 7.38–7.42 (m, 1 H, Ar-*H*), 7.33 (m, 1 H, Ar-*H*), 7.22 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.98 (t, *J* = 7.6 Hz, 1 H, Ar-*H*), 6.92 (dd, *J* ≈ 8.0, 2.4 Hz, 1 H, Ar-*H*), 6.83–6.85 (m, 1 H, Ar-*H*), 4.27 (t, *J* = 5.2 Hz, 2 H, OCH_2), 2.71–2.73 (m, 2 H, CH_2), 2.36 (s, 3 H, CH_3), 1.94–1.95 (m, 2 H, CH_2), 1.79–1.83 (m, 2 H, CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.4, 147.7, 139.4, 135.9, 132.9, 131.6, 131.2, 130.7, 126.6, 125.0, 123.1, 123.0, 121.1, 119.0, 72.7, 30.2, 26.6, 26.0, 23.0 ppm. LC–MS: *m*/*z* = 384, 386 $[M]^+$. $C_{19}H_{18}BrN_3O$ (384.27): calcd. C 59.39, H 4.72, N 10.93; found C 59.61, H 4.64, N 10.81. This compound was crystallized from an ethyl acetate/hexane (2:1) mixture at 4 °C and its X-ray structure was determined.

(B) Synthesis of 23–24 and 43: Representative Procedure for 23: An oven-dried Schlenk tube with a magnetic stirrer bar was charged with CuI (10 mol-%), TMEDA (20 mol-%), and DMF (1 mL) under a nitrogen atmosphere. (1-Iodo-2-prop-2-ynyloxy)benzene (**1a**, 0.5 mmol) and benzyl azide **2a** (0.5 mmol) were added by syringe. The mixture was stirred for 1 h at room temperature, diluted with water (15 mL), and the product was extracted into ethyl acetate (2 × 20 mL). The organic layer was washed with brine (10 mL), dried with sodium sulfate, and the solvent evaporated. The residue was purified by column chromatography on silica gel by using hexane/ethyl acetate (70:30) as eluent to afford **23**. Yield 0.172 g (88%); m.p. 92–94 °C. IR (KBr): $\tilde{\nu}$ = 2917, 2361, 1564, 1474, 1454, 1437, 1273, 1248, 1015, 802, 706 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.75 (dd, *J* = 7.6 Hz, *J* = 1.2 Hz, 1 H, Ar-*H*), 7.64 (s, 1 H, N-C*H*=C), 7.25–7.37 (m, 6 H, Ar-*H*), 6.97 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.72 (dd→t, *J* = 7.6 Hz, 1 H, Ar-*H*), 5.53 (s, 2 H, NCH_2), 5.25 (s, 2 H, OCH_2) ppm (the assignment of NCH_2/OCH_2 protons is tentative in these compounds; NCH_2 protons appear to be those upfield, on the basis of comparison to related compounds reported here). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.8, 144.5, 139.5, 134.6, 129.6, 129.2, 128.8, 128.0, 123.2, 122.9, 113.1, 86.8, 63.7, 54.3 ppm. LC–MS: *m*/*z* = 392 $[M + 1]^+$. $C_{16}H_{14}IN_3O$ (391.21): calcd. C 49.12, H 3.61, N 10.74; found C 49.22, H 3.65, N 10.65.

Compound 24: This compound was synthesized following the procedure for **23**. Yield 0.201 g (87%); m.p. 113–115 °C. IR (KBr): $\tilde{\nu}$ = 3057, 2920, 2855, 1736, 1616, 1497, 1435, 1231, 1044, 822 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.15 (s, 1 H, triazole-*H*), 7.80 (dd, *J* ≈ 8.0, 1.4 Hz, 1 H, Ar-*H*), 7.66 (br., 4 H, Ar-*H*), 7.31–7.33 (m, 1 H, Ar-*H*), 7.02 (d, *J* = 8.0 Hz, 1 H, Ar-*H*), 6.77–6.79 (m, 1 H, Ar-*H*), 5.37 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 156.8, 145.3, 139.7, 136.0, 133.0, 129.8, 123.5, 122.6, 122.1, 120.9, 112.9, 86.8, 63.6 ppm. LC–MS: *m*/*z* = 456, 458 $[M]^+$. $C_{15}H_{11}BrIN_3O$ (456.08): calcd. C 39.50, H 2.43, N 9.21; found C 39.41, H 2.48, N 9.32.

Compound 43: This compound was synthesized following the procedure for **23**. Yield 0.22 g (86%); gummy solid. IR (neat): $\tilde{\nu}$ = 3069, 2944, 1582, 1485, 1246, 1163, 1121, 1019, 750 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.78 (s, 1 H, triazole-*H*), 7.74–7.77 (m, 1 H, Ar-*H*), 7.63–7.66 (m, 2 H, Ar-*H*), 7.22 (dd, *J* ≈ 8.4, 2.6 Hz, 1 H, Ar-*H*), 7.26–7.28 (m, 1 H, Ar-*H*), 6.78–6.80 (m, 1 H, Ar-*H*), 6.68–6.71 (m, 1 H, Ar-*H*), 4.06 (t, *J* ≈ 5.8 Hz, 2 H, OCH_2), 2.90–2.94 (m, 2 H, CH_2), 2.48 (s, 3 H, CH_3), 1.94–2.05 (m, 4 H, 2 CH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 157.4, 148.9, 139.8, 139.4, 136.3, 133.4, 129.5, 124.5, 122.5, 122.4, 119.0, 112.1, 86.7, 68.6, 28.6, 25.8, 25.3, 23.1 ppm. LC–MS: *m*/*z* = 512, 514 $[M]^+$. $C_{19}H_{19}BrIN_3O$ (512.19): calcd. C 44.56, H 3.74, N 8.20; found C 44.65, H 3.71, N 8.32.

(C) General Procedure for the Palladium-Catalyzed Coupling of 6, 11, and 17–18 Leading to 44–47: Compounds **44**–**47** were synthesized essentially following a procedure reported by Fagnou and coworkers.[19] Crushed K_2CO_3 (0.6 mmol, 2 equiv.), substrate **6**, **11**, **17**, or **18** (0.3 mmol, 1 equiv.), $Pd(OAc)_2$ (5 mol-% with respect to substrate), and tricyclohexylphosphane (10 mol-%) were placed in a 5 mL round-bottomed flask equipped with a magnetic stirrer bar. The flask was filled with nitrogen and dimethylacetamide (1.5 mL) was added. The reaction mixture was heated at 130 °C overnight. After the reaction was judged complete by TLC, the mixture was allowed to cool. The crude mixture was loaded directly onto a silica gel column and the product was purified using an ethyl acetate/hexanes (1:2) mixture as eluent.

Compound 44: Yield 0.062 g (82%); m.p. 180–182 °C. IR (KBr): $\tilde{\nu}$ = 2926, 2855, 1725, 1632, 1562, 1449, 1343, 1227, 1128, 1017, 764 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 (d, *J* ≈ 7.6 Hz, 1 H, Ar-*H*), 7.40–7.53 (m, 5 H, Ar-*H*), 7.09 (d, *J* = 7.6 Hz, 1 H, Ar-*H*), 5.49 (s, 2 H, NCH_2), 5.47 (s, 2 H, OCH_2) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.3, 138.6, 138.1, 135.3, 132.0, 131.9, 131.1, 130.8, 129.6, 129.2, 129.1, 122.3, 116.4, 112.9, 64.8, 53.6 ppm. LC–MS: *m*/*z* = 262 $[M + 1]^+$. $C_{16}H_{11}N_3O$ (261.28): calcd. C 73.55, H 4.24, N 16.08; found C 73.41, H 4.19, N 16.23. This compound was crystallized from an ethyl acetate/hexane (2:1) mixture at 25 °C and its X-ray structure was determined.

Compound 45: Yield 0.068 g (79%); m.p. 220–222 °C. IR (KBr): $\tilde{\nu}$ = 2920, 2857, 1647, 1429, 1341, 1032, 972, 758 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.88–7.89 (m, 1 H, Ar-*H*), 7.55–7.57 (m, 1 H, Ar-*H*), 7.47–7.51 (m, 3 H, Ar-*H*), 7.03 (d, *J* = 8.8 Hz, 1 H, Ar-*H*), 5.71 (d, *J* = 14.0 Hz, 1 H, CH_AH_B), 5.62 (d, *J* = 12.8 Hz, 1 H, CH_AH_B), 5.35 (d, *J* = 12.8 Hz, 1 H, CH_AH_B), 5.17 (d, *J* = 14.0 Hz, 1 H, CH_AH_B) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 151.7, 137.8, 135.5, 133.8, 133.1, 133.0$_2$, 132.9$_7$, 130.4, 129.5, 128.8, 128.5, 125.8, 117.3, 115.7, 65.0, 53.3 ppm. LC–MS: *m*/*z* = 296, 298 $[M]^+$. $C_{16}H_{10}ClN_3O$ (295.73): calcd. C 64.98, H 3.41, N 14.21; found C 64.88, H 3.46, N 14.12.

Compound 46: Yield 0.06 g (80%); m.p. 241–243 °C. IR (KBr): $\tilde{\nu}$ = 2922, 2865, 1616, 1516, 1439, 1213, 1152, 1003, 982, 758 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.69–7.88 (m, 4 H, Ar-*H*), 7.46–7.50 (m, 2 H, Ar-*H*), 7.10–7.17 (m, 4 H, Ar-*H*), 6.66–6.79 (m, 4 H, Ar-*H*), 6.08–6.10 (m, 2 H, Ar-*H*), 5.17 and 5.21 (2s, 2 H, 2 OCH_AH_B), 4.18 and 4.21 (2s, 2 H, 2 OCH_AH_B) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 153.4, 138.7, 135.3, 134.4, 133.9, 130.8, 130.4, 129.2, 128.0, 126.2, 122.8, 121.4, 117.5, 112.6, 64.1 ppm. LC–MS: *m*/*z* = 497 $[M + 1]^+$. $C_{30}H_{20}N_6O_2$ (496.53): calcd. C 72.57, H 4.06, N 16.93; found C 72.41, H 4.12, N 17.08.

Compound 47: Yield 0.065 g (77%); m.p. 254–256 °C. IR (KBr): $\tilde{\nu}$ = 2924, 2880, 1647, 1518, 1435, 1208, 1096, 1024, 997, 824, 768 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$): δ = 7.70–7.92 (m, 4 H, Ar-*H*), 7.44–7.52 (m, 2 H, Ar-*H*), 6.93–7.13 (m, 4 H, Ar-*H*), 6.65–6.66 (m, 2 H, Ar-*H*), 5.87 (m, 2 H, Ar-*H*), 5.33 and 5.36 (2s, 2 H, 2 OCH-$_A H_B$), 4.80 and 4.83 (2s, 2 H, 2 OCH_AH_B) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 151.8, 138.6, 134.8, 133.6, 130.5, 130.4, 129.5, 127.1, 126.7, 126.3, 121.7, 119.1, 118.7, 113.7, 64.5 ppm. LC–MS: *m*/*z* = 565, 563 $[M]^+$. $C_{30}H_{18}Cl_2N_6O_2$ (565.42): calcd. C 63.73, H 3.21, N 14.86; found C 63.88, H 3.17, N 14.75. This compound was crystallized from a dichloromethane/hexane (2:1) mixture at 25 °C and its X-ray structure was determined.

Single crystal X-ray data were collected with a Bruker AXS-SMART or OXFORD diffractometer using Mo-K_α (λ = 0.71073 Å) radiation. The structures were solved by direct methods and refined by full-matrix least-squares method using standard procedures.[20] Absorption corrections were performed using the SADABS program, where applicable. In general, all non-hydrogen atoms were refined anisotropically; hydrogen atoms were fixed by geometry or located by a difference Fourier map and refined isotropically. Compounds **37** and **42** show some disorder at one of the carbon atoms of the eight/nine-membered ring.

Crystal Data for 8: $C_{16}H_{13}N_3O_2$, M = 279.29, monoclinic, space group $P2_1/c$, a = 11.0061(11), b = 7.9658(8), c = 16.2080(16) Å, β = 107.149(2)°, V = 1340.8(2) $Å^3$, Z = 4, μ = 0.094 mm^{-1}, data/restraints/parameters: 2362/0/191, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0672, $wR2$ (all data) = 0.0849.

Crystal Data for 31: $C_{17}H_{15}N_3O_2$, M = 293.32, monoclinic, space group $P2_1/c$, a = 8.3038(17), b = 15.312(3), c = 11.271(2) Å, β = 94.644(3)°, V = 1428.4(5) $Å^3$, Z = 4, μ = 0.092 mm^{-1}, data/restraints/parameters: 2516/ 0/200, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0622, $wR2$ (all data) = 0.1186.

Crystal Data for 37: $C_{17}H_{14}BrN_3O$, M = 356.22, monoclinic, space group $P2_1/c$, a = 7.6977(8), b = 13.1470(11), c = 16.0173(17) Å, β = 97.433(9)°, V = 1607.4(3) $Å^3$, Z = 4, μ = 2.562 mm^{-1}, data/restraints/parameters: 2813/ 0/208, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0459, $wR2$ (all data) = 0.0959.

Crystal Data for 42: $C_{19}H_{18}BrN_3O$, M = 384.27, monoclinic, space group $P2_1/n$, a = 11.3442(10), b = 9.4867(8), c = 31.3130(3) Å, β = 90.3130(10)°, V = 3376.1(5) $Å^3$, Z = 8, μ = 2.446 mm^{-1}, data/restraints/parameters: 5902/ 0/453, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0371, $wR2$ (all data) = 0.0946.

Crystal Data for 44: $C_{16}H_{11}N_3O$, M = 261.28, triclinic, space group $P\bar{1}$, a = 8.1536(9), b = 8.2282(8), c = 10.5769(11) Å, α = 111.598(9)°, β = 94.123(9)°, γ = 109.797(9)°, V = 604.91(11) $Å^3$, Z = 2, μ = 0.093 mm^{-1}, data/restraints/parameters: 2140/ 0/181, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0407, $wR2$ (all data) = 0.1057.

Crystal Data for 47: $C_{30}H_{18}Cl_2N_6O_2$, M = 565.4, monoclinic, space group $C2/c$, a = 9.1135(6), b = 17.2974(12), c = 16.1671(11) Å, β = 103.865(7)°, V = 2474.3(3) $Å^3$, Z = 4, μ = 0.306 mm^{-1}, data/restraints/parameters: 2186/ 0/182, R indices [$I > 2\sigma(I)$]: $R1$ = 0.0397, $wR2$ (all data) = 0.0979.

CCDC-832913 (for **8**), -832914 (for **31**), -832915 (for **37**), -832916 (for **42**), -832917 (for **44**), and -832918 (for **47**) 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.

Supporting Information (see footnote on the first page of this article): ^1H and ^{13}C NMR spectra; details of the synthesis of precursors **1a**–**e** and **2a**–**m**; ORTEP drawings.

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