(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 December 2023 (28.12.2023)

WIPO | PCT

(10) International Publication Number
WO 2023/250316 A1

(51) International Patent Classification:
A61K 31/4365 (2006.01) *A61K 31/519* (2006.01)
A61K 31/517 (2006.01) *C07D 495/04* (2006.01)

(21) International Application Number:
PCT/US2023/068717

(22) International Filing Date:
20 June 2023 (20.06.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/354,339 22 June 2022 (22.06.2022) US

(71) Applicant: **PTC THERAPEUTICS, INC.** [US/US]; 100 Corporate Court, South Plainfield, New Jersey 07080 (US).

(72) Inventors: **ARNOLD, Michael A.**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **ANNAND, James R.**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **ARACHCHILAGE, Gayan Mirihana**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **BHATTACHARYYA, Anuradha**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **CHEN, Guangming**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **CHIU, Jackie**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **DAHIYA, Gaurav**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **JIANG, Yao**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **KIZHAKKAYIL MANGADAN, Arun Raj**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **MORRILL, Christie**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **MOTIKA, Stephen E.**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **NARASIMHAN, Jana**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **WOLL, Matthew G.**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **ZHANG, Nanjing**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US). **ZHANG, Xiaoyan**; 100 Corporate Court, South Plainfield, New Jersey 07080 (US).

(74) Agent: **BILCI, Natalie** et al.; 100 Corporate Court, South Plainfield, New Jersey 07080 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*
— *with sequence listing part of description (Rule 5.2(a))*

(54) Title: COMPOUNDS FOR TREATING SPINOCEREBELLAR ATAXIA TYPE 3

(57) **Abstract:** An aspect of the present description relates to compounds useful for improving pre-mRNA splicing in a cell. In particular, another aspect of the present description relates to substituted heteroaryl compounds, forms, and pharmaceutical compositions thereof and methods of use for treating or ameliorating spinocerebellar ataxia type 3 (SCA3), also known as Machado–Joseph disease (MJD).

WO 2023/250316 A1

COMPOUNDS FOR TREATING SPINOCEREBELLAR ATAXIA TYPE 3

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is an International Application claiming benefit of U.S. Provisional Patent Application No. 63/354,339, filed June 22, 2022, entitled COMPOUNDS FOR TREATING SPINOCEREBELLAR ATAXIA TYPE 3, the contents of which are herein incorporated by reference in its entirety for all purposes.

TECHNICAL FIELD

An aspect of the present description relates to compounds useful for improving pre-mRNA splicing in a cell. In particular, another aspect of the present description relates to substituted heteroaryl compounds, forms, and pharmaceutical compositions thereof and methods of use for treating or ameliorating spinocerebellar ataxia type 3 (SCA3), also known as Machado–Joseph disease (MJD).

BACKGROUND

Spinocerebellar ataxia type 3 (SCA3), also known as Machado–Joseph disease (MJD), is a rare autosomal dominantly inherited disease characterized by progressive ataxia. SCA3 is the most common dominant ataxia worldwide. Although the accurate patient population is unknown, it has been estimated that the average prevalence is 1-5/ 100,000 with higher frequency in China, Portugal, Brazil, Netherlands, Germany, and Japan. It is also significant in the United States wherein SCA3 accounts for ~21% of dominant ataxia. Based on the age of onset, there are three subtypes of SCA3: subtype 1 (early-onset, 10-30yr), subtype 2 (average-onset, 30-50yr), and subtype 3 (late-onset, 50-70yr). The SCA3 patients usually survive 10 to 20 years after the onset of symptoms. Symptoms include slowly progressive clumsiness in the arms and legs, a staggering lurching gait that can be mistaken for drunkenness, difficulty with speech and swallowing, impaired eye movements sometimes accompanied by double vision or bulging eyes, and lower limb spasticity; some individuals develop sustained muscle contractions that cause twisting of the body and limbs, repetitive movements, and abnormal postures; and others may develop twitching of the face or tongue, neuropathy, or problems with urination and the autonomic nervous system.

SCA3 is caused by an unstable expansion of cytosine-adenine-guanine (CAG) trinucleotide repeats in the *ATXN3* gene that transcribes into mutant *ATXN3* (m*ATXN3*) mRNA. This expansion in the m*ATXN3* mRNA leads to production of mutant ataxin-3 protein (ATXN3) containing a polymorphic polyglutamine (polyQ) tract. Both the m*ATXN3* mRNA and the mutant ATXN3 protein disrupt several cellular processes resulting in neurodegeneration in the cerebellum, brainstem, and other connected brain regions.

The number of CAG repeats in the *ATXN3* mRNA ranges 10-45 in the healthy population, whereas in SCA3 patients, it can vary from 61-87. The number of CAG repeats between 45-60 is associated with an incomplete penetrance of the disease. As evidenced in other polyQ disorders, the number of repeats inversely correlates with the age of onset in SCA3 patients.

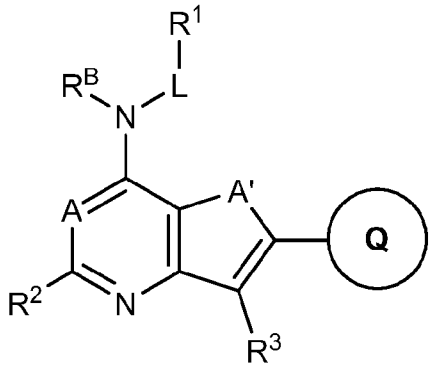
In several preclinical models of SCA3, reduction of ATXN3 protein levels improves SCA3 pathology, thus confirming the importance of ATNX3 lowering as a therapeutic target to ameliorate the downstream pathogenic effects. The present description relates to the use of a compound of Formula (I) or a form or composition thereof for treating SCA3. These sets of compounds induce exon 4 skipping in the *ATXN3* pre-mRNA during the splicing process. Exon 4 skipping of *ATXN3* mRNA changes the open reading frame (ORF) and creates premature termination codons (PTCs) in the *ATXN3* exon 4-skipped mRNA (ΔE4 mRNA). It has been shown that such exon skipping splicing events could serve to reduce gene expression by creating mRNAs with premature termination codons, thus signaling the mRNAs to be degraded rather than translated into proteins. Similarly, *ATXN3* ΔE4 mRNA produced in the presence of these compounds will undergo mRNA degradation resulting in decreased levels of *ATXN3* mRNA, resulting in ATXN3 protein lowering.

To date, there are no disease-modifying therapies available for SCA3, and there exists a need for improved methods and compositions for treating SCA3 and the symptoms associated therewith. The compounds described herein represent potential *ATXN3* pre-mRNA splicing compounds that could be used as a disease-modifying treatment for SCA3.

All other documents referred to herein are incorporated by reference into the present application as though fully set forth herein.

SUMMARY

An aspect of the present description includes compounds of Formula (I):



(I)

or a form thereof, wherein A, A′, L, R^B, R^1, R^2, R^3, and Ring Q are defined herein.

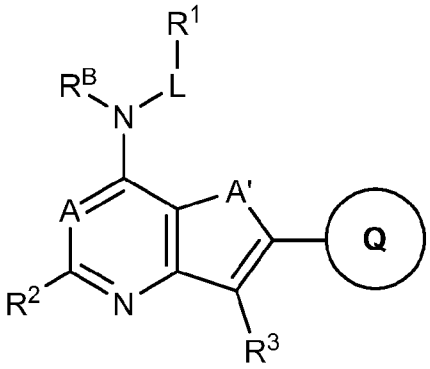
An aspect of the present description includes a method for use of a compound of Formula (I) or a form or composition thereof for treating or ameliorating SCA3 in a subject in need thereof comprising, administering to the subject an effective amount of the compound of Formula (I) or a form or composition thereof.

An aspect of the present description includes a use for a compound of Formula (I) or a form thereof for treating or ameliorating SCA3 in a subject in need thereof comprising, administering to the subject an effective amount of the compound of Formula (I) or a form thereof.

An aspect of the present description includes a use for a compound of Formula (I) or a form thereof in the manufacture of a medicament for treating or ameliorating SCA3 in a subject in need thereof comprising, administering to the subject an effective amount of the medicament.

DETAILED DESCRIPTION

An aspect of the present description relates to compounds of Formula (I):



(I)

or a form thereof, wherein:

A is selected from the group consisting of CR^A and N;

A' is selected from the group consisting of S and $NR^{A'}$;

L is selected from the group consisting of CH_2 and CD_2;

R^A is selected from the group consisting of hydrogen, halo, C_{1-6}alkyl, and C_{3-8}cycloalkyl;

$R^{A'}$ is selected from the group consisting of hydrogen, C_{1-4}alkyl, and halo-C_{1-4}alkyl;

R^B is selected from the group consisting of hydrogen and C_{1-6}alkyl;

R^1 is selected from the group consisting of phenyl, heteroaryl, C_{3-8}cycloalkyl, CO_2C_{1-6}alkyl, C_{2-6}alkenyl, and C_{2-6}alkynyl;

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S;

wherein C_{3-8}cycloalkyl is a saturated or partially unsaturated monocyclic or bicyclic ring system;

wherein phenyl heteroaryl, and C_{3-8}cycloalkyl are substituted with zero, one, two, three, or four, independently selected R^{1a} substituents,

R^{1a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy;

R^2 is selected from the group consisting of hydrogen, cyano, halo, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, and hydroxy-C_{2-6}alkynyl;

R^3 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, SH,

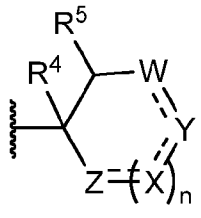
C_{1-6}alkyl, halo-C_{1-6}alkyl, hydroxy-C_{1-6}alkyl, C_{1-6}alkoxy, halo-C_{1-6}alkoxy, thio-C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, hydroxy-C_{2-6}alkynyl, $(CH_3)_3Si$-C_{2-6}alkynyl, heteroaryl-C_{2-6}alkynyl, C_{3-8}cycloalkyl, phenyl, and heteroaryl,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S, and

wherein each instance of C_{3-8}cycloalkyl, phenyl, and heteroaryl are independently substituted with zero, one, two, three, or four, independently selected R^{3a} substituents;

R^{3a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy;

Ring Q is



;

R^4 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, C_{1-6}alkoxy, and halo-C_{1-6}alkoxy;

R^5 is selected from the group consisting of amino, C_{1-4}alkyl-amino, and $(C_{1-4}alkyl)_2$-amino;

W is selected from the group consisting of CH_2, CD_2, CH-R^W, CD-R^W, $C(R^W)_2$, and C(O);

X is selected from the group consisting of CH_2, CD_2, CH-R^X, CD-R^X, $C(R^X)_2$, CH, CD, CR^X, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^X)_2$, C(O), NH, N-C_{1-4}alkyl, N-phenyl, O, S, S(O), and SO_2;

Y is selected from the group consisting of CH_2, CD_2, CH-R^Y, CD-R^Y, $C(R^Y)_2$, CH, CD, CR^Y, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^Y)_2$, N-phenyl, O, S, S(O), and SO_2;

Z is selected from the group consisting of CH_2, CD_2, CH-R^Z, CD-R^Z, $C(R^Z)_2$, CH, CD, CR^Z, NH, N-C_{1-4}alkyl, N-phenyl, O, S, S(O), and SO_2;

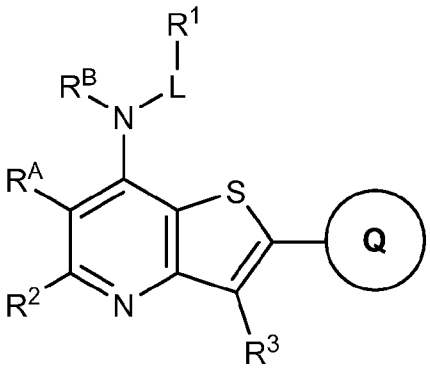
each R^W, R^X, R^Y, R^Z are independently selected from the group consisting of halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, C_{1-6}alkoxy, halo-C_{1-6}alkoxy, amino, C_{1-4}alkyl-amino, (C_{1-4}alkyl)$_2$-amino, CO_2H, CO_2C_{1-6}alkyl, $C(O)NH_2$, $C(O)N(C_{1-6}alkyl)_2$, C(O)-heterocyclyl, and C(O)NH-phenyl, and wherein each R^W, R^X, R^Y, R^Z may combine to form a carbocyclic or heterocyclic ring;

n is selected from the group consisting of 0, 1, 2, and 3; and

– – – – independently represents a single bond or a double bond as valency permits;

wherein a form of the compound is a pharmaceutically acceptable salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

One aspect includes a compound of Formula (I), wherein the compound is a compound of Formula (Ia) or a form thereof



(Ia).

Another aspect includes a compound of Formula (Ia) or a form thereof, wherein

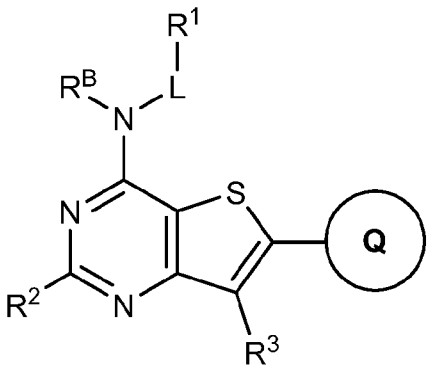
L is CH_2 or CD_2;

R^A is hydrogen;

R^B is hydrogen or CH_3; and

R^2 is Cl or CN.

One aspect includes a compound of Formula (I), wherein the compound is a compound of Formula (Ib) or a form thereof



(Ib).

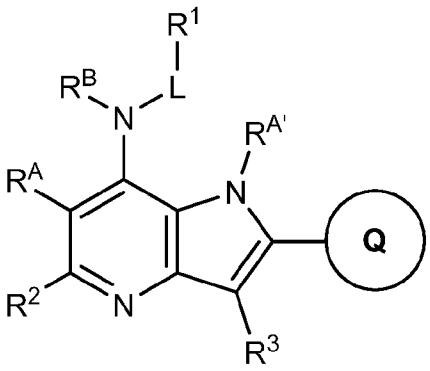
Another aspect includes a compound of Formula (Ib) or a form thereof, wherein

L is CH_2;

R^B is hydrogen; and

R^2 is Cl.

One aspect includes a compound of Formula (I), wherein the compound is a compound of Formula (Ic) or a form thereof



(Ic).

Another aspect includes a compound of Formula (Ic) or a form thereof, wherein

L is CH_2;

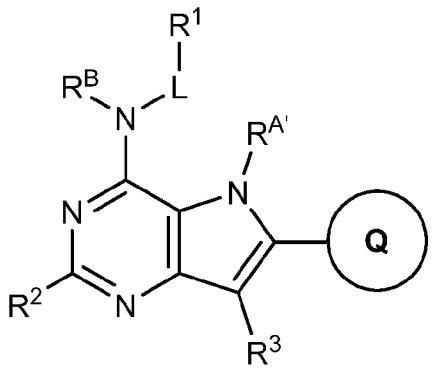
R^A is hydrogen;

$R^{A'}$ is CH_3 or CHF_2;

R^B is hydrogen; and

R^2 is Cl.

One aspect includes a compound of Formula (I), wherein the compound is a compound of Formula (Id) or a form thereof



(Id).

Another aspect includes a compound of Formula (Id) or a form thereof, wherein

L is CH_2;

$R^{A'}$ is CHF_2:

R^B is hydrogen; and

R^2 is Cl.

One aspect includes a compound of Formula (I), wherein A is selected from the group consisting of CR^A and N.

Another aspect includes a compound of Formula (I), wherein A is CR^A.

Another aspect includes a compound of Formula (I), wherein A is N.

One aspect includes a compound of Formula (I), wherein A′ is selected from the group consisting of S and $NR^{A'}$.

Another aspect includes a compound of Formula (I), wherein A′ is S.

Another aspect includes a compound of Formula (I), wherein A′ is $NR^{A'}$.

One aspect includes a compound of Formula (I), wherein L is selected from the group consisting of CH_2 and CD_2.

One aspect includes a compound of Formula (I), wherein R^A is selected from the group consisting of hydrogen, halo, C_{1-6}alkyl, and C_{3-8}cycloalkyl.

Another aspect includes a compound of Formula (I), wherein R^A is hydrogen.

One aspect includes a compound of Formula (I), wherein $R^{A'}$ is selected from the group consisting of hydrogen, C_{1-4}alkyl, and halo-C_{1-4}alkyl.

Another aspect includes a compound of Formula (I), wherein $R^{A'}$ is selected from the group consisting of CH_3 and CHF_2.

One aspect includes a compound of Formula (I), wherein R^B is selected from the group consisting of hydrogen and C_{1-6}alkyl.

Another aspect includes a compound of Formula (I), wherein R^B is selected from the group consisting of hydrogen and CH_3.

One aspect includes a compound of Formula (I), wherein R^1 is selected from the group consisting of phenyl, heteroaryl, C_{3-8}cycloalkyl, CO_2C_{1-6}alkyl, C_{2-6}alkenyl, and C_{2-6}alkynyl;

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S;

wherein C_{3-8}cycloalkyl is a saturated or partially unsaturated monocyclic or bicyclic ring system;

wherein phenyl heteroaryl, and C_{3-8}cycloalkyl are substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

Another aspect includes a compound of Formula (I), wherein R^1 is phenyl substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

Another aspect includes a compound of Formula (I), wherein R^1 is unsubstituted phenyl.

Another aspect includes a compound of Formula (I), wherein R^1 is phenyl substituted with one R^{1a} substituent.

Another aspect includes a compound of Formula (I), wherein R^1 is heteroaryl substituted with zero, one, two, three, or four, independently selected R^{1a} substituents,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S.

Another aspect includes a compound of Formula (I), wherein R^1 is unsubstituted heteroaryl,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S.

Another aspect of includes a compound of Formula (I), wherein R^1 is heteroaryl selected from furanyl, thiophenyl, 1H-pyrazolyl, 1H-imidazolyl, isoxazolyl, 1,3-thiazolyl, 1,3-oxazolyl, tetrazolyl, 1,2,3-triazolyl, 1,2,4-oxadiazolyl, 1,3,4-oxadiazolyl, 1,2,3-thiadiazolyl,

pyridinyl, pyrimidinyl, pyrazinyl, pyridazinyl, benzofuranyl, and quinolinyl, wherein heteroaryl is substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

Another aspect of includes a compound of Formula (I), wherein R^1 is heteroaryl selected from furanyl, and thiophenyl, wherein heteroaryl is substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

Another aspect of includes a compound of Formula (I), wherein R^1 is unsubstituted heteroaryl selected from furanyl, thiophenyl, 1,3-thiazolyl, 1,3-oxazolyl, and pyridinyl.

Another aspect includes a compound of Formula (I), wherein R^1 is heteroaryl selected from furan-2-yl, furan-3-yl, thiophen-2-yl, thiophen-3-yl, 1H-pyrazol-1-yl, 1H-pyrazol-3-yl, 1*H*-pyrazol-4-yl, 1*H*-pyrazol-5-yl, 1*H*-imidazol-1-yl, 1*H*-imidazol-4-yl, isoxazol-3-yl, isoxazol-4-yl, isoxazol-5-yl, 1,3-thiazol-2-yl, 1,3-thiazol-4-yl, 1,3-thiazol-5-yl, 1,3-oxazol-2-yl, 1,3-oxazol-4-yl, 1,3-oxazol-5-yl, 1,2,4-oxadiazol-3-yl, 1,3,4-oxadiazol-2-yl, tetrazol-5-yl, 1,2,3-triazol-4-yl, 1,2,3-triazol-5-yl, 1,2,3-thiadiazol-4-yl, 1,2,3-thiadiazol-5-yl, pyridin-2-yl, pyridin-3-yl, pyridin-4-yl, pyrimidin-4-yl, pyrazin-2-yl, pyridazin-3-yl, pyridazin-4-yl, benzofuran-2-yl, benzofuran-5-yl, and quinoline-4-yl, wherein heteroaryl is substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

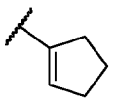
Another aspect includes a compound of Formula (I), wherein R^1 is heteroaryl selected from furan-2-yl, thiophen-2-yl, thiophen-3-yl, 1,3-thiazol-2-yl, 1,3-oxazol-2-yl, and pyridin-4-yl, wherein heteroaryl is substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

Another aspect of includes a compound of Formula (I), wherein R^1 is unsubstituted heteroaryl selected from furan-2-yl, thiophen-2-yl, thiophen-3-yl, 1,3-thiazol-2-yl, 1,3-oxazol-2-yl, and pyridin-4-yl.

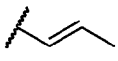
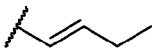
One aspect includes a compound of Formula (I), wherein R^1 is $CO_2C_{1\text{-}6}$alkyl.

Another aspect includes a compound of Formula (I), wherein R^1 is CO_2CH_3.

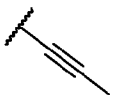
One aspect includes a compound of Formula (I), wherein R^1 is $C_{3\text{-}8}$cycloalkyl, wherein $C_{3\text{-}8}$cycloalkyl is a saturated or partially unsaturated monocyclic or bicyclic ring system substituted with zero, one, two, three, or four, independently selected R^{1a} substituents.

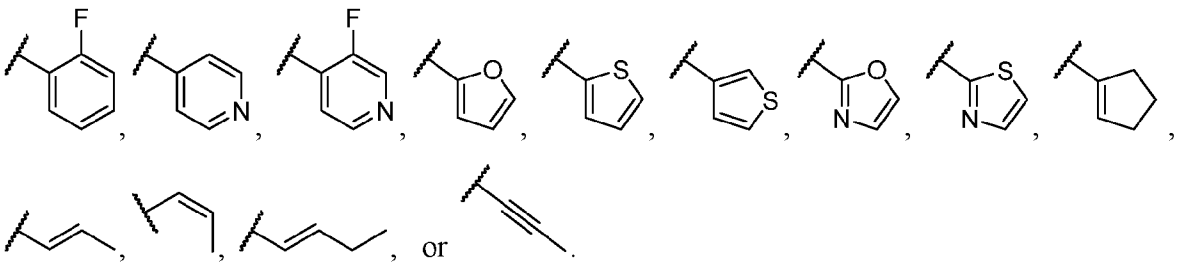
Another aspect includes a compound of Formula (I), wherein R^1 is .

One aspect includes a compound of Formula (I), wherein R^1 is C_{2-6}alkenyl.

Another aspect of includes a compound of Formula (I), wherein R^1 is , , or .

One aspect includes a compound of Formula (I), wherein R^1 is C_{2-6}alkynyl.

Another aspect of includes a compound of Formula (I), wherein R^1 is .

Another aspect of includes a compound of Formula (I), wherein R^1 is phenyl, CO_2CH_3, .

One aspect includes a compound of Formula (I), wherein R^{1a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy.

Another aspect includes a compound of Formula (I), wherein R^{1a} is halo.

Another aspect includes a compound of Formula (I), wherein R^{1a} is halo selected from fluoro, chloro, bromo, and iodo.

Another aspect includes a compound of Formula (I), wherein R^{1a} is fluoro.

One aspect includes a compound of Formula (I), wherein R^2 is selected from the group consisting of hydrogen, cyano, halo, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, and hydroxy-C_{2-6}alkynyl;.

Another aspect includes a compound of Formula (I), wherein R^2 is cyano.

Another aspect includes a compound of Formula (I), wherein R^2 is halo.

Another aspect includes a compound of Formula (I), wherein R^2 is halo selected from fluoro, chloro, bromo, and iodo.

Another aspect includes a compound of Formula (I), wherein R^2 is chloro.

One aspect includes a compound of Formula (I), wherein R^3 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, SH, C_{1-6}alkyl, halo-C_{1-6}alkyl, hydroxy-C_{1-6}alkyl, C_{1-6}alkoxy, halo-C_{1-6}alkoxy, thio-C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl,

hydroxy-C_{2-6}alkynyl, $(CH_3)_3Si$-C_{2-6}alkynyl, heteroaryl-C_{2-6}alkynyl, C_{3-8}cycloalkyl, phenyl, and heteroaryl,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S, and

wherein each instance of C_{3-8}cycloalkyl, phenyl, and heteroaryl are independently substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

Another aspect includes a compound of Formula (I), wherein R^3 is selected from the group consisting of hydrogen, cyano, halo, C_{1-6}alkyl, halo-C_{1-6}alkyl, hydroxy-C_{1-6}alkyl, halo-C_{1-6}alkoxy, C_{2-6}alkenyl, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, hydroxy-C_{2-6}alkynyl, $(CH_3)_3Si$-C_{2-6}alkynyl, heteroaryl-C_{2-6}alkynyl, C_{3-8}cycloalkyl, and phenyl,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S, and

wherein C_{3-8}cycloalkyl, phenyl, and heteroaryl are independently substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

Another aspect includes a compound of Formula (I), wherein R^3 is hydrogen.

Another aspect includes a compound of Formula (I), wherein R^3 is cyano.

Another aspect includes a compound of Formula (I), wherein R^3 is halo.

Another aspect includes a compound of Formula (I), wherein R^3 is halo selected from fluoro, chloro, bromo, and iodo.

Another aspect includes a compound of Formula (I), wherein R^3 is chloro.

Another aspect includes a compound of Formula (I), wherein R^3 is bromo.

Another aspect includes a compound of Formula (I), wherein R^3 is iodo.

Another aspect includes a compound of Formula (I), wherein R^3 is C_{1-6}alkyl selected from methyl, ethyl, propyl, isopropyl, butyl, tert-butyl, pentyl, and hexyl.

Another aspect includes a compound of Formula (I), wherein R^3 is methyl.

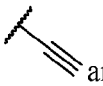
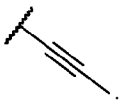
Another aspect includes a compound of Formula (I), wherein R^3 is ethyl.

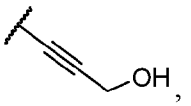
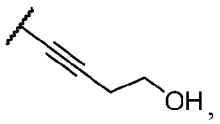
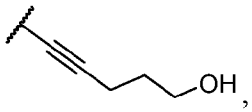
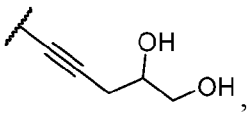
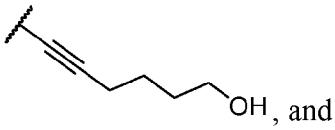
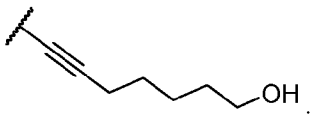
Another aspect includes a compound of Formula (I), wherein R^3 is halo-C_{1-6}alkyl selected from the group consisting of CH_2F, CHF_2, CF_3, and CH_2CH_2F.

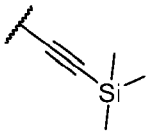
Another aspect includes a compound of Formula (I), wherein R^3 is hydroxy-C_{1-6}alkyl selected from CH_2OH.

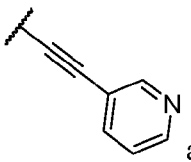
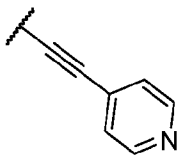
Another aspect includes a compound of Formula (I), wherein R^3 is halo-C_{1-6}alkoxy selected from CH_2OCHF_2.

Another aspect includes a compound of Formula (I), wherein R^3 is C_{2-6}alkenyl selected from $CH{=}CH_2$ and $CH{=}C{=}CH_2$.

Another aspect includes a compound of Formula (I), wherein R^3 is C_{2-6}alkynyl selected from the group consisting of  and .

Another aspect includes a compound of Formula (I), wherein R^3 is hydroxy-C_{2-6}alkynyl selected from the group consisting of , , , , , and .

Another aspect includes a Formula (I), wherein R^3 is $(CH_3)_3Si$-C_{2-6}alkynyl selected from .

Another aspect includes a Formula (I), wherein R^3 is heteroaryl-C_{2-6}alkynyl selected from  and , wherein the heteroaryl ring is substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

Another aspect includes a compound of Formula (I), wherein R^3 is C_{3-8}cycloalkyl selected from cyclopropyl, cyclobutyl, cyclopentyl, cylcohexyl, cycloheptyl, and cyclcooctyl substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

Another aspect includes a compound of Formula (I), wherein R^3 is cyclopropyl substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

Another aspect includes a compound of Formula (I), wherein R^3 is unsubstituted cyclopropyl.

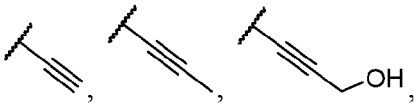
Another aspect includes a compound of Formula (I), wherein R^3 is phenyl substituted with zero, one, two, three, or four, independently selected R^{3a} substituents.

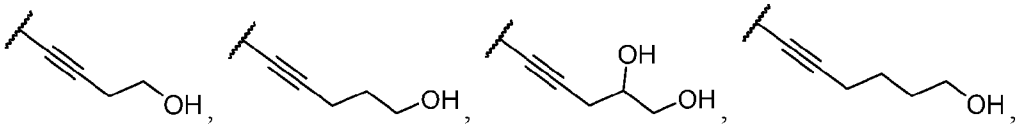
Another aspect includes a compound of Formula (I), wherein R^3 is unsubstituted phenyl.

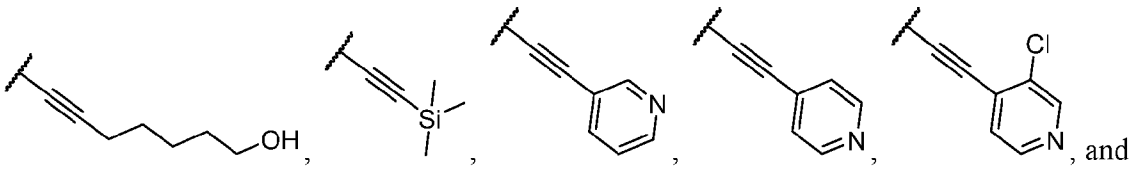
One aspect includes a compound of Formula (I), wherein R^{3a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy.

Another aspect includes a compound of Formula (I), wherein R^{3a} is selected from the group consisting of Cl and OCH_3.

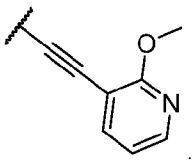
Another aspect includes a compound of Formula (I), wherein R^3 is selected from the group consisting of hydrogen, cyano, Cl, Br, I, CH_3, CH_2CH_3, CHF_2, CF_3, CH_2CH_2F, CH_2OH, CH_2OCHF_2, $CH{=}CH_2$, $CH{=}C{=}CH_2$, cyclopropyl, phenyl,



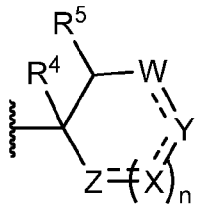




and



One aspect includes a compound of Formula (I), wherein Ring Q is



and any stereoisomers thereof.

One aspect includes a compound of Formula (I), wherein R^4 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, C_{1-6}alkoxy, and halo-C_{1-6}alkoxy.

Another aspect includes a compound of Formula (I), wherein R^4 is selected from the group consisting of hydrogen, halo, and hydroxy.

Another aspect includes a compound of Formula (I), wherein R^4 is selected from the group consisting of hydrogen.

Another aspect includes a compound of Formula (I), wherein R^4 is halo.

Another aspect includes a compound of Formula (I), wherein R^4 is halo selected from fluoro, chloro, bromo, and iodo.

Another aspect includes a compound of Formula (I), wherein R^4 is fluoro.

Another aspect includes a compound of Formula (I), wherein R^4 is hydroxy.

One aspect includes a compound of Formula (I), wherein R^5 is selected from the group consisting of amino, $C_{1\text{-}4}$alkyl-amino, and $(C_{1\text{-}4}alkyl)_2$-amino.

Another aspect includes a compound of Formula (I), wherein R^5 is amino.

Another aspect includes a compound of Formula (I), wherein R^5 is $(C_{1\text{-}4}alkyl)_2$-amino.

Another aspect includes a compound of Formula (I), wherein R^5 is $N_2(CH_3)$.

Another aspect includes a compound of Formula (I), wherein R^5 is $C_{1\text{-}4}$alkyl-amino.

Another aspect includes a compound of Formula (I), wherein R^5 is $NH(CH_3)$.

One aspect includes a compound of Formula (I), wherein W is selected from the group consisting of CH_2, CD_2, CH-R^w, CD-R^w, $C(R^w)_2$, and C(O).

Another aspect includes a compound of Formula (I), wherein W is CH_2.

Another aspect includes a compound of Formula (I), wherein W is CD_2.

Another aspect includes a compound of Formula (I), wherein W is C(O).

One aspect includes a compound of Formula (I), wherein X is selected from the group consisting of CH_2, CD_2, CH-R^X, CD-R^X, $C(R^X)_2$, CH, CD, CR^X, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^X)_2$, C(O), NH, N-$C_{1\text{-}4}$alkyl, N-phenyl, O, S, S(O), and SO_2.

Another aspect includes a compound of Formula (I), wherein X is CH_2.

Another aspect includes a compound of Formula (I), wherein X is CH-R^X.

Another aspect includes a compound of Formula (I), wherein X is $C(R^X)_2$.

Another aspect includes a compound of Formula (I), wherein X is CH.

Another aspect includes a compound of Formula (I), wherein X is CD.

Another aspect includes a compound of Formula (I), wherein X is CR^X.

Another aspect includes a compound of Formula (I), wherein X is C(O).

Another aspect includes a compound of Formula (I), wherein X is NH.

Another aspect includes a compound of Formula (I), wherein X is O.

One aspect includes a compound of Formula (I), wherein Y is selected from the group consisting of CH_2, CD_2, CH-R^Y, CD-R^Y, $C(R^Y)_2$, CH, CD, CR^Y, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^Y)_2$, N-phenyl, O, S, S(O), and SO_2.

Another aspect includes a compound of Formula (I), wherein Y is CH_2.

Another aspect includes a compound of Formula (I), wherein Y is CD_2.

Another aspect includes a compound of Formula (I), wherein Y is CH-R^Y.

Another aspect includes a compound of Formula (I), wherein Y is $C(R^Y)_2$.

Another aspect includes a compound of Formula (I), wherein Y is CH.

Another aspect includes a compound of Formula (I), wherein Y is CD.

Another aspect includes a compound of Formula (I), wherein Y is CR^Y.

Another aspect includes a compound of Formula (I), wherein Y is $C{=}CH_2$.

Another aspect includes a compound of Formula (I), wherein Y is O.

Another aspect includes a compound of Formula (I), wherein Y is N-$C_{1\text{-}4}$alkyl, wherein $C_{1\text{-}4}$alkyl is selected from methyl, ethyl, propyl, isopropyl, butyl, and tert-butyl.

Another aspect includes a compound of Formula (I), wherein Y is N-CH_3.

One aspect includes a compound of Formula (I), wherein Z is selected from the group consisting of CH_2, CD_2, CH-R^Z, CD-R^Z, $C(R^Z)_2$, CH, CD, CR^Z, NH, N-$C_{1\text{-}4}$alkyl, N-phenyl, O, S, S(O), and SO_2.

Another aspect includes a compound of Formula (I), wherein Z is CH_2.

Another aspect includes a compound of Formula (I), wherein Z is CD_2.

Another aspect includes a compound of Formula (I), wherein Z is CH-R^Z.

Another aspect includes a compound of Formula (I), wherein Z is $C(R^Z)_2$.

Another aspect includes a compound of Formula (I), wherein Z is NH.

Another aspect includes a compound of Formula (I), wherein Z is N-phenyl.

Another aspect includes a compound of Formula (I), wherein Z is O.

One aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently selected from the group consisting of halo, hydroxy, $C_{1\text{-}6}$alkyl, halo-$C_{1\text{-}6}$alkyl, $C_{1\text{-}6}$alkoxy, halo-$C_{1\text{-}6}$alkoxy, amino, $C_{1\text{-}4}$alkyl-amino, ($C_{1\text{-}4}$alkyl)$_2$-amino, CO_2H, $CO_2C_{1\text{-}6}$alkyl,

$C(O)NH_2$, $C(O)N(C_{1\text{-}6}alkyl)_2$, C(O)-heterocyclyl, and C(O)NH-phenyl, and wherein each R^W, R^X, R^Y, R^Z may combine to form a carbocyclic or heterocyclic ring.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently halo selected from fluoro, chloro, bromo, and iodo.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently fluoro.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently hydroxy.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $C_{1\text{-}6}alkyl$.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently methyl.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $C_{1\text{-}6}alkoxy$.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently methoxy.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently CO_2H.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $CO_2C_{1\text{-}6}alkyl$.

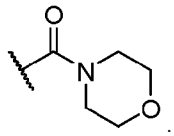
Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $CO_2CH_2CH_3$.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $C(O)NH_2$.

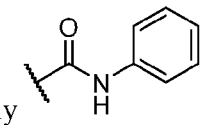
Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $C(O)N(C_{1\text{-}6}alkyl)_2$.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently $C(O)N(CH_3)_2$.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently C(O)-heterocyclyl.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently .

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently C(O)NH-phenyl.

Another aspect includes a compound of Formula (I), wherein each R^W, R^X, R^Y, R^Z are independently .

One aspect includes a compound of Formula (I), wherein n is selected from the group consisting of 0, 1, 2, and 3.

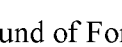
Another aspect includes a compound of Formula (I), wherein n is 0.

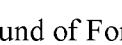
Another aspect includes a compound of Formula (I), wherein n is 1.

Another aspect includes a compound of Formula (I), wherein n is 2.

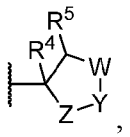
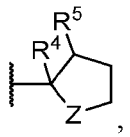
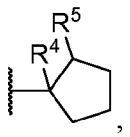
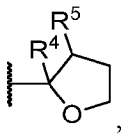
Another aspect includes a compound of Formula (I), wherein n is 3.

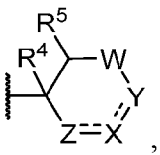
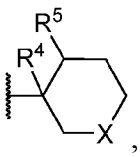
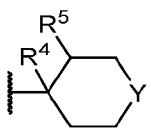
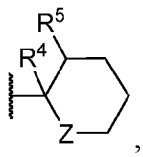
One aspect includes a compound of Formula (I), wherein  independently represents a single bond or a double bond as valency permits.

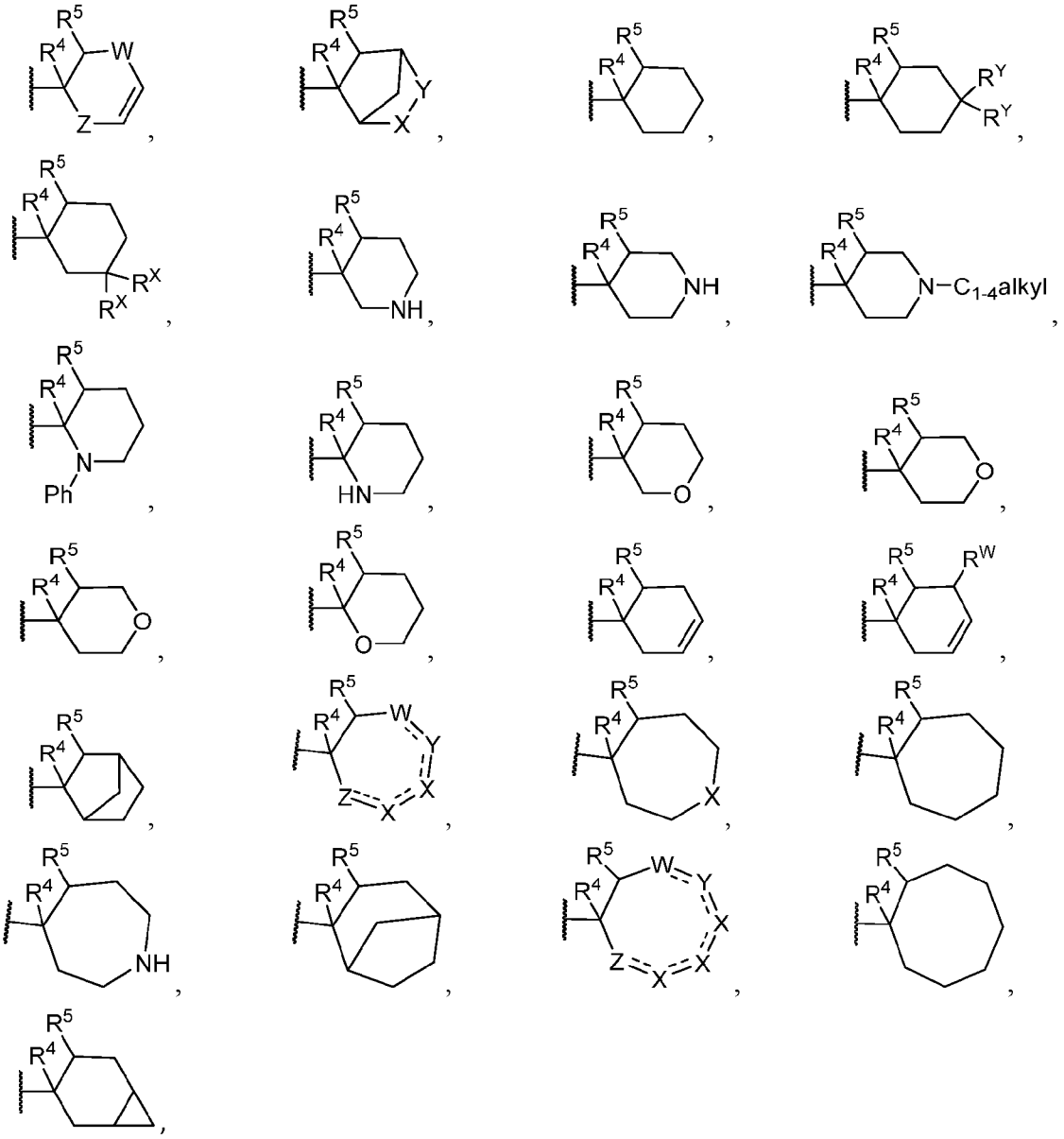
Another aspect includes a compound of Formula (I), wherein  represents a single bond as valency permits.

Another aspect includes a compound of Formula (I), wherein  represents a double bond as valency permits.

One aspect includes a compound of Formula (I), wherein Ring Q is selected from the group consisting of

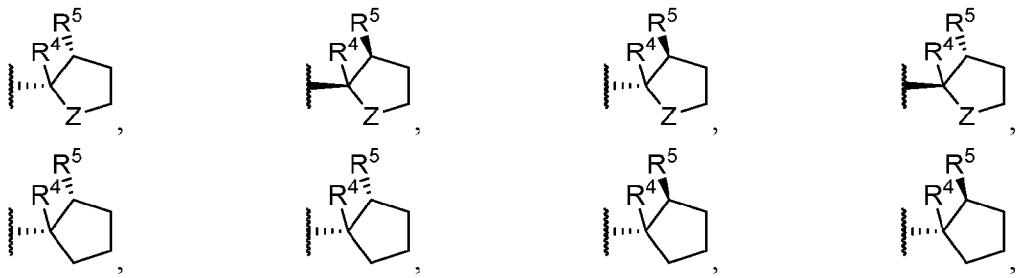
, , , ,

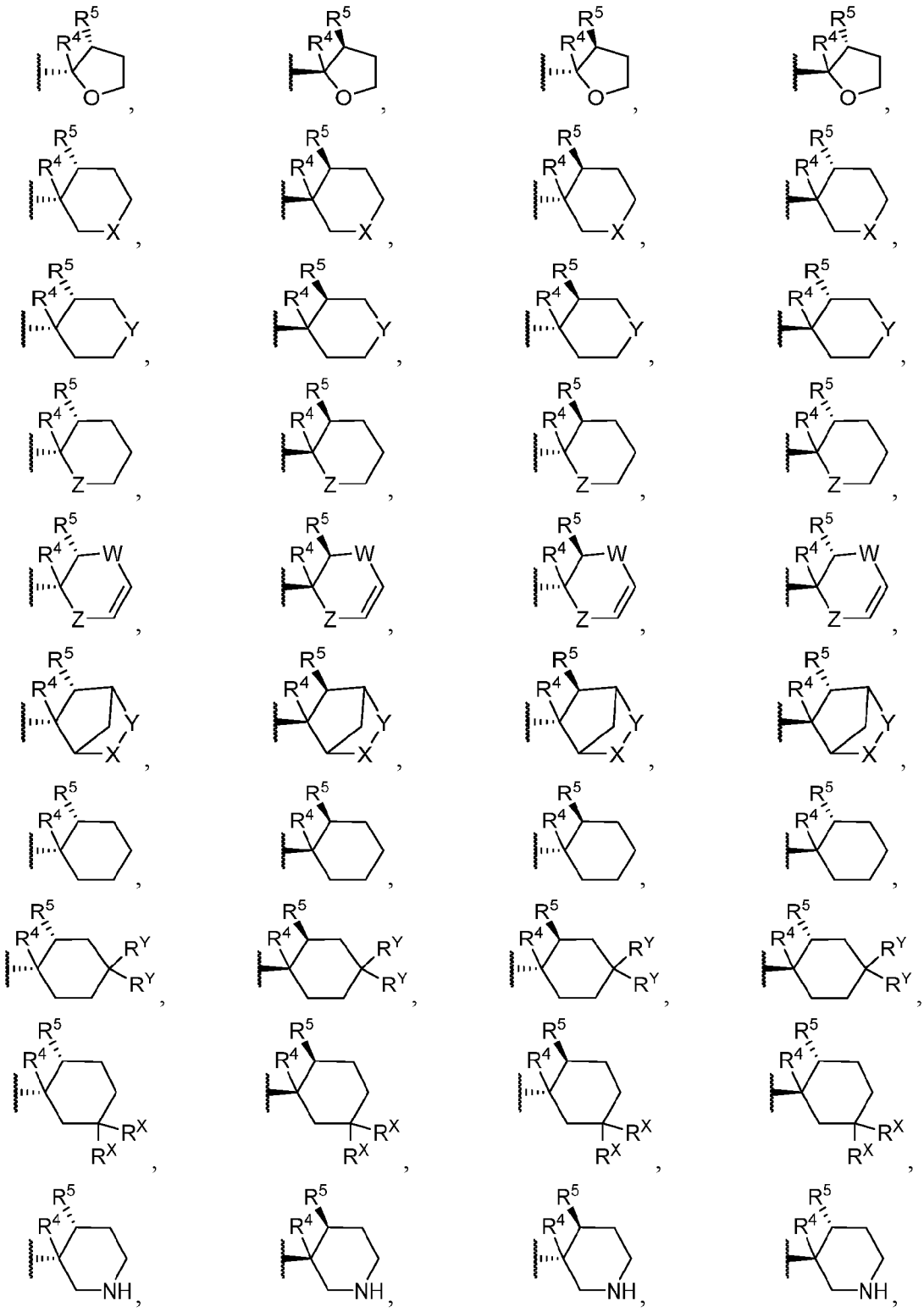
, , , .

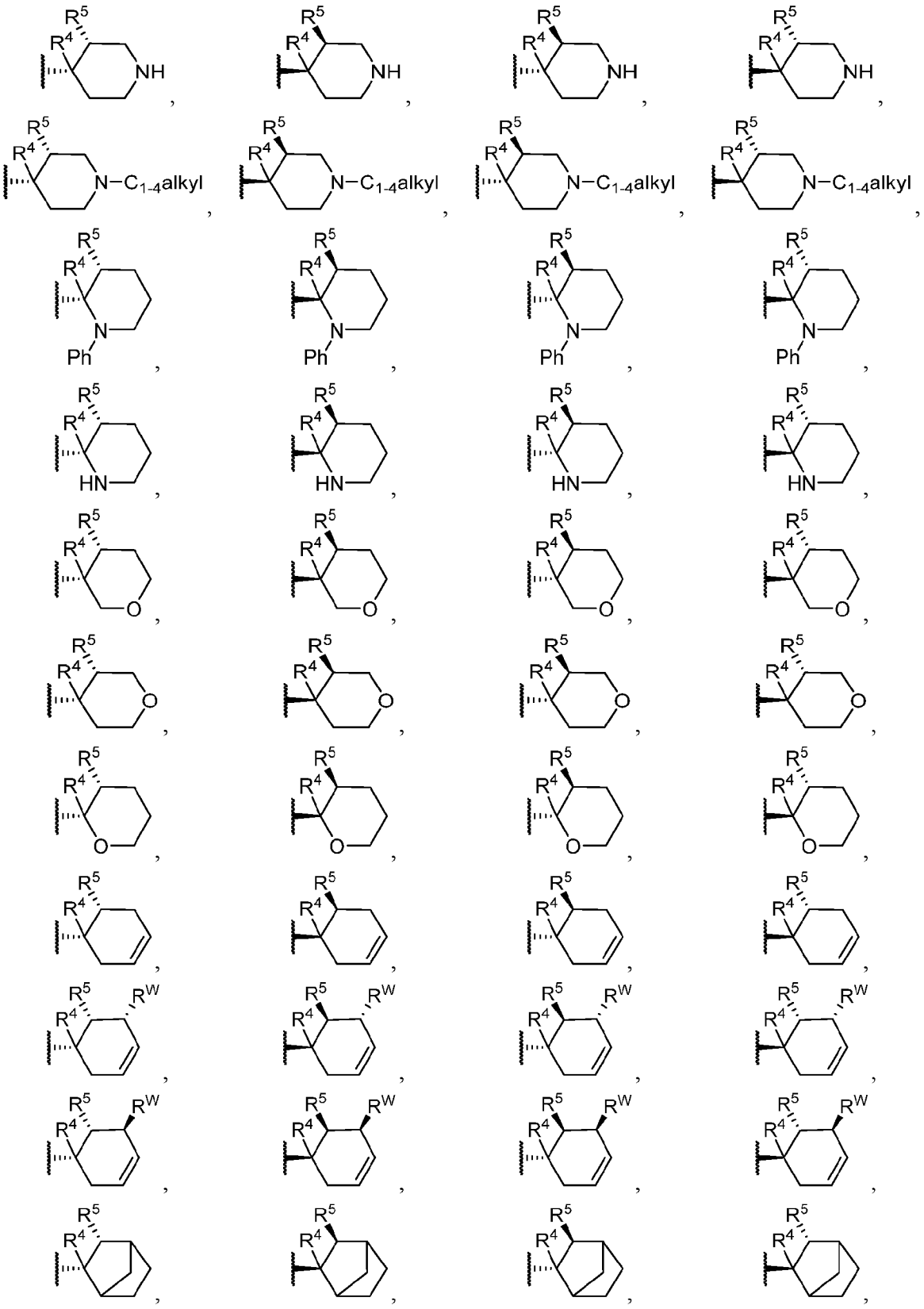


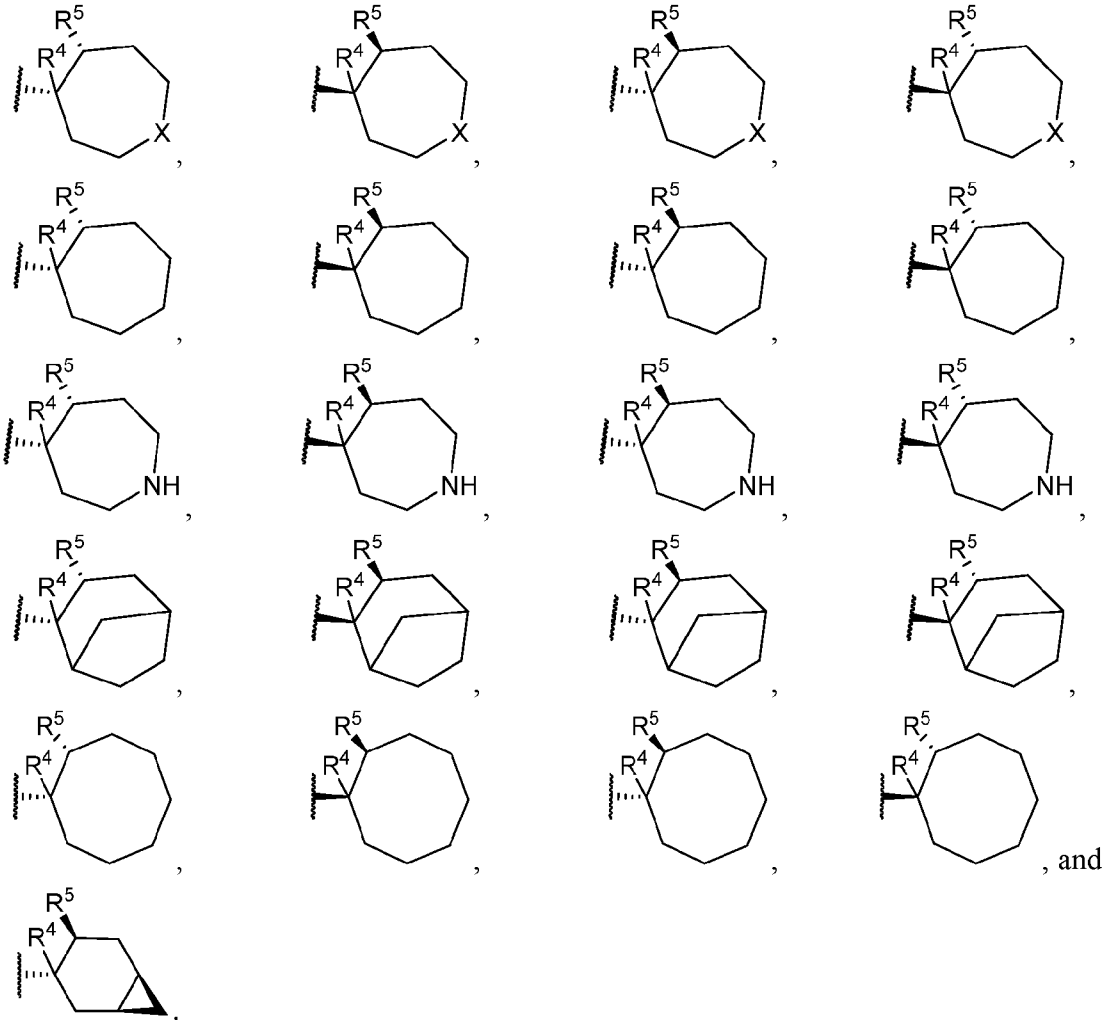
and any stereoisomers thereof.

One aspect includes a compound of Formula (I), wherein Ring Q is selected from the group consisting of



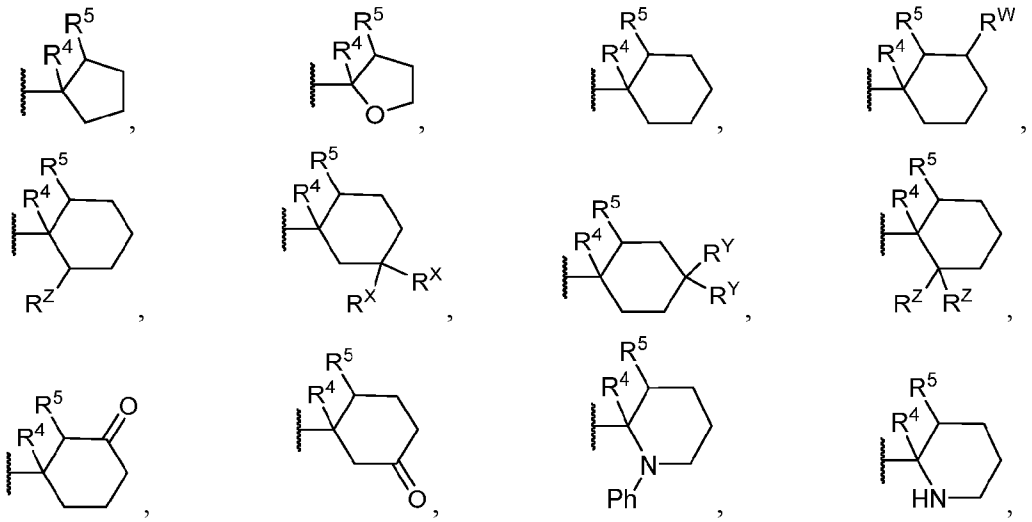


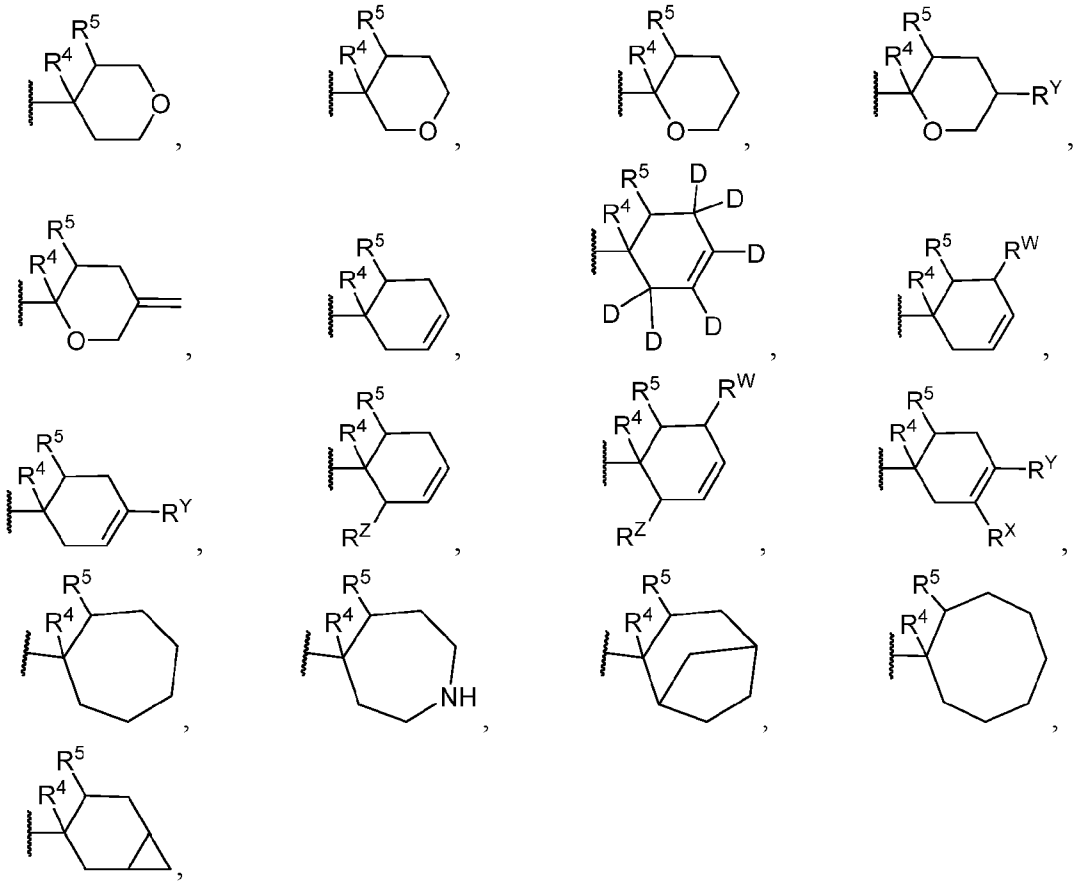




, and

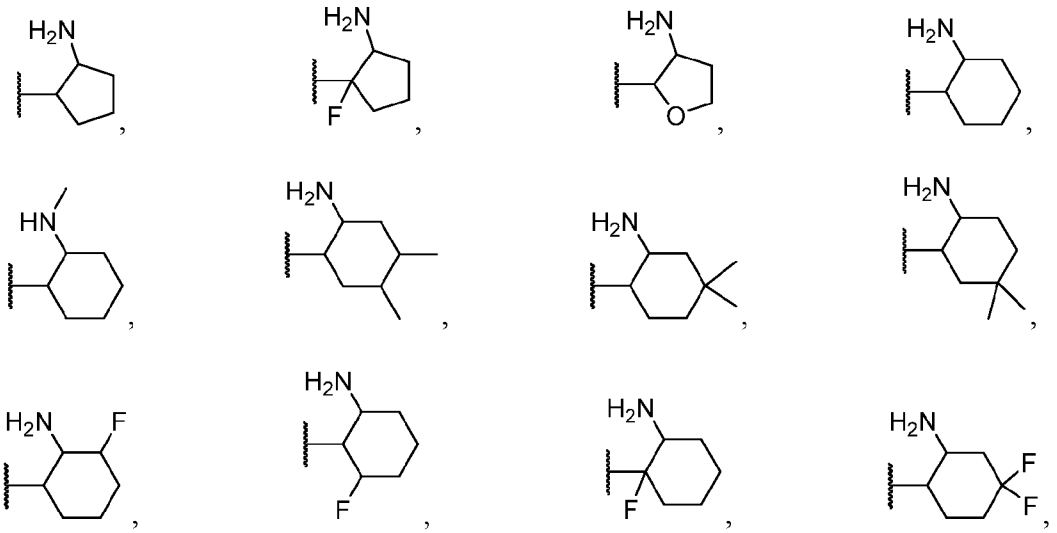
One aspect includes a compound of Formula (I), wherein Ring Q is selected from the group consisting of

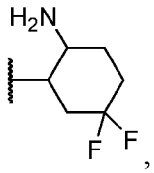
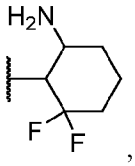
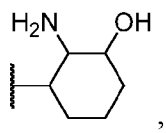
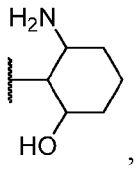
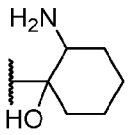
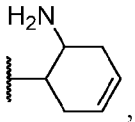
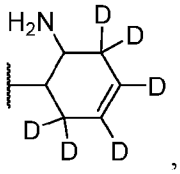
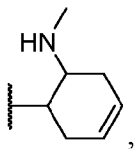
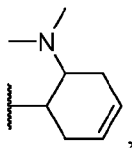
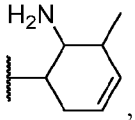
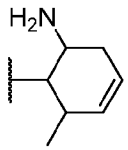
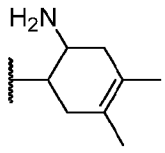
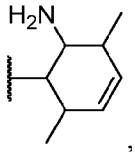
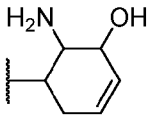
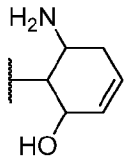
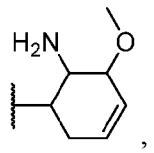
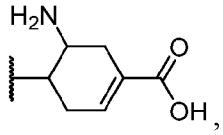
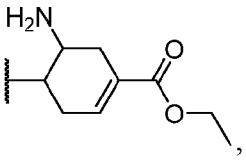
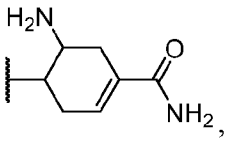
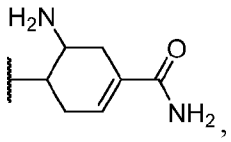
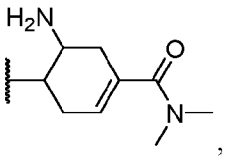
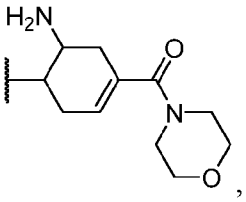
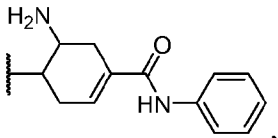
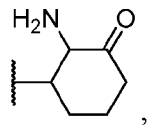
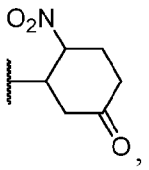
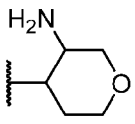
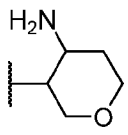
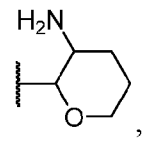
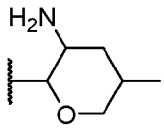
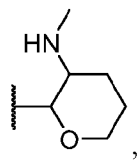
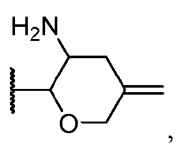
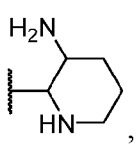


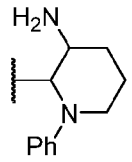
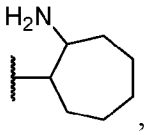
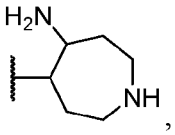
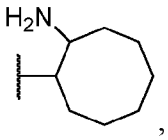
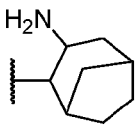
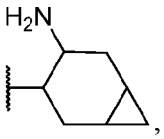


and any stereoisomers thereof.

One aspect includes a compound of Formula (I), wherein Ring Q is selected from the group consisting of

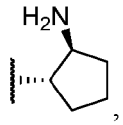
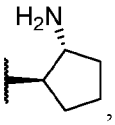
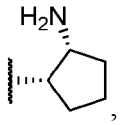
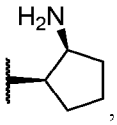
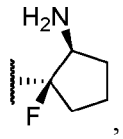
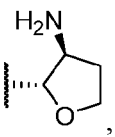
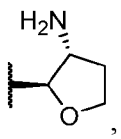
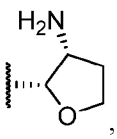
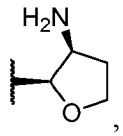
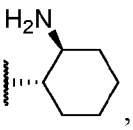
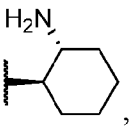
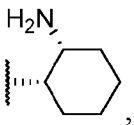
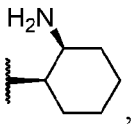
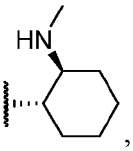
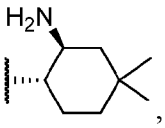
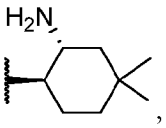
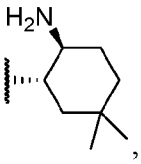
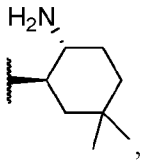
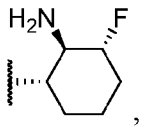
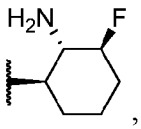
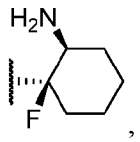
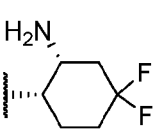
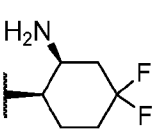
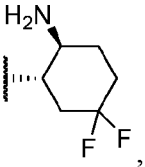


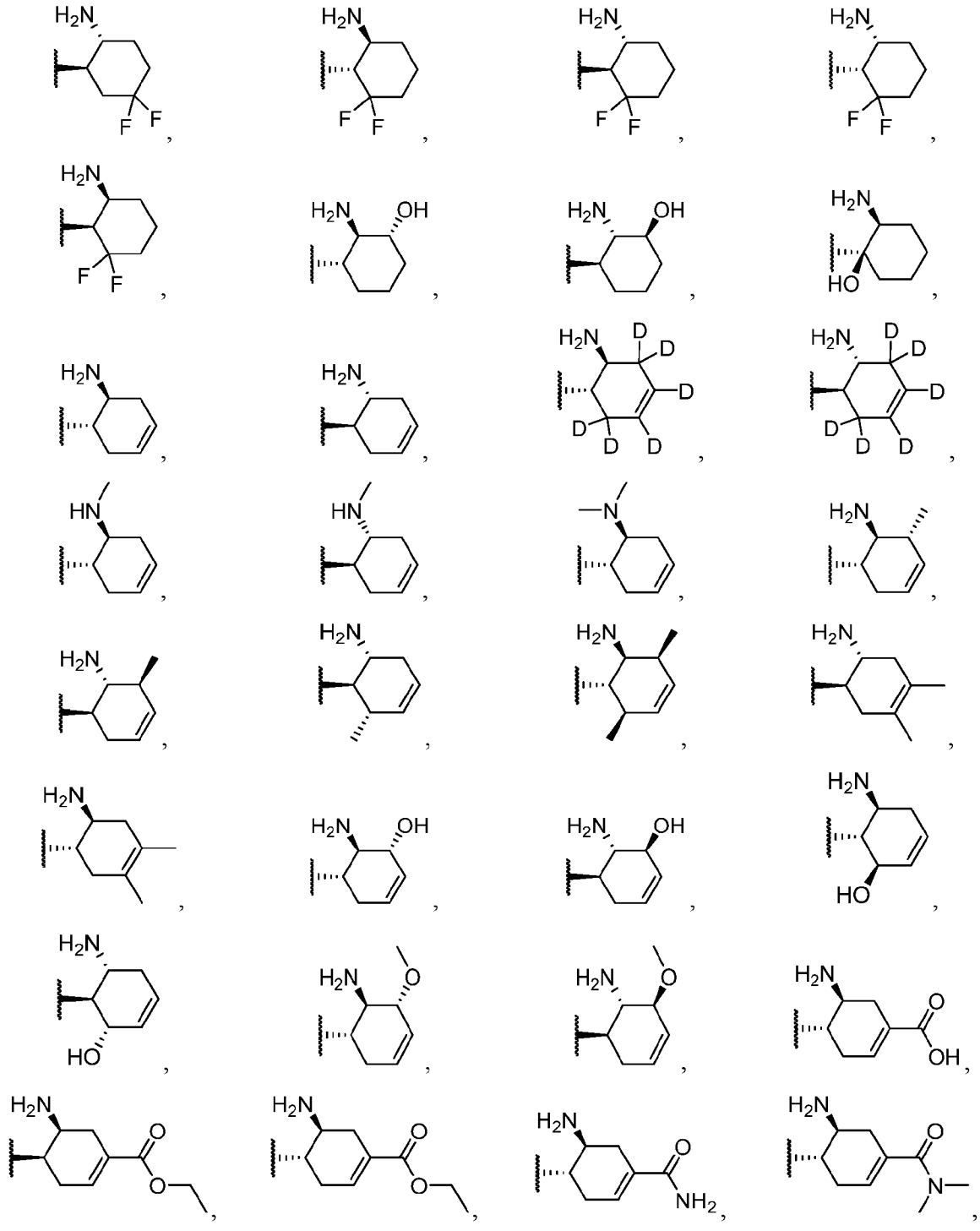

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

,

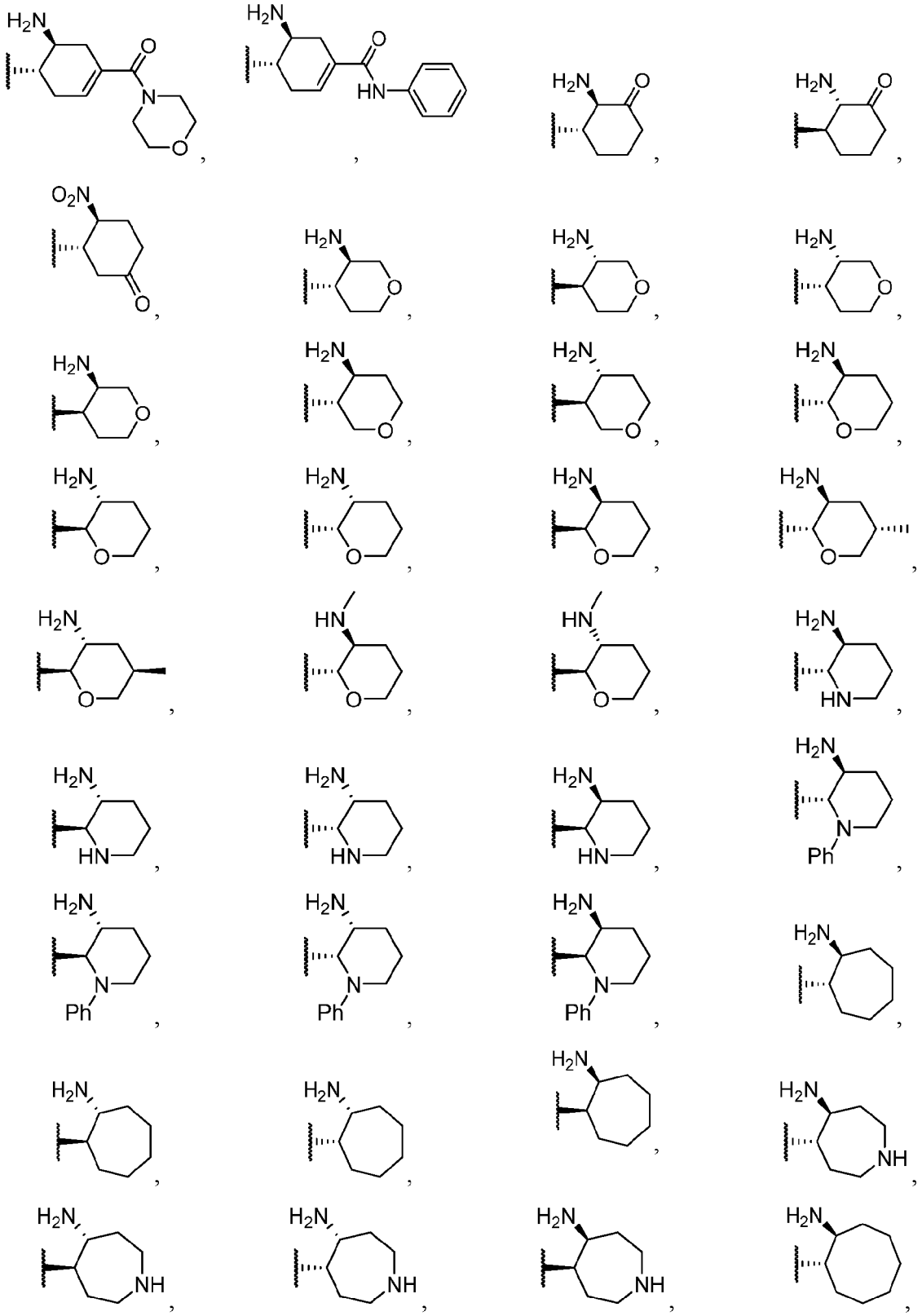







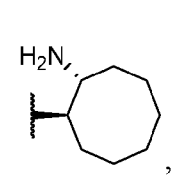
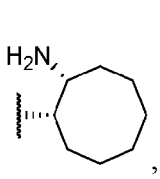
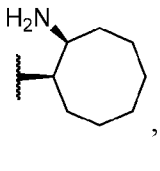
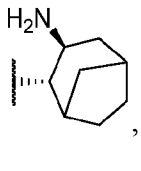
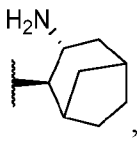
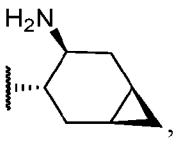
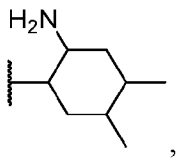
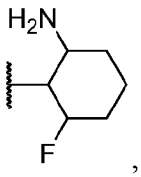
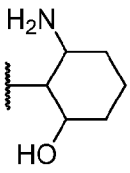
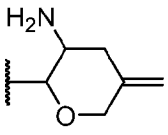
and any stereoisomers thereof.

One aspect includes a compound of Formula (I), wherein Ring Q is selected from the group consisting of

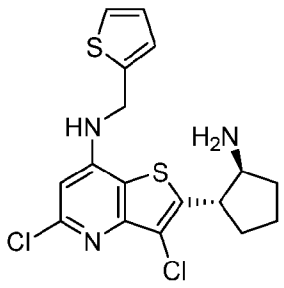
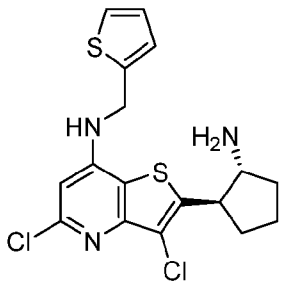
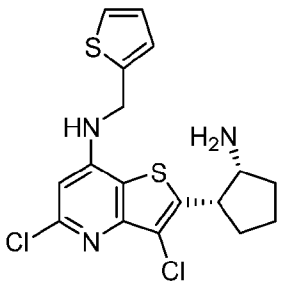
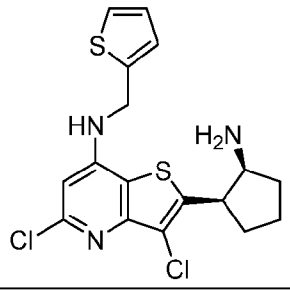
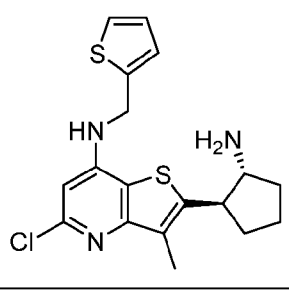
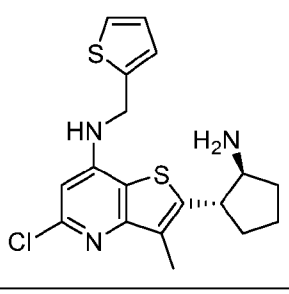

























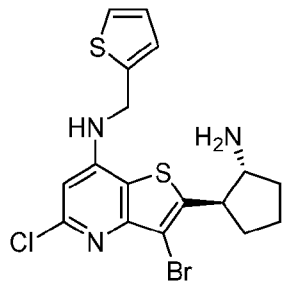
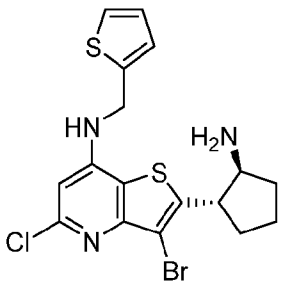
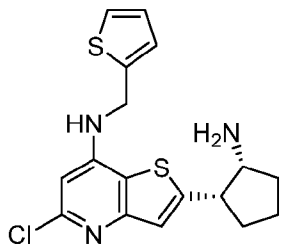
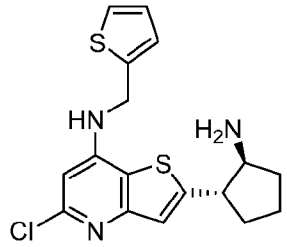
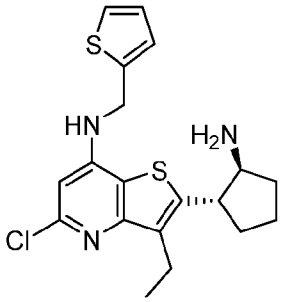
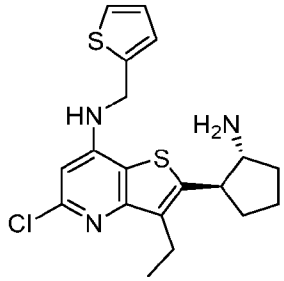
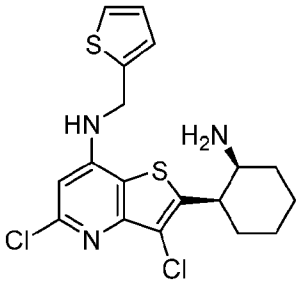
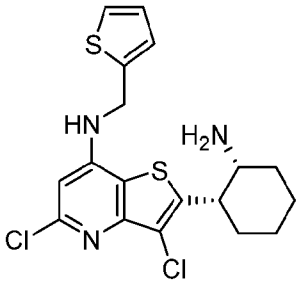
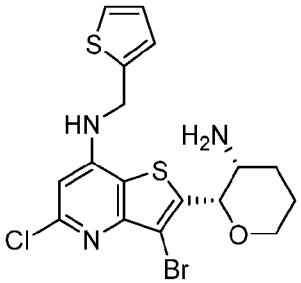
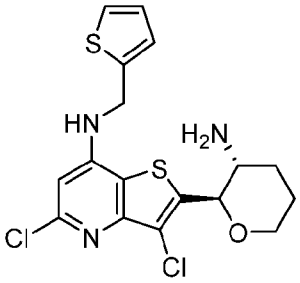
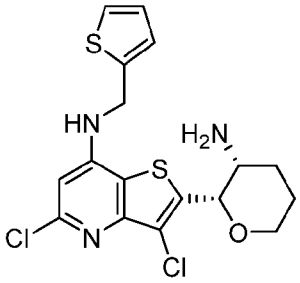
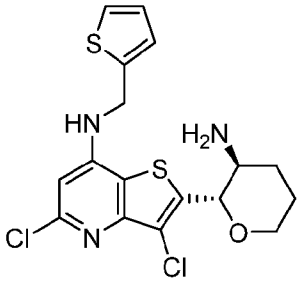


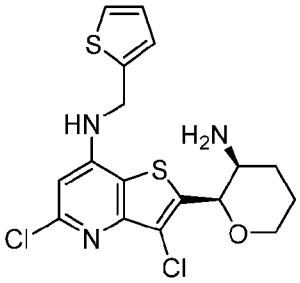
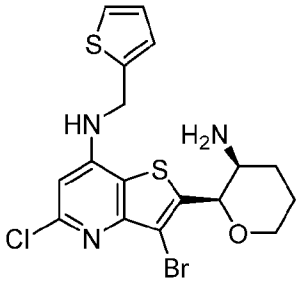
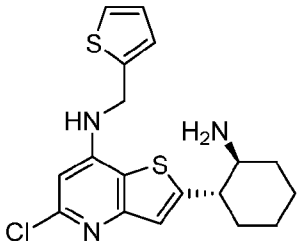
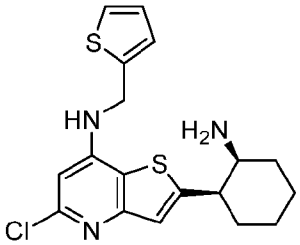
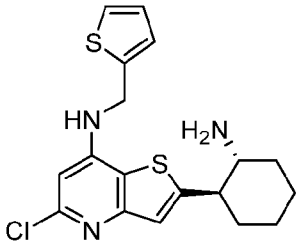
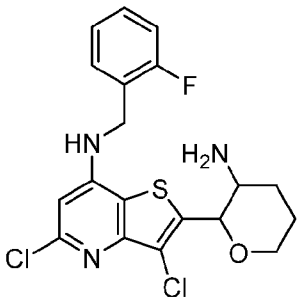
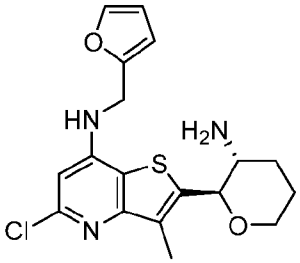
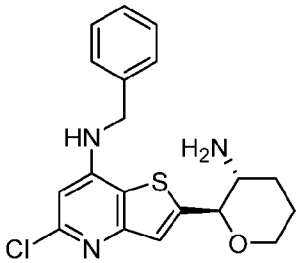
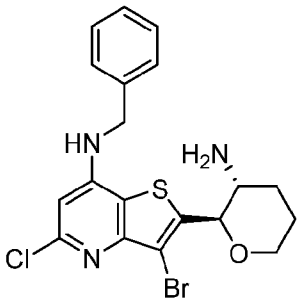
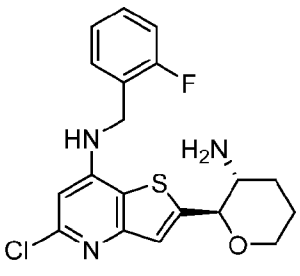
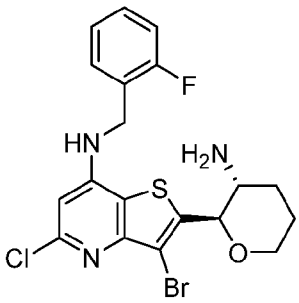
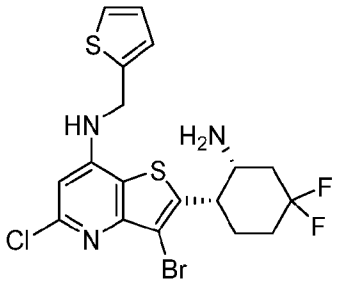


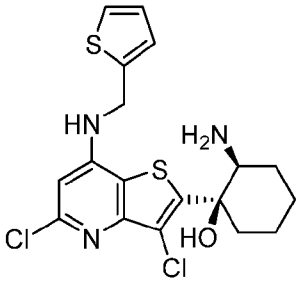
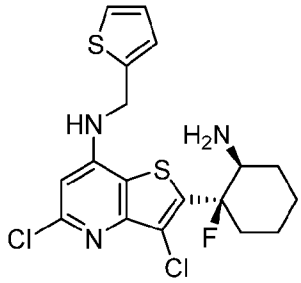
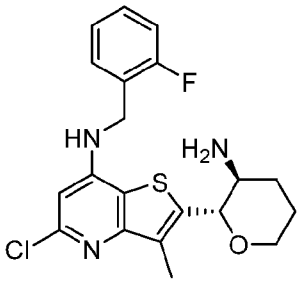
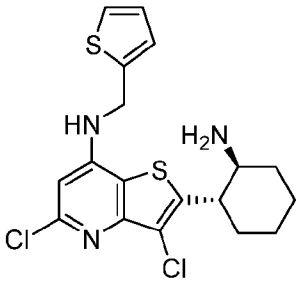
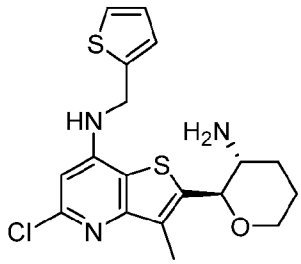
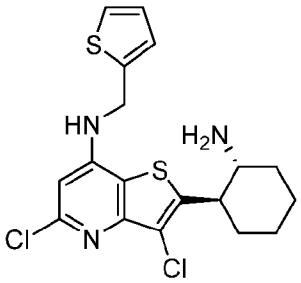
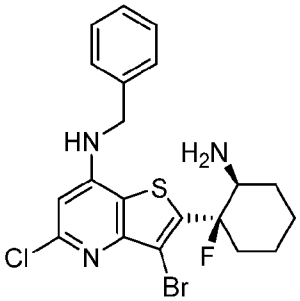
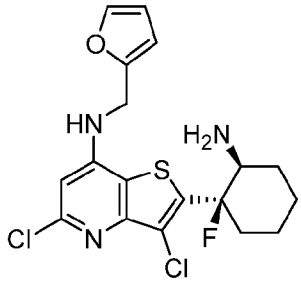
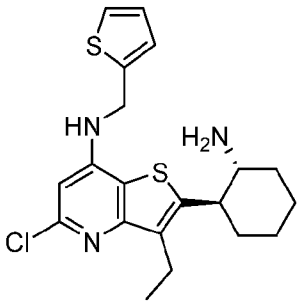
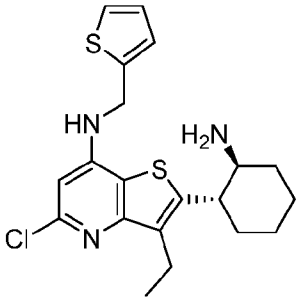
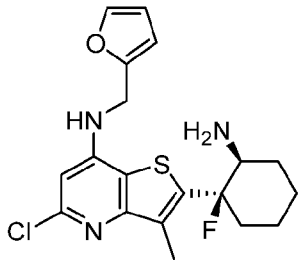
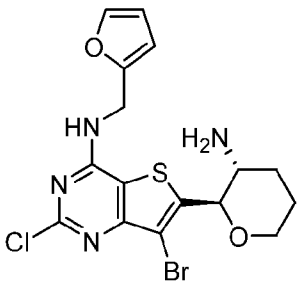










, and

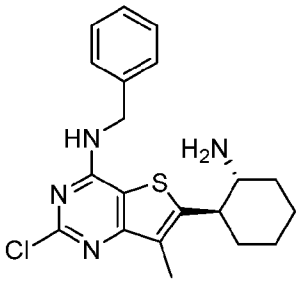
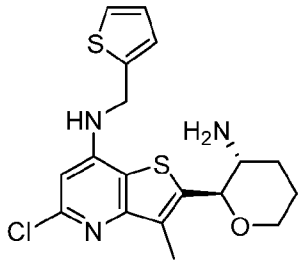
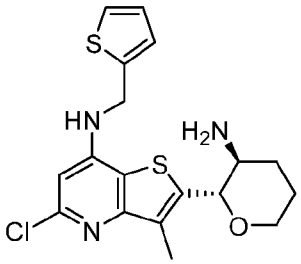
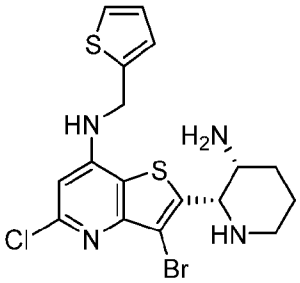
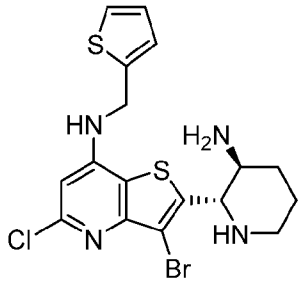
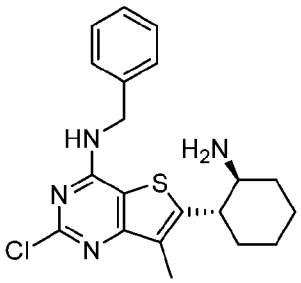
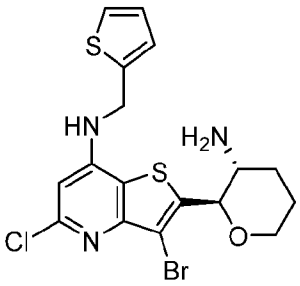
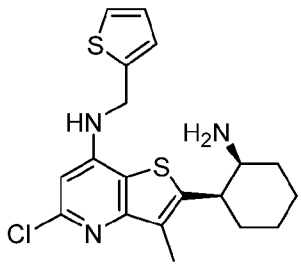
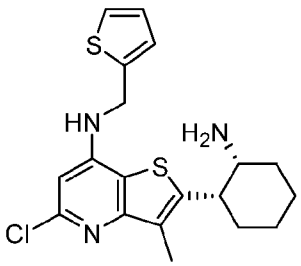
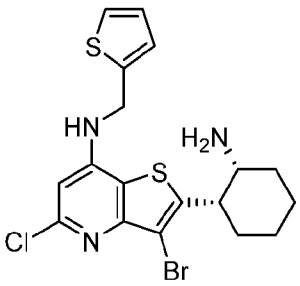
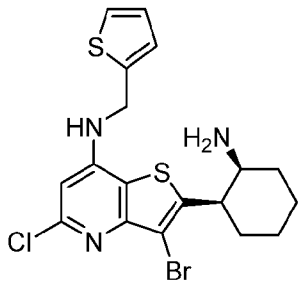
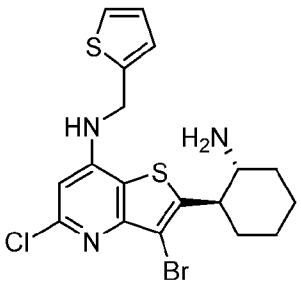
One aspect includes a compound of Formula (I) or a form thereof selected from the group consisting of the following, wherein "#" indicates that the compound is a racemic mixture of enantiomers, and wherein "&" indicates that the compound may exist as the opposite enantiomer:

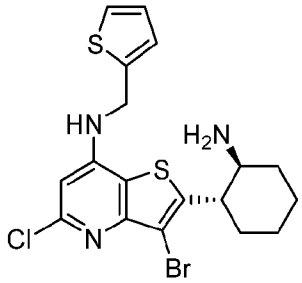
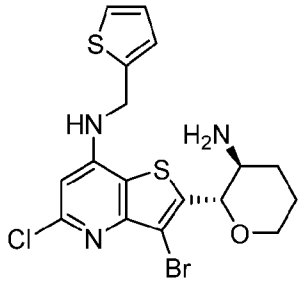
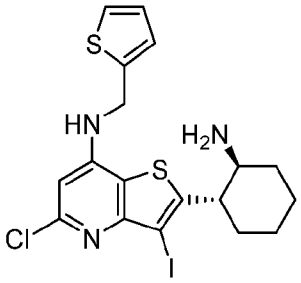
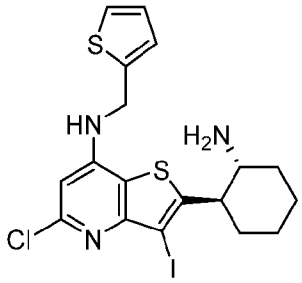
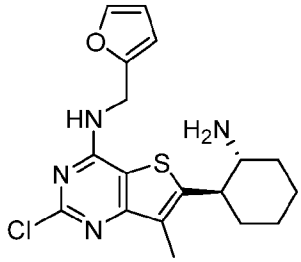
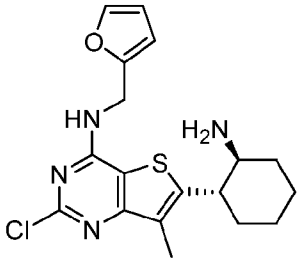
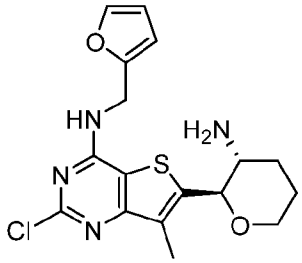
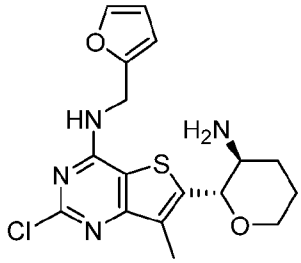
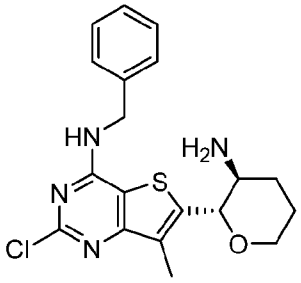
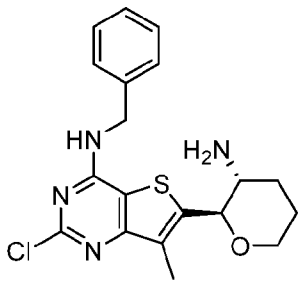
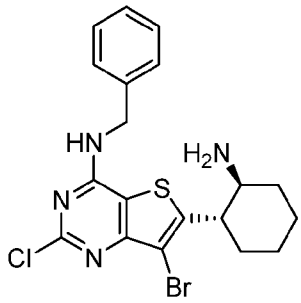
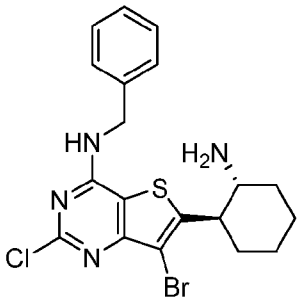
		
1	**2**	**3**
		
4	**5**	**6**

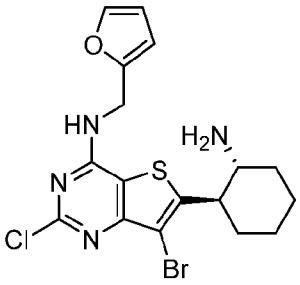
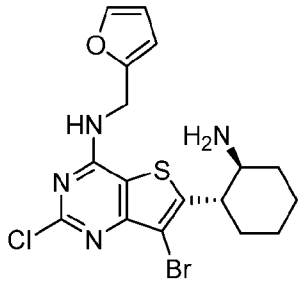
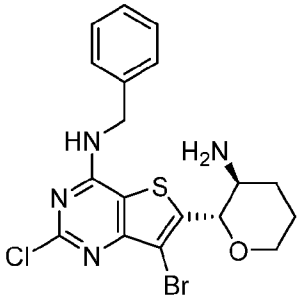
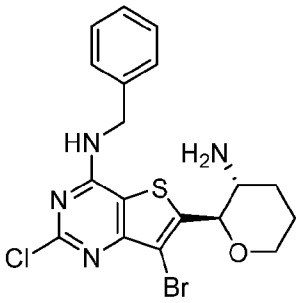
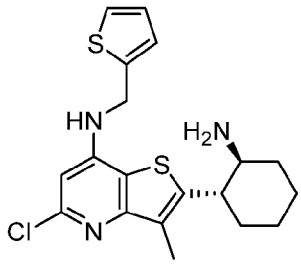
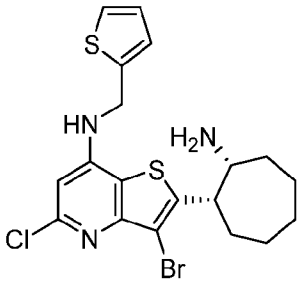
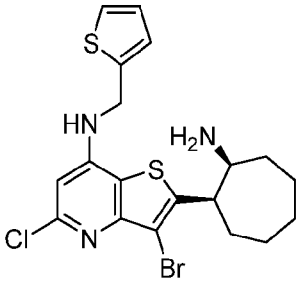
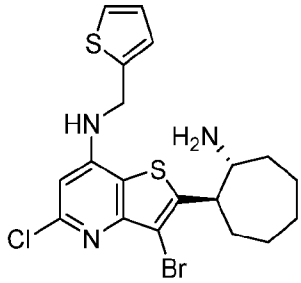
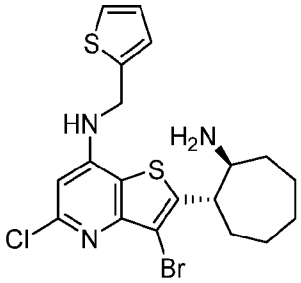
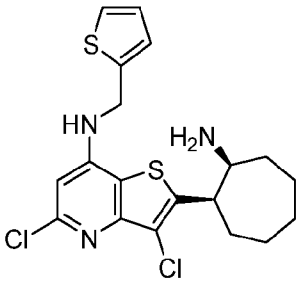
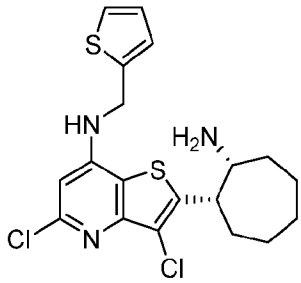
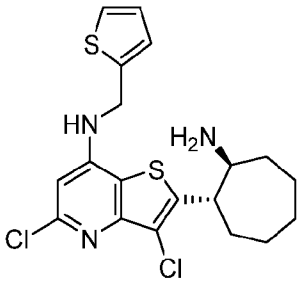
		
7	**8**	**9**
		
10	**11**	**12**
		
13	**14**	**15**
		
16	**17**	**18**

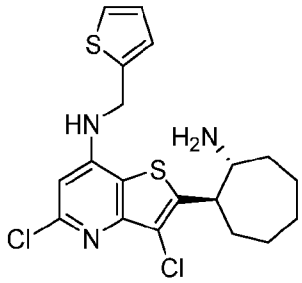
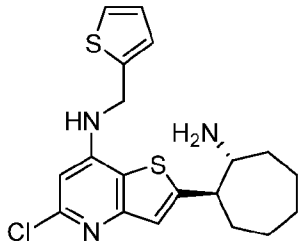
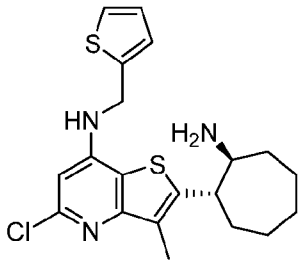
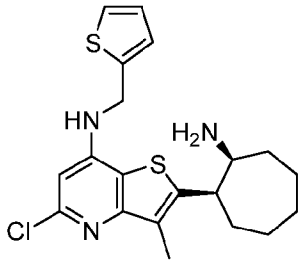
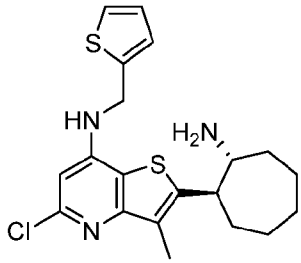
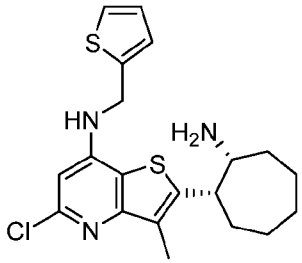
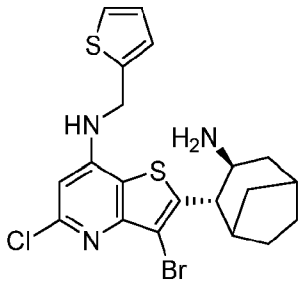
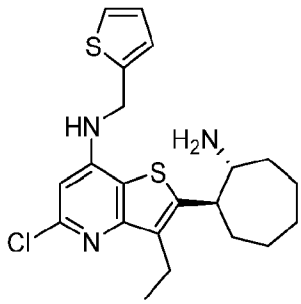
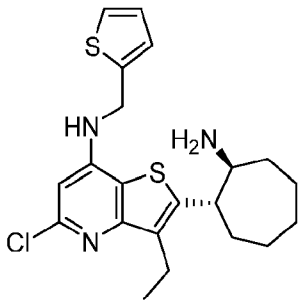
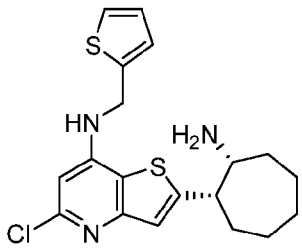
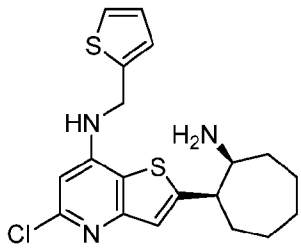
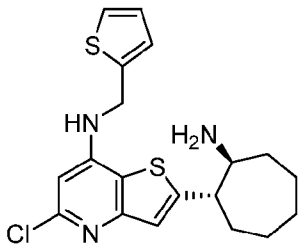
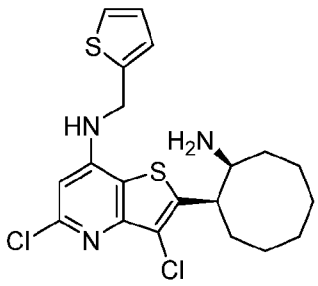
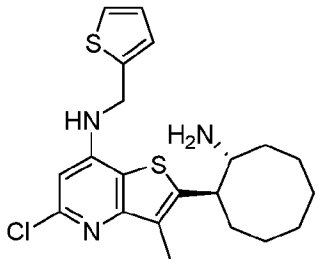
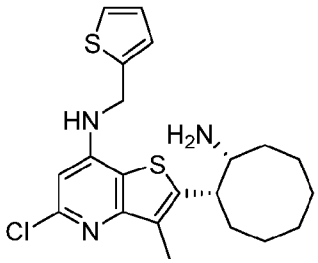
		
19	**20#**	**21**
		
22	**23**	**24**
		
25#	**26#**	**27**
		
28#	**29#**	**30#**

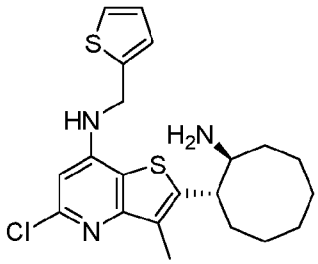
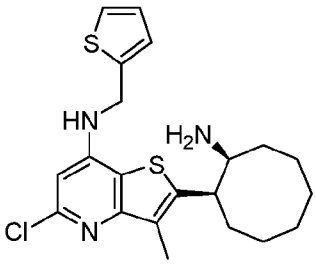
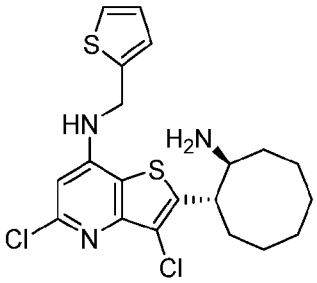
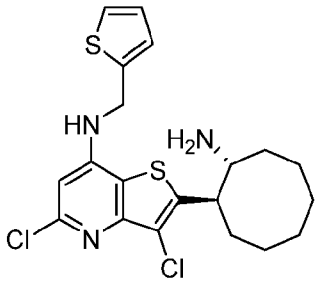
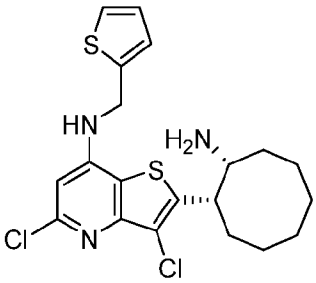
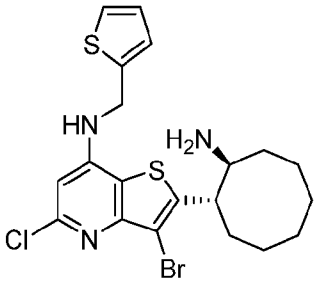
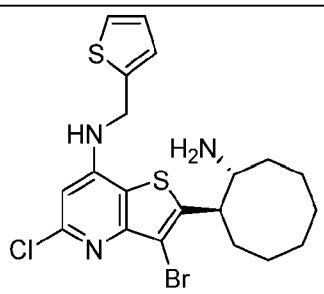
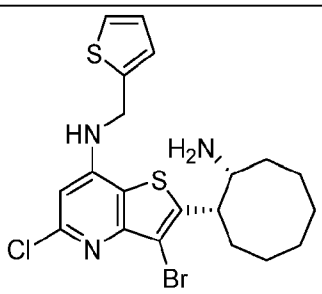
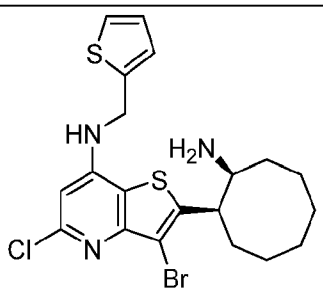
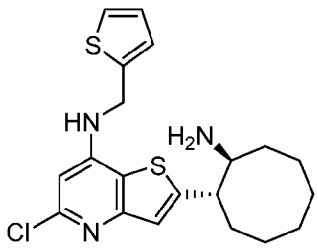
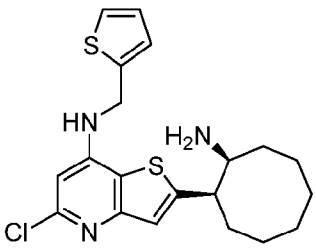
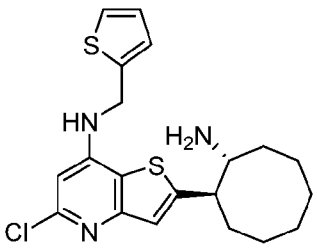
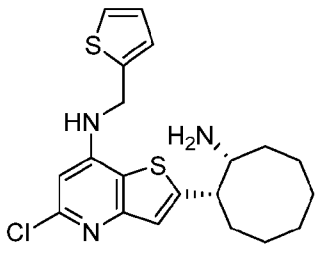
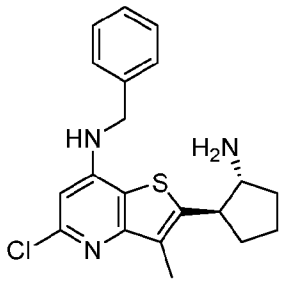
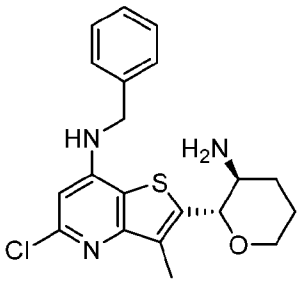
		
31	**32**	**33**
		
34&	**35&**	**36&**
		
37	**38**	**39&**
		
40&	**41**	**42&**

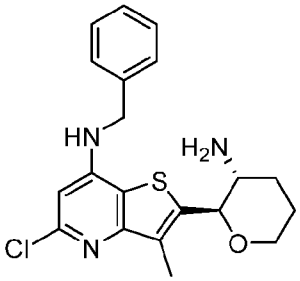
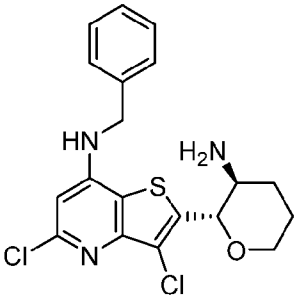
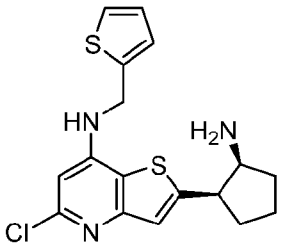
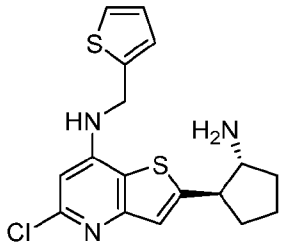
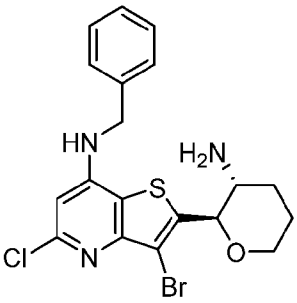
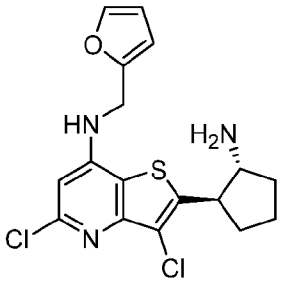
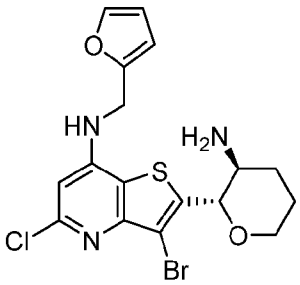
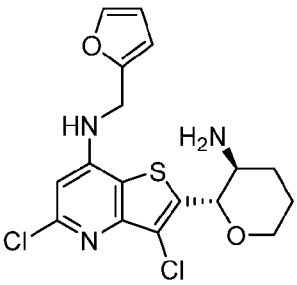
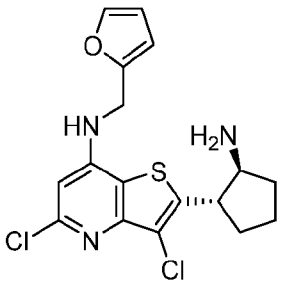
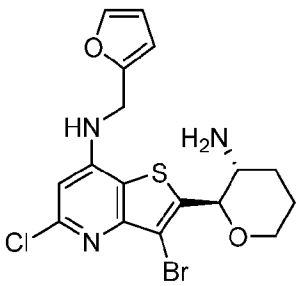
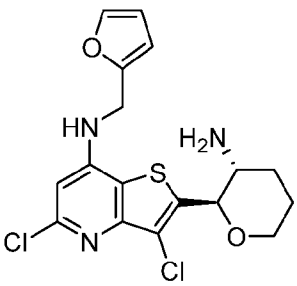
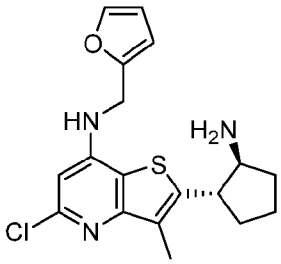
		
43[&]	**44**[&]	**45**[&]
		
46[#]	**47**[#]	**48**[&]
		
49	**50**	**51**
		
52	**53**	**54**

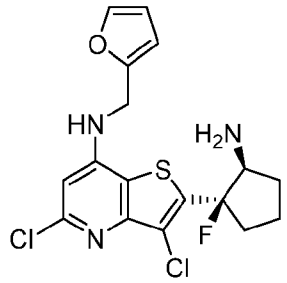
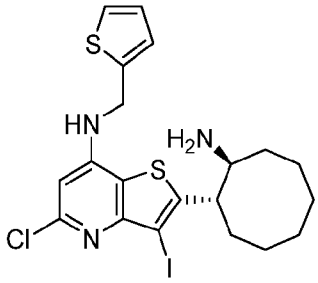
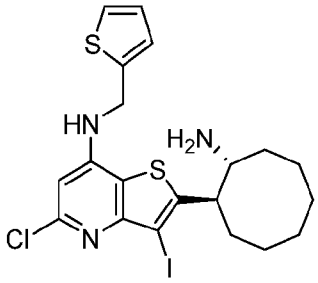
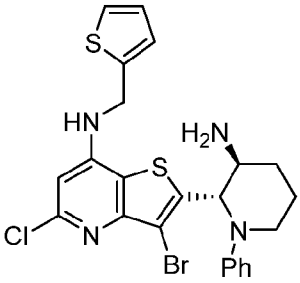
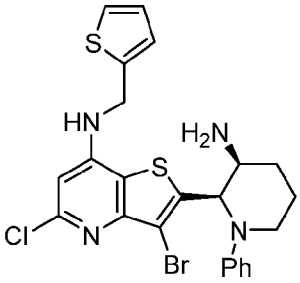
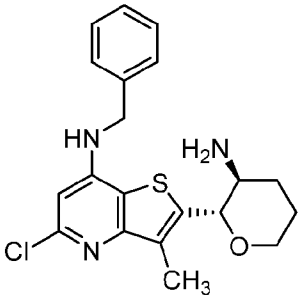
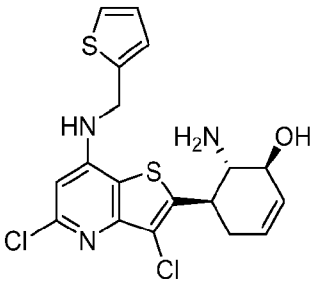
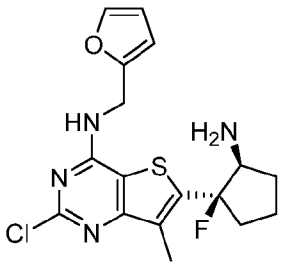
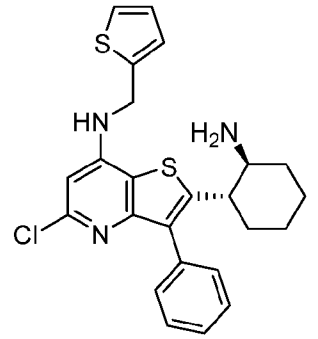
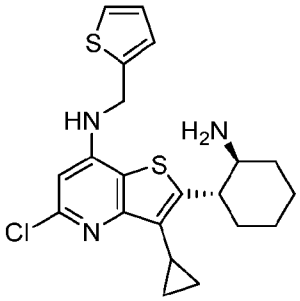
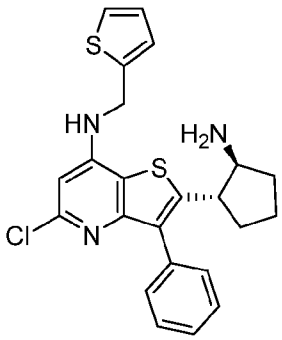
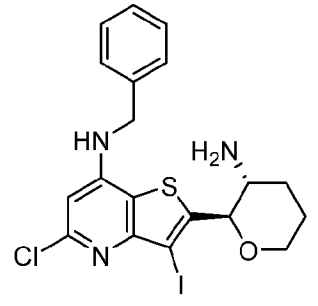
		
55	**56**	**57**
		
58	**59**	**60**
		
61	**62**	**63**
		
64	**65**	**66**

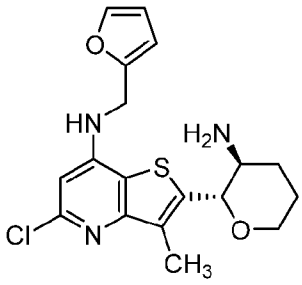
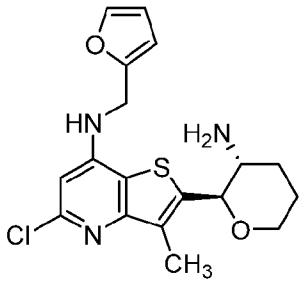
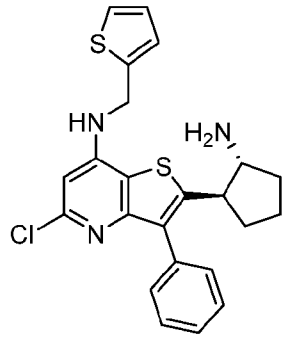
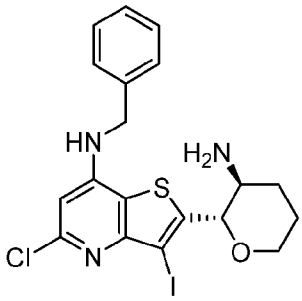
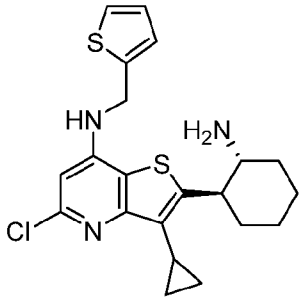
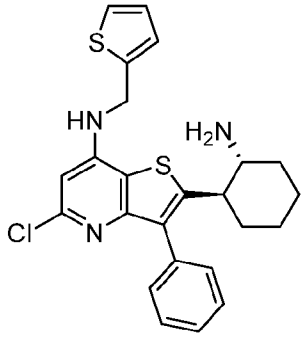
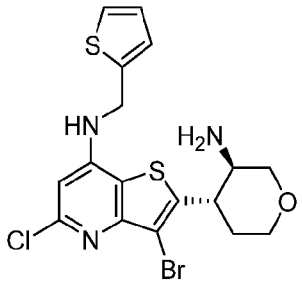
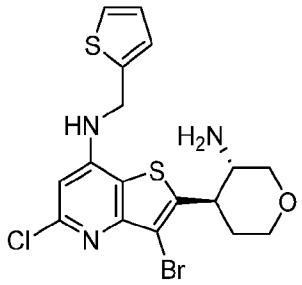
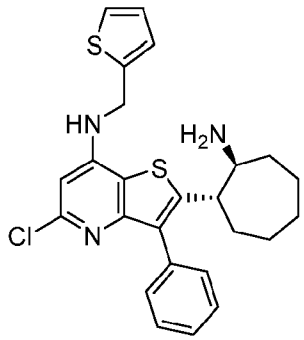
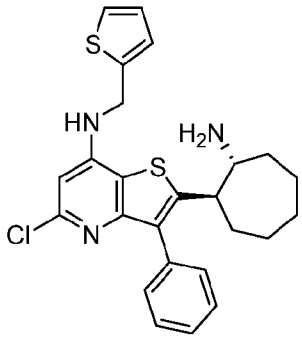
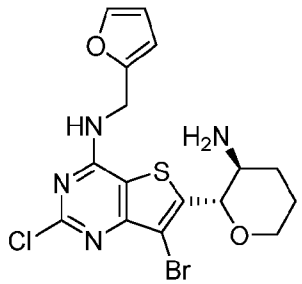
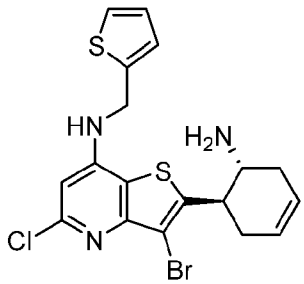
		
67	**68**	**69**
		
70	**71**	**72**
		
73	**74**	**75**
		
76	**77**	**78**

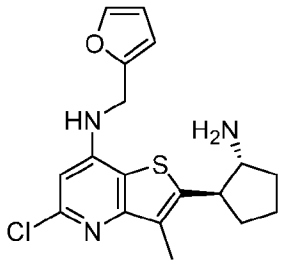
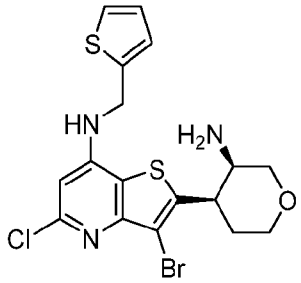
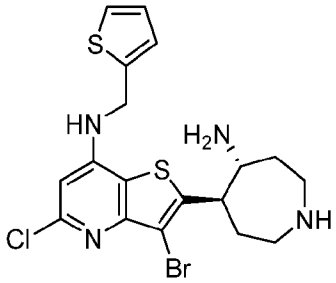
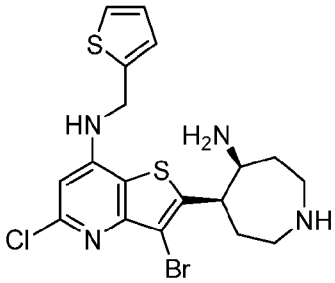
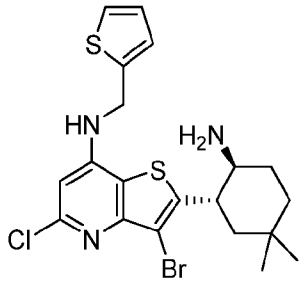
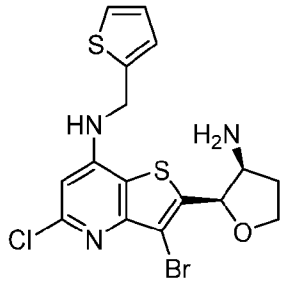
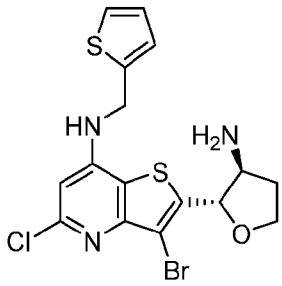
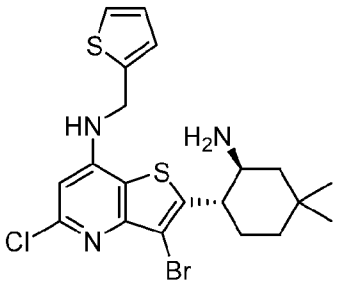
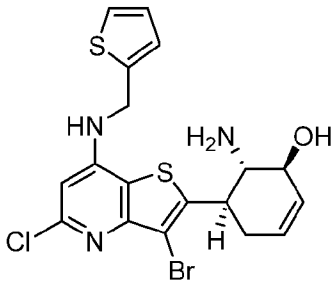
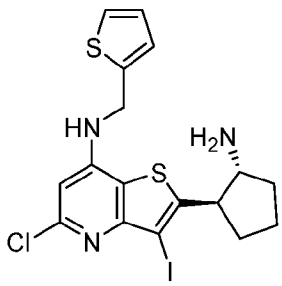
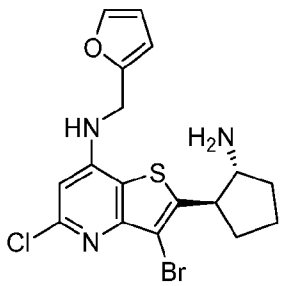
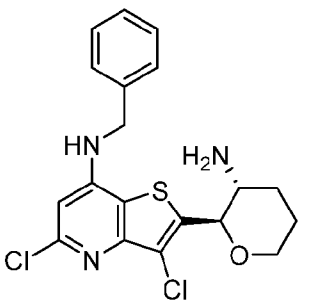
		
79	**80**	**81**
		
82	**83**	**84**
		
85#	**86&**	**87&**
		
88	**89**	**90**
		
91	**92**	**93**

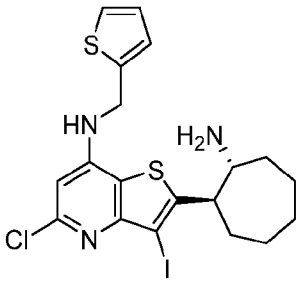
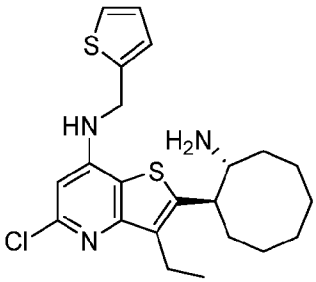
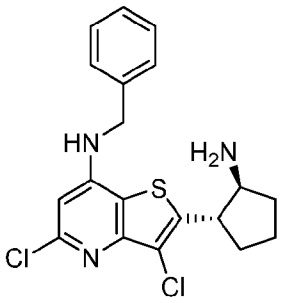
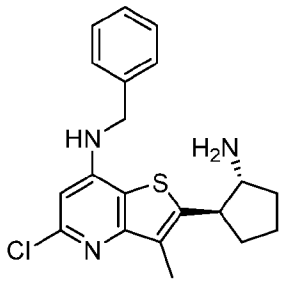
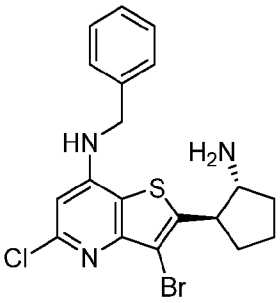
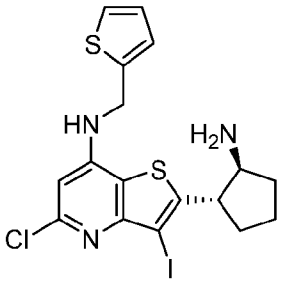
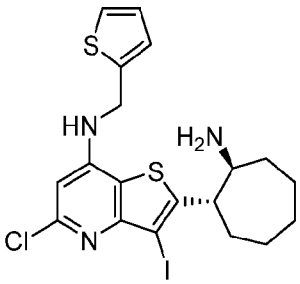
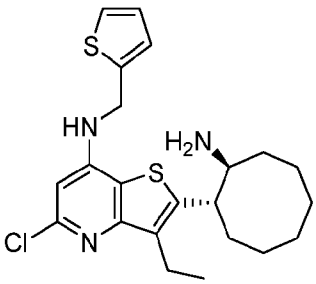
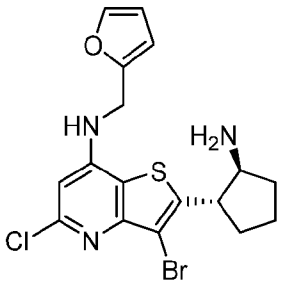
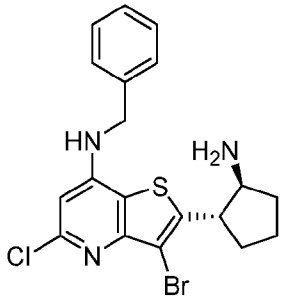
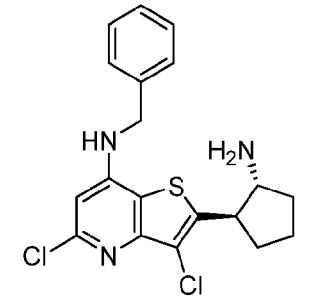
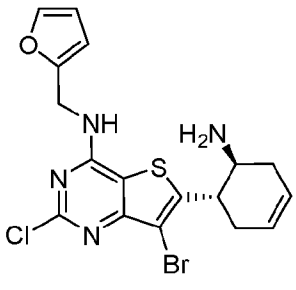
		
94	**95**	**96**
		
97	**98**	**99**
		
100	**101**	**102**
		
103	**104**	**105**
		
106	**107**	**108**

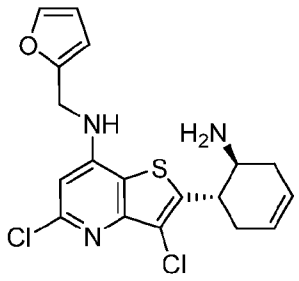
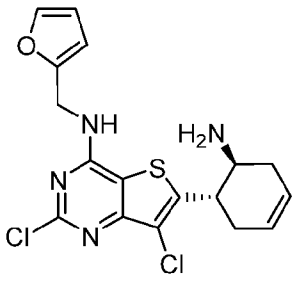
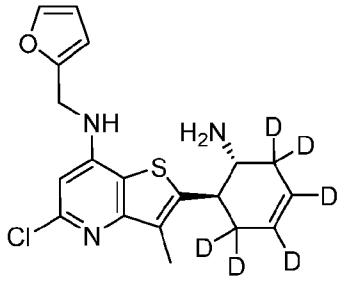
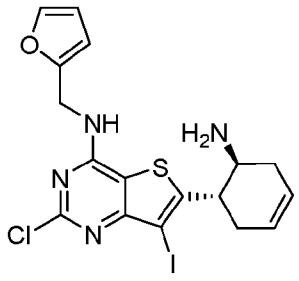
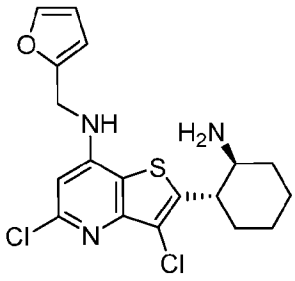
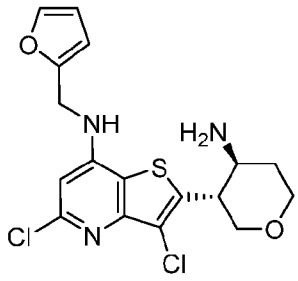
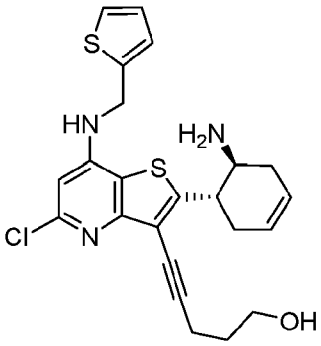
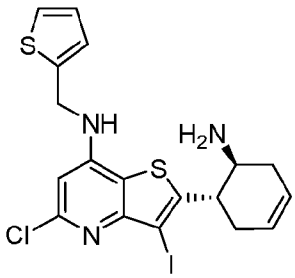
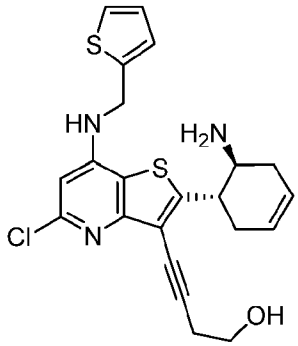
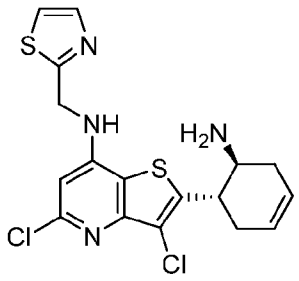
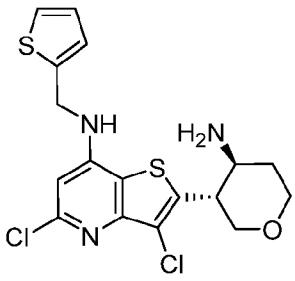
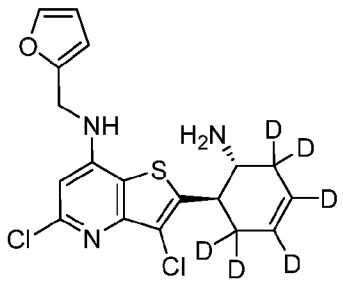
		
109	**110**	**111**
		
112	**113**	**114**
		
115	**116**	**117**
		
118	**119**	**120**

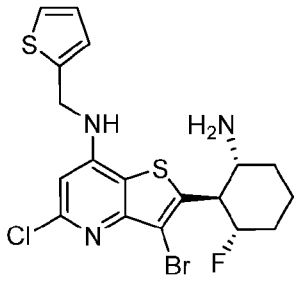
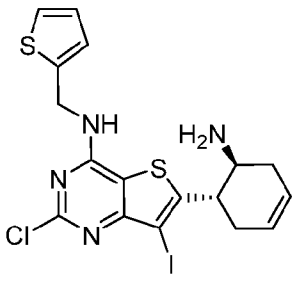
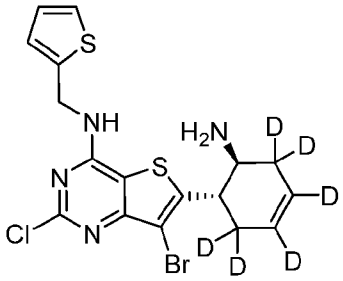
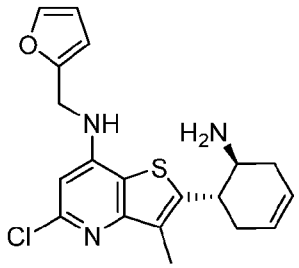
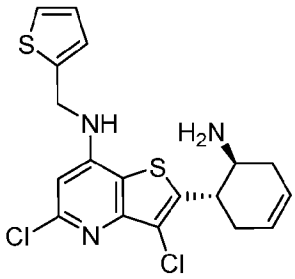
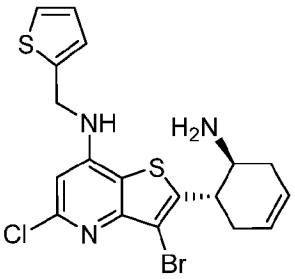
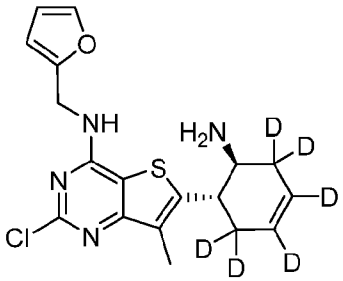
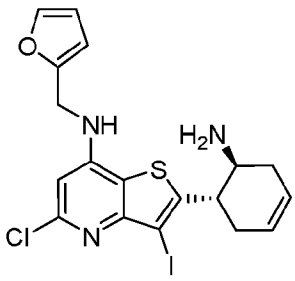
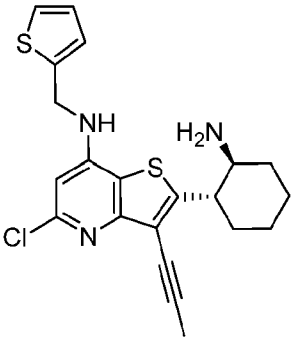
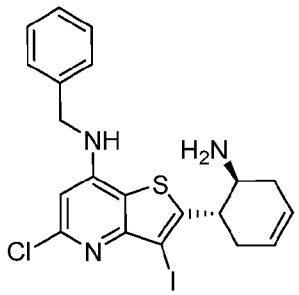
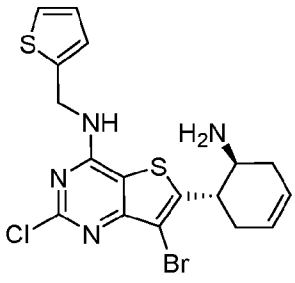
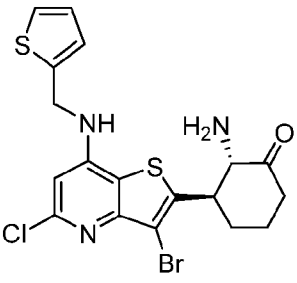
		
121	**122**	**123**
		
124#	**125#**	**126**
		
127#	**128**	**129**
		
130	**131**	**132**

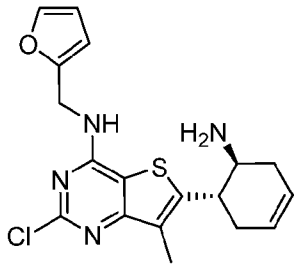
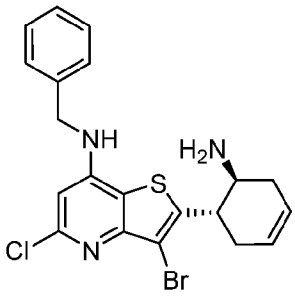
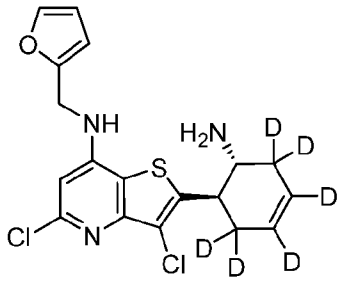
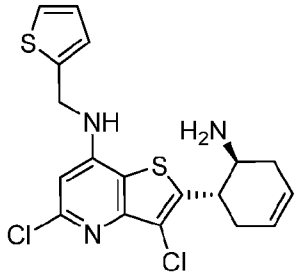
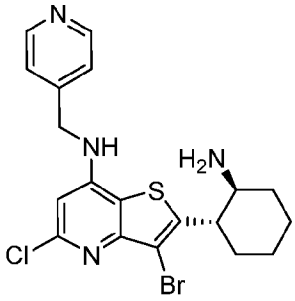
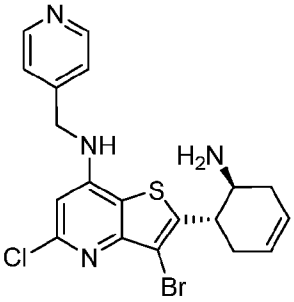
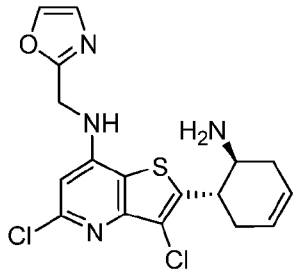
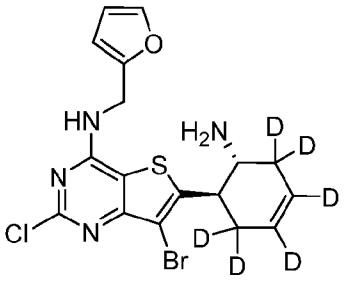
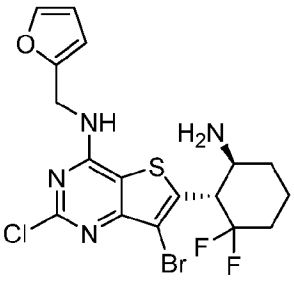
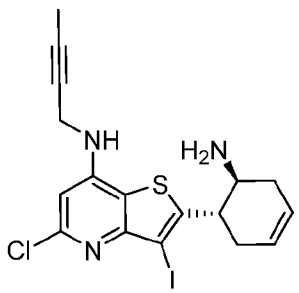
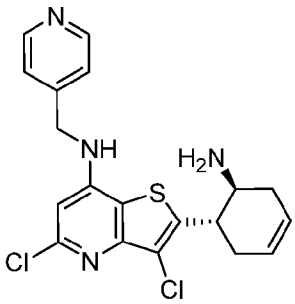
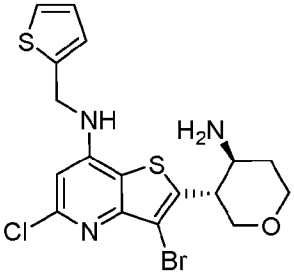
		
133	**134**	**135**
		
136	**137**	**138**
		
139	**140**	**141**
		
142	**143**	**144#**

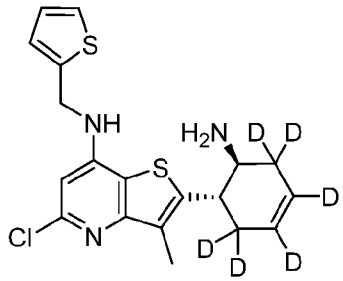
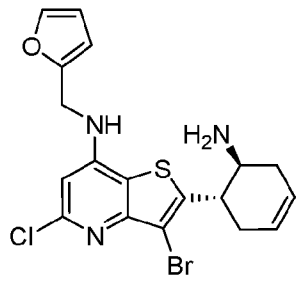
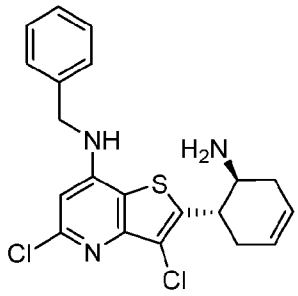
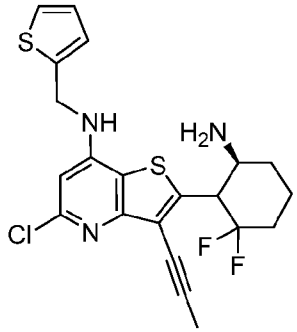
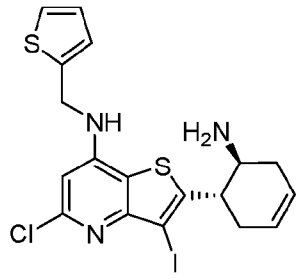
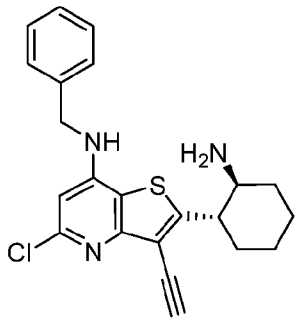
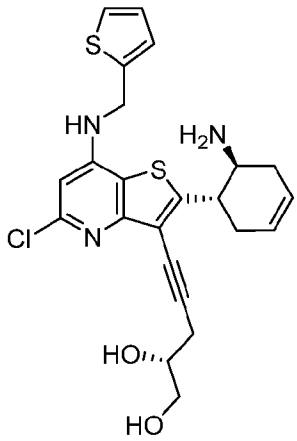
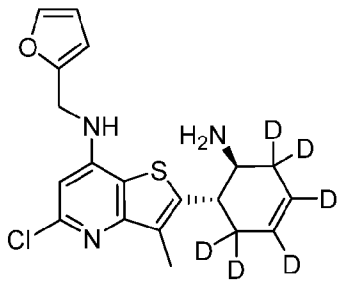
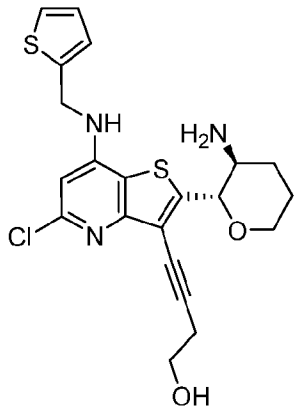
		
145	**146#**	**147#**
		
148#	**149#**	**150#**
		
151#	**152#**	**153#**
		
154	**155**	**156**

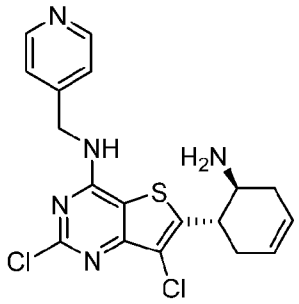
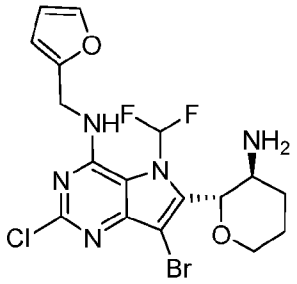
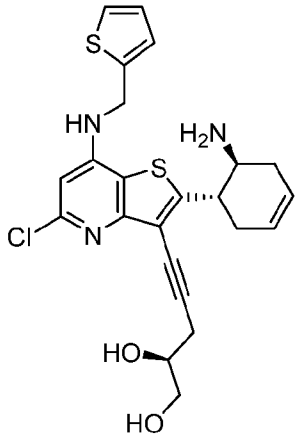
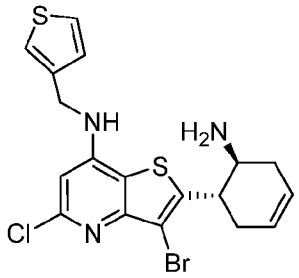
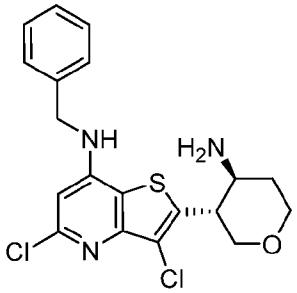
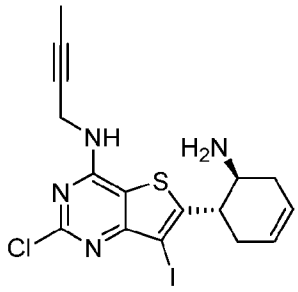
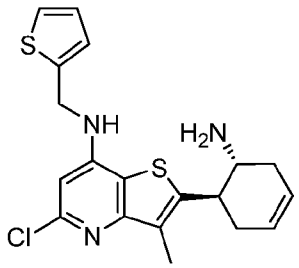
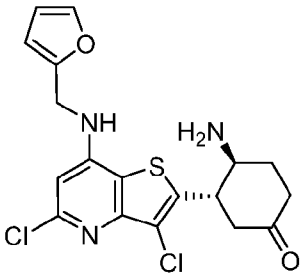
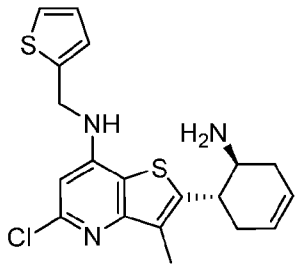
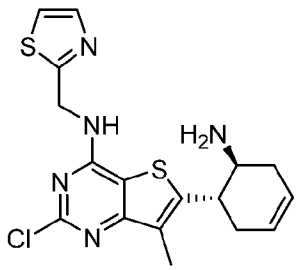
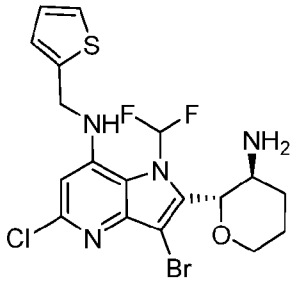
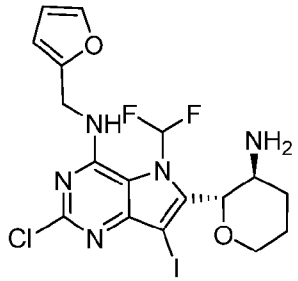
		
157	**158**	**159**
		
160	**161**	**162**
		
163	**164**	**165**
		
166	**167**	**168**

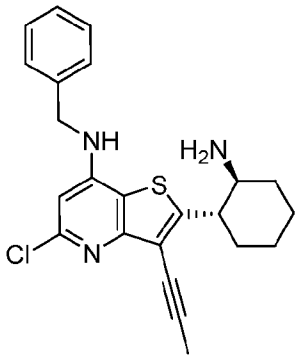
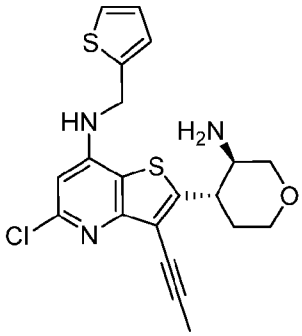
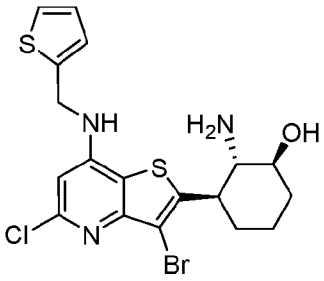
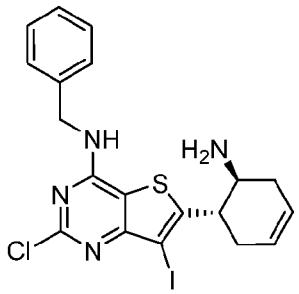
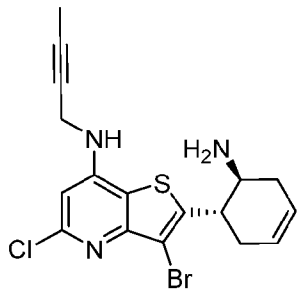
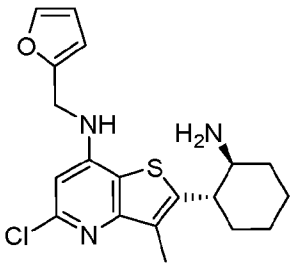
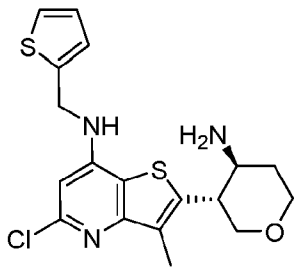
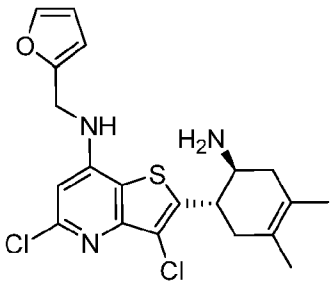
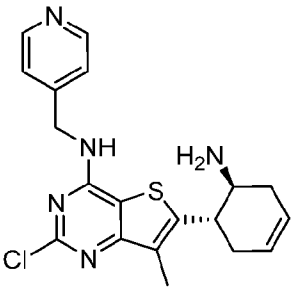
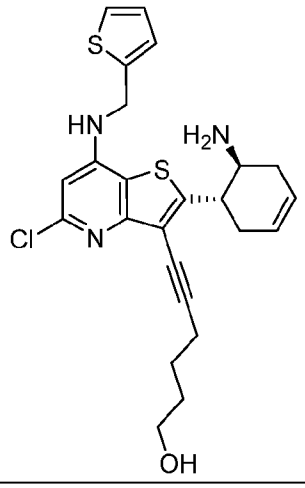
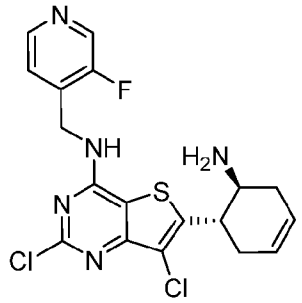
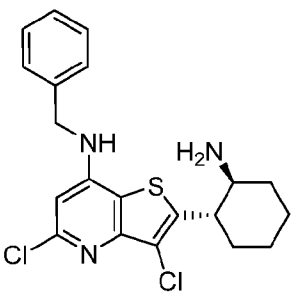
		
169	**170**	**171#**
		
172	**173**	**174**
		
175#	**176**	**177#**
		
178	**179**	**180#**

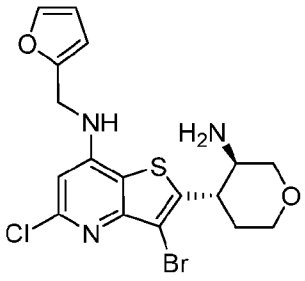
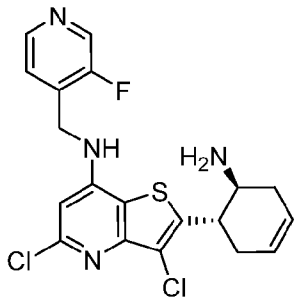
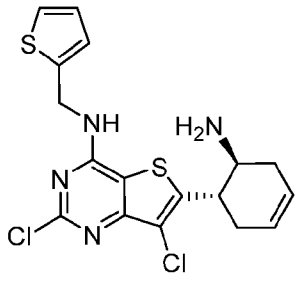
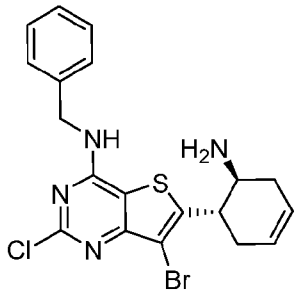
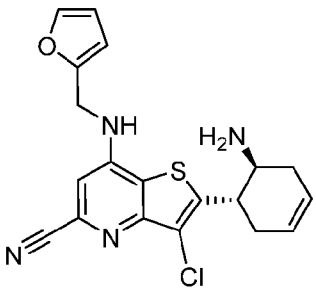
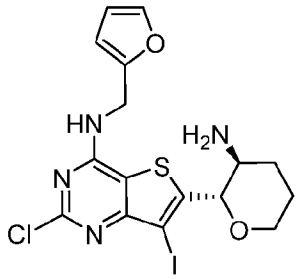
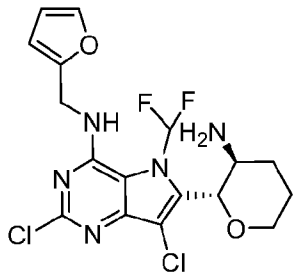
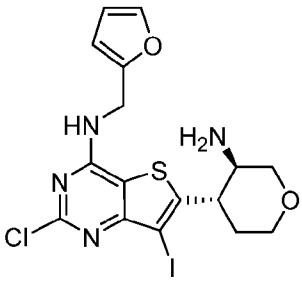
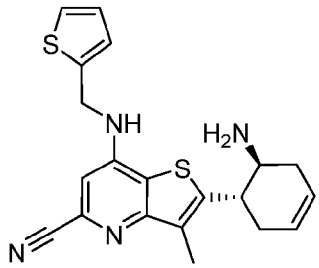
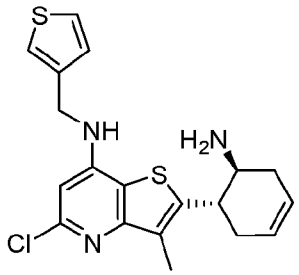
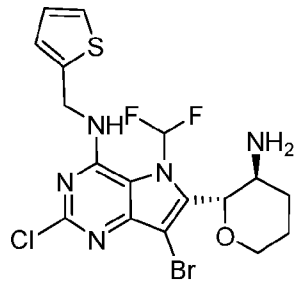
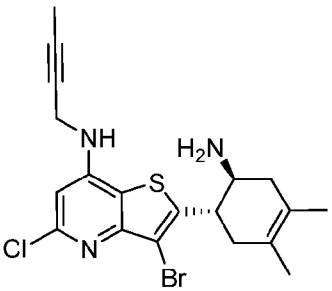
		
181#	**182**	**183**
		
184	**185#**	**186**
		
187	**188**	**189#**
		
190	**191**	**192#**

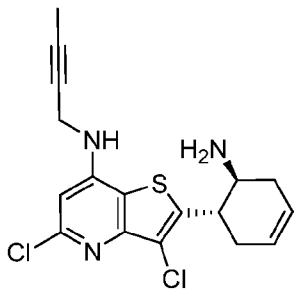
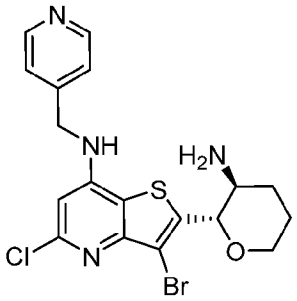
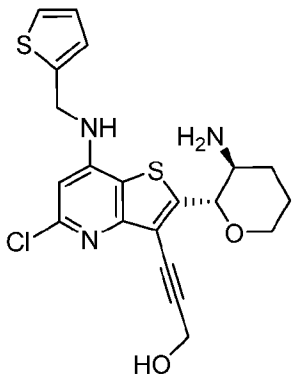
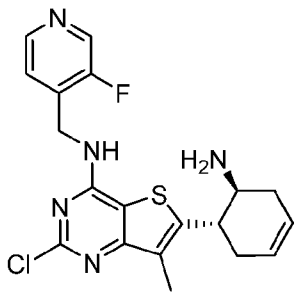
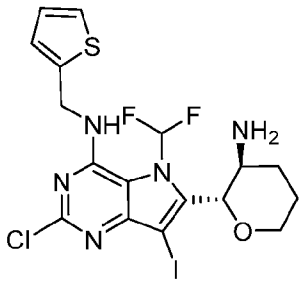
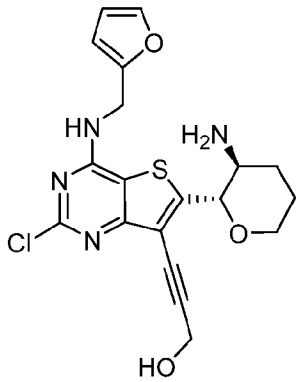
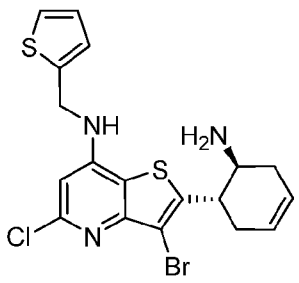
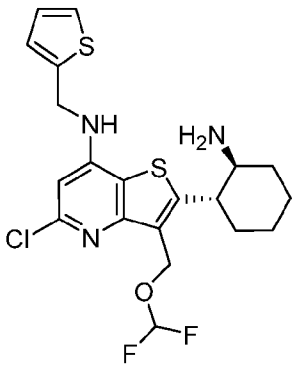
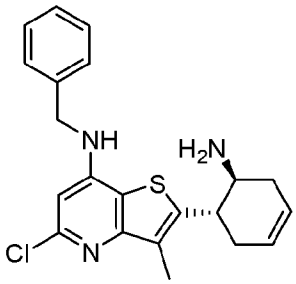
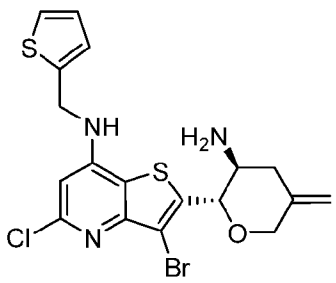
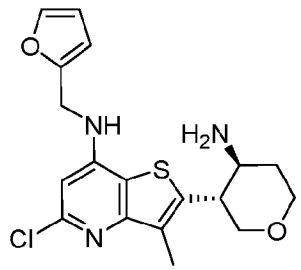
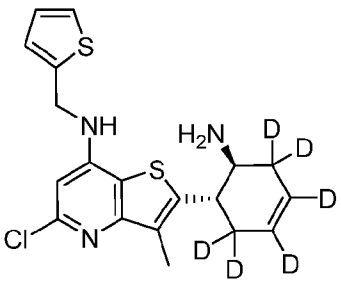
		
193	**194**	**195#**
		
196	**197**	**198**
		
199	**200#**	**201**
		
202	**203**	**204#**

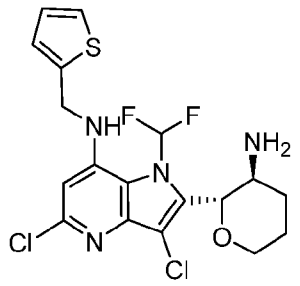
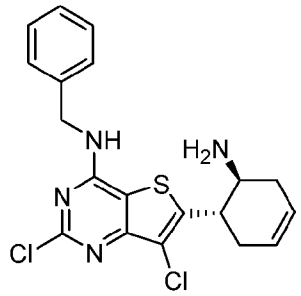
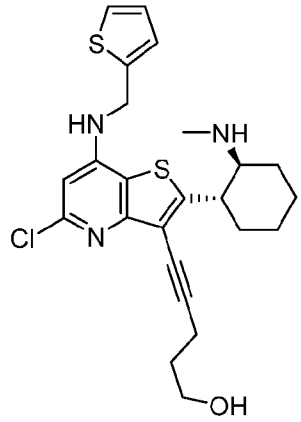
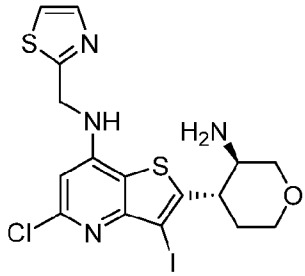
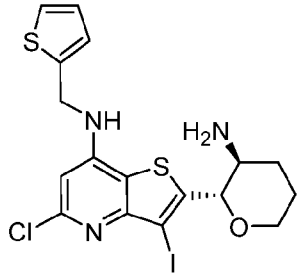
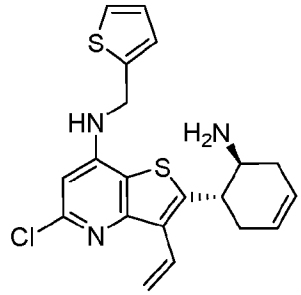
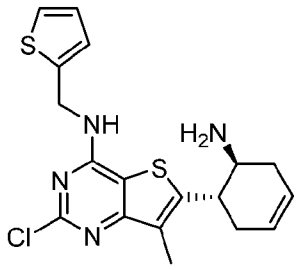
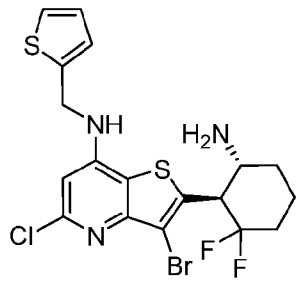
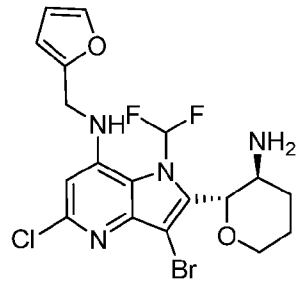
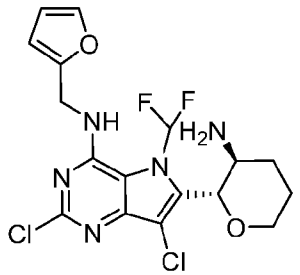
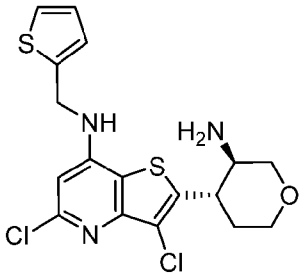
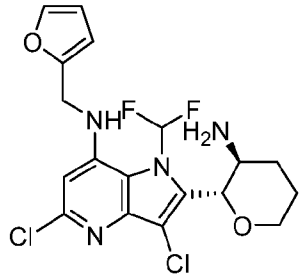
		
205	**206**	**207**
		
208#	**209#**	**210**
		
211	**212**	**213#**

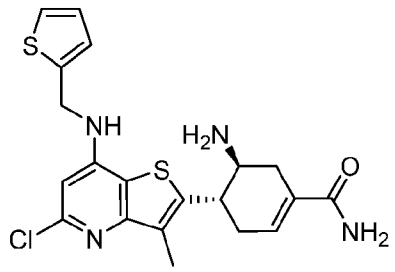
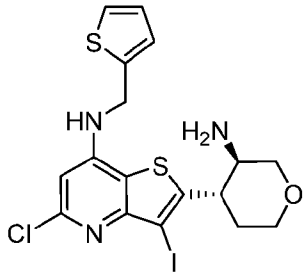
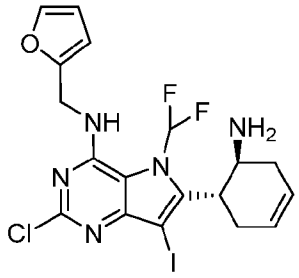
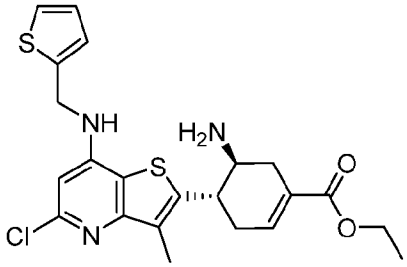
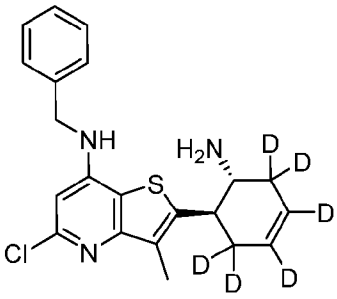
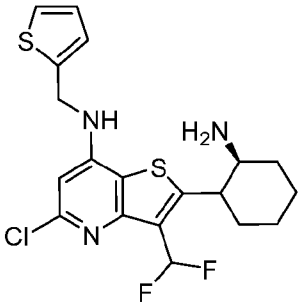
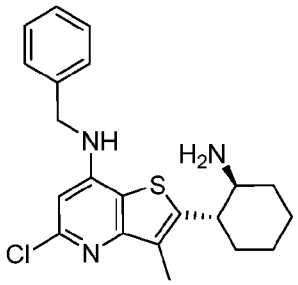
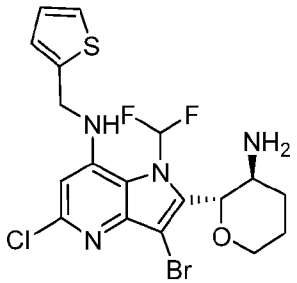
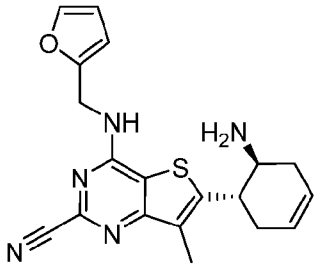
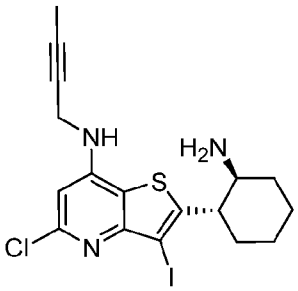
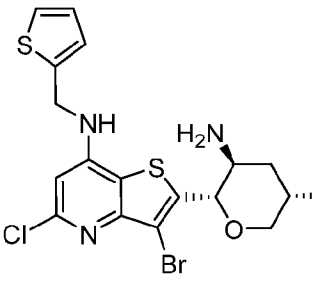
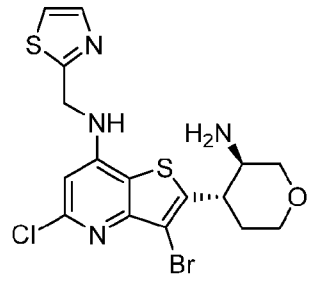
		
214	**215**	**216**
		
217	**218**	**219**
		
220	**221**	**222**
		
223	**224#**	**225**

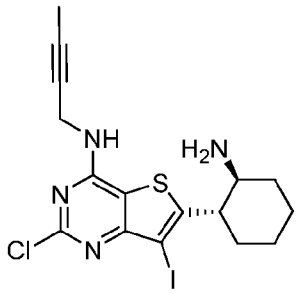
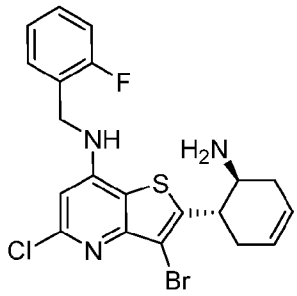
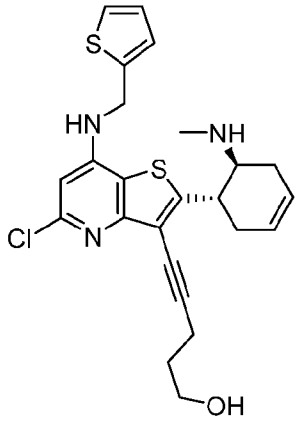
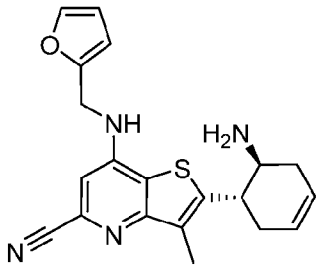
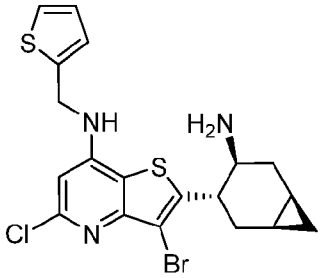
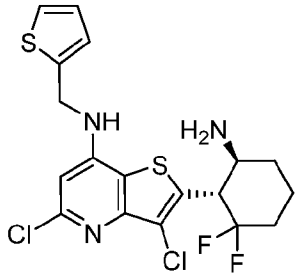
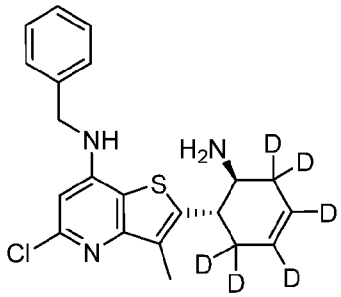
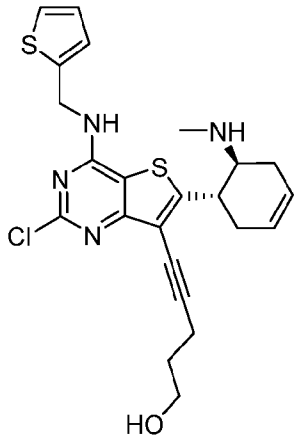
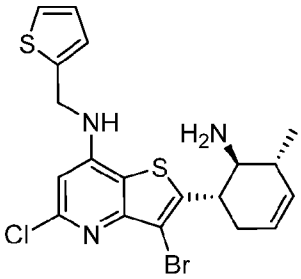
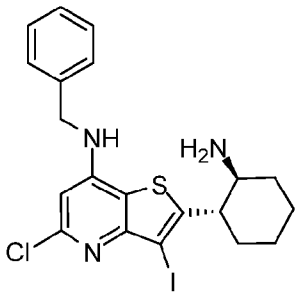
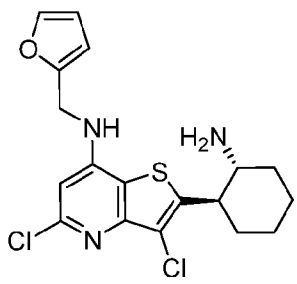
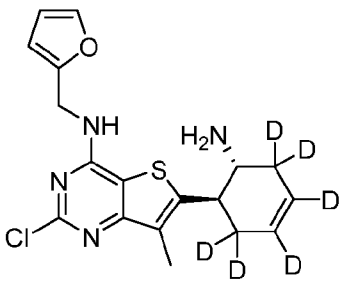
		
226#	**227#**	**228#**
		
229	**230**	**231**
		
232	**233**	**234**
		
235	**236**	**237**

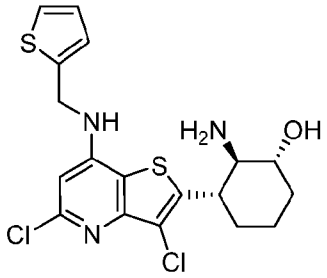
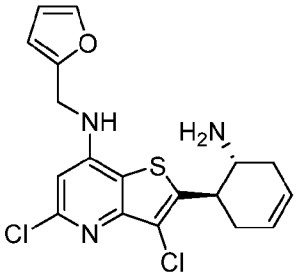
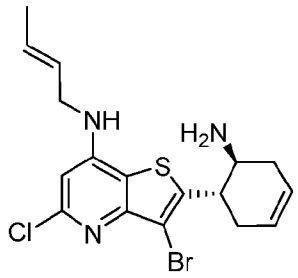
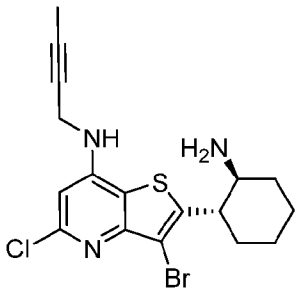
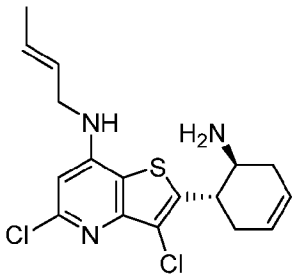
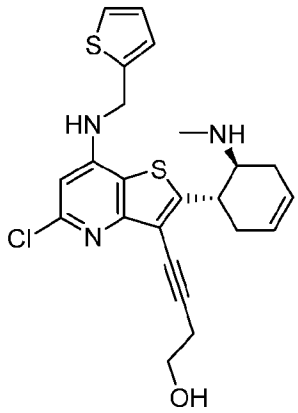
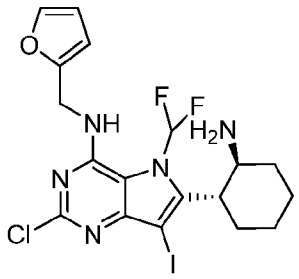
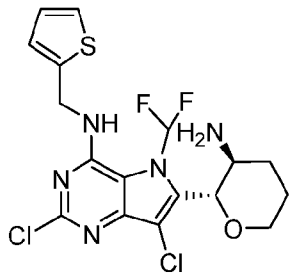
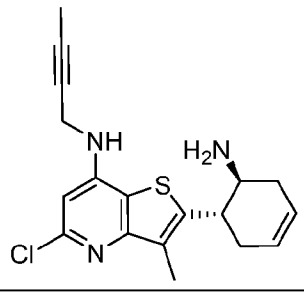
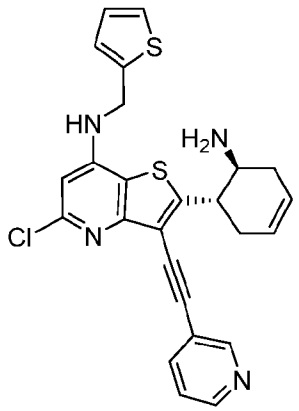
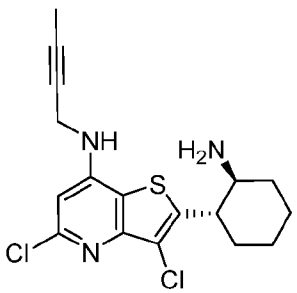
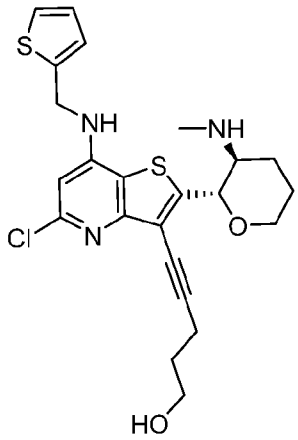
		
238	**239**	**240#**
		
241	**242**	**243#**
		
244	**245#**	**246**
		
247	**248**	**249**

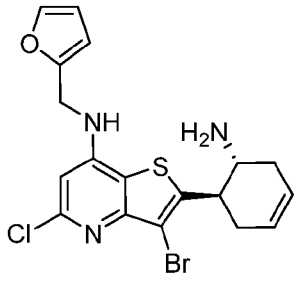
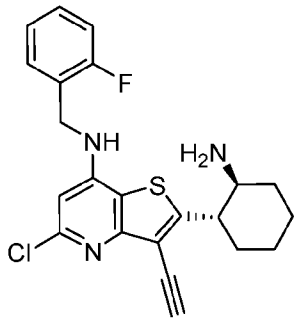
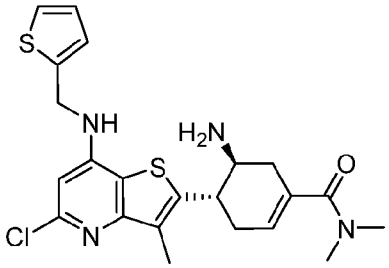
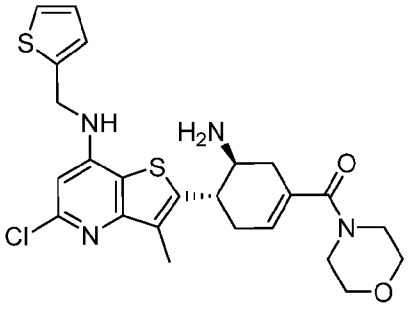
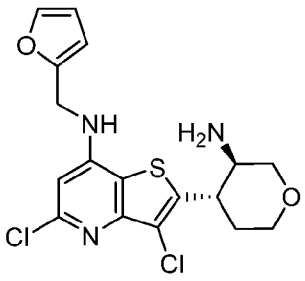
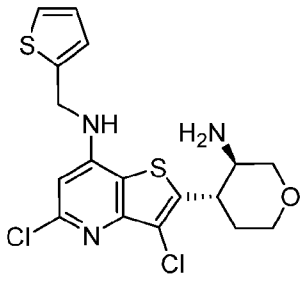
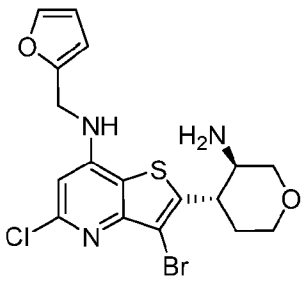
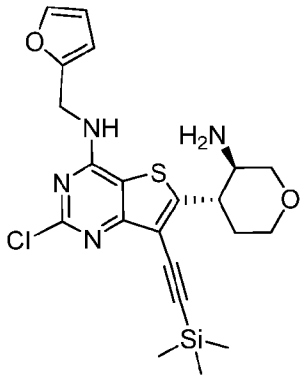
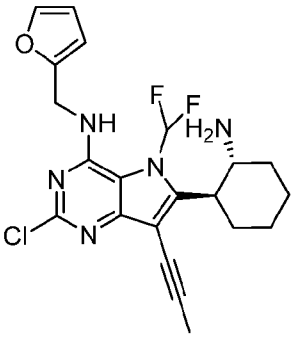
		
250	**251**	**252**
		
253	**254**	**255#**
		
256#	**257#**	**258**
		
259#	**260**	**261**

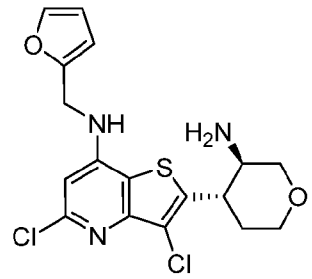
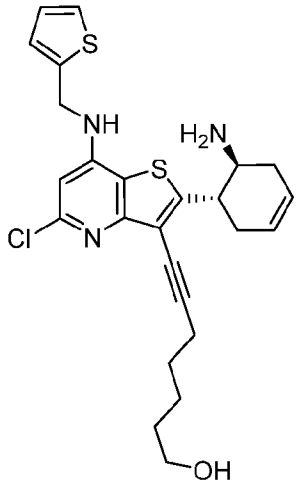
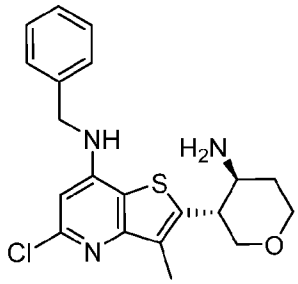
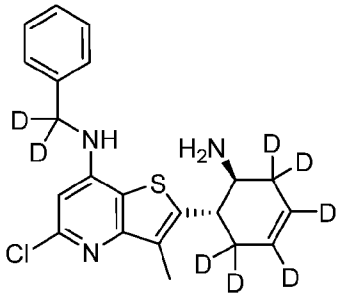
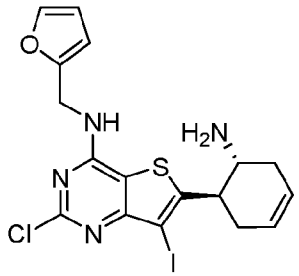
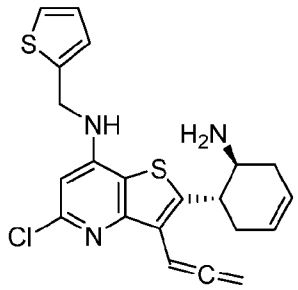
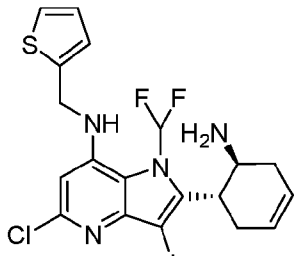
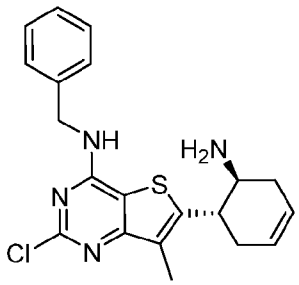
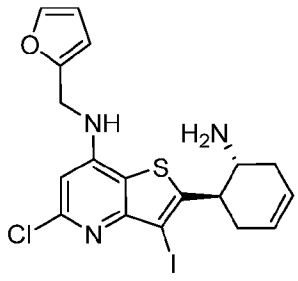
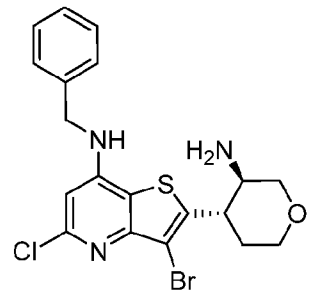
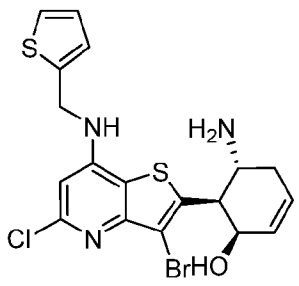
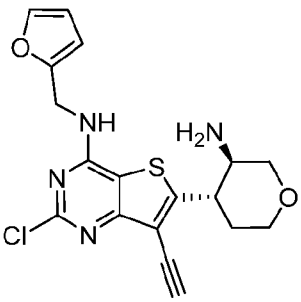
		
262	**263**	**264**
		
265	**266#**	**267**
		
268	**269#**	**270**
		
271	**272#**	**273**

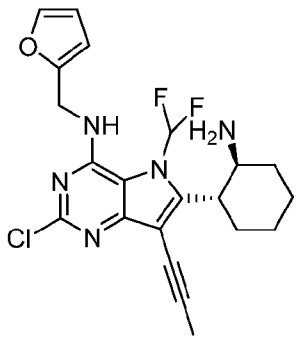
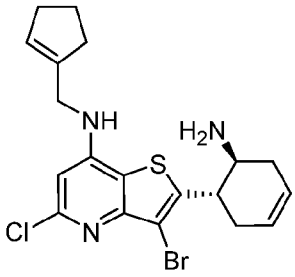
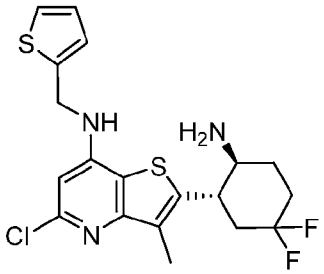
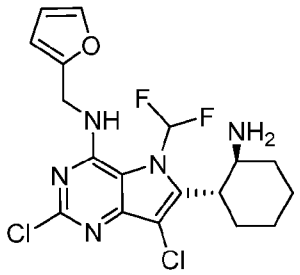
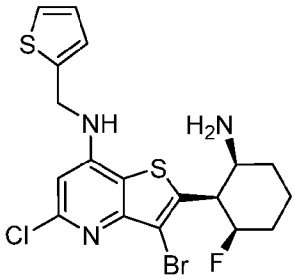
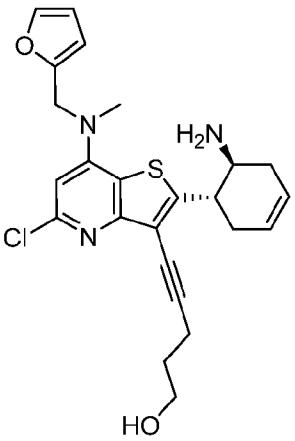
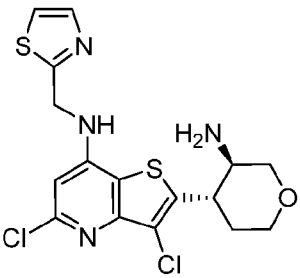
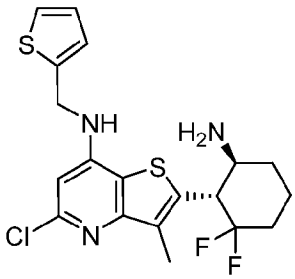
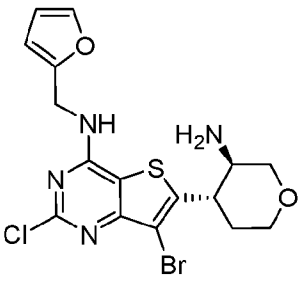
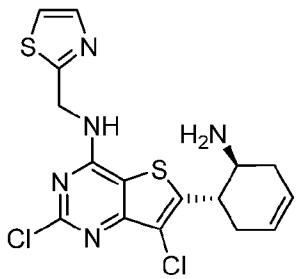
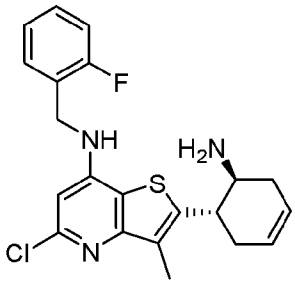
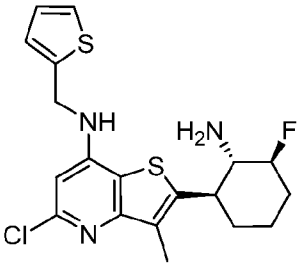
		
274	**275#**	**276**
		
277	**278#**	**279#**
		
280	**281**	**282**
		
283	**284#**	**285**

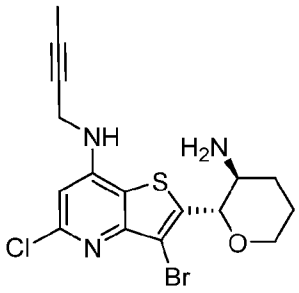
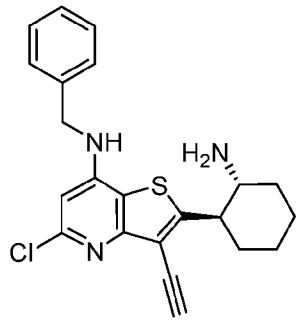
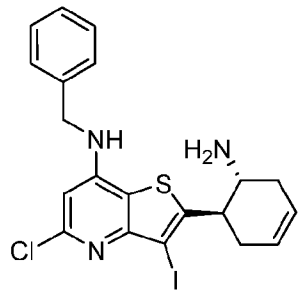
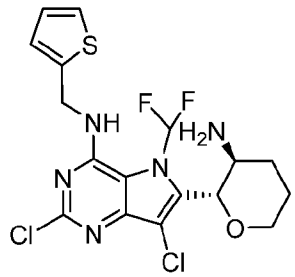
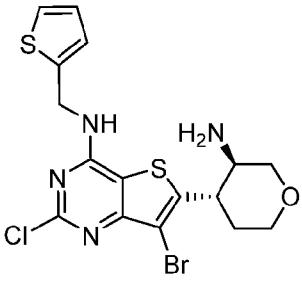
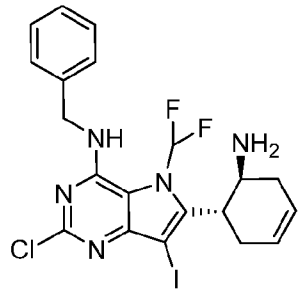
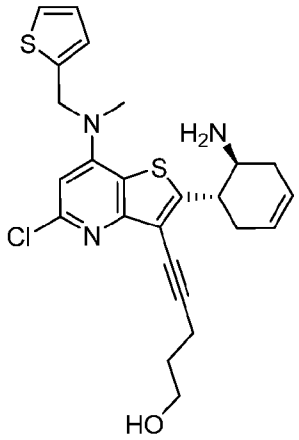
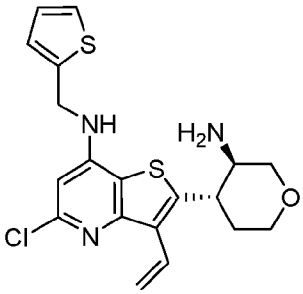
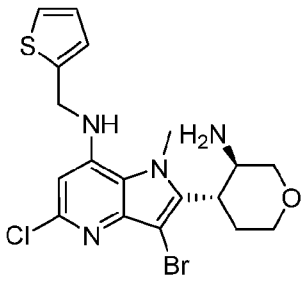
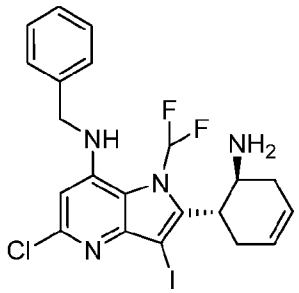
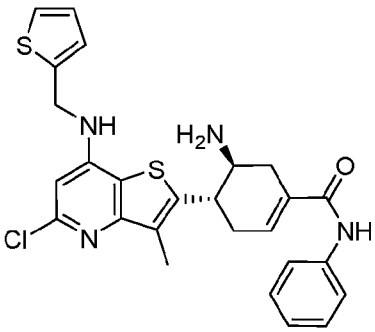
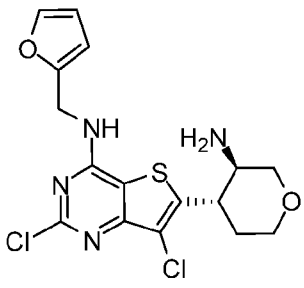
		
286	**287**	**288#**
		
289	**290#**	**291**
		
292	**293#**	**294#**
		
295#	**296**	**297#**

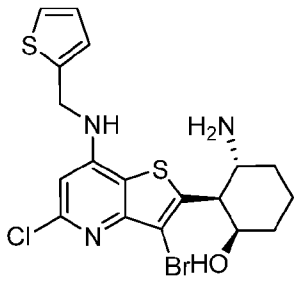
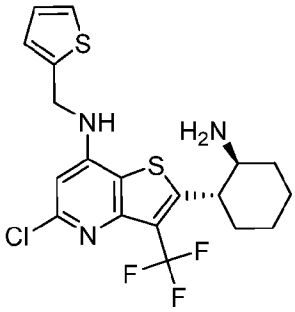
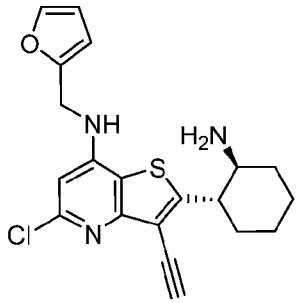
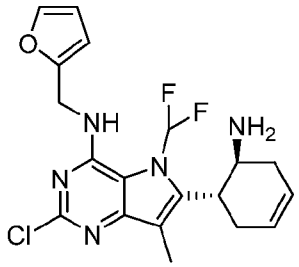
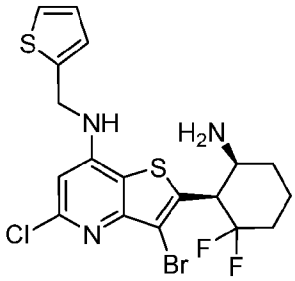
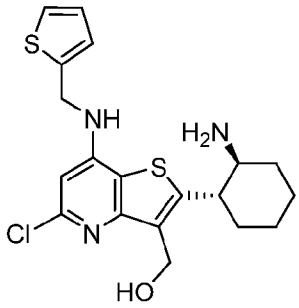
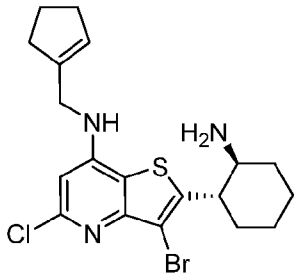
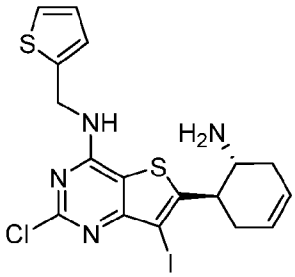
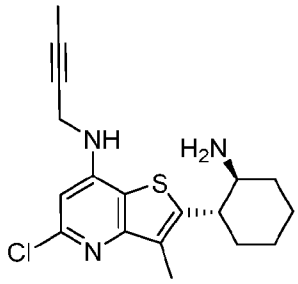
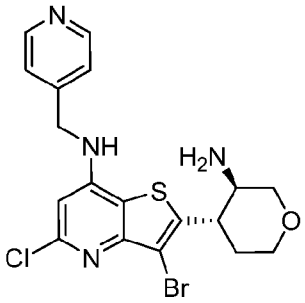
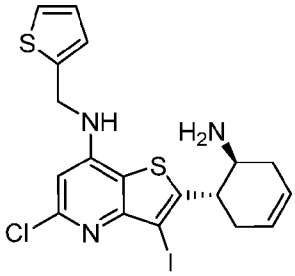
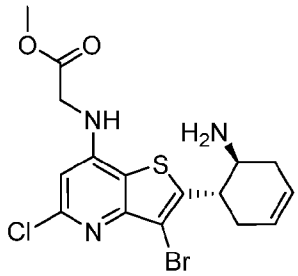
		
298	**299**	**300#**
		
301	**302**	**303**
		
304	**305**	**306**
		
307	**308**	**309#**

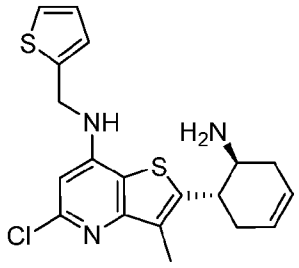
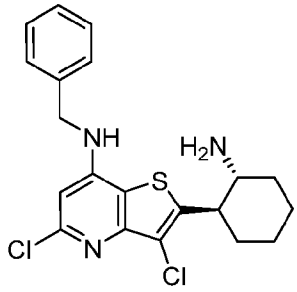
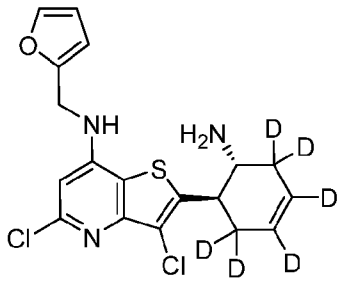
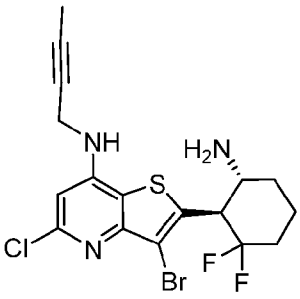
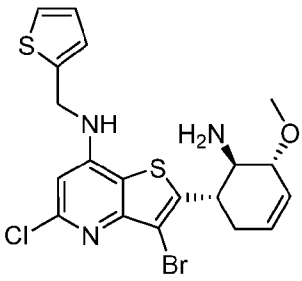
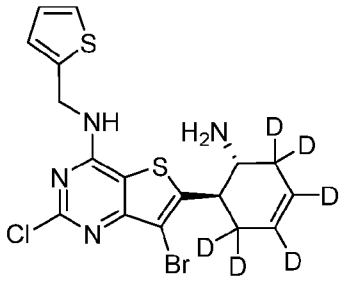
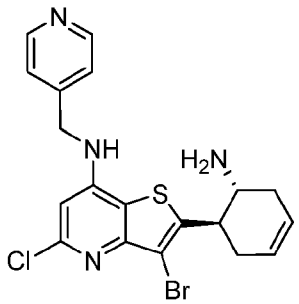
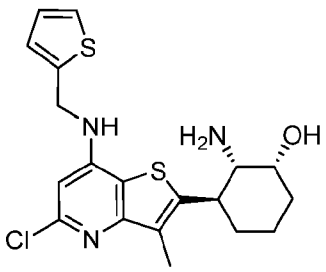
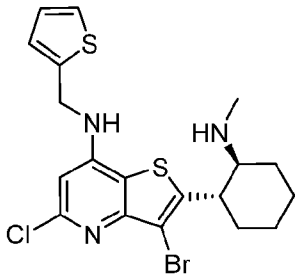
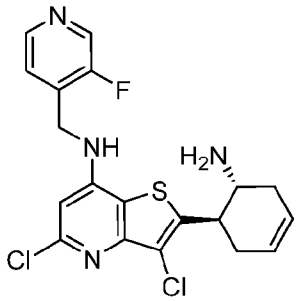
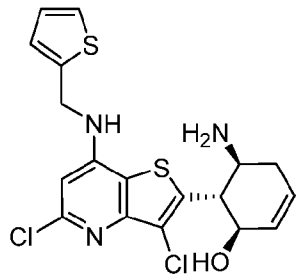
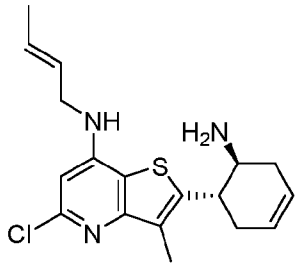
		
310	**311**	**312**
		
313	**314#**	**315#**
		
316#	**317#**	**318**

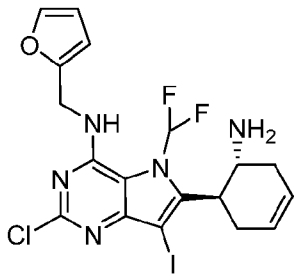
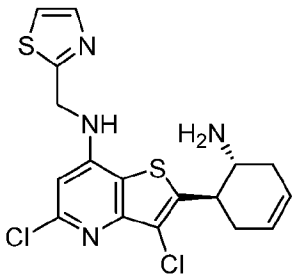
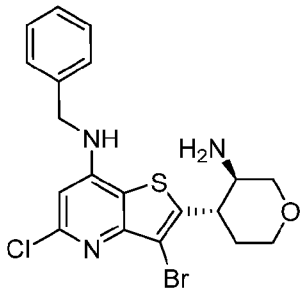
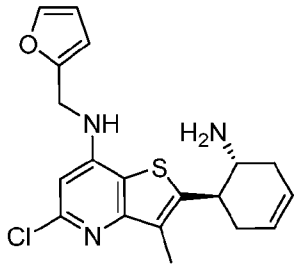
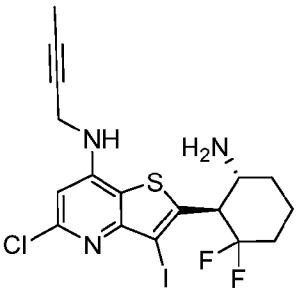
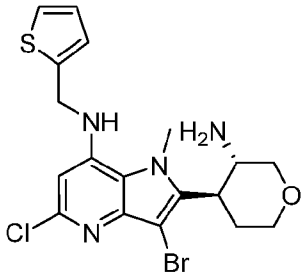
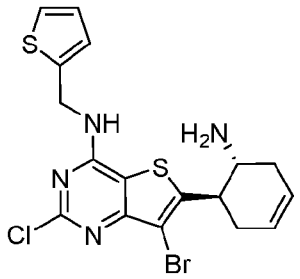
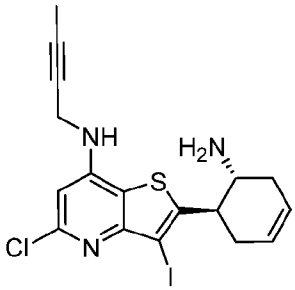
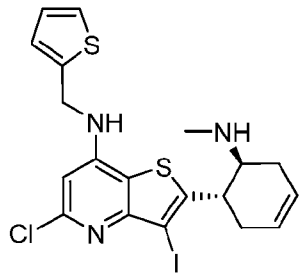
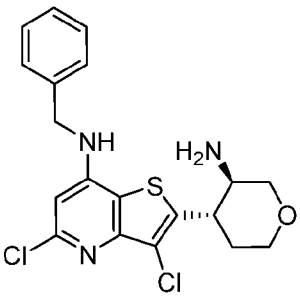
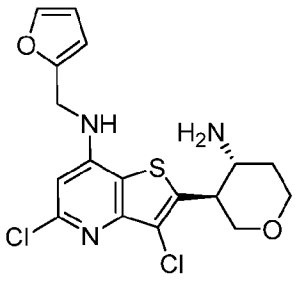
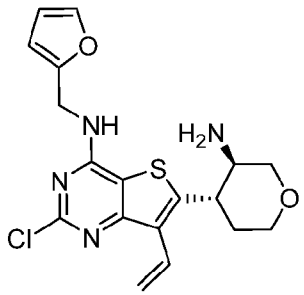
		
319#	**320**	**321**
		
322	**323**	**324#**
		
325	**326**	**327**
		
328#	**329#**	**330#**

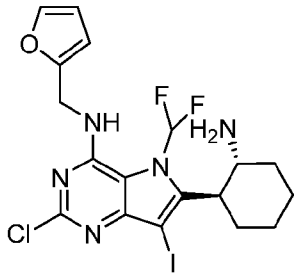
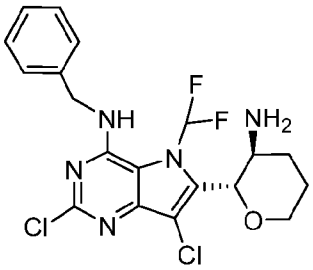
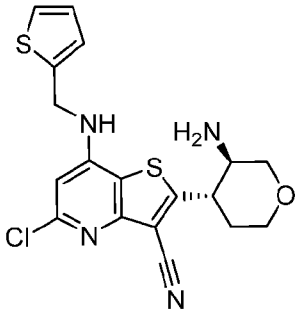
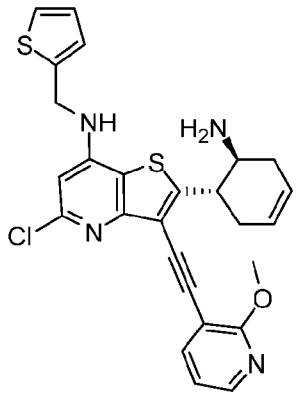
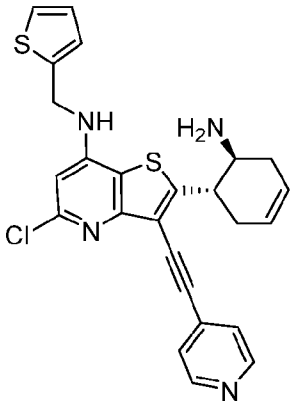
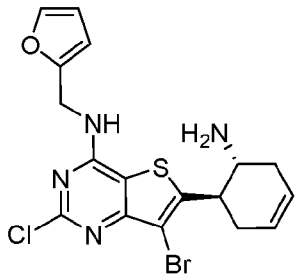
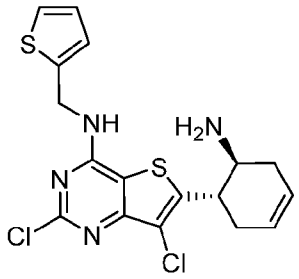
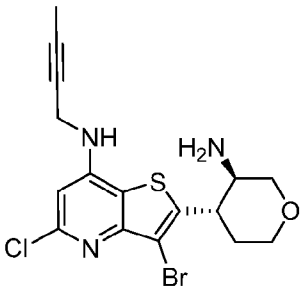
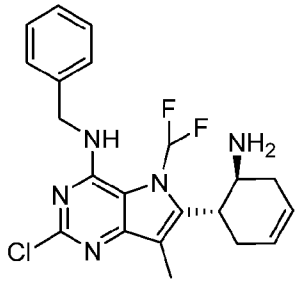
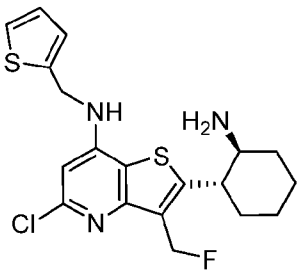
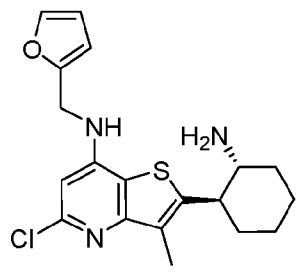
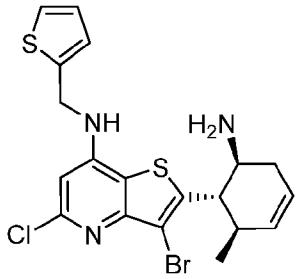
		
331	**332#**	**333#**
		
334#	**335#**	**336**
		
337	**338**	**339#**
		
340	**341**	**342#**

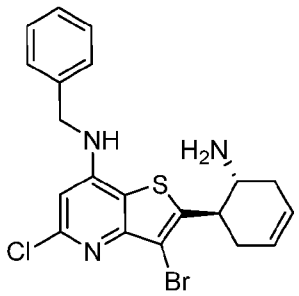
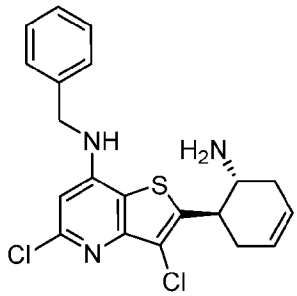
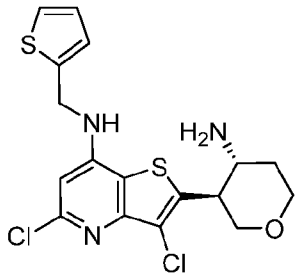
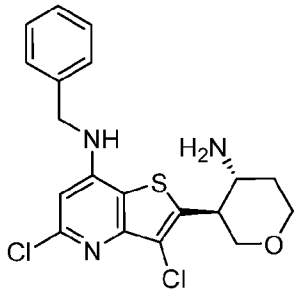
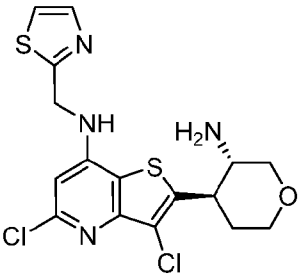
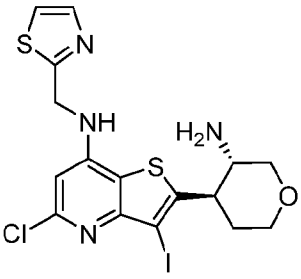
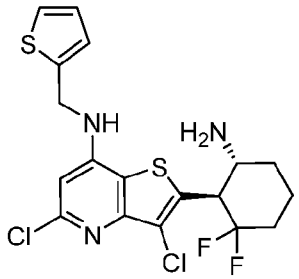
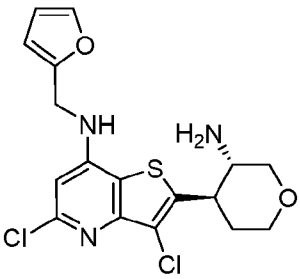
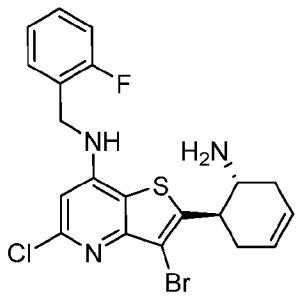
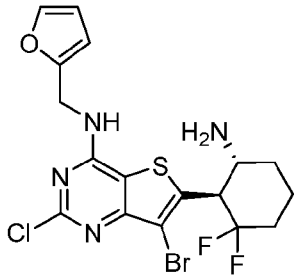
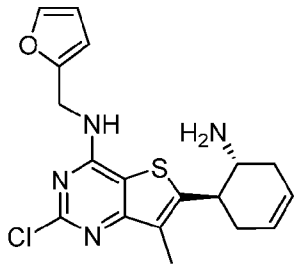
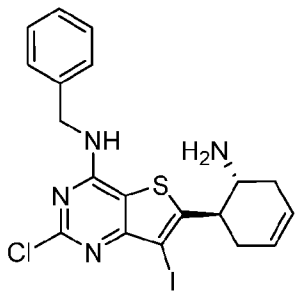
		
343	**344**	**345**
		
346#	**347#**	**348**
		
349	**350#**	**351**
		
352	**353**	**354#**

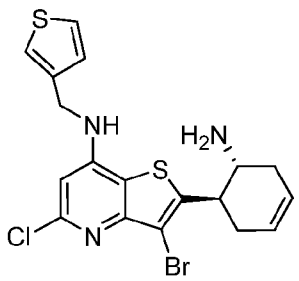
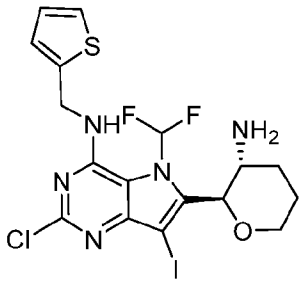
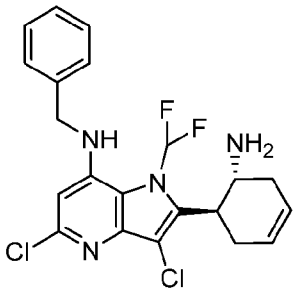
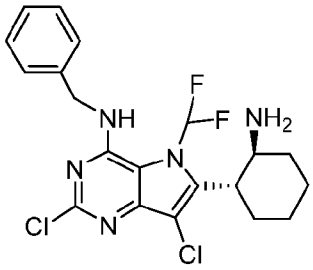
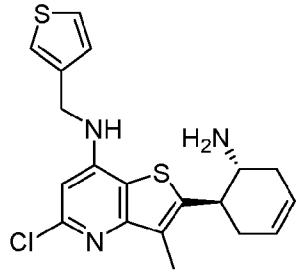
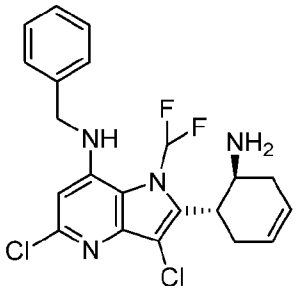
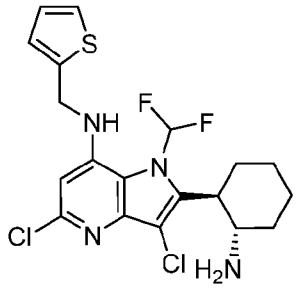
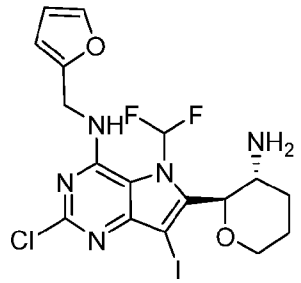
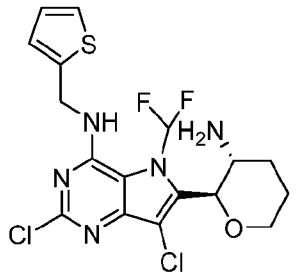
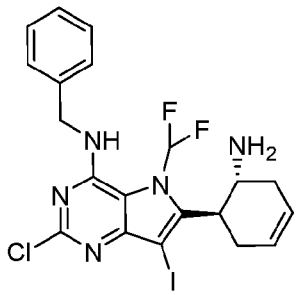
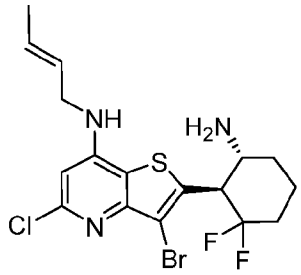
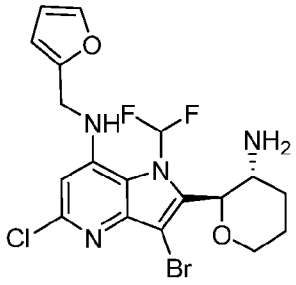
		
355#	**356#**	**357**
		
358#	**359#**	**360#**
		
361	**362**	**363**
		
364	**365#**	**366**

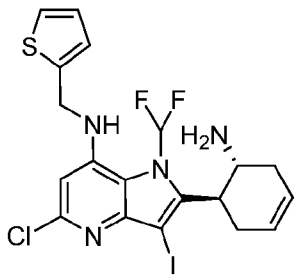
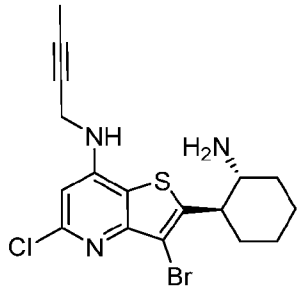
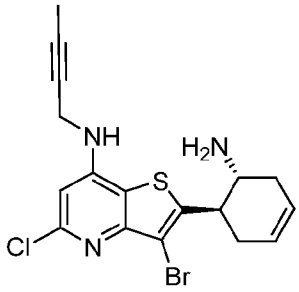
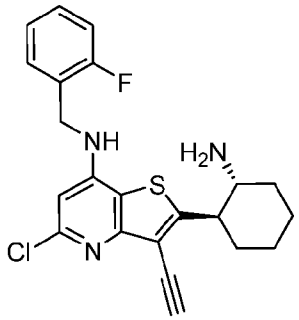
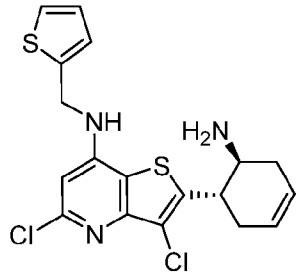
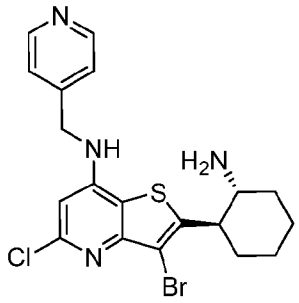
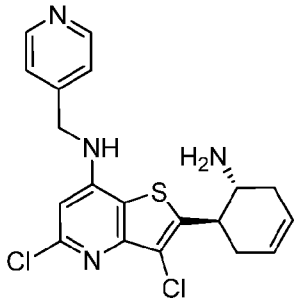
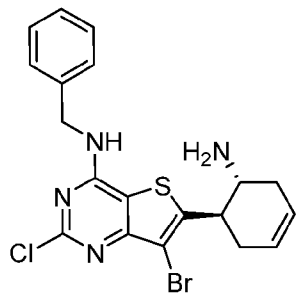
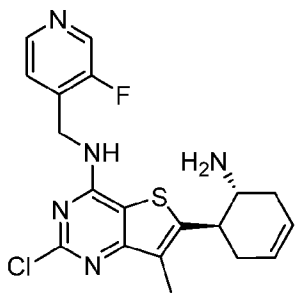
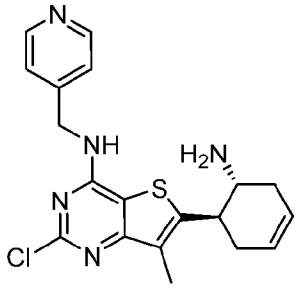
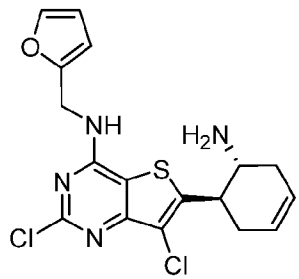
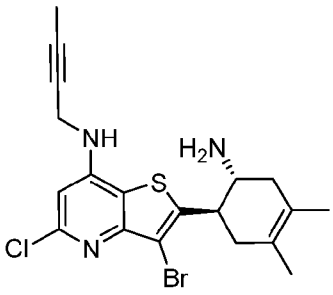
		
367#	**368**	**369**
		
370#	**371#**	**372**
		
373	**374#**	**375#**
		
376	**377**	**378**

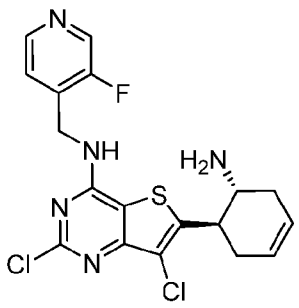
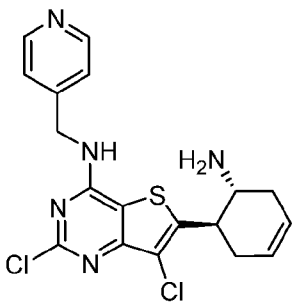
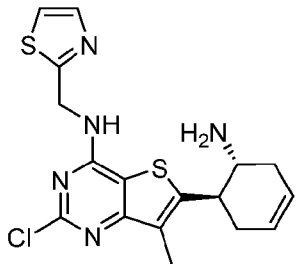
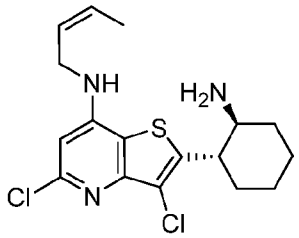
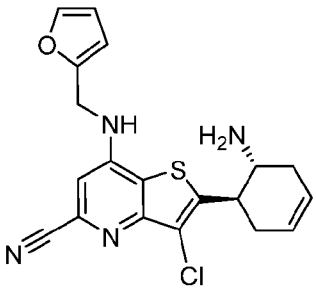
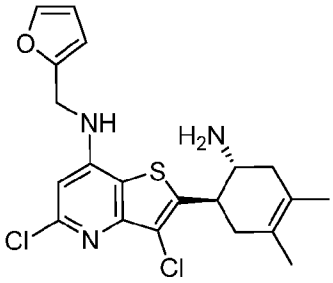
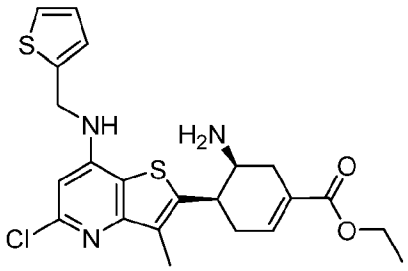
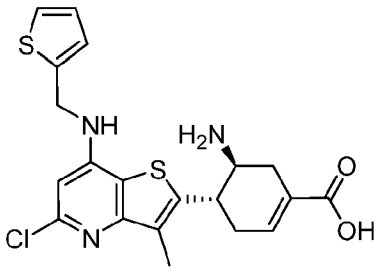
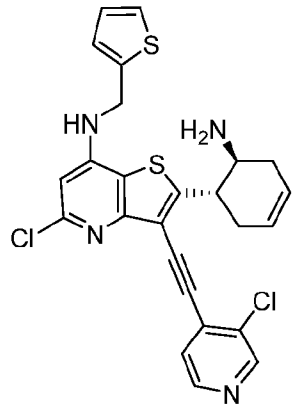
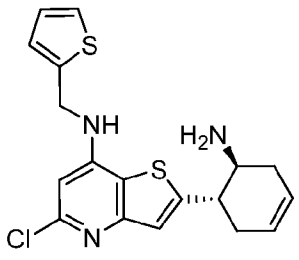
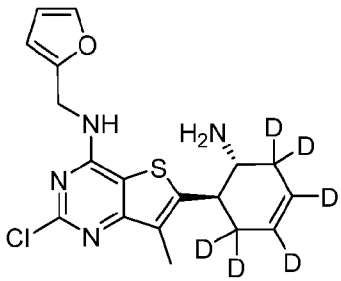
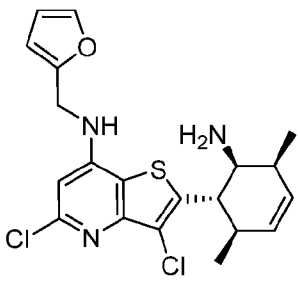
		
379	**380**	**381#**
		
382	**383#**	**384**
		
385	**386**	**387#**
		
388#	**389**	**390#**

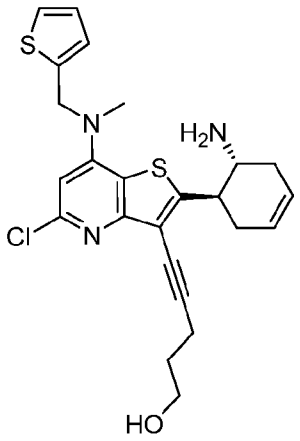
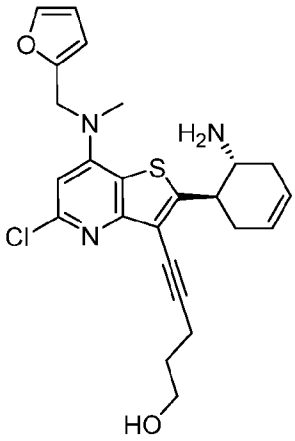
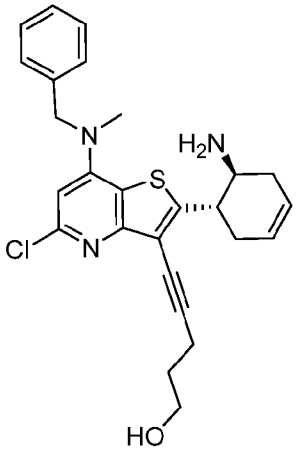
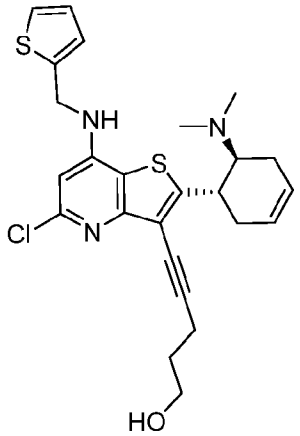
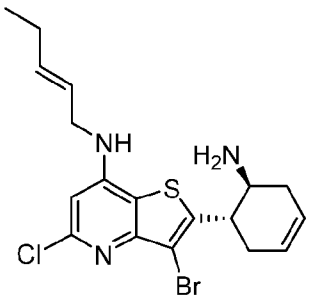
		
391#	**392#**	**393#**
		
394	**395**	**396**
		
397#	**398**	**399**
		
400#	**401**	**402#**

		
403	**404**	**405**
		
406	**407**	**408**
		
409	**410**	**411**
		
412	**413**	**414**

		
415	**416**	**417**
		
418#	**419**	**420**
		
421#	**422**	**423**
		
424	**425#**	**426**

		
427	**428**	**429**
		
430	**431#**	**432**
		
433	**434**	**435**
		
436	**437**	**438**

		
439	**440**	**441**
		
442	**443**	**444**
		
445	**446**	**447**
		
448	**449**	**450**

		
451	**452**	**453**
		
454#, and	**455#**;	

wherein the form of the compound is a pharmaceutically acceptable salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

One aspect includes a compound of Formula (I) or a form thereof selected from

Compound	Name
1	2-((1S,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
2	2-((1R,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
3	2-((1S,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
4	2-((1R,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
5	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
6	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
7	2-((1R,2R)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
8	2-((1S,2S)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
9	2-((1S,2R)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
10	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
11	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
12	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
13	2-((1R,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
14	2-((1S,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
15	2-((2S,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
16	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
17	2-((2S,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
18	2-[(2S,3S)-3-aminotetrahydropyran-2-yl]-3,5-dichloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
19	2-((2R,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
20	3-bromo-5-chloro-2-[(2R,3S)-3-aminotetrahydropyran-2-yl]-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine and 3-bromo-5-chloro-2-[(2S,3R)-3-aminotetrahydropyran-2-yl]-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine
21	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
22	2-((1R,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
23	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
24	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
25	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
26	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine
27	2-(3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
28	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
29	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
30	2-((1R,2S)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2R)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
31	(1R,2S)-2-amino-1-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol
32	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
33	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine
34	2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridine-7-amine
35	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridine-7-amine
36	2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridine-7-amine
37	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
38	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
39	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridine-7-amine
40	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
41	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
42	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine or 6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
43	6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine or 6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine
44	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
45	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
46	2-((2R,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
47	2-((2R,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
48	6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine or 6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine
49	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
50	2-((1R,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
51	2-((1S,2R)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
52	2-((1S,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
53	2-((1R,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
54	2-((1R,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
55	2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
56	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
57	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
58	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
59	6-((1R,2R)-2-aminocyclohexyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
60	6-((1S,2S)-2-aminocyclohexyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
61	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine

Compound	Name
62	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
63	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine
64	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine
65	6-[(1S,2S)-2-aminocyclohexyl]-N-benzyl-7-bromo-2-chloro-thieno[3,2-d]pyrimidin-4-amine
66	6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine
67	6-((1R,2R)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
68	6-((1S,2S)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
69	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine
70	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine
71	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
72	2-((1S,2R)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
73	2-((1R,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
74	2-((1R,2R)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
75	2-((1S,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
76	2-((1S,2R)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
77	2-((1R,2S)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
78	2-((1R,2R)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
79	2-((1S,2S)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
80	2-((1R,2R)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
81	2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
82	2-((1R,2S)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
83	2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
84	2-((1S,2R)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
85	2-((2R,3R)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
86	2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
87	2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine or 2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
88	2-((1S,2R)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
89	2-((1R,2S)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
90	2-((1S,2S)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
91	2-((1R,2S)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
92	2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
93	2-((1S,2R)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
94	2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
95	2-((1R,2S)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
96	2-((1S,2S)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
97	2-((1R,2R)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
98	2-((1S,2R)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
99	2-((1S,2S)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
100	2-((1R,2R)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
101	2-((1S,2R)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
102	2-((1R,2S)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
103	2-((1S,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
104	2-((1R,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
105	2-((1R,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
106	2-((1S,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
107	2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
108	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
109	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
110	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
111	2-((1R,2S)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
112	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
113	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
114	2-((1R,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
115	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
116	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
117	2-((1S,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
118	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
119	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
120	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
121	2-((1R,2S)-2-amino-1-fluorocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
122	2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
123	2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
124	2-((2R,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
125	2-((2R,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
126	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine

Compound	Name
127	(1R,5S,6R)-6-amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol and (1S,5R,6S)-6-amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol
128	6-((1R,2S)-2-amino-1-fluorocyclopentyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
129	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
130	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
131	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
132	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
133	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
134	((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
135	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
136	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
137	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
138	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
139	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
140	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
141	2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
142	2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
143	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
144	2-((1S,6RS)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1R,6SR)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
145	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
146	2-((3R,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
147	2-((4R,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((4S,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
148	2-((4R,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((4S,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
149	2-((1R,2R)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
150	2-((2R,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
151	2-((2R,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
152	2-((1R,2R)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
153	(1R,5S,6R)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol and (1S,5R,6S)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol
154	2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
155	2-((1R,2R)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
156	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
157	2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
158	2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
159	2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine

Compound	Name
160	2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
161	2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
162	2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
163	2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
164	2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
165	2-((1S,2S)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
166	2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
167	2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
168	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
169	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
170	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
171	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
172	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine

Compound	Name
173	2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
174	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
175	5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol and 5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
176	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
177	4-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol and 4-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol
178	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
179	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
180	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
181	2-((1R,2S,6R)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2R,6S)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
182	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine

Compound	Name
183	6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
184	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
185	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
186	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
187	6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
188	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-iodothieno[3,2-b]pyridin-7-amine
189	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
190	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
191	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
192	(2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one and (2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one
193	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
194	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine

Compound	Name
195	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
196	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
197	2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
198	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
199	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(oxazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
200	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
201	6-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
202	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
203	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
204	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
205	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
206	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
207	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
208	2-((6R)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
209	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
210	2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-ethynylthieno[3,2-b]pyridin-7-amine
211	(R)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol
212	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
213	4-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol and 4-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol
214	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
215	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
216	(S)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol
217	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
218	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
219	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine
220	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
221	(3S,4S)-4-amino-3-(3,5-dichloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one
222	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
223	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
224	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
225	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
226	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine
227	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
228	(1R,2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol and (1S,2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol

Compound	Name
229	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine
230	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
231	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
232	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
233	2-((1S,6S)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
234	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
235	6-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hex-5-yn-1-ol
236	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-d]pyrimidin-4-amine
237	2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
238	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
239	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-b]pyridin-7-amine
240	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
241	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine
242	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-chloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile

Compound	Name
243	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine and 6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine
244	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
245	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine
246	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile
247	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine
248	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
249	2-((1S,6S)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
250	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine
251	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
252	3-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol and 3-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol
253	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-((3-fluoropyridin-4-yl)methyl)-7-methylthieno[3,2-d]pyrimidin-4-amine

Compound	Name
254	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-7-iodo-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
255	3-(6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol and 3-(6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol
256	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
257	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-((difluoromethoxy)methyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-((difluoromethoxy)methyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
258	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
259	2-((2R,3R)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
260	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
261	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
262	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
263	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2,7-dichlorothieno[3,2-d]pyrimidin-4-amine

Compound	Name
264	5-(5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
265	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
266	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
267	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine
268	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
269	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
270	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
271	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
272	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
273	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
274	(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxamide

Compound	Name
275	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
276	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
277	ethyl (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate
278	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
279	2-((2R)-2-aminocyclohexyl)-5-chloro-3-(difluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S)-2-aminocyclohexyl)-5-chloro-3-(difluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
280	2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
281	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
282	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-4-((furan-2-ylmethyl)amino)-7-methylthieno[3,2-d]pyrimidine-2-carbonitrile
283	2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
284	2-((2R,3R,5R)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((2S,3S,5S)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
285	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
286	6-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine
287	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
288	5-(5-chloro-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol and 5-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
289	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-((furan-2-ylmethyl)amino)-3-methylthieno[3,2-b]pyridine-5-carbonitrile
290	2-((1R,3R,4R,6S)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,3S,4S,6R)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
291	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
292	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
293	5-(2-chloro-6-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol and 5-(2-chloro-6-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol
294	2-((1R,5S,6R)-6-amino-5-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,5R,6S)-6-amino-5-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
295	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine

Compound	Name
296	2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
297	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
298	(1R,2R,3S)-2-amino-3-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol
299	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
300	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
301	2-((1S,2S)-2-aminocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
302	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine
303	4-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol
304	6-((1S,2S)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
305	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
306	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
307	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
308	2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine
309	5-(5-chloro-2-((2R,3R)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol and 5-(5-chloro-2-((2S,3S)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
310	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
311	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
312	(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)-N,N-dimethylcyclohex-1-ene-1-carboxamide
313	((4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-en-1-yl)(morpholino)methanone
314	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
315	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
316	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
317	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine
318	6-((1R,2R)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-(prop-1-yn-1-yl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
319	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
320	7-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hept-6-yn-1-ol
321	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
322	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(phenylmethyl-d2)thieno[3,2-b]pyridin-7-amine
323	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine
324	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
325	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-1-(difluoromethyl)-3-iodo-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
326	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine
327	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-iodothieno[3,2-b]pyridin-7-amine

Compound	Name
328	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
329	(1R,5R,6S)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol and (1S,5S,6R)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol
330	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
331	6-((1S,2S)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-(prop-1-yn-1-yl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
332	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine
333	2-((1R,2R)-2-amino-5,5-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-amino-5,5-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
334	6-((1S,2S)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine and 6-((1R,2R)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
335	2-((1R,2R,6S)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2S,6R)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
336	5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((furan-2-ylmethyl)(methyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
337	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
338	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
339	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
340	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
341	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine
342	2-((1R,2S,3S)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2R,3R)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
343	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
344	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-ethynylthieno[3,2-b]pyridin-7-amine
345	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
346	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine and 6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine

Compound	Name
347	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
348	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
349	5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-(methyl(thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
350	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine
351	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-1-methyl-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
352	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-1-(difluoromethyl)-3-iodo-1H-pyrrolo[3,2-b]pyridin-7-amine
353	(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)-N-phenylcyclohex-1-ene-1-carboxamide
354	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
355	(1R,2S,3R)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol
356	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-amine and 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
357	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
358	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine
359	2-((1R,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
360	(2-((1S,2S)-2-aminocyclohexyl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)methanol and (2-((1R,2R)-2-aminocyclohexyl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)methanol
361	2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine
362	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
363	2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
364	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
365	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
366	methyl (2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)glycinate

Compound	Name
367	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
368	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
369	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
370	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
371	2-((1R,5S,6S)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,5R,6R)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
372	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
373	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
374	(1R,2S,3R)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol and (1S,2R,3S)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol
375	3-bromo-5-chloro-2-((1R,2R)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 3-bromo-5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
376	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
377	(1R,5S,6R)-5-amino-6-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol
378	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine
379	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
380	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
381	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
382	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
383	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
384	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-1-methyl-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
385	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
386	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine
387	5-chloro-3-iodo-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 5-chloro-3-iodo-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
388	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
389	2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
390	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine
391	6-((1R,2R)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
392	6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine and 6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
393	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile
394	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((2-methoxypyridin-3-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
395	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-4-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
396	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
397	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine

Compound	Name
398	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
399	6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine
400	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
401	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine
402	2-((1R,2S,6R)-6-amino-2-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,2R,6S)-6-amino-2-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
403	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine
404	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
405	2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
406	2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine
407	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
408	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
409	2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
410	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
411	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
412	6-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
413	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
414	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine
415	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine
416	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-7-iodo-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
417	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
418	6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine and 6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
419	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine
420	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
421	2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine and 2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
422	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine

Compound	Name
423	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine
424	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine
425	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
426	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
427	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-1-(difluoromethyl)-3-iodo-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine
428	2-((1R,2R)-2-aminocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
429	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
430	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine
431	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
432	2-((1R,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
433	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine
434	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine

Compound	Name
435	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-((3-fluoropyridin-4-yl)methyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
436	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
437	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
438	2-((1R,6R)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine
439	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-d]pyrimidin-4-amine
440	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
441	6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine
442	2-((1S,2S)-2-aminocyclohexyl)-N-((Z)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine
443	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-chloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile
444	2-((1R,6R)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
445	ethyl (4R,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate
446	(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylic acid
447	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((3-chloropyridin-4-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
448	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

Compound	Name
449	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine
450	2-((1S,2R,5S,6S)-6-amino-2,5-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine
451	5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-(methyl(thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
452	5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((furan-2-ylmethyl)(methyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
453	5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-(benzyl(methyl)amino)-5-chlorothieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol
454	5-(5-chloro-2-((1R,6R)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol and 5-(5-chloro-2-((1S,6S)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol, and
455	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-((E)-pent-2-en-1-yl)thieno[3,2-b]pyridin-7-amine and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-((E)-pent-2-en-1-yl)thieno[3,2-b]pyridin-7-amine;

wherein the form of the compound is a pharmaceutically acceptable salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

One aspect includes a compound of Formula (I) or a form thereof selected from

Compound	Compound Name
24	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine hydrochloride and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine hydrochloride
26	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate

Compound	Compound Name
27	2-(3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate
28	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
29	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
30	2-((1R,2S)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride and
31	(1R,2S)-2-amino-1-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol hydrochloride 2-((1R,2S)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride
32	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride
33	2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate
37	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine hydrochloride
38	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride
41	2-((1R,2S)-2-amino-1-fluorocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine hydrochloride

Compound	Compound Name
46	2-((2R,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
47	2-((2R,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
58	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
71	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
85	2-((2R,3R)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3S)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
124	2-((2R,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
125	2-((2R,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
139	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
140	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate

Compound	Compound Name
146	2-((3R,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((3S,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
147	2-((4R,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((4S,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
148	2-((4R,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((4S,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
149	2-((1R,2R)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
150	2-((2R,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
151	2-((2R,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((2S,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
152	2-((1R,2R)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate

Compound	Compound Name
153	(1R,5S,6R)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate and (1S,5R,6S)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate
175	5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate and 5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate
177	4-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate and 4-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate
183	6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate
185	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
187	6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine trifluoroacetate
189	2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
192	(2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one hydrochloride and (2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one hydrochloride

Compound	Compound Name
195	2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
200	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate and 6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate
204	2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
205	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
208	2-((6R)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
209	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
211	(R)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol trifluoroacetate
212	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate
213	4-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate and 4-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate

Compound	Compound Name
216	(S)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol trifluoroacetate
226	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine formate
227	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
228	(1R,2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate and (1S,2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate
235	6-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hex-5-yn-1-ol trifluoroacetate
238	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
243	6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine trifluoroacetate and 6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine trifluoroacetate
245	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine formate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine formate
252	3-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol trifluoroacetate and 3-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol trifluoroacetate

Compound	Compound Name
255	3-(6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol trifluoroacetate and 3-(6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol trifluoroacetate
259	2-((2R,3R)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
261	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
264	5-(5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate
266	2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride and 2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride
267	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine trifluoroacetate
269	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
272	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
275	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate

Compound	Compound Name
284	2-((2R,3R,5R)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((2S,3S,5S)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
288	5-(5-chloro-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate and 5-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;
290	2-((1R,3R,4R,6S)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,3S,4S,6R)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
292	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate
293	5-(2-chloro-6-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol trifluoroacetate and 5-(2-chloro-6-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol trifluoroacetate
295	2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine formate
300	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine formate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine formate
302	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine formate
303	4-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate

Compound	Compound Name
307	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
309	5-(5-chloro-2-((2R,3R)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate and 5-(5-chloro-2-((2S,3S)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate
314	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
315	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
316	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
317	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate
319	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
320	7-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hept-6-yn-1-ol formate

Compound	Compound Name
322	2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(phenylmethyl-d2)thieno[3,2-b]pyridin-7-amine trifluoroacetate
324	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
329	(1R,5R,6S)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol trifluoroacetate and (1S,5S,6R)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol trifluoroacetate
330	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate
332	2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
334	6-((1S,2S)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine formate and 6-((1R,2R)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine formate
339	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate
342	2-((1R,2S,3S)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,2R,3R)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate

Compound	Compound Name
347	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate
350	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine formate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine formate
354	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate
355	(1R,2S,3R)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate and (1S,2R,3S)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate
359	2-((1R,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
366	methyl (2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)glycinate formate
370	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate
371	2-((1R,5S,6S)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride and 2-((1S,5R,6R)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride

Compound	Compound Name
372	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate
374	(1R,2S,3R)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate and
375	3-bromo-5-chloro-2-((1R,2R)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate and 3-bromo-5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
377	(1R,5S,6R)-5-amino-6-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate
378	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate
381	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate
383	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine trifluoroacetate
387	5-chloro-3-iodo-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 5-chloro-3-iodo-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
388	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate

Compound	Compound Name
390	6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine formate and 6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine formate
393	2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile trifluoroacetate and 2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile trifluoroacetate
394	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((2-methoxypyridin-3-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
395	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-4-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
400	2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate and 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate
410	2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
421	2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine formate and 2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine formate
425	2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate and 2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate
442	2-((1S,2S)-2-aminocyclohexyl)-N-((Z)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate

Compound	Compound Name
447	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((3-chloropyridin-4-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
448	2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate
449	6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine trifluoroacetate
454	5-(5-chloro-2-((1R,6R)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate and 5-(5-chloro-2-((1S,6S)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate;

wherein the form of the compound is a hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

The present application further provides a pharmaceutical composition comprising a compound provided herein, or a pharmaceutically acceptable salt thereof, and at least one pharmaceutically acceptable carrier.

The present application further provides a method of treating spinocerebellar ataxia type 3 (SCA3), the method comprising administering to the subject a therapeutically effective amount of a compound provided herein, or a pharmaceutically acceptable salt thereof.

One aspect of the method or use includes the compound of Formula (I) or a form thereof, wherein exon 4 skipping in the *ATXN3* pre-mRNA is induced during the splicing process.

One aspect of the method or use includes the compound of Formula (I) or a form thereof, wherein levels of *ATXN3* mRNA are decreased.

One aspect of the method or use includes the compound of Formula (I) or a form thereof, wherein ATXN3 protein is decreased.

One aspect of the present description relates to a pharmaceutical composition comprising a compound of Formula (I) or a form thereof and at least one pharmaceutically acceptable excipient for administering to a subject for the treatment of spinocerebellar ataxia type 3 (SCA3), also known as Machado–Joseph disease (MJD).

One aspect of the present description relates to the manufacture of a medicament for the treatment of spinocerebellar ataxia type 3 (SCA3), also known as Machado–Joseph disease (MJD), in a subject comprising a compound of Formula (I) or a form thereof and at least one pharmaceutically acceptable excipient.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Methods and materials are described herein for use in the present invention; other, suitable methods and materials known in the art can also be used.

The materials, methods, and examples are illustrative only and not intended to be limiting. All publications, patent applications, patents, sequences, database entries, and other references mentioned herein are incorporated by reference in their entirety. In case of conflict, the present specification, including definitions, will control.

CHEMICAL DEFINITIONS

The chemical terms used above and throughout the description herein, unless specifically defined otherwise, shall be understood by one of ordinary skill in the art to have the following indicated meanings.

As used herein, the term "C_{1-6}alkyl" generally refers to saturated hydrocarbon radicals having from one to eight carbon atoms in a straight or branched chain configuration, including, but not limited to, methyl, ethyl, n-propyl (also referred to as propyl or propanyl), isopropyl, n-butyl (also referred to as butyl or butanyl), isobutyl, sec-butyl, tert-butyl, n-pentyl (also referred to as pentyl or pentanyl), n-hexyl (also referred to as hexyl or hexanyl), and the like. In certain aspects, C_{1-6}alkyl includes, but is not limited to, C_{1-6}alkyl, C_{1-4}alkyl and the like. A C_{1-6}alkyl radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "C_{2-6}alkenyl" generally refers to partially unsaturated hydrocarbon radicals having from two to eight carbon atoms in a straight or branched chain configuration and one or more carbon-carbon double bonds therein, including, but not limited to, ethenyl (also referred to as vinyl), allyl, propenyl and the like. In certain aspects, C_{2-6}alkenyl includes, but is not limited to, C_{2-6}alkenyl, C_{2-4}alkenyl and the like. A C_{2-6}alkenyl

radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "C_{2-6}alkynyl" generally refers to partially unsaturated hydrocarbon radicals having from two to eight carbon atoms in a straight or branched chain configuration and one or more carbon-carbon triple bonds therein, including, but not limited to, ethynyl (also referred to as acetylenyl), propynyl, butynyl and the like. In certain aspects, C_{2-6}alkynyl includes, but is not limited to, C_{2-6}alkynyl, C_{2-4}alkynyl and the like. A C_{2-6}alkynyl radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "C_{1-6}alkoxy" generally refers to saturated hydrocarbon radicals having from one to eight carbon atoms in a straight or branched chain configuration of the formula: -O-C_{1-6}alkyl, including, but not limited to, methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, isobutoxy, sec-butoxy, tert-butoxy, n-pentoxy, n-hexoxy and the like. In certain aspects, C_{1-6}alkoxy includes, but is not limited to, C_{1-6}alkoxy, C_{1-4}alkoxy and the like. A C_{1-6}alkoxy radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "C_{1-6}alkoxy-C_{2-6}alkynyl" refers to a radical of the formula: -C_{2-6}alkynyl-O-C_{1-6}alkyl, wherein C_{2-6}alkynyl is partially or completely substituted with one or more C_{1-6}alkoxy radicals where allowed by available valences.

As used herein, the term "oxo" refers to a radical of the formula: =O.

As used herein, the term "carboxyl" refers to a radical of the formula: -COOH, -C(O)OH or -CO_2H.

As used herein, the terms "C_{1-6}alkoxy-carbonyl" or " CO_2C_{1-6}alkyl" refer to a radical of the formula: -COO- C_{1-6}alkyl, -C(O)O-C_{1-6}alkyl or -CO_2-C_{1-6}alkyl.

As used herein, the term "carbamoyl" refers to a radical of the formula: -C(O)NH_2.

As used herein, the term "C_{3-8}cycloalkyl" generally refers to a saturated or partially unsaturated monocyclic, bicyclic or polycyclic hydrocarbon radical, including, but not limited to, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cyclohexenyl, and the like. In certain aspects, C_{3-8}cycloalkyl includes, but is not limited to, C_{3-8}cycloalkyl, C_{5-8}cycloalkyl, and the like. A C_{3-10}cycloalkyl radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "aryl" generally refers to a monocyclic, bicyclic or polycyclic aromatic carbon atom ring structure radical, including, but not limited to, phenyl, naphthyl, anthracenyl, fluorenyl, azulenyl, phenanthrenyl and the like. An aryl radical is optionally substituted with substituent species as described herein where allowed by available valences.

As used herein, the term "heteroaryl" generally refers to a monocyclic, bicyclic or polycyclic aromatic carbon atom ring structure radical in which one or more carbon atom ring members have been replaced, where allowed by structural stability, with one or more heteroatoms, such as an O, S or N atom, including, but not limited to, furanyl, thiophenyl, pyrrolyl, pyrazolyl, imidazolyl, isoxazolyl, isothiazolyl, oxazolyl, 1,3-thiazolyl, triazolyl, oxadiazolyl, thiadiazolyl, tetrazolyl, pyridinyl, pyrimidinyl, pyrazinyl, pyridazinyl, triazinyl, indolyl, indazolyl, indolizinyl, isoindolyl, benzofuranyl, benzothiophenyl, benzoimidazolyl, 1,3-benzothiazolyl, 1,3-benzoxazolyl, purinyl, quinolinyl, isoquinolinyl, quinazolinyl, quinoxalinyl and the like. A heteroaryl radical is optionally substituted on a carbon or nitrogen atom ring member with substituent species as described herein where allowed by available valences.

In certain aspects, the nomenclature for a heteroaryl radical may differ, such as in non-limiting examples where furanyl may also be referred to as furyl, thiophenyl may also be referred to as thienyl , pyridinyl may also be referred to as pyridyl, benzothiophenyl may also be referred to as benzothienyl and 1,3-benzoxazolyl may also be referred to as 1,3-benzooxazolyl.

In certain other aspects, the term for a heteroaryl radical may also include other regioisomers, such as in non-limiting examples where the term pyrrolyl may also include 2*H*-pyrrolyl, 3*H*-pyrrolyl and the like, the term pyrazolyl may also include 1*H*-pyrazolyl and the like, the term imidazolyl may also include 1*H*-imidazolyl and the like, the term triazolyl may also include 1*H*-1,2,3-triazolyl and the like, the term oxadiazolyl may also include 1,2,4-oxadiazolyl, 1,3,4-oxadiazolyl and the like, the term tetrazolyl may also include 1*H*-tetrazolyl, 2*H*-tetrazolyl and the like, the term indolyl may also include 1*H*-indolyl and the like, the term indazolyl may also include 1*H*-indazolyl, 2*H*-indazolyl and the like, the term benzoimidazolyl may also include 1*H*-benzoimidazolyl and the term purinyl may also include 9*H*-purinyl and the like.

As used herein, the term "heterocyclyl" generally refers to a saturated or partially unsaturated monocyclic, bicyclic or polycyclic carbon atom ring structure radical in which one or more carbon atom ring members have been replaced, where allowed by structural stability, with a heteroatom, such as an O, S or N atom, including, but not limited to, oxiranyl, oxetanyl, azetidinyl, tetrahydrofuranyl, pyrrolinyl, pyrrolidinyl, pyrazolinyl, pyrazolidinyl, imidazolinyl, imidazolidinyl, isoxazolinyl, isoxazolidinyl, isothiazolinyl, isothiazolidinyl, oxazolinyl, oxazolidinyl, thiazolinyl, thiazolidinyl, triazolinyl, triazolidinyl, oxadiazolinyl, oxadiazolidinyl, thiadiazolinyl, thiadiazolidinyl, tetrazolinyl, tetrazolidinyl, pyranyl, dihydro-2*H*-pyranyl, tetrahydropyranyl, thiopyranyl, 1,3-dioxanyl, 1,3-oxazinanyl, 1,2,5,6-tetrahydropyridinyl, 1,2,3,6-tetrahydropyridinyl, piperidinyl, piperazinyl, morpholinyl, thiomorpholinyl, 1,4-diazepanyl, 1,3-benzodioxolyl, 1,4-benzodioxanyl and the like. A heterocyclyl radical is optionally substituted on a carbon or nitrogen atom ring member with substituent species as described herein where allowed by available valences.

As used herein, the term "C_{1-4}alkyl-amino" refers to a radical of the formula: -NH-C_{1-4}alkyl.

As used herein, the term "halo-C_{1-4}alkyl-amino" refers to a radical of the formula: -NH-C_{1-4}alkyl, wherein C_{1-4}alkyl is partially or completely substituted with one or more halogen atoms where allowed by available valences.

As used herein, the term "(C_{1-4}alkyl)$_2$-amino" refers to a radical of the formula: -N(C_{1-4}alkyl)$_2$.

As used herein, the term "C_{1-6}alkyl-thio" refers to a radical of the formula: -S-C_{1-6}alkyl.

As used herein, the term "C_{1-6}alkyl-sulfoxyl" refers to a radical of the formula: -S(O)-C_{1-6}alkyl.

As used herein, the term "C_{1-6}alkyl-sulfonyl" refers to a radical of the formula: -SO_2-C_{1-6}alkyl.

As used herein, the term "halo" or "halogen" generally refers to a halogen atom radical, including fluoro, chloro, bromo, and iodo.

As used herein, the term "halo-C_{1-6}alkyl" refers to a radical of the formula: -C_{1-6}alkyl-halo, wherein C_{1-6}alkyl is partially or completely substituted with one or more halogen atoms where allowed by available valences.

As used herein, the term "halo-C_{1-6}alkoxy" refers to a radical of the formula: -O-C_{1-6}alkyl-halo, wherein C_{1-6}alkyl is partially or completely substituted with one or more halogen atoms where allowed by available valences.

As used herein, the term "deutero-C_{1-6}alkyl" refers to a radical of the formula: -C_{1-6}alkyl, wherein C_{1-6}alkyl is partially or completely substituted with one or more deuterium atoms where allowed by available valences.

As used herein, the term "hydroxy" refers to a radical of the formula: -OH.

As used herein, the term "hydroxy-C_{1-6}alkyl" refers to a radical of the formula: -C_{1-6}alkyl-OH, wherein C_{1-6}alkyl is partially or completely substituted with one or more hydroxy radicals where allowed by available valences.

As used herein, the term "hydroxy-C_{2-6}alkynyl" refers to a radical of the formula: -C_{2-6}alkynyl-OH, wherein C_{2-6}alkynyl is partially or completely substituted with one or more hydroxy radicals where allowed by available valences.

As used herein, the term "thio-C_{1-6}alkyl" refers to a radical of the formula: -C_{1-6}alkyl-SH, wherein C_{1-6}alkyl is partially or completely substituted with one or more -SH radicals where allowed by available valences.

As used herein, the term "C_{1-6}alkoxy-C_{2-6}alkynyl" refers to a radical of the formula -C_{2-6}alkynyl-C_{1-6}alkoxy, wherein C_{2-6}alkynyl is partially or completely substituted with one or more hydroxy radicals where allowed by available valences.

As used herein, the term "$(CH_3)_3Si$-C_{2-6}alkynyl" refers to a radical of the formula -C_{2-6}alkynyl-$Si(CH_3)_3$.

As used herein, the term "heteroaryl-C_{2-6}alkynyl" refers to a radical of the formula C_{2-6}alkynyl-heteroaryl.

As used herein, the term "substituent" means positional variables on the atoms of a core molecule that are substituted at a designated atom position, replacing one or more hydrogens on the designated atom, provided that the designated atom's normal valency is not exceeded, and that the substitution results in a stable compound. Combinations of substituents and/or variables are permissible only if such combinations result in stable compounds. A person of ordinary skill in the art should note that any carbon as well as heteroatom with valences that appear to be unsatisfied as described or shown herein is assumed to have a sufficient number of hydrogen atom(s) to satisfy the valences described or shown. In certain instances, one or more

substituents having a double bond (e.g., "oxo" or "=O") as the point of attachment may be described, shown or listed herein within a substituent group, wherein the structure may only show a single bond as the point of attachment to the core structure of Formula (I). A person of ordinary skill in the art would understand that, while only a single bond is shown, a double bond is intended for those substituents.

As used herein, the term "and the like," with reference to the definitions of chemical terms provided herein, means that variations in chemical structures that could be expected by one skilled in the art include, without limitation, isomers (including chain, branching or positional structural isomers), hydration of ring systems (including saturation or partial unsaturation of monocyclic, bicyclic or polycyclic ring structures) and all other variations where allowed by available valences which result in a stable compound.

For the purposes of this description, where one or more substituent variables for a compound of Formula (I) or a form thereof encompass functionalities incorporated into a compound of Formula (I), each functionality appearing at any location within the disclosed compound may be independently selected, and as appropriate, independently and/or optionally substituted.

As used herein, the terms "independently selected," or "each selected" refer to functional variables in a substituent list that may occur more than once on the structure of Formula (I), the pattern of substitution at each occurrence is independent of the pattern at any other occurrence. Further, the use of a generic substituent variable on any formula or structure for a compound described herein is understood to include the replacement of the generic substituent with species substituents that are included within the particular genus, *e.g.*, aryl may be replaced with phenyl or naphthalenyl and the like, and that the resulting compound is to be included within the scope of the compounds described herein.

As used herein, the terms "each instance of" or "in each instance, when present," when used preceding a phrase such as "…C_{3-10}cycloalkyl, C_{3-10}cycloalkyl-C_{1-4}alkyl, aryl, aryl-C_{1-4}alkyl, heteroaryl, heteroaryl-C_{1-4}alkyl, heterocyclyl and heterocyclyl-C_{1-4}alkyl," are intended to refer to the C_{3-10}cycloalkyl, aryl, heteroaryl and heterocyclyl ring systems when each are present either alone or as a substituent.

As used herein, the term "optionally substituted" means optional substitution with the specified substituent variables, groups, radicals or moieties.

As used herein, the term "D" refers to a deuterium atom.

As used herein, the term "isotope enriched" means a compounds of Formula I or a form thereof which are identical to those recited herein, but for the fact that one or more atoms are replaced by an atom having an atomic mass or mass number different from the atomic mass or mass number usually found in nature. Examples of isotopes that can be incorporated into compounds of Formula I or a form thereof described herein include isotopes of hydrogen, carbon, nitrogen, oxygen, phosphorus, fluorine and chlorine, such as H^2, H^3, C^{13}, C^{14}, N^{15}, O^{18}, O^{17}, P^{31}, P^{32}, S^{35}, F^{18}, Cl^{35} and Cl^{36}, respectively, each of which is also within the scope of this description.

COMPOUND FORMS

As used herein, the term "form" means a compound of Formula (I) having a form selected from the group consisting of a free acid, free base, salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, and tautomer form thereof.

In certain aspects described herein, the form of the compound of Formula (I) is a free acid, free base or salt thereof.

In certain aspects described herein, the form of the compound of Formula (I) is a salt thereof.

In certain aspects described herein, the form of the compound of Formula (I) is a stereoisomer, racemate, enantiomer or diastereomer thereof.

In certain aspects described herein, the form of the compound of Formula (I) is a tautomer thereof.

In certain aspects described herein, the form of the compound of Formula (I) is a pharmaceutically acceptable form.

In certain aspects described herein, the compound of Formula (I) or a form thereof is isolated for use.

As used herein, the term "isolated" means the physical state of a compound of Formula (I) or a form thereof after being isolated and/or purified from a synthetic process (*e.g.*, from a reaction mixture) or natural source or combination thereof according to an isolation or purification process or processes described herein or which are well known to the skilled artisan (*e.g.*, chromatography, recrystallization and the like) in sufficient purity to be

characterized by standard analytical techniques described herein or well known to the skilled artisan.

As used herein, the term "protected" means that a functional group in a compound of Formula (I) or a form thereof is in a form modified to preclude undesired side reactions at the protected site when the compound is subjected to a reaction. Suitable protecting groups will be recognized by those with ordinary skill in the art as well as by reference to standard textbooks such as, for example, T.W. Greene *et al*, *Protective Groups in organic Synthesis* (1991), Wiley, New York. Such functional groups include hydroxy, phenol, amino and carboxylic acid. Suitable protecting groups for hydroxy or phenol include trialkylsilyl or diarylalkylsilyl (e.g., t-butyldimethylsilyl, t-butyldiphenylsilyl or trimethylsilyl), tetrahydropyranyl, benzyl, substituted benzyl, methyl, methoxymethanol, and the like. Suitable protecting groups for amino, amidino and guanidino include t-butoxycarbonyl, benzyloxycarbonyl, and the like. Suitable protecting groups for carboxylic acid include alkyl, aryl or arylalkyl esters. In certain instances, the protecting group may also be a polymer resin, such as a Wang resin or a 2-chlorotrityl-chloride resin. Protecting groups may be added or removed in accordance with standard techniques, which are well-known to those skilled in the art and as described herein. It will also be appreciated by those skilled in the art, although such protected derivatives of compounds described herein may not possess pharmacological activity as such, they may be administered to a subject and thereafter metabolized in the body to form compounds described herein which are pharmacologically active. Such derivatives may therefore be described as "prodrugs". All prodrugs of compounds described herein are included within the scope of the use described herein.

One or more compounds described herein may exist in unsolvated as well as solvated forms with pharmaceutically acceptable solvents such as water, ethanol, and the like, and the description herein is intended to embrace both solvated and unsolvated forms.

As used herein, the term "solvate" means a physical association of a compound described herein with one or more solvent molecules. This physical association involves varying degrees of ionic and covalent bonding, including hydrogen bonding. In certain instances, the solvate will be capable of isolation, for example when one or more solvent molecules are incorporated in the crystal lattice of the crystalline solid. As used herein,

"solvate" encompasses both solution-phase and isolatable solvates. Non-limiting examples of suitable solvates include ethanolates, methanolates, and the like.

As used herein, the term "hydrate" means a solvate wherein the solvent molecule is water.

The compounds of Formula (I) can form salts, which are intended to be included within the scope of this description. Reference to a compound of Formula (I) or a form thereof herein is understood to include reference to salt forms thereof, unless otherwise indicated. The term "salt(s)", as employed herein, denotes acidic salts formed with inorganic and/or organic acids, as well as basic salts formed with inorganic and/or organic bases. In addition, when a compound of Formula (I) or a form thereof contains both a basic moiety, such as, without limitation an amine moiety, and an acidic moiety, such as, but not limited to a carboxylic acid, zwitterions ("inner salts") may be formed and are included within the term "salt(s)" as used herein.

The term "pharmaceutically acceptable salt(s)", as used herein, means those salts of compounds described herein that are safe and effective (*i.e.*, non-toxic, physiologically acceptable) for use in mammals and that possess biological activity, although other salts are also useful. Salts of the compounds of the Formula (I) may be formed, for example, by reacting a compound of Formula (I) or a form thereof with an amount of acid or base, such as an equivalent amount, in a medium such as one in which the salt precipitates or in an aqueous medium followed by lyophilization.

Pharmaceutically acceptable salts include one or more salts of acidic or basic groups present in compounds described herein. Particular aspects of acid addition salts include, and are not limited to, acetate, ascorbate, benzoate, benzenesulfonate, bisulfate, bitartrate, borate, bromide, butyrate, chloride, citrate, camphorate, camphorsulfonate, ethanesulfonate, formate, fumarate, gentisinate, gluconate, glucaronate, glutamate, iodide, isonicotinate, lactate, maleate, methanesulfonate, naphthalenesulfonate, nitrate, oxalate, pamoate, pantothenate, phosphate, propionate, saccharate, salicylate, succinate, sulfate, tartrate, thiocyanate, toluenesulfonate (also known as tosylate), trifluoroacetate salts and the like. Certain particular aspects of acid addition salts include chloride or dichloride.

Additionally, acids which are generally considered suitable for the formation of pharmaceutically useful salts from basic pharmaceutical compounds are discussed, for

example, by P. Stahl *et al*, Camille G. (eds.) *Handbook of Pharmaceutical Salts. Properties, Selection and Use.* (2002) Zurich: Wiley-VCH; S. Berge *et al*, *Journal of Pharmaceutical Sciences* (1977) 66(1) 1-19; P. Gould, *International J. of Pharmaceutics* (1986) 33, 201-217; Anderson *et al*, *The Practice of Medicinal Chemistry* (1996), Academic Press, New York; and in *The Orange Book* (Food & Drug Administration, Washington, D.C. on their website). These disclosures are incorporated herein by reference thereto.

Suitable basic salts include, but are not limited to, aluminum, ammonium, calcium, lithium, magnesium, potassium, sodium and zinc salts.

All such acid salts and base salts are intended to be included within the scope of pharmaceutically acceptable salts as described herein. In addition, all such acid and base salts are considered equivalent to the free forms of the corresponding compounds for purposes of this description.

Compounds of Formula (I) and forms thereof, may further exist in a tautomeric form. All such tautomeric forms are contemplated and intended to be included within the scope of the compounds of Formula (I) or a form thereof as described herein.

The compounds of Formula (I) or a form thereof may contain asymmetric or chiral centers, and, therefore, exist in different stereoisomeric forms. The present description is intended to include all stereoisomeric forms of the compounds of Formula (I) as well as mixtures thereof, including racemic mixtures.

The compounds described herein may include one or more chiral centers, and as such may exist as racemic mixtures (*R/S*) or as substantially pure enantiomers and diastereomers. The compounds may also exist as substantially pure (*R*) or (*S*) enantiomers (when one chiral center is present). In one particular aspect, the compounds described herein are (*S*) isomers and may exist as enantiomerically pure compositions substantially comprising only the (*S*) isomer. In another particular aspect, the compounds described herein are (*R*) isomers and may exist as enantiomerically pure compositions substantially comprising only the (*R*) isomer. As one of skill in the art will recognize, when more than one chiral center is present, the compounds described herein may also exist as a (*R,R*), (*R,S*), (*S,R*) or (*S,S*) isomer, as defined by *IUPAC* Nomenclature Recommendations.

As used herein, the term "chiral" refers to a carbon atom bonded to four nonidentical substituents. Stereochemical definitions and conventions used herein generally follow S. P.

Parker, Ed., McGraw-Hill Dictionary of Chemical Terms (1984) McGraw-Hill Book Company, New York; and Eliel, E. and Wilen, S., "Stereochemistry of Organic Compounds", John Wiley & Sons, Inc., New York, 1994. In describing an optically active compound, the prefixes D and L, or *R* and *S*, are used to denote the absolute configuration of the molecule about its chiral center(s). The substituents attached to the chiral center under consideration are ranked in accordance with the Sequence Rule of Cahn, Ingold and Prelog. (Cahn et al. Angew. Chem. Inter. Edit. 1966, 5, 385; errata 511).

As used herein, the term "substantially pure" refers to compounds consisting substantially of a single isomer in an amount greater than or equal to 90%, in an amount greater than or equal to 92%, in an amount greater than or equal to 95%, in an amount greater than or equal to 98%, in an amount greater than or equal to 99%, or in an amount equal to 100% of the single isomer.

In one aspect of the description, a compound of Formula (I) or a form thereof is a substantially pure (*S*) enantiomer form present in an amount greater than or equal to 90%, in an amount greater than or equal to 92%, in an amount greater than or equal to 95%, in an amount greater than or equal to 98%, in an amount greater than or equal to 99%, or in an amount equal to 100%.

In one aspect of the description, a compound of Formula (I) or a form thereof is a substantially pure (*R*) enantiomer form present in an amount greater than or equal to 90%, in an amount greater than or equal to 92%, in an amount greater than or equal to 95%, in an amount greater than or equal to 98%, in an amount greater than or equal to 99%, or in an amount equal to 100%.

As used herein, a "racemate" is any mixture of isometric forms that are not "enantiomerically pure", including mixtures such as, without limitation, in a ratio of about 50/50, about 60/40, about 70/30, or about 80/20.

In addition, the present description embraces all geometric and positional isomers. For example, if a compound of Formula (I) or a form thereof incorporates a double bond or a fused ring, both the cis- and trans-forms, as well as mixtures, are embraced within the scope of the description. Diastereomeric mixtures can be separated into their individual diastereomers on the basis of their physical chemical differences by methods well known to those skilled in the art, such as, for example, by chromatography and/or fractional crystallization. Enantiomers

can be separated by use of chiral HPLC column or other chromatographic methods known to those skilled in the art. Enantiomers can also be separated by converting the enantiomeric mixture into a diastereomeric mixture by reaction with an appropriate optically active compound (*e.g.*, chiral auxiliary such as a chiral alcohol or Mosher's acid chloride), separating the diastereomers and converting (*e.g.*, hydrolyzing) the individual diastereomers to the corresponding pure enantiomers. Also, some of the compounds of Formula (I) may be atropisomers (*e.g.*, substituted biaryls) and are considered as part of this description.

All stereoisomers (for example, geometric isomers, optical isomers and the like) of the present compounds (including those of the salts, solvates, esters and prodrugs of the compounds as well as the salts, solvates and esters of the prodrugs), such as those which may exist due to asymmetric carbons on various substituents, including enantiomeric forms (which may exist even in the absence of asymmetric carbons), rotameric forms, atropisomers, and diastereomeric forms, are contemplated within the scope of this description, as are positional isomers (such as, for example, 4-pyridyl and 3-pyridyl). Individual stereoisomers of the compounds described herein may, for example, be substantially free of other isomers, or may be present in a racemic mixture, as described supra.

The use of the terms "salt", "solvate" and the like, is intended to equally apply to enantiomers, stereoisomers, rotamers, tautomers, positional isomers, or racemates of the instant compounds.

Chemical names were obtained using the structure naming feature of ChemDraw® software version 20.1.1 provided by PerkinElmer Informatics, Inc. and generally comport with the IUPAC (International Union for Pure and Applied Chemistry) recommendations on Nomenclature of Organic Chemistry and the CAS Index rules. The chemical names may have only parentheses or may have parentheses and brackets. The stereochemical descriptors may also be placed at different locations within the name itself, depending on the naming convention. One of ordinary skill in the art will recognize these formatting variations and understand they provide the same chemical structure.

COMPOUND USES

Provided herein are methods of treating a disease in a subject in need thereof. As used herein, the terms "subject" or "patient" refer to any animal, including mammals. For example,

mice, rats, other rodents, rabbits, dogs, cats, swine, cattle, sheep, horses, primates, and humans. In some aspects, the subject is a human.

As used herein, the phrase "therapeutically effective amount" refers to the amount of active compound or pharmaceutical agent that elicits the biological or medicinal response that is being sought in a tissue, system, animal, individual or human by a researcher, veterinarian, medical doctor or other clinician. In some aspects, the dosage of the compound, or a pharmaceutically acceptable salt thereof, administered to a subject or individual is about 1 mg to about 2 g, about 1 mg to about 1000 mg, about 1 mg to about 500 mg, about 1 mg to about 100 mg, about 1 mg to 50 mg, or about 50 mg to about 500 mg.

As used herein, the term "treating" or "treatment" refers to one or more of (1) preventing the disease; for example, preventing a disease, condition or disorder in an individual who may be predisposed to the disease, condition or disorder but does not yet experience or display the pathology or symptomatology of the disease; (2) inhibiting the disease; for example, inhibiting a disease, condition or disorder in an individual who is experiencing or displaying the pathology or symptomatology of the disease, condition or disorder (i.e., arresting further development of the pathology and/or symptomatology); and (3) ameliorating the disease; for example, ameliorating a disease, condition or disorder in an individual who is experiencing or displaying the pathology or symptomatology of the disease, condition or disorder (i.e., reversing the pathology and/or symptomatology) such as decreasing the severity of disease or reducing or alleviating one or more symptoms of the disease.

The present application provides a method of treating SCA3 in a subject in need thereof, comprising administering to the subject a therapeutically effective amount of a compound provided herein (i.e., a compound of Formula (I)).

Also provided herein is a method of treating a subject having a disease caused by abnormal repeat expansions in the ATXN3 gene which results in mutant ATXN3 protein possessing a polyQ expansion, comprising administering to the subject a therapeutically effective amount of a compound provided herein (i.e., a compound of Formula (I)).

Also provided herein are methods of lowering ATXN3 mutant protein in a subject, comprising administering to the subject a therapeutically effective amount of a compound provided herein (i.e., a compound of Formula (I)).

In some aspects of the methods provided herein, the compound is selected from the

group of compounds of Formula (I) or a pharmaceutically acceptable salt thereof.

Also provided herein are methods of inducing exon skipping in mutant *ATXN3* pre-mRNA in a subject, comprising administering to a subject an effective amount of a compound of Formula (I) or form thereof.

Also provided herein are methods of inducing exon skipping in mutant *ATXN3* pre-mRNA in a cell, comprising contacting a cell (e.g. ex vivo or in vivo) with a compound of Formula (I) or form thereof.

Also provided herein are methods of inducing exon skipping in mutant *ATXN3* pre-mRNA in a gene comprising contacting the gene (e.g., in a cell or subject expressing the gene) with a compound a compound of Formula (I) or a form thereof.

Also provided therein are methods of inducing exon 4 skipping in the mutant *ATXN3* pre-mRNA in a subject in need thereof, the method comprising administering an effective amount of a compound Formula (I) or a form thereof to the subject.

Also provided therein are methods of inducing exon 4 skipping in the mutant *ATXN3* pre-mRNA in a cell, the method comprising contacting the cell (e.g. ex vivo or in vivo) with a compound Formula (I) or a form thereof to the subject.

Also provided herein are methods of inducing exon 4 skipping in the mutant *ATXN3* pre-mRNA in a gene comprising contacting the gene (e.g., in a cell or subject expressing the gene) with a compound a compound of Formula (I) or a form thereof.

Also provided therein are methods of producing *ATXN3* ΔE4 in a subject in need thereof, the method comprising administering an effective amount of a compound Formula (I) or a form thereof to the subject.

Also provided therein are methods of producing *ATXN3* ΔE4 in a cell, the method comprising contacting the cell (e.g. ex vivo or in vivo) with a compound Formula (I) or a form thereof to the subject.

Also provided herein are methods of producing *ATXN3* ΔE4 in a gene comprising contacting the gene (e.g., in a cell or subject expressing the gene) with a compound a compound of Formula (I) or a form thereof.

Also provided herein are methods for decreasing mutant *ATXN3* mRNA in a subject in need thereof, the method comprising administering an effective amount of a compound of Formula (I) or a form thereof to the subject. For example, such methods include decreasing

mutant *ATXN3* mRNA concentration in serum samples from the subject.

In some aspects, mutant *ATXN3* mRNA can be measured in the serum, for example, in blood samples obtained from the subject prior to administration of a compound of Formula (I) or form thereof and in blood samples obtained from the subject following administration of a compound as provided herein. In some aspects, the blood samples obtained from the subject following administration are obtained after one day, two days, three days, four days, five days, six days, seven days, eight days, nine days, ten days, fourteen days, twenty-one days, twenty-eight days, and/or thirty days of administration of the compound as provided herein. See, for example, F.B. Axelrod et al., Pediatr Res (2011) 70(5): 480-483; and R.S. Shetty et al., Human Molecular Genetics (2011) 20(21): 4093-4101, both of which are incorporated by reference in their entirety.

Further provided herein is a method for decreasing mutant *ATXN3* mRNA in a cell, the method comprising contacting the cell (e.g. ex vivo or in vivo) with a therapeutically effective amount of a compound of Formula (I) or a form salt thereof. The amount of mutant *ATXN3* mRNA in the treated cell is decreased relative to a cell in a subject in the absence of a compound provided herein. The method for decreasing the amount of mutant *ATXN3* mRNA in a cell may be performed by contacting the cell with a compound of Formula (I) or a form thereof in vitro, thereby decreasing the amount of mutant *ATXN3* mRNA of a cell in vitro. Uses of such an in vitro method of decreasing the amount of mutant *ATXN3* mRNA include, but are not limited to, use in a screening assay (for example, wherein a compound of Formula (I) or a form thereof is used as a positive control or standard compared to a compound or compounds of unknown activity or potency in decreasing the amount mutant *ATXN3* mRNA).

In some aspects, the amount of mutant *ATXN3* mRNA is decreased in a cell selected from the group consisting of a lung cell, a muscle cell, a liver cell, a heart cell, a brain cell, a kidney cell, a spleen cell, and a nerve cell (e.g., a sciatic nerve cell or a trigeminal nerve cell), or any combination thereof. In some aspects thereof, the amount of mutant *ATXN3* mRNA is decreased in the plasma.

The method of decreasing mutant *ATXN3* mRNA in a cell may be performed, for example, by contacting a cell, (e.g., a lung cell, a muscle cell, a liver cell, a heart cell, a brain cell, a kidney cell, a spleen cell, or a nerve cell), with a compound of Formula (I) or a form thereof in vivo, thereby decreasing the amount of mutant *ATXN3* mRNA in a subject in vivo.

The contacting is achieved by causing a compound of Formula (I) or a form thereof to be present in a subject in an amount effective to achieve a decrease in the amount of mutant *ATXN3* mRNA. This may be achieved, for example, by administering an effective amount of a compound of Formula (I) or a form thereof to a subject. Uses of such an in vivo method of decreasing the amount of mutant *ATXN3* mRNA include, but are not limited to, use in methods of treating a disease or condition, wherein a decrease in the amount of mutant *ATXN3* mRNA is beneficial.

In some aspects thereof, the amount of mutant *ATXN3* mRNA is decreased in a cell selected from the group consisting of a lung cell, a muscle cell, a liver cell, a heart cell, a brain cell, a kidney cell, a spleen cell, and a nerve cell (e.g., a sciatic nerve cell or a trigeminal nerve cell), or any combination thereof, for example in a subject suffering from SCA3. The method is preferably performed by administering an effective amount of a compound of Formula (I) or a form thereof to a subject who is suffering from SCA3.

Also provided herein are methods for decreasing ATXN3 mutant protein expression in a subject in need thereof, the method comprising administering an effective amount of a compound of Formula (I) or a pharmaceutically acceptable salt thereof to the subject. For example, such methods include decreasing ATXN3 mutant protein expression in serum samples from the subject. Further provided herein are methods for decreasing the mean percentage of ATXN3 mutant protein expression in a subject in need thereof, the method comprising administering an effective amount of a compound of Formula (I) or a form thereof to the subject.

Also provided herein are methods for decreasing ATXN3 mutant protein expression in a cell (e.g., ex vivo or in vivo), the method comprising contacting the cell with a therapeutically effective amount of a compound of Formula (I) or a form thereof. In some aspects the method is an in vitro method. In some aspects, the method is an in vivo method. In some aspects, the amount ATXN3 mutant protein expression is decreased in a cell selected from the group consisting of a lung cell, a muscle cell, a liver cell, a heart cell, a brain cell, a kidney cell, a spleen cell, and a nerve cell (e.g., a sciatic nerve cell or a trigeminal nerve cell), or any combination thereof. In some aspects thereof, the amount of ATXN3 mutant protein expression is decreased in the plasma.

Also provided herein are methods for decreasing ATXN3 mutant protein level in a

subject in need thereof, the method comprising administering an effective amount of a compound of Formula (I) or a form thereof to the subject. For example, such methods include decreasing ATXN3 mutant protein level in serum samples from the subject. Further provided herein are methods for decreasing the mean percentage of ATXN3 mutant protein level in a subject in need thereof, the method comprising administering an effective amount of a compound of Formula (I) or a form thereof, to the subject.

Also provided herein are methods for decreasing ATXN3 mutant protein level in a cell (e.g., ex vivo or in vivo), the method comprising contacting the cell with a therapeutically effective amount of a compound of Formula (I) or a form thereof.

In some aspects, the method is an in vitro method. In some aspects, the method is an in vivo method. In some aspects, the amount of ATXN3 mutant protein level is decreased in a cell selected from the group consisting of a lung cell, a muscle cell, a liver cell, a heart cell, a brain cell, a kidney cell, a spleen cell, and a nerve cell (e.g., a sciatic nerve cell or a trigeminal nerve cell), or any combination thereof. In some aspects thereof, the amount of ATXN3 mutant protein level is decreased in plasma.

In some aspects, one or more of the compounds of Formula (I) or form thereof may be administered to a subject in need thereof in combination with at least one additional pharmaceutical agent.

Additional examples of suitable additional pharmaceutical agents for use in combination with the compounds of the present application for treatment of the diseases provided herein include, but are not limited to, antioxidants, anti-inflammatory agents, steroids, immunosuppressants, or other agents such as therapeutic antibodies. In some aspects, the compounds of Formula (I) or a form thereof may be administered to a subject in need thereof in combination with at least one additional pharmaceutical agent for the treatment of SCA3.

When employed as a therapeutic agent, the compounds provided herein can be administered in the form of a pharmaceutical composition; thus, the methods described herein can include administering a pharmaceutical composition. These compositions can be prepared as described herein or elsewhere, and can be administered by a variety of routes, depending upon whether local or systemic treatment is desired and upon the area to be treated. Administration may be pulmonary (e.g., by inhalation or insufflation of powders or aerosols, including by nebulizer; intratracheal or intranasal), oral, or parenteral. Parenteral

administration may include, but is not limited to intravenous, intraarterial, subcutaneous, intraperitoneal, intramuscular injection or infusion; or intracranial, (e.g., intrathecal, intraocular, or intraventricular) administration. Parenteral administration can be in the form of a single bolus dose, or may be, for example, by a continuous perfusion pump. Conventional pharmaceutical carriers, aqueous, powder or oily bases, thickeners and the like may be necessary or desirable. In some aspects, the compounds provided herein are suitable for oral and parenteral administration. In some aspects, the compounds provided herein are suitable for oral administration. In some aspects, the compounds provided herein are suitable for parenteral administration. In some aspects, the compounds provided herein are suitable for intravenous administration. In some aspects, the compounds provided herein are suitable for transdermal administration (e.g., administration using a patch or microneedle). Pharmaceutical compositions for topical administration may include transdermal patches (e.g., normal or electrostimulated), ointments, lotions, creams, gels, drops, suppositories, sprays, liquids and powders. Conventional pharmaceutical carriers, aqueous, powder or oily bases, thickeners and the like may be necessary or desirable.

Also provided are pharmaceutical compositions which contain, as the active ingredient, a compound of Formula (I) or a form thereof in combination with one or more pharmaceutically acceptable carriers (excipients). In making the compositions provided herein, the active ingredient is typically mixed with an excipient, diluted by an excipient or enclosed within such a carrier in the form of, for example, a capsule, sachet, paper, or other container. When the excipient serves as a diluent, it can be a solid, semi-solid, or liquid material, which acts as a vehicle, carrier or medium for the active ingredient. Thus, the compositions can be in the form of tablets, pills, powders, lozenges, sachets, cachets, elixirs, suspensions, emulsions, solutions, syrups, aerosols (as a solid or in a liquid medium), ointments, soft and hard gelatin capsules, suppositories, sterile injectable solutions, and sterile packaged powders.

Some examples of suitable excipients include, without limitation, lactose, dextrose, sucrose, sorbitol, mannitol, starches, gum acacia, calcium phosphate, alginates, tragacanth, gelatin, calcium silicate, microcrystalline cellulose, polyvinylpyrrolidone, cellulose, water, syrup, and methyl cellulose. The formulations can additionally include, without limitation, lubricating agents such as talc, magnesium stearate, and mineral oil; wetting agents;

emulsifying and suspending agents; preserving agents such as methyl-and propylhydroxy-benzoates; sweetening agents; flavoring agents, or combinations thereof.

The active compound can be effective over a wide dosage range and is generally administered in a pharmaceutically effective amount. It will be understood that the amount of compound to be administered and the schedule of administration will usually be determined by a physician, according to the relevant circumstances, including the condition to be treated, the chosen route of administration, the actual compound administered, the age, weight, and response of the individual subject, the severity of the subject's symptoms, and the like.

In another aspect, the concentration-biological effect relationship observed with regard to a compound of Formula (I) or a form thereof indicate a target plasma concentration ranging from approximately 0.001 μg•hr/mL to approximately 50 μg•hr/mL, from approximately 0.01 μg•hr/mL to approximately 20 μg•hr/mL, from approximately 0.05 μg•hr/mL to approximately 10 μg•hr/mL, or from approximately 0.1 μg•hr/mL to approximately 5 μg•hr/mL. To achieve such plasma concentrations, the compounds described herein may be administered at doses that vary, such as, for example, without limitation, from 1.0 ng to 10,000 mg.

In one aspect, the dose administered to achieve an effective target plasma concentration may be administered based upon subject or patient specific factors, wherein the doses administered on a weight basis may be in the range of from about 0.001 mg/kg/day to about 3500 mg/kg/day, or about 0.001 mg/kg/day to about 3000 mg/kg/day, or about 0.001 mg/kg/day to about 2500 mg/kg/day, or about 0.001 mg/kg/day to about 2000 mg/kg/day, or about 0.001 mg/kg/day to about 1500 mg/kg/day, or about 0.001 mg/kg/day to about 1000 mg/kg/day, or about 0.001 mg/kg/day to about 500 mg/kg/day, or about 0.001 mg/kg/day to about 250 mg/kg/day, or about 0.001 mg/kg/day to about 200 mg/kg/day, or about 0.001 mg/kg/day to about 150 mg/kg/day, or about 0.001 mg/kg/day to about 100 mg/kg/day, or about 0.001 mg/kg/day to about 75 mg/kg/day, or about 0.001 mg/kg/day to about 50 mg/kg/day, or about 0.001 mg/kg/day to about 25 mg/kg/day, or about 0.001 mg/kg/day to about 10 mg/kg/day, or about 0.001 mg/kg/day to about 5 mg/kg/day, or about 0.001 mg/kg/day to about 1 mg/kg/day, or about 0.001 mg/kg/day to about 0.5 mg/kg/day, or about 0.001 mg/kg/day to about 0.1 mg/kg/day, or from about 0.01 mg/kg/day to about 3500 mg/kg/day, or about 0.01 mg/kg/day to about 3000 mg/kg/day, or about 0.01 mg/kg/day to about 2500 mg/kg/day, or about 0.01 mg/kg/day to about 2000 mg/kg/day, or about 0.01

mg/kg/day to about 1500 mg/kg/day, or about 0.01 mg/kg/day to about 1000 mg/kg/day, or about 0.01 mg/kg/day to about 500 mg/kg/day, or about 0.01 mg/kg/day to about 250 mg/kg/day, or about 0.01 mg/kg/day to about 200 mg/kg/day, or about 0.01 mg/kg/day to about 150 mg/kg/day, or about 0.01 mg/kg/day to about 100 mg/kg/day, or about 0.01 mg/kg/day to about 75 mg/kg/day, or about 0.01 mg/kg/day to about 50 mg/kg/day, or about 0.01 mg/kg/day to about 25 mg/kg/day, or about 0.01 mg/kg/day to about 10 mg/kg/day, or about 0.01 mg/kg/day to about 5 mg/kg/day, or about 0.01 mg/kg/day to about 1 mg/kg/day, or about 0.01 mg/kg/day to about 0.5 mg/kg/day, or about 0.01 mg/kg/day to about 0.1 mg/kg/day, or from about 0.1 mg/kg/day to about 3500 mg/kg/day, or about 0.1 mg/kg/day to about 3000 mg/kg/day, or about 0.1 mg/kg/day to about 2500 mg/kg/day, or about 0.1 mg/kg/day to about 2000 mg/kg/day, or about 0.1 mg/kg/day to about 1500 mg/kg/day, or about 0.1 mg/kg/day to about 1000 mg/kg/day, or about 0.1 mg/kg/day to about 500 mg/kg/day, or about 0.1 mg/kg/day to about 250 mg/kg/day, or about 0.1 mg/kg/day to about 200 mg/kg/day, or about 0.1 mg/kg/day to about 150 mg/kg/day, or about 0.1 mg/kg/day to about 100 mg/kg/day, or about 0.1 mg/kg/day to about 75 mg/kg/day, or about 0.1 mg/kg/day to about 50 mg/kg/day, or about 0.1 mg/kg/day to about 25 mg/kg/day, or about 0.1 mg/kg/day to about 10 mg/kg/day, or about 0.1 mg/kg/day to about 5 mg/kg/day, or about 0.1 mg/kg/day to about 1 mg/kg/day, or about 0.1 mg/kg/day to about 0.5 mg/kg/day.

Effective amounts for a given subject may be determined by routine experimentation that is within the skill and judgment of a clinician or a practitioner skilled in the art in light of factors related to the subject. Dosage and administration may be adjusted to provide sufficient levels of the active agent(s) or to maintain the desired effect. Factors which may be taken into account include genetic screening, severity of the disease state, status of disease progression, general health of the subject, ethnicity, age, weight, gender, diet, time of day and frequency of administration, drug combination(s), reaction sensitivities, experience with other therapies, and tolerance/response to therapy.

The dose administered to achieve an effective target plasma concentration may be orally administered once (once in approximately a 24 hour period; i.e., "q.d."), twice (once in approximately a 12 hour period; i.e., "b.i.d." or "q.12h"), thrice (once in approximately an 8 hour period; i.e., "t.i.d." or "q.8h"), or four times (once in approximately a 6 hour period; i.e., "q.d.s.", "q.i.d." or "q.6h") daily.

In certain aspects, the dose administered to achieve an effective target plasma concentration may also be administered in a single, divided, or continuous dose for a patient or subject having a weight in a range of between about 40 to about 200 kg (which dose may be adjusted for patients or subjects above or below this range, particularly children under 40 kg). The typical adult subject is expected to have a median weight in a range of about 70 kg. Long-acting pharmaceutical compositions may be administered every 2, 3 or 4 days, once every week, or once every two weeks depending on half-life and clearance rate of the particular formulation.

The compounds and compositions described herein may be administered to the subject via any drug delivery route known in the art. Nonlimiting examples include oral, ocular, rectal, buccal, topical, nasal, sublingual, transdermal, subcutaneous, intramuscular, intraveneous (bolus and infusion), intracerebral, and pulmonary routes of administration.

In another aspect, the dose administered may be adjusted based upon a dosage form described herein formulated for delivery at about 0.02, 0.025, 0.03, 0.05, 0.06, 0.075, 0.08, 0.09, 0.10, 0.20, 0.25, 0.30, 0.50, 0.60, 0.75, 0.80, 0.90, 1.0, 1.10, 1.20, 1.25, 1.50, 1.75, 2.0, 3.0, 5.0, 10, 20, 30, 40, 50, 100, 150, 200, 250, 300, 400, 500, 1000, 1500, 2000, 2500, 3000 or 4000 mg/day.

For any compound, the effective amount can be estimated initially either in cell culture assays or in relevant animal models, such as a mouse, guinea pig, chimpanzee, marmoset or tamarin animal model. Relevant animal models may also be used to determine the appropriate concentration range and route of administration. Such information can then be used to determine useful doses and routes for administration in humans. Therapeutic efficacy and toxicity may be determined by standard pharmaceutical procedures in cell cultures or experimental animals, *e.g.*, ED_{50} (the dose therapeutically effective in 50% of the population) and LD_{50} (the dose lethal to 50% of the population). The dose ratio between therapeutic and toxic effects is therapeutic index, and can be expressed as the ratio, LD_{50}/ED_{50}. In certain aspects, the effective amount is such that a large therapeutic index is achieved. In further particular aspects, the dosage is within a range of circulating concentrations that include an ED_{50} with little or no toxicity. The dosage may vary within this range depending upon the dosage form employed, sensitivity of the patient, and the route of administration.

Another aspect included within the scope of the present description are the use of *in*

vivo metabolic products of the compounds described herein. Such products may result, for example, from the oxidation, reduction, hydrolysis, amidation, esterification and the like of the administered compound, primarily due to enzymatic processes. Accordingly, the description includes the use of compounds produced by a process comprising contacting a compound described herein with a mammalian tissue or a mammal for a period of time sufficient to yield a metabolic product thereof.

Such products typically are identified by preparing a radio-labeled (*e.g.*, ^{14}C or ^{3}H) compound of Formula (I), administering the radio-labeled compound in a detectable dose (*e.g.*, greater than about 0.5 mg/kg) to a mammal such as a rat, mouse, guinea pig, dog, monkey or human, allowing sufficient time for metabolism to occur (typically about 30 seconds to about 30 hours), and identifying the metabolic conversion products from urine, bile, blood or other biological samples. The conversion products are easily isolated since they are "radiolabeled" by virtue of being isotopically-enriched (others are isolated by the use of antibodies capable of binding epitopes surviving in the metabolite). The metabolite structures are determined in conventional fashion, *e.g.*, by MS or NMR analysis. In general, analysis of metabolites may be done in the same way as conventional drug metabolism studies well-known to those skilled in the art. The conversion products, so long as they are not otherwise found *in vivo*, are useful in diagnostic assays for therapeutic dosing of the compounds described herein even if they possess no biological activity of their own.

COMPOUNDS AND PREPARATION

Examples of representative compounds encompassed by the present invention and within the scope of the invention are provided herein. These examples and preparations which follow are provided to enable those skilled in the art to more clearly understand and to practice the present invention. They should not be considered as limiting the scope of the invention, but merely as being illustrative and representative thereof.

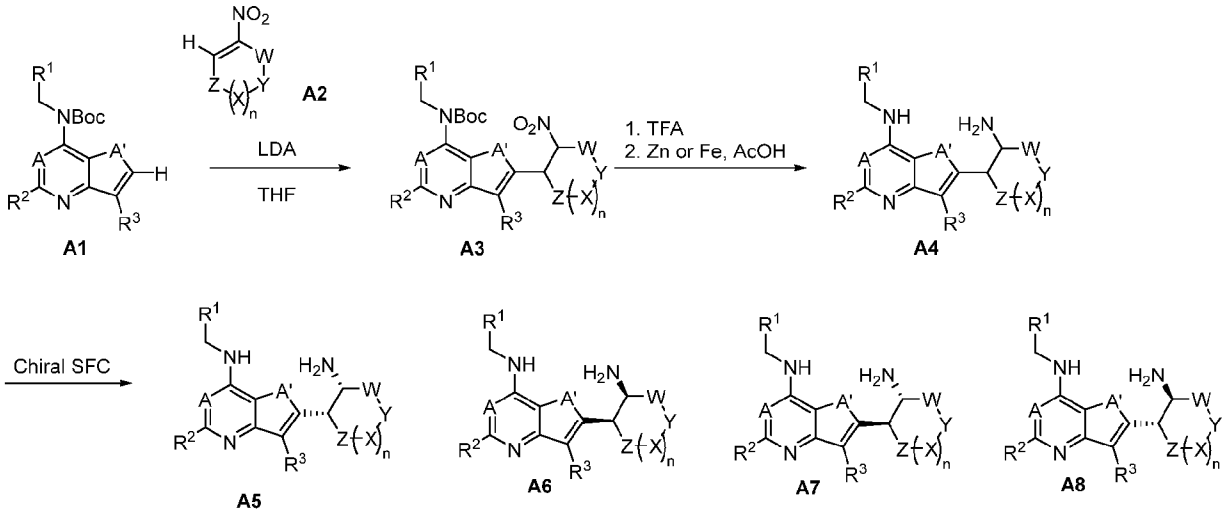
GENERAL SYNTHETIC EXAMPLES

As disclosed herein, the methods for preparing the compounds of Formula (I) or a form thereof described herein commonly use standard, well-known synthetic methodology. Many of the starting materials are commercially available or can be prepared in the Specific Synthetic

Examples that follow using techniques known to those skilled in the art. Functional transformations to modify substituents may also be undertaken where chemically feasible and are considered to be included within the scope of the General Schemes and the knowledge of a person of ordinary skill in the art. Compounds of Formula (I) or a form thereof can be prepared as described in the Schemes below. Depending on the nature of the groups depicted in the schemes below, the final compounds or their precursors may be further elaborated using the standard, well-known synthetic methods.

Scheme A:

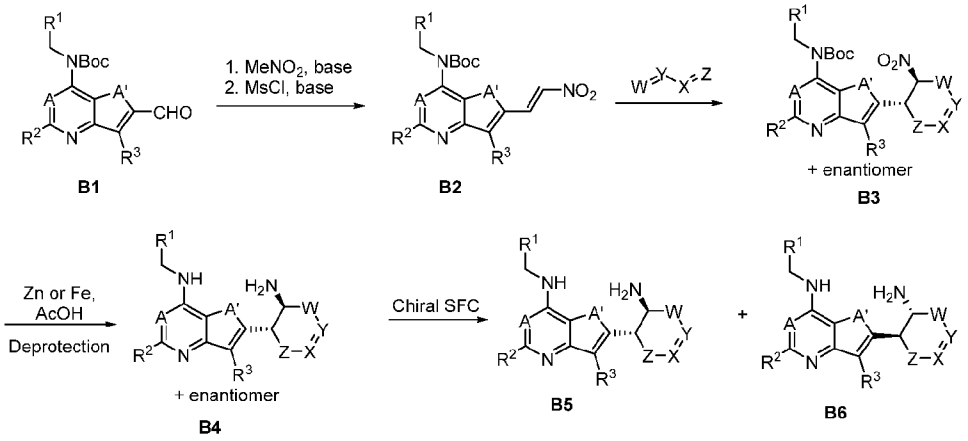
Compounds of Formula (I) may be prepared as described in Scheme A below.



Compound **A1** with A and A' atoms as well as optionally substituted R^1, R^2, and R^3 substituents can be reacted with cyclic nitroolefin **A2** in the presence of a strong base (such as LDA and the like) in a suitable solvent (such as THF and the like) at an appropriate temperature such as −78 °C to give **A3**. Deprotection may be accomplished by treatment with an acid (such as HCl in dioxane or TFA and the like) followed by reduction using Zn or Fe metal in the presence of acid (such as acetic acid and the like) to deliver **A4**. Chiral SFC may be used to separate individual diastereomers **A5**, **A6**, **A7**, and **A8**.

Scheme B:

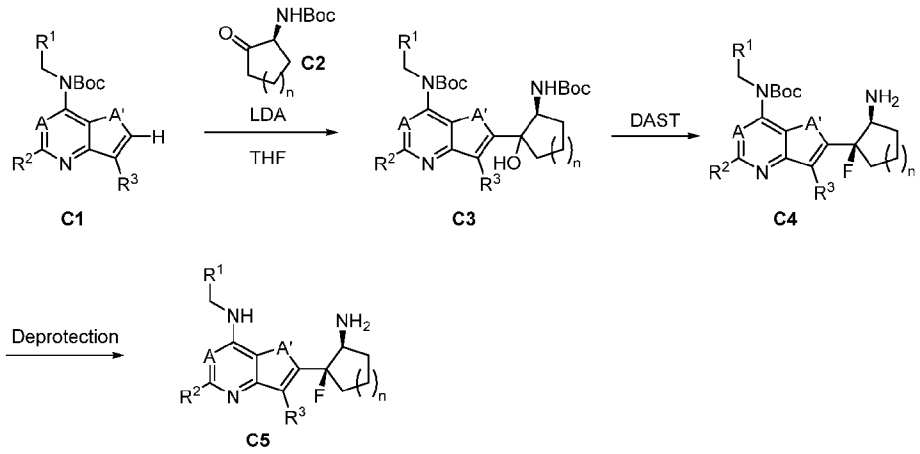
Compounds of Formula (I) may be prepared as described in Scheme B below.



Compound **B1** with A and A' atoms as well as optionally substituted R^1, R^2, and R^3 substituents can be reacted with nitromethane is the presence of base (such as NaOH and the like) followed by dehydration with MsCl in the presence of a suitable base (such as TEA and the like) gives nitroolefin **B2**. Diels-Alder reaction with an optionally substituted olefin in a suitable solvent (such as toluene and the like) at an appropriate temperature (such as 100 °C) affords **B3**. Reduction with Zn or Fe metal in the presence of acid (such as AcOH and the like) followed by protecting group deprotection if necessary provides **B4**. Chiral SFC separation provides **B5** and **B6**.

Scheme C:

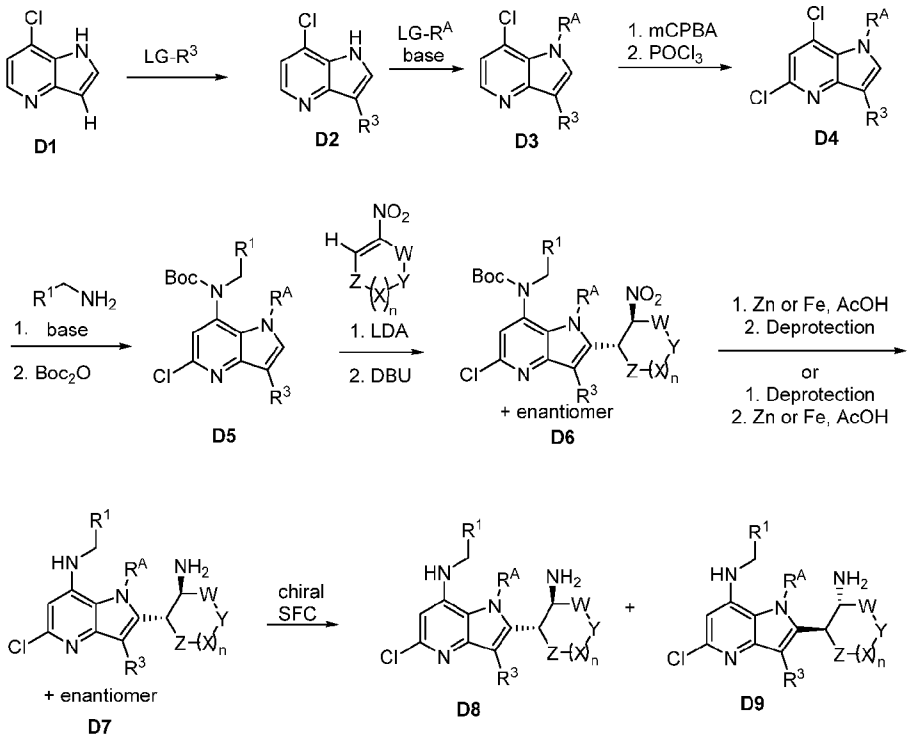
Compounds of Formula (I) may be prepared as described in Scheme C below.



Compound **C1** with A and A' atoms as well as optionally substituted R^1, R^2, and R^3 substituents can be reacted with α-amino ketone **C2** in the presence of a strong base (such as LDA and the like) in a suitable solvent (such as THF and the like) at an appropriate temperature such as −78 °C to give **C3**. Treatment with a deoxyfluorination reagent (such as DAST and the like) in a suitable solvent (such as DCM and the like) affords **C4**. Deprotection may be accomplished by treatment with an acid (such as HCl in dioxane or TFA and the like) to deliver **C5**.

Scheme D:

Compounds of Formula (I) may be prepared as described in Scheme D below.

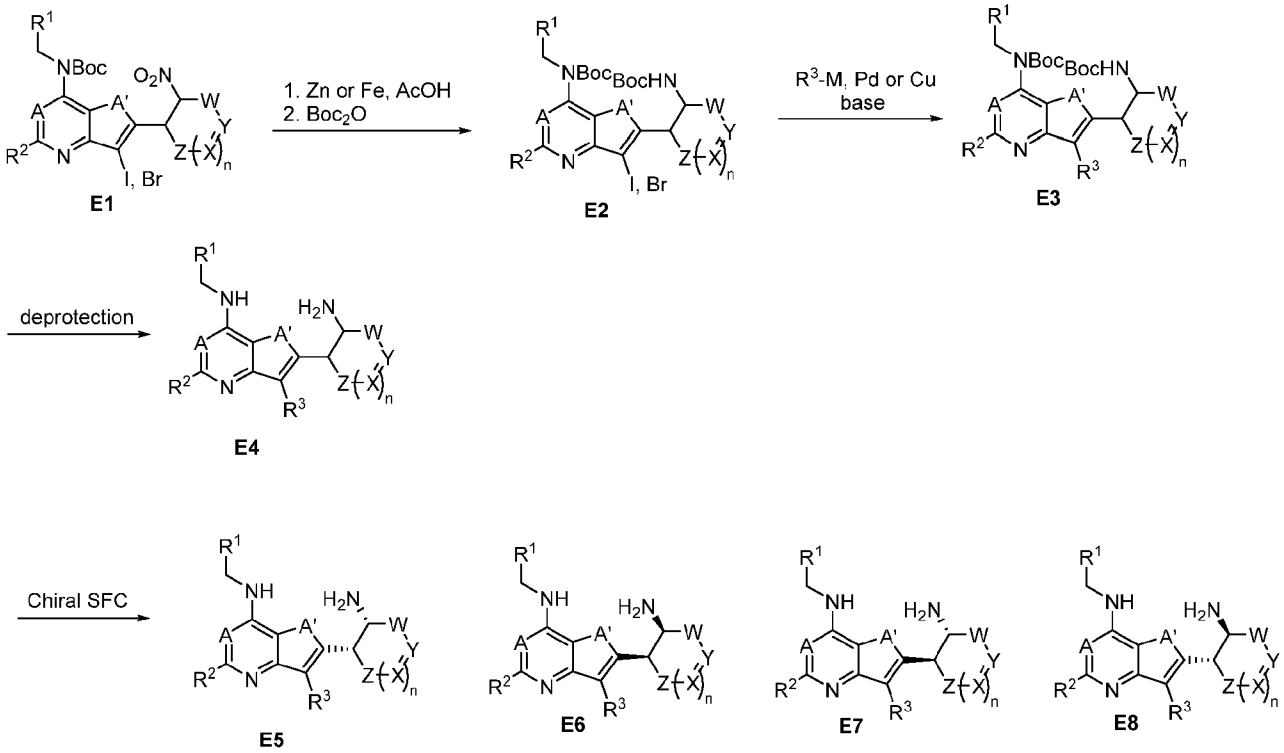


Azaindole **D1** can be reacted with an appropriate electrophile (such as NBS and the like) to deliver optionally substituted **D2**. Optionally substituted azaindole **D2** can be treated with an appropriate electrophile (such as MeI and the like) in the presence of a suitable base (such as Cs_2CO_3 and the like) to afford **D3**. Reaction with an appropriate oxidant (such as mCPBA and the like) followed by treatment with a deoxychlorination reagent (such as $POCl_3$ and the like) at an appropriate temperature (such as 110 °C) provides chloropyridine **D4**. Compound **D4** can be treated with an optionally substituted aryl/heteroarylmethylamine in the

presence of a base (such as TEA and the like) using a suitable solvent (such as DMSO and the like) at an appropriate temperature followed by protection with Boc_2O in the presence of base (such as TEA and the like) to afford intermediate **D5**. Compound **D5** with optionally substituted R^1, R^A, and R^3 substituents can be reacted with a cyclic nitroolefin in the presence of a strong base (such as LDA and the like) in a suitable solvent (such as THF and the like) at an appropriate temperature such as −78 °C followed by treatment with an appropriate base (such as DBU and the like) to give **D6**. Deprotection may be accomplished by treatment with an acid (such as HCl in dioxane or TFA and the like) followed by reduction using Zn or Fe metal in the presence of acid (such as acetic acid and the like) delivers **D7**. Chiral SFC may be used to separate individual enantiomers **D8** and **D9**.

Scheme E:

Compounds of Formula (I) may be prepared as described in Scheme E below.



Reduction of **E1,** having A and A' atoms as well as optionally substituted R^1, R^2, and R^3 substituents, with Zn or Fe metal in the presence of an appropriate acid (such as AcOH or the like) followed by reaction with Boc_2O delivers **E2**. Compound **E2** may be converted into **E3** through reaction with an appropriately functionalized organometallic species in the

presence of a catalyst (such as $Pd(dppf)Cl_2$ and the like) and a base (such as TEA and the like). Compound **E3** may be deprotected with an appropriate acid (TFA or HCl and the like) to afford **E4**. Chiral SFC may then be used to separate the individual diastereomers **E5**, **E6**, **E7**, and **E8**.

SPECIFIC SYNTHETIC EXAMPLES

To describe in more detail and assist in understanding, the following non-limiting examples are offered to more fully illustrate the scope of compounds described herein and are not to be construed as specifically limiting the scope thereof. Such variations of the compounds described herein that may be now known or later developed, which would be within the purview of one skilled in the art to ascertain, are considered to fall within the scope of the compounds as described herein and hereinafter claimed. These examples illustrate the preparation of certain compounds. Those of skill in the art will understand that the techniques described in these examples represent techniques, as described by those of ordinary skill in the art, that function well in synthetic practice, and as such constitute preferred modes for the practice thereof. However, it should be appreciated that those of skill in the art should, in light of the present disclosure, appreciate that many changes can be made in the specific methods that are disclosed and still obtain a like or similar result without departing from the spirit and scope of the present description.

Other than in the following examples of the embodied compounds, unless indicated to the contrary, all numbers expressing quantities of ingredients, reaction conditions, experimental data, and so forth used in the specification and claims are to be understood as being modified by the term "about". Accordingly, all such numbers represent approximations that may vary depending upon the desired properties sought to be obtained by a reaction or as a result of variable experimental conditions. Therefore, within an expected range of experimental reproducibility, the term "about" in the context of the resulting data, refers to a range for data provided that may vary according to a standard deviation from the mean. As well, for experimental results provided, the resulting data may be rounded up or down to present data consistently, without loss of significant figures. At the very least, and not as an attempt to limit the application of the doctrine of equivalents to the scope of the claims, each

numerical parameter should be construed in light of the number of significant digits and rounding techniques used by those of skill in the art.

While the numerical ranges and parameters setting forth the broad scope of the present description are approximations, the numerical values set forth in the examples set forth below are reported as precisely as possible. Any numerical value, however, inherently contains certain errors necessarily resulting from the standard deviation found in their respective testing measurements.

COMPOUND EXAMPLES

As used above, and throughout the present description, the following abbreviations, unless otherwise indicated, shall be understood to have the following meanings:

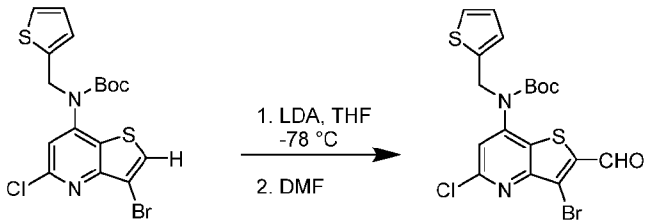
Abbreviation	Meaning
Δ	heating (chemistry), deletion (biology), lack of (biology)
AcOH or HOAc	acetic acid
Ar	argon
ACN	acetonitrile
atm	atmosphere(s)
BHT	butylated hydroxytoluene
Boc	tert-butoxy-carbonyl
°C	degrees Celsius
Celite® or Celite	diatomaceous earth
d	day(s)
DAST	diethylaminosulfur trifluoride
DBU	1,8-diazabicyclo[5.4.0]undec-7-ene
DCM	dichloromethane
IDEA or DIPEA	N,N-diisopropylethylamine
DMAP	4-dimethylaminopyridine
DMP	Dess-Martin periodinane
DMF	dimethylformamide
DMSO	dimethylsulfoxide
DPPA	diphenylphosphoryl azide
EA or EtOAc	ethyl acetate

Abbreviation	Meaning
EtOH	ethanol
eq.	equivalent(s)
h or hr	hour(s)
HATU	1-[bis(dimethylamino)methylene]-1H-1,2,3-triazolo[4,5-b]pyridinium 3-oxid hexafluorophosphate, N-[(dimethylamino)-1H-1,2,3-triazolo-[4,5-b]pyridin-1-ylmethylene]-N-methylmethanaminium hexafluorophosphate N-oxide
hex	hexanes
HPLC	High-performance liquid chromatography
LC/MS, LCMS or LC-MS	liquid chromatographic mass spectroscopy
LDA	lithium diisopropylamide
M	molarity
min	minute(s)
MeOH	methanol
MS	mass spectroscopy
NMR	nuclear magnetic resonance
$Pd(dppf)Cl_2$ or $Pd(dppf)Cl_2$-CH_2Cl_2	[1,1'-bis(diphenylphosphino)ferrocene]dichloropalladium(II), complex with dichloromethane
PhMe or $PhCH_3$	toluene
PE	petroleum ether
psi	pounds per square inch pressure
PTFE	polytetrafluoroethylene
Rt or rt	room temperature
RT	retention time
s or sec	second(s)
SFC	supercritical fluid chromatography
TBAF	tetrabutylammonium fluoride
TBS	tert-butyldimethylsilyl
TEA, Et_3N or NEt_3	triethylamine
TFA	trifluoroacetic acid
Tf_2O	trifluoromethanesulfonic anhydride

Abbreviation	Meaning
THF	tetrahydrofuran
TLC	thin layer chromatography
TMS	trimethylsilyl
UPLCMS	ultra-performance liquid chromatography-mass spectrometry

Intermediate 1

tert-Butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

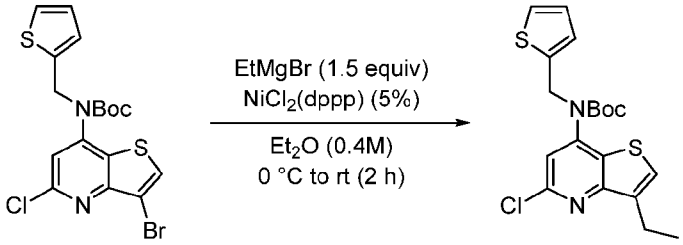


Step 1: tert-Butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (0.50 g, 1.087 mmol, 1.0 eq.), in tetrahydrofuran (10 mL) at -78 °C was added lithium diisopropylamide (0.82 mL, 1.64 mmol, 1.5 eq.). This solution stirred for 30 minutes followed by the addition of dimethylformamide (0.24 mg, 3.2 mmol, 3 eq.). The reaction stirred at -78 °C for one hour followed by warming to room temperature and continued stirring for 1 hour. The reaction was then quenched with aqueous ammonium chloride. The mixture was extracted with ethyl acetate and the organics were washed with water and brine. The organic layer was dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (0 to 50% gradient) to give tert-butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (340 mg, 65% yield). MS *m/z* 485.9, 486.6 $[M+H]^+$; ^1H NMR (400 MHz, CHLOROFORM-*d*) δ ppm 10.26 (s, 1H), 7.19 – 7.14 (m, 2H), 6.81 (dd, *J* = 5.1, 3.4 Hz, 1H), 6.74 (dd, *J* = 3.4, 1.1 Hz, 1H), 4.99 (s, 2H), 1.41 (s, 9H).

Intermediate 2

tert-Butyl (5-chloro-3-ethylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

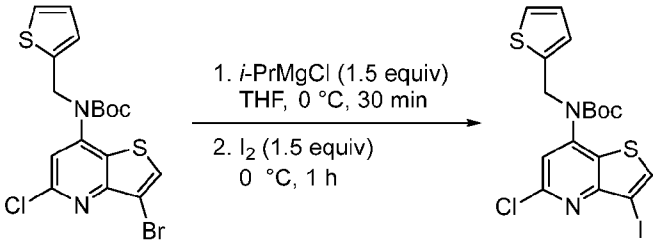


Step 1: tert-Butyl (5-chloro-3-ethylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To an 8-mL vial capped with a septum, *t*-butyl (3-bromo-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (200 mg, 0.43 mmol) and [1,3-bis(diphenylphosphino)propane]nickel(II)chloride (12 mg, 0.022 mmol, 0.05 equiv) were added. The vial was evacuated and back-filled with argon 3 times, and then anhydrous diethyl ether (1 mL) was added. The reaction was placed in an ice bath and allowed to stir, under argon, for 15 minutes, at which point ethylmagnesium bromide (1M) in THF (0.7 mL, 0.7 mmol, 1.5 equiv) was added dropwise via syringe. The ice bath was removed shortly thereafter, and the reaction was allowed to stir at room temperature, under argon, for 2 hours. The reaction mixture was then transferred to separatory funnel, adding ethyl acetate (20 mL) and saturated aqueous ammonium chloride (20 mL). The layers were separated, the aqueous layer was extracted twice with ethyl acetate (20 mL), and the combined organic layers were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude reaction mixture was purified by silica gel chromatography (40 g SiO_2, 0% to 10% ethyl acetate in hexanes) to cleanly obtain 85 mg (48% yield) of *t*-butyl (5-chloro-3-ethylthieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a white solid after lyophilization. MS *m/z* 408.95 $[M+H]^+$, ^1H NMR (DMSO-d_6) δ ppm 7.83 (s, 1H), 7.44 (s, 1H), 7.39-7.42 (m, 1H), 6.82-6.89 (m, 2H), 5.11 (s, 2H), 2.81 (q, *J*=7.46 Hz, 2H), 1.39 (s, 9H), 1.26 (t, *J*=7.50 Hz, 3H).

Intermediate 3

tert-Butyl (5-chloro-3-iodothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

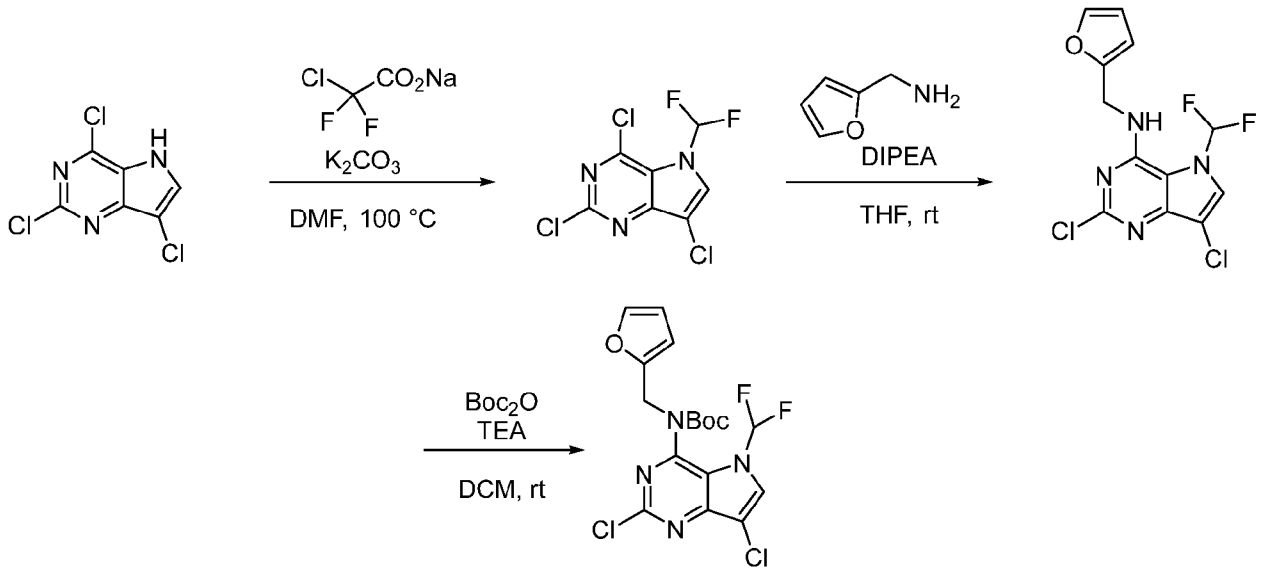


Step 1: tert-Butyl (5-chloro-3-iodothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

t-Butyl (3-bromo-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (200 mg, 0.43 mmol) was added to a 50-mL round-bottom flask, and iodine (166 mg, 0.65 mmol, 1.5 equiv) was added to a 25-mL conical flask. Both flasks underwent 3 cycles of being briefly placed under high vacuum then back-filled with argon. Anhydrous THF (2.2 mL, degassed with argon directly prior to use) was added to each flask, and the resultant solutions were allowed to stir under an argon flow. Both flasks were placed in an ice bath. After about 15 minutes, isopropylmagnesium chloride (2M solution in THF, Acros SureSeal, 0.33 mL, 1.5 equiv) was slowly added to the flask containing the aryl bromide. The reaction, which quickly turned dark reddish-brown, was allowed to stir at 0 °C for 30 minutes, at which point the cold solution of iodine in THF was added via cannula transfer. The reaction was allowed to stir at 0 °C for 1 hour, at which point saturated aqueous ammonium chloride (20 mL) and ethyl acetate (20 mL) were added. The mixture was allowed to stir briefly, open to air, and was then transferred to a separatory funnel. The layers were separated, and the aqueous layer was then extracted 2 times with ethyl acetate (20 mL). The combined organic layers were washed twice with saturated aqueous sodium thiosulfate (40 mL) and once with brine (40 mL), then dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude material was purified by silica gel chromatography (40 g SiO_2, 0% to 10% ethyl acetate gradient in hexanes). The purified residue was lyophilized to obtain 155 mg (70% yield) of *t*-butyl (5-chloro-3-iodothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a white solid. MS *m/z* 506.7 $[M+H]^+$, ^1H NMR (DMSO-d_6) δ ppm 8.44 (s, 1H), 7.60 (s, 1H), 7.37-7.42 (m, 1H), 6.83-6.89 (m, 2H), 5.13 (s, 2H), 1.39 (s, 9H).

Intermediate 4

tert-Butyl (2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate



Step 1: 2,4,7-Trichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidine

To a mixture of 2,4,7-trichloro-5H-pyrrolo[3,2-d]pyrimidine (10.0 g, 45 mmol, 1.0 eq.) in dimethylformamide (100 mL) at room temperature was added sodium chlorodifluoroacetate (8.2 g, 54 mmol, 1.2 eq.) and potassium carbonate (12.4 g, 90 mmol, 2.0 eq.). After stirring at 100 °C for 20 min, the reaction mixture was cooled to room temperature and poured into water (300 mL). The aqueous phase was extracted with EtOAc (3 x 200 mL) and the combined organics were washed with brine (300 mL), dried over Na_2SO_4, filtered, and concentrated. The crude residue was purified by silica gel column chromatography (PE/EA 20:1 to 10:1 gradient) to afford 2,4,7-trichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidine (9.3 g, 75%) as a white solid. MS m/z 271.8 $[M+H]^+$.

Step 2: 2,7-Dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine

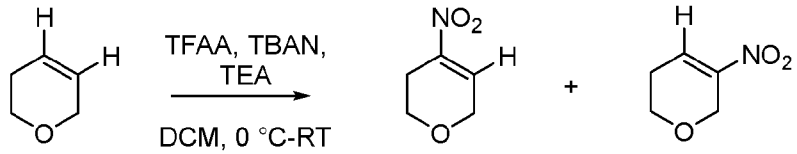
To a solution of 2,4,7-trichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidine (1.0 g, 3.7 mmol, 1.0 eq.) in tetrahydrofuran (15 mL) was added N,N-diisopropylethylamine (2.6 mL, 15 mmol, 4 eq.) and 2-furylmethanamine (0.4 g, 4 mmol, 1.1 eq.). After stirring at room temperature for 2 h, the reaction mixture was diluted with EtOAc (100 mL) and washed with water (100 mL), brine (100 mL), dried over Na2SO4, filtered, and concentrated. The crude

residue was purified by silica gel chromatography (PE/EA 50:1) to afford 2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine (1.1 g, 89%) as a yellow solid. MS m/z 332.9 $[M+H]^+$.

Step 3: tert-Butyl (2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate

To a solution of 2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine (1.1 g, 3.3 mmol, 1 eq.) in tetrahydrofuran (20 mL) was added (Boc)2O (1.5 g, 6.9 mmol, 2.1 eq), TEA (0.7g, 7 mmol, 2.1 eq.) and DMAP (50 mg, 0.4 mmol, 0.1 eq.). After stirring at room temperature for 1 h, the reaction mixture was concentrated and the crude residue was purified by silica gel chromatography (EA/PE 1:10) to afford tert-butyl (2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (1.0 g, 70%) as a yellow solid. MS m/z 434.3 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.82 (s, 1H), 7.26 (d, J = 6.6 Hz, 2H), 6.26-6.16 (m, 2H), 5.3-5.16 (m, 2H), 1.38 (s, 9H).

Intermediates 5 and 6



4-Nitro-3,6-dihydro-2H-pyran; 5-nitro-3,6-dihydro-2H-pyran

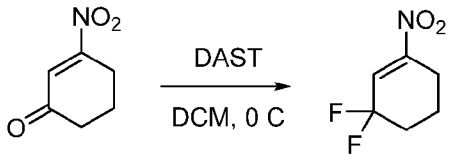
To a solution of 3,6-dihydro-2H-pyran (12.5 g, 149 mmol, 1.0 eq.) in dichloromethane (250 mL), was added tetrabutylammonium nitrate (49.8 g, 164 mmol, 1.1 eq.) at room temperature. The solution was then cooled to 0 °C and trifluoroacetic anhydride (34.3 g, 163 mmol, 1.1 eq.) was added dropwise over 20 minutes. After stirring at room temperature for 2 h, the reaction mixture was again cooled to 0 °C and triethylamine (15.0 g, 149 mmol, 1.0 eq.) was added and stirred for an additional hour. The reaction mixture was diluted with DCM (100 mL) and washed with ice water (2 x 150 mL) followed by brine (2 x 150 mL). The organics were dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The crude residue was purified by silica gel column chromatography (EA/PE, 0-10% gradient) to afford 4-nitro-3,6-dihydro-2H-pyran (500 mg, 3%) as a yellow oil and 5-nitro-3,6-dihydro-2H-pyran (1.8 g, 10%) as a yellow oil.

4-Nitro-3,6-dihydro-2H-pyran: ^{1}H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.31-7.27 (m, 1H), 4.40 (q, *J* = 2.9 Hz, 2H), 3.88 (t, *J* = 5.5 Hz, 2H), 2.71 (ddd, *J* = 5.4, 4.2, 2.6 Hz, 2H).

5-Nitro-3,6-dihydro-2H-pyran: ^{1}H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.40 (t, *J* = 4.2 Hz, 1H), 4.54 (dd, *J* = 4.3, 2.6 Hz, 2H), 3.78 (t, *J* = 5.4 Hz, 2H), 2.54-2.42 (m, 2H).

Intermediate 7

3,3-Difluoro-1-nitrocyclohex-1-ene

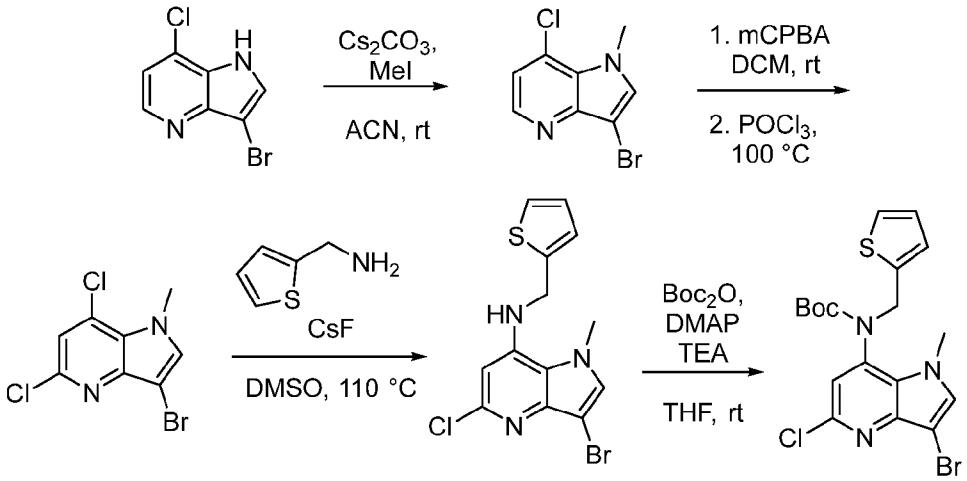


3,3-Difluoro-1-nitrocyclohex-1-ene

To a solution of 3-nitrocyclohex-2-en-1-one (1 g, 7 mmol) in DCM (7 mL), cooled to 0 °C, was added diethylaminosulfur trifluoride (3.43 g, 21 mmol, 3 eq.). The mixture was stirred at rt for 16h then slowly poured a cooled bath of saturated aqueous $NaHCO_3$. The aqueous phase was extracted with EtOAc (2 x 100 mL) and the combined organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude material was purified by silica gel column chromatography (EA/PE 1:20) to afford 3,3-difluoro-1-nitrocyclohex-1-ene (600 mg, 52%) as a yellow oil. ^{1}H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.04 (t, J = 5.4 Hz, 1H), 2.74-2.65 (m, 2H), 2.18-2.08 (m, 2H), 2.03-1.96 (m, 2H).

Intermediate 8

tert-Butyl (3-bromo-5-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



Step 1: 3-Bromo-7-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridine

To a solution of 3-bromo-7-chloro-1H-pyrrolo[3,2-b]pyridine (9.5 g, 41 mmol) in DMF (95 mL) was added Cs_2CO_3 (26.7 g, 82 mmol, 2 eq.) and iodomethane (8.74 g, 62 mmol, 1.5 eq.). After stirring at room temperature for 2 h, the reaction mixture was diluted with water (200 mL) and extracted with EtOAc (200 mL x 2). The combined organics were washed with brine (200 mL x 2), dried over Na_2SO_4, filtered, and concentrated *in vacuo* to afford 3-bromo-7-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridine (7 g, 69%) as yellow solid. MS *m/z* 246.8 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 8.42 (d, *J* = 5.1 Hz, 1 H), 7.34 (s, 1H), 7.20 (d, *J* = 5.1 Hz, 1H), 4.15 (s, 3H).

Step 2: 3-Bromo-5,7-dichloro-1-methyl-1H-pyrrolo[3,2-b]pyridine

The title compound was prepared from 3-bromo-7-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridine according to the procedure described in Intermediate 9, step 3. MS *m/z* 281.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.30 (s, 1H), 7.18 (s, 1H), 4.11 (s, 3H).

Step 3: 3-Bromo-5-chloro-1-methyl-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine

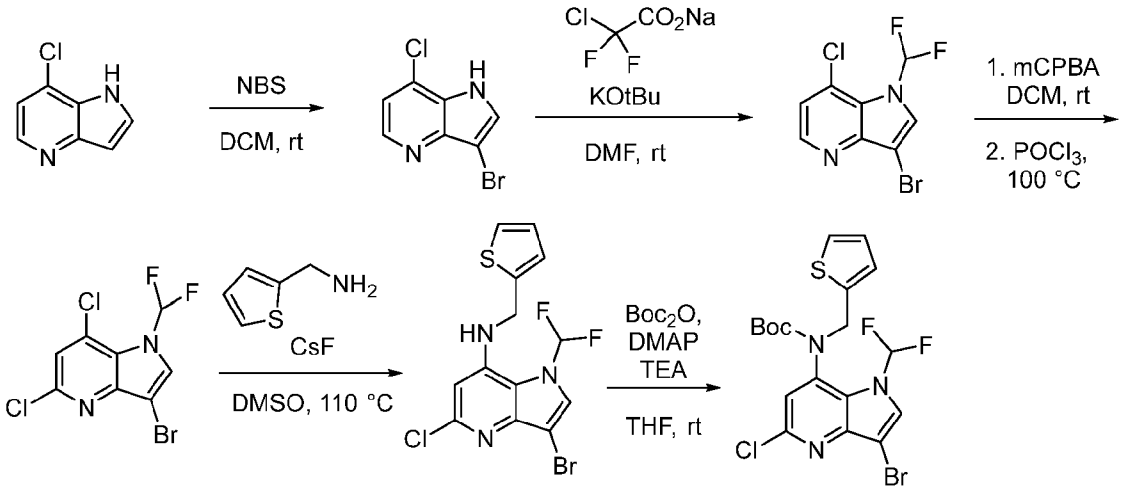
The title compound was prepared from 3-bromo-7-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridine according to the procedure described in Intermediate 9, step 4. MS *m/z* 358.0 $[M+H]^+$.

Step 4: tert-Butyl (3-bromo-5-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

The title compound was prepared from 3-bromo-7-chloro-1-methyl-1H-pyrrolo[3,2-b]pyridine according to the procedure described in Intermediate 9, step 5. MS *m/z* 458.1 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.24 (d, J = 5.0 Hz, 1H), 7.20 (s, 1H), 6.91 (dd, J = 4.9, 3.3 Hz, 2H), 6.81 (s, 1H), 4.98 (d, J = 7.9 Hz, 2H), 3.50 (s, 3H), 1.50 (s, 9H).

Intermediate 9

2-((2S,3S)-3-Aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine



Step 1: tert-Butyl (3-bromo-5-chloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of 7-chloro-1H-pyrrolo[3,2-b]pyridine (500 mg, 2 mmol) in N,N-dimethylformamide (5 mL) was added 1-bromopyrrolidine-2,5-dione (700 mg, 4 mmol, 2 eq.). After stirring at room temperature for 4 h, the reaction mixture was diluted with water (50 mL) and extracted with EtOAc (40 mL x 2). The combined organic layers were washed with brine (100 mL x 2), dried over Na_2SO_4 and concentrated *in vacuo* to give crude product. The crude was triturated from DCM (20 mL) to give 3-bromo-7-chloro-1H-pyrrolo[3,2-b]pyridine (480 mg, 96%) as a yellow solid. MS *m/z* 233.1 $[M+H]^+$.

Step 2: 3-Bromo-7-chloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridine

To a mixture of 3-bromo-7-chloro-1H-pyrrolo[3,2-b]pyridine (1 g, 4.3 mmol) in acetonitrile (15 mL) was added ethyl 2-bromo-2,2-difluoro-acetate (3.5 g, 17 mmol, 4 eq.) and

potassium tert-butoxide (1.95 g, 17 mmol, 4 eq). After stirring at room temperature for 1 h, the reaction mixture was poured into water (100 mL) and extracted with EtOAc (70 mL x 2). The combined organics were washed with brine (100 mL), dried over Na_2SO_4, filtered and concentrated *in vacuo*.

The crude residue was purified by silica gel column chromatography (EA/PE, 0-5% gradient) to give 3-bromo-7-chloro-1-(difluoromethyl)pyrrolo[3,2-b]pyridine (600 mg, 49%) as a yellow solid. MS *m/z* 282.9 $[M+H]^+$.

Step 3: 3-Bromo-5,7-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridine

To a solution of 3-bromo-7-chloro-1-(difluoromethyl)pyrrolo[3,2-b]pyridine (1.6 g, 5.7 mmol) in DCM (20 mL) was added 3-chloroperoxybenzoic acid (3.5 g, 17 mmol, 3 eq.) at 25 °C . After stirring at room temperature for 16 h, the reaction mixture was filtered and the filtrate was concentrated *in vacuo* to afford crude 3-bromo-5,7-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridine as a white solid. To this crude material was added phosphoryl trichloride (20 mL) and the reaction mixture was heated at 90 °C for 1 h. The mixture was then cooled to room temperature and carefully poured into ice water (200 mL). The solution was extracted with EtOAc (2 x 200 mL). The combined organics were washed with saturated aqueous $NaHCO_3$ (3 x 150 mL), brine (150 mL), dried over Na_2SO_4, filtered, and concentrated to afford 3-bromo-5,7-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridine (660 mg, 37%) as a yellow solid. MS *m/z* 316.9 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6) δ: 8.52 (s, 1H), 8.23 (t, J = 59.8 Hz, 1H), 7.80 (s, 1H).

Step 4: 3-Bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine

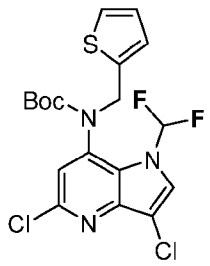
To a solution of 3-bromo-5,7-dichloro-1-(difluoromethyl)pyrrolo[3,2-b]pyridine (840 mg, 2.7 mmol) in DMSO (10 mL) was added 2-thienylmethanamine (330 mg, 3 mmol, 1.1 eq.) and cesium fluoride (808 mg, 5 mmol, 1.8 eq.) at room temperature. After stirring at 110 °C for 16 h, the reaction mixture was cooled to room temperature and poured into water (100 mL). The aqueous solution was extracted with EtOAc (2 x 100 mL) and the combined organics were washed with brine (2 x 100 mL), dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude reside was purified by silica gel column chromatography (EA/Hex 1:1) to afford 3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine (590 mg, 51%) as a yellow solid. MS *m/z* 393.9 $[M+H]^+$.

Step 5: tert-Butyl (3-bromo-5-chloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of 3-bromo-5-chloro-1-(difluoromethyl)-N-(2-thienylmethyl)pyrrolo[3,2-b]pyridin-7-amine (1.5 g, 3.8 mmol) in THF (20 mL) was added di-tert-butyl dicarbonate (1.74 g, 8 mmol, 2 eq.) , triethylamine (0.8 g, 8 mmol, 2 eq.) and DMAP (0.05 g, 0.4 mmol, .1 eq.) at room temperature. After stirring at room temperature for 1 h, the reaction mixture was concentrated and the crude reside was purified by silica gel column chromatography (EA/PE 0-10% gradient) to afford : tert-butyl (3-bromo-5-chloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (2 g, 100%) as a yellow solid. MS *m/z* 494.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.71 (s, 1H), 7.27 (dd, *J* = 5.2, 1.0 Hz, 1H), 7.18, (d, *J* = 60.5 Hz, 1H), 6.97-6.90 (m, 2H), 4.97 (d, *J* = 7.7 Hz, 2H), 1.41, (s, 9H).

Intermediate 10

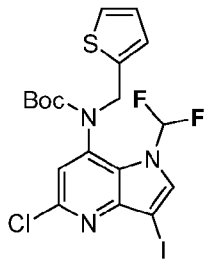
tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 448.1 $[M+H]^+$. ^1H NMR (400 MHz, DMSO-d_6) δ: 8.44 (s, 1H), 7.80-7.40 (m, 2H), 7.07 (s, 1H), 6.96 (dt, J = 8.4, 2.8 Hz, 2H), 5.17 (d, J = 15.5 Hz, 1H), 4.86 (d, J = 15.5 Hz, 1H), 1.36 (s, 9H).

Intermediate 11

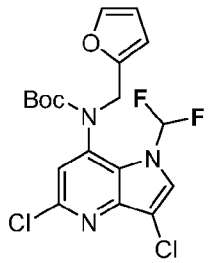
tert-Butyl (5-chloro-1-(difluoromethyl)-3-iodo-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 540.1 $[M+H]^+$.

Intermediate 12

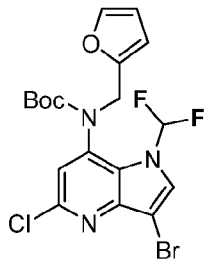
tert-Butyl (5-chloro-1-(difluoromethyl)-3-iodo-1H-pyrrolo[3,2-b]pyridin-7-yl)(furan-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 432.0 $[M+H]^+$.

Intermediate 13

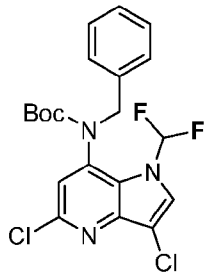
tert-Butyl (3-bromo-5-chloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(furan-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 478.3 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.71 (s, 1H), 7.30-7.12 (m, 1H), 7.04 (s, 1H), 6.25 (s, 1H), 6.17 (d, J = 3.0 Hz, 1H), 5.04 (d, J = 15.9 Hz, 1H), 4.67 (d, J = 15.5 Hz, 1H), 1.37 (s, 9H).

Intermediate 14

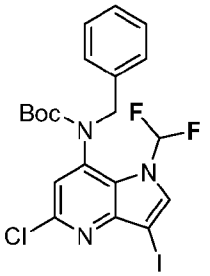
tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 442.2 $[M+H]^+$.

Intermediate 15

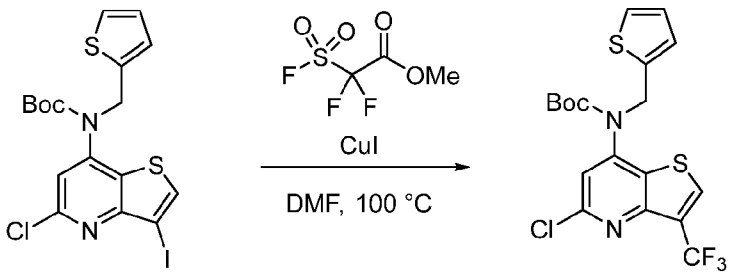
tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



tert-Butyl (3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was prepared according to the procedure outlined in Intermediate 9, steps 1-5, by substituting the appropriate starting materials, reagents, and reaction conditions. MS *m/z* 534.3 $[M+H]^+$.

Intermediate 16

tert-Butyl (5-chloro-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

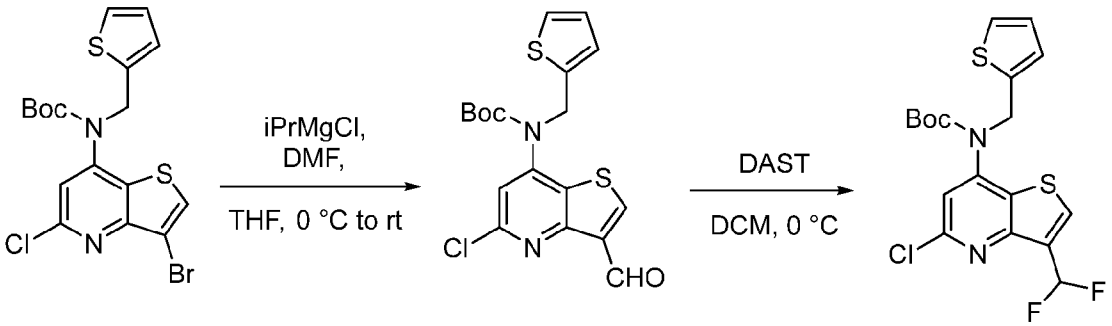


A mixture of tert-butyl (5-chloro-3-iodothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (200 mg, 0.4 mmol, 1.0 eq.), methyl 2,2-difluoro-2-fluorosulfonyl-acetate (0.15 mL, 1.2 mmol, 3 eq.), CuI (75 mg, 0.4 mmol, 1.0 eq.) in DMF (1 mL) was heated at 100 °C for 5 h. The mixture was concentrated *in vacuo* and the crude residue was diluted with EtOAc and the solids were removed by filtration. The filtrate was washed with water (50 mL x 2), brine (100 mL), dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (5-chloro-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (177 mg, 56%) as an off white solid. MS *m/z* 448.9 $[M+H]^+$. ^1H NMR (400 MHz,

CHLOROFORM-*d*) δ: ppm 8.19 (s, 1 H) 7.26 (d, *J*=5.00 Hz, 1 H) 7.19 (s, 1 H) 6.90 (t, *J*=4.25 Hz, 1 H) 6.83 (d, *J*=3.00 Hz, 1 H) 5.08 (s, 2 H) 1.49 (s, 9 H).

Intermediate 17

tert-butyl (5-chloro-3-(difluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



Step 1: tert-Butyl (5-chloro-3-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (1.0 g, 2.2 mmol) (prepared according to the procedure described in WO2020/17430)in THF (18 mL), cooled to 0 °C, was added 2M isopropylmagnesium chloride (1.5 mL, 3 mmol, 1.4 eq.). After stirring at room temperature for 1 hr, DMF (1.7 mL, 20 mmol, 10 eq.) was added and the mixture was stirred for an additional 1 hr. The reaction mixture was quenched with saturated aqueous NH_4Cl (50 mL) and diluted with water (100 mL). The aqueous phase was extracted with EtOAc (2 x 100 mL) and the combined organics were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (5-chloro-3-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (889 mg, 70%) as a yellow oil. MS *m/z* 430.7 $[M+Na]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: ppm 10.47 (s, 1 H) 8.62 (s, 1 H) 7.22 - 7.29 (m, 2 H) 6.80 - 6.95 (m, 2 H) 5.10 (s, 2 H) 1.49 (s, 9 H).

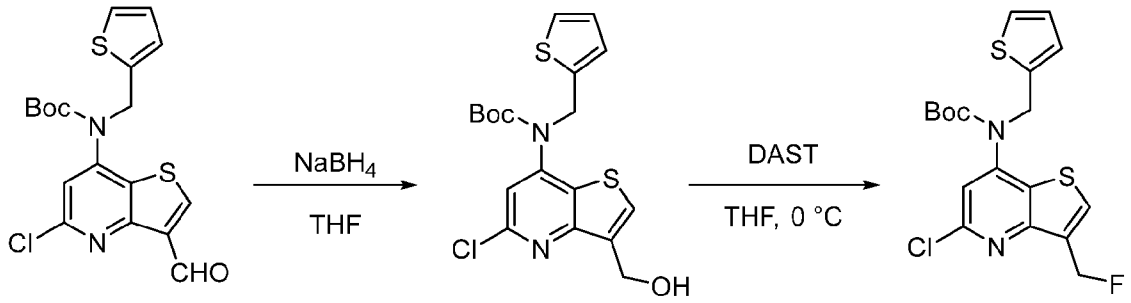
Step 2: tert-butyl (5-chloro-3-(difluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of afford tert-butyl (5-chloro-3-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (120 mg, 0.3 mmol) in DCM (0.5 mL), cooled to 0 °C, was added DAST (0.08 mL, 0.6 mmol, 2 eq.). After stirring at 0 °C for 1 h, the reaction mixture

was allowed to warm to room temperature and stirred overnight. The reaction mixture was then cooled to 0 °C and quenched with aqueous $NaHCO_3$ (2M, 5 mL). After neutralization, the mixture was extracted with EtOAc (3 x 10 mL). The combined organics were washed with brine (10 mL), dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-40% gradient) to afford tert-butyl (5-chloro-3-(difluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (100 mg, 79%) as a yellow oil. MS *m/z* 431.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: ppm 8.12 (s, 1 H) 6.98 - 7.28 (m, 3 H) 6.80 - 6.93 (m, 2 H) 5.08 (s, 2 H) 1.49 (s, 9 H).

Intermediate 18

tert-Butyl (5-chloro-3-(fluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



Step 1: tert-Butyl (5-chloro-3-(hydroxymethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

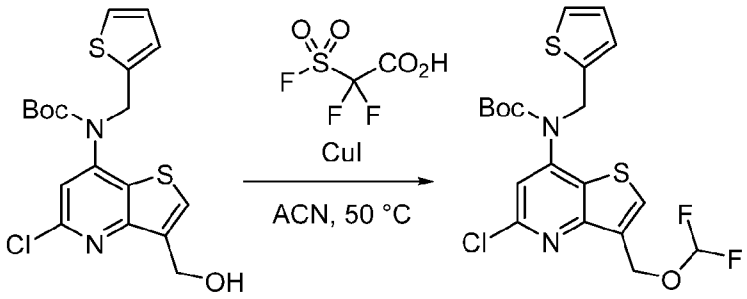
To a solution of tert-butyl (5-chloro-3-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (300 mg, 0.7 mmol) (prepared according to step 1 of Intermediate 17) in THF (2.7 mL), cooled to 0 °C, was added $NaBH_4$ (17 mg, 0.4 mmol, 0.6 eq.). After stirring at room temperature for 1 h, the reaction mixture was diluted with water and extracted with EtOAc (2 x 50 mL). The combined organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (5-chloro-3-(hydroxymethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (220 mg, 73%) as a yellow oil. MS *m/z* 411.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: ppm 7.67 (s, 1 H) 7.25 (d, *J*=5.13 Hz, 1 H) 7.10 (s, 1 H) 6.79 - 6.92 (m, 2 H) 5.08 (s, 2 H) 5.00 (s, 2 H) 1.48 (s, 9 H).

Step 2: tert-Butyl (5-chloro-3-(fluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (5-chloro-3-(hydroxymethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (630 mg, 1.5 mmol) in DCM (3 mL), cooled to 0 °C, was added DAST (0.4 mL, 3 mmol, 2 eq.). After stirring at room temperature for 1 h, the reaction was quenched with saturated aqueous $NaHCO_3$ (5 mL) and diluted with water (50 mL). The aqueous phase was extracted with EtOAc (2 x 100 mL) and the combined organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (5-chloro-3-(fluoromethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (150 mg, 24%) as a yellow oil. MS *m/z* 413.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: ppm 7.76 (d, *J*=1.88 Hz, 1 H) 7.15 (d, *J*=5.00 Hz, 1 H) 7.02 (s, 1 H) 6.68 - 6.86 (m, 2 H) 5.54 - 5.73 (m, 2 H) 4.99 (s, 2 H) 1.39 (s, 9 H).

Intermediate 19

tert-Butyl (5-chloro-3-((difluoromethoxy)methyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



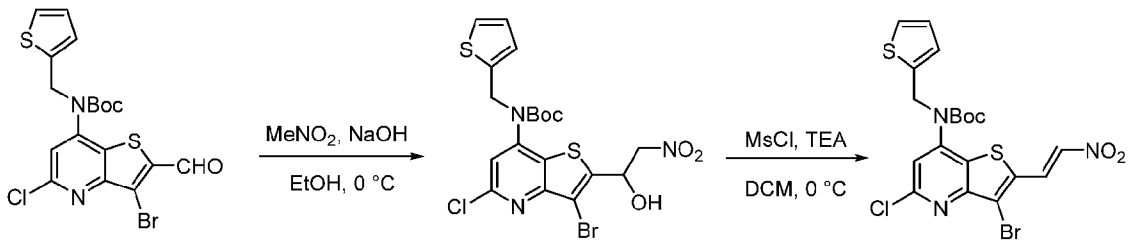
Step 1: tert-Butyl (5-chloro-3-((difluoromethoxy)methyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

A mixture of tert-butyl (5-chloro-3-(hydroxymethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (200 mg, 0.5 mmol) (prepared according to the procedure described in Intermediate 18) and CuI (19 mg, 0.01 mmol, 0.2 eq.) in acetonitrile (1 mL) was stirred at 50 °C. To this mixture was added dropwise 2,2-difluoro-2-(fluorosulfonyl)acetic acid (0.1 mL, 1 mmol, 2 eq.). After stirring at 50 °C for 1 h, the reaction mixture was allowed to cool to room temperature and concentrated *in vacuo*. The crude residue was purified by silica

gel column chromatography to afford tert-butyl (5-chloro-3-((difluoromethoxy)methyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (100 mg, 45%) as a yellow oil. MS *m/z* 461.0 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: ppm 7.77 - 7.82 (m, 1 H) 7.25 (d, *J*=5.00 Hz, 1 H) 7.11 (s, 1 H) 6.90 (t, *J*=4.13 Hz, 1 H) 6.82 (br d, *J*=2.63 Hz, 1 H) 6.23 - 6.65 (m, 1 H) 5.26 (s, 2 H) 5.08 (s, 2 H) 1.48 (s, 9 H).

Intermediate 20

tert-Butyl (E)-(3-bromo-5-chloro-2-(2-nitrovinyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate



Step 1: tert-Butyl (3-bromo-5-chloro-2-(1-hydroxy-2-nitroethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a stirred solution of tert-butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (3 g, 6.2 mmol) and nitromethane (1.2 mL, 22.4 mmol, 3.5 eq.) in EtOH (50 mL), cooled to 0 °C) was added 50% aq. NaOH (7.2 mL). After stirring for 1 h at 0 °C, the reaction mixture was slowly quenched with 2M HCl (20 mL) and then diluted with water (100 mL). The aqueous phase was extracted with EtOAc (2 x 100 mL) and the combined organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (3-bromo-5-chloro-2-(1-hydroxy-2-nitroethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (3.4 g, 77%) as a yellow oil. MS *m/z* 549.6 $[M+H]^+$.

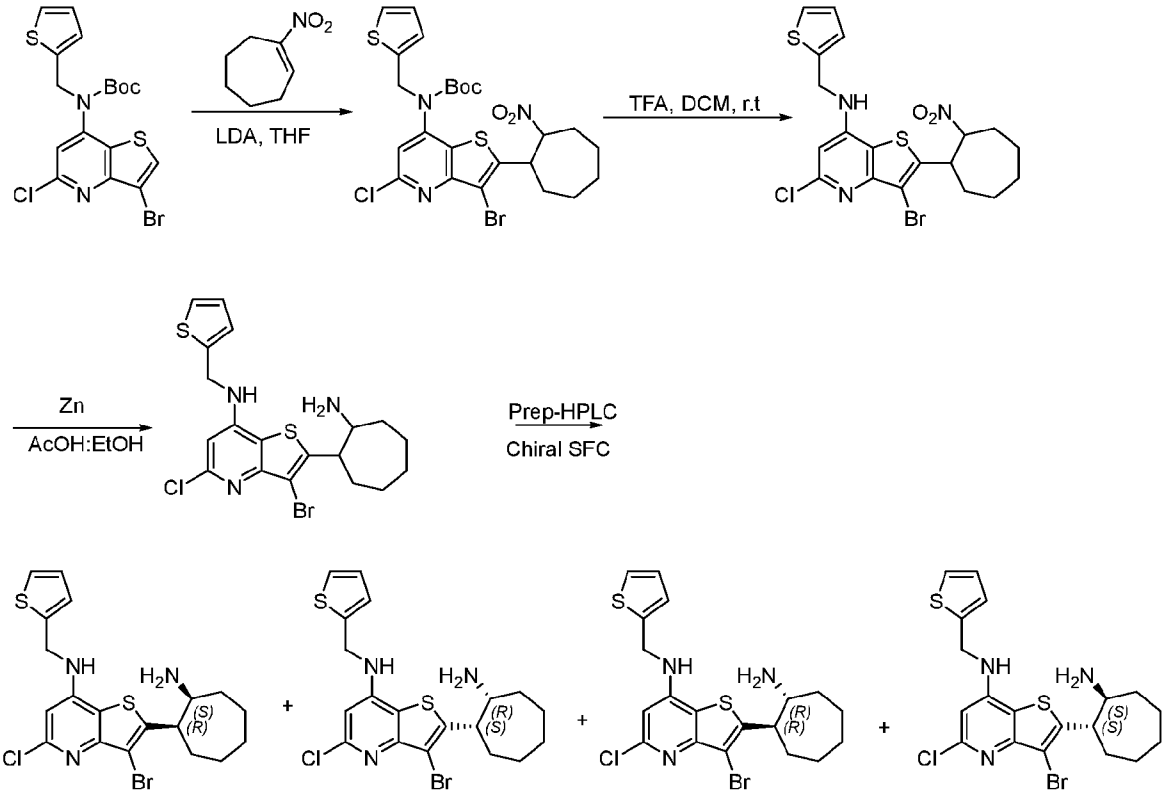
Step 2: tert-Butyl (E)-(3-bromo-5-chloro-2-(2-nitrovinyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of afford tert-butyl (3-bromo-5-chloro-2-(1-hydroxy-2-nitroethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (310 mg, 0.2 mmol) in DCM (2 mL), cooled to 0 °C, was added methanesulfonyl chloride (0.05 mL, 0.22 mmol, 1.1 eq.) and TEA (0.2 mL, 5 mmol, 2.2 eq.). After stirring for 2 h, the reaction mixture was diluted

with water (50 mL) and extracted with DCM (2 x 50 mL). The combined organics were washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford tert-butyl (E)-(3-bromo-5-chloro-2-(2-nitrovinyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (300 mg, 93%) as a yellow oil. MS *m/z* 531.9 $[M+H]^+$. ^1H NMR (CHLOROFORM-d) δ: 8.41 (d, J=13.5 Hz, 1H), 7.64 (d, J=13.5 Hz, 1H), 7.24-7.28 (m, 2H), 6.92 (dd, J=5.0, 3.5 Hz, 1H), 6.84 (d, J=3.4 Hz, 1H), 5.07 (s, 2H), 1.52 (s, 9H).

Example 1

Preparation of Compound 72, Compound 73, Compound 74, and Compound 75



Step 1: tert-Butyl (3-bromo-5-chloro-2-(2-nitrocycloheptyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (1 g, 2.17 mmol) in THF (10 mL) was added lithium diisopropylamide (2M) in THF/heptane/ethylbenzene (1.63 mL, 3.26 mmol, 1.5 eq) at -78 °C. The mixture was stirred at -78°C for 30 min. Then 1-nitrocyclohept-1-ene (397.8 mg, 2.82 mmol) was added, the

mixture was stirred at -78 °C for 3 hours. TLC showed the starting material was remained and new spot was observed. The reaction mixture was diluted by adding NH_4Cl (sat. aq.) (125 mL). The organic layer was extracted with EtOAc (125 ml x3). The combined organic layers were washed with brine, dried over Na_2SO_4, filtered, and then concentrated *in vacuo*. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetates in petroleum ether (0 to 50% gradient) to give tert-butyl (3-bromo-5-chloro-2-(2-nitrocycloheptyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (260 mg, 0.43 mmol) as white solid.

Step 2: 3-Bromo-5-chloro-2-(2-nitrocycloheptyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To a solution of tert-butyl (3-bromo-5-chloro-2-(2-nitrocycloheptyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (50 mg, 0.08 mmol) in CH_2Cl_2 (8 ml) was added TFA (4 mL) at 0 °C. After stirring for 30 minutes at 25 °C, the mixture was concentrated *in vacuo* to give crude 3-bromo-5-chloro-2-(2-nitrocycloheptyl)-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (40 mg, 0.08 mmol 96% Yield) as a white solid which was used in the next step without further purification. MS *m/z* 501.8 $[M+H]^+$

Step 3: 2-(2-Aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To a solution of 3-bromo-5-chloro-2-(2-nitrocycloheptyl)-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (150 mg, 0.3mmol) and zinc (98 mg, 1.5 mmol) in ethanol (8 mL) was added TFA (2 mL, 26.5 mmol) at 0 °C . After stirring the reaction for 30 minutes at 70 °C, the mixture was concentrated and the crude oil was purified by PreP-HPLC to give trans-2-(2-aminocycloheptyl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (25 mg, 0.05 mmol, 18% Yield) as an off-white solid and cis-2-(2-aminocycloheptyl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (60 mg, 0.1 mmol, 43% Yield) as an off-white solid. MS *m/z* 471.8 $[M+H]^+$

Step 4: **2-((1S,2R)-2-Aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine, 2-((1R,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine, 2-((1S,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-**

amine, and **2-((1R,2R)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine**

Cis-2-(2-aminocycloheptyl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (60 mg, 0.13 mmol) was purified by Prep-SFC (Dr.maish Reprosil Chiral-AM, Supercritical CO_2/MeOH (+0.1% 7.0mol/l NH_3 in MeOH)/MeOH) to give 2-[(1R,2R)-2-aminocycloheptyl]-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 72**, 11 mg, 0.02 mmol, 18% Yield) and 2-[(1S,2S)-2-aminocycloheptyl]-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 73**, 16 mg, 0.03 mmol, 27% Yield) as an off-white solid.

2-[(1R,2S)-2-aminocycloheptyl]-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 74**, 2.8 mg, 0.006 mmol, 14 % Yield) and P2-[(1S,2R)-2-aminocycloheptyl]-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 75**, 2.8 mg, 0.006 mmol, 14% Yield) as an off-white solid.

Compound 72: MS *m/z* 472.0 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ ppm 7.97 (t, J = 5.8 Hz, 1H), 7.40 (d, J = 5.0 Hz, 1H), 7.10 (d, J = 2.6 Hz, 1H), 7.00-6.98 (m, 1H), 6.60 (s, 1H), 4.70 (d, J = 5.8 Hz, 2H), 3.50 (d, J = 12 Hz, 1H), 3.31-3.27(m, 1H), 1.95 -1.77 (m, 11H), 1.23 (s, 1H).

Compound 73: MS *m/z* 472.0 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ ppm 7.99 (t, J = 5.8 Hz, 1H), 7.40 (d, J = 5.2 Hz, 1H), 7.10 (d, J = 2.6 Hz, 1H), 7.00-6.98 (m, 1H), 6.58 (s, 1H), 4.71 (d, J = 6.0 Hz, 2H), 3.55 (d, J = 12 Hz, 1H), 3.37-3.27(m, 1H), 2.08-1.43 (m, 11H), 1.25 (s, 1H).

Compound 74: MS *m/z* 471.9 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ ppm 7.96 (s, 1H), 7.40 (d, J = 4.0 Hz, 1H), 7.10 (s, 1H), 7.05 - 6.92 (m, 1H), 6.57 (s, 1H), 4.72 (d, J = 5.6 Hz, 2H), 3.20-3.13 (m, 2H), 1.99 – 1.39 (m, 12H).

Compound 75: MS *m/z* 471.9 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ ppm 7.95 (t, J = 5.8 Hz, 1H), 7.40 (d, J = 5.0 Hz, 1H), 7.11 (d, J = 2.6 Hz, 1H), 7.00 - 6.98 (m, 1H), 6.60 (s, 1H), 4.72 (d, J = 5.8 Hz, 2H), 3.25-3.13 (m, 2H), 1.95-1.45 (m, 12H).

The compounds below were prepared according to the procedure of Example 1 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
1	MS m/z 398.1 $[M+H]^+$; ^{1}HNMR (400 MHz, DMSO-d_6) δ: 7.97 (s, 1H), 7.42 – 7.34 (m, 1H), 7.11 (s, 1H), 6.99 (d, J = 3.4 Hz, 1H), 6.61 (d, J = 4.5 Hz, 1H), 4.73 (s, 2H), 2.11 – 1.57 (m, 7H), 1.49 (m, 1H), 1.25 (m, 2H)
2	MS m/z 398.1 $[M+H]^+$; ^{1}HNMR(400 MHz, DMSO-d_6) δ: 7.97 (s, 1H), 7.40 (d, J = 5.0 Hz, 1H), 7.11 (s, 1H), 6.98 (d, J = 3.4 Hz, 1H), 6.62 (d, J = 4.6 Hz, 1H), 4.72 (s, 2H), 2.11 – 1.57 (m, 7H), 1.49 (m, 1H), 1.25 (m, 2H)
3	MS m/z 398.1 $[M+H]^+$; 1HNMR(400 MHz, DMSO-d_6) δ: 7.98 (t, J = 5.9 Hz, 1H), 7.40 (d, J = 4.9 Hz, 1H), 7.10 (d, J = 3.1 Hz, 1H), 7.04 – 6.93 (m, 1H), 6.58 (s, 1H), 4.71 (d, J = 5.9 Hz, 2H), 2.16 – 1.84 (m, 6H), 1.77 – 1.40 (m, 4H)
4	MS m/z 398.1 $[M+H]^+$; ^{1}HNMR(400 MHz, DMSO-d_6) δ: 7.98 (t, J = 5.8 Hz, 1H), 7.40 (d, J = 5.0 Hz, 1H), 7.10 (s, 1H), 7.00 – 6.96 (m, 1H), 6.58 (s, 1H), 4.71 (d, J = 5.9 Hz, 2H), 2.16 – 1.84 (m, 6H), 1.77 – 1.40 (m, 4H)
13	MS m/z 412.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 0.9 Hz, 1H), 7.08 (d, J = 2.9 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.56 (s, 1H), 4.75 (s, 2H), 3.60 (dt, J = 11.7, 3.6 Hz, 1H), 3.45 (d, J = 3.5 Hz, 1H), 2.03 (dd, J = 12.6, 3.5 Hz, 1H), 1.93 – 1.69 (m, 5H), 1.61 – 1.48 (m, 2H). (3 exchangeable protons are not seen)
14	MS m/z 412.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 0.9 Hz, 1H), 7.08 (d, J = 3.4 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.56 (s, 1H), 4.75 (s, 2H), 3.63 (d, J = 11.4 Hz, 1H), 3.49 (d, J = 3.6 Hz, 1H), 2.08 – 1.97 (m, 1H), 1.93 – 1.69 (m, 5H), 1.62 – 1.50 (m, 2H). (3 exchangeable protons are not seen)
15	MS m/z 459.9 $[M+H]^+$; ^{1}H NMR (400 MHz, DMSO-d_6) δ: 8.03 (s, 1H), 7.41 - 7.39 (m, 1H), 7.10 (s, 1H), 7.00 - 6.98 (m, 1H), 6.63 (s, 1H), 5.07 (s, 1H), 4.75 - 4.73 (m, 2H), 4.05 - 4.00 (m, 1H), 3.75 - 3.65(m, 1H), 3.59 (s, 1H), 3.37 (d, J = 12 Hz, 1H), 3.27 (s, J = 12 Hz, 1H), 2.15 - 1.95 (m, 3H), 1.47 - 1.44 (m, 1H).
16	MS m/z 414.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.09 – 7.06 (m, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 4.76 (s, 2H), 4.66 (d, J = 9.4 Hz, 1H), 4.08 – 4.01 (m, 1H), 3.59 (t, J = 11.6, 3.0 Hz, 1H), 2.83 (ddd, J = 11.3, 9.4, 4.1 Hz, 1H), 2.20 – 2.11 (m, 1H), 1.90 – 1.73 (m, 2H), 1.56 (ddd, J = 24.2, 12.7, 4.5 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
17	MS m/z 414.0 $[M+H]^+$; 1HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.07 (dd, J = 3.4, 0.9 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 5.06 (d, J = 1.8 Hz, 1H), 4.75 (s, 2H), 4.14 (dd, J = 10.5, 3.6 Hz, 1H), 3.73 (td, J = 11.7, 2.8 Hz, 1H), 3.46 (d, J = 1.8 Hz, 1H), 2.01 (ddd, J = 17.9, 11.7, 5.1 Hz, 3H), 1.48 (d, J = 8.1 Hz, 1H). (3 exchangeable protons are not seen)
18	MS m/z 414.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.5, 1.1 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.60 (s, 1H), 4.76 (s, 2H), 4.67 (d, J = 9.4 Hz, 1H), 4.05 (dd, J = 11.5, 4.5 Hz, 1H), 3.59 (td, J = 11.6, 3.0 Hz, 1H), 2.84 (ddd, J = 11.3, 9.5, 4.1 Hz, 1H), 2.16 (d, J = 9.4 Hz, 1H), 1.81 (dt, J = 13.5, 9.7 Hz, 2H), 1.57 (ddd, J = 24.1, 12.8, 4.6 Hz, 1H). (3 exchangeable protons are not seen)
19	MS m/z 414.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.10 – 7.05 (m, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 5.06 (d, J = 1.8 Hz, 1H), 4.74 (s, 2H), 4.18 – 4.10 (m, 1H), 3.73 (td, J = 11.6, 2.8 Hz, 1H), 3.46 (d, J = 1.7 Hz, 1H), 2.08 – 1.93 (m, 3H), 1.48 (d, J = 8.0 Hz, 1H). (3 exchangeable protons are not seen)
20	MS m/z 459.9 $[M+H]^+$; ^{1}H NMR (400 MHz, DMSO-d_6) δ: 7.97 – 7.95 (m, 1H), 7.41 - 7.39 (m, 1H), 7.10 (s, 1H), 7.00 - 6.97 (m, 1H), 6.59 (s, 1H), 4.92 (s, 1H), 4.75 - 4.71 (m, 2H), 4.03 - 3.99 (m, 1H), 3.68 - 3.63 (m, 1H), 3.32 - 3.27 (m, 1H), 2.08 - 1.65 (m, 5H), 1.38 - 1.35 m, 1H), 1.24 (s, 1H)
26	MS m/z 373.9, 376.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.22-7.42 (m, 6H), 6.42-6.49 (m, 1H), 4.67-4.77 (m, 1H), 4.61 (s, 2H), 4.08-4.18 (m, 1H), 3.61-3.74 (m, 1H), 3.34-3.41 (m, 1H), 2.27-2.39 (m, 1H), 1.85-1.99 (m, 2H), 1.71-1.85 (m, 1H). trifluoracetic acid salt, (3 exchangeable protons are not seen)
27	MS m/z 453.28 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30-7.40 (m, 4H), 7.23-7.30 (m, 1H), 7.22-7.31 (m, 1H), 6.48 (s, 1H), 4.95-5.04 (m, 1H), 4.55-4.65 (m, 2H), 4.11-4.21 (m, 1H), 3.63-3.75 (m, 1H), 3.35-3.46 (m, 1H), 2.29-2.39 (m, 1H), 1.80-2.00 (m, 2H). trifluoracetic acid salt, (3 exchangeable protons are not seen)
28	MS m/z 391.9, 393.8 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.28-7.41 (m, 3H), 7.10-7.19 (m, 2H), 6.50-6.55 (m, 1H), 4.70-4.78 (m, 1H), 4.62-4.70 (m, 2H), 4.08-4.18 (m, 1H), 3.61-3.76 (m, 1H), 3.33-3.37 (m, 1H), 2.26-2.39 (m, 1H), 1.87-1.99 (m, 2H), 1.71-1.85 (m, 1H). trifluoracetic acid salt, (3 exchangeable protons are not seen)

Compound	Spectral Data
29	MS m/z 471.8 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.27-7.40 (m, 2H), 7.09-7.20 (m, 2H), 6.51-6.58 (m, 1H), 4.96-5.04 (m, 1H), 4.59-4.69 (m, 2H), 4.11-4.19 (m, 1H), 3.95-4.03 (m, 1H), 3.61-3.76 (m, 1H), 3.35-3.46 (m, 1H), 2.27-2.38 (m, 1H), 1.80-1.99 (m, 2H). trifluoracetic acid salt, (3 exchangeable protons are not seen)
35	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.06 – 2.86 (m, 1H), 2.35 (s, 3H), 2.02 (dd, J = 38.5, 12.1 Hz, 1H), 1.87 (s, 2H), 1.64 – 1.53 (m, 1H), 1.50 – 1.32 (m, 3H). (3 exchangeable protons are not seen)
49	MS m/z 459.9 $[M+H]^+$; ^1H NMR (400 MHz, DMSO-d_6) δ: 8.00 - 7.97 (m, 1H), 7.41 - 7.40 (m, 1H), 7.10 (s, 1H), 7.00 - 6.98 (m, 1H), 6.63 (s, 1H), 4.73 (d, J = 4 Hz, 2H), 4.47 (d, J = 8 Hz, 1H), 3.96 (d, J = 12 Hz, 1H), 3.52 - 3.45 (m, 1H), 2.80 - 2.61 (m, 1H), 2.02 (d, J = 8 Hz, 1H), 1.50 (s, 2H), 1.47 - 1.43 (m, 1H), 1.24 (s, 1H), 0.86 - 0.83 (m, 1H).
50	MS m/z 392.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.50 (s, 1H), 4.74 (s, 2H), 3.08 – 2.91 (m, 2H), 2.35 (s, 3H), 2.03 (dd, J = 37.1, 12.3 Hz, 2H), 1.92 – 1.81 (m, 2H), 1.67 – 1.54 (m, 1H), 1.52 – 1.35 (m, 3H). (3 exchangeable protons are not seen)
51	MS m/z 392.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.06 – 2.86 (m, 2H), 2.35 (s, 3H), 2.02 (dd, J = 38.5, 12.1 Hz, 2H), 1.92 – 1.81 (m, 2H), 1.67 – 1.54 (m, 1H), 1.50 – 1.32 (m, 3H). (3 exchangeable protons are not seen)
52	MS m/z 457.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (s, 1H), 4.75 (s, 2H), 3.59 (dt, J = 11.9, 3.5 Hz, 1H), 3.48 (dd, J = 5.7, 2.5 Hz, 1H), 1.92 – 1.48 (m, 8H). (3 exchangeable protons are not seen)
53	MS m/z 458.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.4, 0.9 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 4.74 (d, J = 9.9 Hz, 2H), 3.73 (ddd, J = 35.7, 19.2, 14.8 Hz, 2H), 1.92 – 1.48 (m, 8H). (3 exchangeable protons are not seen)
54	MS m/z 458.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.0 Hz, 1H), 7.08 (d, J = 2.6 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.56 (d, J = 12.8 Hz, 1H), 4.75 (s, 2H), 3.28 – 3.19 (m, 1H), 3.09 (d, J = 31.5 Hz, 1H), 1.92 – 1.48 (m, 8H). (3 exchangeable protons are not seen)

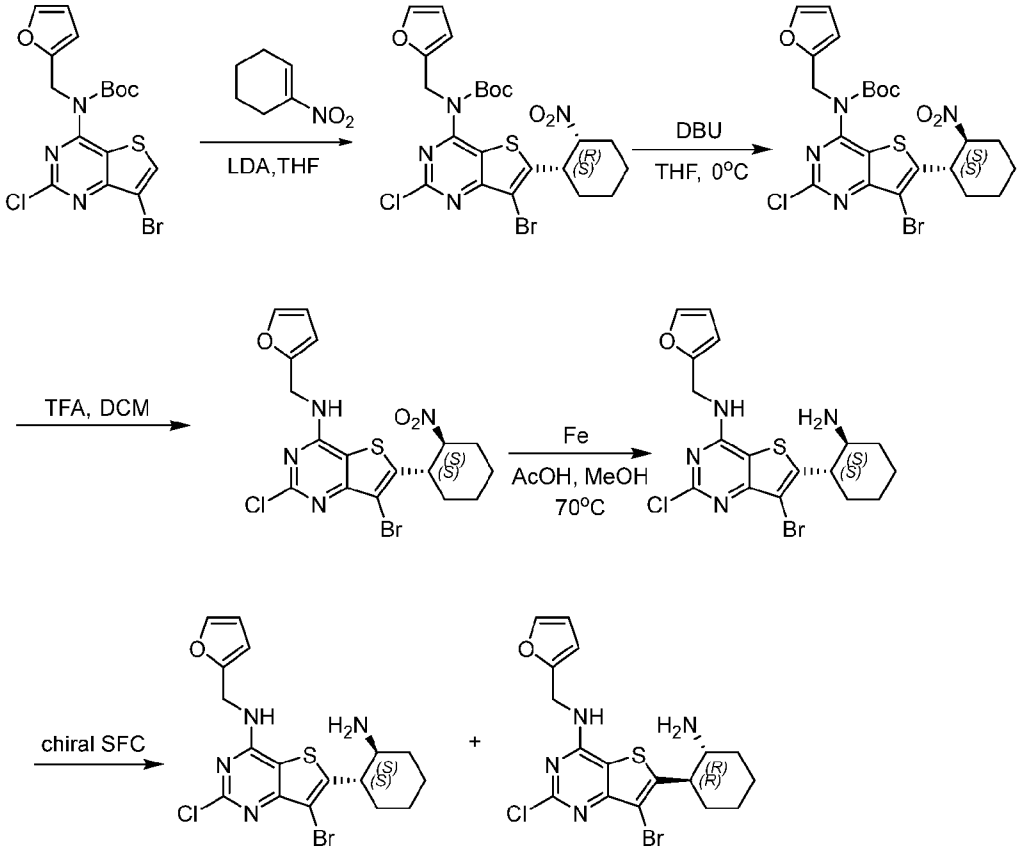
Compound	Spectral Data
55	MS m/z 457.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (s, 1H), 4.75 (s, 2H), 3.59 (dt, J = 11.9, 3.5 Hz, 1H), 3.48 (dd, J = 5.7, 2.5 Hz, 1H), 1.92 – 1.48 (m, 8H). (3 exchangeable protons are not seen)
56	MS m/z 459.9 $[M+H]^+$; ^{1}H NMR (400 MHz, DMSO) δ: 7.98 - 7.97 (m, 1H), 7.41 - 7.40 (m, 1H), 7.11 (s, 1H), 7.00 - 6.98 (m, 1H), 6.63 (s, 1H), 4.73 (d, *J* = 4 Hz, 2H), 4.47 (d, *J* = 8 Hz, 1H), 3.97 - 3.94 (m, 1H), 3.52 - 3.45 (m, 1H), 2.80 - 2.65 (m, 1H), 2.02 - 1.99 (m, 1H), 1.75 (s, 2H), 1.52 - 1.48 (m, 1H), 1.24 (s, 2H).
71	MS m/z 392.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.50 (s, 1H), 4.74 (s, 2H), 3.08 – 2.91 (m, 2H), 2.35 (d, J = 4.4 Hz, 3H), 2.03 (dd, J = 37.1, 12.3 Hz, 2H), 1.92 – 1.81 (m, 2H), 1.67 – 1.54 (m, 1H), 1.52 – 1.35 (m, 3H). (3 exchangeable protons are not seen)
76	MS m/z 426.1 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.07 (s, 1H), 7.01 (dd, J = 7.1, 3.6 Hz, 1H), 6.54 (s, 1H), 4.69 (d, J = 4.8 Hz, 2H), 3.75 – 3.62 (m, 1H), 3.46 (s, 1H), 1.97 – 1.61 (m, 10H). (3 exchangeable protons are not seen)
77	MS m/z 426.1 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.29 (d, J = 5.0 Hz, 1H), 7.07 (s, 1H), 7.03 – 6.99 (m, 1H), 6.54 (s, 1H), 4.69 (d, J = 4.7 Hz, 2H), 3.64 (s, 1H), 3.44 (s, 1H), 1.97 – 1.61 (m, 10H). (3 exchangeable protons are not seen)
78	MS m/z 426.2 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.30 (d,J, J = 5.1 Hz, 1H), 7.08 (d, J = 3.2 Hz, 1H), 7.02 (dd, J = 5.0, 3.6 Hz, 1H), 6.55 (s, 1H), 4.70 (d, J = 4.7 Hz, 2H), 3.24 (t, J = 8.2 Hz, 1H), 3.11 (t, J = 7.2 Hz, 1H), 1.92 – 1.60 (m, 10H), 1.45 (s, 2H). (1 exchangeable protons are not seen)
79	MS m/z 426.2 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.23 (d, J = 4.9 Hz, 1H), 7.00 (s, 1H), 6.96 – 6.93 (m, 1H), 6.49 (s, 1H), 4.63 (d, J = 4.8 Hz, 2H), 3.17 (t, J = 8.4 Hz, 1H), 3.05 (d, J = 7.7 Hz, 1H), 1.83 – 1.55 (m, 10H), 1.36 (s, 2H). (1 exchangeable protons are not seen)
81	MS m/z 406.2 $[M+H]^+$; ^{1}H NMR (400 MHz, DMSO-d_6) δ: 7.64 (t, J = 6.0 Hz, 1H), 7.38 (dd, J = 5.0, 1.1 Hz, 1H), 7.09 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.49 (s, 1H), 4.69 (d, J = 5.9 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.25 (s, 3H), 1.90-1.20 (m, 12H).
82	MS m/z 406.2 $[M+H]^+$; ^{1}H NMR (400 MHz, DMSO-d_6) δ: 7.66 (t, J = 6.0 Hz, 1H), 7.40 – 7.36 (m, 1H), 7.08 (s, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.46 (s, 1H), 4.68 (d, J = 6.0 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.24 (s, 3H), 1.91-1.15 (m, 12H).

Compound	Spectral Data
83	MS m/z 406.1 $[M+H]^+$; ^1H NMR (400 MHz, DMSO-d_6) δ: 7.64 (s, 1H), 7.38 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.48 (s, 1H), 4.69 (d, J = 6.0 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.25 (s, 3H), 1.85 – 1.42 (m, 12H).
84	MS m/z 406.1 $[M+H]^+$; ^1H NMR (400 MHz, DMSO-d_6) δ: 7.66 (t, J = 6.1 Hz, 1H), 7.38 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (d, J = 2.4 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.46 (s, 1H), 4.68 (d, J = 5.9 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.24 (s, 3H), 2.00-1.40 (m, 12H).
91	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, DMSO-d_6) δ: 7.96 (t, J = 6.1 Hz, 1H), 7.39 (dd, J = 5.1, 1.2 Hz, 1H), 7.10 (dd, J = 3.4, 1.0 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (s, 1H), 4.70 (d, J = 6.0 Hz, 2H), 3.90 – 3.68 (m, 1H), 3.04 (d, J = 7.1 Hz, 1H), 2.08 (dd, J = 30.1, 19.2 Hz, 1H), 1.96 – 1.37 (m, 13H).
92	MS m/z 420.3 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 7.64 (t, J = 6.0 Hz, 1H), 7.38 (dd, J = 5.0, 1.1 Hz, 1H), 7.09 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.49 (s, 1H), 4.69 (d, J = 5.9 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.25 (s, 3H), 1.90-1.20 (m, 14H).
93	MS m/z 419.9 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 7.64 (s, 1H), 7.38 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.48 (s, 1H), 4.69 (d, J = 6.0 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.25 (s, 3H), 1.85 – 1.42 (m, 14H).
94	MS m/z 419.9 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 7.66 (t, J = 6.0 Hz, 1H), 7.40 – 7.36 (m, 1H), 7.08 (s, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.46 (s, 1H), 4.68 (d, J = 6.0 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.24 (s, 3H), 1.91-1.15 (m, 14H).
95	MS m/z 420.3 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 7.66 (t, J = 6.1 Hz, 1H), 7.38 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (d, J = 2.4 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.46 (s, 1H), 4.68 (d, J = 5.9 Hz, 2H), 2.98 (dt, J = 6.0, 3.0 Hz, 2H), 2.25 (s, 3H), 2.00-1.40 (m, 14H).
96	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 3.4 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (d, J = 8.4 Hz, 1H), 4.74 (s, 2H), 3.43 (d, J = 5.9 Hz, 2H), 2.03 – 1.62 (m, 12H). (3 exchangeable protons are not seen)
97	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.07 (d, J = 3.2 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.57 (s, 1H), 4.74 (s, 2H), 3.57 – 3.33 (m, 2H), 2.07 – 1.62 (m, 12H). (3 exchangeable protons are not seen)
98	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.07 (d, J = 3.4 Hz, 1H), 7.00 – 6.93 (m, 1H), 6.56 (d, J = 1.7 Hz, 1H), 4.85 (s, 2H), 4.74 (s, 2H), 3.54 – 3.41 (m, 2H), 1.99 – 1.60 (m, 12H). (3 exchangeable protons are not seen)

Compound	Spectral Data
99	MS m/z 486.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.1 Hz, 1H), 7.08 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.57 (s, 1H), 4.75 (s, 2H), 3.53 (d, J = 5.3 Hz, 1H), 3.38 (s, 1H), 1.99 – 1.60 (m, 12H). (3 exchangeable protons are not seen)
100	MS m/z 484.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.08 (d, J = 3.3 Hz, 1H), 7.00 – 6.95 (m, 1H), 6.58 (s, 1H), 4.75 (s, 2H), 3.56 (s, 1H), 3.40 (s, 1H), 1.82 (ddd, J = 72.5, 39.6, 6.2 Hz, 12H). (3 exchangeable protons are not seen)
101	MS m/z 486.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.2 Hz, 1H), 7.08 (d, J = 2.9 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 4.75 (s, 2H), 4.02 (s, 1H), 3.61 (s, 1H), 1.82 (d, J = 74.1 Hz, 12H). (3 exchangeable protons are not seen)
102	MS m/z 486.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.08 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.58 (s, 1H), 4.75 (s, 2H), 4.01 (dd, J = 9.4, 5.7 Hz, 1H), 3.50 (s, 1H), 1.99 – 1.66 (m, 12H). (3 exchangeable protons are not seen)
269	MS m/z 494.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.21 (d, J = 5.1 Hz, 1H), 7.00 (d, J = 3.4 Hz, 1H), 6.88 (dd, J = 5.1, 3.4 Hz, 1H), 6.55 (s, 1H), 4.68 (s, 2H), 4.00 (dd, J = 25.7, 11.6 Hz, 1H), 3.65 – 3.55 (m, 1H), 2.34 - 2.24 (m, 1H), 2.20 - 2.07 (m, 1H), 2.05 – 1.85 (m, 3H), 1.75 – 1.60 (m, 1H). (3 Exchangeable protons not observed).
338	MS m/z 428.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.28 (d, J = 4.6 Hz, 1H), 7.07 (s, 1H), 6.97 (d, J = 4.6 Hz, 1H), 6.51 (s, 1H), 4.75 (s, 2H), 3.50 (dd, J = 27.3, 11.0 Hz, 1H), 3.25 – 3.10 (m, 1H), 2.33 (s, 3H), 2.26 – 2.20 (m, 1H), 2.18 – 2.08 (m, 1H), 2.00 – 1.80 (m, 2H), 1.75 – 1.65 (m, 1H), 1.50 – 1.40 (m, 1H). (3 Exchangeable protons not observed).
359	MS m/z 494.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.21 (d, J = 5.1 Hz, 1H), 7.00 (d, J = 3.4 Hz, 1H), 6.88 (dd, J = 5.1, 3.4 Hz, 1H), 6.55 (s, 1H), 4.68 (s, 2H), 4.56 - 4.44 (m, 1H), 3.90 (d, J = 5.8 Hz, 1H), 2.34 - 2.24 (m, 1H), 2.20 - 2.07 (m, 1H), 2.10 – 1.61 (m, 4H). (3 Exchangeable protons not observed).
370	MS m/z 448.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 6.71 (s, 1H), 4.15 – 4.01 (m, 3H), 3.75 – 3.60 (m, 1H), 2.40 – 2.29 (m, 1H), 2.29 – 2.21 (m, 1H), 2.15 – 1.96 (m, 2H), 1.86 – 1.67 (m, 5H). (3 Exchangeable protons not observed).
383	MS m/z 496.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 6.59 (s, 1H), 4.06 – 3.91 (m, 3H), 3.68 – 3.58 (m, 1H), 2.25 (dt, J = 15.7, 7.1 Hz, 1H), 2.16 (d, J = 12.3 Hz, 1H), 2.05 – 1.88 (m, 2H), 1.76 – 1.68 (m, 4H), 1.68 – 1.57 (m, 1H). (3 Exchangeable protons not observed).

Example 2

Preparation of Compound 67 and Compound 68



Step 1: tert-Butyl (7-bromo-2-chloro-6-((1S,2R)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate

To a solution of tert-butyl (7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (500 mg, 1.1 mmol) in THF (10 mL) was added lithium diisopropylamide (2M) in THF/heptane/ethylbenzene (0.8 mL, 1.7 mmol) at -78 °C. The mixture was stirred at -78 °C for 1 hour. Then 1-nitrocyclohex-1-ene (185.7 mg, 1.5 mmol) was added, the mixture was stirred at -78 °C for 3 hours. TLC showed that most starting materials disappeared and new major spot. The reaction mixture was quenched with saturated ammonium chloride (125 mL) and the organic layer was extracted with EtOAc (125 ml x3). The organic phases were washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by column chromatography on silica gel eluted with (EtOAc/PE =0 to 50%) to give the tert-butyl (7-bromo-2-chloro-6-((1S,2R)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (400 mg, 0.7 mmol, 62% Yield) as white solid. MS *m/z* 573.0

$[M+H]^+$.

Step 2: tert-Butyl (7-bromo-2-chloro-6-((1S,2S)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate

To a solution of tert-butyl (7-bromo-2-chloro-6-((1S,2R)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (329 mg, 0.6 mmol) in THF (10 mL) was added DBU (88 mg, 0.6 mmol, 1 eq) at 0 °C. The mixture was stirred at 0 °C for 3 hours. The mixture was poured into H_2O (50 mL). The organic layer was extracted with EtOAc (50 ml x3), washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by column chromatography on silica gel eluted with (EtOAc /PE =0 to 50%) to give the tert-butyl (7-bromo-2-chloro-6-((1S,2S)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (221 mg, 0.4 mmol, 67% Yield) as a white solid. ^{1}H NMR (CHLOROFORM-*d*) δ ppm 7.29 (dd, *J* = 1.8, 0.8 Hz,1H), 6.32 (d, *J* = 2.7 Hz, 1H), 6.29 (dd, *J* = 3.2,1.8 Hz, 1H), 5.19 (s, 2H), 4.89 (d, *J* = 4.0 Hz, 1H), 3.95 (d, *J* = 3.2 Hz, 1H), 2.50 (d, *J* = 10.0 Hz, 1H), 2.19 (d, *J* = 14.4 Hz, 1H), 2.10-1.80 (m, 3H), 1.80 - 1.40 (m, 3H), 1.53 (s, 9H).

Step 3: 7-Bromo-2-chloro-N-(furan-2-ylmethyl)-6-((1S,2S)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-amine

To a solution of tert-butyl (7-bromo-2-chloro-6-((1S,2S)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-yl)(furan-2-ylmethyl)carbamate (221 mg, 0.4 mmol) in CH_2Cl_2 (4 mL) was added TFA (4 mL). The mixture was stirred at 25 °C for 1 hour and then concentrated under reduced pressure to afford the crude compound, purified by column chromatography on silica gel eluted with (MeOH/ DCM =0 to 10%) to give the 7-bromo-2-chloro-N-(furan-2-ylmethyl)-6-((1S,2S)-2-nitrocyclohexyl)thieno[3,2-d]pyrimidin-4-amine (100 mg, 0.2 mmol, 55% Yield) as a yellow solid. MS *m/z* 470.9 $[M+H]^+$.

Step 4: 6-((1R,2R)-2-Aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine and **6-((1S,2S)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine**

To a solution of 7-bromo-2-chloro-N-(2-furylmethyl)-6-[(1S,2S)-2-nitrocyclohexyl]thieno[3,2-d]pyrimidin-4-amine (400 mg, 0.8 mmol) in ethanol (6 mL) and acetic acid (2 mL, 34.9 mmol) was added Iron (785 mg, 14.0 mmol). The mixture was stirred at 65 °C for 18 hours. The reaction mixture was diluted by adding 25 mL H_2O. The organic

layer was extracted with EtOAc (25 ml x3). The combined organic layers were washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by column chromatography on silica gel eluted with (MeOH/ DCM =0 to10%) followed by purification by Prep-SFC (DAICELCHIRALPAK®OJ, Supercritical CO_2/MeOH (+0.1% 7.0mol/l Ammonia in MeOH)/MeOH) to afford the 6-((1S,2S)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine (**Compound 67**, 26.4 mg, 18%) as off-white solid and 6-((1R,2R)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine (**Compound 68**, 26.3 mg, 18%) as off-white solid.

Compound 67: MS *m/z* 484.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ ppm 7.43 (dd, *J* = 1.8,0.8 Hz, 1H), 6.40 – 6.30 (m, 2H), 4.75 (s, 2H), 3.30 – 3.20 (m, 1H), 3.10 – 2.85 (m, 1H), 2.10 – 2.00 (m, 2H), 2.00 – 1.80 (m, 2H), 1.60- 1.00 (m, 4H) (3 exchangeable protons are not seen).

Compound 68: MS *m/z* 484.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ ppm δ: 7.44-7.42 (m, 1H), 6.40 – 6.30 (m, 2H), 4.75 (s, 2H), 3.30 – 3.20 (m, 1H), 3.10 – 2.85 (m, 1H), 2.10 – 2.00 (m, 2H), 2.00 – 1.80 (m, 2H), 1.60- 1.00 (m, 4H) (3 exchangeable protons are not seen).

The compounds below were prepared according to the procedure of Example 2 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
5	MS m/z 378.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.05 (dd, J = 3.4, 1.0 Hz, 1H), 6.96 (dd, J = 5.1, 3.5 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.37 – 3.31 (m, 2H), 2.35 (s, 3H), 2.21 (ddd, J = 15.5, 9.7, 4.2 Hz, 2H), 1.77 (dddd, J = 20.4, 17.2, 12.6, 8.3 Hz, 4H). (3 exchangeable protons are not seen)
6	MS m/z 378.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.05 (d, J = 3.4 Hz, 1H), 6.96 (dd, J = 5.0, 3.5 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.34 (s, 2H), 2.35 (s, 3H), 2.25 (ddd, J = 15.5, 9.7, 4.2 Hz, 2H), 1.75 (dddd, J = 20.4, 17.2, 12.6, 8.3 Hz, 4H). (3 exchangeable protons are not seen)
7	MS m/z 444.1 $[M+H]^+$; 1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.12 (s, 1H), 7.08 – 7.04 (m, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (s, 1H), 4.74 (s, 2H), 3.20 – 3.00 (m, 2H), 2.40-2.10 (m, 2H), 2.00-1.80 (m, 2H), 1.65-1.50 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
8	MS m/z 444.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.2 Hz, 1H), 7.11 (s, 1H), 7.07 (d, J = 3.4 Hz, 1H), 6.99 – 6.94 (m, 1H), 6.49 (d, J = 1.6 Hz, 1H), 4.74 (s, 2H), 3.60 – 3.40 (m, 2H), 2.25-1.95 (m, 3H), 1.85-1.60 (m, 2H). (3 exchangeable protons are not seen)
11	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (d, J = 2.4 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.39 (d, J = 8.5 Hz, 2H), 2.94 – 2.84 (m, 2H), 2.31 – 2.18 (m, 2H), 1.95 – 1.82 (m, 3H), 1.64 (s, 1H), 1.19 (t, J = 7.5 Hz, 3H). (3 exchangeable protons are not seen).
12	MS m/z 392.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 5.0 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.0, 3.6 Hz, 1H), 6.47 (d, J = 4.3 Hz, 1H), 4.73 (s, 2H), 3.38 (s, 2H), 2.88 (dd, J = 10.0, 7.4 Hz, 2H), 2.31 – 2.16 (m, 2H), 1.84 (dd, J = 27.4, 15.7 Hz, 3H), 1.63 (s, 1H), 1.19 (t, J = 7.5 Hz, 3H). (3 exchangeable protons are not seen).
33	MS m/z 377.9 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 7.51 (br t, J=5.9 Hz, 1H), 7.22-7.30 (m, 2H), 7.06-7.20 (m, 2H), 6.32 (s, 1H), 5.69 (s, 1H), 4.46-4.53 (m, 2H), 4.32 (d, J=9.0 Hz, 1H), 3.84-3.91 (m, 1H), 3.36-3.45 (m, 1H), 2.50-2.60 (m, 1H), 2.25 (s, 3H), 1.89-1.97 (m, 1H), 1.57-1.65 (m, 2H), 1.30-1.43 (m, 1H), 1.24 (br s, 2H).
34	MS m/z 411.9 $[M+H]^+$; ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (d, J = 2.6 Hz, 1H), 7.01 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 4.72 (dd, J = 17.4, 5.1 Hz, 2H), 3.08 (td, J = 11.6, 3.6 Hz, 1H), 2.81 (td, J = 10.5, 3.8 Hz, 1H), 2.13 – 1.96 (m, 2H), 1.92 – 1.78 (m, 2H), 1.33 (ddd, J = 20.4, 12.3, 9.3 Hz, 4H). (3 exchangeable protons are not seen).
36	MS m/z 413.7 $[M+H]^+$; ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.4, 1.0 Hz, 1H), 7.01 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 4.72 (dd, J = 13.3, 4.8 Hz, 2H), 3.13 – 3.05 (m, 1H), 2.85 – 2.78 (m, 1H), 2.13 – 1.96 (m, 2H), 1.92 – 1.78 (m, 2H), 1.33 (ddd, J = 20.4, 12.3, 9.3 Hz, 4H). (3 exchangeable protons are not seen).
39	MS m/z 406.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 4.9 Hz, 1H), 7.06 (s, 1H), 7.00 – 6.92 (m, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 2.90 (dt, J = 15.8, 9.5 Hz, 4H), 2.07 – 1.81 (m, 4H), 1.45 (ddd, J = 34.9, 33.5, 22.2 Hz, 4H), 1.19 (t, J = 7.4 Hz, 3H). (3 exchangeable protons are not seen)

Compound	Spectral Data
40	MS m/z 406.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 5.1 Hz, 1H), 7.06 (s, 1H), 7.00 – 6.93 (m, 1H), 6.52 (s, 1H), 4.75 (s, 2H), 3.20 (t, J = 9.6 Hz, 2H), 2.90 (ddd, J = 59.8, 13.9, 7.1 Hz, 2H), 2.18 (s, 1H), 2.00 (dd, J = 53.6, 14.6 Hz, 3H), 1.72 (d, J = 12.4 Hz, 1H), 1.53 (t, J = 9.2 Hz, 3H), 1.20 (t, J = 7.4 Hz, 3H). (3 exchangeable protons are not seen)
42	MS *m/z* 445.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.43 (s, 1H), 6.35 (q, J = 3.6 Hz, 2H), 4.75 (d, J = 4.5 Hz, 2H), 4.69 (d, J = 9.4 Hz, 1H), 4.04 (dd, J = 11.4, 4.2 Hz, 1H), 3.58 (td, J = 11.6, 3.1 Hz, 1H), 2.82 (td, J = 11.3, 4.1 Hz, 1H), 2.15 (d, J = 12.6 Hz, 1H), 1.82 (dd, J = 14.3, 10.4 Hz, 2H), 1.57 (dd, J = 11.9, 4.5 Hz, 1H). (3 exchangeable protons are not seen).
43	MS m/z 387.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 (d, J = 7.3 Hz, 2H), 7.33 – 7.28 (m, 2H), 7.23 (dd, J = 8.3, 6.1 Hz, 1H), 4.81 – 4.71 (m, 2H), 3.03 – 2.95 (m, 1H), 2.84 (td, J = 10.5, 3.9 Hz, 1H), 2.33 (s, 3H), 2.08 – 1.76 (m, 4H), 1.60 – 1.27 (m, 4H). (3 exchangeable protons are not seen)
44	MS m/z 393.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (dd, J = 3.5, 1.0 Hz, 1H), 6.96 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (s, 1H), 5.05 (s, 1H), 4.74 (s, 2H), 4.18 – 4.08 (m, 1H), 3.73 (dd, J = 11.6, 9.4 Hz, 1H), 3.22 (s, 1H), 2.32 (s, 3H), 2.01 (ddd, J = 19.4, 12.4, 6.2 Hz, 3H), 1.48 (d, J = 11.2 Hz, 1H). (3 exchangeable protons are not seen)
45	MS m/z 393.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.2 Hz, 1H), 7.06 (dd, J = 3.5, 1.0 Hz, 1H), 6.96 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (s, 1H), 5.04 (d, J = 1.2 Hz, 1H), 4.74 (s, 2H), 4.13 (dd, J = 10.6, 3.4 Hz, 1H), 3.72 (dd, J = 11.6, 9.3 Hz, 1H), 3.20 (s, 1H), 2.32 (s, 3H), 2.15 – 1.89 (m, 3H), 1.55 – 1.39 (m, 1H). (3 exchangeable protons are not seen).
48	MS m/z 387.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 (d, J = 7.2 Hz, 2H), 7.31 (dd, J = 10.0, 4.7 Hz, 2H), 7.26 – 7.20 (m, 1H), 4.81 – 4.70 (m, 2H), 3.09 – 3.00 (m, 1H), 2.93 (td, J = 10.5, 3.7 Hz, 1H), 2.33 (s, 3H), 1.94 (ddd, J = 26.5, 24.0, 11.4 Hz, 4H), 1.62 – 1.34 (m, 4H). (3 exchangeable protons are not seen)
57	MS m/z 503.7 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.0 Hz, 1H), 7.07 (d, J = 2.6 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.56 (s, 1H), 4.75 (s, 2H), 3.28 – 3.20 (m, 1H), 3.12 (s, 1H), 2.06 (dd, J = 27.5, 12.8 Hz, 2H), 1.88 (t, J = 12.9 Hz, 2H), 1.64 – 1.41 (m, 4H). (3 exchangeable protons are not seen).

Compound	Spectral Data
58	MS m/z 503.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 4.9 Hz, 1H), 7.07 (d, J = 3.1 Hz, 1H), 6.99 – 6.95 (m, 1H), 6.55 (s, 1H), 4.74 (s, 2H), 3.25 – 3.14 (m, 1H), 3.05 (d, J = 6.9 Hz, 1H), 2.04 (dd, J = 25.5, 13.1 Hz, 2H), 1.85 (d, J = 11.0 Hz, 2H), 1.58 – 1.36 (m, 4H). (3 exchangeable protons are not seen)
59	MS m/z 377.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 – 7.39 (m, 1H), 6.37 – 6.29 (m, 2H), 4.79 – 4.69 (m, 2H), 3.14 – 2.96 (m, 2H), 2.33 (s, 3H), 2.09 (d, J = 10.5 Hz, 1H), 2.00 (d, J = 10.5 Hz, 1H), 1.89 (d, J = 20.1 Hz, 2H), 1.62 – 1.40 (m, 4H). (3 exchangeable protons are not seen).
60	MS m/z 377.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.42 (d, J = 1.0 Hz, 1H), 6.36 – 6.30 (m, 2H), 4.79 – 4.68 (m, 2H), 3.08 (td, J = 11.2, 3.5 Hz, 1H), 2.99 (t, J = 10.2 Hz, 1H), 2.33 (s, 3H), 2.08 (d, J = 12.1 Hz, 1H), 1.99 (d, J = 11.7 Hz, 1H), 1.94 – 1.83 (m, 2H), 1.65 – 1.37 (m, 4H). (3 exchangeable protons are not seen)
61	MS m/z 379.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.42 (dd, J = 1.8, 0.8 Hz, 1H), 6.34 (dt, J = 8.8, 2.5 Hz, 2H), 4.80 – 4.69 (m, 2H), 4.61 (d, J = 9.4 Hz, 1H), 4.09 – 4.01 (m, 1H), 3.60 (td, J = 11.6, 3.1 Hz, 1H), 2.96 (td, J = 11.4, 4.1 Hz, 1H), 2.39 (s, 3H), 2.24 – 2.14 (m, 1H), 1.84 (dt, J = 24.7, 8.7 Hz, 2H), 1.61 (ddd, J = 24.4, 12.6, 4.7 Hz, 1H). (3 exchangeable protons are not seen).
62	MS m/z 379.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.42 (dd, J = 1.8, 0.8 Hz, 1H), 6.33 (ddd, J = 3.8, 3.2, 1.3 Hz, 2H), 4.79 – 4.69 (m, 2H), 4.51 (d, J = 9.3 Hz, 1H), 4.06 – 3.99 (m, 1H), 3.58 (td, J = 11.7, 2.9 Hz, 1H), 2.80 (ddd, J = 11.3, 9.3, 4.1 Hz, 1H), 2.39 (s, 3H), 2.13 (d, J = 10.3 Hz, 1H), 1.90 – 1.71 (m, 2H), 1.53 (ddd, J = 24.1, 12.8, 4.5 Hz, 1H). (3 exchangeable protons are not seen)
63	MS m/z 389.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.40 – 7.35 (m, 2H), 7.33 – 7.28 (m, 2H), 7.26 – 7.21 (m, 1H), 4.76 (q, J = 15.1 Hz, 2H), 4.51 (d, J = 9.3 Hz, 1H), 4.06 – 3.99 (m, 1H), 3.58 (td, J = 11.6, 2.9 Hz, 1H), 2.80 (ddd, J = 11.3, 9.3, 4.1 Hz, 1H), 2.38 (d ,J, J = 3.0 Hz, 3H), 2.17 – 2.09 (m, 1H), 1.89 – 1.72 (m, 2H), 1.59 – 1.47 (m, 1H). (3 exchangeable protons are not seen)
64	MS m/z 389.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.40 – 7.35 (m, 2H), 7.33 – 7.28 (m, 2H), 7.26 – 7.21 (m, 1H), 4.82 – 4.74 (m, 2H), 4.70 (d, J = 9.5 Hz, 1H), 4.11 – 4.04 (m, 1H), 3.63 (td, J = 11.5, 3.4 Hz, 1H), 3.13 (ddd, J = 11.6, 9.7, 4.1 Hz, 1H), 2.40 (d, J = 4.8 Hz, 3H), 2.28 – 2.20 (m, 1H), 1.86 (dd, J = 11.0, 3.9 Hz, 2H), 1.70 (ddd, J = 24.4, 12.3, 4.7 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
65	MS m/z 453.0 $[M+H]^+$; ^{1}H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.40 – 7.32 (m, 5H), 5.31 (s, 1H), 4.83 (t, J = 7.4 Hz, 2H), 3.11 (dd, J = 14.6, 6.9 Hz, 1H), 2.83 (td, J = 10.5, 3.9 Hz, 1H), 2.03 (t, J = 12.0 Hz, 2H), 1.83 (d, J = 8.0 Hz, 2H), 1.41 – 1.22 (m, 4H). (2 exchangeable protons are not seen)
66	MS m/z 453.1 $[M+H]^+$; ^{1}H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.35 (dt, J = 10.7, 4.4 Hz, 5H), 5.30 (s, 1H), 4.84 (d, J = 5.6 Hz, 2H), 3.11 (dd, J = 14.6, 6.8 Hz, 1H), 2.83 (td, J = 10.4, 3.9 Hz, 1H), 2.03 (t, J = 12.3 Hz, 2H), 1.84 (s, 2H), 1.45 – 1.22 (m, 4H). (2 exchangeable protons are not seen)
69	MS m/z 455.0 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.40 – 7.31 (m, 5H), 5.30 (s, 1H), 4.85 (d, J = 5.5 Hz, 2H), 4.62 (d, J = 9.2 Hz, 1H), 4.09 (dd, J = 11.5, 4.5 Hz, 1H), 3.56 (td, J = 11.8, 2.8 Hz, 1H), 2.84 – 2.68 (m, 1H), 2.18 (d, J = 10.8 Hz, 1H), 1.82 (dt, J = 30.8, 11.4 Hz, 2H). (3 exchangeable protons are not seen).
70	MS m/z 455.0 $[M+H]^+$; ^{1}HNMR(400 MHz, CHLOROFORM-*d*) δ: 7.39 – 7.30 (m, 5H), 5.30 (s, 1H), 4.85 (d, J = 5.5 Hz, 2H), 4.62 (d ,J, J = 9.2 Hz, 1H), 4.09 (dd, J = 11.6, 4.6 Hz, 1H), 3.56 (td, J = 11.8, 2.7 Hz, 1H), 2.84 – 2.74 (m, 1H), 2.18 (d, J = 12.8 Hz, 1H), 1.90 – 1.75 (m, 2H). (3 exchangeable protons are not seen).
85	MS *m/z* 484.0 $[M+H]^+$; ^{1}H NMR (DMSO-d_6) δ: 8.19 (s, 0.8H, formic acid), 7.96 (t, *J* = 6.0 Hz, 1H), 7.34 (d, *J* = 5.1 Hz, 1H), 7.05 (d, *J* = 3.4 Hz, 1H), 6.92 (dd, *J* = 5.1, 3.4 Hz, 1H), 6.54 (s, 1H), 4.66 (d, *J* = 6.0 Hz, 2H), 3.64 (dd, *J* = 6.4, 3.4 Hz, 1H), 3.33 – 3.25 (m, 2H), 2.33 – 2.26 (m, 1H), 2.26 – 2.19 (m, 1H), 1.83 – 1.76 (m, 1H), 1.76 – 1.54 (m, 6H), 1.54 – 1.43 (m, 1H), 1.15 – 1.05 (m, 1H).MS *m/z* 484.0 $[M+H]^+$;
86	MS m/z 420.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 4.2 Hz, 1H), 7.06 (d, J = 2.6 Hz, 1H), 6.96 (dd, J = 5.0, 3.6 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.11 (s, 2H), 2.89 (dt, J = 14.2, 6.5 Hz, 2H), 1.96-1.55 (m, 10H), 1.18 (t, J = 7.5 Hz, 3H) (3 exchangeable protons are not seen)
87	MS *m/z* 420.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.96 (dd, J = 5.0, 3.5 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.14 – 3.08 (m, 2H), 2.89 (dt, J = 14.0, 6.4 Hz, 2H), 1.96-1.55 (m, 10H), 1.18 (t, J = 7.5 Hz, 3H) (3 exchangeable protons are not seen).
107	MS m/z 372.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.30 (m, 4H), 7.25 (t, J = 6.5 Hz, 1H), 6.30 (s, 1H), 4.56 (s, 2H), 3.37 – 3.32 (m, 2H), 2.35 (s, 3H), 2.29 – 2.13 (m, 2H), 1.95 – 1.78 (m, 3H), 1.67 – 1.56 (m, 2H). (3 exchangeable protons are not seen).

Compound	Spectral Data
108	MS m/z 454.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.34 (d, J = 6.7 Hz, 5H), 6.41 (s, 1H), 4.69 (d, J = 9.3 Hz, 1H), 4.58 (s, 2H), 4.06 (d, J = 11.2 Hz, 1H), 3.60 (dt, J = 11.6, 5.9 Hz, 1H), 2.87 (s, 3H), 2.16 (d, J = 10.1 Hz, 1H), 1.81 (d, J = 11.9 Hz, 2H), 1.59-1.50 (m, 2H) (3 exchangeable protons are not seen)
109	MS m/z 388.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.30 (m, 4H), 7.27 – 7.21 (m, 1H), 6.34 (s, 1H), 4.57 (s, 2H), 4.52 (d, J = 9.3 Hz, 1H), 4.04 (dd, J = 11.3, 4.5 Hz, 1H), 3.60 (td, J = 11.7, 2.8 Hz, 1H), 2.86 (s, 3H), 2.15 (d, J = 12.7 Hz, 1H), 1.81 (dt, J = 21.4, 11.1 Hz, 2H), 1.59-1.50 (m, 2H) (3 exchangeable protons are not seen)
110	MS m/z 408.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.38 – 7.31 (m, 4H), 7.26 (t, J = 6.4 Hz, 1H), 6.42 (s, 1H), 4.68 (d, J = 9.4 Hz, 1H), 4.58 (s, 2H), 4.09 – 4.01 (m, 1H), 3.60 (td, J = 11.6, 3.0 Hz, 1H), 2.86 (td, J = 11.3, 4.1 Hz, 1H), 2.17 (d, J = 10.3 Hz, 1H), 1.91 – 1.74 (m, 2H), 1.58 (ddd, J = 24.3, 12.6, 4.5 Hz, 1H). (3 exchangeable protons are not seen)
113	MS m/z 454.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 (dt, J = 23.5, 6.9 Hz, 5H), 6.41 (s, 1H), 4.69 (d, J = 9.4 Hz, 1H), 4.58 (s, 2H), 4.05 (d, J = 11.5 Hz, 1H), 3.59 (s, 1H), 2.87 (td, J = 11.2, 4.0 Hz, 1H), 2.16 (d, J = 10.9 Hz, 1H), 1.80 (s, 2H), 1.63 – 1.50 (m, 1H). (3 exchangeable protons are not seen).
114	MS m/z 382.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.64 (s, 1H), 6.34 (d, J = 14.1 Hz, 2H), 4.54 (s, 2H), 3.52 – 3.44 (m, 2H), 2.22 (brs, 2H), 1.93 (brs, 1H), 1.65 (brs, 3H). (3 exchangeable protons are not seen)
115	MS m/z 444.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.66 (s, 1H), 6.35 (d, J = 12.2 Hz, 2H), 4.72 (d, J = 9.4 Hz, 1H), 4.54 (s, 2H), 4.06 (d, J = 9.0 Hz, 1H), 3.60 (t, J = 11.0 Hz, 1H), 2.93 (s, 1H), 2.16 (s, 1H), 1.81 (s, 2H), 1.61 (d, J = 12.4 Hz, 1H). (3 exchangeable protons are not seen).
116	MS m/z 398.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (d, J = 1.0 Hz, 1H), 6.64 (d, J = 9.5 Hz, 1H), 6.37 – 6.34 (m, 1H), 6.33 (d, J = 2.7 Hz, 1H), 4.67 (d, J = 9.4 Hz, 1H), 4.54 (s, 2H), 4.07 – 4.01 (m, 1H), 3.59 (td, J = 11.6, 3.0 Hz, 1H), 3.33 (d, J = 12.3 Hz, 1H), 2.90 – 2.76 (m, 1H), 2.16 (d, J = 10.6 Hz, 1H), 1.83 (dd, J = 24.4, 20.5 Hz, 2H). (3 exchangeable protons are not seen)
117	MS m/z 382.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.64 (s, 1H), 6.34 (d, J = 14.1 Hz, 2H), 4.54 (s, 2H), 3.52 – 3.44 (m, 2H), 2.22 (brs, 2H), 1.93 (brs, 1H), 1.65 (brs, 3H). (3 exchangeable protons are not seen)

Compound	Spectral Data
118	MS m/z 444.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (d, J = 1.0 Hz, 1H), 6.65 (s, 1H), 6.38 – 6.30 (m, 2H), 4.67 (d, J = 9.4 Hz, 1H), 4.54 (s, 2H), 4.07 – 3.99 (m, 1H), 3.59 (td, J = 11.6, 3.0 Hz, 1H), 2.88 – 2.80 (m, 1H), 2.15 (d, J = 10.9 Hz, 1H), 1.89 – 1.75 (m, 2H), 1.56 (ddd, J = 24.2, 12.6, 4.6 Hz, 1H). (3 exchangeable protons are not seen)
119	MS m/z 398.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.71 (s, 1H), 6.42 – 6.28 (m, 2H), 4.98 (s, 1H), 4.55 (s, 2H), 4.13 (d, J = 11.1 Hz, 1H), 3.66 (t, J = 8.9 Hz, 1H), 3.37 (dd, J = 10.6, 4.0 Hz, 1H), 2.31 (d, J = 11.6 Hz, 1H), 1.85 (dd, J = 20.3, 8.8 Hz, 3H). (3 exchangeable protons are not seen)
120	MS m/z 362.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.53 (s, 1H), 6.35 (dd, J = 3.2, 1.9 Hz, 1H), 6.29 (d, J = 2.6 Hz, 1H), 4.52 (s, 2H), 3.35 (brs, 1H), 2.35 (s, 3H), 2.29 – 2.13 (m, 2H), 1.96 – 1.75 (m, 4H), 1.58 (d, J = 9.3 Hz, 1H). (3 exchangeable protons are not seen)
122	MS m/z 532.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.54 (s, 1H), 4.74 (s, 2H), 4.00 (d, J = 11.2 Hz, 1H), 3.35 (s, 1H), 2.26 (d, J = 8.3 Hz, 1H), 2.01 – 1.62 (m, 11H). (3 exchangeable protons are not seen)
123	MS m/z 532.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.0 Hz, 1H), 7.07 (d, J = 3.1 Hz, 1H), 7.00 – 6.95 (m, 1H), 6.54 (s, 1H), 4.74 (s, 2H), 4.00 (d, J = 11.3 Hz, 1H), 3.35 (brs, 1H), 2.26 (d, J = 8.4 Hz, 1H), 1.78 (td, J = 34.6, 17.7 Hz, 11H). (3 exchangeable protons are not seen)
126	MS m/z 388.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.38 – 7.22 (m, 5H), 6.34 (s, 1H), 4.57 (s, 2H), 4.52 (d, J = 9.3 Hz, 1H), 4.04 (d, J = 11.2 Hz, 1H), 3.65 – 3.54 (m, 1H), 2.91 – 2.81 (m, 1H), 2.42 (s, 3H), 2.15 (d, J = 12.8 Hz, 1H), 1.81 (dd, J = 29.4, 13.3 Hz, 2H), 1.54 (ddd, J = 24.3, 12.9, 4.5 Hz, 1H). (3 exchangeable protons are not seen)
132	MS m/z 500.1 $[M+H]^+$; ^{1}H NMR (400 MHz, METHANOL-d_4) δ: 7.37 – 7.31 (m, 4H), 7.26 (d, J = 6.6 Hz, 1H), 6.39 (s, 1H), 4.69 (s, 1H), 4.57 (s, 2H), 4.07 (d, J = 9.1 Hz, 1H), 3.61 (t, J = 11.3 Hz, 1H), 3.08 (d, J = 42.5 Hz, 1H), 2.17 (s, 1H), 1.81 (s, 2H), 1.60 (s, 1H). (3 exchangeable protons are not seen)
133	MS m/z 378.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.56 (d, J = 8.9 Hz, 1H), 6.35 (dd, J = 3.2, 1.8 Hz, 1H), 6.30 (d, J = 2.5 Hz, 1H), 4.53 – 4.49 (m, 3H), 4.03 (dd, J = 11.4, 4.4 Hz, 1H), 3.59 (d, J = 2.8 Hz, 1H), 2.85 (ddd, J = 11.2, 9.3, 4.1 Hz, 1H), 2.41 (s, 3H), 2.14 (d, J = 12.6 Hz, 1H), 1.80 (d, J = 16.2 Hz, 2H), 1.53 (dd, J = 11.5, 4.4 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
134	MS m/z 378.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.57 (s, 1H), 6.38 – 6.33 (m, 1H), 6.30 (d, J = 3.1 Hz, 1H), 4.53 (t, J = 4.6 Hz, 3H), 4.02 (s, 1H), 3.60 (d, J = 2.8 Hz, 1H), 2.88 (d, J = 2.0 Hz, 1H), 2.41 (s, 3H), 2.15 (d, J = 11.3 Hz, 1H), 1.85 (d, J = 50.0 Hz, 2H), 1.55 (dd, J = 11.6, 4.5 Hz, 1H). (3 exchangeable protons are not seen)
136	MS m/z 500.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.31 (m, 4H), 7.29 – 7.24 (m, 1H), 6.44 (s, 1H), 4.96 (d, J = 9.8 Hz, 1H), 4.58 (s, 2H), 4.13 (d, J = 9.9 Hz, 1H), 3.67 (dd, J = 11.4, 8.1 Hz, 1H), 3.46 – 3.38 (m, 1H), 2.36 (d, J = 14.9 Hz, 1H), 1.95 – 1.78 (m, 3H). (3 exchangeable protons are not seen)
143	MS m/z 445.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 – 7.39 (m, 1H), 6.35 (dd, J = 4.1, 2.3 Hz, 2H), 4.75 (d, J = 5.5 Hz, 2H), 4.67 (d, J = 9.3 Hz, 1H), 4.02 (d, J = 4.6 Hz, 1H), 3.61 – 3.53 (m, 1H), 2.79 (dd, J = 4.1, 1.9 Hz, 1H), 2.14 (d, J = 11.6 Hz, 1H), 1.78 (s, 2H), 1.62 – 1.50 (m, 1H). (3 exchangeable protons are not seen)
145	MS m/z 362.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.46 – 7.42 (m, 1H), 6.53 (s, 1H), 6.35 (dd, J = 3.2, 1.9 Hz, 1H), 6.31 – 6.26 (m, 1H), 4.51 (s, 2H), 3.33 (s, 1H), 2.36 (d, J = 7.4 Hz, 3H), 2.29 – 2.23 (m, 1H), 2.18 – 2.12 (m, 1H), 1.92 – 1.77 (m, 4H), 1.62 (d, J = 9.7 Hz, 1H). (3 exchangeable protons are not seen)
154	MS m/z 489.7 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 4.9 Hz, 1H), 7.07 (s, 1H), 7.01 – 6.95 (m, 1H), 6.59 (s, 1H), 4.75 (s, 2H), 3.82 (dd, J = 15.2, 7.8 Hz, 2H), 2.41 (dd, J = 14.1, 7.4 Hz, 2H), 1.96 (ddd, J = 29.8, 14.9, 7.1 Hz, 6H). (3 exchangeable protons are not seen)
155	MS m/z 428.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.62 (s, 1H), 6.34 (d, J = 14.6 Hz, 2H), 4.53 (s, 2H), 3.55 – 3.39 (m, 2H), 2.34 (d, J = 10.8 Hz, 1H), 2.19 (d, J = 7.3 Hz, 1H), 1.95 – 1.74 (m, 3H), 1.61 (d, J = 10.1 Hz, 1H). (3 exchangeable protons are not seen)
156	MS m/z 408.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.38 – 7.31 (m, 4H), 7.29 – 7.23 (m, 1H), 6.43 (s, 1H), 4.76 (d,J, J = 9.5 Hz, 1H), 4.58 (s, 2H), 4.08 (dd, J = 12.4, 3.1 Hz, 1H), 3.62 (td, J = 11.5, 3.1 Hz, 1H), 2.99 (td, J = 11.3, 4.1 Hz, 1H), 2.21 (d, J = 10.0 Hz, 1H), 1.90 – 1.76 (m, 2H), 1.65 (ddd, J = 24.5, 12.4, 4.4 Hz, 1H). (3 exchangeable protons are not seen)
157	MS m/z 518.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.07 (d, J = 2.4 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 4.74 (s, 2H), 3.37 (s, 2H), 1.88 (dd, J = 24.5, 11.0 Hz, 6H), 1.77 – 1.67 (m, 4H). (3 exchangeable protons are not seen)

Compound	Spectral Data
158	MS m/z 434.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (s, 1H), 4.73 (s, 2H), 3.34 (s, 2H), 2.89 (dt, J = 13.9, 6.3 Hz, 2H), 2.04 – 1.84 (m, 6H), 1.67 (d, J = 19.5 Hz, 6H), 1.20 (t, J = 7.5 Hz, 3H). (3 exchangeable protons are not seen)
159	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.34 (dd, J = 9.0, 5.3 Hz, 4H), 7.27 (d,J, J = 6.3 Hz, 1H), 6.40 (s, 1H), 4.57 (s, 2H), 3.52 – 3.39 (m, 2H), 2.34 (d, J = 7.7 Hz, 1H), 2.20 (d, J = 7.4 Hz, 1H), 2.03 (s, 1H), 1.90 (dd, J = 14.0, 6.3 Hz, 2H), 1.62 (d, J = 9.2 Hz, 1H). (3 exchangeable protons are not seen)
160	MS m/z 372.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.30 (m, 4H), 7.29 – 7.22 (m, 1H), 6.35 (s, 1H), 4.56 (s, 2H), 3.65 – 3.56 (m, 2H), 2.39 – 2.30 (m, 5H), 2.02 – 1.90 (m, 3H), 1.78 (s, 1H). (3 exchangeable protons are not seen)
161	MS m/z 438.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.42 – 7.25 (m, 5H), 6.40 (s, 1H), 4.57 (s, 2H), 3.61 – 3.47 (m, 2H), 2.44 – 2.33 (m, 1H), 2.23 (dd, J = 12.7, 5.2 Hz, 1H), 1.98 – 1.83 (m, 3H), 1.69 (dd, J = 21.6, 8.0 Hz, 1H). (3 exchangeable protons are not seen)
162	MS m/z 489.7 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.54 (s, 1H), 4.74 (s, 2H), 3.50 (t, J = 6.4 Hz, 2H), 2.37 (dd, J = 12.3, 4.7 Hz, 1H), 2.25 – 2.14 (m, 1H), 1.99 – 1.78 (m, 3H), 1.64 (d, J = 8.7 Hz, 1H). (3 exchangeable protons are not seen)
163	MS m/z 518.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.08 (d, J = 3.4 Hz, 1H), 7.00 – 6.94 (m, 1H), 6.59 (s, 1H), 4.75 (s, 2H), 3.56 (s, 2H), 2.05 – 1.89 (m, 6H), 1.73 (s, 4H). (3 exchangeable protons are not seen)
164	MS m/z 434.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.06 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.0, 3.5 Hz, 1H), 6.47 (s, 1H), 4.73 (s, 2H), 3.27 (t, J = 4.1 Hz, 2H), 2.89 (dd, J = 12.1, 7.5 Hz, 2H), 2.00 – 1.74 (m, 8H), 1.63 (d, J = 7.1 Hz, 4H), 1.20 (t, J = 7.5 Hz, 3H). (3 exchangeable protons are not seen)
165	MS m/z 428.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.61 (s, 1H), 6.38 – 6.28 (m, 2H), 4.53 (s, 2H), 3.53 – 3.38 (m, 2H), 2.38 – 2.28 (m, 1H), 2.17 (dt, J = 12.6, 6.2 Hz, 1H), 1.96 – 1.74 (m, 3H), 1.60 (dd, J = 18.9, 10.1 Hz, 1H). (3 exchangeable protons are not seen)
166	MS m/z 438.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.32 (dt, J = 23.5, 6.9 Hz, 5H), 6.41 (s, 1H), 4.69 (d, J = 9.4 Hz, 1H), 4.58 (s, 2H), 4.05 (d, J = 11.5 Hz, 1H), 3.59 (s, 1H), 2.87 (td, J = 11.2, 4.0 Hz, 1H), 2.16 (d, J = 10.9 Hz, 1H), 1.80 (s, 2H), 1.63 – 1.50 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
167	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.34 (d, J = 5.8 Hz, 4H), 7.26 (s, 1H), 6.41 (s, 1H), 4.57 (s, 2H), 3.56 – 3.45 (m, 2H), 2.35 (d, J = 7.0 Hz, 1H), 2.22 (d, J = 10.9 Hz, 1H), 2.04 (brs, 1H), 1.91 (brs, 2H), 1.66 (brs, 1H). (3 exchangeable protons are not seen)
173	MS m/z 395.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (s, 1H), 6.64 (d, J = 2.9 Hz, 1H), 6.34 (d, J = 12.7 Hz, 2H), 4.54 (s, 2H), 3.13 (s, 1H), 2.91 (d, J = 10.5 Hz, 1H), 2.03 (dd, J = 26.6, 12.4 Hz, 2H), 1.86 (s, 2H), 1.60 – 1.35 (m, 4H). (3 exchangeable protons are not seen)
174	MS m/z 398.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.66 (s, 1H), 6.38 – 6.31 (m, 2H), 4.54 (s, 2H), 4.07 (d, J = 11.8 Hz, 1H), 3.99 (dd, J = 10.9, 3.6 Hz, 1H), 3.60 (t, J = 11.0 Hz, 1H), 3.51 – 3.38 (m, 2H), 3.19 (t, J = 20.6 Hz, 1H), 2.00 (d, J = 9.4 Hz, 1H), 1.74 – 1.62 (m, 1H). (3 exchangeable protons are not seen)
179	MS m/z 414.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.30 (d, J = 4.1 Hz, 1H), 7.08 (d, J = 2.6 Hz, 1H), 6.98 (dd, J = 5.0, 3.6 Hz, 1H), 6.59 (s, 1H), 4.76 (s, 2H), 4.18 – 3.95 (m, 2H), 3.60 (t, J = 12.1 Hz, 1H), 3.51 – 3.39 (m, 2H), 3.20 (d, J = 10.0 Hz, 1H), 2.01 (d, J = 11.2 Hz, 1H), 1.68 (dd, J = 21.4, 10.0 Hz, 1H). (3 exchangeable protons are not seen)
197	MS m/z 453.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.51 (d, J = 5.6 Hz, 2H), 7.44 (d, J = 5.2 Hz, 2H), 6.39 (s, 1H), 4.69 (s, 2H), 3.26 (dd, J = 17.4, 8.5 Hz, 1H), 3.06 (t, J = 8.7 Hz, 1H), 2.09 (dd, J = 23.0, 12.5 Hz, 2H), 1.89 (d, J = 11.1 Hz, 2H), 1.69 – 1.45 (m, 4H). (3 exchangeable protons are not seen)
201	MS m/z 477.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 – 7.41 (m, 1H), 6.37 – 6.32 (m, 2H), 4.82 – 4.70 (m, 2H), 3.78 (dd, J = 28.1, 12.0 Hz, 1H), 3.13 (s, 1H), 2.21 (s, 1H), 2.12 – 1.91 (m, 3H), 1.71 (dd, J = 16.7, 11.9 Hz, 1H), 1.54 – 1.43 (m, 1H)., (3 exchangeable protons are not seen)
215	MS m/z 493.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.20 (dd, J = 59.8, 56.2 Hz, 1H), 7.31 – 6.91 (m, 3H), 5.08 – 4.91 (m, 3H), 4.17 (d, J = 11.2 Hz, 1H), 3.63 (t, J = 11.9 Hz, 1H), 3.19 (d, J = 47.9 Hz, 1H), 2.39 – 2.22 (m, 1H), 2.11 – 1.66 (m, 3H). (3 exchangeable protons are not seen)
218	MS m/z 408.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.39 – 7.31 (m, 4H), 7.27 (d, J = 6.3 Hz, 1H), 6.44 (s, 1H), 4.58 (s, 2H), 4.10 (d, J = 7.4 Hz, 1H), 4.05 – 3.98 (m, 1H), 3.62 (t, J = 11.2 Hz, 1H), 3.57 – 3.45 (m, 2H), 3.34 (s, 1H), 2.05 (d, J = 11.0 Hz, 1H), 1.75 (dd, J = 11.3, 7.4 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
224	MS *m/z* 493.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 8.15 (dd, J = 60.9, 56.5 Hz, 1H), 7.27 – 7.21 (m, 1H), 7.02 (d, J = 2.8 Hz, 1H), 6.90 (dd, J = 5.0, 3.6 Hz, 1H), 6.61 (s, 1H), 4.69 – 4.61 (m, 3H), 4.07 – 4.01 (m, 1H), 3.49 (t, J = 11.0 Hz, 1H), 2.92 (t, J = 8.6 Hz, 1H), 2.13 (d, J = 12.1 Hz, 1H), 2.06 – 1.74 (m, 1H), 1.69 (d, J = 13.1 Hz, 1H), 1.60 – 1.36 (m, 1H). (3, exchangeable protons not observed).
225	MS m/z 523.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.26 (dd, J = 60.5, 56.5 Hz, 1H), 7.44 (s, 1H), 6.45 – 6.26 (m, 2H), 4.80 (t, J = 9.1 Hz, 2H), 4.71 (d, J = 10.1 Hz, 1H), 4.13 (dd, J = 11.3, 4.4 Hz, 1H), 3.56 (t, J = 10.9 Hz, 1H), 2.93 (td, J = 10.5, 3.9 Hz, 1H), 2.21 (d, J = 10.6 Hz, 1H), 1.94 (dt, J = 13.2, 9.0 Hz, 1H), 1.77 (d, J = 13.9 Hz, 1H), 1.54 (ddd, J = 16.9, 13.1, 3.9 Hz, 1H). (3 exchangeable protons are not seen)
231	MS m/z 376.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.0 Hz, 1H), 6.54 (s, 1H), 6.35 (dd, J = 3.2, 1.9 Hz, 1H), 6.30 (d, J = 2.6 Hz, 1H), 4.52 (s, 2H), 3.01 – 2.92 (m, 1H), 2.84 (td, J = 10.5, 3.8 Hz, 1H), 2.34 (s, 3H), 2.04 (dd, J = 13.8, 4.4 Hz, 1H), 1.99 – 1.91 (m, 1H), 1.85 (t, J = 10.7 Hz, 2H), 1.57 – 1.32 (m, 4H). (3 exchangeable protons are not seen)
232	MS m/z 394.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 5.0 Hz, 1H), 7.06 (d, J = 2.7 Hz, 1H), 6.99 – 6.94 (m, 1H), 6.50 (s, 1H), 4.74 (s, 2H), 4.07 (d, J = 7.6 Hz, 1H), 3.94 (dd, J = 11.5, 4.2 Hz, 1H), 3.60 (t, J = 11.0 Hz, 1H), 3.46 (t, J = 11.2 Hz, 1H), 3.28 – 3.19 (m, 1H), 3.13 (s, 1H), 2.38 (d, J = 4.2 Hz, 3H), 2.07 – 1.93 (m, 1H), 1.74 – 1.59 (m, 1H). (3 exchangeable protons are not seen)
237	MS m/z 406.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.38 – 7.32 (m, 4H), 7.29 – 7.23 (m, 1H), 6.40 (s, 1H), 4.57 (s, 2H), 3.19 – 3.11 (m, 1H), 2.95 – 2.87 (m, 1H), 2.04 (dd, J = 23.0, 13.1 Hz, 2H), 1.86 (t, J = 9.5 Hz, 2H), 1.61 (d, J = 12.4 Hz, 1H), 1.43 (dt, J = 27.5, 12.0 Hz, 3H). (3 exchangeable protons are not seen)
243	MS m/z 491.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.43 (s, 1H), 6.38 – 6.33 (m, 2H), 4.99 (d, *J* = 9.8 Hz, 1H), 4.83 – 4.69 (m, 2H), 4.16 – 4.10 (m, 1H), 3.67 (td, *J* = 11.4, 2.8 Hz, 1H), 3.41 (td, *J* = 10.6, 4.0 Hz, 1H), 2.34 – 2.28 (m, 1H), 1.98 – 1.80 (m, 3H). (3 Exchangeable protons not observed).
244	MS m/z 432.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.17 (dd, J = 59.4, 56.3 Hz, 1H), 7.44 (s, 1H), 6.36 (d, J = 1.2 Hz, 2H), 4.98 (d, J = 10.5 Hz, 1H), 4.80 (d, J = 15.5 Hz, 2H), 4.20 (dd, J = 11.6, 4.4 Hz, 1H), 3.67 (t, J = 11.1 Hz, 1H), 3.49 (d, J = 9.6 Hz, 1H), 2.36 (d, J = 13.6 Hz, 1H), 2.06 (d, J = 13.0 Hz, 1H), 1.85 (dd, J = 24.0, 13.4 Hz, 2H). (3 exchangeable protons are not seen)

Compound	Spectral Data
248	MS m/z 493.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.22 (dd, J = 60.3, 56.6 Hz, 1H), 7.31 – 6.91 (m, 3H), 5.06 – 4.93 (m, 2H), 4.74 (dd, J = 21.5, 10.1 Hz, 1H), 4.12 (dd, J = 11.4, 4.3 Hz, 1H), 3.54 (dd, J = 28.0, 17.6 Hz, 1H), 3.15 – 2.84 (m, 1H), 2.19 (dd, J = 18.3, 13.5 Hz, 1H), 1.93 (t, J = 12.7 Hz, 1H), 1.77 (d, J = 14.1 Hz, 1H), 1.55 (dd, J = 24.2, 9.2 Hz, 1H). (3 exchangeable protons are not seen)
251	MS m/z 454.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.50 - 8.47 (m, 2H), 7.43 -7.40 (m, 2H), 6.39 (s, 1H), 4.77 (d,J, J =8.0 Hz, 1H), 4.68 (s, 2H), 4.12 – 4.04 (m, 1H), 3.66 - 3.68 (m, 1H), 3.04 – 2.95 (m, 1H), 2.25 – 2.17 (m, 1H), 1.91 - 1.79 (m, 2H), 1.70 - 1.60 (m, 1H). (3 exchangeable protons are not seen)
254	MS m/z 540.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.24 (dd, J = 60.6, 56.5 Hz, 1H), 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.11 (d, J = 2.8 Hz, 1H), 6.95 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (t, J = 9.6 Hz, 2H), 4.70 (d, J = 10.1 Hz, 1H), 4.13 (d, J = 6.8 Hz, 1H), 3.56 (t, J = 10.9 Hz, 1H), 2.93 (dd, J = 10.3, 6.7 Hz, 1H), 2.21 (d, J = 12.7 Hz, 1H), 1.94 (d, J = 12.9 Hz, 1H), 1.77 (d, J = 12.9 Hz, 1H), 1.61 – 1.45 (m, 1H). (3 exchangeable protons are not seen)
257	MS m/z 457.95 $[M+H]^+$; ^{1}H NMR (METHANOL-d$_4$) δ: 7.20 (br d, J=4.9 Hz, 1H), 6.98 (br s, 1H), 6.88 (br s, 1H), 6.21-6.66 (m, 2H), 5.07 (br s, 2H), 4.66 (s, 2H), 3.22-3.29 (m, 1H), 2.98-3.18 (m, 1H), 1.96-2.20 (m, 2H), 1.74-1.93 (m, 2H), 1.31-1.63 (m, 4H). (3 exchangeable protons are not seen)
260	MS m/z 378.0 $[M+H]^+$; ^{1}HNMR (400 MHz, METHANOL-d_4) δ: 7.44 (s, 1H), 6.56 (s, 1H), 6.37 – 6.28 (m, 2H), 4.52 (s, 2H), 4.07 (d, J = 8.0 Hz, 1H), 3.94 (dd, J = 11.4, 4.4 Hz, 1H), 3.60 (s, 1H), 3.46 (t, J = 11.2 Hz, 1H), 3.25 (d,J, J = 4.2 Hz, 1H), 3.13 (s, 1H), 2.38 (s, 3H), 1.98 (d, J = 10.8 Hz, 1H), 1.67 (d, J = 7.5 Hz, 1H). (3 exchangeable protons are not seen)
262	MS m/z 447.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.19 (dd, J = 60.4, 56.6 Hz, 1H), 7.34 (dd, J = 5.1, 1.1 Hz, 1H), 7.12 (d, J = 3.1 Hz, 1H), 7.00 (dd, J = 5.1, 3.5 Hz, 1H), 6.73 (s, 1H), 4.83 (s, 21H), 4.79 (s, 2H), 4.17 (dd, J = 11.5, 4.3 Hz, 1H), 3.63 (td, J = 12.2, 2.1 Hz, 1H), 2.30 (d, J = 13.1 Hz, 1H), 2.01 (dd, J = 9.1, 3.9 Hz, 1H), 1.88 – 1.64 (m, 2H). (3 exchangeable protons are not seen)
265	MS m/z 507.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.76 (d, J = 2.8 Hz, 1H), 7.53 (s, 1H), 6.51 (s, 1H), 4.88 (s, 2H), 4.04 (dd, J = 14.6, 10.3 Hz, 2H), 3.55 (t, J = 11.1 Hz, 1H), 3.46 – 3.36 (m, 1H), 3.21 (dd, J = 26.2, 8.8 Hz, 2H), 1.94 (dd, J = 33.6, 19.7 Hz, 2H). (3 exchangeable protons are not seen)

Compound	Spectral Data
266	MS m/z 506.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.3 Hz, 1H), 7.08 (dd, J = 3.5, 1.3 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.62 (s, 1H), 4.99 (d, J = 9.8 Hz, 1H), 4.77 (s, 3H), 4.18 – 4.10 (m, 1H), 3.68 (td, J = 11.2, 3.6 Hz, 1H), 3.44 (dd, J = 10.0, 3.9 Hz, 1H), 2.36 – 2.25 (m, 1H), 1.98 – 1.79 (m, 3H). (3 Exchangeable protons not observed).
270	MS m/z 476.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.24 (dd, J = 61.1, 56.5 Hz, 1H), 7.48 (s, 1H), 6.74 (s, 1H), 6.48 – 6.31 (m, 2H), 4.71 (d, J = 10.1 Hz, 1H), 4.59 (s, 2H), 4.13 (dd, J = 11.4, 4.9 Hz, 1H), 3.55 (dd, J = 30.9, 20.5 Hz, 1H), 2.97 (s, 1H), 2.21 (d, J = 12.2 Hz, 1H), 1.95 (d, J = 13.1 Hz, 1H), 1.78 (d, J = 12.7 Hz, 1H), 1.55 (d, J = 14.7 Hz, 1H). (3 exchangeable protons are not seen)
271	MS m/z 432.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.17 (dd, J = 59.4, 56.3 Hz, 1H), 7.44 (s, 1H), 6.36 (d, J = 1.2 Hz, 2H), 4.98 (d, J = 10.5 Hz, 1H), 4.80 (d, J = 15.5 Hz, 2H), 4.20 (dd, J = 11.6, 4.4 Hz, 1H), 3.67 (t, J = 11.1 Hz, 1H), 3.49 (d, J = 9.6 Hz, 1H), 2.36 (d, J = 13.6 Hz, 1H), 2.06 (d, J = 13.0 Hz, 1H), 1.85 (dd, J = 24.0, 13.4 Hz, 2H). (3 exchangeable protons are not seen)
273	MS m/z 431.3 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.21 (dd, J = 60.9, 56.6 Hz, 1H), 7.49 – 7.45 (m, 1H), 6.74 (s, 1H), 6.38 (dt, J = 7.0, 2.2 Hz, 2H), 4.69 (d, J = 10.1 Hz, 1H), 4.59 (s, 2H), 4.13 (dd, J = 11.4, 4.5 Hz, 1H), 3.59 (dd, J = 17.8, 6.1 Hz, 1H), 3.05 – 2.92 (m, 1H), 2.21 (d, J = 13.3 Hz, 1H), 2.01 – 1.87 (m, 1H), 1.78 (d, J = 14.4 Hz, 1H), 1.56 (dt, J = 24.6, 6.9 Hz, 1H). (3 exchangeable protons are not seen)
279	MS m/z 427.95 $[M+H]^+$; ^{1}H NMR (METHANOL-d$_4$) δ: 7.11-7.28 (m, 2H), 6.95-7.02 (m, 1H), 6.85-6.90 (m, 1H), 6.47 (s, 1H), 4.66 (s, 2H), 3.32 (br s, 1H), 3.22-3.25 (m, 1H), 2.06 (br s, 2H), 1.71-1.89 (m, 2H), 1.28-1.61 (m, 4H). (3 exchangeable protons are not seen)
280	MS m/z 386.3 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.21 (m, 5H), 6.31 (s, 1H), 4.56 (s, 2H), 2.97 (t, J = 10.9 Hz, 1H), 2.86 (t, J = 10.3 Hz, 1H), 2.34 (d, J = 6.6 Hz, 3H), 2.07 – 1.79 (m, 4H), 1.61 – 1.30 (m, 4H). (3 exchangeable protons are not seen)
281	MS *m/z* 491.0 $[M-H]^-$; ^{1}H NMR (DMSO-d_6) δ: 8.35 – 7.98 (m, 1H), 7.36 (dd, J = 5.0, 1.3 Hz, 1H), 7.10 – 7.02 (m, 1H), 6.94 (dd, J = 5.1, 3.4 Hz, 1H), 6.62 (s, 1H), 6.06 (s, 1H), 4.78 (d, J = 5.4 Hz, 2H), 4.42 (d, J = 10.0 Hz, 1H), 3.94 (d, J = 12.2 Hz, 1H), 3.39 (t, J = 11.5 Hz, 1H), 2.83 (s, 1H), 1.98 (d, J = 12.6 Hz, 1H), 1.86 (d, J = 13.5 Hz, 1H), 1.56 (d, J = 13.5 Hz, 1H), 1.33 (q, J = 11.2 Hz, 1H). (2, exchangeable protons not observed).

Compound	Spectral Data
283	MS m/z 459.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.60 (s, 1H), 4.10-3.94 (m, 2H), 3.26-3.10 (m, 1H), 3.06-2.94 (m, 1H), 2.15-1.97 (m, 2H), 1.96-1.75 (m, 5H), 1.59 – 1.30 (m, 4H). (3 exchangeable protons are not seen)
285	MS m/z 460.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.78 (d, J = 3.3 Hz, 1H), 7.54 (d, J = 3.3 Hz, 1H), 6.55 (s, 1H), 4.89 (d, J = 8.1 Hz, 2H), 4.04 (td, J = 11.8, 3.9 Hz, 2H), 3.56 (td, J = 11.7, 2.3 Hz, 1H), 3.40 (td, J = 11.5, 4.3 Hz, 1H), 3.25 (t, J = 10.7 Hz, 1H), 3.08 (td, J = 10.2, 4.5 Hz, 1H), 2.02 – 1.84 (m, 2H). (3 exchangeable protons are not seen)
286	MS m/z 460.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.60 (s, 1H), 4.10-3.94 (m, 2H), 3.26-3.10 (m, 1H), 3.06-2.94 (m, 1H), 2.15-1.97 (m, 2H), 1.96-1.75 (m, 5H), 1.59 – 1.30 (m, 4H). (3 exchangeable protons are not seen)
291	MS m/z 448.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.32 (d, J = 5.1 Hz, 1H), 7.11 (s, 1H), 7.04 – 6.96 (m, 1H), 6.62 (s, 1H), 4.79 (s, 2H), 3.75 (dd, J = 27.8, 10.0 Hz, 1H), 3.16 (s, 1H), 2.24 (s, 1H), 2.04 (dd, J = 39.0, 27.5 Hz, 3H), 1.73 (d, J = 14.7 Hz, 1H), 1.51 (d, J = 11.6 Hz, 1H). (3 exchangeable protons are not seen)
295	MS *m/z* $[M+H]^+$ 497.8; ^{1}H NMR (METHANOL-d_4) δ: 8.45 (s, 1H), 7.28 – 7.21 (m, 4H), 7.17 (d, *J* = 6.7 Hz, 1H), 6.31 (s, 1H), 4.48 (s, 2H), 3.29 – 3.23 (m, 2H), 2.09 – 1.91 (m, 2H), 1.88 – 1.72 (m, 2H), 1.55 (s, 1H), 1.40 (s, 3H). Formic acid salt, (3, exchangeable protons not observed).
296	MS m/z 395.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.65 (s, 1H), 6.34 (dd, J = 12.6, 2.3 Hz, 2H), 4.54 (s, 2H), 3.19 (t, J = 9.4 Hz, 1H), 2.99 (s, 1H), 2.05 (dd, J = 27.2, 12.7 Hz, 2H), 1.88 (s, 2H), 1.67 – 1.57 (m, 1H), 1.52 – 1.38 (m, 3H). (3 exchangeable protons are not seen)
301	MS m/z 414.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.63 – 6.60 (m, 1H), 4.06 (d, J = 2.3 Hz, 2H), 3.17 (t, J = 10.9 Hz, 1H), 2.93 (t, J = 10.4 Hz, 1H), 2.03 (dd, J = 24.3, 12.8 Hz, 2H), 1.93 – 1.74 (m, 4H), 1.64 – 1.26 (m, 5H). (3 exchangeable protons are not seen)
304	MS m/z 521.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.00 (t, J = 57.8 Hz, 1H), 7.43 (s, 1H), 6.35 (d, J = 3.0 Hz, 2H), 4.80 (s, 2H), 3.89 (s, 1H), 2.84 (s, 1H), 2.33 (s, 1H), 2.10 (s, 1H), 1.83 (s, 3H), 1.57 – 1.27 (m, 3H). (3 exchangeable protons are not seen)

Compound	Spectral Data
305	MS m/z 448.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.29 – 7.96 (m, 1H), 7.29 (d, J = 5.0 Hz, 1H), 7.12 (d, J = 3.3 Hz, 1H), 6.95 (dd, J = 5.0, 3.6 Hz, 1H), 5.06 – 4.92 (m, 3H), 4.20 (dd, J = 11.5, 4.3 Hz, 1H), 3.67 (t, J = 11.0 Hz, 1H), 3.53 (td, J = 11.1, 4.2 Hz, 1H), 2.36 (d, J = 9.9 Hz, 1H), 2.15 – 1.96 (m, 1H), 1.95 – 1.76 (m, 2H). (3 exchangeable protons are not seen)
308	MS m/z 368.1$[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.63 (s, 1H), 4.07 (d, J = 2.2 Hz, 2H), 3.20 – 3.09 (m, 1H), 2.91 (s, 1H), 2.03 (dd, J = 25.7, 11.3 Hz, 2H), 1.89 – 1.77 (m, 5H), 1.60 – 1.30 (m, 4H). (3 exchangeable protons are not seen)
321	MS m/z 388.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.34 (d, J = 6.8 Hz, 5H), 6.34 (s, 1H), 4.56 (s, 2H), 4.09 (d, J = 8.3 Hz, 1H), 3.96 (dd, J = 11.6, 4.5 Hz, 1H), 3.61 (t, J = 11.5 Hz, 1H), 3.49 (s, 2H), 2.38 (d, J = 4.2 Hz, 3H), 2.03 (dd, J = 13.3, 4.2 Hz, 1H), 1.70 (d, J = 16.3 Hz, 21H). (3 exchangeable protons are not seen)
334	MS m/z 431.6 $[M+H]^+$; ^{1}H NMR (METHANOL-d4) δ: 7.68-8.04 (m, 1H), 7.34 (s, 1H), 6.26 (s, 2H), 4.71 (d, J=3.0 Hz, 2H), 3.61-3.76 (m, 1H), 2.86-3.01 (m, 1H), 1.96-2.09 (m, 2H), 1.79 (br s, 3H), 1.20-1.52 (m, 3H) (3 exchangeable protons are not seen)
337	MS m/z 415.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.78 (d, J = 3.3 Hz, 1H), 7.54 (d, J = 3.3 Hz, 1H), 6.57 (s, 1H), 4.91 (s, 2H), 4.05 (s, 2H), 3.57 (s, 1H), 3.48 (s, 2H), 3.13 (s, 1H), 1.95 (s, 2H). (3 exchangeable protons are not seen)
343	MS m/z 415.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.64 (d, J = 2.8 Hz, 1H), 4.71 – 4.64 (m, 1H), 4.06 (t, J = 7.8 Hz, 3H), 3.60 (dt, J = 11.8, 6.0 Hz, 1H), 2.92 – 2.77 (m, 1H), 2.15 (d, J = 10.0 Hz, 1H), 1.85 – 1.75 (m, 5H), 1.66 – 1.51 (m, 1H). (3 exchangeable protons are not seen)
346	MS m/z 448.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.29 – 7.96 (m, 1H), 7.29 (d, J = 5.0 Hz, 1H), 7.12 (d, J = 3.3 Hz, 1H), 6.95 (dd, J = 5.0, 3.6 Hz, 1H), 5.06 – 4.92 (m, 3H), 4.20 (dd, J = 11.5, 4.3 Hz, 1H), 3.67 (t, J = 11.0 Hz, 1H), 3.53 (td, J = 11.1, 4.2 Hz, 1H), 2.36 (d, J = 9.9 Hz, 1H), 2.15 – 1.96 (m, 1H), 1.95 – 1.76 (m, 2H). (3 exchangeable protons are not seen)
351	MS m/z 457.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.10 (d, J = 3.3 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.43 (d, J = 1.8 Hz, 1H), 4.68 (s, 2H), 4.10 – 3.98 (m, 5H), 3.78 (brs, 1H), 3.52 (t, J = 11.9 Hz, 1H), 3.18 (t, J = 10.6 Hz, 1H), 3.07 (brs, 1H), 2.45 (d, J = 12.5 Hz, 1H), 1.73 (d, J = 12.9 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
356	MS m/z 444.0 $[M-H]^-$; ^1H NMR (DMSO-d_6) δ: 7.97 (br t, J=5.8 Hz, 1H), 7.34 (d, J=5.0 Hz, 1H), 7.04 (br s, 1H), 6.92 (t, J=4.1 Hz, 1H), 6.56 (s, 1H), 4.66 (br d, J=5.5 Hz, 2H), 2.98-3.44 (m, 4H), 1.92 (br s, 2H), 1.61-1.73 (m, 2H), 1.04-1.43 (m, 4H)
360	MS m/z 408.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.16-7.23 (m, 1H), 6.94-7.00 (m, 1H), 6.84-6.91 (m, 1H), 6.45 (s, 1H), 4.79 (s, 2H), 4.68-4.72 (m, 1H), 4.66 (s, 2H), 3.24-3.29 (m, 1H), 2.00-2.12 (m, 2H), 1.75-1.92 (m, 2H), 1.56-1.69 (m, 1H), 1.36-1.51 (m, 3H) (4 exchangeable protons are not seen)
361	MS *m/z* 440.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.55 (s, 1H), 6.46 (s, 1H), 5.60 − 5.58 (m, 1H), 4.02 (s, 2H), 3.26 (dd, *J* = 11.8, 3.4 Hz, 1H), 3.16 − 3.11 (m, 1H), 2.38 − 2.31 (m, 4H), 2.14 − 2.03 (m, 2H), 1.97 − 1.86 (m, 4H), 1.69 − 1.60 (m, 1H), 1.54 − 1.41 (m, 3H). Formic acid salt (3 Exchangeable protons not observed).
363	MS m/z 348.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.55 (s, 1H), 4.07-4.01 (m, 2H), 3.02 – 2.78 (m, 2H), 2.36 (s, 3H), 2.10-2.00 (m, 1H), 2.09-1.86 (m, 3H), 1.85-1.75 (m, 3H), 1.62 – 1.34 (m, 4H). (3 exchangeable protons are not seen)
364	MS m/z 455.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.49 (d, J = 6.1 Hz, 2H), 7.42 (d, J = 5.9 Hz, 2H), 6.38 (s, 1H), 4.67 (s, 2H), 4.16 – 3.97 (m, 2H), 3.56 (dd, J = 11.8, 9.4 Hz, 1H), 3.41 (td, J = 11.2, 4.3 Hz, 1H), 3.25 (t, J = 10.7 Hz, 1H), 3.08 (dt, J = 10.1, 5.0 Hz, 1H), 2.04 – 1.82 (m, 2H). (3 exchangeable protons are not seen)
368	MS m/z 406.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.37 – 7.31 (m, 4H), 7.26 (d, J = 6.5 Hz, 1H), 6.40 (s, 1H), 4.57 (s, 2H), 3.16 (d, J = 2.1 Hz, 1H), 2.93 (s, 1H), 1.99 (s, 2H), 1.86 (s, 2H), 1.49 (dd, J = 37.7, 28.3 Hz, 4H). (3 exchangeable protons are not seen)
384	MS m/z 457.1$[M+H]^+$; ^{1}HNMR (400 MHz, METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.10 (d, J = 3.3 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.43 (d, J = 1.8 Hz, 1H), 4.68 (s, 2H), 4.10 – 3.98 (m, 5H), 3.78 (brs, 1H), 3.52 (t, J = 11.9 Hz, 1H), 3.18 (t, J = 10.6 Hz, 1H), 3.07 (brs, 1H), 2.45 (d, J = 12.5 Hz, 1H), 1.73 (d, J = 12.9 Hz, 1H). (3 exchangeable protons are not seen)
389	MS m/z 398.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.35 (s, 1H), 6.62 (s, 1H), 6.30 – 6.23 (m, 2H), 4.46 (s, 2H), 4.05 (d, J = 8.2 Hz, 1H), 3.98 (d, J = 7.5 Hz, 1H), 3.56 (t, J = 10.9 Hz, 4H), 2.05 (d, J = 10.5 Hz, 1H), 1.79 (s, 1H). (3 exchangeable protons are not seen)
391	MS m/z 521.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.00 (t, J = 57.7 Hz, 1H), 7.43 (s, 1H), 6.64 – 6.18 (m, 2H), 4.80 (s, 2H), 3.89 (s, 1H), 2.85 (s, 1H), 2.33 (s, 1H), 2.07 (s, 1H), 1.84 (s, 3H), 1.59 – 1.27 (m, 3H). (3 exchangeable protons are not seen)

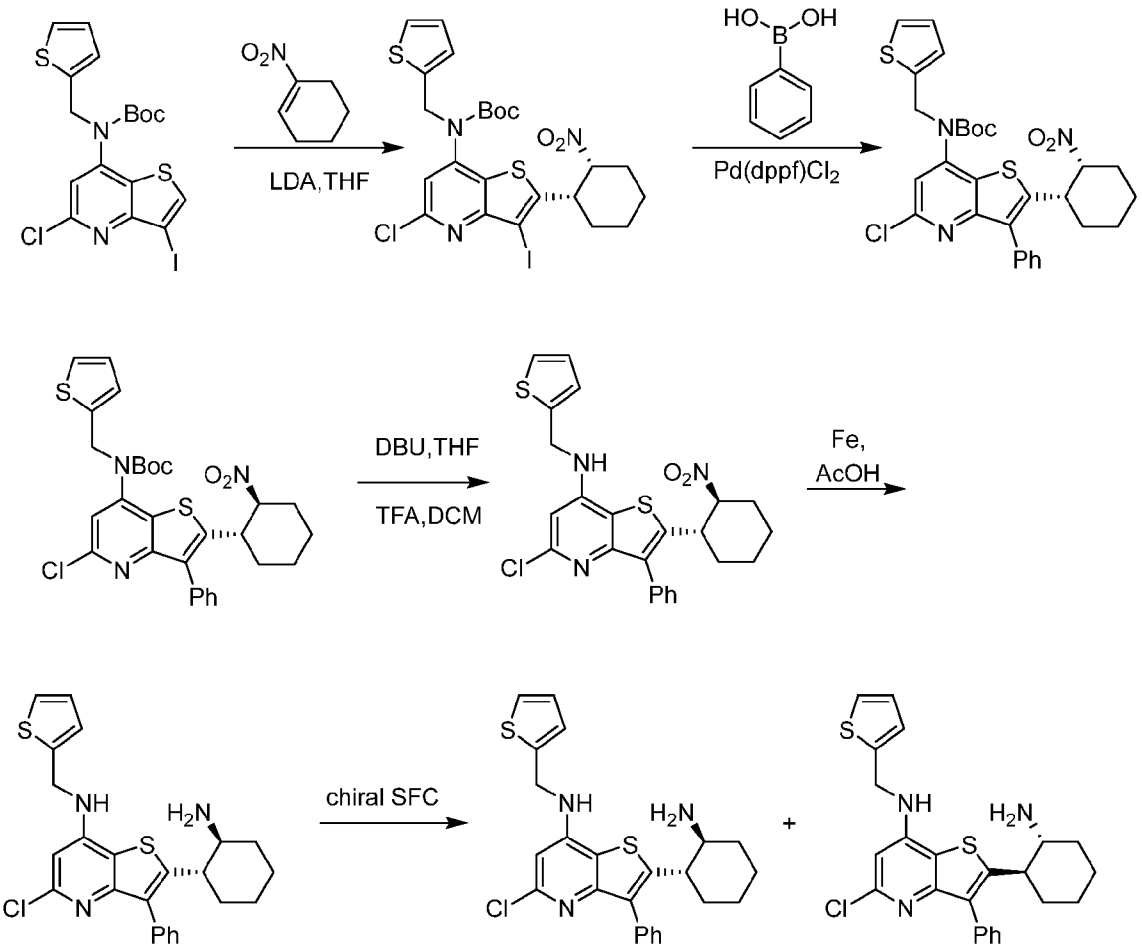
Compound	Spectral Data
392	MS m/z 431.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.05-8.40 (m, 1H), 7.46 (s, 1H), 6.38 (s, 2H), 4.85 (br d, J=2.8 Hz, 2H), 4.72 (br s, 1H), 4.10-4.21 (m, 1H), 3.55-3.66 (m, 1H), 2.95-3.09 (m, 1H), 2.19-2.31 (m, 1H), 1.90-2.06 (m, 1H), 1.76-1.86 (m, 1H), 1.53-1.65 (m, 1H) (3 exchangeable protons are not seen)
398	MS m/z 416.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.63 (s, 1H), 4.08 – 3.98 (m, 4H), 3.55 (d, J = 2.3 Hz, 1H), 3.43 – 3.34 (m, 1H), 3.24 (t, J = 10.7 Hz, 1H), 3.07 (dd, J = 10.3, 4.6 Hz, 1H), 2.03 – 1.82 (m, 2H), 1.80 (t, J = 2.0 Hz, 3H). (3 exchangeable protons are not seen)
400	MS m/z 410.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.44 (s, 1H), 7.19 (d, J=5.0 Hz, 1H), 6.98 (d, J=3.3 Hz, 1H), 6.85-6.91 (m, 1H), 6.46 (s, 1H), 5.46-5.67 (m, 2H), 4.66 (s, 2H), 3.13-3.19 (m, 1H), 2.97-3.08 (m, 1H), 1.96-2.09 (m, 2H), 1.73-1.89 (m, 2H), 1.52-1.69 (m, 1H), 1.33-1.50 (m, 3H). (3 exchangeable protons are not seen)
401	MS m/z 376.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.0 Hz, 1H), 6.54 (s, 1H), 6.35 (dd, J = 3.2, 1.9 Hz, 1H), 6.30 (d, J = 2.6 Hz, 1H), 4.52 (s, 2H), 3.01 – 2.92 (m, 1H), 2.84 (td, J = 10.5, 3.8 Hz, 1H), 2.34 (s, 3H), 2.04 (dd, J = 13.8, 4.4 Hz, 1H), 1.99 – 1.91 (m, 1H), 1.85 (t, J = 10.7 Hz, 2H), 1.57 – 1.32 (m, 4H). (3 exchangeable protons are not seen)
405	MS m/z 414.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.1 Hz, 1H), 7.08 (d, J = 3.3 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.62 (d, J = 1.9 Hz, 1H), 4.76 (s, 2H), 4.14 – 4.00 (m, 2H), 3.67 – 3.50 (m, 3H), 3.41 (s, 1H), 2.07 (d, J = 13.0 Hz, 1H), 1.76 (d, J = 11.2 Hz, 1H). (3 exchangeable protons are not seen)
406	MS m/z 408.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.39 – 7.31 (m, 4H), 7.27 (d, J = 6.3 Hz, 1H), 6.42 (s, 1H), 4.58 (s, 2H), 4.07 (d, J = 7.6 Hz, 1H), 3.99 (dd, J = 11.0, 4.1 Hz, 1H), 3.60 (t, J = 11.1 Hz, 1H), 3.48 (t, J = 10.8 Hz, 1H), 3.40 (dd, J = 9.9, 4.1 Hz, 1H), 3.15 (td, J = 10.4, 4.0 Hz, 1H), 2.00 (d, J = 9.4 Hz, 1H), 1.73 – 1.58 (m, 1H). (3 exchangeable protons are not seen)
407	MS m/z 415.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.78 (d, J = 3.3 Hz, 1H), 7.54 (d, J = 3.3 Hz, 1H), 6.57 (s, 1H), 4.91 (s, 2H), 4.06 (dd, J = 19.4, 8.1 Hz, 2H), 3.55 (d, J = 8.3 Hz, 1H), 3.45 (d, J = 22.3 Hz, 2H), 3.13 (s, 1H), 1.96 (d, J = 11.3 Hz, 2H). (3 exchangeable protons are not seen)
408	MS m/z 507.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.79 (s, 1H), 7.55 (s, 1H), 6.54 (s, 1H), 4.91 (s, 2H), 4.08 (d, J = 10.9 Hz, 2H), 3.58 (t, J = 11.9 Hz, 1H), 3.43 (d, J = 8.8 Hz, 1H), 3.29 (s, 2H), 1.98 (dd, J = 31.8, 14.2 Hz, 2H). (3 exchangeable protons are not seen)

Compound	Spectral Data
409	MS m/z 448.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.32 (d, J = 5.1 Hz, 1H), 7.11 (s, 1H), 7.04 – 6.96 (m, 1H), 6.62 (s, 1H), 4.79 (s, 2H), 3.75 (dd, J = 27.8, 10.0 Hz, 1H), 3.16 (s, 1H), 2.24 (s, 1H), 2.04 (dd, J = 39.0, 27.5 Hz, 3H), 1.73 (d, J = 14.7 Hz, 1H), 1.51 (d, J = 11.6 Hz, 1H). (3 exchangeable protons are not seen)
412	MS m/z 477.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.45 – 7.41 (m, 1H), 6.37 – 6.32 (m, 2H), 4.82 – 4.70 (m, 2H), 3.78 (dd, J = 28.1, 12.0 Hz, 1H), 3.13 (s, 1H), 2.21 (s, 1H), 2.12 – 1.91 (m, 3H), 1.71 (dd, J = 16.7, 11.9 Hz, 1H), 1.54 – 1.43 (m, 1H). (3 exchangeable protons are not seen)
416	MS m/z 540.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.24 (dd, J = 60.5, 56.5 Hz, 1H), 7.28 (dd, J = 5.1, 1.1 Hz, 1H), 7.11 (d, J = 2.7 Hz, 1H), 6.95 (dd, J = 5.1, 3.5 Hz, 1H), 5.00 (t, J = 9.7 Hz, 2H), 4.71 (d, J = 10.1 Hz, 1H), 4.13 (d, J = 7.2 Hz, 1H), 3.56 (t, J = 11.0 Hz, 1H), 2.92 (d, J = 10.5 Hz, 1H), 2.21 (d, J = 12.6 Hz, 1H), 2.03 – 1.84 (m, 1H), 1.77 (d, J = 13.5 Hz, 1H), 1.54 (dd, J = 24.1, 8.9 Hz, 1H. (3 exchangeable protons are not seen)
418	MS m/z 440.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d4) δ: 7.87 (s, 1H), 7.11-7.34 (m, 5H), 4.72 (s, 2H), 3.83-3.98 (m, 1H), 2.99-3.12 (m, 1H), 1.95-2.14 (m, 2H), 1.75-1.91 (m, 3H), 1.31-1.50 (m, 3H) (3 exchangeable protons are not seen)
421	MS *m/z* 445.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 8.44 (s, 1H), 8.04 – 7.69 (m, 1H), 7.24 (d, *J* = 5.1 Hz, 1H), 7.02 (d, *J* = 3.4 Hz, 1H), 6.90 (dd, *J* = 5.2, 3.5 Hz, 1H), 6.61 (s, 1H), 4.67 (s, 2H), 3.74 (s, 1H), 2.95 (s, 1H), 2.05 (d, *J* = 12.7 Hz, 2H), 1.89 – 1.71 (m, 3H), 1.52 – 1.24 (m, 3H). Formic acid salt, (3, exchangeable protons not observed).
422	MS m/z 523.9 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.26 (dd, J = 60.5, 56.4 Hz, 1H), 7.44 (s, 1H), 6.35 (d, J = 3.1 Hz, 2H), 4.80 (t, J = 9.3 Hz, 2H), 4.73 (d, J = 10.1 Hz, 1H), 4.14 (dd, J = 11.6, 4.4 Hz, 1H), 3.57 (t, J = 11.0 Hz, 1H), 2.97 (t, J = 8.6 Hz, 1H), 2.22 (d, J = 10.2 Hz, 1H), 2.04 – 1.88 (m, 1H), 1.78 (d, J = 13.6 Hz, 1H), 1.65 – 1.48 (m, 1H). (3 exchangeable protons are not seen)
423	MS m/z 448.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.29 – 7.96 (m, 1H), 7.29 (d, J = 5.0 Hz, 1H), 7.12 (d, J = 3.3 Hz, 1H), 6.95 (dd, J = 5.0, 3.6 Hz, 1H), 5.06 – 4.92 (m, 3H), 4.20 (dd, J = 11.5, 4.3 Hz, 1H), 3.67 (t, J = 11.0 Hz, 1H), 3.53 (td, J = 11.1, 4.2 Hz, 1H), 2.36 (d, J = 9.9 Hz, 1H), 2.15 – 1.96 (m, 1H), 1.95 – 1.76 (m, 2H). (3 exchangeable protons are not seen)

Compound	Spectral Data
425	MS *m/z* 376.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.20 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.17 (s, 1H), 7.02 – 6.96 (m, 1H), 6.88 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 5.79 (d, *J* = 10.5 Hz, 1H), 5.67 (d, *J* = 10.5 Hz, 1H), 4.67 (s, 2H), 3.60 – 3.49 (m, 1H), 3.33 (ddd, J = 10.1, 10.1, 5.5 Hz, 1H), 2.62 – 2.42 (m, 3H), 2.25 – 2.14 (m, 1H). (3 Exchangeable protons not observed).
426	MS m/z 476.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.24 (dd, J = 61.1, 56.6 Hz, 1H), 7.48 (s, 1H), 6.72 (d, J = 18.4 Hz, 1H), 6.40 – 6.27 (m, 2H), 4.73 (t, J = 11.7 Hz, 1H), 4.59 (s, 2H), 4.18 – 4.05 (m, 1H), 3.58 (t, J = 12.0 Hz, 1H), 2.97 (s, 1H), 2.22 (d, J = 9.6 Hz, 1H), 1.95 (d, J = 13.6 Hz, 1H), 1.79 (d, J = 13.0 Hz, 1H), 1.63 – 1.48 (m, 1H)... (3 exchangeable protons are not seen)
428	MS m/z 414.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 6.62 (d, J = 2.4 Hz, 1H), 4.06 (d, J = 2.2 Hz, 2H), 3.22 – 3.11 (m, 1H), 2.98 – 2.88 (m, 1H), 2.03 (dd, J = 23.6, 12.6 Hz, 2H), 1.94 – 1.73 (m, 4H), 1.61 – 1.27 (m, 5H). (3 exchangeable protons are not seen)
432	MS m/z 453.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 8.51 (d, J = 5.9 Hz, 2H), 7.44 (d, J = 5.6 Hz, 2H), 6.38 (d, J = 7.0 Hz, 1H), 4.69 (s, 2H), 3.22 (dd, J = 15.5, 6.8 Hz, 1H), 2.98 (t, J = 10.0 Hz, 1H), 2.08 (dd, J = 20.6, 13.3 Hz, 2H), 1.90 (s, 2H), 1.67 – 1.35 (m, 4H). (3 exchangeable protons are not seen)
442	MS *m/z* 370.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 6.51 (s, 1H), 5.80 – 5.67 (m, 1H), 5.50 (dtd, *J* = 10.7, 6.4, 1.8 Hz, 1H), 4.02 (d, *J* = 6.4 Hz, 2H), 3.46 – 3.35 (m, 2H), 2.25 – 2.18 (m, 1H), 2.15 – 2.08 (m, 1H), 2.02 – 1.88 (m, 2H), 1.80 (d, *J* = 6.9, 3H), 1.78 – 1.70 (m, 1H), 1.67 – 1.42 (m, 3H). (3 Exchangeable protons not observed).

Example 3

Preparation of Compound 129 and Compound 138



Step 1: tert-Butyl N-[5-chloro-3-iodo-2-[(1S,2R)-2-nitrocyclohexyl]thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate

To a solution of tert-butyl N-(5-chloro-3-iodo-thieno[3,2-b]pyridin-7-yl)-N-(2-thienylmethyl)carbamate (1, 1 g, 2.0 mmol) in THF (10 mL) was added lithium diisopropylamide (2M) in THF/heptane/ethylbenzene (1.28 mL) at -78 °C and stirred for 1h, then added 1-nitrocyclohexene (2, 497.5 mg, 4 mmol) at -78 °C. The mixture was stirred at -78 °C for 3h. The mixture was quenched with saturated ammonium chloride solution and extracted with EtOAc. The combined organic layers dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by flash column eluting with (EtOAc/PE ~5.1%) to give tert-butyl N-[5-chloro-3-iodo-2-[(1S,2R)-2-nitrocyclohexyl]thieno[3,2-

b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (1.1 g, 88% Yield) as a white solid. MS *m/z* 633.8 $[M+H]^+$.

Step 2: tert-Butyl N-[5-chloro-2-[(1S,2R)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate

To a solution of tert-butyl N-[5-chloro-3-iodo-2-[(1S,2R)-2-nitrocyclohexyl]thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (300 mg, 0.5 mmol) in 1,4-dioxane (6 mL) and H_2O (1.2 mL) was added K_2CO_3 (163.26 mg,1.2 mmol) and phenylboronic acid (57.7 mg, 0.473 mmol) at 25°C. Then the mixture was stirred at 65 °C for 2.5 hours. The reaction mixture was poured into water and extracted with EtOAc, then washed with brine and dried over Na_2SO_4, filtered and concentrated to dryness to get crude product which was purified by flash column eluting with (EtOAc/ PE ~15%) to give tert-butyl N-[5-chloro-2-[(1S,2R)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (200 mg, 72% Yield) as a yellow oil. MS *m/z* 583.9 $[M+H]^+$.

Step 3: tert-Butyl N-[5-chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate

To a solution of tert-butyl N-[5-chloro-2-[(1S,2R)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (200 mg, 0.3 mmol) in THF (5 mL)was added diazabicycloundecane (52 mg, 0.3 mmol, 1.0 eq) at 0 °C. The mixture was stirred at 0 °C for 5h. The mixture was added H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo* to give tert-butyl N-[5-chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (140 mg, 93% Yield) as a light yellow solid. ^{1}H NMR (CHLOROFORM-*d*) δ ppm 7.51 (t, *J* = 7.3 Hz, 2H), 7.46 (d, *J* = 7.2 Hz, 1H), 7.39 (d, *J* = 7.0 Hz, 2H), 7.24 (s, 1H), 6.99 (s, 1H), 6.92 – 6.88 (m, 1H), 6.83 (d, *J* = 3.4 Hz, 1H), 5.03 (s, 2H), 4.69 (td, *J* = 11.4, 4.1 Hz, 1H), 3.81 – 3.71 (m, 1H), 2.37 (d, *J* = 12.9 Hz, 1H), 2.10 (d, *J* = 10.6 Hz, 1H), 1.98 – 1.77 (m, 4H), 1.61 (s, 2H), 1.47 (s, 9H).

Step 4: 5-Chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine

To a solution of tert-butyl N-[5-chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (140 mg, 0.2 mmol) in DCM (4 mL) was added TFA (4 mL). The mixture was stirred at rt for 1h. The mixture was concentrated

under vacuum to give the crude 5-chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (116 mg , 100% Yield) as a brown oil. MS *m/z* 484.0 $[M+H]^+$.

Step 5: 2-((1S,2S)-2-Aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine and **2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno [3,2-b] pyridin-7-amine**

To a solution of 5-chloro-2-[(1S,2S)-2-nitrocyclohexyl]-3-phenyl-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (116 mg, 0.2 mmol) in MeOH (8 mL) and AcOH (2 mL) was added Iron (269 mg, 4.8 mmol). The mixture was stirred at 70 °C for 16h. The mixture was filtered with diatomaceous earth, then concentrated and purified by flash column eluting with (MeOH/ DCM ~6.4%) to give 2-[(1S,2S)-2-aminocyclohexyl]-5-chloro-3-cyclopropyl-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine (8, 130 mg) as a yellow oil. The oil was purified by SFC (DAICELCHIRALPAK®OJ, Supercritical CO_2/MeOH(+0.1% 7.0mol/l Ammonia in MeOH)/MeOH) to give 2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 129**, 28 mg, 22% Yield) and 2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 138**, 42.2 mg, 33% Yield) as a white solid.

Compound 129: MS *m/z* 454.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ ppm 7.47 (dd, *J* = 9.0, 5.7 Hz, 2H), 7.43 – 7.38 (m, 3H), 7.29 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.09 – 7.06 (m, 1H), 6.98 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.51 (s, 1H), 4.77 (s, 2H), 2.99 – 2.81 (m, 2H), 2.07 – 1.93 (m, 2H), 1.79 (s, 2H), 1.64 (d, *J* = 11.3 Hz, 1H), 1.51 – 1.42 (m, 1H), 1.29 (m, 2H) (3 exchangeable protons are not seen).

Compound 138: MS *m/z* 454.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ ppm 7.51 (t, *J* = 7.2 Hz, 2H), 7.46 – 7.39 (m, 3H), 7.30 (dd, *J* = 5.1, 1.2 Hz, 2H), 7.11 – 7.08 (m, 1H), 6.98 (dd, *J* = 5.1, 3.5 Hz, 1H), 4.78 (s, 2H), 3.33 (s, 1H), 3.12 (d, *J* = 3.5 Hz, 1H), 2.21 (s, 1H), 2.07 (s, 1H), 1.87 (d, *J* = 10.7 Hz, 2H), 1.82 – 1.74 (m, 1H), 1.48 (d, *J* = 11.4 Hz, 1H), 1.38 – 1.31 (m, 2H) (3 exchangeable protons are not seen).

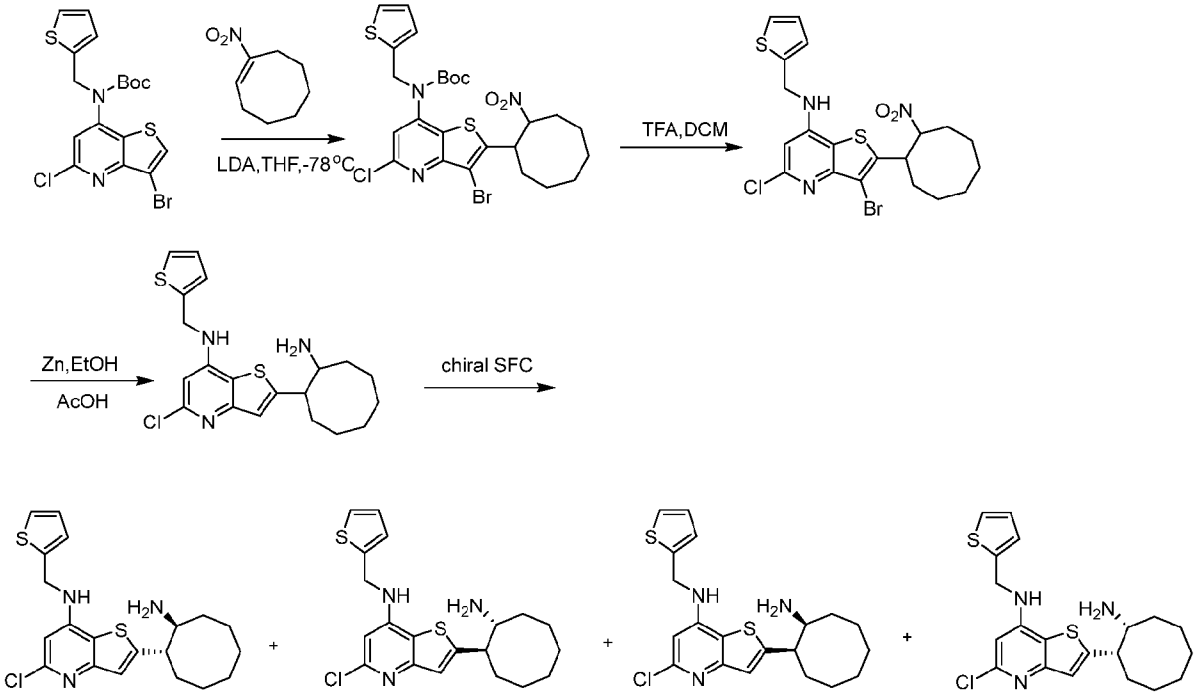
The compounds below were prepared according to the procedure of Example 3 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
130	MS m/z 418.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.27 (d, J = 5.0 Hz, 1H), 7.05 (s, 1H), 6.96 (s, 1H), 6.44 (s, 1H), 4.72 (s, 2H), 3.25 – 3.20 (m, 1H), 2.89 (s, 1H), 2.03 (dd, J = 35.4, 11.6 Hz, 2H), 1.88 (d, J = 5.5 Hz, 3H), 1.58 – 1.31 (m, 4H), 1.04 (s, 2H), 0.97 (d, J = 8.2 Hz, 2H). (3 exchangeable protons are not seen)
131	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.47 (d, J = 7.1 Hz, 2H), 7.41 (dd, J = 5.2, 2.4 Hz, 3H), 7.29 (dd, J = 5.1, 1.0 Hz, 1H), 7.08 (d, J = 2.6 Hz, 1H), 7.00 – 6.96 (m, 1H), 6.51 (s, 1H), 4.77 (s, 2H), 3.51 – 3.43 (m, 1H), 3.27 (s, 1H), 2.23 (t, J = 8.1 Hz, 1H), 2.15 (dd, J = 12.6, 5.3 Hz, 1H), 1.90 – 1.80 (m, 3H), 1.52 (d, J = 8.3 Hz, 1H). (3 exchangeable protons are not seen)
135	MS m/z 440.0 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.46 (d, J = 6.6 Hz, 2H), 7.41 (d, J = 6.8 Hz, 3H), 7.29 (d, J = 4.0 Hz, 1H), 7.08 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.0, 3.5 Hz, 1H), 6.50 (s, 1H), 4.76 (s, 2H), 3.44 (s, 1H), 3.23 (d, J = 9.0 Hz, 1H), 2.23 (d, J = 8.1 Hz, 1H), 2.18 – 2.08 (m, 1H), 1.91 – 1.78 (m, 3H), 1.50 (dd, J = 15.6, 6.4 Hz, 1H). (3 exchangeable protons are not seen)
137	MS m/z 418.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.27 (s, 1H), 7.05 (s, 1H), 6.96 (s, 1H), 6.49 (s, 1H), 4.73 (s, 2H), 3.53 (s, 1H), 2.21 (s, 1H), 2.10 (d, J = 12.2 Hz, 1H), 1.92 (dd, J = 31.7, 18.6 Hz, 4H), 1.64 (dd, J = 54.3, 11.9 Hz, 4H), 1.06 (s, 2H), 1.01 (d, J = 8.2 Hz, 2H). (3 exchangeable protons are not seen)
141	MS m/z 469.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.48 (t, J = 7.3 Hz, 2H), 7.40 (dd, J = 8.7, 7.0 Hz, 3H), 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.08 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.51 (s, 1H), 4.77 (s, 2H), 3.20 (s, 1H), 3.07 (dd, J = 12.2, 6.5 Hz, 1H), 1.97 – 1.81 (m, 4H), 1.73-158 (m, 10H). (3 exchangeable protons are not seen)
142	MS m/z 469.8 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.51 (t, J = 7.2 Hz, 2H), 7.45 – 7.38 (m, 3H), 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (d, J = 2.5 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.54 (s, 1H), 4.78 (s, 2H), 3.49 – 3.38 (m, 1H), 3.25 – 3.17 (m, 1H), 2.08-158 (m, 10H). (3 exchangeable protons are not seen)

Compound	Spectral Data
267	MS m/z 402.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.3 Hz, 1H), 7.08 (dd, J = 3.2, 1.3 Hz, 1H), 7.01 – 6.97 (m, 1H), 6.94 (dd, J = 16.8, 10.9 Hz, 1H), 6.58 (s, 1H), 6.42 (dd, J = 16.8, 2.1 Hz, 1H), 5.90 (d, J = 10.5 Hz, 1H), 5.78 (d, J = 10.5 Hz, 1H), 5.61 (dd, J = 10.9, 2.1 Hz, 1H), 4.76 (s, 2H), 3.79 (ddd, J = 9.9, 9.8, 5.8 Hz, 1H), 3.67 (ddd, J = 9.8, 9.7, 5.3 Hz, 1H), 2.70 – 2.56 (m, 3H), 2.38 – 2.27 (m, 1H). (3 Exchangeable protons not observed).
350	MS m/z 406.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.55 (s, 0.4H, formic acid), 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.07 (dt, J = 3.5, 1.2 Hz, 1H), 7.03 – 6.91 (m, 2H), 6.51 (s, 1H), 6.38 (dd, J = 17.7, 2.2 Hz, 1H), 5.53 (dd, J = 11.7, 2.2 Hz, 1H), 4.74 (s, 2H), 4.10 – 3.98 (m, 2H), 3.56 (td, J = 11.3, 4.2 Hz, 1H), 3.42 – 3.33 (m, 1H), 3.27 – 3.18 (m, 1H), 3.02 (td, J = 10.2, 4.6 Hz, 1H), 1.98 – 1.85 (m, 2H). (3 Exchangeable protons not observed).
390	MS m/z 391.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.55 (s, 0.2H, formic acid), 7.43 (s, 1H), 6.94 (dd, J = 17.7, 11.9 Hz, 1H), 6.44 (dd, J = 17.7, 2.4 Hz, 1H), 6.39 – 6.30 (m, 2H), 5.55 (dd, J = 11.7, 2.1 Hz, 1H), 4.80 – 4.69 (m, 2H), 4.10 – 3.95 (m, 2H), 3.54 (td, J = 11.7, 2.6 Hz, 1H), 3.36 (td, J = 11.0, 4.5 Hz, 1H), 3.21 (t, J = 10.7 Hz, 1H), 2.99 (td, J = 10.2, 4.5 Hz, 1H), 1.96 – 1.81 (m, 2H). (3 Exchangeable protons not observed).

Example 4

Preparation of Compound 103, Compound 104, Compound 105, and Compound 106



Step 1. tert-Butyl (3-bromo-5-chloro-2-(2-nitrocyclooctyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of 24-1 (1.0 g, 2.17 mmol) in THF (12 mL) was added 2M lithium diisopropylamide (1.63 mL) at -78 °C and stirred for 1h, then added (E)-1-nitrocyclooct-1-ene (506.3 mg, 3.26 mmol) at -78 °C. The mixture was stirred at -78 °C for 3h. The reaction mixture was then quenched with saturated ammonium chloride solution and extracted with EtOAc. The combined organic layers were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by flash column eluting with (EtOAc/PE ~5.1%) to give 24-2(550 mg, 41% Yield) as a white solid. ^{1}H NMR (CHLOROFORM-*d*) δ ppm 7.22 (dd, *J* = 5.1, 1.1 Hz, 1H), 7.07 (s, 1H), 6.87 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.79 (d, *J* = 2.9 Hz, 1H), 5.06 – 4.94 (m, 3H), 4.27 (dt, *J* = 11.0, 3.8 Hz, 1H), 2.51 – 2.32 (m, 3H), 2.10 - 1.90 (m, 3H), 1.81 – 1.67 (m, 6H), 1.44 (s, 9H).

Step 2. 3-Bromo-5-chloro-2-(2-nitrocyclooctyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To a solution of tert-butyl (3-bromo-5-chloro-2-(2-nitrocyclooctyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (550 mg, 0.89 mmol) in DCM (8 mL) was

added TFA (8 mL). The mixture was stirred at rt for 1h. The mixture was concentrated under vacuum to give the crude 3-bromo-5-chloro-2-(2-nitrocyclooctyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (130 mg, 28% Yield) as a brown oil. MS *m/z* 516.0 $[M+H]^+$.

Step 3. 2-((1S,2S)-2-Aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine, 2-((1R,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine, 2-((1R,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine, and **2-((1S,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine**

To a solution of 24-3 (130 mg, 0.25 mmol) in MeOH (8 mL) and AcOH (2 mL) was added Iron (82.5 mg, 1.26 mmol). The mixture was stirred at 100 °C for 16 h. The reaction mixture was cooled to rt and filtered with diatomaceous earth, then concentrated and purified by flash column eluting with (MeOH/ DCM ~6.4%) to give a white solid. The solid was purified by SFC (DAICELCHIRALPAK®IC, supercritical CO_2/MeOH (+0.1% 7.0 M NH_3 in MeOH/MeOH) to give 2-((1R,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 103)** 2.3 mg, 3% Yield), 2-((1S,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 104**, 8.9 mg, 11% Yield), 2-((1R,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 105**, 1.3 mg, 1.67% Yield) and 2-((1S,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (**Compound 106**, 18.1 mg, 23.21% Yield) as a white solid.

Compound 103: MS *m/z* 406.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ ppm 7.29 (dd, *J* = 5.1, 1.1 Hz, 1H), 7.14 (s, 1H), 7.07 (d, *J* = 2.5 Hz, 1H), 6.97 (dd, *J* = 5.0, 3.5 Hz, 1H), 6.51 (s, 1H), 4.75 (s, 2H), 3.41 (d, *J* = 6.8 Hz, 1H), 3.21 – 3.08 (m, 1H), 2.14 – 1.84 (m, 6H), 1.77 – 1.58 (m, 6H) (3 exchangeable protons are not seen).

Compound 104: MS *m/z* 406.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ ppm 7.29 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.12 (s, 1H), 7.07 (dd, *J* = 3.5, 1.1 Hz, 1H), 6.97 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.50 (dt, *J* = 10.7, 3.7 Hz, 1H), 3.42 – 3.34 (m, 1H), 2.21 – 2.09 (m, 1H), 1.99 (d, *J* = 13.7 Hz, 1H), 1.91 – 1.66 (m, 10H) (3 exchangeable protons are not seen).

Compound 105: MS *m/z* 406.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ ppm 7.29 (dd, *J* = 5.1, 1.0 Hz, 1H), 7.18 (s, 1H), 7.08 (d, *J* = 2.6 Hz, 1H), 6.97 (dd, *J* = 5.0, 3.5 Hz, 1H), 6.53

(s, 1H), 4.75 (s, 2H), 3.63 – 3.55 (m, 1H), 3.26 (d, *J* = 7.9 Hz, 1H), 2.15 – 1.93 (m, 6H), 1.70 (d, *J* = 67.1 Hz, 6H) (3 exchangeable protons are not seen).

Compound 106: MS *m/z* 406.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ ppm 7.29 (d, *J* = 4.6 Hz, 1H), 7.16 (s, 1H), 7.07 (s, 1H), 7.00 – 6.90 (m, 1H), 6.51 (s, 1H), 4.75 (s, 2H), 3.57 (s, 2H), 2.10 (s, 2H), 1.89 (s, 3H), 1.72 (d, *J* = 38.6 Hz, 7H) (3 exchangeable protons are not seen).

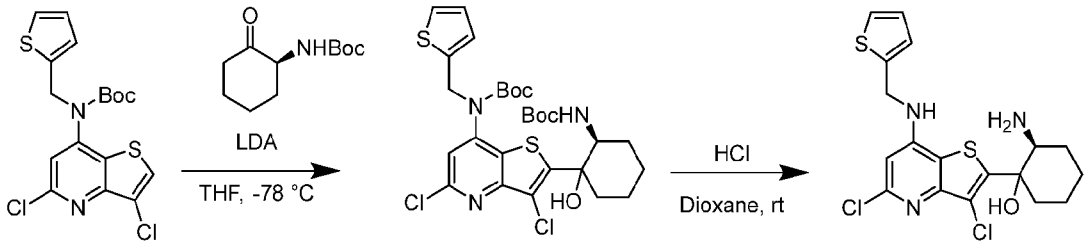
The compounds below were prepared according to the procedure of Example 4 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
9	MS m/z 363.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: ppm 7.29 (dd, *J*=5.13, 1.13 Hz, 1 H) 7.11 (d, *J*=1.38 Hz, 1 H) 7.05 - 7.08 (m, 1 H) 6.97 (dd, *J*=5.00, 3.50 Hz, 1 H) 6.45 - 6.54 (m, 1 H) 4.74 (s, 2 H) 3.42 - 3.62 (m, 2 H) 2.14 (br s, 4 H) 1.61 - 1.87 (m, 2 H). (3 exchangeable protons are not seen)
10	MS m/z 364.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: ppm 7.29 (dd, *J*=5.07, 1.19 Hz, 1 H) 7.11 (s, 1 H) 7.07 (dd, *J*=3.44, 1.06 Hz, 1 H) 6.97 (dd, *J*=5.13, 3.50 Hz, 1 H) 6.48 (s, 1 H) 4.74 (s, 2 H) 3.21 - 3.27 (m, 1 H) 3.01 - 3.15 (m, 1 H) 2.10 - 2.38 (m, 2 H) 1.83 - 1.97 (m, 3 H) 1.51 - 1.69 (m, 1 H). (3 exchangeable protons are not seen)
21	MS m/z 378.1 $[M+H]^+$; ^1HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.13 (s, 1H), 7.07 (d, J = 2.5 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.50 (s, 1H), 4.75 (s, 2H), 2.95 – 2.87 (m, 1H), 2.80 (dd, J = 15.3, 6.9 Hz, 1H), 2.06 (d, J = 12.9 Hz, 2H), 1.85 (d, J = 12.2 Hz, 2H), 1.69 – 1.60 (m, 1H), 1.53 – 1.31 (m, 3H). (3 exchangeable protons are not seen)
22	MS m/z 378.1 $[M+H]^+$; ^1HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.11 – 7.03 (m, 2H), 6.96 (dt, J = 12.2, 6.1 Hz, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.36 (t, J = 8.0 Hz, 1H), 3.29 – 3.22 (m, 1H), 1.93 – 1.82 (m, 3H), 1.71 – 1.46 (m, 3H), 1.38 – 1.25 (m, 2H). (3 exchangeable protons are not seen)
23	MS m/z 378.1 $[M+H]^+$; ^1HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.18 – 7.12 (m, 1H), 7.07 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (d, J = 19.3 Hz, 1H), 4.74 (d, J = 6.9 Hz, 2H), 3.00 (td, J = 10.8, 3.8 Hz, 1H), 2.90 – 2.79 (m, 1H), 2.08 (d, J = 13.1 Hz, 2H), 1.88 (t, J = 12.6 Hz, 2H), 1.35 – 1.24 (m, 4H). (3 exchangeable protons are not seen)

80	MS m/z 392.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.12 (s, 1H), 7.07 (dd, J = 3.5, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.50 (s, 1H), 4.74 (s, 2H), 3.16 (dd, J = 11.6, 6.5 Hz, 1H), 2.95 (td, J = 9.4, 3.3 Hz, 1H), 1.98 – 1.83 (m, 5H), 1.70 (d, J = 15.2 Hz, 5H). (3 exchangeable protons are not seen)
88	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.14 (s, 1H), 7.07 (dd, J = 3.4, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.52 (s, 1H), 4.75 (s, 2H), 3.55 (d, J = 9.8 Hz, 2H), 2.14 (s, 1H), 2.04 – 1.84 (m, 6H), 1.59 (s, 3H). (3 exchangeable protons are not seen)
89	MS m/z 392.2 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 4.9 Hz, 1H), 7.08 (d, J = 13.3 Hz, 2H), 7.00 – 6.95 (m, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.41 (s, 2H), 1.91 (dd, J = 60.4, 36.1 Hz, 7H), 1.58 (s, 3H). (3 exchangeable protons are not seen)
90	MS m/z 392.1 $[M+H]^+$; ^{1}HNMR(400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.2 Hz, 1H), 7.17 (s, 1H), 7.07 (dd, J = 3.4, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.53 (s, 1H), 4.75 (s, 2H), 3.46 – 3.36 (m, 1H), 3.13 (td, J = 9.7, 3.4 Hz, 1H), 2.09 – 1.84 (m, 6H), 1.71 (t, J = 8.2 Hz, 4H). (3 exchangeable protons are not seen)
111	MS m/z 364.1 $[M+H]^+$; ^{1}H NMR(400MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1Hz, 1H), 7.11 (s, 1H), 7.07 (d, J = 2.5Hz, 1H), 6.97 (dd, J = 5.1, 3.5Hz, 1H), 6.49 (s, 1H), 4.74 (s, 2H), 3.55 (dd, J = 9.7, 5.8Hz, 1H), 3.52 – 3.43 (m, 1H), 2.25 – 1.95 (m, 5H), 1.81 (dt, J = 13.9, 9.4Hz, 1H), 1.68 (ddd, J = 12.8, 9.1, 4.7Hz, 1H). (3 exchangeable protons are not seen)
112	MS m/z 364.1 $[M+H]^+$; ^{1}H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.11 (s, 1H), 7.07 (dd, J = 3.4, 1.0 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.48 (s, 1H), 4.74 (s, 2H), 3.55 (dd, J = 9.7, 5.8Hz, 1H), 3.52 – 3.43 (m, 1H), 2.25 – 1.95 (m, 5H), 1.81 (dt, J = 13.9, 9.4Hz, 1H), 1.68 (ddd, J = 12.8, 9.1, 4.7Hz, 1H). (3 exchangeable protons are not seen)

Example 5

Preparation of Compound 31



Step 1: tert-Butyl (2-((2S)-2-((tert-butoxycarbonyl)amino)-1-hydroxycyclohexyl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

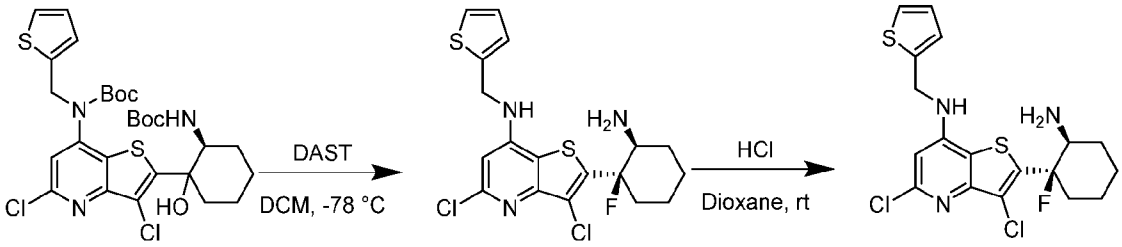
To a solution of tert-butyl N-(3,5-dichlorothieno[3,2-b]pyridin-7-yl)-N-(2-thienylmethyl)carbamate (200 mg, 0.4815 mmol) in THF (2 mL), cooled to -78°C, was added lithium diisopropylamide (2.0 M) in THF/heptane/ethylbenzene (0.31 mL, 0.62 mmol, 1.3 eq). After 15 min, a solution of (S)-N-Boc-2-aminocyclohexanone (140 mg, 0.630172 mmol, 1.3 eq) in THF (1 mL) was added to the reaction solution, and the mixture was stirred at room temperature for 30 min. The reaction was quenched with NH_4Cl (sat. aq.). The reaction mixture was diluted with EtOAc and washed with water and brine. The combined organic layers were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetate in hexanes (0-50% gradient) to afford tert-butyl N-[2-[(2S)-2-(tert-butoxycarbonylamino)-1-hydroxy-cyclohexyl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (75 mg, 25% Yield) as a clear oil. MS *m/z* 628.3, 630.1 $[M+H]^-$, ^{1}H NMR (CHLOROFORM-*d*) δ: 7.29 (s, 1H), 7.24 (dd, *J*=5.1, 0.9 Hz, 1H), 7.03 (s, 1H), 6.90 (dd, *J*=5.0, 3.5 Hz, 1H), 6.80 (d, *J*=3.1 Hz, 1H), 5.05 (s, 2H), 4.21 (br s, 1H), 1.80-1.95 (m, 4H), 1.63-1.73 (m, 2H), 1.51-1.63 (m, 2H), 1.48 (s, 9H), 1.30 (s, 9H).

Step 2: (2S)-2-Amino-1-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol

General Boc-deprotection procedure: A solution of tert-butyl N-[2-[(2S)-2-(tert-butoxycarbonylamino)-1-hydroxy-cyclohexyl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (75 mg, 0.1193 mmol) and HCl (4 M) in dioxane (1 mL) was stirred at room temperature for 6 hr. Reaction mixture was diluted with diethyl ether and filtered. The filter cake was purified on preparative HPLC eluting with 10-100% ACN in water with 0.1% formic acid to afford (2S)-2-amino-1-[3,5-dichloro-7-(2-thienylmethylamino)thieno[3,2-b]pyridin-2-yl]cyclohexanol (28 mg, 50%). MS *m/z* 427.9, 429.8 $[M+H]^+$, ^{1}H NMR (METHANOL-d_4) δ: 7.18-7.22 (m, 1H), 6.98 (d, *J*=2.6 Hz, 1H), 6.88 (dd, *J*=4.9, 3.7 Hz, 1H), 6.47 (s, 1H), 4.66 (s, 2H), 3.81 (dd, *J*=11.5, 4.3 Hz, 1H), 2.39-2.57 (m, 1H), 1.75-1.90 (m, 3H), 1.56-1.75 (m, 3H), 1.40-1.56 (m, 1H). HCl salt, (5 exchangeable protons are not seen).

Example 6

Preparation of Compound 32



Step 1: tert-Butyl (2-((1R,2S)-2-((tert-butoxycarbonyl)amino)-1-fluorocyclohexyl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl N-[2-[(2S)-2-(tert-butoxycarbonylamino)-1-hydroxy-cyclohexyl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (120 mg, 0.2 mmol) in CH_2Cl_2 (2 mL), cooled to -78 °C, was added diethylaminosulfur trifluoride (0.1 mL, 0.8 mmol, 3 eq). After stirring for 1 h at -78 °C, the reaction was allowed to warm to rt for 30 min then quenched with $NaHCO_3$ (sat. aq.). The reaction mixture was diluted with DCM and the organic layer was separated, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetate in hexanes (0-40% gradient) to afford tert-butyl N-[2-[(2S)-2-(tert-butoxycarbonylamino)-1-fluoro-cyclohexyl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (58 mg, 48%) as a clear oil. MS *m/z* 630.1 632.2 $[M+H]^+$, ^1H NMR (CHLOROFORM-*d*) δ: 7.17 (d, *J*=5.0 Hz, 1H), 6.99 (s, 1H), 6.79-6.84 (m, 1H), 6.73 (d, *J*=3.1 Hz, 1H), 5.41 (br s, 1H), 4.96 (s, 2H), 4.11-4.21 (m, 1H), 2.37-2.48 (m, 1H), 2.26-2.37 (m, 1H), 2.00-2.15 (m, 2H), 1.61-1.72 (m, 2H), 1.48-1.61 (m, 2H), 1.40 (s, 9H), 1.37 (s, 9H).

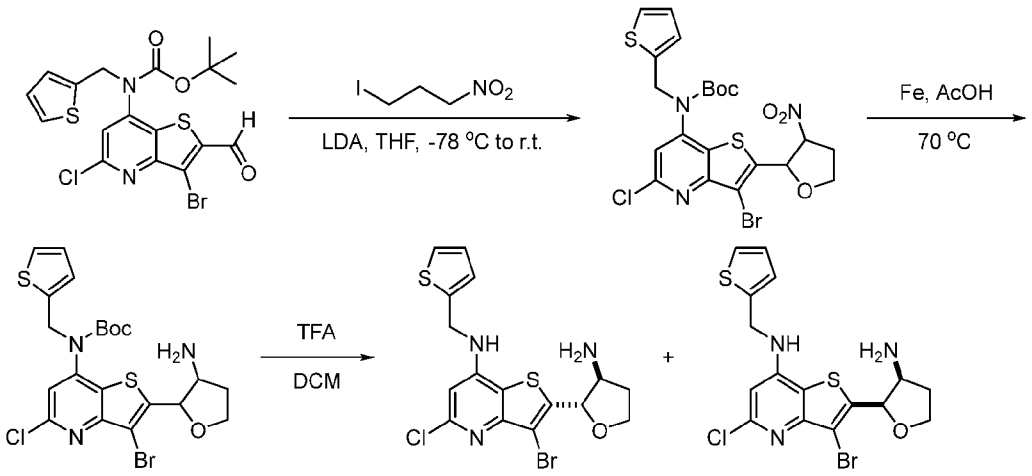
Step 2: Deprotection of tert-butyl N-[2-[(2S)-2-(tert-butoxycarbonylamino)-1-fluoro-cyclohexyl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (58 mg, 0.1 mmol) using the general Boc deprotection procedure described in Step 2 of Example 5 gave 2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (34 mg, 85%). MS *m/z* 429.9, 431.8 $[M+H]^+$, ^1H NMR (METHANOL-d_4) δ: 7.20 (d, *J*=5.1 Hz, 1H), 6.96-7.00 (m, 1H), 6.85-6.90 (m, 1H), 6.51 (s, 1H), 4.66 (s, 2H), 3.58-3.75 (m, 1H), 2.23-2.45 (m, 1H), 2.05 (br d, *J*=10.6 Hz, 1H), 1.87 (br d, *J*=11.4 Hz, 1H), 1.71-1.83 (m, 1H), 1.43-1.69 (m, 4H). HCl salt, (4 exchangeable protons are not seen).

The compounds below were prepared according to the procedure of Example 6 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
37	MS m/z 467.9, 469.8, 471.9 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.24-7.43 (m, 5H), 6.54 (s, 1H), 4.37-4.54 (m, 1H), 2.52-2.77 (m, 1H), 2.15 (br d, J=3.5 Hz, 2H), 1.64-2.07 (m, 5H). (4 exchangeable protons are not seen)
38	MS m/z 413.9, 415.8 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.47 (d, J=1.0 Hz, 1H), 6.74 (s, 1H), 6.33-6.43 (m, 2H), 4.58 (s, 2H), 4.23-4.39 (m, 1H), 2.41-2.67 (m, 1H), 2.11-2.32 (m, 2H), 1.63-2.06 (m, 5H). (4 exchangeable protons are not seen)
41	MS m/z 394.0, 395.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: ppm 7.46 (d, *J*=1.00 Hz, 1 H) 6.70 (s, 1 H) 6.28 - 6.43 (m, 2 H) 4.57 (s, 2 H) 3.83 - 4.04 (m, 1 H) 2.51 (s, 3 H) 2.07 - 2.37 (m, 3 H) 1.60 - 2.04 (m, 5 H). (4 exchangeable protons are not seen).
121	MS m/z 400.0 $[M+H]^+$; ^1H NMR(400 MHz, METHANOL-d_4) δ: 7.45 (d, J = 1.0 Hz, 1H), 6.67 (d, J = 10.3 Hz, 1H), 6.36 (dd, J = 3.2, 1.9 Hz, 1H), 6.33 (d, J = 3.1 Hz, 1H), 4.54 (s, 2H), 3.91 (ddd, J = 25.3, 11.3, 7.7 Hz, 1H), 2.77 (d, J = 38.9 Hz, 1H), 2.42 – 2.12 (m, 2H), 2.04 – 1.84 (m, 2H), 1.83 – 1.66 (m, 1H). (3 exchangeable protons are not seen).
128	MS m/z 381.1 $[M+H]^+$; ^1H NMR(400 MHz, METHANOL-d_4) δ: 7.42 (dd, J = 1.8, 0.8 Hz, 1H), 6.38 – 6.29 (m, 2H), 4.74 (s, 2H), 3.77 – 3.60 (m, 1H), 2.48 (dd, J = 12.0, 6.0 Hz, 1H), 2.39 (dd, J = 14.5, 3.6 Hz, 4H), 2.23 (ddd, J = 11.3, 7.9, 3.3 Hz, 1H), 2.06 – 1.86 (m, 2H), 1.86 – 1.73 (m, 1H). (3 exchangeable protons are not seen).

Example 7

Preparation of Compounds 150 and 151



Step 1: tert-butyl (3-bromo-5-chloro-2-(3-nitrotetrahydrofuran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a THF (10 mL) solution of tert-butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (488 mg, 1.0 mmol, 1.0 eq.), prepared according to a previous procedure, was added 1-iodo-3-nitropropane (323 mg, 1.5 mmol, 1.5 eq.). The mixture was cooled to -78 °C, at which point lithium diisopropylamide (1 M in hexanes, 1.3 mL, 1.3 mmol, 1.3 eq.) was added dropwise. The mixture was warmed to room temperature overnight. The mixture was then diluted with ethyl acetate and washed with water and brine. The organic layer was dried over Na_2SO_4, filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 35% gradient) to give tert-butyl (3-bromo-5-chloro-2-(3-nitrotetrahydrofuran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a mixture of diastereomers (368 mg, 64% yield). MS *m/z* 576.0 $[M+H]^+$.

Step 2: tert-Butyl (2-(3-aminotetrahydrofuran-2-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

tert-Butyl (3-bromo-5-chloro-2-(3-nitrotetrahydrofuran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a mixture of diastereomers (273 mg, 0.5 mmol, 1.0 eq.) was mixed with iron powder (280 mg, 5 mmol, 10.0 eq.) and acetic acid (5 mL). The mixture was heated at 70 °C for 2 h. After the reaction cooled down, the mixture was filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with methanol (0.1 % NH_3) in DCM (0 to 20% gradient) to give tert-butyl (2-(3-aminotetrahydrofuran-2-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a diastereomeric mixture (218 mg, 80% yield). MS *m/z* 546.0 $[M+H]^+$.

Step 3: 2-(trans-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and **2-(*cis*-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine**

To a DCM (2 mL) solution of tert-butyl (2-(3-aminotetrahydrofuran-2-yl)-3-bromo-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (55 mg, 0.1 mmol, 1.0 eq.) was added trifluoroacetic acid (2 mL) at room temperature. After stirring for 1 h, the mixture was concentrated *in vacuo*. The residue was purified by reverse phase column chromatography with acetonitrile (0.1% formic acid) in water (0.1% formic acid) (0 to 40% gradient) to give 2-

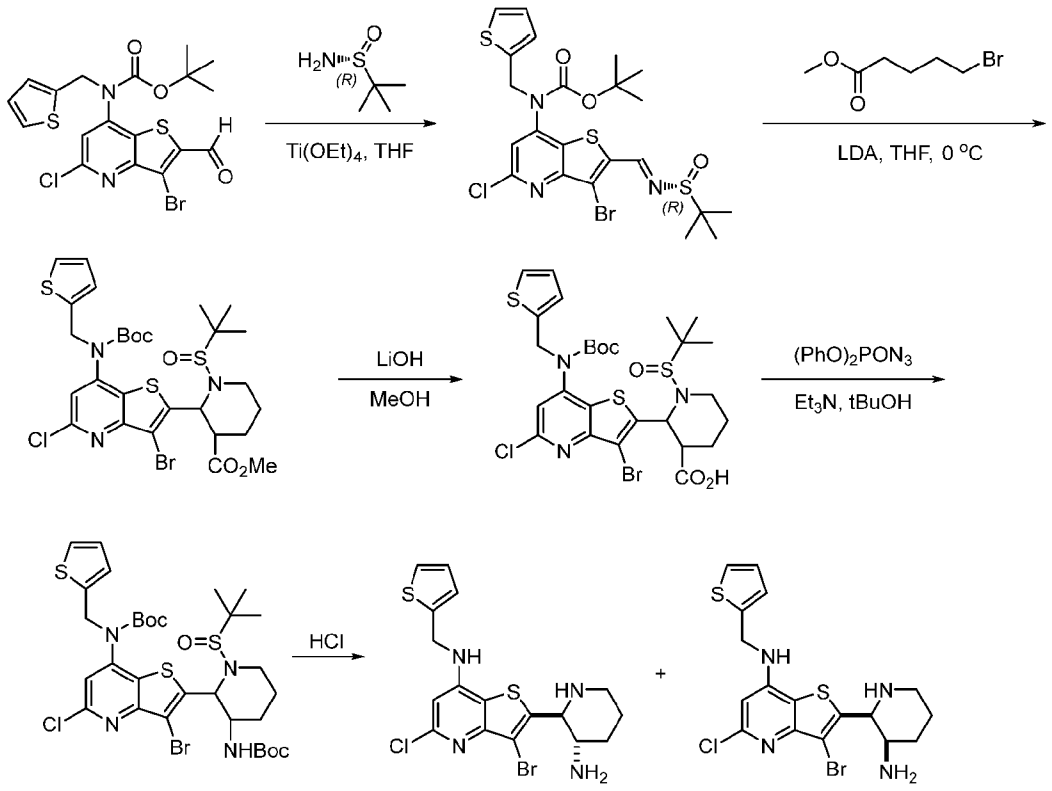
(*trans*-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and 2-(*cis*-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine as two separate diastereomers.

Compound 150: MS *m/z* 446.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.36 (s, 1H), 7.32 (d, *J* = 5.1 Hz, 1H), 7.12 – 7.08 (m, 1H), 7.03 – 6.97 (m, 1H), 6.63 (s, 1H), 5.41 (s, 1H), 4.78 (s, 2H), 4.38 (td, *J* = 8.8, 4.2 Hz, 1H), 4.23 (tt, *J* = 8.3 Hz, 1H), 4.05 – 3.98 (m, 1H), 2.55 – 2.42 (m, 1H), 2.20 – 2.10 (m, 1H). formic acid salt, (4 exchangeable protons are not seen).

Compound 151: MS *m/z* 446.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.35 (s, 1H), 7.30 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.12 – 7.06 (m, 1H), 6.98 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.63 (s, 1H), 5.36 (d, *J* = 4.1 Hz, 1H), 4.77 (s, 2H), 4.41 – 4.26 (m, 2H), 4.04 (td, *J* = 9.4, 5.3 Hz, 1H), 2.67 (dt, *J* = 9.4, 7.0 Hz, 1H), 2.22 – 2.12 (m, 1H). formic acid salt, (4 exchangeable protons are not seen).

Example 8

Preparation of Compounds 46 and 47



Step 1: tert-Butyl (*R,E*)-(3-bromo-2-(((tert-butylsulfinyl)imino)methyl)-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

tert-Butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (488 mg, 1.0 mmol, 1.0 eq.), prepared according to a previous procedure, was dissolved in THF (5 mL). $Ti(OEt)_4$ (456 mg, 2.0 mmol, 2.0 eq.) and (*R*)-2-methylpropane-2-sulfinamide (182 mg, 1.5 mmol, 1.5 eq.) were added and the vial was heated to 50 °C. Conversion was monitored by LCMS, and the mixture was cooled to room temperature after completion. Once at room temperature, the mixture was poured into an equal volume of brine while rapidly stirring. The resulting suspension was filtered through a plug of Celite, and the filter cake was washed with EtOAc. The filtrate was transferred to a separatory funnel where the organic layer was washed with brine. The brine layer was extracted once with a small volume of EtOAc, and the combined organic portions were dried over Na_2SO_4, filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 100% gradient) to give tert-butyl (*R,E*)-(3-bromo-2-(((tert-butylsulfinyl)imino)methyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (561 mg, 95% yield). MS *m/z* 592.0 $[M+H]^+$.

Step 2: Methyl 2-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylate

To a mixture of tert-butyl (*R,E*)-(3-bromo-2-(((tert-butylsulfinyl)imino)methyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (473 mg, 0.8 mmol, 1.0 eq.) in THF (8 mL) was added methyl 5-bromovalerate (234 mg, 1.2 mmol, 1.5 eq.). The reaction mixture was cooled to 0 °C. Lithium diisopropylamide (1M in hexanes, 1.0 mL, 1.3 eq.) was added dropwise to the reaction. LCMS showed the reaction completed after 1 h. The reaction was quenched with saturated NH_4Cl then diluted with ethyl acetate and washed with brine. The organic layer was dried over Na_2SO_4, filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 50% gradient) to give methyl 2-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-b]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylate (197 mg, 35% yield) as a diastereomeric mixture. MS *m/z* 706.1 $[M+H]^+$.

Step 3: 2-(3-Bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylic acid

To a solution of methyl 2-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylate (353 mg, 0.5 mmol. 1.0 eq.) in MeOH (5 mL) was added lithium hydroxide (24 mg, 1.0 mmol, 2.0 eq.). The reaction mixture was allowed to stir at 50 °C for 4 h. The reaction was quenched with saturated NH_4Cl then diluted with ethyl acetate and washed with brine. The organic layer was dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 100% gradient) to give 2-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylic acid (296 mg, 84% yield) as a mixture of diastereomers. MS *m/z* 706.1 $[M+H]^+$.

Step 4: tert-Butyl (3-bromo-2-(3-((tert-butoxycarbonyl)amino)-1-(tert-butylsulfinyl)piperidin-2-yl)-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of 2-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-1-(tert-butylsulfinyl)piperidine-3-carboxylic acid (141 mg, 0.2 mmol, 1.0 eq.) in tert-butanol (2 mL) was added triethylamine (40 mg, 0.4 mmol, 2.0 eq.) and diphenylphosphoryl azide (83 mg, 0.3 mmol, 1.5 eq.). The reaction was allowed to stir at 90 °C for 3 h. The reaction was quenched with saturated NH_4Cl then diluted with ethyl acetate and washed with brine. The organic layer was dried over Na_2SO_4, filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 50% gradient) to give tert-butyl (3-bromo-2-(3-((tert-butoxycarbonyl)amino)-1-(tert-butylsulfinyl)piperidin-2-yl)-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (70 mg, 46% yield) as a mixture of diastereomers. MS *m/z* 763.1 $[M+H]^+$.

Step 5: 2-(trans-3-Aminopiperidin-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and **2-(*cis*-3-aminopiperidin-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine**

To a DCM (2 mL) solution of tert-butyl (3-bromo-2-(3-((tert-butoxycarbonyl)amino)-1-(tert-butylsulfinyl)piperidin-2-yl)-5-chlorothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (152 mg, 0.2 mmol, 1.0 eq.) from Step 4 was added 2M HCl in dioxane (1 mL, 2 mmol, 10 eq.) at room temperature. After stirring for 1 h, the mixture was concentrated *in vacuo*. The residue was purified by reverse phase column chromatography with acetonitrile

(0.1% formic acid) in water (0.1% formic acid) (0 to 40% gradient) to give 2-(*trans*-3-aminopiperidin-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and 2-(*cis*-3-aminopiperidin-2-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine as two separate diastereomers.

Compound 46: MS *m/z* 459.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ 8.55 (s, 1H), 7.30 (d, *J* = 5.2 Hz, 1H), 7.08 (d, *J* = 3.5 Hz, 1H), 6.98 (dd, *J* = 5.2, 3.5 Hz, 1H), 6.57 (s, 1H), 4.75 (s, 2H), 4.50 (d, *J* = 2.3 Hz, 1H), 3.53 – 3.47 (m, 1H), 3.17 (d, *J* = 12.1 Hz, 1H), 2.86 (td, *J* = 11.9, 3.0 Hz, 1H), 2.05 – 1.75 (m, 3H), 1.62 – 1.52 (m, 1H). formic acid salt, (5 exchangeable protons not seen).

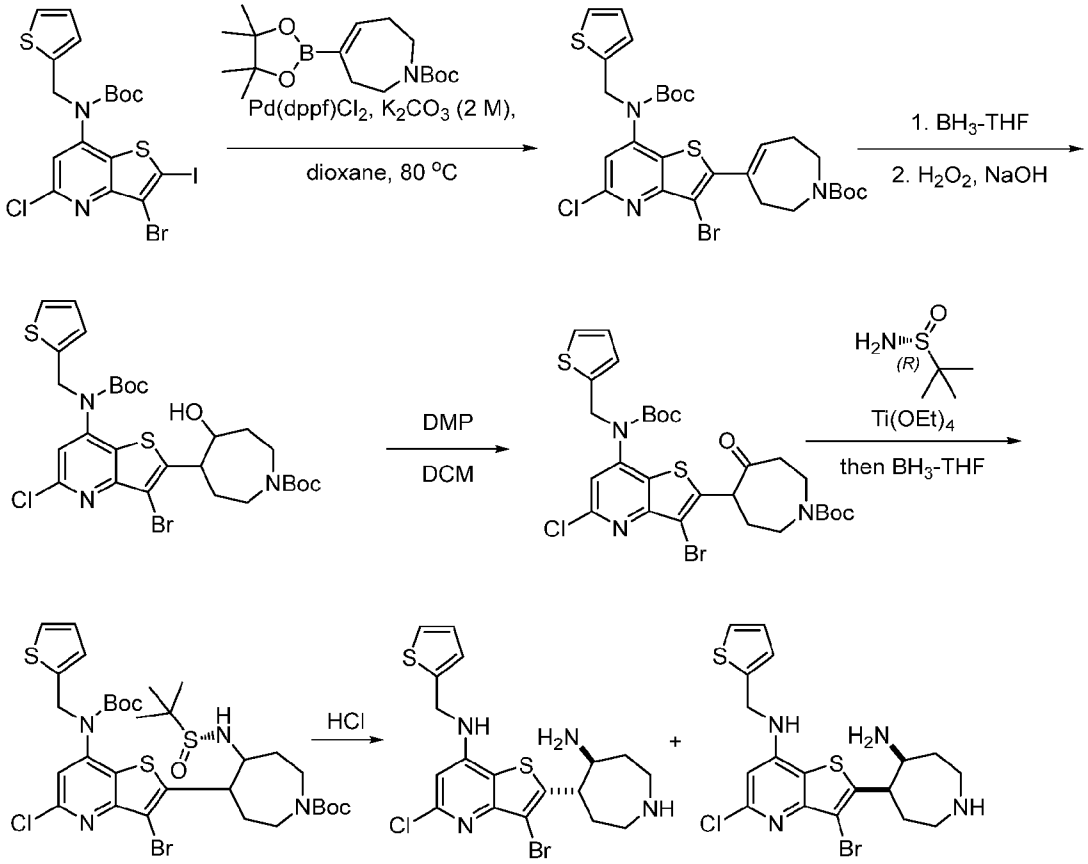
Compound 47: MS *m/z* 459.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ 8.55 (s, 1H), 7.30 (d, *J* = 5.2 Hz, 1H), 7.09 (d, *J* = 3.5 Hz, 1H), 6.98 (dd, *J* = 5.2, 3.5 Hz, 1H), 6.60 (s, 1H), 4.76 (s, 2H), 4.53 (*d*, *J* = 2.3 Hz, 1H), 3.63 – 3.55 (m, 1H), 3.18 (d, *J* = 11.8 Hz, 1H), 2.88 (dd, *J* = 13.2, 10.2 Hz, 1H), 2.07 – 1.90 (m, 2H), 1.89 – 1.75 (m, 1H), 1.65 – 1.55 (m, 1H). formic acid salt, (5 exchangeable protons not seen)

The compounds below were prepared according to the procedure of Example 8 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
124	MS *m/z* 535.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.53 (s, 0.6H, formic acid), 7.27 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.20 – 7.08 (m, 4H), 7.05 – 6.99 (m, 1H), 6.97 – 6.87 (m, 2H), 6.49 (s, 1H), 4.81 (d, *J* = 7.9 Hz, 1H), 4.67 (s, 2H), 3.50 – 3.34 (m, 2H), 3.01 (ddd, *J* = 13.1, 9.0, 4.3 Hz, 1H), 2.23 (ddd, *J* = 13.1, 4.3, 4.3 Hz, 1H), 2.08 – 1.90 (m, 2H), 1.79 – 1.65 (m, 1H). (3 Exchangeable protons not observed).
125	MS *m/z* 535.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.28 (d, *J* = 5.0 Hz, 1H), 7.20 (t, *J* = 7.9 Hz, 2H), 7.09 (d, *J* = 7.9 Hz, 2H), 7.05 – 7.00 (m, 1H), 6.98 – 6.91 (m, 2H), 6.55 (s, 1H), 5.51 (d, *J* = 3.4 Hz, 1H), 4.75 – 4.60 (m, 2H), 3.95 – 3.88 (m, 1H), 3.62 – 3.52 (m, 1H), 3.18 – 3.05 (m, 1H), 2.22 – 2.06 (m, 3H), 1.92 – 1.80 (m, 1H). (3 Exchangeable protons not observed).

Example 9

Preparation of Compounds 147 and 148



Step 1: tert-Butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-2,3,6,7-tetrahydro-1*H*-azepine-1-carboxylate

tert-Butyl (3-bromo-5-chloro-2-iodothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (584 mg, 1 mmol, 1.0 eq.) (prepared following a previously described example) and tert-butyl 4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,3,6,7-tetrahydro-1*H*-azepine-1-carboxylate (420 mg, 1.3 mmol, 1.3 eq.) were mixed in 10 mL dioxane. Catalyst $Pd(dppf)Cl_2$ (73 mg, 0.1 mmol, 0.1 eq.) and 2 M aqueous K_2CO_3 solution (1.25 mL, 2.5 eq.) were added to the reaction. The reaction mixture was purged by argon vigorously for 5 min. The reaction was allowed to stir at 80 °C for 6 h. The mixture was cooled to room temperature and diluted with ethyl acetate and washed with water and brine. The organic layer was dried over Na_2SO_4, filtered and concentrated *in vacuo*. The residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 60% gradient) to give tert-butyl 4-(3-

bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-2,3,6,7-tetrahydro-1*H*-azepine-1-carboxylate (537 mg, 82% yield). MS *m/z* 656.1 $[M+H]^+$.

Step 2: tert-Butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-hydroxyazepane-1-carboxylate

A THF solution (6 mL) of tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-2,3,6,7-tetrahydro-1*H*-azepine-1-carboxylate (524 mg, 0.8 mmol, 1.0 eq.) was cooled to 0 °C. 1 M of borane THF complex solution (2.4 mL, 2.4 mmol, 3.0 eq.) was added to the reaction dropwise. The reaction was allowed to warm to room temperature overnight. LCMS showed complete consumption of starting material. The reaction was cooled to 0 °C, to which was added 2 mL ethanol, 2 M aqueous sodium hydroxide (1 mL) and 30% aq H_2O_2 (1 mL) sequentially. The reaction was allowed to warm up to room temperature and stir for an additional 2 h. The reaction mixture was then poured into a separatory funnel and diluted with CH_2Cl_2. The water layer was washed with CH_2Cl_2 and the organic layers were combined and dried with Na_2SO_4. After filtration and removal of the solvent *in vacuo*, the crude mixture was purified by silica gel chromatography to give tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-hydroxyazepane-1-carboxylate (188 mg, 35% yield). MS *m/z* 674.1 $[M+H]^+$.

Step 3: tert-Butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-oxoazepane-1-carboxylate

To a DCM (5 mL) solution of tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-hydroxyazepane-1-carboxylate (337 mg, 0.5 mmol, 1.0 eq.) was added Dess–Martin periodinane (318 mg, 0.75 mmol, 1.5 eq.). The reaction was allowed to stir at room temperature for 1 h, and quenched with saturated $NaHCO_3$ and saturated $Na_2S_2O_3$. The reaction mixture was then poured into a separatory funnel and diluted with CH_2Cl_2. The water layer was washed with CH_2Cl_2 and the organic layers were combined and dried with Na_2SO_4. After filtration and removal of the solvent *in vacuo*, the crude mixture was purified by silica gel chromatography to give tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-oxoazepane-1-carboxylate (285 mg, 85% yield). MS *m/z* 672.1 $[M+H]^+$.

Step 4: tert-Butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-((tert-butylsulfinyl)amino)azepane-1-carboxylate

tert-Butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-oxoazepane-1-carboxylate (168 mg, 0.25 mmol, 1.0 eq.) and (*R*)-2-methylpropane-2-sulfinamide (61 mg, 0.5 mmol, 2.0 eq.) were mixed in $Ti(OEt)_4$ (3 mL) and heated to 50 °C overnight. After the reaction mixture was cooled to room temperature, THF was added followed by 1 M of borane THF complex solution (0.4 mL, 0.4 mmol, 1.6 eq.). The reaction was complete in 10 minutes. The mixture was added to a stirring solution of aqueous K_2CO_3. After filtration and removal of the solvent, the crude mixture was purified by silica gel chromatography to give tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-((tert-butylsulfinyl)amino)azepane-1-carboxylate (146 mg, 75% yield) as a mixture of diastereomers. MS *m/z* 777.1 $[M+H]^+$.

Step 5: 2-(trans-5-Aminoazepan-4-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and **2-(*cis*-5-aminoazepan-4-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine**

To a DCM (2 mL) solution of tert-butyl 4-(3-bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-*b*]pyridin-2-yl)-5-((tert-butylsulfinyl)amino)azepane-1-carboxylate (78 mg, 0.1 mmol, 1.0 eq.) was added 2M HCl in dioxane (1 mL, 2 mmol, 20 eq.) at room temperature. After stirring for 1 h, the mixture was concentrated *in vacuo*. The residue was purified by reverse phase column chromatography with acetonitrile (0.1% formic acid) in water (0.1% formic acid) (0 to 40% gradient) to 2-(*trans*-5-aminoazepan-4-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine and 2-(*cis*-5-aminoazepan-4-yl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine as two separate diastereomers. MS *m/z* 473.0 $[M+H]^+$.

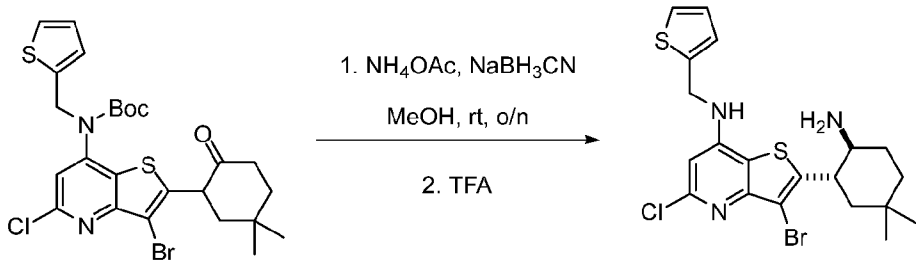
Compound 147: MS *m/z* 473.0 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 9.25 (brs, 1H), 8.10 (t, *J* = 6.0 Hz, 2H), 7.41 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.5 Hz, 1H), 6.99 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.69 (s, 1H), 4.83 – 4.67 (m, 2H), 4.20 – 4.05 (m, 1H), 4.05 – 3.96 (m, 1H), 3.80 – 3.65 (m, 2H), 3.30 – 3.18 (m, 1H), 3.07 (t, *J* = 12.0 Hz, 1H), 2.37 – 2.27 (m, 2H), 2.24 – 2.12 (m, 1H), 2.10 – 2.00 (m, 1H), 1.98 – 1.85 (m, 1H).

Compound 148: MS *m/z* 473.0 $[M+H]^+$;^1H NMR (DMSO-d_6) δ: 9.43 (brs, 1H, TFA peak), 9.21 (brs, 1H), 8.21 (brs, 2H), 8.07 (t, *J* = 6.0 Hz, 1H), 7.41 (d, *J* = 5.0 Hz, 1H), 7.11 (d,

J = 3.5 Hz, 1H), 7.00 (dd, J = 5.0, 3.5 Hz, 1H), 6.70 (s, 1H), 4.85 – 4.69 (m, 2H), 3.95 – 3.85 (m, 1H), 3.73 – 3.63 (m, 2H), 3.35 – 3.25 (m, 2H), 3.19 (t, J = 11.0 Hz, 1H), 2.10 – 2.02 (m, 2H), 2.02 – 1.88 (m, 2H).

Example 10

Preparation of Compound 149



Step 1: 2-(trans-2-Amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine

tert-Butyl (3-bromo-5-chloro-2-(5,5-dimethyl-2-oxocyclohexyl)thieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (117 mg, 0.2 mmol) was prepared according to the procedure of Example 9 by substituting the appropriate starting materials. The reductive amination/deprotection procedure followed Example 11, which afforded 2-(*trans*-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-*N*-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine (15 mg, 15% yield). MS *m/z* 486.0 $[M+H]^+$. ^{1}H NMR (METHANOL-d_4) δ: 8.54 (s, 1H, formic acid), 7.30 (d, J = 5.1 Hz, 1H), 7.09 (d, J = 3.5 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.60 (s, 1H), 4.76 (s, 2H), 3.60 (td, J = 11.7, 3.8 Hz, 1H), 3.18 (d, J = 11.7 Hz, 1H), 1.99 (dt, J = 13.2, 3.4 Hz, 1H), 1.82 – 1.69 (m, 2H), 1.66 – 1.46 (m, 3H), 1.14 (s, 3H), 1.03 (s, 3H). formic acid salt, (4 exchangeable protons not observed).

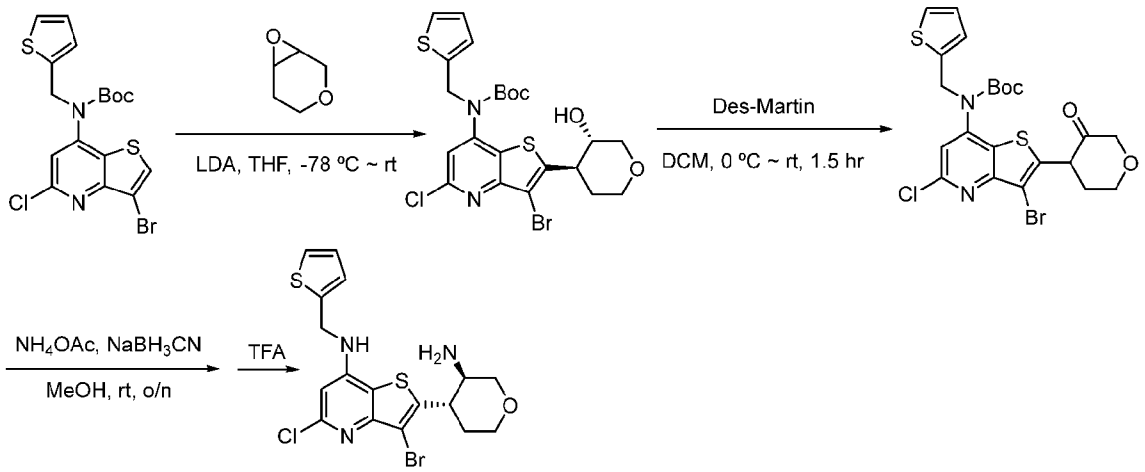
The compounds below were prepared according to Example 10 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
30	MS *m/z* 491.9, 493.8, 495.8 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.36-7.32 (m, 1H), 7.13 (d, J = 2.63 Hz, 1H), 7.01 (dd, J = 5.0 , 3.6 Hz, 1H), 6.80 (s, 1H), 4.86-4.82 (m, 2H), 4.25 (br s, 1H), 4.02 (dt, J = 12.1, 3.9 Hz, 1H), 2.75-2.17 (m, 6H). (4 exchangeable protons not observed).

Compound	Spectral Data
152	MS *m/z* 486.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 1H, formic acid), 7.30 (dd, *J* = 5.1, 1.4 Hz, 1H), 7.09 (dd, *J* = 3.6, 1.4 Hz, 1H), 6.98 (dd, *J* = 5.1, 3.6 Hz, 1H), 6.60 (s, 1H), 4.76 (s, 2H), 4.10 (d, *J* = 4.8 Hz, 1H), 3.61 (dt, *J* = 10.4, 4.8 Hz, 1H), 2.19 – 2.06 (m, 1H), 1.96 – 1.90 (m, 1H), 1.90 – 1.76 (m, 2H), 1.68 – 1.54 (m, 1H), 1.50 – 1.35 (m, 1H), 1.15 (s, 3H), 1.09 (s, 3H). Formic acid salt, (4 exchangeable protons not observed).
204	MS *m/z* 458.0, 460.0, 462.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (t, J=5.3 Hz, 1H), 7.11 (br s, 1H), 6.93-7.04 (m, 1H), 6.66 (d, J=15.6 Hz, 1H), 4.79 (d, J=4.6 Hz, 2H), 4.08-4.28 (m, 2H), 3.88-4.01 (m, 1H), 3.61-3.82 (m, 3H), 2.13-2.28 (m, 1H), 1.85-1.96 (m, 1H). (4 exchangeable protons not observed).
333	MS *m/z* 428.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 − 7.29 (m, 1H), 7.07 (s, 1H), 6.99 − 6.97 (m, 1H). 6.53 (s, 1H), 4.75 (s, 2H), 3.24 (br s, 1H), 3.17 (br s, 1H), 2.38 (s, 3H), 2.34 − 2.29 (m, 1H), 2.24 − 2.09 (m, 3H), 2.06 − 1.99 (m, 1H), 1.76 − 1.68 (m, 1H) (3 Exchangeable protons not observed).
375	MS *m/z* 470.0, 472.0, 474.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (d, J=5.0 Hz, 1H), 7.07-7.14 (m, 1H), 6.96-7.04 (m, 1H), 6.67 (s, 1H), 4.79 (s, 2H), 3.46-3.62 (m, 2H), 2.67 (s, 3H), 2.33-2.43 (m, 1H), 2.12-2.21 (m, 1H), 2.02-2.12 (m, 1H), 1.88-1.99 (m, 1H), 1.73-1.86 (m, 1H), 1.48-1.65 (m, 3H). (4 exchangeable protons not observed).

Example 11

Preparation of Compound 139



Step 1: trans-tert-Butyl (3-bromo-5-chloro-2-((3S,4R)-3-hydroxytetrahydro-2H-pyran-4-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

A solution of tert-butyl N-(3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl)-N-(2-thienylmethyl)carbamate (1.38 g, 3.0 mmol) and 3,7-dioxabicyclo[4.1.0]heptane (901 mg, 9.0 mmol) in THF (20 mL, 246 mmol, 100 mass%) was cooled at -78 °C under argon, followed by the addition of LDA in THF/hexanes (3.9 mL, 3.9 mmol, 1.0 mol/L) dropwise. The mixture was stirred at -78 °C for 1 hr and the cooling bath was removed and stirred for an additional hour at RT, quenched with NH_4Cl (aq.) and stirred for 0.5 hr, extracted with ethyl acetate and dried. This was purified on a silica column, eluted with ethyl acetate in hexanes (0~50%), to provide tert-butyl (3-bromo-5-chloro-2-(3-hydroxytetrahydro-2H-pyran-4-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (824 mg 49% Yield). MS *m/z* 559.9 $[M+H]^+$, ^1H NMR (CHLOROFORM-*d*) δ: 7.25 (dd, *J*=5.0, 1.0 Hz, 1H), 7.09 (s, 1H), 6.89 (dd, *J*=5.0, 3.5 Hz, 1H), 6.80 (d, *J*=3.3 Hz, 1H), 4.97-5.08 (m, 2H), 4.09-4.20 (m, 2H), 3.99-4.07 (m, 1H), 3.84-3.95 (m, 1H), 3.44-3.60 (m, 1H), 3.25-3.37 (m, 1H), 2.00-2.04 (m, 1H), 1.81-1.96 (m, 1H), 1.41-1.58 (m, 9H).

Step 2: tert-Butyl N-[3-bromo-5-chloro-2-(3-oxotetrahydropyran-4-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate

To a solution of tert-butyl (3-bromo-5-chloro-2-(3-hydroxytetrahydro-2H-pyran-4-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (824 mg, 1.47 mmol), at 0 °C was added Dess-Martin periodinane (965 mg, 2.20 mmol). The cooling bath was removed after the addition, and the reaction mixture was stirred at rt for 1.5 hr. LC-MS showed a complete conversion achieved. This was diluted with dichloromethane and washed with sodium thiosulfate, Na_2CO_3 (aq.), dried and filtered to remove drying agent. The filtrate was evaporated to dryness and the residue was chromatographed (ethyl acetate in hexanes, 0 ~ 60%) to provide tert-butyl N-[3-bromo-5-chloro-2-(3-oxotetrahydropyran-4-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (799 mg, 97% Yield). MS *m/z* 558.7 $[M+H]^+$.

Step 3: trans-2(-3-Aminotetrahydropyran-4-yl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;2,2,2-trifluoroacetic acid

A mixture of tert-butyl N-[3-bromo-5-chloro-2-(3-oxotetrahydropyran-4-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (400 mg, 0.72 mmol) and ammonium acetate (553 mg, 7.17 mmol) in methanol (1.5 mL) was stirred at rt for 30 min, followed by the addition of $NaBH_3CN$ (47 mg, 0.72 mmol). The mixture was stirred at rt overnight, and diluted with ethyl acetate and water and separated. Aqueous layer was extracted with ethyl acetate.

The combined organics was washed with water and brine, dried and concentrated. The residue was chromatographed (ethyl acetate in hexanes, 0 ~ 100%) to provide tert-butyl N-[2-[(3R,4S)-3-aminotetrahydropyran-4-yl]-3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate. This was dissolved in dichloromethane (2 mL) and treated with trifluoroacetic acid (2 mL) at rt for 1.5 hr and evaporated. The residue was purified on a prep C18 column (Sunfire C18), eluted with 0.1% TFA modified acetonitrile in water (0 ~ 100%) to provide *trans*-2-(3-aminotetrahydropyran-4-yl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;2,2,2-trifluoroacetic acid (75 mg, 18% Yield). MS *m/z* 460.0 $[M+H]^+$, ^1H NMR (METHANOL-d_4) δ 7.27-7.34 (m, 1H), 7.05-7.12 (m, 1H), 6.95-7.02 (m, 1H), 6.60-6.68 (m, 1H), 4.76-4.81 (m, 2H), 4.18-4.26 (m, 1H), 4.06-4.15 (m, 1H), 3.68-3.79 (m, 1H), 3.55-3.67 (m, 2H), 3.47-3.55 (m, 1H), 2.04-2.16 (m, 2H). trifluoracetic acid salt, (4 exchangeable protons are not seen).

The compounds below were prepared according to the procedure of Example 11 by substituting the appropriate starting materials, reagents, and reaction conditions, and followed by chiral SFC resolution if needed.

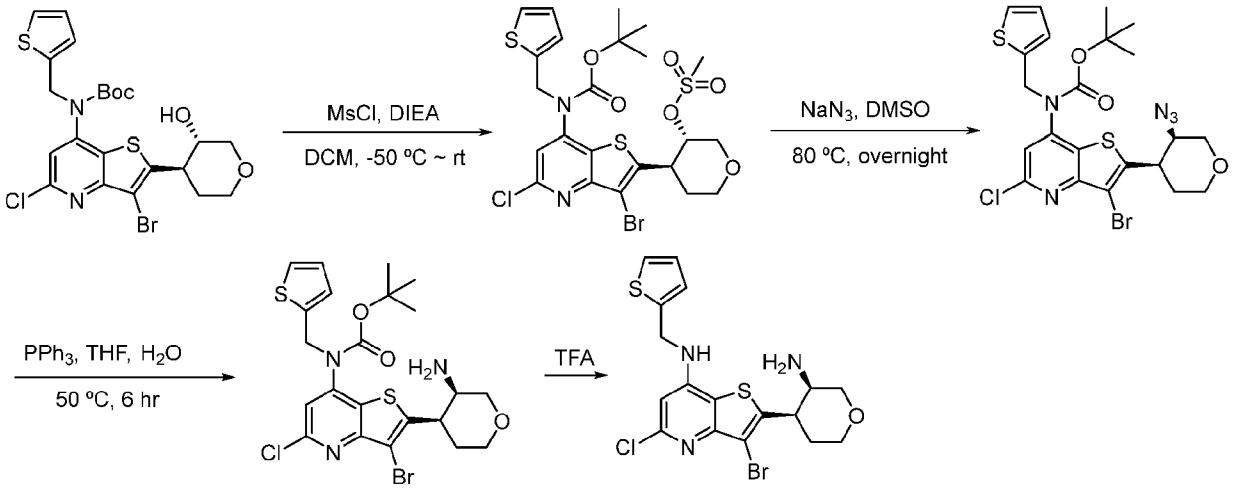
Compound	Spectral Data
140	MS m/z 460.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.27-7.34 (m, 1H), 7.06-7.13 (m, 1H), 6.95-7.02 (m, 1H), 6.64 (s, 1H), 4.75-4.81 (m, 2H), 4.18-4.26 (m, 1H), 4.07-4.15 (m, 1H), 3.68-3.78 (m, 1H), 3.55-3.67 (m, 2H), 3.45-3.55 (m, 1H), 2.04-2.18 (m, 2H). trifluoracetic acid salt, (3 exchangeable protons are not seen)
238	MS m/z 444.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.47 (s, 1H), 6.72 (s, 1H), 6.34-6.42 (m, 2H), 4.58 (s, 2H), 4.20-4.27 (m, 1H), 4.08-4.15 (m, 1H), 3.49-3.79 (m, 4H), 2.07-2.17 (m, 2H). (3 exchangeable protons are not seen)
245	MS m/z 491.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.44 (s, 1H), 6.37 – 6.30 (m, 2H), 4.77 (s, 2H), 4.10 – 3.95 (m, 2H), 3.62 – 3.51 (m, 1H), 3.45 (td, J = 11.2, 4.0 Hz, 1H), 3.30 – 3.22 (m, 1H), 3.18 (td, J = 10.5, 4.0 Hz, 1H), 2.05 – 1.95 (m, 1H), 1.92 – 1.79 (m, 1H). (3 Exchangeable protons not observed).
272	MS m/z 414.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30-7.37 (m, 1H), 7.09-7.13 (m, 1H), 6.97-7.03 (m, 1H), 6.67 (s, 1H), 4.80 (s, 2H), 4.20-4.27 (m, 1H), 4.09-4.16 (m, 1H), 3.52-3.76 (m, 4H), 2.09-2.17 (m, 2H). (3 exchangeable protons are not seen)

Compound	Spectral Data
275	MS m/z 506.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.35 (s, 1H, formic acid), 7.33 – 7.27 (m, 1H), 7.11 – 7.06 (m, 1H), 6.98 (dd, J = 5.1, 3.4 Hz, 1H), 6.60 (s, 1H), 4.76 (s, 2H), 4.18 (dd, J = 10.9, 4.2 Hz, 1H), 4.10 – 4.02 (m, 1H), 3.70 – 3.49 (m, 3H), 3.44 (dd, J = 12.3, 8.6 Hz, 1H), 2.10 – 1.93 (m, 2H). (3 Exchangeable protons not observed).
314	MS m/z 398.0 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.47 (d, J=1.1 Hz, 1H), 6.73 (s, 1H), 6.32-6.41 (m, 2H), 4.58 (s, 2H), 4.23 (dd, J=10.4, 3.6 Hz, 1H), 4.12 (br d, J=11.5 Hz, 1H), 3.47-3.76 (m, 4H), 2.07-2.18 (m, 2H). (3 exchangeable protons are not seen)
315	MS m/z 414.1 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.30-7.37 (m, 1H), 7.09-7.13 (m, 1H), 6.97-7.03 (m, 1H), 6.67 (s, 1H), 4.80 (s, 2H), 4.20-4.27 (m, 1H), 4.09-4.16 (m, 1H), 3.52-3.76 (m, 4H), 2.09-2.17 (m, 2H). (3 exchangeable protons are not seen)
316	MS m/z 444.0 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.47 (s, 1H), 6.72 (s, 1H), 6.34-6.42 (m, 2H), 4.58 (s, 2H), 4.20-4.27 (m, 1H), 4.08-4.15 (m, 1H), 3.49-3.79 (m, 4H), 2.07-2.17 (m, 2H). (3 exchangeable protons are not seen)
319	MS m/z 398.0 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.47 (d, J=1.1 Hz, 1H), 6.73 (s, 1H), 6.32-6.41 (m, 2H), 4.58 (s, 2H), 4.23 (dd, J=10.4, 3.6 Hz, 1H), 4.12 (br d, J=11.5 Hz, 1H), 3.47-3.76 (m, 4H), 2.07-2.18 (m, 2H)., (3 exchangeable protons are not seen)
328	MS m/z 454.0 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 7.38 (s, 5H), 6.49 (s, 1H), 4.61 (s, 2H), 4.20-4.29 (m, 1H), 4.08-4.17 (m, 1H), 3.70-3.80 (m, 1H), 3.58-3.69 (m, 2H), 3.49-3.58 (m, 1H), 2.08-2.19 (m, 2H). (3 exchangeable protons are not seen)
339	MS m/z 445.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.43 (s, 1H), 6.37 – 6.32 (m, 2H), 4.76 (s, 2H), 4.03 (td, J = 11.9, 4.3 Hz, 2H), 3.54 (t, J = 11.7 Hz, 1H), 3.42 (td, J = 11.1, 4.1 Hz, 1H), 3.24 (t, J = 10.7 Hz, 1H), 3.07 (td, J = 10.3, 4.6 Hz, 1H), 2.02 - 1.95 (m, 1H), 1.94 - 1.81 (m, 1H). (3 Exchangeable protons not observed).
347	MS m/z 461.0 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 9.07 (t, J = 5.9 Hz, 1H), 7.34 (d, J = 5.1 Hz, 1H), 7.01 (d, J = 3.5 Hz, 1H), 6.91 (dd, J = 5.1, 3.5 Hz, 1H), 4.84 - 4.69 (m, 2H), 3.90 – 3.75 (m, 2H), 3.34 (t, J = 11.6 Hz, 1H), 3.13 (td, J = 11.2, 3.9 Hz, 1H), 3.00 (t, J = 10.6 Hz, 1H), 2.76 (td, J = 10.1, 4.5 Hz, 1H), 1.82 (d, J = 13.8 Hz, 1H), 1.65 – 1.50 (m, 1H). (2 Exchangeable protons not observed).
354	MS m/z 399.0 $[M+H]^+$; ^1H NMR (DMSO-d_6) δ: 9.05 (t, J = 5.5 Hz, 1H), 8.36 (s, 0.2 H, formic acid), 7.61 (d, J = 1.8 Hz, 1H), 6.42 (dd, J = 3.3, 1.8 Hz, 1H), 6.35 (d, J = 3.3 Hz, 1H), 4.75 – 4.60 (m, 2H), 4.00 – 3.84 (m, 2H), 3.50 – 3.35 (m, 1H), 3.23 – 3.14 (m, 1H), 3.07 (t, J = 10.5 Hz, 1H), 2.79 (td, J = 10.1, 4.5 Hz, 1H), 1.88 (dd, J = 13.3, 3.9 Hz, 1H), 1.75 – 1.60 (m, 1H).

Compound	Spectral Data
381	MS m/z 454.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.38 (s, 5H), 6.49 (s, 1H), 4.61 (s, 2H), 4.20-4.29 (m, 1H), 4.08-4.17 (m, 1H), 3.70-3.80 (m, 1H), 3.58-3.69 (m, 2H), 3.49-3.58 (m, 1H), 2.08-2.19 (m, 2H). (3 exchangeable protons are not seen)
388	MS m/z 408.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.38 (s, 4H), 7.27-7.32 (m, 1H), 6.49 (s, 1H), 4.61 (s, 2H), 4.21-4.27 (m, 1H), 4.09-4.16 (m, 1H), 3.49-3.77 (m, 4H), 2.09-2.17 (m, 2H). (3 exchangeable protons are not seen)
410	MS m/z 398.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.47 (d, J=1.1 Hz, 1H), 6.73 (s, 1H), 6.32-6.41 (m, 2H), 4.58 (s, 2H), 4.23 (dd, J=10.4, 3.6 Hz, 1H), 4.12 (br d, J=11.5 Hz, 1H), 3.47-3.76 (m, 4H), 2.07-2.18 (m, 2H)., (3 exchangeable protons are not seen)

Example 12

Preparation of Compound 146



Step 1: trans-4-(3-Bromo-7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chlorothieno[3,2-b]pyridin-2-yl)tetrahydro-2H-pyran-3-yl methanesulfonate

To a solution of tert-butyl N-[3-bromo-5-chloro-2-(3-hydroxytetrahydropyran-4-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (162 mg, 0.29 mmol), prepared in Example 11, N,N-diisopropyamine (101 µL, 0.58 mmol) in dichloromethane (5 mL), at -50 °C, was added methanesulfonyl chloride (27 µL, 0.35 mmol) and stirred for 0.5 hr, then warmed up to rt and stirred for an additional 0.5 hr. LC/MS showed a clean conversion achieved. The reaction was quenched by $NaHCO_3$ (aq.) and the organic was separated and dried, evaporated to dryness, used directly. MS *m/z* 639.1 $[M+H]^+$.

Step 2: cis-tert-Butyl N-[2-(3-azidotetrahydropyran-4-yl)-3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate

The material prepared in Step 1, was treated with sodium azide (188 mg, 2.90 mmol) in DMSO (1.0 mL) at 80 °C overnight, cooled, diluted with ethyl acetate, washed with water and brine, dried over anhydrous $MgSO_4$, and filtered. The solvent was removed and the residue was chromatographed (ethyl acetate in hexanes, 0 ~ 70%) to provide tert-butyl N-[2-(3-azidotetrahydropyran-4-yl)-3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (24 mg, 14% Yield). MS *m/z* 585.5 $[M+H]^+$.

Step 3: cis-tert-Butyl (2-((3R,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

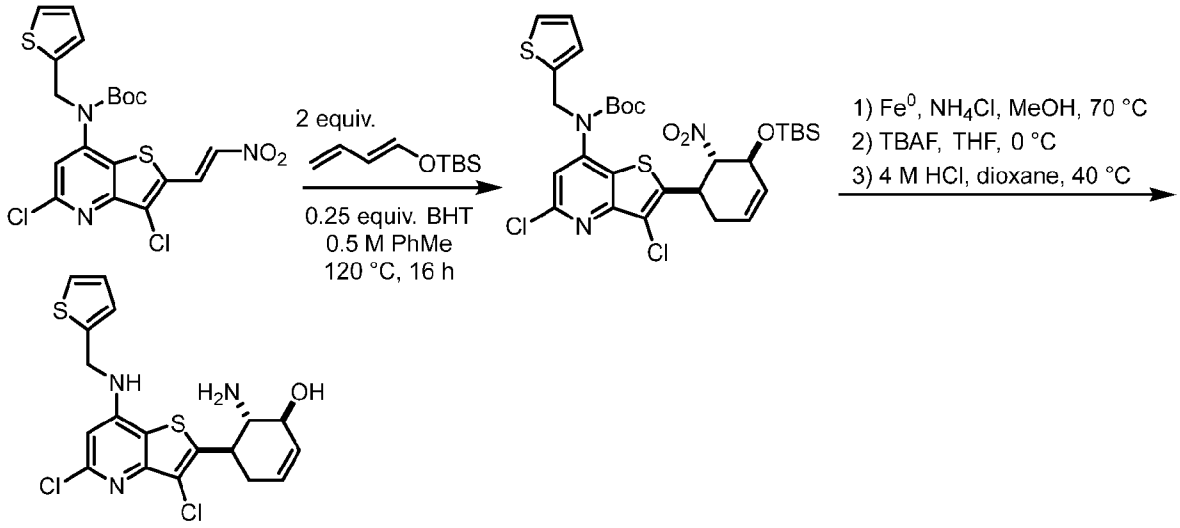
To a solution of *cis*-tert-butyl N-[2-(3-azidotetrahydropyran-4-yl)-3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (24 mg, 0.041 mmol) in tetrahydrofuran (1 mL, 12.3 mmol, 100 mass%) and water (0.25 mL, 14 mmol) was added triphenylphospine (12 mg, 0.045 mmol). The mixture was stirred at 50 °C for 6 hr and evaporated. The crude residue was used without further purification. MS *m/z* 559.6 $[M+H]^+$.

Step 4: 2-(3-Aminotetrahydropyran-4-yl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;formic acid

The above material was treated with dichloromethane (0.5 mL) and trifluoroacetic acid (1 mL) at rt for 3 hr and evaporated to dryness. The residue was purified by on a Sunfire column using 0.1% formic acid modified acetonitrile/H_2O (0 ~ 100%) to provide 2-(3-aminotetrahydropyran-4-yl)-3-bromo-5-chloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;formic acid (14 mg, 62 % Yield, 2 steps) as a white powder. MS *m/z* 459.7 $[M+H]^+$, ^1H NMR (METHANOL-d_4) δ 8.19-8.43 (m, 1H), 7.30 (d, *J*=5.0 Hz, 1H), 7.05-7.13 (m, 1H), 6.94-7.03 (m, 1H), 6.61 (s, 1H), 4.77 (s, 2H), 4.13-4.23 (m, 1H), 3.97-4.13 (m, 2H), 3.85-3.97 (m, 2H), 3.64-3.79 (m, 1H), 2.41-2.58 (m, 1H), 1.92-2.08 (m, 1H). formic acid salt, (4 exchangeable protons are not seen).

Example 13

Preparation of Compound 127



Step 1: tert-Butyl (2-((1R/S,5S/R,6S/R)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (E)-(3,5-dichloro-2-(2-nitrovinyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (1.04 g, 2.15 mmol, 1.0 eq.) and in toluene (4.3 mL) was added butylated hydroxytoluene (BHT, 118 mg, 0.53 mmol, 0.25 eq.) followed by (E)-(buta-1,3-dien-1-yloxy)(tert-butyl)dimethylsilane (792 mg, 4.3 mmol, 2.0 eq.). The mixture was carefully sparged with nitrogen and sealed before stirring, protected from the light, at 120 °C for 24 h. The crude reaction mixture was crudely purified through a short silica gel column with ethyl acetate and hexanes (5 to 30% gradient) to yield a 2:2:1 mixture (937 mg, 65% yield) of tert-butyl (2-((1R/S,5S/R,6S/R)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate:tert-butyl (2-((1R/S,5R/S,6S/R)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate:tert-butyl (2-((1S/R,2S/R,6R/S)-2-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate. From which the desired regio- and diastereomer, tert-butyl (2-((1R/S,5S/R,6S/R)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (370 mg) was isolated after C18 chromatography with 0.1% formic acid modified acetonitrile in water (30 to 100% gradient). MS *m/z* 692.1 $[M+Na]^+$ ^1H NMR (400

MHz, CHLOROFORM-*d*) δ : 7.21 (dd, *J* = 5.2, 1.3 Hz, 1H), 7.08 (s, 1H), 6.86 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.77 (d, *J* = 3.5 Hz, 1H), 5.83 – 5.73 (m, 1H), 5.65 (d, *J* = 10.3 Hz, 1H), 5.08 – 4.82 (m, 4H), 4.20 (td, *J* = 11.3, 6.0 Hz, 1H), 2.64 – 2.42 (m, 2H), 1.43 (s, 9H), 0.85 (s, 9H), 0.08 (s, 3H), 0.00 (s, 3H)

Step 2: (1S/R,5R/S,6S/R)-6-Amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol

To a solution of tert-butyl (3-chloro-2-((1R/S,5S/R,6S/R)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (94 mg, 0.14 mmol, 1.0 eq.) in methanol (1.4 mL) was added iron dust (78 mg, 1.4 mmol, 10 eq.) and ammonium chloride (374 mg, 7.0 mmol, 50 eq.) and the resulting suspension was stirred at 70 °C for 16 h. The suspension was neutralized with aqueous sodium bicarbonate filtered over Celite and the Celite was washed with ethyl acetate. The resulting bilayer was extracted with ethyl acetate and the combined extracts were washed with saturated sodium bicarbonate and brine. The organic layer was dried over $MgSO_4$, filtered and concentrated *in vacuo* to provide a residue (87 mg) that was used without further purification. The residue was dissolved in THF (1.1 mL) cooled to 0 °C and a solution of tetrabutylammonium fluoride (1.0 M, 0.14 mL) was added dropwise. The mixture was stirred at 0 °C for a further 20 minutes before being quenched with aqueous sodium bicarbonate and extracted with ethyl acetate. The combined organic extracts were washed with brine, dried over $MgSO_4$, filtered and concentrated *in vacuo* to yield a residue (48 mg) that was used without further purification. The residue was dissolved in 4M hydrochloric acid in dioxane (1 mL) and the solution was heated to 40 °C for 40 min. At which point the reaction mixture was concentrated *in vacuo* and purified by C18 chromatography with 0.1% formic acid modified acetonitrile in water (30 to 100% gradient) to yield (1S/R,5R/S,6S/R)-6-amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol (30 mg, 50% yield). MS *m/z* 425.9 $[M+H]^+$ ^1H NMR (METHANOL-d_4) δ : 7.21 (d, *J* = 5.1 Hz, 1H), 6.98 (s, 1H), 6.88 (t, *J* = 4.2 Hz, 1H), 6.51 (s, 1H), 5.71 (d, *J* = 11.0 Hz, 1H), 5.62 (d, *J* = 10.5 Hz, 1H), 4.66 (s, 2H), 4.07 (d, *J* = 8.2 Hz, 1H), 3.54 (q, *J* = 9.5 Hz, 1H), 3.12 (t, *J* = 10.1 Hz, 1H), 2.40 (s, 2H) (4 exchangeable protons not observed).

The compound below was prepared according to the procedure of Example 13 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
144	MS m/z 456.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 (dd, J = 5.1, 1.2 Hz, 1H), 7.10 (dd, J = 3.4, 1.0 Hz, 1H), 7.00 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 5.83 – 5.72 (m, 2H), 4.77 (s, 2H), 3.50 (dd, J = 10.1, 5.6 Hz, 1H), 3.31 – 3.24 (m, 1H), 2.59 – 2.47 (m, 2H), 2.46 – 2.34 (m, 1H), 2.18 – 2.05 (m, 1H). (3 exchangeable protons are not seen)
153	MS m/z 471.9 [M+H]+; 1H NMR (ACETONE-d6) δ: 8.13 (s, 1H), 7.37 (dd, J = 5.1, 1.2 Hz, 1H), 7.16 (d, J = 3.4 Hz, 1H), 7.00 (dd, J = 5.0, 3.5 Hz, 2H), 6.66 (s, 1H), 5.78 (s, 2H), 4.87 (dd, J = 6.0, 3.4 Hz, 2H), 4.28 (s, 1H), 3.95 – 3.80 (m, 2H), 2.52 (d, J = 17.8 Hz, 1H), 2.42 – 2.29 (m, 1H). Formic acid salt, (4, exchangeable protons not observed).
168	MS m/z 441.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.43 (s, 1H), 6.37 – 6.31 (m, 2H), 5.81 - 5.73 (m, 2H), 4.75 (d, J = 2.4 Hz, 2H), 3.57 – 3.45 (m, 1H), 3.29 - 3.22 (m, 1H), 2.58 - 2.36 (m, 3H), 2.16 - 2.03 (m, 1H). (3 exchangeable protons are not seen)
169	MS m/z 394.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.46-7.42 (m, 1H), 6.71 (s, 1H), 6.37-6.30 (m, 2H), 5.92-5.86 (m, 1H), 5.81-5.75 (m, 1H), 4.55 (s, 2H), 3.80-3.71 (m, 2H), 2.70-2.56 (m, 3H), 2.42-2.30 (m, 1H). (3 exchangeable protons are not seen)
170	MS m/z 395.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.40-7.30 (m, 1H), 6.30-6.20 (m, 2H), 5.60-5.58 (m, 2H), 4.63 (s, 2H), 3.46 (dd, J = 9.7, 5.6 Hz, 1H), 3.30 (d, J = 4.7 Hz, 1H), 2.51 – 2.30 (m, 3H), 2.19-1.98 (m, 1H). (3 exchangeable protons are not seen)
171	MS *m/z* 380.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.46 (dd, J = 1.9, 0.8 Hz, 1H), 6.66 (d, J = 1.3 Hz, 1H), 6.38 (dd, J = 3.3, 1.9 Hz, 1H), 6.34 (d, J = 3.3 Hz, 1H), 4.56 (s, 2H), 3.69 – 3.58 (m, 2H), 2.42 (s, 3H). (3, exchangeable protons not observed).
172	MS m/z 487.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.42 (d, J = 0.9 Hz, 1H), 6.34 (dt, J = 6.0, 2.9 Hz, 2H), 5.82 – 5.69 (m, 2H), 4.79 – 4.70 (m, 2H), 3.52 (td, J = 10.1, 5.5 Hz, 1H), 3.34 (s, 1H), 2.56 – 2.44 (m, 2H), 2.34 (q, J = 6.7 Hz, 1H), 2.15 – 2.03 (m, 1H). (3 exchangeable protons are not seen)
176	MS m/z 502.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 2.6 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (s, 1H), 5.78 (d, J = 12.7 Hz, 2H), 4.74 (s, 2H), 3.50 (dd, J = 10.1, 5.5 Hz, 1H), 3.36 (dd, J = 9.5, 5.4 Hz, 1H), 2.52 (d, J = 16.7 Hz, 2H), 2.42 – 2.32 (m, 1H), 2.05 (dd, J = 20.6, 17.8 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
178	MS m/z 411.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.78 (d, J = 3.2 Hz, 1H), 7.54 (d, J = 3.2 Hz, 1H), 6.56 (s, 1H), 5.88 - 5.61 (m, 2H), 4.90 (s, 2H), 3.55 - 3.40 (m, 1H), 3.28 – 3.15 (m, 1H), 2.61 - 2.35 (m, 3H), 2.20 - 2.00 (m, 1H). (3 exchangeable protons are not seen)
180	MS *m/z* 400.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.35 (dd, *J* = 1.9, 0.9 Hz, 1H), 6.62 (d, *J* = 0.8 Hz, 1H), 6.29 – 6.23 (m, 2H), 4.45 (s, 2H), 3.65 (s, 2H). (3, exchangeable protons not observed).
182	MS m/z 502.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 – 7.24 (m, 1H), 7.10 – 7.05 (m, 1H), 6.97 – 6.91 (m, 1H), 5.83 – 5.70 (m, 2H), 4.99 – 4.87 (m, 2H), 3.58 – 3.44 (m, 1H), 3.35 – 3.31 (m, 1H),2.61 – 2.42 (m, 2H), 2.39 – 2.25 (m, 1H), 2.16 – 2.02 (m, 1H). (3 exchangeable protons are not seen)
183	MS *m/z* 446.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (s, 1H), 6.25 (t, *J* = 3.2 Hz, 2H), 4.66 (d, *J* = 3.8 Hz, 2H), 3.49 (d, *J* = 10.0 Hz, 1H), 3.32 (d, *J* = 10.0 Hz, 1H). (3, exchangeable protons not observed).
184	MS m/z 374.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.57 (s, 1H), 6.37 – 6.29 (m, 2H), 5.77 (d, J = 7.3 Hz, 2H), 4.52 (s, 2H), 3.39 (ddd, J = 23.3, 21.7, 17.4 Hz, 2H), 2.58 – 2.40 (m, 3H), 2.37 (s, 3H), 2.17 (s, 1H). (3 exchangeable protons are not seen)
185	MS *m/z* 408.1 $[M-H]^•$; ^1H NMR (METHANOL-d_4) δ: 8.29 (s, 1H), 7.32 (d, *J* = 5.2 Hz, 1H), 7.11 (d, *J* = 3.4 Hz, 1H), 7.00 (t, *J* = 4.2 Hz, 1H), 6.63 (s, 1H), 5.92 (d, *J* = 10.3 Hz, 1H), 5.81 (d, *J* = 9.9 Hz, 1H), 4.77 (s, 2H), 3.79 (d, *J* = 5.9 Hz, 2H), 2.67 (dd, *J* = 15.9, 7.7 Hz, 3H), 2.39 (d, *J* = 16.6 Hz, 1H). Formic acid salt, (3, exchangeable protons not observed).
186	MS m/z 456.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 (dd, J = 5.1, 1.2 Hz, 1H), 7.10 (dd, J = 3.4, 1.0 Hz, 1H), 7.00 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 5.83 – 5.72 (m, 2H), 4.77 (s, 2H), 3.50 (dd, J = 10.1, 5.6 Hz, 1H), 3.31 – 3.24 (m, 1H), 2.59 – 2.47 (m, 2H), 2.46 – 2.34 (m, 1H), 2.18 – 2.05 (m, 1H). (3 exchangeable protons are not seen)
187	MS *m/z* 381.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (s, 1H), 6.24 (dd, *J* = 8.8, 2.7 Hz, 2H), 4.65 (d, *J* = 9.1 Hz, 2H), 3.39 (d, *J* = 10.2 Hz, 1H), 3.32 (d, *J* = 10.5 Hz, 1H), 2.26 (s, 3H). (3, exchangeable protons not observed).
188	MS m/z 486.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.63 (s, 1H), 6.37 – 6.29 (m, 2H), 5.79 (d, J = 12.0 Hz, 2H), 4.52 (s, 2H), 3.59 (ddd, J = 20.7, 12.0, 5.7 Hz, 2H), 2.53 (s, 2H), 2.47 (s, 1H), 2.21 (s, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
190	MS m/z 496.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.39 – 7.30 (m, 4H), 7.26 (t, J = 6.5 Hz, 1H), 6.39 (s, 1H), 5.78 (s, 2H), 4.56 (s, 2H), 3.56 (td, J = 9.8, 5.5 Hz, 1H), 3.49 – 3.38 (m, 1H), 2.49 (dd, J = 44.5, 10.3 Hz, 3H), 2.18 (s, 1H). (3 exchangeable protons are not seen)
191	MS m/z 456.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.27 (d, J = 4.1 Hz, 1H), 7.09 (d, J = 3.4 Hz, 1H), 6.94 (dd, J = 5.1, 3.6 Hz, 1H), 5.75 (s, 2H), 4.92 (d, J = 1.9 Hz, 2H), 3.55 – 3.47 (m, 1H), 3.28 – 3.23 (m, 1H), 2.48 (dd, J = 34.9, 18.3 Hz, 3H), 2.10 (s, 1H). (3 exchangeable protons are not seen)
193	MS m/z 375.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.42 (s, 1H), 6.33 (d, J = 7.8 Hz, 2H), 5.74 (s, 2H), 4.75-4.69 (m, 2H), 3.36-3.32 (m, 1H), 3.19-3.09 (m, 1H), 2.54-2.43 (m, 2H), 2.39-2.35 (m, 1H), 2.34 (s, 3H), 2.14-2.04 (m, 1H). (3 exchangeable protons are not seen)
194	MS m/z 450.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.39 – 7.31 (m, 4H), 7.26 (t, J = 6.5 Hz, 1H), 6.41 (s, 1H), 5.77 (s, 2H), 4.57 (s, 2H), 3.52 (td, J = 10.0, 5.5 Hz, 1H), 3.31 (s, 1H), 2.58 – 2.36 (m, 3H), 2.12 (dd, J = 15.7, 10.5 Hz, 1H). (3 exchangeable protons are not seen)
195	MS *m/z* 400.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.35 (dd, *J* = 1.9, 0.9 Hz, 1H), 6.62 (d, *J* = 0.8 Hz, 1H), 6.29 – 6.23 (m, 2H), 4.45 (s, 2H), 3.65 (s, 2H). (3, exchangeable protons not observed).
196	MS m/z 410.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.1 Hz, 1H), 7.09 (d, J = 2.6 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.64 (s, 1H), 5.91 (d, J = 10.4 Hz, 1H), 5.79 (d, J = 10.2 Hz, 1H), 4.75 (d, J = 9.3 Hz, 2H), 3.76 (d, J = 4.6 Hz, 2H), 2.65 (d, J = 16.4 Hz, 3H), 2.35 (d, J = 15.3 Hz, 1H). (3 exchangeable protons are not seen)
198	MS m/z 450.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.49 (dd, J = 4.6, 1.5 Hz, 2H), 7.42 (d, J = 6.1 Hz, 2H), 6.37 (s, 1H), 5.77 (s, 2H), 4.67 (s, 2H), 3.53 (td, J = 10.0, 5.5 Hz, 1H), 3.30 – 3.22 (m, 1H), 2.49 (dt, J = 26.4, 12.4 Hz, 3H), 2.20 – 2.05 (m, 1H). (3 exchangeable protons are not seen)
200	MS *m/z* 446.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.44 (s, 1H), 7.33 (s, 1H), 6.25 (t, *J* = 3.2 Hz, 2H), 4.66 (d, *J* = 3.8 Hz, 2H), 3.49 (d, *J* = 10.0 Hz, 1H), 3.32 (d, *J* = 10.0 Hz, 1H). Formic acid salt, (3, exchangeable protons not observed).
202	MS m/z 458.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.61 (s, 1H), 5.80-5.70 (m, 2H), 4.10-4.00 (m, 2H), 3.55-3.45 (m, 1H), 3.37 – 3.34 (m, 1H), 2.55-2.49 (m, 2H), 2.45-2.29 (m, 1H), 2.19-2.05 (m, 1H), 1.85-1.75 (m, 3H). (3 exchangeable protons are not seen)

Compound	Spectral Data
203	MS m/z 405.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.51 (d, J = 6.1 Hz, 2H), 7.44 (d, J = 5.8 Hz, 2H), 6.39 (s, 1H), 5.83 – 5.74 (m, 2H), 4.68 (d, J = 6.9 Hz, 2H), 3.53 (td, J = 10.0, 5.6 Hz, 1H), 3.29 (dd, J = 9.7, 5.4 Hz, 1H), 2.59 – 2.39 (m, 3H), 2.22 – 2.08 (m, 1H). (3 exchangeable protons are not seen)
205	MS *m/z* 396.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.57 (s, 1H), 7.31 (dt, *J* = 4.1, 1.9 Hz, 1H), 7.10 (d, *J* = 3.8 Hz, 1H), 7.00 (dd, *J* = 5.1, 3.3 Hz, 1H), 6.55 (d, *J* = 2.8 Hz, 1H), 4.77 (s, 2H), 3.49 – 3.36 (m, 2H), 2.40 (s, 3H). Formic acid salt, (3, exchangeable protons not observed).
206	MS m/z 440.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.69 (s, 1H), 6.38 – 6.32 (m, 2H), 5.90 (d, J = 10.1 Hz, 1H), 5.79 (d, J = 10.0 Hz, 1H), 4.54 (s, 2H), 3.77 (d, J = 6.4 Hz, 2H), 2.61 (s, 3H), 2.32 (d, J = 15.9 Hz, 1H). (3 exchangeable protons are not seen)
207	MS m/z 403.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.38 – 7.31 (m, 4H), 7.27 (d, J = 6.6 Hz, 1H), 6.42 (s, 1H), 5.77 (s, 2H), 4.57 (s, 2H), 3.50 (td, J = 10.0, 5.5 Hz, 1H), 3.27 (d, J = 10.1 Hz, 1H), 2.48 (dd, J = 27.9, 13.6 Hz, 3H), 2.16 (s, 1H). (3 exchangeable protons are not seen)
209	MS m/z 502.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 2.6 Hz, 1H), 6.97 (dd, J = 5.1, 3.5 Hz, 1H), 6.56 (s, 1H), 5.78 (d, J = 12.7 Hz, 2H), 4.74 (s, 2H), 3.50 (dd, J = 10.1, 5.5 Hz, 1H), 3.36 (dd, J = 9.5, 5.4 Hz, 1H), 2.52 (d, J = 16.7 Hz, 2H), 2.42 – 2.32 (m, 1H), 2.05 (dd, J = 20.6, 17.8 Hz, 1H). (3 exchangeable protons are not seen)
212	MS *m/z* 380.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.46 (dd, *J* = 1.9, 0.8 Hz, 1H), 6.66 (d, *J* = 1.3 Hz, 1H), 6.38 (dd, *J* = 3.3, 1.9 Hz, 1H), 6.34 (d, *J* = 3.3 Hz, 1H), 4.56 (s, 2H), 3.69 – 3.58 (m, 2H), 2.42 (s, 3H). (3, exchangeable protons not observed).
214	MS m/z 406.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.55-8.46 (m, 2H), 7.45-7.37 (m, 2H), 5.90 – 5.73 (m, 2H), 4.84-4.80(m, 2H), 3.70 – 3.45 (m, 2H), 2.61 – 2.50 (m, 2H), 2.23-2.21 (m, 1H), 1.95-1.93 (m, 1H). (3 exchangeable protons are not seen)
217	MS m/z 455.8 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.40 (s, 1H), 7.29 (s, 1H), 7.08 (d,J, J = 4.6 Hz, 1H), 6.56 (s, 1H), 5.90 (s, 1H), 5.81 (s, 1H), 4.58 (s, 2H), 3.80 (s, 2H), 2.63 (s, 3H), 2.36 (s, 1H). (3 exchangeable protons are not seen)
219	MS m/z 458.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 5.78 – 5.75 (m, 2H), 4.30 - 4.26 (m, 2H), 3.57 - 3.49 (m, 1H), 3.38 - 3.32 (m, 1H), 2.58 – 2.46 (m, 2H), 2.41 – 2.30 (m, 1H), 2.18 – 2.05 (m, 1H), 1.81 - 1.78 (m, 3H). (3 exchangeable protons are not seen)

Compound	Spectral Data
220	MS *m/z* 387.9 $[M-H]^-$; ^1H NMR (METHANOL-d_4) δ: 7.30 (d, *J* = 5.1 Hz, 1H), 7.08 (d, *J* = 3.5 Hz, 1H), 6.98 (dd, *J* = 5.7, 3.2 Hz, 1H), 6.52 (s, 1H), 5.78 (q, *J* = 7.3 Hz, 2H), 4.75 (s, 2H), 3.42 – 3.34 (m, 1H), 3.33 (s, 3H), 3.26 (td, *J* = 9.9, 5.3 Hz, 1H), 2.60 – 2.40 (m, 3H), 2.20 – 2.10 (m, 1H). (3, exchangeable protons not observed).
221	MS *m/z* 410.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.45 (s, 1H), 6.70-6.60 (m, 1H), 6.39 – 6.30 (m, 2H), 4.55 (s, 2H), 3.75-3.45 (m, 1H), 3.25-3.09 (m, 1H), 2.86 – 2.41 (m, 1H), 2.24 – 1.96 (m, 2H), 1.93-1.91 (m, 1H), 1.90-1.80 (m, 1H), 1.76-1.65 (m, 1H). (3, exchangeable protons not observed).
222	MS m/z 390.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.33 – 7.23 (m, 1H), 7.11 – 7.01 (m, 1H), 7.00 – 6.91 (m, 1H), 6.49 (s, 1H), 5.83 – 5.66 (m, 2H), 4.74 (s, 2H), 3.29 – 3.25 (m, 1H), 3.20 – 3.11 (m, 1H), 2.55 – 2.27 (m, 6H), 2.15 – 2.02 (m, 1H). (3 exchangeable protons are not seen)
223	MS m/z 392.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.72 (d, J = 3.4 Hz, 1H), 7.50 (d, J = 3.4 Hz, 1H), 5.88-5.73 (m, 2H), 5.1-4.98 (m, 2H), 3.54 – 3.47 (m, 1H), 3.46-3.37 (m, 1H), 2.61-2.53 (m, 2H), 2.49-2.42 (m, 1H), 2.37 (s, 3H), 2.29-2.16 (m, 1H). (3 exchangeable protons are not seen)
228	MS *m/z* 474.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (d, *J* = 5.2 Hz, 1H), 7.11 (d, *J* = 3.4 Hz, 1H), 7.00 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.66 (s, 1H), 4.79 (s, 2H), 3.73 – 3.65 (m, 1H), 3.63 – 3.52 (m, 1H), 3.26 – 3.12 (m, 1H), 2.21 – 2.14 (m, 1H), 2.13 – 2.04 (m, 1H), 2.00 – 1.92 (m, 1H), 1.60 (q, *J* = 11.5 Hz, 2H), 1.37 – 1.23 (m, 1H). Trifluoroacetic acid salt, (5, exchangeable protons not observed).
229	MS *m/z* 497.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (ddd, J = 28.3, 18.3, 7.3 Hz, 5H), 5.75 (s, 2H), 4.81 – 4.71 (m, 2H), 3.52 (td, J = 10.0, 5.4 Hz, 1H), 3.34 (s, 1H), 2.51 (t, J = 12.6 Hz, 2H), 2.40 – 2.27 (m, 1H), 2.09 (dd, J = 19.4, 9.1 Hz, 1H). (3, exchangeable protons not observed).
230	MS m/z 411.8 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.65 (d, J = 1.1 Hz, 1H), 5.78 (s, 2H), 4.09 (q, J = 2.3 Hz, 2H), 3.58 – 3.43 (m, 1H), 3.31 – 3.21 (m, 1H), 2.49 (ddd, J = 36.9, 20.8, 7.0 Hz, 3H), 2.23 – 1.98 (m, 1H), 1.82 (t, J = 2.4 Hz, 3H). (3 exchangeable protons are not seen)
233	MS *m/z* 422.4 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.46 – 7.43 (m, 1H), 6.65 – 6.60 (m, 1H), 6.38 – 6.28 (m, 2H), 4.53 (s, 2H), 3.51 – 3.38 (m, 1H), 3.23 – 3.15 (m, 1H), 2.40 – 2.02 (m, 5H), 1.69 (s, 7H). (3, exchangeable protons not observed).

Compound	Spectral Data
234	MS m/z 386.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.57 - 8.36 (m, 2H), 7.47 - 7.33 (m, 2H), 5.83 – 5.67 (m, 2H), 4.83 - 4.77 (m, 2H), 3.52 - 3.35 (m, 1H), 3.28 – 3.21 (m, 1H), 2.61 - 2.47 (m, 2H), 2.45 – 2.30 (m, 4H), 2.22 - 2.07 (m, 1H). (3 exchangeable protons are not seen)
236	MS m/z 424.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.56-8.52 (m, 1H), 8.38-8.34 (m, 1H), 7.45 – 7.32 (m, 1H), 5.79-5.66 (m, 2H), 4.76 (s, 2H), 3.15-3.02 (m, 2H), 2.45 – 2.32 (m, 2H), 2.29 – 2.19 (m, 1H), 2.04-1.94 (m, 1H). (3 exchangeable protons are not seen)
239	MS m/z 424.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.51 - 8.42 (m, 1H), 8.39 - 8.27 (m, 1H), 7.44 – 7.25 (m, 1H), 6.48 (s, 1H), 5.93 - 5.66 (m, 2H), 4.82 - 4.67 (m, 2H), 3.60 -3.45 (m, 1H), 3.37 - 3.32 (m, 1H), 2.67 – 2.33 (m, 3H), 2.25 - 2.04 (m, 1H). (3 exchangeable protons are not seen)
240	MS m/z 411.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.27 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (dd, J = 3.5, 1.0 Hz, 1H), 6.94 (dd, J = 5.1, 3.5 Hz, 1H), 5.78 – 5.71 (m, 2H), 4.92 (s, 2H), 3.48 (td, J = 10.0, 5.5 Hz, 1H), 3.22 (td, J = 9.5, 5.4 Hz, 1H), 2.53 – 2.33 (m, 3H), 2.15 – 2.03 (m, 1H). (3 exchangeable protons are not seen)
241	MS m/z 451.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.60 - 7.00 (m, 5H), 5.75 (d, J = 2.6 Hz, 2H), 4.81 – 4.72 (m, 2H), 3.60-3.40 (m, 1H), 3.30-3.20 (m, 1H), 2.55 – 2.32 (m, 3H), 2.13 – 2.01 (m, 1H). (3 exchangeable protons are not seen)
247	MS m/z 390.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.38 (dd, J = 4.9, 3.0 Hz, 1H), 7.27 (s, 1H), 7.08 (d, J = 4.5 Hz, 1H), 6.43 (s, 1H), 5.75 (s, 2H), 4.56 (s, 2H), 3.24 – 3.11 (m, 2H), 2.46 (dd, J = 31.9, 15.5 Hz, 3H), 2.34 (d, J = 15.1 Hz, 3H), 2.10 (s, 1H). (3 exchangeable protons are not seen)
249	MS *m/z* 440.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 6.63 (s, 1H), 4.15 – 3.99 (m, 2H), 3.58 – 3.42 (m, 1H), 3.26 – 3.17 (m, 1H), 2.42 – 2.00 (m, 4H), 1.79 (t, J = 2.3 Hz, 3H), 1.73 – 1.64 (m, 6H). (3, exchangeable protons not observed).
250	MS m/z 366.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.62 (d, J = 8.0 Hz, 1H), 5.81 – 5.71 (m, 2H), 4.07 (dd, J = 4.5, 2.2 Hz, 2H), 3.46 (td, J = 10.1, 5.5 Hz, 1H), 3.22 (td, J = 9.7, 5.3 Hz, 1H), 2.58 – 2.33 (m, 3H), 2.18 – 2.04 (m, 1H), 1.79 (t, J = 2.3 Hz, 3H). (3 exchangeable protons are not seen)
253	MS m/z 404.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.43-8.40 (m, 1H), 8.32-8.29 (m, 1H), 7.47-8.42 (m, 1H), 5.77-5.73 (m, 2H), 4.87 (s, 2H), 3.38-3.34 (m, 1H), 3.18-3.10 (m, 1H), 2.53-2.44 (m, 2H), 2.40-2.28 (m, 4H), 2.14 – 2.04 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
256	MS m/z 456.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 (dd, J = 5.1, 1.2 Hz, 1H), 7.10 (dd, J = 3.4, 1.0 Hz, 1H), 7.00 (dd, J = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 5.83 – 5.72 (m, 2H), 4.77 (s, 2H), 3.50 (dd, J = 10.1, 5.6 Hz, 1H), 3.31 – 3.24 (m, 1H), 2.59 – 2.47 (m, 2H), 2.46 – 2.34 (m, 1H), 2.18 – 2.05 (m, 1H). (3 exchangeable protons are not seen)
258	MS m/z 383.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.38 – 7.29 (m, 4H), 7.25 (t, J = 6.7 Hz, 1H), 6.31 (d, J = 8.9 Hz, 1H), 5.75 (s, 2H), 4.56 (s, 2H), 3.32 (s, 1H), 3.23 – 3.09 (m, 1H), 2.56 – 2.30 (m, 6H), 2.11 (s, 1H). (3 exchangeable protons are not seen)
261	MS *m/z* 396.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.20 (dd, *J* = 5.1, 1.4 Hz, 1H), 6.98 (d, *J* = 3.4 Hz, 1H), 6.88 (t, *J* = 4.4 Hz, 1H), 6.48 (s, 1H), 4.66 (s, 2H), 3.59 – 3.47 (m, 2H), 2.30 (s, 3H). (3, exchangeable protons not observed).
263	MS m/z 405.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.40 - 7.35 (m, 2H), 7.34 - 7.28 (m, 2H), 7.27 - 7.22 (m, 1H), 5.76 - 5.73 (m, 2H), 4.76 (s, 2H), 3.51 - 3.43 (m, 1H), 3.26 - 3.18 (m, 1H), 2.55 - 2.45 (m, 2H), 2.43 – 2.32 (m, 1H), 2.14 - 2.04m, 1H). (3 exchangeable protons are not seen)
268	MS m/z 391.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.25 (dd, J = 5.1, 1.1 Hz, 1H), 7.07 (d, J = 3.0 Hz, 1H), 6.93 (dd, J = 5.1, 3.5 Hz, 1H), 5.75 (t, J = 9.1 Hz, 2H), 4.92 (t, J = 9.1 Hz, 2H), 3.30 – 3.26 (m, 1H), 3.13 (td, J = 9.8, 5.3 Hz, 1H), 2.47 (dd, J = 10.0, 6.3 Hz, 2H), 2.39 – 2.26 (m, 4H), 2.13 – 2.02 (m, 1H). (3 exchangeable protons are not seen)
276	MS m/z 520.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.99 (t, J = 57.6 Hz, 1H), 7.43 (s, 1H), 6.38 – 6.32 (m, 2H), 5.75 (s, 2H), 4.80 (s, 2H), 4.04 (s, 1H), 2.86 (s, 1H), 2.48 (d, J = 19.3 Hz, 1H), 2.36 (d, J = 16.8 Hz, 1H), 2.06 (d, J = 14.6 Hz, 1H), 1.41 – 1.19 (m, 1H). (3 exchangeable protons are not seen)
278	MS *m/z* 390.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.40 – 7.33 (m, 4H), 7.31 – 7.25 (m, 1H), 6.45 – 6.42 (m, 1H), 4.60 (s, 2H), 3.70 – 3.59 (m, 2H), 2.42 (s, 3H). (3, exchangeable protons not observed).
287	MS m/z 468.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.33 (dt, J = 13.3, 6.9 Hz, 2H), 7.12 (dd, J = 12.9, 5.7 Hz, 2H), 6.44 (d, J = 7.7 Hz, 1H), 5.77 (d, J = 12.8 Hz, 2H), 4.61 (s, 2H), 3.50 (td, J = 10.0, 5.5 Hz, 1H), 3.30 – 3.23 (m, 1H), 2.59 – 2.35 (m, 3H), 2.18 – 2.01 (m, 1H). (3 exchangeable protons are not seen)
292	MS *m/z* 390.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.40 – 7.33 (m, 4H), 7.31 – 7.25 (m, 1H), 6.45 – 6.42 (m, 1H), 4.60 (s, 2H), 3.70 – 3.59 (m, 2H), 2.42 (s, 3H). (3, exchangeable protons not observed).

Compound	Spectral Data
294	MS *m/z* 469.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.31 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.13 – 7.03 (m, 1H), 6.99 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.59 (s, 1H), 5.72 (ddd, *J* = 9.9, 4.9, 2.4 Hz, 1H), 5.57 (dq, *J* = 9.9, 1.9 Hz, 1H), 4.77 (s, 2H), 3.55 (td, *J* = 10.8, 5.8 Hz, 1H), 2.85 (dd, *J* = 10.8, 8.9 Hz, 1H), 2.52 – 2.30 (m, 2H), 2.31 – 2.17 (m, 1H), 1.20 (d, *J* = 7.0 Hz, 3H). (3, exchangeable protons not observed).
297	MS *m/z* 381.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (s, 1H), 6.24 (dd, *J* = 8.8, 2.7 Hz, 2H), 4.65 (d, *J* = 9.1 Hz, 2H), 3.39 (d, *J* = 10.2 Hz, 1H), 3.32 (d, *J* = 10.5 Hz, 1H), 2.26 (s, 3H). (3, exchangeable protons not observed).
298	MS *m/z* 427.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.5 Hz, 1H), 7.03 – 6.98 (m, 1H), 6.67 (s, 1H), 4.79 (s, 2H), 3.67 (d, *J* = 10.2 Hz, 1H), 3.52 (s, 1H), 3.21 (s, 1H), 2.18 (d, *J* = 11.0 Hz, 1H), 2.09 (d, *J* = 13.5 Hz, 1H), 1.96 (d, *J* = 11.5 Hz, 1H), 1.79 (s, 1H), 1.60 (q, *J* = 12.0 Hz, 2H). (4, exchangeable protons not observed).
299	MS m/z 394.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.46-7.43 (m, 1H), 6.64 (s, 1H), 6.38 – 6.35 (m, 1H), 6.34-6.31 (m, 1H), 5.79-5.72 (m, 2H), 4.54 (s, 2H), 3.52-3.43 (m, 1H), 3.29-3.20 (m, 1H), 2.55-2.36 (m, 3H), 2.16-2.05 (m, 1H). (3 exchangeable protons are not seen)
300	MS m/z 412.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 0.6H, formic acid), 6.51 (s, 1H), 5.88 – 5.65 (m, 3H), 5.61 – 5.50 (m, 1H), 3.91 (d, *J* = 5.6 Hz, 2H), 3.66 – 3.56 (m, 1H), 3.54 – 3.42 (m, 1H), 2.63 – 2.41 (m, 3H), 2.25 – 2.12 (m, 1H), 1.72 (dd, *J* = 6.5, 1.6 Hz, 3H). (3 Exchangeable protons not observed).
302	MS m/z 368.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 0.5H, formic acid), 6.52 (s, 1H), 5.90 – 5.69 (m, 3H), 5.61 – 5.50 (m, 1H), 3.91 (d, *J* = 5.7 Hz, 2H), 3.59 (ddd, *J* = 9.8, 9.8, 5.7 Hz, 1H), 3.48 – 3.39 (m, 1H), 2.62 – 2.42 (m, 3H), 2.26 – 2.15 (m, 1H), 1.75 – 1.69 (m, 3H). (3 Exchangeable protons not observed).
306	MS m/z 346.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.61 (s, 1H), 5.82-5.69 (m, 2H), 4.10 – 4.02 (m, 2H), 3.32-3.27 (m, 1Hii),3.21 – 3.12 (m, 1H), 2.55 – 2.24 (m, 6H), 2.19 – 2.03 (m, 1H), 1.81-1.75 (m, 3H). (3 exchangeable protons are not seen)
310	MS m/z 440.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.45 (s, 1H), 6.64 (s, 1H), 6.38 – 6.35 (m, 1H), 6.33 (d, J = 3.2 Hz, 1H), 5.76 (s, 2H), 4.54 (s, 2H), 3.49 (dt, J = 10.2, 5.1 Hz, 1H), 3.28 – 3.20 (m, 1H), 2.54 – 2.46 (m, 2H), 2.43 – 2.34 (m, 1H), 2.12 (d, J = 9.6 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
322	MS *m/z* 392.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.29 – 7.20 (m, 4H), 7.20 – 7.11 (m, 1H), 6.32 (dd, *J* = 4.5, 2.4 Hz, 1H), 3.59 – 3.45 (m, 2H), 2.30 (s, 3H). (3, exchangeable protons not observed).
323	MS m/z 487.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.42 (d, J = 0.8 Hz, 1H), 6.34 (dt, J = 6.1, 3.2 Hz, 2H), 5.79 – 5.71 (m, 2H), 4.79 – 4.69 (m, 2H), 3.52 (td, J = 10.0, 5.4 Hz, 1H), 3.34 (d, J = 5.4 Hz, 1H), 2.56 – 2.45 (m, 2H), 2.39 – 2.29 (m, 1H), 2.15 – 2.03 (m, 1H). (3 exchangeable protons are not seen)
325	MS m/z 535.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.89 (t, J = 58.1 Hz, 1H), 7.24 (d, J = 5.1 Hz, 1H), 7.01 (s, 1H), 6.90 (dd, J = 5.0, 3.6 Hz, 1H), 6.59 (s, 1H), 5.65 (s, 2H), 4.66 (s, 2H), 3.95 (s, 1H), 2.74 (s, 1H), 2.33 (dd, J = 45.7, 18.2 Hz, 2H), 2.03 – 1.86 (m, 1H). (3 exchangeable protons are not seen)
326	MS m/z 385.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.37 (d, J = 7.3 Hz, 2H), 7.31 (t, J = 7.4 Hz, 2H), 7.24 (t, J = 7.2 Hz, 1H), 5.76 (s, 2H), 4.81 – 4.70 (m, 2H), 3.65 (s, 1H), 3.45 – 3.36 (m, 1H), 2.52 (d, J = 20.1 Hz, 2H), 2.38 (d, J = 27.5 Hz, 4H), 2.18 (s, 1H). (3 exchangeable protons are not seen)
327	MS m/z 486.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.44 (s, 1H), 6.61 (s, 1H), 6.37 – 6.29 (m, 2H), 5.76 (s, 2H), 4.52 (s, 2H), 3.52 (d, J = 5.4 Hz, 1H), 3.36 (d, J = 5.5 Hz, 1H), 2.51 (d, J = 18.3 Hz, 2H), 2.41 – 2.29 (m, 1H), 2.15 (s, 1H). (3 exchangeable protons are not seen)
329	MS *m/z* 472.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.4 Hz, 1H), 7.00 (t, *J* = 4.3 Hz, 1H), 6.66 (s, 1H), 5.96 (d, *J* = 10.7 Hz, 1H), 5.90 (d, *J* = 11.1 Hz, 1H), 4.79 (s, 2H), 4.69 (d, *J* = 7.8 Hz, 1H), 3.94 (q, *J* = 8.6 Hz, 1H), 3.71 (dd, *J* = 10.5, 7.8 Hz, 1H), 2.66 (d, *J* = 17.3 Hz, 1H), 2.46 – 2.35 (m, 1H). Trifluoroacetic acid salt, (5, exchangeable protons not observed).
332	MS m/z 438.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 0.6H, formic acid), 6.48 (d, *J* = 7.7 Hz, 1H), 5.92 – 5.72 (m, 2H), 5.58 (dd, *J* = 5.5, 3.4 Hz, 1H), 4.88 (s, 2H), 4.08 – 3.98 (m, 2H), 3.71 – 3.57 (m, 1H), 3.54 – 3.45 (m, 1H), 2.75 – 2.45 (m, 1H), 2.40 – 2.15 (m, 3H), 1.98 – 1.88 (m, 2H). (3 Exchangeable protons not observed).
340	MS m/z 413.6 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.73 (d, J = 3.6 Hz, 1H), 7.52 (d, J = 3.2 Hz, 1H), 5.83 - 5.65 (m, 2H), 5.07 (s, 2H), 3.57 - 3.45 (m, 1H), 3.27 - 3.17 (m, 1H), 2.59 – 2.31 (m, 3H), 2.17 - 2.04 (m, 1H). (3 exchangeable protons are not seen)
341	MS m/z 402.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 (dt, J = 13.2, 6.9 Hz, 2H), 7.12 (t, J = 8.5 Hz, 2H), 6.37 (s, 1H), 5.75 (s, 2H), 4.61 (s, 2H), 3.49 – 3.32 (m, 1H), 3.23 – 2.91 (m, 1H), 2.64 – 2.33 (m, 6H), 2.17 – 1.99 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
345	MS m/z 496.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.38 – 7.30 (m, 4H), 7.25 (ddd, J = 8.5, 4.0, 2.0 Hz, 1H), 6.37 (d, J = 7.9 Hz, 1H), 5.76 (s, 2H), 4.56 (s, 2H), 3.51 (td, J = 10.1, 5.5 Hz, 1H), 3.35 (dd, J = 9.7, 5.4 Hz, 1H), 2.58 – 2.29 (m, 3H), 2.16 – 2.04 (m, 1H). (3 exchangeable protons are not seen)
348	MS m/z 530.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.00 (t, J = 57.6 Hz, 1H), 7.40 (d, J = 7.3 Hz, 2H), 7.32 (t, J = 7.4 Hz, 2H), 7.26 (d, J = 7.2 Hz, 1H), 5.77 (s, 2H), 4.81 (s, 2H), 4.16 (s, 1H), 2.88 (s, 1H), 2.52 (d, J = 15.3 Hz, 1H), 2.39 (d, J = 16.8 Hz, 1H), 2.19 – 1.99 (m, 1H), 1.28 (s, 1H). (3 exchangeable protons are not seen)
352	MS m/z 529.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.00 (t, J = 57.9 Hz, 1H), 7.34 (dq, J = 28.4, 7.2 Hz, 5H), 6.54 (s, 1H), 5.76 (s, 2H), 4.56 (s, 2H), 4.09 (s, 1H), 3.34 (s, 1H), 2.84 (s, 1H), 2.44 (dd, J = 49.9, 15.4 Hz, 2H), 2.12 – 1.98 (m, 1H). (3 exchangeable protons are not seen)
355	MS *m/z* 474.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.5 Hz, 1H), 7.00 (t, *J* = 4.3 Hz, 1H), 6.66 (s, 1H), 4.80 (s, 2H), 3.92 (s, 1H), 3.59 – 3.35 (m, 2H), 2.18 (d, *J* = 11.0 Hz, 2H), 2.00 (s, 1H), 1.70 – 1.48 (m, 3H). Trifluoroacetic acid salt, (5, exchangeable protons not observed).
358	MS m/z 408.4$[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.89 (t, J = 58.2 Hz, 1H), 7.43 (d, J = 0.9 Hz, 1H), 6.38 – 6.31 (m, 2H), 5.74 (s, 2H), 4.79 (s, 2H), 3.58 – 3.45 (m, 1H), 3.22 – 3.10 (m, 1H), 2.47 (dt, J = 35.2, 18.3 Hz, 3H), 2.28 (s, 3H), 2.11 – 1.99 (m, 1H). (3 exchangeable protons are not seen)
362	MS m/z 502.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.27 (d,J, J = 4.4 Hz, 1H), 7.08 (d, J = 3.1 Hz, 1H), 6.94 (q, J = 5.0, 3.5 Hz, 1H), 5.82 – 5.70 (m, 2H), 5.00 – 4.86 (m, 2H), 3.59 – 3.43 (m, 1H), 3.38 – 3.32 (m, 1H), 2.59 – 2.43 (m, 2H), 2.41 – 2.27 (m, 1H), 2.18 – 1.99 (m, 1H). (3 exchangeable protons are not seen)
365	MS m/z 502.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.29 (d, J = 5.1 Hz, 1H), 7.07 (d, J = 3.4 Hz, 1H), 6.99 – 6.95 (m, 1H),6.55 (s, 1H), 5.76 (s, 2H), 4.74 (s, 2H), 3.50 (td, J = 10.2, 5.5 Hz, 1H), 3.37 – 3.32 (m, 1H), 2.51 (d, J =17.5 Hz, 2H), 2.36 (dd, J = 14.2, 10.4 Hz, 1H), 2.15 – 2.03 (m, 1H). (3 exchangeable protons are not seen)
366	MS m/z 430.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.58 (s, 0.4H, formic acid), 6.52 (s, 1H), 5.88 (d, *J* = 10.4 Hz, 1H), 5.79 (d, *J* = 10.4 Hz, 1H), 4.21 (s, 2H), 3.78 (s, 3H), 3.77 – 3.64 (m, 2H), 2.70 – 2.50 (m, 3H), 2.35 – 2.22 (m, 1H). (3 Exchangeable protons not observed).

Compound	Spectral Data
367	MS m/z 390.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.33 – 7.23 (m, 1H), 7.11 – 7.01 (m, 1H), 7.00 – 6.91 (m, 1H), 6.49 (s, 1H), 5.83 – 5.66 (m, 2H), 4.74 (s, 2H), 3.29 – 3.25 (m, 1H), 3.20 – 3.11 (m, 1H), 2.55 – 2.27 (m, 6H), 2.15 – 2.02 (m, 1H). (3 exchangeable protons are not seen)
369	MS *m/z* 400.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.35 (dd, J = 1.9, 0.9 Hz, 1H), 6.62 (d, J = 0.8 Hz, 1H), 6.29 – 6.23 (m, 2H), 4.45 (s, 2H), 3.65 (s, 2H). (3, exchangeable protons not observed).
372	MS *m/z* 446.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 (s, 1H), 6.25 (t, J = 3.2 Hz, 2H), 4.66 (d, J = 3.8 Hz, 2H), 3.49 (d, J = 10.0 Hz, 1H), 3.32 (d, J = 10.0 Hz, 1H). (3, exchangeable protons not observed).
373	MS m/z 450.8 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.49 (dd, J = 4.6, 1.5 Hz, 2H), 7.42 (d, J = 6.1 Hz, 2H), 6.37 (s, 1H), 5.77 (s, 2H), 4.67 (s, 2H), 3.52 (tt, J = 14.2, 7.1 Hz, 1H), 3.27 (s, 1H), 2.64 – 2.35 (m, 3H), 2.12 (dd, J = 16.1, 10.8 Hz, 1H). (3 exchangeable protons are not seen)
374	MS *m/z* 407.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.31 (dd, J = 5.3, 1.1 Hz, 1H), 7.10 (d, J = 3.4 Hz, 1H), 6.99 (dd, J = 5.1, 3.5 Hz, 1H), 6.58 (s, 1H), 4.78 (s, 2H), 3.74 – 3.61 (m, 1H), 3.39 (s, 1H), 3.14 (d, J = 10.8 Hz, 1H), 2.39 (s, 3H), 2.18 (d, J = 10.7 Hz, 1H), 2.06 (d, J = 13.7 Hz, 1H), 1.94 (d, J = 11.3 Hz, 1H), 1.79 – 1.66 (m, 1H), 1.59 (q, J = 12.8 Hz, 2H). Trifluoroacetic acid salt, (4, exchangeable protons not observed).
376	MS m/z 424.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.53 - 8.40 (m, 1H), 8.39 - 8.26 (m, 1H), 7.46 – 7.29 (m, 1H), 6.46 (s, 1H), 5.85 - 5.67 (m, 2H), 4.80 - 4.64 (m, 2H), 3.58 - 3.41 (m, 1H), 3.27 - 3.17 (m, 1H), 2.63 – 2.29 (m, 3H), 2.25 (m, 1H). (3 exchangeable protons are not seen)
377	MS *m/z* $[M+H]^+$ 425.9; ^1H NMR (METHANOL-d_4) δ: 7.21 (d, J = 5.1 Hz, 1H), 6.99 (d, J = 3.5 Hz, 1H), 6.93 – 6.83 (m, 1H), 6.54 (s, 1H), 5.77 (s, 2H), 4.67 (s, 2H), 4.51 (d, J = 8.7 Hz, 1H), 3.71 – 3.55 (m, 1H), 3.50 – 3.41 (m, 1H), 2.51 (d, J = 17.3 Hz, 1H), 2.22 (dd, J = 17.7, 9.5 Hz, 1H). (4, exchangeable protons not observed).
378	MS m/z 348.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 6.50 (s, 1H), 5.94 – 5.85 (m, 1H), 5.81 – 5.69 (m, 2H), 5.60 – 5.52 (m, 1H), 3.91 (d, J = 5.5 Hz, 2H), 3.70 – 3.56 (m, 2H), 2.70 – 2.50 (m, 3H), 2.40 (s, 3H), 2.39 – 2.28 (m, 1H), 1.71 (d, J = 6.6 Hz, 3H). (3 Exchangeable protons not observed).

Compound	Spectral Data
379	MS m/z 520.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.99 (t, J = 57.6 Hz, 1H), 7.43 (s, 1H), 6.38 – 6.32 (m, 2H), 5.75 (s, 2H), 4.80 (s, 2H), 4.04 (s, 1H), 2.86 (s, 1H), 2.48 (d, J = 19.3 Hz, 1H), 2.36 (d, J = 16.8 Hz, 1H), 2.06 (d, J = 14.6 Hz, 1H), 1.41 – 1.19 (m, 1H). (3 exchangeable protons are not seen)
380	MS m/z 410.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.78 (d, J = 3.2 Hz, 1H), 7.54 (d, J = 3.2 Hz, 1H), 6.56 (s, 1H), 5.82 - 5.70 (m, 2H), 4.90 (s, 2H), 3.62 - 3.42 (m, 1H), 3.30 - 3.15 (m, 1H), 2.60 - 2.35 (m, 3H), 2.20 - 2.00 (m, 1H). (3 exchangeable protons are not seen)
382	MS m/z 374.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.56 (s, 1H), 6.35 (d, J = 1.8 Hz, 1H), 6.31 (s, 1H), 5.75 (s, 2H), 4.52 (s, 2H), 3.34 (d, J = 4.0 Hz, 1H), 3.20 (d, J = 19.8 Hz, 1H), 2.46 (dd, J = 32.2, 16.5 Hz, 3H), 2.36 (s, 3H), 2.17 – 2.05 (m, 1H). (3 exchangeable protons are not seen)
385	MS m/z 454.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.28 (d, J = 5.1 Hz, 1H), 7.09 (d, J = 3.5 Hz, 1H), 6.96 – 6.92 (m, 1H), 5.81 (d, J = 22.5 Hz, 2H), 4.93 (d, J = 5.8 Hz, 2H), 3.72 – 3.56 (m, 2H), 2.56 (d, J = 15.9 Hz, 3H), 2.27 (s, 1H). (3 exchangeable protons are not seen)
386	MS m/z 458.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.61 (s, 1H), 5.80-5.70 (m, 2H), 4.10-4.00 (m, 2H), 3.55-3.45 (m, 1H), 3.37 – 3.34 (m, 1H), 2.55-2.49 (m, 2H), 2.45-2.29 (m, 1H), 2.19-2.05 (m, 1H), 1.85-1.75 (m, 3H). (3 exchangeable protons are not seen)
396	MS m/z 441.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.43 (s, 1H), 6.37 – 6.31 (m, 2H), 5.81 - 5.73 (m, 2H), 4.75 (d, J = 2.4 Hz, 2H), 3.57 – 3.45 (m, 1H), 3.29 - 3.22 (m, 1H), 2.58 - 2.36 (m, 3H), 2.16 - 2.03 (m, 1H). (3 exchangeable protons are not seen)
397	MS m/z 411.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.27 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (dd, J = 3.5, 1.0 Hz, 1H), 6.94 (dd, J = 5.1, 3.5 Hz, 1H), 5.78 – 5.71 (m, 2H), 4.92 (s, 2H), 3.48 (td, J = 10.0, 5.5 Hz, 1H), 3.22 (td, J = 9.5, 5.4 Hz, 1H), 2.53 – 2.33 (m, 3H), 2.15 – 2.03 (m, 1H). (3 exchangeable protons are not seen)
399	MS m/z 418.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.90 (t, J = 58.2 Hz, 1H), 7.39 (d, J = 7.4 Hz, 2H), 7.35 – 7.28 (m, 2H), 7.28 – 7.22 (m, 1H), 5.81 – 5.66 (m, 2H), 4.80 (s, 2H), 3.61 – 3.42 (m, 1H), 3.23 – 3.09 (m, 1H), 2.60 – 2.44 (m, 2H), 2.39 (dd, J = 17.0, 5.6 Hz, 1H), 2.28 (s, 3H), 2.13 – 1.97 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
402	MS *m/z* 469.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.13 – 7.08 (m, 1H), 7.00 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.63 (s, 1H), 5.81 – 5.73 (m, 1H), 5.67 (d, *J* = 10.1 Hz, 1H), 4.78 (s, 2H), 3.44 (s, 1H), 3.26 – 3.21 (m, 1H), 2.70 (s, 1H), 2.57 (d, *J* = 17.4 Hz, 1H), 2.20 (t, *J* = 13.9 Hz, 1H), 0.99 (d, *J* = 7.1 Hz, 3H). (3, exchangeable protons not observed).
403	MS m/z 448.3 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.41 – 7.31 (m, 4H), 7.27 (d, J = 6.5 Hz, 1H), 6.41 (s, 1H), 5.77 (s, 2H), 4.57 (s, 2H), 3.54 (dt, J = 10.1, 4.9 Hz, 1H), 3.36 (d, J = 9.3 Hz, 1H), 2.61 – 2.37 (m, 3H), 2.17 (s, 1H). (3 exchangeable protons are not seen)
404	MS m/z 403.8 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.38 – 7.31 (m, 4H), 7.27 (d, J = 6.5 Hz, 1H), 6.41 (s, 1H), 5.76 (s, 2H), 4.57 (s, 2H), 3.48 (td, J = 10.1, 5.6 Hz, 1H), 3.29 – 3.20 (m, 1H), 2.57 – 2.32 (m, 3H), 2.10 (dd, J = 14.4, 9.6 Hz, 1H). (3 exchangeable protons are not seen)
411	MS m/z 468.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.33 (dt, J = 20.5, 6.7 Hz, 2H), 7.13 (dd, J = 12.6, 6.0 Hz, 2H), 6.44 (d, J = 11.0 Hz, 1H), 5.77 (d, J = 6.4 Hz, 2H), 4.62 (s, 2H), 3.85 – 3.36 (m, 2H), 2.62 – 2.38 (m, 3H), 2.12 (dd, J = 15.4, 10.4 Hz, 1H). (3 exchangeable protons are not seen)
413	MS *m/z* 375.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.42 (s, 1H), 6.36 – 6.30 (m, 2H), 5.82-5.72 (m, 2H), 4.77-4.71m, 2H), 3.47 – 3.41 (m, 1H), 3.37-3.33 (m, 1H), 2.59-2.49 (m, 2H), 2.46-2.40 (m, 1H), 2.35 (s, 3H), 2.224-2.14 (m, 1H). (3, exchangeable protons not observed).
414	MS m/z 497.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.30 (ddd, J = 28.1, 18.2, 7.2 Hz, 5H), 5.75 (s, 2H), 4.80 – 4.71 (m, 2H), 3.51 (td, J = 10.1, 5.5 Hz, 1H), 3.33 (s, 1H), 2.57 – 2.43 (m, 2H), 2.39 – 2.28 (m, 1H), 2.09 (dd, J = 18.8, 9.3 Hz, 1H). (3 exchangeable protons are not seen)
415	MS m/z 496.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.39 (d, J = 2.7 Hz, 1H), 7.28 (s, 1H), 7.09 (d, J = 4.8 Hz, 1H), 6.50 (s, 1H), 5.76 (s, 2H), 4.57 (s, 2H), 3.49 (s, 1H), 3.26 (s, 1H), 2.56 – 2.35 (m, 3H), 2.11 (s, 1H). (3 exchangeable protons are not seen)
417	MS m/z 437.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.97 (t, J = 58.0 Hz, 1H), 7.42 – 7.25 (m, 5H), 6.53 (s, 1H), 5.76 – 5.71 (m, 2H), 4.57 (s, 2H), 3.92 – 3.75 (m, 1H), 3.24 (td, J = 11.2, 5.6 Hz, 1H), 2.84 – 2.67 (m, 1H), 2.57 – 2.31 (m, 2H), 2.06 (dd, J = 15.3, 10.3 Hz, 1H). (3 exchangeable protons are not seen)
419	MS m/z 390.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.39 (s, 1H), 7.27 (s, 1H), 7.08 (d, J = 5.1 Hz, 1H), 6.49 (s, 1H), 5.88 (s, 1H), 5.79 (s, 1H), 4.57 (s, 2H), 3.64 (s, 2H), 2.75 – 2.52 (m, 3H), 2.39 (s, 3H), 2.37 – 2.29 (m, 1H). (3 exchangeable protons are not seen)

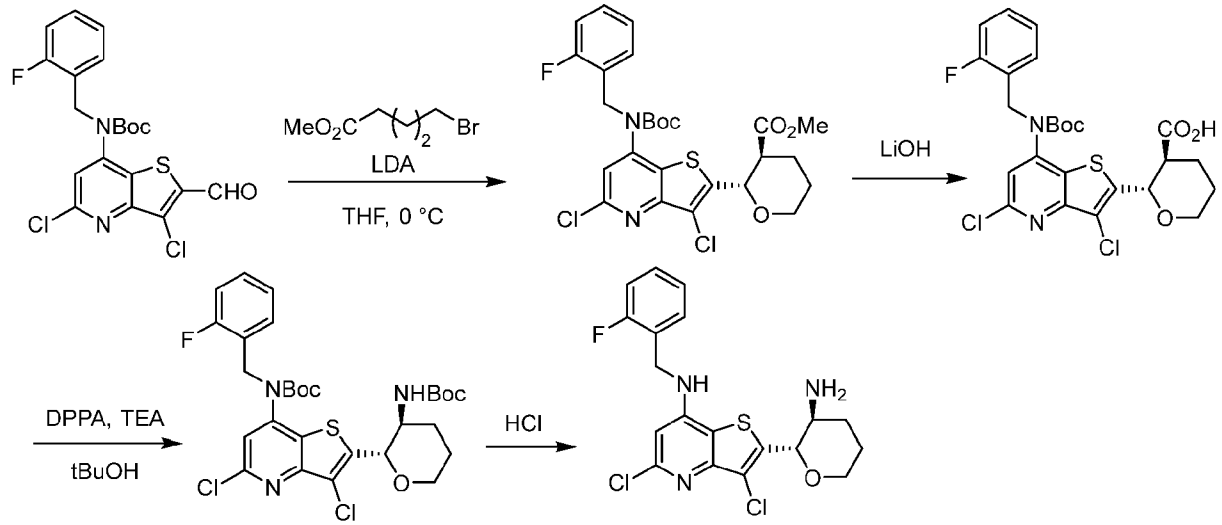
Compound	Spectral Data
420	MS m/z 437.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.97 (t, J = 58.0 Hz, 1H), 7.43 – 7.24 (m, 5H), 6.54 (s, 1H), 5.76 – 5.72 (m, 2H), 4.57 (s, 2H), 3.89 – 3.76 (m, 1H), 3.24 (td, J = 11.3, 5.5 Hz, 1H), 2.75 (t, J = 12.5 Hz, 1H), 2.55 – 2.30 (m, 2H), 2.06 (dd, J = 15.2, 10.2 Hz, 1H). (3 exchangeable protons are not seen)
424	MS m/z 530.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.00 (t, J = 57.7 Hz, 1H), 7.39 (d, J = 7.4 Hz, 2H), 7.32 (t, J = 7.4 Hz, 2H), 7.25 (t, J = 7.3 Hz, 1H), 5.74 (s, 2H), 4.81 (s, 2H), 4.00 (s, 1H), 2.87 (s, 1H), 2.47 (d, J = 16.1 Hz, 1H), 2.35 (d, J = 17.8 Hz, 1H), 2.03 (t, J = 11.4 Hz, 1H), 1.26 (d, J = 19.4 Hz, 1H). (3 exchangeable protons are not seen)
427	MS m/z 535.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.01 (t, J = 58.2 Hz, 1H), 7.36 (d, J = 5.1 Hz, 1H), 7.14 (d, J = 3.4 Hz, 1H), 7.05 – 6.99 (m, 1H), 6.70 (s, 1H), 5.77 (s, 2H), 4.78 (s, 2H), 4.06 (s, 1H), 2.85 (s, 1H), 2.44 (dd, J = 46.7, 18.8 Hz, 2H), 2.06 (s, 1H). (3 exchangeable protons are not seen)
429	MS m/z 411.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 6.63 (d, J = 4.1 Hz, 1H), 5.75 (s, 2H), 4.06 (d, J = 2.2 Hz, 2H), 3.49 (td, J = 10.2, 5.2 Hz, 1H), 3.25 (dd, J = 14.8, 9.4 Hz, 1H), 2.44 (dd, J = 37.6, 10.1 Hz, 3H), 2.24 – 2.00 (m, 1H), 1.79 (t, J = 2.3 Hz, 3H). (3 exchangeable protons are not seen)
431	MS *m/z* 408.1 $[M-H]^-$; ^1H NMR (METHANOL-d_4) δ: 8.29 (s, 1H), 7.32 (d, *J* = 5.2 Hz, 1H), 7.11 (d, *J* = 3.4 Hz, 1H), 7.00 (t, *J* = 4.2 Hz, 1H), 6.63 (s, 1H), 5.92 (d, *J* = 10.3 Hz, 1H), 5.81 (d, *J* = 9.9 Hz, 1H), 4.77 (s, 2H), 3.79 (d, *J* = 5.9 Hz, 2H), 2.67 (dd, *J* = 15.9, 7.7 Hz, 3H), 2.39 (d, *J* = 16.6 Hz, 1H). Formic acid salt, (3, exchangeable protons not observed).
433	MS m/z 405.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.49 (d, J = 6.0 Hz, 2H), 7.42 (d, J = 5.7 Hz, 2H), 6.38 (s, 1H), 5.77 (s, 2H), 4.67 (s, 2H), 3.48 (m, 1H), 3.25 m, 1H), 2.44 (m, 3H), 2.09 (m, 1H). (3 exchangeable protons are not seen)
434	MS m/z 451.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.30 (ddd, J = 28.1, 18.1, 7.4 Hz, 5H), 5.77 (d, J = 14.9 Hz, 2H), 4.82 – 4.70 (m, 2H), 3.55 – 3.44 (m, 1H), 3.25 (dd, J = 9.4, 5.5 Hz, 1H), 2.59 – 2.29 (m, 3H), 2.11 (d, J = 9.4 Hz, 1H). (3 exchangeable protons are not seen)
435	MS m/z 404.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.43-8.40 (m, 1H), 8.33-8.28 (m, 1H), 7.47-7.42 (m, 1H), 5.77-5.72 (m, 2H), 4.87 (s, 2H), 3.38-3.32 (m, 1H), 3.19-3.10 (m, 1H), 2.54-2.45 (m, 2H), 2.39 – 2.30 (m, 4H), 2.14 – 2.01 (m, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
436	MS m/z 386.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.57 - 8.36 (m, 2H), 7.47 - 7.33 (m, 2H), 5.83 – 5.67 (m, 2H), 4.83 - 4.77 (m, 2H), 3.52 - 3.35 (m, 1H), 3.28 – 3.21 (m, 1H), 2.61 - 2.47 (m, 2H), 2.45 – 2.30 (m, 4H), 2.22 - 2.07 (m, 1H). (3 exchangeable protons are not seen)
437	MS m/z 395.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.40-7.30 (m, 1H), 6.30-6.20 (m, 2H), 5.60-5.58 (m, 2H), 4.63 (s, 2H), 3.46 (dd, J = 9.7, 5.6 Hz, 1H), 3.30 (d, J = 4.7 Hz, 1H), 2.51 – 2.30 (m, 3H), 2.19-1.98 (m, 1H). (3 exchangeable protons are not seen)
438	MS *m/z* 440.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 6.63 (s, 1H), 4.15 – 3.99 (m, 2H), 3.58 – 3.42 (m, 1H), 3.26 – 3.17 (m, 1H), 2.42 – 2.00 (m, 4H), 1.79 (t, J = 2.3 Hz, 3H), 1.73 – 1.64 (m, 6H). (3, exchangeable protons not observed).
439	MS m/z 424.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.55-8.35 (m, 1H), 8.38-8.35 (m, 1H), 7.44 – 7.37 (m, 1H), 5.8-5.5(m, 2H), 4.76 (s, 2H), 3.11 – 3.02 (m, 2H), 2.2.45-2.19 (m, 2H), 2.27 – 2.19 (m, 1H), 2.04-1.94 (m, 1H). (3 exchangeable protons are not seen)
440	MS m/z 406.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.50-8.45(m, 2H), 7.45-7.39 (m, 2H), 5.85-5.70 (m, 2H), 4...84-4.78 (m, 2H), 3.54 – 3.44 (m, 1H), 3.28-3.15 (m, 1H), 2.59 – 2.35 (m, 3H), 2.16-2.02 (m, 1H). (3 exchangeable protons are not seen)
441	MS m/z 392.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.72 (d, J = 3.4 Hz, 1H), 7.50 (d, J = 3.4 Hz, 1H), 5.87-5.73 (m, 2H), 5.1-5.02 (m, 2H), 3.57-3.49 (m, 1H), 3.36-3.47 (m, 1H), 2.64-2.52 (m, 2H), 2.50-2.43 (m, 1H), 2.37 (s, 3H), 2.28-2.16 (m, 1H). (3 exchangeable protons are not seen)
444	MS *m/z* 422.4 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.46 – 7.43 (m, 1H), 6.65 – 6.60 (m, 1H), 6.38 – 6.28 (m, 2H), 4.53 (s, 2H), 3.51 – 3.38 (m, 1H), 3.23 – 3.15 (m, 1H), 2.40 – 2.02 (m, 5H), 1.69 (s, 7H). (3, exchangeable protons not observed).
448	MS *m/z* 450.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 6.54 (s, 1H), 5.79 – 5.68 (m, 1H), 5.55 – 5.46 (m, 1H), 4.10 (dd, *J* = 25.6, 11.5 Hz, 1H), 4.03 (s, 2H), 3.75 – 3.62 (m, 1H), 2.40 – 2.30 (m, 1H), 2.29 – 2.22 (m, 1H), 2.15 – 1.98 (m, 2H), 1.85 – 1.77 (m, 4H), 1.77 – 1.69 (m, 1H). (3 Exchangeable protons not observed).
449	MS *m/z* 381.0 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (s, 1H), 6.24 (dd, *J* = 8.8, 2.7 Hz, 2H), 4.65 (d, *J* = 9.1 Hz, 2H), 3.39 (d, *J* = 10.2 Hz, 1H), 3.32 (d, *J* = 10.5 Hz, 1H), 2.26 (s, 3H). (3, exchangeable protons not observed).

Compound	Spectral Data
450	MS *m/z* 422.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.48 (s, 1H), 6.74 – 6.60 (m, 1H), 6.38 (dd, J = 8.2, 2.5 Hz, 2H), 5.87 –5.72 (m, 1H), 5.55 (d, J = 10.0 Hz, 1H), 4.60 – 4.55 (m, 2H), 3.89 – 3.66 (m, 1H), 3.15 (s, 1H), 2.71 (d, J = 5.9 Hz, 1H), 2.29 (s, 1H), 1.26 (t, J = 7.8 Hz, 3H), 0.97 (d, J = 7.2 Hz, 3H) (3, exchangeable protons not observed).

Example 14

Preparation of Compound 24



Step 1: Methyl (2S,3S)-2-(7-((tert-butoxycarbonyl)(2-fluorobenzyl)amino)-3,5-dichlorothieno[3,2-b]pyridin-2-yl)tetrahydro-2H-pyran-3-carboxylate

To a solution of tert-butyl N-(3,5-dichloro-2-formyl-thieno[3,2-b]pyridin-7-yl)-N-[(2-fluorophenyl)methyl]carbamate (500 mg, 1.1 mmol), prepared according to the procedure for Intermediate 1, and methyl 5-bromovalerate (0.2 mL, 1 mmol) in THF (5 mL), cooled to 0 °C was added lithium diisopropylamide (2.0 M) in THF/heptane/ethylbenzene (1.2 mL, 2.4 mmol, 2.3 eq). dropwise. The ice bath was removed and the reaction was stirred at rt for 16 h. The reaction was quenched with NH_4Cl (sat. aq.). The reaction mixture was diluted with EtOAc and washed with water and brine. The combined organic layers were dried over $MgSO_4$, filtered, and concentrated *in vacuo*. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetate in hexanes (0-40% gradient) to afford methyl (2S,3S)-2-[7-[tert-butoxycarbonyl-[(2-fluorophenyl)methyl]amino]-3,5-dichloro-thieno[3,2-b]pyridin-2-yl]tetrahydropyran-3-carboxylate (167 mg, 27 % Yield) as a light yellow oil. MS *m/z* 568.8, 570.7 $[M+H]^+$; ^1H NMR (CHLOROFORM-*d*) δ: 7.21-7.36 (m, 2H),

6.94-7.16 (m, 3H), 5.16 (d, *J*=10.1 Hz, 1H), 4.93-5.08 (m, 2H), 4.15-4.22 (m, 1H), 3.63-3.77 (m, 1H), 3.54 (s, 3H), 2.77 (ddd, *J*=12.0, 10.1, 3.8 Hz, 1H), 2.15-2.29 (m, 1H), 1.96-2.07 (m, 1H), 1.79 (br s, 2H), 1.43 (s, 9H).

Step 2: (2S,3S)-2-(7-((tert-Butoxycarbonyl)(2-fluorobenzyl)amino)-3,5-dichlorothieno[3,2-b]pyridin-2-yl)tetrahydro-2H-pyran-3-carboxylic acid

A mixture of methyl (2S,3S)-2-[7-[tert-butoxycarbonyl-[(2-fluorophenyl)methyl]amino]-3,5-dichloro-thieno[3,2-b]pyridin-2-yl]tetrahydropyran-3-carboxylate (167 mg, 0.3 mmol), aqueous lithium hydroxide (2.2 mL, 2.2 mmol, 1 mol/L) and methanol (5 mL) was stirred at 50 °C for 2 hr. Cooled to rt and concentrated. Diluted with DCM and neutralized with 1M Citric acid. Organic phase was separated and concentrated to afford crude tert-butyl N-[3,5-dichloro-2-[(2S)-tetrahydropyran-2-yl]thieno[3,2-b]pyridin-7-yl]-N-[(2-fluorophenyl)methyl]carbamate;carbon dioxide (126 mg, 77 % Yield) which was used in the next step without further purification. MS *m/z* 554.8, 556.8 $[M+H]^+$.

Step 3: tert-Butyl (2-((2S,3S)-3-((tert-butoxycarbonyl)amino)tetrahydro-2H-pyran-2-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl)(2-fluorobenzyl)carbamate

A mixture of tert-butyl N-[3,5-dichloro-2-[(2S)-tetrahydropyran-2-yl]thieno[3,2-b]pyridin-7-yl]-N-[(2-fluorophenyl)methyl]carbamate;carbon dioxide (126 mg, 0.2 mmol), triethylamine (0.06 mL, 0.4 mmol, 2.0 eq), diphenylphosphoryl azide (0.1 mL, 0.5 mmol, 2.0 eq), and tert-butyl alcohol (2 mL) was heated at 50 °C for 1h. The reaction mixture was then cooled to rt and concentrated. The crude residue was purified on silica gel eluting with ethyl acetates in hexane (0-40%) to afford tert-butyl N-[2-[(2S,3S)-3-(tert-butoxycarbonylamino)tetrahydropyran-2-yl]-3,5-dichloro-thieno[3,2-b]pyridin-7-yl]-N-[(2-fluorophenyl)methyl]carbamate (85 mg, 60% Yield). MS *m/z* 625.8, 627.6 $[M+H]^+$; ^{1}H NMR (CHLOROFORM-*d*) δ: 7.22-7.27 (m, 2H), 6.96-7.12 (m, 3H), 5.02 (s, 2H), 4.75 (d, *J*=9.6 Hz, 1H), 4.49-4.61 (m, 1H), 4.16-4.19 (m, 1H), 3.66-3.79 (m, 1H), 3.50-3.64 (m, 1H), 2.22-2.33 (m, 1H), 1.78-1.99 (m, 2H), 1.61-1.69 (m, 1H), 1.44 (s, 9H), 1.18 (s, 9H).

Step 4: 2-((2S,3S)-3-Aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine

A mixture of tert-butyl N-[3,5-dichloro-2-[rac-(2S,3S)-3-(tert-butoxycarbonylamino)tetrahydropyran-2-yl]thieno[3,2-b]pyridin-7-yl]-N-[(2-fluorophenyl)methyl]carbamate (85 mg, 0.1mmol) and HCl (4 M in dioxane) (2 mL) was

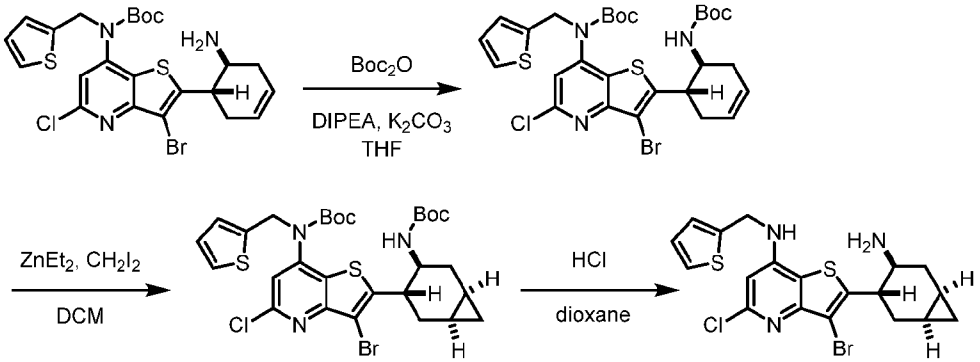
stirred at rt for 2h. Reaction mixture was concentrated and the solid was triturated with Et_2O and filtered to afford 3,5-dichloro-N-[(2-fluorophenyl)methyl]-2-[rac-(2S,3S)-3-aminotetrahydropyran-2-yl]thieno[3,2-b]pyridin-7-amine hydrochloride (72 mg, 69% Yield). MS *m/z* 425.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33-7.50 (m, 2H), 7.11-7.23 (m, 2H), 6.78 (s, 1H), 5.01 (d, *J*=9.8 Hz, 1H), 4.74 (s, 2H), 4.09-4.23 (m, 1H), 3.67-3.77 (m, 1H), 3.41 (td, *J*=10.4, 4.1 Hz, 1H), 2.28-2.41 (m, 1H), 1.82-1.97 (m, 3H) (4 exchangeable protons not observed).

The compounds below were prepared according to the procedure of Example 14 by substituting the appropriate starting materials, reagents, and reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
25	MS m/z 378.0 [M+H]+; 1HNMR(400 MHz, METHANOL-d4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.57 (s, 1H), 6.38 – 6.33 (m, 1H), 6.30 (d, J = 3.1 Hz, 1H), 4.53 (t, J = 4.6 Hz, 3H), 4.02 (s, 1H), 3.60 (d, J = 2.8 Hz, 1H), 2.88 (d, J = 2.0 Hz, 1H), 2.41 (s, 3H), 2.15 (d, J = 11.3 Hz, 1H), 1.85 (d, J = 50.0 Hz, 2H), 1.55 (dd, J = 11.6, 4.5 Hz, 1H). (3 exchangeable protons are not seen)

Example 15

Preparation of Compound 290



Step 1: tert-Butyl (3-bromo-2-((1S/R,6S/R)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (2-((1S/R,6S/R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (201 mg, 0.36 mmol) (prepared according to Example 13 using Intermediate 20) in THF (1.8 mL) was added potassium carbonate (100 mg, 0.73 mmol, 2.0 eq) and diisopropylethylamine (0.127 mL, 0.73

mmol, 2.0 eq). The mixture was stirred until the starting material was consumed as determined by UPLCMS. The reaction mixture was separated between NH_4Cl (sat. aq.) (15 mL) and ethyl acetate (15 mL). The aqueous layer was extracted with EtOAc (15 ml x2). The combined organic layers were washed with brine, dried over $MgSO_4$, filtered, and then concentrated onto Celite. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetates in hexanes to give tert-butyl (3-bromo-2-((1S/R,6S/R)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (200 mg, 0.31 mmol, 84% yield) as a white solid. MS *m/z* 677.9 $[M+Na]^+$

Step 2: tert-Butyl (3-bromo-2-((1S/R,3S/R,4S/R,6R/S)-4-((tert-butoxycarbonyl)amino)bicyclo[4.1.0]heptan-3-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

A solution of diethyl zinc (1 M in CH_2Cl, 0.46 mL, 0.46 mmol) was added to CH_2Cl_2 (0.76 mL) at 0 °C then diiodomethane (0.055 mL, 0.69 mmol) was added dropwise. After stirring for 1 h 0 °C, a solution of tert-butyl (3-bromo-2-((1S/R,6S/R)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (50 mg, 0.076 mmol) in CH_2Cl_2 (0.2 mL) was added and the reaction was allowed to come to 25 °C overnight with stirring. The resulting mixture was diluted in CH_2Cl_2 washed with NH_4Cl (sat. aq.) and brine, dried over $MgSO_4$, filtered, and then concentrated onto Celite. The crude residue was purified by flash column chromatography on silica gel eluting with ethyl acetates in hexanes to give tert-butyl (3-bromo-2-((1S/R,3S/R,4S/R,6R/S)-4-((tert-butoxycarbonyl)amino)bicyclo[4.1.0]heptan-3-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (31 mg, 0.0.46 mmol, 61% yield) as a single diastereomer and a white solid. MS *m/z* 691.9 $[M+Na]^+$

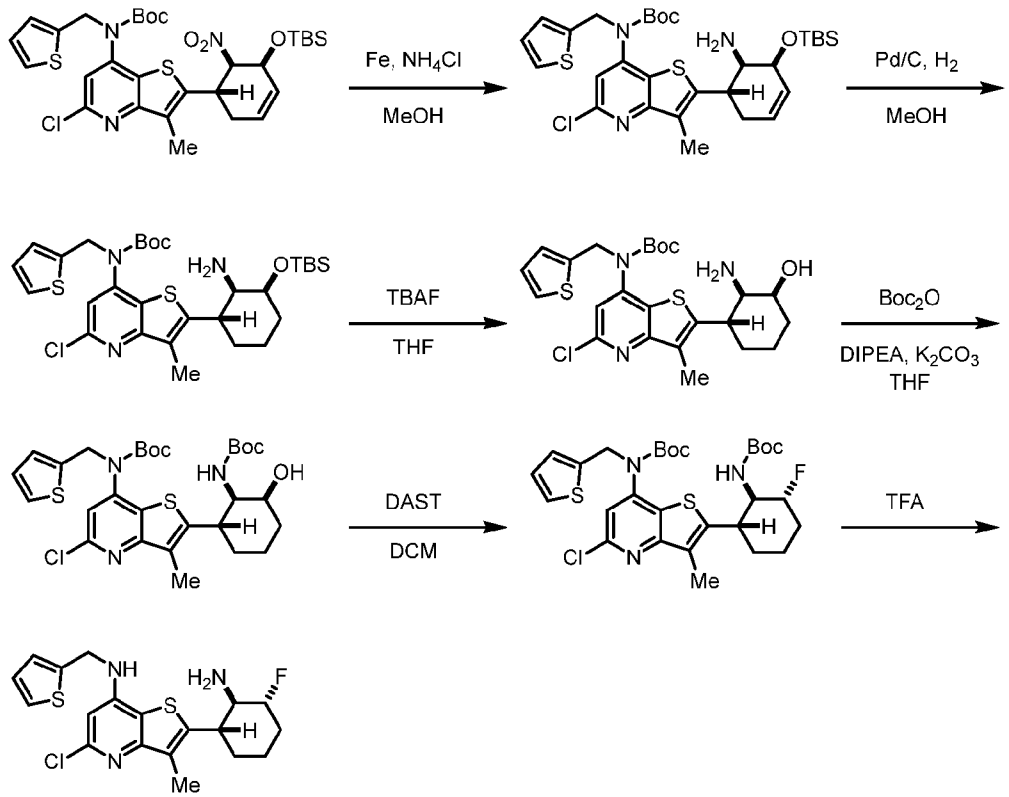
Step 3: 2-((1S/R,3S/R,4S/R,6R/S)-4-Aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

A solution of tert-butyl (3-bromo-2-((1S/R,3S/R,4S/R,6R/S)-4-((tert-butoxycarbonyl)amino)bicyclo[4.1.0]heptan-3-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (31 mg, 0.046 mmol) in 4 M HCl in dioxanes (1 mL) was stirred at 30 °C for 30 m. The mixture was basified with 1 M NaOH, separated between ethyl acetate and water and the free based reaction mixture was concentrated and the crude oil was purified by reverse phased C18 chromatography in TFA modified water and acetonitrile to give

2-((1S/R,3S/R,4S/R,6R/S)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (15 mg, 69% yield) as an off-white solid. MS *m/z* $[M+H]^+$ 470.0; ^{1}H NMR (METHANOL-d_4) δ: 7.33 (d, J = 5.1 Hz, 1H), 7.11 (d, J = 3.4 Hz, 1H), 7.00 (dd, J = 5.1, 3.6 Hz, 1H), 6.66 (s, 1H), 4.79 (s, 2H), 3.50 (td, J = 11.4, 6.1 Hz, 1H), 3.39 – 3.34 (m, 1H), 2.73 – 2.62 (m, 1H), 2.42 – 2.35 (m, 2H), 1.70 (t, J = 12.3 Hz, 1H), 1.33 – 1.13 (m, 2H), 0.88 (td, J = 8.9, 5.0 Hz, 1H), 0.36 (q, J = 5.3 Hz, 1H). Trifluoroacetic acid salt, (4 exchangeable protons not observed).

Example 16

Preparation of Compound 342



Step 1: tert-Butyl (2-((1S/R,5S/R,6R/S)-6-amino-5-((tert-butyldimethylsilyl)oxy)cyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To tert-butyl (2-((1S/R,5S/R,6R/S)-5-((tert-butyldimethylsilyl)oxy)-6-nitrocyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (3 g, 4.6 mmol, prepared according to Example 13), iron powder (2.06 g, 36.8 mmol, 8.0 eq), and ammonium chloride (12.3 g, 230 mmol, 50 eq) was added MeOH (46 mL) and the slurry was

stirred at 55 °C until the starting material was consumed as determined by UPLCMS. The reaction mixture was filtered through Celite, concentrated *in vacuo*, and separated between 1 M NaOH (200 mL) and ethyl acetate (200 mL). The aqueous layer was extracted with EtOAc (100 ml x2). The combined organic layers were washed with brine, dried over $MgSO_4$, filtered, and then concentrated to give tert-butyl (2-((1S/R,5S/R,6R/S)-6-amino-5-((tert-butyldimethylsilyl)oxy)cyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate crudely, as an orange semisolid (2.6 g) which was used without further purification. MS *m/z* 620.6 $[M+H]^+$.

Step 2: tert-Butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-((tert-butyldimethylsilyl)oxy)cyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

Crude tert-butyl (2-((1S/R,5S/R,6R/S)-6-amino-5-((tert-butyldimethylsilyl)oxy)cyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (750 mg, 1.2 mmol) was added as a solution in MeOH (2 mL) to a slurry of 20% w/w palladium on carbon (300 mg) in MeOH (5 mL) under an inert atmosphere. The resulting mixture was vacuum sparged with nitrogen and the hydrogen before being pressurized to 7 atm under an atmosphere of hydrogen and left under agitation for 5 d. The reaction mixture was filtered through Celite, and concentrated *in vacuo* to give crude tert-butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-((tert-butyldimethylsilyl)oxy)cyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a colorless semisolid (746 mg) which was used without further purification. MS *m/z* 622.5 $[M+H]^+$.

Step 3: tert-Butyl (2-((1S/R,5S/R,6R/S)-6-amino-5-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To crude tert-butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-((tert-butyldimethylsilyl)oxy)cyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (480 mg, 0.77 mmol) in THF (7.7 mL) at 0 °C was added a solution of TBAF (1 M in THF, 2.3 mL, 3 eq) dropwise over 15 min. The reaction was quenched with saturated aqueous sodium bicarbonate and extracted with EtOAc (3 x 15 mL). The combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated *in vacuo* onto Celite before being purified by silica gel chromatography in a DCM/MeOH gradient to provide tert-butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-

b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a colorless semisolid (320 mg). MS *m/z* 622.5 $[M+H]^+$; ^1H NMR (CHLOROFORM-*d*) δ: 7.15 (d, J = 5.1 Hz, 1H), 6.91 (s, 1H), 6.79 (t, J = 4.4 Hz, 1H), 6.70 (d, J = 3.4 Hz, 1H), 5.01 – 4.85 (m, 2H), 3.36 (s, 1H), 3.02 – 2.91 (m, 1H), 2.58 (s, 1H), 2.34 (s, 3H), 2.00 (d, J = 11.4 Hz, 1H), 1.89 – 1.71 (m, 2H), 1.70 – 1.62 (m, 2H), 1.38 (s, 10H). (3 exchangeable protons not observed).

Step 4: tert-Butyl (2-((1S/R,2R/S,3S/R)-2-((tert-butoxycarbonyl)amino)-3-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To tert-butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (160 mg, 0.31 mmol), DMAP (19 mg, 0.16 mmol, 0.5 eq), and potassium carbonate (131 mg, 0.95 mmol, 3 eq) in THF (3.1 mL) at 0 °C was added a solution of Boc anhydride (1 M in DCM, 0.47 mL, 1.5 eq). The reaction allowed to come to room temperature with stirring until the substrate was found to be consumed by UPLCMS at which point the reaction was separated between saturated aqueous sodium bicarbonate and EtOAc. The aqueous phase was extracted with EtOAc (3 x 15 mL). The combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated *in vacuo* onto Celite before being purified by silica gel chromatography in an EtOAc/hexanes gradient to provide tert-butyl (2-((1S/R,2R/S,3S/R)-2-((tert-butoxycarbonyl)amino)-3-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a colorless semisolid (100 mg, 52% yield). MS *m/z* 608.1 $[M+H]^+$; ^1H NMR (CHLOROFORM-*d*) δ: 7.24 (d, *J* = 5.0 Hz, 1H), 6.98 (s, 1H), 6.89 (t, *J* = 4.2 Hz, 1H), 6.80 (s, 1H), 5.05 (s, 2H), 4.43 (s, 1H), 3.74 (s, 1H), 3.43 (t, *J* = 9.2 Hz, 1H), 3.30 (s, 1H), 2.45 (s, 3H), 2.01 (d, *J* = 13.2 Hz, 1H), 1.91 (s, 1H), 1.66 – 1.45 (m, 13H), 1.27 (s, 9H).

Step 5: tert-Butyl (2-((1S/R,2R/S,3R/S)-2-((tert-butoxycarbonyl)amino)-3-fluorocyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To tert-butyl (2-((1S/R,2R/S,3S/R)-2-amino-3-hydroxycyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (24.5 mg, 0.04 mmol) in DCM (0.4 mL) at 0 °C in a PTFE vial was added Diethylaminosulfur trifluoride (DAST, 1 M in DCM, 0.052 mL, 0.052 mmol, 1.3 eq) and the reaction was held at 0 °C with stirring for 7 h

at which point the reaction was quenched with aqueous sodium bicarbonate and extracted with DCM (2 x 10 mL). The combined organic layers were washed with aqueous sodium bicarbonate, and brine before being dried over $MgSO_4$, and concentrated *in vacuo* to yield a crude mixture containing tert-butyl (2-((1S/R,2R/S,3R/S)-2-((tert-butoxycarbonyl)amino)-3-fluorocyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (MS *m/z* 610.0 $[M+H]^+$) which was used without further purification.

Step 6: 2-((1S/R,2R/S,3R/S)-2-Amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To crude tert-butyl (2-((1S/R,2R/S,3R/S)-2-((tert-butoxycarbonyl)amino)-3-fluorocyclohexyl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate was added TFA (0.5 mL) and the solution was heated to 40 °C with stirring for 15 min. The reaction was purified by a C18 reverse phased chromatography in TFA modified water/MeCN gradient to yield 2-((1S/R,2R/S,3R/S)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (5 mg) MS *m/z* $[M+H]^+$ 409.9; ^1H NMR (METHANOL-d_4) δ: 7.20 (dd, *J* = 5.1, 1.2 Hz, 1H), 6.98 (dd, *J* = 3.5, 1.3 Hz, 1H), 6.88 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 5.10 – 4.88 (m, 1H), 4.67 (s, 2H), 3.65 – 3.44 (m, 2H), 2.30 (s, 3H), 2.19 (s, 1H), 2.00 (d, *J* = 11.4 Hz, 1H), 1.86 – 1.61 (m, 4H). Trifluoroacetic acid salt, (3 exchangeable protons not observed).

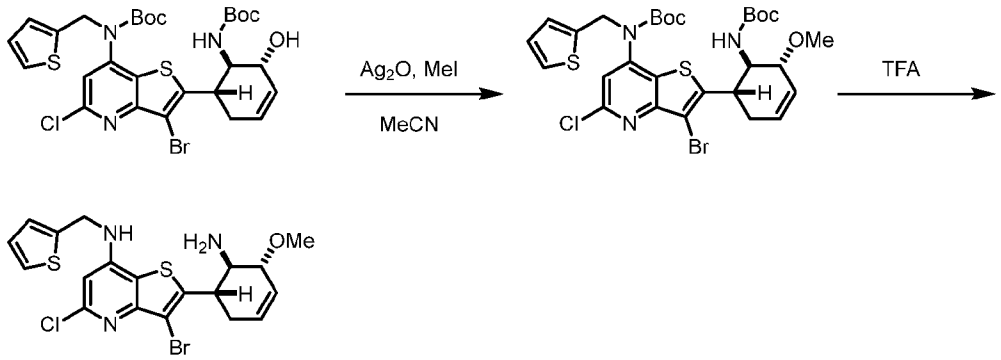
The compounds below were prepared according to the procedure of Example 16 by substituting the appropriate starting materials, reagents, and reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
181	MS *m/z* $[M-H]^-$ 473.8; ^1H NMR (METHANOL-d_4) δ: 7.26 – 7.15 (m, 1H), 6.99 (d, *J* = 3.4 Hz, 1H), 6.88 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.49 (s, 1H), 4.70 – 4.46 (m, 3H), 3.28 (s, 1H), 2.90 (s, 1H), 2.14 (dt, *J* = 9.3, 4.4 Hz, 1H), 1.95 – 1.77 (m, 2H), 1.54 (t, *J* = 11.9 Hz, 1H), 1.43 (q, *J* = 14.1 Hz, 1H), 1.35 – 1.22 (m, 1H). (3, exchangeable protons not observed).
25	MS m/z 378.0 [M+H]+; 1HNMR(400 MHz, METHANOL-d4) δ: 7.44 (d, J = 1.1 Hz, 1H), 6.57 (s, 1H), 6.38 – 6.33 (m, 1H), 6.30 (d, J = 3.1 Hz, 1H), 4.53 (t, J = 4.6 Hz, 3H), 4.02 (s, 1H), 3.60 (d, J = 2.8 Hz, 1H), 2.88 (d, J = 2.0 Hz, 1H), 2.41 (s, 3H), 2.15 (d, J = 11.3 Hz, 1H), 1.85 (d, J = 50.0 Hz, 2H), 1.55 (dd, J = 11.6, 4.5 Hz, 1H). (3 exchangeable protons are not seen)

Compound	Spectral Data
335	MS *m/z* [M-H]⁻ 473.8; ^{1}H NMR (METHANOL-*d*4) δ: 7.32 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.4 Hz, 1H), 7.00 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.60 (s, 1H), 5.25 – 5.01 (m, 1H), 4.78 (s, 2H), 3.82 – 3.67 (m, 1H), 3.60 (s, 1H), 2.33 – 2.22 (m, 1H), 1.95 – 1.64 (m, 5H). (3, exchangeable protons not observed).

Example 17

Preparation of Compound 371



Step 1: tert-Butyl (3-bromo-2-((1S/R,5R/S,6R/S)-6-((tert-butoxycarbonyl)amino)-5-methoxycyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To tert-butyl (3-bromo-2-((1S/R,5R/S,6R/S)-6-((tert-butoxycarbonyl)amino)-5-hydroxycyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (46.8 mg, 0.070 mmol, prepared according to Example 13), and silver (I) oxide (80.8 mg, 0.35 mmol, 5.0 eq) in acetonitrile (0.35 mL) was added methyl iodide (0.043 mL, 0.70 mmol, 10 eq) and the resulting mixture proceeded with stirring for 3 d. The crude slurry was separated between saturated aqueous sodium bicarbonate and ethyl acetate, extracted with ethyl acetate and the combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated onto Celite. Purification by silica gel chromatography in gradient EtOAc/hexanes yielded tert-butyl (3-bromo-2-((1S/R,5R/S,6R/S)-6-((tert-butoxycarbonyl)amino)-5-methoxycyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (23 mg, 48% yield) as a colorless semisolid. MS *m/z* $[M+H]^+$ 685.8; ^{1}H NMR (CHLOROFORM-*d*) δ: 7.25 (dd, *J* = 5.1, 1.3 Hz, 1H), 7.03 (s, 1H), 6.90 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.82 – 6.74 (m, 1H), 5.93 – 5.80 (m, 2H), 5.13 – 4.90 (m, 2H),

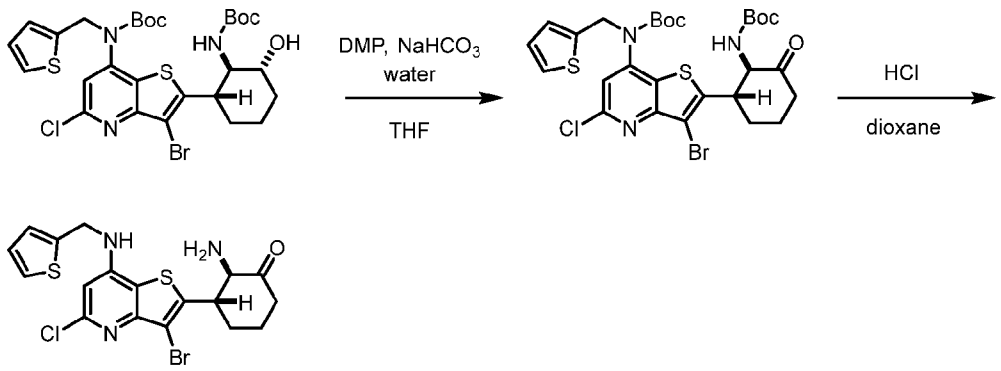
4.58 (s, 1H), 4.16 (dd, J = 10.6, 6.5 Hz, 1H), 3.94 (q, J = 7.4 Hz, 2H), 3.44 (s, 3H), 2.62 – 2.44 (m, 2H), 1.48 (s, 9H), 1.21 (s, 9H).

Step 2: 2-((1S/R,5R/S,6R/S)-6-Amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To tert-butyl (3-bromo-2-((1S/R,5R/S,6R/S)-6-((tert-butoxycarbonyl)amino)-5-methoxycyclohex-3-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (23 mg, 0.057 mmol) was added 4 M HCl in dioxane (0.5 mL) and the solution was heated to 40 °C with stirring for 30 min before 2 mL of diethyl ether was added. The resulting precipitate was filtered and washed with ether to yield (2R/S,3S/R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one (31 mg, 90% yield) MS m/z $[M+H]^+$ 471.7; ^{1}H NMR (DMSO-d_6) δ: 8.30 – 8.20 (m, 2H), 8.16 (t, J = 6.0 Hz, 1H), 7.42 (dd, J = 5.1, 1.3 Hz, 1H), 7.17 – 7.06 (m, 1H), 7.00 (dd, J = 5.1, 3.5 Hz, 1H), 6.69 (s, 1H), 4.82 – 4.62 (m, 3H), 4.54 (s, 1H), 3.72 (t, J = 11.7 Hz, 1H), 3.57 (s, 1H), 2.88 (td, J = 14.0, 6.0 Hz, 1H), 2.28 – 2.06 (m, 3H), 1.76 (t, J = 13.6 Hz, 1H). HCl salt.

Example 18

Preparation of Compound 192



Step 1 tert-Butyl (3-bromo-2-((1S/R,2R/S)-2-((tert-butoxycarbonyl)amino)-3-oxocyclohexyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To tert-butyl (3-bromo-2-((1S/R,2R/S,3R/S)-2-((tert-butoxycarbonyl)amino)-3-hydroxycyclohexyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (49 mg, 0.073 mmol, prepared according to Example 13), sodium bicarbonate (61.2 mg, 0.73 mmol, 10.0 eq), and Dess-Martin periodinane (DMP, 46.3 mg, 0.11 mmol, 1.5 eq) in DCM (0.35 mL) was added water (0.0013 mL, 0.073 mmol, 1.0 eq) and the resulting mixture

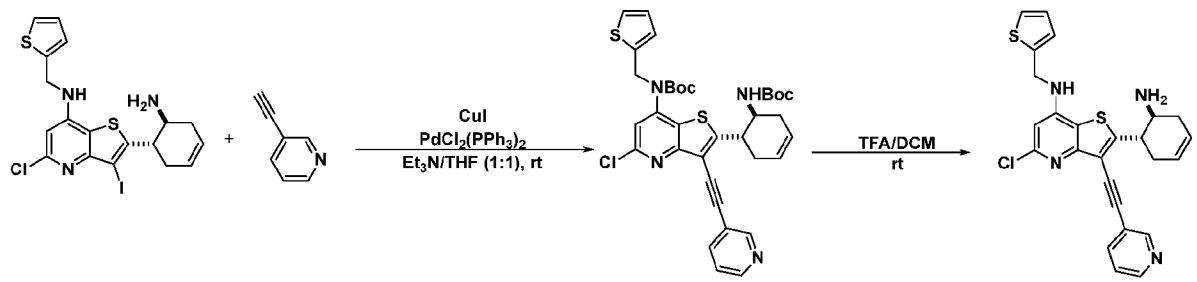
proceeded with stirring for 2 h. The reaction was quenched with 1:1 saturated aqueous sodium thiosulfate: saturated aqueous sodium bicarbonate (2 mL) with stirring for 30 m. The crude slurry was separated between water and DCM, extracted with DCM and the combined organic layers were washed with brine, dried over $MgSO_4$, and concentrated onto Celite. Purification by silica gel chromatography in gradient EtOAc/hexanes yielded tert-butyl (3-bromo-2-((1S/R,2R/S)-2-((tert-butoxycarbonyl)amino)-3-oxocyclohexyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (38 mg, 78% yield) as a colorless semisolid. ^{1}H NMR (CHLOROFORM-*d*) δ: 7.46 – 6.53 (m, 4H), 5.38 – 4.86 (m, 2H), 4.77 – 4.37 (m, 1H), 3.61 (td, *J* = 12.1, 3.6 Hz, 1H), 2.95 – 2.47 (m, 2H), 2.47 – 2.09 (m, 3H), 2.02 – 1.71 (m, 1H), 1.48 (s, 9H), 1.21 (s, 9H).

Step 2: (2R/S,3S/R)-2-Amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one

To tert-butyl (3-bromo-2-((1S/R,2R/S)-2-((tert-butoxycarbonyl)amino)-3-oxocyclohexyl)-5-chlorothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (38 mg, 0.035) was added TFA (0.5 mL) and the solution was heated to 40 °C with stirring for 15 min. The reaction was purified by a C18 reverse phased chromatography in TFA modified water/MeCN gradient to yield 2-((1S/R,5R/S,6R/S)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (30 mg, 89% yield) MS *m/z* $[M+H]^+$ 486.0; ^{1}H NMR (DMSO-d_6) δ: 8.13 (s, 3H), 7.41 (dd, *J* = 5.1, 1.3 Hz, 1H), 7.12 (d, *J* = 3.4 Hz, 1H), 7.00 (dd, *J* = 5.1, 3.4 Hz, 1H), 6.68 (d, *J* = 2.1 Hz, 1H), 5.95 (d, *J* = 11.7 Hz, 2H), 4.75 (d, *J* = 5.0 Hz, 2H), 4.19 (s, 1H), 3.73 (s, 1H), 3.57 (s, 1H), 3.40 (s, 3H) 2.60 – 2.52 (m, 2H).

Example 19

Preparation of Compound 307



Step 1: rac-tert-Butyl (2-((1*S*,6*S*)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate.

To an oven dried 10 mL vial was added $Pd(PPh_3)_2Cl_2$ (4 mg, 0.006 mmol), CuI (2 mg, 0.012 mmol) and rac-2-((1*S*,6*S*)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (70 mg, 0.099 mmol). Placed this vial under Argon flow for 10 minutes. 3-ethynylpyridine (103mg, 0.996 mmol), Et_3N (0.67 mL), and THF (0.67 mL) were then added, and the solution was left to stir overnight under argon atmosphere. The reaction mixture was diluted with ethyl acetate (5 mL) and then washed with water (2 x 5 mL) followed by brine solution (5 mL). Dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. The resulting residue was purified by silica gel column chromatography with ethyl acetate in hexanes (5 to 70% gradient) to give rac-tert-butyl (2-((1*S*,6*S*)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate as a white solid (48.4 mg, 72% yield). MS m/z 677.3 $[M+H]^+$.

Step 2: rac-2-((1*S*,6*S*)-6-Aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine.

To a DCM (1.5 mL) solution of rac-tert-butyl (2-((1*S*,6*S*)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (48 mg, 0.071 mmol, 1.0 eq.) was added trifluoroacetic acid (1.5 mL) at room temperature. After stirring for 1 h, the mixture was concentrated *in vacuo*. The residue was purified by reverse phase column chromatography with acetonitrile (0.1% trifluoroacetic acid) in water (0.1% trifluoroacetic acid) (0 to 70% gradient) to give rac-2-((1*S*,6*S*)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine. MS m/z 477.3 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.92 (s, 1H), 8.62 (d, J = 5.0 Hz, 1H), 8.36 – 8.22 (m, 1H), 7.64 – 7.61 (m, 1H), 7.32 (d, J = 5.0 Hz, 1H), 7.11 (d, J = 3.0 Hz, 1H), 7.00 – 6.98 (m, 1H), 6.67 (s, 1H), 5.94 (d, J = 10.2 Hz, 1H), 5.82 (d, J = 10.1 Hz, 1H), 4.79 (s, 2H), 4.00 – 3.94 (m, 1H), 3.91 – 3.74 (m, 1H), 2.83 – 2.72 (m, 2H), 2.71 – 2.63 (m, 1H), 2.45 – 2.28 (m, 1H). Trifluoroacetic acid salt (4 exchangeable protons not seen).

The compounds below were prepared according to the procedure of Example 19 by substituting the appropriate starting materials, reagents, and reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
175	MS m/z 458.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.0, 1.3 Hz, 1H), 7.09 (dd, J = 3.5, 1.3 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.61 (s, 1H), 5.91 (d, J = 10.1 Hz, 1H), 5.78 (d, J = 10.1 Hz, 1H), 4.76 (s, 2H), 3.94 (td, J = 9.5, 5.4 Hz, 1H), 3.74 (t, J = 6.0 Hz, 2H), 3.67 (td, J = 9.8, 5.9 Hz, 1H), 2.80 – 2.60 (m, 5H), 2.38 – 2.28 (m, 1H), 1.92 – 1.82 (m, 2H). (4 Exchangeable protons not observed).
177	MS m/z 444.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.31 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (dd, J = 3.5, 1.2 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.62 (s, 1H), 5.94 – 5.86 (m, 1H), 5.82 – 5.74 (m, 1H), 4.77 (s, 2H), 3.94 – 3.87 (m, 1H), 3.82 (t, J = 6.0 Hz, 2H), 3.79 – 3.62 (m, 1H), 2.76 (t, J = 6.0 Hz, 2H), 2.72 – 2.56 (m, 3H), 2.41 – 2.26 (m, 1H). (4 Exchangeable protons not observed).
189	MS *m/z* $[M+H]^+$ 416.5; ^1H NMR (METHANOL-d_4) δ: 8.44 (s, 1H), 7.20 (d, J = 5.1 Hz, 1H), 6.98 (d, J = 3.4 Hz, 1H), 6.88 (t, J = 4.4 Hz, 1H), 6.47 (s, 1H), 4.65 (s, 2H), 3.29 (s, 1H), 3.16 (d, J = 10.8 Hz, 1H), 2.07 (s, 4H), 1.98 (d, J = 13.5 Hz, 1H), 1.89 – 1.74 (m, 2H), 1.67 (t, J = 12.2 Hz, 1H), 1.39 (q, J = 11.4 Hz, 3H). Formic acid salt, (3, exchangeable protons not observed).
208	MS m/z 452.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.0, 1.5 Hz, 1H), 7.09 (dd, J = 3.6, 1.5 Hz, 1H), 7.01 – 6.95 (m, 1H), 6.62 (s, 1H), 4.77 (s, 2H), 4.02 (dd, J = 25.9, 11.7 Hz, 1H), 3.60 – 3.55 (m, 1H), 2.36 – 2.29 (m, 1H), 2.25 (d, J = 12.8 Hz, 1H), 2.18 (s, 3H), 2.13 – 1.94 (m, 2H), 1.86 – 1.66 (m, 2H). (3 Exchangeable protons not observed).
210	MS *m/z* 396.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.37 (d, J = 6.4 Hz, 4H), 7.29 (d, J = 6.9 Hz, 1H), 6.39 (d, J = 11.0 Hz, 1H), 4.59 (s, 2H), 3.94 (s, 1H), 3.19 (d, J = 12.2 Hz, 1H), 3.02 (d, J = 11.0 Hz, 1H), 2.08 (t, J = 12.5 Hz, 2H), 1.89 (s, 2H), 1.71 (d, J = 12.9 Hz, 1H), 1.53 – 1.35 (m, 3H) (3, exchangeable protons not observed).
211	MS m/z 474.1 [M+H]+; ^1H NMR (METHANOL-d_4) δ: 7.31 (d, J = 5.1 Hz, 1H), 7.10 – 7.06 (m, 1H), 7.01 – 6.95 (m, 1H), 6.62 (s, 1H), 5.90 (d, J = 10.1 Hz, 1H), 5.79 (d, J = 10.1 Hz, 1H), 4.76 (s, 2H), 3.96 – 3.83 (m, 2H), 3.77 – 3.69 (m, 1H), 3.64 (t, J = 5.6 Hz, 2H), 2.88 – 2.80 (m, 1H), 2.75 (d, J = 6.4 Hz, 1H), 2.71 (d, J = 6.4 Hz, 1H), 2.68 – 2.56 (m, 2H), 2.40 – 2.30 (m, 1H). (5 Exchangeable protons not observed).

Compound	Spectral Data
213	MS m/z 448.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.33 – 7.28 (m, 1H), 7.09 (s, 1H), 7.00 – 6.95 (m, 1H), 6.62 (s, 1H), 5.01 (d, J = 9.8 Hz, 1H), 4.77 (s, 2H), 4.15 (d, J = 11.6 Hz, 1H), 3.90 – 3.80 (m, 2H), 3.67 (t, J = 11.3 Hz, 1H), 3.36 (d, J = 10.9 Hz, 1H), 2.82 – 2.75 (m, 2H), 2.31 (d, J = 11.7 Hz, 1H), 2.00 – 1.80 (m, 3H). (4 Exchangeable protons not observed).
216	MS m/z 474.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.09 (d, J = 3.5 Hz, 1H), 7.01 – 6.95 (m, 1H), 6.62 (s, 1H), 5.90 (d, J = 10.4 Hz, 1H), 5.78 (d, J = 10.6 Hz, 1H), 4.76 (s, 2H), 3.96 – 3.83 (m, 2H), 3.77 – 3.69 (m, 1H), 3.64 (t, J = 5.5 Hz, 2H), 2.88 – 2.80 (m, 1H), 2.75 (d, J = 6.4 Hz, 1H), 2.71 (d, J = 6.4 Hz, 1H), 2.68 – 2.56 (m, 2H), 2.40 – 2.30 (m, 1H). (5 Exchangeable protons not observed).
226	MS *m/z* $[M+H]^+$ 410.5; ^1H NMR (METHANOL-d_4) δ: 8.45 (s, 1H), 7.29 – 7.20 (m, 4H), 7.17 (d, J = 6.5 Hz, 1H), 6.29 (s, 1H), 4.47 (s, 2H), 3.13 (d, J = 9.3 Hz, 2H), 2.13 – 1.91 (m, 5H), 1.79 (d, J = 16.3 Hz, 2H), 1.65 (d, J = 12.7 Hz, 1H), 1.39 (q, J = 16.7 Hz, 3H). Formic acid salt, (3, exchangeable protons not observed).
227	MS m/z 418.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 1H, formic acid), 7.30 (dt, J = 5.0, 1.5 Hz, 1H), 7.08 (dd, J = 3.5, 1.5 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.55 (s, 1H), 4.75 (s, 2H), 4.15 – 4.00 (m, 2H), 3.68 – 3.51 (m, 2H), 3.43 – 3.34 (m, 1H), 3.26 (dd, J = 10.4, 10.4 Hz, 1H), 3.17 (dd, J = 10.4, 4.3 Hz, 1H), 2.18 (s, 3H), 2.05 – 1.98 (m, 1H). (3 Exchangeable protons not observed).
235	MS m/z 472.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.09 (dd, J = 3.5, 1.2 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.60 (s, 1H), 5.90 (d, J = 10.2 Hz, 1H), 5.79 (d, J = 10.2 Hz, 1H), 4.76 (s, 2H), 4.04 – 3.94 (m, 1H), 3.70 – 3.58 (m, 3H), 2.82 – 2.70 (m, 1H), 2.68 – 2.56 (m, 4H), 2.36 – 2.25 (m, 1H), 1.80 – 1.69 (m, 4H). (4 Exchangeable protons not observed).
252	MS m/z 434.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.45 (d, J = 4.9 Hz, 1H), 7.23 (d, J = 3.5 Hz, 1H), 7.13 (dd, J = 4.9, 3.5 Hz, 1H), 6.74 (s, 1H), 5.13 (d, J = 9.8 Hz, 1H), 4.90 (s, 2H), 4.69 (s, 2H), 4.28 (d, J = 11.8 Hz, 1H), 3.81 (t, J = 10.5 Hz, 1H), 3.55 (t, J = 10.9 Hz, 1H), 2.48 (d, J = 11.2 Hz, 1H), 2.13 – 1.95 (m, 3H). (4 Exchangeable protons not observed).
255	MS m/z 419.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.44 (s, 1H), 6.40 – 6.33 (m, 2H), 4.99 (d, J = 9.9 Hz, 1H), 4.82 – 4.68 (m, 2H), 4.53 (s, 2H), 4.14 (d, J = 11.8 Hz, 1H), 3.72 – 3.62 (m, 1H), 2.31 (d, J = 10.9 Hz, 1H), 1.99 – 1.80 (m, 3H). (3 Exchangeable protons not observed).

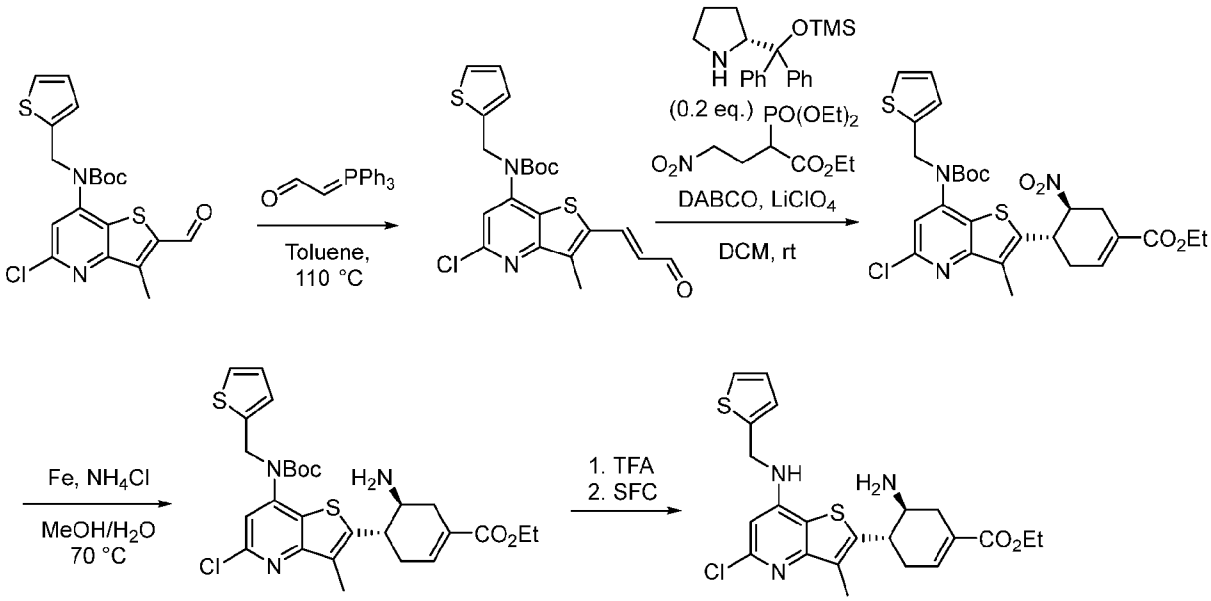
Compound	Spectral Data
311	MS *m/z* 413.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.41 – 7.31 (m, 2H), 7.16 (t, J = 7.5 Hz, 2H), 6.44 (s, 1H), 4.64 (s, 2H), 3.94 (s, 1H), 3.24 – 3.12 (m, 1H), 2.99 (s, 1H), 2.06 (d, J = 13.0 Hz, 2H), 1.89 (s, 2H), 1.70 (d, J = 12.6 Hz, 1H), 1.43 (dd, J = 45.3, 12.1 Hz, 3H) (3, exchangeable protons not observed).
317	MS m/z 461.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.26 (d, *J* = 1.6 Hz, 1H), 6.22 – 6.16 (m, 2H), 4.59 (s, 2H), 4.04 (dd, *J* = 11.6, 4.5 Hz, 1H), 3.92 (dd, *J* = 11.6, 4.3 Hz, 1H), 3.83 (td, *J* = 10.5, 4.5 Hz, 1H), 3.43 – 3.33 (m, 1H), 3.32 – 3.19 (m, 2H), 2.28 – 2.14 (m, 1H), 1.89 (d, *J* = 12.6 Hz, 1H), 0.15 (s, 9H). (3 Exchangeable protons not observed).
318	MS m/z 434.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.92 (t,J, J = 57.2 Hz, 1H), 7.43 (s, 1H), 6.35 (d,J, J = 1.7 Hz, 2H), 4.78 (t,J, J = 11.9 Hz, 2H), 4.32 (s, 1H), 3.13 (s, 1H), 2.23 (s, 1H), 2.17 (s, 3H), 2.00 (d,J, J = 26.2 Hz, 2H), 1.90 (s, 1H), 1.52 (s, 3H). (4 Exchangeable protons not observed).
320	MS m/z 486.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 8.54 (s, 0.6H, formic acid), 7.30 (d, *J* = 5.1 Hz, 1H), 7.08 (d, *J* = 3.5 Hz, 1H), 6.98 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.57 (s, 1H), 5.84 (d, *J* = 10.8 Hz, 1H), 5.76 (d, *J* = 10.8 Hz, 1H), 4.75 (s, 2H), 3.70 (ddd, *J* = 9.7, 9.3, 9.3 Hz, 1H), 3.62 – 3.57 (m, 2H), 3.52 (ddd, *J* = 10.0, 9.7, 5.9 Hz, 1H), 2.70 – 2.50 (m, 5H), 2.25 – 2.14 (m, 1H), 1.70 (tt, *J* = 6.9, 6.9 Hz, 2H), 1.59 (m, 4H). (4 Exchangeable protons not observed).
330	MS m/z 389.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.44 (s, 1H), 6.38 – 6.34 (m, 2H), 4.76 (d, *J* = 3.8 Hz, 2H), 4.25 – 4.15 (m, 2H), 4.09 (d, *J* = 11.8 Hz, 1H), 3.75 – 3.64 (m, 2H), 3.59 (td, *J* = 11.4, 2.5 Hz, 1H), 3.50 – 3.43 (m, 1H), 2.27 – 2.03 (m, 2H). (3 Exchangeable protons not observed).
331	MS m/z 434.3 $[M+H]^+$; ^1HNMR(400 MHz, METHANOL-d_4) δ 7.93 (t, J = 57.8 Hz, 1H), 7.43 (s, 1H), 6.35 (d, J = 4.4 Hz, 2H), 4.79 (s, 3H), 3.72-3.60 (m, 1H), 2.90-2.76 (m, 1H), 2.13 (s, 3H), 2.08-2.0 (m, 1H), 1.95-1.76 (m, 3H), 1.43-1.28 (m, 3H). (3 exchangeable protons are not seen)
336	MS *m/z* 456.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.55 - 7.40 (m, 1H), 6.67 (s, 1H), 6.39 – 6.29 (m, 2H), 5.81 - 5.68 (m, 2H), 4.82 - 4.76 (m, 2H), 3.76- 3.69 (m, 2H), 3.44 – 3.35 (m, 2H), 3.26 (s, 3H), 2.64 (t,J, J = 7.0 Hz, 2H), 2.56 - 2.40 (m, 3H), 2.15 - 1.97 (m, 1H), 1.91 -1.80 (m, 2H). (3, exchangeable protons not observed).
344	MS *m/z* 396.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.37 – 7.31 (m, 4H), 7.26 (t, J = 6.4 Hz, 1H), 6.37 (s, 1H), 4.57 (s, 2H), 3.91 (s, 1H), 3.21 – 3.13 (m, 1H), 2.96 (td, J = 10.6, 3.9 Hz, 1H), 2.05 (t, J = 12.1 Hz, 2H), 1.85 (d, J = 9.2 Hz, 2H), 1.67 (d, J = 12.7 Hz, 1H), 1.50 – 1.28 (m, 3H) (3, exchangeable protons not observed).

Compound	Spectral Data
349	MS *m/z* 472.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (dd, J = 5.2, 1.2 Hz, 1H), 7.06 - 7.00 (m, 1H), 6.98- 6.64 (m, 1H), 6.64 (s, 1H), 5.84 - 5.65 (m, 2H), 5.03 (s, 2H), 3.80 - 3.70 (m, 2H), 3.45 - 3.32 (m, 2H), 3.26 - 3.19 (m, 3H), 2.64 (t, J = 7.0 Hz, 2H), 2.54 - 2.42 (m, 3H), 2.12 - 2.00 (m, 1H), 1.92 - 1.81 (m, 2H) (3, exchangeable protons not observed).
357	MS *m/z* 385.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.45 (s, 1H), 6.60 (s, 1H), 6.36 (s, 1H), 6.32 (s, 1H), 4.53 (s, 2H), 3.91 (s, 1H), 3.15 (d, J = 11.8 Hz, 1H), 2.94 (s, 1H), 2.06 (d, J = 14.9 Hz, 2H), 1.86 (s, 2H), 1.66 (d, J = 13.0 Hz, 1H), 1.51 – 1.42 (m, 2H), 1.33 (s, 1H). (3, exchangeable protons not observed).
394	MS m/z 507.2 [M+H]+ 1H NMR (500 MHz, METHANOL-d_4) δ: 8.17 – 8.14 (m, 1H), 8.09 – 8.06 (m, 1H), 7.34 – 7.29 (m, 1H), 7.11 – 7.08 (m, 1H), 7.04 – 7.01 (m 1H), 7.00 – 6.97 (m, 1H), 6.65 (s, 1H), 5.96 (d, J = 10.0 Hz, 1H), 5.83 (d, J = 10.5 Hz, 1H), 4.78 (s, 2H), 4.47 (td, J = 10.6, 5.5 Hz, 1H), 4.01 (s, 3H), 3.62 (td, J = 10.6, 5.5 Hz, 1H), 3.08 – 2.97 (m, 1H), 2.79 – 2.57 (m, 2H), 2.42 – 2.30 (m, 1H). Trifluoroacetic acid salt (4 exchangeable protons not seen).
395	MS m/z 477.2 $[M+H]^+$ ^1H NMR (400 MHz, METHANOL-d_4) δ: 8.71 (d, *J* = 5.2 Hz, 2H), 7.94 (d, *J* = 5.1 Hz, 2H), 7.32 (d, *J* = 5.1 Hz, 1H), 7.13 – 7.08 (m, 1H), 7.02 – 6.96 (m, 1H), 6.68 (s, 1H), 5.95 (d, *J* = 10.1 Hz, 1H), 5.83 (d, *J* = 10.0 Hz, 1H), 4.79 (s, 2H), 4.01 – 3.92 (m, 1H), 3.91 – 3.81 (m, 1H), 2.78 – 2.64 (m, 3H), 2.44 – 2.32 (m, 1H). Trifluoroacetic acid salt (4 exchangeable protons not seen).
430	MS *m/z* 413.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.41 – 7.31 (m, 2H), 7.16 (t, J = 7.5 Hz, 2H), 6.44 (s, 1H), 4.64 (s, 2H), 3.94 (s, 1H), 3.24 – 3.12 (m, 1H), 2.99 (s, 1H), 2.06 (d, J = 13.0 Hz, 2H), 1.89 (s, 2H), 1.70 (d, J = 12.6 Hz, 1H), 1.43 (dd, J = 45.3, 12.1 Hz, 3H) (3, exchangeable protons not observed).
447	MS m/z 511.1 [M+H]+ 1H NMR (400 MHz, METHANOL-d_4) δ: 8.69 (s, 1H), 8.54 (d, J = 5.0 Hz, 1H), 7.87 (d, J = 5.0 Hz, 1H), 7.32 (d, J = 5.0 Hz, 1H), 7.13 – 7.09 (m, 1H), 7.02 – 6.97 (m, 1H), 6.69 (s, 1H), 5.92 (d, J = 10.4 Hz, 1H), 5.81 (d, J = 10.4 Hz, 1H), 4.79 (s, 2H), 4.28 – 4.18 (m, 1H), 3.84 – 3.76 (m, 1H), 2.96 – 2.85 (m, 1H), 2.77 – 2.63 (m, 2H), 2.39 – 2.24 (m, 1H). Trifluoroacetic acid salt (4 exchangeable protons not seen).
451	MS *m/z* 472.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (dd, J = 5.2, 1.2 Hz, 1H), 7.07 - 7.01 (m, 1H), 6.67 - 6.60 (m, 1H), 6.64 (s, 1H), 5.85 - 5.65 (m, 2H), 5.10 - 4.95 (m, 2H), 3.80 - 3.70 (m, 2H), 3.45 – 3.34 (m, 2H), 3.25 - 3.20 (m, 3H), 2.70 - 2.60 (m, 2H), 2.53 – 2.42 (m, 3H), 2.12 - 1.98 (m, 1H), 1.92 - 1.81 (m, 2H). (3 exchangeable protons not seen).

Compound	Spectral Data
452	MS *m/z* 456.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.51 - 7.36 (m, 1H), 6.74 - 6.57 (m, 1H), 6.47 – 6.25 (m, 2H), 5.82 - 5.62 (m, 2H), 4.79 (s, 2H), 3.80 -3. 65 (m, 2H), 3.45 - 3.34(m, 2H), 3.27 - 3.22 (m, 3H), 2.64 (t,J, J = 7.0 Hz, 2H), 2.53 - 2.42 (m, 3H), 2.12 - 2.00 (m, 1H), 1.92 - 1.81 (m, 2H). (3 exchangeable protons not seen).
453	MS *m/z* 466.2 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.38 - 7.21 (m, 6H), 6.58 - 6.52 (m, 1H), 5.78 – 5.65 (m, 2H), 4.89 (s, 2H), 3.77 - 3.71 (m, 2H), 3.24 (s, 3H), 2.66 – 2.60 (m, 2H), 2.48 - 2.41 (m, 3H), 2.10 - 1.98 (m, 1H), 1.89 - 1.82 (m, 2H). (1 exchangeable protons not seen).
454	MS *m/z* 486.2 $[M+H]^+$; ^1H NMR (METHANOL-d4) δ: 8.55 (s, 1H), 7.31 (br s, 1H), 7.07-7.13 (m, 1H), 7.00 (br s, 1H), 6.55 (s, 1H), 5.73-5.86 (m, 2H), 4.76 (s, 2H), 3.71-3.81 (m, 3H), 2.65 (s, 5H), 2.38 (br s, 6H), 1.87 (br t, J=6.6 Hz, 2H). (2 exchangeable protons not seen).

Example 20

Preparation of Compound 445



Step 1: tert-Butyl (E)-(5-chloro-3-methyl-2-(3-oxoprop-1-en-1-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (5-chloro-2-formyl-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (6.9 g, 16.3 mmol) in toluene (100 mL) was added (triphenylphosphaneylidene)acetaldehyde (5.46 g, 18 mmol, 1.1 eq.). After stirring at 110 °C for 12 h, the reaction mixture was cooled to room temperature and concentrated *in vacuo*. The

crude residue was purified by silica gel chromatography (DCM/PE 0-60% gradient) to afford tert-butyl (E)-(5-chloro-3-methyl-2-(3-oxoprop-1-en-1-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (5.6g, 76%) as a yellow solid. MS m/z 449.0 $[M+H]^+$.

Step 2: Ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-nitrocyclohex-1-ene-1-carboxylate

To a solution of tert-butyl (E)-(5-chloro-3-methyl-2-(3-oxoprop-1-en-1-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (5.6 g, 12.5 mmol) was added ethyl 2-(diethoxyphosphoryl)-4-nitrobutanoate (4.45 g, 15 mmol, 1.2 eq.) (prepared according to the procedure in *J. Med. Chem.* **2005**, *48*, 3516-3521), (R)-2-(diphenyl((trimethylsilyl)oxy)methyl)pyrrolidine (812 mg, 2.5 mmol, 0.2 eq.), DABCO (1.4 g, 12.5 mmol, 1.0 eq.) and $LiClO_4$ (1.33 g, 12.5 mmol, 1.0 eq.). After stirring at room temperature for 48 h, the reaction mixture was concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/PE 0-15% gradient) to afford ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-nitrocyclohex-1-ene-1-carboxylate (1.1 g, 15%) as a yellow solid. MS m/z 592.0 $[M+H]^+$.

Step 3: ethyl (4S,5S)-5-amino-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate

To a solution of ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-nitrocyclohex-1-ene-1-carboxylate (500 mg, 844 mmol) in MeOH (18 mL) and H_2O (2 mL) was added Fe powder (472 mg, 8.4 mol, 10 eq.) and NH_4Cl (903 mg, 17 mmol, 2.0 eq.). After stirring the reaction mixture at 70 °C for 12 h, the reaction mixture was cooled to room temperature and filtered through a pad of Celite, washing with MeOH (50 mL x 2). The filtrate was concentrated to afford crude ethyl (4S,5S)-5-amino-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate (450 mg, 95%) as a yellow solid that was used without further purification. MS m/z 562.0 $[M+H]^+$.

Step 4: Ethyl (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate

To a solution of ethyl (4S,5S)-5-amino-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate (450 mg, 800 mmol) in DCM (5 mL) was added TFA (2 mL). After stirring at room

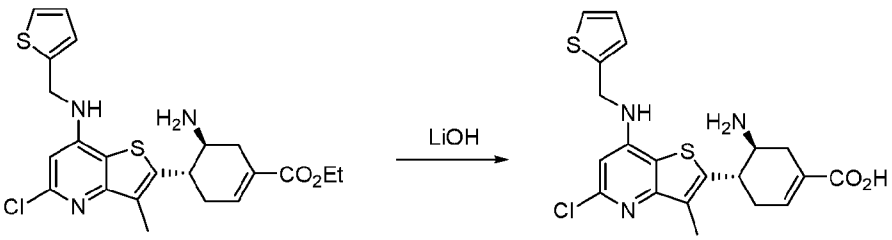
temperature for 2 h, the reaction mixture was concentrated *in vacuo* and purified by reverse phase silica gel chromatography (MeCN/H_2O 5-95% gradient) followed by prep-SFC (Dr.Maish Reprosil Chiral-AM, Supercritical CO_2/MeOH (+0.1% 7.0mol/l NH_3 in MeOH)/MeOH)to afford ethyl (4S,5S)-5-amino-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate (35 mg, 10%) as a white solid. MS m/z 462.0 $[M+H]^+$; $]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.34-7.25 (m, 1H), 7.09 – 7.01 (m, 2H), 6.99 – 6.94 (m, 1H), 6.58-6.49 (m, 1H), 4.72 (s, 2H), 4.26-4.12 (m, 2H), 3.40-3.34 (m, 2H), 2.91 – 2.82 (m, 1H), 2.80-2.65 (m, 1H), 2.59-2.49 (m, 1H), 2.45-2.25 (m, 4H), 1.33-1.25 (m, 3H). (3 Exchangeable protons not observed).

The compounds below were prepared according to the procedure of Example 20 by substituting the appropriate starting materials, reagents, and reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
277	MS m/z 462.0 $[M+H]^+$; $]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.34-7.25 (m, 1H), 7.09 – 7.01 (m, 2H), 6.99 – 6.94 (m, 1H), 6.58-6.49 (m, 1H), 4.72 (s, 2H), 4.26-4.12 (m, 2H), 3.40-3.34 (m, 2H), 2.91 – 2.82 (m, 1H), 2.80-2.65 (m, 1H), 2.59-2.49 (m, 1H), 2.45-2.25 (m, 4H), 1.33-1.25 (m, 3H) (3 Exchangeable protons not observed).

Example 21

Preparation of Compound 446



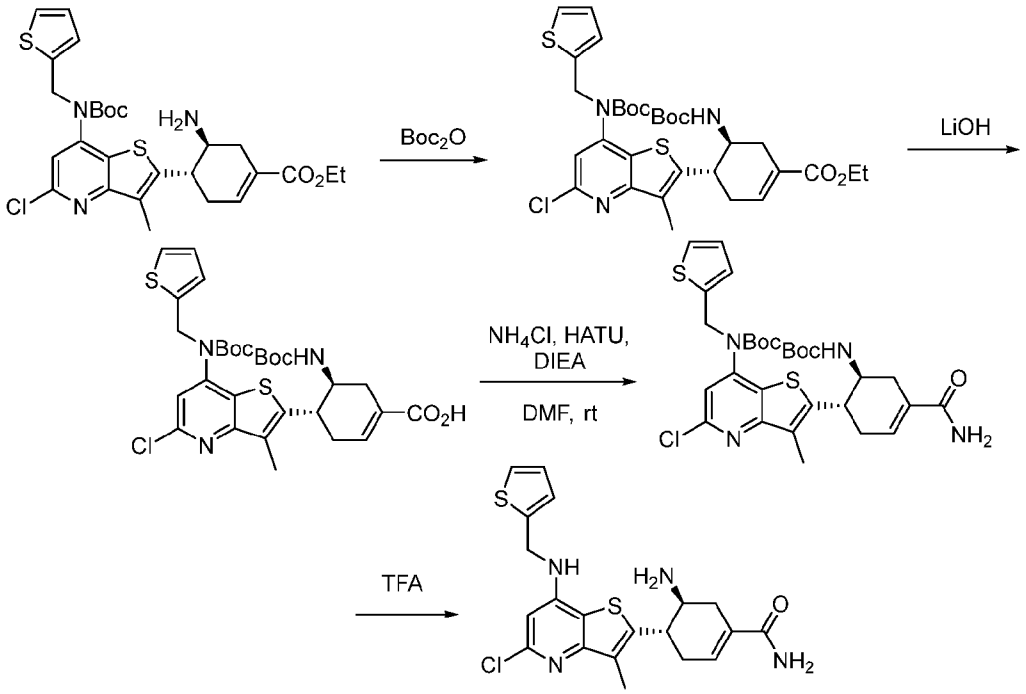
Step 1: (4S,5S)-5-Amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylic acid

Ethyl (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate (50 mg, 0.1 mmol) (prepared in Example 20, step 4) was hydrolyzed according to the procedure described in Example 22, step 2 to afford (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylic acid (30 mg, 60%) as

white solid. MS m/z 433.9 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.35-7.25 (m, 1H), 7.18-7.05 (m, 2H), 7.05-6.95 (m, 1H), 6.54 (s, 1H), 4.75 (s, 2H), 4.60 (s, 2H), 3.82-3.65 (m, 2H), 3.05-2.97 (m, 1H), 2.90-2.87 (m, 1H), 2.75-2.68 (m, 1H), 2.62-2.54 (m, 1H), 2.40 (s, 3H).

Example 22

Preparation of Compound 274



Step1: Ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylate

To a solution of ethyl (4S,5S)-5-amino-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate (280 mg, 0.5 mmol) (prepared according to Example 20) in THF (5 mL) was added Boc_2O (217 mg, 1.0 mmol, 2 eq.) and TEA (151 mg, 1.5 mmol, 3 eq.). After stirring at room temperature for 12 h, the reaction mixture was concentrated *in vacuo* and the crude residue was purified by silica gel column chromatography (EA/PE 0-15% gradient) to afford ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylate (320 mg, 98 %) as a white solid. MS m/z 661.9 $[M+H]^+$.

Step 2: (4S,5S)-4-(7-((tert-Butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylic acid

To a solution of ethyl (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylate (290 mg, 0.44 mmol) in a mixture of THF (4 mL), MeOH (1 mL), and H_2O (1 mL) was added lithium hydroxide monohydrate (92 mg, 2.2 mmol, 5 eq.). After stirring at room temperature for 3 h, the reaction mixture was diluted with H_2O (20 mL), acidified to pH 5 with 1M HCl, and extracted with EtOAc (20 mL x 2). The combined organics were washed with brine (20 mL x 2), dried over Na_2SO_4, filtered and concentrated *in vacuo* to afford crude (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylic acid (260 mg, 94%) as a white solid. MS m/z 634.0 $[M+H]^+$.

Step 3: tert-Butyl (2-((1S,6S)-6-((tert-butoxycarbonyl)amino)-4-carbamoylcyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of (4S,5S)-4-(7-((tert-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-methylthieno[3,2-b]pyridin-2-yl)-5-((tert-butoxycarbonyl)amino)cyclohex-1-ene-1-carboxylic acid (100 mg, 0.16 mmol) in DMF (2 mL) was added HATU (73 mg, 0.19 mmol, 1.2 eq.), NH_4Cl (42 mg, 0.8 mmol, 5 eq.), and DIEA (102 mg, 0.8 mmol, 1.2 eq.). After stirring at room temperature for 12 h, the reaction mixture was diluted with H_2O (30 mL) and extracted with EtOAc (30 mL x 2). The combined organics were washed with brine (30 mL x 2), dried over Na_2SO_4, filtered, and concentrated *in vacuo* to afford crude tert-butyl (2-((1S,6S)-6-((tert-butoxycarbonyl)amino)-4-carbamoylcyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (99 mg, 99%) as a yellow oil that was used without further purification. MS m/z 633.1 $[M+H]^+$.

Step 4: (4S,5S)-5-Amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxamide

tert-Butyl (2-((1S,6S)-6-((tert-butoxycarbonyl)amino)-4-carbamoylcyclohex-3-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (100 mg, 0.16 mmol) was deprotected according to the procedure described in Example 5, step 2 to afford (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-

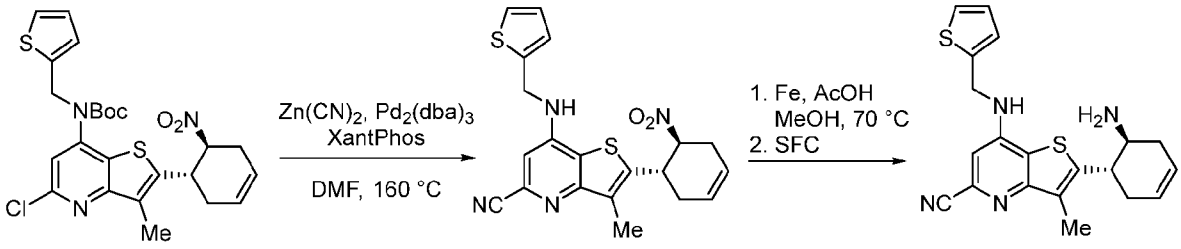
yl)cyclohex-1-ene-1-carboxamide (54 mg, 79%) as a white solid. MS m/z 433.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.29 (t, J = 4.9 Hz, 1H), 7.07 (t, J = 5.8 Hz, 1H), 6.97 (dd, J = 8.4, 4.6 Hz,1H), 6.80 (d, J = 29.9 Hz, 1H), 6.61 (d, J = 5.4 Hz, 1H), 4.76 (d, J = 11.6 Hz, 2H), 3.91 – 3.60 (m, 2H), 3.06 – 2.45 (m, 4H), 2.42 (d, J = 7.7 Hz, 3H).

The compound below was prepared according to the procedure of Example 22 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
312	MS m/z 460.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 - 7.27 (m, 1H), 7.10 - 7.08 (m, 1H),7.00 - 6.95 (m, 1H), 6.65 – 6.60 (m, 1H), 6.06 (s, 1H), 4.78 (s, 2H), 3.80 – 3.65(m, 2H), 3.25 – 3.10 (m, 3H), 3.00 (s, 3H), 2.85 – 2.73 (m, 2H), 2.48 - 2.72 (m, 2H), 2.42 (s, 3H). (3 exchangeable protons are not seen)
313	MS m/z 503.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.08 (s, 1H), 6.97 (t, J = 4.2 Hz, 1H), 6.61 (s, 1H), 6.09 (d, J = 17.1 Hz, 1H), 4.77 (s, 2H), 4.13 – 3.72 (m, 2H), 2.87 – 2.60 (m, 3H), 2.52 (s, 1H), 2.41 (s, 3H). (3 exchangeable protons are not seen)
353	MS m/z 508.9 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.64 – 7.57 (m, 2H), 7.36 - 7.25 (m, 3H), 7.16 – 7.03 (m, 2H), 6.99 – 6.89 (m, 1H), 6.82 (s, 1H), 6.60 - 6.58 (m, 1H), 4.77 - 4.72 (m, 2H), 3.81 – 3.65 (m, 2H), 3.15 – 3.06 (m, 1H), 2.90 - 2.87 (m, 1H), 2.79 – 2.68 (m, 1H), 2.63 – 2.51 (m, 1H), 2.45 - 2.40 (m, 3H (3 exchangeable protons are not seen)

Example 23

Preparation of Compound 246



Step 1: 3-Methyl-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile

A mixture of tert-butyl (5-chloro-3-methyl-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (prepared according to the procedures described in Example 13) (1.0 g, 0.4 mmol), zinc cyanide (900 mg, 1.5 mmol, 4 eq.), 4,5-bis(diphenylphosphino)-9,9-dimethylxanthene (110 mg, 0.2 mmol, 0.2 eq.), tris(dibenzylideneacetone)dipalladium (88 mg, 0.1 mmol, 0.2 eq.), and DMF (10 mL) was heated at 160 °C for 1 h in a microwave reactor. The reaction mixture was allowed to cool to room temperature and diluted with water (50 mL). The aqueous solution was extracted with EtOAc (50 mL x 2). The combined organics were washed with brine (2 x 50 mL), dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/Hex 0-50% gradient) to afford 3-methyl-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile (280 mg, 35%) as a white solid. MS m/z 411.1 $[M+H]^+$.

Step 2: tert-Butyl (2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-chloro-5-cyanothieno[3,2-b]pyridin-7-yl)(furan-2-ylmethyl)carbamate

According to the procedure described in step 4 of Example 2, 3-methyl-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile (250 mg, 0.6 mmol) was reduced to followed by SFC separation (using conditions described in Example 1) to afford 3-methyl-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile (70 mg, 30%) as a white solid. MS m/z 381.2 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.32 – 7.26 (m, 1H), 7.13 – 7.05 (m, 1H), 7.01 – 6.94 (m, 1H), 6.91 (s, 1H), 5.82 – 5.70 (m, 2H), 4.80 (s, 2H), 3.41 – 3.32 (m, 1H), 3.22 – 3.11 (m, 1H), 2.55 – 2.31 (m, 6H), 2.20 – 2.00 (m, 1H).

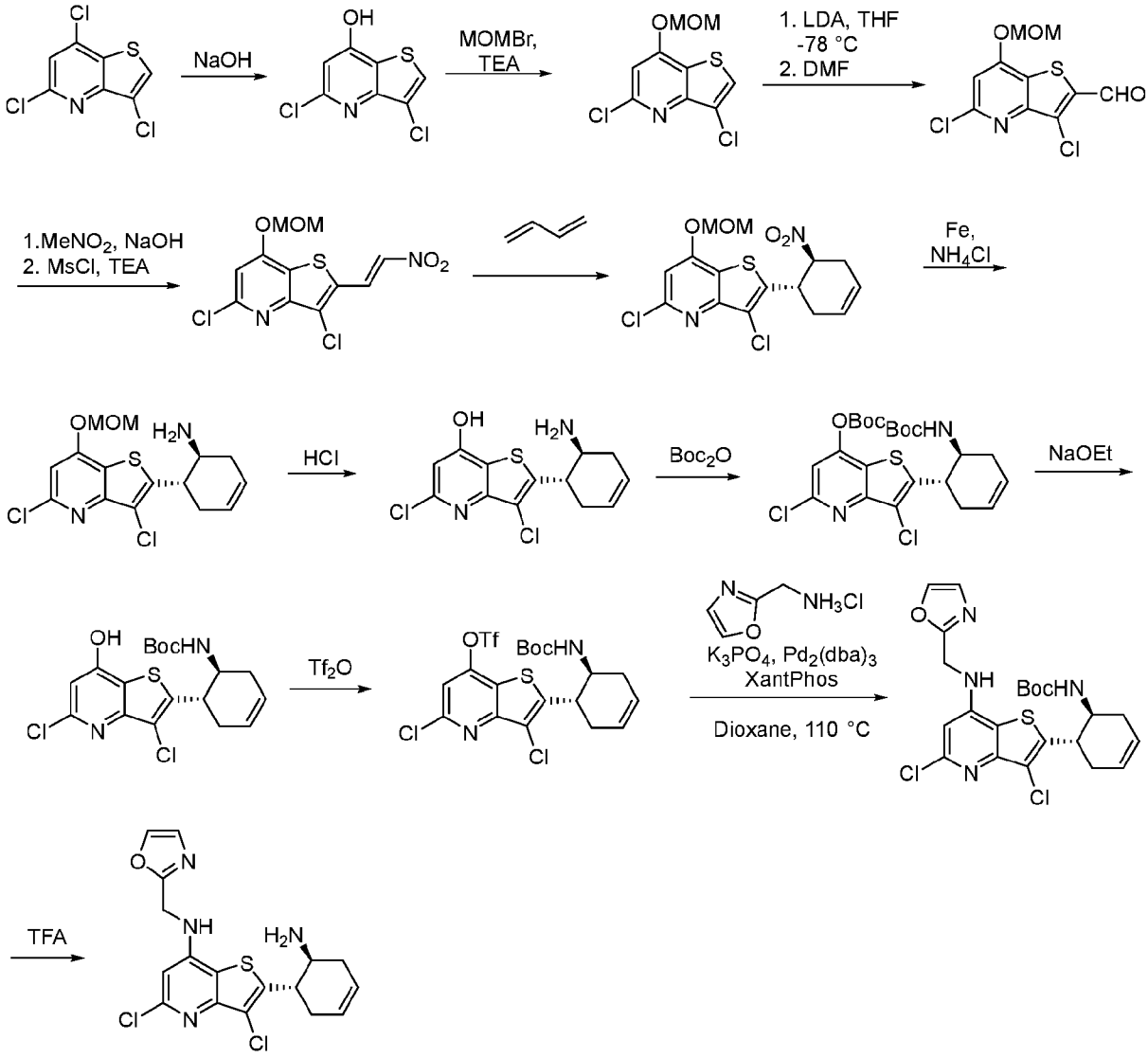
The compound below was prepared according to the procedure of Example 23 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
242	MS m/z 385.1 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.47 - 7.44 (m, 1H), 7.11 – 7.03 (m, 1H), 6.38 - 6.34 (m, 2H), 5.87 - 5.72 (m, 2H), 4.62 – 4.57 (m, 2H), 3.60 – 3.49 (m, 1H), 3.39 - 3.32 (m, 1H), 2.59 - 2.42 (m, 3H), 2.22 – 2.11 (m, 1H). (3 exchangeable protons are not seen)
282	MS m/z 365.0 $[M+H]^+$; ^1H NMR (400 MHz, METHANOL-d_4) δ: 7.46 – 7.38 (m, 2H), 6.42 – 6.27 (m, 2H), 5.86 – 5.68 (m, 2H), 4.80 – 4.71

Compound	Spectral Data
	(m, 2H), 3.41 – 3.32 (m, 1H), 3.24 – 3.11 (m, 1H), 2.56 – 2.24 (m, 6H), 2.20 – 2.00 (m, 1H). (3 exchangeable protons are not seen)
289	MS m/z 365.1 $[M+H]^+$; ^{1}H NMR (400 MHz, METHANOL-d_4) δ: 7.46 – 7.38 (m, 2H), 6.42 – 6.27 (m, 2H), 5.86 – 5.68 (m, 2H), 4.80 – 4.71 (m, 2H), 3.41 – 3.32 (m, 1H), 3.24 – 3.11 (m, 1H), 2.56 – 2.24 (m, 6H), 2.20 – 2.00 (m, 1H). (3 exchangeable protons are not seen)
443	MS m/z 385.1 $[M+H]^+$; ^{1}H NMR (400 MHz, METHANOL-d_4) δ: 7.47 - 7.44 (m, 1H), 7.11 – 7.03 (m, 1H), 6.38 - 6.34 (m, 2H), 5.87 - 5.72 (m, 2H), 4.62 – 4.57 (m, 2H), 3.60 – 3.49 (m, 1H), 3.39 - 3.32 (m, 1H), 2.59 - 2.42 (m, 3H), 2.22 – 2.11 (m, 1H). (3 exchangeable protons are not seen)

Example 24

Preparation of Compound 199



Step 1: 3,5-Dichlorothieno[3,2-b]pyridin-7-ol

To a solution of 3,5,7-trichlorothieno[3,2-b]pyridine (30 g, 126 mmol) in a mixture of DMSO (300 mL) and H_2O (60 mL) was added NaOH (12.6 g, 314 mmol, 2.5 eq.). After stirring at 110 °C for 12 h, the reaction mixture was cooled to room temperature, diluted with H_2O (300 mL) and acidified to pH 5 with conc. HCl. The mixture was filtered to give 3,5-dichlorothieno[3,2-b]pyridin-7-ol (27 g, 98%) as a yellow solid that was used without further purification. MS m/z 219.8 $[M+H]^+$.

Step 2: 3,5-Dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine

To a solution cooled of 3,5-dichlorothieno[3,2-b]pyridin-7-ol (27 g, 123 mmol) and TEA (85.3 mL, 613 mmol, 5 eq.) in DMF (200 mL), at 0 °C, was added MOMBr (30 mL, 368 mmol, 3 eq.) dropwise. After stirring at room temperature for 2 h, the reaction mixture was diluted with EtOAc (500 mL) and washed with water (500 mL x 5) and brine (500 mL x 2). The organic solution was dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude solid was purified by silica gel column chromatography (EA/PE 0-20% gradient) to afford 3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine (20 g, 62%) as a yellow solid. MS m/z 263.8 $[M+H]^+$.

Step 3: 3,5-Dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine-2-carbaldehyde

According to the procedure described in step 1 of Intermediate 1, 3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine (20 g, 76 mmol) was used to afford crude 3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine-2-carbaldehyde (22.1 g, 99%) as a yellow solid. MS m/z 291.8 $[M+H]^+$.

Step 4: (E)-3,5-Dichloro-7-(methoxymethoxy)-2-(2-nitrovinyl)thieno[3,2-b]pyridine

According to the procedure described in steps 2 and 3 of Intermediate 1, 3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridine-2-carbaldehyde (22 g, 75 mmol) was used to afford (E)-3,5-dichloro-7-(methoxymethoxy)-2-(2-nitrovinyl)thieno[3,2-b]pyridine (21 g, 83%) as a yellow solid. MS m/z 335.2 $[M+H]^+$.

Step 5: 3,5-Dichloro-7-(methoxymethoxy)-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)thieno[3,2-b]pyridine

According to the procedure described in step 1 of Example 13, 3,5-dichloro-7-(methoxymethoxy)-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)thieno[3,2-b]pyridine (7 g, 21 mmol) was used to afford crude (E)-3,5-dichloro-7-(methoxymethoxy)-2-(2-nitrovinyl)thieno[3,2-b]pyridine (23 g, 99%) as a yellow oil. MS m/z 388.8 $[M+H]^+$.

Step 6: (1S,6S)-6-(3,5-Dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-amine

According to the procedure described in step 2 of Example 13, 3,5-dichloro-7-(methoxymethoxy)-2-((1S,6S)-6-nitrocyclohex-3-en-1-yl)thieno[3,2-b]pyridine (23 g, 59 mmol) was used to afford crude (1S,6S)-6-(3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-amine (20 g, 94%) as a yellow solid. MS m/z 359.0 $[M+H]^+$.

Step 7: 2-((1S,6S)-6-Aminocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-ol

To a solution of crude (1S,6S)-6-(3,5-dichloro-7-(methoxymethoxy)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-amine (20 g, 56 mmol) in EtOAc (200 mL) was added 4M HCl (solution in dioxane, 20 mL). After stirring at room temperature for 2 h, the reaction mixture was concentrated *in vacuo* to afford crude 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-ol (17 g, 97%) as a yellow solid which was used without further purification. MS m/z 315.0 $[M+H]^+$.

Step 8: tert-Butyl ((1S,6S)-6-(7-((tert-butoxycarbonyl)oxy)-3,5-dichlorothieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate

To a solution of crude 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-ol (17 g, 28 mmol) in THF (30 mL) was added TEA (20 mL, 141 mmol, 5 eq.) and Boc_2O (12.3 g, 57 mmol, 2 eq.). After stirring at room temperature for 12 h, the reaction mixture was concentrated *in vacuo* and the crude residue was purified by silica gel column chromatography (EA/PE 0-15% gradient) to afford tert-butyl ((1S,6S)-6-(7-((tert-butoxycarbonyl)oxy)-3,5-dichlorothieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate (9.5 g, 48%) as a yellow oil. MS m/z 414.8 $[M\text{-}Boc+H]^+$.

Step 9: tert-Butyl ((1S,6S)-6-(3,5-dichloro-7-hydroxythieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate

To a solution of tert-butyl ((1S,6S)-6-(7-((tert-butoxycarbonyl)oxy)-3,5-dichlorothieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate (9.5 g, 18 mmol) in MeOH (20 mL) was added NaOEt (2.5 g, 37 mmol, 2 eq.). After stirring at room temperature for 2 h, the reaction mixture was concentrated *in vacuo* to afford crude tert-butyl ((1S,6S)-6-(3,5-dichloro-7-hydroxythieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate (4.5 g, 59%) as a yellow solid which was used without further purification. MS m/z 414.8 $[M+H]^+$.

Step 10: 2-((1S,6S)-6-((tert-Butoxycarbonyl)amino)cyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl trifluoromethanesulfonate

To a solution of crude 2-((1S,6S)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl trifluoromethanesulfonate (3.0 g, 7.2 mmol) in pyridine (30 mL), cooled to 0 °C, was added Tf_2O (1.8 mL, 10.8 mmol, 1.5 eq.) dropwise. After stirring at room temperature for 2 h, the reaction mixture was diluted with EtOAc (100 mL) and washed with water (100 mL x 5) and brine (200 mL x 2). The organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel

column chromatography (EA/PE 0-10% gradient) to afford 2-((1S,6S)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl trifluoromethanesulfonate (2.5 g, 63%) as a white solid. MS m/z 546.8 $[M+H]^+$.

Step 11: tert-Butyl ((1S,6S)-6-(3,5-dichloro-7-((oxazol-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate

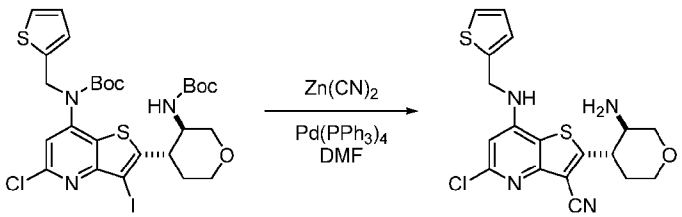
A mixture of 2-((1S,6S)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-yl trifluoromethanesulfonate (500 mg, 0.9 mmol), oxazol-2-ylmethanamine hydrogen chloride (148 mg, 1.1 mmol, 1.2 eq.), K_3PO_4 (156 mg, 4 mmol, 4 eq.), 4,5-bis(diphenylphosphino)-9,9-dimethylxanthene (22 mg, 0.02 mmol, 0.2 eq.), tris(dibenzylideneacetone)dipalladium (17 mg, 0.01 mmol, 0.1 eq.), and dioxane (10 mL) was was stirred 110 °C for 12 h. The reaction mixture was cooled to room temperature and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography to afford tert-butyl ((1S,6S)-6-(3,5-dichloro-7-((oxazol-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate (200 mg, 44%) as a yellow oil. MS m/z 494.9 $[M+H]^+$.

Step 12: 2-((1S,6S)-6-Aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(oxazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

tert-Butyl ((1S,6S)-6-(3,5-dichloro-7-((oxazol-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-3-en-1-yl)carbamate (200 mg, 0.4 mmol) was deprotected according to the procedure described in Example 5, step 2 to afford 2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(oxazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (33 mg, 21%) as a white solid. MS m/z 395.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.95-6.85 (m, 1H), 7.24-7.10 (m, 1H), 6.70-6.59 (m, 1H), 5.85-5.70 (m, 2H), 4.65 (s, 2H), 3.59 – 3.50 (m, 1H), 3.28-3.14 (m, 1H), 2.60 – 2.38 (m, 3H), 2.30-2.05 (m, 1H).

Example 25

Preparation of Compound 393

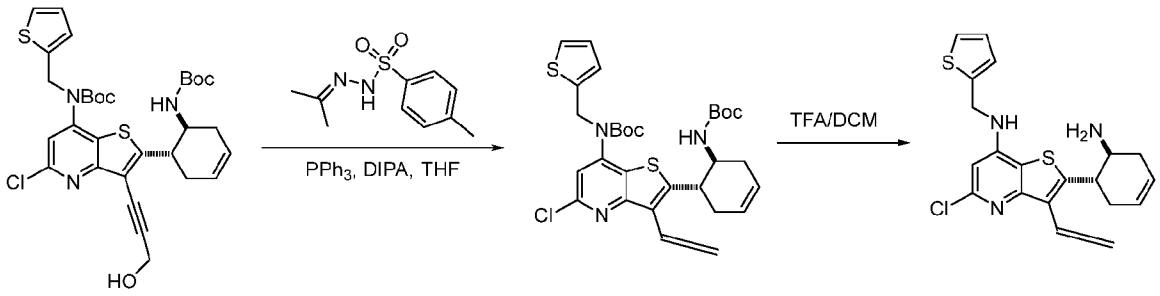


Step 1: rac-2-((3*R*,4*S*)-3-Aminotetrahydro-2*H*-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-*b*]pyridine-3-carbonitrile

An oven-dried, 8-mL reaction vial was charged with $Pd(PPh_3)_4$ (11.6 mg, 0.01 mmol, 0.1 eq), Zinc Cyanide (7 mg, 0.06 mmol, 0.6 eq) and rac-*tert*-butyl (2-((3*R*,4*S*)-3-((tert-butoxycarbonyl)amino)tetrahydro-2*H*-pyran-4-yl)-5-chloro-3-iodothieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (70.6 mg, 0.1 mmol) which was prepared by following the procedure in Example 11. DMF (1.0 mL) was added to the mixture and the solution was degassed with argon. The sealed vial was heated at 100 °C overnight. After cooling, 0.2 mL of NH_4Cl (sat. aq.) and 0.2 mL of $NaHCO_3$ (sat. aq.) were added. The mixture was filtered and washed with DCM (0.5 mL x 3). The combined filtrate was concentrated and purified by preparative HPLC eluting with 10-100% ACN in water with 0.1% TFA to provide rac-2-((3*R*,4*S*)-3-aminotetrahydro-2*H*-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-*b*]pyridine-3-carbonitrile (16.2 mg, 40% yield). MS m/z 405.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.32 (d, *J* = 5.1 Hz, 1H), 7.11 (d, *J* = 3.5 Hz, 1H), 6.99 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.70 (s, 1H), 4.79 (s, 2H), 4.08 (dd, *J* = 12.7, 3.6 Hz, 1H), 4.03 – 3.96 (m, 1H), 3.93 – 3.84 (m, 1H), 3.84 – 3.78 (m, 1H), 3.75 (dt, *J* = 10.0, 5.2 Hz, 1H), 3.64 (ddd, *J* = 12.2, 9.1, 4.0 Hz, 1H), 2.00 – 1.85 (m, 2H). (3 Exchangeable protons not observed).

Example 26

Preparation of Compound 324



Step 1: rac-*tert*-Butyl (2-((1*S*,6*S*)-6-((*tert*-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)thieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

An oven-dried, 8-mL reaction vial was charged with PPh_3 (39.3 mg, 0.15 mmol, 1.5 eq), *N*-isopropylidene-*N*′-2-nitrobenzenesulfonyl hydrazine (IPNBSH) (33.9 mg, 0.15 mmol,

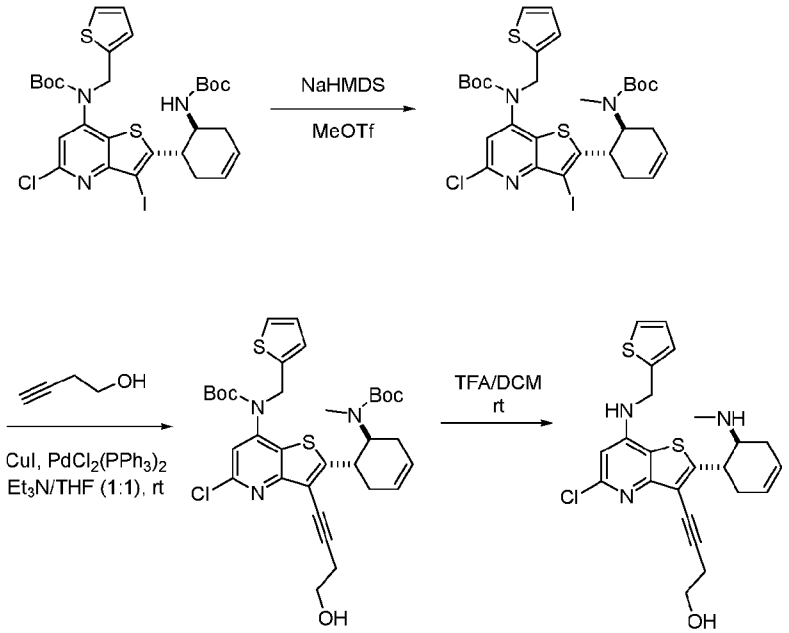
1.5 eq) and rac-*tert*-butyl (2-((1*S*,6*S*)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(3-hydroxyprop-1-yn-1-yl)thieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (63.0 mg, 0.1 mmol) which was prepared by following the procedure Example 19. Anhydrous THF (1.0 mL) was added to the reaction vial. The solution was cooled to 0 °C followed by dropwise addition of DIAD (30.3 mg, 0.15 mmol, 1.5 eq). After 5 min, the solution was then allowed to warm to room temperature and stirred for 2 h. A 1:1 Trifluoroethanol/H_2O mixture was added and the mixture was stirred overnight. The crude mixture was concentrated *in vacuo* and then purified by silica gel flash column chromatography on silica gel eluting with 0-100% EtOAc in hexanes to provide rac-*tert*-butyl (2-((1*S*,6*S*)-6-((*tert*-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)thieno[3,2-*b*]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (27.6 mg, 45% yield). MS m/z 614.2 $[M+H]^+$.

Step 2: rac-2-((1*S*,6*S*)-6-Aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine

Removal of the Boc group following the general procedure described in Step 2 Example 19 provided rac-2-((1*S*,6*S*)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-*b*]pyridin-7-amine (13.6 mg. 73% yield). MS m/z 414.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.2 Hz, 1H), 7.08 (dd, J = 3.5, 1.2 Hz, 1H), 6.98 (dd, J = 5.1, 3.5 Hz, 1H), 6.75 (t, J = 7.1 Hz, 1H), 6.58 (s, 1H), 5.94 – 5.87 (m, 1H), 5.80 – 5.74 (m, 1H), 5.28 – 5.08 (m, 2H), 4.76 (s, 2H), 4.06 (td, J = 9.3, 5.7 Hz, 1H), 3.73 (td, J = 9.3, 5.4 Hz, 1H), 2.72 – 2.58 (m, 2H), 2.59 – 2.43 (m, 1H), 2.34 – 2.23 (m, 1H). (3 Exchangeable protons not observed).

Example 27

Preparation of Compound 303



Step 1: *tert*-Butyl (rac-(1*S*,6*S*)-6-(7-((*tert*-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-iodothieno[3,2-*b*]pyridin-2-yl)cyclohex-3-en-1-yl)(methyl)carbamate

To a solution of tert-butyl (2-((1S,6S)-6-((tert-butoxycarbonyl)amino)cyclohex-3-en-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (70 mg, 0.1 mmol) (which was prepared according to the procedures in Example 13) in THF (1.0 mL) was added sodium bis(trimethylsilyl)amide (1.0 mol/L) in THF (0.12 mL, 0.12 mmol, 1.2 eq.) dropwise at -78°C, followed by addition of methyl trifluoromethanesulfonate (24.5 mg, 0.15 mmol, 1.5 eq.). The reaction was stirred under -50°C for 1 hour, then quenched with saturated aqueous NH_4Cl. The organic layer was washed with water, brine and dried over sodium sulfate and evaporated. The residue was purified by flash column chromatography on silica gel eluting with 0-100% EtOAc in hexanes to provide *tert*-butyl (rac-(1*S*,6*S*)-6-(7-((*tert*-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-iodothieno[3,2-*b*]pyridin-2-yl)cyclohex-3-en-1-yl)(methyl)carbamate (53.7 mg, 75% yield). MS m/z 716.1 $[M+H]^+$.

Step 2: *tert*-Butyl (rac-(1*S*,6*S*)-6-(7-((*tert*-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-(4-hydroxybut-1-yn-1-yl)thieno[3,2-*b*]pyridin-2-yl)cyclohex-3-en-1-yl)(methyl)carbamate

Installation of the alkyne group following the general procedure described in Step 1 from Example 19 provided *tert*-butyl (rac-(1*S*,6*S*)-6-(7-((*tert*-butoxycarbonyl)(thiophen-2-ylmethyl)amino)-5-chloro-3-(4-hydroxybut-1-yn-1-yl)thieno[3,2-*b*]pyridin-2-yl)cyclohex-3-en-1-yl)(methyl)carbamate (42.3 mg. 86% yield). MS m/z 658.2 $[M+H]^+$.

Step 3: 4-(5-Chloro-2-(rac-(1*S*,6*S*)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-*b*]pyridin-3-yl)but-3-yn-1-ol

Removal of the Boc group following the general procedure described in Step 2 from Example 19 provided 4-(5-chloro-2-(rac-(1*S*,6*S*)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-*b*]pyridin-3-yl)but-3-yn-1-ol (17.7 mg. 60% yield). MS m/z 458.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.3 Hz, 1H), 7.09 (dd, J = 3.6, 1.3 Hz, 1H), 6.98 (dd, J = 5.1, 3.6 Hz, 1H), 6.62 (s, 1H), 5.93 (d, J = 10.3 Hz, 1H), 5.81 (d, J = 10.3 Hz, 1H), 4.76 (s, 2H), 3.95 – 3.84 (m, 2H), 3.81 (t, J = 6.1 Hz, 2H), 2.77 (t, J = 6.1 Hz, 2H), 2.74 (s, 3H), 2.70 – 2.60 (m, 3H), 2.42 – 2.30 (m, 1H). (3 Exchangeable protons not observed).

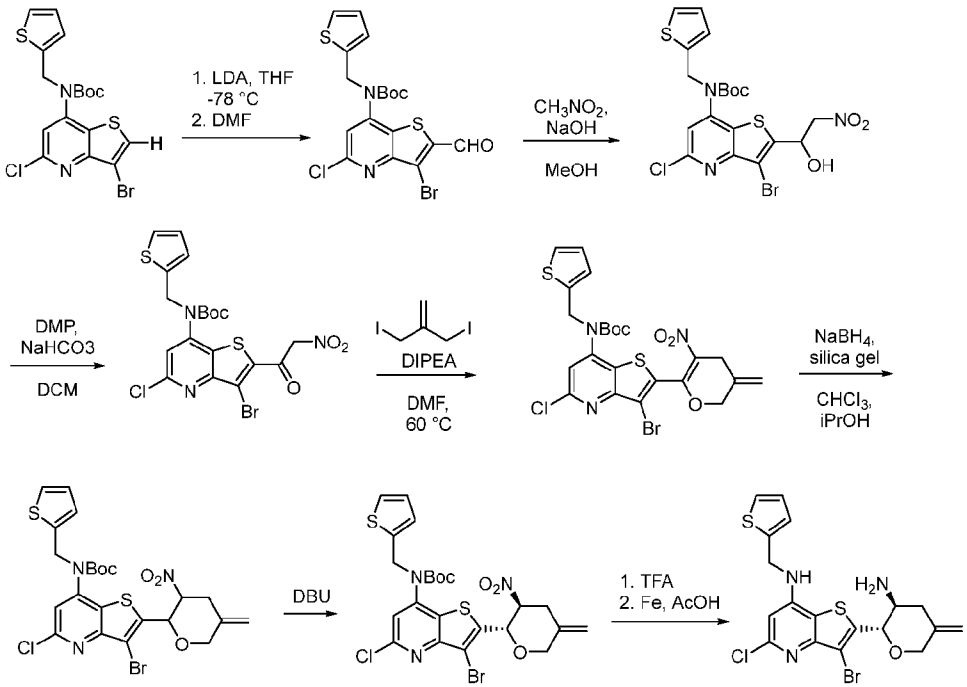
The compounds below were prepared according to Example 27 by substituting the appropriate starting materials, reagents, reaction conditions, and followed by chiral SFC resolution if needed.

Compound	Spectral Data
288	MS m/z 472.**1** $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.08 (d, J = 3.4 Hz, 1H), 6.98 (dd, J = 5.1, 3.4 Hz, 1H), 6.62 (s, 1H), 5.93 (d, J = 10.4 Hz, 1H), 5.81 (d, J = 10.4 Hz, 1H), 4.76 (s, 2H), 3.95 – 3.78 (m, 2H), 3.74 (t, J = 6.1 Hz, 2H), 2.74 (s, 3H), 2.72 – 2.60 (m, 5H), 2.42 – 2.30 (m, 1H), 1.88 (tt, J = 6.6, 6.6 Hz, 2H). (3 Exchangeable protons not observed).
264	MS m/z 474.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30 (d, J = 5.1 Hz, 1H), 7.09 (d, J = 3.4 Hz, 1H), 6.98 (dd, J = 5.1, 3.4 Hz, 1H), 6.61 (s, 1H), 4.76 (s, 2H), 3.76 (t, J = 6.1 Hz, 2H), 3.66 – 3.52 (m, 1H), 3.51 – 3.40 (m, 1H), 2.70 – 2.66 (m, 2H), 2.66 (s, 3H), 2.35 – 2.26 (m, 1H), 2.15 – 2.10 (m, 1H), 2.07 – 1.99 (m, 1H), 1.95 – 1.82 (m, 4H), 1.60 – 1.45 (m, 3H). (3 Exchangeable protons not observed).
293	MS m/z 473.1 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.28 (dd, J = 5.2, 1.4 Hz, 1H), 7.11 – 7.07 (m, 1H), 6.95 (dd, J = 5.2, 3.4 Hz, 1H), 5.92 (d, J = 10.6 Hz, 1H), 5.80 (d, J = 10.6 Hz, 1H), 4.98 – 4.88 (m, 2H), 3.93 – 3.80 (m, 2H), 3.74 (t, J = 6.1 Hz, 2H), 2.74 (s, 3H), 2.69 – 2.58 (m, 5H), 2.40 – 2.32 (m, 1H), 1.88 (tt, J = 6.6, 6.6 Hz, 2H). (3 Exchangeable protons not observed).

Compound	Spectral Data
309	MS m/z 476.1 $[M+H]^+$; ^1H NMR (METHANOL-d_4) δ: 7.30 (d, J = 5.0 Hz, 1H), 7.11 – 7.06 (m, 1H), 7.01 – 6.95 (m, 1H), 6.63 (s, 1H), 5.04 (d, J = 9.6 Hz, 1H), 4.77 (s, 2H), 4.17 – 4.10 (m, 1H), 3.82 – 3.75 (m, 2H), 3.68 (td, J = 11.4, 3.4 Hz, 1H), 3.48 – 3.40 (m, 1H), 2.72 – 2.65 (m, 5H), 2.47 – 2.40 (m, 1H), 2.00 – 1.79 (m, 5H). (3 Exchangeable protons not observed).
387	MS *m/z* $[M+H]^+$ 515.9; ^1H NMR (METHANOL-d_4) δ: 8.43 (s, 1H), 7.20 (dt, J = 5.4, 1.7 Hz, 1H), 6.98 (d, J = 3.7 Hz, 1H), 6.92 – 6.81 (m, 1H), 6.48 (d, J = 2.5 Hz, 1H), 5.72 (d, J = 16.6 Hz, 2H), 4.64 (d, J = 2.4 Hz, 2H), 3.65 (s, 1H), 3.35 – 3.26 (m, 1H), 2.55 – 2.44 (m, 2H), 2.41 (s, 3H), 2.40 – 2.29 (m, 1H), 2.09 (d, J = 17.9 Hz, 1H). Formic acid salt, (2, exchangeable protons not observed).

Example 28

Preparation of Compound 259



Step 1: tert-Butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl N-(3-bromo-5-chloro-thieno[3,2-b]pyridin-7-yl)-N-(2-thienylmethyl)carbamate (5 g, 11 mmol) (prepared according to the procedure described in WO2020/17430) in THF (50 mL) was added 2M lithium diisopropylamide (6 mL, 1.2 eq.) at -78 °C and stirred for 1h, followed by addition of DMF (2.4 g) at -78 °C. After stirring at -78 °C

for an additional 3h, the reaction mixture was quenched with saturated aqueous NH_4Cl and extracted with EtOAc (2 x 100 mL). The combined organics were dried over Na_2SO_4, filtered, and concentrated. The crude reside was purified by silica gel column chromatography (DCM/PE 1:3) to afford tert-butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (5.1 g, 96%) as a light yellow solid. MS *m/z* 488.8 $[M+H]^+$. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 10.32 (s, 1H), 7.23 (d, *J* = 7.1 Hz, 2H), 6.87 (dd, *J* = 4.9, 3.6 Hz, 1H), 6.81 (d, *J* = 3.3 Hz, 1H), 5.06 (s, 2H), 1.47 (s, 9H).

Step 2: tert-Butyl (3-bromo-5-chloro-2-(1-hydroxy-2-nitroethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of NaOH (1M aqueous, 36 mL) in MeOH (120 mL), cooled to -10 °C, was added tert-butyl (3-bromo-5-chloro-2-formylthieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (14.4 g, 30 mmol) followed by addition of nitromethane (2.16 g, 30 mmol, 1.0 eq.) in MeOH (50 mL) dropwise. After stirring at 0 °C for 1 h, the reaction mixture was poured into water (300 mL) and extracted with EtOAc (3 x 400 mL). The combined organic phase was washed with brine (500 mL), dried over Na_2SO_4, filtered, and concentrated. The crude residue was purified by silica gel column chromatography (EA/PE 0-15% gradient) to afford tert-butyl (3-bromo-5-chloro-2-(1-hydroxy-2-nitroethyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (13.3 g, 82%) as a yellow oil. ^1H NMR (400 MHz, CHLOROFORM-*d*) δ: 7.23 (dd, J = 5.1, 1.1 Hz, 1H), 6.88 (dd, *J* = 5.1, 3.5 Hz, 1H), 6.80 (d, *J* = 2.6 Hz, 1H), 5.95 (dd, *J* = 6.4, 3.3 Hz, 1H), 5.09-4.96 (m, 2H), 4.78 (dd, *J* = 13.5, 2.6 Hz, 1H), 4.60 (dd, *J* = 13.5, 9.6 Hz, 1H), 4.17 (t, *J* = 8.2 Hz, 1H), 1.48 (s, 9H).

Step 3: tert-Butyl (3-bromo-5-chloro-2-(2-nitroacetyl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl N-[3-bromo-5-chloro-2-(1-hydroxy-2-nitro-ethyl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (13.3 g, 24 mmol) in DCM (130 mL), cooled to 0 °C, was added Na_2CO_3 (3.98 g, 48 mmol, 2 eq.) and Dess-Martin periodinane (15.1 g, 35.6 mmol, 1.5 eq.). After stirring at 0 °C for 3 h, hexane (400 mL) was added and the solution was stirred at room temperature for 10 min. The solution was then filtered and the filtrate was concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/PE, 0-20% gradient) to afford tert-butyl N-[3-bromo-5-chloro-2-(2-nitroacetyl)thieno[3,2-

b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (11 g, 83.%) as a yellow solid. MS *m/z* 548.0 $[M+H]^+$.

Step 4: tert-Butyl (3-bromo-5-chloro-2-(3-methylene-5-nitro-3,4-dihydro-2H-pyran-6-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl N-[3-bromo-5-chloro-2-(2-nitroacetyl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (11 g, 20.12 mmol) in DMF (110 mL) was added 3-iodo-2-(iodomethyl)prop-1-ene (11.55 g, 37.51 mmol, 1.9 eq.) and DIPEA (6.49 g, 50.2 mmol, 2.5 eq.). After stirring at 60 °C for 2 h, the reaction mixture was cooled to room temperature and diluted with water (100 mL). The aqueous phase was extracted with EtOAc (3 x 100 mL) and the combined organics were washed with brine, dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/PE 0-20% gradient) to afford tert-butyl N-[3-bromo-5-chloro-2-(5-methylene-3-nitro-4H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (5.5 g, 46%) as a colorless oil. MS *m/z* 599.7 $[M+H]^+$.

Step 5: tert-Butyl (3-bromo-5-chloro-2-(5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl N-[3-bromo-5-chloro-2-(5-methylene-3-nitro-4H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl]-N-(2-thienylmethyl)carbamate (5.5 g, 9.2 mmol) in chloroform (165 mL) and 2-propanol (33 mL) was added silica gel (14.6 g) and $NaBH_4$ (1.3 g, 34 mmol, 3.7 eq.) at 25 °C. After stirring at room temperature for 2 h, the reaction mixture was quenched with aqueous NH_4Cl (1M, 100 mL), diluted with water, and extracted with EtOAc (3 x 100 mL). The combined organics were dried over Na_2SO_4, filtered, and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/PE 0-20% gradient) to afford tert-butyl (3-bromo-5-chloro-2-(5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (2.7 g, 2.0 mmol, 67%) as a mixture of diastereomers. MS *m/z* 602.0 $[M+H]^+$.

Step 6: tert-Butyl (3-bromo-5-chloro-2-((2S,3S)-5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate

To a solution of tert-butyl (3-bromo-5-chloro-2-(5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (680 mg, 1.1 mmol) in THF (20 mL) was added dropwise 2,3,4,6,7,8,9,10-octahydropyrimido[1,2-a]azepine (86 mg,

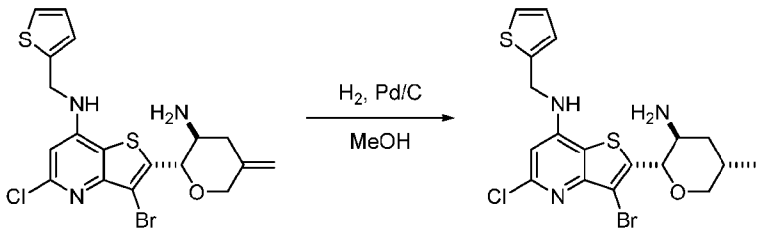
0.56 mmol, 0.5 eq.) at 0 °C under N2. The mixture was stirred for 2 h at 0 °C. The reaction was then quenched with water (50 ml), and extracted with EtOAc (50 ml ×2). The combined organic layers were washed with brine (100 ml), dried over Na_2SO_4, filtered and concentrated *in vacuo*. The crude residue was purified by silica gel column chromatography (EA/PE 0-20% gradient) to afford tert-butyl (3-bromo-5-chloro-2-((2S,3S)-5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (260 mg, 38%) as a white solid. MS *m/z* 602.0 $[M+H]^+$.

Step 7: rac-2-((2S,3S)-3-Amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To a solution of afford tert-butyl (3-bromo-5-chloro-2-((2S,3S)-5-methylene-3-nitrotetrahydro-2H-pyran-2-yl)thieno[3,2-b]pyridin-7-yl)(thiophen-2-ylmethyl)carbamate (1 g, 2 mmol) in EtOH (15 mL) and AcOH (5 mL) was added iron (1.55 g, 28 mmol, 2.9 eq.) at 25 °C. After stirring for 12 h at 65 °C, the reaction mixture was cooled to room temperature and filtered, rinsing with DCM (50 mL x 2). The filtrate was concentrated and the crude residue was purified by silica gel column chromatography (MeOH/DCM 0-10% gradient) to give rac-2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (870 mg, 92%) as a yellow solid. MS *m/z* 471.8 $[M+H]^+$.^{1}H NMR (400 MHz, METHANOL-d4) δ: 7.29 (dd, *J* = 5.1, 1.2 Hz, 1H), 7.08 (dd, *J* = 3.5, 1.0 Hz, 1H), 6.97(dd, *J* = 5.1, 3.5 Hz, 1H), 6.63 (s, 1H), 5.14 (t, *J* = 12.2 Hz, 3H), 4.76 (s, 2H), 4.41 (d, *J* = 12.6 Hz, 1H),4.26 (d, *J* = 12.7 Hz, 1H), 3.46 (ddd, *J* = 11.7, 9.7, 4.7 Hz, 1H), 2.95 (dd, *J* = 13.5, 4.0 Hz, 1H), 2.66 (d, *J*= 12.3 Hz, 1H) (3 exchangeable protons are not seen).

Example 29

Preparation of Compound 284



Step 1: rac-2-((2*S*,3*S*,5*S*)-3-Amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine

To a 1.0 mL MeOH solution of rac-2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (23.6 mg, 0.05 mmol) which was provided by following the procedure in Example 28, was added Pd/C (10 wt. % loading, 10.6 mg, 0.01 mmol, 0.2 eq.). The reaction mixture was sparged by hydrogen gas for 5 min using a hydrogen balloon. The reaction was then allowed to stir at room temperature under the hydrogen balloon for 2 h. The catalyst was filtered off and washed with MeOH. The mixture was concentrated and purified by flash column chromatography on silica gel eluting with 0-40% MeOH in DCM to provide rac-2-((2*S*,3*S*,5*S*)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine (20.8 mg, 88% yield). MS m/z 472.0 $[M+H]^+$; ^{1}H NMR (METHANOL-d_4) δ: 7.30 (dd, J = 5.1, 1.3 Hz, 1H), 7.12 – 7.06 (m, 1H), 6.98 (dd, J = 5.1, 3.6 Hz, 1H), 6.64 (s, 1H), 4.98 (d, J = 9.4 Hz, 1H), 4.77 (s, 2H), 3.88 – 3.83 (m, 2H), 3.73 – 3.59 (m, 1H), 2.24 – 2.14 (m, 1H), 2.14 – 2.00 (m, 2H), 1.28 (d, J = 7.1 Hz, 3H). (3 Exchangeable protons not observed).

BIOLOGICAL EXAMPLES

The following *in vitro* biological examples demonstrate the usefulness of the compounds of the present description for treating SCA3.

To describe in more detail and assist in understanding the present description, the following non-limiting biological examples are offered to more fully illustrate the scope of the description and are not to be construed as specifically limiting the scope thereof. Such variations of the present description that may be now known or later developed, which would be within the purview of one skilled in the art to ascertain, are considered to fall within the scope of the present description and as hereinafter claimed.

Example 1

Endogenous Total ATXN3 (tATXN3) Protein Assay

Meso Scale Discovery (MSD) 96-well or 384-well plates were coated overnight at 4 °C with Ataxin 3 mouse monoclonal antibody (Invitrogen, MA3-082) at a concentration of 0.5

μg/mL in PBS (30 μL per well). Plates were then washed three times with 300 μL wash buffer (0.05% TWEEN®-20, polyethylene glycol sorbitan monolaurate, in PBS) and blocked (Meso Scale Diagnostics, R93BA-1; 5% BSA in PBS) for 2 h at RT with rotational shaking and then washed three times with wash buffer.

Test compounds were serially diluted 3.16-fold in 100% DMSO to generate a 7-point concentration curve. Aliquots of 0.5 μL of diluted compounds were transferred to a 96-well flat bottom plate by a liquid handler. An aliquot of 0.5 μL DMSO was also transferred to separate wells and used as controls. Duplicate samples were set up for each compound concentration and for the DMSO control.

Cells were thawed and incubated in cell culture media (DMEM, 10% FBS, and 1% antibiotic cocktail) for 72 h. Cells were trypsinized, counted, and re-suspended to a concentration of 100,000 cells/mL in cell culture media. A 100 μL aliquot of the cell suspensions were plated at 10,000 cells per well in the compound containing 96 well microtiter plate and incubated for in a cell culture incubator (37 °C, 5% CO_2, 100% relative humidity). After 48 h, the medium was removed and 50-100 μL of lysis buffer (Meso Scale Diagnostics, R60TX-2) containing 1X halt protease inhibitor cocktail of (Thermo Scientific, Halt™ Protease Inhibitor Cocktail ,78430) per well was added to cells to provide a "cell lysate". The plate was placed on a shaker at 4 °C for 30 minutes, then stored at -80 °C.

Cell lysate samples (25 μL) were transferred to the antibody-coated MSD plate and incubated overnight at 4 °C. After removal of the lysates, the plate was washed three times with wash buffer, and 25 μL of Ataxin 3 recombinant rabbit monoclonal antibody (Invitrogen, #702788) secondary antibody (diluted to 0.25 μg/mL in 0.05% TWEEN®-20 in blocking buffer) was added to each well and incubated with shaking for 1-2 h at room temperature. Following incubation with the secondary antibody, the wells were rinsed with wash buffer and then 25 μL of Anti Rabbit Antibody Goat SULFO-TAG Labeled (Meso Scale Diagnostics, R32AB-1) detecting antibody (diluted to 0.25 μg/mL in 0.05% TWEEN®-20 in blocking buffer) was added to each well and incubated with shaking for 1 h at room temperature. After rinsing three times with wash buffer, 150 μL of Read Buffer T with surfactant (tris-based buffer containing tripropylamine, Meso Scale Diagnostics, R92TC-1) were added to each empty well, and the plate was imaged on a SI 6000 imager (MSD) according to manufacturers'

instructions provided for 96- or 384- well plates. The resulting average IC_{50} values (μM) for the representative compounds tested are shown in Table 1.

An average $IC_{50} > 1$ μM is indicated by one star (*), between > 0.3 μM and ≤ 1 μM is indicated by two stars (**), between > 0.03 μM and ≤ 0.3 μM is indicated by three stars (***),and ≤ 0.03 μM is indicated by four stars (****).

Table 1

Cpd	IC_{50}	Cpd	IC_{50}	Cpd	IC_{50}
1	****	153	****	305	***
2	*	154	*	306	***
3	*	155	*	307	***
4	***	156	*	308	***
5	*	157	*	309	***
6	***	158	*	310	***
7	**	159	*	311	***
8	****	160	*	312	***
9	*	161	*	313	***
10	**	162	****	314	***
11	**	163	***	315	***
12	*	164	*	316	***
13	***	165	****	317	***
14	*	166	***	318	***
15	**	167	**	319	***
16	*	168	****	320	***
17	*	169	****	321	***
18	****	170	****	322	***
19	***	171	****	323	***
20	***	172	****	324	***
21	***	173	****	325	***
22	**	174	****	326	***
23	*	175	****	327	***
24	***	176	****	328	***
25	***	177	****	329	***
26	**	178	****	330	***
27	***	179	****	331	***

Cpd	IC_{50}
28	*
29	***
30	*
31	*
32	***
33	***
34	****
35	**
36	*
37	**
38	***
39	*
40	***
41	***
42	**
43	*
44	*
45	****
46	*
47	*
48	***
49	*
50	**
51	*
52	*
53	**
54	***
55	***
56	**
57	****
58	*
59	*
60	****
61	*

Cpd	IC_{50}
180	****
181	****
182	****
183	****
184	****
185	****
186	****
187	****
188	****
189	****
190	****
191	****
192	****
193	****
194	****
195	****
196	****
197	****
198	****
199	****
200	****
201	****
202	****
203	****
204	****
205	****
206	****
207	****
208	****
209	****
210	****
211	****
212	****
213	****

Cpd	IC_{50}
332	***
333	***
334	***
335	***
336	***
337	***
338	***
339	***
340	***
341	***
342	***
343	***
344	***
345	***
346	***
347	***
348	***
349	***
350	***
351	***
352	***
353	***
354	***
355	***
356	***
357	***
358	***
359	***
360	***
361	***
362	***
363	***
364	***
365	***

Cpd	IC_{50}
62	***
63	***
64	*
65	****
66	*
67	**
68	****
69	***
70	*
71	****
72	*
73	**
74	*
75	***
76	*
77	*
78	*
79	***
80	*
81	***
82	**
83	*
84	*
85	*
86	*
87	***
88	*
89	*
90	**
91	*
92	*
93	*
94	**
95	*

Cpd	IC_{50}
214	****
215	****
216	****
217	****
218	****
219	****
220	****
221	****
222	****
223	****
224	****
225	****
226	****
227	****
228	****
229	****
230	****
231	****
232	****
233	****
234	****
235	****
236	****
237	****
238	****
239	****
240	****
241	****
242	****
243	****
244	****
245	****
246	****
247	***

Cpd	IC_{50}
366	***
367	***
368	***
369	***
370	***
371	***
372	***
373	***
374	***
375	***
376	***
377	***
378	***
379	***
380	***
381	***
382	***
383	***
384	***
385	***
386	***
387	***
388	***
389	**
390	**
391	**
392	**
393	**
394	**
395	**
396	**
397	**
398	**
399	**

Cpd	IC_{50}
96	***
97	*
98	*
99	***
100	*
101	*
102	*
103	*
104	*
105	*
106	*
107	**
108	****
109	***
110	***
111	*
112	*
113	*
114	*
115	****
116	****
117	****
118	**
119	*
120	***
121	*
122	*
123	*
124	*
125	*
126	***
127	***
128	*
129	**

Cpd	IC_{50}
248	***
249	***
250	***
251	***
252	***
253	***
254	***
255	***
256	***
257	***
258	***
259	***
260	***
261	***
262	***
263	***
264	***
265	***
266	***
267	***
268	***
269	***
270	***
271	***
272	***
273	***
274	***
275	***
276	***
277	***
278	***
279	***
280	***
281	***

Cpd	IC_{50}
400	**
401	*
402	****
403	**
404	***
405	****
406	***
407	***
408	***
409	***
410	***
411	***
412	**
413	***
414	**
415	**
416	***
417	****
418	***
419	***
420	***
421	****
422	***
423	***
424	***
425	*
426	**
427	***
428	**
429	****
430	***
431	****
432	***
433	***

Cpd	IC_{50}
130	***
131	*
132	**
133	****
134	*
135	*
136	****
137	*
138	***
139	***
140	**
141	*
142	*
143	****
144	****
145	*
146	*
147	*
148	*
149	***
150	***
151	***
152	***

Cpd	IC_{50}
282	***
283	***
284	***
285	***
286	***
287	***
288	***
289	***
290	***
291	***
292	***
293	***
294	***
295	***
296	***
297	***
298	***
299	***
300	***
301	***
302	***
303	***
304	***

Cpd	IC_{50}
434	***
435	***
436	*
437	****
438	**
439	**
440	*
441	***
442	***
443	****
444	*
445	**
446	****
447	**
448	*
449	***
450	**
451	***
452	***
453	**
454	**
455	**

Example 2

RT-qPCR Assay to Quantify Exon 4 Skipping in *ATXN3* pre-mRNA in Cells

Test compounds were serially diluted 3.16-fold in 100% DMSO to generate a 7-point concentration curve. Aliquots of 0.5 μL of diluted compounds were transferred to a 96-well flat bottom plate by a liquid handler. An aliquot of 0.5 μL DMSO was also transferred to separate wells and used as controls. Duplicate samples were set up for each compound concentration and for the DMSO control.

Cells were thawed and incubated in cell culture media (DMEM, 10% FBS, and 1% antibiotic cocktail) for 72 h. Cells were trypsinized, counted, and re-suspended to a

concentration of 100,000 cells/mL in cell culture media. A 100 µL aliquot of the cell suspensions were plated at 10,000 cells per well in the compound containing 96 well microtiter plate and incubated for in a cell culture incubator (37 °C, 5% CO_2, 100% relative humidity).

After 24 h, media was aspirated from the cells and 50 µL of the RCL2 lysis buffer (10 mM Tris-HCL pH 7.4, 150 mM NaCl, 0.33% IGEPAL® CA-630) was added to each well and incubated at RT for 1 min. Chilled nuclease free water (50 µL per well) was added and the plates were immediately transferred on ice. After 1 min on ice, plates were frozen at - 80 °C overnight.

Preparation of RT-qPCR reaction mixture:

Reagent	Volume (µL)	Supplier and Catalogue No.
RT-PCR buffer (2X)	5.0	Thermo Fisher, 4387391
RT-PCR enzyme mixture (25X)	0.4	Thermo Fisher, 4387391
Target Primer/Probe (60X)	0.16	Thermo Fisher, 4331182
In house *GAPDH* assay (20X)	0.5	
H_2O	1.94	

Abbreviations:

GAPDH, glyceraldehyde 3-phosphate dehydrogenase

Target: *TaqMan assay ID Hs00245261_m1*

In house *GAPDH* assay:

Forward primer – 5′ caacggatttggtcgtattgg *3′*

Reverse primer – 5′ tgatggcaacaatatccactttacc *3′*

Probe (VIC-TAMRA) – 5′ cgcctggtcaccagggctgct 3′

An aliquot of 2 µL/well of the cell lysates was transferred using the liquid handler to the Armadillo 384-Well PCR plate containing 8 µL/well of the RT-qPCR reaction mixture that was prepared as detailed above. The plates were then sealed with MicroAmp™ Optical Adhesive Film followed by spinning down for 1 min and placed in the CFX384 thermocycler (BioRad).

The RT-qPCR was carried out at the following temperatures for the indicated time:

Step 1: 48 °C (30 min)

Step 2: 95 °C (10 min)

Step 3: 95 °C (15 sec)

Step 4: 60 °C (1 min);

then, repeated Steps 3 and 4 for a total of 40 cycles.

The percent exon 4 skipping was calculated for each dose of compound treatment using Equations 1 and 2.

Equation 1

$$Realtive\ gene\ expression\ = \frac{2^{-Ct(target)}}{1.9^{-Ct(GAPDH)}}$$

Equation 2

$$Percent\ exon\ 4\ skipping\ (\%)\ = 1 - \left[\frac{Realtive\ gene\ expression, Compound}{Realtive\ gene\ expression, DMSO}\right] \times 100$$

Data were fit to a dose response curve and the IC_{50} was interpolated using XLfit® statistical and curve fitting package. The resulting IC_{50} values (μM) for the representative compounds tested are shown in Table 2.

An average IC_{50} > 1 μM is indicated by one star (*), between > 0.3 μM and ≤ 1 μM is indicated by two stars (**), between > 0.03 μM and ≤ 0.3 μM is indicated by three stars (***),and ≤ 0.03 μM is indicated by four stars (****).

Table 2

Cpd	IC_{50}
1	****
2	*
3	*
4	***
5	*
6	***
7	**
8	****
9	**
10	**
11	***

Cpd	IC_{50}
153	****
154	*
155	**
156	*
157	*
158	*
159	*
160	*
161	*
162	****
163	****

Cpd	IC_{50}
305	***
306	***
307	***
308	***
309	***
310	***
311	***
312	***
313	***
314	***
315	***

Cpd	IC_{50}
12	*
13	***
14	*
15	**
16	*
17	*
18	****
19	***
20	***
21	***
22	**
23	*
24	***
25	***
26	**
27	****
28	*
29	***
30	*
31	*
32	***
33	***
34	****
35	**
36	*
37	***
38	***
39	*
40	***
41	***
42	**
43	*
44	*
45	****

Cpd	IC_{50}
164	**
165	****
166	***
167	***
168	****
169	****
170	*****
171	****
172	****
173	****
174	****
175	****
176	****
177	****
178	****
179	****
180	****
181	****
182	****
183	****
184	****
185	****
186	****
187	****
188	****
189	****
190	****
191	****
192	****
193	****
194	****
195	****
196	****
197	****

Cpd	IC_{50}
316	***
317	***
318	***
319	***
320	***
321	***
322	***
323	***
324	***
325	***
326	***
327	***
328	***
329	***
330	***
331	***
332	***
333	***
334	***
335	***
336	***
337	***
338	***
339	***
340	***
341	***
342	***
343	***
344	***
345	***
346	***
347	***
348	***
349	***

Cpd	IC_{50}
46	*
47	**
48	***
49	*
50	***
51	*
52	*
53	**
54	***
55	***
56	***
57	****
58	*
59	**
60	****
61	*
62	****
63	***
64	*
65	****
66	*
67	**
68	****
69	****
70	*
71	****
72	*
73	**
74	*
75	***
76	*
77	**
78	*
79	***

Cpd	IC_{50}
198	****
199	****
200	****
201	****
202	****
203	****
204	****
205	****
206	****
207	****
208	****
209	****
210	****
211	****
212	****
213	****
214	****
215	****
216	****
217	****
218	****
219	****
220	****
221	****
222	****
223	****
224	****
225	****
226	****
227	****
228	****
229	****
230	****
231	****

Cpd	IC_{50}
350	***
351	***
352	***
353	***
354	***
355	***
356	***
357	***
358	***
359	***
360	***
361	***
362	***
363	***
364	***
365	***
366	***
367	***
368	***
369	***
370	***
371	***
372	***
373	***
374	***
375	***
376	***
377	***
378	***
379	***
380	***
381	***
382	***
383	***

Cpd	IC_{50}
80	*
81	***
82	**
83	*
84	*
85	*
86	*
87	***
88	*
89	*
90	**
91	*
92	*
93	*
94	***
95	*
96	***
97	*
98	*
99	***
100	*
101	*
102	*
103	*
104	*
105	*
106	*
107	**
108	****
109	***
110	****
111	**
112	*
113	*

Cpd	IC_{50}
232	****
233	****
234	****
235	****
236	****
237	****
238	***
239	****
240	****
241	****
242	****
243	****
244	****
245	****
246	***
247	***
248	***
249	****
250	***
251	****
252	****
253	****
254	***
255	****
256	****
257	****
258	****
259	***
260	****
261	***
262	***
263	***
264	****
265	****

Cpd	IC_{50}
384	***
385	***
386	***
387	**
388	***
389	**
390	***
391	**
392	***
393	****
394	**
395	***
396	***
397	**
398	***
399	**
400	**
401	**
402	****
403	***
404	***
405	****
406	****
407	***
408	***
409	***
410	***
411	***
412	**
413	***
414	***
415	**
416	***
417	****

Cpd	IC_{50}
114	*
115	****
116	****
117	****
118	**
119	*
120	***
121	*
122	*
123	*
124	*
125	*
126	***
127	***
128	*
129	***
130	***
131	*
132	*
133	****
134	*
135	*
136	****
137	*
138	**
139	****
140	**
141	*
142	*
143	****
144	****
145	***
146	*
147	*

Cpd	IC_{50}
266	***
267	***
268	***
269	***
270	***
271	***
272	***
273	****
274	***
275	***
276	***
277	****
278	***
279	***
280	***
281	***
282	***
283	***
284	***
285	***
286	***
287	***
288	***
289	***
290	***
291	***
292	***
293	***
294	***
295	***
296	***
297	***
298	***
299	***

Cpd	IC_{50}
418	***
419	***
420	***
421	****
422	***
423	****
424	****
425	**
426	***
427	****
428	**
429	****
430	***
431	****
432	***
433	***
434	***
435	****
436	**
437	****
438	***
439	**
440	**
441	***
442	***
443	****
444	**
445	**
446	****
447	**
448	***
449	**
450	**
451	***

Cpd	IC_{50}
148	*
149	***
150	***
151	***
152	***

Cpd	IC_{50}
300	***
301	***
302	***
303	***
304	***

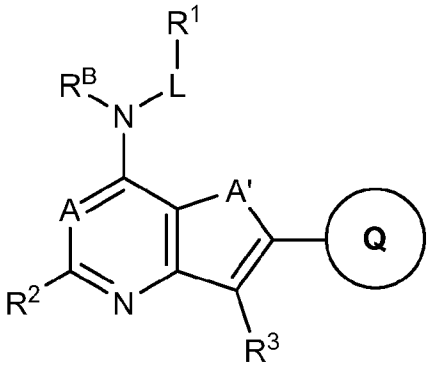
Cpd	IC_{50}
452	***
453	**
454	**
455	**

Without regard to whether a document cited herein was specifically and individually indicated as being incorporated by reference, all documents referred to herein are incorporated by reference into the present application for any and all purposes to the same extent as if each individual reference was fully set forth herein.

Having now fully described the subject matter of the claims, it will be understood by those having ordinary skill in the art that the same can be performed within a wide range of equivalents without affecting the scope of the subject matter or particular aspects described herein. It is intended that the appended claims be interpreted to include all such equivalents.

What is claimed is:

1. A compound of Formula (I):



(I)

or a form thereof, wherein

A is selected from the group consisting of CR^A and N;

A′ is selected from the group consisting of S and $NR^{A'}$;

L is selected from the group consisting of CH_2 and CD_2;

R^A is selected from the group consisting of hydrogen, halo, C_{1-6}alkyl, and C_{3-8}cycloalkyl;

$R^{A'}$ is selected from the group consisting of hydrogen, C_{1-4}alkyl, and halo-C_{1-4}alkyl;

R^B is selected from the group consisting of hydrogen and C_{1-6}alkyl;

R^1 is selected from the group consisting of phenyl, heteroaryl, C_{3-8}cycloalkyl, CO_2C_{1-6}alkyl, C_{2-6}alkenyl, and C_{2-6}alkynyl;

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S;

wherein C_{3-8}cycloalkyl is a saturated or partially unsaturated monocyclic or bicyclic ring system;

wherein phenyl, heteroaryl, and C_{3-8}cycloalkyl are substituted with zero, one, two, three, or four, independently selected R^{1a} substituents,

R^{1a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy;

R^2 is selected from the group consisting of hydrogen, cyano, halo, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, and hydroxy-C_{2-6}alkynyl;

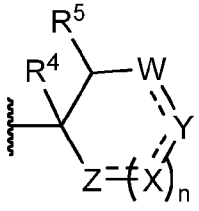
R^3 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, SH, C_{1-6}alkyl, halo-C_{1-6}alkyl, hydroxy-C_{1-6}alkyl, C_{1-6}alkoxy, halo-C_{1-6}alkoxy, thio-C_{1-6}alkyl, C_{2-6}alkenyl, C_{2-6}alkynyl, C_{1-6}alkoxy-C_{2-6}alkynyl, hydroxy-C_{2-6}alkynyl, $(CH_3)_3Si$-C_{2-6}alkynyl, heteroaryl-C_{2-6}alkynyl, C_{3-8}cycloalkyl, phenyl, and heteroaryl,

wherein heteroaryl is a 5-11 membered monocyclic or bicyclic aromatic carbon atom ring structure radical containing 1-3 heteroatoms selected from N, O, and S, and

wherein each instance of C_{3-8}cycloalkyl, phenyl, and heteroaryl are independently substituted with zero, one, two, three, or four, independently selected R^{3a} substituents;

R^{3a} is selected from the group consisting of cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, hydroxy-C_{1-6}alkyl, deutero-C_{1-6}alkyl, and C_{1-6}alkoxy;

Ring Q is



;

R^4 is selected from the group consisting of hydrogen, cyano, halo, hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, C_{1-6}alkoxy, and halo-C_{1-6}alkoxy;

R^5 is selected from the group consisting of amino, C_{1-4}alkyl-amino, and $(C_{1-4}alkyl)_2$-amino;

W is selected from the group consisting of CH_2, CD_2, CH-R^W, CD-R^W, $C(R^W)_2$, and C(O);

X is selected from the group consisting of CH_2, CD_2, CH-R^X, CD-R^X, $C(R^X)_2$, CH, CD, CR^X, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^X)_2$, C(O), NH, N-C_{1-4}alkyl, N-phenyl, O, S, S(O), and SO_2;

Y is selected from the group consisting of CH_2, CD_2, CH-R^Y, CD-R^Y, $C(R^Y)_2$, CH, CD, CR^Y, $C{=}CH_2$, $C{=}CD_2$, $C{=}C(R^Y)_2$, N-phenyl, O, S, S(O), and SO_2;

Z is selected from the group consisting of CH_2, CD_2, CH-R^Z, CD-R^Z, $C(R^Z)_2$, CH, CD, CR^Z, NH, N-C_{1-4}alkyl, N-phenyl, O, S, S(O), and SO_2;

each R^W, R^X, R^Y, R^Z are independently selected from the group consisting of halo,

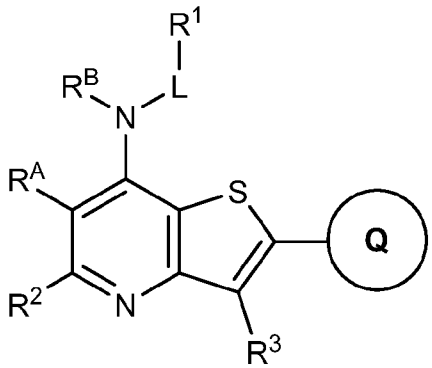
hydroxy, C_{1-6}alkyl, halo-C_{1-6}alkyl, C_{1-6}alkoxy, halo-C_{1-6}alkoxy, amino, C_{1-4}alkyl-amino, $(C_{1-4}alkyl)_2$-amino, CO_2H, CO_2C_{1-6}alkyl, $C(O)NH_2$, $C(O)N(C_{1-6}alkyl)_2$, C(O)-heterocyclyl, and C(O)NH-phenyl, and wherein each R^W, R^X, R^Y, R^Z may combine to form a carbocyclic or heterocyclic ring;

n is selected from the group consisting of 0, 1, 2, and 3; and

– – – – independently represents a single bond or a double bond as valency permits;

wherein a form of the compound is a pharmaceutically acceptable salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

2. The compound of claim 1, wherein the compound is a compound of Formula (Ia):



(Ia)

or a form thereof, wherein

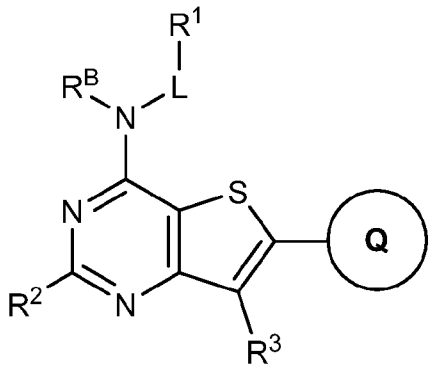
L is CH_2 or CD_2;

R^A is hydrogen;

R^B is hydrogen or CH_3; and

R^2 is Cl or CN.

3. The compound of claim 1, wherein the compound is a compound of Formula (Ib):



(Ib)

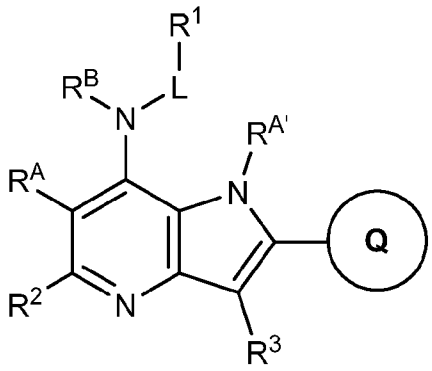
or a form thereof, wherein

L is CH_2;

R^B is hydrogen; and

R^2 is Cl.

4. The compound of claim 1, wherein the compound is a compound of Formula (Ic):



(Ic)

or a form thereof, wherein

L is CH_2;

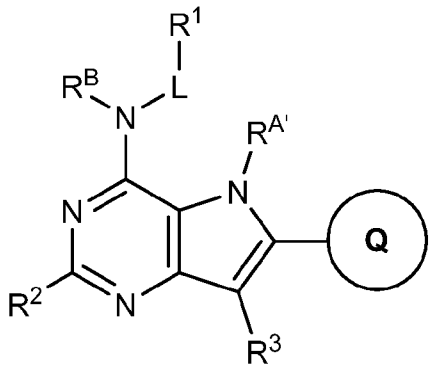
R^A is hydrogen;

$R^{A'}$ is CH_3 or CHF_2;

R^B is hydrogen; and

R^2 is Cl.

5. The compound of claim 1, wherein the compound is a compound of Formula (Id):



(Id)

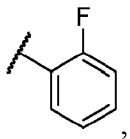
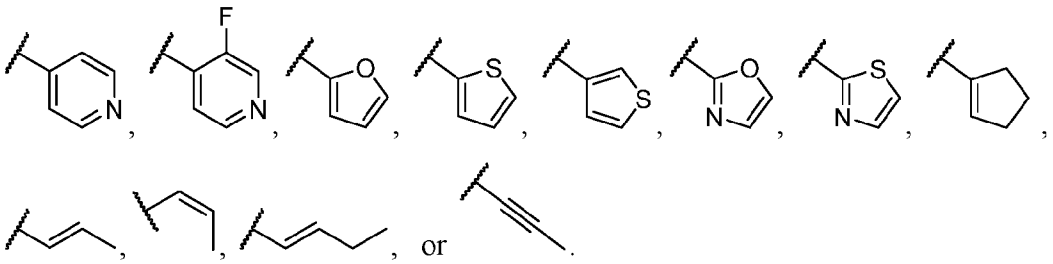
or a form thereof, wherein

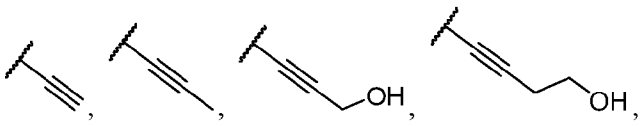
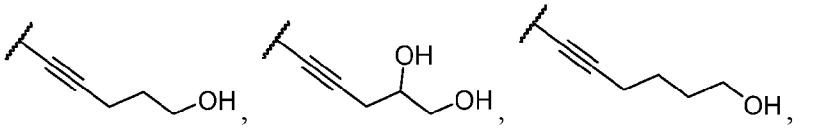
L is CH_2;

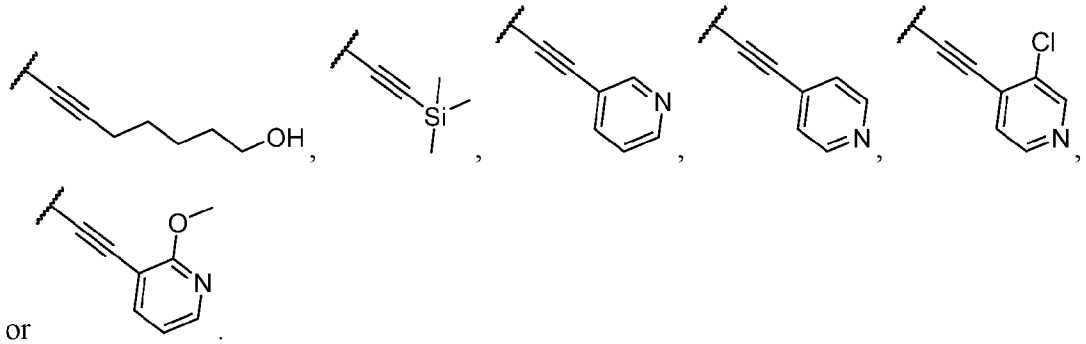
$R^{A'}$ is CHF_2:

R^B is hydrogen; and

R^2 is Cl.

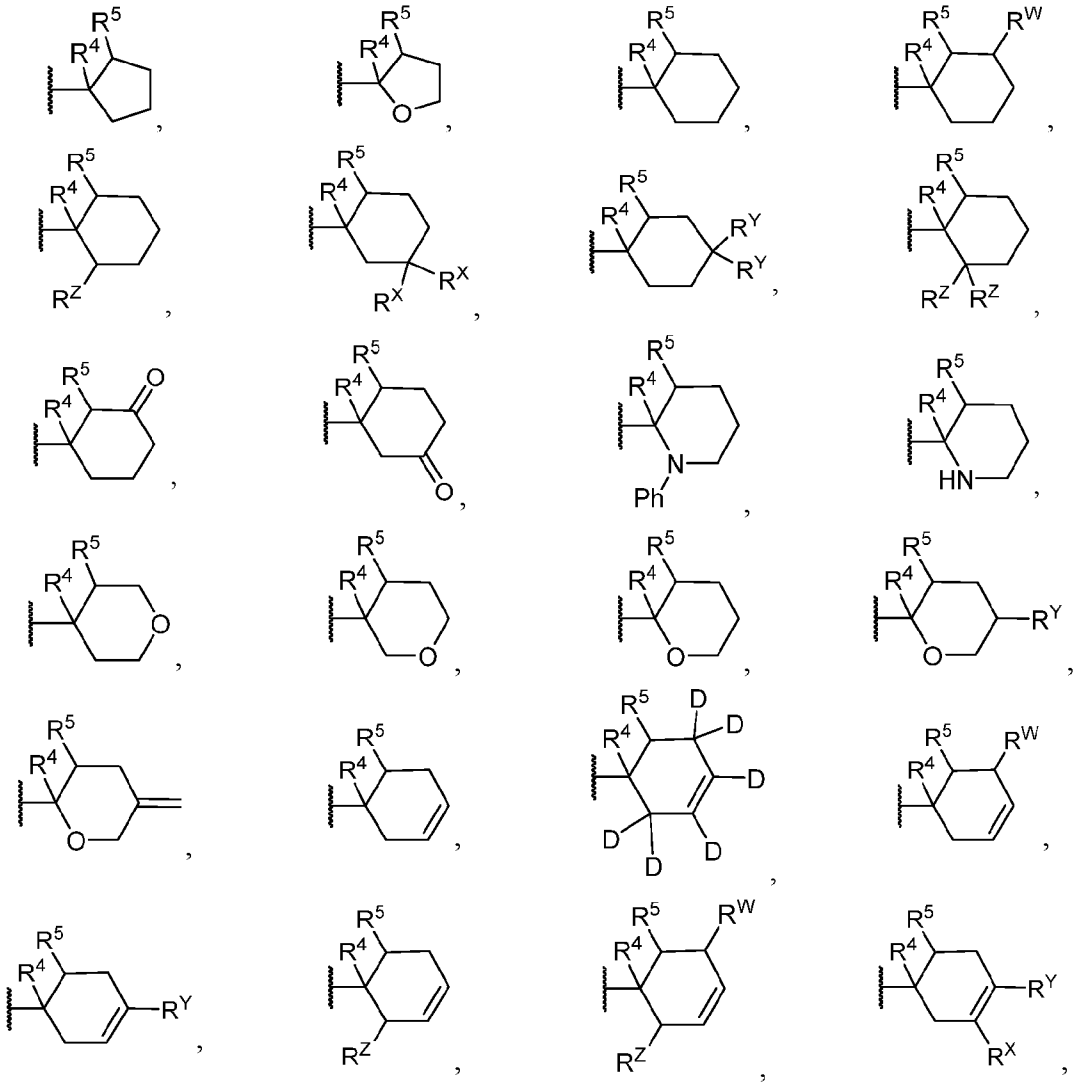
6. The compound of any one of claims 1 to 5, wherein R^1 is phenyl, CO_2CH_3, , , or .

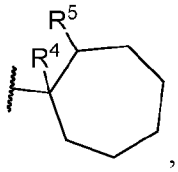
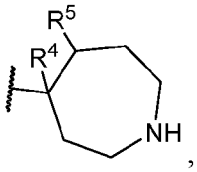
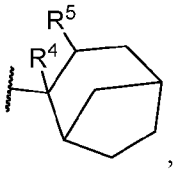
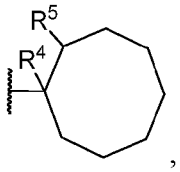
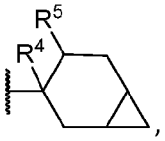
7. The compound of any one of claims 1 to 6, wherein R^3 is hydrogen, cyano, Cl, Br, I, CH_3, CH_2CH_3, CH_2F, CHF_2, CF_3, CH_2CH_2F, CH_2OH, CH_2OCHF_2, $CH{=}CH_2$, $CH{=}C{=}CH_2$, cyclopropyl, phenyl, , .



or .

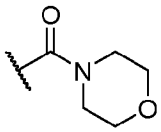
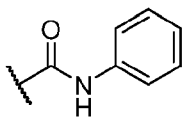
8. The compound of any one of claims 1 to 7, wherein Q is:



or any stereoisomers forms thereof.

9. The compound of any one of claims 1 to 8, wherein
R^4 is hydrogen, F, or hydroxy; and
R^5 is amino, $NH(CH_3)$, or $N(CH_3)_2$.

10. The compound of any one of claims 1-9, wherein R^W, R^X, R^Y, R^Z are each independently selected from F, hydroxy, CH_3, OCH_3, CO_2H, $CO_2CH_2CH_3$, $C(O)NH_2$, $C(O)N(CH_3)_2$, , or .

11. A compound selected from:

2-((1S,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-[(2S,3S)-3-aminotetrahydropyran-2-yl]-3,5-dichloro-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

3-bromo-5-chloro-2-[(2R,3S)-3-aminotetrahydropyran-2-yl]-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;

3-bromo-5-chloro-2-[(2S,3R)-3-aminotetrahydropyran-2-yl]-N-(2-thienylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine;

2-(3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(1R,2S)-2-amino-1-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,2R)-2-aminocyclohexyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1S,2S)-2-aminocyclohexyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-[(1S,2S)-2-aminocyclohexyl]-N-benzyl-7-bromo-2-chloro-thieno[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,2S)-2-aminocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocycloheptyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclooctyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclooctyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclooctyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R)-2-aminocyclooctyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,2S)-2-amino-1-fluorocyclopentyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

(1R,5S,6R)-6-amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

(1S,5R,6S)-6-amino-5-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

6-((1R,2S)-2-amino-1-fluorocyclopentyl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-cyclopropyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-phenyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,6RS)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6SR)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((3R,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((4R,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((4S,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((4R,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((4S,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(1R,5S,6R)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

(1S,5R,6S)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

2-((1R,2R)-2-aminocyclopentyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocycloheptyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclooctyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocycloheptyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclooctyl)-5-chloro-3-ethyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclopentyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclopentyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

4-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol;

4-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2S,6R)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R,6S)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

(2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one;

(2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(oxazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((6R)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-ethynylthieno[3,2-b]pyridin-7-amine;

(R)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

4-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol;

4-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

(S)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(3S,4S)-4-amino-3-(3,5-dichloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(1R,2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

(1S,2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hex-5-yn-1-ol;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-chloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-7-bromo-2-chloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

3-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol;

3-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-((3-fluoropyridin-4-yl)methyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-7-iodo-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

3-(6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol;

3-(6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-((difluoromethoxy)methyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-((difluoromethoxy)methyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2,7-dichlorothieno[3,2-d]pyrimidin-4-amine;

5-(5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxamide;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

ethyl (4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2R)-2-aminocyclohexyl)-5-chloro-3-(difluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S)-2-aminocyclohexyl)-5-chloro-3-(difluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-4-((furan-2-ylmethyl)amino)-7-methylthieno[3,2-d]pyrimidine-2-carbonitrile;

2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((2R,3R,5R)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S,5S)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

5-(5-chloro-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-((furan-2-ylmethyl)amino)-3-methylthieno[3,2-b]pyridine-5-carbonitrile;

2-((1R,3R,4R,6S)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,3S,4S,6R)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

5-(2-chloro-6-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol;

5-(2-chloro-6-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol;

2-((1R,5S,6R)-6-amino-5-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,5R,6S)-6-amino-5-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

(1R,2R,3S)-2-amino-3-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

4-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol;

6-((1S,2S)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

5-(5-chloro-2-((2R,3R)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(5-chloro-2-((2S,3S)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)-N,N-dimethylcyclohex-1-ene-1-carboxamide;

((4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-en-1-yl)(morpholino)methanone;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-(prop-1-yn-1-yl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

7-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hept-6-yn-1-ol;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(phenylmethyl-d2)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-1-(difluoromethyl)-3-iodo-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-iodothieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

(1R,5R,6S)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

(1S,5S,6R)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,2S)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-(prop-1-yn-1-yl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-amino-5,5-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-amino-5,5-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,2S)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,2R,6S)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S,6R)-2-amino-6-fluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((furan-2-ylmethyl)(methyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,2S,3S)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R,3R)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-ethynylthieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-(methyl(thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-1-methyl-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-5-chloro-1-(difluoromethyl)-3-iodo-1H-pyrrolo[3,2-b]pyridin-7-amine;

(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)-N-phenylcyclohex-1-ene-1-carboxamide;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

(1R,2S,3R)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

(1S,2R,3S)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(thiophen-2-ylmethyl)-3-(trifluoromethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((1S,6s)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(2-((1S,2S)-2-aminocyclohexyl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)methanol;

(2-((1R,2R)-2-aminocyclohexyl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)methanol;

2-((1S,2S)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

methyl (2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)glycinate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,5S,6S)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,5R,6R)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

(1R,2S,3R)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

(1S,2R,3S)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol;

3-bromo-5-chloro-2-((1R,2R)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

3-bromo-5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-b]pyridin-7-amine;

(1R,5S,6R)-5-amino-6-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-1-methyl-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine;

5-chloro-3-iodo-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

5-chloro-3-iodo-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((2-methoxypyridin-3-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-4-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-methyl-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine;

2-((1R,2S,6R)-6-amino-2-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,2R,6S)-6-amino-2-methylcyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiazol-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

6-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-7-iodothieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-7-iodo-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((1S,2S)-2-aminocyclohexyl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((1R,2R)-2-aminocyclohexyl)-N-benzyl-2,7-dichloro-5-(difluoromethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-methyl-N-(thiophen-3-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-benzyl-3,5-dichloro-1-(difluoromethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2,7-dichloro-5-(difluoromethyl)-N-(thiophen-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-2-chloro-5-(difluoromethyl)-7-iodo-5H-pyrrolo[3,2-d]pyrimidin-4-amine;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-1-(difluoromethyl)-N-(furan-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-1-(difluoromethyl)-3-iodo-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-ethynyl-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,2R)-2-aminocyclohexyl)-3-bromo-5-chloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-N-benzyl-7-bromo-2-chlorothieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-N-((3-fluoropyridin-4-yl)methyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1R,6R)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-((3-fluoropyridin-4-yl)methyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2,7-dichloro-N-(pyridin-4-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl)-2-chloro-7-methyl-N-(thiazol-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine;

2-((1S,2S)-2-aminocyclohexyl)-N-((Z)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-chloro-7-((furan-2-ylmethyl)amino)thieno[3,2-b]pyridine-5-carbonitrile;

2-((1R,6R)-6-amino-3,4-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

ethyl (4R,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylate;

(4S,5S)-5-amino-4-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-1-ene-1-carboxylic acid;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((3-chloropyridin-4-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine;

2-((1S,2R,5S,6S)-6-amino-2,5-dimethylcyclohex-3-en-1-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine;

5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-(methyl(thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((furan-2-ylmethyl)(methyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-7-(benzyl(methyl)amino)-5-chlorothieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(5-chloro-2-((1R,6R)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

5-(5-chloro-2-((1S,6S)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-((E)-pent-2-en-1-yl)thieno[3,2-b]pyridin-7-amine; and

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-((E)-pent-2-en-1-yl)thieno[3,2-b]pyridin-7-amine;

or form thereof, wherein the form of the compound is a pharmaceutically acceptable salt, hydrate, solvate, racemate, enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

12. A compound selected from:

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3,5-dichloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-(3-aminotetrahydro-2H-pyran-2-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(2-fluorobenzyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,2S)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((1S,2R)-2-amino-4,4-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

(1R,2S)-2-amino-1-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol hydrochloride;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-N-(2-fluorobenzyl)-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine hydrochloride;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((1R,2S)-2-amino-1-fluorocyclohexyl)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine hydrochloride;

2-((2R,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3R)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3S)-3-aminopiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3R)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3S)-3-aminobicyclo[3.2.1]octan-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3S)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3R)-3-amino-1-phenylpiperidin-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((3S,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((4R,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((4S,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((4R,5S)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((4S,5R)-5-aminoazepan-4-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,2R)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-amino-5,5-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3R)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2S,3S)-3-aminotetrahydrofuran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1R,2R)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-amino-4,4-dimethylcyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

(1R,5S,6R)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate;

(1S,5R,6S)-6-amino-5-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate;

5-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate;

5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate;

4-(2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate;

4-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

-(2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one hydrochloride;

(2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-one hydrochloride;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

6-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

2-((3R,4S)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-4-aminotetrahydro-2H-pyran-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((6R)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((6S)-6-amino-2,2-difluorocyclohexyl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

(R)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-N-(furan-2-ylmethyl)-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate;

4-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate;

4-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate;

(S)-5-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yne-1,2-diol trifluoroacetate;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-(prop-1-yn-1-yl)thieno[3,2-b]pyridin-7-amine formate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-(prop-1-yn-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

(1R,2R,3S)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

(1S,2S,3R)-2-amino-3-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

6-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hex-5-yn-1-ol trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine formate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-iodothieno[3,2-d]pyrimidin-4-amine formate;

3-(2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol trifluoroacetate;

3-(2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)prop-2-yn-1-ol trifluoroacetate;

3-(6-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol trifluoroacetate;

3-(6-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-2-chloro-4-((furan-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)prop-2-yn-1-ol trifluoroacetate;

2-((2R,3R)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3S)-3-amino-5-methylenetetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

5-(5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;

2-((2R,3R)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((2S,3S)-3-aminotetrahydro-2H-pyran-2-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-3-iodo-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((2R,3R,5R)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((2S,3S,5S)-3-amino-5-methyltetrahydro-2H-pyran-2-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

5-(5-chloro-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;

5-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;

2-((1R,3R,4R,6S)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,3S,4S,6R)-4-aminobicyclo[4.1.0]heptan-3-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-N-benzyl-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate;

5-(2-chloro-6-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol trifluoroacetate;

5-(2-chloro-6-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-4-((thiophen-2-ylmethyl)amino)thieno[3,2-d]pyrimidin-7-yl)pent-4-yn-1-ol trifluoroacetate;

2-((1R,2R)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-aminocyclohexyl)-N-benzyl-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine formate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine formate;

4-(5-chloro-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)but-3-yn-1-ol trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-3-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

5-(5-chloro-2-((2R,3R)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;

5-(5-chloro-2-((2S,3S)-3-(methylamino)tetrahydro-2H-pyran-2-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3-bromo-5-chloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-((trimethylsilyl)ethynyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

7-(2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)hept-6-yn-1-ol formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-5-chloro-3-methyl-N-(phenylmethyl-d2)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(propa-1,2-dien-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

(1R,5R,6S)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol trifluoroacetate;

(1S,5S,6R)-5-amino-6-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol trifluoroacetate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-7-ethynyl-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

2-((1R,6R)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(cyclopent-1-en-1-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

6-((1S,2S)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine formate;

6-((1R,2R)-2-aminocyclohexyl)-2,7-dichloro-5-(difluoromethyl)-N-(furan-2-ylmethyl)-5H-pyrrolo[3,2-d]pyrimidin-4-amine formate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

2-((1R,2S,3S)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,2R,3R)-2-amino-3-fluorocyclohexyl)-5-chloro-3-methyl-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine formate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-N-(thiophen-2-ylmethyl)-3-vinylthieno[3,2-b]pyridin-7-amine formate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2,7-dichloro-N-(furan-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine formate;

(1R,2S,3R)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

(1S,2R,3S)-3-amino-2-(3-bromo-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

2-((1R,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

methyl (2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-3-bromo-5-chlorothieno[3,2-b]pyridin-7-yl)glycinate formate;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-(but-2-yn-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,5S,6S)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

2-((1S,5R,6R)-6-amino-5-methoxycyclohex-3-en-1-yl)-3-bromo-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine hydrochloride;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-7-bromo-2-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

(1R,2S,3R)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

(1S,2R,3S)-2-amino-3-(5-chloro-3-methyl-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohexan-1-ol trifluoroacetate;

3-bromo-5-chloro-2-((1R,2R)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

3-bromo-5-chloro-2-((1S,2S)-2-(methylamino)cyclohexyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

(1R,5S,6R)-5-amino-6-(3,5-dichloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-2-yl)cyclohex-2-en-1-ol formate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-N-((E)-but-2-en-1-yl)-5-chloro-3-methylthieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3-bromo-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-N-(but-2-yn-1-yl)-5-chloro-3-iodothieno[3,2-b]pyridin-7-amine trifluoroacetate;

5-chloro-3-iodo-2-((1R,6R)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

5-chloro-3-iodo-2-((1S,6S)-6-(methylamino)cyclohex-3-en-1-yl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-N-benzyl-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine formate;

6-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-2-chloro-N-(furan-2-ylmethyl)-7-vinylthieno[3,2-d]pyrimidin-4-amine formate;

2-((3R,4S)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile trifluoroacetate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-5-chloro-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridine-3-carbonitrile trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((2-methoxypyridin-3-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-(pyridin-4-ylethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,2S)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((1R,2R)-2-aminocyclohexyl)-5-chloro-3-(fluoromethyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine formate;

2-((3S,4R)-3-aminotetrahydro-2H-pyran-4-yl)-3,5-dichloro-N-(furan-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1R,2R)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine formate;

2-((1S,2S)-2-aminocyclohexyl)-3,5-dichloro-1-(difluoromethyl)-N-(thiophen-2-ylmethyl)-1H-pyrrolo[3,2-b]pyridin-7-amine formate;

2-((1R,6S)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6R)-6-amino-2,2-difluorocyclohexyl)-3-bromo-N-((E)-but-2-en-1-yl)-5-chlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,2S)-2-aminocyclohexyl)-N-((Z)-but-2-en-1-yl)-3,5-dichlorothieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-3-((3-chloropyridin-4-yl)ethynyl)-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

2-((1S,6S)-6-aminocyclohex-3-en-1-yl)-5-chloro-N-(thiophen-2-ylmethyl)thieno[3,2-b]pyridin-7-amine trifluoroacetate;

6-((1R,6R)-6-aminocyclohex-3-en-1-yl-2,2,3,4,5,5-d6)-2-chloro-N-(furan-2-ylmethyl)-7-methylthieno[3,2-d]pyrimidin-4-amine trifluoroacetate;

5-(5-chloro-2-((1R,6R)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate; and

5-(5-chloro-2-((1S,6S)-6-(dimethylamino)cyclohex-3-en-1-yl)-7-((thiophen-2-ylmethyl)amino)thieno[3,2-b]pyridin-3-yl)pent-4-yn-1-ol formate;

or form thereof, wherein the form of the compound is a hydrate, solvate, racemate,

enantiomer, diastereomer, stereoisomer, tautomer or isotope enriched form thereof.

13. A method of treating spinocerebellar ataxia type 3 comprising administering to a subject in need thereof an effective amount of the compound of any one of claims 1 to 12.

14. The method of claim 13, wherein the effective amount of the compound or form thereof induces exon skipping in *ATXN3* pre-mRNA in the subject.

15. The method of claim 13, wherein the effective amount of the compound or form thereof induces exon skipping in the subject.

16. A pharmaceutical composition comprising an effective amount of the compound of any one of claims 1 to 12 in admixture with a pharmaceutically acceptable excipient.