Supporting Information

2-Aminobenzimidazoles as Antibiofilm agents against *Salmonella enterica* serovar Typhimurium

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Experimental

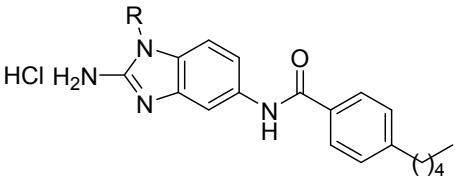
All reagents used for chemical synthesis were purchased from commercially available sources and used without further purification. Chromatography was performed using 60 Å mesh standard grade silica gel from Sorbtech. NMR solvents were obtained from Cambridge Isotope Laboratories and used as is. All ^{1}H NMR (300 or 400 MHz) and ^{13}C NMR (75, 100, or 175 MHz) spectra were recorded at 25 °C on Varian Mercury spectrometers. Chemical shifts (δ) are given in parts per million relative to tetramethylsilane or the respective NMR solvent; coupling constants (J) are in hertz (Hz). Abbreviations used are s, singlet; brs, broad singlet; d, doublet; dd, doublet of doublets; t, triplet; dt, doublet of triplets; m, multiplet. Mass spectra were obtained at the NCSU Department of Chemistry Mass Spectrometry Facility. Infrared spectra were obtained on an FT/IR-4100 spectrophotometer (ν_{max} in cm^{-1}). UV absorbance was recorded on a Genesys 10 scanning UV/visible spectrophotometer (λ_{max} in nm). The purities of the tested compounds were all verified to be >95% by LC-MS analysis on a Shimadzu LC-MS 2020 with Kinetex, 2.6 mm, C18 50 × 2.10 mm.

Biology Experimental

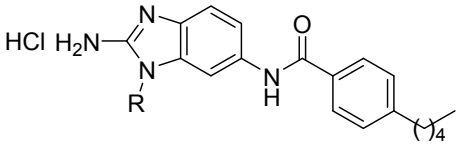
Procedure to Determine the Inhibitory Effect of Test Compounds on *Salmonella* Typhimurium ATCC 14028 Biofilms: Inhibition assays were performed by taking an overnight culture of *S.* Typhimurium ATCC 14028 in tryptic soy broth (TSB, BD™ Bacto™) and subculturing it at an OD_{600} of 0.08 into 1:20 TSB:Water. Stock solutions of predetermined concentrations of the test compounds were then made in 1 mL of bacterial culture. The resulting bacterial suspension was aliquoted (100 µL) into the wells of a 96-well PVC microtiter plate. Sample plates were then incubated for 24 h at 30 °C. After incubation, the medium was discarded from the wells and the plates were washed thoroughly with water. Plates were then stained with 110 µL of 0.1% solution of crystal violet (CV) and then incubated at ambient temperature for 30 min. Plates were washed with water again and the remaining stain was solubilized with 200 µL of 95% ethanol. A sample of 125 µL of solubilized CV stain from each well was transferred to the corresponding wells of a polystyrene microtiter dish. Biofilm inhibition was quantitated by measuring the OD_{540} of each well in which a negative control lane wherein no biofilm was formed served as a background and was subtracted out.

Growth Curves: S. typhimurium was grown overnight in TSB, and this culture was used to inoculate fresh 1:20 TSB (OD_{600}=0.08). Inoculated medium was aliquoted (3 mL) into culture tubes, and compound was added, with untreated inoculated medium serving as the control. Tubes were incubated at 30 °C with shaking. Samples were taken at 2, 4, 6, 8, and 24 h time points, serially diluted in fresh 1:20 TSB, and plated on nutrient agar. Plates were incubated at 37 °C overnight in stationary conditions, and the number of colonies was enumerated.

Complete 2-ABI library Inhibition Data against *S.* Typhimurium 14028



1, 5a-n



9a-e

Compound	R=	IC_{50} (μM)
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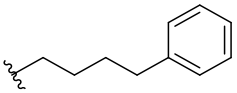
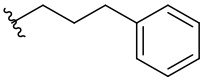
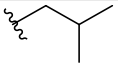
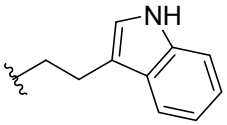
5b		9.59±0.23
5c		10.8±0.56
1		13.1±0.6
5d		10-15
5e		10-15
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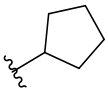
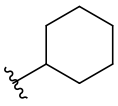
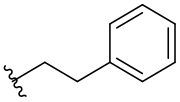
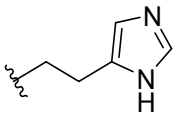
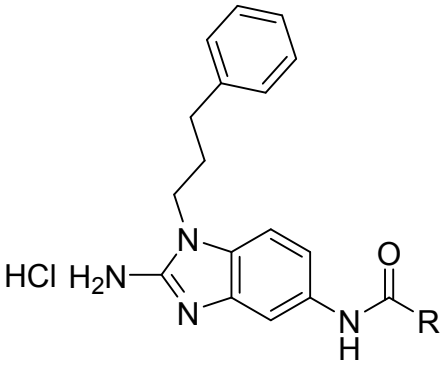
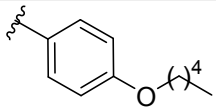
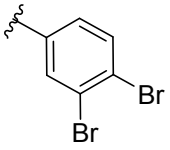
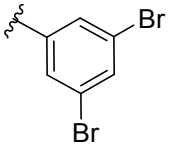
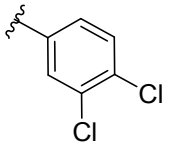
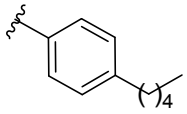
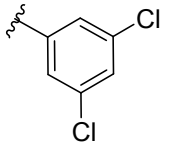
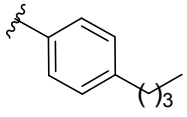
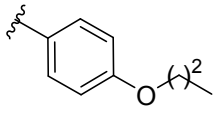
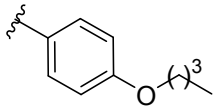
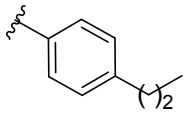
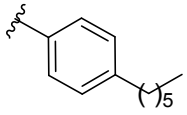
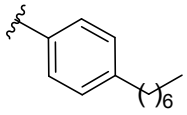
5g		15-20
5h		15-20
5i		20-40

5j		20-40
5o	H	20-40
5k		20-40
5l		>40
5m		>50
5n		>50
9a		10-15
9b		10-15
9c		20-40
9d		20-40
9e		20-40



10a-t

Compound	R=	IC_{50} (μM)
10a		5.22±0.11
10b		5.38±0.79
10c		5.58±0.21
10d		6.30±1.29
1		13.1±0.6
10e		13.3±0.49
10f		10-15
10g		10-15

10h		10-15
10i		10-15
10j		15-20
10k		15-20
10l		15-20
10m		15-20
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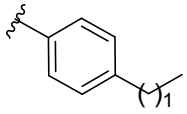
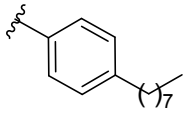
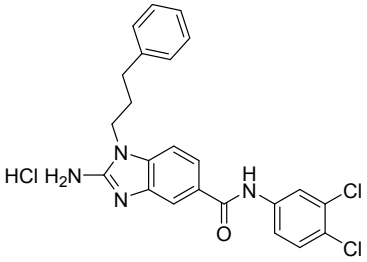
10o		20-40
10p		20-40
10q		>40
10r		>50
10s		>50
10t		>50



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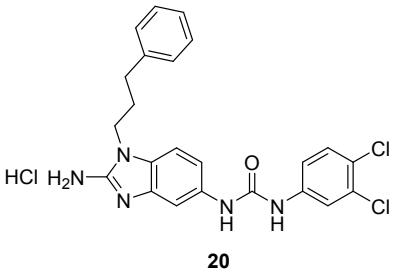
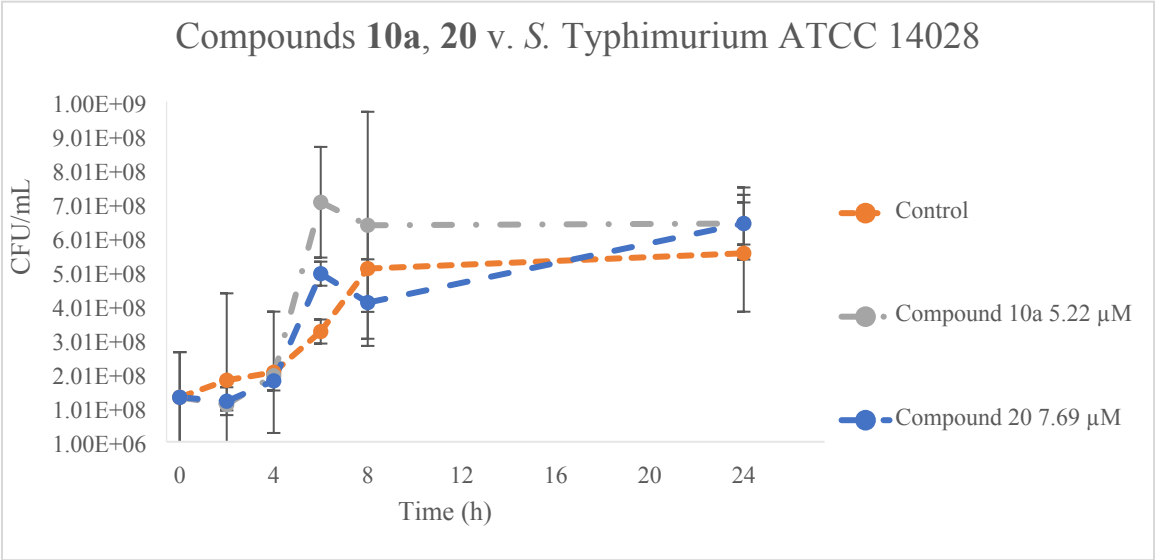


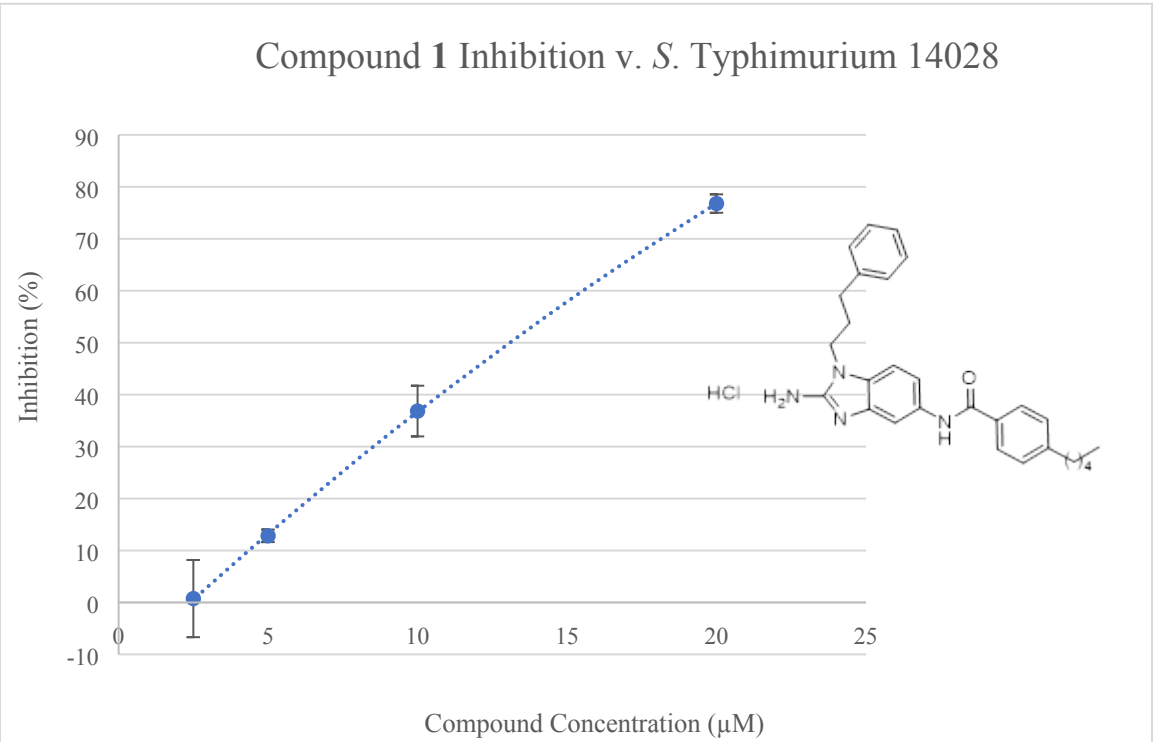
20

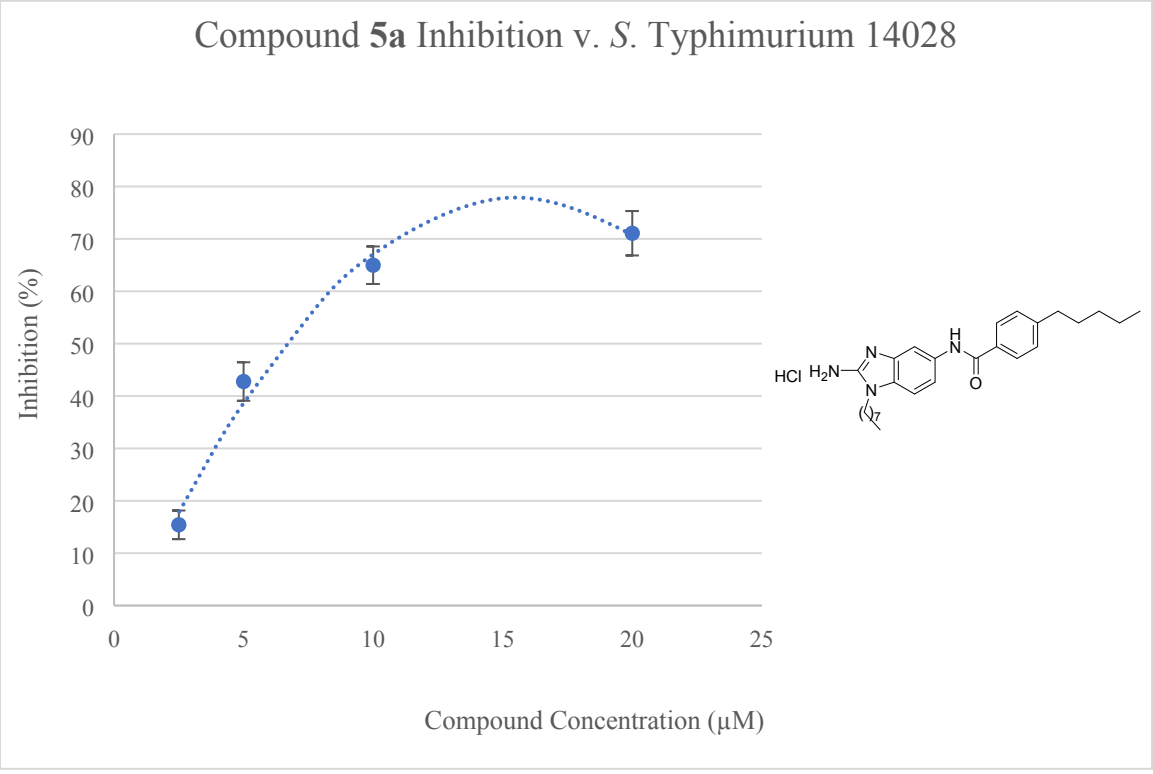
Compound	IC_{50} (μM)
15	12.6±1.8
20	7.69±0.25

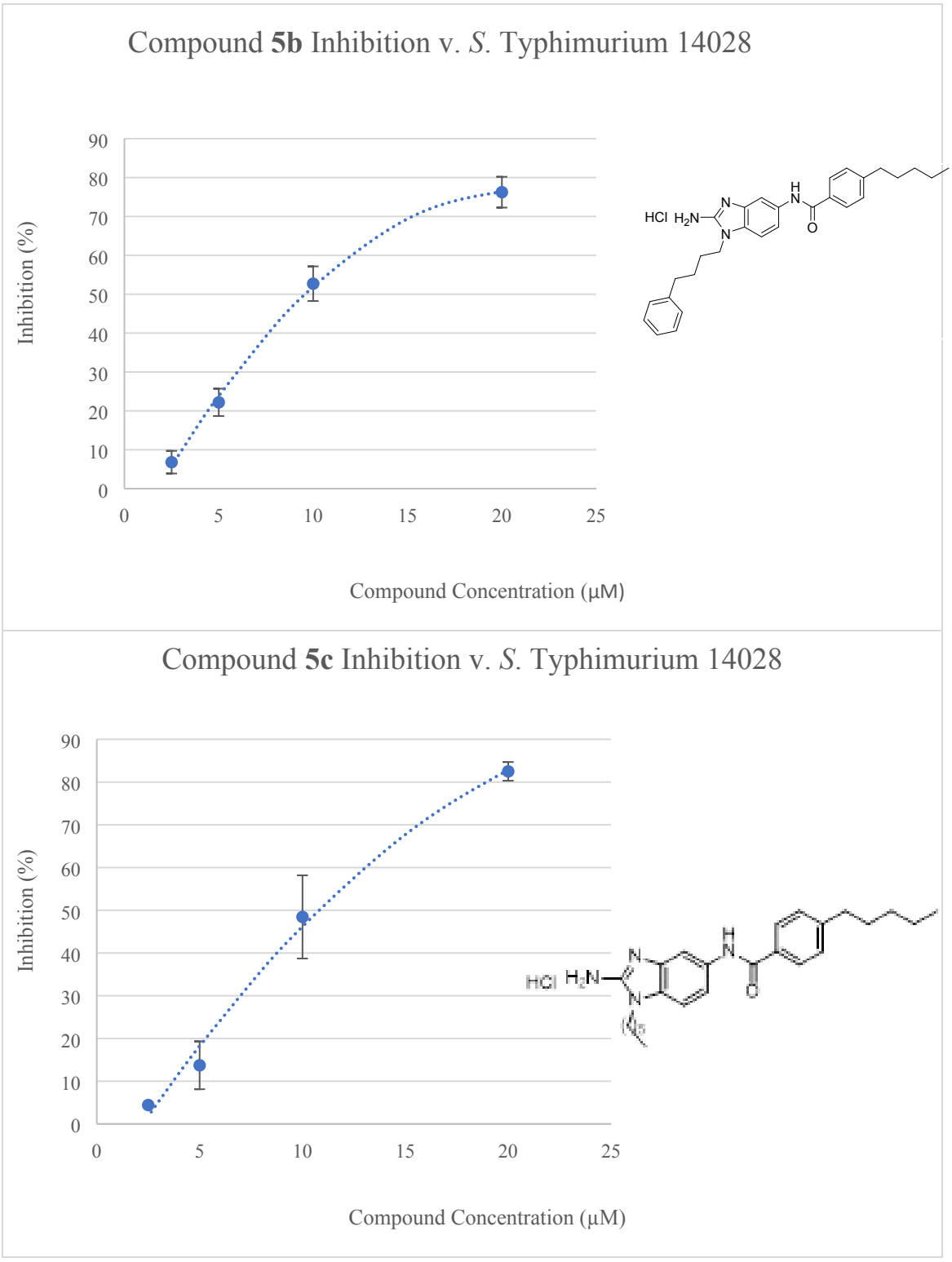
Growth curves for select compounds against *S.* Typhimurium ATCC 14028:

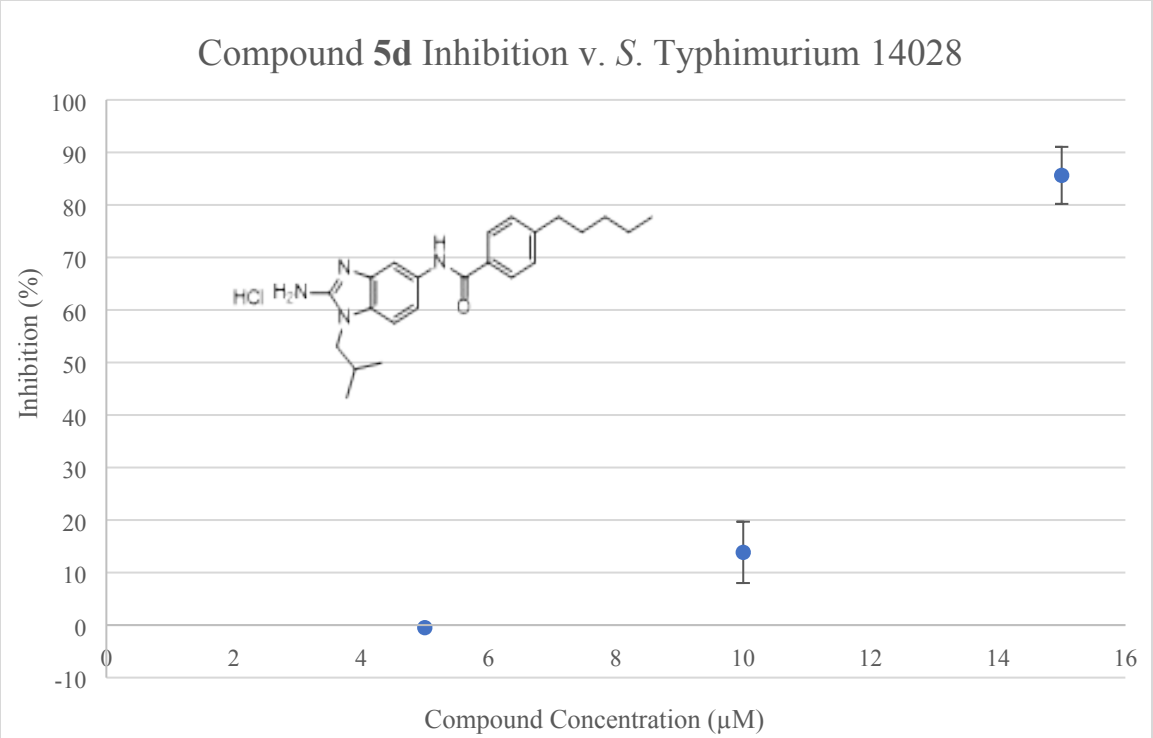


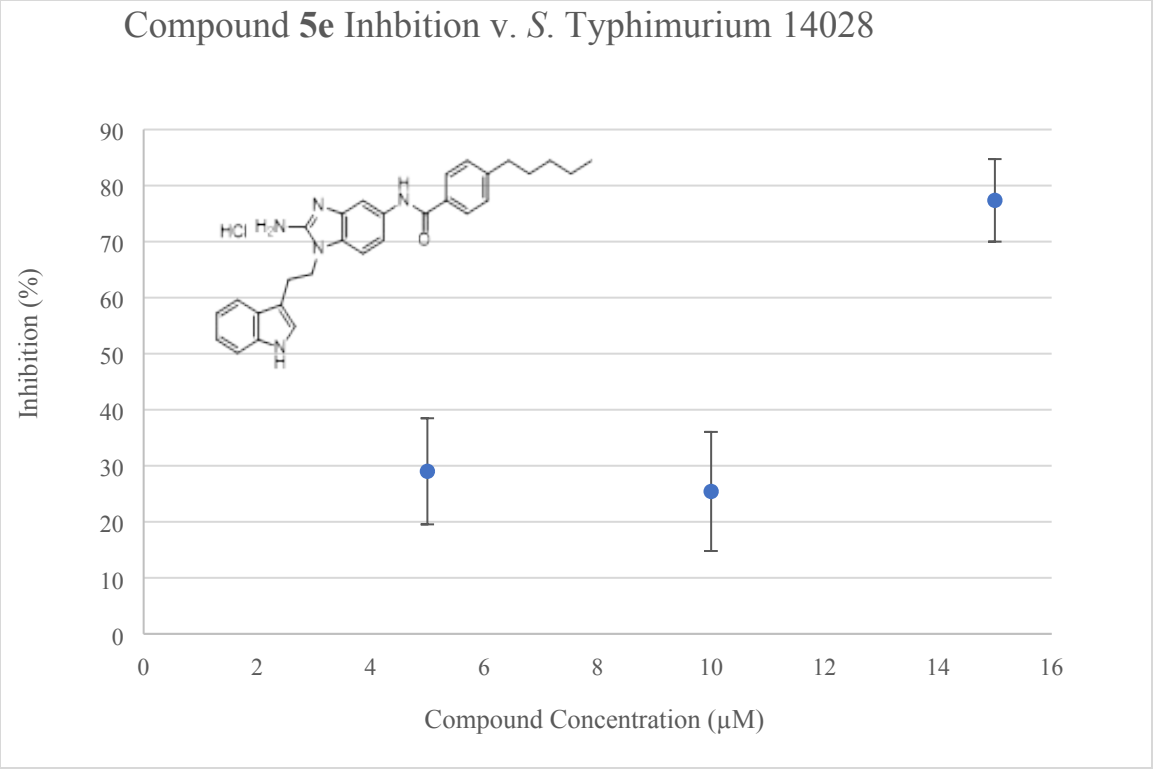
Complete *S.* Typhimurium Inhibition Dose Response Curves

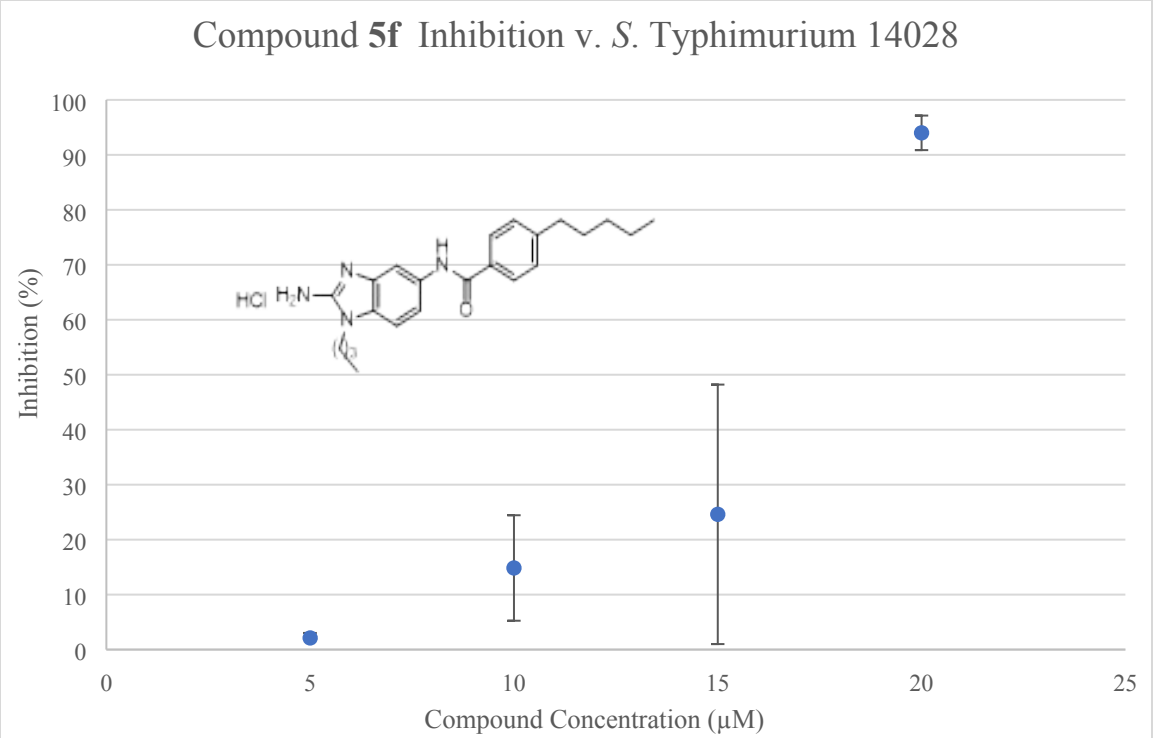

Compound 1 Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
-10
0
5
10
15
20
25
Compound Concentration (µM)
HCl
H2N
N
N
H
O
4

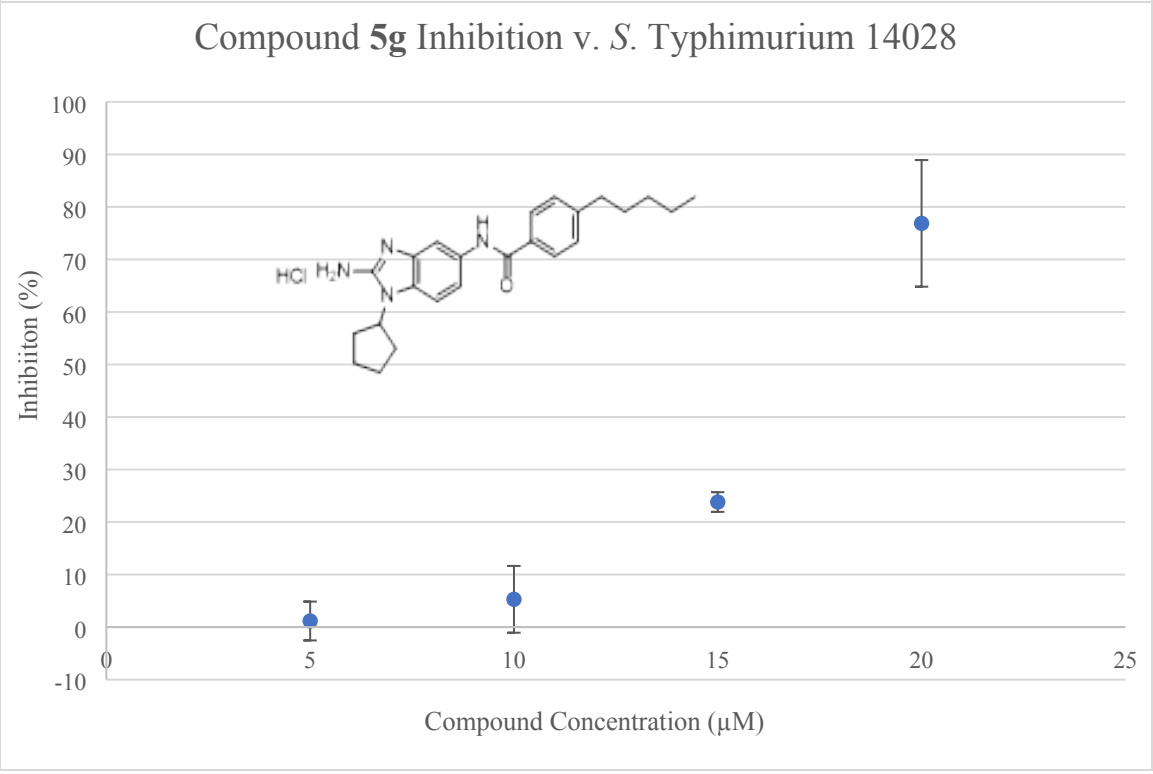

Compound 5a Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (µM)
HCl
H2N
N
N
H
O
7

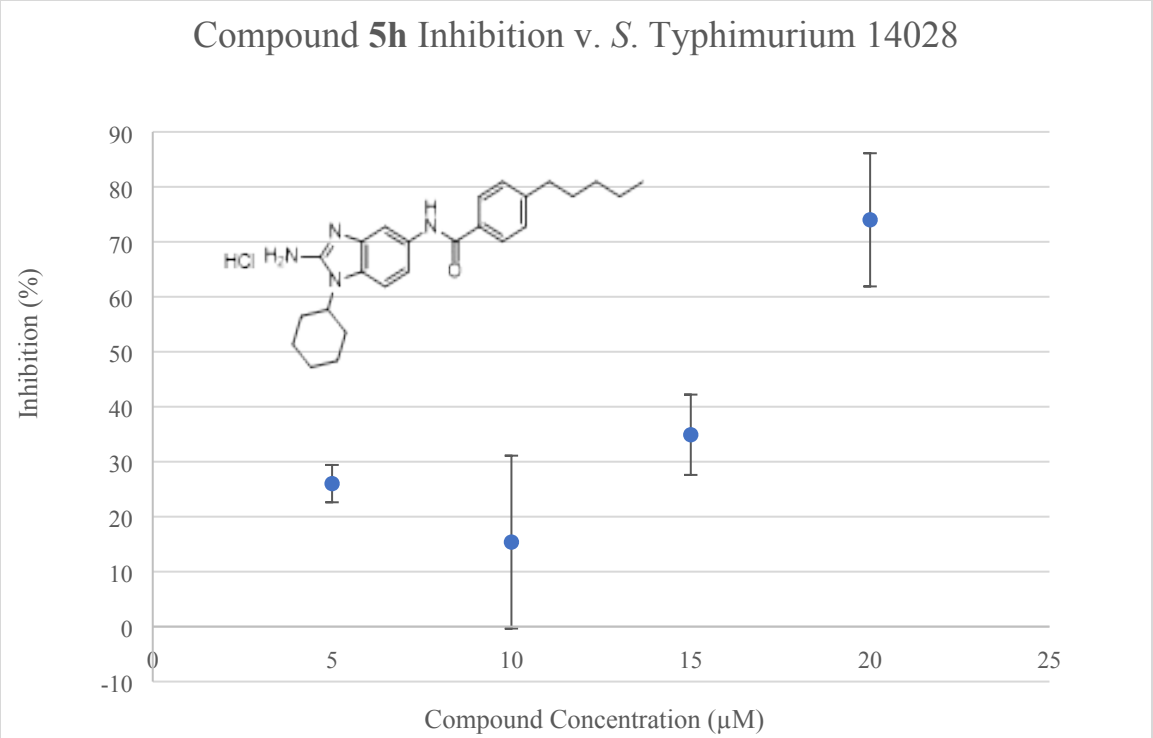

Compound 5b Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (µM)
HCl H2N
N
H
N
N
O
Compound 5c Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (µM)
HCl H2N
N
H
N
N
O

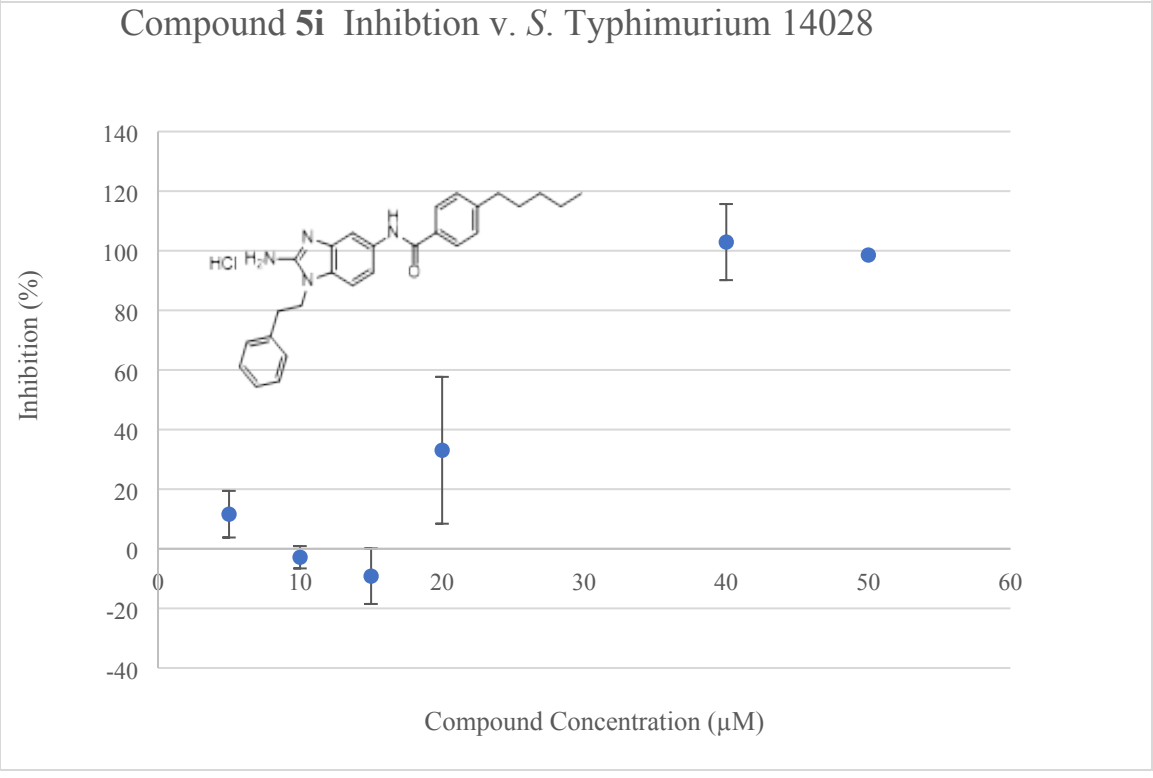

Compound 5d Inhibition v. S. Typhimurium 14028
Inhibition (%)
100
90
80
70
60
50
40
30
20
10
0
-10
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
HCl H2N
N
H
N
O

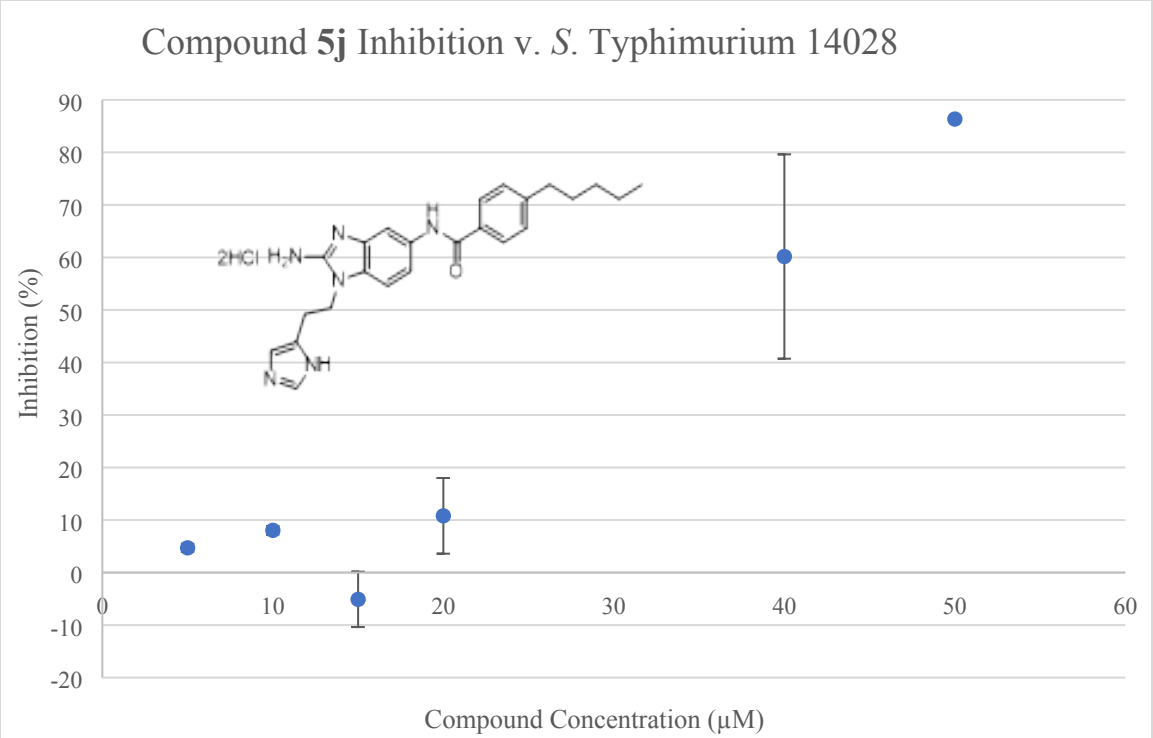

Compound 5e Inhbition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
HCl H2N
N
H
N
O
N
H

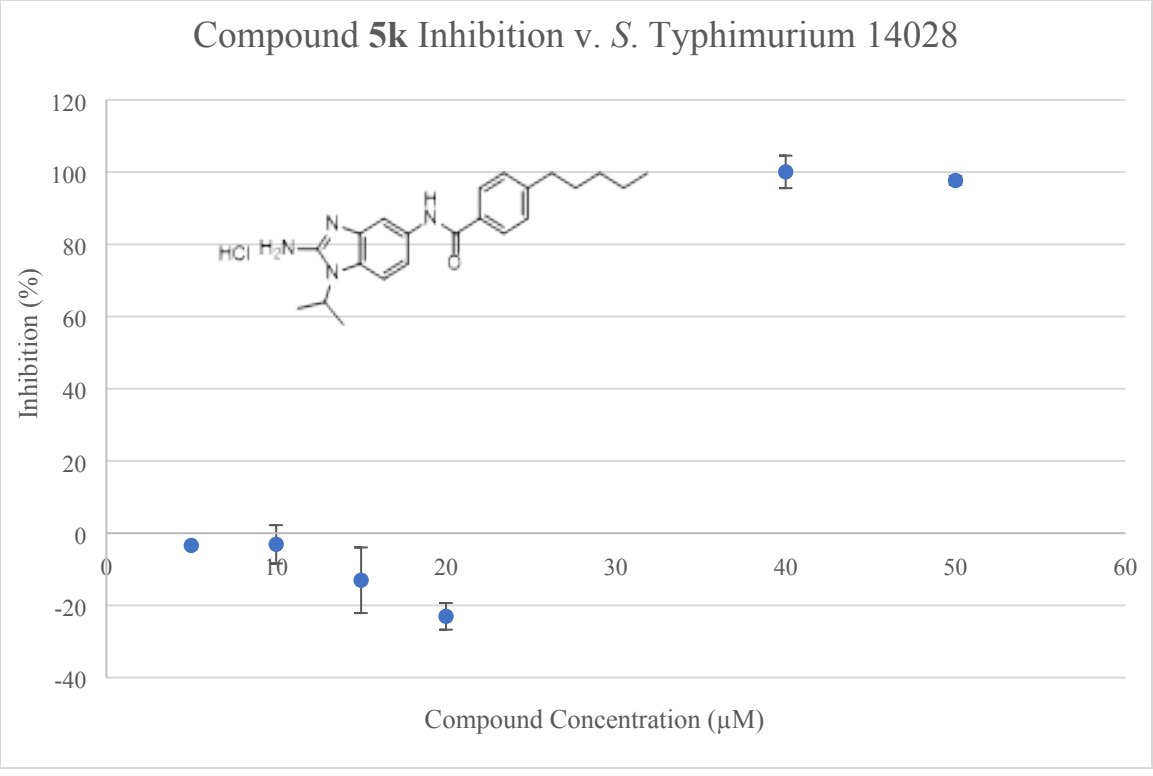

Compound 5f Inhibition v. S. Typhimurium 14028
Inhibition (%)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (µM)

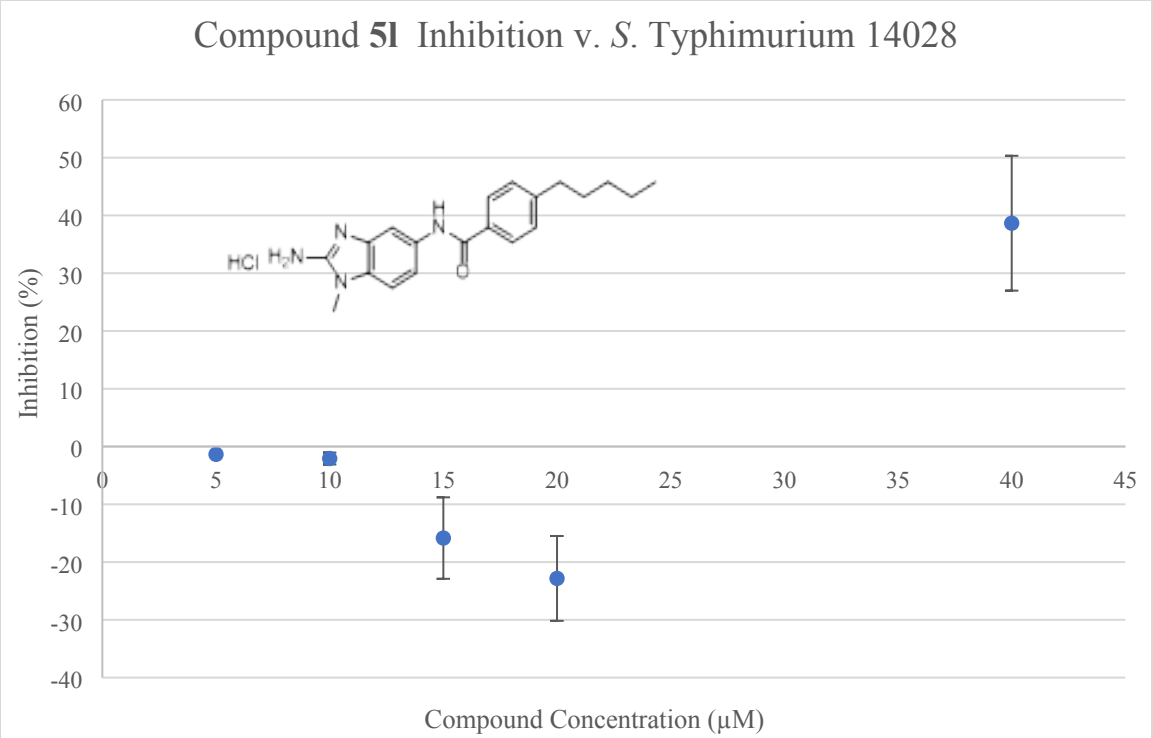

Compound 5g Inhibition v. S. Typhimurium 14028
Inhibiiton (%)
100
90
80
70
60
50
40
30
20
10
0
-10
0
5
10
15
20
25
Compound Concentration (µM)

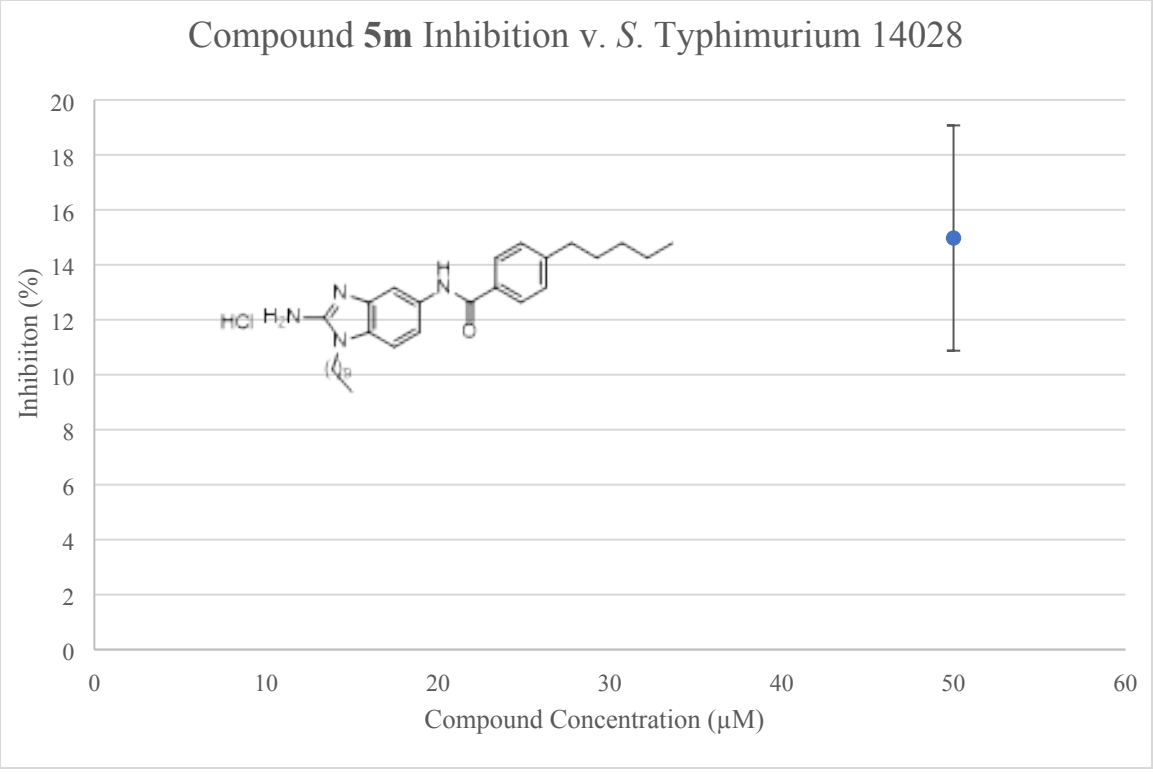

Compound 5h Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
-10
0
5
10
15
20
25
Compound Concentration (µM)
HCl
H2N
N
H
N
O

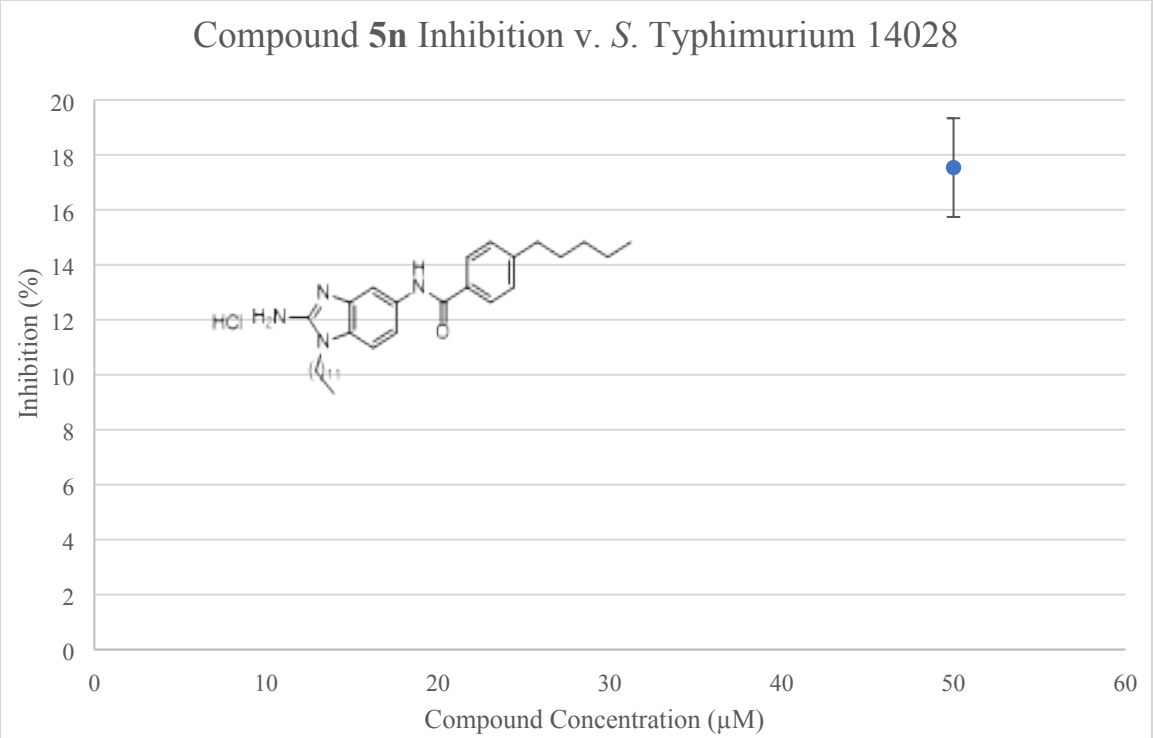

Compound 5i Inhibtion v. S. Typhimurium 14028
Inhibition (%)
140
120
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)
HCl
H2N
N
H
N
O

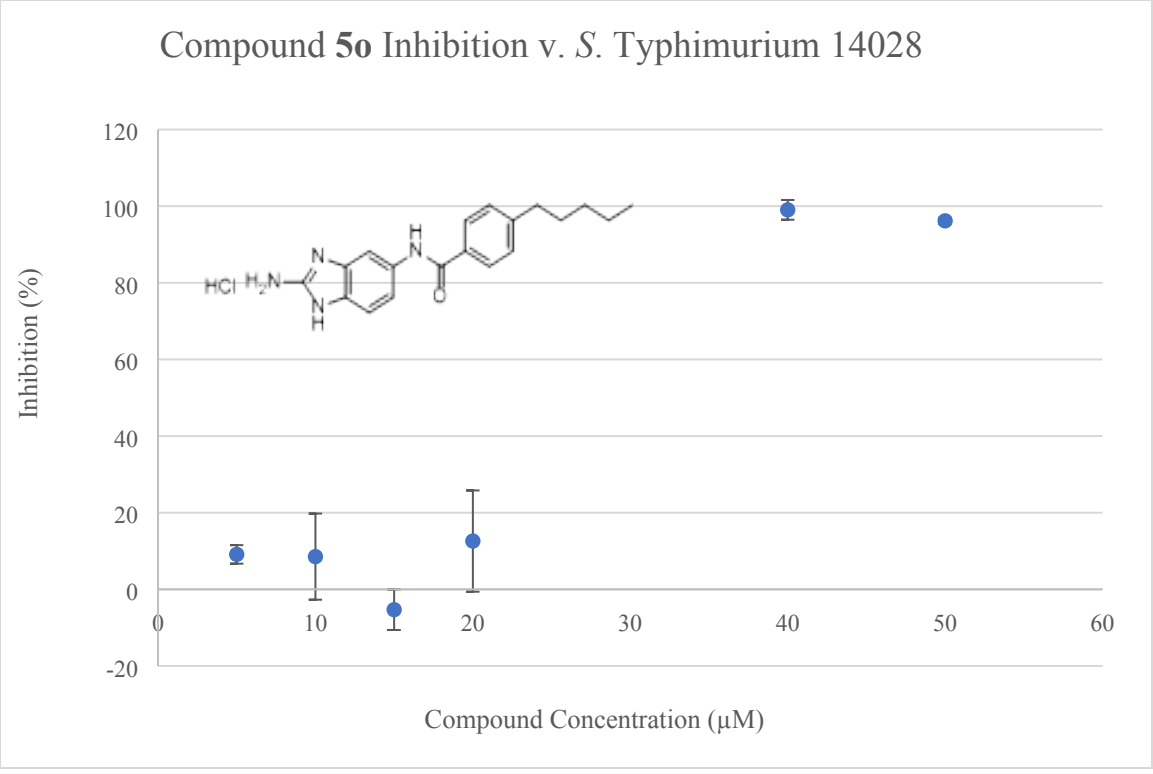

Compound 5j Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
-10
-20
0
10
20
30
40
50
60
Compound Concentration (µM)
2HCl H2N
N
N
H
N
O
NH
N

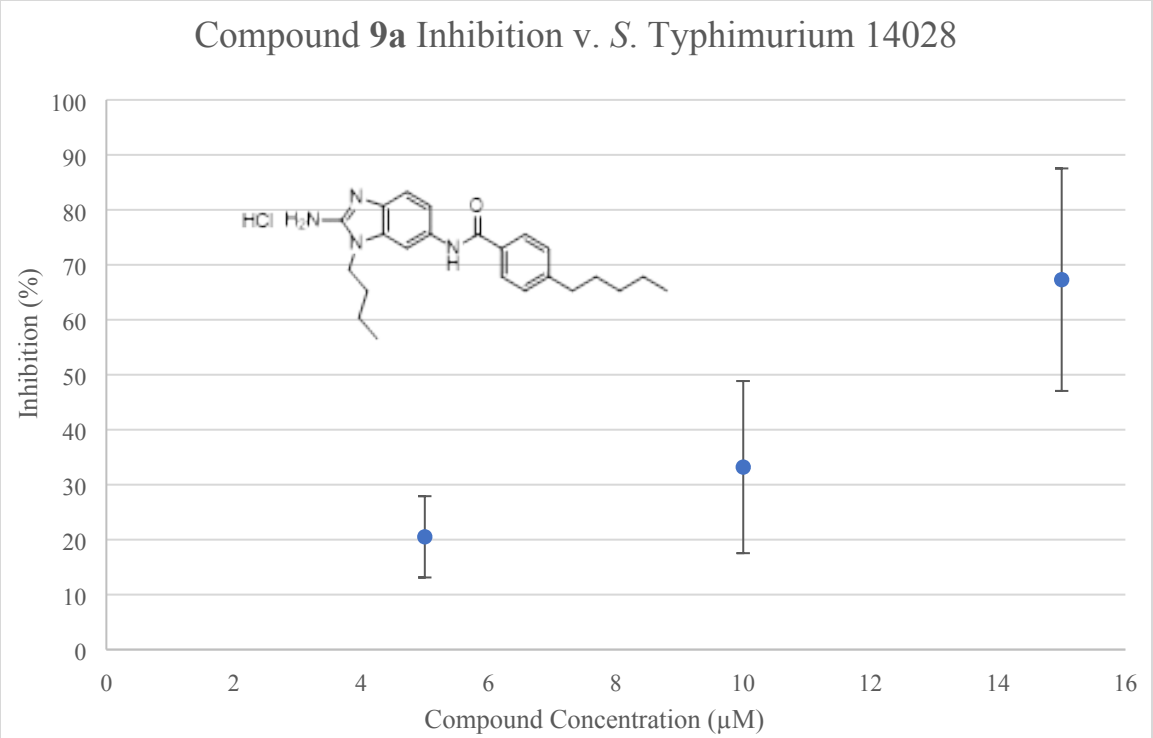

Compound 5k Inhibition v. S. Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)
HCl H2N
N
N
H
N
O

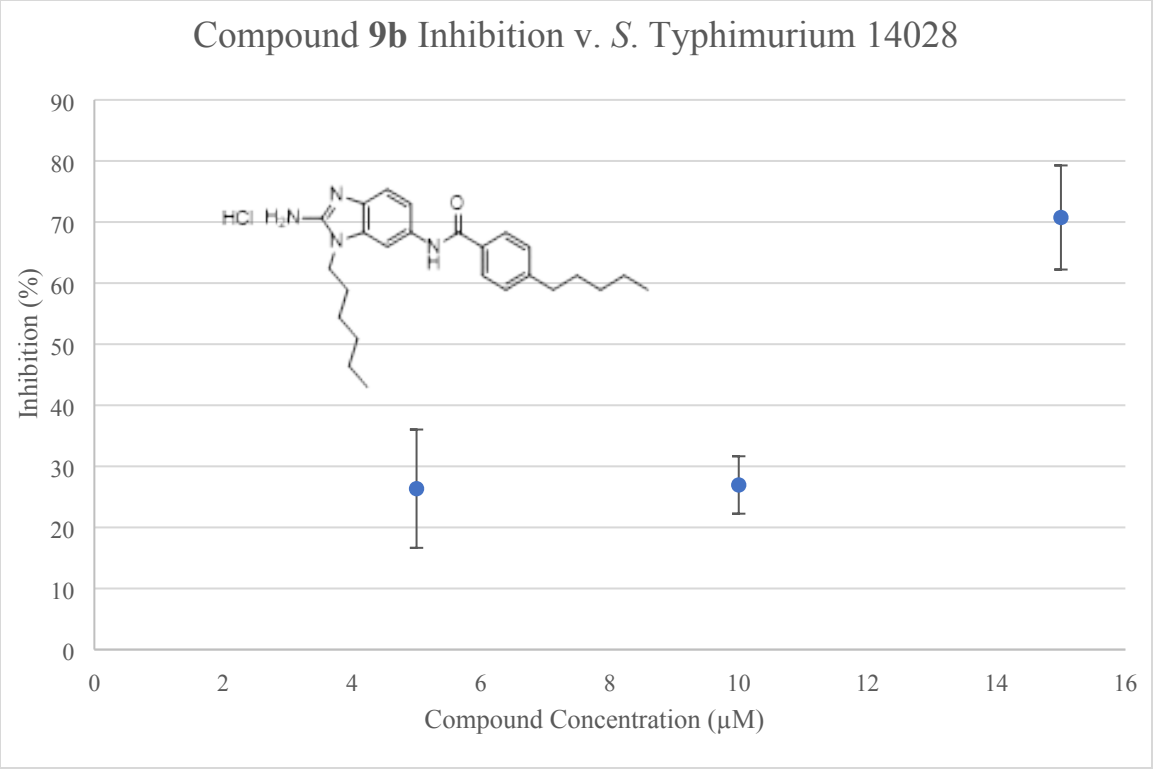

Compound 5l Inhibition v. S. Typhimurium 14028
Inhibition (%)
60
50
40
30
20
10
0
-10
-20
-30
-40
0
5
10
15
20
25
30
35
40
45
Compound Concentration (µM)

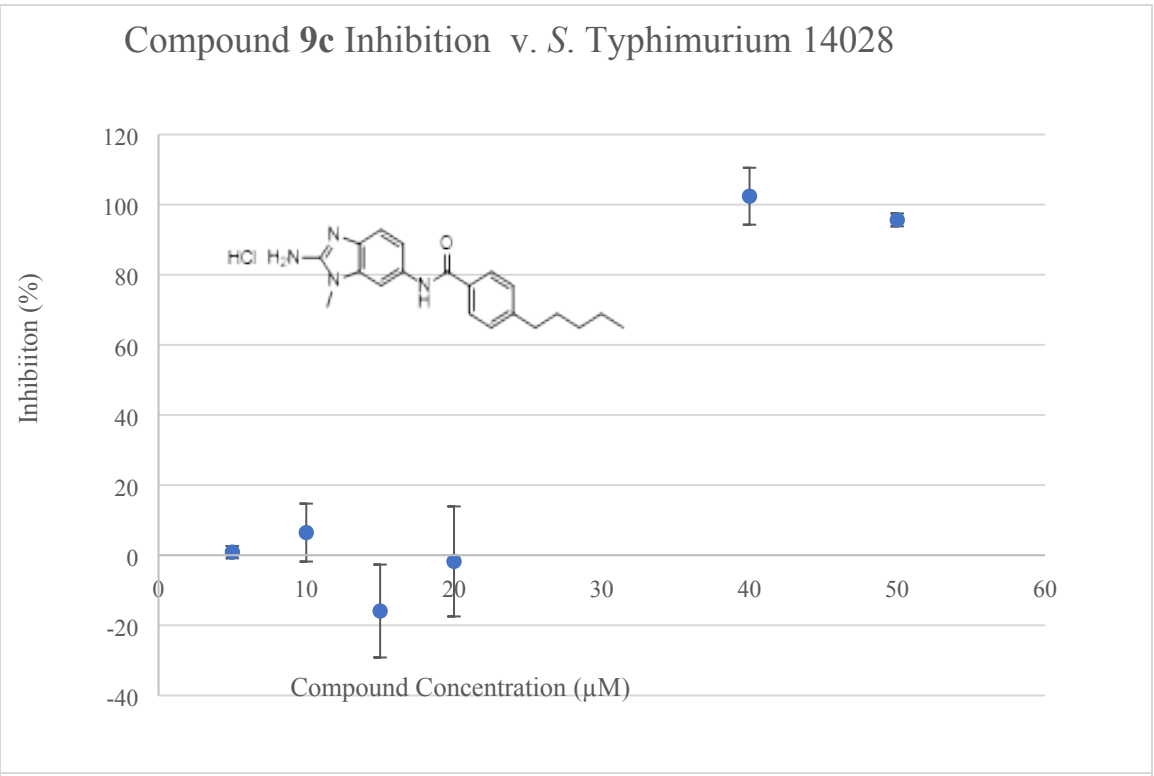

Compound 5m Inhibition v. S. Typhimurium 14028
Inhibiiton (%)
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
Compound Concentration (µM)

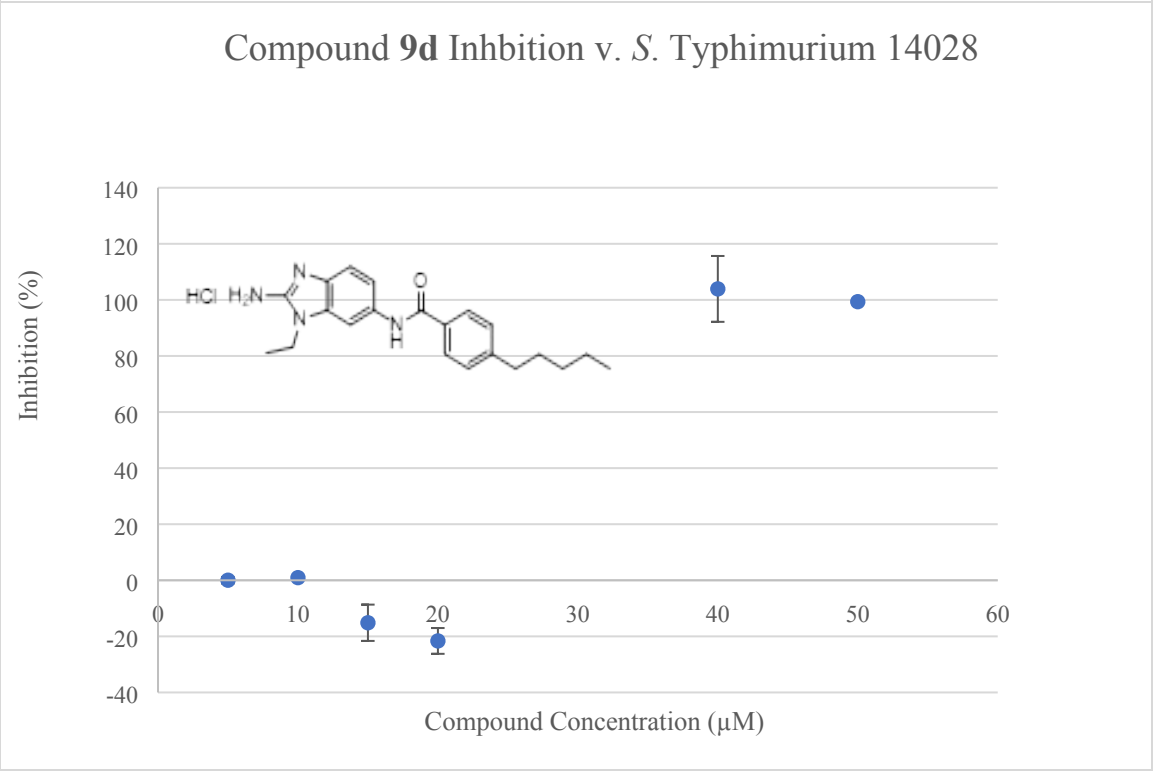

Compound 5n Inhibition v. S. Typhimurium 14028
Inhibition (%)
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
Compound Concentration (µM)


Compound 5o Inhibition v. S. Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60
Compound Concentration (µM)

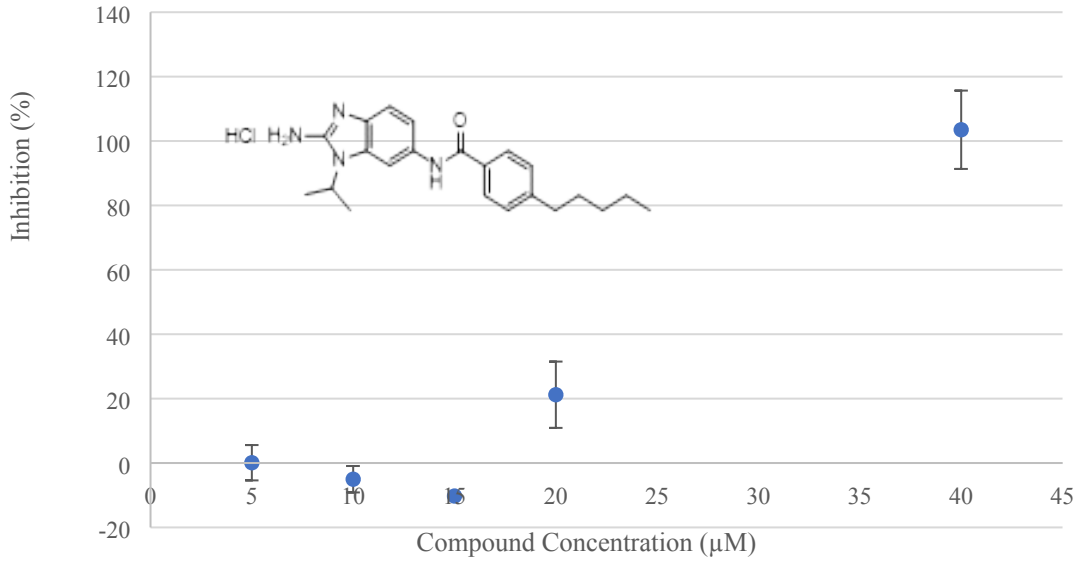

Compound 9a Inhibition v. S. Typhimurium 14028
Inhibition (%)
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
HCl H2N
N
N
H
O


Compound 9b Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
HCl H2N
N
N
H
O

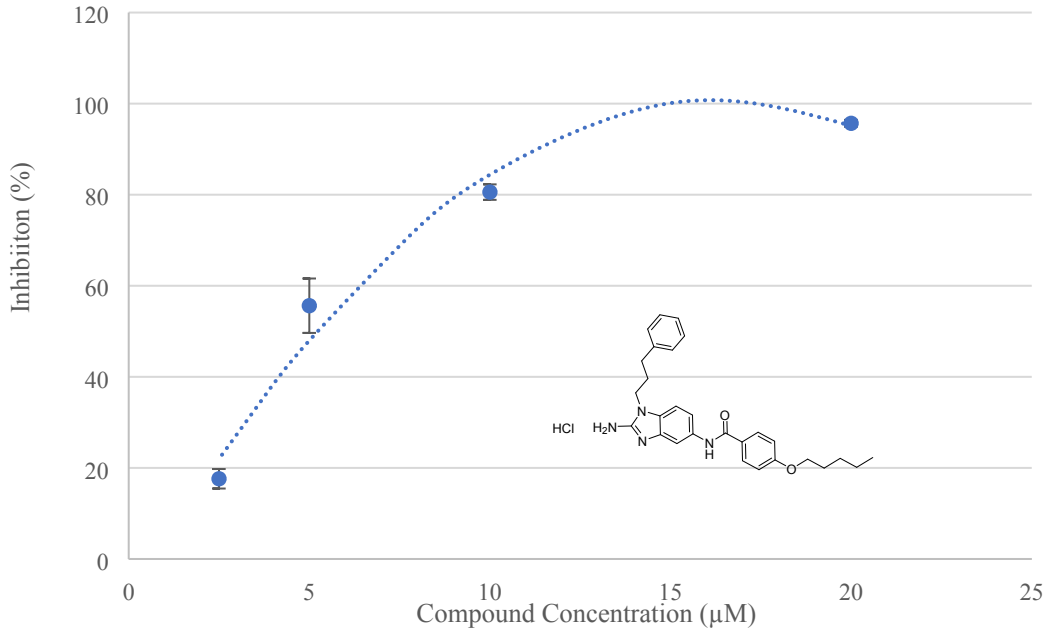

Compound 9c Inhibition v. S. Typhimurium 14028
Inhibiton (%)
120
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)

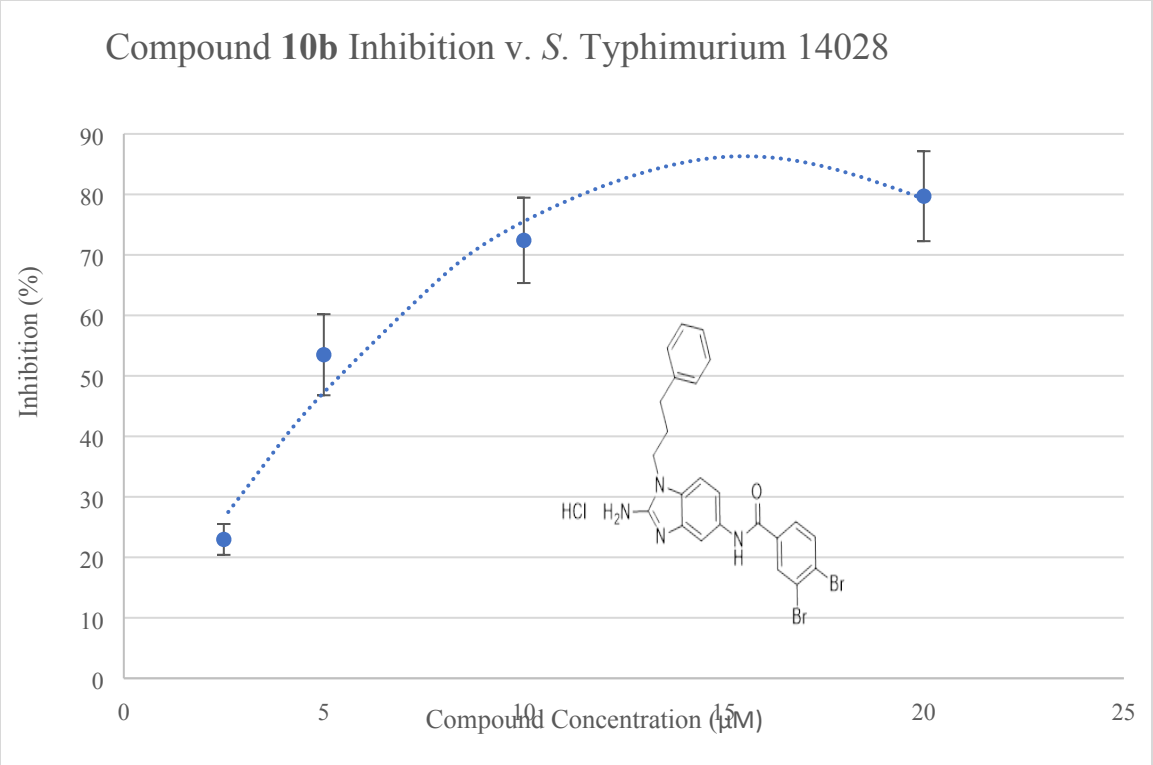

Compound 9d Inhbition v. S. Typhimurium 14028
Inhibition (%)
140
120
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)

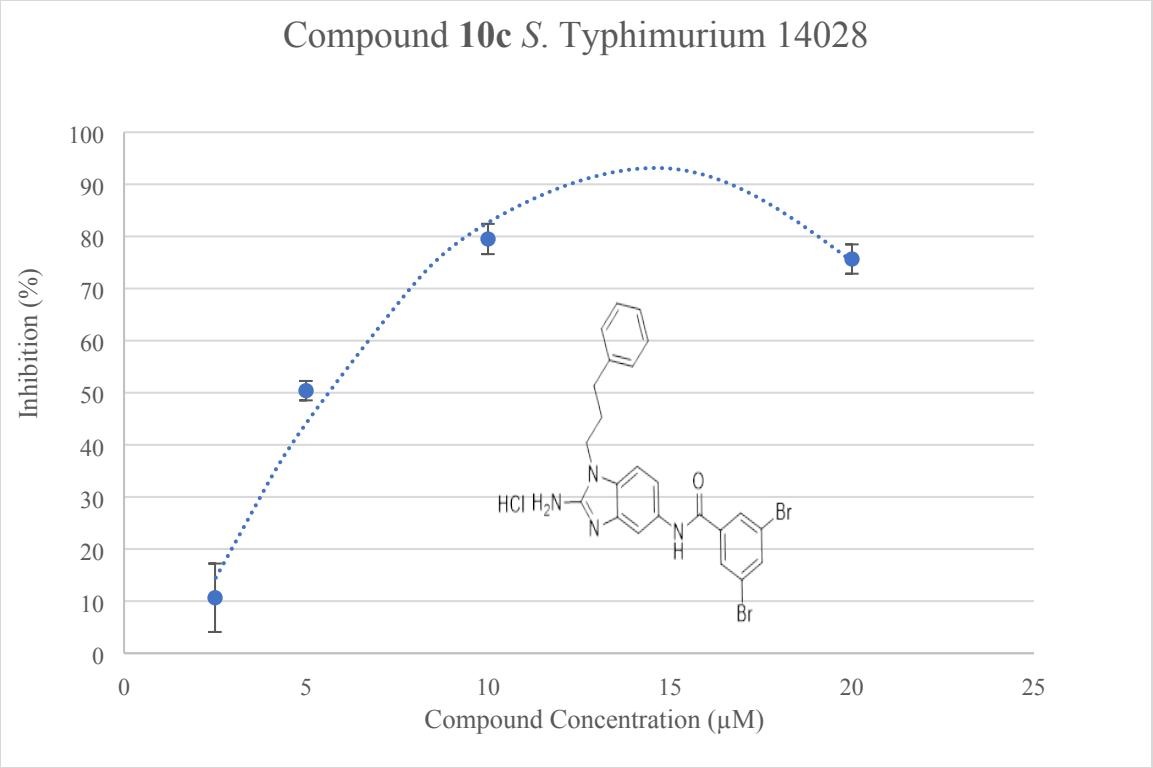
Compound **9e** Inhibition v. *S.* Typhimurium 14028

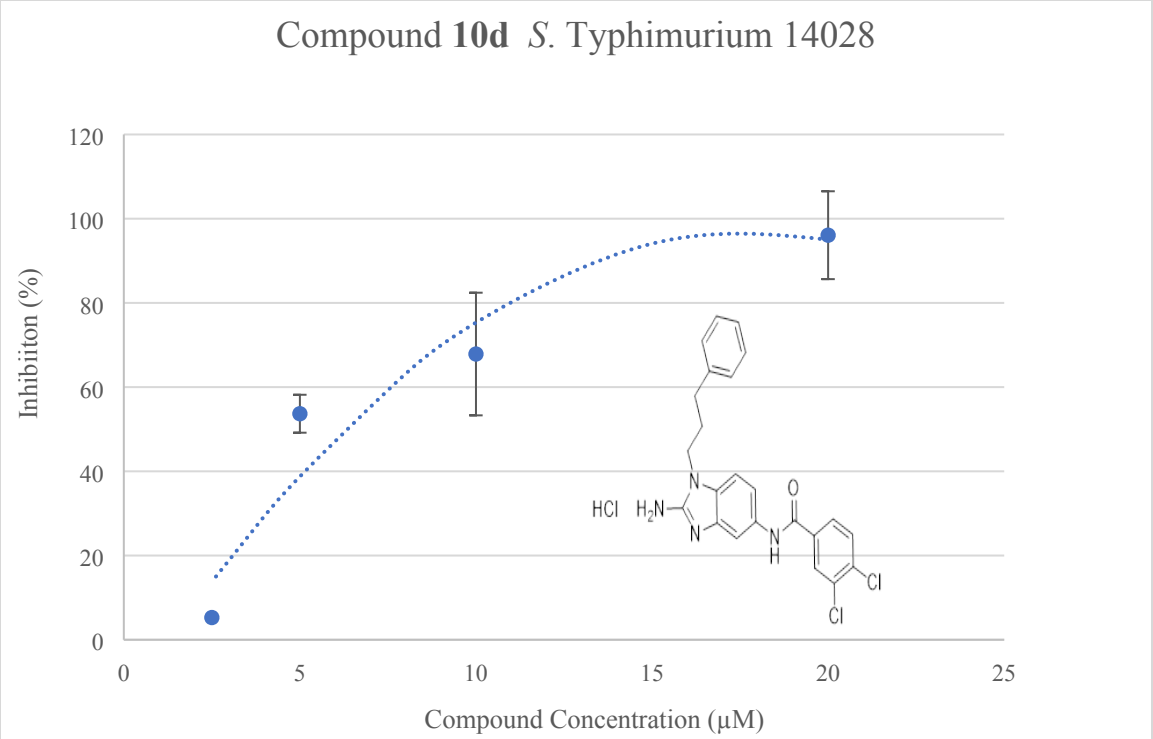


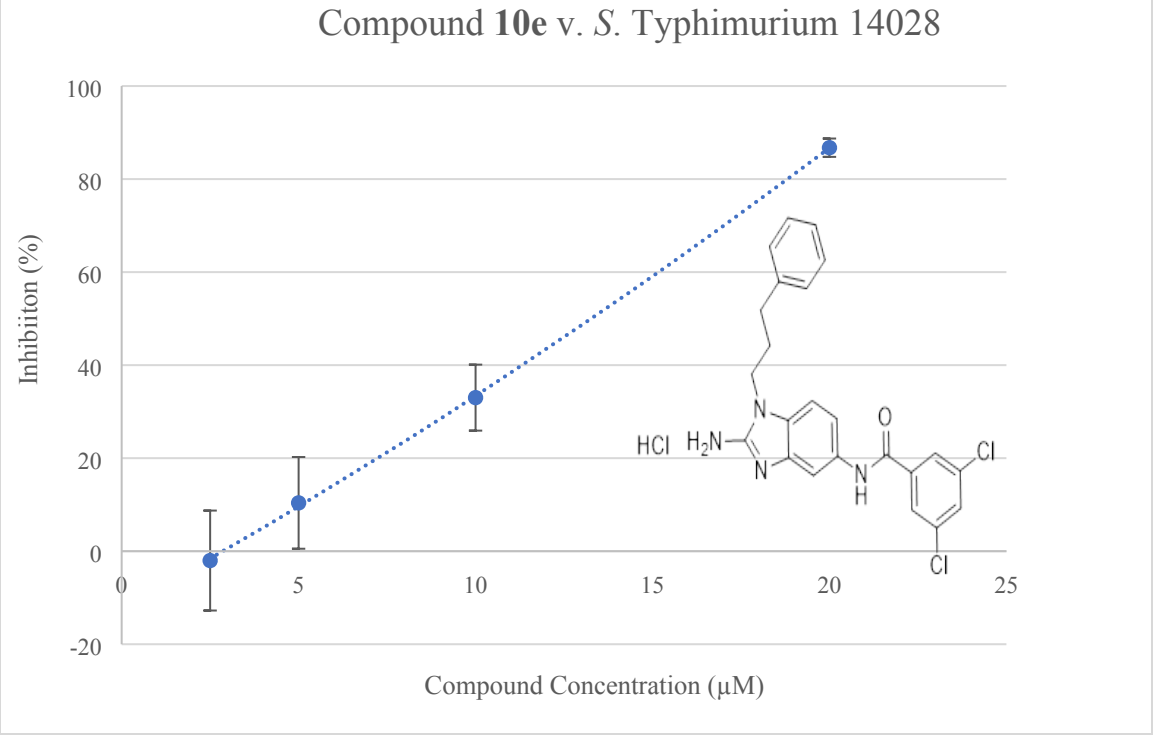
Compound **10a** v. *S.* Typhimurium 14028

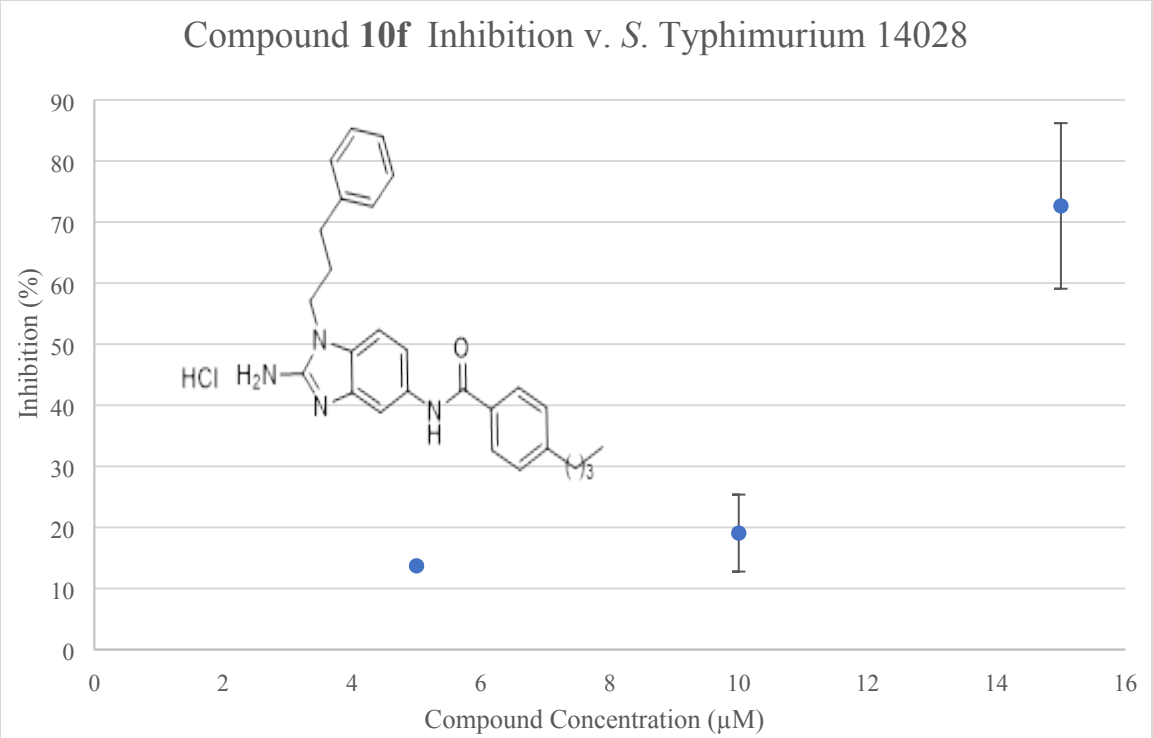


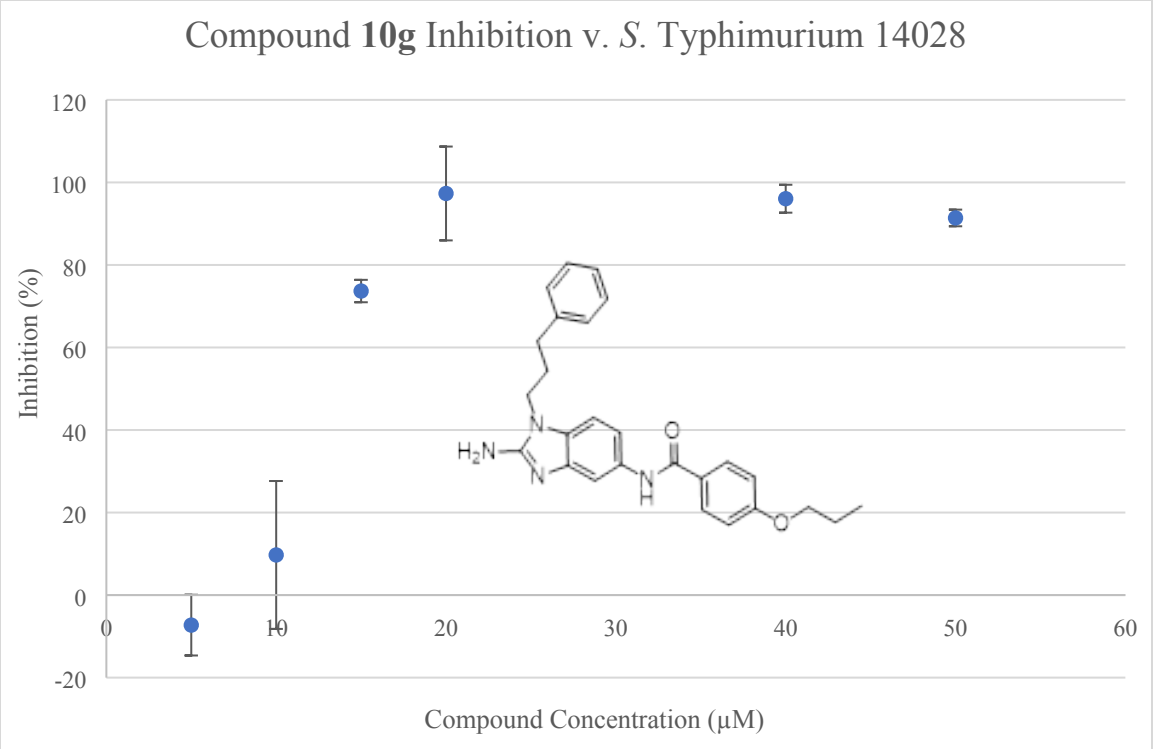

Compound 10b Inhibition v. S. Typhimurium 14028
Inhibition (%)
0
10
20
30
40
50
60
70
80
90
0
5
10
15
20
25
Compound Concentration (µM)
HCl H2N
N
N
O
N
H
Br
Br

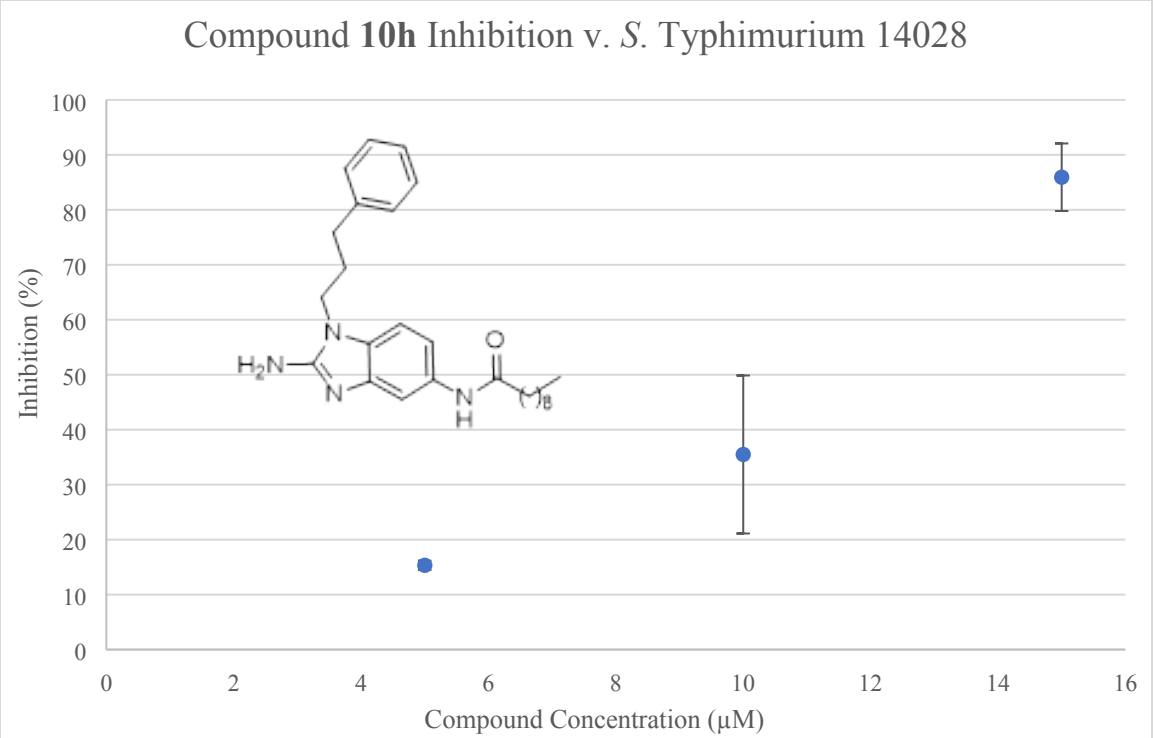

Compound 10c S. Typhimurium 14028
Inhibition (%)
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
Compound Concentration (µM)
HCl H2N
N
N
O
N
H
Br
Br

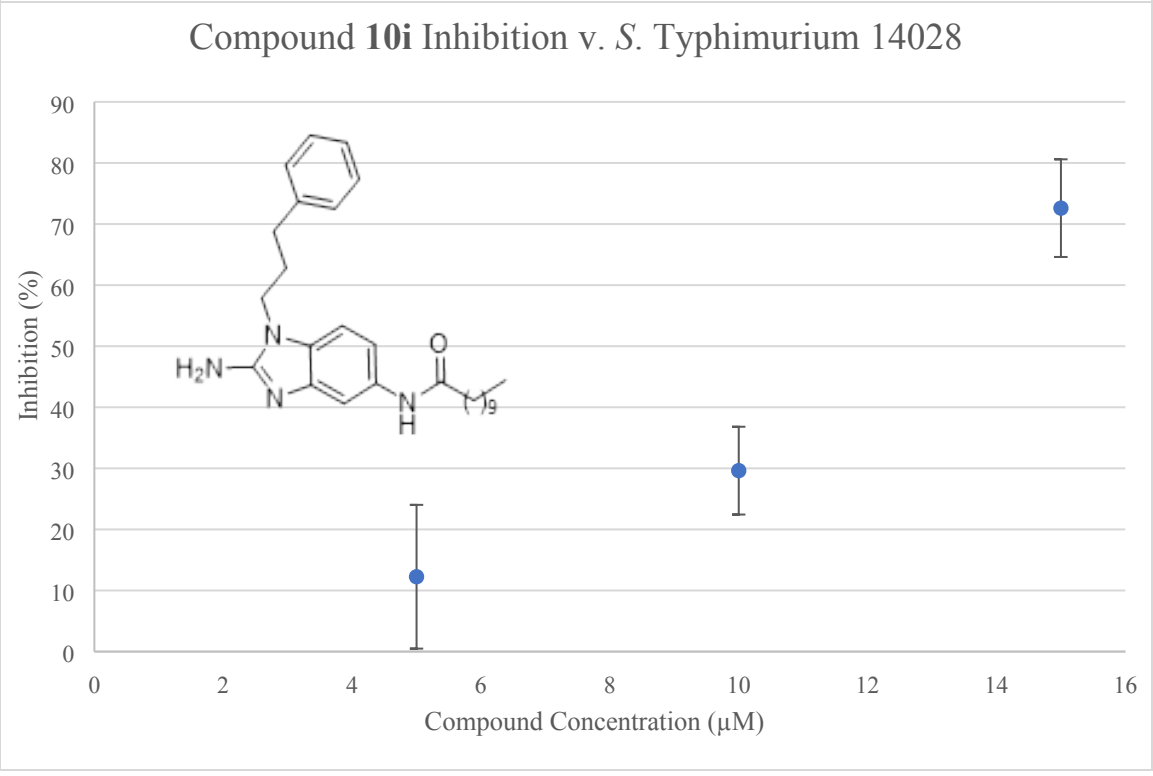

Compound 10d S. Typhimurium 14028
Inhibiiton (%)
120
100
80
60
40
20
0
0
5
10
15
20
25
Compound Concentration (µM)
HCl
H2N
N
N
H
O
Cl
Cl

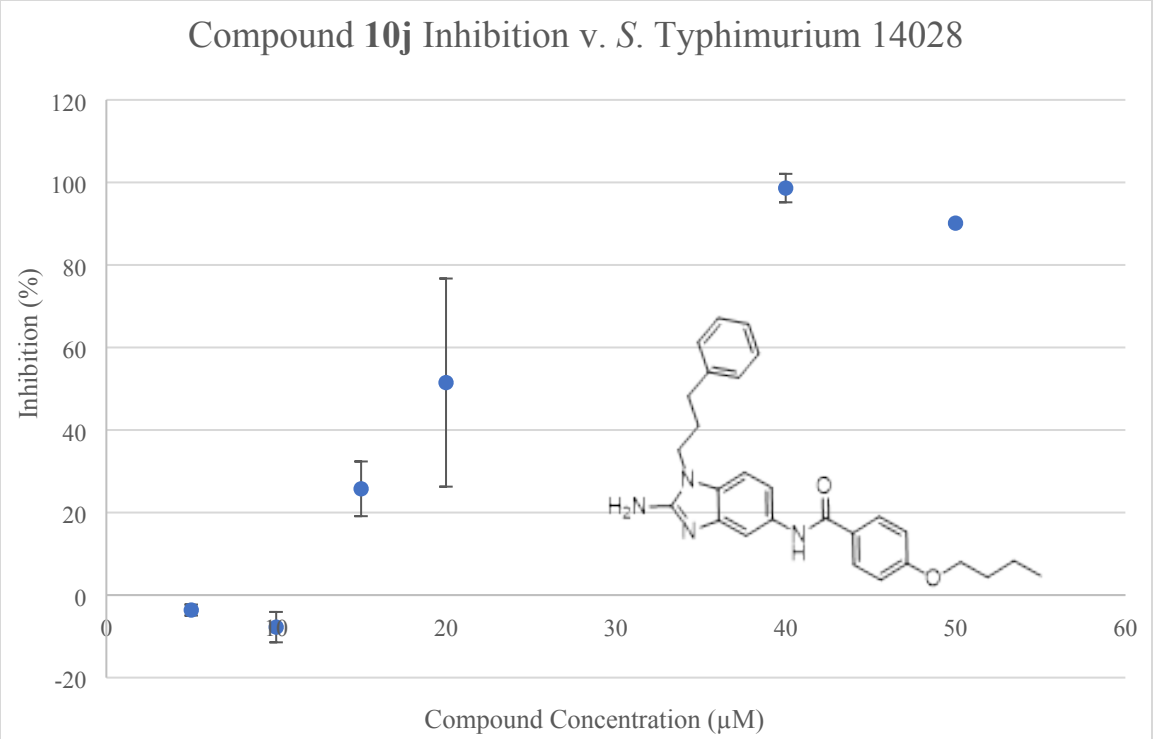

Compound 10e v. S. Typhimurium 14028
Inhibiiton (%)
100
80
60
40
20
0
-20
0
5
10
15
20
25
Compound Concentration (µM)
HCl
H2N
N
N
H
O
Cl
Cl

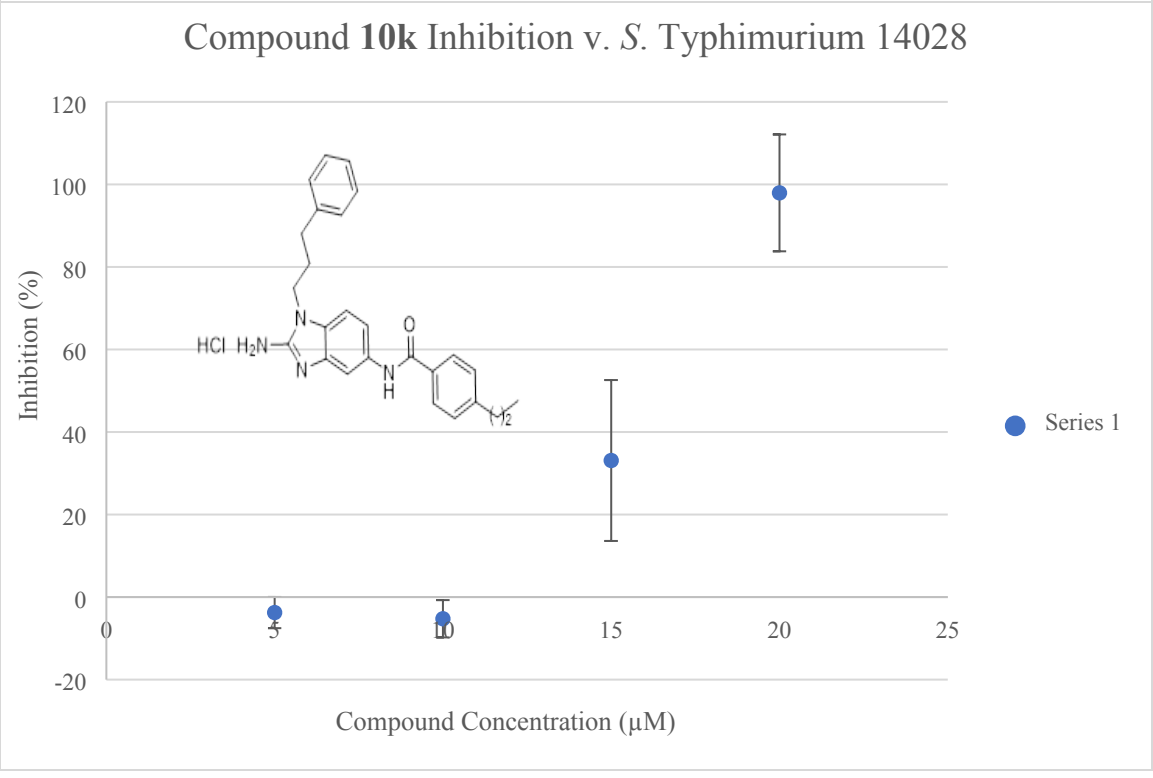

Compound 10f Inhibition v. S. Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
HCl
H2N
N
N
H
O
(CH2)3

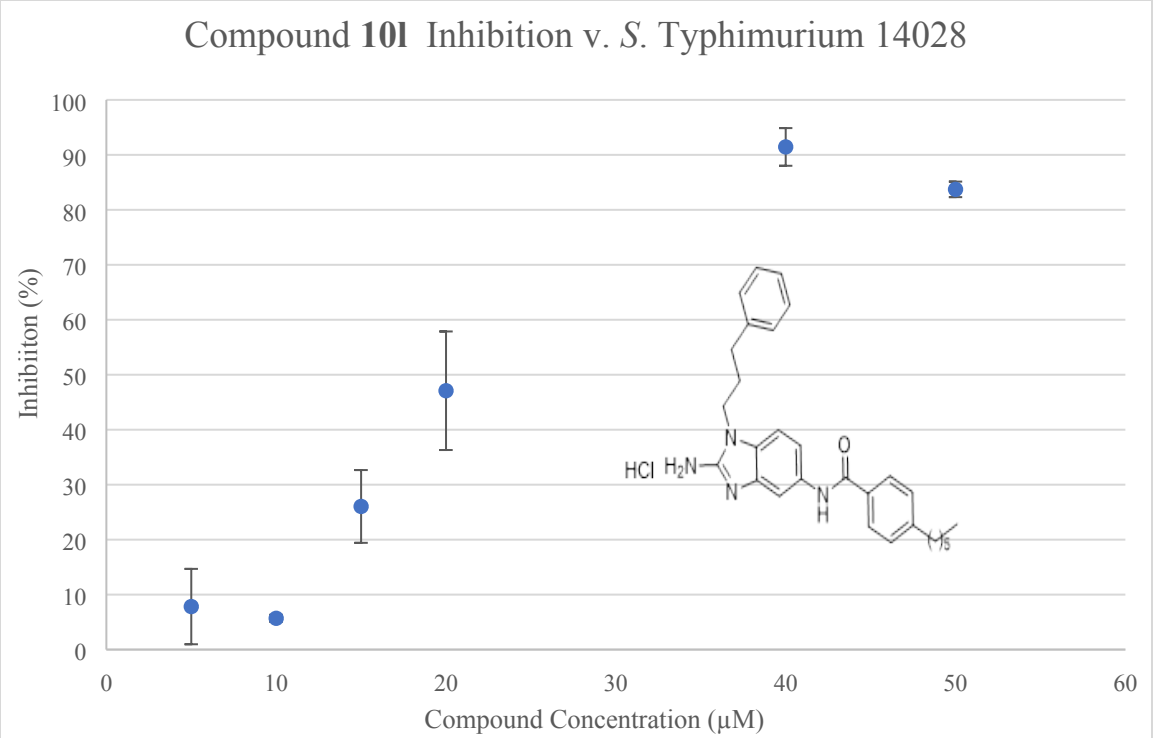

Compound 10g Inhibition v. S. Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60
Compound Concentration (µM)
H2N
N
N
H
O
O

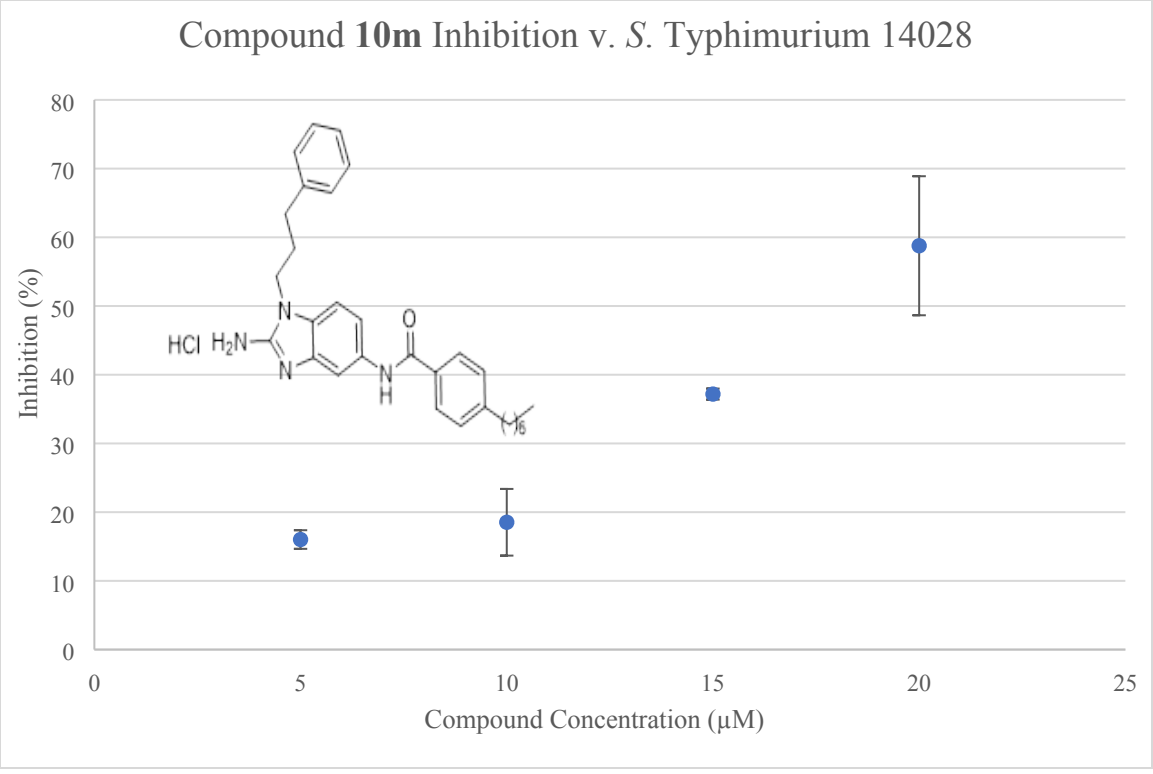

Compound **10h** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
H_2N
N
N
N
H
O
$(CH_2)_8$

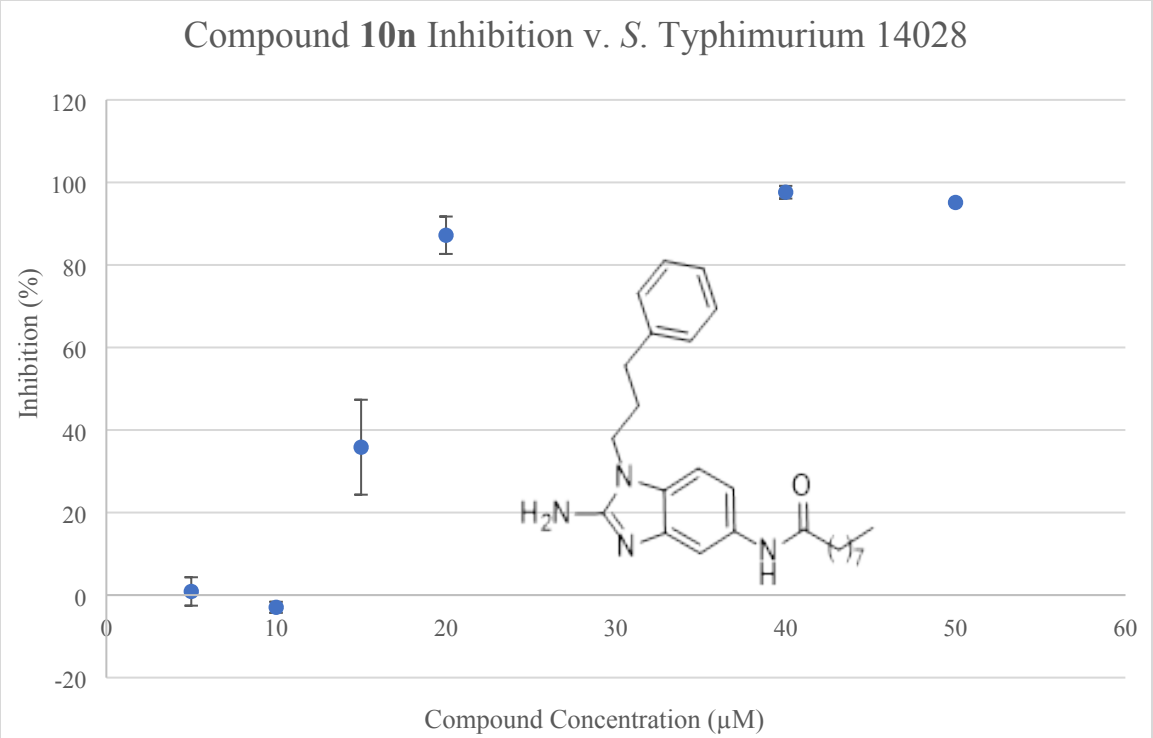

Compound **10i** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
Compound Concentration (µM)
H_2N
N
N
N
H
O
$(CH_2)_9$

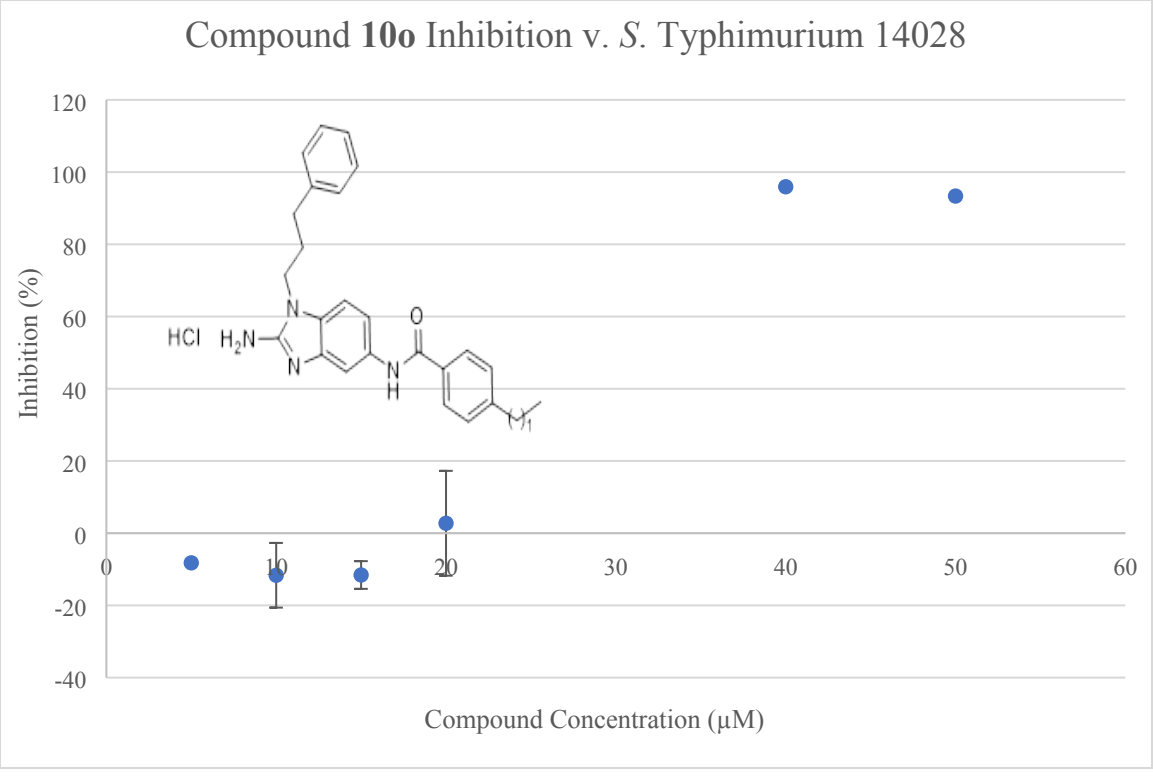

Compound **10j** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60
Compound Concentration (µM)

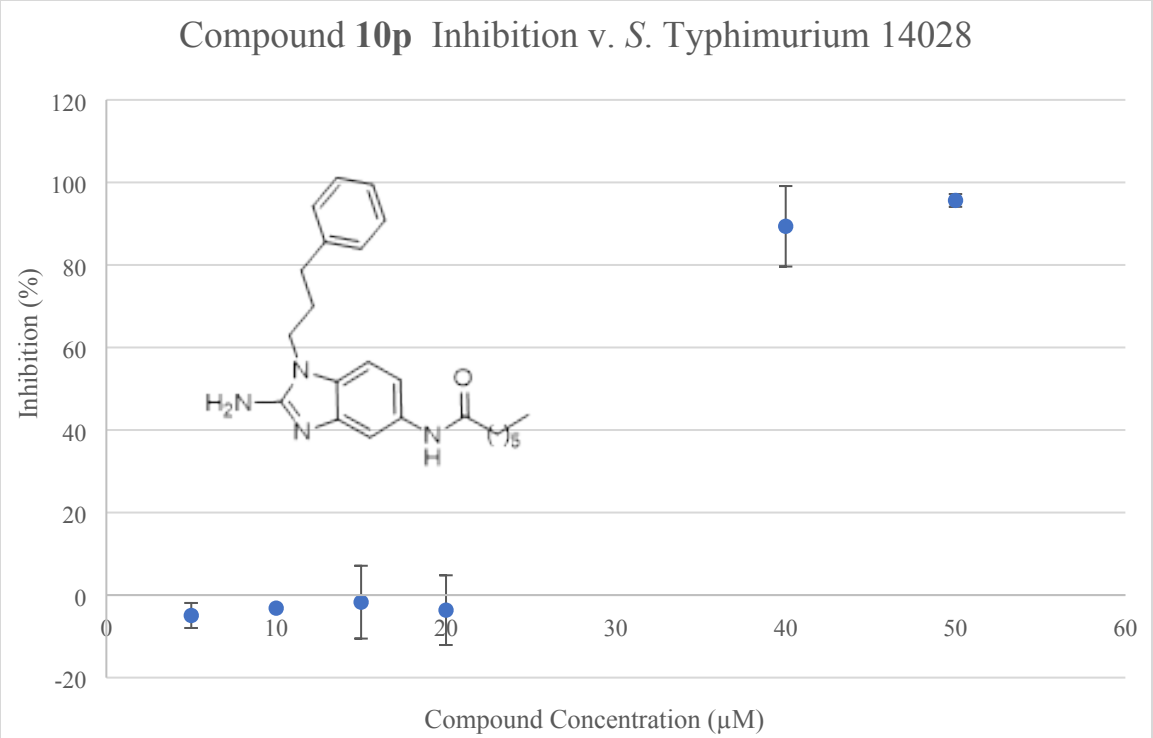

Compound **10k** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
5
10
15
20
25
Compound Concentration (µM)
Series 1

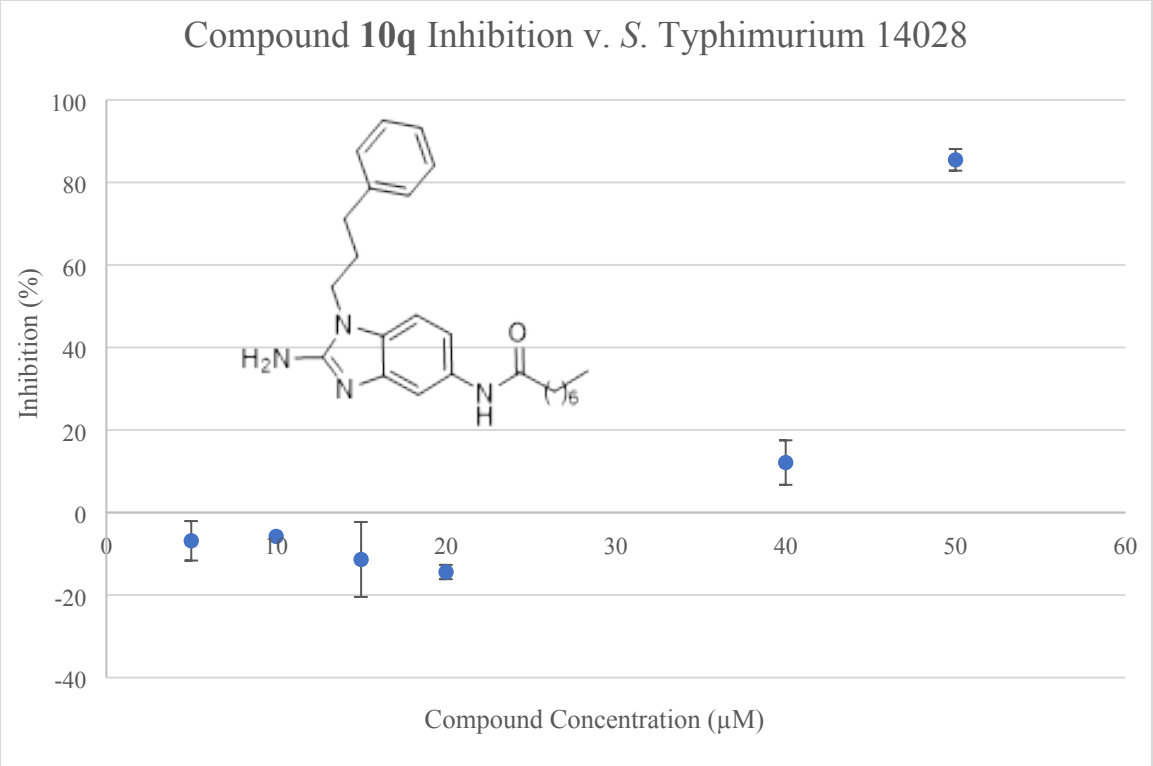

Compound 10l Inhibition v. S. Typhimurium 14028
Inhibiton (%)
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
Compound Concentration (µM)
HCl H2N
N
N
N
H
O
(CH2)6

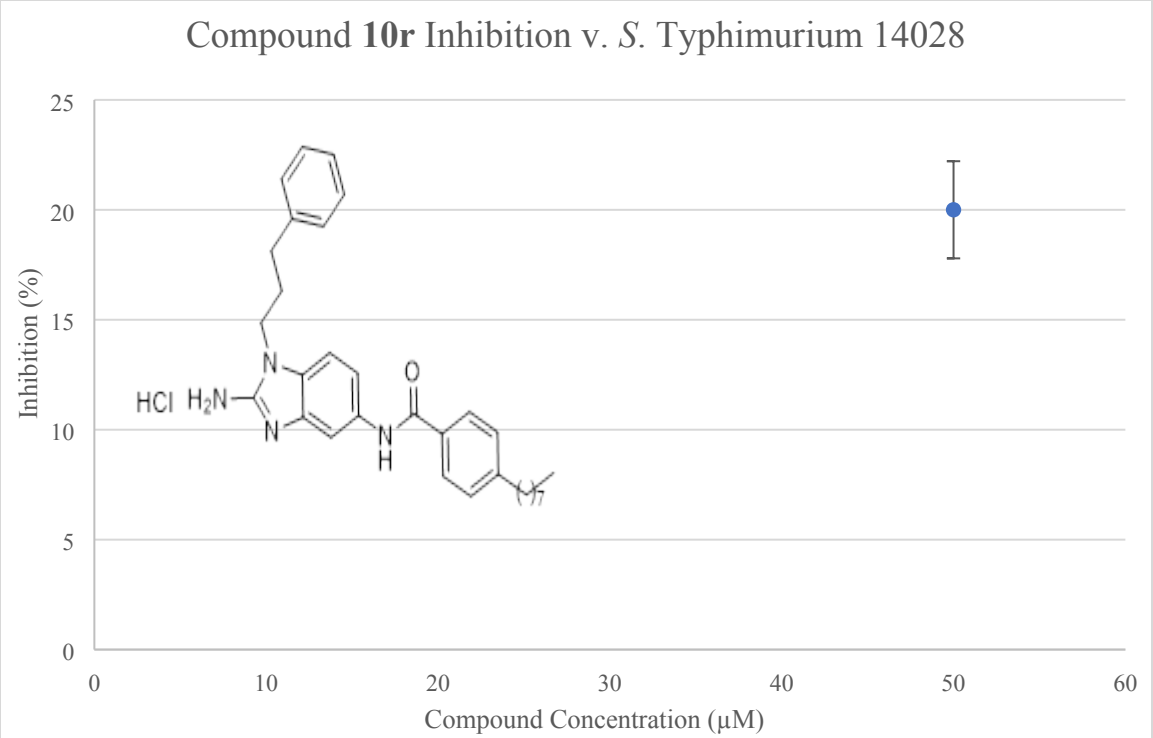

Compound 10m Inhibition v. S. Typhimurium 14028
Inhibition (%)
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (µM)
HCl H2N
N
N
N
H
O
(CH2)6

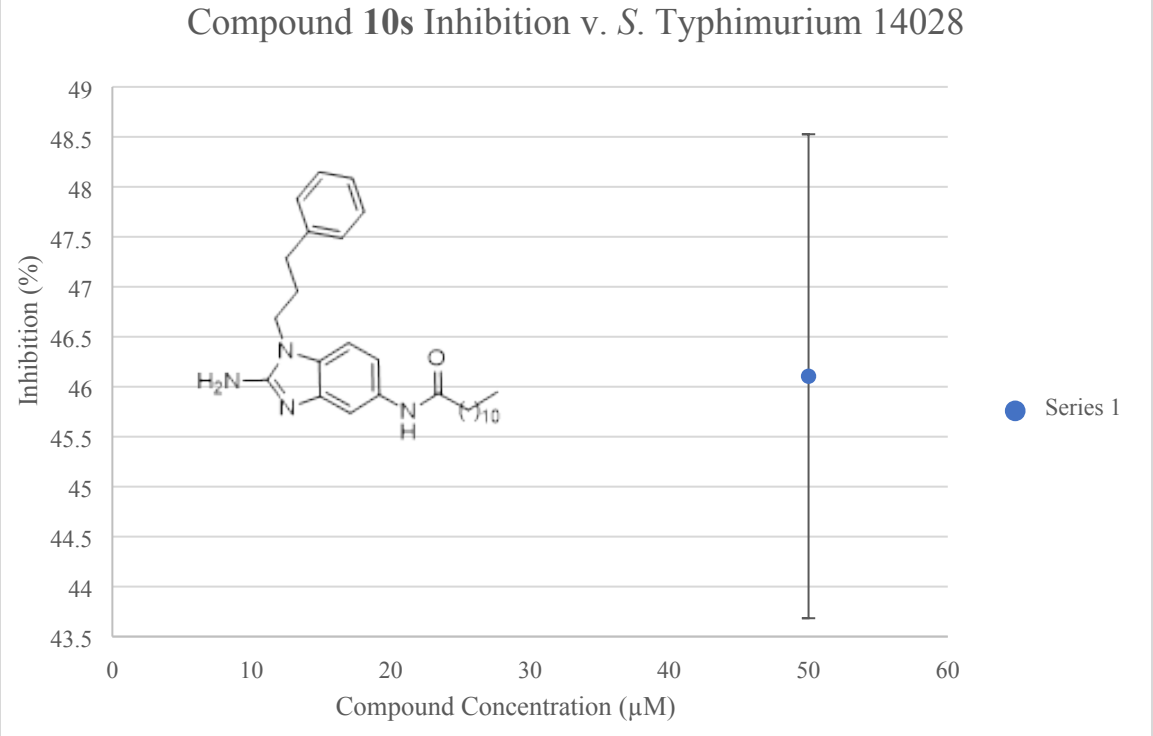

Compound **10n** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60
Compound Concentration (µM)
H_2N
N
N
N
H
O

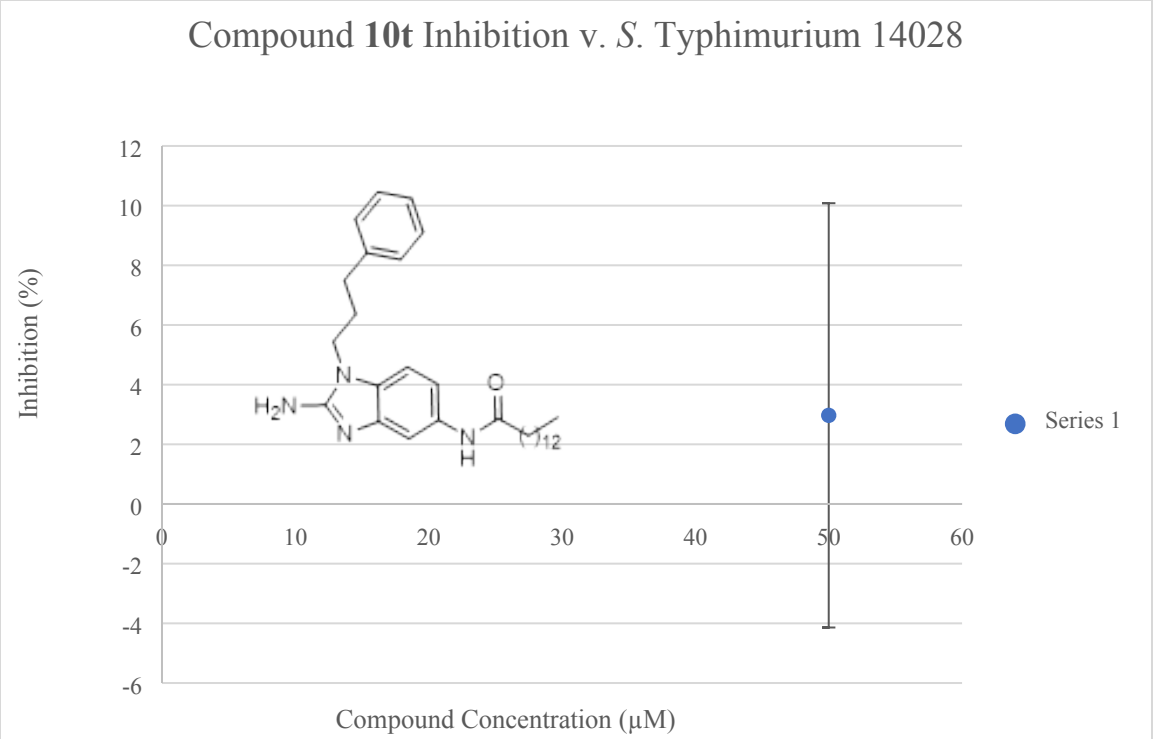

Compound **10o** Inhibition v. *S.* Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)
HCl
H_2N
N
N
N
H
O

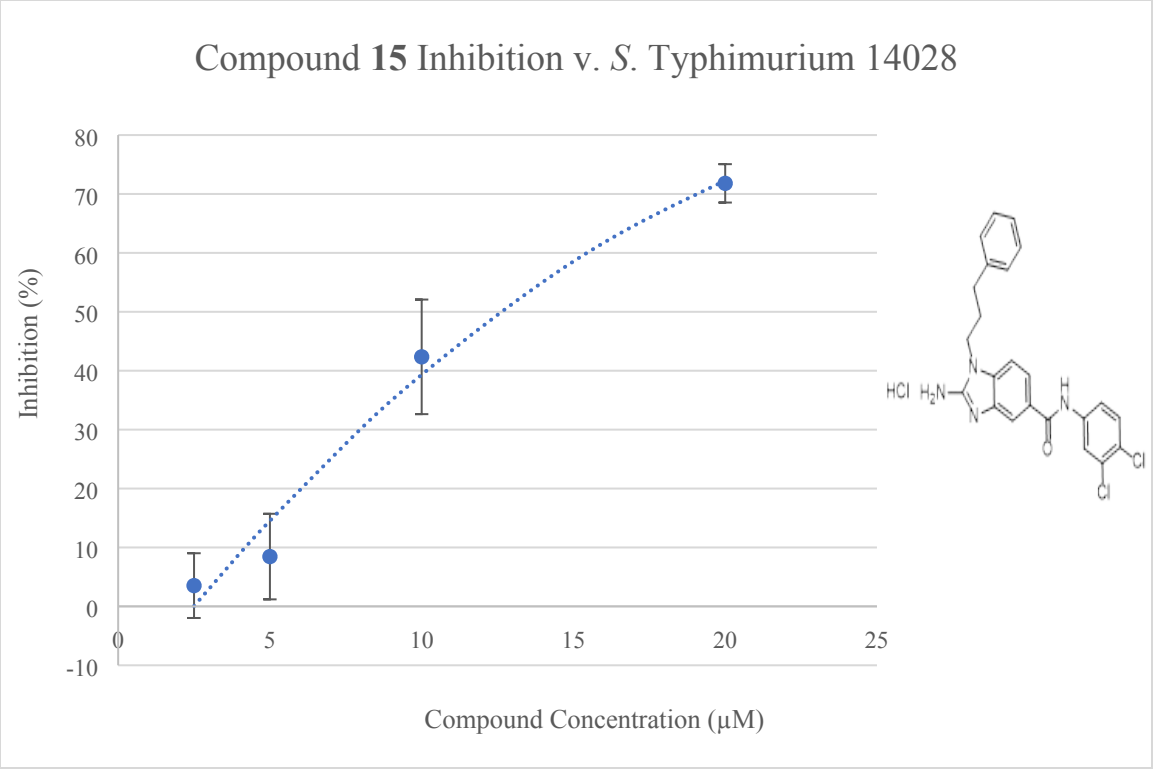

Compound 10p Inhibition v. S. Typhimurium 14028
Inhibition (%)
120
100
80
60
40
20
0
-20
0
10
20
30
40
50
60
Compound Concentration (µM)

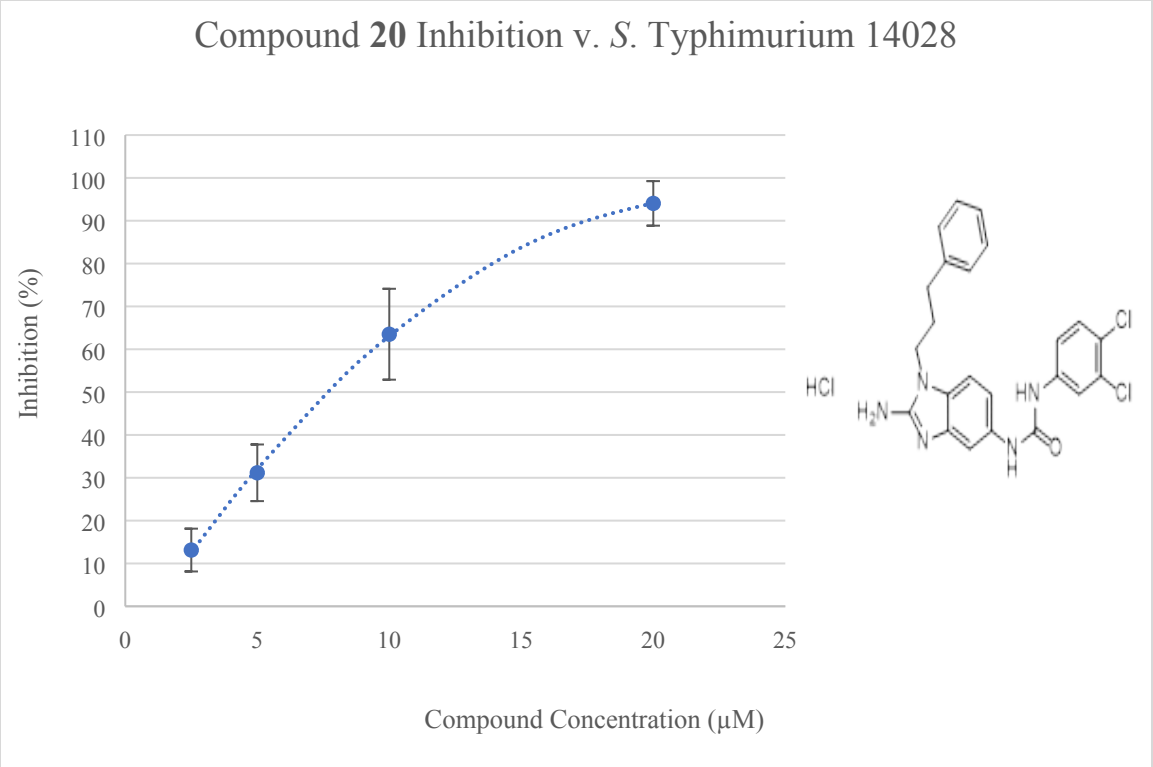

Compound 10q Inhibition v. S. Typhimurium 14028
Inhibition (%)
100
80
60
40
20
0
-20
-40
0
10
20
30
40
50
60
Compound Concentration (µM)


Compound 10r Inhibition v. S. Typhimurium 14028
Inhibition (%)
25
20
15
10
5
0
0
10
20
30
40
50
60
Compound Concentration (µM)
HCl H2N
N
N
H
O
(CH2)7


Compound 10s Inhibition v. S. Typhimurium 14028
Inhibition (%)
49
48.5
48
47.5
47
46.5
46
45.5
45
44.5
44
43.5
0
10
20
30
40
50
60
Compound Concentration (µM)
H2N
N
N
H
O
(CH2)10
Series 1


Compound 10t Inhibition v. S. Typhimurium 14028
Inhibition (%)
12
10
8
6
4
2
0
-2
-4
-6
0
10
20
30
40
50
60
Compound Concentration (µM)
Series 1


Compound 15 Inhibition v. S. Typhimurium 14028
Inhibition (%)
80
70
60
50
40
30
20
10
0
-10
0
5
10
15
20
25
Compound Concentration (µM)


Compound 20 Inhibition v. S. Typhimurium 14028
Inhibition (%)
110
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
Compound Concentration (μM)
HCl
Cl
Cl
HN
N
N
N
H
H2N
O

General Synthetic Procedures

General synthetic procedure for aniline acylation (Compounds **3, 7**): To a solution of nitroaniline (1.0 g, 6.41 mmol) in anhydrous Dichloromethane (35 mL), was added DMAP (0.782 g, 1.0 mmol), and 4- pentylbenzoyl chloride (1.69 mL, 8.32 mmol) dropwise. The reaction was stirred under N2 for 16 hours, after which it was washed with H2O (3 x 100 mL), saturated aqueous NaHCO3 (2 x 100 mL), and saturated aqueous NaCl (1 x 100 mL). It was then dried with sodium sulfate and purified on silica gel, using EtOAc/Hexanes (30%) as the eluting solvent.

General synthetic procedure for S_NAr substitution (Compounds **4a-n, 8a-e, 13, 17**): Compounds **3**, **7**, **12**, or **16** were added to a round bottom flask and dissolved in ethanol (1.0g, 0.5 M). To this mixture the corresponding amine (3-5 equivalents) was added dropwise. The reaction mixture was then heated to reflux and allowed to stir for 16 hours. The mixture was then cooled to room temperature. Water was added to the reaction mixture, causing the product to precipitate out of solution. This mixture was then cooled to 0° C. The product was then filtered and washed with cold water. The solid was then dried under high vacuum overnight.

General procedure for the 2-ABI nitro reduction and cyclization (Compounds **5a-n**, **9a-e**, **14**, **18**): The appropriate nitro-compound was dissolved in ethanol (1.0 g, 0.4 M), and 10% Pd/C (0.1 g) was added to the mixture. The reaction mixture was then heated to reflux. Ammonium formate was then dissolved in ethanol and added dropwise to the reaction mixture which was allowed to stir until completion, via TLC analysis. The mixture was then cooled to room temperature, and quickly filtered through a pad of celite which was washed with dichloromethane. The crude product was then placed under nitrogen, and solid cyanogen bromide (10 eq) was added to the crude product and allowed to stir overnight. The reaction mixture was then concentrated and purified using column chromatography (1-5% MeOH/NH_3-DCM). Methanol supplemented with 12N HCl was added to the product forming the HCl salt, which was then dried under high vacuum overnight.

General synthetic procedure for methyl ester synthesis (Compound **12**): To a solution of 4-fluoro-3-nitrobenzoic acid (2.00 g, 10.8 mmol) in MeOH (20 mL) at 0° C was added thionyl chloride (2.35 mL, 32.4 mmol) dropwise, and the reaction mixture was allowed to stir overnight. After completion, the reaction was extracted with diluted in water and extracted with ethyl acetate (3 x 20 mL). The combined organic layers were then washed with saturated sodium bicarbonate (2 x 30 mL). The organic layer was then dried with sodium sulfate, and the product was concentrated to yield the product with no further purification.

General synthetic procedure for saponification followed by EDC coupling (Compound **15**): 2-ABI methyl ester (compound **14**, 0.200 g, 0.645 mmol) was dissolved in a 1:1 mixture of MeOH:H_2O (20 mL) to which a 5M solution of sodium hydroxide (10 mL) was added. The mixture was then heated to reflux while stirring for 16 hours. After completion, the methanol was removed under reduced pressure. The remaining aqueous solution was then cooled to 0° C, and 12N HCl was added until the pH reached ~2. The resulting precipitate was then isolated using vacuum filtration and allowed to dry under high vacuum for 2 hours. A solution of carboxylic acid (0.107 g, 0.362 mmol), EDC (0.073, 0.471 mmol), DMAP (0.044 g, 0.362

mmol), and 3,4-dichloroaniline (0.176 g, 1.09 mmol) was made in a 5:1 mixture of DCM: DMF. The reaction was allowed to stir for 16 hours at room temperature. After completion, the DCM was removed under reduced pressure. The remaining solution was then dissolved in ethyl acetate (25 mL) washed with water (1 x 40 mL), saturated sodium bicarbonate (2 x 15 mL), and brine (1 x 20 mL). The organic layer was then dried over sodium sulfate and concentrated under reduced pressure to yield the crude product. The crude product was then purified using flash chromatography (0.5-5% MeOH-NH_3/DCM). Methanol supplemented with 12N HCl was added to the product forming the HCl salt, which was then dried under high vacuum overnight.

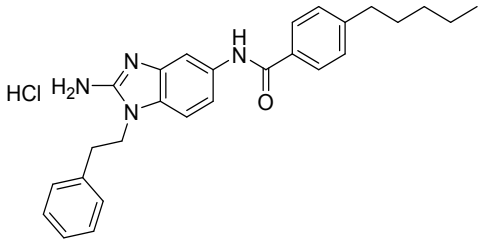
General synthetic procedure for aniline boc protection (Compound **16**): To a solution of 4-fluoro-3-nitroaniline (5.0 g, 32.03 mmol) in anhydrous THF (150 mL) was added triethylamine (44.7 mL, 320.28 mmol) and DMAP (0.039 g, 0.32 mmol). Di-tert-butyl dicarbonate (10.49 g, 48.4 mmol) was added, and solution was stirred at room temperature overnight (16 h). The solvent was removed under reduced pressure, and the crude product was dissolved in ethyl acetate (100mL), and washed with 1N HCl (3 x 100 mL), saturated sodium bicarbonate (3 x 100 mL), and brine (1 x 100 mL). The organic layer was dried over sodium sulfate. The solvent was removed under reduced pressure, and the crude product was purified via flash chromatography (5-20% ethyl acetate/hexanes).

General synthetic procedure for 2-ABI alloc protection (Compound **19**): Compound **18** (1.15 g, 3.14 mmol) was placed under an inert atmosphere and dissolved in DCM (25 mL). To the reaction mixture was added 0.05 equivalents of $Sc(OTf)_3$ and triethylamine triethylamine (0.482 mL, 3.45 mmol). The reaction mixture was cooled to 0 °C. Allyl chloroformate (0.365 mL, 3.45 mmol) was slowly added dropwise to the reaction mixture. The reaction mixture was stirred at 0 °C for 20 min and allowed to warm up to room temperature overnight. The solvent was removed under reduced pressure, and the crude product was dissolved in DCM (100 mL). The organic layer was washed with saturated sodium bicarbonate (3 x 100 mL), and brine (1 x 100 mL). The organic layer was dried over sodium sulfate. The solvent was removed under reduced pressure, and the crude product was purified via flash chromatography (1-5% MeOH-NH_3/DCM).

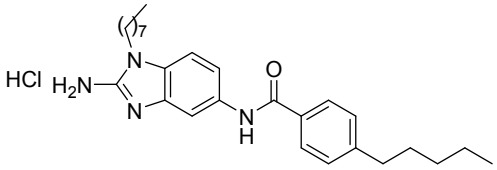
General synthetic procedure for Boc deprotection, urea coupling followed by alloc deprotection (Compound **20**): Compound **19** (0.123 g, 0.273 mmol) was dissolved in 30% TFA/DCM under an inert atmosphere at 0 °C. The reaction was allowed to stir for 4 h, and upon completion via TLC analysis, the solvent was then removed under reduced pressure. The crude product was dissolved in DCM, and washed with saturated sodium bicarbonate (3 x 100 mL). The organic layer was dried over sodium sulfate, and the solvent was removed under reduced pressure. The crude product was then dissolved in dichloromethane (10 mL) to which sodium carbonate (0.046g, 0.434 mmol) and water (5 mL) was added and the mixture was allowed to stir for 10 minutes at room temperature. A solution of triphosgene (0.027g, 0.089 mmol) in DCM (5 mL) was added to the reaction mixture. After allowing the mixture to stir for 1 hour, 3,4-dichloroaniline (0.088 g, 0.542 mmol) in DCM (1 mL) was added dropwise to the reaction mixture. The reaction was then allowed to stir for 16 hours at room temperature. Following the completion of the reaction, the product was extracted with dichloromethane (15 mL) and washed with water (2 x 20 mL) and brine (1 x 20 mL). The crude mixture was then purified with flash chromatography (0.5-1.5% MeOH-NH_3/DCM) to yield the product. After allowing the product to dry under high vacuum for 2 hours, the alloc protected urea (0.023 g, 0.427 mmol) was then

placed under nitrogen and dissolved in ethanol (10 mL) at 0° C. Next, tetrakis(triphenylphosphine)palladium (0) (0.0001 g, 0.0001 mmol) and sodium borohydride (0.003g, 0.085 mmol) were added to the reaction mixture and allowed to stir for 1 hour while warming to room temperature. The reaction was then acidified to pH 2.5-3 using 12 N HCl, and the reaction was allowed to stir for 4 h. After completion, the reaction was extracted with 1:1 EtOAC/Hex (2 x 20 mL). The combined organic layers were washed with water (20 mL), saturated $NaHCO_3$ (20 mL), brine (20 mL), dried ($MgSO_4$) and concentrated under reduced pressure. The residue was then purified using flash chromatography (1-5% MeOH-NH_3/DCM) to yield the desired product. Methanol supplemented with 12N HCl was added to the product forming the HCl salt, which was then dried under high vacuum overnight.

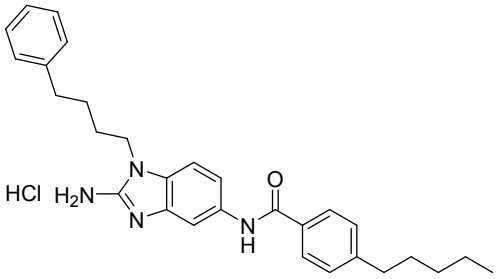
Previously Reported Compounds



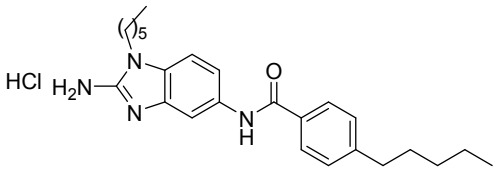
***N*-(2-Amino-1-phenethyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (1):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



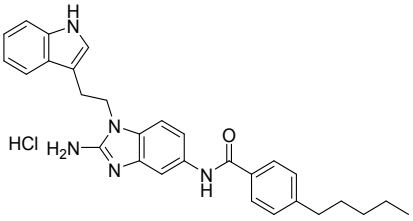
***N*-(2-Amino-1-octyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5a):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



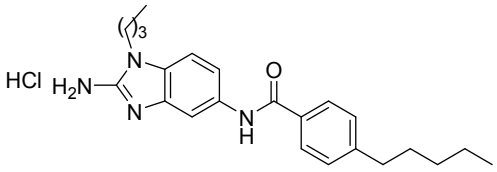
***N*-(2-Amino-1-(4-phenylbutyl)-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5b):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



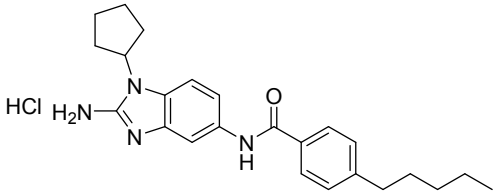
***N*-(2-Amino-1-hexyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5c):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



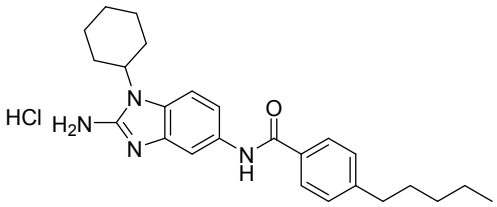
***N*-(1-(2-(1*H*-Indol-3-yl)ethyl)-2-amino-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5e):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



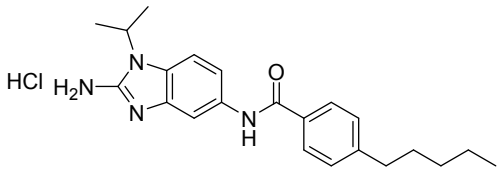
***N*-(2-Amino-1-butyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5f):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



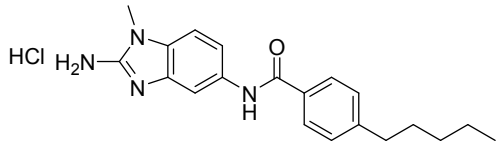
***N*-(2-Amino-1-cyclopentyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5g):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



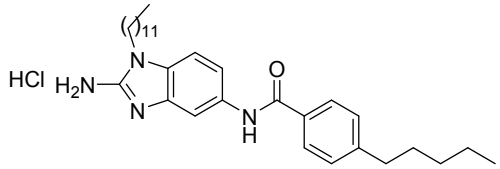
***N*-(2-Amino-1-cyclohexyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5h):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



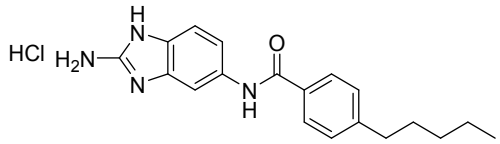
***N*-(2-Amino-1-isopropyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5k):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



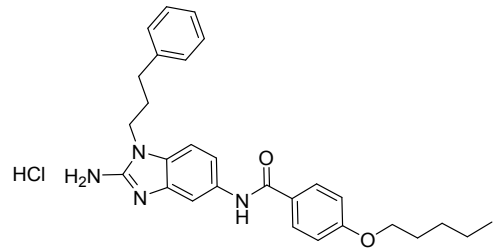
***N*-(2-Amino-1-methyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5l):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



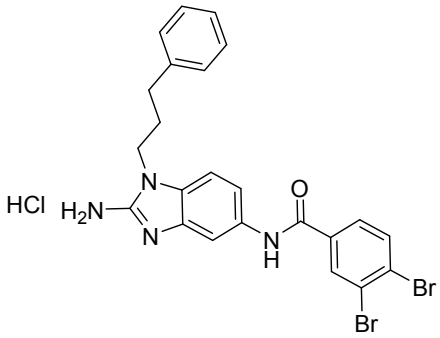
***N*-(2-Amino-1-dodecyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5n):** Compound was synthesized using previously reported methods.[1] Spectral data was consistent with previous reports.[1]



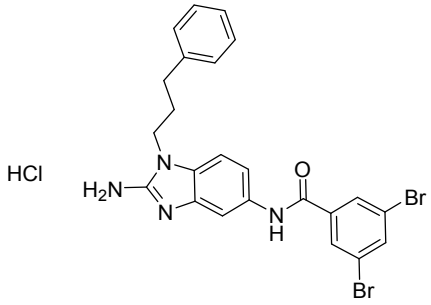
***N*-(2-Amino-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5o):** Compound was synthesized using previously reported methods.[2] Spectral data was consistent with previous reports.[2]



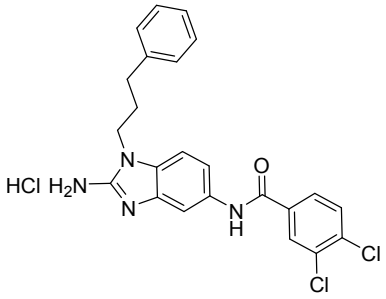
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-pentoxybenzamide hydrochloride (10a):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



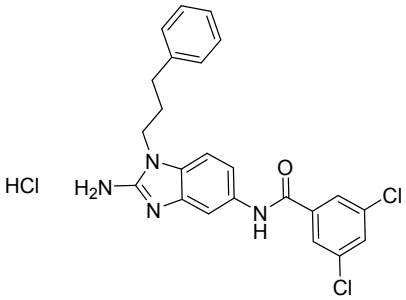
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-3,4-dibromobenzamide hydrochloride (10b):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



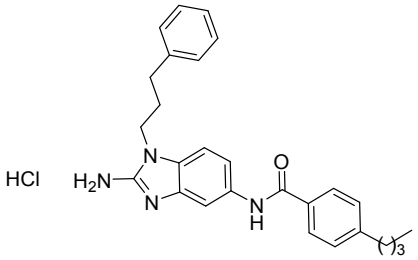
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-3,5-dibromobenzamide hydrochloride (10c):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



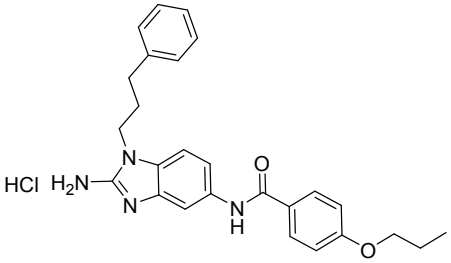
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-3,4-dichlorobenzamide hydrochloride (10d):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



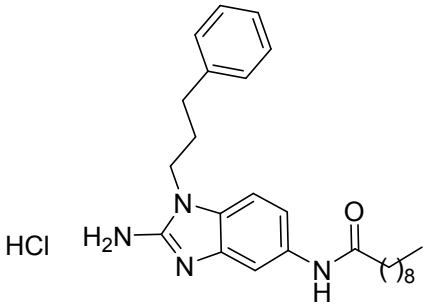
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-3,5-dichlorobenzamide hydrochloride (10e):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



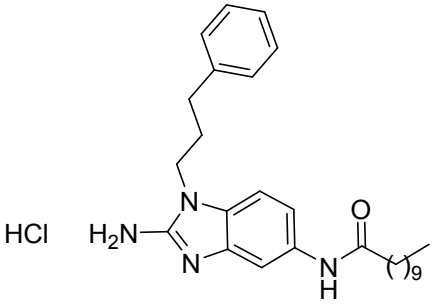
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-butylbenzamide hydrochloride (10f):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



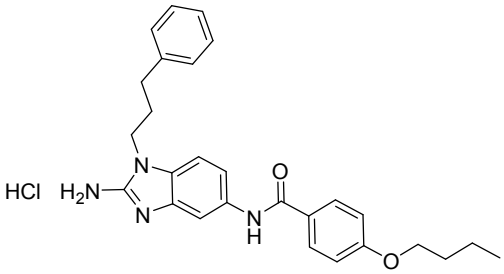
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-propoxybenzamide hydrochloride (10g):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



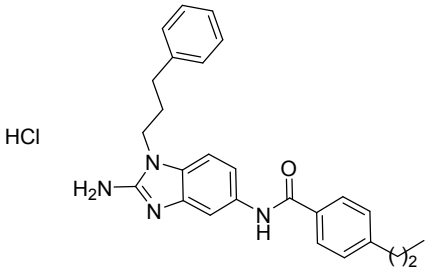
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)decanamide hydrochloride (10h):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



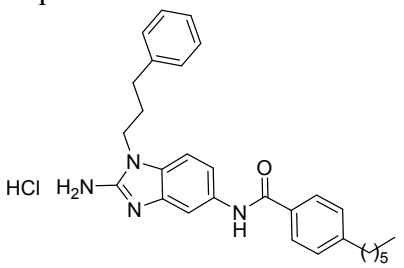
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)undecanamide hydrochloride (10i):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



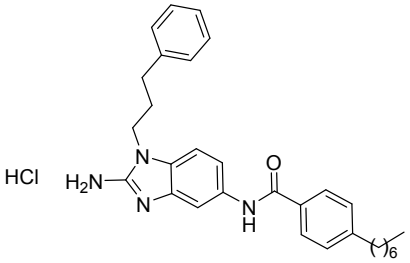
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-butoxybenzamide hydrochloride (10j):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



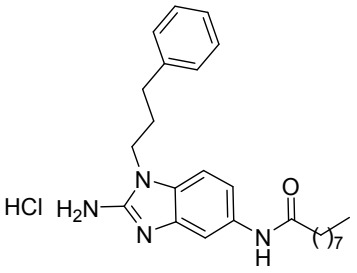
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-propylbenzamide hydrochloride (10k):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



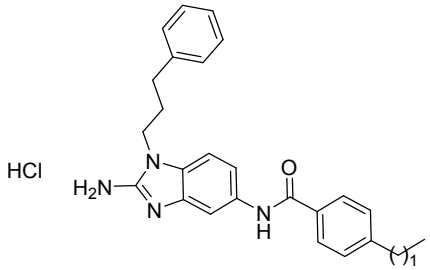
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-hexylbenzamide hydrochloride (10l):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



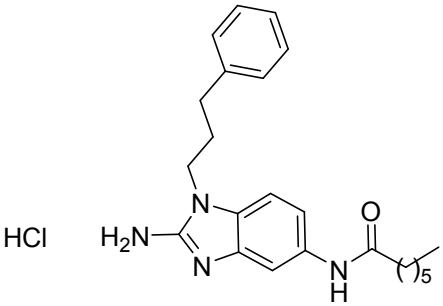
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-heptylbenzamide hydrochloride (10m):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



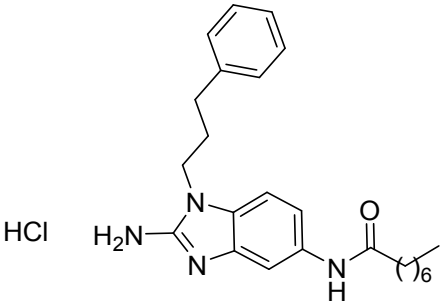
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)nonanamide hydrochloride (10n):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



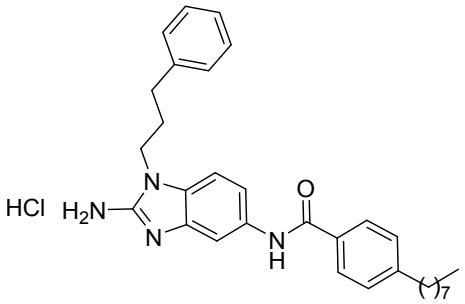
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-ethylbenzamide hydrochloride (10o):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



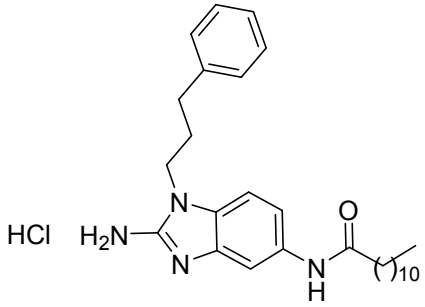
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)heptanamide hydrochloride (10p):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



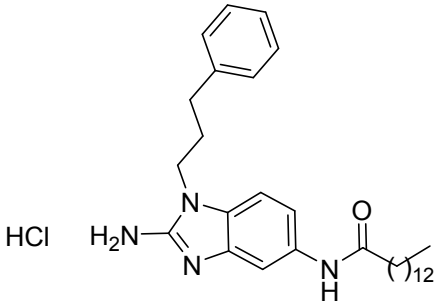
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)octanamide hydrochloride (10q):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



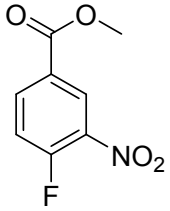
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-4-octylbenzamide hydrochloride (10r):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



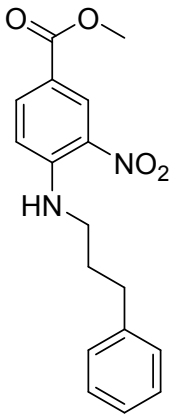
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)dodecanamide hydrochloride (10s):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



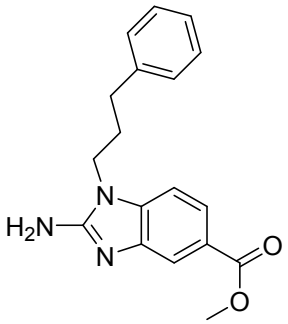
***N*-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)tetradecanamide hydrochloride (10t):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]



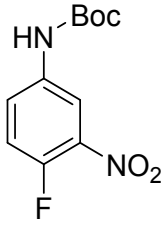
Methyl 4-fluoro-3-nitrobenzoate (12): Compound was synthesized using previously reported methods.[4] Spectral data was consistent with previous reports.[4]



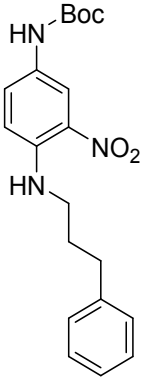
Methyl 3-nitro-4-((3-phenylpropyl)amino)benzoate (13): Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[5]



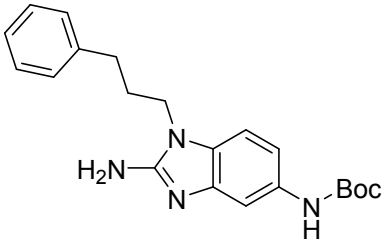
Methyl 2-amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazole-5-carboxylate (14): Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[5]



***tert*-Butyl (4-fluoro-3-nitrophenyl)carbamate (16):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]

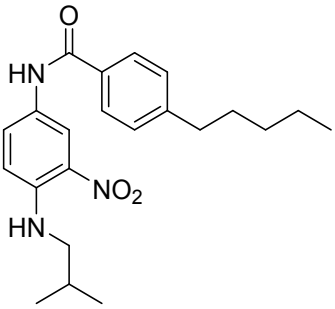


***tert*-Butyl (3-nitro-4-((3-phenylpropyl)amino)phenyl)carbamate (17):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]

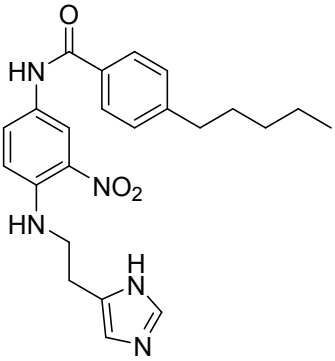


***tert*-Butyl (2-amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)carbamate (18):** Compound was synthesized using previously reported methods.[3] Spectral data was consistent with previous reports.[3]

Novel Compound Characterization

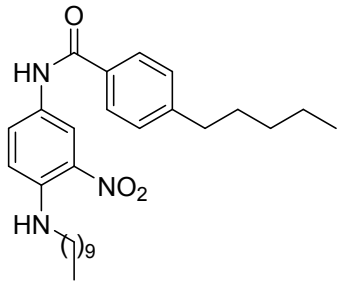


***N*-(4-(Isobutylamino)-3-nitrophenyl)-4-pentylbenzamide (4d):** The title compound was synthesized from **3** following the general procedure to afford **4d** as a red solid (35%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.70 (brs, 1H), 8.24 (d, *J* = 2.4 Hz, 1H), 8.06 (t, *J* = 4.8 Hz, 1H), 7.79 (d, *J* = 8.4 Hz, 3H), 7.16 (d, *J* = 8.1 Hz, 2H), 6.70 (d, *J* = 8.7 Hz, 1H), 3.04 (t, *J* = 6.0 Hz, 2H), 2.58 (t, *J* = 7.2 Hz, 2H), 1.94 (m, *J* = 6.6 Hz, 1H), 1.56 (m, 2H), 1.30 (m, 4H), 1.02 (d, *J* = 6.9 Hz, 6H), 0.81 (t, *J* = 6.8 Hz, 3H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.5, 147.3, 143.4, 131.6, 131.5, 130.4, 128.6, 127.3, 126.5, 118.7, 114.1, 50.8, 35.8, 31.5, 30.8, 28.0, 22.5, 20.4, 14.0 ppm; UV (λ_{max} nm) 296; IR ν_{max} (cm^{-1}) 3257, 2970, 1666, 1514, 800; HRMS (ESI) calcd for $C_{22}H_{29}N_3O_3$ $[M+H]^+$ 384.2282, found 384.2279.

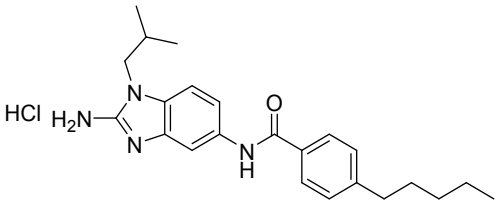


***N*-(4-((2-(1*H*-Imidazol-5-yl)ethyl)amino)-3-nitrophenyl)-4-pentylbenzamide (4j):** The title compound was synthesized from **3** following the general procedure to afford **4j** as a red solid (53%). ^{1}H NMR (400 MHz, DMSO-d_6) δ 10.30 (s, 1H), 8.69 (s, 1H), 8.23 (brs, 1H), 7.94 (m,

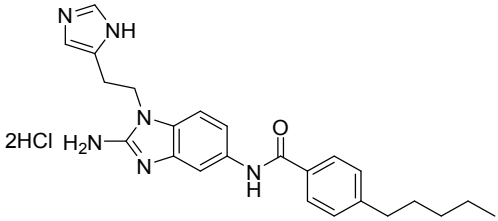
3H), 7.60 (s, 1H), 7.32 (d, J = 8.0 Hz, 2H), 7.12 (d, J = 9.2 Hz, 1H), 6.93 (brs, 1H), 3.59 (m, 2H), 3.48 (brs, 3H), 2.88 (m, 2H), 2.63 (m, 2H), 1.55 (m, 2H), 1.26 (m, 4H), 0.84 (t, J = 6.8 Hz, 3H) ppm; ^{13}C NMR (100 MHz, DMSO-d_6) δ 165.2, 146.2, 142.2, 135.1, 132.0, 130.7, 129.8, 128.3, 127.8, 127.7, 116.4, 114.7, 42.7, 35.0, 30.9, 30.5, 22.0, 14.0 ppm; UV (λ_{max} nm) 292; IR ν_{max} (cm^{-1}) 3344, 2954, 1637, 1312, 811; HRMS (ESI) calcd for $C_{23}H_{27}N_5O_3$ $[M+H]^+$ 422.2187, found 422.2188.



***N*-(4-(Decylamino)-3-nitrophenyl)-4-pentylbenzamide (4m):** The title compound was synthesized from **3** following the general procedure to afford **4m** as a red solid (80%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.35 (brs, 1H), 8.21 (s, 1H), 7.97 (m, 1H), 7.87 (d, J = 8.7 Hz, 1H), 7.80 (d, J = 7.8 Hz, 2H), 7.23 (d, J = 7.5, 2H), 6.79 (d, J = 9.3 Hz, 1H), 3.24 (m, 2H), 2.63 (t, J = 7.8 Hz, 2H), 1.68 (m, 5H), 1.27 (m, 17H), 0.88 (m, 6H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.2, 147.5, 143.3, 131.7, 131.4, 130.6, 128.8, 127.3, 126.5, 118.4, 114.3, 43.3, 35.9, 32.0, 31.5, 31.0, 29.8, 29.6, 29.4 (x2), 29.1, 27.2, 22.8, 22.6, 14.2, 14.1 ppm; UV (λ_{max} nm) 296; IR ν_{max} (cm^{-1}) 3370, 2920, 1649, 1520, 884; HRMS (ESI) calcd for $C_{28}H_{41}N_3O_3$ $[M+H]^+$ 468.3221, found 468.3220.

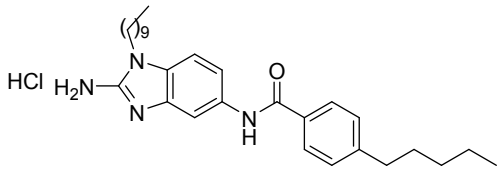


***N*-(2-Amino-1-isbutyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5d):** The title compound was synthesized from **4d** following the general procedure to afford **5d** as a white (53%). ^{1}H δ (300 MHz, CD_3OD) 7.86 (d, J = 7.5 Hz, 2H), 7.59 (s, 1H), 7.30 (m, 3H), 7.15 (m, 1H), 3.82 (d, J = 7.8 Hz, 2H), 2.68 (t, J = 7.5 Hz, 2H), 2.23 (m, 1H), 1.67 (m, 2H), 1.36 (m, 4H), 0.95 (m, 9H) ppm; ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.8, 151.8, 148.7, 136.8, 133.2, 130.1, 129.7, 128.7 (x2), 118.0, 111.8, 105.7, 50.6, 36.7, 32.5, 32.1, 28.9, 23.5, 19.9, 14.4 ppm; UV (λ_{max} nm) 286; IR ν_{max} (cm^{-1}) 3227, 2945, 1663, 1514, 767; HRMS (ESI) calcd for $C_{23}H_{30}N_4O$ $[M+H]^+$ 379.2492, found 379.2495.

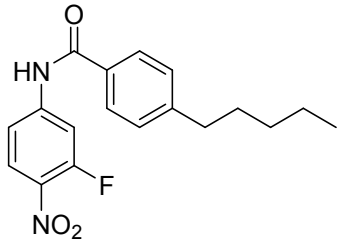


***N*-(1-(2-(1*H*-Imidazol-5-yl)ethyl)-2-amino-1H-benzo[d]imidazol-5-yl)-4-pentylbenzamide dihydrochloride (5j):** The title compound was synthesized from **4j** following the general

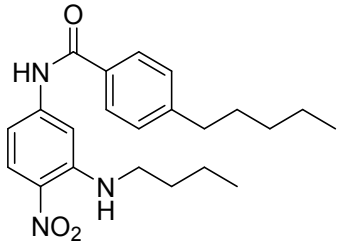
procedure to afford **5j** as a brown solid (61%). ^{1}H NMR (300 MHz, CD_3OD) δ 7.86 (m, 3H), 7.65 (s, 1H), 7.33 (m, 2H), 7.16 (d, *J* = 8.7 Hz, 2H) 6.83 (s, 1H), 4.29 (t, *J* = 6.9 Hz, 2H), 3.04 (t, *J* = 6.6 Hz, 2H), 2.68 (t, *J* = 7.5 Hz, 2H), 1.65 (m, 2H), 1.28 (m, 4H), 0.91 (t, *J* = 7.2 Hz, 3H) ppm; ^{13}C NMR (100 MHz, CD_3OD) δ 168.6, 151.5, 148.6, 136.9, 134.9, 133.0, 130.6, 130.0, 129.6, 128.7, 127.8, 118.9, 118.2, 111.1, 105.8, 43.2, 36.6, 32.4, 31.9, 24.1, 23.4, 14.3 ppm; UV (λ_{max} nm) 294; IR ν_{max} (cm^{-1}) 3231, 2925, 1669, 1504, 805; HRMS (ESI) calcd for $C_{24}H_{28}N_6O$ $[M+H]^+$ 417.2397, found 417.2398.



***N*-(2-Amino-1-decyl-1*H*-benzo[d]imidazol-5-yl)-4-pentylbenzamide hydrochloride (5m):** The title compound was synthesized from **4m** following the general procedure to afford **5m** as a white solid (39%). ^{1}H NMR (300 MHz, CD_3OD) δ 7.85 (m, 2H), 7.60 (brs, 1H), 7.29 (m, 3H), 7.09 (m, 1H), 3.95 (m, 2H), 2.65 (t, *J* = 6.6 Hz, 2H), 1.71 (m, 4H), 1.31 (m, 18H), 0.89 (m, 6H) ppm; ^{13}C NMR (100 MHz, CD_3OD) δ 168.8, 156.4, 148.3, 141.8, 134.0, 133.8, 132.3, 129.6, 128.6, 115.4, 109.7, 108.7, 43.3, 36.7, 33.0, 32.6, 32.1, 30.7, 30.6, 30.5, 30.4, 29.7, 27.7, 23.7, 23.6, 14.5, 14.4 ppm; UV (λ_{max} nm) 296; IR ν_{max} (cm^{-1}) 3231, 2921, 1661, 1452, 801; HRMS (ESI) calcd for $C_{29}H_{42}N_4O$ $[M+H]^+$ 463.3431, found 463.3434.

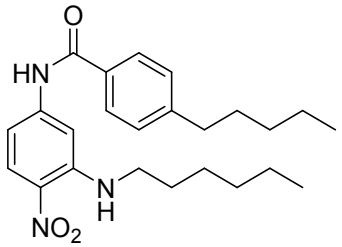


***N*-(3-Fluoro-4-nitrophenyl)-4-pentylbenzamide (7):** The title compound was synthesized from **6** following the general procedure to afford **7** as a yellow solid (m.p = 105 ˚C, 98%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.60 (s, 1H), 8.04 (t, *J* = 8.7 Hz, 1H), 7.92 (m, 1H), 7.78 (d, *J* = 7.5 Hz, 2H), 7.43 (d, *J* = 8.4 Hz, 1H), 7.26 (d, *J* = 8.4 Hz, 2H), 2.64 (5, *J* = 7.5 Hz, 2H), 1.63 (m, 2H), 1.32 (m, 4H), 0.88 (t, *J* = 6.6 Hz, 3H) ppm; ^{13}C NMR (100 MHz,$CDCl_3$) δ 166.4, 158.1, 155.5, 148.8, 145.3, 145.2, 130.9, 129.1, 127.4, 127.3, 127.3, 114.9, 114.9, 108.9, 35.9, 31.5, 30.9, 22.6, 14.1 ppm; IR ν_{max} (cm^{-1}) 3337, 2863, 1649, 1567, 1270, 866; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 331.1453, found 331.1451.

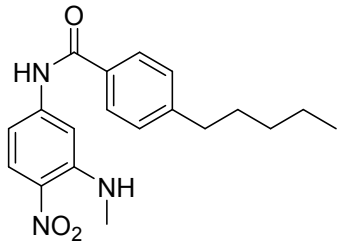


***N*-(4-Nitro-3-(butylamino)phenyl)-4-pentylbenzamide (8a):** The title compound was synthesized from **7** following the general procedure to afford **8a** as a yellow solid (85%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.59 (s, 1H), 8.20 (s, 1H), 8.08 (d, *J* = 9.2 Hz, 1H), 7.80 (d, *J* = 8.0 Hz, 2H), 7.69 (s, 1H), 7.23 (d, *J* = 8.0 Hz, 2H), 6.68 (d, *J* = 9.6 Hz, 1H), 3.26 (m, 2H), 2.64 (m, 2H), 1.66 (m, 4H), 1.4 (m, 2H), 1.31 (m, 4H), 0.95 (m, 3H), 0.86 (m, 3H) ppm; ^{13}C NMR (100

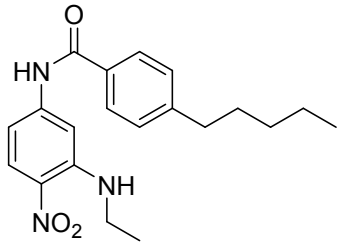
MHz,$CDCl_3$) δ 166.5, 148.1, 147.3, 145.5, 131.5, 128.9, 128.2, 127.6, 127.3, 107.9, 102.4, 42.9, 35.9, 21.5, 31.0, 30.9, 22.5, 20.3, 14.0, 13.8 ppm; UV (λ_{max} nm) 320; IR ν_{max} (cm^{-1}) 3293, 2952, 1676, 1391, 800; HRMS (ESI) calcd for $C_{22}H_{29}N_3O_3$ $[M+H]^+$ 384.2282, found 384.2285.



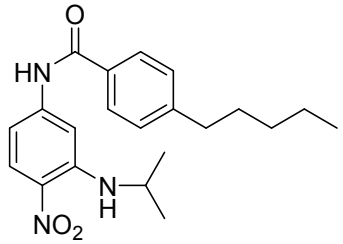
***N*-(3-(Hexylamino)-4-nitrophenyl)-4-pentylbenzamide (8b):** The title compound was synthesized from **7** following the general procedure to afford **8b** as an orange solid (90%). ^1H NMR (400 MHz, $CDCl_3$) δ 8.26 (s, 1H), 8.16 (d, *J* = 9.2 Hz, 1H), 8.00 (s, 1H), 7.79 (d, *J* = 7.2 Hz, 2H), 7.74 (s, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 6.54 (d, 9.2 Hz, 1H), 3.34 (m, 2H), 2.67 (t, *J* = 7.2 Hz, 1.8 Hz, m, 2H), 1.73 (m, 2H), 1.65 (m, 2H), 1.45 (m, 2H), 1.33 (m, 8H), 0.90 (m, 6H) ppm; ^{13}C NMR (100 MHz,$CDCl_3$) δ 166.6, 148.0, 147.2, 145.6, 131.4, 128.8, 128.0, 127.3, 108.0, 102.4, 43.1, 35.8, 31.5, 30.8, 28.2, 26.7, 22.5, 22.4, 14.0 ppm; UV (λ_{max} nm) 320; IR ν_{max} (cm^{-1}) 3295, 2955, 1678, 1395, 804; HRMS (ESI) calcd for $C_{24}H_{33}N_3O_3$ $[M+H]^+$ 412.2595, found 412.2601.



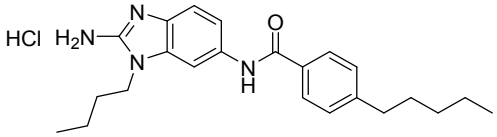
***N*-(3-(Methylamino)-4-nitrophenyl)-4-pentylbenzamide (8c):** The title compound was synthesized from **7** following the general procedure to afford **8c** as a yellow solid (m.p = 127 ˚C, 100%). ^1H NMR (300 MHz, $CDCl_3$) δ 8.21 (m, 3H), 7.78 (m, 2H), 7.68 (s, 1H), 7.24 (m, 3H), 6.60 (m, 1H), 3.04 (d, *J* = 4.5 Hz, 3H), 2.63 (t, *J* = 4.5 Hz, 2H), 1.64 (m, 2H), 1.36 (m, 4H), 0.91 (m, 3H) ppm; ^{13}C NMR (100 MHz,$CDCl_3$) δ 166.6, 148.0, 147.9, 145.6, 131.3, 128.7, 128.0, 127.5, 127.3, 108.1, 102.0, 35.8, 31.4, 30.8, 29.6, 22.5, 14.0 ppm; IR ν_{max} (cm^{-1}) 3376, 2951, 1654, 1567, 1469, 803; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 342.1812, found 342.1809.



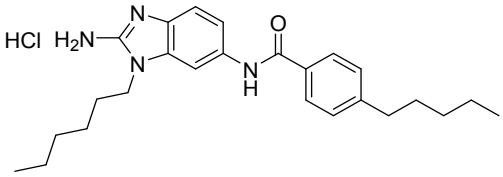
***N*-(3-(Ethylamino)-4-nitrophenyl)-4-pentylbenzamide (8d):** The title compound was synthesized from **7** following the general procedure to afford **8d** as a yellow solid (m.p = 125 ˚C, 89%). ^1H NMR (300 MHz, $CDCl_3$) δ 8.15 (m, 3H), 7.75 (m, 3H), 7.22 (m, 2H), 6.58 (m, 1H), 3.38 (m, 2H), 2.65 (m, 2H), 1.65 (m, 2H), 1.33 (m, 7H), 0.87 (m, 3H) ppm; ^{13}C NMR (100 MHz,$CDCl_3$) δ 166.6, 148.1, 147.0, 145.6, 131.4, 128.8, 128.1, 127.4, 127.3, 108.0, 102.4, 37.8, 35.8, 31.4, 30.8, 22.5, 14.2, 14.0 ppm; IR ν_{max} (cm^{-1}) 3378, 2950, 1658, 1560, 1473, 798; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 356.1969, found 356.1965.



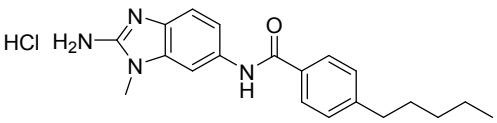
***N*-(3-(Isopropylamino)-4-nitrophenyl)-4-pentylbenzamide (8e):** The title compound was synthesized from **7** following the general procedure to afford **8e** as a yellow solid (53%). ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.59 (s, 1H), 8.20 (d, *J* = 6.9 Hz, 1H), 8.07 (dd, *J*=9.3 Hz, 3.6 Hz, 1H), 7.78 (m, 3H), 7.21 (m, 2H), 6.64 (m, 1H), 3.80 (m, 1H), 2.63 (m, 2H), 1.57 (t, *J*=5.1 Hz, 2H), 1.27 (m, 10H), 0.85 (m, 3H) ppm; ^{13}C NMR (100 MHz,$CDCl_3$) δ 166.9, 147.9, 146.2, 145.7, 131.3, 128.6, 128.0, 127.3, 127.2, 108.1, 102.7, 44.0, 35.7, 31.3, 30.7, 22.4 (x2), 13.9 ppm; UV (λ_{max} nm) 320; IR ν_{max} (cm^{-1}) 3295, 2955, 1678, 1395, 804; HRMS (ESI) calcd for $C_{11}H_{16}N_4S$ $[M+H]^+$ 370.2125, found 370.2124.



***N*-(2-Amino-1-butyl-1*H*-benzo[d]imidazol-6-yl)-4-pentylbenzamide hydrochloride (9a):** The title compound was synthesized from **8a** following the general procedure to afford **9a** as a brown solid (74%). '^{1}H NMR (300 MHz, CD_3OD) δ 8.03 (s, 1H), 7.88 (d, *J* = 8.1 Hz, 2H), 7.54 (d, *J* = 8.4 Hz, 1H), 7.33 (m, 3H), 4.11 (t, *J* = 7.2 Hz, 2H), 2.67 (t, *J* = 6.9 Hz, 2H), 1.78 (m, 2H), 1.65 (m, 2H), 1.44 (m, 2H), 1.32 (m, 4H), 1.00 (t, *J* = 7.2 Hz, 3H), 0.91 (t, *J* = 6.9 Hz, 3H) ppm; ^{13}C NMR (100 MHz,CD_3OD) δ 168.7, 141.6, 148.7, 136.4, 133.1, 131.7, 129.6, 128.7, 126.5, 118.6, 112.6, 104.4, 48.4, 43.8, 36.7, 32.5, 32.0, 31.0, 23.5, 20.9, 14.4, 14.1 ppm; UV (λ_{max} nm) 298; IR ν_{max} (cm^{-1}) 3316, 2961, 1638, 1499, 1426, 763; HRMS (ESI) calcd for $C_{23}H_{30}N_4O$ $[M+H]^+$ 379.2492, found 379.2497.

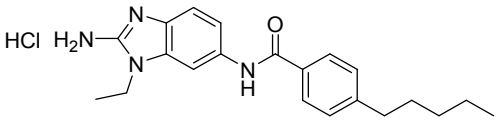


***N*-(2-Amino-1-hexyl-1*H*-benzo[d]imidazol-6-yl)-4-pentylbenzamide hydrochloride (9b):** The title compound was synthesized from **8b** following the general procedure to afford **9b** as a burgundy solid (69%). ^{1}H NMR (300 MHz, CD_3OD) δ 8.01 (d, *J* = 1.8 Hz, 1H), 7.89 (d, *J* = 8.1 Hz, 2H), 7.58 (dd, *J*=8.4 Hz, 1.5 Hz, 1H), 7.33 (d, *J* = 8.1 Hz, 1H), 7.27 (d, *J* = 8.1 Hz, 2H), 4.05 (t, *J* = 7.5 Hz, 2H), 2.61 (t, *J* = 7.5, 2H), 1.70 (m, 2H), 1.35 (m, 2H), 1.29 (m, 10H), 0.83 (m, 6H) ppm; ^{13}C NMR (100 MHz,CD_3OD) δ 168.5, 151.4, 148.6, 136.4, 133.0, 131.6, 129.5, 128.7, 126.4, 118.5, 112.5, 104.2, 43.9, 36.7, 32.5 (x2), 32.0, 28.9, 27.2, 23.5 (x2), 14.4, 14.3 ppm; UV (λ_{max} nm) 298; IR ν_{max} (cm^{-1}) 3312, 2960, 1643, 1497, 1432, 758; HRMS (ESI) calcd for $C_{25}H_{34}N_4O$ $[M+H]^+$ 407.2805, found 407.2810.

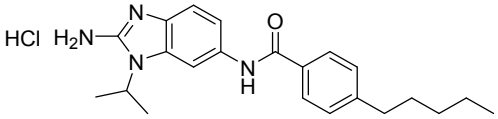


***N*-(2-Amino-1-methyl-1*H*-benzo[d]imidazol-6-yl)-4-pentylbenzamide hydrochloride (9c):** The title compound was synthesized from **8c** following the general procedure to afford **9c** as a

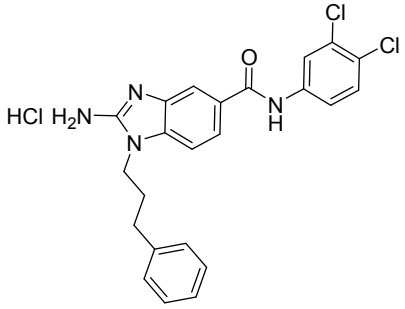
white solid (m.p = 232 ˚C, 15%). ^{1}H NMR (300 MHz, CD_3OD) δ 7.86 (d, *J* = 7.2 Hz, 2H), 7.66 (s, 1H), 7.32 (d, *J* = 7.8 Hz, 2H), 7.17 (s, 2H), 3.53 (s, 3H), 2.67 (t, *J* = 7.2 Hz, 2H), 1.65 (m, 2H), 1.34 (m, 4H), 0.90 (t, *J* = 6.8 Hz, 3H) ppm; ^{13}C NMR (100 MHz,CD_3OD) δ 168.8, 157.0, 148.4, 139.5, 135.6, 133.8, 132.4, 129.6, 128.6, 116.8, 115.3, 103.2, 36.7, 32.6, 32.2, 28.8, 23.6, 14.4 ppm; IR ν_{max} (cm^{-1}) 3295, 2955, 1678, 1510, 1454, 732; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 337.2023, found 337.2023.



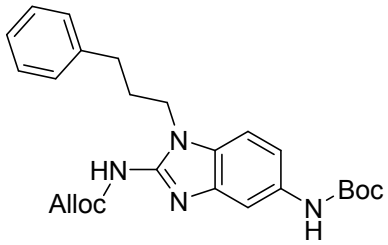
***N*-(2-Amino-1-ethyl-1*H*-benzo[d]imidazol-6-yl)-4-pentylbenzamide hydrochloride (9d):** The title compound was synthesized from **8d** following the general procedure to afford **9d** as a white-pink solid (m.p = 234 ˚C, 30%). ^{1}H NMR (400 MHz, CD_3OD) δ 7.98 (s, 1H), 7.87 (d, *J* = 8.0 Hz, 2H), 7.55 (d, *J* = 8.8 Hz, 1H), 7.29 (m, 3H), 4.13 (q, *J* = 7.2 Hz, 2H), 2.61 (t, *J* = 7.6 Hz, 2H), 1.59 (m, 2H), 1.36 (t, *J* = 7.2 Hz, 3H), 1.30 (m, 4H), 0.89 (t, *J* = 6.4 Hz, 3H) ppm; ^{13}C NMR (100 MHz,CD_3OD) δ 168.4, 151.4, 148.5, 136.4, 133.0, 131.1, 129.5, 128.7, 126.5, 118.6, 112.5, 104.1, 38.9, 36.7, 32.5, 32.0, 23.5, 14.4, 13.4 ppm; IR ν_{max} (cm^{-1}) 3299, 2940, 1659, 1540, 1470, 750; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 351.2179, found 351.2181.



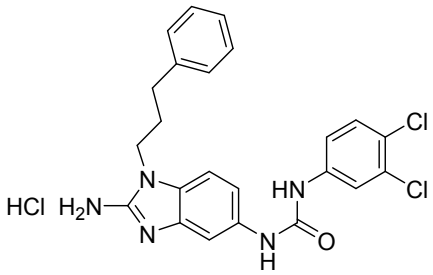
***N*-(2-Amino-1-isopropyl-1*H*-benzo[d]imidazol-6-yl)-4-pentylbenzamide hydrochloride (9e):** The title compound was synthesized from **8e** following the general procedure to afford **9e** as a red solid(m.p = 252 ˚C, 20%). ^{1}H NMR (400 MHz, CD_3OD) δ 8.29 (s, 1H), 7.89 (d, *J* = 7.6 Hz, 2H), 7.56 (d, *J* = 8.4 Hz, 1H), 7.36 (m, 3H), 4.77 (m, *J* = 6.4 Hz, 1H), 2.68 (t, *J* = 7.2 Hz, 2H), 1.67 (m, 8H), 1.33 (m, 4H), 0.90 (t, *J* = 6.8 Hz, 3H) ppm; ^{13}C NMR (100 MHz,CD_3OD) δ 168.9, 151.1, 148.7, 136.1, 133.3, 130.1, 129.7, 128.7, 127.1, 118.4, 112.7, 106.5, 36.7, 32.6, 32.1, 23.5, 20.2, 14.4 ppm; IR ν_{max} (cm^{-1}) 3315, 2963, 1640, 1497, 1432, 763; HRMS (ESI) calcd for $C_{11}H_{15}N_3S$ $[M+H]^+$ 365.2336, found 365.2338.



2-Amino-*N*-(3,4-dichlorophenyl)-1-(3-phenylpropyl)-1*H*-benzo[d]imidazole-5-carboxamide hydrochloride (15): The title compound was synthesized from **14** following the general procedure to afford **15** as a white solid (40%). ^{1}H NMR (400 MHz, CD_3OD) δ 8.01 (s, 1H), 7.92 (m, 2H), 7.60 (m, 1H), 7.43 (m, 2H), 7.25 (m, 2H), 7.17 (m, 3H), 4.23 (t, *J* = 6.6 Hz, 2H), 2.75 (t, *J* = 7.4 Hz, 2H), 2.15 (t, *J* = 6.8 Hz, 2H) ppm; ^{13}C NMR (175 MHz, CD_3OD) δ 167.2, 152.3, 141.7, 139.8, 134.3, 133.0, 131.5, 131.3, 130.1, 129.5, 129.2, 127.8, 127.2, 124.6, 123.1, 121.4, 112.5, 111.0, 43.9, 33.5, 30.3 ppm; UV (λ_{max} nm) 298; IR ν_{max} (cm^{-1}) 3303, 1567, 1472, 1214, 856, 700; HRMS (ESI) calcd for $C_{23}H_{20}Cl_2N_4O$ $[M+H]^+$ 439.1087, found 439.1096.



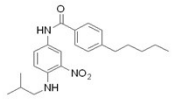
Allyl *tert*-Butyl (1-(3-phenylpropyl)-1*H*-benzo[d]imidazole-2,5-diyl)dicarbamate (19): The title compound was synthesized from **18** following the general procedure to afford **19** as a brown oil (25%). ^{1}H NMR (300 MHz, CD_3OD) δ 7.62 (brs, 1H), 7.19 (m, 2H), 7.11 (m, 3H), 6.97 (d, *J* = 8.8 Hz, 2H), 6.00 (m, 1H), 5.36 (m, 1H), 5.18 (m, 1H), 4.61 (m, 2H), 3.35 (t, *J* = 7.6 Hz, 2H), 2.57 (t, *J* = 7.6 Hz, 2H), 1.95 (t, *J* = 7.2 Hz, 2H), 1.49 (s, 9H) ppm; ^{13}C NMR (100 MHz, CD_3OD) δ 163.6, 155.2, 154.3, 142.3, 136.3, 134.9, 129.9, 129.3 (x2), 126.9, 126.6, 117.4, 115.5, 110.2, 103.6, 80.7, 67.1, 42.5, 33.7, 30.9, 28.7 ppm; UV (λ_{max} nm) 312; IR ν_{max} (cm^{-1}) 2929, 1710, 1499, 1364, 1150, 1052, 700; HRMS (ESI) calcd for $C_{25}H_{30}N_4O_4$ $[M+H]^+$ 451.2340, found 451.2351.

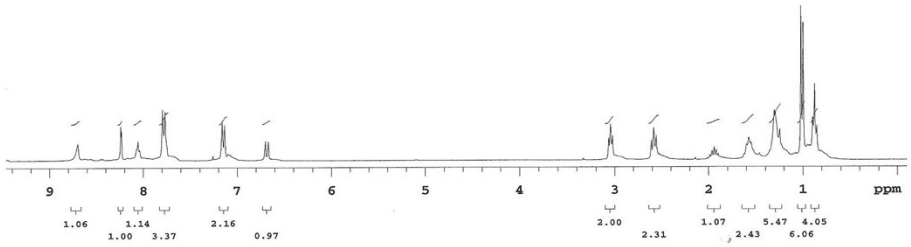


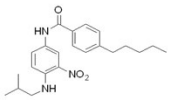
1-(2-Amino-1-(3-phenylpropyl)-1*H*-benzo[d]imidazol-5-yl)-3-(3,4-dichlorophenyl)urea hydrochloride (19): The title compound was synthesized from **19** following the general procedure to afford **20** as a brown solid (20%). ^{1}H NMR (300 MHz, CD_3OD) δ 7.72 (m, 2H), 7.31 (m, 4H), 7.17 (m, 5H), 4.08 (t, *J* = 7.4 Hz, 2H), 2.71 (t, *J* = 7.8 Hz, 2H), 2.08 (t, *J* = 7.2 Hz, 2H) ppm; ^{13}C NMR (175 MHz, CD_3OD) δ 154.5, 151.2, 141.8, 140.6, 137.3, 133.1, 131.3, 130.4, 129.5, 129.2, 127.2, 127.0, 125.9, 121.1, 119.3, 116.2, 111.2, 103.7, 43.5, 33.6, 30.4 ppm; UV (λ_{max} nm) 298; IR ν_{max} (cm^{-1}) 2918, 1638, 1583, 1301, 1023, 813; HRMS (ESI) calcd for $C_{23}H_{21}Cl_2N_5O$ $[M+H]^+$ 454.1196, found 454.1203.

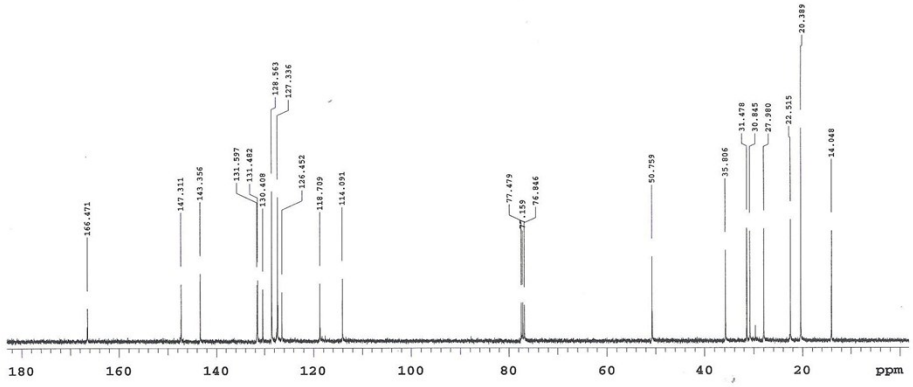
NMR Spectra

Compound **4d**

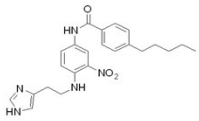


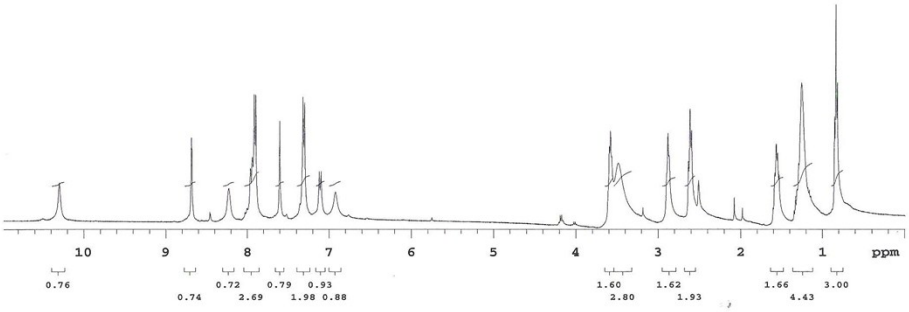


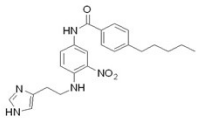


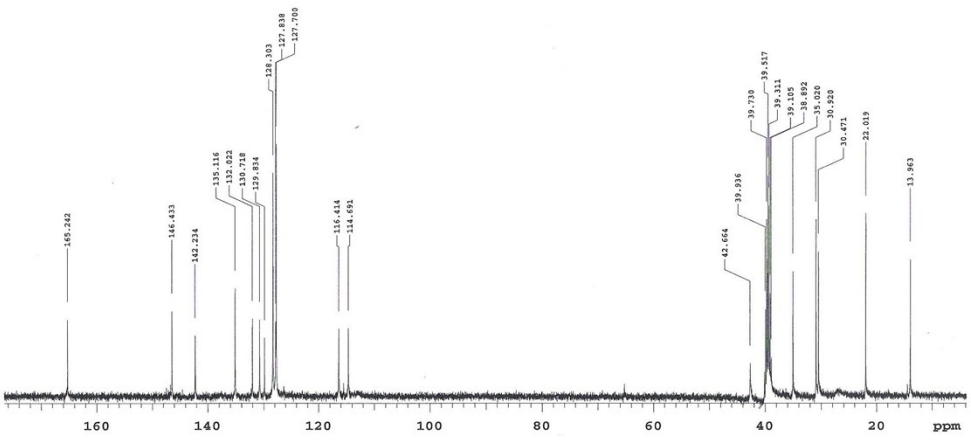


Compound **4j**

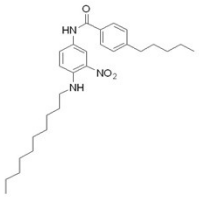


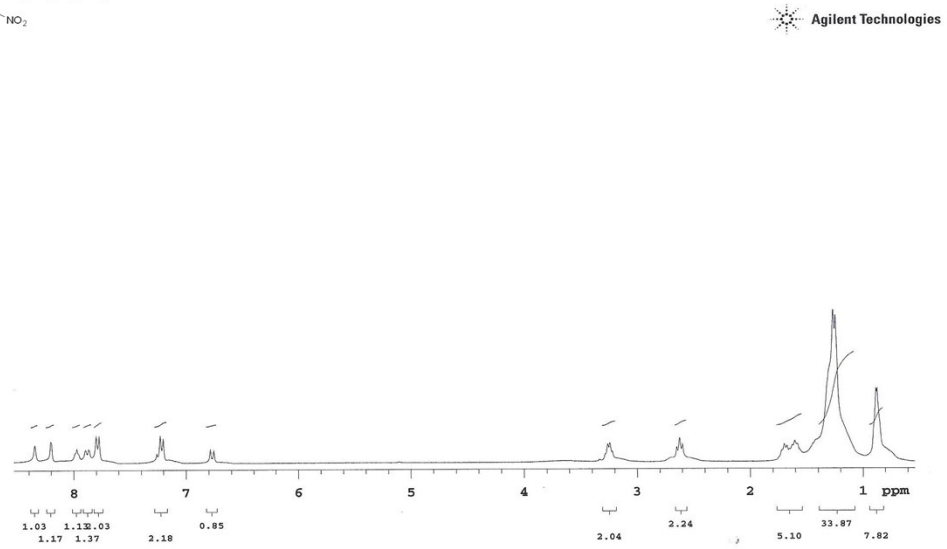

10
9
8
7
6
5
4
3
2
1
ppm
0.76
0.74
0.72
2.69
0.79
1.98
0.93
0.88
1.60
2.80
1.62
1.93
1.66
4.43
3.00

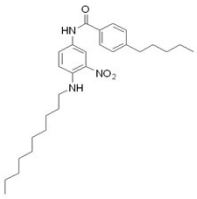


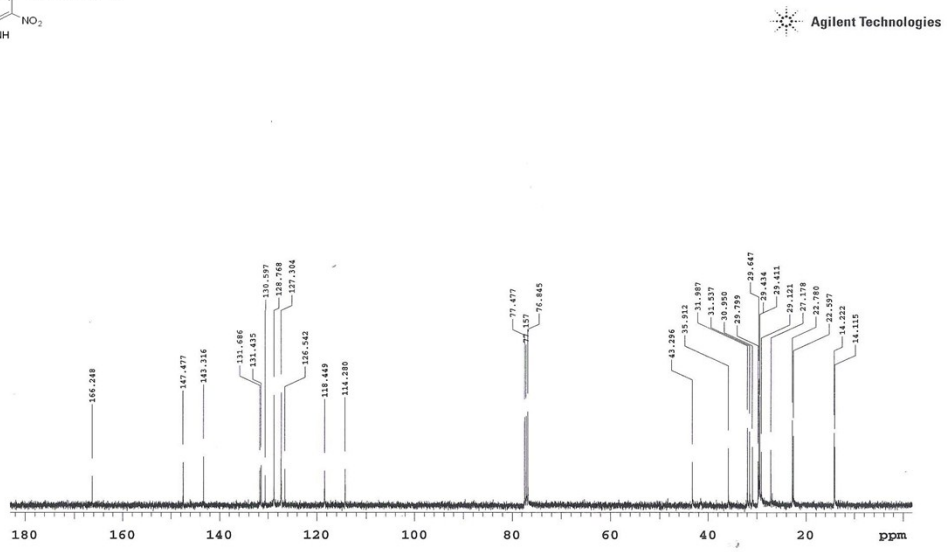

165.242
146.433
142.234
135.116
132.022
130.718
129.834
126.303
127.838
127.700
116.414
114.691
42.664
39.936
39.730
39.517
39.311
39.105
38.892
35.020
30.920
30.471
22.019
13.963
160
140
120
100
80
60
40
20
ppm

Compound **4m**

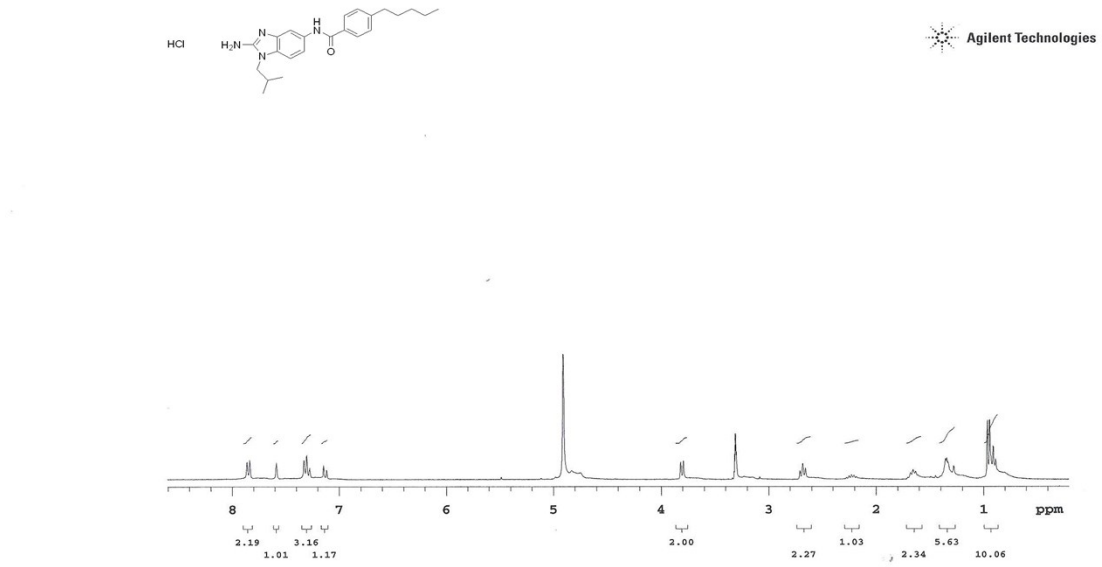

HN
O
NO2
NH

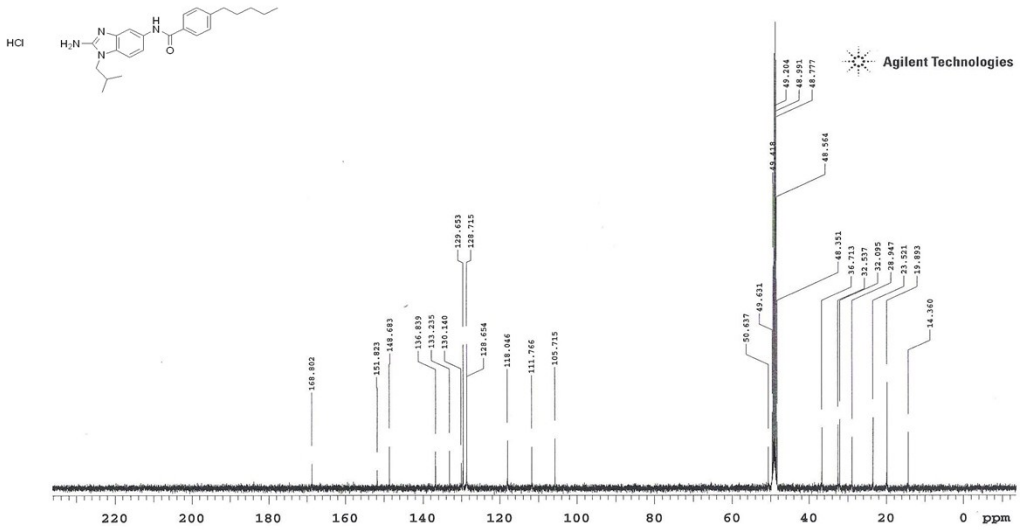

Agilent Technologies
8
7
6
5
4
3
2
1 ppm
1.03
1.17
1.13
1.37
2.03
2.18
0.85
2.04
2.24
5.10
33.87
7.82


HN
O
NO2
NH

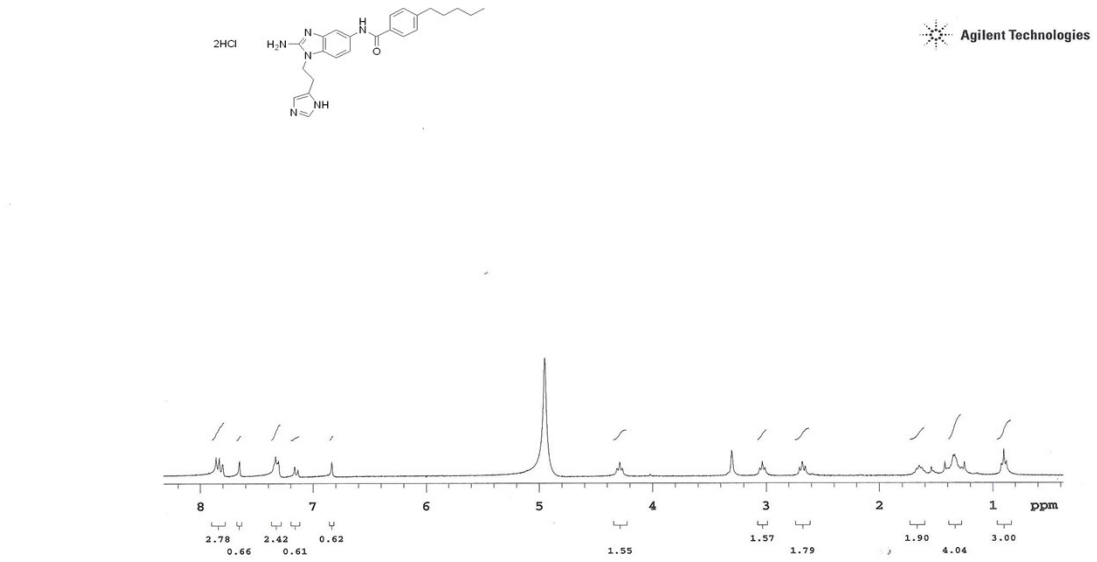

Agilent Technologies
166.248
147.477
143.316
131.686
131.435
130.597
128.768
127.304
126.542
118.469
114.280
77.477
77.157
76.845
43.296
35.912
31.987
31.537
30.950
29.799
29.647
29.434
29.411
29.121
27.178
22.780
22.597
14.222
14.115
180
160
140
120
100
80
60
40
20
ppm

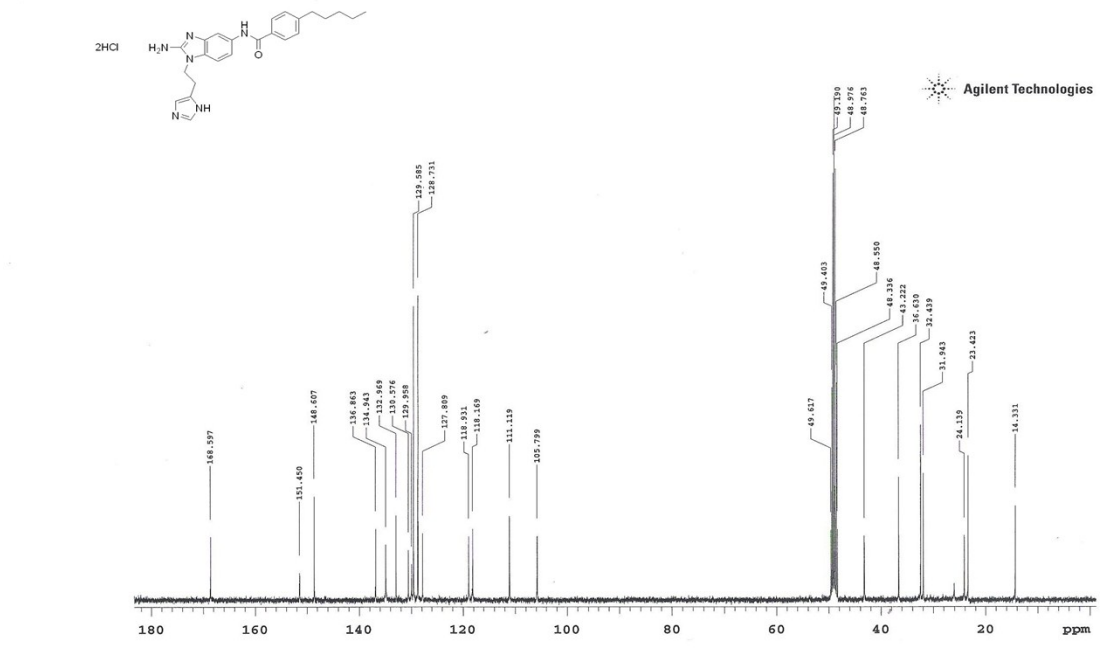
Compound **5d**


HCl
Agilent Technologies
8
7
6
5
4
3
2
1
ppm
2.19
1.01
3.16
1.17
2.00
2.27
1.03
2.34
5.63
10.06

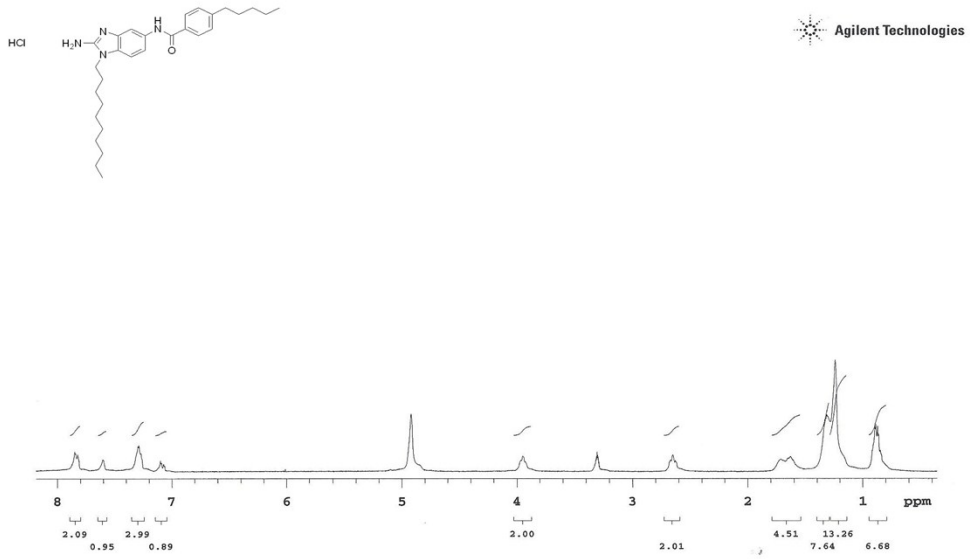

HCl
Agilent Technologies
49.204
48.991
48.777
48.564
49.418
50.637
49.631
160.802
151.823
140.683
136.839
135.235
130.140
129.653
128.715
128.654
118.046
111.766
105.715
46.351
35.713
32.537
32.095
28.947
23.521
19.893
14.360
220
200
180
160
140
120
100
80
60
40
20
0
ppm

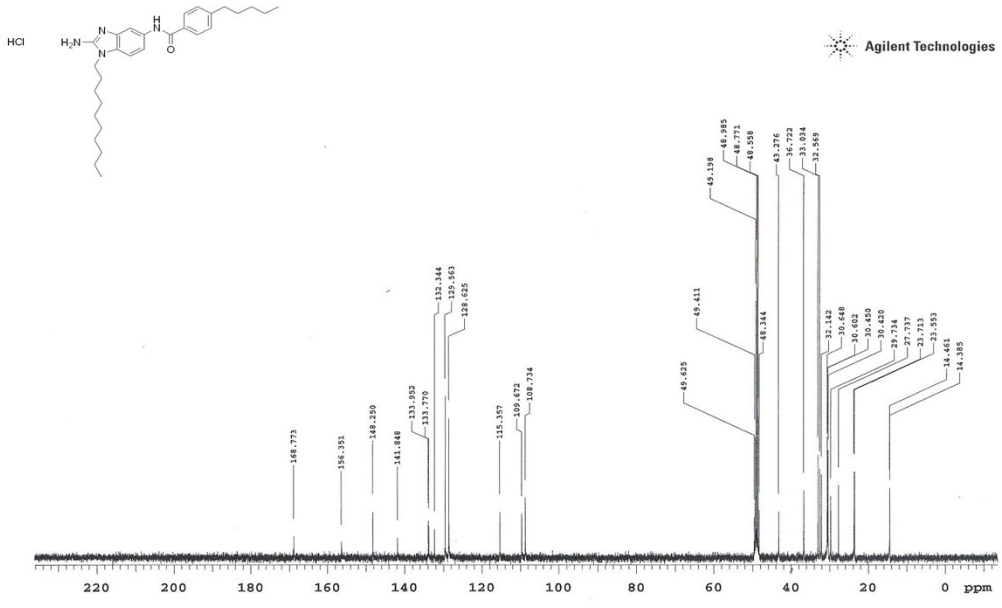
Compound **5j**


2HCl
Agilent Technologies
8
7
6
5
4
3
2
1
ppm
2.78
0.66
2.42
0.61
0.62
1.55
1.57
1.79
1.90
4.04
3.00


2HCl
Agilent Technologies
168.597
151.450
148.607
136.863
134.943
132.969
130.576
129.958
129.585
128.731
127.809
118.931
118.169
111.119
105.799
49.739
48.976
48.763
49.403
48.550
48.336
43.222
36.639
32.439
31.943
23.423
24.139
14.331
49.617
180
160
140
120
100
80
60
40
20
ppm

Compound **5m**


HCl
Agilent Technologies
8
7
6
5
4
3
2
1
ppm
2.09
0.95
2.99
0.89
2.00
2.01
4.51
13.26
7.64
6.68


HCl
Agilent Technologies
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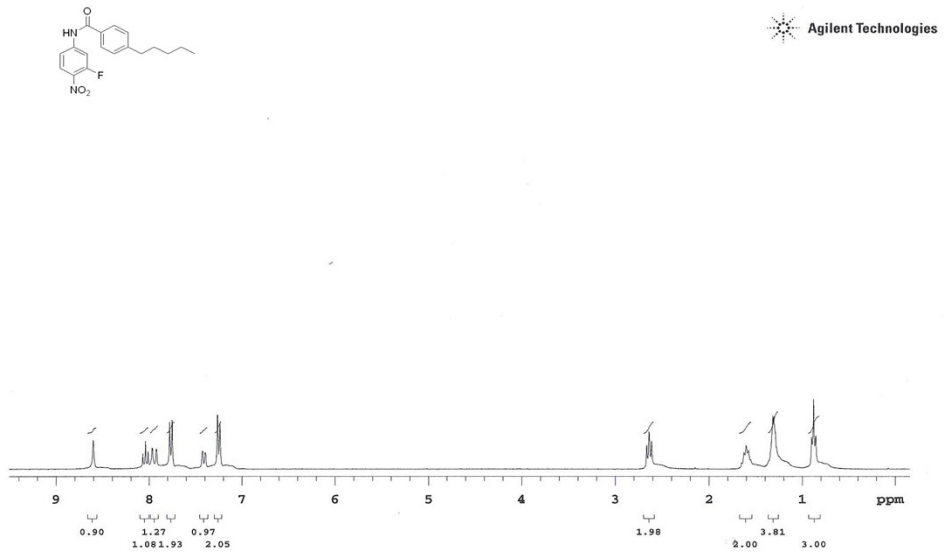
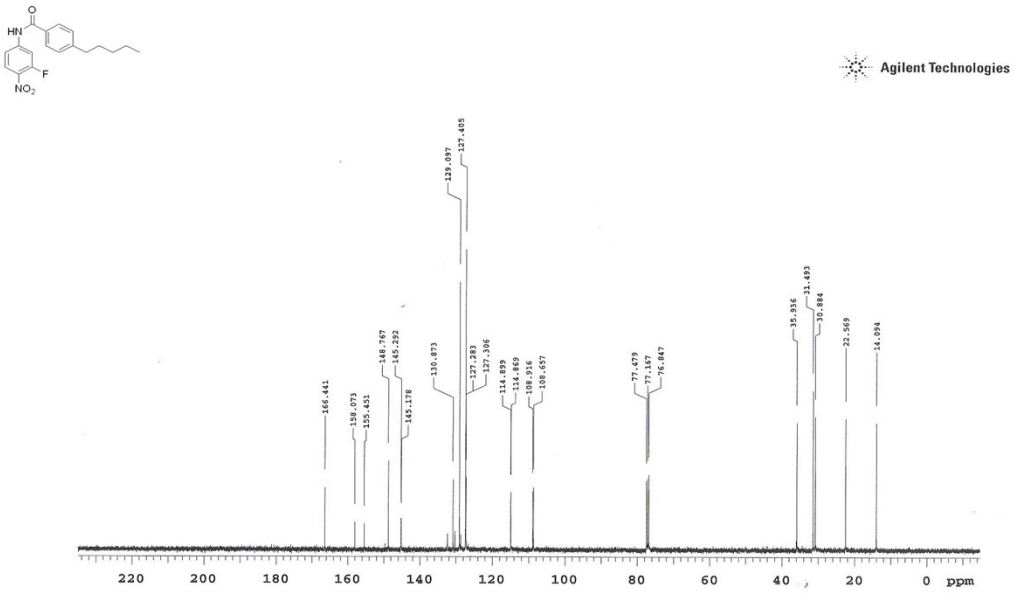
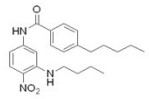
133.952
133.770
132.344
129.563
128.625
115.357
109.672
108.734
49.411
49.139
48.385
48.771
48.558
48.344
49.625
43.276
36.722
33.034
32.569
32.142
30.648
30.602
30.459
30.420
29.734
27.737
23.713
23.553
14.461
14.385
220
200
180
160
140
120
100
80
60
40
20
0
ppm

Compound **7**

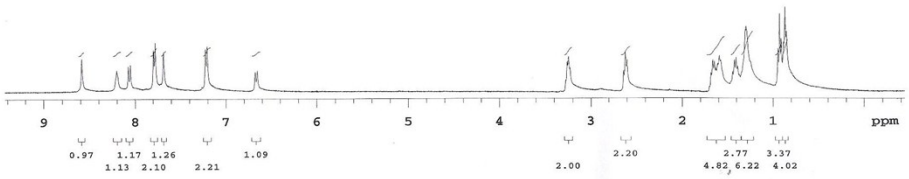

Agilent Technologies
9
8
7
6
5
4
3
2
1
ppm
0.90
1.27
1.08
1.93
0.97
2.05
1.98
3.81
2.00
3.00

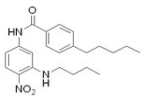

Agilent Technologies
166.441
158.073
155.451
148.767
145.292
145.178
130.873
129.097
127.405
127.283
127.306
114.899
114.869
108.916
108.657
77.479
77.167
76.847
35.936
31.493
30.884
22.569
14.094
220
200
180
160
140
120
100
80
60
40
20
0
ppm

Compound **8a**

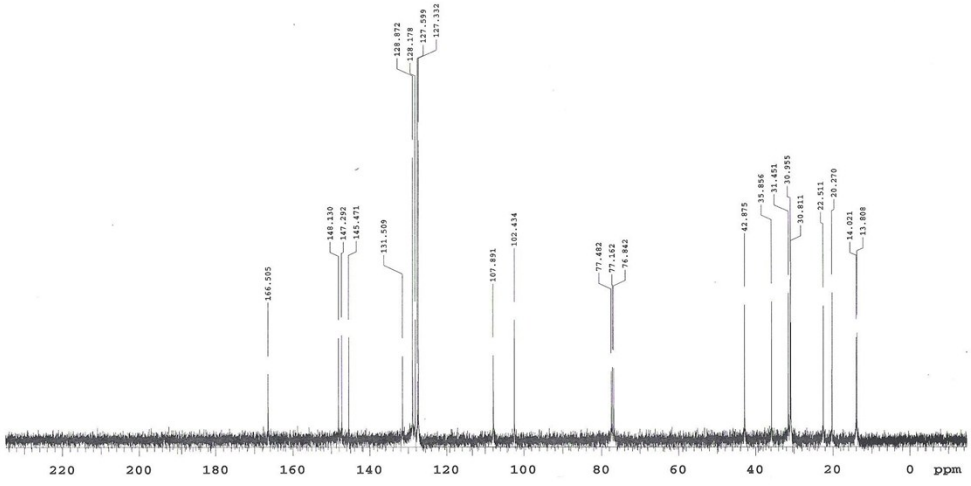



Agilent Technologies

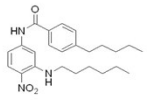

9
8
7
6
5
4
3
2
1
ppm
0.97
1.17
1.13
1.26
2.10
2.21
1.09
2.00
2.20
2.77
4.82
3.37
6.22
4.02

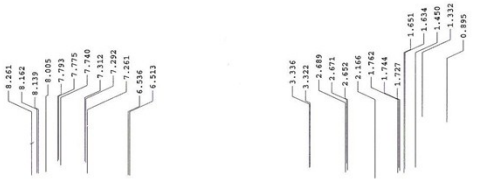


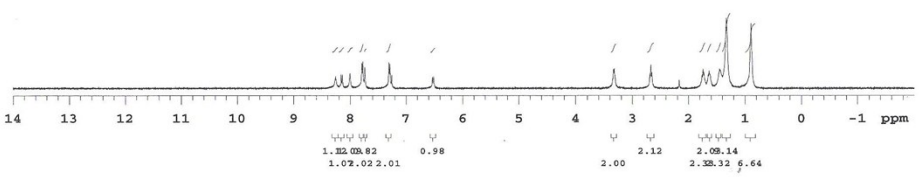

Agilent Technologies

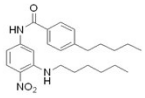

166.595
148.130
147.292
145.471
131.589
128.972
128.178
127.599
127.332
107.891
102.434
77.482
77.162
76.842
42.875
35.856
31.451
30.955
30.811
22.511
20.270
14.021
13.868
220
200
180
160
140
120
100
80
60
40
20
0
ppm

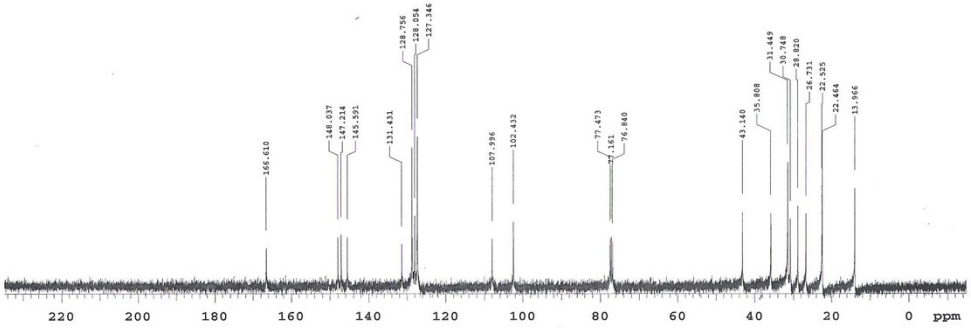
Compound **8b**



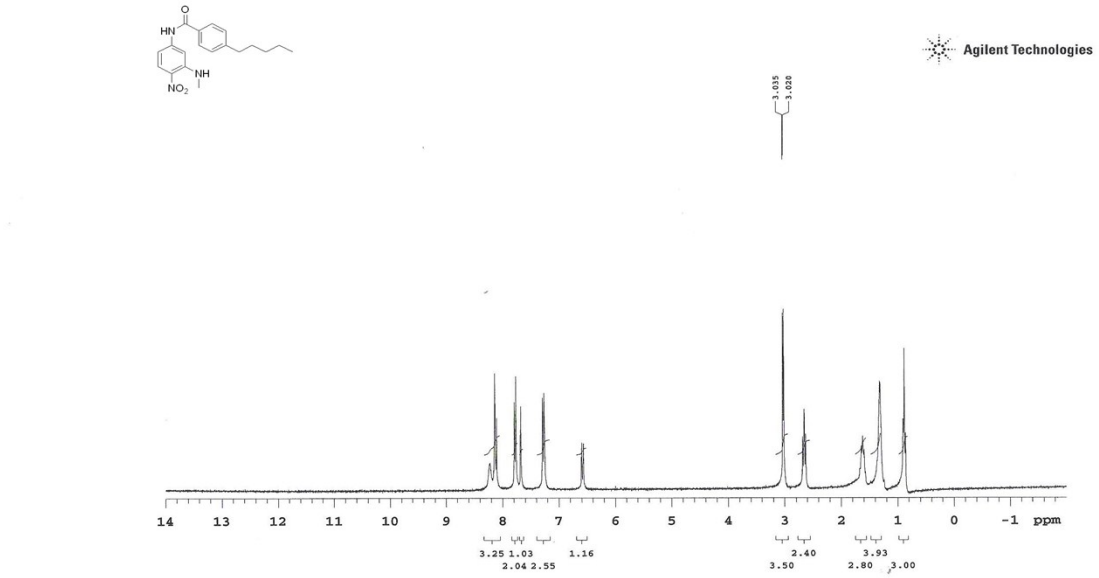


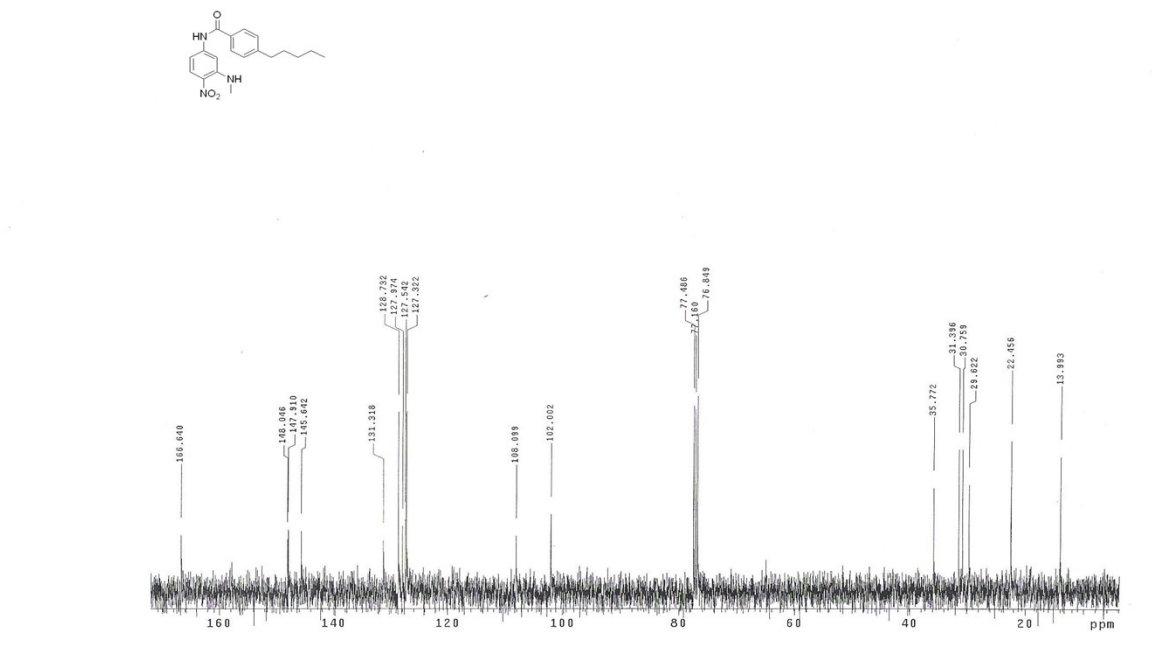




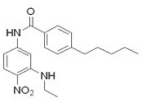


Compound **8c**

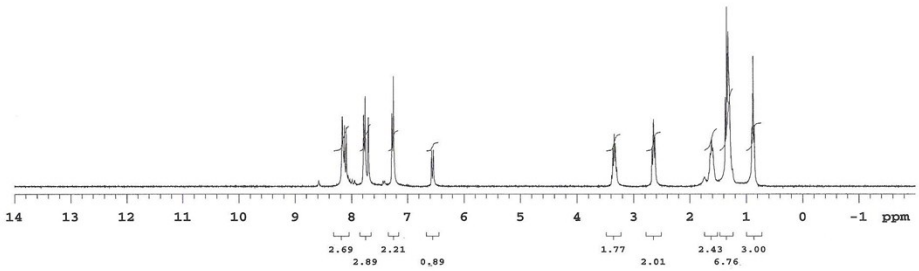

Agilent Technologies
3.035
3.020
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 ppm
3.25 1.03 1.16 2.40 3.93
2.04 2.55 3.50 2.80 3.00

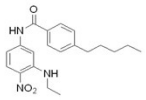

168.640
148.046
147.910
145.642
131.318
128.732
127.974
127.542
127.322
108.099
102.002
77.486
77.169
76.849
35.772
31.396
30.759
29.822
22.456
13.993
160 140 120 100 80 60 40 20 ppm

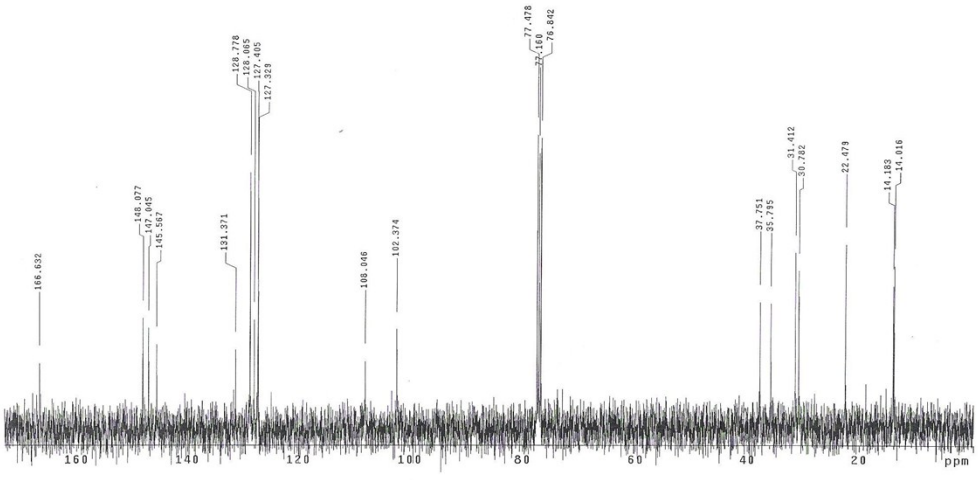
Compound **8d**



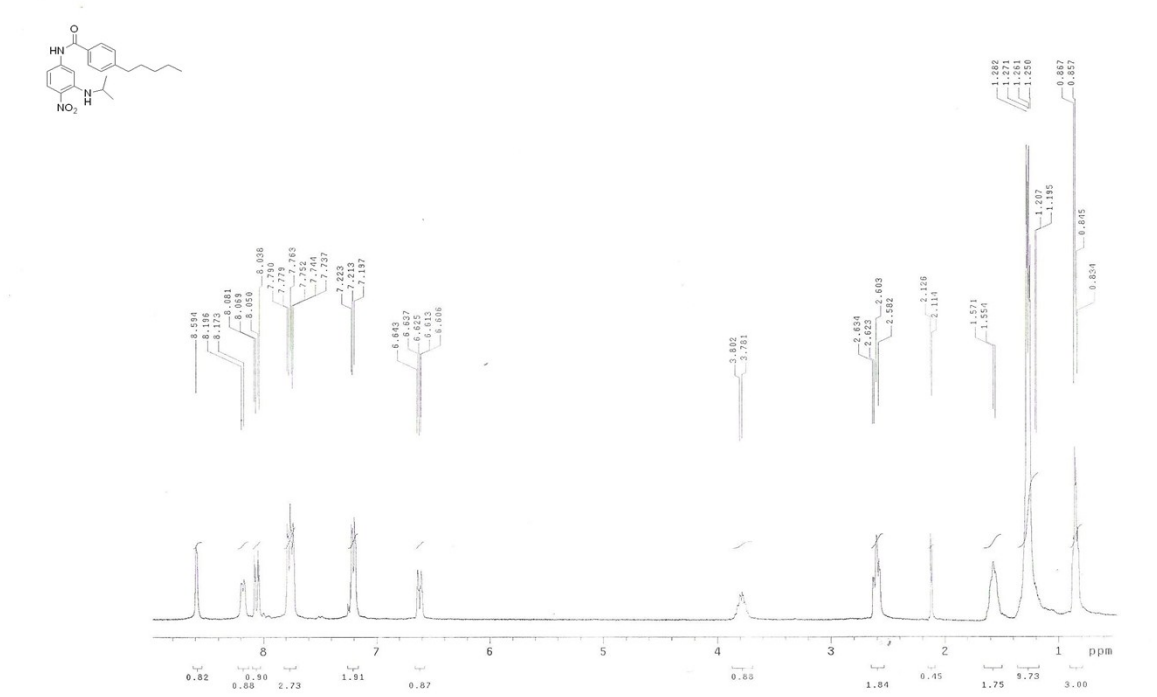

Agilent Technologies

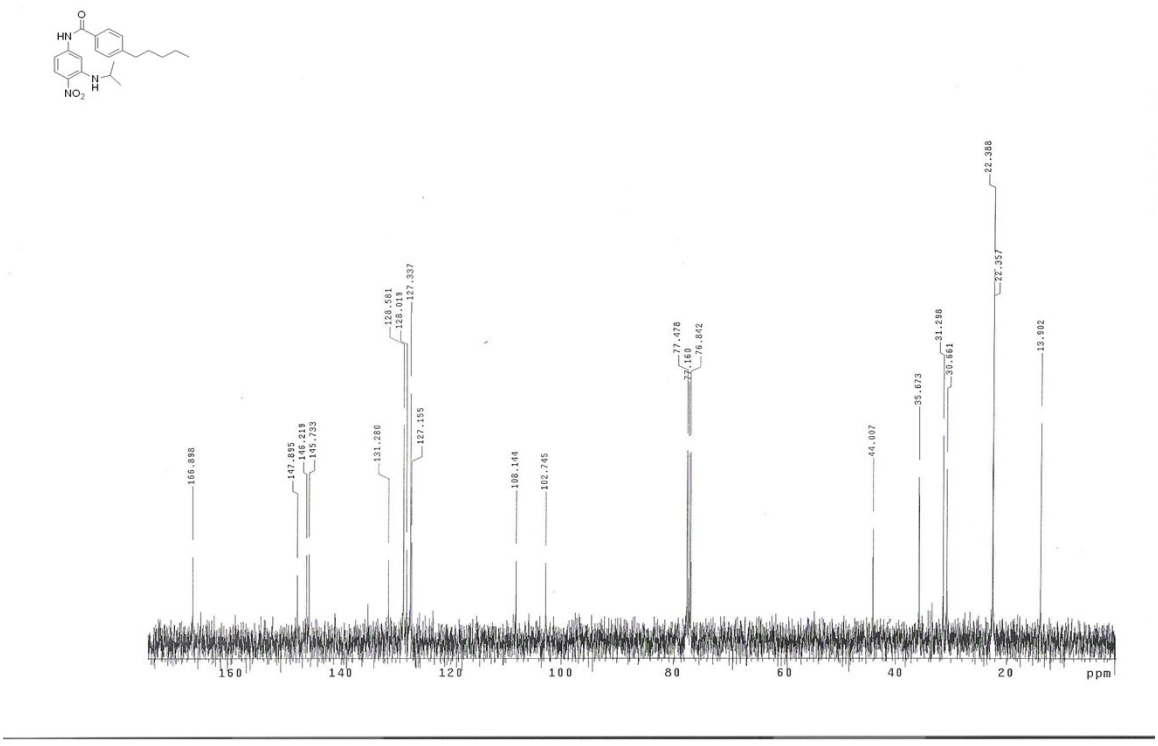

14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 ppm
2.69
2.89
2.21
0.89
1.77
2.01
2.43
6.76
3.00



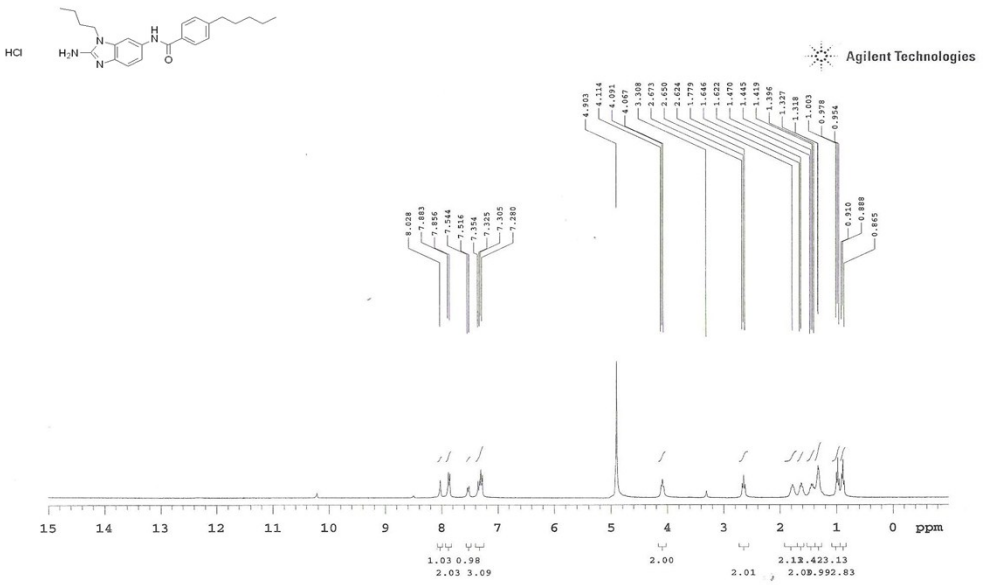

166.632
148.077
147.045
145.567
131.371
128.778
128.605
127.405
127.323
108.046
102.374
77.478
77.160
76.842
37.751
35.735
31.412
30.762
22.479
14.183
14.016
160 140 120 100 80 60 40 20 ppm

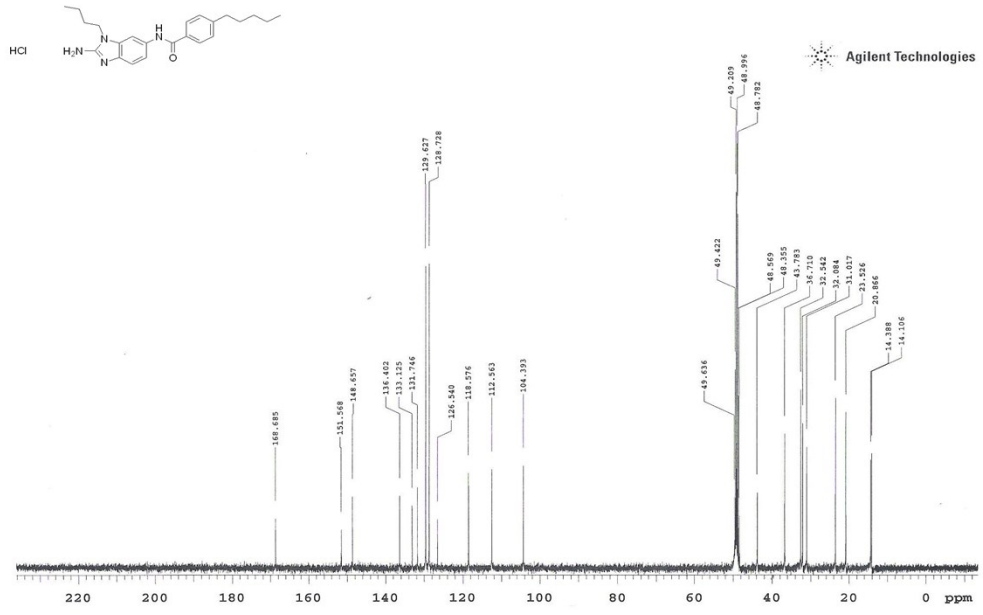
Compound **8e**



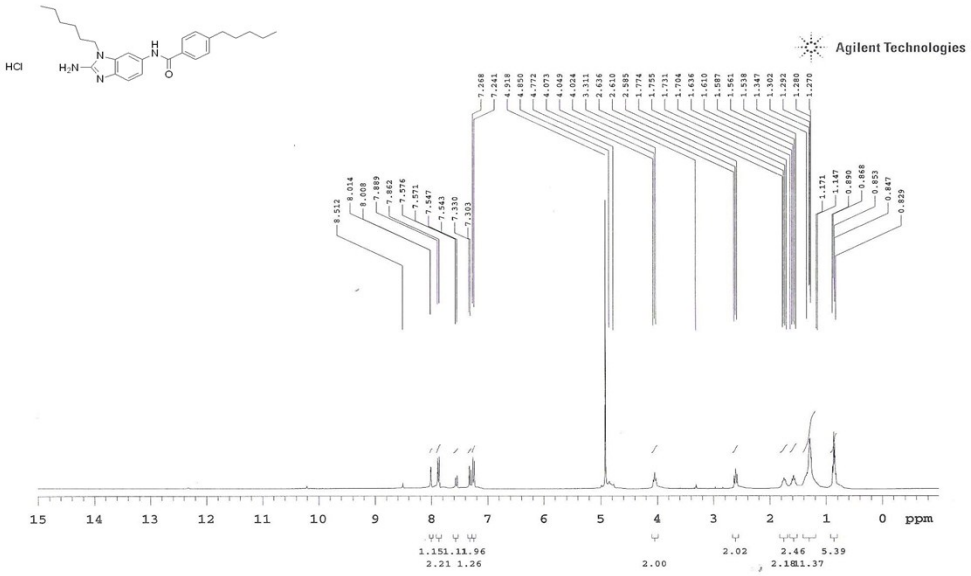


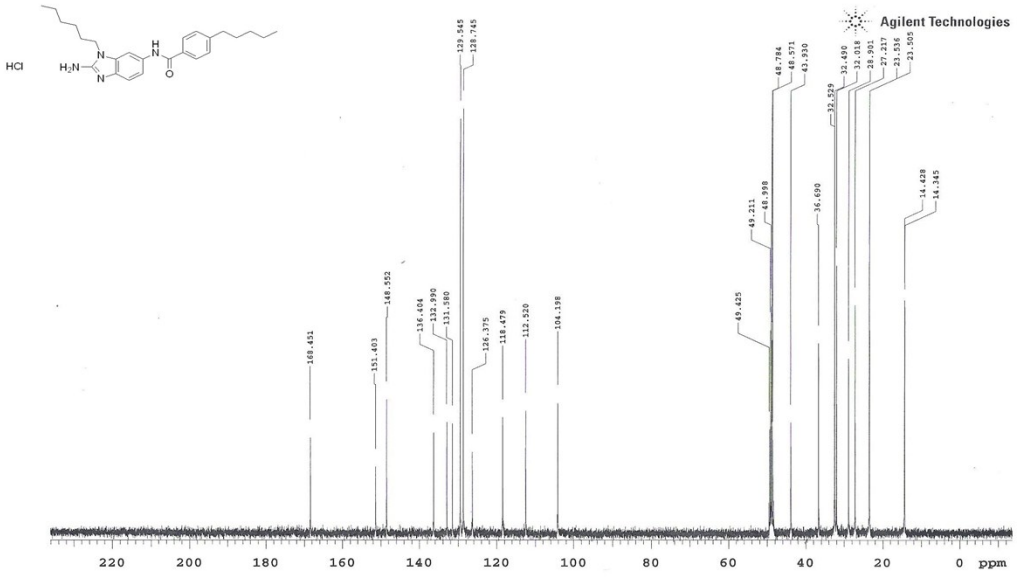
Compound **9a**


HCl
Agilent Technologies
8.038
7.883
7.856
7.544
7.516
7.354
7.325
7.305
7.280
4.903
4.114
4.091
4.067
3.308
2.673
2.650
2.624
1.779
1.646
1.622
1.470
1.445
1.419
1.396
1.327
1.318
1.103
0.978
0.954
0.910
0.888
0.865
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 ppm
1.03 0.98
2.03 3.09
2.00
2.01
2.12 2.42 3.13
2.07 2.99 2.83

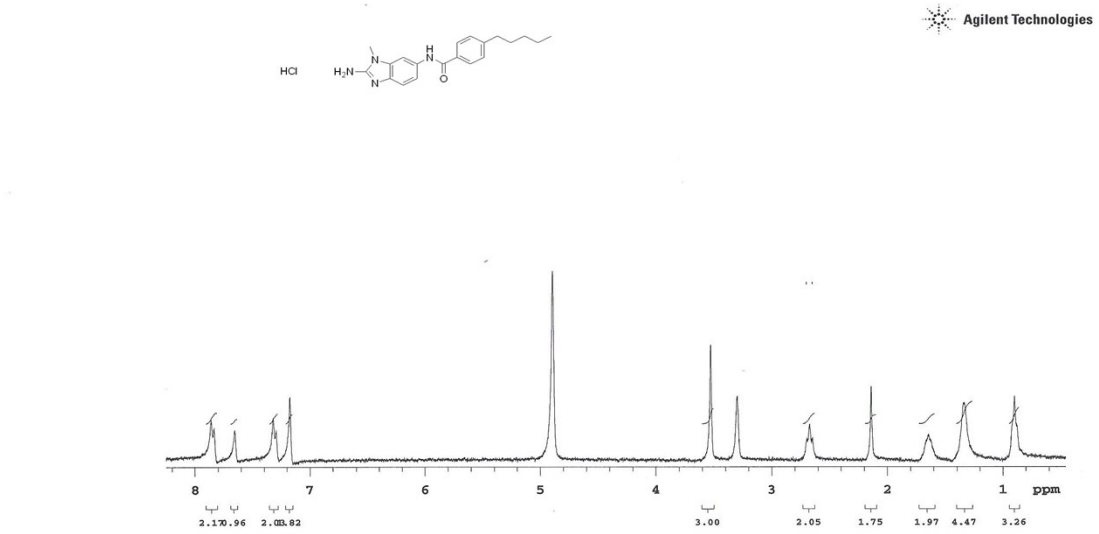

HCl
Agilent Technologies
49.309
48.996
48.792
49.422
48.569
48.355
43.783
36.710
32.542
32.084
31.017
23.526
20.866
14.388
14.106
49.636
168.685
151.568
148.657
136.402
133.125
131.746
129.627
128.728
126.540
118.576
112.563
104.393
220 200 180 160 140 120 100 80 60 40 20 0 ppm

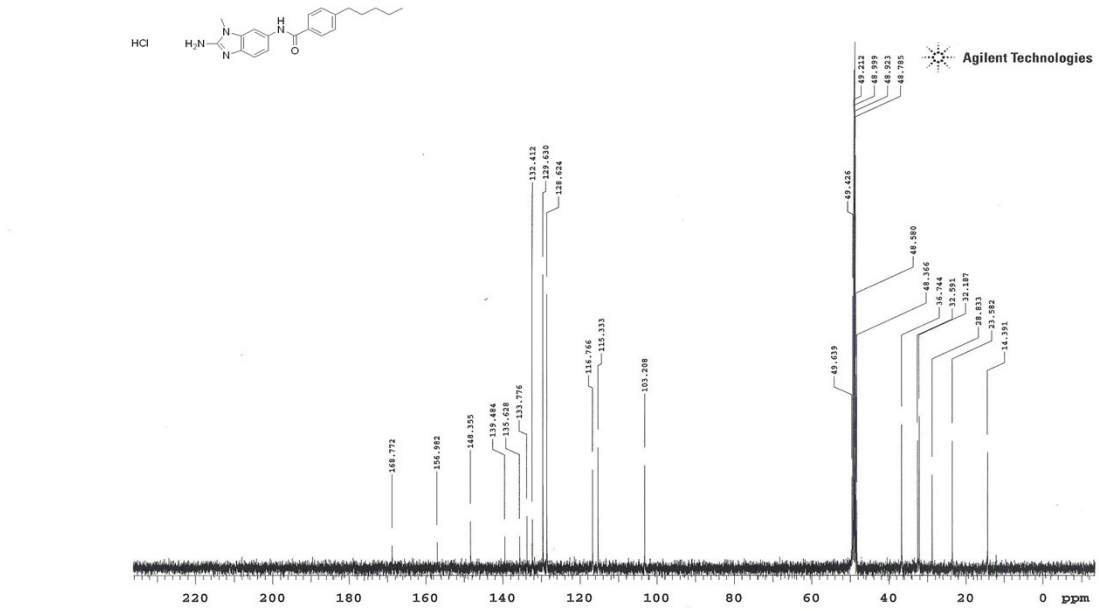
Compound **9b**


HCl
Agilent Technologies
8.512
8.014
8.008
7.889
7.862
7.576
7.571
7.547
7.543
7.330
7.303
7.268
7.241
4.938
4.850
4.772
4.073
4.049
4.024
3.311
2.636
2.610
2.585
1.774
1.755
1.731
1.704
1.636
1.610
1.587
1.561
1.538
1.347
1.302
1.292
1.280
1.270
1.171
1.147
0.890
0.868
0.853
0.847
0.829
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 ppm
1.15 1.11 1.96
2.21 1.26
2.00
2.02
2.46 5.39
2.18 1.37

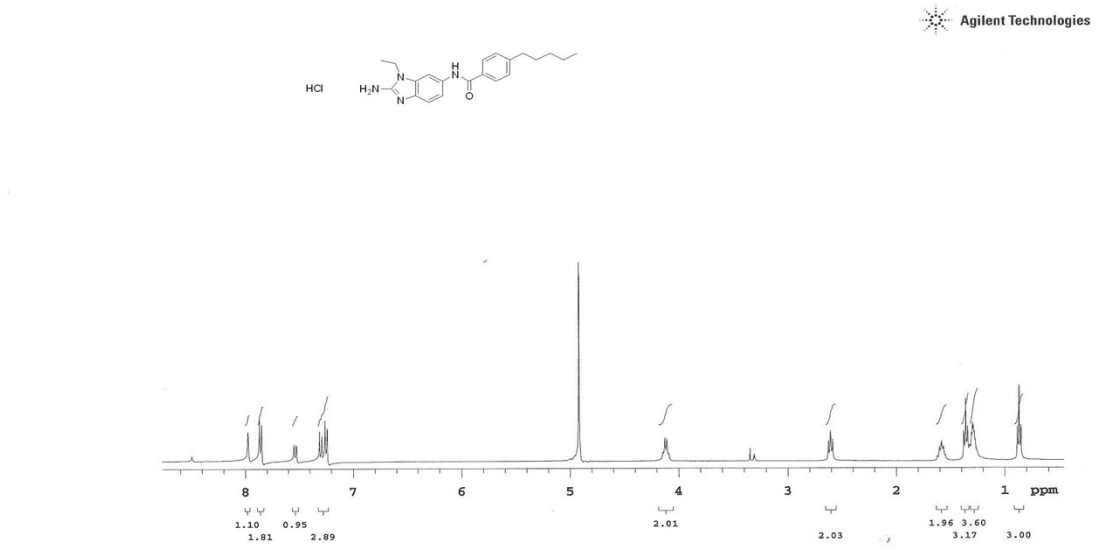

HCl
Agilent Technologies
169.491
151.403
148.552
136.404
132.990
131.380
129.545
128.745
126.375
118.479
112.520
104.138
49.425
49.211
48.998
46.784
46.571
43.930
36.699
32.529
32.490
32.018
28.981
27.217
23.536
23.505
14.428
14.345
220 200 180 160 140 120 100 80 60 40 20 0 ppm

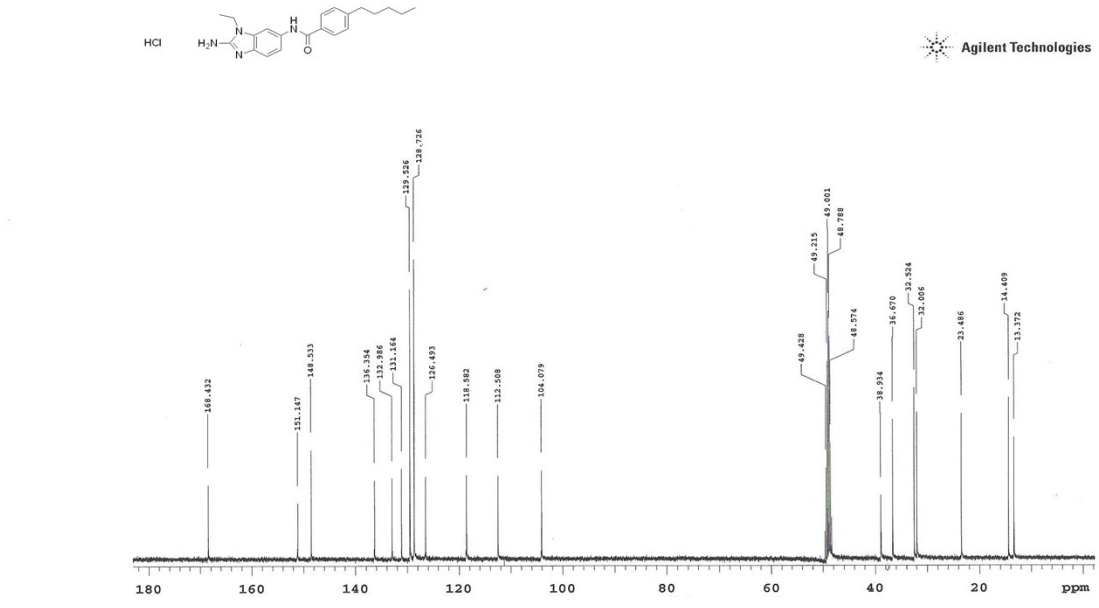
Compound **9c**


HCl
Agilent Technologies
8
7
6
5
4
3
2
1
ppm
2.17
0.96
2.00
1.82
3.00
2.05
1.75
1.97
4.47
3.26

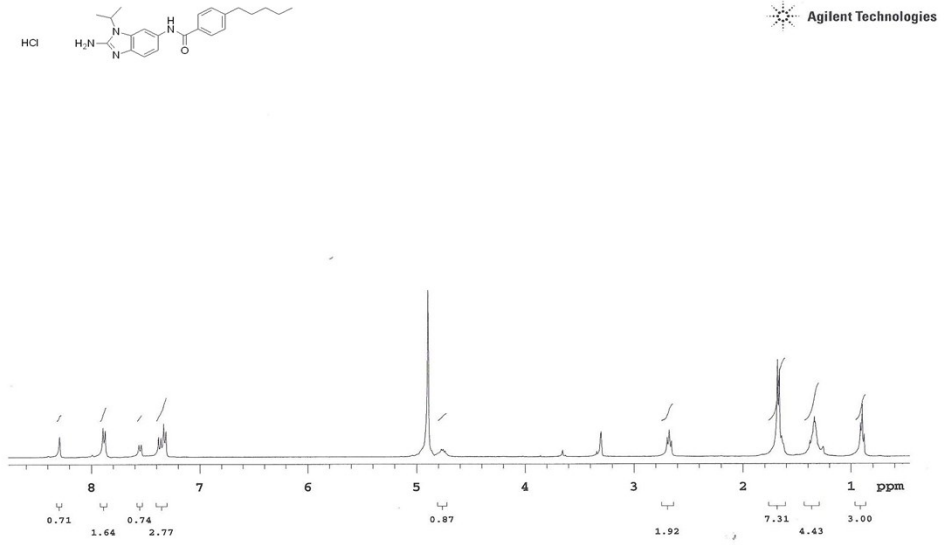

HCl
Agilent Technologies
160.772
156.982
148.355
139.484
135.628
133.776
132.412
129.630
128.624
116.766
115.333
103.208
49.426
49.619
48.580
48.366
36.744
32.591
32.187
28.833
23.582
14.391
220
200
180
160
140
120
100
80
60
40
20
0
ppm

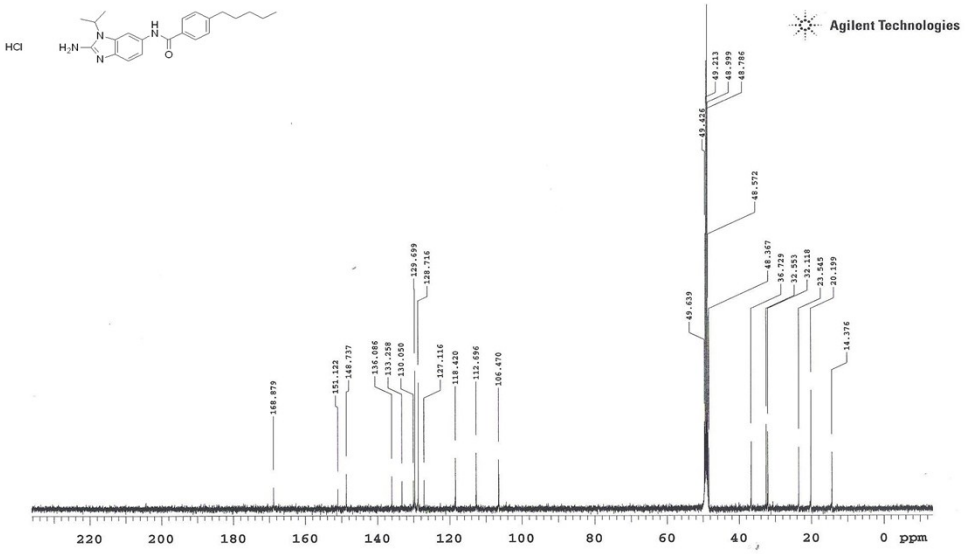
Compound **9d**


Agilent Technologies
HCl
8
7
6
5
4
3
2
1
ppm
1.10
1.81
0.95
2.89
2.01
2.03
1.96
3.17
3.60
3.00

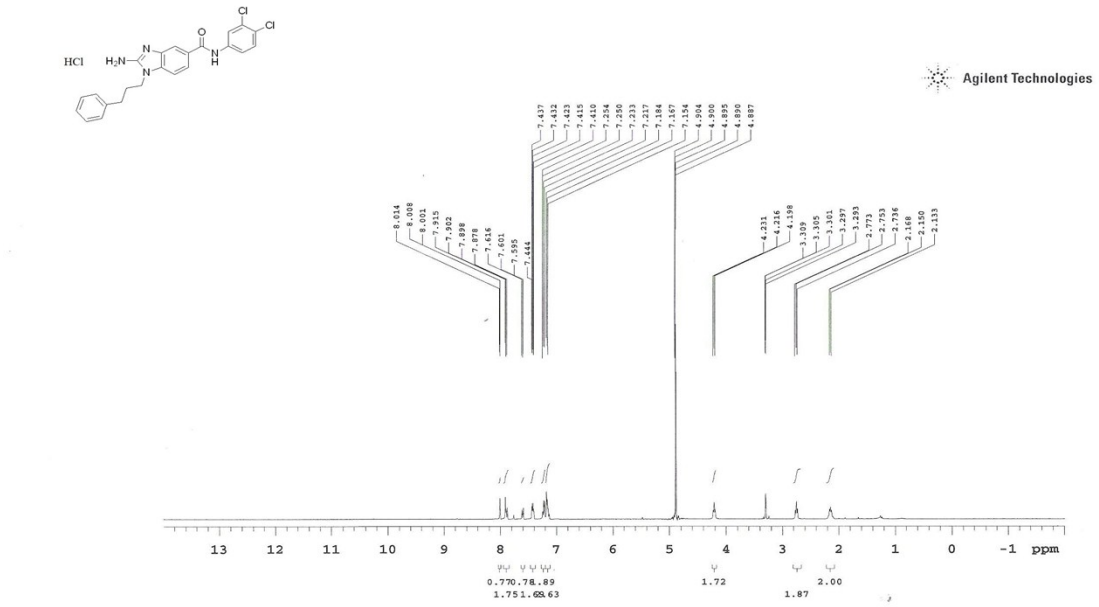

HCl
Agilent Technologies
168.432
151.147
148.533
136.354
132.986
131.164
129.526
128.726
126.493
118.582
112.508
104.079
49.428
49.215
49.001
48.788
48.574
38.934
36.670
32.524
32.006
23.486
14.409
13.372
180
160
140
120
100
80
60
40
20
ppm

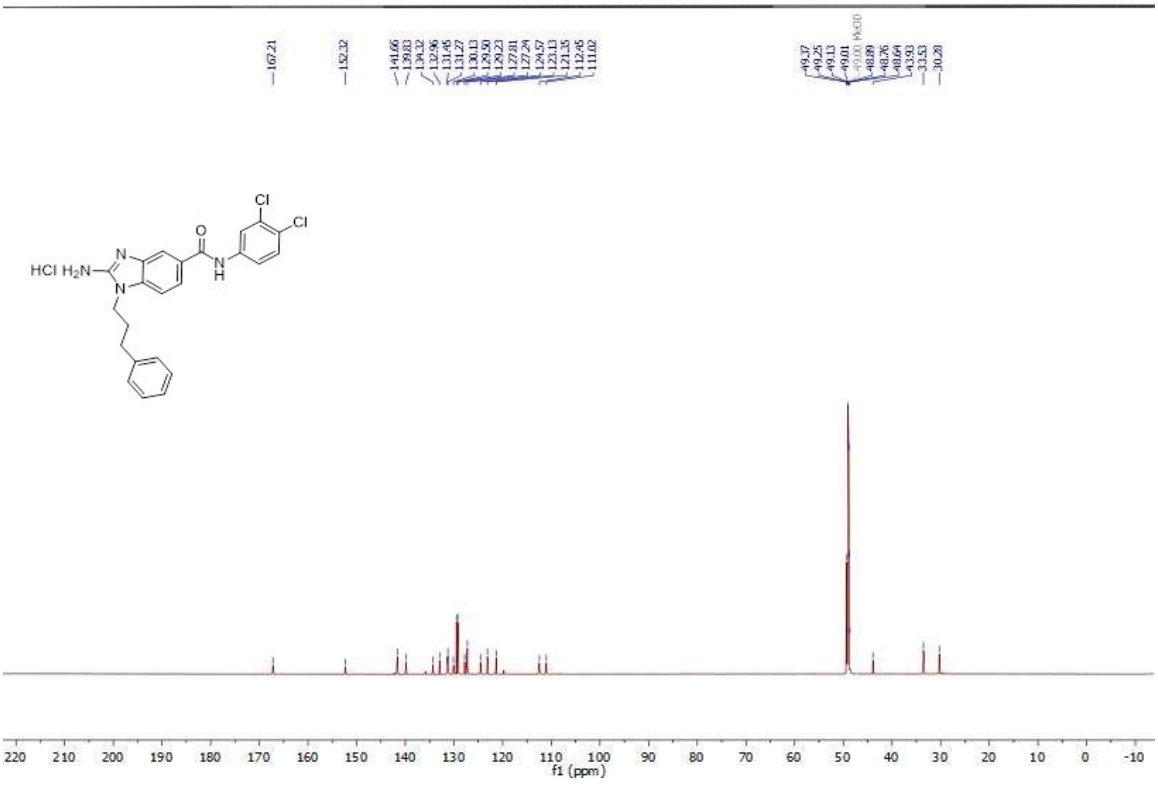
Compound **9e**


HCl
Agilent Technologies
8
7
6
5
4
3
2
1
ppm
0.71
1.64
0.74
2.77
0.87
1.92
7.31
4.43
3.00

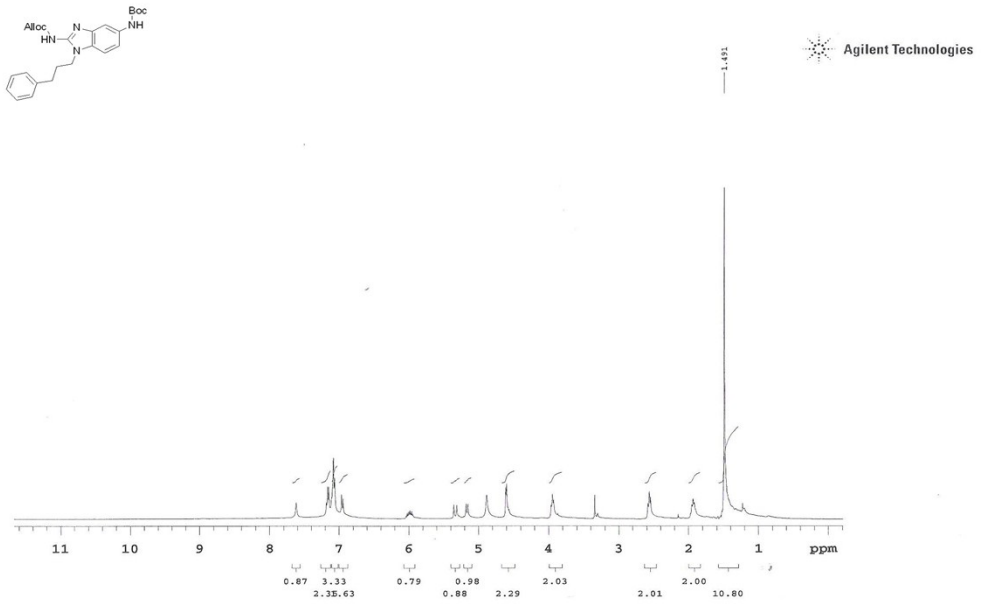

HCl
Agilent Technologies
49.213
48.959
48.706
48.572
48.367
36.729
32.553
32.118
23.545
20.199
14.376
49.639
168.879
151.122
148.737
136.086
133.258
130.050
129.699
128.716
127.116
118.420
112.696
106.470
220
200
180
160
140
120
100
80
60
40
20
0
ppm

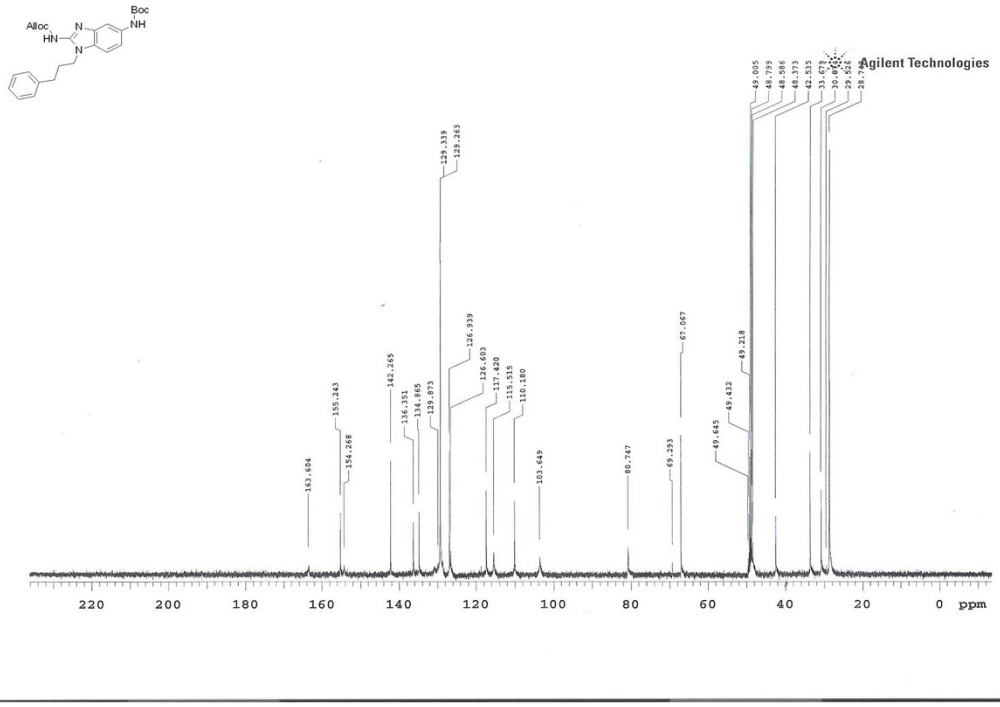
Compound **15**


HCl
Agilent Technologies
13 12 11 10 9 8 7 6 5 4 3 2 1 0 -1 ppm

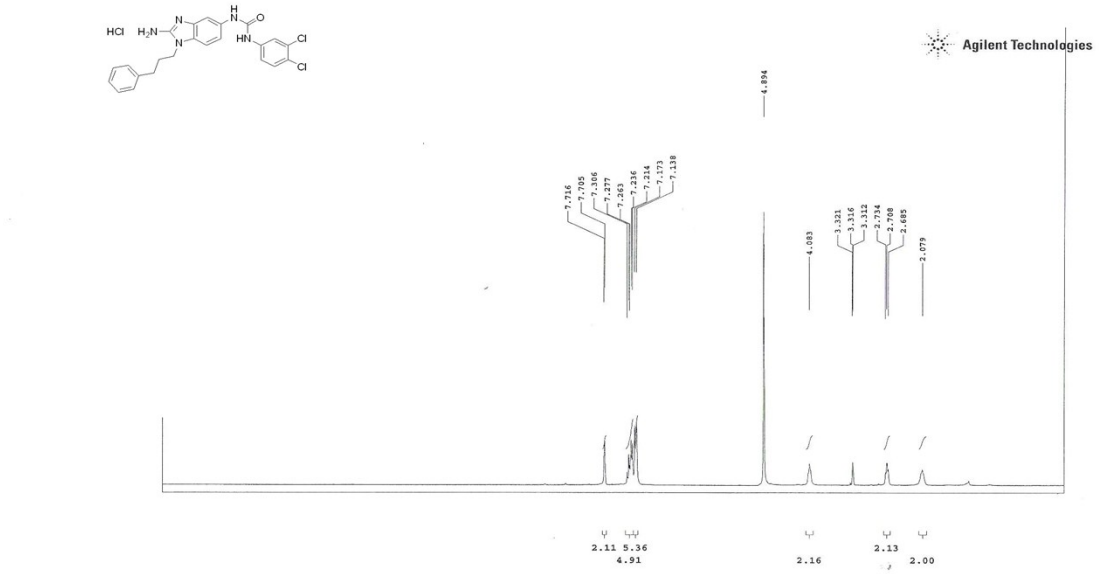

HCl
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

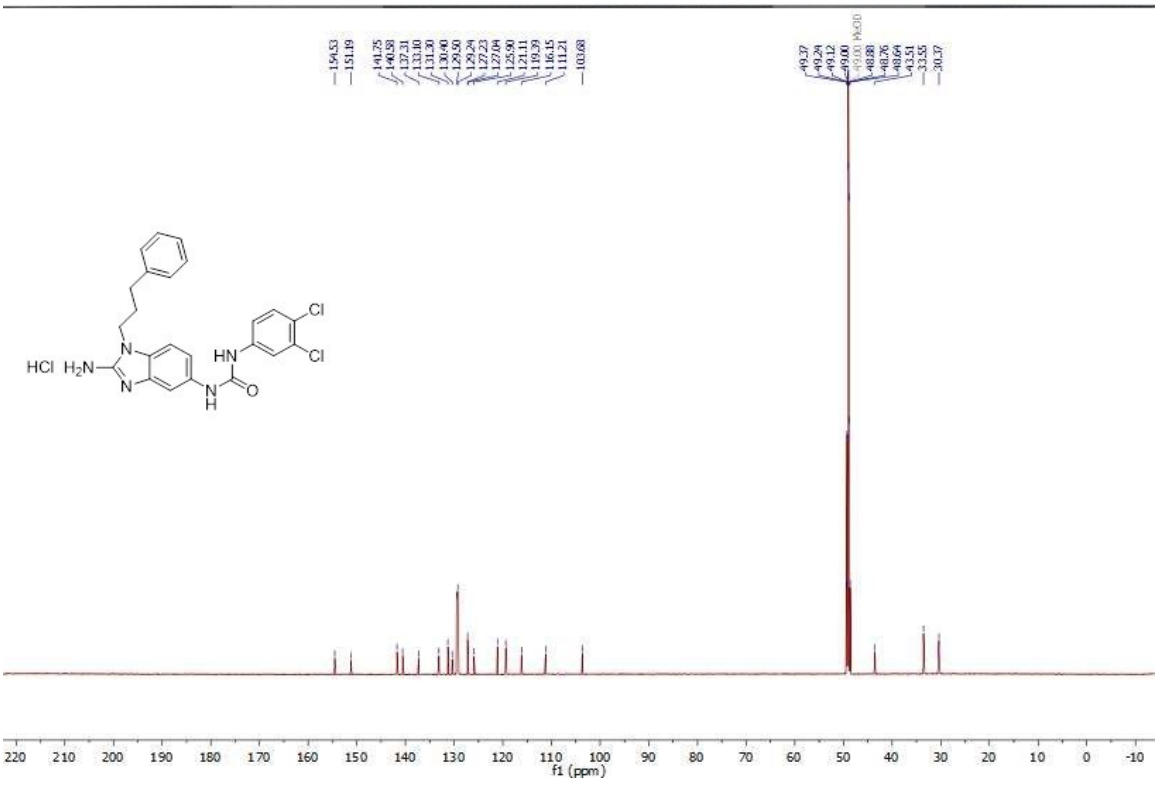
Compound **19**


Alloc
HN
N
N
Boc
NH
Agilent Technologies
1.491
11
10
9
8
7
6
5
4
3
2
1
ppm
0.87
3.33
2.35
5.63
0.79
0.98
0.88
2.29
2.03
2.01
2.00
10.80


Alloc
HN
N
N
Boc
NH
Agilent Technologies
49.005
48.799
48.586
48.373
42.535
33.679
30.
29.524
28.7
163.604
155.243
154.268
142.265
136.351
134.865
129.873
129.339
129.263
126.939
126.603
117.420
115.515
110.180
103.649
80.747
69.293
67.067
49.645
49.432
49.218
220
200
180
160
140
120
100
80
60
40
20
0
ppm

Compound **20**


Agilent Technologies
4.894
7.716
7.705
7.306
7.277
7.263
7.236
7.214
7.173
7.138
4.083
3.321
3.316
3.312
2.734
2.708
2.685
2.079
2.11
5.36
4.91
2.16
2.13
2.00


154.53
151.49
141.75
140.58
137.31
133.10
131.30
130.40
129.50
129.24
127.23
127.04
125.90
121.11
119.39
116.15
111.21
103.68
49.37
49.29
49.12
49.00
48.88
48.76
48.64
43.51
33.55
30.37
HCl H2N
HN
Cl
Cl
N
N
H
O
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

References

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