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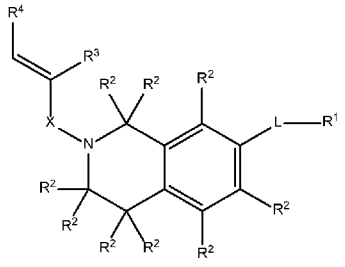
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(54) Title: COMPOUNDS AND METHODS FOR YAP/TEAD MODULATION AND INDICATIONS THEREFOR



(I)

(57) Abstract: Disclosed are compounds of Formula (I) or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog thereof, wherein R^1, R^2, R^3, R^4, L and X are as described in any of the embodiments described in this disclosure; compositions thereof; and uses thereof.

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COMPOUNDS AND METHODS FOR YAP/TEAD MODULATION AND INDICATIONS THEREFOR

RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 63/187,226, filed on May 11, 2021. The entire teachings of the above application are incorporated herein by reference.

FIELD

[0002] The present disclosure relates to organic compounds useful for therapy in mammals, and in particular for modulating the interaction of YAP and TEAD for treatment of various diseases associated with the Hippo signaling pathway.

BACKGROUND

[0003] YAP and TEAD are two proteins involved in the Hippo signalling pathway, which modulates tissue homeostasis, cell proliferation, tumoral transformation and apoptosis. This pathway involves a series of kinases leading to the phosphorylation of two transcriptional co-activators, YAP and TAZ. YAP/TAZ do not comprise a DNA binding domain, but they bind to TEAD transcription factor family (TEAD-1, TEAD-2, TEAD-3 and TEAD-4) to mediate target gene expression such as connective tissue growth factor (CTGF), cysteine-rich angiogenic inducer 61 (CYR61) and others to promote cell growth, proliferation, migration, and survival. (Gandhi T. K. Boopathy et al., Role of Hippo Pathway-YAP/TAZ Signaling in Angiogenesis, *Front Cell Dev Biol.* 2019; 7: 49). When upstream kinases are inactive, YAP and TAZ are not phosphorylated and translocate to the nucleus, binding to TEAD. Deregulation of the Hippo pathway is involved in a broad variety of tumors, including breast, therefore, its targeting represents an approach for the treatment of cancers that harbor functional alterations of this pathway. (Dominguez-Berrocal et al., New Therapeutic Approach for Targeting Hippo Signalling Pathway. *Sci Rep* 9, 4771 (2019)). As an example, one of the small molecules used to target this signalling pathway is Verteporfin, which associates to YAP and inhibits binding to TEAD.

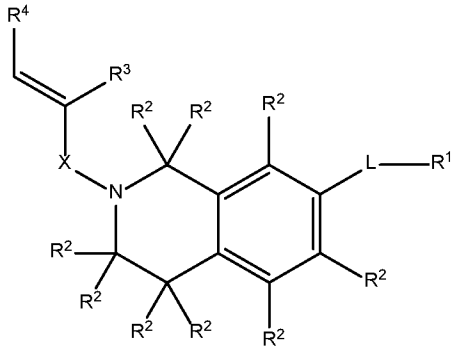
[0004] Compounds that modulate, and more specifically, inhibit the interaction between YAP and TEAD (i.e., YAP/TEAD inhibitors), and thereby reduce the expression of YAP/TEAD target genes and display anti-proliferative effects in cancer cell lines controlled by the Hippo signaling pathway represent a new class of potential therapeutics capable of

modulating tumor growth and other diseases. As there are no YAP/TEAD inhibitors that are currently approved for the treatment or prevention of diseases in humans, there is an unmet need for new compounds that are capable of modulating YAP/TEAD.

SUMMARY

[0005] One embodiment of the disclosure relates to novel compounds, as described in any of the embodiments herein, or a pharmaceutically acceptable salt, a tautomer, a stereoisomer or a deuterated analog thereof, wherein these novel compounds can modulate YAP/TEAD.

[0006] Another embodiment of this disclosure relates to a compound of Formula (I):



(I)

or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog thereof, wherein R^1, R^2, R^3, R^4, L and X are as described in any of the embodiments (including any of the subembodiments thereof) in this disclosure.

[0007] Other embodiments and sub-embodiments of Formula (I) are further described herein in this disclosure.

[0008] Another embodiment of the disclosure relates to a pharmaceutical composition comprising a compound according to Formula (I) or any embodiment and sub-embodiment of Formula (I) described herein in this disclosure, or a pharmaceutically acceptable salt, a tautomer, a stereoisomer or a deuterated analog of any of these compounds, and a pharmaceutically acceptable carrier or excipient.

[0009] Another embodiment of the disclosure relates to a pharmaceutical composition comprising a compound according to Formula (I), or any embodiment of Formula (I) described herein in this disclosure, or a pharmaceutically acceptable salt, a tautomer, a stereoisomer or a deuterated analog of any of these compounds, and another therapeutic agent.

[0010] Another embodiment of this disclosure relates to a method for treating a subject with a disease or condition mediated, at least in part, YAP/TEAD, said method comprising administering to the subject an effective amount of a compound according to Formula (I), or any embodiment of Formula (I) described in this disclosure, or a pharmaceutically acceptable salt, a tautomer, a stereoisomer or a deuterated analog of any of these compounds, or a pharmaceutical composition of any of the compounds as described in this disclosure.

[0011] Also provided herein is the use of a compound according to Formula (I), or any embodiment of Formula (I) described in this disclosure, or a pharmaceutically acceptable salt, a tautomer, a stereoisomer or a deuterated analog of any of these compounds, or a pharmaceutical composition of any of the compounds as described in this disclosure, for the treatment of a disease or condition mediated by YAP/TEAD.

[0012] Additional embodiments are described are further described in the Detailed Description of this disclosure.

DETAILED DESCRIPTION

I. Definitions

[0013] As used herein the following definitions apply unless clearly indicated otherwise:

[0014] It is noted here that as used herein and the appended claims, the singular forms "a," "an," and "the" include plural reference unless the context clearly dictates otherwise.

[0015] Unless a point of attachment indicates otherwise, the chemical moieties listed in the definitions of the variables of Formula (I) of this disclosure, and all the embodiments thereof, are to be read from left to right, wherein the right hand side is directly attached to the parent structure as defined. However, if a point of attachment (e.g., a dash "-") is shown on the left hand side of the chemical moiety (e.g., -C_1-C_6alkyl-N(R^6)$_2$), then the left hand side of this chemical moiety is attached directly to the parent moiety as defined.

[0016] It is assumed that when considering generic descriptions of compounds described herein for the purpose of constructing a compound, such construction results in the creation of a stable structure. That is, one of ordinary skill in the art would recognize that, theoretically, some constructs would not normally be considered as stable compounds (that is, sterically practical and/or synthetically feasible).

[0017] "Alkyl," by itself, or as part of another substituent, means, unless otherwise stated, a straight or branched chain hydrocarbon, having the number of carbon atoms

designated (i.e., C_1-C_6 means one to six carbons). Representative alkyl groups include straight and branched chain alkyl groups having 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12 carbon atoms. Further representative alkyl groups include straight and branched chain alkyl groups having 1, 2, 3, 4, 5, 6, 7 or 8 carbon atoms. Examples of alkyl groups include methyl, ethyl, n-propyl, isopropyl, n-butyl, t-butyl, isobutyl, sec-butyl, n-pentyl, n-hexyl, n-heptyl, n-octyl, and the like. For each of the definitions herein (e.g., alkyl, alkoxy, heterocycloalkylalkyl, heteroarylalkyl, etc.), when a prefix is not included to indicate the number of carbon atoms in an alkyl portion, the alkyl moiety or portion thereof will have 12 or fewer main chain carbon atoms or 8 or fewer main chain carbon atoms or 6 or fewer main chain carbon atoms. For example, C_1-C_6alkyl refers to a straight or branched hydrocarbon having 1, 2, 3, 4, 5 or 6 carbon atoms and includes, but is not limited to, $-CH_3$, C_2alkyl, C_3alkyl, C_4alkyl, C_5alkyl, C_6alkyl, C_1-C_2alkyl, C_2alkyl, C_3alkyl, C_1-C_3alkyl, C_1-C_4alkyl, C_1-C_5alkyl, C_1-C_6alkyl, C_2-C_3alkyl, C_2-C_4alkyl, C_2-C_5alkyl, C_2-C_6alkyl, C_3-C_4alkyl, C_3-C_5alkyl, C_3-C_6alkyl, C_4-C_5alkyl, C_4-C_6alkyl, C_5-C_6 alkyl and C_6alkyl. While it is understood that substitutions are attached at any available atom to produce a stable compound, when optionally substituted alkyl is an R group of a moiety such as -OR (e.g. alkoxy), -SR (e.g. thioalkyl), -NHR (e.g. alkylamino), -C(O)NHR, and the like, substitution of the alkyl R group is such that substitution of the alkyl carbon bound to any O, S, or N of the moiety (except where N is a heteroaryl ring atom) excludes substituents that would result in any O, S, or N of the substituent (except where N is a heteroaryl ring atom) being bound to the alkyl carbon bound to any O, S, or N of the moiety.

[0018] "Alkylene" by itself or as part of another substituent means a linear or branched saturated divalent hydrocarbon moiety derived from an alkane having the number of carbon atoms indicated in the prefix. For example, (i.e., C_1-C_6 means one to six carbons; C_1-C_6alkylene is meant to include methylene, ethylene, propylene, 2-methylpropylene, pentylene, hexylene and the like). C_{1-4} alkylene includes methylene $-CH_2-$, ethylene $-CH_2CH_2-$, propylene $-CH_2CH_2CH_2-$, and isopropylene $-CH(CH_3)CH_2-$, $-CH_2CH(CH_3)-$, $-CH_2-(CH_2)_2CH_2-$, $-CH_2-CH(CH_3)CH_2-$, $-CH_2-C(CH_3)_2-CH_2-CH_2CH(CH_3)-$. Typically, an alkyl (or alkylene) group will have from 1 to 24 carbon atoms, with those groups having 10 or fewer, 8 or fewer, or 6 or fewer carbon atoms. When a prefix is not included to indicate the number of carbon atoms in an alkylene portion, the alkylene moiety or portion thereof will have 12 or fewer main chain carbon atoms or 8 or fewer main chain carbon atoms, 6 or fewer main chain carbon atoms, or 4 or fewer main

chain carbon atoms, or 3 or fewer main chain carbon atoms, or 2 or fewer main chain carbon atoms, or 1 carbon atom.

[0019] "Alkoxy" or "alkoxyl" refers to a –O-alkyl group, where alkyl is as defined herein. By way of example, "C_1-C_6alkoxy" refers to a –O-C_1-C_6alkyl group, where alkyl is as defined herein. While it is understood that substitutions on alkoxy are attached at any available atom to produce a stable compound, substitution of alkoxy is such that O, S, or N (except where N is a heteroaryl ring atom), are not bound to the alkyl carbon bound to the alkoxy O. Further, where alkoxy is described as a substituent of another moiety, the alkoxy oxygen is not bound to a carbon atom that is bound to an O, S, or N of the other moiety (except where N is a heteroaryl ring atom), or to an alkene or alkyne carbon of the other moiety.

[0020] "Amino" or "amine" denotes the group NH_2.

[0021] "Aryl" by itself, or as part of another substituent, unless otherwise stated, refers to a monocyclic, bicyclic or polycyclic polyunsaturated aromatic hydrocarbon radical containing 6 to 14 ring carbon atoms, which can be a single ring or multiple rings (up to three rings) which are fused together or linked covalently. Aryl, however, does not encompass or overlap in any way with heteroaryl defined below. If one or more aryl rings are fused with a heteroaryl ring, the resulting ring system is heteroaryl. Non-limiting examples of unsubstituted aryl groups include phenyl, 1-naphthyl and 2-naphthyl. The term "arylene" refers to a divalent aryl, wherein the aryl is as defined herein.

[0022] "Cycloalkyl" or "Carbocycle" or "Carbocyclic" by itself, or as part of another substituent, unless otherwise stated, refers to saturated or partially unsaturated, nonaromatic monocyclic ring, bridged rings, spiro rings, fused rings (e.g., bicyclic or tricyclic carbon ring systems), or cubane, having the number of carbon atoms indicated in the prefix or if unspecified having 3-6, also 4-6, and also 5-6 ring members per ring, such as cyclopropyl, cyclopentyl, cyclohexyl, where one or two ring carbon atoms may optionally be replaced by a carbonyl. Further, the term cycloalkyl is intended to encompass ring systems fused to an aromatic ring (e.g., of an aryl or heteroaryl), regardless of the point of attachment to the remainder of the molecule. Cycloalkyl refers to hydrocarbon rings having the indicated number of ring atoms (e.g., C_{3-6} cycloalkyl and 3-6 membered cycloalkyl both mean three to six ring carbon atoms). The term "cycloalkenyl" refers to a cycloalkyl having at least one unit of unsaturation. A substituent of a cycloalkyl or cycloalkenyl may be at the point of attachment of the cycloalkyl or cycloalkenyl group, forming a quaternary center.

[0023] "Halogen" or "halo" refers to all halogens, that is, chloro (Cl), fluoro (F), bromo (Br), or iodo (I).

[0024] "Heteroatom" is meant to include oxygen (O), nitrogen (N), and sulfur (S).

[0025] "Heteroaryl" refers to a monocyclic or bicyclic aromatic ring radical containing 5-9 ring atoms (also referred to in this disclosure as a 5-9 membered heteroaryl, including monocyclic aromatic ring radicals containing 5 or 6 ring atoms (also referred to in this disclosure as a 5-6 membered heteroaryl), containing one or more, 14, 13, or 12, heteroatoms independently selected from the group consisting of O, S, and N. Any aromatic ring or ring system containing at least one heteroatom is a heteroaryl regardless of the point of attachment (i.e., through any one of the fused rings). Heteroaryl is also intended to include oxidized S or N, such as sulfinyl, sulfonyl and Noxide of a tertiary ring nitrogen. A carbon or nitrogen atom is the point of attachment of the heteroaryl ring structure such that a stable compound is produced. Examples of heteroaryl groups include, but are not limited to, pyridyl, pyridazinyl, pyrazinyl, indolizinyl, benzo[b]thienyl, quinazolinyl, purinyl, indolyl, quinolinyl, pyrimidinyl, pyrrolyl, pyrazolyl, oxazolyl, thiazolyl, thienyl, isoxazolyl, oxathiadiazolyl, isothiazolyl, tetrazolyl, imidazolyl, triazolyl, furanyl, benzofuryl, indolyl, triazinyl, quinoxalinyl, cinnolinyl, phthalazinyl, benzotriazinyl, benzimidazolyl, benzopyrazolyl, benzotriazolyl, benzisoxazolyl, isobenzofuryl, isoindolyl, indolizinyl, benzotriazinyl, thienopyridyl, thienopyrimidinyl, pyrazolopyrimidinyl, imidazopyridines, benzothiaxolyl, benzothienyl, quinolyl, isoquinolyl, indazolyl, pteridinyl and thiadiazolyl. "Nitrogen containing heteroaryl" refers to heteroaryl wherein at least one of the ring heteroatoms is N.

[0026] The term "heteroarylalkyl" refers to an alkyl group substituted with a heteroaryl group, where both terms are as defined herein.

[0027] "Heterocycloalkyl" refers to a saturated or partially unsaturated non-aromatic cycloalkyl group that contains from one to five heteroatoms selected from N, O, S (including S(O) and $S(O)_2$), or P (including phosphine oxide) wherein the nitrogen, sulfur, and phosphorous atoms are optionally oxidized, and the nitrogen atom(s) are optionally quarternized, the remaining ring atoms being C, where one or two C atoms may optionally be present as a carbonyl. Further, the term heterocycloalkyl is intended to encompass any ring or ring system containing at least one heteroatom that is not a heteroaryl, regardless of the point of attachment to the remainder of the molecule. Heterocycloalkyl groups include those having a ring with a formally charge-separated aromatic resonance structure, for example, N-methylpyridonyl. The heterocycloalkyl may be substituted with one or two oxo groups, and

can include sulfone and sulfoxide derivatives. The heterocycloalkyl may be a monocyclic, a fused bicyclic or a fused polycyclic ring system of 3 to 12, 4 to 10, 5 to 10, or 5 to 6 ring atoms in which one to five ring atoms are heteroatoms selected from –N=, -N-, -O-, -S-, -S(O)-, or $–S(O)_2$- and further wherein one or two ring atoms are optionally replaced by a -C(O)- group. As an example, a 4-6 membered heterocycloalkyl is a heterocycloalkyl with 4-6 ring members having at least one heteroatom. The heterocycloalkyl can also be a heterocyclic alkyl ring fused with a cycloalkyl. Non limiting examples of heterocycloalkyl groups include pyrrolidinyl, piperidinyl, morpholinyl, pyridonyl, and the like. A heterocycloalkyl group can be attached to the remainder of the molecule through a ring carbon or a heteroatom. "Heterocycloalkenyl" refers to a heterocycloalkyl having at least one unit of unsaturation. A substituent of a heterocycloalkyl or heterocycloalkenyl may be at the point of attachment of the heterocycloalkyl or heterocycloalkenyl group, forming a quaternary center.

[0028] The term "heterocycloalkylalkyl" refers to an alkyl group substituted with a heterocycloalkyl group. Examples include, but are not limited to, azetidinylmethyl, morpholinomethyl, and the like.

[0029] "Hydroxyl" or "hydroxy" refers to the group OH. The term "hydroxyalkyl" or "hydroxyalkylene" refers to an alkyl group or alkylene group, respectively as defined herein, substituted with 1-5 hydroxy groups.

[0030] "Optional substituents" or "optionally substituted" as used throughout the disclosure means that the substitution on a compound may or may not occur, and that the description includes instances where the substitution occurs and instances in which the substitution does not. For example, the phrase "optionally substituted with 1-3 T^1 groups" means that the T^1 group may but need not be present. It is assumed in this disclosure that optional substitution on a compound occurs in a way that would result in a stable compound.

[0031] As used herein in connection with compounds of the disclosure, the term "synthesizing" and like terms means chemical synthesis from one or more precursor materials.

[0032] As used herein, the term "composition" refers to a formulation suitable for administration to an intended animal subject for therapeutic purposes that contains at least one pharmaceutically active compound and at least one pharmaceutically acceptable carrier or excipient.

[0033] The term "pharmaceutically acceptable" indicates that the indicated material does not have properties that would cause a reasonably prudent medical practitioner to avoid

administration of the material to a patient, taking into consideration the disease or conditions to be treated and the respective route of administration. For example, it is commonly required that such a material be essentially sterile, e.g., for injectables.

[0034] "Pharmaceutically acceptable salt" refers to a salt which is acceptable for administration to a patient, such as a mammal (e.g., salts having acceptable mammalian safety for a given dosage regime). Contemplated pharmaceutically acceptable salt forms include, without limitation, mono, bis, tris, tetrakis, and so on. Pharmaceutically acceptable salts are non-toxic in the amounts and concentrations at which they are administered. The preparation of such salts can facilitate the pharmacological use by altering the physical characteristics of a compound without preventing it from exerting its physiological effect. Useful alterations in physical properties include lowering the melting point to facilitate transmucosal administration and increasing the solubility to facilitate administering higher concentrations of the drug. Such salts can be derived from pharmaceutically acceptable inorganic or organic bases and from pharmaceutically-acceptable inorganic or organic acids, depending on the particular substituents found on the compounds described herein.

[0035] Pharmaceutically acceptable salts can be prepared by standard techniques. For example, the free-base form of a compound can be dissolved in a suitable solvent, such as an aqueous or aqueous-alcohol solution containing the appropriate acid and then isolated by evaporating the solution. In another example, a salt can be prepared by reacting the free base and acid in an organic solvent.

[0036] When compounds of the present disclosure contain relatively acidic functionalities, base addition salts can be obtained by contacting the neutral form of such compounds with a sufficient amount of the desired base (i.e., a primary, secondary, tertiary, quaternary, or cyclic amine; an alkali metal hydroxide; alkaline earth metal hydroxide; or the like), either neat or in a suitable inert solvent. The desired acid can be, for example, a pyranosidyl acid (such as glucuronic acid or galacturonic acid), an alpha-hydroxy acid (such as citric acid or tartaric acid), an amino acid (such as aspartic acid or glutamic acid), an aromatic acid (such as benzoic acid or cinnamic acid), a sulfonic acid (such as p-toluenesulfonic acid or ethanesulfonic acid), or the like. In some embodiments, salts can be derived from pharmaceutically acceptable acids such as acetic, trifluoroacetic, propionic, ascorbic, benzenesulfonic, benzoic, camphorsulfonic, citric, ethanesulfonic, fumaric, glycolic, gluconic, glucoronic, glutamic, hippuric, hydrobromic, hydrochloric, isethionic, lactic, lactobionic, maleic, malic, malonic, mandelic, oxalic, methanesulfonic, mucic, naphthalenesulfonic, nicotinic, nitric, pamoic, pantothenic, phosphoric, succinic, sulfuric,

sulfamic, hydroiodic, carbonic, tartaric, p-toluenesulfonic, pyruvic, aspartic, benzoic, cinnamic, anthranilic, mesylic, salicylic, p-hydroxybenzoic, phenylacetic, embonic (pamoic), ethanesulfonic, benzenesulfonic, 2-hydroxyethanesulfonic, sulfanilic, stearic, cyclohexylsulfamic, cyclohexylaminosulfonic, quinic, algenic, hydroxybutyric, galactaric and galacturonic acid and the like.

[0037] Also included are salts of amino acids such as arginate and the like, and salts of organic acids like glucuronic or galactunoric acids and the like (see, for example, Berge, S. M. et al., "Pharmaceutical Salts," J. Pharmaceutical Science, 1977, 66:1-19). Certain specific compounds of the present disclosure contain both basic and acidic functionalities that allow the compounds to be converted into either base or acid addition salts.

[0038] The neutral forms of the compounds may be regenerated by contacting the salt with a base or acid and isolating the parent compound in the conventional manner. The parent form of the compound differs from the various salt forms in certain physical properties, such as solubility in polar solvents, but otherwise the salts are equivalent to the parent form of the compound for the purposes of the present disclosure.

[0039] The pharmaceutically acceptable salt of the different compounds may be present as a complex. Examples of complexes include 8-chlorotheophylline complex (analogous to, e.g., dimenhydrinate: diphenhydramine 8-chlorotheophylline (1:1) complex; Dramamine) and various cyclodextrin inclusion complexes.

[0040] The term "deuterated" as used herein alone or as part of a group, means substituted deuterium atoms. The term "deuterated analog" as used herein alone or as part of a group, means substituted deuterium atoms in place of hydrogen. The deuterated analog of the disclosure may be a fully or partially deuterium substituted derivative. In some embodiments, the deuterium substituted derivative of the disclosure holds a fully or partially deuterium substituted alkyl, aryl or heteroaryl group.

[0041] The disclosure also embraces isotopically-labeled compounds of the present disclosure 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. All isotopic variations of the compounds of the present disclosure, whether radioactive or not, are intended to be encompassed within the scope of the present disclosure. Examples of isotopes that can be incorporated into compounds of the disclosure include isotopes of hydrogen, carbon, nitrogen, oxygen, phosphorous, fluorine, and chlorine, such as, but not limited to ^{2}H (deuterium, D), ^{3}H (tritium), ^{11}C, ^{13}C, ^{14}C, ^{15}N, ^{18}F, ^{31}P, ^{32}P, ^{35}S, ^{36}Cl, and ^{125}I. Unless otherwise stated, when a

position is designated specifically as "H" or "hydrogen," the position is understood to have hydrogen at its natural abundance isotopic composition or its isotopes, such as deuterium (D) or tritium (^{3}H). Certain isotopically-labeled compounds of the present disclosure (e.g., those labeled with ^{3}H and ^{14}C) are useful in compound and/or substrate tissue distribution assays. Tritiated (i.e., ^{3}H) and carbon-14 (i.e., ^{14}C) and fluorine-18 (^{18}F) isotopes are useful for their ease of preparation and detectability. Further, substitution with heavier isotopes such as deuterium (i.e., ^{2}H) may afford certain therapeutic advantages resulting from greater metabolic stability (e.g., increased *in vivo* half-life or reduced dosage requirements) and hence may be preferred in some circumstances. Isotopically labeled compounds of the present disclosure can generally be prepared by following procedures analogous to those described in the Schemes and in the Examples herein below, by substituting an isotopically labeled reagent for a non-isotopically labeled reagent.

[0042] "Prodrugs" means any compound which releases an active parent drug according to Formula (I) *in vivo* when such prodrug is administered to a subject. Prodrugs of a compound of Formula (I) are prepared by modifying functional groups present in the compound of Formula (I) in such a way, either in routine manipulation or *in vivo*, that the modifications may be cleaved *in vivo* to release the parent compound. Prodrugs may proceed from prodrug form to active form in a single step or may have one or more intermediate forms which may themselves have activity or may be inactive. Some prodrugs are activated enzymatically to yield the active compound, or a compound which, upon further chemical reaction, yields the active compound. Prodrugs include compounds of Formula (I) wherein a hydroxy, amino, carboxyl or sulfhydryl group in a compound of Formula (I) is bonded to any group that may be cleaved *in vivo* to regenerate the free hydroxyl, amino, or sulfhydryl group, respectively. Examples of prodrugs include, but are not limited to esters (e.g., acetate, formate, and benzoate derivatives), amides, guanidines, carbamates (e.g., N,N-dimethylaminocarbonyl) of hydroxy functional groups in compounds of Formula (I), and the like. Other examples of prodrugs include, without limitation, carbonates, ureides, solvates, or hydrates of the active compound. Preparation, selection, and use of prodrugs is discussed in T. Higuchi and V. Stella, "Pro-drugs as Novel Delivery Systems," Vol. 14 of the A.C.S. Symposium Series; "Design of Prodrugs," ed. H. Bundgaard, Elsevier, 1985; and in Bioreversible Carriers in Drug Design, ed. Edward B. Roche, American Pharmaceutical Association and Pergamon Press, 1987, each of which are hereby incorporated by reference in their entirety.

[0043] As described in The Practice of Medicinal Chemistry, Ch. 31-32 (Ed. Wermuth, Academic Press, San Diego, CA, 2001), prodrugs can be conceptually divided into two non-exclusive categories, bioprecursor prodrugs and carrier prodrugs. Generally, bioprecursor prodrugs are compounds that are inactive or have low activity compared to the corresponding active drug compound, that contain one or more protective groups and are converted to an active form by metabolism or solvolysis. Both the active drug form and any released metabolic products should have acceptably low toxicity. Typically, the formation of active drug compound involves a metabolic process or reaction that is one of the follow types:

(1) Oxidative reactions: Oxidative reactions are exemplified without limitation to reactions such as oxidation of alcohol, carbonyl, and acid functionalities, hydroxylation of aliphatic carbons, hydroxylation of alicyclic carbon atoms, oxidation of aromatic carbon atoms, oxidation of carbon-carbon double bonds, oxidation of nitrogen-containing functional groups, oxidation of silicon, phosphorus, arsenic, and sulfur, oxidative N-dealkylation, oxidative O- and S-dealkylation, oxidative deamination, as well as other oxidative reactions.

(2) Reductive reactions: Reductive reactions are exemplified without limitation to reactions such as reduction of carbonyl functionalities, reduction of alcohol functionalities and carbon-carbon double bonds, reduction of nitrogen-containing functional groups, and other reduction reactions.

(3) Reactions without change in the oxidation state: Reactions without change in the state of oxidation are exemplified without limitation to reactions such as hydrolysis of esters and ethers, hydrolytic cleavage of carbon-nitrogen single bonds, hydrolytic cleavage of non-aromatic heterocycles, hydration and dehydration at multiple bonds, new atomic linkages resulting from dehydration reactions, hydrolytic dehalogenation, removal of hydrogen halide molecule, and other such reactions.

[0044] Carrier prodrugs are drug compounds that contain a transport moiety, e.g., that improves uptake and/or localized delivery to a site(s) of action. Desirably for such a carrier prodrug, the linkage between the drug moiety and the transport moiety is a covalent bond, the prodrug is inactive or less active than the drug compound, the prodrug and any release transport moiety are acceptably non-toxic. For prodrugs where the transport moiety is intended to enhance uptake, typically the release of the transport moiety should be rapid. In other cases, it is desirable to utilize a moiety that provides slow release, e.g., certain polymers or other moieties, such as cyclodextrins. (See, e.g., Cheng *et al.*, U.S. Patent Publ. No. 2004/0077595, incorporated herein by reference.) Such carrier prodrugs are often

advantageous for orally administered drugs. Carrier prodrugs can, for example, be used to improve one or more of the following properties: increased lipophilicity, increased duration of pharmacological effects, increased site-specificity, decreased toxicity and adverse reactions, and/or improvement in drug formulation (e.g., stability, water solubility, suppression of an undesirable organoleptic or physiochemical property). For example, lipophilicity can be increased by esterification of hydroxyl groups with lipophilic carboxylic acids, or of carboxylic acid groups with alcohols, e.g., aliphatic alcohols.

[0045] The term "carrier" is also meant to include microspheres, liposomes, micelles, nanoparticles (naturally-equipped nanocarriers, for example, exosomes), and the like. It is known that exosomes can be highly effective drug carriers, and there are various ways in which drugs can be loaded into exosomes, including those techniques described in J Control Release. 2015 December 10; 219: 396–405, the contents of which are incorporated by reference in its entirety.

[0046] Metabolites, e.g., active metabolites, overlap with prodrugs as described above, e.g., bioprecursor prodrugs. Thus, such metabolites are pharmacologically active compounds or compounds that further metabolize to pharmacologically active compounds that are derivatives resulting from metabolic process in the body of a subject. Of these, active metabolites are such pharmacologically active derivative compounds. For prodrugs, the prodrug compound is generally inactive or of lower activity than the metabolic product. For active metabolites, the parent compound may be either an active compound or may be an inactive prodrug.

[0047] Prodrugs and active metabolites may be identified using routine techniques known in the art. See, e.g., Bertolini et al., 1997, J. Med. Chem., 40:2011-2016; Shan et al., 1997, J Pharm Sci 86(7):756-757; Bagshawe, 1995, Drug Dev. Res., 34:220-230.

[0048] "Tautomer" means compounds produced by the phenomenon wherein a proton of one atom of a molecule shifts to another atom. *See*, Jerry March, Advanced Organic Chemistry: Reactions, Mechanisms and Structures, Fourth Edition, John Wiley & Sons, pages 69-74 (1992). The tautomers also refer to one of two or more structural isomers that exist in equilibrium and are readily converted from one isomeric form to another. Examples of include keto-enol tautomers, such as acetone/propen-2-ol, imine-enamine tautomers and the like, ring-chain tautomers, such as glucose/2,3,4,5,6-pentahydroxy-hexanal and the like, the tautomeric forms of heteroaryl groups containing a -N=C(H)-NH- ring atom arrangement, such as pyrazoles, imidazoles, benzimidazoles, triazoles, and tetrazoles. Where the compound contains, for example, a keto or oxime group or an aromatic moiety, tautomeric

isomerism ('tautomerism') can occur. The compounds described herein may have one or more tautomers and therefore include various isomers. A person of ordinary skill in the art would recognize that other tautomeric ring atom arrangements are possible. All such isomeric forms of these compounds are expressly included in the present disclosure.

[0049] "Isomers" mean compounds that have identical molecular Formulae but differ in the nature or sequence of bonding of their atoms or in the arrangement of their atoms in space. Isomers that differ in the arrangement of their atoms in space are termed "stereoisomers." "Stereoisomer" and "stereoisomers" refer to compounds that exist in different stereoisomeric forms, for example, if they possess one or more asymmetric centers or a double bond with asymmetric substitution and, therefore, can be produced as individual stereoisomers or as mixtures. Stereoisomers include enantiomers and diastereomers. Stereoisomers that are not mirror images of one another are termed "diastereomers" and those that are non-superimposable mirror images of each other are termed "enantiomers." When a compound has an asymmetric center, for example, an atom such as carbon bonded to four different groups, a pair of enantiomers is possible. An enantiomer can be characterized by the absolute configuration of its asymmetric center and is described by the R- and S-sequencing rules of Cahn and Prelog, or by the manner in which the molecule rotates the plane of polarized light and designated as dextrorotatory or levorotatory (i.e., as (+) or (-)-isomers respectively). A chiral compound can exist as either individual enantiomer or as a mixture thereof. A mixture containing equal proportions of the enantiomers is called a "racemic mixture." As another example, stereoisomers include geometric isomers, such as cis- or trans- orientation of substituents on adjacent carbons of a double bond. Unless otherwise indicated, the description is intended to include individual stereoisomers as well as mixtures. The methods for the determination of stereochemistry and the separation of stereoisomers are well-known in the art (see discussion in Chapter 4 of ADVANCED ORGANIC CHEMISTRY, 6th edition J. March, John Wiley and Sons, New York, 2007) differ in the chirality of one or more stereocenters.

[0050] In the context of the use, testing, or screening of compounds that are or may be modulators, the term "contacting" means that the compound(s) are caused to be in sufficient proximity to a particular molecule, complex, cell, tissue, organism, or other specified material that potential binding interactions and/or chemical reaction between the compound and other specified material can occur.

[0051] By "assaying" is meant the creation of experimental conditions and the gathering of data regarding a particular result of the exposure to specific experimental

conditions. For example, enzymes can be assayed based on their ability to act upon a detectable substrate. A compound can be assayed based on its ability to bind to a particular target molecule or molecules.

[0052] As used herein, the terms "ligand" and "modulator" are used equivalently to refer to a compound that changes (i.e., increases or decreases) the activity of a target biomolecule, e.g., an enzyme such as those described herein. Generally, a ligand or modulator will be a small molecule, where "small molecule refers to a compound with a molecular weight of 1500 Daltons or less, 1000 Daltons or less, 800 Daltons or less, or 600 Daltons or less. Thus, an "improved ligand" is one that possesses better pharmacological and/or pharmacokinetic properties than a reference compound, where "better" can be defined by one skilled in the relevant art for a particular biological system or therapeutic use.

[0053] The term "binds" in connection with the interaction between a target and a potential binding compound indicates that the potential binding compound associates with the target to a statistically significant degree as compared to association with proteins generally (i.e., non-specific binding). Thus, the term "binding compound" refers to a compound that has a statistically significant association with a target molecule. In some embodiments, a binding compound interacts with a specified target with a dissociation constant (K_D) of 10 mM or less, 1,000 μM or less, 100 μM or less, 10 μM or less, 1 μM or less, 1,000 nM or less, 100 nM or less, 10 nM or less, or 1 nM or less. In the context of compounds binding to a target, the terms "greater affinity" and "selective" indicates that the compound binds more tightly than a reference compound, or than the same compound in a reference condition, i.e., with a lower dissociation constant. In some embodiments, the greater affinity is at least 2, 3, 4, 5, 8, 10, 50, 100, 200, 400, 500, 1000, or 10,000-fold greater affinity.

[0054] The terms "modulate," "modulation," and the like refer to the ability of a compound to increase or decrease the function and/or expression of a target, such as the interaction between YAP and TEAD, where such function may include transcription regulatory activity and/or binding. Modulation may occur *in vitro* or *in vivo*. Modulation, as described herein, includes the inhibition, antagonism, partial antagonism, activation, agonism or partial agonism of a function or characteristic associated with YAP/TEAD, either directly or indirectly, and/or the upregulation or downregulation of the expression YAP/TEAD, either directly or indirectly. In another embodiment, the modulation is direct. Inhibitors or antagonists are compounds that, e.g., bind to, partially or totally block stimulation, decrease, prevent, inhibit, delay activation, inactivate, desensitize, or downregulate signal transduction.

Activators or agonists are compounds that, e.g., bind to, stimulate, increase, open, activate, facilitate, enhance activation, activate, sensitize or upregulate signal transduction.

[0055] As used herein, the terms "treat," "treating," "therapy," "therapies," and like terms refer to the administration of material, e.g., any one or more compound(s) as described herein in an amount effective to inhibit YAP/TEAD. In other embodiments, the terms "treat," "treating," "therapy," "therapies," and like terms refer to the administration of material, e.g., any one or more compound(s) as described herein is an amount effective to prevent, alleviate, or ameliorate one or more symptoms of a disease or condition, i.e., indication, and/or to prolong the survival of the subject being treated.

[0056] The terms "prevent," "preventing," "prevention" and grammatical variations thereof as used herein, refers to a method of partially or completely delaying or precluding the onset or recurrence of a disease, disorder or condition and/or one or more of its attendant symptoms or barring a subject from acquiring or reacquiring a disorder or condition or reducing a subject's risk of acquiring or requiring a disorder or condition or one or more of its attendant symptoms.

[0057] As used herein, the term "subject," "animal subject," and the like refers to a living organism including, but not limited to, human and non-human vertebrates, e.g., any mammal, such as a human, other primates, sports animals and animals of commercial interest such as cattle, horses, ovines, or porcines, rodents, or pets such as dogs and cats.

[0058] "Unit dosage form" refers to a composition intended for a single administration to treat a subject suffering from a disease or medical condition. Each unit dosage form typically comprises each of the active ingredients of this disclosure plus pharmaceutically acceptable excipients. Examples of unit dosage forms are individual tablets, individual capsules, bulk powders, liquid solutions, ointments, creams, eye drops, suppositories, emulsions or suspensions. Treatment of the disease or condition may require periodic administration of unit dosage forms, for example: one unit dosage form two or more times a day, one with each meal, one every four hours or other interval, or only one per day. The expression "oral unit dosage form" indicates a unit dosage form designed to be taken orally.

[0059] The term "administering" refers to oral administration, administration as a suppository, topical contact, intravenous, intraperitoneal, intramuscular, intralesional, intranasal or subcutaneous administration, or the implantation of a slow-release device e.g., a mini-osmotic pump, to a subject. Administration is by any route, including parenteral and transmucosal (e.g., buccal, sublingual, palatal, gingival, nasal, vaginal, rectal, or

transdermal). Parenteral administration includes, e.g., intravenous, intramuscular, intra-arteriole, intradermal, subcutaneous, intraperitoneal, intraventricular, and intracranial. Other modes of delivery include, but are not limited to, the use of liposomal formulations, intravenous infusion, transdermal patches, etc.

[0060] In the present context, the term "therapeutically effective" or "effective amount" indicates that a compound or material or amount of the compound or material when administered is sufficient or effective to prevent, alleviate, or ameliorate one or more symptoms of a disease, disorder or medical condition being treated, and/or to prolong the survival of the subject being treated. The therapeutically effective amount will vary depending on the compound, the disease, disorder or condition and its severity and the age, weight, etc., of the mammal to be treated. In general, satisfactory results in subjects are indicated to be obtained at a daily dosage of from about 0.1 to about 10 g/kg subject body weight. In some embodiments, a daily dose ranges from about 0.10 to 10.0 mg/kg of body weight, from about 1.0 to 3.0 mg/kg of body weight, from about 3 to 10 mg/kg of body weight, from about 3 to 150 mg/kg of body weight, from about 3 to 100 mg/kg of body weight, from about 10 to 100 mg/kg of body weight, from about 10 to 150 mg/kg of body weight, or from about 150 to 1000 mg/kg of body weight. The dosage can be conveniently administered, e.g., in divided doses up to four times a day or in sustained-release form.

[0061] As used herein, the term "YAP/TEAD mediated disease or condition" (which is also meant to mean "YAP or TEAD mediated disease or condition" or "YAP and/or TEAD mediated disease or condition") refers to a disease or condition in which the biological function of YAP/TEAD affect the development and/or course of the disease or condition, and/or in which modulation of the interaction of YAP/TEAD (such as YAP/TEAD mediated transcription) alters the development, course, and/or symptoms. A of YAP/TEAD mediated disease or condition includes a disease or condition for which the disruption YAP/TEAD interactions (for example, by TEAD inhibition), and/or inhibition of YAP/TEAD mediated transcription provides a therapeutic benefit, e.g., wherein treatment with YAP/TEAD inhibitors, including compounds described herein, provides a therapeutic benefit to the subject suffering from or at risk of the disease or condition. A YAP/TEAD mediated disease or condition is intended to include a cancer that harbors loss of function mutations in YAP/TEAD, or a cancer where there is activation of YAP/TEAD. A YAP/TEAD mediated disease or condition is also intended to include various human carcinomas, including those of colon, lung, pancreas, and ovary, as well as diseases or conditions associated with tumor neovascularization, and invasiveness.

[0062] Also, in the context of compounds binding to a biomolecular target, the term "greater specificity" indicates that a compound binds to a specified target to a greater extent than to another biomolecule or biomolecules that may be present under relevant binding conditions, where binding to such other biomolecules produces a different biological activity than binding to the specified target. Typically, the specificity is with reference to a limited set of other biomolecules, e.g., in the case of YAP or TEAD. In particular embodiments, the greater specificity is at least 2, 3, 4, 5, 8, 10, 50, 100, 200, 400, 500, or 1000-fold greater specificity.

[0063] As used herein in connection with binding compounds or ligands, the term "specific for YAP/TEAD," and terms of like import mean that a particular compound binds to YAP or TEAD to a statistically greater extent than to other epigenetic targets that may be present in a particular sample. Also, where biological activity other than binding is indicated, the term "specific for YAP or TEAD" indicates that a particular compound has greater biological effect associated with binding YAP or TEAD than to other enzymes, e.g., enzyme activity inhibition.

[0064] The term "first line cancer therapy" refers to therapy administered to a subject as an initial regimen to reduce the number of cancer cells. First line therapy is also referred to as induction therapy, primary therapy and primary treatment. First-line therapy can be an administered combination with one or more agents. A summary of currently accepted approaches to first line treatment for certain disease can be found in the NCI guidelines for such diseases.

[0065] The term "second line cancer therapy" refers to a cancer treatment that is administered to a subject who does not respond to first line therapy, that is, often first line therapy is administered or who has a recurrence of cancer after being in remission. In certain embodiments, second line therapy that may be administered includes a repeat of the initial successful cancer therapy, which may be any of the treatments described under "first line cancer therapy." A summary of the currently accepted approaches to second line treatment for certain diseases is described in the NCI guidelines for such diseases.

[0066] The term "refractory" refers to wherein a subject fails to respond or is otherwise resistant to cancer therapy or treatment. The cancer therapy may be first-line, second-line or any subsequently administered treatment. In certain embodiments, refractory refers to a condition where a subject fails to achieve complete remission after two induction attempts. A subject may be refractory due to a cancer cell's intrinsic resistance to a particular

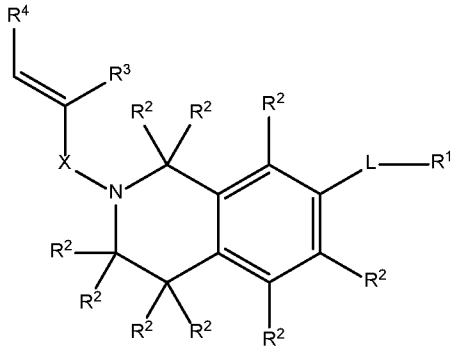
therapy, or the subject may be refractory due to an acquired resistance that develops during the course of a particular therapy.

[0067] In addition, abbreviations as used herein have respective meanings as follows:

°C	Degree Celsius
AcOH	Acetic acid
BOC	tert-butoxycarbonyl
DMF	Dimethylformamide
DMSO	Dimethylsulfoxide
EtOAc	Ethyl Acetate
ESI	Electrospray ionization
HPLC	High Performance Liquid Chromatography
IC_{50}	Half minimal (50%) inhibitory concentration
LCMS	Liquid Chromatography Mass Spectrometry
[M+H+]+ or (MH)+	Mass peak plus hydrogen
[M-H-]- or (MH)-	Mass peak minus hydrogen
Me	Methyl
MeOH	Methanol
MS	Mass spectrometry
N	Normal
PMB	(4-methoxyphenyl)methanamine or para-methoxy benzyl
RP	Reverse phase
RT	Room temperature
TLC	Thin-layer chromatography
THF	Tetrahydrofuran
XantPhos	4,5-bis(diphenylphosphino)-9,9-dimethylxanthene

II. Compounds

[0068] **Embodiment 1** of this disclosure relates to a compound having Formula (I):



(I)

or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog thereof, wherein:

R^1 is phenyl, heteroaryl, cycloalkyl, or heterocycloalkyl, wherein R^1 is substituted with 0-1 G^1 groups and 0-4 G^2 groups;

X is -C(O)- or -$S(O)_2$-;

G^1 is -$S(O)_2$alkyl, cycloalkyl optionally substituted with one or more R^5, or phenyl optionally substituted with one or more R^5;

each **G^2** is independently selected from halogen, OH, CN, alkyl optionally substituted with one or more R^5, alkoxy optionally substituted with one or more R^5;

each **R^2** is independently H, halogen, -C(O)O-alkyl or C_1-C_3alkyl optionally substituted with 1-3 halogens or two R^2 groups together with the carbon to which they are attached can form -CO-, provided that not more than one R^2 is -C(O)O-alkyl;

L is -O-, -$OC(R^8)_2$-, -$N(R^6)$-, -$N(R^6)$-$C(R^8)_2$, -$[C(R^8)_2]_{1-2}$-, -$C(R^8)_2O$-, or -$C(R^8)_2$–$N(R^6)$-;

R^3 is H, halogen, alkyl, hydroxyalkyl, or haloalkyl;

R^4 is H, halogen, alkyl, hydroxyalkyl, heterocycloalkylalkyl, heteroarylalkyl, or -alkyl-$N(R^6)_2$, wherein each alkyl, hydroxyalkyl, heterocycloalkylalkyl, heteroarylalkyl, -alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently halogen or OH;

each **R^6** is independently H or alkyl optionally substituted with one or more R^5;

each **R^7** is independently alkyl, alkoxy, hydroxyalkyl, halogen, or hydroxy; and

each **R^8** is independently H, halogen, or alkyl optionally substituted with one or more R^5.

[0069] **Embodiment 2** of this disclosure relates to the compound according to Embodiment 1, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl,

wherein R^1 is substituted 0-4 G^2 groups,

each **G^2** is independently selected from halogen, OH, CN, C_1-C_6alkyl optionally substituted with 1-3 R^5, C_1-C_6alkoxy optionally substituted with 1-3 R^5;

each **R^2** is independently H, halogen, or CH_3;

R^3 is H, halogen C_1-C_3alkyl, C_1-C_3hydroxyalkyl, or C_1-C_3haloalkyl;

L is -O-, -OCH_2-, -N(H)-, -$N(CH_3)$-, -N(H)-$C(R^8)_2$, -$[(CR^8)_2]_{1\text{-}2}$-, -C $(R^8)_2$O-, or -C $(R^8)_2$–N(H);

R^4 is H, halogen, C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_6alkyl-$N(R^6)_2$, wherein each C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently halogen C_1-C_3haloalkyl, or OH;

each **R^6** is independently H or C_1-C_6alkyl optionally substituted with 1-3 R^5;

each **R^7** is independently C_1-C_6alkyl, C_1-C_6alkoxy, C_1-C_6hydroxyalkyl, halogen, or hydroxy; and

each **R^8** is independently H, halogen, or C_1-C_6alkyl optionally substituted with 1-3 R^5.

[0070] **Embodiment 3** of this disclosure relates to the compound according to Embodiment 2, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-3 G^2 groups,

each **G^2** is independently selected from Cl, F, OH, CN, C_1-C_4alkyl optionally substituted with 1-3 R^5, C_1-C_4alkoxy optionally substituted with 1-3 R^5;

each **R^2** is independently H, Cl, F, or CH_3;

R^3 is H, Cl, F, C_1-C_2alkyl, C_1-C_2hydroxyalkyl, or C_1-C_2haloalkyl;

L is -O-, -OCH_2-, -N(H)-, or $N(H)C(H)_2$;

R^4 is H, F, Cl, C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$, wherein each C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

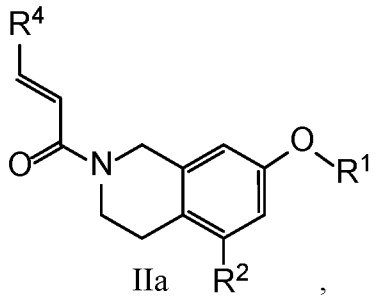
each **R^5** is independently Cl, F, or OH;

each **R^6** is independently H or C$_1$-C$_4$alkyl optionally substituted with 1-3 R^5;

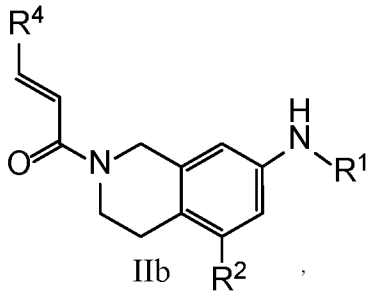
each **R^7** is independently C$_1$-C$_4$alkyl, C$_1$-C$_4$alkoxy, C$_1$-C$_4$hydroxyalkyl, Cl, F, or hydroxy; and

each **R^8** is independently H, halogen, or C$_1$-C$_4$alkyl optionally substituted with 1-3 R^5.

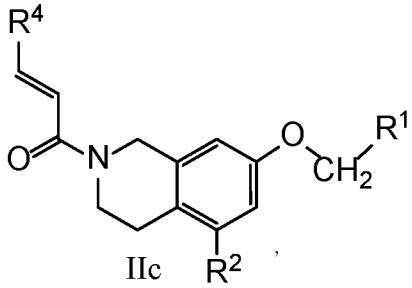
[0071] **Embodiment 4** of this disclosure relates to the compound according to Embodiment 1 having one of the following formulae:



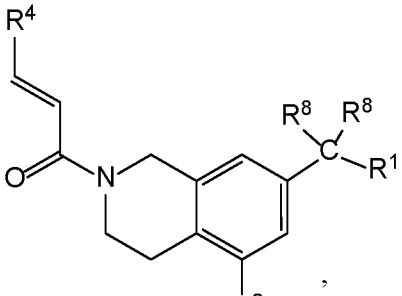
IIa ,



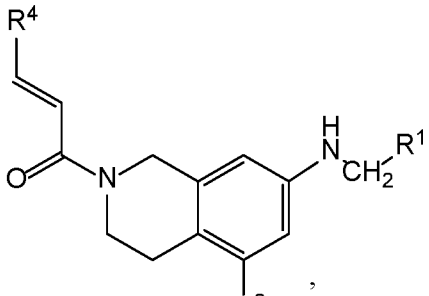
IIb ,



IIc ,



IId ,



IIe ,

or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog of any of formulae IIa, IIb, IIc, IId or IIe.

[0072] **Embodiment 5** of this disclosure relates to the compound according to Embodiment 4, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C$_4$-C$_{10}$ cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-4 G^2 groups,

each **G^2** is independently selected from halogen, OH, CN, C$_1$-C$_6$alkyl optionally substituted with one or more R^5, C$_1$-C$_6$alkoxy optionally substituted with 1-3 R^5;

R^2 is H, halogen, or CH$_3$;

R^4 is H, halogen, C$_1$-C$_6$alkyl, C$_1$-C$_6$hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C$_1$-C$_6$alkyl-N(R^6)$_2$, wherein each C$_1$-C$_6$alkyl, C$_1$-C$_6$hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -alkyl-N(R^6)$_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently halogen C$_1$-C$_3$haloalkyl, or OH;

each **R⁶** is independently H or C_1-C_6alkyl optionally substituted with 1-3 R^5;

each **R⁷** is independently C_1-C_6alkyl, C_1-C_6alkoxy, C_1-C_6hydroxyalkyl, halogen, or hydroxy; and

each **R⁸** is independently H, halogen, or C_1-C_6alkyl optionally substituted with 1-3 R^5.

[0073] **Embodiment 6** of this disclosure relates to the compound according to Embodiment 5, wherein:

R¹ is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-3 G^2 groups,

each **G²** is independently selected from Cl, F, OH, CN, C_1-C_4alkyl optionally substituted with one or more R^5, C_1-C_4alkoxy optionally substituted with 1-3 R^5;

R² is H, Cl, F, or CH_3;

R⁴ is H, F, Cl, C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$, wherein each C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R⁵** is independently Cl, F, or OH;

each **R⁶** is independently H or C_1-C_4alkyl optionally substituted with 1-3 R^5;

each **R⁷** is independently C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4hydroxyalkyl, Cl, F, or hydroxy; and

each **R⁸** is independently H, halogen, or C_1-C_4alkyl optionally substituted with 1-3 R^5.

[0074] **Embodiment 7** of this disclosure relates to the compound according to Embodiment 6, wherein R^1 is phenyl or pyridyl substituted with 1-3 groups independently selected from Cl, F, CF_3, and CN.

[0075] **Embodiment 8** of this disclosure relates to the compound according to Embodiment 7, wherein R^1 is phenyl or pyridyl, wherein the phenyl or pyridyl is substituted with 1 CF_3 and optionally substituted with 1-2 F.

[0076] **Embodiment 9** of this disclosure relates to formic acid salt according to the compound in any of the preceding Embodiments.

[0077] **Embodiment 10** of this disclosure relates to the compound according to Embodiment 1 selected from Table 1, or a pharmaceutically acceptable salt thereof.

[0078] Compounds contemplated herein are described with reference to both generic formulae and specific compounds. In addition, the compounds described herein may exist in a number of different forms or derivatives, all within the scope of the present disclosure.

These include, for example, tautomers, stereoisomers, racemic mixtures, regioisomers, salts, prodrugs (e.g., carboxylic acid esters), and active metabolites.

[0079] It is understood that some compounds may exhibit tautomerism. In such cases, the formulae provided herein expressly depict only one of the possible tautomeric forms. It is therefore to be understood that the formulae provided herein are intended to represent any tautomeric form of the depicted compounds and are not to be limited merely to the specific tautomeric form depicted by the drawings of the formulae.

[0080] Likewise, some of the compounds according to the present disclosure may exist as stereoisomers as defined herein. All such single stereoisomers, racemates and mixtures thereof are intended to be within the scope of the present disclosure. Unless specified to the contrary, all such stereoisomeric forms are included within the formulae provided herein.

[0081] In some embodiments, a chiral compound of the present disclosure is in a form that contains at least 80% of a single isomer (60% enantiomeric excess ("e.e.") or diastereomeric excess ("d.e.")), or at least 85% (70% e.e. or d.e.), 90% (80% e.e. or d.e.), 95% (90% e.e. or d.e.), 97.5% (95% e.e. or d.e.), or 99% (98% e.e. or d.e.). As generally understood by those skilled in the art, an optically pure compound having one chiral center is one that consists essentially of one of the two possible enantiomers (i.e., is enantiomerically pure), and an optically pure compound having more than one chiral center is one that is both diastereomerically pure and enantiomerically pure. In some embodiments, the compound is present in optically pure form.

[0082] For compounds in which synthesis involves addition of a single group at a double bond, particularly a carbon-carbon double bond, the addition may occur at either of the double bond-linked atoms. For such compounds, the present disclosure includes both such regioisomers.

[0083] In addition to the present formulae and compounds described herein, the disclosure also includes prodrugs (generally pharmaceutically acceptable prodrugs), active metabolic derivatives (active metabolites), and their pharmaceutically acceptable salts.

[0084] Unless specified to the contrary, specification of a compound herein includes pharmaceutically acceptable salts of such compound.

[0085] In some embodiments, compounds of the disclosure are complexed with an acid or a base, including base addition salts such as ammonium, diethylamine, ethanolamine, ethylenediamine, diethanolamine, t-butylamine, piperazine, meglumine; acid addition salts, such as acetate, acetylsalicylate, besylate, camsylate, citrate, formate, fumarate, glutarate,

hydrochlorate, maleate, mesylate, nitrate, oxalate, phosphate, succinate, sulfate, tartrate, thiocyanate and tosylate; and amino acids such as alanine, arginine, asparagine, aspartic acid, cysteine, glutamine, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tryptophan, tyrosine or valine. In some instances, the amorphous form of the complex is facilitated by additional processing, such as by spray-drying, mechanochemical methods such as roller compaction, or microwave irradiation of the parent compound mixed with the acid or base. Such methods may also include addition of ionic and/or non-ionic polymer systems, including, but not limited to, hydroxypropyl methyl cellulose acetate succinate (HPMCAS) and methacrylic acid copolymer (e.g., Eudragit® L100-55), that further stabilize the amorphous nature of the complex. Such amorphous complexes provide several advantages. For example, lowering of the melting temperature relative to the free base facilitates additional processing, such as hot melt extrusion, to further improve the biopharmaceutical properties of the compound. Also, the amorphous complex is readily friable, which provides improved compression for loading of the solid into capsule or tablet form.

III. Formulations and Administration

[0086] **Embodiment 11** of this disclosure relates to a pharmaceutical composition comprising a compound in one of **Embodiments 1-10**, or any of the subembodiments thereof, and a pharmaceutically acceptable carrier.

[0087] **Embodiment 12** of this disclosure relates to the pharmaceutical composition of **Embodiment 11**, further comprising a second pharmaceutical agent.

[0088] Suitable dosage forms, in part, depend upon the use or the route of administration, for example, oral, transdermal, transmucosal, inhalant, or by injection (parenteral). Such dosage forms should allow the compound to reach target cells. Other factors are well known in the art, and include considerations such as toxicity and dosage forms that retard the compound or composition from exerting its effects. Techniques and formulations generally may be found in The Science and Practice of Pharmacy, 21st edition, Lippincott, Williams and Wilkins, Philadelphia, PA, 2005 (hereby incorporated by reference herein).

[0089] Compounds of the present disclosure (i.e., any of the compounds described in **Embodiments 1-9**, including any of the subembodiments thereof) can be formulated as pharmaceutically acceptable salts.

[0090] Carriers or excipients can be used to produce compositions. The carriers or excipients can be chosen to facilitate administration of the compound. Examples of carriers

include calcium carbonate, calcium phosphate, various sugars such as lactose, glucose, or sucrose, or types of starch, cellulose derivatives, gelatin, vegetable oils, polyethylene glycols and physiologically compatible solvents. Examples of physiologically compatible solvents include sterile solutions of water for injection (WFI), saline solution, and dextrose.

[0091] The compounds can be administered by different routes including intravenous, intraperitoneal, subcutaneous, intramuscular, oral, transmucosal, rectal, transdermal, or inhalant. In some embodiments, the compounds can be administered by oral administration. For oral administration, for example, the compounds can be formulated into conventional oral dosage forms such as capsules, tablets, and liquid preparations such as syrups, elixirs, and concentrated drops.

[0092] For inhalants, compounds of the disclosure may be formulated as dry powder or a suitable solution, suspension, or aerosol. Powders and solutions may be formulated with suitable additives known in the art. For example, powders may include a suitable powder base such as lactose or starch, and solutions may comprise propylene glycol, sterile water, ethanol, sodium chloride and other additives, such as acid, alkali and buffer salts. Such solutions or suspensions may be administered by inhaling via spray, pump, atomizer, or nebulizer, and the like. The compounds of the disclosure may also be used in combination with other inhaled therapies, for example corticosteroids such as fluticasone propionate, beclomethasone dipropionate, triamcinolone acetonide, budesonide, and mometasone furoate; beta agonists such as albuterol, salmeterol, and formoterol; anticholinergic agents such as ipratropium bromide or tiotropium; vasodilators such as treprostinal and iloprost; enzymes such as DNAase; therapeutic proteins; immunoglobulin antibodies; an oligonucleotide, such as single or double stranded DNA or RNA, siRNA; antibiotics such as tobramycin; muscarinic receptor antagonists; leukotriene antagonists; cytokine antagonists; protease inhibitors; cromolyn sodium; nedocril sodium; and sodium cromoglycate.

[0093] Pharmaceutical preparations for oral use can be obtained, for example, by combining the active compounds with solid excipients, optionally grinding a resulting mixture, and processing the mixture of granules, after adding suitable auxiliaries, if desired, to obtain tablets or dragee cores. Suitable excipients are, in particular, fillers such as sugars, including lactose, sucrose, mannitol, or sorbitol; cellulose preparations, for example, maize starch, wheat starch, rice starch, potato starch, gelatin, gum tragacanth, methyl cellulose, hydroxypropylmethyl-cellulose, sodium carboxymethylcellulose (CMC), and/or polyvinylpyrrolidone (PVP: povidone). If desired, disintegrating agents may be added, such

as the cross-linked polyvinylpyrrolidone, agar, or alginic acid, or a salt thereof such as sodium alginate.

[0094] Dragee cores are provided with suitable coatings. For this purpose, concentrated sugar solutions may be used, which may optionally contain, for example, gum arabic, talc, poly-vinylpyrrolidone, carbopol gel, polyethylene glycol (PEG), and/or titanium dioxide, lacquer solutions, and suitable organic solvents or solvent mixtures. Dye-stuffs or pigments may be added to the tablets or dragee coatings for identification or to characterize different combinations of active compound doses.

[0095] Pharmaceutical preparations that can be used orally include push-fit capsules made of gelatin ("gelcaps"), as well as soft, sealed capsules made of gelatin, and a plasticizer, such as glycerol or sorbitol. The push-fit capsules can contain the active ingredients in admixture with filler such as lactose, binders such as starches, and/or lubricants such as talc or magnesium stearate and, optionally, stabilizers. In soft capsules, the active compounds may be dissolved or suspended in suitable liquids, such as fatty oils, liquid paraffin, or liquid polyethylene glycols (PEGs). In addition, stabilizers may be added.

[0096] Alternatively, injection (parenteral administration) may be used, e.g., intramuscular, intravenous, intraperitoneal, and/or subcutaneous. For injection, the compounds of the disclosure are formulated in sterile liquid solutions, such as in physiologically compatible buffers or solutions, such as saline solution, Hank's solution, or Ringer's solution. In addition, the compounds may be formulated in solid form and redissolved or suspended immediately prior to use. Lyophilized forms can also be produced.

[0097] Administration can also be by transmucosal, topical, transdermal, or inhalant means. For transmucosal, topical or transdermal administration, penetrants appropriate to the barrier to be permeated are used in the formulation. Such penetrants are generally known in the art, and include, for example, for transmucosal administration, bile salts and fusidic acid derivatives. In addition, detergents may be used to facilitate permeation. Transmucosal administration, for example, may be through nasal sprays or suppositories (rectal or vaginal).

[0098] The topical compositions of this disclosure are formulated as oils, creams, lotions, ointments, and the like by choice of appropriate carriers known in the art. Suitable carriers include vegetable or mineral oils, white petrolatum (white soft paraffin), branched chain fats or oils, animal fats and high molecular weight alcohol (greater than C_{12}). In another embodiment, the carriers are those in which the active ingredient is soluble. Emulsifiers, stabilizers, humectants and antioxidants may also be included as well as agents imparting color or fragrance, if desired. Creams for topical application are formulated from a

mixture of mineral oil, self-emulsifying beeswax and water in which mixture the active ingredient, dissolved in a small amount solvent (e.g., an oil), is admixed. Additionally, administration by transdermal means may comprise a transdermal patch or dressing such as a bandage impregnated with an active ingredient and optionally one or more carriers or diluents known in the art. To be administered in the form of a transdermal delivery system, the dosage administration will, of course, be continuous rather than intermittent throughout the dosage regimen.

[0099] The amounts of various compounds to be administered can be determined by standard procedures taking into account factors such as the compound IC_{50}, the biological half-life of the compound, the age, size, and weight of the subject, and the indication being treated. The importance of these and other factors are well known to those of ordinary skill in the art. Generally, a dose will be between about 0.01 and 50 mg/kg, or 0.1 and 20 mg/kg of the subject being treated. Multiple doses may be used.

[0100] The compounds of the disclosure may also be used in combination with other therapies for treating the same disease. Such combination use includes administration of the compounds and one or more other therapeutics at different times, or co-administration of the compound and one or more other therapies. In some embodiments, dosage may be modified for one or more of the compounds of the disclosure or other therapeutics used in combination, e.g., reduction in the amount dosed relative to a compound or therapy used alone, by methods well known to those of ordinary skill in the art.

[0101] It is understood that use in combination includes use with other therapies, drugs, medical procedures etc., where the other therapy or procedure may be administered at different times (e.g. within a short time, such as within hours (e.g. 1, 2, 3, 4-24 hours), or within a longer time (e.g. 1-2 days, 2-4 days, 4-7 days, 1-4 weeks)) than a compound of the present disclosure, or at the same time as a compound of the disclosure. Use in combination also includes use with a therapy or medical procedure that is administered once or infrequently, such as surgery, along with a compound of the disclosure administered within a short time or longer time before or after the other therapy or procedure. In some embodiments, the present disclosure provides for delivery of compounds of the disclosure and one or more other drug therapeutics delivered by a different route of administration or by the same route of administration. The use in combination for any route of administration includes delivery of compounds of the disclosure and one or more other drug therapeutics delivered by the same route of administration together in any formulation, including formulations where the two compounds are chemically linked in such a way that they

maintain their therapeutic activity when administered. In one aspect, the other drug therapy may be co-administered with one or more compounds of the disclosure. Use in combination by co-administration includes administration of co-formulations or formulations of chemically joined compounds, or administration of two or more compounds in separate formulations within a short time of each other (e.g. within an hour, 2 hours, 3 hours, up to 24 hours), administered by the same or different routes. Co-administration of separate formulations includes co-administration by delivery via one device, for example the same inhalant device, the same syringe, etc., or administration from separate devices within a short time of each other. Co-formulations of compounds of the disclosure and one or more additional drug therapies delivered by the same route includes preparation of the materials together such that they can be administered by one device, including the separate compounds combined in one formulation, or compounds that are modified such that they are chemically joined, yet still maintain their biological activity. Such chemically joined compounds may have a linkage that is substantially maintained in vivo, or the linkage may break down in vivo, separating the two active components.

IV. Methods of Use

Disease indications and modulations YAP/TEAD

Exemplary Diseases Associated with YAP/TEAD

Polycystic kidney disease

[0102] YAP and TAZ appear to serve functions in Polycystic kidney disease (PKD) progression. Increased YAP expression was also observed in human PKD patients. TAZ forms a complex with Polycystin-2 (PC2, the protein product of PKD1), thereby targeting it for ubiquitination and degradation. It was observed that TAZ knockout results in PKD, and also results in the down-regulation of other genes necessary for proper cilia development and function implicating YAP as a potential therapeutic target for PKD (Steven W Plouffe et al; Disease Implications of the Hippo/YAP Pathway; *Trends Mol Med.* 2015 Apr; 21(4): 212–222.).

Neurodegenerative Diseases

[0103] Hippo pathway components are involved in neurological diseases. For instance, studies reported that YAP/TAZ mediate gene transcription induced by AβPP, the precursor of Amyloid β which is believed to be a driver of Alzheimer's disease implicating YAP as a potential therapeutic target for Alzheimer's disease (Steven W Plouffe et al., 2015).

Arrhythmogenic cardiomyopathy and Holt-Oram syndrome

[0104] The Hippo pathway plays a role in heart diseases. Arrhythmogenic right ventricular cardiomyopathy (ARVC) is characterized by thinning of the right ventricular walls, arrhythmias, and replacement of the myocardium with fibroadipocytes. It has been shown that YAP are phosphorylated in human ARVC hearts, and that overexpressing a constitutively active YAP mutant in cardiomyocytes results in adipogenesis, further supporting the role of the Hippo pathway in ARVC and implicating YAP as a potential therapeutic target for ARVC (Steven W Plouffe et al., 2015).

Liver Cancer

[0105] YAP is frequently overexpressed in hepatocellular carcinoma (HCC) and is required to sustain increased cell proliferation and tumor growth. In addition, risk factors for HCC include hepatitis infection and exposure to xenobiotics, and these have also been implicated in activating YAP. For example, the Hepatitis B virus X protein (HBx) directly increases YAP expression by enhancing YAP gene transcription. In another example, TCPOBOP is a xenobiotic mimic that activates constitutive androstane receptor to increase YAP protein levels and induce HCC. Further, it was observed that inducing YAP overexpression in a liver-specific transgenic model causes abnormal hepatocyte proliferation and suppressed apoptosis, resulting in increased liver size and HCC implicating YAP as a potential therapeutic target for HCC (Steven W Plouffe et al., 2015).

Epithelioid hemangioendothelioma

[0106] Epithelioid hemangioendothelioma (EHE) is a vascular tumor generally found in the lung, bone, and skin. It has been observed that YAP/TAZ chromosome translocations occur in virtually all EHE cases that strongly suggest that dysregulated YAP/TAZ fusion proteins may act as cancer drivers for EHE implicating YAP as a potential therapeutic target for EHE. (Steven W Plouffe et al., 2015).

Breast Cancer

[0107] YAP/TAZ activity has been correlated with increased risk of metastasis and reduced survival in various human breast cancer subtypes. TAZ is highly expressed in invasive breast cancer cell lines and primary breast cancers. Further, TAZ overexpression is sufficient to induce cell proliferation, transformation in breast cancer cell lines. Similarly, overexpressing YAP in breast cancer cell lines induces tumor formation and growth in xenograft experiments, and deleting YAP prevents tumor growth in an oncogene-induced breast cancer model implicating YAP as a potential therapeutic target for breast cancer (Steven W Plouffe et al., 2015).

Lung Cancer

[0108] YAP/TAZ are both highly expressed in non-small cell lung cancer (NSCLC) in humans. Knockdown of either YAP or TAZ in NSCLC cells suppresses proliferation, invasion, and tumor growth in mice. High YAP expression is correlated with advanced stage, lymph node metastasis, and decreased survival in lung cancer. Further, it has been shown that knockdown of either YAP or TAZ is sufficient to decrease cell migration *in vitro* and metastasis *in vivo* in lung cancer implicating YAP as a potential therapeutic target for NSCLC (Steven W Plouffe et al., 2015).

Malignant Mesothelioma

[0109] It has been observed that knocking down YAP in malignant mesothelioma cells is sufficient to inhibit cell proliferation and anchorage-independent growth implicating dysregulation of the Hippo pathway in malignant mesothelioma and YAP as a potential therapeutic target for malignant mesothelioma (Steven W Plouffe et al., 2015).

Pancreatic cancer

[0110] Pancreatic ductal adenocarcinoma (PDAC) often have increased YAP expression, and elevated YAP expression is correlated with poor prognosis. Further, it has been observed that YAP knockdown results in reduced proliferation and reduced anchorage-independent growth in pancreatic cancer cells suggesting YAP may play an important role in PDAC progression. It was also reported that in a mouse model expressing mutated KRAS, that deleting YAP is sufficient to prevent PDAC (Steven W Plouffe et al., 2015).

Kaposi sarcoma

[0111] YAP/TAZ plays a major role in Kaposi sarcoma (KS). It has been shown that tissue samples from human KS patients elevated levels of YAP/TAZ. Recently, it was shown that KSHV encodes a viral GPCR (vGPCR), activating YAP/TAZ, and that cells overexpressing vGPCR failed to grow in a xenograft mouse model when YAP/TAZ were depleted, indicating that YAP/TAZ are necessary for KSHV-induced tumorigenesis (Steven W Plouffe et al., 2015).

Uveal Melanoma

[0112] 80% of Uveal Melanoma (UM) cases are characterized by activating mutations in either GNAQ or GNA11 encoding Gq or G11 respectively (Gq/11). It has been shown that that Gq/11 can activate YAP, and treating UM with Verteporfin, a drug which blocks YAP-TEAD interaction inhibits UM tumor growth in mice (Steven W Plouffe et al., 2015).

Renal Cell Carcinoma

[0113] YAP has been implicated in renal cell carcinoma (RCC). A recent report found there is increased YAP activity in RCC and that RCC tissues show elevated levels of YAP, and knocking down YAP in RCC cell lines blocks cell proliferation and increases apoptosis (Steven W Plouffe et al., 2015).

Colorectal Cancer

[0114] It has been observed that YAP is often overexpressed in colorectal cancer (CRC), and YAP/TAZ activity is correlated with decreased survival. In mice, inducing YAP overexpression in the intestine results in dysplasia after two days, although the intestine regenerates once induction is stopped. Further, it was observed that in knockout mice which developed adenomas after 13 weeks and polyps after 13 months, that these phenotypes were blocked by deleting YAP, indicating that these pathologies are YAP-dependent. In addition, increased YAP protein levels were observed in human CRC liver metastases and were correlated with CRC relapse (Steven W Plouffe et al., 2015).

Multiple Myeloma

The Hippo pathway plays an important role in regulating lymphocyte apoptosis. YAP acts as a tumor suppressor in several hematological cancers, including multiple myeloma (MM), lymphoma, and leukemia (Steven W Plouffe et al., 2015).

Nervous System Tumors

[0115] The Hippo pathway is involved in several nervous system tumors. Loss of function mutations in NF2 causes Neurofibromatosis Type 2, a genetic disorder characterized by increased YAP expression and NF2 inhibits YAP activity and loss of function mutations in NF2 results in increased YAP accumulation, so loss of NF2 and subsequent tumor growth could be due to aberrant YAP activity. In the central nervous system, NF2 expression is also significantly reduced in human malignant gliomas, and expression of NF2 has been shown to inhibit human glioma growth both *in vitro* and *in vivo*. Likewise, YAP is highly expressed in many human brain tumors including infiltrating gliomas, and YAP overexpression promotes glioblastoma growth in vitro (Steven W Plouffe et al., 2015).

[0116] The methods and compounds will typically be used in therapy for human subjects. However, they may also be used to treat similar or identical indications in other animal subjects.

[0117] In certain embodiments, the patient is 60 years or older and relapsed after a first line cancer therapy. In certain embodiments, the patient is 18 years or older and is relapsed or refractory after a second line cancer therapy. In certain embodiments, the patient

is 60 years or older and is primary refractory to a first line cancer therapy. In certain embodiments, the patient is 70 years or older and is previously untreated. In certain embodiments, the patient is 70 years or older and is ineligible and/or unlikely to benefit from cancer therapy.

[0118] In certain embodiments, the therapeutically effective amount used in the methods provided herein is at least 10 mg per day. In certain embodiments, the therapeutically effective amount is 10, 50, 90, 100, 135, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200, or 2500 mg per day. In other embodiments, the therapeutically effective amount is 10, 50, 90, 100, 135, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200, 2500, 3000, 3500, 4000, 4500, or 5000 mg per day or more. In certain embodiments, the compound is administered continuously.

[0119] In certain embodiments, provided herein is a method for treating a diseases or condition mediated by YAP or TEAD by administering to a mammal having a disease or condition at least 10, 50, 90, 100, 135, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2200, 2500, 3000, 3500, 4000, 4500, or 5000 mg per day of any of the compounds described in a compound in one of **Embodiments 1-10,** or a pharmaceutically acceptable salt, deuterated analog, a tautomer or a stereoisomer thereof, and wherein the compound is administered on an empty stomach.

[0120] **Embodiment 13** of this disclosure relates to a method for treating a subject with a disease or condition mediated by YAP/TEAD, said method comprising administering to the subject an effective amount of a compound in one of **Embodiments 1-10**, or any of the subembodiments thereof, or a pharmaceutically acceptable salt, deuterated analog, a tautomer or a stereoisomer thereof, or a pharmaceutical composition in one of **Embodiments 11-12**.

[0121] **Embodiment 14** of this disclosure relates to a method for treatment of a disease or condition according to **Embodiment 13**, wherein the disease or condition is a cancer, a neurodegenerative disease, a heart related disorder, or a kidney-related disorder. **Embodiment 15** of this disclosure relates to a method for treatment of a disease or condition according to **Embodiment 13** or **14**, wherein the disease or condition is polycystic kidney disease, Alzheimer's disease, arrhythmogenic cardiomyopathy, Holt-Oram syndrome, liver cancer, epithelioid hemangioendothelioma, breast cancer, lung cancer, malignant mesothelioma, pancreatic cancer, Kaposi sarcoma, uveal melanoma, renal cell carcinoma, colorectal cancer, multiple myeloma, neurofibromatosis Type 2, glioma, or glioblastoma.

V. Combination Therapy

[0122] YAP/TEAD modulators may be usefully combined with another pharmacologically active compound, or with two or more other pharmacologically active compounds, particularly in the treatment of cancer. In one embodiment, the composition includes any one or more compound(s) as described herein along with one or more compounds that are therapeutically effective for the same disease indication, wherein the compounds have a synergistic effect on the disease indication. In one embodiment, the composition includes any one or more compound(s) as described herein effective in treating a cancer and one or more other compounds that are effective in treating the same cancer, further wherein the compounds are synergistically effective in treating the cancer.

[0123] **Embodiment 16** of this disclosure relates the method according to any one of **Embodiments 13-15**, further comprising administering one or more additional therapeutic agents.

[0124] **Embodiment 17** of this disclosure relates the method according to **Embodiment 16**, wherein the one or more additional therapeutic agents is one or more of i) an alkylating agent selected from adozelesin, altretamine, bizelesin, busulfan, carboplatin, carboquone, carmustine, chlorambucil, cisplatin, cyclophosphamide, dacarbazine, estramustine, fotemustine, hepsulfam, ifosfamide, improsulfan, irofulven, lomustine, mechlorethamine, melphalan, oxaliplatin, piposulfan, semustine, streptozocin, temozolomide, thiotepa, and treosulfan; ii) an antibiotic selected from bleomycin, dactinomycin, daunorubicin, doxorubicin, epirubicin, idarubicin, menogaril, mitomycin, mitoxantrone, neocarzinostatin, pentostatin, and plicamycin; iii) an antimetabolite selected from azacitidine, capecitabine, cladribine, clofarabine, cytarabine, decitabine, floxuridine, fludarabine, 5-fluorouracil, ftorafur, gemcitabine, hydroxyurea, mercaptopurine, methotrexate, nelarabine, pemetrexed, raltitrexed, thioguanine, and trimetrexate; iv) an immune checkpoint agent selected from a PD-1 inhibitor, a PD-L1 inhibitor, and an anti-CTLA4 inhibitor; v) a hormone or hormone antagonist selected from enzalutamide, abiraterone, anastrozole, androgens, buserelin, diethylstilbestrol, exemestane, flutamide, fulvestrant, goserelin, idoxifene, letrozole, leuprolide, magestrol, raloxifene, tamoxifen, and toremifene; vi) a taxane selected from DJ-927, docetaxel, TPI 287, paclitaxel and DHA-paclitaxel; vii) a retinoid selected from alitretinoin, bexarotene, fenretinide, isotretinoin, and tretinoin; viii) an alkaloid selected from etoposide, homoharringtonine, teniposide, vinblastine, vincristine, vindesine, and vinorelbine; ix) an antiangiogenic agent selected from AE-941 (GW786034, Neovastat), ABT-510, 2-methoxyestradiol, lenalidomide, and thalidomide; x) a topoisomerase inhibitor

selected from amsacrine, edotecarin, exatecan, irinotecan, SN-38 (7-ethyl-10-hydroxy-camptothecin), rubitecan, topotecan, and 9-aminocamptothecin; xi) a kinase inhibitor selected from erlotinib, gefitinib, flavopiridol, imatinib mesylate, lapatinib, sorafenib, sunitinib malate, 7-hydroxystaurosporine, and vatalanib; xii) a targeted signal transduction inhibitor selected from bortezomib, geldanamycin, and rapamycin; xiii) a biological response modifier selected from imiquimod, interferon-α and interleukin-2; xiv) an IDO inhibitor; xv) a chemotherapeutic agent selected from 3-AP (3-amino-2-carboxyaldehyde thiosemicarbazone), altrasentan, aminoglutethimide, anagrelide, asparaginase, bryostatin-1, cilengitide, elesclomol, eribulin mesylate, ixabepilone, lonidamine, masoprocol, mitoguanazone, oblimersen, sulindac, testolactone, tiazofurin, an mTOR inhibitor, a PI3K inhibitor, a Cdk4 inhibitor, an Akt inhibitor, a Hsp90 inhibitor, a farnesyltransferase inhibitor and an aromatase inhibitor (anastrozole letrozole exemestane); xvi) a BRAF inhibitor e.g.,vemurafenib, dabrafenib, or encorafenib; xvii) a Mek inhibitor e.g, cobimetinib, trametinib, binimetinib or selumetinib; xviii) a c-Kit mutant inhibitor, xix) an EGFR inhibitor, xx) an epigenetic modulator; xxi) other adenosine axis blockade agents selected from CD39, CD38, A2AR and A2BR; xxii) agonists of TNFA super family member; or xxiii) an anti-ErbB2 mAb.

[0125] In another embodiment, the present disclosure provides a method of treating a cancer in a subject in need thereof by administering to the subject an effective amount of a composition including any one or more compound(s) as described herein in combination with one or more other therapies or medical procedures effective in treating the cancer. Other therapies or medical procedures include suitable anticancer therapy (e.g. drug therapy, vaccine therapy, gene therapy, photodynamic therapy) or medical procedure (e.g. surgery, radiation treatment, hyperthermia heating, bone marrow or stem cell transplant). In one embodiment, the one or more suitable anticancer therapies or medical procedures is selected from treatment with a chemotherapeutic agent (e.g. chemotherapeutic drug), radiation treatment (e.g. x-ray, gamma-ray, or electron, proton, neutron, or alpha-particle beam), hyperthermia heating (e.g. microwave, ultrasound, radiofrequency ablation), Vaccine therapy (e.g. AFP gene hepatocellular carcinoma vaccine, AFP adenoviral vector vaccine, AG-858, allogeneic GM-CSF-secretion breast cancer vaccine, dendritic cell peptide vaccines), gene therapy (e.g. Ad5CMV-p53 vector, adenovector encoding MDA7, adenovirus 5-tumor necrosis factor alpha), photodynamic therapy (e.g. aminolevulinic acid, motexatin lutetium), surgery, or bone marrow and stem cell transplantation.

VI. Kits

[0126] In another aspect, the present disclosure provides kits that include one or more compounds as described in any one of a compound in one of **Embodiments 1-10**, or a pharmaceutically acceptable salt, deuterated analog, a tautomer or a stereoisomer thereof, or a pharmaceutical composition in one of **Embodiments 11-12**. In some embodiments, the compound or composition is packaged, e.g., in a vial, bottle, flask, which may be further packaged, e.g., within a box, envelope, or bag. The compound or composition may be approved by the U.S. Food and Drug Administration or similar regulatory agency for administration to a mammal, e.g., a human. The compound or composition may be approved for administration to a mammal, e.g., a human, for a YAP/TEAD mediated disease or condition. The kits described herein may include written instructions for use and/or other indication that the compound or composition is suitable or approved for administration to a mammal, e.g., a human, for a YAP/TEAD mediated disease or condition. The compound or composition may be packaged in unit dose or single dose form, e.g., single dose pills, capsules, or the like.

VII. Binding Assays

[0127] The methods of the present disclosure can involve assays that are able to detect the binding of compounds to a target molecule. Such binding is at a statistically significant level, with a confidence level of at least 90%, or at least 95, 97, 98, 99% or greater confidence level that the assay signal represents binding to the target molecule, i.e., is distinguished from background. In some embodiments, controls are used to distinguish target binding from non-specific binding. A large variety of assays indicative of binding are known for different target types and can be used for this disclosure.

[0128] Binding compounds can be characterized by their effect on the activity of the target molecule. Thus, a "low activity" compound has an inhibitory concentration (IC_{50}) or effective concentration (EC_{50}) of greater than 1 μM under standard conditions. By "very low activity" is meant an IC_{50} or EC_{50} of above 100 μM under standard conditions. By "extremely low activity" is meant an IC_{50} or EC_{50} of above 1 mM under standard conditions. By "moderate activity" is meant an IC_{50} or EC_{50} of 200 nM to 1 μM under standard conditions. By "moderately high activity" is meant an IC_{50} or EC_{50} of 1 nM to 200 nM. By "high activity" is meant an IC_{50} or EC_{50} of below 1 nM under standard conditions. The IC_{50} or EC_{50} is defined as the concentration of compound at which 50% of the activity of the target molecule (e.g. enzyme or other protein) activity being measured is lost or gained relative to the range of activity observed when no compound is present. Activity can be

measured using methods known to those of ordinary skill in the art, e.g., by measuring any detectable product or signal produced by occurrence of an enzymatic reaction, or other activity by a protein being measured.

[0129] By "background signal" in reference to a binding assay is meant the signal that is recorded under standard conditions for the particular assay in the absence of a test compound, molecular scaffold, or ligand that binds to the target molecule. Persons of ordinary skill in the art will realize that accepted methods exist and are widely available for determining background signal.

[0130] By "standard deviation" is meant the square root of the variance. The variance is a measure of how spread out a distribution is. It is computed as the average squared deviation of each number from its mean. For example, for the numbers 1, 2, and 3, the mean is 2 and the variance is:

$$\sigma^2 = \frac{(1-2)^2 + (2-2)^2 + (3-2)^2}{3} = 0.667 .$$

Surface Plasmon Resonance

[0131] Binding parameters can be measured using surface plasmon resonance, for example, with a BIAcore® chip (Biacore, Japan) coated with immobilized binding components. Surface plasmon resonance is used to characterize the microscopic association and dissociation constants of reaction between an sFv or other ligand directed against target molecules. Such methods are generally described in the following references which are incorporated herein by reference. Vely F. *et al.*, (2000) BIAcore® analysis to test phosphopeptide-SH2 domain interactions, Methods in Molecular Biology. 121:313-21; Liparoto *et al.*, (1999) Biosensor analysis of the interleukin-2 receptor complex, Journal of Molecular Recognition. 12:316-21; Lipschultz *et al.*, (2000) Experimental design for analysis of complex kinetics using surface plasmon resonance, Methods. 20(3):310-8; Malmqvist., (1999) BIACORE: an affinity biosensor system for characterization of biomolecular interactions, Biochemical Society Transactions 27:335-40; Alfthan, (1998) Surface plasmon resonance biosensors as a tool in antibody engineering, Biosensors & Bioelectronics. 13:653-63; Fivash *et al.*, (1998) BIAcore for macromolecular interaction, Current Opinion in Biotechnology. 9:97-101; Price *et al.*; (1998) Summary report on the ISOBM TD-4 Workshop: analysis of 56 monoclonal antibodies against the MUC1 mucin. Tumour Biology 19 Suppl 1:1-20; Malmqvist *et al*, (1997) Biomolecular interaction analysis: affinity biosensor technologies for functional analysis of proteins, Current Opinion in Chemical Biology. 1:378-83; O'Shannessy *et al.*, (1996) Interpretation of deviations from pseudo-first-

order kinetic behavior in the characterization of ligand binding by biosensor technology, Analytical Biochemistry. 236:275-83; Malmborg *et al.*, (1995) BIAcore as a tool in antibody engineering, Journal of Immunological Methods. 183:7-13; Van Regenmortel, (1994) Use of biosensors to characterize recombinant proteins, Developments in Biological Standardization. 83:143-51; and O'Shannessy, (1994) Determination of kinetic rate and equilibrium binding constants for macromolecular interactions: a critique of the surface plasmon resonance literature, Current Opinions in Biotechnology. 5:65-71.

[0132] BIAcore® uses the optical properties of surface plasmon resonance (SPR) to detect alterations in protein concentration bound to a dextran matrix lying on the surface of a gold/glass sensor chip interface, a dextran biosensor matrix. In brief, proteins are covalently bound to the dextran matrix at a known concentration and a ligand for the protein is injected through the dextran matrix. Near infrared light, directed onto the opposite side of the sensor chip surface is reflected and also induces an evanescent wave in the gold film, which in turn, causes an intensity dip in the reflected light at a particular angle known as the resonance angle. If the refractive index of the sensor chip surface is altered (e.g. by ligand binding to the bound protein) a shift occurs in the resonance angle. This angle shift can be measured and is expressed as resonance units (RUs) such that 1000 RUs is equivalent to a change in surface protein concentration of 1 ng/mm^2. These changes are displayed with respect to time along the y-axis of a sensorgram, which depicts the association and dissociation of any biological reaction.

High Throughput Screening (HTS) Assays

[0133] HTS typically uses automated assays to search through large numbers of compounds for a desired activity. Typically HTS assays are used to find new drugs by screening for chemicals that act on a particular enzyme or molecule. For example, if a chemical inactivates an enzyme it might prove to be effective in preventing a process in a cell which causes a disease. High throughput methods enable researchers to assay thousands of different chemicals against each target molecule very quickly using robotic handling systems and automated analysis of results.

[0134] As used herein, "high throughput screening" or "HTS" refers to the rapid in vitro screening of large numbers of compounds (libraries); generally tens to hundreds of thousands of compounds, using robotic screening assays. Ultra-high-throughput Screening (uHTS) generally refers to the high-throughput screening accelerated to greater than 100,000 tests per day.

[0135] To achieve high-throughput screening, it is advantageous to house samples on a multicontainer carrier or platform. A multicontainer carrier facilitates measuring reactions of a plurality of candidate compounds simultaneously. Multi-well microplates may be used as the carrier. Such multi-well microplates, and methods for their use in numerous assays, are both known in the art and commercially available.

[0136] Screening assays may include controls for purposes of calibration and confirmation of proper manipulation of the components of the assay. Blank wells that contain all of the reactants but no member of the chemical library are usually included. As another example, a known inhibitor (or activator) of an enzyme for which modulators are sought, can be incubated with one sample of the assay, and the resulting decrease (or increase) in the enzyme activity used as a comparator or control. It will be appreciated that modulators can also be combined with the enzyme activators or inhibitors to find modulators which inhibit the enzyme activation or repression that is otherwise caused by the presence of the known the enzyme modulator.

Measuring Enzymatic and Binding Reactions During Screening Assays

[0137] Techniques for measuring the progression of enzymatic and binding reactions, e.g., in multicontainer carriers, are known in the art and include, but are not limited to, the following.

[0138] Spectrophotometric and spectrofluorometric assays are well known in the art. Examples of such assays include the use of colorimetric assays for the detection of peroxides, as described in Gordon, A. J. and Ford, R. A., (1972) The Chemist's Companion: A Handbook Of Practical Data, Techniques, And References, John Wiley and Sons, N.Y., Page 437.

[0139] Fluorescence spectrometry may be used to monitor the generation of reaction products. Fluorescence methodology is generally more sensitive than the absorption methodology. The use of fluorescent probes is well known to those skilled in the art. For reviews, see Bashford *et al.*, (1987) Spectrophotometry and Spectrofluorometry: A Practical Approach, pp. 91-114, IRL Press Ltd.; and Bell, (1981) Spectroscopy In Biochemistry, Vol. I, pp. 155-194, CRC Press.

[0140] In spectrofluorometric methods, enzymes are exposed to substrates that change their intrinsic fluorescence when processed by the target enzyme. Typically, the substrate is nonfluorescent and is converted to a fluorophore through one or more reactions. As a non-limiting example, SMase activity can be detected using the Amplex® Red reagent (Molecular Probes, Eugene, OR). In order to measure sphingomyelinase activity using

Amplex® Red, the following reactions occur. First, SMase hydrolyzes sphingomyelin to yield ceramide and phosphorylcholine. Second, alkaline phosphatase hydrolyzes phosphorylcholine to yield choline. Third, choline is oxidized by choline oxidase to betaine. Finally, H_2O_2, in the presence of horseradish peroxidase, reacts with Amplex® Red to produce the fluorescent product, Resorufin, and the signal therefrom is detected using spectrofluorometry.

[0141] Fluorescence polarization (FP) is based on a decrease in the speed of molecular rotation of a fluorophore that occurs upon binding to a larger molecule, such as a receptor protein, allowing for polarized fluorescent emission by the bound ligand. FP is empirically determined by measuring the vertical and horizontal components of fluorophore emission following excitation with plane polarized light. Polarized emission is increased when the molecular rotation of a fluorophore is reduced. A fluorophore produces a larger polarized signal when it is bound to a larger molecule (i.e. a receptor), slowing molecular rotation of the fluorophore. The magnitude of the polarized signal relates quantitatively to the extent of fluorescent ligand binding. Accordingly, polarization of the "bound" signal depends on maintenance of high affinity binding.

[0142] FP is a homogeneous technology and reactions are very rapid, taking seconds to minutes to reach equilibrium. The reagents are stable, and large batches may be prepared, resulting in high reproducibility. Because of these properties, FP has proven to be highly automatable, often performed with a single incubation with a single, premixed, tracer-receptor reagent. For a review, see Owicki et al., (1997), Application of Fluorescence Polarization Assays in High-Throughput Screening, Genetic Engineering News, 17:27.

[0143] FP is particularly desirable since its readout is independent of the emission intensity (Checovich, W. J., et al., (1995) Nature 375:254-256; Dandliker, W. B., et al., (1981) Methods in Enzymology 74:3-28) and is thus insensitive to the presence of colored compounds that quench fluorescence emission. FP and FRET (see below) are well-suited for identifying compounds that block interactions between sphingolipid receptors and their ligands. See, for example, Parker *et al.*, (2000) Development of high throughput screening assays using fluorescence polarization: nuclear receptor-ligand-binding and kinase/phosphatase assays, J Biomol Screen 5:77-88.

[0144] Fluorophores derived from sphingolipids that may be used in FP assays are commercially available. For example, Molecular Probes (Eugene, OR) currently sells sphingomyelin and one ceramide flurophores. These are, respectively, N-(4,4-difluoro-5,7-dimethyl-4-bora-3a,4a-diaza-s-indacene- 3-pentanoyl)sphingosyl phosphocholine

(BODIPY® FL C5-sphingomyelin); N-(4,4-difluoro-5,7-dimethyl-4-bora-3a,4a-diaza-s-indacene- 3-dodecanoyl)sphingosyl phosphocholine (BODIPY® FL C12-sphingomyelin); and N-(4,4-difluoro-5,7-dimethyl-4-bora-3a,4a-diaza-s-indacene- 3-pentanoyl)sphingosine (BODIPY® FL C5-ceramide). U.S. Patent No. 4,150,949, (Immunoassay for gentamicin), discloses fluorescein-labelled gentamicins, including fluoresceinthiocarbanyl gentamicin. Additional fluorophores may be prepared using methods well known to the skilled artisan.

[0145] Exemplary normal-and-polarized fluorescence readers include the POLARION® fluorescence polarization system (Tecan AG, Hombrechtikon, Switzerland). General multiwell plate readers for other assays are available, such as the VERSAMAX® reader and the SPECTRAMAX® multiwell plate spectrophotometer (both from Molecular Devices).

[0146] Fluorescence resonance energy transfer (FRET) is another useful assay for detecting interaction and has been described. See, e.g., Heim et al., (1996) Curr. Biol. 6:178-182; Mitra et al., (1996) Gene 173:13-17; and Selvin et al., (1995) Meth. Enzymol. 246:300-345. FRET detects the transfer of energy between two fluorescent substances in close proximity, having known excitation and emission wavelengths. As an example, a protein can be expressed as a fusion protein with green fluorescent protein (GFP). When two fluorescent proteins are in proximity, such as when a protein specifically interacts with a target molecule, the resonance energy can be transferred from one excited molecule to the other. As a result, the emission spectrum of the sample shifts, which can be measured by a fluorometer, such as a fMAX multiwell fluorometer (Molecular Devices, Sunnyvale Calif.).

[0147] Scintillation proximity assay (SPA) is a particularly useful assay for detecting an interaction with the target molecule. SPA is widely used in the pharmaceutical industry and has been described (Hanselman et al., (1997) J. Lipid Res. 38:2365-2373; Kahl et al., (1996) Anal. Biochem. 243:282-283; Undenfriend et al., (1987) Anal. Biochem. 161:494-500). See also U.S. Patent Nos. 4,626,513 and 4,568,649, and European Patent No. 0,154,734. One commercially available system uses FLASHPLATE® scintillant-coated plates (NEN Life Science Products, Boston, MA).

[0148] The target molecule can be bound to the scintillator plates by a variety of well-known means. Scintillant plates are available that are derivatized to bind to fusion proteins such as GST, His6 or Flag fusion proteins. Where the target molecule is a protein complex or a multimer, one protein or subunit can be attached to the plate first, then the other components of the complex added later under binding conditions, resulting in a bound complex.

[0149] In a typical SPA assay, the gene products in the expression pool will have been radiolabeled and added to the wells, and allowed to interact with the solid phase, which is the immobilized target molecule and scintillant coating in the wells. The assay can be measured immediately or allowed to reach equilibrium. Either way, when a radiolabel becomes sufficiently close to the scintillant coating, it produces a signal detectable by a device such as a TOPCOUNT NXT® microplate scintillation counter (Packard BioScience Co., Meriden Conn.). If a radiolabeled expression product binds to the target molecule, the radiolabel remains in proximity to the scintillant long enough to produce a detectable signal.

[0150] In contrast, the labeled proteins that do not bind to the target molecule, or bind only briefly, will not remain near the scintillant long enough to produce a signal above background. Any time spent near the scintillant caused by random Brownian motion will also not result in a significant amount of signal. Likewise, residual unincorporated radiolabel used during the expression step may be present, but will not generate significant signal because it will be in solution rather than interacting with the target molecule. These non-binding interactions will therefore cause a certain level of background signal that can be mathematically removed. If too many signals are obtained, salt or other modifiers can be added directly to the assay plates until the desired specificity is obtained (Nichols *et al.*, (1998) Anal. Biochem. 257:112-119).

General Synthesis

[0151] The compounds may be prepared using the methods disclosed herein and routine modifications thereof, which will be apparent given the disclosure herein and methods well known in the art. Conventional and well-known synthetic methods may be used in addition to the teachings herein. The synthesis of typical compounds described herein may be accomplished as described in the following examples. If available, reagents may be purchased commercially, e.g., from Sigma Aldrich or other chemical suppliers.

[0152] The compounds of this disclosure can be prepared from readily available starting materials using, for example, the following general methods and procedures. It will be appreciated that where typical or preferred process conditions (i.e., reaction temperatures, times, mole ratios of reactants, solvents, pressures, etc.) are given, other process conditions can also be used unless otherwise stated. Optimum reaction conditions may vary with the particular reactants or solvent used, but such conditions can be determined by one skilled in the art by routine optimization procedures.

[0153] Additionally, as will be apparent to those skilled in the art, conventional protecting groups may be necessary to prevent certain functional groups from undergoing

undesired reactions. Suitable protecting groups for various functional groups as well as suitable conditions for protecting and deprotecting particular functional groups are well known in the art. For example, numerous protecting groups are described in Wuts, P. G. M., Greene, T. W., & Greene, T. W. (2006). Greene's protective groups in organic synthesis. Hoboken, N.J., Wiley-Interscience, and references cited therein.

[0154] The compounds of this disclosure may contain one or more asymmetric or chiral centers. Accordingly, if desired, such compounds can be prepared or isolated as pure stereoisomers, i.e., as individual enantiomers or diastereomers or as stereoisomer-enriched mixtures. All such stereoisomers (and enriched mixtures) are included within the scope of this disclosure, unless otherwise indicated. Pure stereoisomers (or enriched mixtures) may be prepared using, for example, optically active starting materials or stereoselective reagents well-known in the art. Alternatively, racemic mixtures of such compounds can be separated using, for example, chiral column chromatography, supercritical fluid chromathography, chiral seed crystals, chiral resolving agents, and the like.

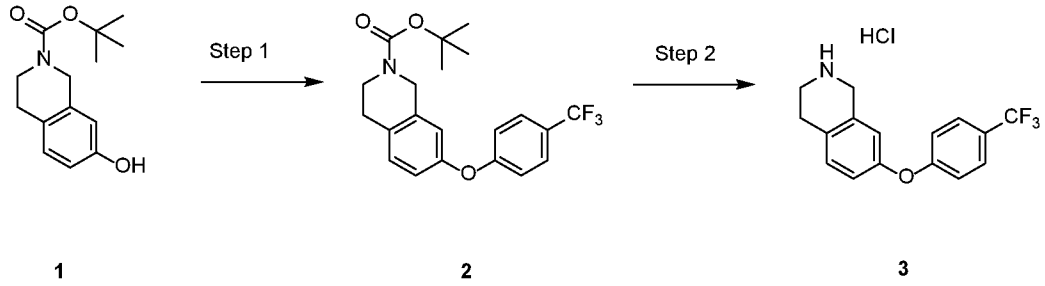
[0155] The starting materials for the following reactions are generally known compounds or can be prepared by known procedures or obvious modifications thereof. For example, many of the starting materials are available from commercial suppliers such as Aldrich Chemical Co. (Milwaukee, Wisconsin, USA), Bachem (Torrance, California, USA), Emka-Chemce or Sigma (St. Louis, Missouri, USA). Others may be prepared by procedures or obvious modifications thereof, described in standard reference texts such as Fieser and Fieser's Reagents for Organic Synthesis, Volumes 1-15 (John Wiley, and Sons, 1991), Rodd's Chemistry of Carbon Compounds, Volumes 1-5, and Supplementals (Elsevier Science Publishers, 1989) organic Reactions, Volumes 1-40 (John Wiley, and Sons, 1991), March's Advanced Organic Chemistry, (John Wiley, and Sons, 5th Edition, 2001), and Larock's Comprehensive Organic Transformations (VCH Publishers Inc., 1989).

[0156] It will also be appreciated that in each of the schemes, the addition of any substituent may result in the production of a number of isomeric products (including, but not limited to, enantiomers or one or more diastereomers) any or all of which may be isolated and purified using conventional techniques. When enantiomerically pure or enriched compounds are desired, chiral chromatography and/or enantiomerically pure or enriched starting materials may be employed as conventionally used in the art or as described in the Examples.

[0157] Compounds of the present disclosure may be synthesized in accordance with the examples described below. The examples may be altered by substitution of the starting materials with other materials having similar structures to result in corresponding products.

The structure of the desired product will generally make apparent to a person of skill in the art the required starting materials.

[0158] Synthesis of Intermediate 3

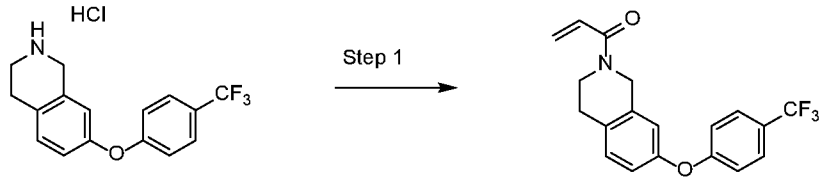


1 2 3

[0159] **Step 1: Preparation of *tert*-butyl 7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 2**: To a dried 20 mL microwavable vial containing a dried microwave compatible flea stir bar was added *tert*-butyl 7-hydroxy-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**1**, 454 mg, 1.82 mmol), 1-iodo-4-(trifluoromethyl)benzene (296 µL, 548 mg, 2.01 mmol), *N*,*N*-dimethylglycine (125 mg, 1.22 mmol), cuprous iodide (70.3 mg, 0.369 mmol), cesium carbonate (1.20 g, 3.67 mmol), and DMSO (15.0 mL). The reaction was placed under nitrogen, sealed, and heated to 130 °C for 8 h. The reaction was subsequently added to 5.3 M ammonium chloride (250 mL) and extracted with ethyl acetate (2 x 250 mL). The organic fraction was washed with water (1 x 250 mL) and 5 M sodium chloride (1 x 250 mL), dried over sodium sulfate, filtered, evaporated, and purified by normal phase flash column chromatography (silica gel, 0-50% ethyl acetate in hexanes), giving *tert*-butyl 7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**2**, 545 mg. LC/ESI-MS $[M\text{-}tBu+MeCN+2H]^+ = 379.0$.

[0160] **Step 2: Preparation of 7-[4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride 3** : To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added *tert*-butyl 7-[4-(trifluoromethyl)phenoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**2**, 335 mg, 0.850 mmol) and HCl (4.0 M in 1,4-Dioxane, 5.0 mL, 20.0 mmol). The reaction was placed under nitrogen and stirred at 20 °C for 5 minutes. The reaction was subsequently evaporated and precipitated from ether (20 mL), giving 7-[4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**3**, 252 mg). LC/ESI-MS $[M+H]^+ = 294.4$.

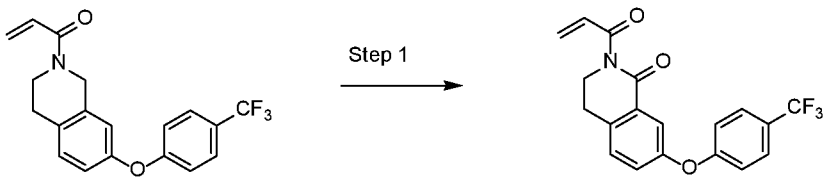
[0161] **Example 1**



3 P-0018

[0162] **Step 1: Preparation of 1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0018)**: To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added 7-[4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**3**, 252 mg, 0.765 mmol) and acetonitrile (5.0 mL). The reaction was placed under nitrogen and cooled to 0 °C, whereupon triethylamine (352 µL, 256 mg, 2.53 mmol) was added slowly, dropwise, by micropipettor. The reaction was stirred at 0 °C for 1 minute. To the reaction was subsequently added, slowly, dropwise, by micropipettor, acryloyl chloride (68.4 µL, 76.2 mg, 0.842 mmol). The reaction was stirred at 0 °C for 1 hour. The reaction was subsequently added to 5.3 M ammonium chloride (100 mL) and extracted with ethyl acetate (2 x 100 mL). The organic fraction was washed with water (1 x 100 mL) and 5 M sodium chloride (1 x 100 mL), dried over sodium sulfate, filtered, evaporated, and purified by normal phase flash column chromatography (silica gel, 0-100% ethyl acetate in hexanes), giving 1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0018**, 164 mg). LC/ESI-MS $[M+H]^+$ = 348.0.

[0163] **Example 2**

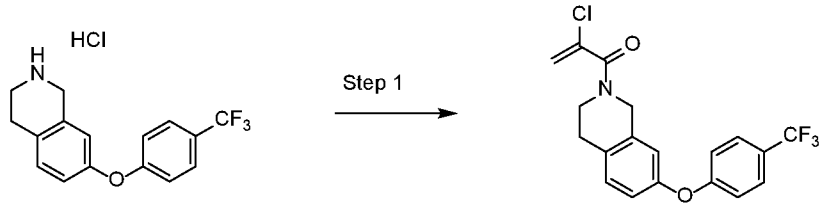


P-0018 P-0128

[0164] **Step 1: Preparation of 2-acryloyl-7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-1(2*H*)-one (P-0128)**: To a solution of 1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0018**, 150 mg, 432 µmol) in dichloromethane (5 mL) was added *meta*-chloroperoxybenzoic acid (186 mg, 864 µmol, 80% purity). The mixture was stirred at 25 °C for 2 hours and then at 40 °C for 3 days. Saturated aqueous $Na_2S_2O_3$ (10 mL) was added to quench the reaction. The

mixture was then extracted with ethyl acetate (20 mL). The organic layer was dried over sodium sulfate, filtered, and concentrated to give a crude material, which was subsequently purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford 2-acryloyl-7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-1(2*H*)-one (**P-0128**, 8.2 mg). LC/ESI-MS $[M+H]^+ = 362.0$.

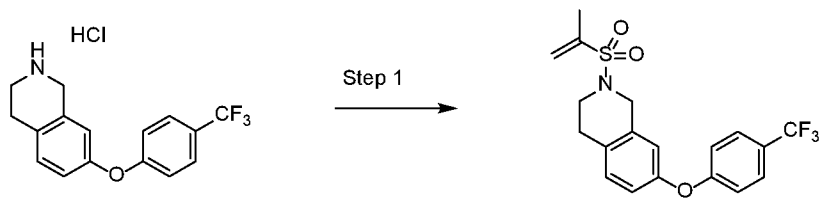
[0165] Example 3



3 P-0124

[0166] Step 1: Preparation of 2-chloro-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0124): To a solution of 7-[4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**3**, 0.69 g, 2.09 mmol) and triethylamine (0.87 mL, 6.28 mmol) in THF (20.0 mL) was added dropwise 2-chloroprop-2-enoyl chloride (0.23 mL, 2.51 mmol) at 0 °C. The reaction was stirred at 0 °C for 45 minutes. The reaction mixture was diluted with saturated ammonium chloride (100 mL), extracted with ethyl acetate (2 x 30 mL), dried over magnesium sulfate, filtered, concentrated onto Celite, and purified by normal phase chromatography (24 g silica gel, 0-60% ethyl acetate in hexanes) to afford a residue. The residue was re-dissolved in 20% water/dioxane (10 mL), frozen at -78 °C, and placed under lyophilization conditions for 15 hours. This procedure afforded 2-chloro-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0124**, 668 mg). LC/ESI-MS $[M+H]^+ = 382.1$.

[0167] Example 4

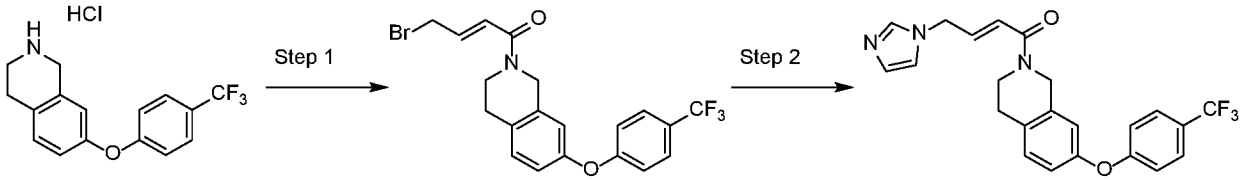


3 P-0127

[0168] Step 1: Preparation of 2-(prop-1-en-2-ylsulfonyl)-7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline (P-0127): To a solution of 7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline hydrochloride (**3**, 200 mg, 608

μmol) in dichloromethane (5 mL) was added triethylamine (138 mg, 1.36 mmol) and the mixture was cooled to 0 °C. Then, prop-1-ene-2-sulfonyl chloride (95.9 mg, 682 μmol) was added, and the mixture was stirred at 0 °C for 5 minutes. The mixture was diluted with dichloromethane (20 mL) and washed with water (10 mL x 2). The organic layer was dried over sodium sulfate, filtered, and concentrated to get a crude mixture, which was purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford 2-(prop-1-en-2-ylsulfonyl)-7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline (**P-0127**, 6.7 mg). LC/ESI-MS $[M+H]^+$ = 398.0.

[0169] Example 5



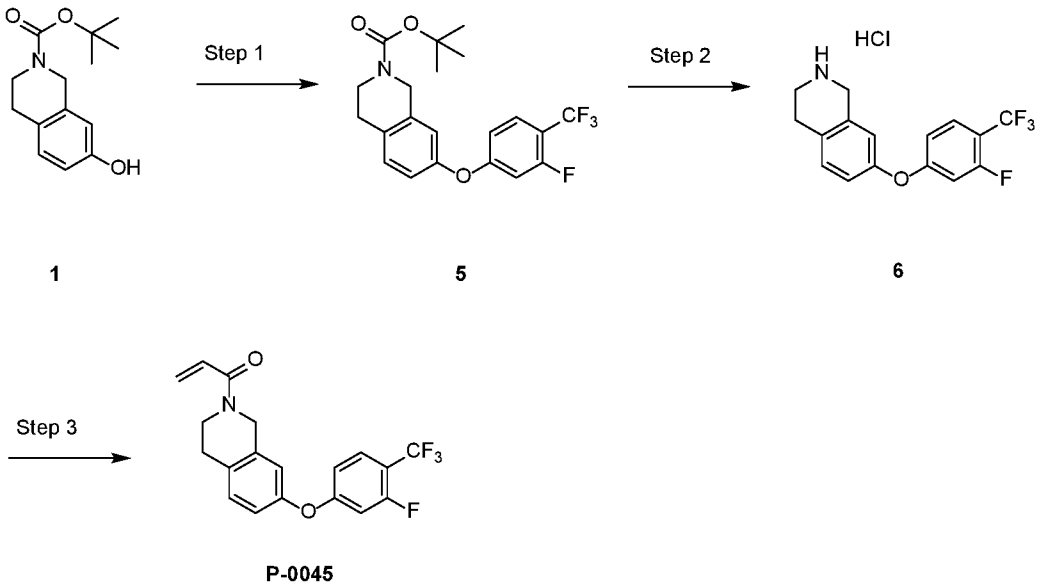
3 **4** **P-0119**

[0170] Step 1: Preparation of (*E*)-4-bromo-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)but-2-en-1-one 4: To a 100 mL round-bottom flask under nitrogen was added (*E*)-4-bromobut-2-enoic acid (1.50 g, 9.10 mmol), dichloromethane (10 mL) and DMF (66.5 mg, 910 μmol, 70.0 μL). Then, oxalyl chloride (1.15 g, 9.10 mmol, 796 μL) was added dropwise with stirring at 0 °C for 30 minutes. The resulting solution was stirred at 25 °C for an additional 60 minutes. The above reaction solution was added to a mixture of 7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline hydrochloride (**3**, 3.0 g, 9.10 mmol) and sodium carbonate (2.89 g, 27.3 mmol) in dichloromethane (30 mL) at 0 °C, and the resulting mixture was stirred at temperature for 1 hour. The reaction mixture was filtered and the filtrate was concentrated to get a crude material, which was subsequently purified by column chromatography (silica gel column, 85-100% ethyl acetate in petroleum ether) to afford (*E*)-4-bromo-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)but-2-en-1-one (**4**, 2.8 g). LC/ESI-MS $[M+H]^+$ = 442.0.

[0171] Step 2: Preparation of (*E*)-4-(1*H*-imidazol-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)but-2-en-1-one formic acid salt P-0119 (formic acid salt): A mixture of (*E*)-4-bromo-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)but-2-en-1-one (4, 300 mg, 681 μmol) and 1*H*-imidazole (139 mg, 2.04 mmol) dissolved in dichloromethane (5 mL) was stirred at 25 °C for 2 hours. The mixture was concentrated to get a crude material, which was

subsequently purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford (*E*)-4-(1*H*-imidazol-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)but-2-en-1-one formic acid salt (P-0119 formic acid salt, 62.2 mg). LC/ESI-MS $[M+H]^+ = 428.1$.

[0172] Example 6



1 5 6

P-0045

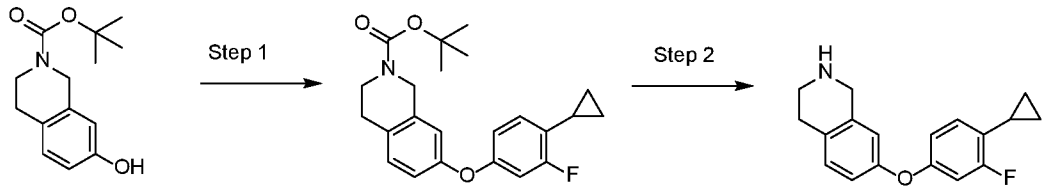
[0173] Step 1: Preparation of *tert*-butyl 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate 5: To a dried 20 mL microwavable vial containing a dried microwave compatible flea stir bar was added *tert*-butyl 7-hydroxy-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**1**, 499 mg, 2.00 mmol), 4-bromo-2-fluoro-1-(trifluoromethyl)benzene (424 µL, 729 mg, 3.00 mmol), *N*,*N*-dimethylglycine (131 mg, 1.27 mmol), cuprous iodide (80.4 mg, 0.422 mmol), cesium carbonate (1.31 g, 4.02 mmol), and DMSO (15.0 mL). The reaction was placed under nitrogen, sealed, and heated to 130 °C for 5 hours. The reaction was subsequently added to 5.3 M ammonium chloride (100 mL) and extracted with ethyl acetate (2 x 100 mL). The organic fraction was washed with water (1 x 100 mL) and 5 M sodium chloride (1 x 100 mL), dried over sodium sulfate, filtered, evaporated, and purified by normal phase flash column chromatography (silica gel, 0-25% ethyl acetates in hexanes). The material remained impure and was subsequently purified by reverse phase flash column chromatography (C18 column, 50-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), giving *tert*-butyl 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**5**, 291 mg). LC/ESI-MS $[M\text{-}tBu+MeCN+2H]^+ = 397.4$.

[0174] Step 2: Preparation of 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride 6: To a dried 20 mL glass scintillation vial

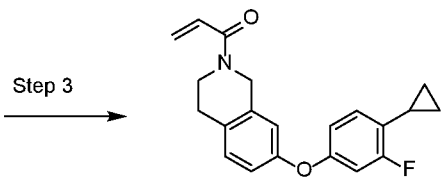
containing a dried flea stir bar was added *tert*-butyl 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**5**, 291 mg, 0.707 mmol) and HCl (4.0 M in 1,4-Dioxane, 2.0 mL, 8.00 mmol). The reaction was placed under nitrogen and stirred at 20 °C for 15 minutes. The reaction was subsequently evaporated and precipitated from ether (20 mL), giving 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**6**, 199 mg). LC/ESI-MS $[M+H]^+ = 312.4$.

[0175] **Step 3: Preparation of 1-(7-(3-fluoro-4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one P-0045**: To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added 7-[3-fluoro-4-(trifluoromethyl)phenoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**6**, 199 mg, 0.573 mmol) and THF (5.0 mL). The reaction was placed under nitrogen and cooled to 0 °C, whereupon triethylamine (240 µL, 174 mg, 1.72 mmol) was added slowly, dropwise, by micropipettor. The reaction was stirred at 0 °C for 1 minute. To the reaction was subsequently added, slowly, dropwise, by micropipettor, acryloyl chloride (69.8 µL, 77.8 mg, 0.859 mmol). The reaction was stirred at 0 °C for 30 minutes. The reaction was subsequently added to 5.3 M ammonium chloride (100 mL) and extracted with ethyl acetate (2 x 100 mL). The organic fraction was dried over sodium sulfate, filtered, evaporated, and purified by reverse phase flash column chromatography (C18 column, 0-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), giving 1-(7-(3-fluoro-4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0045**, 150 mg). LC/ESI-MS $[M+H]^+ = 366.4$.

[0176] **Example 7**



1 7 8



P-0050

[0177] **Step 1: Preparation of *tert*-butyl 7-(4-cyclopropyl-3-fluoro-phenoxy)-3,4-dihydro-1*H*-isoquinoline-2-carboxylate 7**: To a dried 5 mL microwavable vial containing a

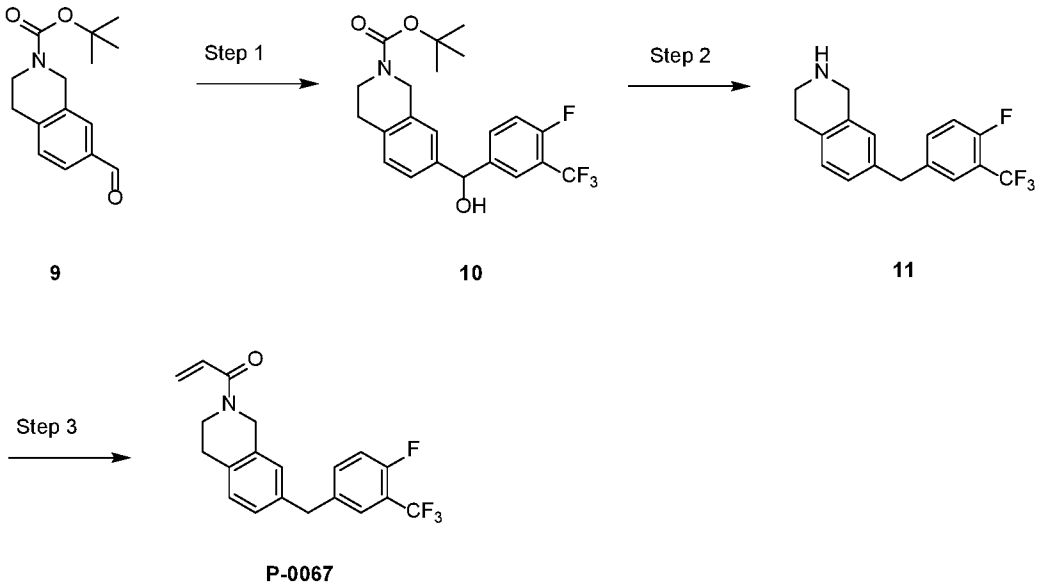
dried microwave compatible flea stir bar was added *tert*-butyl 7-hydroxy-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**1**, 126 mg, 0.505 mmol), 4-bromo-1-cyclopropyl-2-fluoro-benzene (74.0 μL, 118 mg, 0.551 mmol), *N*,*N*-dimethylglycine (38.3 mg, 0.371 mmol), cuprous iodide (21.7 mg, 0.114 mmol), cesium carbonate (328 mg, 1.01 mmol), and DMSO (5.0 mL). The reaction was placed under nitrogen, sealed, and heated to 130 °C for 17 hours. The reaction was subsequently added to 5.3 M ammonium chloride (100 mL) and extracted with ethyl acetate (2 x 100 mL). The organic fraction was washed with water (1 x 100 mL) and 5 M sodium chloride (1 x 100 mL), dried over sodium sulfate, filtered, evaporated, and purified by normal phase flash column chromatography (silica gel, 0-50% ethyl acetate in hexanes), giving *tert*-butyl 7-(4-cyclopropyl-3-fluoro-phenoxy)-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**7**, 125 mg). LC/ESI-MS $[M\text{-}tBu+MeCN+2H]^+ = 369.1$.

[0178] Step 2: Preparation of 7-(4-cyclopropyl-3-fluoro-phenoxy)-1,2,3,4-tetrahydroisoquinoline 8: To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added *tert*-butyl 7-(4-cyclopropyl-3-fluoro-phenoxy)-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**7**, 125 mg, 0.327 mmol) and dichloromethane (2.0 mL). The reaction was placed under nitrogen and stirred at 20 °C, whereupon trifluoroacetic acid (2.0 mL, 2.98 g, 26.1 mmol) was added slowly, dropwise, by syringe. The reaction was stirred at 20 °C for 30 minutes. The reaction was subsequently evaporated, added to 1.2 M sodium bicarbonate (10 mL), and extracted with ethyl acetate (2 x 10 mL). The organic fraction was dried over sodium sulfate, filtered, and evaporated, giving 7-(4-cyclopropyl-3-fluoro-phenoxy)-1,2,3,4-tetrahydroisoquinoline (**8**, 86.4 mg). LC/ESI-MS $[M+H]^+ = 284.4$.

[0179] Step 3: Preparation of 1-(7-(4-cyclopropyl-3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0050): To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added 7-(4-cyclopropyl-3-fluoro-phenoxy)-1,2,3,4-tetrahydroisoquinoline (**8**, 86.4 mg, 0.305 mmol) and dichloromethane (3.0 mL). The reaction was placed under nitrogen and cooled to 0 °C, whereupon triethylamine (93.5 μL, 67.9 mg, 0.671 mmol) was added slowly, dropwise, by micropipettor. The reaction was stirred at 0 °C for 1 minute. To the reaction was subsequently added, slowly, dropwise, by micropipettor, acryloyl chloride (27.3 μL, 30.4 mg, 0.336 mmol). The reaction was stirred at 0 °C for 1 hour. The reaction was subsequently evaporated, purified by normal phase flash column chromatography (silica gel, 0-50% ethyl acetate in hexanes), and thence purified by reverse phase flash column chromatography (C18 column, 0-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), giving 1-(7-(4-cyclopropyl-3-fluorophenoxy)-3,4-

dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0050**, 4.9 mg). LC/ESI-MS $[M+H]^+$ = 338.1.

[0180] Example 8



9 **10** **11**

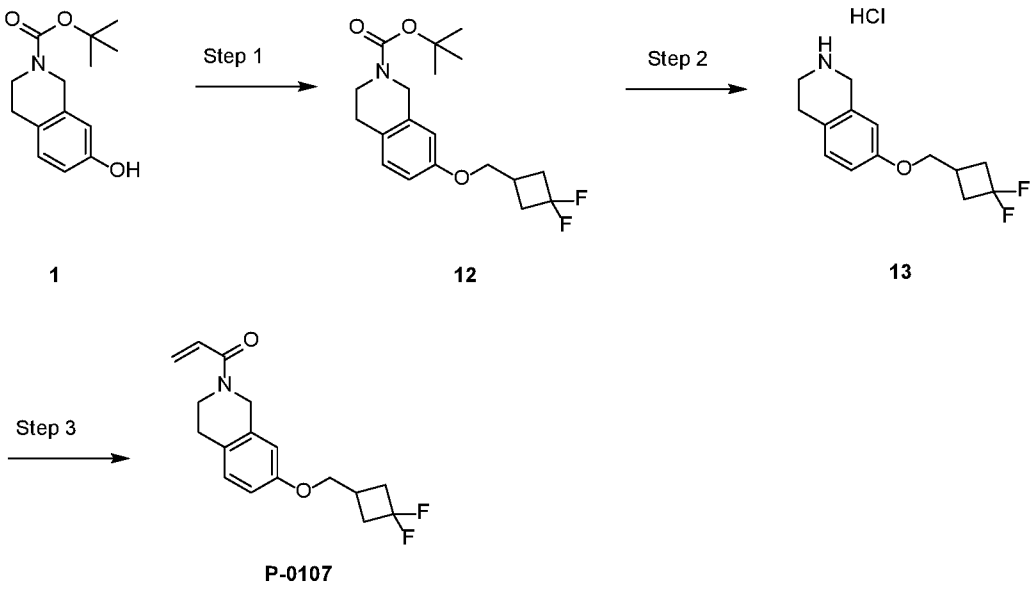
P-0067

[0181] Step 1: Preparation of *tert*-butyl 7-[[4-fluoro-3-(trifluoromethyl)phenyl]-hydroxy-methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate 10: To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added 1-fluoro-4-iodo-2-(trifluoromethyl)benzene (153 μL, 290 mg, 1.00 mmol) and THF (5.0 mL). The reaction was placed under nitrogen and cooled to 0 °C, whereupon isopropyl magnesium chloride (2.0 M in THF, 500 μL, 1.00 mmol) was added slowly, dropwise, by syringe. The reaction was stirred at 0 °C for 30 minutes. To a separate dried 20 mL glass scintillation vial containing a dried flea stir bar was added *tert*-butyl 7-formyl-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (9, 266 mg, 1.02 mmol) and THF (5.0 mL). The reaction was placed under nitrogen and stirred at 0 °C, whereupon the entirety of the former halogen exchanged solution was added slowly, dropwise, by syringe. The reaction was stirred at 0 °C for 1 hour. The reaction was subsequently quenched with acetic acid (117 μL, 123 mg, 2.05 mmol), added to 5.3 M ammonium chloride (100 mL), and extracted with ethyl acetate (2 x 100 mL). The organic fraction was dried over sodium sulfate, filtered, evaporated, purified by reverse phase flash column chromatography (C18 column, 0-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), and thence purified by normal phase flash column chromatography (silica gel, 0-50% ethyl acetate in hexanes), giving *tert*-butyl 7-[[4-fluoro-3-(trifluoromethyl)phenyl]-hydroxy-methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (10, 130 mg). LC/ESI-MS $[M-tBu+MeCN+2H]^+$ = 411.0.

[0182] Step 2: Preparation of 7-[[4-fluoro-3-(trifluoromethyl)phenyl]methyl]-1,2,3,4-tetrahydroisoquinoline 11: To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added *tert*-butyl 7-[[4-fluoro-3-(trifluoromethyl)phenyl]-hydroxy-methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**10**, 130 mg, 0.306 mmol), triethylsilane (500 μL, 364 mg, 3.13 mmol), and dichloromethane (2.0 mL). The reaction was placed under nitrogen and stirred at 20 °C, whereupon trifluoroacetic acid (1.0 mL, 1.49 g, 13.1 mmol) was added slowly, dropwise, by syringe. The reaction was stirred at 20 °C for 5 days. The reaction was subsequently evaporated and purified by reverse phase flash column chromatography (C18 column, 0-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), giving 7-[[4-fluoro-3-(trifluoromethyl)phenyl]methyl]-1,2,3,4-tetrahydroisoquinoline (**11**, 96.3 mg). LC/ESI-MS $[M+H]^+$ = 310.4.

[0183] Step 3: Preparation of 1-(7-(4-fluoro-3-(trifluoromethyl)benzyl)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0067): To a dried 20 mL glass scintillation vial containing a dried flea stir bar was added 7-[[4-fluoro-3-(trifluoromethyl)phenyl]methyl]-1,2,3,4-tetrahydroisoquinoline (**11**, 96.3 mg, 0.311 mmol) and THF (3.0 mL). The reaction was placed under nitrogen and cooled to 0 °C, whereupon triethylamine (130 μL, 94.5 mg, 0.934 mmol) was added slowly, dropwise, by micropipettor. The reaction was stirred at 0 °C for 1 minute. To the reaction was subsequently added, slowly, dropwise, by micropipettor, acryloyl chloride (38.0 μL, 42.3 mg, 0.468 mmol). The reaction was stirred at 0 °C for 30 minutes. The reaction was subsequently added to 5.3 M ammonium chloride (100 mL) and extracted with ethyl acetate (2 x 100 mL). The organic fraction was dried over sodium sulfate, filtered, evaporated, and purified by reverse phase flash column chromatography (C18 column, 0-100% MeCN (0.1% formic acid) in water (0.1% formic acid)), giving 1-(7-(4-fluoro-3-(trifluoromethyl)benzyl)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0067**, 17.1 mg). LC/ESI-MS $[M+H]^+$ = 364.4.

[0184] Example 9



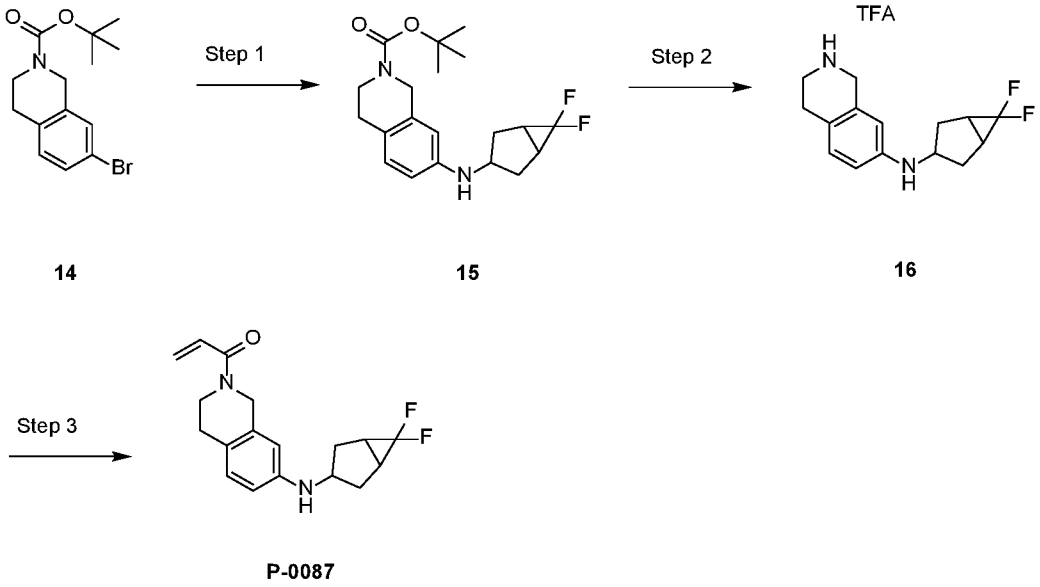
[0185] Step 1: Preparation of *tert*-butyl 7-[(3,3-difluorocyclobutyl)methoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate 12: To a solution of *tert*-butyl 7-hydroxy-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**1**, 0.10 g, 0.40 mmol) in DMF (4.0 mL) was added NaH (60% in mineral oil, 0.024 g, 0.60 mmol) at 0 °C. The reaction was stirred at 0 °C for 5 minutes. Subsequently, 3-(bromomethyl)-1,1-difluoro-cyclobutane (0.15 g, 0.80 mmol) was added and the mixture was heated in an oil bath at 60 °C for 3.5 hours. The reaction mixture was diluted with water, extracted with ethyl acetate (2 x 10 mL), dried over magnesium sulfate, filtered, concentrated onto Celite, and purified by normal phase chromatography (12 g silica gel, 0-60% ethyl acetate in hexanes) to afford *tert*-butyl 7-[(3,3-difluorocyclobutyl)methoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**12**, 89 mg).

[0186] Step 2: Preparation of 7-[(3,3-difluorocyclobutyl)methoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride 13: To a solution of *tert*-butyl 7-[(3,3-difluorocyclobutyl)methoxy]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**12**, 0.089 g, 0.25 mmol) in dichloromethane (3.0 mL) was added HCl (4 N in dioxane, 0.63 mL) and the reaction was stirred at room temperature for 2 hours. The mixture was then concentrated *in vacuo* and dried to afford 7-[(3,3-difluorocyclobutyl)methoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**13**, 73 mg). LC/ESI-MS $[M+H]^+ = 254.2$.

[0187] Step 3: Preparation of 1-(7-((3,3-difluorocyclobutyl)methoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0107): To a mixture of 7-[(3,3-difluorocyclobutyl)methoxy]-1,2,3,4-tetrahydroisoquinoline hydrochloride (**13**, 0.073 g, 0.25 mmol) and triethylamine (0.10 mL, 0.75 mmol) at 0 °C was added prop-2-enoyl chloride (0.02 mL, 0.25 mmol). The reaction mixture was stirred at 0 °C for 20 minutes. The reaction

was diluted with saturated aqueous ammonium chloride, extracted with ethyl acetate (2 x 10 mL), dried over magnesium sulfate, filtered, concentrated onto Celite, and purified by normal phase chromatography (4 g silica gel, 0-50% ethyl acetate in hexanes) to afford 1-(7-((3,3-difluorocyclobutyl)methoxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (**P-0107**, 58 mg). LC/ESI-MS $[M+H]^+ = 308.2$.

[0188] Example 10



14 15 16

P-0087

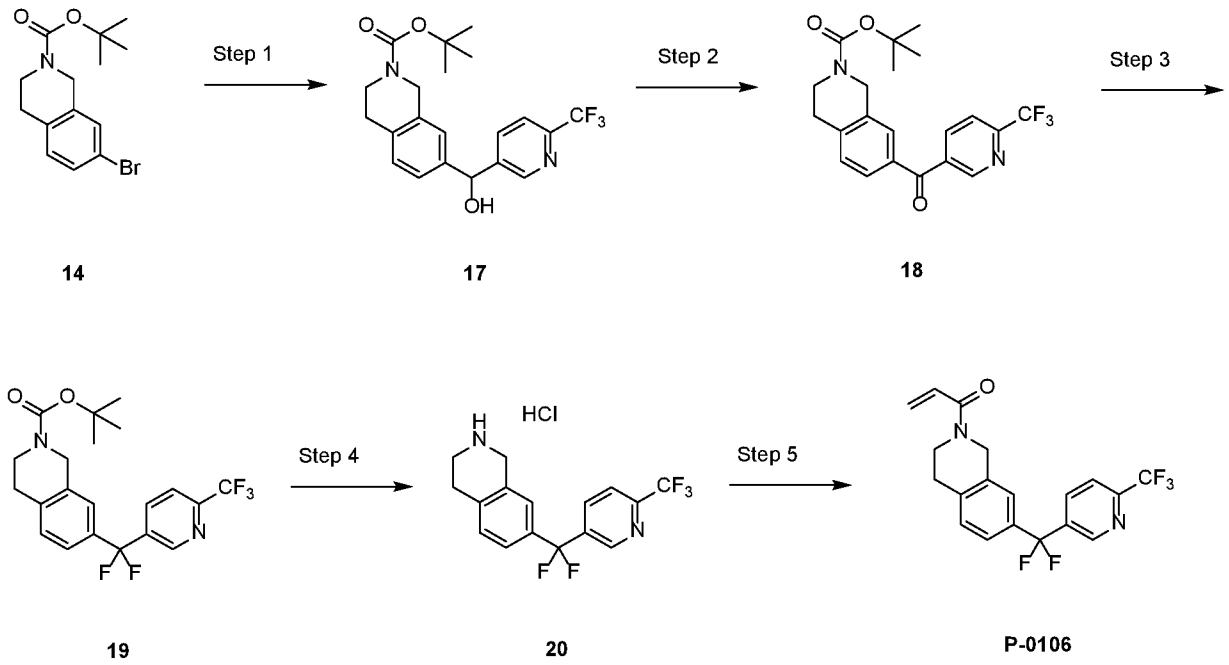
[0189] Step 1: Preparation of *tert*-butyl 7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 15: To a solution of *tert*-butyl 7-bromo-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (14, 500 mg, 1.60 mmol) in toluene (10 mL) were added 6,6-difluorobicyclo[3.1.0]hexan-3-amine hydrochloride (407 mg, 2.40 mmol), Xphos-Pd-G2 (126 mg, 160 μmol), and sodium *tert*-butoxide (308 mg, 3.20 mmol). The mixture was stirred at 100 °C for 12 hours under nitrogen. The mixture was diluted with ethyl acetate (30 mL) and washed with water (15 mL x 3). The organic layer was dried over sodium sulfate, filtered, and concentrated to give a residue, which was subsequently purified by column chromatography (silica gel, 85-100% ethyl acetate in petroleum ether) to afford *tert*-butyl 7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (15, 167 mg, 29%). LC/ESI-MS $[M+H]^+ = 365.2$.

[0190] Step 2: Preparation of *N*-(6,6-difluorobicyclo[3.1.0]hexan-3-yl)-1,2,3,4-tetrahydroisoquinolin-7-amine trifluoroacetic acid salt 16: To a solution of *tert*-butyl 7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (15, 167 mg, 458 μmol) in dichloromethane (5 mL) was added trifluoroacetic acid (2 mL). The mixture was stirred at 25 °C for 30 minutes. The mixture was concentrated to afford *N*-

(6,6-difluorobicyclo[3.1.0]hexan-3-yl)-1,2,3,4-tetrahydroisoquinolin-7-amine trifluoroacetic acid salt (16, 110 mg). LC/ESI-MS $[M+H]^+$ = 265.2.

[0191] Step 3: Preparation of 1-(7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0087): To a solution of *N*-(6,6-difluorobicyclo[3.1.0]hexan-3-yl)-1,2,3,4-tetrahydroisoquinolin-7-amine trifluoroacetic acid salt (16, 110 mg, 291 μmol) in dichloromethane (3 mL) was added triethylamine (58.8 mg, 581 μmol). The mixture was cooled to 0 °C, and acryloyl chloride (15.8 mg, 174 μmol) was added slowly. The mixture was stirred at 0 °C for 5 minutes. The mixture was diluted with dichloromethane (5 mL) and washed with water (3 mL x 2). The organic layer was dried over sodium sulfate, filtered, and concentrated to give a residue, which was subsequently purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford 1-(7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0087, 14.7 mg). LC/ESI-MS $[M+H]^+$ = 319.1.

[0192] Example 11



14 17 18 19 20 P-0106

[0193] Step 1: Preparation of *tert*-butyl 7-(hydroxy(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 17: To a solution of *tert*-butyl 7-bromo-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (14, 10.0 g, 32.0 mmol) in THF (300 mL) at -78 °C under nitrogen was added *n*-BuLi (2.5 M in hexanes, 26.9 mL) drop-wise. The mixture was stirred at -78 °C for 20 minutes. Subsequently, 6-(trifluoromethyl)nicotinaldehyde (11.2 g, 64.1 mmol) was added in one portion. The mixture was stirred at -78 °C for 5 minutes. Saturated aqueous ammonium chloride (100 mL) was

added to quench the reaction. The mixture was extracted with ethyl acetate (200 mL). The organic layer was washed with water (80 mL x 2), dried over sodium sulfate, filtered, and concentrated to give a crude material, which was purified by column chromatography (silica gel, 78-100% ethyl acetate in petroleum ether) to afford *tert*-butyl 7-(hydroxy(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (17, 2.73 g). LC/ESI-MS $[M\text{-}tBu+H]^+ = 352.9$.

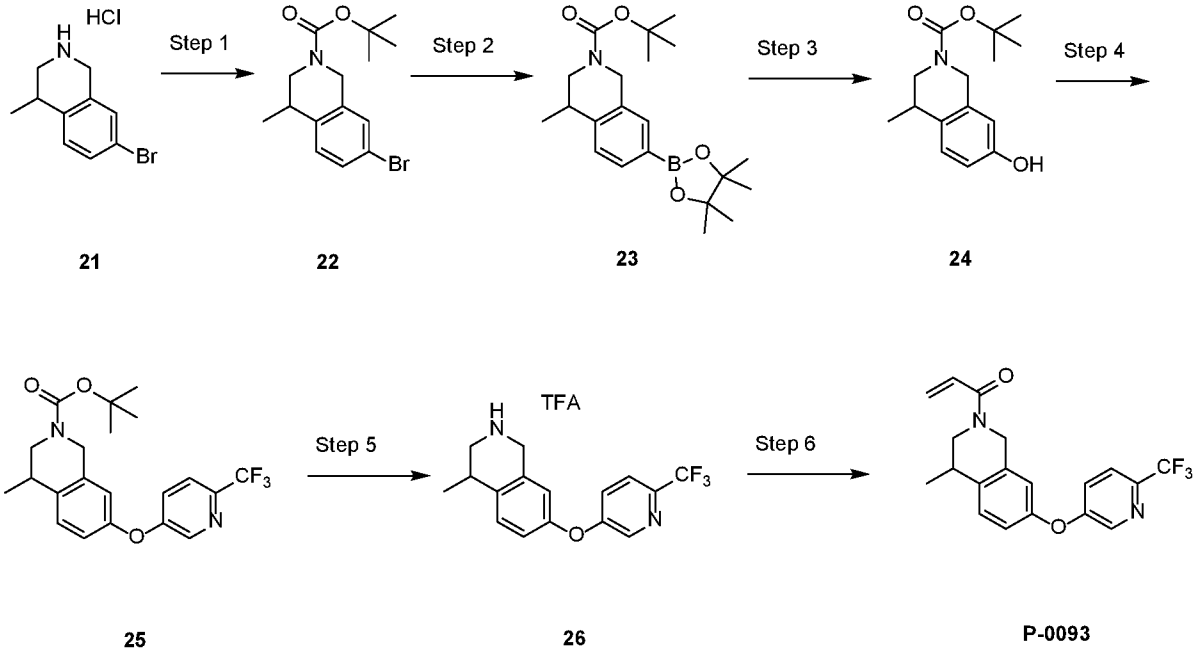
[0194] Step 2: Preparation of *tert*-butyl 7-(6-(trifluoromethyl)nicotinoyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 18: To a solution of *tert*-butyl 7-(hydroxy(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**17**, 2.73 g, 6.68 mmol) in dichloromethane (30 mL) was added Dess-Martin periodinane (4.25 g, 10.0 mmol, 3.10 mL) at 0 °C. The mixture was stirred at 25 °C for 3 hours. The mixture was diluted with dichloromethane (50 mL) and washed with water (25 mL x 3). The organic layer was dried over sodium sulfate, filtered, and concentrated to give a crude material, which was subsequently purified by silica gel chromatography (85-100% ethyl acetate in petroleum ether) to give *tert*-butyl 7-(6-(trifluoromethyl)nicotinoyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**18**, 2.53 g). LC/ESI-MS $[M\text{-}tBu+H]^+ = 352.0$.

[0195] Step 3: Preparation of *tert*-butyl 7-[difluoro-[6-(trifluoromethyl)-3-pyridyl]methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate 19: To *tert*-butyl 7-(6-(trifluoromethyl)nicotinoyl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (18, 2.53 g, 6.23 mmol) was added DAST (25 mL) at 0 °C. The mixture was stirred at 25 °C for 3 days and then at 30 °C for 1 day. The reaction was diluted with dichloromethane (30 mL), and the mixture was added to a saturated aqueous solution of ammonium chloride (50 mL) at 0 °C. The mixture was then separated and extracted with ethyl acetate (80 mL). The organic layer was dried over sodium sulfate, filtered, and concentrated to give a crude material, which was purified by silica gel chromatography (85-100% ethyl acetate in petroleum ether) to provide *tert*-butyl 7-[difluoro-[6-(trifluoromethyl)-3-pyridyl]methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (19, 838 mg). LC/ESI-MS $[M\text{-}tBu+H]^+ = 372.8$.

[0196] Step 4: Preparation of 7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-1,2,3,4-tetrahydroisoquinoline hydrochloride 20: To a solution of *tert*-butyl 7-[difluoro-[6-(trifluoromethyl)-3-pyridyl]methyl]-3,4-dihydro-1*H*-isoquinoline-2-carboxylate (**19**, 838 mg, 1.96 mmol) in dichloromethane (6 mL) was added hydrochloric acid (4 M in dioxane, 5 mL). The mixture was stirred at 25 °C for 30 minutes. The mixture was concentrated to afford 7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-1,2,3,4-tetrahydroisoquinoline hydrochloride (**20**, 710 mg). LC/ESI-MS $[M+H]^+ = 328.5$.

[0197] **Step 5: Preparation of 1-(7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0106)**: To a solution of 7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-1,2,3,4-tetrahydroisoquinoline hydrochloride (20, 710 mg, 1.95 mmol) in dichloromethane (10 mL) was added triethylamine (394 mg, 3.89 mmol). The mixture was cooled to 0 °C, and acryloyl chloride (176 mg, 1.95 mmol) was added slowly. The mixture was stirred at temperature for 5 minutes. The mixture was concentrated, and the residue was purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford 1-(7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0106, 228 mg). LC/ESI-MS $[M+H]^+ = 382.9$.

[0198] **Example 12**



[0199] **Step 1: Preparation of *tert*-butyl 7-bromo-4-methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 22**: A mixture of 7-bromo-4-methyl-1,2,3,4-tetrahydroisoquinoline hydrochloride (**21**, 900 mg, 3.98 mmol), sodium bicarbonate (1.00 g, 11.9 mmol), and boc anhydride (1.30 g, 5.97 mmol) in ethyl acetate (10 mL) and water (10 mL) was stirred at 20 °C for 16 hours. The reaction mixture was poured into water (10 mL), and the aqueous phase was extracted with ethyl acetate (20 mL x 2). The combined organic solution was washed with brine (20 mL), dried over anhydrous sodium sulfate, filtered, and concentrated under reduced pressure. The resulting residue was purified by flash silica gel chromatography (0-40% ethyl acetate in petroleum ether) to afford *tert*-butyl 7-bromo-4-

methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**22**, 1.07 g). LC/ESI-MS $[M\text{-}tBu+H]^+$ = 270.0.

[0200] Step 2: Preparation of *tert*-butyl 4-methyl-7-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 23: To a mixture of *tert*-butyl 7-bromo-4-methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (22, 1.0 g, 3.07 mmol) and 4,4,4',4',5,5,5',5'-octamethyl-2,2'-bi(1,3,2-dioxaborolane) (934 mg, 3.68 mmol) in dioxane (10 mL) were added potassium acetate (903 mg, 9.20 mmol) and Pd(dppf)$Cl_2.CH_2Cl_2$ (250 mg, 307 μmol) under nitrogen. The mixture was stirred at 100 °C for 16 hours. The crude reaction was poured into water (10 mL), and the aqueous phase was extracted with ethyl acetate (10 mL). The combined organic solution was washed with brine (50 mL), dried over anhydrous sodium sulfate, filtered, and concentrated under reduced pressure. The resulting residue was purified by flash silica gel chromatography (0-100% ethyl acetate in petroleum ether) to afford *tert*-butyl 4-methyl-7-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (23, 1.09 g). LC/ESI-MS $[M\text{-}tBu+H]^+$ = 318.0.

[0201] Step 3: Preparation of *tert*-butyl 7-hydroxy-4-methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 24: To a mixture of *tert*-butyl 4-methyl-7-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**23**, 1.0 g, 2.68 mmol) and NaOH (6 M aqueous, 2.23 mL) in dichloromethane (10 mL) was added hydrogen peroxide (2.46 g, 21.7 mmol, 2.08 mL, 30% in water) in one portion at 0 °C under nitrogen. The mixture was stirred at 20 °C for 1 hour. The reaction was quenched by the addition of aqueous $Na_2S_2O_3$ (50 mL) at 0 °C, and the resulting mixture was stirred at temperature for 10 minutes. The aqueous phase was extracted with dichloromethane (10 mL x 2), and the combined organic solution was washed with brine (30 mL), dried over anhydrous sodium sulfate, filtered, and concentrated under reduced pressure. The resulting residue was purified by flash silica gel chromatography (0-30% ethyl acetate in petroleum ether) to afford *tert*-butyl 7-hydroxy-4-methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (**24**, 0.46 g). LC/ESI-MS $[M\text{-}tBu+H]^+$ = 208.8.

[0202] Step 4: Preparation of *tert*-butyl 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate 25: To a mixture of 5-iodo-2-(trifluoromethyl)pyridine (207 mg, 760 μmol) and *tert*-butyl 7-hydroxy-4-methyl-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (24, 200 mg, 760 μmol) in DMSO (5 mL) were added *N*,*N*-dimethylglycine (54.8 mg, 532 μmol), CuI (28.9 mg, 152 μmol), and cesium carbonate (495 mg, 1.52 mmol). The mixture was stirred at 130 °C under nitrogen for 16

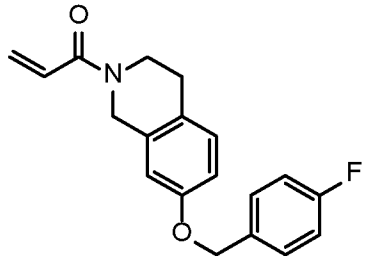
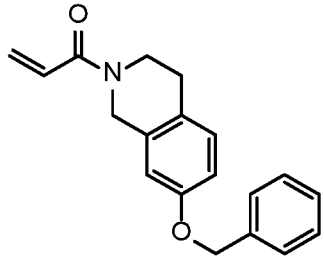
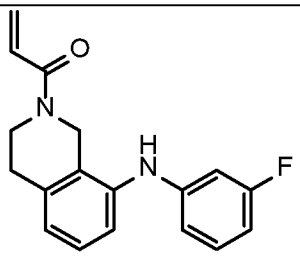
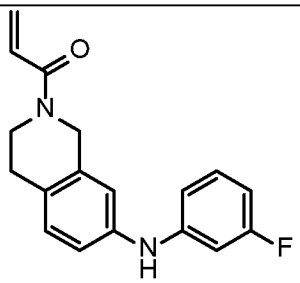
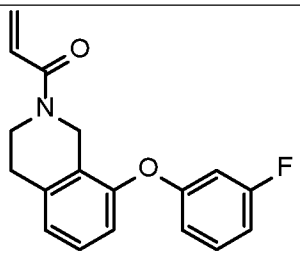
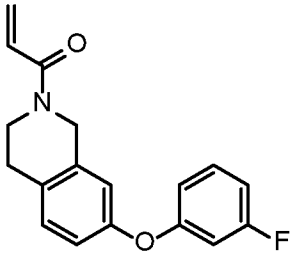
hours. Water (10 mL) was added to the crude reaction mixture and the aqueous phase was extracted with ethyl acetate (10 mL x 2). The combined organic phase was washed with brine (10 mL), dried over anhydrous sodium sulfate, filtered, and concentrated under reduced pressure. The resulting residue was purified by flash silica gel chromatography (0-30% ethyl acetate in petroleum ether) to afford *tert*-butyl 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (25, 0.20 g). LC/ESI-MS $[M\text{-}tBu+H]^+ = 352.6$.

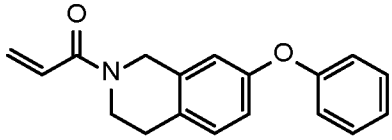
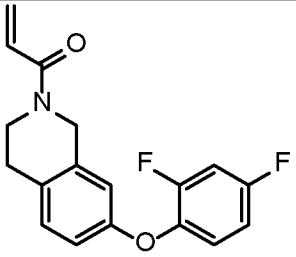
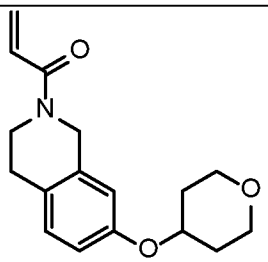
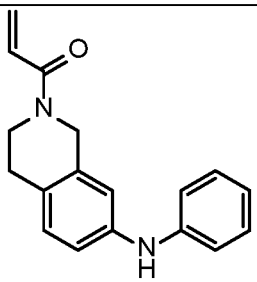
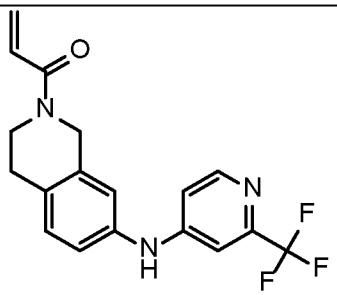
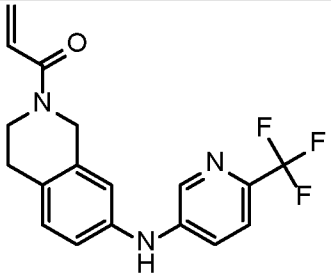
[0203] Step 5: Preparation of 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-1,2,3,4-tetrahydroisoquinoline trifluoroacetic acid salt 26: To a mixture of *tert*-butyl 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinoline-2(1*H*)-carboxylate (25, 200 mg, 490 μmol) in dichloromethane (4 mL) was added trifluoroacetic acid (55.8 mg, 490 μmol, 36.3 μL) at 20 °C. The mixture was stirred for 30 minutes. The suspension was concentrated by evaporation under reduced pressure to give 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-1,2,3,4-tetrahydroisoquinoline trifluoroacetic acid salt (26, 0.20 g). LC/ESI-MS $[M+H]^+ = 309.4$.

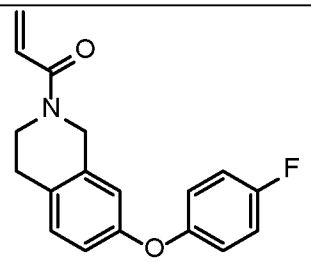
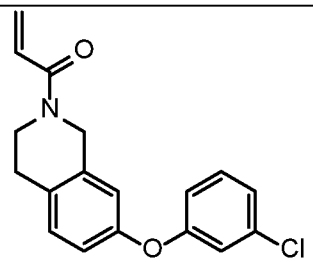
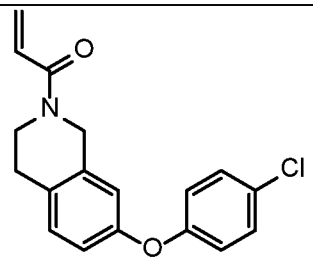
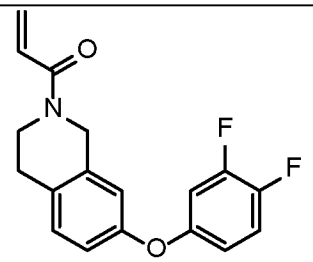
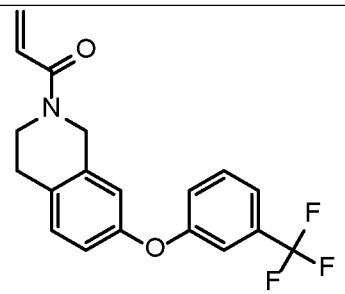
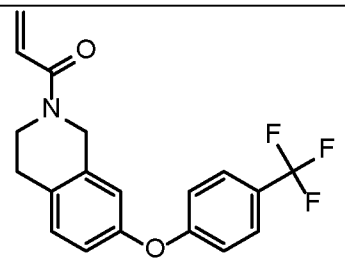
[0204] Step 6: Preparation of 1-(4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0093): To a mixture of 4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-1,2,3,4-tetrahydroisoquinoline trifluoroacetic acid salt (26, 200 mg, crude) in dichloromethane (1 mL) was added a solution of triethylamine (95.8 mg, 947 μmol, 132 μL) and acryloyl chloride (42.9 mg, 474 μmol) in dichloromethane (1 mL) at 0 °C under nitrogen. The mixture was stirred at 0 °C for 1 hour. The reaction was then quenched with saturated aqueous ammonium chloride (3 mL). The mixture was extracted with dichloromethane (5 mL), and the combined organic layer was washed with brine (2 mL x 2), dried over anhydrous sodium sulfate, filtered, and concentrated by evaporation under reduced pressure to give a crude material. This material was then purified by preparatory HPLC (0-100% MeCN in water with 0.1% formic acid) to afford 1-(4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1*H*)-yl)prop-2-en-1-one (P-0093, 41.9 mg). LC/ESI-MS $[M+H]^+ = 363.0$.

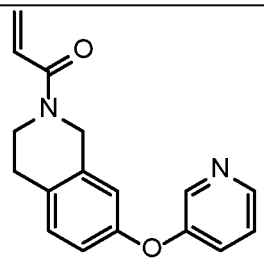
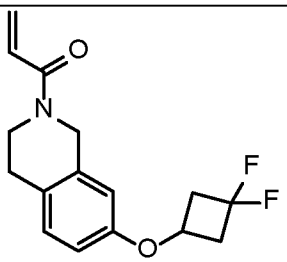
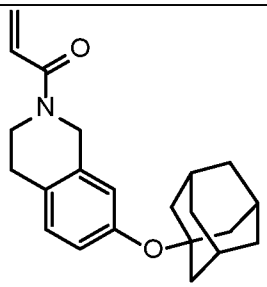
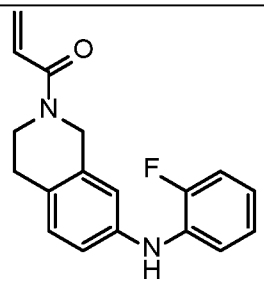
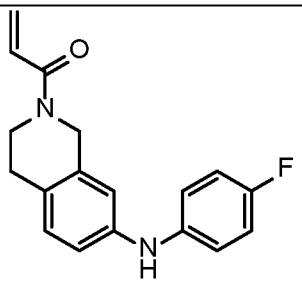
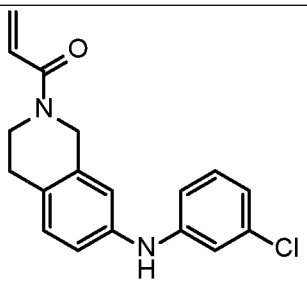
[0205] All compounds in Table 1 listed below can be made according to the synthetic examples described in this disclosure, and by making any necessary substitutions of starting materials that the skilled artisan would be able to obtain either commercially or otherwise.

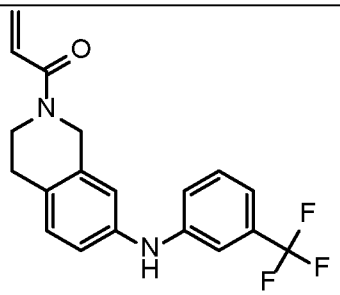
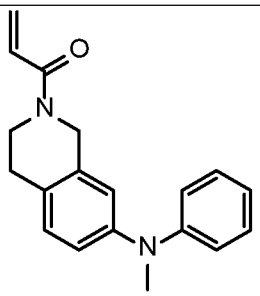
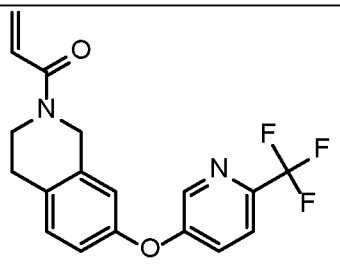
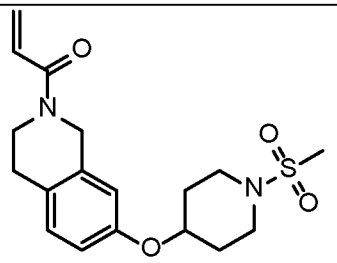
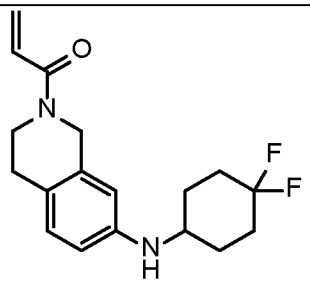
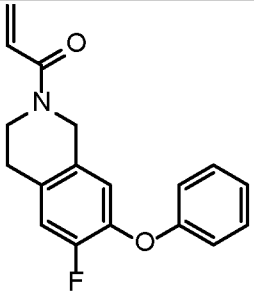
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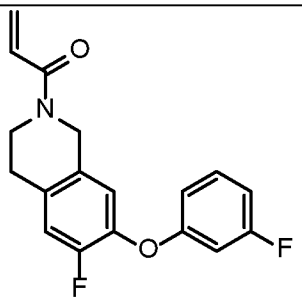
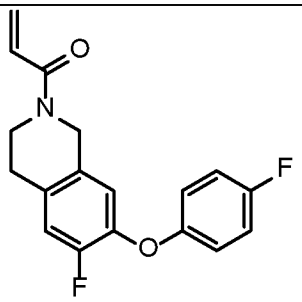
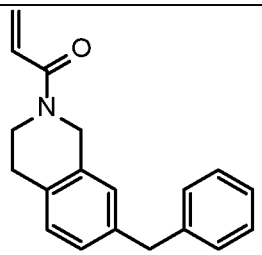
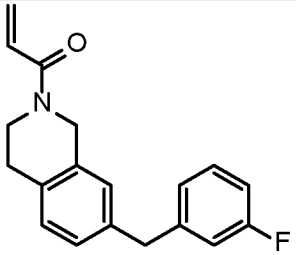
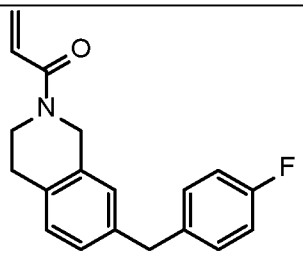
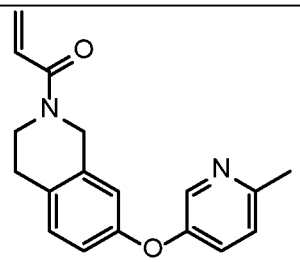
P #	Structure	Name	(MH)+
P-0001		1-(7-((4-fluorobenzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	312.2
P-0002		1-(7-(benzyloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	294.2
P-0003		1-(8-((3-fluorophenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	297.4
P-0004		1-(7-((3-fluorophenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	297.4
P-0005		1-(8-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	298.4
P-0006		1-(7-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	298.4

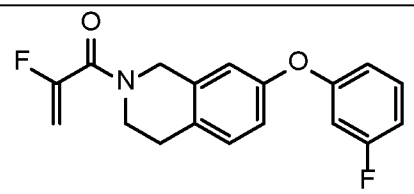
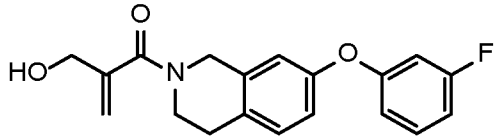
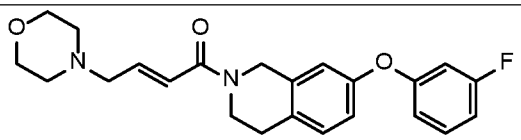
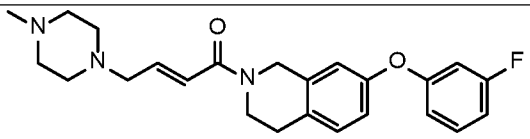
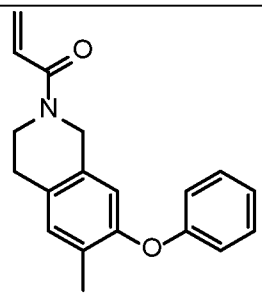
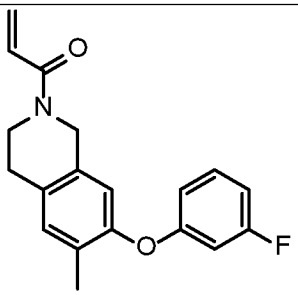
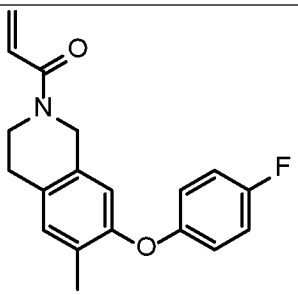
P-0007		1-(7-phenoxy-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0008		1-(7-(2,4-difluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0009		1-(7-((tetrahydro-2H-pyran-4-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0010		1-(7-(phenylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0011		1-(7-((2-(trifluoromethyl)pyridin-4-yl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0012		1-(7-((6-(trifluoromethyl)pyridin-3-yl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

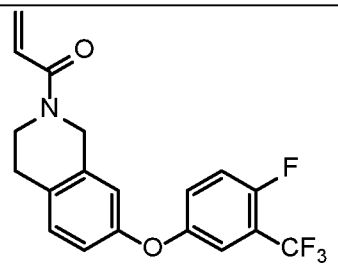
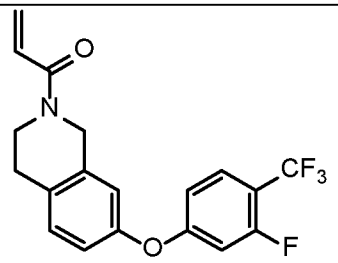
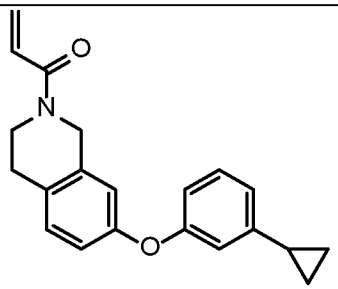
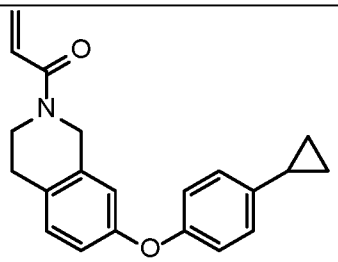
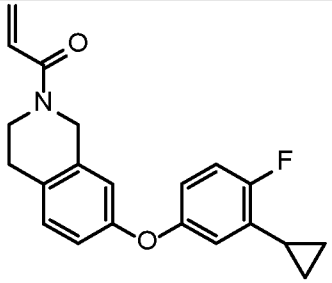
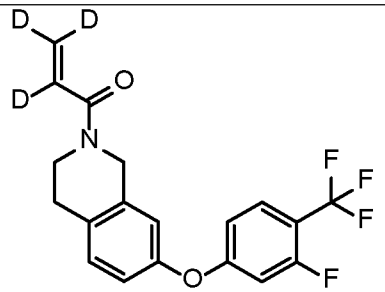
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P-0014		1-(7-(3-chlorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0015		1-(7-(4-chlorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0016		1-(7-(3,4-difluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0017		1-(7-(3-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0018		1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	347.33

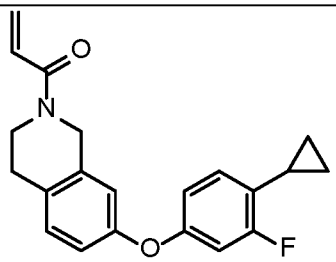
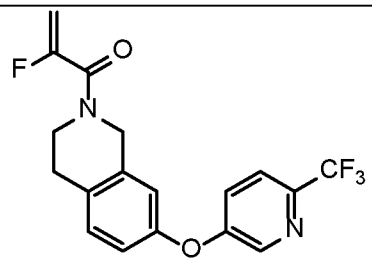
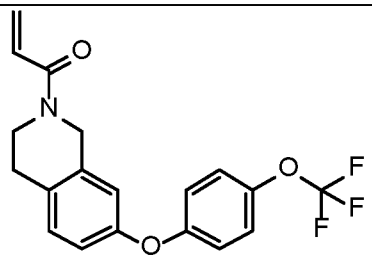
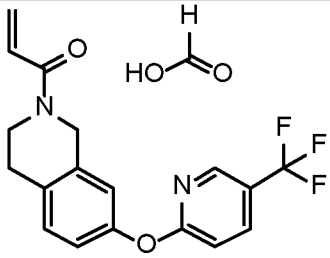
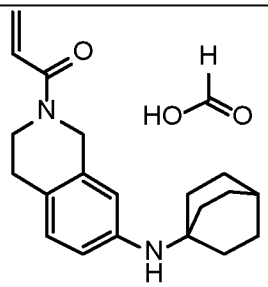
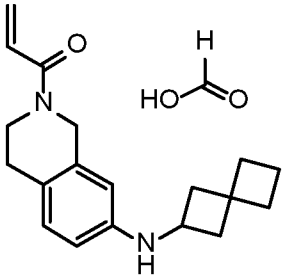
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P-0020		1-(7-(3,3-difluorocyclobutoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0021		1-(7-(((3R,5R)-adamantan-1-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0022		1-(7-((2-fluorophenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0023		1-(7-((4-fluorophenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0024		1-(7-((3-chlorophenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

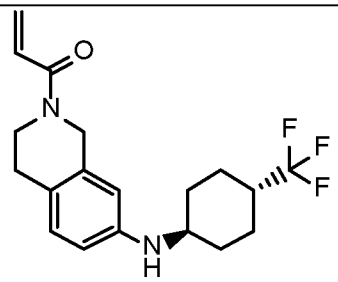
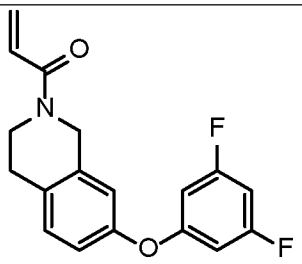
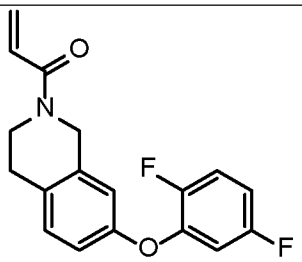
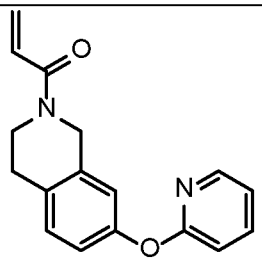
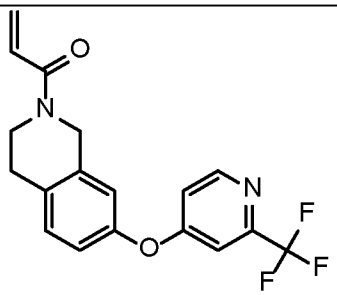
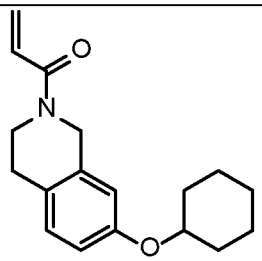
P-0025		1-(7-((3-(trifluoromethyl)phenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0026		1-(7-(methyl(phenyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0027		1-(7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	349.35
P-0028		1-(7-((1-(methylsulfonyl)piperidin-4-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0029		1-(7-((4,4-difluorocyclohexyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0030		1-(6-fluoro-7-phenoxy-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	298.40

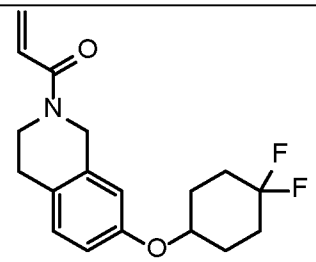
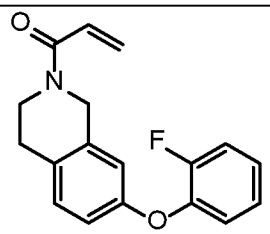
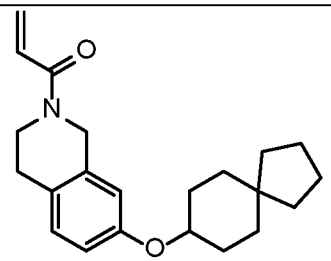
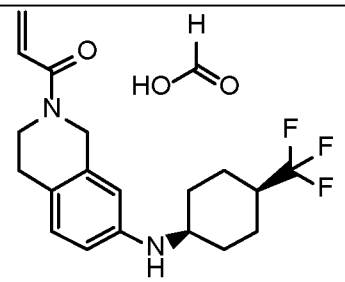
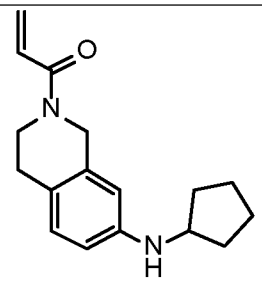
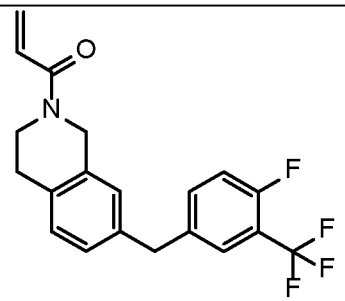
P-0031		1-(6-fluoro-7-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	316.35
P-0032		1-(6-fluoro-7-(4-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	316.35
P-0033		1-(7-benzyl-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	278.45
P-0034		1-(7-(3-fluorobenzyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	296.45
P-0035		1-(7-(4-fluorobenzyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	296.45
P-0036		1-(7-((6-methylpyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

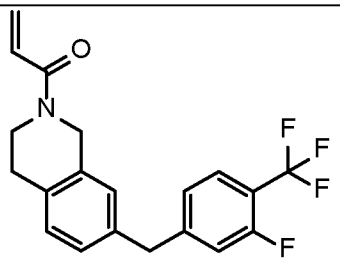
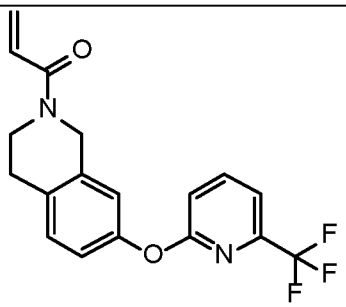
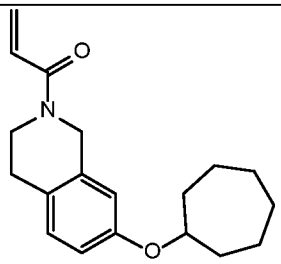
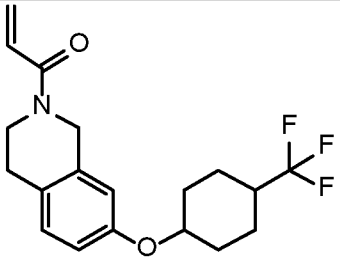
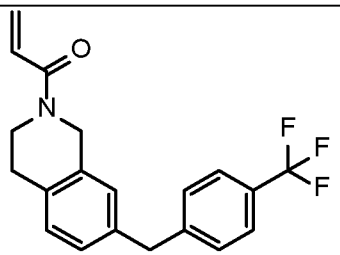
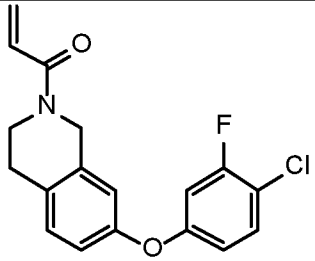
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P-0038		1-(7-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)-2-(hydroxymethyl)prop-2-en-1-one	
P-0039		(E)-1-(7-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)-4-morpholinobut-2-en-1-one	
P-0040		(E)-1-(7-(3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)-4-(4-methylpiperazin-1-yl)but-2-en-1-one	
P-0041		1-(6-methyl-7-phenoxy-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	294.4
P-0042		1-(7-(3-fluorophenoxy)-6-methyl-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	312.4
P-0043		1-(7-(4-fluorophenoxy)-6-methyl-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	312.4

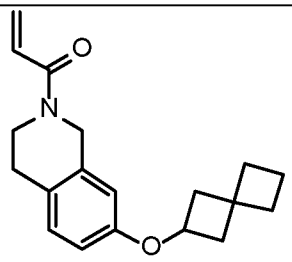
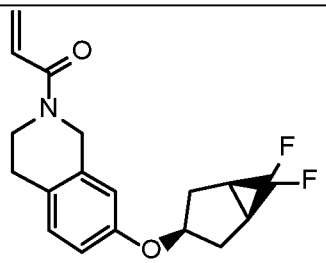
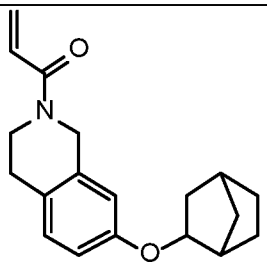
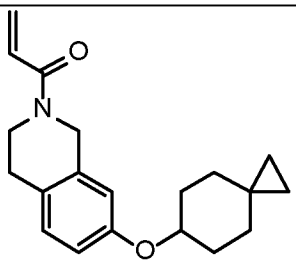
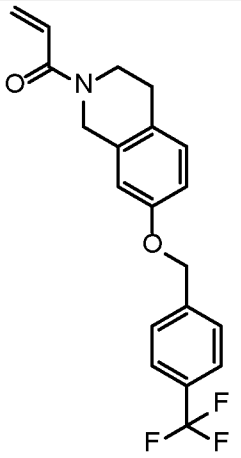
P-0044		1-(7-(4-fluoro-3-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	366.4
P-0045		1-(7-(3-fluoro-4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	366.4
P-0046		1-(7-(3-cyclopropylphenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	320.1
P-0047		1-(7-(4-cyclopropylphenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	320.0
P-0048		1-(7-(3-cyclopropyl-4-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	338.5
P-0049		1-(7-(3-fluoro-4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one-2,3,3-d3	369.2

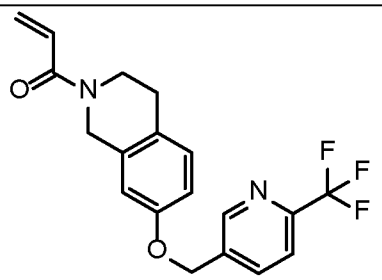
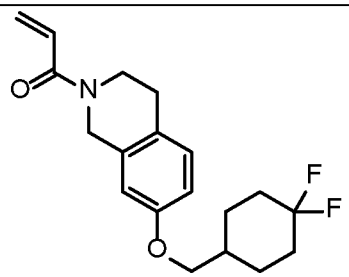
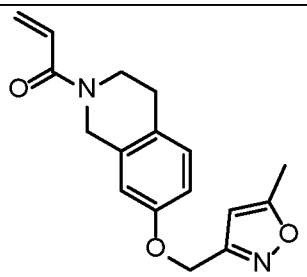
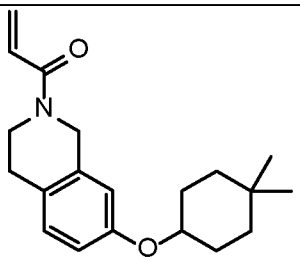
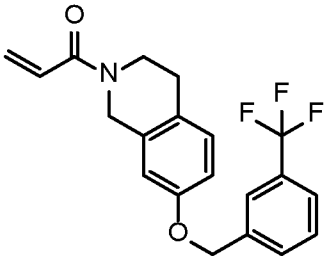
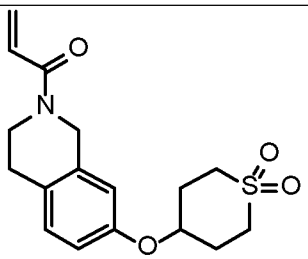
P-0050		1-(7-(4-cyclopropyl-3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	366.0
P-0051		2-fluoro-1-(7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	367.0
P-0052		1-(7-(4-(trifluoromethoxy)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0053		1-(7-((5-(trifluoromethyl)pyridin-2-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one formate	
P-0054		1-(7-(bicyclo[2.2.2]octan-1-ylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one formate	
P-0055		1-(7-(spiro[3.3]heptan-2-ylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one formate	

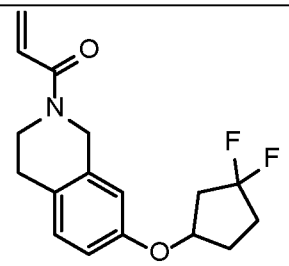
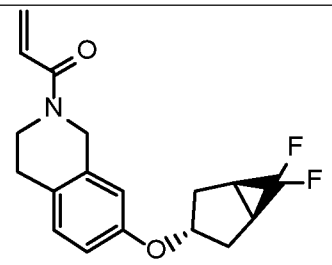
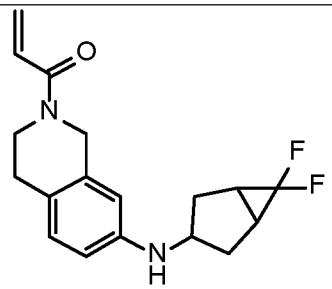
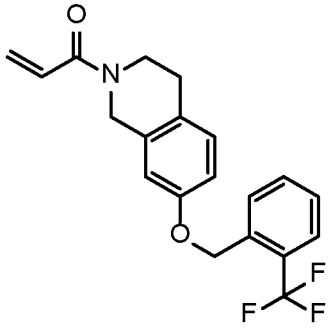
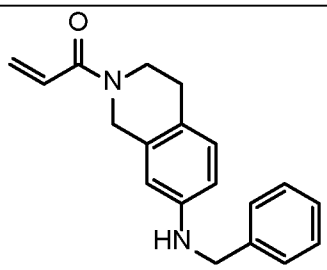
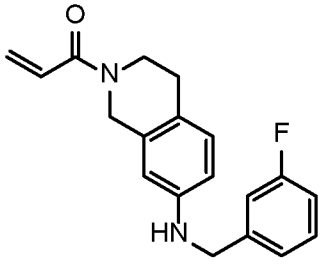
P-0056		1-(7-(((1r,4r)-4-(trifluoromethyl)cyclohexyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0057		1-(7-(3,5-difluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0058		1-(7-(2,5-difluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0059		1-(7-(pyridin-2-yloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0060		1-(7-((2-(trifluoromethyl)pyridin-4-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0061		1-(7-(cyclohexyloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

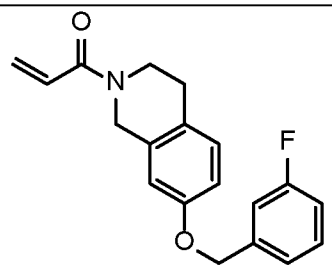
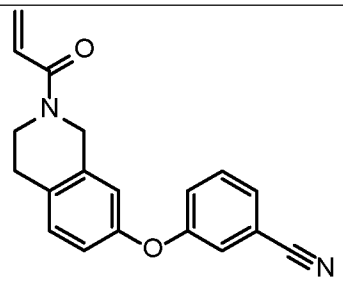
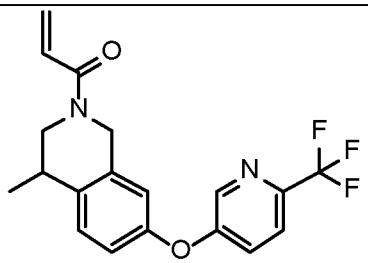
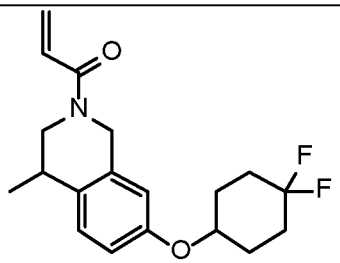
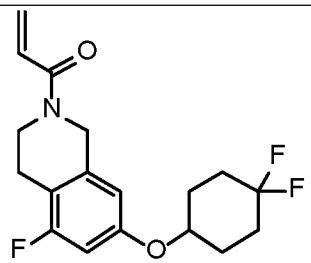
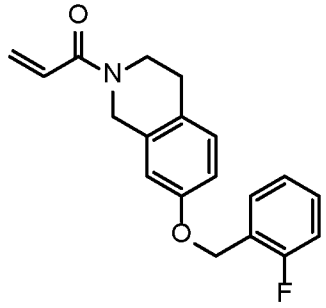
P-0062		1-(7-((4,4-difluorocyclohexyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0063		1-(7-(2-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0064		1-(7-(spiro[4.5]decan-8-yloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0065		1-(7-(((1s,4s)-4-(trifluoromethyl)cyclohexyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one formate	
P-0066		1-(7-(cyclopentylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0067		1-(7-(4-fluoro-3-(trifluoromethyl)benzyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	364.4

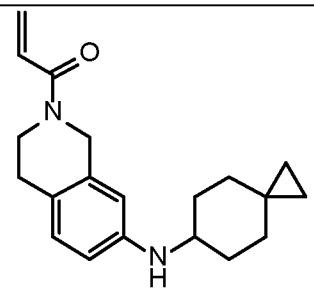
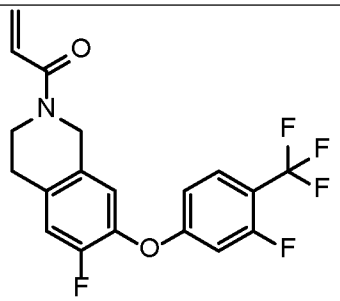
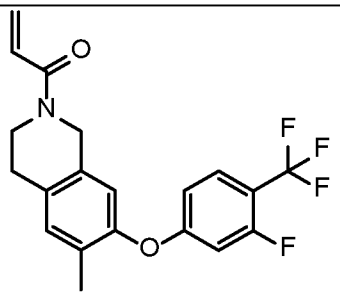
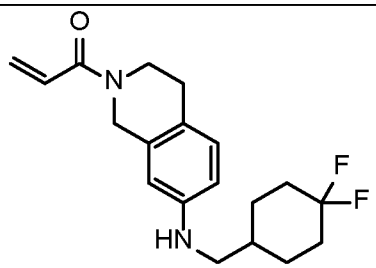
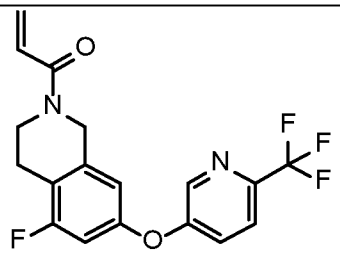
P-0068		1-(7-(3-fluoro-4-(trifluoromethyl)benzyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	364.4
P-0069		1-(7-((6-(trifluoromethyl)pyridin-2-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0070		1-(7-(cycloheptyloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0071		1-(7-((4-(trifluoromethyl)cyclohexyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0072		1-(7-(4-(trifluoromethyl)benzyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	346.4
P-0073		1-(7-(4-chloro-3-fluorophenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

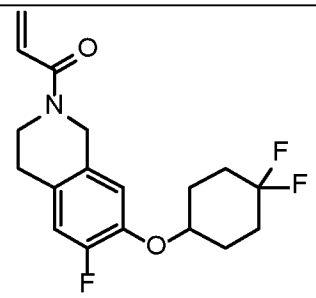
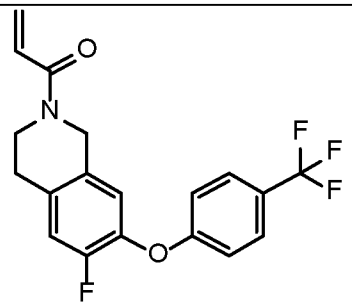
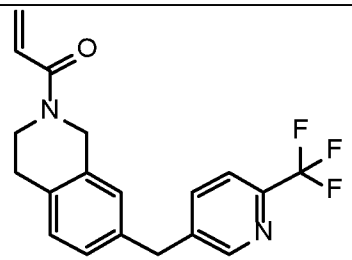
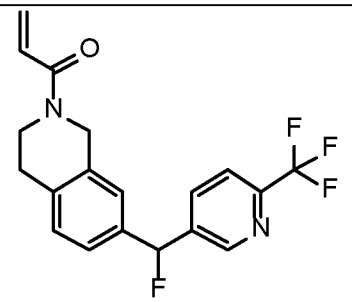
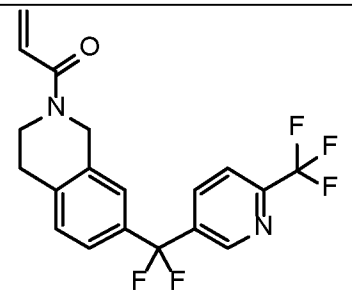
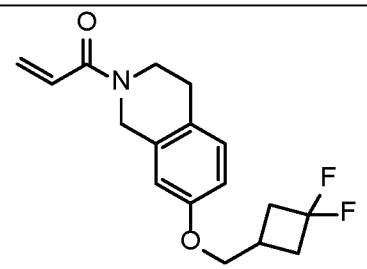
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P-0075		1-(7-(((1R,3r,5S)-6,6-difluorobicyclo[3.1.0]hexan-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0076		1-(7-(bicyclo[2.2.1]heptan-2-yloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0077		1-(7-(spiro[2.5]octan-6-yloxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0078		1-(7-((4-(trifluoromethyl)benzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	362.2

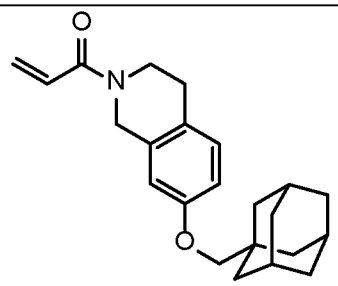
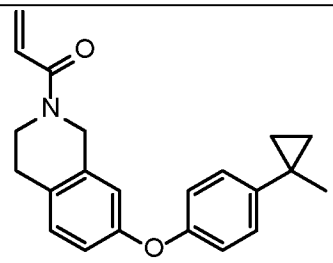
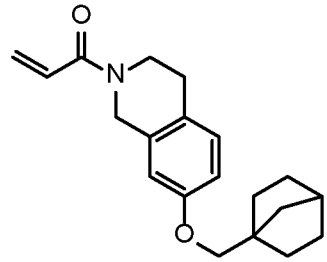
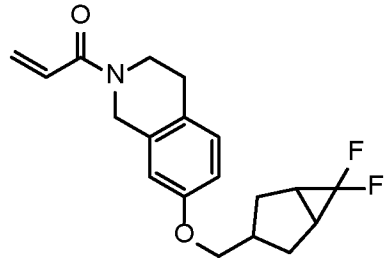
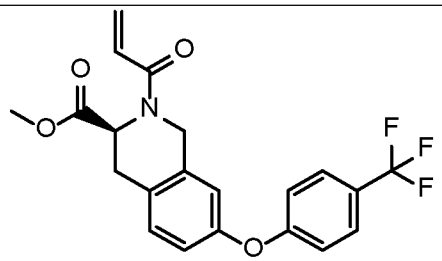
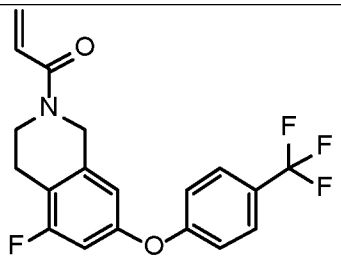
P-0079		1-(7-((6-(trifluoromethyl)pyridin-3-yl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	363.1
P-0080		1-(7-((4,4-difluorocyclohexyl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	336.2
P-0081		1-(7-((5-methylisoxazol-3-yl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	299.1
P-0082		1-(7-((4,4-dimethylcyclohexyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	314.5
P-0083		1-(7-((3-(trifluoromethyl)benzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	362.2
P-0084		1-(7-((1,1-dioxidotetrahydro-2H-thiopyran-4-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

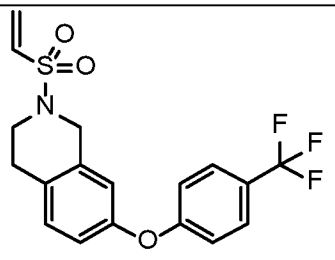
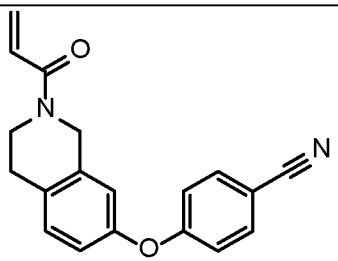
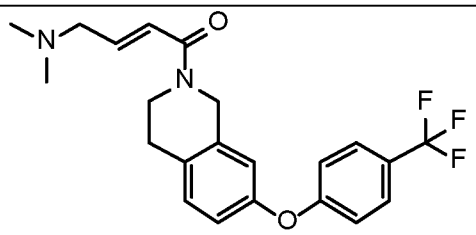
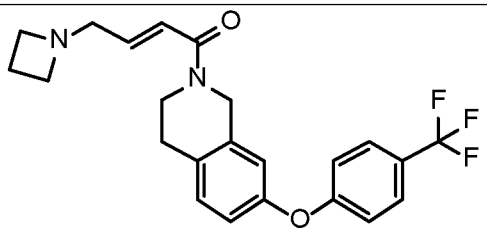
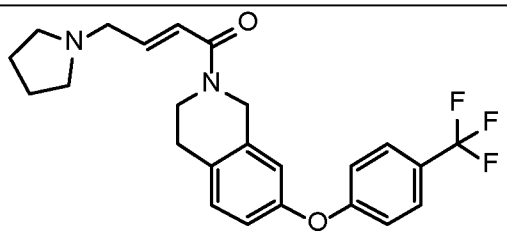
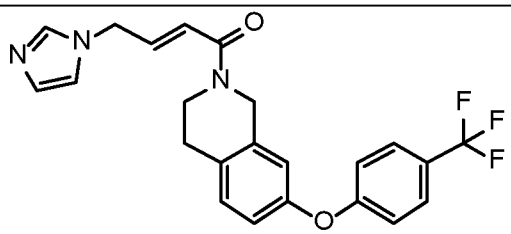
P-0085		1-(7-((3,3-difluorocyclopentyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0086		1-(7-(((1R,3s,5S)-6,6-difluorobicyclo[3.1.0]hexan-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0087		1-(7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0088		1-(7-((2-(trifluoromethyl)benzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	362.2
P-0089		1-(7-(benzylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	293.2
P-0090		1-(7-((3-fluorobenzyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	311.2

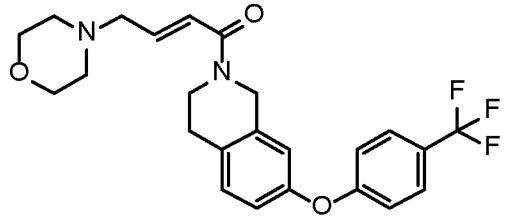
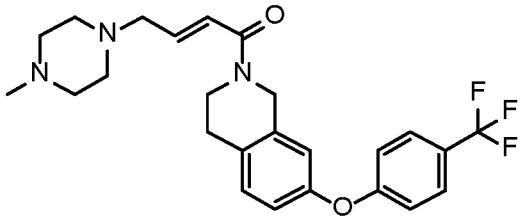
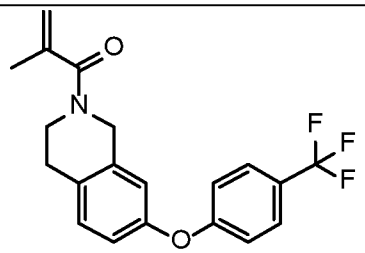
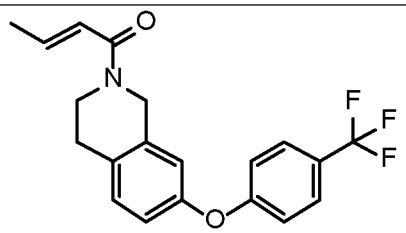
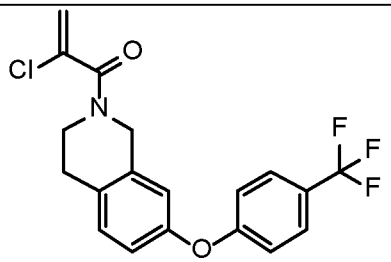
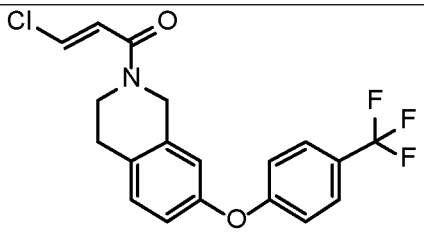
P-0091		1-(7-((3-fluorobenzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	311.2
P-0092		3-((2-acryloyl-1,2,3,4-tetrahydroisoquinolin-7-yl)oxy)benzonitrile	305.2
P-0093		1-(4-methyl-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0094		1-(7-((4,4-difluorocyclohexyl)oxy)-4-methyl-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0095		1-(7-((4,4-difluorocyclohexyl)oxy)-5-fluoro-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0096		1-(7-((2-fluorobenzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	312.2

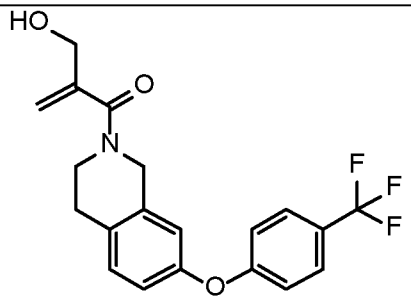
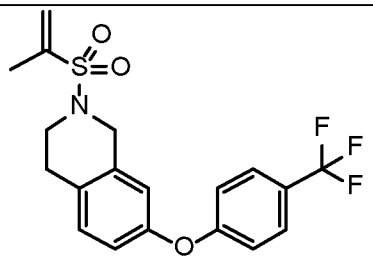
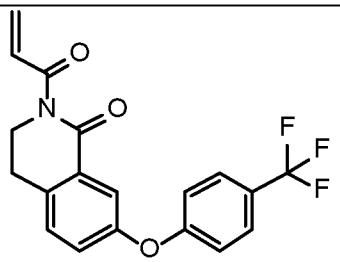
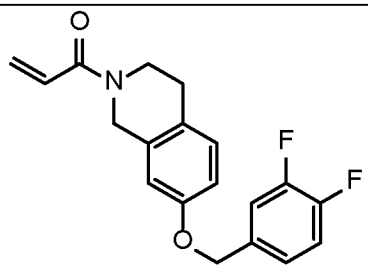
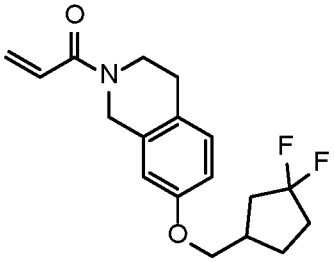
P-0097		1-(7-(spiro[2.5]octan-6-ylamino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0098		1-(6-fluoro-7-(3-fluoro-4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	383.95
P-0099		1-(7-(3-fluoro-4-(trifluoromethyl)phenoxy)-6-methyl-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	380.35
P-0100		1-(7-(((4,4-difluorocyclohexyl)methyl)amino)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	335.2
P-0101		1-(5-fluoro-7-((6-(trifluoromethyl)pyridin-3-yl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

P-0102		1-(7-((4,4-difluorocyclohexyl)oxy)-6-fluoro-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0103		1-(6-fluoro-7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0104		1-(7-((6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0105		1-(7-(fluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0106		1-(7-(difluoro(6-(trifluoromethyl)pyridin-3-yl)methyl)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0107		1-(7-((3,3-difluorocyclobutyl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	308.2

P-0108		1-(7-(((3r,5r,7r)-adamantan-1-yl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	352.3
P-0109		1-(7-(4-(1-methylcyclopropyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	334.50
P-0110		1-(7-(bicyclo[2.2.1]heptan-1-ylmethoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	312.2
P-0111		1-(7-((6,6-difluorobicyclo[3.1.0]hexan-3-yl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	334.2
P-0112		methyl (S)-2-acryloyl-7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline-3-carboxylate	406.35
P-0113		1-(5-fluoro-7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

P-0114		7-(4-(trifluoromethyl)phenoxy)-2-(vinylsulfonyl)-1,2,3,4-tetrahydroisoquinoline	
P-0115		4-((2-acryloyl-1,2,3,4-tetrahydroisoquinolin-7-yl)oxy)benzonitrile	305.2
P-0116		(E)-4-(dimethylamino)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0117		(E)-4-(azetidin-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0118		(E)-4-(pyrrolidin-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0119		(E)-4-(1H-imidazol-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	

P-0120		(E)-4-morpholino-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0121		(E)-4-(4-methylpiperazin-1-yl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0122		2-methyl-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0123		(E)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)but-2-en-1-one	
P-0124		2-chloro-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	382.1
P-0125		(E)-3-chloro-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	

P-0126		2-(hydroxymethyl)-1-(7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	
P-0127		2-(prop-1-en-2-ylsulfonyl)-7-(4-(trifluoromethyl)phenoxy)-1,2,3,4-tetrahydroisoquinoline	
P-0128		2-acryloyl-7-(4-(trifluoromethyl)phenoxy)-3,4-dihydroisoquinolin-1(2H)-one	
P-0129		1-(7-((3,4-difluorobenzyl)oxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	330.2
P-0130		1-(7-((3,3-difluorocyclopentyl)methoxy)-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one	322.2

Biological Examples

Biological Test Methods

Determine inhibitor activity against TEAD-dependent transcription in a cell-based reporter assay

The human mesothelioma cell line MSTO-211H was stably transfected with a pGL4.21 plasmid containing a synthetic promoter with 12 copies of the GTIIC TEAD response element that drives the expression of a luciferase reporter gene [1] using Lipofectamine transfection reagent (Thermo Fisher). Transfected cells were selected using puromycin and single cell clones expressing this construct (referred to as MSTO-211H+12XGTIIC) were generated by limiting dilution. MSTO-211H cells was characterized by genetic alterations in key components of the Hippo pathway[2], resulting in up-regulation of YAP/TEAD-mediated transcription. Stable expression of the 12XGTIIC reporter construct in MSTO-211H cells resulted in constitutive luciferase expression. Treatment of these cells with inhibitors targeting TEAD resulted in decreased luciferase expression. To evaluate TEAD inhibitors, the MSTO-211H+12XGTIIC cell line was seeded in a 96-well plate in 50µL of culture media at 1 x 10^4 cells per well and incubated at 37°C overnight. Serial dilutions of compounds (in total volume of 50 µL of culture media) were added to the cells and incubated at 37°C for 24 hours. Each plate included cells treated with DMSO as high controls and cells treated with 20 µM of the reference compound K-975 (a known TEAD inhibitor)[3] as low controls. Cell viability was assayed by the addition of 25 µL of CellTiter-Fluor reagent (Promega) followed by a 30-minute incubation at 37°C and quantification of the fluorescence signal (Ex400/Em505). Subsequently, luciferase expression was assayed by the addition of 25 µL of ONE-Glo reagent (Promega) followed by a 10-minute incubation at room temperature and quantification of the luminescence signal. The luminescence signal was normalized to the fluorescence signal to correct for any loss in cell viability over the 24-hour compound incubation period. The percentage of inhibition of normalized luminescence signal, indicative of compound-mediated inhibition of TEAD-dependent transcription, at individual compound concentrations relative to high and low controls was calculated. The data were analyzed by using nonlinear regression to generate IC_{50} values for individual compounds.

References

1. Dupont, S. *et al.* Role of YAP/TAZ in mechanotransduction. *Nature* **474**, 179–184 (2011).

2. Miyanaga, A. *et al.* Hippo pathway gene mutations in malignant mesothelioma: Revealed by RNA and targeted exon sequencing. *Journal of Thoracic Oncology* **10**, 844–851 (2015).

3. Kaneda, A. *et al.* The novel potent TEAD inhibitor, K-975, inhibits YAP1/ TAZ-TEAD protein-protein interactions and exerts an anti-tumor effect on malignant pleural mesothelioma. *Am J Cancer Res* vol. 10 (2020).

[0206] The following Table 2 provides data indicating biochemical and/or cell inhibitory activity for exemplary compounds as described herein in Table 1. In Table 2 below, activity is provided as follows: +++ = 0.001 μM < IC_{50} <0.5 μM; ++ = 0.5 μM < IC_{50} < 20 μM , + = IC_{50} > 20 μM, X = >20 μM

TABLE 2

P #	MSTO-211H GMean IC50 (uM) Cell Assay Reporter Cell Variant: TEAD
P-0001	+++
P-0002	+++
P-0003	++
P-0004	+++
P-0005	+++
P-0006	+++
P-0007	+++
P-0008	+++
P-0009	+++
P-0010	+++
P-0011	++
P-0012	++
P-0013	+++
P-0014	+++
P-0015	+++

P-0016	+++
P-0017	+++
P-0018	+++
P-019	+++
P-0020	+++
P-0021	+++
P-0022	+++
P-0023	+++
P-0024	+++
P-0025	+++
P-0026	+++
P-0027	+++
P-0028	++
P-0029	+++
P-0030	+++
P-0031	+++
P-0032	+++
P-0033	+++
P-0034	+++
P-0035	+++
P-0036	+++
P-0037	+++
P-0038	+++
P-0039	+
P-0040	+
P-0041	+++
P-0042	+++
P-0043	+++
P-0044	+++
P-0045	+++
P-0046	+++
P-0047	+++

P-0048	+++
P-0049	+++
P-0050	+++
P-0051	+++
P-0052	+
P-0053	+++
P-0054	+++
P-0055	+++
P-0056	+++
P-0057	+++
P-0058	+++
P-0059	+
P-0060	+++
P-0061	+++
P-0062	+++
P-0063	+++
P-0064	++
P-0065	+++
P-0066	+++
P-0067	+++
P-0068	+++
P-0069	++
P-0070	+++
P-0071	+++
P-0072	+++
P-0073	+++
P-0074	+++
P-0075	+++
P-0076	+++
P-0077	+++
P-0078	++
P-0079	+

P-0080	+++
P-0081	+
P-0082	+++
P-0083	+++
P-0084	+++
P-0085	+++
P-0086	+++
P-0087	+++
P-0088	+++
P-0089	+++
P-0090	+++
P-0091	+++
P-0092	+++
P-0093	+++
P-0094	+++
P-0095	+++
P-0096	+
P-0097	++
P-0098	+++
P-0099	+++
P-0100	+++
P-0101	+++
P-0102	+++
P-0103	+++
P-0104	+++
P-0105	++
P-0106	+++
P-0107	+++
P-0108	+++
P-0109	+++
P-0110	+++
P-0111	+++

P-0112	+++
P-0113	+++
P-0114	++
P-0115	+++
P-0116	++
P-0117	++
P-0118	++
P-0119	+++
P-0120	++
P-0121	++
P-0122	++
P-0123	+++
P-0124	+++
P-0125	+++
P-0126	+++
P-0127	+++
P-0128	+++
P-0129	+
P-0130	+++

[0207] All patents and other references cited herein are indicative of the level of skill of those skilled in the art to which the disclosure pertains, and are incorporated by reference in their entireties, including any tables and figures, to the same extent as if each reference had been incorporated by reference in its entirety individually.

[0208] One skilled in the art would readily appreciate that the present disclosure is well adapted to obtain the ends and advantages mentioned, as well as those inherent therein. The methods, variances, and compositions described herein as presently representative of the embodiments described herein are exemplary and are not intended as limitations on the scope of the disclosure. Changes therein and other uses will occur to those skilled in the art, which are encompassed within the spirit of the disclosure, are defined by the scope of the claims.

[0209] It will be readily apparent to one skilled in the art that varying substitutions and modifications may be made to the present disclosure described herein without departing from the scope and spirit of the disclosure. For example, variations can be made to provide

additional compounds of the compounds of this disclosure and/or various methods of administration can be used. Thus, such additional embodiments are within the scope of the present disclosure and the following claims.

[0210] The present disclosure illustratively described herein suitably may be practiced in the absence of any element or elements, limitation or limitations which is not specifically described herein. The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention that in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the disclosure claimed. Thus, it should be understood that although the present disclosure has been specifically described by the embodiments and optional features, modification and variation of the concepts herein described may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this disclosure as defined by the appended claims.

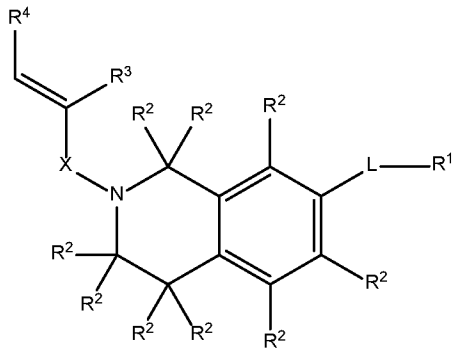
[0211] In addition, where features or aspects of the disclosure are described in terms grouping of alternatives, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the groups described herein.

[0212] Also, unless indicated to the contrary, where various numerical values are provided for embodiments, additional embodiments are described by taking any 2 different values as the endpoints of a range. Such ranges are also within the scope of the present disclosure.

[0213] Thus, additional embodiments are within the scope of the disclosure and within the following claims.

What is claimed is:

1. A compound of Formula (I):



(I)

or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog thereof, wherein:

R^1 is phenyl, heteroaryl, cycloalkyl, or heterocycloalkyl, wherein R^1 is substituted with 0-1 G^1 groups and 0-4 G^2 groups;

X is -C(O)- or -$S(O)_2$-;

G^1 is -$S(O)_2$alkyl, cycloalkyl optionally substituted with one or more R^5, or phenyl optionally substituted with one or more R^5;

each **G^2** is independently selected from halogen, OH, CN, alkyl optionally substituted with one or more R^5, alkoxy optionally substituted with one or more R^5;

each **R^2** is independently H, halogen, -C(O)O-alkyl or C_1-C_3alkyl optionally substituted with 1-3 halogens or two R^2 groups together with the carbon to which they are attached can form -CO- provided that not more than one R^2 is -C(O)O-alkyl;

L is -O-, -$OC(R^8)_2$-, -$N(R^6)$-, -$N(R^6)$-$C(R^8)_2$, -$[C(R^8)_2]_{1-2}$-, -$C(R^8)_2O$-, or -$C(R^8)_2$–$N(R^6)$-;

R^3 is H, halogen, alkyl, hydroxyalkyl, or haloalkyl;

R^4 is H, halogen, alkyl, hydroxyalkyl, heterocycloalkylalkyl, heteroarylalkyl, or -alkyl-$N(R^6)_2$, wherein each alkyl, hydroxyalkyl, heterocycloalkylalkyl, heteroarylalkyl, -alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently halogen or OH;

each **R^6** is independently H or alkyl optionally substituted with one or more R^5;

each **R^7** is independently alkyl, alkoxy, hydroxyalkyl, halogen, or hydroxy; and

each **R^8** is independently H, halogen, or alkyl optionally substituted with one or more R^5.

2. The compound according to claim 1, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl,

wherein R^1 is substituted 0-4 G^2 groups,

each **G^2** is independently selected from halogen, OH, CN, C_1-C_6alkyl optionally substituted with 1-3 R^5, C_1-C_6alkoxy optionally substituted with 1-3 R^5;

each **R^2** is independently H, halogen, or CH_3;

R^3 is H, halogen C_1-C_3alkyl, C_1-C_3hydroxyalkyl, or C_1-C_3haloalkyl;

L is -O-, -OCH_2-, -N(H)-, -$N(CH_3)$-, -N(H)-$C(R^8)_2$, -$[(CR^8)_2]_{1-2}$-, -$C(R^8)_2O$-, or -$C(R^8)_2$–N(H);

R^4 is H, halogen, C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_6alkyl-$N(R^6)_2$, wherein each C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently halogen C_1-C_3haloalkyl, or OH;

each **R^6** is independently H or C_1-C_6alkyl optionally substituted with 1-3 R^5;

each **R^7** is independently C_1-C_6alkyl, C_1-C_6alkoxy, C_1-C_6hydroxyalkyl, halogen, or hydroxy; and

each **R^8** is independently H, halogen, or C_1-C_6alkyl optionally substituted with 1-3 R^5.

3. The compound according to claim 2, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-3 G^2 groups,

each **G^2** is independently selected from Cl, F, OH, CN, C_1-C_4alkyl optionally substituted with 1-3 R^5, C_1-C_4alkoxy optionally substituted with 1-3 R^5;

each **R^2** is independently H, Cl, F, or CH_3;

R^3 is H, Cl, F, C_1-C_2alkyl, C_1-C_2hydroxyalkyl, or C_1-C_2haloalkyl;

L is -O-, -OCH_2-, -N(H)-, or $N(H)C(H)_2$;

R^4 is H, F, Cl, C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$, wherein each C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

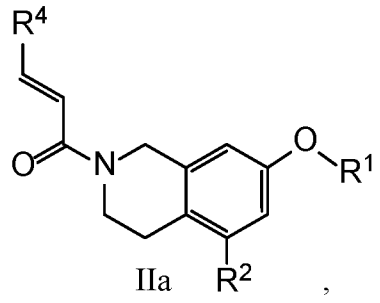
each **R^5** is independently Cl, F, or OH;

each **R^6** is independently H or C_1-C_4alkyl optionally substituted with 1-3 R^5;

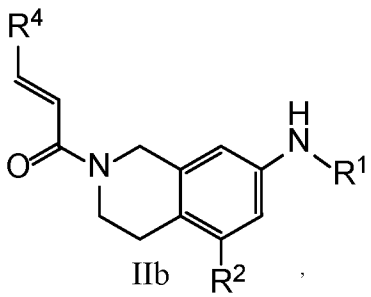
each **R**^{7} is independently C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4hydroxyalkyl, Cl, F, or hydroxy; and

each **R**^{8} is independently H, halogen or C_1-C_4alkyl optionally substituted with 1-3 R^5.

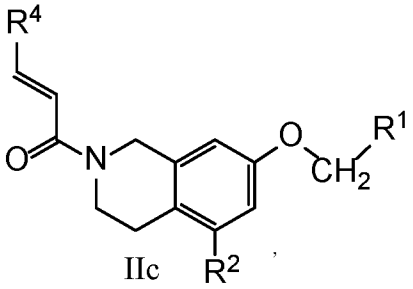
4. A compound according to claim 1 having one of the following formulae:



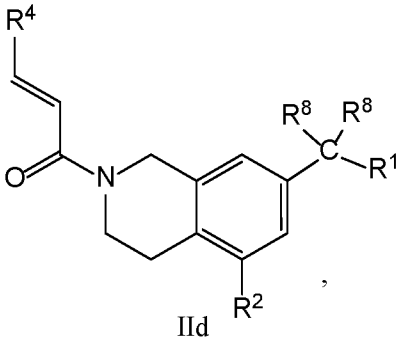
IIa ,



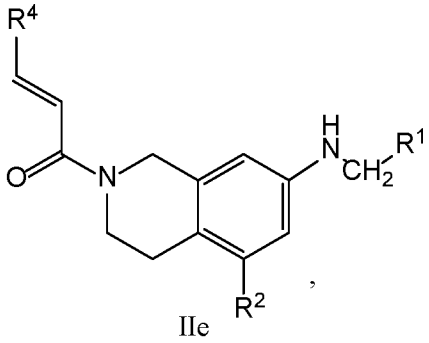
IIb ,



IIc ,



IId ,



IIe ,

or a pharmaceutically acceptable salt, a tautomer, a stereoisomer, or a deuterated analog of any of formulae IIa, IIb, IIc, IId or IIe.

5. The compound according to claim 4, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-4 G^2 groups,

each **G**^{2} is independently selected from halogen, OH, CN, C_1-C_6alkyl optionally substituted with one or more R^5, C_1-C_6alkoxy optionally substituted with 1-3 R^5;

R^2 is H, halogen, or CH_3;

R^4 is H, halogen, C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_6alkyl-$N(R^6)_2$, wherein each C_1-C_6alkyl, C_1-C_6hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R**^{5} is independently halogen C_1-C_3haloalkyl, or OH;

each **R**^{6} is independently H or C_1-C_6alkyl optionally substituted with 1-3 R^5;

each **R^7** is independently C_1-C_6alkyl, C_1-C_6alkoxy, C_1-C_6hydroxyalkyl, halogen, or hydroxy; and

each **R^8** is independently H, halogen, or C_1-C_6alkyl optionally substituted with 1-3 R^5.

6. The compound according to claim 5, wherein:

R^1 is phenyl, 5-6 membered heteroaryl, C_4-C_{10} cycloalkyl, or 5-6 membered heterocycloalkyl, wherein R^1 is substituted 0-3 G^2 groups,

each **G^2** is independently selected from Cl, F, OH, CN, C_1-C_4alkyl optionally substituted with one or more R^5, C_1-C_4alkoxy optionally substituted with 1-3 R^5;

R^2 is H, Cl, F, or CH_3;

R^4 is H, F, Cl, C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$, wherein each C_1-C_4alkyl, C_1-C_4hydroxyalkyl, 4-6 membered heterocycloalkylalkyl, 5-6 membered heteroarylalkyl, or -C_1-C_4alkyl-$N(R^6)_2$ is optionally substituted with 1-3 R^7;

each **R^5** is independently Cl, F, or OH;

each **R^6** is independently H or C_1-C_4alkyl optionally substituted with 1-3 R^5;

each **R^7** is independently C_1-C_4alkyl, C_1-C_4alkoxy, C_1-C_4hydroxyalkyl, Cl, F, or hydroxy; and

each **R^8** is independently H, halogen, or C_1-C_4alkyl optionally substituted with 1-3 R^5.

7. The compound according to claim 6, wherein R^1 is phenyl or pyridyl substituted with 1-3 groups independently selected from Cl, F, CF_3 and CN.

8. The compound according to claim 7, wherein R^1 is phenyl or pyridyl, wherein the phenyl or pyridyl is substituted with 1 CF_3 and optionally substituted with 1-2 F.

9. A formic acid salt according to the compound in any of the preceding claims.

10. A compound selected from Table 1, or a pharmaceutically acceptable salt thereof.

11. A pharmaceutical composition comprising a compound in any one of the preceding claims, and a pharmaceutically acceptable carrier.

12. The pharmaceutical composition of claim 11, further comprising a second pharmaceutical agent.

13. A method for treating a subject with a disease or condition mediated by YAP/TEAD, said method comprising administering to the subject an effective amount of a compound in any one of claims 1-10, or a pharmaceutically acceptable salt, deuterated analog, a tautomer or a stereoisomer thereof, or a pharmaceutical composition in any one of claims 11-12.

14. A method for treatment of a disease or condition according to claim 13, wherein the disease or condition is a cancer, a neurodegenerative disease, a heart related disorder, or a kidney-related disorder.

15. A method for treatment of a disease or condition according to claim 13 or 14, wherein the disease or condition is polycystic kidney disease, Alzheimer's disease, arrhythmogenic cardiomyopathy, Holt-Oram syndrome, liver cancer, epithelioid hemangioendothelioma, breast cancer, lung cancer, malignant mesothelioma, pancreatic cancer, Kaposi sarcoma, uveal melanoma, renal cell carcinoma, colorectal cancer, multiple myeloma, neurofibromatosis Type 2, glioma, or glioblastoma.

16. The method according to any one of claims 13-15, further comprising administering one or more additional therapeutic agents.

17. The method according to claim 16, wherein the one or more additional therapeutic agents is one or more of i) an alkylating agent selected from adozelesin, altretamine, bizelesin, busulfan, carboplatin, carboquone, carmustine, chlorambucil, cisplatin, cyclophosphamide, dacarbazine, estramustine, fotemustine, hepsulfam, ifosfamide, improsulfan, irofulven, lomustine, mechlorethamine, melphalan, oxaliplatin, piposulfan, semustine, streptozocin, temozolomide, thiotepa, and treosulfan; ii) an antibiotic selected from bleomycin, dactinomycin, daunorubicin, doxorubicin, epirubicin, idarubicin, menogaril, mitomycin, mitoxantrone, neocarzinostatin, pentostatin, and plicamycin; iii) an antimetabolite selected from azacitidine, capecitabine, cladribine, clofarabine, cytarabine, decitabine, floxuridine, fludarabine, 5-fluorouracil, ftorafur, gemcitabine, hydroxyurea, mercaptopurine, methotrexate, nelarabine, pemetrexed, raltitrexed, thioguanine, and trimetrexate; iv) an immune checkpoint agent selected from a PD-1 inhibitor, a PD-L1 inhibitor, and an anti-CTLA4 inhibitor; v) a hormone or hormone antagonist selected from enzalutamide, abiraterone, anastrozole, androgens, buserelin, diethylstilbestrol, exemestane, flutamide, fulvestrant, goserelin, idoxifene, letrozole, leuprolide, magestrol, raloxifene, tamoxifen, and toremifene; vi) a taxane selected from DJ-927, docetaxel, TPI 287, paclitaxel and DHA-paclitaxel; vii) a retinoid selected from alitretinoin, bexarotene, fenretinide, isotretinoin, and tretinoin; viii) an alkaloid selected from etoposide, homoharringtonine, teniposide, vinblastine, vincristine, vindesine, and vinorelbine; ix) an antiangiogenic agent selected from AE-941 (GW786034, Neovastat), ABT-510, 2-methoxyestradiol, lenalidomide, and thalidomide; x) a topoisomerase inhibitor selected from amsacrine, edotecarin, exatecan, irinotecan, SN-38 (7-ethyl-10-hydroxy-camptothecin), rubitecan, topotecan, and 9-aminocamptothecin; xi) a kinase inhibitor selected from erlotinib, gefitinib, flavopiridol,

imatinib mesylate, lapatinib, sorafenib, sunitinib malate, 7-hydroxystaurosporine, and vatalanib; xii) a targeted signal transduction inhibitor selected from bortezomib, geldanamycin, and rapamycin; xiii) a biological response modifier selected from imiquimod, interferon-α and interleukin-2; xiv) an IDO inhibitor; xv) a chemotherapeutic agent selected from 3-AP (3-amino-2-carboxyaldehyde thiosemicarbazone), altrasentan, aminoglutethimide, anagrelide, asparaginase, bryostatin-1, cilengitide, elesclomol, eribulin mesylate, ixabepilone, lonidamine, masoprocol, mitoguanazone, oblimersen, sulindac, testolactone, tiazofurin, an mTOR inhibitor, a PI3K inhibitor, a Cdk4 inhibitor, an Akt inhibitor, a Hsp90 inhibitor, a farnesyltransferase inhibitor and an aromatase inhibitor (anastrozole letrozole exemestane); xvi) a BRAF inhibitor; xvii) a Mek inhibitor; xviii) c-Kit mutant inhibitor, xix) an EGFR inhibitor, xx) an epigenetic modulator; xxi) other adenosine axis blockade agents selected from CD39, CD38, A2AR and A2BR; or xxii) agonists of TNFA super family member; and xxiii) an anti-ErbB2 mAb.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference		FOR FURTHER ACTION
4303.1008 WO		see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US22/28736	11 May 2022 (11.05.2022)	11 May 2021 (11.05.2021)
Applicant OPNA IMMUNO-ONCOLOGY SA		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☒ **Certain claims were found unsearchable** (see Box No. II).

3. ☒ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No._____

   ☐ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☒ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US22/28736

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claims Nos.: 11-17
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-***-Please See Supplemental Page-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Group I+ , Claims 1-10 (in part), compound of Formula I, wherein: R1 is phenyl, wherein R1 is substituted with 0 G1 groups and 0 G2 groups; X is -C(O)-; each R2 is H; L is -O-; R3 is H; R4 is H (compound).

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US22/28736

A. CLASSIFICATION OF SUBJECT MATTER

IPC - INV. A61K 31/472; A61K 31/47; A61P 25/28; C07D 217/04; C07F 9/62 (2022.01)
ADD. A61P 9/00; A61P 13/12 (2022.01)

CPC - INV. A61K 31/472; A61K 31/47; A61P 25/28; C07D 217/04; C07F 9/62
ADD. A61P 9/00; A61P 13/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/0059705 A1 (MJALLI, AMM et al.) 17 March 2005; paragraphs [0020], [0250], [0406], [0412]	1-10
A	US 2017/0115303 A1 (THE SCRIPPS RESEARCH INSTITUTE) 27 April 2017; abstract; paragraphs [0447]-[0448]	1-10
A	WO 2008/022467 A1 (LAUTENS, M et al.) 28 February 2008; page 13, lines 5-15; page 45, lines 15-20; page 46, lines 1-5	1-10
A	WO 2015/078417 A1 (SICHUAN GOODDOCTOR PHARMA GROUP CO LTD) 04 June 2015, machine translation; abstract translation; claim 10, translation; page 8, second paragraph, translation; page 18, first paragraph, original	1-10
A	US 2011/0269736 A1 (ECKHARDT, M et al.) 3 November 2011; paragraphs [0257]-[0258]	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 July 2022 (16.07.2022)	SEP 29 2022
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas Telephone No. PCT Helpdesk: 571-272-4300

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US22/28736

-***-Continued From Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I+ , Claims 1-10 (in part), compound of Formula I, wherein: R1 is phenyl, wherein R1 is substituted with 0 G1 groups and 0 G2 groups; X is -C(O)-; each R2 is H; L is -O-; R3 is H; R4 is H (compound) are directed to a tetrahydroisoquinoline-based compound and formic acid salts thereof.

The compounds of Claims 1-10 (each in-part) are believed to encompass the first named invention of Groups I+ and are the claims that will be searched to the extent that they comprise a compound encompassing the compound of Formula I, wherein: R1 is phenyl, wherein R1 is substituted with 0 G1 groups and 0 G2 groups; X is -C(O)-; each R2 is H; L is -O-; R3 is H; R4 is H (first exemplary compound). This first named invention of Group I+ has been selected to encompass the first species of the genus found in claim 1 based on the guidance set forth in section 10.54 of the PCT International Search and Preliminary Examination Guidelines.

Applicant is invited to elect additional compounds, with specified substituents for each Rx, and where available as an option within at least one searchable claim, to be searched. Additional compound(s) will be searched upon the payment of additional fees. Applicants must specify the searchable claims that encompass any additionally elected compound(s). Applicants must further indicate, if applicable, the claims which encompass the first named invention, if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched/examined. An exemplary election would be the compound of Formula I, wherein: R1 is heteroaryl, wherein R1 is substituted with 1 G1 group and 1 G2 group, G1 is -S(O)2alkyl, G2 is halogen; X is -S(O)2-; each R2 is halogen; L is -OC(R8)2-, R8 is H; R3 is halogen; R4 is halogen (compound).

Groups I+ share the technical features including the compound comprising the 3,4-dihydroisoquinolinyl core of Formula I, in which a vinyl substituent is attached to the N2 nitrogen atom of the 3,4-dihydroisoquinolinyl core through the linker X, and where another substituent is attached to the C7 carbon atom of the 3,4-dihydroisoquinolinyl core through the linker L. However, these shared technical features are previously disclosed by US 2017/0115303 A1 to The Scripps Research Institute (hereinafter "Scripps").

Scripps discloses the compound comprising the 3,4-dihydroisoquinolinyl core of Formula I (formula 56, or 1-(6,7-dimethoxy-3,4-dihydroisoquinolin-2(1H)-yl)prop-2-en-1-one; paragraphs [0447]-[0448]), in which a vinyl substituent is attached to the N2 nitrogen atom of the 3,4-dihydroisoquinolinyl core through the linker X (in formula 56, the vinyl group is attached to the N2 nitrogen atom of the 3,4-dihydroisoquinolinyl core through the linker X, X is -C(O)-; paragraphs [0447]-[0448]), and where another substituent is attached to the C7 carbon atom of the 3,4-dihydroisoquinolinyl core through the linker L (the methyl group is attached to the C7 carbon atom of the 3,4-dihydroisoquinolinyl core through the oxygen linker; paragraphs [0447]-[0448]).

Since none of the special technical features of the Group I+ is found in more than one of the inventions, and since all of the shared technical features are previously disclosed by the Scripps reference, unity of invention is lacking.