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Note

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Regioselective base-mediated cyclizations of mono-*N*-acylpropargylguanadines.

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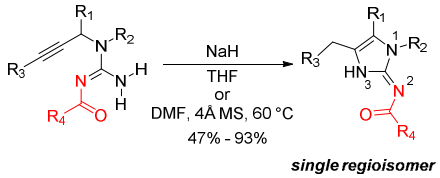
Abstract: A regioselective base-mediated cyclization of mono-*N*-acylpropargylguanidines is reported. A related Ag(I)-catalyzed hydroamination strategy was recently employed to yield N^3-Cbz-protected ene-guanidines which found utility in the synthesis of naamidine A. Herein we report the base-catalyzed hydroamination of mono-*N*-acylpropargylguanidines which proceeds with the opposite regiochemistry to deliver isomerized N^2-acyl-2-aminoimidazoles with broad substrate scope, circumventing the problematic regiospecific acylation of free 2-aminoimidazoles.



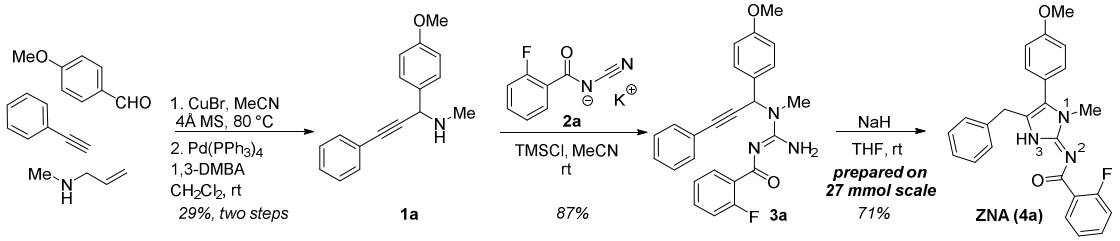
2-aminoimidazoles' abundance in marine natural product cores has motivated the development of methodology to access these nitrogen-rich heterocycles with robust chemistry.[1] Tailoring of the heterocycle to the 2-monoacylaminoimidazole scaffold has yielded a class of pharmacologically privileged compounds that include transforming growth factor β1 receptor (TGFβ1) inhibitors,[2] glial inflammation suppressors,[3] anti-hepatitis C agents,[4] and Pgp-multidrug resistance reversal agents.[5]

We were particularly inspired by the unique EGF-dependent cytotoxicological profile of naamidine A, a 2-aminoimidazole alkaloid originally isolated from the marine sponge *Leucetta chagosensis*, and its applications in breast cancer therapy.[6,7] Extending our methodology for the synthesis of naamidine A, we reported a number of first generation analogs.[8] Initial screening of these compounds identified a compound dubbed zinaamidole A (ZNA, **4a**) as a promising lead due to its anti-proliferative activity (EC_{50} = 8.8 μM) against drug-resistant pleural effusion cells (PE1005339) derived from patients with breast cancer as well as immortalized, cancerous MCF-7 cells (EC_{50} = 3.3 μM).[9] In additional assays, ZNA showed negligible cytotoxicity against normal primary

epithelial cells or the untransformed breast cancer cell line MCF-10A, and was significantly more selective than its natural product inspiration naamidine A.[10,11] This selectivity of growth inhibition against cancerous tissue necessitated efforts towards a scalable, modular synthesis of ZNA and structurally related compounds.

Initial efforts to generate simplified naamidine A analogs focused on the treatment of a free 2-aminoimidazole with an acid chloride, yielding a problematic 1:2 mixture of mono and bis-N^2-acylated products respectively; a similar phenomenon was reported by Jiang and coworkers.[7] Our solution relied on treatment of mono-Cbz protected propargylguanidines with $AgNO_3$, yielding a N^3-Cbz-ene-guanidine bearing an exo-cyclic alkene as a single regioisomer.[8] This allowed for the selective acylation of N^2, followed by Cbz deprotection of N^3 to yield N^2-acyl-2-aminoimidazoles such as ZNA. We reasoned that deprotonation of the mono-*N*-acylpropargylguanidine might allow for preferential cyclization through the more reactive, non-acylated, guanidine nitrogen to directly give N^2-acyl-2-aminoimidazoles without the need for this protection/de-protection sequence. Examples of diverse metal-catalyzed and base-mediated hydroaminations exist in the literature[12,13], including the synthesis of imidazole-2-thiones from propargylthioureas[14]; however, the reactivity and regioselectivity of mono-*N*-acylpropargylguanidines hydroaminations has not been explored. If this reactivity were realized, it would greatly facilitate the preparation of ZNA analogues for biological evaluation.

To evaluate this hypothesis, we treated propargylamine **1a** with potassium *N*-cyano-2-fluorobenzamide **2a** activated by TMSCl to deliver mono-*N*-acylpropargylguanidines **3a** (Scheme 1). To our delight, addition of one equivalent of NaH to compound **3a** in THF afforded a material that was identical to ZNA, indicating that not only had the cyclization occurred exclusively through the non-acylated nitrogen, but subsequent double bond isomerization directly yielded the N^2-acyl-2-aminoimidzole. These results were confirmed by spectroscopic methods, and permitted the multi-gram synthesis of ZNA in four transformations. A crystal structure of **4a** has been reported previously.[8]



Scheme 1. Second generation synthesis of ZNA.

Further exploration of the efficiency and selectivity of this transformation began with the preparation of mono-*N*-acylpropargylguanidines from potassium salts of *N*-cyanobenzamides activated by TMSCl and respective secondary propargylic amines (Table 1). All of the performed reactions proceeded in good yield at room temperature, usually reaching completion within 20 minutes. Generally, more electron-deficient *N*-cyanobenzamides performed better in the guanidinylation step, presumably due to the increased reactivity of their *N*-silylcarbodiimide intermediates. Initial investigation into the scope of the NaH mediated hydroamination of mono-*N*-acylpropargylguandidines revealed that the reaction is amenable to electron-donating and withdrawing aryl substituents at the R^1 and R^4 positions. Introduction of a cyclopropyl group at the R^3 position gave comparable yields to aryl substituents (e.g. **4i-4l**). Carbamoyl guanidines also cyclize selectively under these conditions as illustrated by **4m**. The regiochemistry is further supported by the X-ray structure of **4m** (Figure 1). Interestingly this N^2-carbamoyl derivative exists as the endocyclic N^3-imino tautomer in contrast to structures of the amides at N^2, previously obtained in our laboratory, which exist predominantly as the exocyclic N^2-imino tautomers.

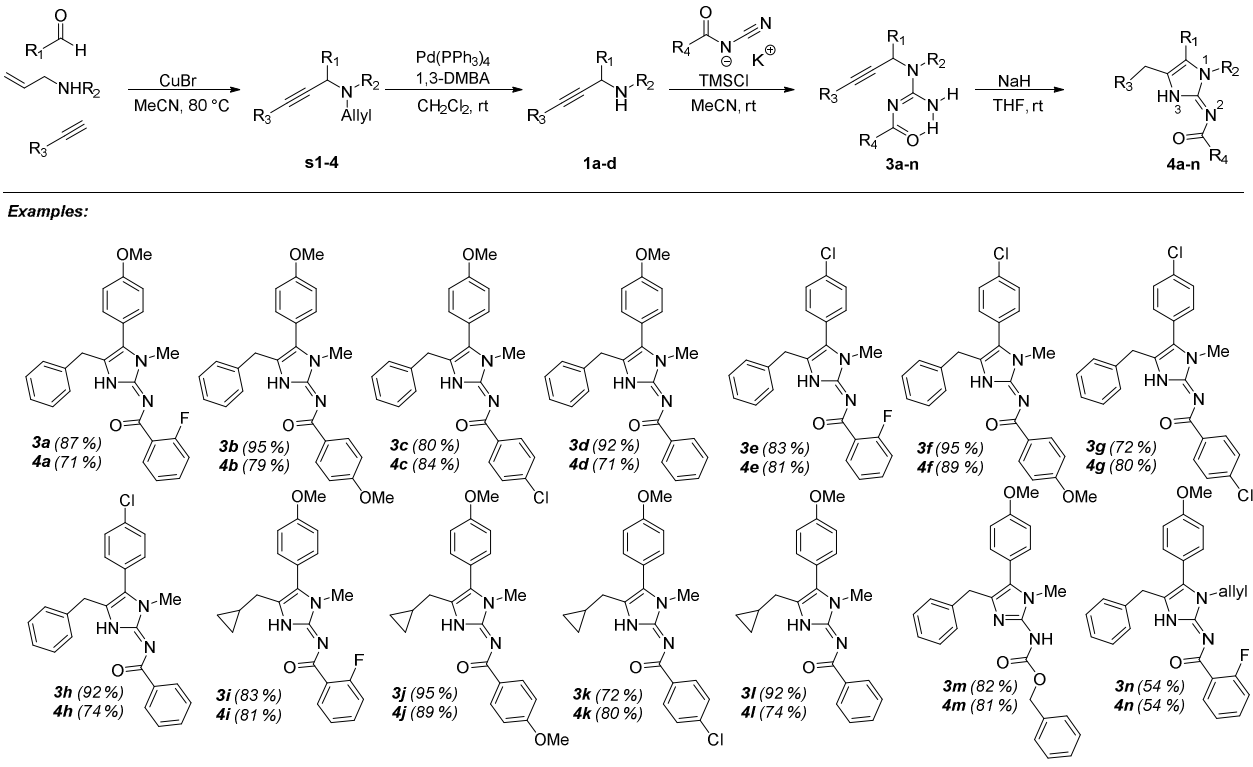


Table 1. Substrate scope of the synthesis of N^2-acyl-2-aminoimidazoles.

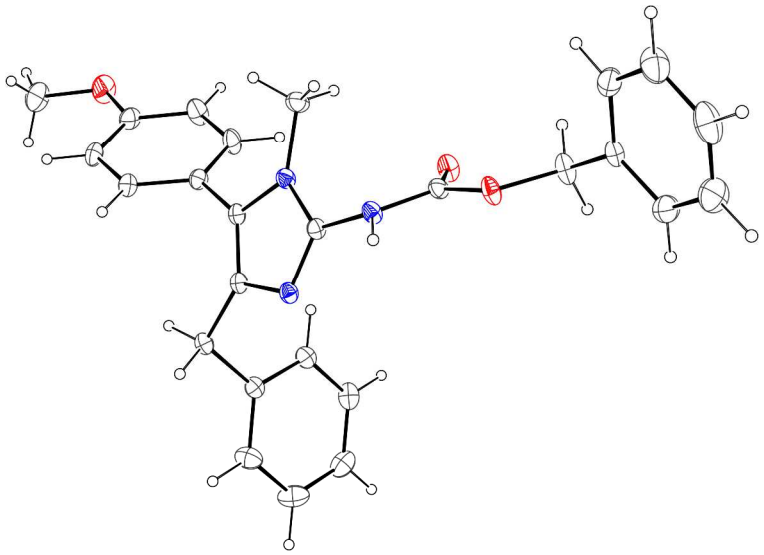


Figure 1. Crystal structure of **4m** (ellipsoids are shown at 35% probability level).

Cyclization of substrates in which the R^1 position was unsubstituted or alkyl-substituted failed to undergo cyclization with our initial conditions. This was surprising, as we have never observed a reaction dependence on this substituent in the metal-catalyzed cyclizations (Ag^I or Rh^{II}).[13] For example, when we attempted the cyclization of **3p** (R^1 = iPr) under the same conditions as the aryl-substituted propargylguanidines in Table 1 we observed only starting material accompanied by decomposition products, as evidenced by NMR spectroscopy of the crude material (Table 2).

After optimization of this reaction, it was found that treatment of **3p** with NaH in DMF at 60 °C with molecular sieves proceeded cleanly to give the desired *N*^{2}-acyl-2-aminoimidazole with minimal byproducts as judged by ^{1}H- NMR. It appears that the intermediate cyclic ene-guanidine is prone to decomposition if strict anhydrous conditions are not maintained. Since the isomerization of the cyclic ene-guanidine to the *N*^{2}-acyl-2-aminoimidazole is facilitated by the aromatic group at R^1, we presume that the increased lifetime of the cyclic ene-guanidine when R^1 = alkyl leads to decomposition and lowers the efficiency of the transformation in those substrates. Under these optimized conditions, a variety of alkyl substituted substrates can be cyclized including the dialkyl substrate **3q** to give **4q** and the unsubstituted substrates **3r-t** to give **4r-t**.

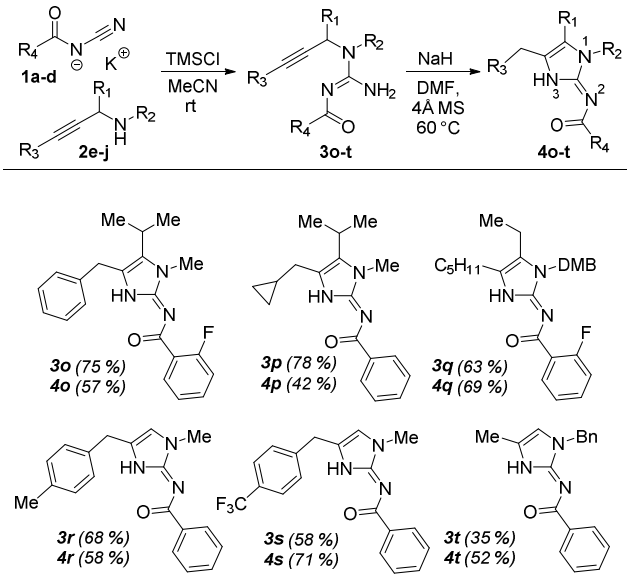


Table 2. Optimized conditions for synthesis C^5 alkyl and C^5 unsubstituted 2-acylaminoimidazoles from mono-*N*-acylpropargylguanidines.

In summary, we have reported a synthetically useful and broadly applicable means of generating N^2-acyl-2-acylaminoimidazoles with high regiochemical fidelity through the base-mediated hydroamination of mono-N-acylpropargylguanidines. This provides a robust 4-step synthesis of highly substituted N^2-acyl-2-aminoimidazoles from commercially available starting materials, contrasted to the lengthy methods used in other procedures, and avoids the use of a protecting group strategy when furnishing the N^2-acyl-2-acylaminoimidazoles.

Experimental Section:

General Experimental Considerations: Unless otherwise noted all starting materials were either known compounds or were obtained from commercial sources and used without purification. All reactions requiring anhydrous conditions were performed under a positive pressure of nitrogen using flame-dried glassware. Silver nitrate was purchased from Sigma-Aldrich. Dichloromethane (CH_2Cl_2), acetonitrile (CH_3CN), tetrahydrofuran (C_4H_8O), dimethylformamide (C_3H_7NO), and diethyl ether (Et_2O) were degassed with argon and passed through a solvent purification system (J.C. Meyer of Glass Contour) containing either alumina or molecular sieves. Flash chromatography was performed on Merk silica gel Kieselgel 60 (230-400 mesh) from EM science with the indicated solvent. ^{1}H NMR spectra were recorded on Varian Unity-300, Inova-400, or VXR-500 MHz

spectrometers as indicated. The chemical shifts (δ) of proton resonances are reported relative to $CDCl_3$ or CD_3OD, using the following format: chemical shift [multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, app = apparent, br = broad), coupling constant(s) (J in Hz), integral].[15,16] ^{13}C NMR spectra were recorded at 75, 100, or 125 MHz. The chemical shifts of carbon resonances are reported relative to the deuterated solvent peak. Mass spectra were obtained at the University of Utah CIF on a LCT XE premier (ESI/APCI-TOF) for HRMS.

General Procedure for the 3-component coupling: *N-(1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl)-N-methylprop-2-en-1-amine* (**s1**). In a 250 mL high pressure flask containing a magnetic stir bar were added *p*-anisaldehyde (10 g, 73.4 mmol), phenylacetylene (7.5 g, 73.4 mmol), *N*-allylmethylamine (4.75 g, 66.7 mmol), oven-dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 2 g) and acetonitrile (200 mL). The flask was sealed and placed in a preheated 80 ˚C oil bath for 24h. The reaction flask was removed from the oil bath and allowed to cool to room temperature. CuBr (0.95 g, 6.67mmol) was then added and the flask was sealed and returned to the preheated 80˚C oil bath for 48h. The reaction tube was removed from the oil bath and allowed to cool to room temperature. The mixture was filtered through diatomaceous earth and rinsed with EtOAc (50 mL). The filtrate was concentrated under reduced pressure. The crude product was purified via flash chromatography, eluting with 9:1 hexanes/EtOAc to give a dark orange oil (12.7 g, 65%). R_f = 0.78 (2:1 hexanes/EtOAc); ^1H NMR ($CDCl_3$, 300 MHz): δ 7.59-7.53 (m, 4H), 7.37-7.26 (m, 3H), 6.49 (d, *J* = 8.7 Hz, 2H), 5.92 (ddt, *J* = 6.6 Hz, 10.5 Hz, 17.4 Hz, 1H), 5.33 (dd, *J* = 17.4 Hz, 2.0 Hz, 1H), 5.19 (dd, *J* = 9.3 Hz, 2.0 Hz, 1H), 4.94 (s, 1H), 3.83 (s, 3H), 3.19 (d, *J* = 6.6 Hz, 2H), 2.24 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 159.1, 136.3, 131.9, 131.1, 129.7, 128.4, 128.2, 123.4, 117.7, 113.6, 88.3, 85.3, 59.3, 57.8, 55.4, 37.8 ppm. IR (thin film) 2948, 2834, 2786, 1642, 1609, 1583, 1507, 1488, 1441, 1301, 1244, 1169, 1126, 1107, 1033, 994, 962, 916, 850, 807, 778, 754, 689, 583, 524 cm^{-1}. HRMS (ESI-TOF) m/z: [M + H]+ Calcd for $C_{20}H_{21}NO$ 292.1701; Found 292.1699.

N-(1-(4-Chlorophenyl)-3-phenylprop-2-yn-1-yl)-N-methylprop-2-en-1-amine (**s2**). Prepared from the 3-component coupling of 4-chlorobenzaldehyde (5 g, 35.57 mmol), phenylacetylene (3.9 mL, 35.57 mmol), *N*-allylmethylamine (3.07 mL, 32.34 mmol), oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 2 g), and acetonitrile (200 mL), with flash chromatography purification using silica gel eluting with 9:1 hexanes/EtOAc to

yield a dark orange oil (5.84 g, 61%). R_f = 0.75 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.65-7.61 (m, 2H), 7.59-7.56 (m, 2H), 7.40-7.34 (m, 5H), 5.90-5.91 (m, 1H), 5.35 (dd, *J* = 17.0 Hz, 2.0 Hz, 1H), 5.23 (dd, *J* = 10.5 Hz, 2.0 Hz, 1H), 4.98 (s, 1H), 3.21 (d, *J* = 6.0 Hz, 2H), 2.26 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz): δ 137.5, 135.9, 133.3, 131.8, 129.8, 128.4, 128.3 (2), 122.9, 117.9, 88.7, 84.2, 59.1, 57.8, 37.6 ppm. IR (thin film): 1487, 1442, 1402, 1089, 1014, 994, 962, 920, 853, 796, 689, 592, 582 cm^{-1}. HRMS (ESI-TOF) m/z: [M + H]+ Calcd for $C_{19}H_{19}NCl$ 296.1026; Found 296.1206.

N-(3-Cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylprop-2-en-1-amine (**s3**). Prepared from the 3-component coupling of *p*-anisaldehyde (500 mg, 4.12 mmol), cyclopropylacetylene (0.35 mL, 4.12 mmol), *N*-allylmethylamine (0.36 mL, .38 mmol), oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 2 g), CuBr (0.46 g, 3.23 mmol), and acetonitrile (100 mL), with flash chromatography purification using silica gel eluting with 9:1 hexanes/EtOAc to yield a dark orange oil (226 mg, 22%). R_f = 0.68 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.43 (d, *J* = 8.5 Hz, 2H), 6.86 (d, *J* = 8.5 Hz, 2H), 5.84-5.81 (m, 1H), 5.23 (dd, *J* = 17.0 Hz, 1.5 Hz, 1H), 5.12 (d, *J* = 6.5 Hz, 1H), 4.62 (s, 1H), 3.04 (t, *J* = 7.5 Hz, 2H), 2.10 (s, 3H), 1.40-1.32 (m, 1H), 0.84-0.80 (m, 2H), 0.75-0.71 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 159.1, 136.6, 131.7, 129.7, 117.5, 113.5, 91.7, 77.5, 59.0, 57.7, 55.5, 37.8, 8.8, 0.2 ppm. IR (thin film): 1610, 1507, 1361, 1243, 1109, 1035, 1016, 999, 918, 982, 850, 808, 777, 584 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{17}H_{22}NO$ 256.1701; Found 256.1701.

N-Allyl-N-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)prop-2-en-1-amine (**s4**). Prepared from the 3-component coupling of *p*-anisaldehyde (4.0 mL, 33 mmol), phenylacetylene (3.55 mL, 33 mmol), *n*-diallylamine (3.7 mL, 30 mmol), CuBr (430 mg, 3 mmol), oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 1 g), and acetonitrile (100 mL), with flash chromatography purification using silica gel eluting with 9:1 hexanes/EtOAc to yield a light yellow oil (3.55 g, 38%). R_f = 0.75 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.59 (d, *J* = 8.5 Hz, 2H), 7.55-7.54 (m, 2H), 7.53-7.51 (m, 3H), 6.89 (d, *J* = 8.5 Hz, 2H), 5.90-5.83 (m, 1H), 5.27 (d, *J* = 17.0 Hz, 1H), 5.14 (d, *J* = 10.0 Hz, 1H), 5.05 (s, 1H), 3.82 (s, 3H), 3.28 (dd, *J* = 14.0 Hz, 2.0 Hz, 2H), 3.04 (dd, *J* = 14.0 Hz, 8.0 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 159.1, 136.8, 132.1, 132.0, 131.6, 129.6, 128.5,

128.3, 123.6, 117.5, 113.7, 88.9, 85.9, 56.2, 55.5, 53.7 ppm. IR (thin film): 1609, 1508, 1489, 1447, 1301, 1246, 1170, 1108, 1036, 995, 971, 919, 848, 811, 759, 691 cm $^{-1}$. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{22}H_{24}NO$ 318.1858; Found 318.1867.

N-Allyl-1-cyclopropyl-N,4-dimethylpent-1-yn-3-amine (**s5**). Prepared from the 3-component coupling of isobutyraldehyde, cyclopropylacetylene, *n*-allylmethylamine.[17]

N-Allyl-N,4-dimethyl-1-phenylpent-1-yn-3-amine (**s6**). Prepared from the 3-component coupling of isobutyraldehyde, phenylacetylene, *n*-allylmethylamine, CuBr, oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 1 g), and acetonitrile (100 mL), with flash chromatography purification using silica gel eluting with 9:1 hexanes/EtOAc to yield a light yellow oil (3.5 g, 46%). R_f = 0.74 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.47-7.44 (m, 2H), 7.32-7.29, (m, 3H), 5.88 (ddt, *J* = 6.0 Hz, 10.5 Hz, 17.0 Hz, 1H), 5.27 (d, *J* = 17.0 Hz, 2H), 5.17 (d, *J* = 10.5 Hz, 2H), 3.23 (dd, *J* = 5.0 Hz, 13.5 Hz, 1H), 3.19 (d, *J* = 9.0 Hz, 1H), 2.91 (dq, *J* = 16.5 Hz, 6.5 Hz, 1H), 1.13 (d, *J* = 6.5 Hz, 3H), 1.05 (d, *J* = 6.5 Hz, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 136.2, 131.7, 128.4, 128.2, 127.8, 123.6, 117.4, 86.4, 63.2, 58.2, 37.8, 31.0, 20.8, 19.9 ppm. IR (thin film) 1952, 1643, 1598, 1488, 1443, 1412, 1383, 1364, 1326, 1261, 1208, 1163, 1096, 1069, 1027, 995, 917, 753, 689, 595, 545 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{16}H_{22}N$ 228.1752; Found 228.1751.

N-Allyl-N-(2,4-dimethoxybenzyl)non-4-yn-3-amine (**s7**). Prepared from the 3-component coupling of propionaldehyde, 1-hexyne, *n*-allyldimethoxybenzylamine.[17]

N-Methyl-N-(3-(p-tolyl)prop-2-yn-1-yl)prop-2-en-1-amine (**s8**). Prepared from the 3-component coupling of formaldehyde, 1-ethynyl-4-methylbenzene, *n*-allylmethylamine, CuBr, oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 1 g) and acetonitrile (100 mL), with flash chromatography purification using silica gel eluting with 9:1 hexanes/EtOAc to yield a light yellow oil (78%). R_f = 0.44 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.33 (d, *J* = 8.3 Hz, 2H), 7.09 (d, *J* = 8.3 Hz, 2H), 5.89 (ddt, *J* = 4.0 Hz, 6.5 Hz, 10.3 Hz, 1H), 5.25 (d, *J* = 17.5 Hz, 1H), 5.17 (d, *J* = 10.3 Hz, 1H), 3.54 (s, 1H), 3.14 (d, *J* = 6.5 Hz, 2H), 2.38 (s, 3H), 2.33 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 138.1, 135.1, 131.6, 129.0, 120.1, 118.3, 85.6, 83.3, 59.1, 46.0, 41.6, 21.4 ppm.

IR (thin film) 2918, 1787, 1643, 1509, 1449, 1359, 1325, 1254, 1193, 1128, 1107, 1032, 994, 968, 921, 814, 677, 629, 566 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{14}H_{18}N$ 200.1439; Found 200.1440.

N-Methyl-N-(3-(4-(trifluoromethyl)phenyl)prop-2-yn-1-yl)prop-2-en-1-amine (**s9**). Prepared from the 3-component coupling of formaldehyde, 1-ethynyl-4-trifluoromethylbenzene, *n*-allylmethylamine.[13]

General Procedure for the deallylation of amines: *1-(4-Methoxyphenyl)-N-methyl-3-phenylprop-2-yn-1-amine* (**1a**). In a 250 mL round bottom flask containing a magnetic stir bar were added $Pd(PPh_3)_4$ (0.22 g, 0.19 mmol), *N,N*-dimethylbarbituric acid (9.0 g, 57.69 mmol) and CH_2Cl_2 (100 mL). A solution of *N*-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)-*N*-methylprop-2-en-1-amine (**s1**) (5.6 g, 19.23 mmol) in 25 mL in CH_2Cl_2 was added, and the reaction mixture was allowed to stir at room temperature under N_2 for 12h. The solvent was then removed under reduced pressure and the crude product was re-dissolved in Et_2O (75 mL). The organic layer was washed with $NaHCO_3$ (20 mL) and then acidified with 2M HCl (5 mL). The aqueous layer was collected and neutralized with 10% NaOH, and partitioned with CH_2Cl_2 (70 mL). The organic layer was collected, and the aqueous layer was extracted with additional CH_2Cl_2 (2 x 50 mL). The organic extracts were combined, and then dried and filtered over Na_2SO_4 to give a dark orange oil (2.13 g, 44%). R_f = 0.22 (2:1 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.54-7.48 (m, 4H), 7.33-7.31 (m, 3H), 6.9 (d, *J* = 8.7 Hz, 2H), 5.18 (s, 1H), 3.81 (s, 3H), 2.56 (s, 3H), 1.81 (s, 1H) ppm. ^{13}C NMR ($CDCl_3$, 75 MHz): δ 159.2, 132.4, 131.7, 128.8, 128.3, 128.1, 123.1, 113.8, 89.2, 85.5, 55.6, 55.3, 33.7 ppm. IR (thin film) 2953, 2834, 2790, 1609, 1584, 1508, 1488, 1462, 1440, 1301, 1243, 1171, 1095, 1031, 956, 913, 829, 754, 727, 703, 689, 573, 547, 524 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{17}H_{17}NONa$ 274.1208; Found 274.1213.

1-(4-Chlorophenyl)-N-methyl-3-phenylprop-2-yn-1-amine (**1b**). Prepared from the deallylation of **s2** (8.0 g, 26.29 mmol) as a dark orange oil (3.29 g, 49%). R_f = 0.29 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.54-7.61 (m, 2H), 7.50-7.48 (m, 2H), 7.36-7.29 (m, 5H), 4.72 (s, 1H), 2.54 (s, 3H), 1.43 (s, 1H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 139.9, 133.4, 132.0, 129.3, 128.8, 128.6, 128.5, 123.1, 88.7, 86.3, 55.8, 33.9 ppm. IR (thin

film) 1488, 1442, 1264, 1090, 1015, 732, 703, 691, 579, 543 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{16}H_{15}NCl$ 256.0893; Found 256.0890.

N-(3-Cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylprop-2-en-1-amine (**1c**). Prepared from the deallylation of **s3** as a dark orange oil (1.07 g, 42%). R_f = 0.23 (6:4 hexanes/EtOAc); ^1H NMR ($CDCl_3$, 500 MHz): δ 7.38 (d, *J* = 8.5 Hz, 2H), 6.85 (d, *J* = 8.5 Hz, 2H), 4.40 (s, 1H), 2.42 (s, 3H), 1.31-1.25 (m, 1H), 0.79-0.73 (m, 2H), 0.70-0.66 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 159.3, 133.0, 132.3, 128.9, 113.9, 89.2, 75.0, 55.5, 33.7, 8.5, 0.2 ppm. IR (thin film) 1609, 1508, 1463, 1440, 1301, 1243, 1171, 1029, 892, 831, 810, 779, 722, 585, 541 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{14}H_{18}NO$ 216.1388; Found 216.1393.

N-(1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl)prop-2-en-1-amine (**1d**). Prepared from the deallylation of **s4** (3.55 g, 11.2 mmol) as a dark orange oil (0.96 g, 31%). R_f = 0.59 (6:4 hexanes/EtOAc); ^1H NMR ($CDCl_3$, 500 MHz): δ 7.52 (d, *J* = 8.5 Hz, 2H), 7.49-7.47 (m, 2H), 7.33-7.31 (m, 3H), 6.92 (d, *J* = 8.5 Hz, 2H), 5.97 (ddt, *J* = 7Hz, 10.5 Hz, 6.5 Hz, 1H), 5.27 (dd, *J* = 17 Hz, 1.5 Hz), 5.14 (dd, *J* =10.5 Hz, 1.5 Hz), 4.70 (s, 1H), 3.82 (s, 3H), 3.44 (dqt, *J* = 6 Hz, 13.5 Hz, 1.5 Hz, 2H), 1.67 (s, 1H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 159.4, 136.6, 132.8, 131.9, 129.0, 128.5, 128.4, 116.7, 114.1, 89.7, 85.6, 55.6, 53.5, 30.1 ppm. IR (thin film) 2834, 1609, 1585, 1508, 1489, 1442, 1417, 1302, 1245, 1171, 1094, 1070, 1033, 995, 917, 832, 788, 756, 691, 579, 548 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{19}H_{20}NO$ 278.1545; Found 278.1537.

1-Cyclopropyl-N,4-dimethylpent-1-yn-3-amine (**1e**). Prepared from the deallylation of **s5**.[17]

N,4-Dimethyl-1-phenylpent-1-yn-3-amine (**1f**). Prepared from the deallylation of **s6** (1.36 g, 6.0 mmol) as a dark orange oil (0.78g, 70%). R_f = 0.35 (6:4 hexanes/EtOAc); ^1H NMR ($CDCl_3$, 500 MHz): δ 7.44-7.40 (m, 2H), 7.30-7.24 (m, 3H), 3.31 (s, 1H), 2.56 (s, 3H), 1.61 (br.s., 1H), 1.06-1.04 (m, 6H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 131.7, 128.2, 127.8, 123.5, 89.2, 84.7, 59.0, 24.6, 32.7, 19.8, 17.9 ppm. IR (thin film) 2958, 2870, 1597, 1489,

1467, 1442, 1383, 1366, 1343, 1322, 1131, 1106, 1070, 1028, 990, 914, 754, 689, 580, 545 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{13}H_{18}N$ 188.1439; Found 188.1447.

N-(2,4-Dimethoxybenzyl)non-4-yn-3-amine (**1g**). Prepared from the deallylation of **s7**.[17]

N-Methyl-3-(p-tolyl)prop-2-yn-1-amine (**1h**). Prepared from the deallylation of **s8** as a dark orange oil (226 mg, 35%). R_f = 0.18 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.31 (d, *J* = 8Hz, 2H), 7.09 (d, *J* = 8.5 Hz, 2H), 3.60 (s, 2H), 2.53 (s, 3H), 2.33 (s, 3H), 1.15 (br.s.,1H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 128.2, 131.5, 129.0, 85.9, 84.1, 40.5, 35.0, 21.4 ppm. IR (thin film) 2919, 2791, 1792, 1675, 1548, 1508, 1427, 1407, 1379, 1345, 1257, 1180, 1107, 1077, 1020, 948, 815, 753, 722, 696, 541 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{11}H_{13}N$ 160.1126 ; Found 160.1135.

N-methyl-3-(4-(trifluoromethyl)phenyl)prop-2-yn-1-amine (**1i**). Prepared from the deallylation of **s9**.[13]

N-benzylprop-2-yn-1-amine (**1j**). Prepared according to Merlic *et al.*[18]

General Procedure for the preparation of potassium N-cyanobenzamides: (**2a**). *Potassium N-cyano-2-fluorobenzamide:* A one-necked 500 mL round bottom flask open to the atmosphere, equipped with a magnetic stirring bar is charged with cyanamide (6.3 g, 0.15 mol) and distilled water (200 mL). Sodium hydroxide pellets (12.3 g, 0.308 mol) are then added in portions (~3 x 4 g) over a 15 minute period. The mixture is then stirred for 30 min. at room temperature and then cooled to 0 °C. The flask is fitted with a 1000 mL addition funnel and the addition funnel charged with 2-fluorobenzoyl chloride (23.5 g, 0.15 mol). The 2-fluorobenzoyl chloride is then added dropwise over a span of 20 min. After addition of the benzoyl chloride the reaction is stirred for an additional 3 hours at room temperature. The mixture is transferred to a 500 mL separatory funnel and washed with diethyl ether (1 x 50 mL). The aqueous layer is then transferred to a 1-L Erlenmeyer flask equipped with a

magnetic stirring bar and acidified to pH = 2 with conc. HCl (approx. 15 mL). Dichloromethane (200 mL) is then added to dissolve the solids and the mixture transferred to a 500 mL separatory funnel. After separation of the layers, the aqueous fraction is extracted with dichlormethane (2 x 100 mL) and the combined organics dried over anhydrous Na_2SO_4. The organics were filtered through a sintered glass funnel and the resultant sodium sulfate was washed with dichloromethane (2 x 50 mL). The solvent was removed on a rotary evaporator and then the flask transferred to a high-vac line for 3 hours. The resulting white solid was then dissolved in MeOH (50 mL) and added dropwise to a 500 mL round bottom flask equipped with a stir bar containing potassium hydroxide (8.0g, 0.143 mol) dissolved in MeOH (200 mL) at 0 °C. The flask is stoppered and allowed to stand in a -20 °C freezer overnight. The crude solid is collected on a Buchner funnel and washed with cold MeOH (2 x 50 mL) to give a fine white powder after sufficient drying under vacuum (19.8 g, 65%). Mp: 276-278 °C. NMR (d_6-DMSO, 500 MHz): δ 7.63 (td, J = 7.7, 1.9 Hz, 1H), 7.32 (tdd, J = 7.3, 4.9, 2.0 Hz, 1H), 7.10 – 7.02 (m, 2H) ppm. ^{13}C NMR (d_6-DMSO, 125MHz): δ 173.2, 160.0 (d, J_{CF} = 250.0 Hz), 130.7 (d, J_{CF} = 3.1 Hz), 130.6 (d, J_{CF} = 8.4 Hz), 128.1 (d, J_{CF} = 11.8 Hz), 123.4 (d, J_{CF} = 2.6 Hz), 121.9, 116.0 (d, J_{CF} = 22.7 Hz) ppm. IR (solid) 2160, 1626, 1612, 1612, 1591, 1547, 1485, 1450, 1360, 1293, 1220, 1108, 1098, 1039, 897 cm^{-1}. HRMS (ESI-TOF) [M - H]- m/z: Calc. $C_8H_4N_2OF$ 163.0308; Found 163.0308.

Potassium N-cyano-4-methoxybenzamide (**2b**). Prepared according to the general procedure for the preparation of potassium cyanobenzamides using 4-methoxybenzoyl chloride to yield a white solid (47% yield). Mp: 328-330 °C (decomposition). ^{1}H NMR (d_6-DMSO, 500 MHz): δ 7.86 (d, J = 8.8 Hz, 2H), 6.84 (d, J = 8.8 Hz, 2H), 3.76 (s, 3H) ppm. ^{13}C NMR (d_6-DMSO, 125MHz): δ 174.5, 160.8, 131.1, 129.8, 123.2, 112.6, 55.1 ppm. IR (solid) 2154, 1593, 1550, 1508, 1344, 1308, 1241, 1169, 1157, 1117, 1105, 1037, 1021, 1001, 951, 886 cm^{-1}. HRMS (ESI-TOF) [M - H]- m/z: Calc. $C_9H_7N_2O_2$ 175.0508; Found 175.0513.

Potassium N-cyano-4-chlorobenzamide (**2c**). Prepared according to the general procedure for the preparation of potassium cyanobenzamides using 4-chlorobenzoyl chloride to yield a white solid (62% yield). Mp: >350 °C. ^{1}H NMR (d_6-DMSO, 500 MHz): δ 7.91 (d, J = 8.5 Hz, 2H), 7.35 (d, J = 8.5 Hz, 2H) ppm. ^{13}C NMR (d_6-DMSO, 125MHz): δ 173.6, 137.3, 134.7, 130.0, 127.5, 122.5 ppm. IR (solid) 2154, 1588, 1548, 1487, 1402, 1340, 1283,

1193, 1173, 1094, 1019, 1007, 885 cm^{-1}. HRMS (ESI-TOF) [M - H]- m/z: Calc. $C_8H_4N_2OCl$ 179.0012; Found 179.0017.

Potassium N-cyanobenzamide (**2d**). Prepared according to the general procedure for the preparation of potassium cyanobenzamides using benzoyl chloride to yield a white solid (65% yield). Mp: 345-347 °C. ^{1}H NMR (d_6-DMSO, 500 MHz): δ 7.93 (d, J = 6.9 Hz, 2H), 7.38 (t, J = 7.3 Hz, 1H), 7.31 (d, J = 6.9 Hz, 2H) ppm. ^{13}C NMR (d_6-DMSO, 125MHz): δ 175.0, 138.4, 129.9, 128.1, 127.5, 123.1 ppm. IR (solid) 2160, 1595, 1556, 1492, 1446, 1344, 1300, 1103, 1028, 1012, 934, 890 cm^{-1}. HRMS (ESI-TOF) [M - H]- m/z: Calc. $C_8H_5N_2O$ 145.0402; Found 145.0398.

Potassium benzyloxycarbonylcyanamide (**2e**). Prepared according to Looper *et al.*[19]

Preparation of mono-N-acylguanidines from propargylamines: 2-*Fluoro-N-(N-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide* (**3a**). In a 50 mL round bottom flask containing a magnetic stir bar were added **2a** (97 mg, 0.48 mmol), chlorotrimethylsilane (64 μL, 0.50 mmol) and acetonitrile (10 mL) under N_2. The solution was stirred at room temperature for 10 minutes. A solution of **1a** (100 mg, 0.40 mmol) in acetonitrile (5 mL) was then added, and the reaction mixture was allowed to stir at room temperature for 1h. The solvent was then removed under reduced pressure and the crude product was re-dissolved in EtOAc (50 mL). The organic layer was washed with $NaHCO_3$ (20 mL) and brine (20 mL) and dried and filtered over Na_2SO_4. The crude product was purified via flash chromatography, eluting with 6:4 hexanes/EtOAc to give a foamy white oil (124 mg, 75% yield). (**3a**) was prepared by guanylation of **1a** (100 mg, 0.40 mmol) with **2a** (89 mg, 0.48 mmol) as a foamy white oil (124 mg, 75%). R_f = 0.16 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.06 (t, J = 12.5 Hz, 1H), 7.65 (s, 1H), 7.58-7.51 (m, 4H), 7.38-7.32 (m, 4H), 7.18 (t, J = 13.0 Hz, 1H), 7.07 (t, J = 13.0 Hz, 1H), 6.92 (d, J = 14.5 Hz, 2H), 3.81 (s, 3H), 2.86 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.5, 162.0 (d, J_{CF} = 254.3 Hz), 160.7. 159.7. 148.0. 138.4. 132.2. 132.1 (2), 129.0, 128.8 (d, J_{CF} = 24.6 Hz), 128.6, 123.6 (d, J_{CF} = 3.9 Hz), 122.6, 116.8 (d, J_{CF} = 23.2 Hz), 114.7, 114.2 , 87.0, 75.4, 55.6, 50.9, 29.3 ppm. IR (thin film) 1673, 1588, 1560, 1533, 1509, 1452, 1423, 1355, 1304, 1247, 1218, 1173, 1153, 1030, 897, 845, 758,

732, 691, 590, 550 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{25}H_{22}N_3O_2NaF$ 438.1594; Found 438.1599.

4-Methoxy-N-(N-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3b**). Prepared by guanylation of **1a** (100 mg, 0.40 mmol) with **2b** (103 mg, 0.48 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (119.8 mg, 70% yield). R_f = 0.13 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.25 (d, *J* = 9.5 Hz, 2H), 7.65 (s, 1H), 7.58 (d, *J* = 9.0 Hz, 2H), 7.55-7.52 (m, 2H), 7.37-7.35 (m, 3H), 6.92-6.91 (m, 2H), 3.84 (s, 3H), 3.81 (s, 3H), 2.87 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.9, 162.3, 160.7, 159.7, 132.1, 131.8, 131.3, 129.0, 128.6, 122.7, 114.3, 113.3, 87.0, 85.5, 55.6, 55.5, 50.8, 29.4 ppm. IR (thin film) 1583, 1558, 1528, 1508, 1464, 1424, 1351, 1305, 1263, 1248, 1173, 1155, 1032, 893, 788, 730, 701, 653, 554 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{26}H_{25}N_3O_3Na$ 450.1794; Found 450.1799.

4-Chloro-N-(N-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3c**). Prepared by guanylation of **1a** (100 mg, 0.40 mmol) with **2c** (105 mg, 0.48 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (140 mg, 81%). R_f = 0.22 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.20 (d, *J* = 8.5 Hz, 2H), 7.65 (s, 1H), 7.57-7.51 (m, 4H), 7.38-7.33 (m, 5H), 6.92 (d, *J* = 8.5 Hz, 2H), 3.82 (s, 3H), 2.89 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.1, 160.9, 159.8, 137.5, 137.4, 132.1, 130.8, 129.4, 129.0, 128.9, 128.6, 128.3, 122.6, 114.3, 87.2, 85.2, 55.6, 50.9, 29.5 ppm. IR (thin film) 1583, 1582, 1528, 1508, 1488, 1464, 1421, 1350, 1304, 1246, 1171, 1116, 1111, 1086, 1058, 1034, 1012, 996, 974, 893, 853, 801, 772, 755, 733, 710, 689, 621, 587, 553 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{25}H_{23}N_3O_2Cl$ 432.1479; Found 432.1489.

N-(N-(1-(4-Methoxyphenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3d**).). Prepared by guanylation of **1a** (100 mg, 0.40 mmol) with **2c** (81 mg, 0.48 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (121.3 mg, 76% yield). R_f = 0.22 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.28 (d, *J* = 7 Hz, 2H), 7.71 (s, 1H), 7.58 (d, *J* = 9 Hz, 2H), 7.55-

7.52 (m, 2H), 7.47-7.33 (m, 7H), 6.92 (d, J = 8 Hz, 2H), 3.82 (s, 3H), 2.89 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 177.2, 160.9, 159.7, 139.0, 132.1, 131.3, 129.6, 129.4, 129.0, 128.9, 128.6, 128.1, 122.6, 114.2, 87.1, 85.4, 55.6, 50.9, 29.4 ppm. IR (thin film) 1587, 1556, 1530, 1508, 1489, 1448, 1422, 1353, 1299, 1247, 1171, 1067, 1026, 891, 756, 733, 710, 689, 621, 587, 553 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{25}H_{23}N_3O_2Na$ 420.1688; Found 420.1697.

N-(N-(1-(4-Chlorophenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)-2-fluorobenzamide (**3e**). Prepared by guanylation of **1b** (100 mg, 0.39 mmol) with **2a** (81 mg, 0.47 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (90 mg, 62% yield). R_f = 0.32 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.03 (t, J = 7.5 Hz, 1H), 7.69 (s, 1H), 7.58 (d, J = 8.5 Hz, 2H), 7.53-7.51 (m, 2H), 7.39-7.33 (m, 6H), 7.14 (t, J = 8.0, 1H), 7.13-7.05 (m, 1H), 2.87 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.6, 162.0 (d, J_{CF} = 254.6 Hz), 160.7, 136.1, 134.3, 132.2 (d, J_{CF} = 8.8 Hz), 132.0 (3), 128.1, 129.0 (2), 128.6, 126.6 (d, J_{CF} = 15.2 Hz), 122.3, 116.8 (d, J_{CF} = 23.3 Hz), 87.5, 84.5, 50.9, 29.4 ppm IR (thin film) 1683, 1589, 1560, 1531, 1488, 1452, 1426, 1353, 1327, 1290, 1263, 1218, 1175, 1152, 1130, 1091, 1062, 1032, 1014, 897, 844, 791, 756, 737, 691, 669, 539 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{24}H_{19}N_3OFNaCl$ 442.1098; Found 442.1099.

N-(N-(1-(4-Chlorophenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)-4-methoxybenzamide (**3f**). Prepared by guanylation of **1b** (100 mg, 0.39 mmol) with **2b** (101 mg, 0.47 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (94 mg, 56% yield). R_f = 0.21 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.21 (d, J = 9.0 Hz, 2H), 7.73 (s, 1H), 7.59 (d, J = 8.5 Hz, 2H), 7.53-7.51 (m, 2H), 7.36-7.33 (m, 5H), 6.89 (d, J = 9.0 Hz, 2H), 3.83 (s, 3H), 2.86 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 177.0, 162.4, 160.7, 136.3, 134.3, 132.1, 131.6, 131.3, 129.1, 128.7, 122.4, 113.3, 87.5, 84.7, 50.6, 50.8, 29.5 ppm. IR (thin film) 1654, 1603, 1455, 1383, 1300, 1273, 1257, 1169, 1125, 1069, 1035, 1011, 932, 914, 855, 769, 685, 639, 612 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{25}H_{22}N_3O_2NaCl$ 454.1298; Found 454.1296.

4-Chloro-N-(N-(1-(4-chlorophenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3g**). Prepared by guanylation of **1b** (100 mg, 0.39 mmol) with **2c** (102 mg, 0.47 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (80 mg, 47% yield). R_f= 0.37 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.17 (d, *J* = 8.5 Hz, 2H), 7.68 (s, 1H), 7.57 (d, *J* = 8.5 Hz, 2H), 7.54-7.52 (m, 2H), 7.39-7.35 (m, 7H), 2.89 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.2, 173.2, 160.9, 137.5, 137.3, 136.0, 134.5, 132.1, 130.8, 129.2, 129.1, 129.0, 128.7, 128.3, 122.3, 87.7, 84.4, 51.0, 29.6 ppm. IR (thin film) 3310, 3169, 1684, 1586, 1556, 1523, 1488, 1469, 1422, 1358, 1323, 1290, 1242, 1159, 1031, 1089, 1064, 1015, 997, 978, 896, 856, 792, 779, 755, 689, 629, 548 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{24}H_{20}N_3OCl_2$ 436.0983; Found 436.0988.

N-(N-(1-(4-Chlorophenyl)-3-phenylprop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3h**). Prepared by guanylation of **1b** (100 mg, 0.39 mmol) with **2d** (81 mg, 0.47 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (90 mg, 57% yield). R_f= 0.27 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.26 (d, *J* = 8.0 Hz, 2H), 7.55 (s, 1H), 7.60 (d, *J* = 8.5 Hz, 2H), 7.58-7.52 (m, 2H), 7.48-7.33 (m, 8H), 2.88 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 177.3, 160.9, 138.8, 136.2, 134.4, 132.1, 131.4, 129.4, 129.1, 128.7, 128.1, 122.3, 87.6, 84.6, 50.9, 29.5 ppm. IR (thin film) 1585, 1580, 1509, 1490, 1456, 1356, 1329, 1250, 1172, 1156, 1101, 1032, 892, 850, 788, 758, 692 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{24}H_{21}N_3OCl$ 402.1373; Found 402.1374.

N-(N-(3-Cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylcarbamimidoyl)-2-fluorobenzamide (**3i**). Prepared by guanylation of **1c** (100 mg, 0.46 mmol) with **2a** (93 mg, 0.46 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (74% yield). R_f = 0.21 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.02 (dt, *J* = 1.8, 7.8 Hz, 1H), 7.45 (d, *J* = 8.5 Hz, 2H), 7.38-7.33 (m, 1H), 7.18 (t, *J* = 7.8 Hz, 1H), 7.06 (dd, *J* = 1.0, 8.3 Hz, 1H), 6.87 (d, *J* = 7.3 Hz, 2H), 3.79 (s, 3H), 2.76 (s, 3H), 1.39-1.31 (m, 1H), 0.85-0.80 (m, 2H), 0.78-0.73 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.4, 162.9 (d, J_{CF} = 254.4 Hz), 160.5, 159.4, 132.2 (d, J_{CF} = 9.8 Hz), 132.0, 131.9, 128.8, 127.8 (d, J_{CF} = 9.0 Hz), 123.5 (d, J_{CF} = 3.8 Hz), 116.8 (d, J_{CF} = 23.2 Hz), 113.9, 90.7, 71.2, 55.5, 50.4, 8.5 (2) ppm. IR (thin film) 3336, 2933,

1588, 1559, 1536, 1509, 1453, 1425, 1353, 1248, 1173, 1031, 897 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{22}H_{22}N_3O_2NaF$ 402.1594; Found 402.1601.

N-(N-(3-Cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylcarbamimidoyl)-4-methoxybenzamide (**3j**). Prepared by guanylation of **1c** (100 mg, 0.46 mmol) with **2b** (100 mg, 0.46 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (83% yield). R_f = 0.16 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.2 (d, *J* = 6.0 Hz, 2H), 7.47 (d, *J* = 7.5 Hz, 2H), 6.87 (t, *J* = 7.5 Hz, 4H), 3.83 (s, 3H), 3.78 (s, 3H), 2.77 (s, 3H), 1.40-1.32 (m, 1H), 0.86-0.80 (m, 2H), 0.79-0.73 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.7, 173.1 162.1, 160.5, 159.4, 131.7, 131.1, 130.1, 128.8, 113.9, 113.1, 90.6, 71.2, 55.4, 50.3, 29.1 8.6, 8.5 ppm. IR (thin film) 2933, 1585, 1528, 1507, 1462, 1349, 1346, 1152, 1029 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{23}H_{26}N_3O_3$ 392.1974; Found 392.1974.

4-Chloro-N-(N-(3-cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3k**). Prepared by guanylation of **1c** (100 mg, 0.46 mmol) with **2c** (100 mg, 0.46 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (80% yield). R_f = 0.35 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.17 (d, *J* = 8.4 Hz, 2H), 7.45 (d, *J* = 7.9 Hz, 2H), 7.43 (d, *J* = 9.1 Hz, 2H), 6.87 (d, *J* = 8.4 Hz, 2H), 3.79 (s, 3H), 2.78 (s, 3H), 1.40-1.33 (m, 1H), 0.86-0.82 (m, 2H), 0.79-0.74 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.9, 173.1, 160.7, 159.5, 137.5, 137.2, 130.7, 129,8, 128.7, 128.1, 114.0, 90.8, 71.0, 55.4, 50.5, 29.2, 8.6, 8.5 ppm. IR (thin film) 3355, 2932, 1552, 1530, 1508, 1422, 1349, 1246, 1172, 1087, 1030, 1013 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{22}H_{22}N_3O_2NaCl$ 418.1303; Found 418.1300.

N-(N-(3-Cyclopropyl-1-(4-methoxyphenyl)prop-2-yn-1-yl)-N-methylcarbamimidoyl)benzamide (**3l**). Prepared by guanylation of **1c** (100 mg, 0.46 mmol) with **2d** (85 mg, 0.46 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (65% yield). R_f = 0.26 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.25 (d, *J* = 7.2 Hz, 2H), 7.48 (d, *J* = 9.7 Hz, 2H), 7.44 (d, *J* = 7.9 Hz, 1H), 7.39 (d, *J* = 7.9 Hz, 2H), 6.87 (d, *J* = 8.8 Hz, 2H), 3.79 (s, 3H), 2.78 (s, 3H), 1.4-1.33 (m, 1H), 0.86-0.81 (m, 2H), 0.79-0.75 (m,

2H). ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.9, 160.7, 159.4, 139.0, 131.2, 132.2, 131.1, 130.0, 129.2, 128.8κ, 127.9, 114.0, 90.7, 71.2, 55.4, 29.2, 8.6, 8.5 ppm. IR (thin film) 3346, 2962, 1588, 1552, 1536, 1467, 1423, 1353, 1329, 1168, 1066, 893 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{22}H_{23}N_3O_2Na$ 384.1688; Found 384.1693.

Benzyl (Z)-5-benzylidene-2-imino-4-(4-methoxyphenyl)-3-methylimidazolidine-1-carboxylate (**3m**). Prepared by guanylation of **1a** with **2e**, with purification on silica gel eluting with 1:1 hexanes/EtOAc to give a dark orange oil (2.97 g, 82%). R_f = 0.48 (1:1 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.51-7.43 (m, 6H), 7.36-7.25 (m, 7H), 6.90 (d, *J* = 6.3 Hz, 2H), 5.18 (s, 2H), 3.80 (s, 3H), 2.80 (s, 3H). ^{13}C NMR ($CDCl_3$, 300MHz): δ 164.1, 160.9, 159.4, 137.6, 131.9, 129.0, 128.7, 128.6, 128.4, 128.0, 127.7, 122.2, 113.9, 86.6, 85.2, 66.9, 55.3, 50.6, 29.7 ppm. IR (thin film) 3403, 2932, 1646, 1584, 1532, 1508, 1488, 1440, 1376, 1273, 1246, 1121, 1150, 1110, 1027, 908, 845, 799, 775, 755, 729, 690, 647, 586, 552 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{26}H_{26}N_3O_3$ 428.1974; Found 428.1979.

N-(N-Allyl-N-(1-(4-methoxyphenyl)-3-phenylprop-2-yn-1-yl)carbamimidoyl)-2-fluorobenzamide (**3n**). Prepared by guanylation of **1d** with **2a,** with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (54% yield). ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.08 (dt, *J* = 8.0 Hz, 2.0 Hz, 1H), 7.64 (s, 1H), 7.61 (d, *J* = 9.0 Hz, 2H), 7.40-7.3 (m, 2H), 7.15 (t, *J* = 7.5 Hz, 1H), 7.08 (dd, *J* = 11.0 Hz, 8.5 Hz, 1H), 6.91 (d, *J* = 9.0 Hz, 2H), 5.77-5.72 (m, 1H), 5.32 (d, *J* = 17.0 Hz, 1H), 5.25 (dd, *J* = 10.0 Hz, 1.5 Hz, 1H), 3.95 (ABq, *J* = 15 Hz, 38 Hz, 2H), 3.82 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.8, 162.0 (d, J_{CF} = 254.6 Hz), 161.0, 159.8, 134.0, 132.2 (d, J_{CF} = 8.3 Hz), 132.1 (d, J_{CF} = 1.5 Hz), 132.0, 129.7, 129.2, 128.9, 128.6, 127.8 (d, J_{CF} = 3.8 Hz), 123.6 (d, J_{CF} = 3.8 Hz), 122.6, 118.5, 114.2, 87.1, 85.7, 55.6, 50.8, 47.1 ppm. IR (thin film) 1586, 1560, 1510, 1452, 1327, 1248, 1219, 1173, 1152, 1096, 1031, 906, 836, 757, 726, 690, 668, 646 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{27}H_{25}N_3O_2F$ 442.1931; Found 442.1925.

2-Fluoro-N-(N-methyl-N-(4-methyl-1-phenylpent-1-yn-3-yl)carbamimidoyl)benzamide (**3o).** Prepared by guanylation of **1e** (100mg, 0.53 mmol) with **2a** (128 mg, 0.64 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (136 mg, 75%). R_f = 0.29 (6:4 hexanes/EtOAc); ^{1}H

NMR ($CDCl_3$, 500 MHz): δ 8.00 (dt, J = 2 Hz, 7.5 Hz, 1H), 7.44-7.41 (m, 2H), 7.39-7.34 (m, 1H), 7.32-7.28 (m, 3H), 7.16-7.13 (m, 1H), 7.09-7.05 (m, 1H), 5.94 (br.s., 1H), 3.05 (s, 3H), 2.11-2.05 (m, 1H), 1.17 (d, J = 7.0 Hz, 3H), 0.98 (d, J = 7.0 Hz, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.0, 161.7 (d, J_{CF} = 254.5 Hz), 160.7, 132.8 (d, J_{CF} = 9.2 Hz), 131.7 (d, J_{CF} = 3.4 Hz), 128.4, 128.3, 127.7 (d, J_{CF} = 8.9 Hz), 123.3 (d, J_{CF} = 3.8 Hz), 122.7, 116.7 (d, J_{CF} = 23.2 Hz), 86.4, 85.5, 34.8, 32.8, 29.8, 19.5, 19.1 ppm IR (thin film) 1587, 1554, 1534, 1467, 1451, 1421, 1359, 1330, 1277, 1260, 1217, 1184, 1155, 1098, 1062, 1032, 985, 896, 754, 731, 690, 626 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{21}H_{23}N_3OF$ 352.1825; Found 352.1830.

N-(N-(1-Cyclopropyl-4-methylpent-1-yn-3-yl)-N-methylcarbamimidoyl)benzamide (**3p**). Prepared by guanylation of **1e** (111 mg, 0.66 mmol) with **2d** (100 mg, 0.66 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (78% yield). R_f = 0.64 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.18 (d, J = 9 Hz, 1H), 7.46-7.35 (m, 2H), 5.51 (bs, 2H), 2.97 (s, 3H), 1.96 (sextet, J = 7.3 Hz, 1H), 1.3-1.22 (m, 1H), 1.09 (d, J = 7.7 Hz, 3H), 0.91 (d, J = 6.8 Hz, 3H), 0.8-0.75 (m, 2H), 0.7-0.65 (m, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 176.7, 139.1, 131.0, 129.1, 127.8, 89.2, 77.4, 54.8, 33.0, 19.6, 19.3, 8.5, 8.4 ppm. IR (thin film) 3337, 2961, 1588, 1556, 1469, 1450, 1425, 1354, 1239, 1154, 1046 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{18}H_{22}N_3OFNa$ 338.1645; Found 338.1635.

N-(N-(2,4-Dimethoxybenzyl)-N-(non-4-yn-3-yl)carbamimidoyl)-2-fluorobenzamide (**3q**). Prepared by guanylation of **1f** (500 mg, 1.72 mmol) with **2a** (420 mg, 2.07 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (446 mg, 63%). R_f = 0.41 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.99 (dt, J = 2.0 Hz, 8.0 Hz, 1H), 7.37-7.28 (m, 2 H), 7.14-7.11 (m, 1H), 7.07-7.03 (m, 1H), 6.49-6.45 (m, 2H), 5.98 (br.s., 1H), 4.54 (s, 1H), 3.86 (s, 3H), 3.80 (s, 3H), 2.13 (dt, J = 2.0 Hz, 6.5 Hz, 2H), 1.82-1.66 (m, 2H), 1.38-1.24 (m, 4H), 1.01 (t, J = 7.0 Hz, 3H), 0.84 (t, J = 7.5 Hz, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.1, 161.7 (d, J_{CF} = 254.5 Hz), 160.4, 157.2, 131.8 (d, J_{CF} = 1.7 Hz), 131.6 (d, J_{CF} = 8.8 Hz), 129.1, 127.8 (d, J_{CF} = 8.9 Hz), 123.2 (d, J_{CF} = 3.8 Hz), 116.6 (d, J_{CF} = 23.3 Hz), 116.0, 104.5, 98.2, 86.2, 77.9, 55.4 (2), 50.8, 41.3, 30.6, 28.3, 21.8, 18.3, 13.6, 10.8 ppm. IR (thin film) 2957, 2933, 1587, 1666, 1524, 1504, 1452, 1373, 1333,

1291, 1256, 1206, 1177, 1155, 1135, 1116, 1092, 1033, 958, 907, 894, 833, 759, 730, 669, 646, 564 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{26}H_{33}N_3O_3F$ 454.2506; Found 454.2509.

2-Fluoro-N-(N-methyl-N-(3-(p-tolyl)prop-2-yn-1-yl)carbamimidoyl)benzamide (**3r**). Prepared by guanylation of **1g** (150 mg, 0.94 mmol) with **1a** (228 mg, 1.13 mmol), with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (207 mg, 68%). R_f = 0.21 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.04 (t, J = 10.5Hz, 1H), 7.39-7.32 (m, 3H), 7.16-7.02 (m, 4H), 4.66 (s, 2H), 3.11 (s, 3H), 2.32 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 175.4kk, 161.7 (d, J_{CF} = 254.4 Hz), 160.6, 138.7, 131.9 (3), 131.7, 127.6 (d, J_{CF} = 8.8 Hz), 123.4 (d, J_{CF} = 3.8 Hz), 116.6 (d, J_{CF} = 22.8 Hz), 84.8, 82.6, 39.1, 33.7, 21.5 ppm. IR (thin film) 1587, 1546, 1509, 1431, 1423, 1333, 1261, 1215, 1178, 1153, 1134, 1098, 1065, 1021, 946, 896, 816, 758, 729, 654, 569 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{19}H_{19}N_3OF$ 324.1512; Found 324.1519.

N-(N-methyl-N-(3-(4-(trifluoromethyl)phenyl)prop-2-yn-1-yl)carbamimidoyl)benzamide (**3s**). Prepared by guanylation of **1h** with **2d**, with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (1.23g, 58%). R_f = 0.24 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.26-8.24 (m, 2H), 7.55-7.26 (m, 7H), 4.76 (s, 2H), 3.13 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 177.3, 160.9, 138.9, 132.3, 131.4, 130.5 (q, J_{CF} = 32.5 Hz), 129.3, 128.1, 125.5 (q, J_{CF} = 3.7 Hz), 124.0 (q, J_{CF} = 270.6 Hz), 86.6, 83.3, 39.4, 34.0 ppm. IR (thin film) 1589, 1555, 1424, 1318, 1163, 1120, 1064, 1016, 907 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{19}H_{17}N_3OF_3$ 360.1324; Found 360.1324.

N-(N-benzyl-N-(prop-2-yn-1-yl)carbamimidoyl)benzamide (**3t**). Prepared by guanylation of **1i** with **2d**, with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (127.2 mg, 35%). R_f = 0.43 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.25 (d, J = 7.0 Hz, 2H), 7.47-7.29 (m, 8H), 4.83 (s, 2H), 4.36 (s, 2H), 2.34 (t, J = 2.5 Hz, 1H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 177.6, 161.2, 138.9, 136.2, 131.4, 129.4, 12.3, 128.2, 128.1, 127.5, 78.4, 73.7, 50.8, 37.0 ppm. IR (thin film) 1588, 1553, 1530, 1450, 1418, 1367, 1332, 1298, 1202, 1166, 1118, 1068, 1027, 1001, 958, 907 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{18}H_{18}N_3O$ 292.1450; Found 292.1448.

NaH-mediated Cyclizations: *N-(4-Benzyl-5-(4-methoxyphenyl)-1-methyl-1H-imidazol-2(3H)-ylidene)-2-fluorobenzamide* (**4a**). In a 25 mL round bottom flask containing a magnetic stir bar were added **3a** (402.5 mg, 0.97 mmol) and THF (30 mL) under N_2. The solution was stirred at room temperature, and NaH (22.5 mg, 0.97 mmol) was added, resulting in a bright yellow solution. The reaction was stirred for 30 minutes, after which the solvent was removed under reduced pressure and the crude product was re-dissolved in EtOAc (25 mL). The organic layer was washed with saturated aqueous NH_4Cl (10 mL) and brine (10 mL), dried over Na_2SO_4, filtered, and concentrated. The resulting yellow solid required no further purification (330 mg, 82%). R_f = 0.41 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.07 (t, J = 8.0 Hz, 2H), 7.34-7.32 (m, 1H), 7.32-7.27 (m, 4H), 7.21 (t, J = 8.5 Hz, 1H), 7.19-7.16 (m, 3H), 7.08 (t, J = 9.5 Hz, 1H), 7.00 (d, J = 8.5 Hz, 2H), 3.86 (s, 3H), 3.81 (s, 2H), 3.44 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 171.8k, 162.5 (d, J_{CF} = 253.4 Hz), 160.2, 148.7, 137.8, 131.8, 131.7 (d, J_{CF} = 1.9 Hz), 131.6, 128.8, 128.2, 126.8, 126.4, 124.8, 123.6 (d, J_{CF} = 3.8 Hz), 119.9, 116.5 (d, J_{CF} = 22.9 Hz), 114.5, 55.4, 31.0, 30.1 ppm. IR (thin film) 2929, 2360, 2340, 1684, 1569, 1511, 1494, 1455, 1401, 1339, 1290, 1248, 1176, 1032, 834, 815, 757, 731, 696, 667 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{25}H_{22}N_3O_2FNa$ 438.1594; Found 438.1601.

N-(4-Benzyl-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-4-methoxybenzamide (**4b**). Prepared *via* NaH-mediated cyclization of (**3b**) (31.5 mg, 0.074 mmol) in THF as a yellow foam (26.5 mg, 84%). R_f = 0.21 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 300 MHz): δ 8.08 (d, J = 8.7 Hz, 2H), 7.30–7.21 (m, 5H), 7.14 (d, J = 8.7 Hz, 2H), 7.01 (d, J = 9.0 Hz, 2H), 6.90 (d, J = 8.7 Hz, 2H), 3.87 (s, 3H), 3.85 (s, 3H), 3.82 (s, 2H), 3.47 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 161.8, 160.2, 137.7, 131.6, 130.5, 128.5, 128.2, 126.8, 124.4, 119.9, 114.5, 113.1, 55.4, 55.3, 30.7, 30.0 ppm. IR (thin film) 1671, 1603, 1567, 1508, 1454, 1414, 1398, 1349, 1308, 1289, 1246, 1175, 1163, 1108, 1028, 1005, 882, 835, 799, 765, 733, 697, 608 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{26}H_{26}N_3O_3$ 428.1974; Found 428.1971.

N-(4-Benzyl-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-4-chlorobenzamide (**4c**). Prepared *via* NaH-mediated cyclization of **3c** in THF as a yellow foam (42.2 mg, 82%). R_f = 0.38 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.19 (d, *J* = 8.0 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.30–7.21 (m, 5H), 7.12 (d, *J* = 7.5 Hz, 2H), 7.01 (d, *J* = 8.0 Hz, 2H), 3.86 (s, 3H), 3.82 (s, 2H), 3.47 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 173.7, 160.5, 150.6, 137.6, 137.2, 136.8, 131.8, 130.4, 129.2, 128.4, 128.2, 127.2, 124.5, 120.4, 119.8, 113.8, 55.6, 50.8, 30.1 ppm. IR (thin film) 1670, 1603, 1566, 1508, 1453, 1348, 1307, 1280, 1242, 1174, 1162, 1108, 1027, 835, 779, 733, 697, 607 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{25}H_{23}N_3O_2Cl$ 432.1479; Found 432.1480.

N-(4-Benzyl-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4d**). Prepared *via* NaH-mediated cyclization of **3d** in THF as a yellow foam (55.4 mg, 63%). R_f = 0.47 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.27 (d, *J* = 7.0 Hz, 2H), 7.45-7.40 (m, 3H), 7.32-7.27 (m, 4H), 7.22-? (m, 1H), 7.15 (d, *J* = 7.5 Hz, 2H), 7.01 (d, *J* = 9.0 Hz, 2H), 3.86 (s, 3H), 3.83 (s, 2H), 3.49 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 160.5, 138.7, 131.9, 130.8, 129.2, 128.9, 128.4, 128.1, 127.2, 124.5, 120.0, 114.8, 55.7, 32.4, 31.0 ppm. IR (thin film) 3061, 2933, 1675, 1636, 1566, 1541, 1494, 1464, 1453, 199, 1350, 1288, 1246, 1174, 1108, 1025, 1004, 906, 832, 718, 709, 645, 593 cm^{-1}. HRMS [M + H]+ (ESI-TOF) m/z: Calcd for $C_{25}H_{24}N_3O_2$ 398.1869; Found 398.1869.

N-(4-Benzyl-5-(4-chlorophenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-2-fluorobenzamide (**4e**). Prepared *via* NaH-mediated cyclization of **3e** in THF as a yellow foam (32.7 mg, 62%). R_f = 0.38 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.08 (t, *J* = 2.5 Hz, 1H), 7.46 (d, *J* = 8 Hz, 2H), 7.40 (m, 1H), 7.30-7.25 (m, 4H), 7.22-7.10 (m, 5H), 3.84 (s, 2H), 3.43 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 171.0, 161.4 (d, J_{CF} = 252.5 Hz), 147.9, 137.7, 135.2, 132.3 (d, J_{CF} = 8.8 Hz), 131.7 (d, J_{CF} = 2.5 Hz), 131.5, 129.3, 128.9, 128.2, 126.9, 126.5, 124.3, 123.8 (d, J_{CF} = 2.5 Hz), 116.6, 116.4, 31.2, 30.5 ppm. IR (thin film) 1682, 1567, 1490, 1352, 1221, 1091, 1010, 906 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{24}H_{20}N_3OFCl$ 420.1279; Found 420.1278.

N-(4-Benzyl-5-(4-chlorophenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-4-methoxybenzamide (**4f**). Prepared *via* cyclization of **3f** in THF as an off-white foam (25.7 mg, 74%). R_f = 0.38 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 300 MHz): δ 8.19 (d, *J* = 8.7 Hz, 2H), 7.46 (d, *J* = 8.4 Hz, 2H), 7.30-7.23 (m, 5H), 7.13 (d, *J* = 8.4 Hz, 2H), 6.90 (d, *J* = 9.0 Hz, 2H), 3.84 (s, 2H), 3.83 (s, 2H), 3.48 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 162.0, 137.5, 135.2, 131.6, 131.4, 130.5, 129.5, 129.3, 128.9, 128.2, 128.1, 126.9, 126.5, 114.6, 113.5, 113.6, 55.3, 30.9, 30.2 ppm. IR (thin film) 1671, 1568, 1513, 1491, 1452, 1346, 1309, 1248, 1174, 1162, 1090, 881, 831, 779, 764, 728, 696, 607 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{25}H_{23}N_3O_2Cl$ 432.1479; Found 432.1480.

N-(4-Benzyl-5-(4-chlorophenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-4-chlorobenzamide (**4g**). Prepared *via* NaH-mediated cyclization of **3g** in THF as a yellow foam (35.1 mg, 64%). R_f= 0.68 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.18 (d, *J* = 8.5 Hz, 2H), 7.47 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.30-7.25 (m, 5H), 7.12 (d, *J* = 7.0 Hz, 2H), 3.83 (s, 2H), 3.48 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 137.1, 136.7, 135.8, 131.7, 130.4, 129.7, 129.3, 128.3, 127.4, 126.2, 123.6, 30.8, 30.4 ppm. IR (thin film) 1571, 1492, 1397, 1350, 1091, 1012, 767 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{24}H_{20}N_3OCl_2$ 436.0983; Found, 436.0984.

N-(4-Benzyl-5-(4-chlorophenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4h**). Prepared *via* NaH-mediated cyclization of **3h** in THF as a white foam (39.3 mg, 77%). R_f = 0.40 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.24 (d, *J* = 8.0 Hz, 2H), 7.46 (d, *J* = 8.0 Hz, 2H), 7.45-7.39 (m, 3H), 7.30-7.20 (m, 5H), 7.12 (d, *J* = 7.0 Hz, 2H), 3.83 (s, 2H), 3.48 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 174.1, 149.9, 137.8, 137.7, 135.4, 131.6, 131.1, 129.6, 129.1, 128.9, 128.3, 128.1, 127.1, 126.6, 124.0, 122.6, 31.1, 30.5 ppm. IR (thin film) 1678, 1566, 1492, 1467, 1453, 1396, 1353, 1304, 1280, 1169, 1092, 1025, 1011, 876, 831, 741, 711 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{24}H_{20}N_3ONaCl$ 424.1193; Found 424.1203.

N-(4-(Cyclopropylmethyl)-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-2-fluorobenzamide (**4i**). Prepared *via* NaH-mediated cyclization of **3i** in THF as a yellow foam (45.6 mg, 86%). R_f = 0.3 (6:4

hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.09 (dt, *J* = 1.7, 6.1 Hz, 1H), 7.40-7.34 (m, 2H), 7.23 (d, *J* = 7.3 Hz, 2H), 7.16 (t, *J* = 8.4, 1H), 7.09 (dd, *J* = 3.0 Hz, 8.4 Hz, 1H), 6.99 (d, *J* = 9.0 Hz, 2H), 3.86 (s, 3H), 3.42 (s, 3H), 2.40 (d, *J* = 6.7 Hz, 2H), 0.97-0.88 (m, 1H), 0.56 (d, *J* = 8.3 Hz, 2H), 0.17 (d, *J* = 4.8 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 172.5, 161.5 (d, J_{CF} = 252.5 Hz), 160.1, 149.1, 131.7, 131.6 (d, J_{CF} = 2.5 Hz), 131.5 (d, J_{CF} = 8.8 Hz), 127.1 (d, J_{CF} = 8.8 Hz), 123.5 (d, J_{CF} = 3.8 Hz), 123.3, 122.4, 120.0, 116.5 (d, J_{CF} = 22.5 Hz), 114.3, 55.3, 29.9, 29.3, 10.2, 4.5 ppm. IR (thin film) 2934, 1566, 1510, 1480, 1353, 1247, 1174, 1031 cm^{-1}. HRMS (ESI-TOF)[M + Na]+ m/z: Calcd for $C_{22}H_{22}N_3O_2FNa$ 402.1594; Found 402.1598.

N-(4-(Cyclopropylmethyl)-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-4-methoxybenzamide (**4j**). Prepared *via* NaH-mediated cyclization of **3j** in THF as a yellow foam (63.2 mg, 84%). R_f = 0.27 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.27 (d, *J* = 8.2 Hz, 2H), 7.24 (d, *J* = 8.6 Hz, 2H), 7.00 (d, *J* = 8.6 Hz, 2H), 6.92 (d, *J* = 8.2 Hz, 2H), 3.86 (s, 3H), 3.85 (s, 3H), 3.45 (s, 3H), 2.39 (d, *J* = 6.8 Hz, 2H), 0.97-0.88 (m, 1H), 0.57 (d, *J* = 8.1 Hz, 2H), 0.17 (d, *J* = 4.7 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 174.5, 172.8, 161.8, 160.1, 131.8, 130.6, 122.9, 120.9, 120.2, 114.4, 113.1, 94.9, 55.5, 55.4, 29.8, 29.3, 10.3, 4.6 ppm. IR (thin film) 2931, 2836, 1568, 1509, 1463, 1348, 1290, 1246, 1163, 1100, 1030 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{23}H_{25}N_3O_3Na$ 414.1794; Found 414.1794.

4-Chloro-N-(4-(cyclopropylmethyl)-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4k**). Prepared *via* NaH-mediated cyclization of **3k** in THF as a yellow foam (48.2 mg, 87%). R_f = 0.48 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.24 (d, *J* = 7.8 Hz, 2H), 7.37 (d, *J* = 8.5 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.00 (d, *J* = 8.4 Hz, 2H), 3.86 (s, 3H), 3.45 (s, 3H), 2.40 (d, *J* = 6.8 Hz, 2H), 0.97-0.88 (m, 1H), 0.57 (d, *J* = 7.1 Hz, 2H), 0.18 (d, *J* = 5.5 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 173.8, 173.2, 160.3, 150.3, 137.3, 136.7, 131.8, 130.3, 128.1, 123.2, 121.7, 120.0, 114.5, 55.6, 29.9, 29.3, 10.2, 4.7 ppm. IR (thin film) 2929, 1822, 1725, 1569, 1512, 1466, 1348, 1289, 1248, 1162, 1087, 1013 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{22}H_{22}N_3O_2NaCl$ 418.1298; Found 418.1302.

N-(4-(Cyclopropylmethyl)-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4l**). Prepared *via* NaH-mediated cyclization of **3l** in THF as a yellow foam (52.3 mg, 91%). R_f = 0.55 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.31 (d, *J* = 7.3 Hz, 2H), 7.47-7.39 (m, 4H), 7.24 (d, *J* = 9.0 Hz, 3H), 7.01 (d, *J* = 8.7 Hz, 2H), 3.87 (s, 3H), 3.47 (s, 3H), 2.41 (d, *J* = 7.3 Hz, 2H), 0.97-0.89 (m, 1H), 0.58 (d, *J* = 7.8 Hz, 2H), 0.19 (d, *J* = 4.8 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 174.9, 173.0, 160.2, 138.8, 130.7, 128.9, 128.0, 123.1, 120.2, 114.5, 55.5, 29.9, 29.3, 10.3,k 4.7 ppm. IR (thin film) 2979, 1821, 1724, 1569, 1511, 1464, 1349, 1287, 1248, 1138, 1023 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{22}H_{23}N_3O_2Na$ 384.1688; Found 384.1690.

Benzyl (4-benzyl-5-(4-methoxyphenyl)-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)carbamate (**4m**). Prepared *via* NaH-mediated cyclization of **3m** in THF as a yellow foam (3.0 g, 81 %). R_f = 0.22 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 7.41 (d, *J* = 6.9 Hz, 2H), 7.29-7.19 (m, 8H), 7.11 (d, *J* = 6.9 Hz, 2H), 6.99 (d, *J* = 8.9 Hz, 2H), 5.15 (s, 2H), 3.84 (s, 3H), 3.77 (s, 2H), 3.32 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 162.9, 160.3, 150.2, 137.9, 137.8, 131.8, 129.1, 128.5, 128.3, 128.1, 127.6, 127.1, 124.6, 121.2, 120.0, 114.6, 66.9, 55.6, 31.0, 30.2 ppm. IR (thin film) 1724, 1590, 1508, 1298, 1244, 1210, 1175, 1059, 906 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{26}H_{26}N_3O_3$ 428.1974; Found 428.1974.

N-(1-allyl-4-benzyl-5-(4-methoxyphenyl)-1,3-dihydro-2H-imidazol-2-ylidene)-2-fluorobenzamide (**4n**) was obtained via NaH-mediated cyclization cyclization of **3n** in THF as a yellow foam (42.6 mg, 54%). R_f = 0.50 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.06 (dt, *J* = 1.5 Hz, 8.0 Hz, 1H), 7.56-7.53 (m, 1H), 7.29-7.26 (m, 4H), 7.23-7.20 (m, 1H), 7.15-7.12 (m, 2H), 7.09-7.05 (m, 1H), 6.98 (d, *J* = 9.0 Hz, 2H), 5.91-5.83 (m, 1H), 5.12 (dd, *J* = 1.0 Hz, 10.0 Hz, 1H), 4.96 (dd, *J* = 1.0 Hz, 17.5 Hz, 1H), 3.86 (s, 3H), 3.80 (s, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 161.9 (d, J_{CF} = 252.8 Hz), 160.5, 137.9, 132.9, 132.2, 132.1, 132.0 (3), 129.1, 128.4, 127.1, 123.7 (d, J_{CF} = 3.8 Hz), 120.0, 117.8, 116.7 (d, J_{CF} = 23.2 Hz), 114.5 55.6, 45.5, 31.1 ppm. IR (thin film) 2924, 1567, 1512, 1364, 1290, 1252, 1176, 1032, 759, 687 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{27}H_{25}N_3O_2F$ 442.1931; Found 442.1929.

NaH-mediated cyclization of C^5-alkyl or C^5-unsubstituted mono-N-acylpropargylguanidines: *N-(4-Benzyl-5-isopropyl-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)-2-fluorobenzamide* (**4o**). In a 25 mL oven-dried round bottom flask containing a magnetic stir bar were added **3o** (141 mg, 0.40 mmol), oven dried molecular sieves (Grade 564, 3 Å, 8-12 mesh) (*ca.* 20 mg) and DMF (10 mL) under N_2. The solution was stirred at room temperature, and NaH (5 mg, 0.25 mmol) was added, resulting in a bright yellow solution. The reaction temperature was then elevated to 60 ˚C, and allowed to stir for 8 hours. The solvent was removed under reduced pressure and the crude product was re-dissolved in EtOAc (25 mL). The organic layer was washed with saturated aqueous NH_4Cl (10 mL) and saturated aqueous LiCl (3 x 10 mL). The organics were dried over Na_2SO_4, filtered, and concentrated. The resulting yellow oil was purified by column chromatography, eluting with 6:4 hexanes/EtOAc to yield an off-white foam (80.4 mg, 57%). R_f= 0.32 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.03 (t, J = 8.0 Hz, 1H), 7.35-7.03 (m, 8H), 3.92 (s, 3H), 3.12-3.05 (m, 1H), 1.31 (d, J = 7.0 Hz, 6H) ppm. . ^{13}C NMR ($CDCl_3$, 125 MHz): δ 172.2, 161.5 (d, J_{CF} = 252.9), 149.3, 137.6, 131.6 (d, J_{CF} = 1.9 Hz), 131.5 (d, J_{CF} = 8.7 Hz), 128.9, 128.1, 127.0 (d, J_{CF} = 6.9 Hz), 126.9, 123.4 (d, J_{CF} = 3.7 Hz), 118.4, 116.5 (d, J_{CF} = 23.2 Hz), 31.0, 29.5, 24.5, 24.6, 19.9 ppm. IR (thin film) 1564, 1481, 1452, 1356, 1260, 1216, 1153, 1096, 1030, 906, 870, 815, 756, 724, 694, 644, 561 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{21}H_{23}N_3OF$ 352.1825; Found 352.1832.

N-(4-(cyclopropylmethyl)-5-isopropyl-1-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4p**). Prepared *via* NaH-mediated cyclization of **3p** in DMF at 60 ˚C as a yellow foam (33.2 mg, 42%). R_f = 0.39 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.29 (d, J = 6.4 Hz, 2H), 7.43-7.38 (m, 3H), 3.63 (s, 3H), 3.02 (sp, J = 7.9 Hz, 1H), 2.49 (d, J = 6.8 Hz, 2H), 1.33 (d, J = 6.8 Hz, 6H), δ 0.99-0.90 (m, 1H), δ 0.63 (q, J = 4.8 Hz, 2H), δ 0.26 (q, J = 4.8 Hz, 2H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 174.7, 173.2, 138.7, 130.5, 128.7, 127.9, 126.4, 118.9, 29.4, 24.5, 21.8, 10.3, 4.7 ppm. IR (thin film) 3286, 2925, 1737, 1567, 1465, 1367, 1244, 1169, 1022 cm^{-1}. HRMS (ESI-TOF) [M + Na]+ m/z: Calcd for $C_{18}H_{23}N_3ONa$ 320.1739; Found 320.1743.

N-(1-(2,4-dimethoxybenzyl)-5-ethyl-4-pentyl-1,3-dihydro-2H-imidazol-2-ylidene)-2-fluorobenzamide (**4q**). Prepared obtained *via* NaH-mediated cyclization of **3q** in DMF at 60° C as a colorless foam (59.2 mg, 69%). R_f=

0.44 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.04 (t, J = 7.0 Hz, 1H), 7.34-7.30 (m, 1H), 7.11-6.98 (m, 3H), 6.45 (s, 1H), 6.39 (d, J = 8.5 Hz, 1H), 5.17 (s, 2H), 3.85 (s, 3H), 3.77 (s, 3H), 2.48-2.41 (m, 4H), 1.62-1.58 (m, 1H), 1.36-1.29 (m, 4H), 0.99 (t, J = 8.0 Hz, 3H), 0.89 (t, J = 7.0 Hz, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): 172.7, 161.7 (d, J_{CF} = 253.4 Hz), 160.3, 157.3, 150.1, 131.8 (d, J_{CF} = 2.0 Hz), 131.2 (d, J_{CF} = 8.8 Hz), 129.1, 127.5, 123.3 (d, J_{CF} = 3.7 Hz), 120.2, 117.5, 116.4 (d, J_{CF} = 23.0 Hz), 110.0, 104.4, 98.2 55.4, 55.3, 39.2, 31.3, 28.8, 24.2, 22.4, 16.0, 14.5, 14.0 ppm. IR (thin film) 2931, 2858, 1611, 1587, 1563, 1500, 1482, 1460, 1420, 1356, 1287, 1264, 1208, 1157, 1119, 1034, 897, 819, 758, 734 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{26}H_{33}FN_3O_3$ 454.2506; Found 454.2501.

2-Fluoro-N-(1-methyl-4-(4-methylbenzyl)-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4r**) was obtained *via* NaH-mediated cyclization of **3r** in DMF at 60° C as a colorless foam (57.6 mg, 58%). R_f = 0.24 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.04 (t, J = 7.5 Hz, 1H), 7.39-7.32 (m, 1H), 7.15-7.04 (m, 6H), 6.21 (s, 1H), 3.78 (s, 2H), 3.51 (s, 3H), 2.32 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 171.7, 161.4 (d, J_{CF} = 252.7 Hz), 149.0, 136.7, 133.7, 131.9 (d, J_{CF} = 8.9 Hz), 131.7 (d, J_{CF} = 2.0 Hz), 129.5, 128.5, 126.6, 126.3, 123.6 (d, J_{CF} = 3.7 Hz), 116.5 (d, J_{CF} = 23.3 Hz), 112.4, 31.8, 31.6, 21.0 ppm. IR (thin film) 1684, 1623, 1564, 1514, 1481, 1448, 1355, 1296, 1260, 1215, 1154, 1126, 1092, 1032, 898, 852, 802, 754, 730, 688, 644 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{19}H_{19}N_3OF$ 324.1512; Found 324.1512.

N-(1-Methyl-4-(4-(trifluoromethyl)benzyl)-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4s**). Prepared *via* NaH-mediated cyclization of **3s** in DMF at 60° C, with flash chromatography purification eluting with 6:4 hexanes/EtOAc to yield a foamy white oil (802 mg, 71% yield). R_f = 0.19 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.23 (d, J = 7.5 Hz, 2H), 7.53 (d, J = 8.0 Hz, 2H), 7.47-7.36 (m, 3H), 7.27-7.24 (m, 2H), 6.22 (s, 1H), 3.84 (s, 2H), 3.53 (s, 3H) ppm. ^{13}C NMR ($CDCl_3$, 125 MHz): δ 173.7, 149.9, 141.5, 137.8, 131.1, 129.5 (q, J_{CF} = 30.4 Hz), 129.1, 128.9, 128.1, 125.8 (q, J_{CF} = 2.1 Hz), 124.3 (q, J_{CF} = 272.0 Hz), 113.2, 32.1, 31.9 ppm. IR (thin film) 1570, 1558, 1367, 1352, 1160, 1106, 1065 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{19}H_{17}N_3OF_3$ 360.1324; Found 360.1323.

N-(1-Benzyl-4-methyl-1,3-dihydro-2H-imidazol-2-ylidene)benzamide (**4t**). Prepared *via* NaH-mediated cyclization of **3t** in DMF at 60° C as a colorless foam (82.4 mg, 52%). R_f= 0.19 (6:4 hexanes/EtOAc); ^{1}H NMR ($CDCl_3$, 500 MHz): δ 8.30 (d, *J* = 8.0 Hz, 2H), 7.45-7.30 (m, 8H), 6.17 (s, 1H), 5.17 (s, 2H), 2.14 (s, 3H) ppm. ^{13}C ($CDCl_3$, 125 MHz): δ 174.9, 151.1, 138.8, 136.5, 130.8, 129.1 (2), 128.4, 128.0, 121.1, 110.0, 95.0, 48.1, 11.0 ppm. IR (thin film) 3219, 1629, 1590, 1567, 1544, 1496, 1488, 1471, 1455, 1381, 1349, 1300, 1138, 1024 cm^{-1}. HRMS (ESI-TOF) [M + H]+ m/z: Calcd for $C_{18}H_{18}N_3O$ 292.1450; Found 292.1451.

Supporting Information:

X-ray crystal structure data for **4m**. Copies of ^{1}H NMR and ^{13}C NMR spectra for all new compounds.

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