

INHIBITORS OF RECEPTOR INTERACTING PROTEIN KINASE I FOR THE TREATMENT OF DISEASE

[001] This application claims the benefit of priority of United States Provisional Application No. 62/907,146, filed 27 Sep, 2019, the disclosure of which is hereby incorporated by reference as if written herein in its entirety.

[002] Disclosed herein are new compounds and compositions and their application as pharmaceuticals for the treatment of disease. Methods of inhibition of RIPK1 in a human or animal subject are also provided for the treatment of diseases mediated by RIPK1 such as neurodegenerative disorders, inflammatory disorders, and cancer.

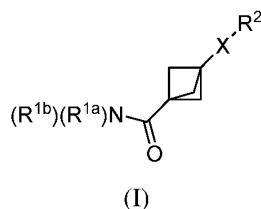
[003] The role of Receptor Interacting Protein Kinase 1(RIPK1) in the regulation of apoptotic or necroptotic cell death pathways has been reported, and its emerging role in the mediation coordinating the response to pro-inflammatory signaling in a number of cell types and contexts is emerging. RIPK1 consists of an N-terminal kinase domain, a RHIM (RIP homotypic interaction motif) domain, and a death domain, which collectively undergo extensive post-translational modification in response to signaling through various receptors such as tumor necrosis factor receptors (TNFRs), toll-like receptors, NOD-like receptor, and others. RIPK1 has been most extensively studied in the context of TNFR1 signaling, which triggers its recruitment to the C-terminal domain of the receptor via the protein TRADD (TNF receptor associated death domain protein). There RIPK1 is ubiquitinated by the E3 ubiquitin ligases TNF receptor-associated factor 2 (TRAF2) or TRAF5 and the cellular inhibitor of apoptosis proteins (cIAPs) cIAP1 and cIAP2. This molecular assembly is known as complex 1. Cyldromatosis (CYLD) then mediates the deubiquitination of RIPK1 to allow assembly of complex IIb, also known as the necrosome. The necrosome consists of the RIPK1 homolog RIPK3 and the pseudokinase MLKL. The assembly and function of the necrosome is inhibited by caspase 8 such that only when caspase 8 activity is blocked is the necrosome functional. In that context the necrosome causes necroptosis, an inflammatory form of programmed cell death in which membrane lysis causes the release of cellular contents into the extracellular space.

[004] RIPK1 can also, in different contexts, regulate apoptosis and inflammation. When cIAPs are inhibited so that RIPK1 ubiquitination does not occur, RIPK1 participates in apoptosis. Ubiquitinated RIPK1 can also recruit NF-KB essential modulator (NEMO) and TAK1 binding protein 2 or 3 (TAB2/3), leading to activation of inhibitor of kappa B (IKB) kinase beta (IKK) and transforming growth factor beta (TGF)-activated kinase 1 (TAK1),

which in turn promotes the NF- κ B pro-inflammatory or pro-survival gene expression programs. Given its role in inflammation, RIPK1 has been implicated in many diseases featuring chronic and acute inflammatory signaling, including viral infections, sepsis, retinal degeneration, traumatic brain injury, ischemic stroke, intracerebral hemorrhage, amyotrophic lateral sclerosis, acute kidney injury, myocardial reperfusion injury, Alzheimer's disease, ulcerative colitis, osteoarthritis, and others. In animal models of these diseases, RIPK1 kinase inhibitors such as necrostatin-1 have shown to be effective, leading to the development of such molecules for clinical trials in a number of indications.

Detailed Description

[005] Provided herein is Embodiment 1, a compound of structural Formula (I):



or a salt thereof, wherein:

X is alkylene and is optionally substituted with one or more R^7 ,

or X is chosen from carbamoyl, carbonyl, and a bond;

R^{1a} and R^{1b} are independently chosen from H and alkyl, which is optionally substituted with one R^3 , and which is optionally substituted with one or more R^4 ,

or R^{1a} and R^{1b} , together with the intervening nitrogen, combine to form heterocycloalkyl or heteroaryl, either of which is optionally substituted with one R^3 , and either of which is optionally substituted with one or more R^4 ;

R^2 is chosen from hydrogen, hydroxy, cyano, and halo,

or R^2 is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl, (alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R^5 ;

R^3 is chosen from aryl, (aryl)oxy, heteroaryl, (heteroaryl)oxy, cycloalkyl, and heterocycloalkyl, any of which is optionally substituted with one or more R^6 ;

each R^4 is independently chosen from alkyl, halo, cyano, and hydroxy;

each R^5 is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, $P(O)(CH_3)_2$, SO_2CH_3 , aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with one or more alkyl;

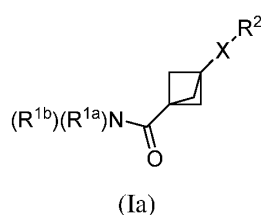
two R^5 , together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;

each R^6 is independently chosen from halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and

each R^7 is independently chosen from alkyl, cyano, halo, and hydroxy.

[006] Certain compounds disclosed herein possess useful RIPK1 inhibiting activity, and may be used in the treatment or prophylaxis of a disease or condition in which RIPK1 plays an active role. Thus, in broad aspect, certain embodiments also provide pharmaceutical compositions comprising one or more compounds disclosed herein together with a pharmaceutically acceptable carrier, as well as methods of making and using the compounds and compositions. Certain embodiments provide methods for inhibiting RIPK1. Other embodiments provide methods for treating a RIPK1-mediated disorder in a patient in need of such treatment, comprising administering to said patient a therapeutically effective amount of a compound or composition as disclosed herein. Also provided is the use of certain compounds disclosed herein for use in the manufacture of a medicament for the treatment of a disease or condition ameliorated by the inhibition of RIPK1.

[007] Also provided herein is Embodiment 2, a compound of structural Formula (Ia):



or a salt thereof, wherein:

X is alkylene and is optionally substituted with one or more R^7 ,

or X is chosen from carbamoyl, carbonyl, and a bond;

R^{1a} and R^{1b} are independently chosen from H and alkyl, which is optionally substituted with one R^3 , and which is optionally substituted with one or more R^4 ,

or R^{1a} and R^{1b}, together with the intervening nitrogen, combine to form heterocycloalkyl or heteroaryl, either of which is optionally substituted with one R³, and either of which is optionally substituted with one or more R⁴;
R² is chosen from hydrogen, hydroxy, cyano, and halo,
or R² is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl, (alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R⁵;
R³ is chosen from aryl, (aryl)oxy, heteroaryl, (heteroaryl)oxy, cycloalkyl, and heterocycloalkyl, any of which is optionally substituted with one or more R⁶;
each R⁴ is independently chosen from alkyl, halo, cyano, and hydroxy;
each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with one or more alkyl;
two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;
each R⁶ is independently chosen from halo, alkyl, cyano, alkoxy, hydroxy, haloalkyl, and haloalkoxy; and
each R⁷ is independently chosen from alkyl, cyano, halo, and hydroxy.

[008] Also provided are the following embodiments:

[009] Embodiment **3**: in some embodiments, such as, the compound of Embodiment **1**, each R⁴ is independently chosen from methyl, halo, and cyano.

[010] Embodiment **4**: in some embodiments, such as, the compound of Embodiment **3**, each R⁴ is independently chosen from halo and cyano.

[011] Embodiment **5**: in some embodiments, such as, the compound of Embodiment **4**, each R⁴ is independently chosen from fluoro and cyano.

[012] Embodiment **6**: in some embodiments, such as, the compound of any one of Embodiments **1 – 5**:

R^{1a} is alkyl, which is optionally substituted with one R³, and which is optionally substituted with one or more R⁴; and
R^{1b} is H.

- [013] Embodiment **7**: in some embodiments, such as, the compound of Embodiment **6**, R^{1a} is alkyl, which is substituted with 1 R^3 , and which is optionally substituted with one or more R^4 .
- [014] Embodiment **8**: in some embodiments, such as, the compound of either one of Embodiments **6** and **7**, R^{1a} is optionally substituted with 1, 2, or 3 R^4 .
- [015] Embodiment **9**: in some embodiments, such as, the compound of Embodiment **8**, R^{1a} is substituted with 1, 2, or 3 R^4 .
- [016] Embodiment **10**: in some embodiments, such as, the compound of Embodiment **9**, R^{1a} is substituted with 1 or 2 R^4 .
- [017] Embodiment **11**: in some embodiments, such as, the compound of Embodiment **9**, R^{1a} is substituted with 2 R^4 .
- [018] Embodiment **12**: in some embodiments, such as, the compound of Embodiment **9**, R^{1a} is substituted with 2 or 3 R^4 .
- [019] Embodiment **13**: in some embodiments, such as, the compound of Embodiment **9**, R^{1a} is substituted with 3 R^4 .
- [020] Embodiment **14**: in some embodiments, such as, the compound of Embodiment **8**, R^{1a} is optionally substituted with 1 or 2 R^4 .
- [021] Embodiment **15**: in some embodiments, such as, the compound of Embodiment **14**, R^{1a} is optionally substituted with 1 R^4 .
- [022] Embodiment **16**: in some embodiments, such as, the compound of Embodiment **14**, R^{1a} is substituted with 1 R^4 .
- [023] Embodiment **17**: in some embodiments, such as, the compound of any one of Embodiments **1** – **5**, R^{1a} and R^{1b} , together with the intervening nitrogen, combine to form heterocycloalkyl or heteroaryl, either of which is optionally substituted with one R^3 , and either of which is optionally substituted with one or more R^4 .
- [024] Embodiment **18**: in some embodiments, such as, the compound of Embodiment **17**, R^{1a} and R^{1b} , together with the intervening nitrogen, combine to form heterocycloalkyl, which is optionally substituted with one R^3 , and which is optionally substituted with one or more R^4 .
- [025] Embodiment **19**: in some embodiments, such as, the compound of Embodiment **18**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen, has 5 or 6 members.

[026] Embodiment **20**: in some embodiments, such as, the compound of Embodiment **19**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen, has 5 members.

[027] Embodiment **21**: in some embodiments, such as, the compound of Embodiment **20**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen, is chosen from pyrazoline and pyrrolidine.

[028] Embodiment **22**: in some embodiments, such as, the compound of any one of Embodiments **18** – **21**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 1 R^3 , and which is optionally substituted with one or more R^4 .

[029] Embodiment **23**: in some embodiments, such as, the compound of any one of Embodiments **18** – **22**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is optionally substituted with 1, 2, or 3 R^4 .

[030] Embodiment **24**: in some embodiments, such as, the compound of Embodiment **23**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 1, 2, or 3 R^4 .

[031] Embodiment **25**: in some embodiments, such as, the compound of Embodiment **24**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 1 or 2 R^4 .

[032] Embodiment **26**: in some embodiments, such as, the compound of Embodiment **24**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 2 R^4 .

[033] Embodiment **27**: in some embodiments, such as, the compound of Embodiment **24**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 2 or 3 R^4 .

[034] Embodiment **28**: in some embodiments, such as, the compound of Embodiment **24**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is substituted with 3 R^4 .

[035] Embodiment **29**: in some embodiments, such as, the compound of Embodiment **23**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is optionally substituted with 1 or 2 R^4 .

[036] Embodiment **30**: in some embodiments, such as, the compound of Embodiment **29**, the heterocycloalkyl formed by R^{1a} and R^{1b} , together with the intervening nitrogen is optionally substituted with 1 R^4 .

[037] Embodiment **31**: in some embodiments, such as, the compound of Embodiment **29**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen is substituted with 1 R⁴.

[038] Embodiment **32**: in some embodiments, such as, the compound of any one of Embodiments **9 – 13** and **24 – 28**, at least one R⁴ is halo.

[039] Embodiment **33**: in some embodiments, such as, the compound of any one of Embodiments **12, 13, 27**, and **28**, at least two R⁴ are halo.

[040] Embodiment **34**: in some embodiments, such as, the compound of any one of Embodiments **1 – 33**, R⁴ is halo.

[041] Embodiment **35**: in some embodiments, such as, the compound of any one of Embodiments **9 – 13** and **24 – 28**, at least one R⁴ is fluoro.

[042] Embodiment **36**: in some embodiments, such as, the compound of any one of Embodiments **12, 13, 27**, and **28**, at least two R⁴ are fluoro.

[043] Embodiment **37**: in some embodiments, such as, the compound of any one of Embodiments **1 – 36**, R⁴ is fluoro.

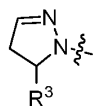
[044] Embodiment **38**: in some embodiments, such as, the compound of Embodiment **14**, R^{1a} is unsubstituted with an R⁴.

[045] Embodiment **39**: in some embodiments, such as, the compound of Embodiment **29**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen is unsubstituted with an R⁴.

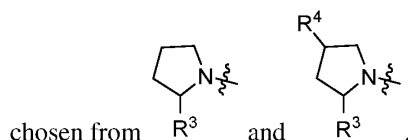
[046] Embodiment **40**: in some embodiments, such as, the compound of any one of Embodiments **22 – 39**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen, is pyrazoline.

[047] Embodiment **41**: in some embodiments, such as, the compound of any one of Embodiments **22 – 39**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen, is pyrrolidine.

[048] Embodiment **42**: in some embodiments, such as, the compound of Embodiment **22**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen is



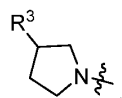
[049] Embodiment **43**: in some embodiments, such as, the compound of Embodiment **22**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen is



[050] Embodiment **44**: in some embodiments, such as, the compound of Embodiment **43**, R⁴ is halo.

[051] Embodiment **45**: in some embodiments, such as, the compound of Embodiment **43**, R⁴ is fluoro.

[052] Embodiment **46**: in some embodiments, such as, the compound of Embodiment **22**, the heterocycloalkyl formed by R^{1a} and R^{1b}, together with the intervening nitrogen is



[053] Embodiment **47**: in some embodiments, such as, the compound of any one of Embodiments **1 – 46**, each R⁶ is independently chosen from halo, alkyl, cyano, alkoxy, hydroxy, haloalkyl, and haloalkoxy.

[054] Embodiment **48**: in some embodiments, such as, the compound of Embodiment **47**, each R⁶ is independently chosen from halo, methyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, and trifluoromethoxy.

[055] Embodiment **49**: in some embodiments, such as, the compound of Embodiment **48**, each R⁶ is independently chosen from halo, methyl, cyano, and methoxy.

[056] Embodiment **50**: in some embodiments, such as, the compound of any one of Embodiments **1 – 46**, each R⁶ is independently chosen from halo, C₁₋₆alkyl, C₃₋₇cycloalkyl, cyano, C₁₋₆alkoxy, hydroxy, C₁₋₆haloalkyl, C₁₋₆hydroxyalkyl, and C₁₋₆haloalkoxy.

[057] Embodiment **51**: in some embodiments, such as, the compound of Embodiment **50**, each R⁶ is independently chosen from halo, methyl, cyclopropyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, hydroxymethyl, and trifluoromethoxy.

[058] Embodiment **52**: in some embodiments, such as, the compound of Embodiment **51**, each R⁶ is independently chosen from halo, methyl, cyclopropyl, cyano, hydroxymethyl, and methoxy.

[059] Embodiment **53**: in some embodiments, such as, the compound of Embodiment **52**, each R⁶ is independently chosen from halo, methyl, and cyano.

[060] Embodiment **54**: in some embodiments, such as, the compound of Embodiment **53**, each R^6 is independently chosen from halo and cyano.

[061] Embodiment **55**: in some embodiments, such as, the compound of any one of Embodiments **1 – 54**, R^3 is optionally substituted with 1, 2, or 3 R^6 .

[062] Embodiment **56**: in some embodiments, such as, the compound of Embodiment **55**, R^3 is substituted with 1, 2, or 3 R^6 .

[063] Embodiment **57**: in some embodiments, such as, the compound of Embodiment **56**, R^3 is substituted with 1 or 2 R^6 .

[064] Embodiment **58**: in some embodiments, such as, the compound of Embodiment **56**, R^3 is substituted with 2 R^6 .

[065] Embodiment **59**: in some embodiments, such as, the compound of Embodiment **56**, R^3 is substituted with 2 or 3 R^6 .

[066] Embodiment **60**: in some embodiments, such as, the compound of Embodiment **56**, R^3 is substituted with 3 R^6 .

[067] Embodiment **61**: in some embodiments, such as, the compound of any one of Embodiments **57 – 60**, at least one R^6 is halo.

[068] Embodiment **62**: in some embodiments, such as, the compound of any one of Embodiments **57 – 60**, at least one R^6 is fluoro.

[069] Embodiment **63**: in some embodiments, such as, the compound of either one of Embodiments **59** and **60**, at least two R^6 are halo.

[070] Embodiment **64**: in some embodiments, such as, the compound of either one of Embodiments **59** and **60**, at least two R^6 are fluoro.

[071] Embodiment **65**: in some embodiments, such as, the compound of Embodiment **55**, R^3 is optionally substituted with 1 or 2 R^6 .

[072] Embodiment **66**: in some embodiments, such as, the compound of Embodiment **65**, R^3 is optionally substituted with 1 R^6 .

[073] Embodiment **67**: in some embodiments, such as, the compound of Embodiment **65**, R^3 is substituted with 1 R^6 .

[074] Embodiment **68**: in some embodiments, such as, the compound of any one of Embodiments **1 – 67**, R^6 is halo.

[075] Embodiment **69**: in some embodiments, such as, the compound of any one of Embodiments **1 – 67**, R^6 is fluoro.

[076] Embodiment **70**: in some embodiments, such as, the compound of any one of Embodiments **1 – 46**, R^3 is unsubstituted with an R^6 .

[077] Embodiment **71**: in some embodiments, such as, the compound of any one of Embodiments **1 – 70**, R^3 is chosen from aryl, (aryl)oxy, heteroaryl, and (heteroaryl)oxy.

[078] Embodiment **72**: in some embodiments, such as, the compound of Embodiment **71**, R^3 is chosen from C_{6-10} aryl, (C_{6-10} aryl)oxy, 5-10-membered heteroaryl, and (5-10-membered heteroaryl)oxy.

[079] Embodiment **73**: in some embodiments, such as, the compound of Embodiment **72**, R^3 is chosen from phenyl, phenoxy, pyridinyl, pyridazinyl, pyrimidinyl, pyrazinyl, (pyridinyl)oxy, (pyridazinyl)oxy, (pyrimidinyl)oxy, (pyrazinyl)oxy, thiazolyl, (thiazolyl)oxy, pyrazolyl, and (pyrazolyl)oxy.

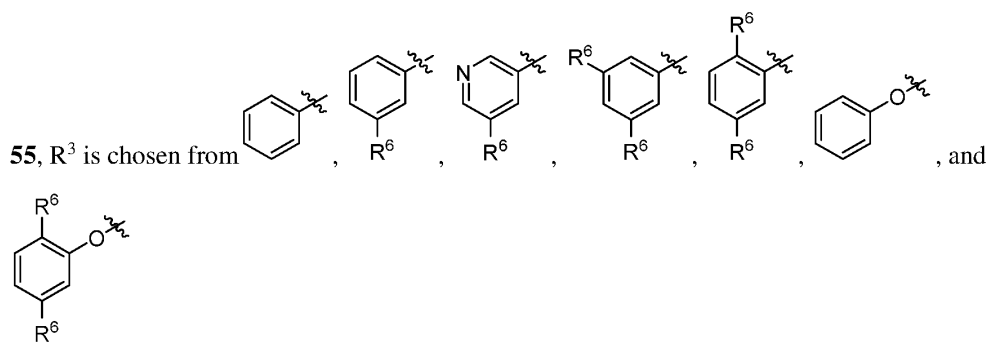
[080] Embodiment **74**: in some embodiments, such as, the compound of Embodiment **72**, R^3 is chosen from C_{6-10} aryl, (C_{6-10} aryl)oxy, 6-10-membered heteroaryl, and (6-10-membered heteroaryl)oxy.

[081] Embodiment **75**: in some embodiments, such as, the compound of Embodiment **74**, R^3 is chosen from phenyl, phenoxy, pyridinyl, pyridazinyl, pyrimidinyl, pyrazinyl, (pyridinyl)oxy, (pyridazinyl)oxy, (pyrimidinyl)oxy, and (pyrazinyl)oxy.

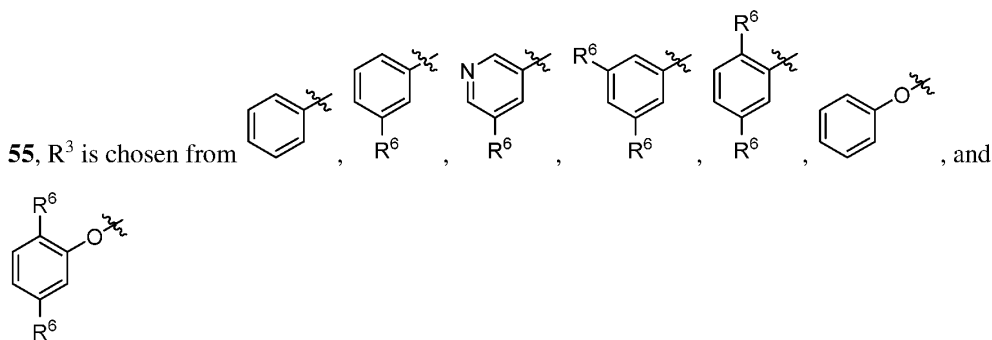
[082] Embodiment **76**: in some embodiments, such as, the compound of Embodiment **75**, R^3 is chosen from phenyl, phenoxy, pyridinyl, and (pyridinyl)oxy.

[083] Embodiment **77**: in some embodiments, such as, the compound of Embodiment **76**, R^3 is chosen from phenyl, phenoxy, and pyridinyl.

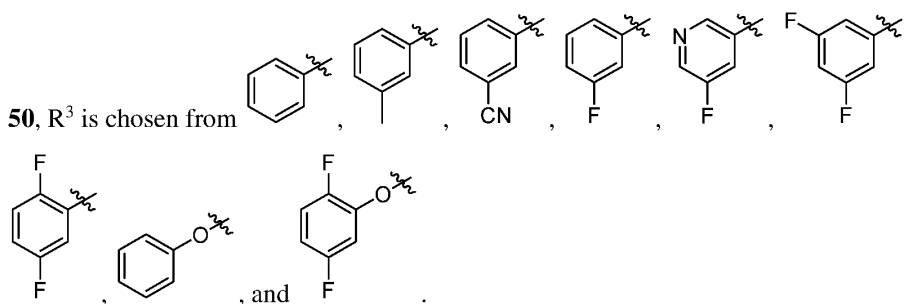
[084] Embodiment **78**: in some embodiments, such as, the compound of Embodiment



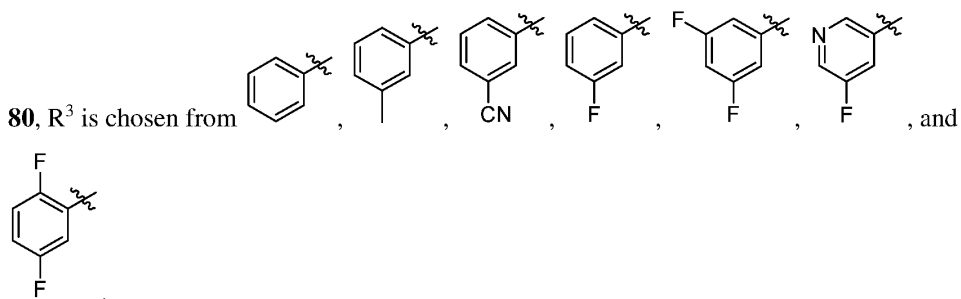
[085] Embodiment **79**: in some embodiments, such as, the compound of Embodiment



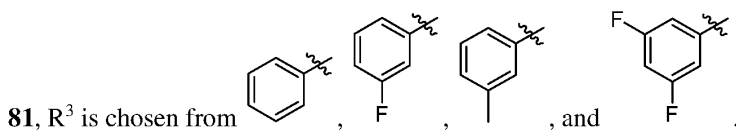
[086] Embodiment **80**: in some embodiments, such as, the compound of Embodiment



[087] Embodiment **81**: in some embodiments, such as, the compound of Embodiment



[088] Embodiment **82**: in some embodiments, such as, the compound of Embodiment



[089] Embodiment **83**: in some embodiments, such as, the compound of Embodiment

56, R^3 is chosen from aryl and heteroaryl.

[090] Embodiment **84**: in some embodiments, such as, the compound of Embodiment

83, R^3 is chosen from phenyl and pyridinyl.

[091] Embodiment **85**: in some embodiments, such as, the compound of Embodiment **84**, R^3 is phenyl.

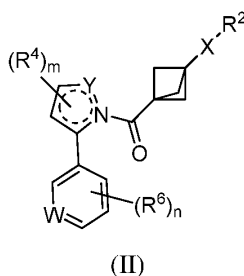
[092] Embodiment **86**: in some embodiments, such as, the compound of Embodiment **56**, R^3 is chosen from (aryl)oxy and (heteroaryl)oxy.

[093] Embodiment **87**: in some embodiments, such as, the compound of Embodiment **86**, R^3 is phenoxy.

[094] Embodiment **88**: in some embodiments, such as, the compound of any one of Embodiments **83 – 87**, R^6 is halo.

[095] Embodiment **89**: in some embodiments, such as, the compound of any one of Embodiments **83 – 87**, R^6 is fluoro.

[096] Also provided herein is Embodiment **90**, the compound of Embodiment **1** having structural Formula (II):



or a salt thereof, wherein:

m is chosen from 0, 1, and 2;

n is chosen from 0, 1, 2, and 3;

W is chosen from $C(R^{6a})$ and N ;

X is alkylene and is optionally substituted with one or more R^7 ,

or X is chosen from carbamoyl, carbonyl, and a bond;

Y is chosen from CH_2 , CH , NH , and N ;

Y and the intervening carbons and nitrogen combine to form heterocycloalkyl or heteroaryl;

R^2 is chosen from hydrogen, hydroxy, cyano, and halo,

or R^2 is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl,

alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy,

(alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl,

(alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R⁵; each R⁴ is independently chosen from halo, cyano, and hydroxy; each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with one or more alkyl; two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl; each R⁶ is independently chosen from halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; R^{6a} is chosen from H, halo, alkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and each R⁷ is independently chosen from alkyl, cyano, halo, and hydroxy.

[0097] Embodiment **91**: in some embodiments, such as, the compound of Embodiment **90**, m is chosen from 0 and 1.

[0098] Embodiment **92**: in some embodiments, such as, the compound of Embodiment **91**, m is 1.

[0099] Embodiment **93**: in some embodiments, such as, the compound of Embodiment **91**, m is 0.

[0100] Embodiment **94**: in some embodiments, such as, the compound of any one of Embodiments **90** – **93**, n is chosen from 0, 1, and 2.

[0101] Embodiment **95**: in some embodiments, such as, the compound of Embodiment **94**, n is chosen from 0 and 1.

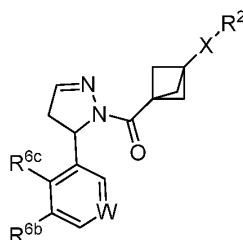
[0102] Embodiment **96**: in some embodiments, such as, the compound of Embodiment **94**, n is chosen from 1 and 2.

[0103] Embodiment **97**: in some embodiments, such as, the compound of Embodiment **95**, n is 1.

[0104] Embodiment **98**: in some embodiments, such as, the compound of any one of Embodiments **90** – **97**, R^{6a} is chosen from H, halo, alkyl, cyano, alkoxy, hydroxy, haloalkyl, and haloalkoxy.

- [0105] Embodiment **99**: in some embodiments, such as, the compound of Embodiment **98**, R^{6a} is chosen from H, fluoro, chloro, methyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, and trifluoromethoxy.
- [0106] Embodiment **100**: in some embodiments, such as, the compound of Embodiment **99**, R^{6a} is chosen from H, fluoro, methyl, cyano, and methoxy.
- [0107] Embodiment **101**: in some embodiments, such as, the compound of Embodiment **100**, R^{6a} is chosen from H and fluoro.
- [0108] Embodiment **102**: in some embodiments, such as, the compound of Embodiment **100**, R^{6a} is H.
- [0109] Embodiment **103**: in some embodiments, such as, the compound of any one of Embodiments **90 – 97**, R^{6a} is chosen from H, fluoro, chloro, methyl, cyclopropyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, hydroxymethyl, and trifluoromethoxy.
- [0110] Embodiment **104**: in some embodiments, such as, the compound of Embodiment **103**, R^{6a} is chosen from H, fluoro, methyl, cyclopropyl, cyano, hydroxymethyl, and methoxy.
- [0111] Embodiment **105**: in some embodiments, such as, the compound of any one of Embodiments **90 – 104**, each R^6 is independently chosen from halo, alkyl, cyano, alkoxy, hydroxy, haloalkyl, and haloalkoxy.
- [0112] Embodiment **106**: in some embodiments, such as, the compound of Embodiment **105**, each R^6 is independently chosen from fluoro, chloro, methyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, and trifluoromethoxy.
- [0113] Embodiment **107**: in some embodiments, such as, the compound of Embodiment **106**, each R^6 is independently chosen from fluoro, methyl, cyano, and methoxy.
- [0114] Embodiment **108**: in some embodiments, such as, the compound of any one of Embodiments **90 – 104**, each R^6 is independently chosen from halo, C_{1-6} alkyl, C_{3-7} cycloalkyl, cyano, C_{1-6} alkoxy, hydroxy, C_{1-6} haloalkyl, C_{1-6} hydroxyalkyl, and C_{1-6} haloalkoxy.
- [0115] Embodiment **109**: in some embodiments, such as, the compound of Embodiment **108**, each R^6 is independently chosen from fluoro, chloro, methyl, cyclopropyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, hydroxymethyl, and trifluoromethoxy.
- [0116] Embodiment **110**: in some embodiments, such as, the compound of Embodiment **109**, each R^6 is independently chosen from fluoro, methyl, cyclopropyl, cyano, hydroxymethyl, and methoxy.
- [0117] Embodiment **111**: in some embodiments, such as, the compound of Embodiment **95**, n is 0.

[0118] Also provided herein is Embodiment **112**, the compound of Embodiment **90** having structural Formula (III):



(III)

or a salt thereof, wherein:

W is chosen from C(R^{6a}) and N;

X is alkylene and is optionally substituted with one or more R⁷,

or X is chosen from carbamoyl, carbonyl, and a bond;

R² is chosen from hydrogen, hydroxy, cyano, and halo,

or R² is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl, (alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R⁵;

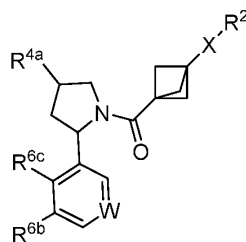
each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with one or more alkyl;

two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;

R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and

each R⁷ is independently chosen from alkyl, cyano, halo, and hydroxy.

[0119] Also provided herein is Embodiment **113**: the compound of Embodiment **90** having structural Formula (IV):



(IV)

or a salt thereof, wherein:

W is chosen from C(R^{6a}) and N;

X is alkylene and is optionally substituted with one or more R⁷,

or X is chosen from carbamoyl, carbonyl, and a bond;

R² is chosen from hydrogen, hydroxy, cyano, and halo,

or R² is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl, (alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R⁵;

R^{4a} is chosen from H, halo, cyano, and hydroxy;

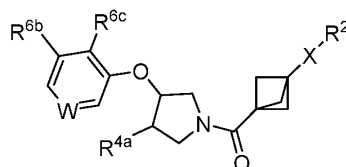
each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with alkyl;

two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;

R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and

each R⁷ is independently chosen from alkyl, cyano, halo, and hydroxy.

[0120] Also provided herein is Embodiment **114**: the compound of Embodiment **1** having structural Formula (V):



(V)

or a salt thereof, wherein:

W is chosen from C(R^{6a}) and N;

X is alkylene and is optionally substituted with one or more R⁷,

or X is chosen from carbamoyl, carbonyl, and a bond;

R² is chosen from hydrogen, hydroxy, cyano, and halo,

or R² is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl, (alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with one or more R⁵;

R^{4a} is chosen from H, halo, cyano, and hydroxy;

each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with alkyl;

two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;

R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and

each R⁷ is independently chosen from alkyl, cyano, halo, and hydroxy.

[0121] Embodiment **115**: in some embodiments, such as, the compound of any one of Embodiments **112** – **114**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, C₁₋₆alkyl, cyano, C₁₋₆alkoxy, hydroxy, C₁₋₆haloalkyl, C₁₋₆hydroxyalkyl, and C₁₋₆haloalkoxy.

[0122] Embodiment **116**: in some embodiments, such as, the compound of Embodiment **115**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, chloro, methyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, hydroxymethyl, and trifluoromethoxy.

[0123] Embodiment **117**: in some embodiments, such as, the compound of Embodiment **116**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, methyl, cyano, hydroxymethyl, and methoxy.

[0124] Embodiment **118**: in some embodiments, such as, the compound of Embodiment **117**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, methyl, cyano, and methoxy.

[0125] Embodiment **119**: in some embodiments, such as, the compound of Embodiment **118**, R^{6a} , R^{6b} , and R^{6c} are independently chosen from H and fluoro.

[0126] Embodiment **120**: in some embodiments, such as, the compound of any one of Embodiments **112 – 119**, exactly one of R^{6a} , R^{6b} , and R^{6c} is H.

[0127] Embodiment **121**: in some embodiments, such as, the compound of Embodiment **120**, R^{6b} is H.

[0128] Embodiment **122**: in some embodiments, such as, the compound of Embodiment **120**, R^{6c} is H.

[0129] Embodiment **123**: in some embodiments, such as, the compound of any one of Embodiments **112 – 119**, exactly two of R^{6a} , R^{6b} , and R^{6c} are H.

[0130] Embodiment **124**: in some embodiments, such as, the compound of any one of Embodiments **112 – 119**, W is C(R^{6a}).

[0131] Embodiment **125**: in some embodiments, such as, the compound of Embodiment **124**, R^{6a} is H.

[0132] Embodiment **126**: in some embodiments, such as, the compound of any one of Embodiments **112 – 119**, W is N.

[0133] Embodiment **127**: in some embodiments, such as, the compound of either one of Embodiments **125** and **126**, exactly one of R^{6b} and R^{6c} is H.

[0134] Embodiment **128**: in some embodiments, such as, the compound of either one of Embodiments **125** and **126**, R^{6b} and R^{6c} are H.

[0135] Embodiment **129**: in some embodiments, such as, the compound of any one of Embodiments **112 – 128**, R^{4a} is chosen from H, halo, and cyano.

[0136] Embodiment **130**: in some embodiments, such as, the compound of Embodiment **129**, R^{4a} is chosen from H and fluoro.

[0137] Embodiment **131**: in some embodiments, such as, the compound of Embodiment **130**, R^{4a} is fluoro.

[0138] Embodiment **132**: in some embodiments, such as, the compound of Embodiment **129**, R^{4a} is H.

[0139] Embodiment **133**: in some embodiments, such as, the compound of any one of Embodiments **1 – 132**, R^2 is chosen from alkyl, amino, cycloalkyl, heterocycloalkyl, aryl, heteroaryl, alkoxy, (cycloalkyl)oxy, (heterocycloalkyl)oxy, (aryl)oxy, (heteroaryl)oxy, (alkyl)carbonyl, (cycloalkyl)carbonyl, (heterocycloalkyl)carbonyl, (aryl)carbonyl,

(alkyl)amino, (cycloalkyl)amino, (heterocycloalkyl)amino, (aryl)amino, and (heteroaryl)amino, any of which is optionally substituted with 1, 2, or 3 R⁵.

[0140] Embodiment **134**: in some embodiments, such as, the compound of Embodiment **133**:

each R⁵ is independently chosen from halo, cyano, -CONH₂, -CONHCH₃, -CON(CH₃)₂, C₁₋₆alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₃₋₇cycloalkyl, C₁₋₆haloalkyl, oxo, P(O)(CH₃)₂, and SO₂CH₃; and two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl.

[0141] Embodiment **135**: in some embodiments, such as, the compound of Embodiment **134**:

each R⁵ is independently chosen from fluoro, chloro, cyano, C₁₋₆alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₃₋₇cycloalkyl, and trifluoromethyl; and two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl.

[0142] Embodiment **136**: in some embodiments, such as, the compound of Embodiment **135**:

each R⁵ is independently chosen from fluoro, cyano, methyl, methoxy, hydroxymethyl, methoxymethyl, cyclopropyl, and trifluoromethyl; and two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl.

[0143] Embodiment **137**: in some embodiments, such as, the compound of Embodiment **133**, each R⁵ is independently chosen from halo, cyano, -CONH₂, -CONHCH₃, -CON(CH₃)₂, C₁₋₆alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₃₋₇cycloalkyl, C₁₋₆haloalkyl, oxo, P(O)(CH₃)₂, and SO₂CH₃.

[0144] Embodiment **138**: in some embodiments, such as, the compound of Embodiment **137**, each R⁵ is independently chosen from fluoro, chloro, cyano, C₁₋₆alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₃₋₇cycloalkyl, and trifluoromethyl.

[0145] Embodiment **139**: in some embodiments, such as, the compound of Embodiment **138**, each R⁵ is independently chosen from fluoro, cyano, methyl, methoxy, hydroxymethyl, methoxymethyl, cyclopropyl, and trifluoromethyl.

[0146] Embodiment **140**: in some embodiments, such as, the compound of Embodiment **137**, each R⁵ is independently chosen from F, Cl, Br, CN, CONH₂, methyl, methoxy, P(O)(CH₃)₂, and (methyl)pyrazolyl.

[0147] Embodiment **141**: in some embodiments, such as, the compound of Embodiment **140**, each R^5 is independently chosen from F, methyl, CN, and methoxy.

[0148] Embodiment **142**: in some embodiments, such as, the compound of Embodiment **141**, each R^5 is independently chosen from F, methyl, and CN.

[0149] Embodiment **143**: in some embodiments, such as, the compound of Embodiment **142**, each R^5 is CN.

[0150] Embodiment **144**: in some embodiments, such as, the compound of Embodiment **133**, R^5 is heteroaryl optionally substituted with 1 or 2 alkyl.

[0151] Embodiment **145**: in some embodiments, such as, the compound of Embodiment **144**, R^5 is chosen from pyrrole, pyrazole, and imidazole, any of which is optionally substituted with 1 alkyl.

[0152] Embodiment **146**: in some embodiments, such as, the compound of Embodiment **144**, R^5 is chosen from pyridine, pyridazine, pyrimidine, and pyrazine, any of which is optionally substituted with 1 alkyl.

[0153] Embodiment **147**: in some embodiments, such as, the compound of Embodiment **144**, R^5 is heteroaryl optionally substituted with 1 methyl.

[0154] Embodiment **148**: in some embodiments, such as, the compound of any one of Embodiments **133 – 147**, R^2 is chosen from aryl, heteroaryl, (aryl)oxy, and (heteroaryl)oxy.

[0155] Embodiment **149**: in some embodiments, such as, the compound of Embodiment **148**, R^2 is chosen from aryl and heteroaryl.

[0156] Embodiment **150**: in some embodiments, such as, the compound of Embodiment **148**, R^2 is chosen from (aryl)oxy and (heteroaryl)oxy.

[0157] Embodiment **151**: in some embodiments, such as, the compound of any one of Embodiments **133 – 147**, R^2 is chosen from C_{1-6} alkyl, NH_2 , $NH(C_{1-6}alkyl)$, $N(C_{1-6}alkyl)_2$, C_{3-7} cycloalkyl, 3-7 membered heterocycloalkyl, $C_{6-10}aryl$, 5-10 membered heteroaryl, $C_{1-6}alkoxy$, $(C_{3-7}cycloalkyl)oxy$, (3-7 membered heterocycloalkyl)oxy, $(C_{6-10}aryl)oxy$, (5-10 membered heteroaryl)oxy, $(C_{1-6}alkyl)carbonyl$, $(C_{3-7}cycloalkyl)carbonyl$, (3-7 membered heterocycloalkyl)carbonyl, $(C_{6-10}aryl)carbonyl$, $NH(C_{1-6}alkyl)$, $NH(C_{3-7}cycloalkyl)$, $NH(3-7 membered heterocycloalkyl)$, $NH(C_{6-10}aryl)$, and $NH(5-10 membered heteroaryl)$.

[0158] Embodiment **152**: in some embodiments, such as, the compound of Embodiment **151**, R^2 is chosen from NH_2 , $NH(C_{1-6}alkyl)$, $N(C_{1-6}alkyl)_2$, $NH(C_{3-7}cycloalkyl)$, $NH(3-7 membered heterocycloalkyl)$, $NH(C_{6-10}aryl)$, and $NH(5-10 membered heteroaryl)$.

[0159] Embodiment **153**: in some embodiments, such as, the compound of Embodiment **152**, R^2 is chosen from NH_2 , $NH(C_{1-6}alkyl)$, $NH(C_{6-10}aryl)$, and $NH(5-10\text{ membered heteroaryl})$.

[0160] Embodiment **154**: in some embodiments, such as, the compound of Embodiment **152**, R^2 is chosen from NH_2 , $NHCH_3$, $NH(phenyl)$, $NH(pyrimidin-2-yl)$, and $NH(pyrimidin-4-yl)$.

[0161] Embodiment **155**: in some embodiments, such as, the compound of Embodiment **151**, R^2 is 5-10 membered heteroaryl.

[0162] Embodiment **156**: in some embodiments, such as, the compound of Embodiment **151**, R^2 is chosen from pyrazol-1-yl, 1*H*-indazol-1-yl, 2*H*-indazol-2-yl, 1*H*-pyrazolo[3,4-*c*]pyridin-1-yl, imidazol-1-yl, benzo[*d*]imidazol-1-yl, 1*H*-1,2,3-triazol-1-yl, 2*H*-1,2,3-triazol-2-yl, 1*H*-benzo[*d*][1,2,3]triazol-1-yl, and 2*H*-benzo[*d*][1,2,3]triazol-2-yl.

[0163] Embodiment **157**: in some embodiments, such as, the compound of Embodiment **151**, R^2 is chosen from $C_{1-6}alkoxy$, $(C_{3-7}cycloalkyl)oxy$, (3-7 membered heterocycloalkyl)*oxy*, $(C_{6-10}aryl)oxy$, and (5-10 membered heteroaryl)*oxy*.

[0164] Embodiment **158**: in some embodiments, such as, the compound of Embodiment **157**, R^2 is chosen from $C_{1-6}alkoxy$, $(C_{3-7}cycloalkyl)oxy$, and (3-7 membered heterocycloalkyl)*oxy*.

[0165] Embodiment **159**: in some embodiments, such as, the compound of Embodiment **157**, R^2 is chosen from $(C_{6-10}aryl)oxy$, and (5-10 membered heteroaryl)*oxy*.

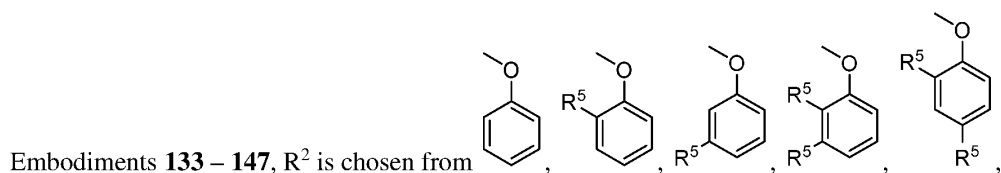
[0166] Embodiment **160**: in some embodiments, such as, the compound of any one of Embodiments **133 – 159**, R^2 is optionally substituted with 1 or 2 R^5 .

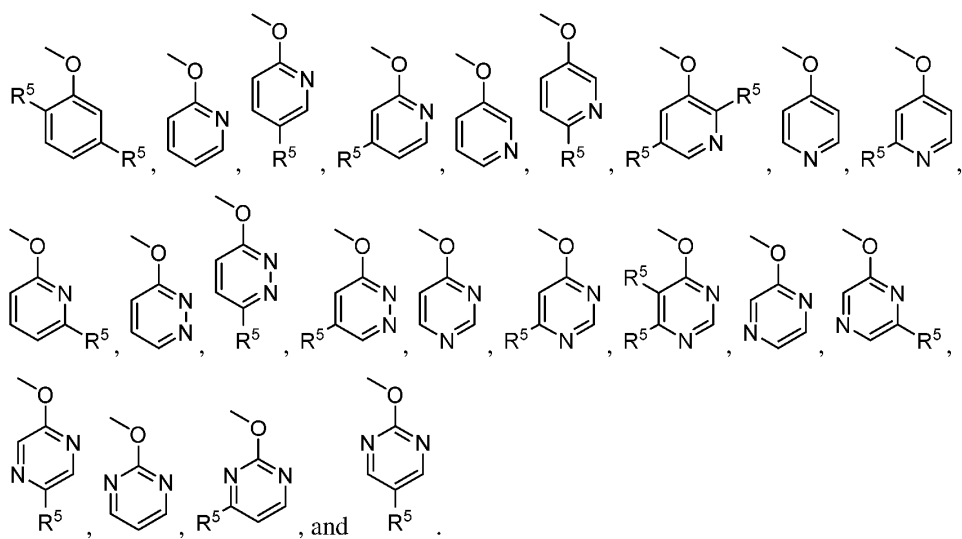
[0167] Embodiment **161**: in some embodiments, such as, the compound of Embodiment **160**, R^2 is optionally substituted with 1 R^5 .

[0168] Embodiment **162**: in some embodiments, such as, the compound of Embodiment **161**, R^2 is substituted with 1 R^5 .

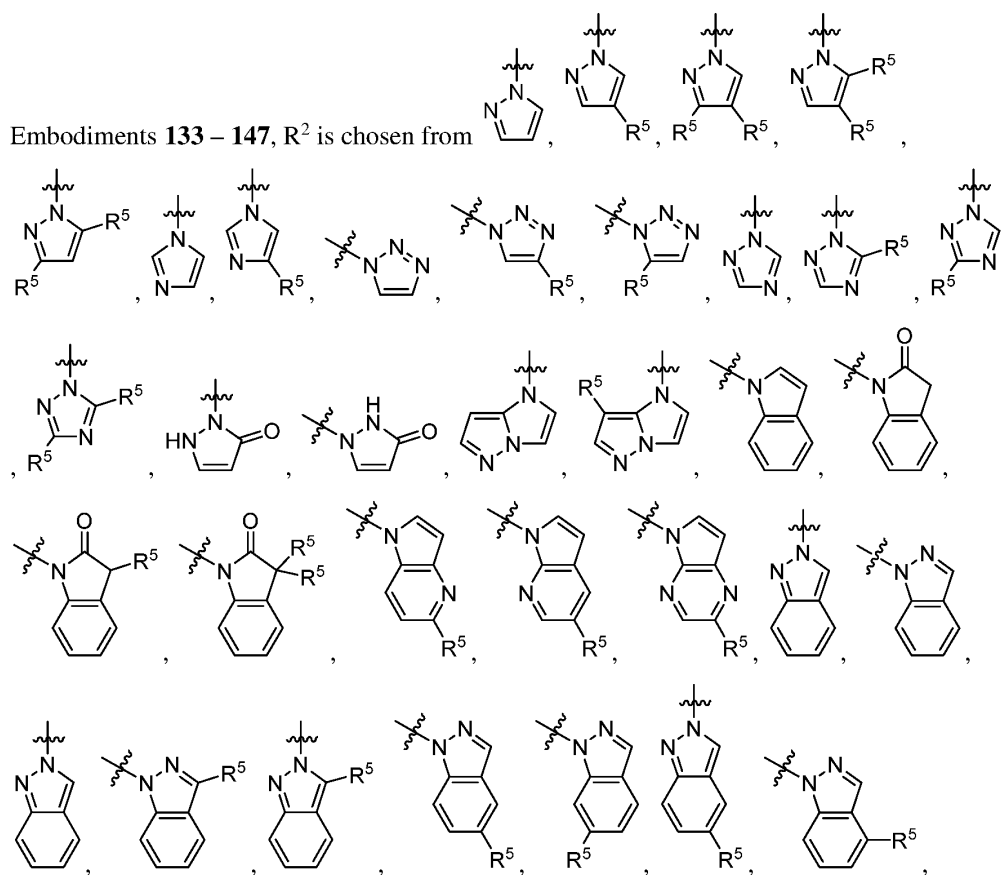
[0169] Embodiment **163**: in some embodiments, such as, the compound of Embodiment **161**, R^2 is unsubstituted with an R^5 .

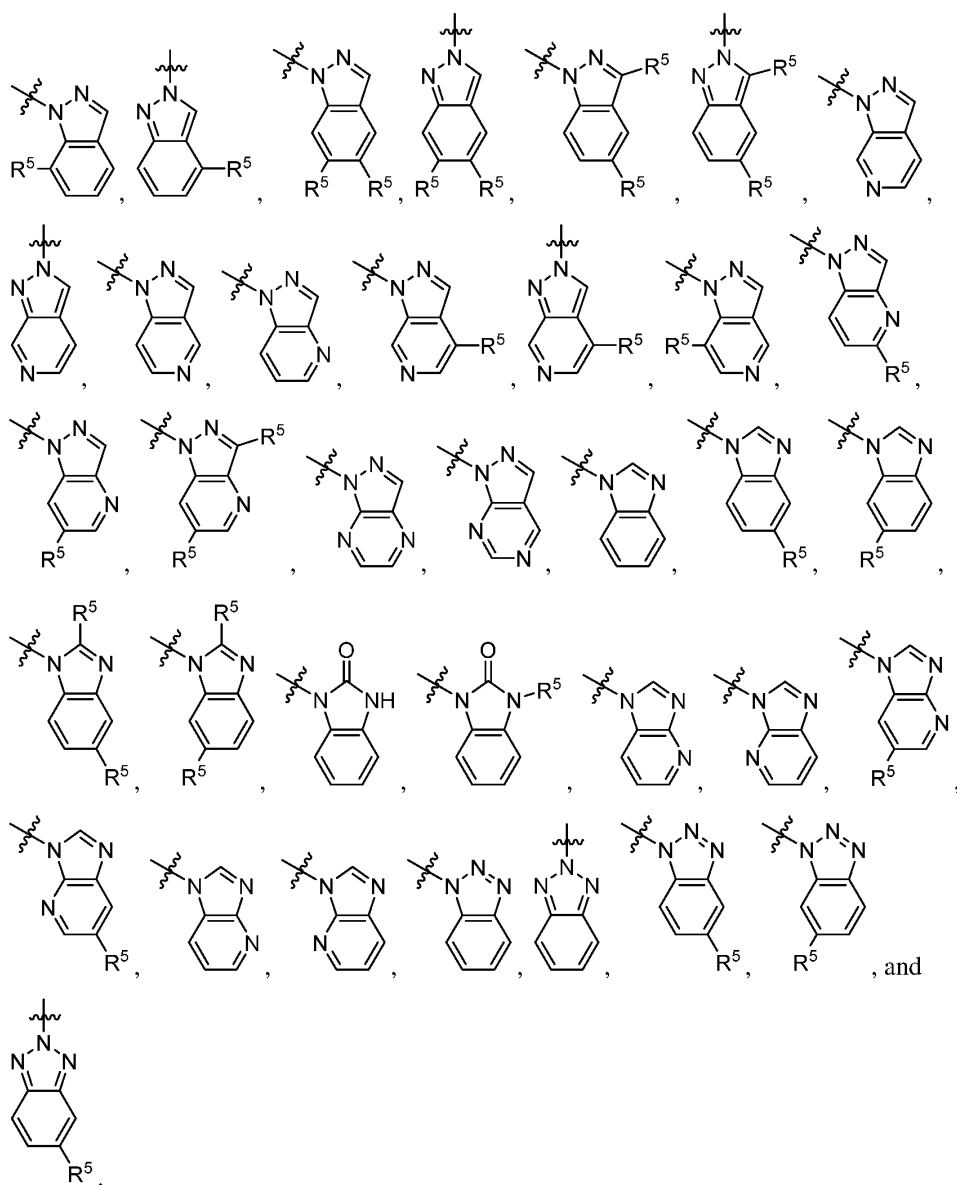
[0170] Embodiment **164**: in some embodiments, such as, the compound of any one of



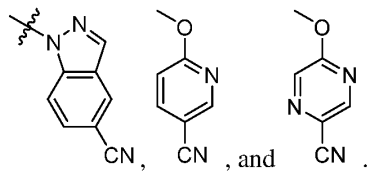


[0171] Embodiment **165**: in some embodiments, such as, the compound of any one of





[0172] Embodiment **166**: in some embodiments, such as, the compound of any one of



Embodiments **1** – **132**, R^2 is chosen from

[0173] Embodiment **167**: in some embodiments, such as, the compound of any one of Embodiments **1** – **132**, R^2 is chosen from H, hydroxy, cyano, and halo.

[0174] Embodiment **168**: in some embodiments, such as, the compound of Embodiment **167**, R^2 is chosen from fluoro and chloro.

[0175] Embodiment **169**: in some embodiments, such as, the compound of any one of Embodiments **133 – 168**, each R^7 is independently chosen from C_{1-6} alkyl, cyano, halo, and hydroxy.

[0176] Embodiment **170**: in some embodiments, such as, the compound of Embodiment **169**, each R^7 is independently chosen from $-CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH_2CH_2CH_2CH_3$, cyano, fluoro, chloro, and hydroxy.

[0177] Embodiment **171**: in some embodiments, such as, the compound of Embodiment **170**, each R^7 is independently chosen from CH_3 , cyano, fluoro, chloro, and hydroxy.

[0178] Embodiment **172**: in some embodiments, such as, the compound of any one of Embodiments **133 – 171**, X is alkylene and is optionally substituted with 1 R^7 .

[0179] Embodiment **173**: in some embodiments, such as, the compound of Embodiment **172**, X is C_{1-6} alkylene and is optionally substituted with 1 R^7 .

[0180] Embodiment **174**: in some embodiments, such as, the compound of Embodiment **172**, X is alkylene and is unsubstituted with an R^7 .

[0181] Embodiment **175**: in some embodiments, such as, the compound of Embodiment **173**, X is chosen from $-CH_2-$ and $-CHR^7-$.

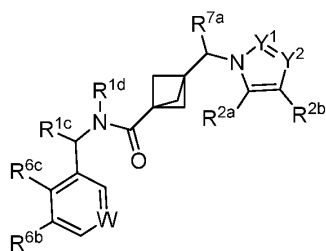
[0182] Embodiment **176**: in some embodiments, such as, the compound of Embodiment **172**, X is chosen from $-CH_2-$, $-CH(CH_3)-$, $-CHOH-$, and $-CHF-$.

[0183] Embodiment **177**: in some embodiments, such as, the compound of Embodiment **176**, X is $-CH_2-$.

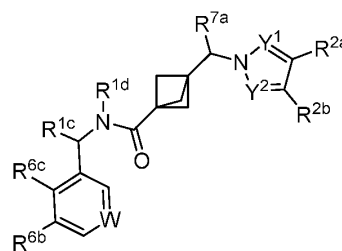
[0184] Embodiment **178**: in some embodiments, such as, the compound of any one of Embodiments **133 – 168**, X is carbamoyl.

[0185] Embodiment **179**: in some embodiments, such as, the compound of any one of Embodiments **133 – 168**, X is carbonyl.

[0186] Also provided herein is Embodiment **180**: the compound of Embodiment **90** having either structural Formula (VIa) or structural Formula (VIb):



(VIa)



(VIb)

or a salt thereof, wherein:

W is chosen from C(R^{6a}) and N;

Y¹ and Y² are independently chosen from CH, C(R⁵), and N;

R^{1c} and R^{1d}, together with the intervening carbon and nitrogen, combine to form a 5-membered heterocycloalkyl which is optionally substituted with one R⁴;

R^{2a} and R^{2b} are independently chosen from H, hydroxy, cyano, halo, and alkyl,

or R^{2a} and R^{2b} combine to form alkylene or heteroalkylene, either of which is optionally substituted with 1 or 2 R⁵;

R⁴ is chosen from halo, cyano, and hydroxy;

each R⁵ is independently chosen from halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, oxo, P(O)(CH₃)₂, SO₂CH₃, aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with alkyl;

two R⁵, together with the intervening atoms, optionally combine to form a cycloalkyl or heterocycloalkyl;

R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and

R^{7a} is chosen from H, alkyl, cyano, halo, and hydroxy.

[0187] Embodiment **181**: in some embodiments, such as, the compound of Embodiment **180**, Y¹ and Y² are independently chosen from CH, C(CH₃), and N.

[0188] Embodiment **182**: in some embodiments, such as, the compound of Embodiment **180**, Y¹ and Y² are independently chosen from CH and N.

[0189] Embodiment **183**: in some embodiments, such as, the compound of any one of Embodiments **180** – **182**, R^{2a} and R^{2b} combine to form alkylene or heteroalkylene chosen from -CH₂CH₂CH₂-, -CH=CH-CH=CH-, -N=CH-CH=CH-, -CH=N-CH=CH-, -CH=CH-

N=CH-, and

-CH=CH-CH=N-, any of which is optionally substituted with 1 or 2 R⁵.

[0190] Embodiment **184**: in some embodiments, such as, the compound of Embodiment **183**, R^{2a} and R^{2b} combine to form -CH=CH-CH=CH-, which is optionally substituted with 1 or 2 R⁵.

[0191] Embodiment **185**: in some embodiments, such as, the compound of any one of Embodiments **180** – **184**, each R⁵ is independently chosen from fluoro, chloro, cyano, C₁-alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, C₁₋₆alkoxyC₁₋₆alkyl, C₃₋₇cycloalkyl, and trifluoromethyl.

[0192] Embodiment **186**: in some embodiments, such as, the compound of Embodiment **185**, each R⁵ is independently chosen from fluoro, cyano, methyl, methoxy, hydroxymethyl, methoxymethyl, cyclopropyl, and trifluoromethyl.

[0193] Embodiment **187**: in some embodiments, such as, the compound of any one of Embodiments **180** – **186**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, halo, C₁₋₆alkyl, C₃₋₇cycloalkyl, cyano, C₁₋₆alkoxy, hydroxy, C₁₋₆haloalkyl, C₁₋₆hydroxyalkyl, and C₁₋₆haloalkoxy.

[0194] Embodiment **188**: in some embodiments, such as, the compound of Embodiment **187**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, chloro, methyl, cyclopropyl, cyano, methoxy, hydroxy, difluoromethyl, trifluoromethyl, hydroxymethyl, and trifluoromethoxy.

[0195] Embodiment **189**: in some embodiments, such as, the compound of Embodiment **188**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, methyl, cyclopropyl, cyano, hydroxymethyl, and methoxy.

[0196] Embodiment **190**: in some embodiments, such as, the compound of Embodiment **189**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H, fluoro, methyl, cyano, and methoxy.

[0197] Embodiment **191**: in some embodiments, such as, the compound of Embodiment **190**, R^{6a}, R^{6b}, and R^{6c} are independently chosen from H and fluoro.

[0198] Embodiment **192**: in some embodiments, such as, the compound of any one of Embodiments **180** – **191**, exactly one of R^{6a}, R^{6b}, and R^{6c} is H.

[0199] Embodiment **193**: in some embodiments, such as, the compound of Embodiment **120**, R^{6b} is H.

[0200] Embodiment **194**: in some embodiments, such as, the compound of Embodiment **120**, R^{6c} is H.

[0201] Embodiment **195**: in some embodiments, such as, the compound of any one of Embodiments **112** – **119**, exactly two of R^{6a}, R^{6b}, and R^{6c} are H.

Y and the intervening carbons and nitrogen combine to form heterocycloalkyl;
 Y^1 is chosen from $C(R^{5b})$ and N;
 Y^2 is chosen from $C(R^{5c})$ and N;
 Z is chosen from O, NH, and $N(CH_3)$;
 R^{1c} and R^{1d} , together with the intervening carbon and nitrogen, combine to form a 5-membered heterocycloalkyl which is optionally substituted with one R^4 ;
 R^{2a} and R^{2b} are independently chosen from H, hydroxy, cyano, halo, and alkyl, or R^{2a} and R^{2b} combine to form alkylene or heteroalkylene, either of which is optionally substituted with 1 or 2 R^5 ;
 R^{4a} is chosen from H, halo, cyano, and hydroxy;
 R^{5a} , R^{5b} , R^{5c} , and R^{5d} are independently chosen from H, halo, cyano, amido, alkyl, alkoxy, cyanoalkyl, hydroxyalkyl, alkoxyalkyl, cycloalkyl, haloalkyl, $P(O)(CH_3)_2$, SO_2CH_3 , aryl optionally substituted with one or more alkyl, and heteroaryl optionally substituted with alkyl;
 R^{6a} , R^{6b} , R^{6c} , R^{6d} , and R^{6e} are independently chosen from H, halo, alkyl, cycloalkyl, cyano, alkoxy, hydroxy, haloalkyl, hydroxyalkyl, and haloalkoxy; and
 R^{7a} is chosen from H, alkyl, cyano, halo, and hydroxy.

[0211] Embodiment **205**: in some embodiments, such as, the compound of Embodiment **204**, the heterocycloalkyl formed by Y and the intervening carbons and nitrogen is chosen from pyrazoline and pyrrolidine.

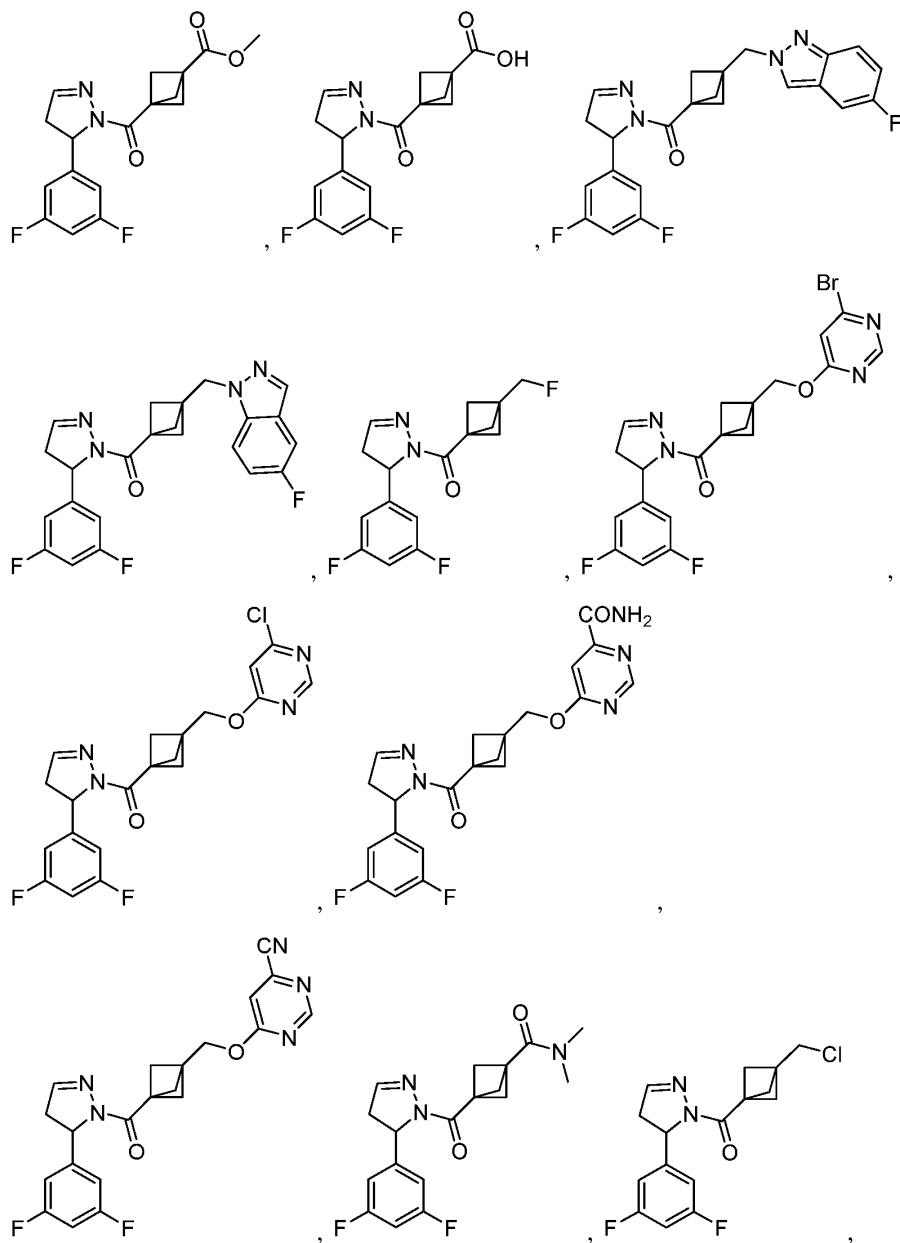
[0212] Embodiment **206**: in some embodiments, such as, the compound of either one of Embodiments **204** and **205**, R^{5a} , R^{5b} , R^{5c} , and R^{5d} are independently chosen from H, halo, cyano, $CONH_2$, C_{1-6} alkyl, C_{1-6} alkoxy, cyano C_{1-6} alkyl, hydroxy C_{1-6} alkyl, C_{1-6} alkoxy C_{1-6} alkyl, C_{3-7} cycloalkyl, halo C_{1-6} alkyl, $P(O)(CH_3)_2$, SO_2CH_3 , and 5- to 7-membered heteroaryl optionally substituted with methyl.

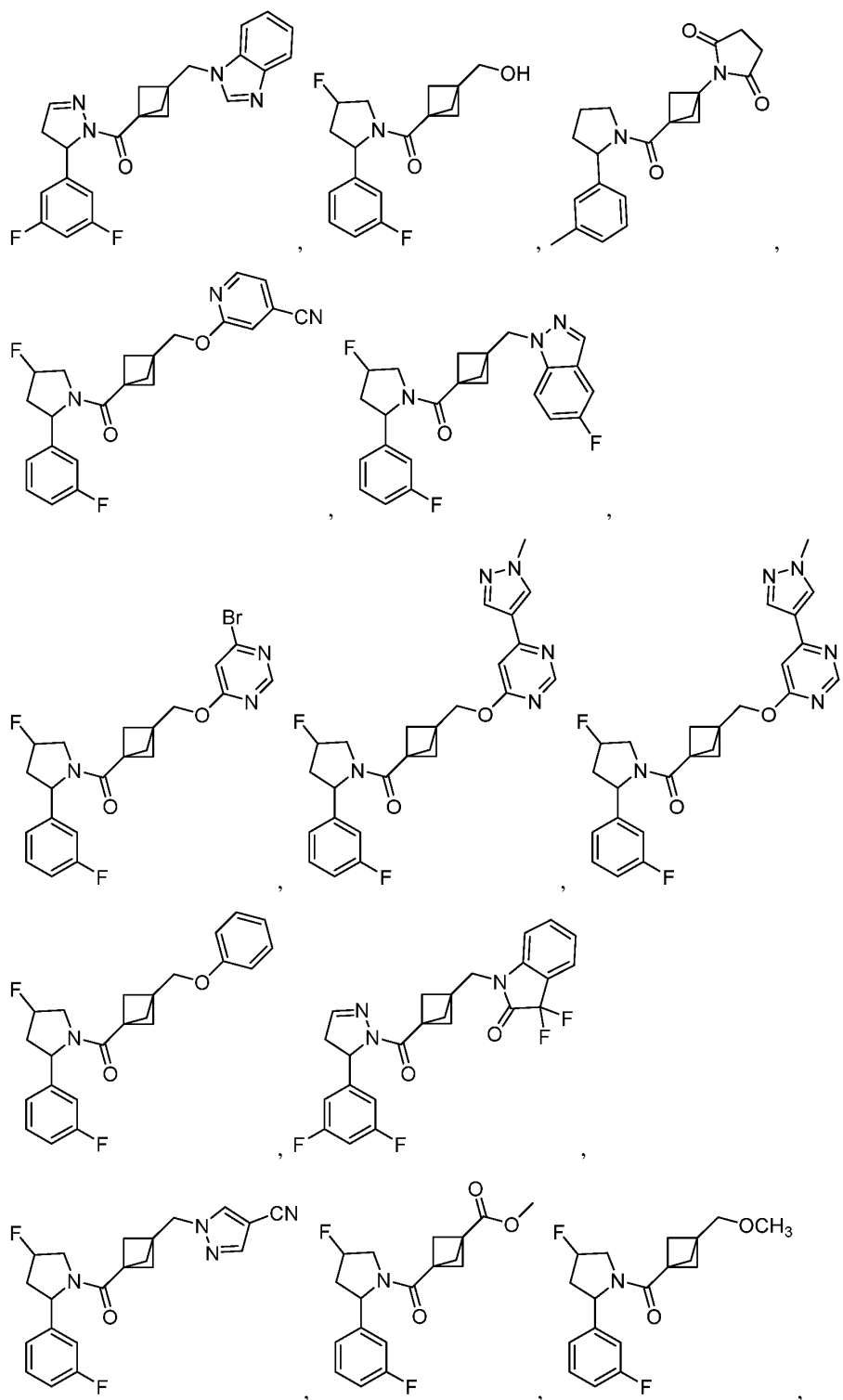
[0213] Embodiment **207**: in some embodiments, such as, the compound of Embodiment **206**, R^{5a} , R^{5b} , R^{5c} , and R^{5d} are independently chosen from H, halo, cyano, $CONH_2$, methyl, methoxy, and (methyl)pyrazolyl.

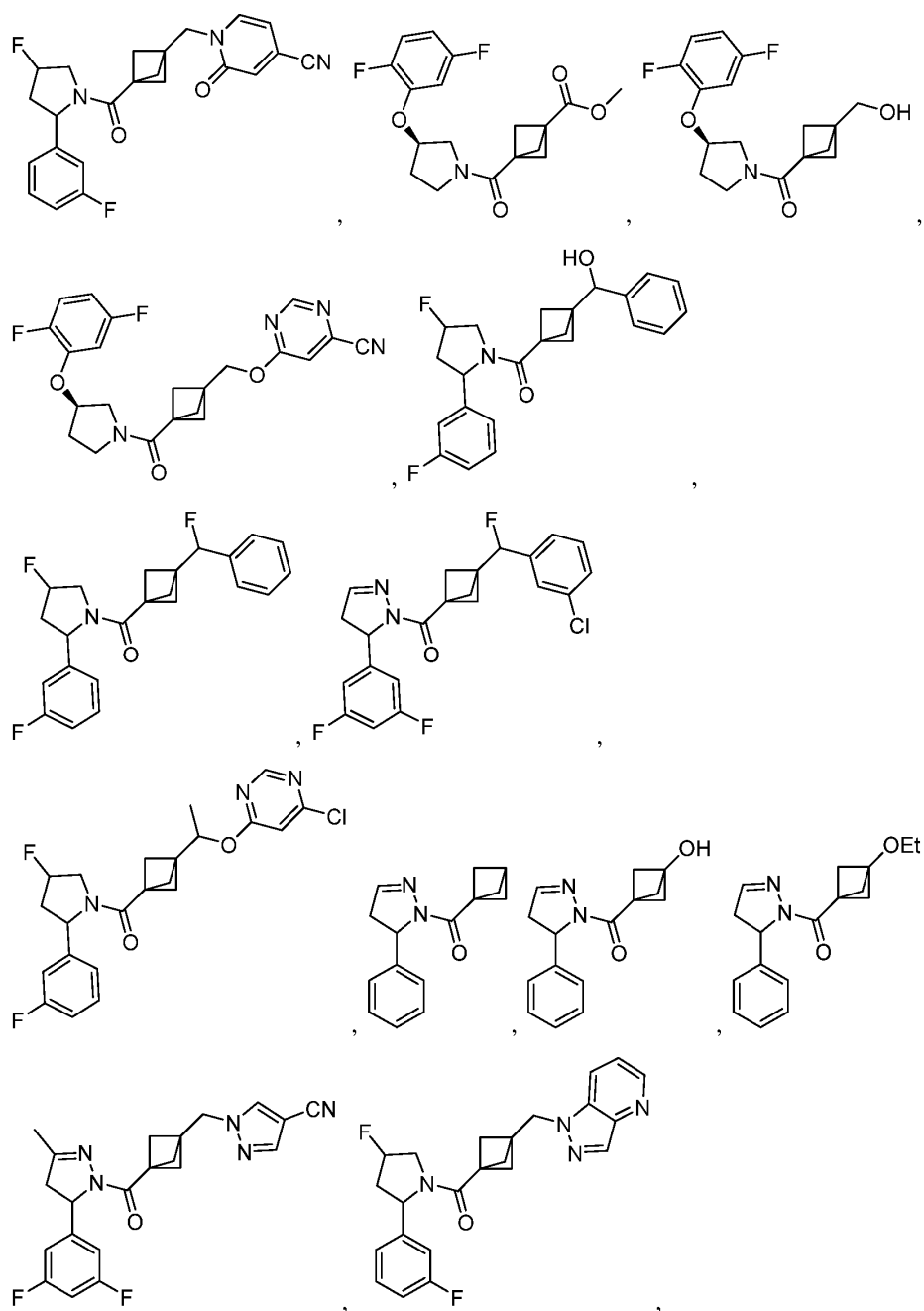
[0214] Embodiment **208**: in some embodiments, such as, the compound of any one of Embodiments **204** – **207**, at least one of R^{5a} and R^{5d} is H.

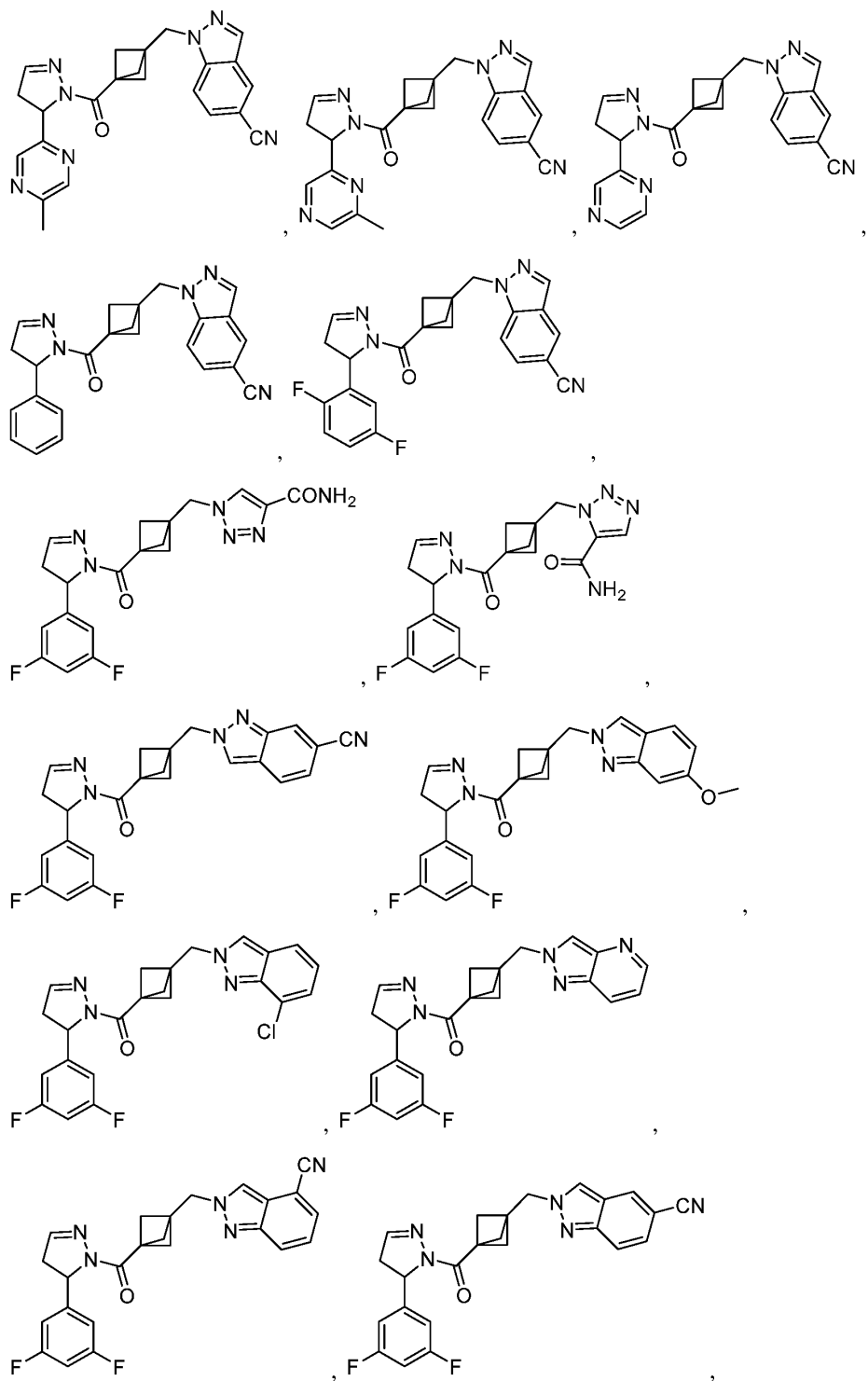
[0215] Embodiment **209**: in some embodiments, such as, the compound of Embodiment **208**, R^{5a} and R^{5d} are H.

- [0216] Embodiment **210**: in some embodiments, such as, the compound of any one of Embodiments **204 – 209**, at most one of Y^1 and Y^2 is N.
- [0217] Embodiment **211**: in some embodiments, such as, the compound of any one of Embodiments **204 – 210**, Y^1 is $C(R^{5b})$.
- [0218] Embodiment **212**: in some embodiments, such as, the compound of any one of Embodiments **204 – 211**, Y^2 is $C(R^{5c})$.
- [0219] Embodiment **213**: in some embodiments, such as, the compound of any one of Embodiments **204 – 212**, R^{6a} , R^{6b} , R^{6c} , R^{6d} , and R^{6e} are independently chosen from H, halo, methyl, cyclopropyl, cyano, methoxy, hydroxy, halomethyl, hydroxymethyl and halomethoxy.
- [0220] Embodiment **214**: in some embodiments, such as, the compound of Embodiment **213**, R^{6a} , R^{6b} , R^{6c} , R^{6d} , and R^{6e} are independently chosen from H, halo, methyl, cyclopropyl, cyano, and hydroxymethyl.
- [0221] Embodiment **215**: in some embodiments, such as, the compound of Embodiment **214**, R^{6a} , R^{6b} , R^{6c} , R^{6d} , and R^{6e} are independently chosen from H, fluoro, and methyl.
- [0222] Embodiment **216**: in some embodiments, such as, the compound of any one of Embodiments **204 – 215**, at least one of R^{6a} , R^{6c} , and R^{6d} is H.
- [0223] Embodiment **217**: in some embodiments, such as, the compound of Embodiment **216**, at least two of R^{6a} , R^{6c} , and R^{6d} are H.
- [0224] Embodiment **218**: in some embodiments, such as, the compound of Embodiment **217**, R^{6a} , R^{6c} , and R^{6d} are H.
- [0225] Embodiment **219**: in some embodiments, such as, the compound of any one of Embodiments **204 – 218**, at most one of W^1 and W^2 is N.
- [0226] Embodiment **220**: in some embodiments, such as, the compound of any one of Embodiments **204 – 219**, W^1 is $C(R^{6b})$.
- [0227] Embodiment **221**: in some embodiments, such as, the compound of Embodiment **220**, W^1 is chosen from CH and CF.
- [0228] Embodiment **222**: in some embodiments, such as, the compound of any one of Embodiments **204 – 221**, W^2 is $C(R^{6e})$.
- [0229] Embodiment **223**: in some embodiments, such as, the compound of Embodiment **222**, W^2 is chosen from CH and CF.
- [0230] Embodiment **224**: in some embodiments, the compound is chosen from:



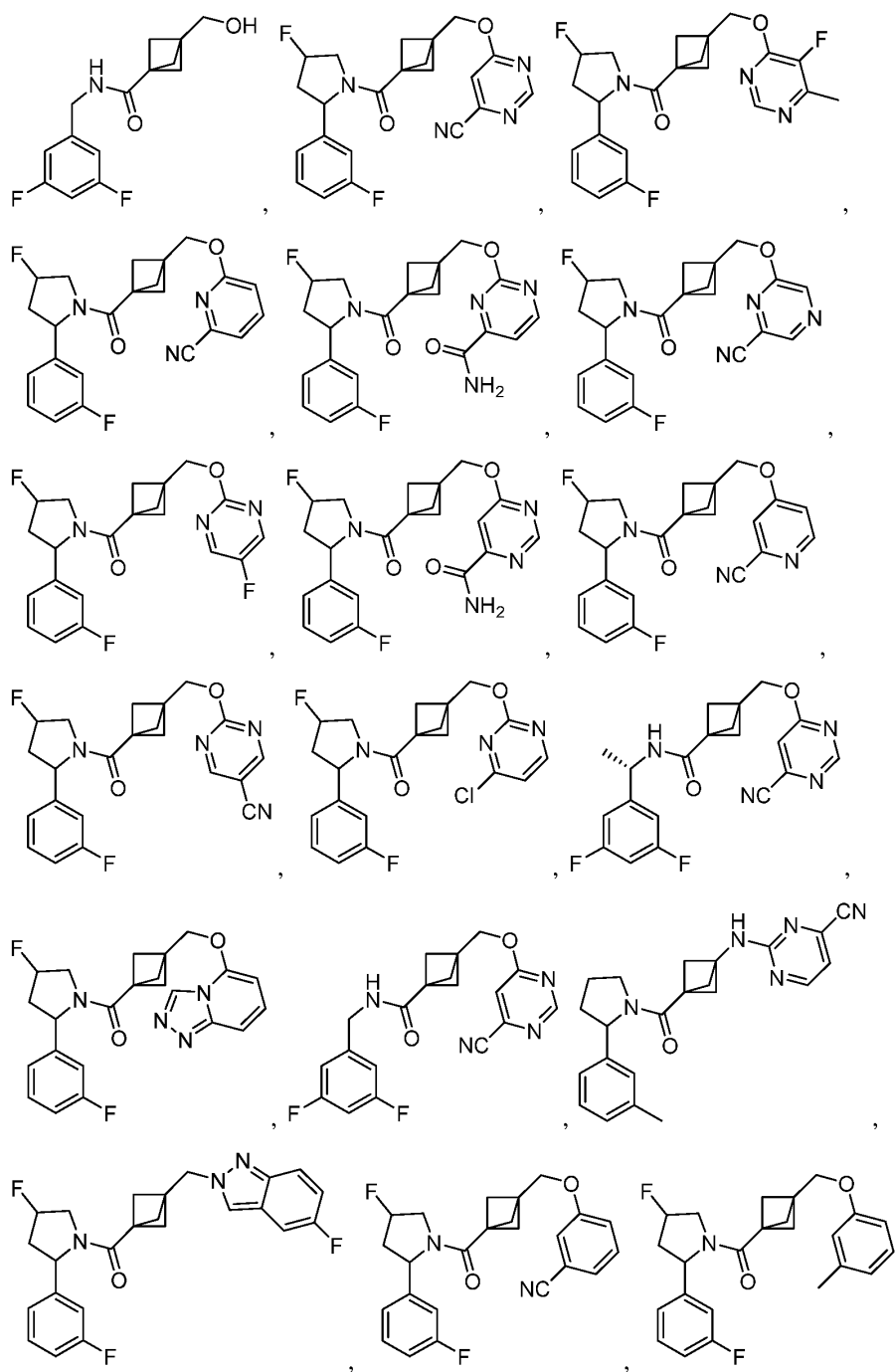


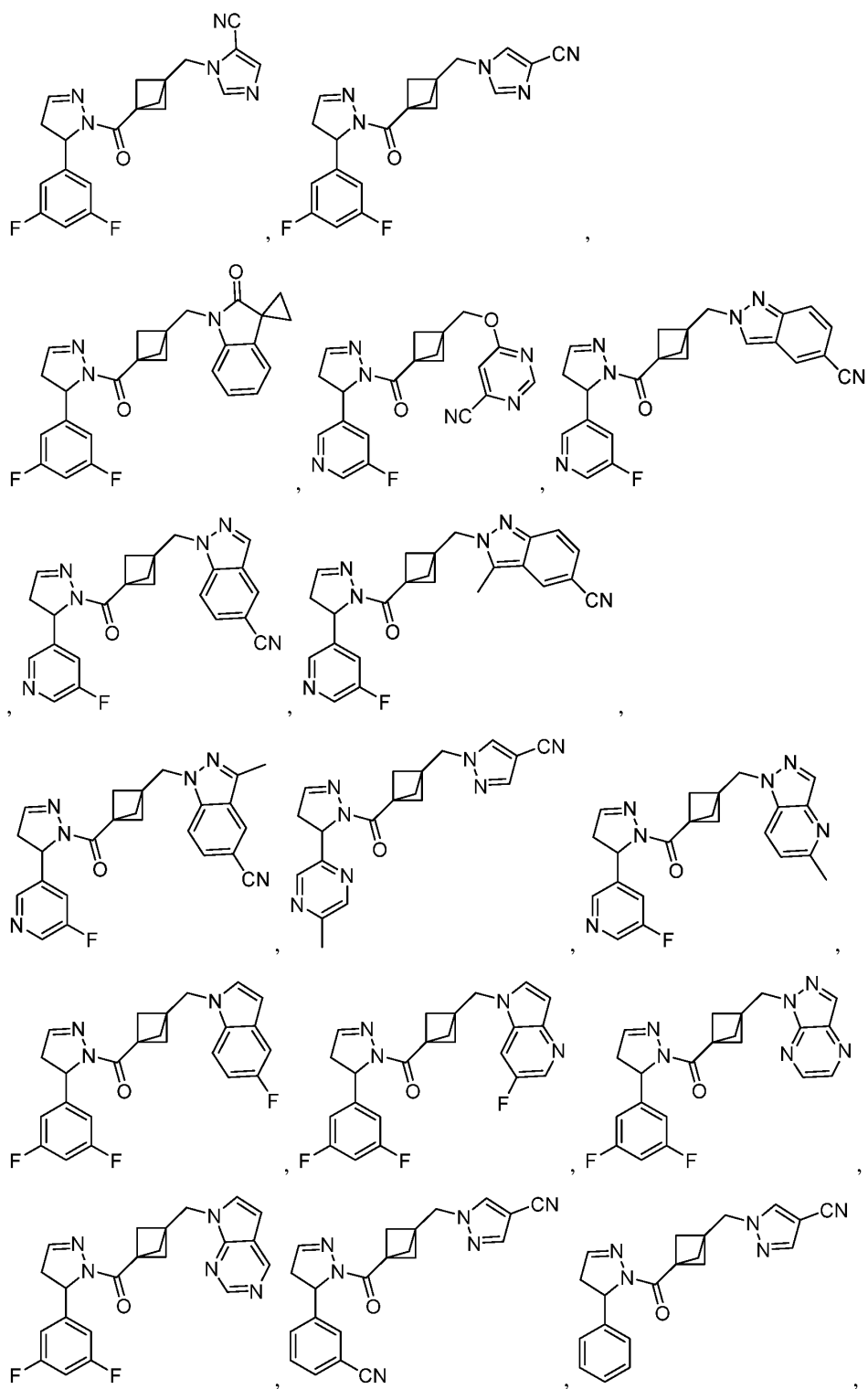


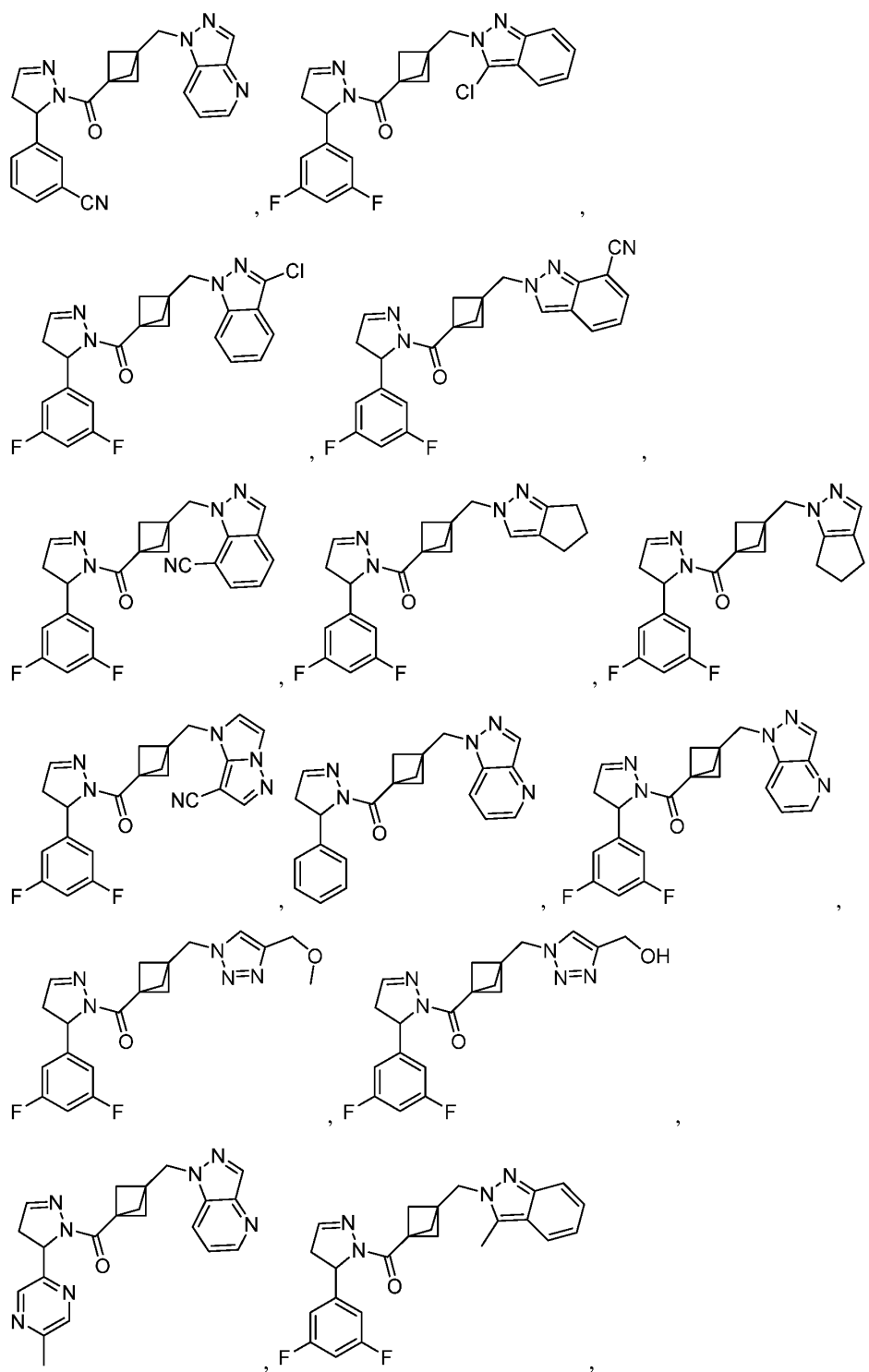


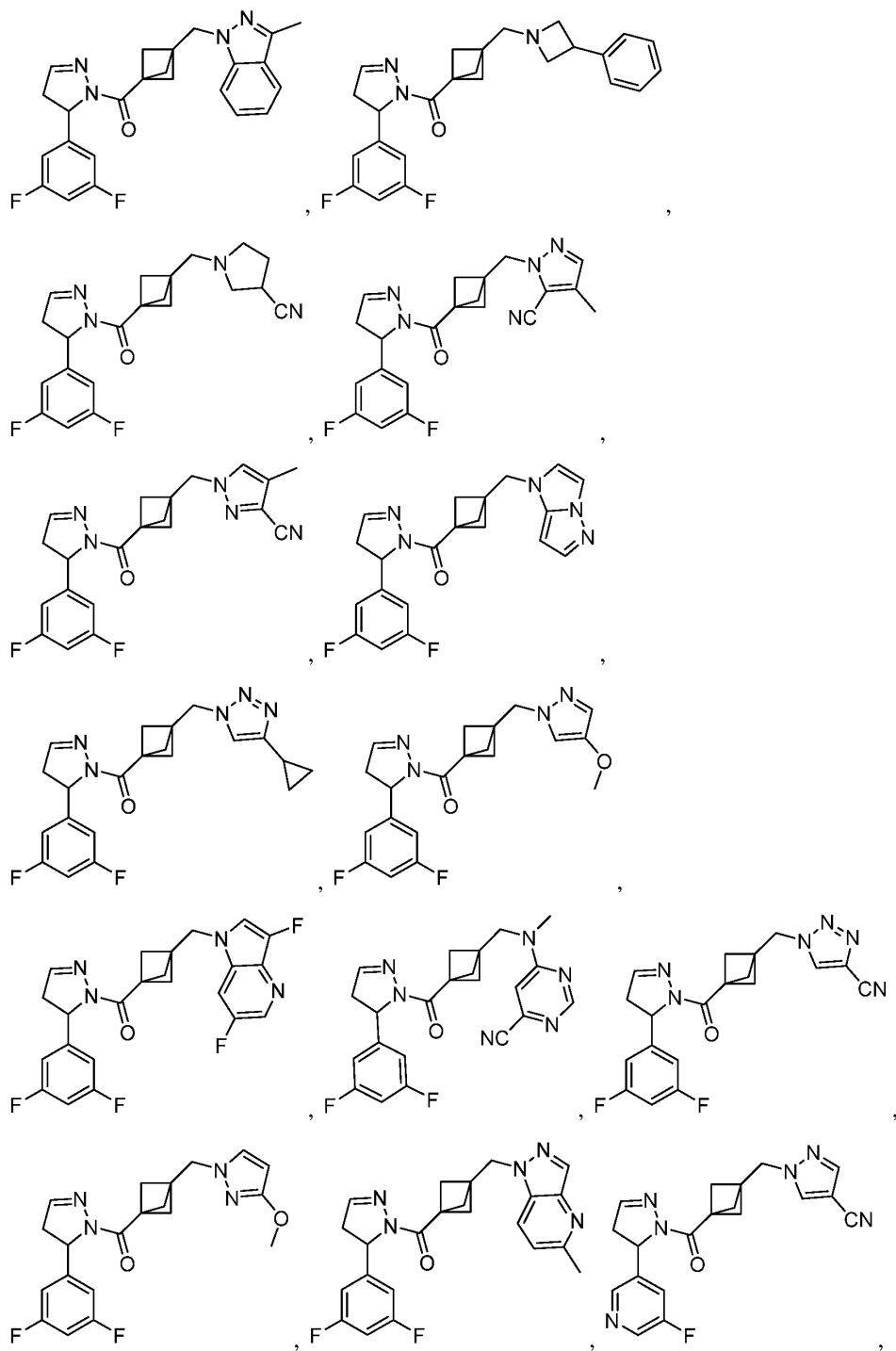


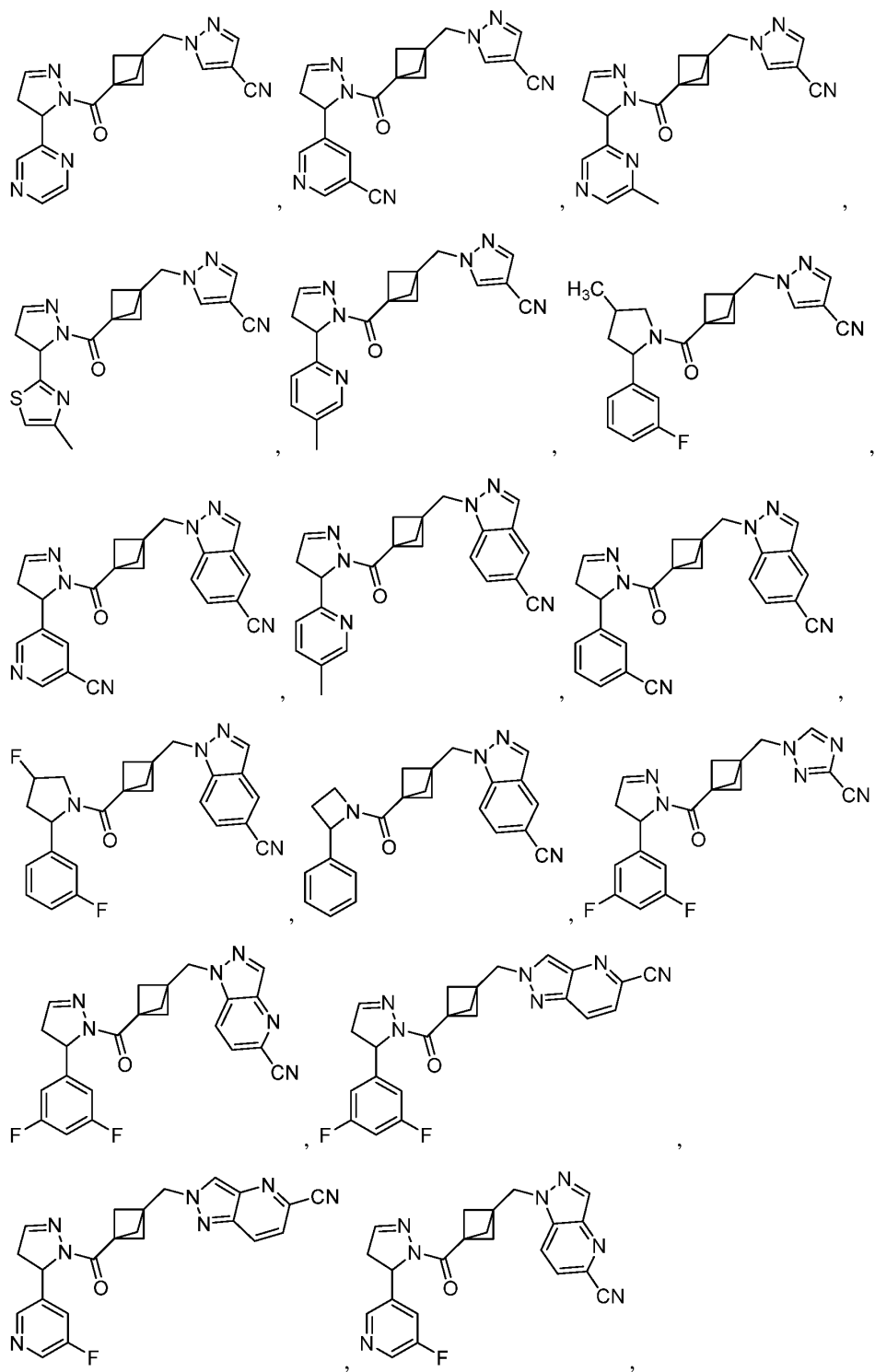


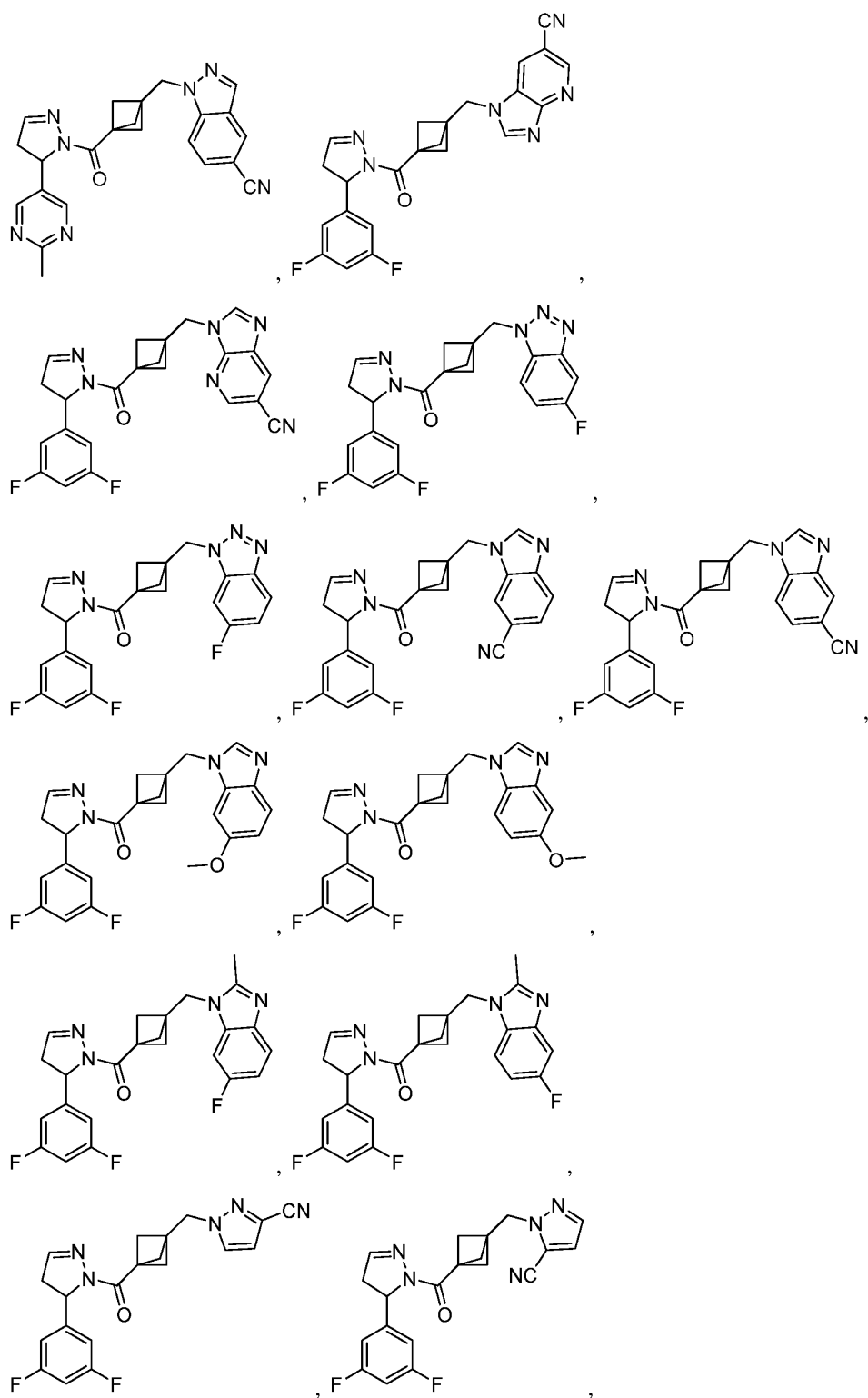


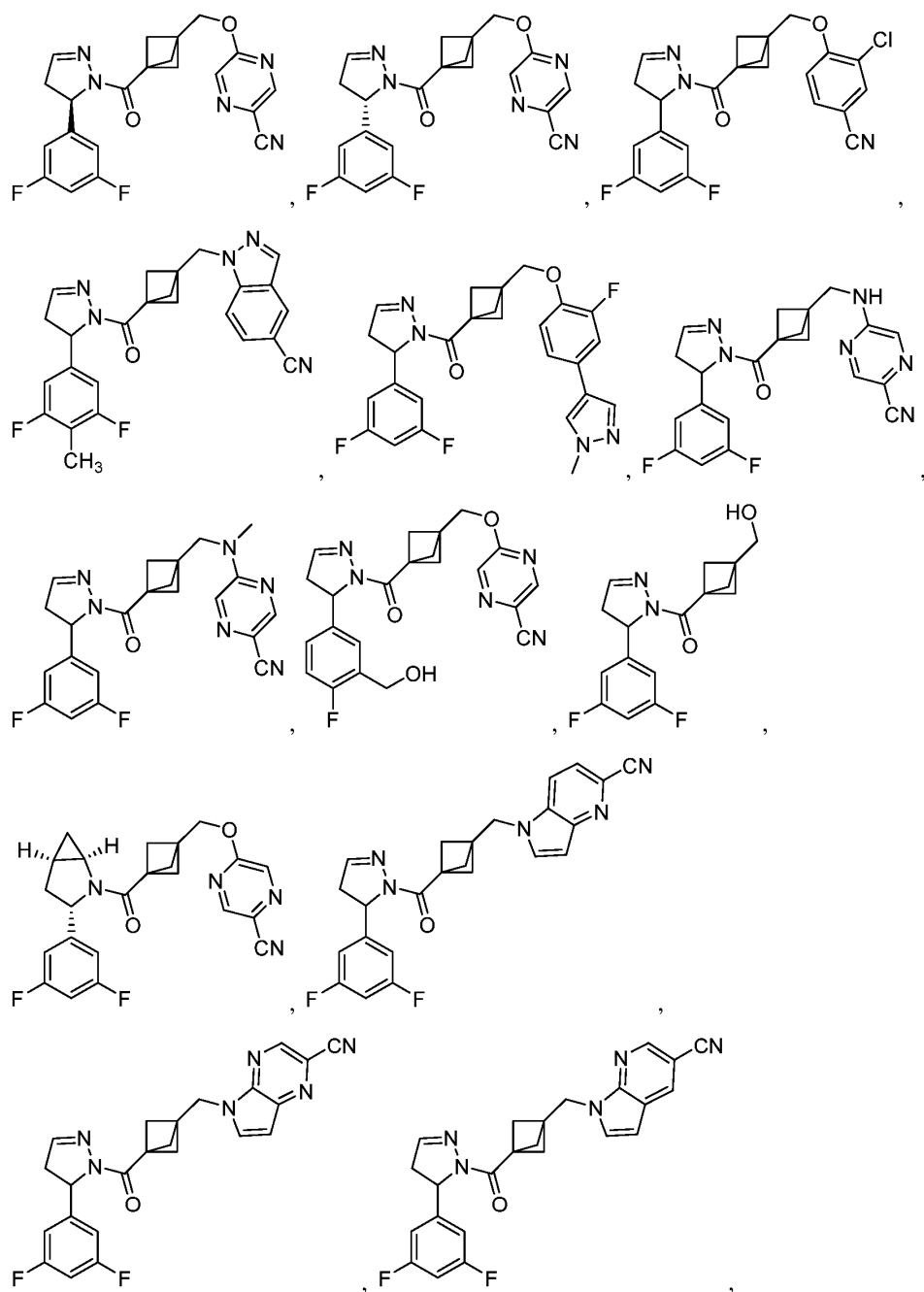


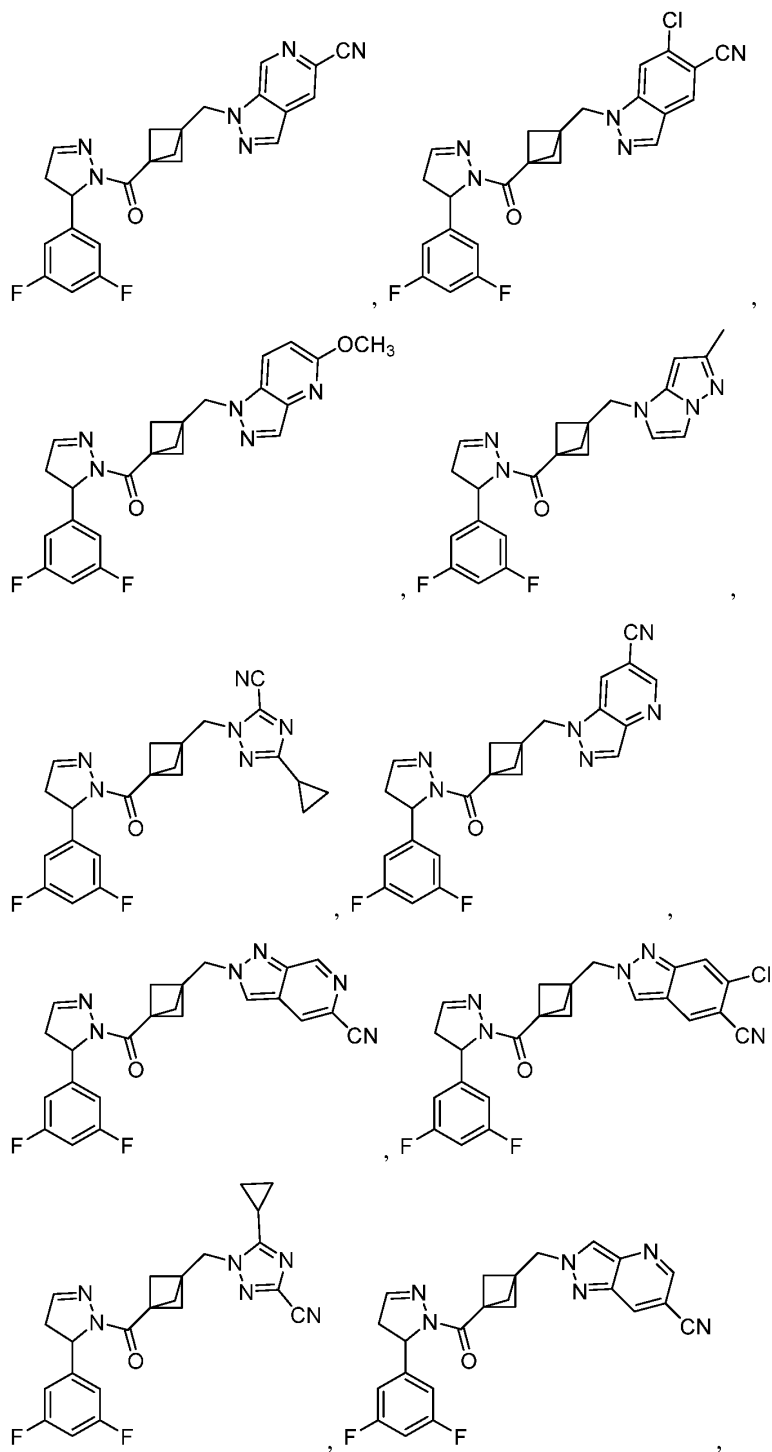


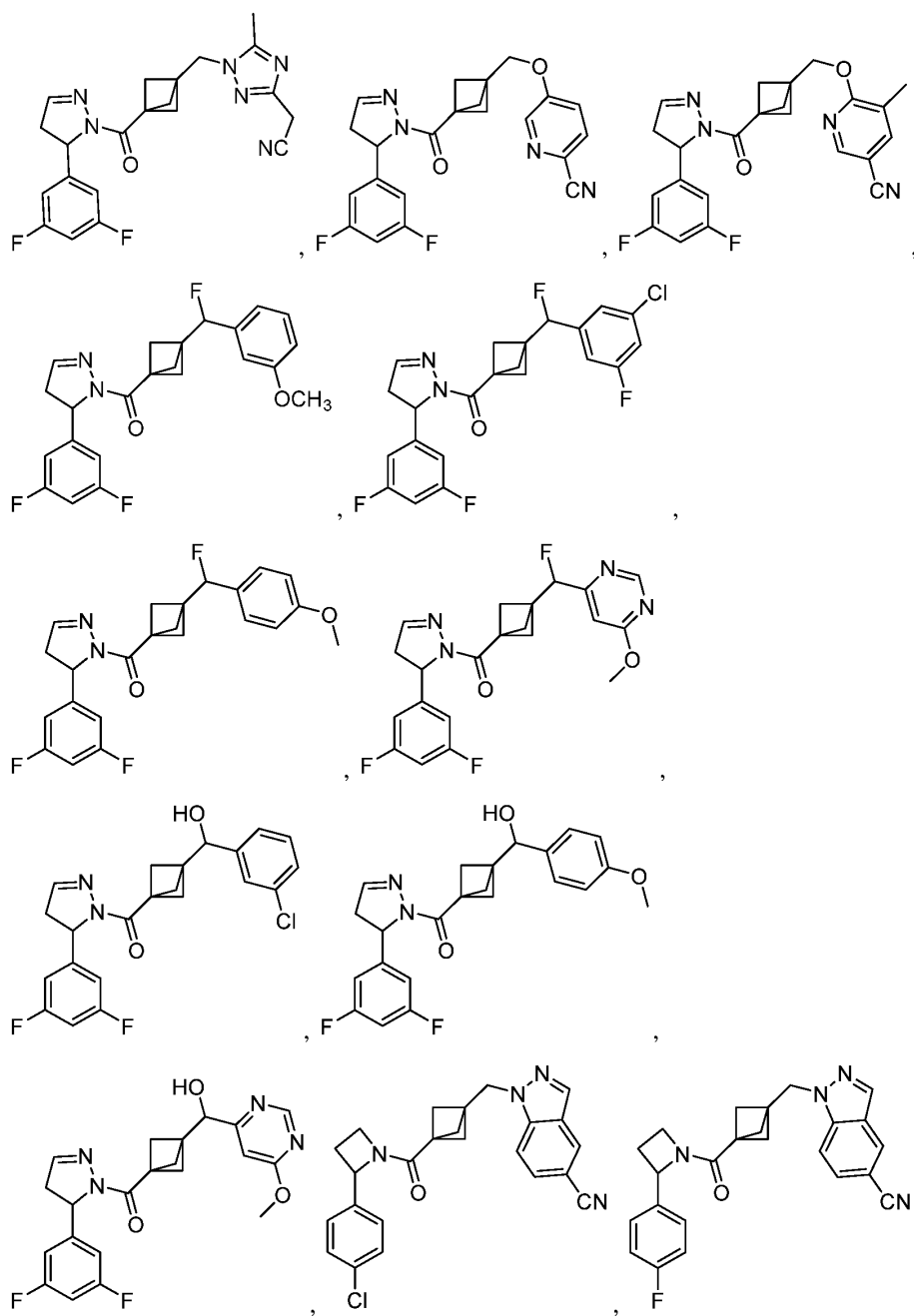


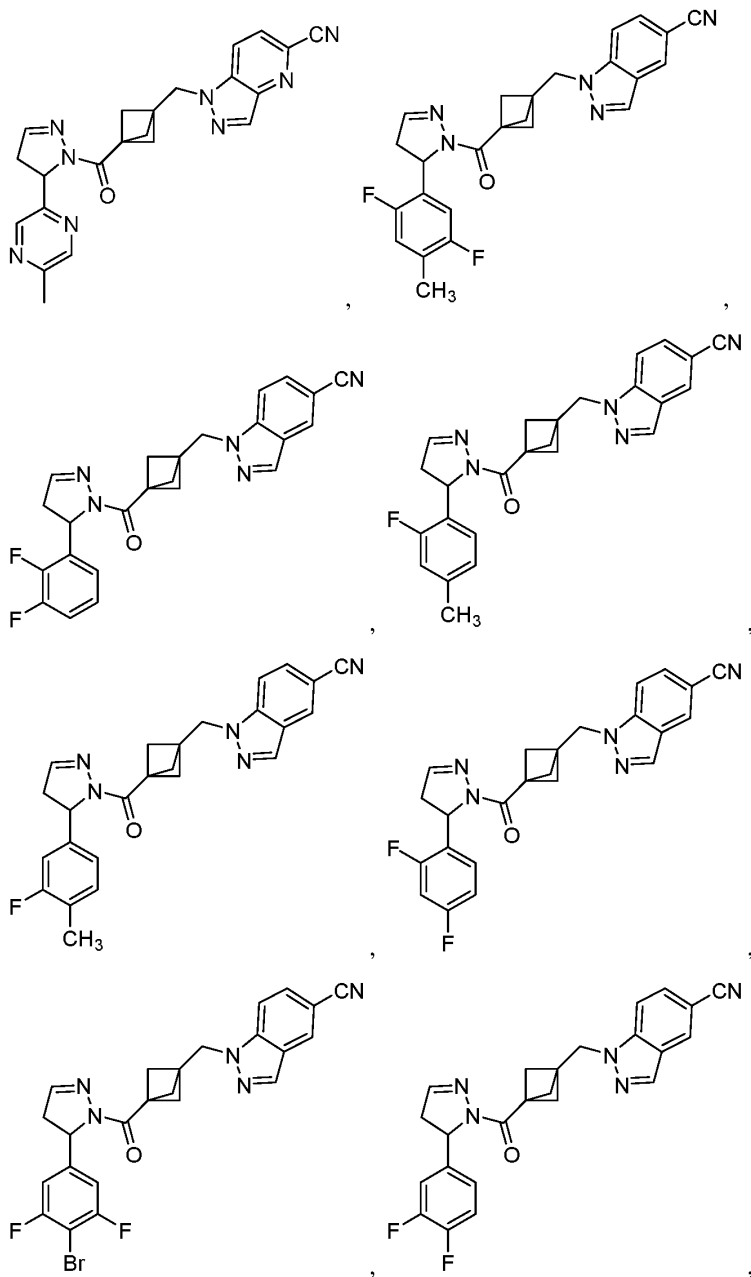


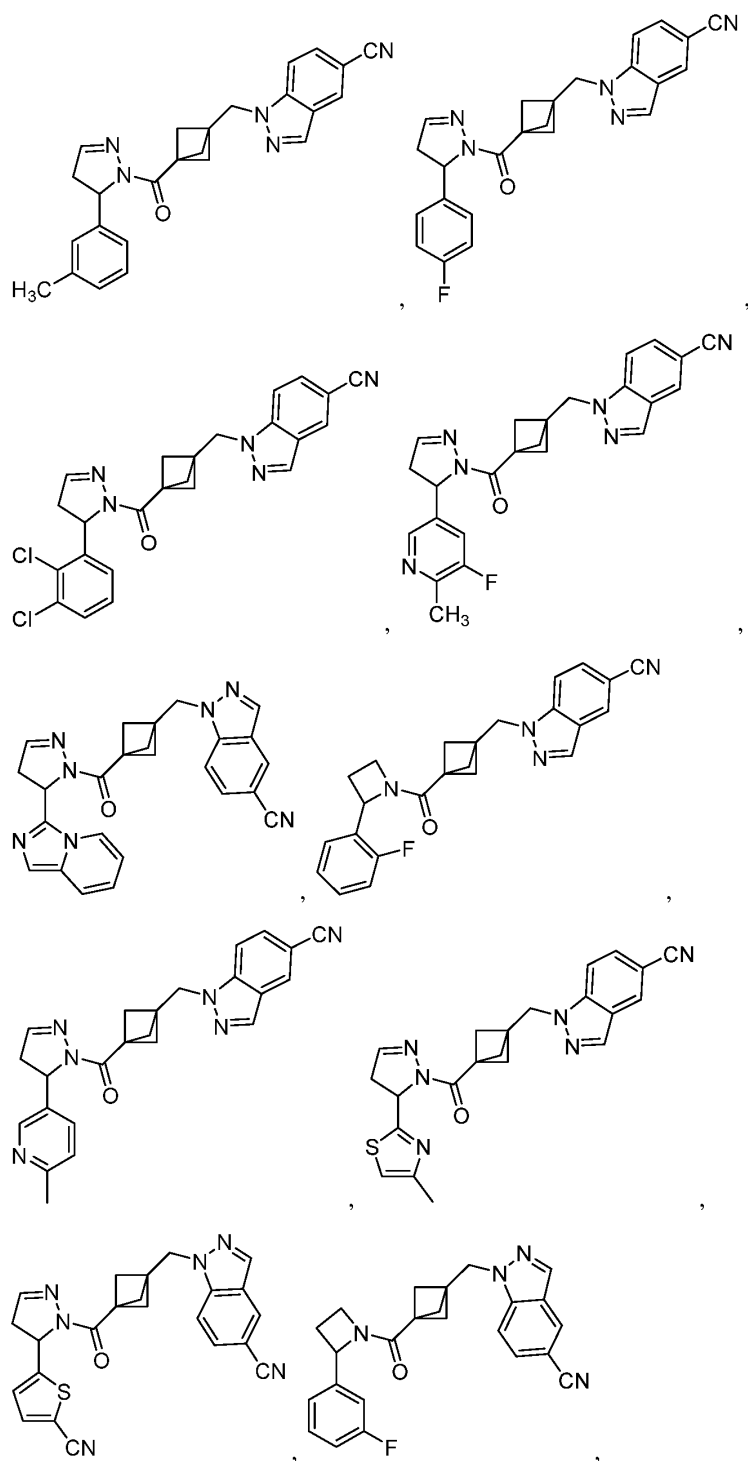


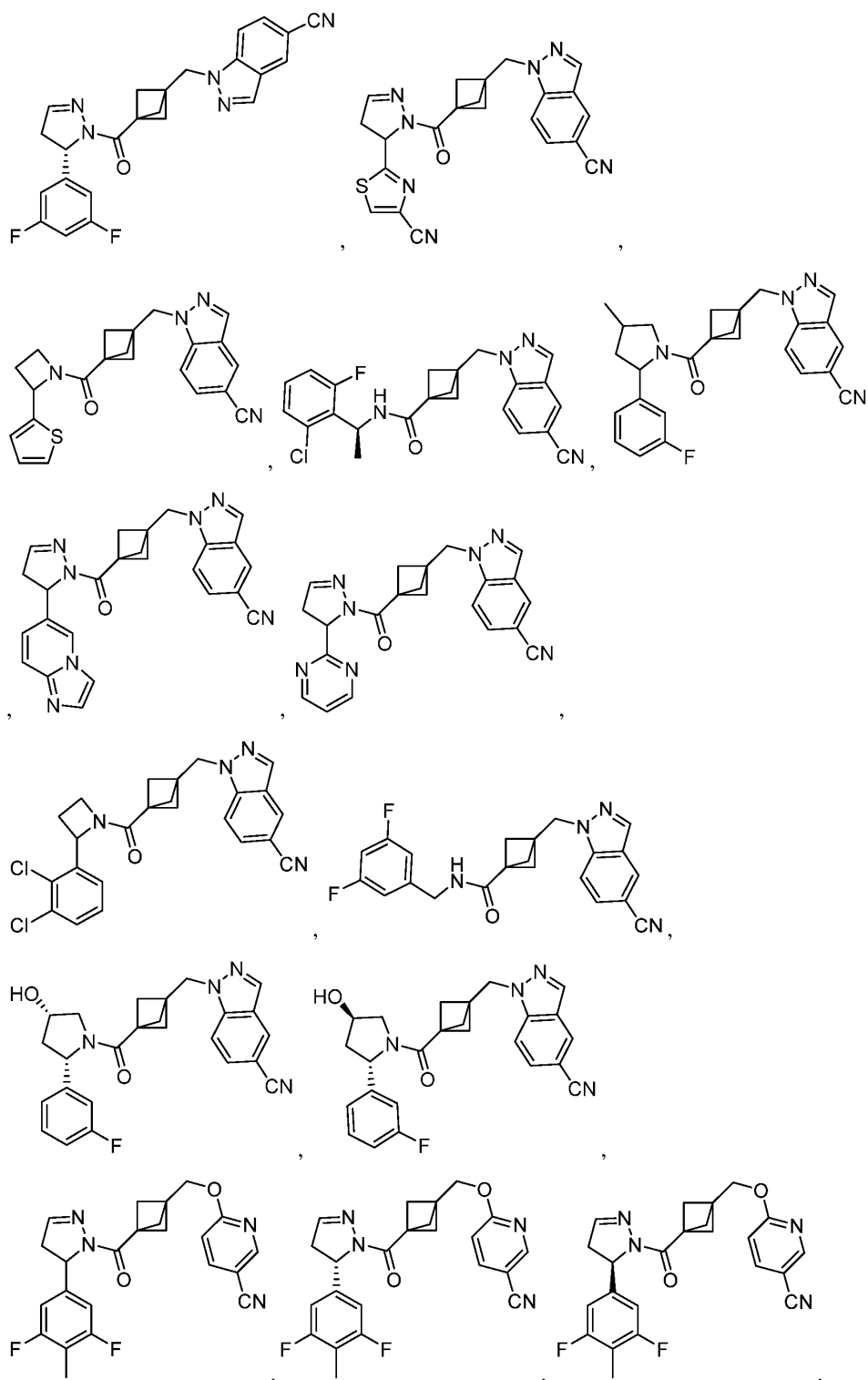


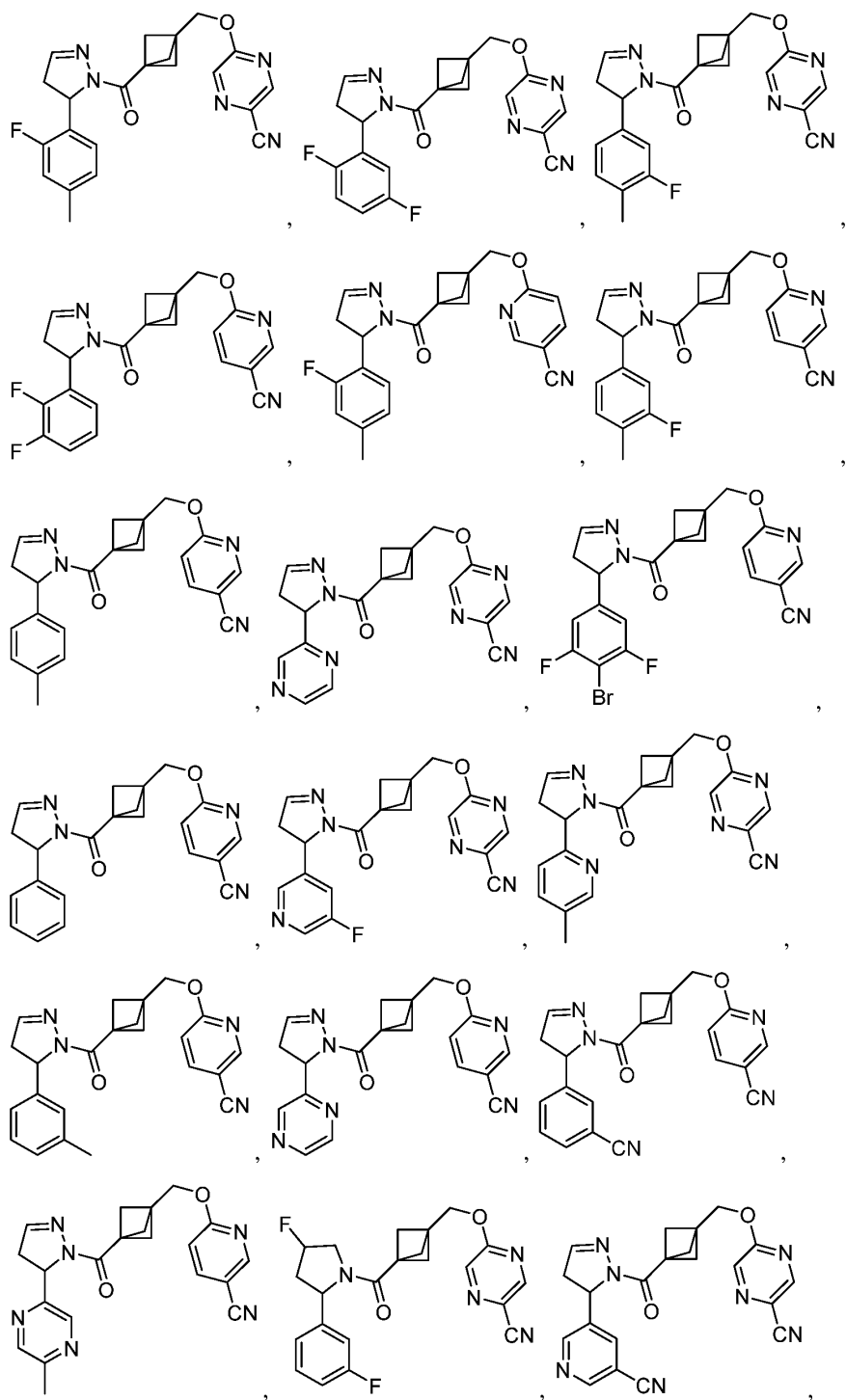


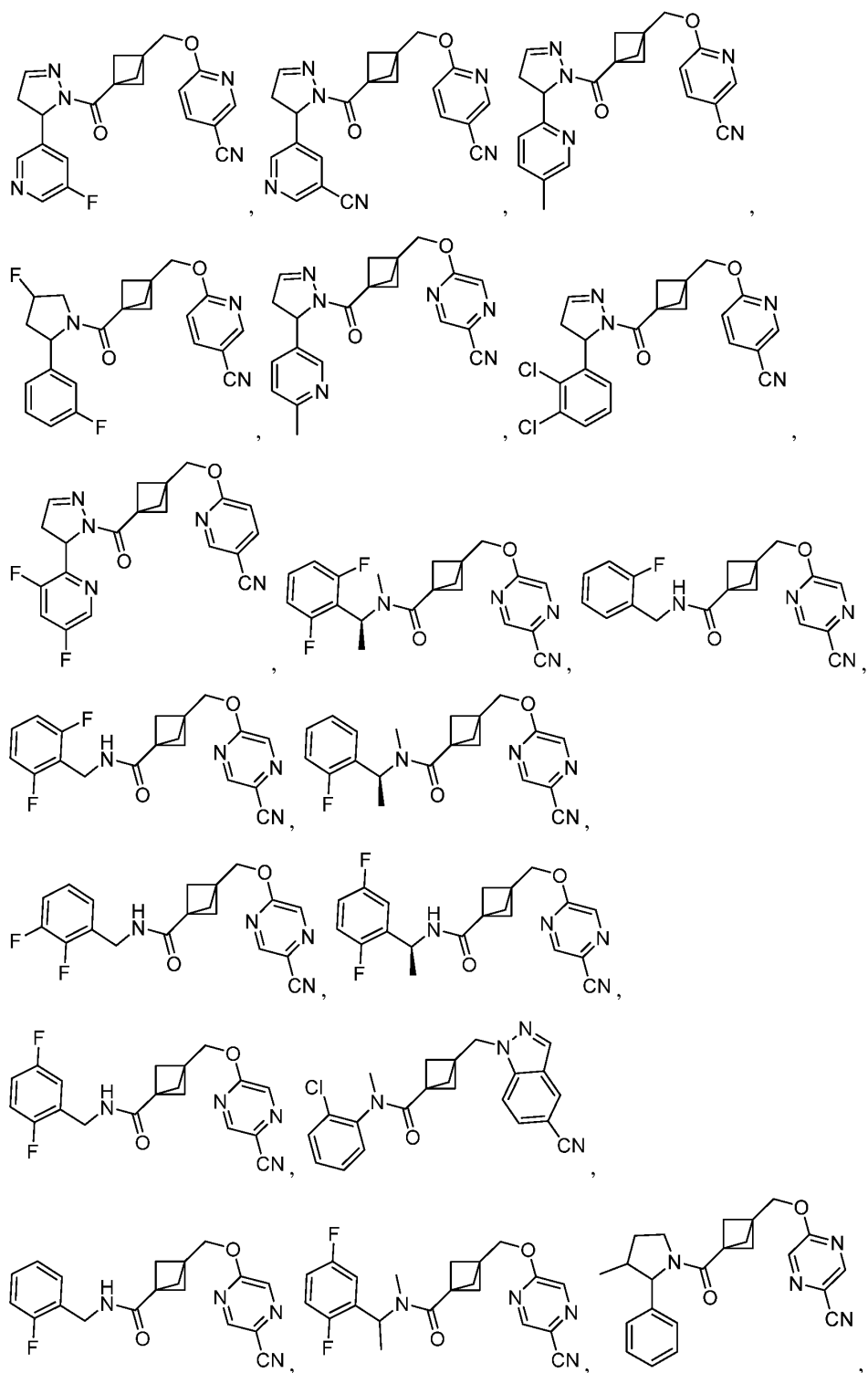


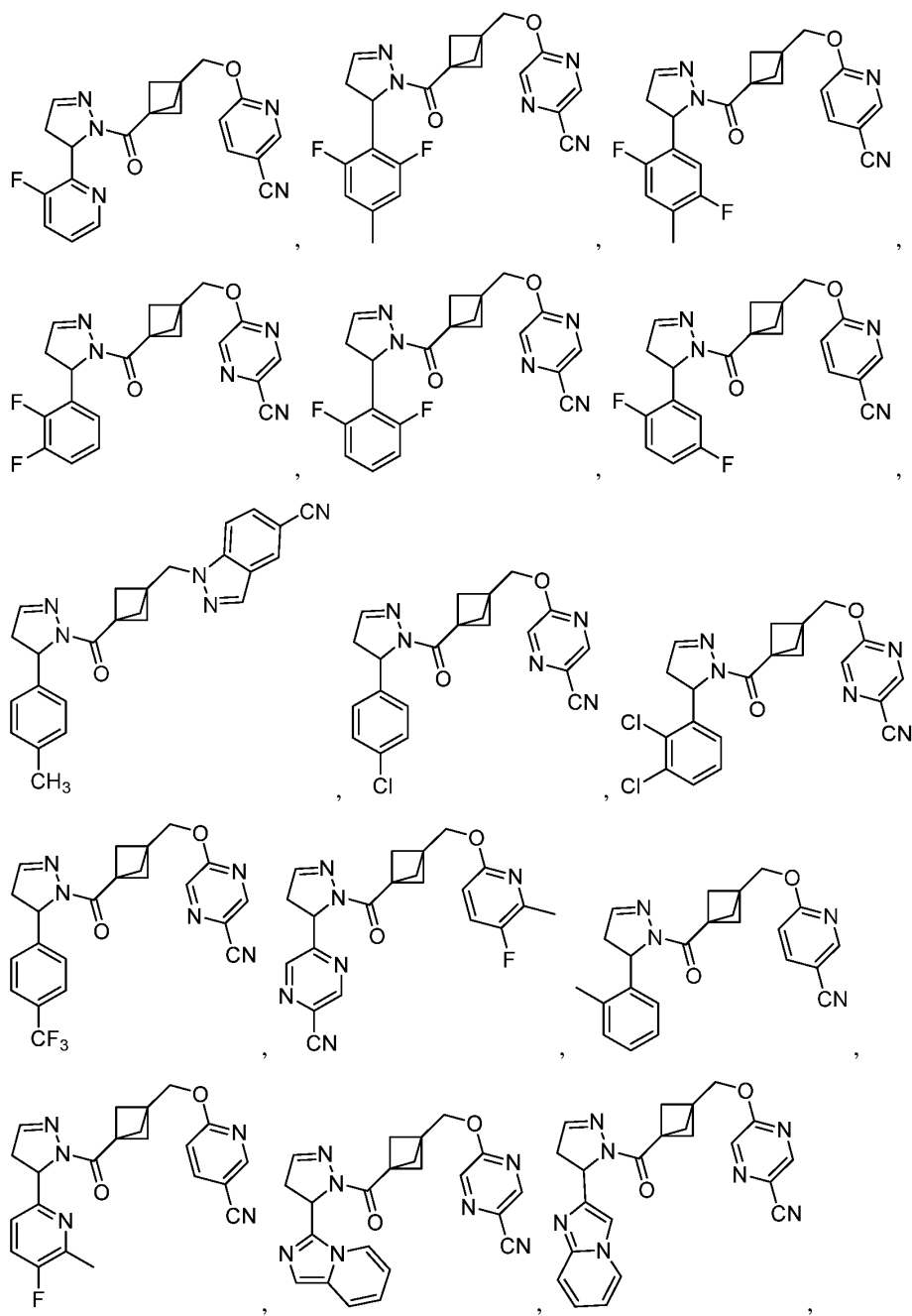


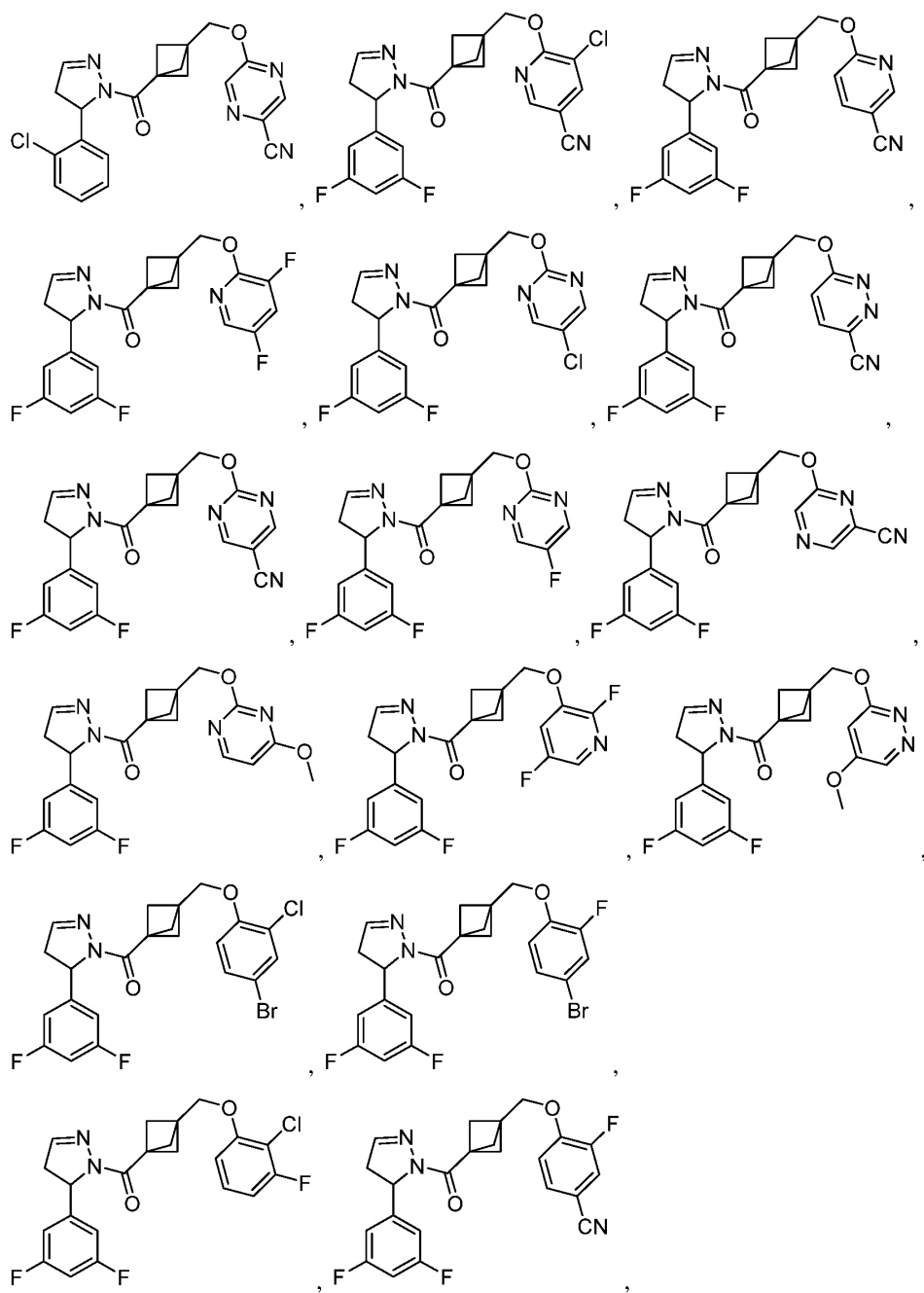


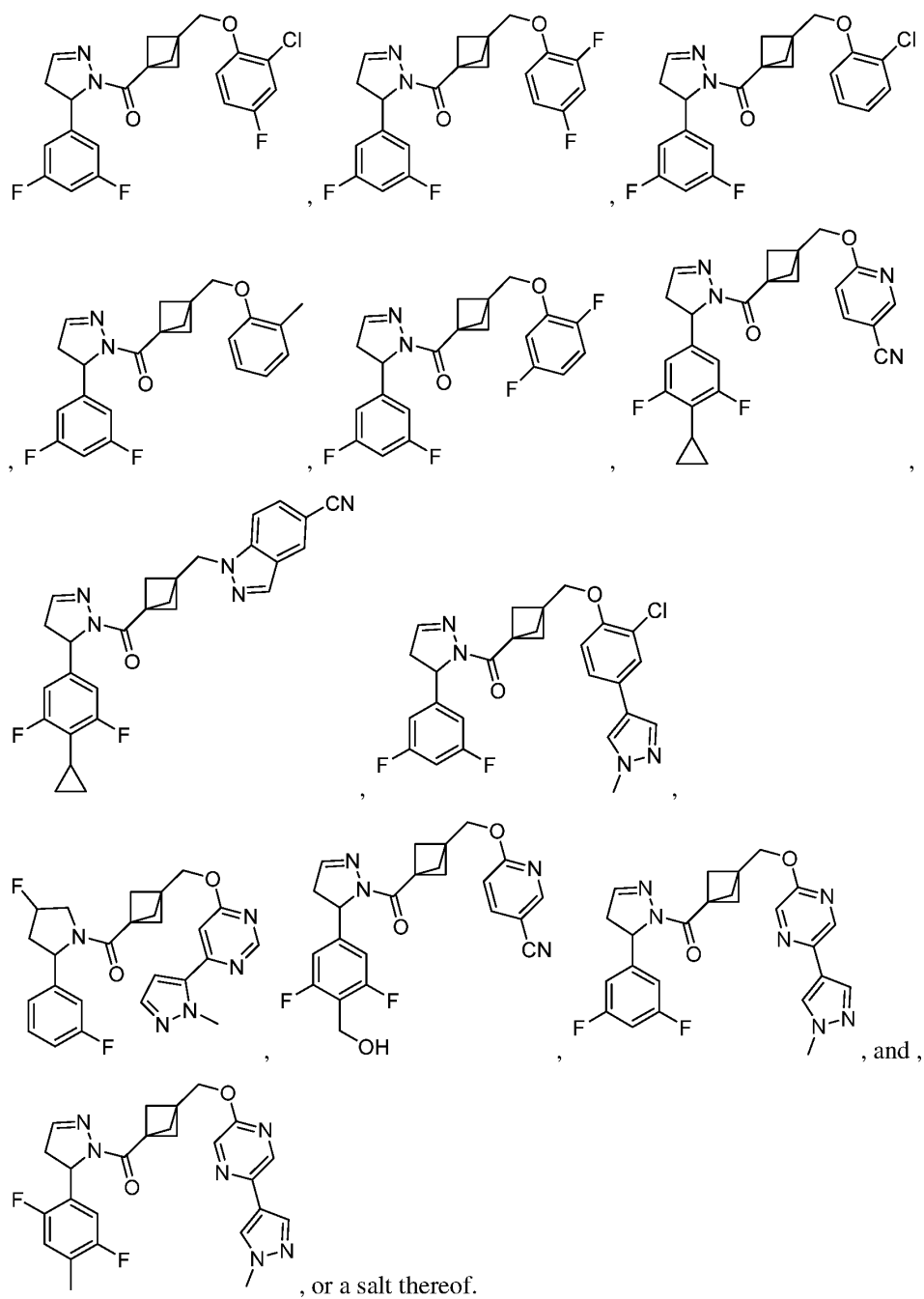












[0231] Also provided are embodiments wherein any embodiment above may be combined with any one or more of these embodiments, provided the combination is not mutually exclusive.

[0232] As used herein, two embodiments are “mutually exclusive” when one is defined to be something which is different than the other. For example, an embodiment wherein two groups combine to form a cycloalkyl is mutually exclusive with an embodiment in which one group is ethyl the other group is hydrogen. Similarly, an embodiment wherein one group is CH₂ is mutually exclusive with an embodiment wherein the same group is NH.

[0233] Also provided is a compound chosen from the Examples disclosed herein.

[0234] Also provided are methods of inhibiting at least one RIPK1 function comprising the step of contacting RIPK1 with a compound as described herein. The cell phenotype, cell proliferation, activity of RIPK1, change in biochemical output produced by active RIPK1, expression of RIPK1, or binding of RIPK1 with a natural binding partner may be monitored. Such methods may be modes of treatment of disease, biological assays, cellular assays, biochemical assays, or the like.

[0235] Also provided herein are methods of treatment of a RIPK1-mediated disease comprising the administration of a therapeutically effective amount of a compound as disclosed herein, or a salt thereof, to a patient in need thereof.

[0236] In certain embodiments, the disease is chosen from neurodegenerative disorders, inflammatory disorders, and cancer.

[0237] In certain embodiments, the disease is cancer. In certain embodiments, the cancer is treated by promoting an appropriate immune response to the tumor. In certain embodiments, the appropriate immune response to the tumor comprises, or results in, one or more of the following:

- an increase in the number or activity, or degree of tumor infiltration, of cytotoxic T-lymphocytes and/or natural killer cells;
- an increase in the number or activity of M1 macrophages in the tumor microenvironment and/or a decrease in the in the number or activity of M2 macrophages in the tumor microenvironment;
- a decrease in the number or activity of regulatory T cells; and
- a decrease in the number or activity of myeloid-derived suppressor cells.

[0238] Also provided herein is a compound as disclosed herein for use as a medicament.

[0239] Also provided herein is a compound as disclosed herein for use as a medicament for the treatment of a RIPK1-mediated disease.

[0240] Also provided is the use of a compound as disclosed herein as a medicament.

[0241] Also provided is the use of a compound as disclosed herein as a medicament for the treatment of a RIPK1-mediated disease.

- [0242] Also provided is a compound as disclosed herein for use in the manufacture of a medicament for the treatment of a RIPK1-mediated disease.
- [0243] Also provided is the use of a compound as disclosed herein for the treatment of a RIPK1-mediated disease.
- [0244] Also provided herein is a method of inhibition of RIPK1 comprising contacting RIPK1 with a compound as disclosed herein, or a salt thereof.
- [0245] Also provided herein is a method for achieving an effect in a patient comprising the administration of a therapeutically effective amount of a compound as disclosed herein, or a salt thereof, to a patient wherein the effect is chosen from cognition enhancement.
- [0246] Also provided is a method of modulation of a RIPK1-mediated function in a subject comprising the administration of a therapeutically effective amount of a compound as disclosed herein.
- [0247] Also provided is a pharmaceutical composition comprising a compound as disclosed herein, together with a pharmaceutically acceptable carrier.
- [0248] In certain embodiments, the pharmaceutical composition is formulated for oral administration.
- [0249] In certain embodiments, the oral pharmaceutical composition is chosen from a tablet and a capsule.

Definitions

- [0250] As used herein, the terms below have the meanings indicated.
- [0251] When ranges of values are disclosed, and the notation “from n_1 ... to n_2 ” or “between n_1 ... and n_2 ” is used, where n_1 and n_2 are the numbers, then unless otherwise specified, this notation is intended to include the numbers themselves and the range between them. This range may be integral or continuous between and including the end values. By way of example, the range “from 2 to 6 carbons” is intended to include two, three, four, five, and six carbons, since carbons come in integer units. Compare, by way of example, the range “from 1 to 3 μM (micromolar),” which is intended to include 1 μM , 3 μM , and everything in between to any number of significant figures (e.g., 1.255 μM , 2.1 μM , 2.9999 μM , etc.).
- [0252] The term “about,” as used herein, is intended to qualify the numerical values which it modifies, denoting such a value as variable within a margin of error. When no particular margin of error, such as a standard deviation to a mean value given in a chart or table of data, is recited, the term “about” should be understood to mean that range which

would encompass the recited value and the range which would be included by rounding up or down to that figure as well, taking into account significant figures.

[0253] The term “acyl,” as used herein, alone or in combination, refers to a carbonyl attached to an alkenyl, alkyl, aryl, cycloalkyl, heteroaryl, heterocycle, or any other moiety where the atom attached to the carbonyl is carbon. An “acetyl” group refers to a $-\text{C}(\text{O})\text{CH}_3$ group. An “alkylcarbonyl” or “alkanoyl” group refers to an alkyl group attached to the parent molecular moiety through a carbonyl group. Examples of such groups include methylcarbonyl and ethylcarbonyl. Examples of acyl groups include formyl, alkanoyl and aroyl.

[0254] The term “alkenyl,” as used herein, alone or in combination, refers to a straight-chain or branched-chain hydrocarbon radical having one or more double bonds and containing from 2 to 20 carbon atoms. In certain embodiments, said alkenyl will comprise from 2 to 6 carbon atoms. The term “alkenylene” refers to a carbon-carbon double bond system attached at two or more positions such as ethenylene $[(-\text{CH}=\text{CH}-), (-\text{C}::\text{C}-)]$. Examples of suitable alkenyl radicals include ethenyl, propenyl, 2-methylpropenyl, 1,4-butadienyl and the like. Unless otherwise specified, the term “alkenyl” may include “alkenylene” groups.

[0255] The term “alkoxy,” as used herein, alone or in combination, refers to an alkyl ether radical wherein the term alkyl is as defined below. Examples of suitable alkyl ether radicals include methoxy, ethoxy, n-propoxy, isopropoxy, n-butoxy, iso-butoxy, sec-butoxy, tert-butoxy, and the like.

[0256] The term “alkyl,” as used herein, alone or in combination, refers to a straight-chain or branched-chain alkyl radical containing from 1 to 20 carbon atoms. In certain embodiments, said alkyl will comprise from 1 to 10 carbon atoms. In further embodiments, said alkyl will comprise from 1 to 8 carbon atoms. Alkyl groups are optionally substituted as defined herein. Examples of alkyl radicals include methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl, sec-butyl, tert-butyl, pentyl, iso-amyl, hexyl, octyl, nonyl and the like.

[0257] The term “alkylene,” as used herein, alone or in combination, refers to a straight chain saturated or unsaturated hydrocarbon attached at two positions, such as methylene $(-\text{CH}_2-)$, ethylene $(-\text{CH}_2\text{CH}_2-)$, and propylene $(-\text{CH}_2\text{CH}_2\text{CH}_2-)$. “Alkylene” thus consists of units chosen from $-\text{CH}_2-$ and $-\text{CH}=\text{CH}-$. Representative alkylenes include $-\text{CH}_2-$, $-\text{CH}_2\text{CH}_2-$, $-\text{CH}=\text{CH}-$, $-\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{CH}=\text{CH}-$, and $-\text{CH}=\text{CH}-\text{CH}=\text{CH}-$. Alkylenes can be characterized by the count of atoms in the chain; thus, the representative alkylenes have 1, 2, 2, 3, 3, and 4 atoms, respectively.

[0258] The term “alkylamino,” as used herein, alone or in combination, refers to an alkyl group attached to the parent molecular moiety through an amino group. Suitable alkylamino groups may be mono- or dialkylated, forming groups such as, for example, N-methylamino, N-ethylamino, N,N-dimethylamino, N,N-ethylmethylamino and the like.

[0259] The term “alkylidene,” as used herein, alone or in combination, refers to an alkenyl group in which one carbon atom of the carbon-carbon double bond belongs to the moiety to which the alkenyl group is attached.

[0260] The term “alkylthio,” as used herein, alone or in combination, refers to an alkyl thioether (R-S-) radical wherein the term alkyl is as defined above and wherein the sulfur may be singly or doubly oxidized. Examples of suitable alkyl thioether radicals include methylthio, ethylthio, n-propylthio, isopropylthio, n-butylthio, iso-butylthio, sec-butylthio, tert-butylthio, methanesulfonyl, ethanesulfinyl, and the like.

[0261] The term “alkynyl,” as used herein, alone or in combination, refers to a straight-chain or branched chain hydrocarbon radical having one or more triple bonds and containing from 2 to 20 carbon atoms. In certain embodiments, said alkynyl comprises from 2 to 6 carbon atoms. In further embodiments, said alkynyl comprises from 2 to 4 carbon atoms. The term “alkynylene” refers to a carbon-carbon triple bond attached at two positions such as ethynylene (-C:::C-, -C≡C-). Examples of alkynyl radicals include ethynyl, propynyl, hydroxypropynyl, butyn-1-yl, butyn-2-yl, pentyn-1-yl, 3-methylbutyn-1-yl, hexyn-2-yl, and the like. Unless otherwise specified, the term “alkynyl” may include “alkynylene” groups.

[0262] The terms “amido” and “carbamoyl,” as used herein, when alone, refer to an amino group as described below attached to the parent molecular moiety through a carbonyl group, or vice versa. The terms “amido” and “carbamoyl,” as used herein, when in combination, refer to either of -C(O)NH- and -NHC(O)-. The term “C-amido” as used herein, alone or in combination, refers to a -C(O)N(RR') group with R and R' as defined herein or as defined by the specifically enumerated “R” groups designated. The term “N-amido” as used herein, alone or in combination, refers to a RC(O)N(R')- group, with R and R' as defined herein or as defined by the specifically enumerated “R” groups designated. The term “acylamino” as used herein, alone or in combination, embraces an acyl group attached to the parent moiety through an amino group. An example of an “acylamino” group is acetylamino (CH₃C(O)NH-).

[0263] The term “amino,” as used herein, alone or in combination, refers to -NRR' wherein R and R' are independently chosen from hydrogen, alkyl, acyl, heteroalkyl, aryl,

cycloalkyl, heteroaryl, and heterocycloalkyl, any of which may themselves be optionally substituted. Additionally, R and R' may combine to form heterocycloalkyl, either of which is optionally substituted.

[0264] The term "aryl," as used herein, alone or in combination, means a carbocyclic aromatic system containing one, two or three rings wherein such polycyclic ring systems are fused together. The term "aryl" embraces aromatic groups such as phenyl, naphthyl, anthracenyl, and phenanthryl.

[0265] The term "arylalkenyl" or "aralkenyl," as used herein, alone or in combination, refers to an aryl group attached to the parent molecular moiety through an alkenyl group.

[0266] The term "arylalkoxy" or "aralkoxy," as used herein, alone or in combination, refers to an aryl group attached to the parent molecular moiety through an alkoxy group.

[0267] The term "arylalkyl" or "aralkyl," as used herein, alone or in combination, refers to an aryl group attached to the parent molecular moiety through an alkyl group.

[0268] The term "arylalkynyl" or "aralkynyl," as used herein, alone or in combination, refers to an aryl group attached to the parent molecular moiety through an alkynyl group.

[0269] The term "arylalkanoyl" or "aralkanoyl" or "aroyl," as used herein, alone or in combination, refers to an acyl radical derived from an aryl-substituted alkanecarboxylic acid such as benzoyl, naphthoyl, phenylacetyl, 3-phenylpropionyl (hydrocinnamoyl), 4-phenylbutyryl, (2-naphthyl)acetyl, 4-chlorohydrocinnamoyl, and the like.

[0270] The term aryloxy as used herein, alone or in combination, refers to an aryl group attached to the parent molecular moiety through an oxy.

[0271] The terms "benzo" and "benz," as used herein, alone or in combination, refer to the divalent radical $C_6H_4=$ derived from benzene. Examples include benzothiophene and benzimidazole.

[0272] The term "carbamate," as used herein, alone or in combination, refers to an ester of carbamic acid ($-NHCOO-$) which may be attached to the parent molecular moiety from either the nitrogen or acid end, and which is optionally substituted as defined herein.

[0273] The term "O-carbamyl" as used herein, alone or in combination, refers to a $-OC(O)NRR'$, group-with R and R' as defined herein.

[0274] The term "N-carbamyl" as used herein, alone or in combination, refers to a $ROC(O)NR'$ - group, with R and R' as defined herein.

[0275] The term "carbonyl," as used herein, when alone includes formyl [$-C(O)H$] and in combination is a $-C(O)-$ group.

[0276] The term “carboxyl” or “carboxy,” as used herein, refers to -C(O)OH or the corresponding “carboxylate” anion, such as is in a carboxylic acid salt. An “O-carboxy” group refers to a RC(O)O- group, where R is as defined herein. A “C-carboxy” group refers to a -C(O)OR groups where R is as defined herein.

[0277] The term “cyano,” as used herein, alone or in combination, refers to -CN.

[0278] The term “cycloalkyl,” or, alternatively, “carbocycle,” as used herein, alone or in combination, refers to a saturated or partially saturated monocyclic, bicyclic or tricyclic alkyl group wherein each cyclic moiety contains from 3 to 12 carbon atom ring members and which may optionally be a benzo fused ring system which is optionally substituted as defined herein. In certain embodiments, said cycloalkyl will comprise from 5 to 7 carbon atoms. In certain embodiments, said cycloalkyl will comprise a spirocycle ring system. Examples of such cycloalkyl groups include cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, tetrahydronaphthyl, indanyl, octahydronaphthyl, 2,3-dihydro-1*H*-indenyl, adamantyl and the like. “Bicyclic” and “tricyclic” as used herein are intended to include both fused ring systems, such as decahydronaphthalene, octahydronaphthalene as well as the multicyclic (multicentered) saturated or partially unsaturated type. The latter type of isomer is exemplified in general by, bicyclo[1.1.1]pentane, camphor, adamantane, and bicyclo[3.2.1]octane.

[0279] The term “ester,” as used herein, alone or in combination, refers to a carboxy group bridging two moieties linked at carbon atoms.

[0280] The term “ether,” as used herein, alone or in combination, refers to an oxy group bridging two moieties linked at carbon atoms.

[0281] The term “halo,” or “halogen,” as used herein, alone or in combination, refers to fluorine, chlorine, bromine, or iodine.

[0282] The term “haloalkoxy,” as used herein, alone or in combination, refers to a haloalkyl group attached to the parent molecular moiety through an oxygen atom.

[0283] The term “haloalkyl,” as used herein, alone or in combination, refers to an alkyl radical having the meaning as defined above wherein one or more hydrogens are replaced with a halogen. Specifically embraced are monohaloalkyl, dihaloalkyl and polyhaloalkyl radicals. A monohaloalkyl radical, for one example, may have an iodo, bromo, chloro or fluoro atom within the radical. Dihalo and polyhaloalkyl radicals may have two or more of the same halo atoms or a combination of different halo radicals. Examples of haloalkyl radicals include fluoromethyl, difluoromethyl, trifluoromethyl, chloromethyl, dichloromethyl, trichloromethyl, pentafluoroethyl, heptafluoropropyl, difluorochloromethyl,

dichlorofluoromethyl, difluoroethyl, difluoropropyl, dichloroethyl and dichloropropyl.

“Haloalkylene” refers to a haloalkyl group attached at two or more positions. Examples include fluoromethylene

(-CFH-), difluoromethylene (-CF₂-), chloromethylene (-CHCl-) and the like.

[0284] The term “heteroalkyl,” as used herein, alone or in combination, refers to a stable straight or branched chain, or combinations thereof, fully saturated or containing from 1 to 3 degrees of unsaturation, consisting of the stated number of carbon atoms and one, two, or three heteroatoms chosen from N, O, and S, and wherein the N and S atoms may optionally be oxidized and the N heteroatom may optionally be quaternized. The heteroatom(s) may be placed at any interior position of the heteroalkyl group. Up to two heteroatoms may be consecutive, such as, for example, -CH₂-NH-OCH₃.

[0285] The term “heteroalkylene,” as used herein, alone or in combination, refers to an alkylene in which either one or both of the following hold: (a) one or more -CH₂- groups is substituted with -NH- groups, and / or (b) one or more -CH= groups is substituted with -N= groups. Representative heteroalkylenes include -CH₂NH-, -CH=NH-, -NHCH₂CH₂-, -CH₂NHCH₂-, -NHCH=CH-, -NHCH₂CH₂CH₂-, -CH=CH-N=CH, and -CH=CH-CH=N-. As with alkylenes, heteroalkylenes can be characterized by the count of atoms in the chain; thus, the representative alkylenes have 2, 2, 3, 3, 3, 4, 4, and 4 atoms, respectively.

[0286] The term “heteroaryl,” as used herein, alone or in combination, refers to a 3 to 15 membered unsaturated heteromonocyclic ring, or a fused monocyclic, bicyclic, or tricyclic ring system in which at least one of the fused rings is aromatic, which contains at least one atom chosen from N, O, and S. In certain embodiments, said heteroaryl will comprise from 1 to 4 heteroatoms as ring members. In further embodiments, said heteroaryl will comprise from 1 to 2 heteroatoms as ring members. In certain embodiments, said heteroaryl will comprise from 5 to 7 atoms. The term also embraces fused polycyclic groups wherein heterocyclic rings are fused with aryl rings wherein heteroaryl rings are fused with other heteroaryl rings wherein heteroaryl rings are fused with heterocycloalkyl rings, or wherein heteroaryl rings are fused with cycloalkyl rings. Examples of heteroaryl groups include pyrrolyl, pyrrolinyl, imidazolyl, pyrazolyl, pyridinyl, pyrimidinyl, pyrazinyl, pyridazinyl, triazolyl, pyranyl, furyl, thienyl, oxazolyl, isoxazolyl, oxadiazolyl, thiazolyl, thiadiazolyl, isothiazolyl, indolyl, isoindolyl, indoliziny, benzimidazolyl, quinolyl, isoquinolyl, quinoxaliny, quinazolinyl, indazolyl, benzotriazolyl, benzodioxolyl, benzopyranyl, benzoxazolyl, benzoxadiazolyl, benzothiazolyl, benzothiadiazolyl, benzofuryl, benzothienyl, chromonyl, coumarinyl, benzopyranyl, tetrahydroquinoliny, tetrazolopyridazinyl,

tetrahydroisoquinoliny, thienopyridiny, furopyridiny, pyrrolopyridiny and the like.

Exemplary tricyclic heterocyclic groups include carbazoly, benzidoly, phenanthroliny, dibenzofurany, acridiny, phenanthridiny, xantheny and the like.

[0287] The terms “heterocycloalkyl” and, interchangeably, “heterocycle,” as used herein, alone or in combination, each refer to a saturated, partially unsaturated, or fully unsaturated (but nonaromatic) monocyclic, bicyclic, or tricyclic heterocyclic group containing at least one heteroatom as a ring member wherein each said heteroatom may be independently chosen from nitrogen, oxygen, and sulfur. In certain embodiments, said heterocycloalkyl will comprise a spirocycle ring system. In certain embodiments, said heterocycloalkyl will comprise from 1 to 4 heteroatoms as ring members. In further embodiments, said heterocycloalkyl will comprise from 1 to 2 heteroatoms as ring members. In certain embodiments, said heterocycloalkyl will comprise from 3 to 8 ring members in each ring. In further embodiments, said heterocycloalkyl will comprise from 3 to 7 ring members in each ring. In yet further embodiments, said heterocycloalkyl will comprise from 5 to 6 ring members in each ring. “Heterocycloalkyl” and “heterocycle” are intended to include sulfones, sulfoxides, N-oxides of tertiary nitrogen ring members, and carbocyclic fused and benzo fused ring systems; additionally, both terms also include systems where a heterocycle ring is fused to an aryl group, as defined herein, or an additional heterocycle group. Examples of heterocycle groups include aziridiny, azetidiny, 1,3-benzodioxoly, dihydroisoindoly, dihydroisoquinoliny, dihydrocinnoliny, dihydrobenzodioxiny, dihydro[1,3]oxazolo[4,5-*b*]pyridiny, benzothiazoly, dihydroindoly, dihydropyridiny, 1,3-dioxany, 1,4-dioxany, 1,3-dioxolany, isoindoliny, morpholiny, piperaziny, pyrrolidiny, tetrahydropyridiny, piperidiny, thiomorpholiny, and the like. The heterocycle groups is optionally substituted unless specifically prohibited.

[0288] The term “hydraziny” as used herein, alone or in combination, refers to two amino groups joined by a single bond, i.e., -N-N-.

[0289] The term “hydroxy,” as used herein, alone or in combination, refers to -OH.

[0290] The term “hydroxyalkyl,” as used herein, alone or in combination, refers to a hydroxy group attached to the parent molecular moiety through an alkyl group.

[0291] The term “imino,” as used herein, alone or in combination, refers to =N-.

[0292] The term “iminohydroxy,” as used herein, alone or in combination, refers to =N(OH) and =N-O-.

[0293] The phrase “in the main chain” refers to the longest contiguous or adjacent chain of carbon atoms starting at the point of attachment of a group to the compounds of any one of the formulas disclosed herein.

[0294] The term “isocyanato” refers to a -NCO group.

[0295] The term “isothiocyanato” refers to a -NCS group.

[0296] The phrase “linear chain of atoms” refers to the longest straight chain of atoms independently chosen from carbon, nitrogen, oxygen and sulfur.

[0297] The term “lower,” as used herein, alone or in a combination, where not otherwise specifically defined, means containing from 1 to and including 6 carbon atoms (i.e., C₁-C₆ alkyl).

[0298] The term “lower aryl,” as used herein, alone or in combination, means phenyl or naphthyl, either of which is optionally substituted as provided.

[0299] The term “lower heteroaryl,” as used herein, alone or in combination, means either 1) monocyclic heteroaryl comprising five or six ring members, of which between one and four said members may be heteroatoms chosen from N, O, and S, or 2) bicyclic heteroaryl wherein each of the fused rings comprises five or six ring members, comprising between them one to four heteroatoms chosen from N, O, and S.

[0300] The term “lower cycloalkyl,” as used herein, alone or in combination, means a monocyclic cycloalkyl having between three and six ring members (i.e., C₃-C₆ cycloalkyl). Lower cycloalkyls may be unsaturated. Examples of lower cycloalkyl include cyclopropyl, cyclobutyl, cyclopentyl, and cyclohexyl.

[0301] The term “lower heterocycloalkyl,” as used herein, alone or in combination, means a monocyclic heterocycloalkyl having between three and six ring members, of which between one and four may be heteroatoms chosen from N, O, and S (i.e., C₃-C₆ heterocycloalkyl). Examples of lower heterocycloalkyls include pyrrolidinyl, imidazolidinyl, pyrazolidinyl, piperidinyl, piperazinyl, and morpholinyl. Lower heterocycloalkyls may be unsaturated.

[0302] The term “lower amino,” as used herein, alone or in combination, refers to -NRR' wherein R and R' are independently chosen from hydrogen and lower alkyl, either of which is optionally substituted.

[0303] The term “mercaptyl” as used herein, alone or in combination, refers to an RS-group, where R is as defined herein.

[0304] The term “nitro,” as used herein, alone or in combination, refers to -NO₂.

[0305] The terms “oxy” or “oxa,” as used herein, alone or in combination, refer to -O-.

- [0306] The term “oxo,” as used herein, alone or in combination, refers to =O.
- [0307] The term “perhaloalkoxy” refers to an alkoxy group where all of the hydrogen atoms are replaced by halogen atoms.
- [0308] The term “perhaloalkyl” as used herein, alone or in combination, refers to an alkyl group where all of the hydrogen atoms are replaced by halogen atoms.
- [0309] The term “spirocycle ring system” refers to a polycyclic ring system comprising two rings such that a single atom is common to both rings.
- [0310] The terms “sulfonate,” “sulfonic acid,” and “sulfonic,” as used herein, alone or in combination, refer to the SO_3H group and its anion as the sulfonic acid is used in salt formation.
- [0311] The term “sulfanyl,” as used herein, alone or in combination, refers to $\text{S}-$.
- [0312] The term “sulfinyl,” as used herein, alone or in combination, refers to $\text{S(O)}-$.
- [0313] The term “sulfonyl,” as used herein, alone or in combination, refers to S(O)_2- .
- [0314] The term “N-sulfonamido” refers to a $\text{RS(=O)}_2\text{NR}'$ group with R and R' as defined herein.
- [0315] The term “S-sulfonamido” refers to a $\text{S(=O)}_2\text{NRR}'$ group, with R and R' as defined herein.
- [0316] The terms “thia” and “thio,” as used herein, alone or in combination, refer to a $\text{S}-$ group or an ether wherein the oxygen is replaced with sulfur. The oxidized derivatives of the thio group, namely sulfinyl and sulfonyl, are included in the definition of thia and thio.
- [0317] The term “thiol,” as used herein, alone or in combination, refers to an SH group.
- [0318] The term “thiocarbonyl,” as used herein, when alone includes thioformyl C(S)H and in combination is a $\text{C(S)}-$ group.
- [0319] The term “N-thiocarbamyl” refers to an $\text{ROC(S)NR}'$ group, with R and R' as defined herein.
- [0320] The term “O-thiocarbamyl” refers to a $\text{OC(S)NRR}'$ group with R and R' as defined herein.
- [0321] The term “thiocyanato” refers to a CNS group.
- [0322] The term “trihalomethanesulfonamido” refers to a $\text{X}_3\text{CS(O)}_2\text{NR}-$ group with X is a halogen and R as defined herein.
- [0323] The term “trihalomethanesulfonyl” refers to a $\text{X}_3\text{CS(O)}_2-$ group where X is a halogen.
- [0324] The term “trihalomethoxy” refers to a $\text{X}_3\text{CO}-$ group where X is a halogen.

[0325] The term “trisubstituted silyl,” as used herein, alone or in combination, refers to a silicone group substituted at its three free valences with groups as listed herein under the definition of substituted amino. Examples include trimethylsilyl, tert-butyldimethylsilyl, triphenylsilyl and the like.

[0326] Any definition herein may be used in combination with any other definition to describe a composite structural group. By convention, the trailing element of any such definition is that which attaches to the parent moiety. For example, the composite group alkylamido would represent an alkyl group attached to the parent molecule through an amido group, and the term alkoxyalkyl would represent an alkoxy group attached to the parent molecule through an alkyl group.

[0327] When a group is defined to be “null,” what is meant is that said group is absent.

[0328] The term “optionally substituted” means the antecedent group may be substituted or unsubstituted. When substituted, the substituents of an “optionally substituted” group may include, without limitation, one or more substituents independently chosen from the following groups or a particular designated set of groups, alone or in combination: lower alkyl, lower alkenyl, lower alkynyl, lower alkanoyl, lower heteroalkyl, lower heterocycloalkyl, lower haloalkyl, lower haloalkenyl, lower haloalkynyl, lower perhaloalkyl, lower perhaloalkoxy, lower cycloalkyl, phenyl, aryl, aryloxy, lower alkoxy, lower haloalkoxy, oxo, lower acyloxy, carbonyl, carboxyl, lower alkylcarbonyl, lower carboxyester, lower carboxamido, cyano, hydrogen, halogen, hydroxy, amino, lower alkylamino, arylamino, amido, nitro, thiol, lower alkylthio, lower haloalkylthio, lower perhaloalkylthio, arylthio, sulfonate, sulfonic acid, trisubstituted silyl, N₃, SH, SCH₃, C(O)CH₃, CO₂CH₃, CO₂H, pyridinyl, thiophene, furanyl, lower carbamate, and lower urea. Where structurally feasible, two substituents may be joined together to form a fused five-, six-, or seven-membered carbocyclic or heterocyclic ring consisting of zero to three heteroatoms, for example forming methylenedioxy or ethylenedioxy. An optionally substituted group may be unsubstituted (e.g., -CH₂CH₃), fully substituted (e.g., -CF₂CF₃), monosubstituted (e.g., -CH₂CH₂F) or substituted at a level anywhere in-between fully substituted and monosubstituted (e.g., -CH₂CF₃). Where substituents are recited without qualification as to substitution, both substituted and unsubstituted forms are encompassed. Where a substituent is qualified as “substituted,” the substituted form is specifically intended. Additionally, different sets of optional substituents to a particular moiety may be defined as needed; in these cases, the optional substitution will be as defined, often immediately following the phrase, “optionally substituted with.”

[0329] The term R or the term R', appearing by itself and without a number designation, unless otherwise defined, refers to a moiety chosen from hydrogen, alkyl, cycloalkyl, heteroalkyl, aryl, heteroaryl and heterocycloalkyl, any of which is optionally substituted. Such R and R' groups should be understood to be optionally substituted as defined herein. Whether an R group has a number designation or not, every R group, including R, R' and Rⁿ where n=(1, 2, 3, ...n), every substituent, and every term should be understood to be independent of every other in terms of selection from a group. Should any variable, substituent, or term (e.g. aryl, heterocycle, R, etc.) occur more than one time in a formula or generic structure, its definition at each occurrence is independent of the definition at every other occurrence. Those of skill in the art will further recognize that certain groups may be attached to a parent molecule or may occupy a position in a chain of elements from either end as written. For example, an unsymmetrical group such as -C(O)N(R)- may be attached to the parent moiety at either the carbon or the nitrogen.

[0330] Asymmetric centers exist in the compounds disclosed herein. These centers are designated by the symbols "R" or "S," depending on the configuration of substituents around the chiral carbon atom. It should be understood that the invention encompasses all stereochemical isomeric forms, including diastereomeric, enantiomeric, and epimeric forms, as well as d-isomers and l-isomers, and mixtures thereof. Individual stereoisomers of compounds can be prepared synthetically from commercially available starting materials which contain chiral centers or by preparation of mixtures of enantiomeric products followed by separation such as conversion to a mixture of diastereomers followed by separation or recrystallization, chromatographic techniques, direct separation of enantiomers on chiral chromatographic columns, or any other appropriate method known in the art. Starting compounds of particular stereochemistry are either commercially available or can be made and resolved by techniques known in the art. Additionally, the compounds disclosed herein may exist as geometric isomers. The present invention includes all cis, trans, syn, anti, entgegen (E), and zusammen (Z) isomers as well as the appropriate mixtures thereof. Additionally, compounds may exist as tautomers; all tautomeric isomers are provided by this invention. Additionally, the compounds disclosed herein can exist in unsolvated as well as solvated forms with pharmaceutically acceptable solvents such as water, ethanol, and the like. In general, the solvated forms are considered equivalent to the unsolvated forms.

[0331] The term "bond" refers to a covalent linkage between two atoms, or two moieties when the atoms joined by the bond are considered to be part of larger substructure. A bond may be single, double, or triple unless otherwise specified. A dashed line between two atoms

in a drawing of a molecule indicates that an additional bond may be present or absent at that position.

[0332] The term "disease" as used herein is intended to be generally synonymous, and is used interchangeably with, the terms "disorder," "syndrome," and "condition" (as in medical condition), in that all reflect an abnormal condition of the human or animal body or of one of its parts that impairs normal functioning, is typically manifested by distinguishing signs and symptoms, and causes the human or animal to have a reduced duration or quality of life.

[0333] A "cognitive disorder," as used herein refers to a mental health disorder in which loss of cognitive function is the primary symptom, and which primarily affects learning, memory, perception, and / or problem solving. Cognitive disorders include amnesia, dementia, and delirium. Causes may include damage to the memory portions of the brain, whether from trauma or chemotherapy.

[0334] The term "combination therapy" means the administration of two or more therapeutic agents to treat a therapeutic condition or disorder described in the present disclosure. Such administration encompasses co-administration of these therapeutic agents in a substantially simultaneous manner, such as in a single capsule having a fixed ratio of active ingredients or in multiple, separate capsules for each active ingredient. In addition, such administration also encompasses use of each type of therapeutic agent in a sequential manner. In either case, the treatment regimen will provide beneficial effects of the drug combination in treating the conditions or disorders described herein.

[0335] "RIPK1 binder" is used herein to refer to a compound that exhibits an K_d with respect to RIPK1 of no more than about 100 μM and more typically not more than about 50 μM , as measured in the RIPK1 binding assay described generally herein. The RIPK1 binding assay measures the K_d (dissociation constant) for the binding of a compound with the active site of RIPK1. Certain compounds disclosed herein have been discovered to bind to RIPK1. In certain embodiments, compounds will exhibit an K_d with respect to RIPK1 of no more than about 10 μM ; in further embodiments, compounds will exhibit a K_d with respect to RIPK1 of no more than about 1 μM ; in yet further embodiments, compounds will exhibit a K_d with respect to RIPK1 of not more than about 0.1 μM ; in yet further embodiments, compounds will exhibit a K_d with respect to RIPK1 of not more than about 10 nM, as measured in the RIPK1 assay described herein.

[0336] The phrase "therapeutically effective" is intended to qualify the amount of active ingredients used in the treatment of a disease or disorder or on the effecting of a clinical endpoint.

[0337] The term “therapeutically acceptable” refers to those compounds (or salts, prodrugs, tautomers, zwitterionic forms, etc.) which are suitable for use in contact with the tissues of patients without undue toxicity, irritation, and allergic response, are commensurate with a reasonable benefit / risk ratio, and are effective for their intended use.

[0338] As used herein, reference to “treatment” of a patient is intended to include prophylaxis. Treatment may also be preemptive in nature, i.e., it may include prevention of disease. Prevention of a disease may involve complete protection from disease, for example as in the case of prevention of infection with a pathogen, or may involve prevention of disease progression. For example, prevention of a disease may not mean complete foreclosure of any effect related to the diseases at any level, but instead may mean prevention of the symptoms of a disease to a clinically significant or detectable level. Prevention of diseases may also mean prevention of progression of a disease to a later stage of the disease.

[0339] The term “patient” is generally synonymous with the term “subject” and includes all mammals including humans. Examples of patients include humans, livestock such as cows, goats, sheep, pigs, and rabbits, and companion animals such as dogs, cats, rabbits, and horses. Preferably, the patient is a human.

[0340] The term “prodrug” refers to a compound that is made more active in vivo. Certain compounds disclosed herein may also exist as prodrugs, as described in *Hydrolysis in Drug and Prodrug Metabolism: Chemistry, Biochemistry, and Enzymology* (Testa, Bernard and Mayer, Joachim M. Wiley-VHCA, Zurich, Switzerland 2003). Prodrugs of the compounds described herein are structurally modified forms of the compound that readily undergo chemical changes under physiological conditions to provide the compound. Additionally, prodrugs can be converted to the compound by chemical or biochemical methods in an ex vivo environment. For example, prodrugs can be slowly converted to a compound when placed in a transdermal patch reservoir with a suitable enzyme or chemical reagent. Prodrugs are often useful because, in some situations, they may be easier to administer than the compound, or parent drug. They may, for instance, be bioavailable by oral administration whereas the parent drug is not. The prodrug may also have improved solubility in pharmaceutical compositions over the parent drug. A wide variety of prodrug derivatives are known in the art, such as those that rely on hydrolytic cleavage or oxidative activation of the prodrug. An example, without limitation, of a prodrug would be a compound which is administered as an ester (the “prodrug”), but then is metabolically hydrolyzed to the carboxylic acid, the active entity. Additional examples include peptidyl derivatives of a compound.

Salts and Polymorphs

[0341] The compounds disclosed herein can exist as therapeutically acceptable salts. The present invention includes compounds listed above in the form of salts, including acid addition salts. Suitable salts include those formed with both organic and inorganic acids. Such acid addition salts will normally be pharmaceutically acceptable. However, salts of non-pharmaceutically acceptable salts may be of utility in the preparation and purification of the compound in question. Basic addition salts may also be formed and be pharmaceutically acceptable. For a more complete discussion of the preparation and selection of salts, refer to *Pharmaceutical Salts: Properties, Selection, and Use* (Stahl, P. Heinrich. Wiley-VCHA, Zurich, Switzerland, 2002).

[0342] The term “therapeutically acceptable salt,” as used herein, represents salts or zwitterionic forms of the compounds disclosed herein which are water or oil-soluble or dispersible and therapeutically acceptable as defined herein. The salts can be prepared during the final isolation and purification of the compounds or separately by reacting the appropriate compound in the form of the free base with a suitable acid. Representative acid addition salts include acetate, adipate, alginate, L-ascorbate, aspartate, benzoate, benzenesulfonate (besylate), bisulfate, butyrate, camphorate, camphorsulfonate, citrate, digluconate, formate, fumarate, gentisate, glutarate, glycerophosphate, glycolate, hemisulfate, heptanoate, hexanoate, hippurate, hydrochloride, hydrobromide, hydroiodide, 2-hydroxyethansulfonate (isethionate), lactate, maleate, malonate, DL-mandelate, mesitylenesulfonate, methanesulfonate, naphthylenesulfonate, nicotinate, 2-naphthalenesulfonate, oxalate, pamoate, pectinate, persulfate, 3-phenylpropionate, phosphonate, picrate, pivalate, propionate, pyroglutamate, succinate, sulfonate, tartrate, L-tartrate, trichloroacetate, trifluoroacetate, phosphate, glutamate, bicarbonate, para-toluenesulfonate (p-tosylate), and undecanoate. Also, basic groups in the compounds disclosed herein can be quaternized with methyl, ethyl, propyl, and butyl chlorides, bromides, and iodides; dimethyl, diethyl, dibutyl, and diamyl sulfates; decyl, lauryl, myristyl, and steryl chlorides, bromides, and iodides; and benzyl and phenethyl bromides. Examples of acids which can be employed to form therapeutically acceptable addition salts include inorganic acids such as hydrochloric, hydrobromic, sulfuric, and phosphoric, and organic acids such as oxalic, maleic, succinic, and citric. Salts can also be formed by coordination of the compounds with an alkali metal or

alkaline earth ion. Hence, the present invention contemplates sodium, potassium, magnesium, and calcium salts of the compounds disclosed herein, and the like.

[0343] Basic addition salts can be prepared during the final isolation and purification of the compounds by reacting a carboxy group with a suitable base such as the hydroxide, carbonate, or bicarbonate of a metal cation or with ammonia or an organic primary, secondary, or tertiary amine. The cations of therapeutically acceptable salts include lithium, sodium, potassium, calcium, magnesium, and aluminum, as well as nontoxic quaternary amine cations such as ammonium, tetramethylammonium, tetraethylammonium, methylamine, dimethylamine, trimethylamine, triethylamine, diethylamine, ethylamine, tributylamine, pyridine, *N,N*-dimethylaniline, *N*-methylpiperidine, *N*-methylmorpholine, dicyclohexylamine, procaine, dibenzylamine, *N,N*-dibenzylphenethylamine, 1-phenamine, and *N,N'*-dibenzylethylenediamine. Other representative organic amines useful for the formation of base addition salts include ethylenediamine, ethanolamine, diethanolamine, piperidine, and piperazine.

[0344] While it may be possible for the compounds of the subject invention to be administered as the raw chemical, it is also possible to present them as a pharmaceutical formulation. Accordingly, provided herein are pharmaceutical formulations which comprise one or more of certain compounds disclosed herein, or one or more pharmaceutically acceptable salts, esters, prodrugs, amides, or solvates thereof, together with one or more pharmaceutically acceptable carriers thereof and optionally one or more other therapeutic ingredients. The carrier(s) must be "acceptable" in the sense of being compatible with the other ingredients of the formulation and not deleterious to the recipient thereof. Proper formulation is dependent upon the route of administration chosen. Any of the well-known techniques, carriers, and excipients may be used as suitable and as understood in the art. The pharmaceutical compositions disclosed herein may be manufactured in any manner known in the art, *e.g.*, by means of conventional mixing, dissolving, granulating, dragee-making, levigating, emulsifying, encapsulating, entrapping or compression processes.

Formulations

[0345] The formulations include those suitable for oral, parenteral (including subcutaneous, intradermal, intramuscular, intravenous, intraarticular, and intramedullary), intraperitoneal, transmucosal, transdermal, rectal and topical (including dermal, buccal, sublingual and intraocular) administration although the most suitable route may depend upon

for example the condition and disorder of the recipient. The formulations may conveniently be presented in unit dosage form and may be prepared by any of the methods well known in the art of pharmacy. Typically, these methods include the step of bringing into association a compound of the subject invention or a pharmaceutically acceptable salt, ester, amide, prodrug or solvate thereof ("active ingredient") with the carrier which constitutes one or more accessory ingredients. In general, the formulations are prepared by uniformly and intimately bringing into association the active ingredient with liquid carriers or finely divided solid carriers or both and then, if necessary, shaping the product into the desired formulation.

[0346] Formulations of the compounds disclosed herein suitable for oral administration may be presented as discrete units such as capsules, cachets or tablets each containing a predetermined amount of the active ingredient; as a powder or granules; as a solution or a suspension in an aqueous liquid or a non-aqueous liquid; or as an oil-in-water liquid emulsion or a water-in-oil liquid emulsion. The active ingredient may also be presented as a bolus, electuary or paste.

[0347] Pharmaceutical preparations which can be used orally include tablets, push-fit capsules made of gelatin, as well as soft, sealed capsules made of gelatin and a plasticizer, such as glycerol or sorbitol. Tablets may be made by compression or molding, optionally with one or more accessory ingredients. Compressed tablets may be prepared by compressing in a suitable machine the active ingredient in a free-flowing form such as a powder or granules, optionally mixed with binders, inert diluents, or lubricating, surface active or dispersing agents. Molded tablets may be made by molding in a suitable machine a mixture of the powdered compound moistened with an inert liquid diluent. The tablets may optionally be coated or scored and may be formulated so as to provide slow or controlled release of the active ingredient therein. All formulations for oral administration should be in dosages suitable for such administration. 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. In addition, stabilizers may be added. Dragee cores are provided with suitable coatings. For this purpose, concentrated sugar solutions may be used, which may optionally contain gum arabic, talc, polyvinyl pyrrolidone, carbopol gel, polyethylene glycol, and / or titanium dioxide, lacquer solutions, and suitable organic solvents or solvent mixtures. Dyestuffs or pigments may be added to the tablets or dragee coatings for identification or to characterize different combinations of active compound doses.

[0348] The compounds may be formulated for parenteral administration by injection, *e.g.*, by bolus injection or continuous infusion. Formulations for injection may be presented in unit dosage form, *e.g.*, in ampoules or in multi-dose containers, with an added preservative. The compositions may take such forms as suspensions, solutions or emulsions in oily or aqueous vehicles, and may contain formulatory agents such as suspending, stabilizing and / or dispersing agents. The formulations may be presented in unit-dose or multi-dose containers, for example sealed ampoules and vials, and may be stored in powder form or in a freeze-dried (lyophilized) condition requiring only the addition of the sterile liquid carrier, for example, saline or sterile pyrogen-free water, immediately prior to use. Extemporaneous injection solutions and suspensions may be prepared from sterile powders, granules and tablets of the kind previously described.

[0349] Formulations for parenteral administration include aqueous and non-aqueous (oily) sterile injection solutions of the active compounds which may contain antioxidants, buffers, bacteriostats and solutes which render the formulation isotonic with the blood of the intended recipient; and aqueous and non-aqueous sterile suspensions which may include suspending agents and thickening agents. Suitable lipophilic solvents or vehicles include fatty oils such as sesame oil, or synthetic fatty acid esters, such as ethyl oleate or triglycerides, or liposomes. Aqueous injection suspensions may contain substances which increase the viscosity of the suspension, such as sodium carboxymethyl cellulose, sorbitol, or dextran. Optionally, the suspension may also contain suitable stabilizers or agents which increase the solubility of the compounds to allow for the preparation of highly concentrated solutions.

[0350] In addition to the formulations described previously, the compounds may also be formulated as a depot preparation. Such long acting formulations may be administered by implantation (for example subcutaneously or intramuscularly) or by intramuscular injection. Thus, for example, the compounds may be formulated with suitable polymeric or hydrophobic materials (for example as an emulsion in an acceptable oil) or ion exchange resins, or as sparingly soluble derivatives, for example, as a sparingly soluble salt.

[0351] For buccal or sublingual administration, the compositions may take the form of tablets, lozenges, pastilles, or gels formulated in conventional manner. Such compositions may comprise the active ingredient in a flavored basis such as sucrose and acacia or tragacanth.

[0352] The compounds may also be formulated in rectal compositions such as suppositories or retention enemas, *e.g.*, containing conventional suppository bases such as cocoa butter, polyethylene glycol, or other glycerides.

[0353] Certain compounds disclosed herein may be administered topically, that is by non-systemic administration. This includes the application of a compound disclosed herein externally to the epidermis or the buccal cavity and the instillation of such a compound into the ear, eye and nose, such that the compound does not significantly enter the blood stream. In contrast, systemic administration refers to oral, intravenous, intraperitoneal and intramuscular administration.

[0354] Formulations suitable for topical administration include liquid or semi-liquid preparations suitable for penetration through the skin to the site of inflammation such as gels, liniments, lotions, creams, ointments or pastes, and drops suitable for administration to the eye, ear or nose. The active ingredient for topical administration may comprise, for example, from 0.001% to 10% w / w (by weight) of the formulation. In certain embodiments, the active ingredient may comprise as much as 10% w / w. In other embodiments, it may comprise less than 5% w / w. In certain embodiments, the active ingredient may comprise from 2% w / w to 5% w / w. In other embodiments, it may comprise from 0.1% to 1% w / w of the formulation.

[0355] For administration by inhalation, compounds may be conveniently delivered from an insufflator, nebulizer pressurized packs or other convenient means of delivering an aerosol spray. Pressurized packs may comprise a suitable propellant such as dichlorodifluoromethane, trichlorofluoromethane, dichlorotetrafluoroethane, carbon dioxide or other suitable gas. In the case of a pressurized aerosol, the dosage unit may be determined by providing a valve to deliver a metered amount. Alternatively, for administration by inhalation or insufflation, the compounds according to the invention may take the form of a dry powder composition, for example a powder mix of the compound and a suitable powder base such as lactose or starch. The powder composition may be presented in unit dosage form, in for example, capsules, cartridges, gelatin or blister packs from which the powder may be administered with the aid of an inhalator or insufflator.

[0356] Preferred unit dosage formulations are those containing an effective dose, as herein below recited, or an appropriate fraction thereof, of the active ingredient.

[0357] It should be understood that in addition to the ingredients particularly mentioned above, the formulations described above may include other agents conventional in the art having regard to the type of formulation in question, for example those suitable for oral administration may include flavoring agents.

Administration and Treatment

[0358] Compounds may be administered orally or via injection at a dose of from 0.1 to 500 mg / kg per day. The dose range for adult humans is generally from 5 mg to 2 g / day. Tablets or other forms of presentation provided in discrete units may conveniently contain an amount of one or more compounds which is effective at such dosage or as a multiple of the same, for instance, units containing 5 mg to 500 mg, usually around 10 mg to 200 mg.

[0359] The amount of active ingredient that may be combined with the carrier materials to produce a single dosage form will vary depending upon the host treated and the particular mode of administration.

[0360] The compounds can be administered in various modes, e.g. orally, topically, or by injection. The precise amount of compound administered to a patient will be the responsibility of the attendant physician. The specific dose level for any particular patient will depend upon a variety of factors including the activity of the specific compound employed, the age, body weight, general health, sex, diets, time of administration, route of administration, rate of excretion, drug combination, the precise disorder being treated, and the severity of the indication or condition being treated. Also, the route of administration may vary depending on the condition and its severity.

[0361] In certain instances, it may be appropriate to administer at least one of the compounds described herein (or a pharmaceutically acceptable salt, ester, or prodrug thereof) in combination with another therapeutic agent. By way of example only, if one of the side effects experienced by a patient upon receiving one of the compounds herein is hypertension, then it may be appropriate to administer an anti-hypertensive agent in combination with the initial therapeutic agent. Or, by way of example only, the therapeutic effectiveness of one of the compounds described herein may be enhanced by administration of an adjuvant (i.e., by itself the adjuvant may only have minimal therapeutic benefit, but in combination with another therapeutic agent, the overall therapeutic benefit to the patient is enhanced). Or, by way of example only, the benefit of experienced by a patient may be increased by administering one of the compounds described herein with another therapeutic agent (which also includes a therapeutic regimen) that also has therapeutic benefit. By way of example only, in a treatment for diabetes involving administration of one of the compounds described herein, increased therapeutic benefit may result by also providing the patient with another therapeutic agent for diabetes. In any case, regardless of the disease, disorder or condition being treated, the overall benefit experienced by the patient may simply be additive of the two therapeutic agents or the patient may experience a synergistic benefit.

[0362] Specific, non-limiting examples of possible combination therapies include use of certain compounds of the invention with: donepezil, rivastigmine, galantamine, and memantine. Further examples include anti-amyloid antibodies and vaccines, anti-Aβ antibodies and vaccines, anti-tau antibodies and vaccines, β-secretase inhibitors, 5-HT4 agonists, 5-HT6 antagonists, 5-HT1a antagonists, α7 nicotinic receptor agonists, 5-HT3 receptor antagonists, PDE4 inhibitors, O-glycanase inhibitors, and other medicines approved for the treatment of Alzheimer's disease. Further examples include metformin, minocycline, tissue plasminogen activator, and other therapies that improve neuronal survival.

[0363] In any case, the multiple therapeutic agents (at least one of which is a compound disclosed herein) may be administered in any order or even simultaneously. If simultaneously, the multiple therapeutic agents may be provided in a single, unified form, or in multiple forms (by way of example only, either as a single pill or as two separate pills). One of the therapeutic agents may be given in multiple doses, or both may be given as multiple doses. If not simultaneous, the timing between the multiple doses may be any duration of time ranging from a few minutes to four weeks.

[0364] Thus, in another aspect, certain embodiments provide methods for treating RIPK1-mediated disorders in a human or animal subject in need of such treatment comprising administering to said subject an amount of a compound disclosed herein effective to reduce or prevent said disorder in the subject, in combination with at least one additional agent for the treatment of said disorder that is known in the art. In a related aspect, certain embodiments provide therapeutic compositions comprising at least one compound disclosed herein in combination with one or more additional agents for the treatment of RIPK1-mediated disorders.

[0365] In a related aspect, certain embodiments provide methods for the treatment of cancer that comprise the coadministration of another therapeutic agent. In some embodiments, the other therapeutic agent is a checkpoint inhibitor. In some embodiments, the other therapeutic agent is chosen from an anti-PD1 inhibitor, an anti-PDL1 inhibitor, an anti-CTLA4 inhibitor, an anti-OX50 inhibitor, an anti-TIM3 inhibitor, and an anti-LAG3 inhibitor.

[0366] For use in cancer and neoplastic diseases a RIPK1 inhibitor may be optimally used together with one or more of the following non-limiting examples of anti-cancer agents:

- 1) inhibitors or modulators of a protein involved in one or more of the DNA damage repair (DDR) pathways such as:

- a. PARP1/2, including, but not limited to: olaparib, niraparib, rucaparib;
 - b. checkpoint kinase 1 (CHK1), including, but not limited to: UCN-01, AZD7762, PF477736, SCH900776, MK-8776, LY2603618, V158411, and EXEL-9844;
 - c. checkpoint kinase 2 (CHK2), including, but not limited to: PV1019, NSC 109555, and VRX0466617;
 - d. dual CHK1 / CHK2, including, but not limited to: XL-844, AZD7762, and PF-473336;
 - e. WEE1, including, but not limited to: MK-1775 and PD0166285;
 - f. ATM, including, but not limited to KU-55933,
 - g. DNA-dependent protein kinase, including, but not limited to NU7441 and M3814; and
 - h. Additional proteins involved in DDR;
- 2) Inhibitors or modulators of one or more immune checkpoints, including, but not limited to:
- a. PD-1 inhibitors such as nivolumab (OPDIVO), pembrolizumab (KEYTRUDA), pidilizumab (CT-011), and AMP-224 (AMPLIMMUNE);
 - b. PD-L1 inhibitors such as Atezolizumab (TECENTRIQ), Avelumab (Bavencio), Durvalumab (Imfinzi), MPDL3280A (Tecentriq), BMS-936559, and MEDI4736;
 - c. anti-CTLA-4 antibodies such as ipilimumab (YERVOY) and CP-675,206 (TREMELIMUMAB);
 - d. inhibitors of T-cell immunoglobulin and mucin domain 3 (Tim-3);
 - e. inhibitors of V-domain Ig suppressor of T cell activation (Vista);
 - f. inhibitors of band T lymphocyte attenuator (BTLA);
 - g. inhibitors of lymphocyte activation gene 3 (LAG3); and
 - h. inhibitors of T cell immunoglobulin and immunoreceptor tyrosine-based inhibitory motif domain (TIGIT);
- 3) telomerase inhibitors or telomeric DNA binding compounds;
- 4) alkylating agents, including, but not limited to: chlorambucil (LEUKERAN), oxaliplatin (ELOXATIN), streptozocin (ZANOSAR), dacarbazine, ifosfamide, lomustine (CCNU), procarbazine (MATULAN), temozolomide (TEMODAR), and thiotepa;

- 5) DNA crosslinking agents, including, but not limited to: carmustine, chlorambucil (LEUKERAN), carboplatin (PARAPLATIN), cisplatin (PLATIN), busulfan (MYLERAN), melphalan (ALKERAN), mitomycin (MITOSOL), and cyclophosphamide (ENDOXAN);
- 6) anti-metabolites, including, but not limited to: cladribine (LEUSTATIN), cytarabine, (ARA-C), mercaptopurine (PURINETHOL), thioguanine, pentostatin (NIPENT), cytosine arabinoside (cytarabine, ARA-C), gemcitabine (GEMZAR), fluorouracil (5-FU, CARAC), capecitabine (XELODA), leucovorin (FUSILEV), methotrexate (RHEUMATREX), and raltitrexed;
- 7) antimitotic, which are often plant alkaloids and terpenoids, or derivatives thereof including but limited to: taxanes such as docetaxel (TAXITERE), paclitaxel (ABRAXANE, TAXOL), vinca alkaloids such as vincristine (ONCOVIN), vinblastine, vindesine, and vinorelbine (NAVELBINE);
- 8) topoisomerase inhibitors, including, but not limited to: amacrine, camptothecin (CTP), genistein, irinotecan (CAMPTOSAR), topotecan (HYCAMTIN), doxorubicin (ADRIAMYCIN), daunorubicin (CERUBIDINE), epirubicin (ELLENC), ICRF-193, teniposide (VUMON), mitoxantrone (NOVANTRONE), and etoposide (EPOSIN);
- 9) DNA replication inhibitors, including, but not limited to: fludarabine (FLUDARA), aphidicolin, ganciclovir, and cidofovir;
- 10) ribonucleoside diphosphate reductase inhibitors, including, but not limited to: hydroxyurea;
- 11) transcription inhibitors, including, but not limited to: actinomycin D (dactinomycin, COSMEGEN) and plicamycin (mithramycin);
- 12) DNA cleaving agents, including, but not limited to: bleomycin (BLENOXANE), idarubicin,
- 13) cytotoxic antibiotics, including, but not limited to: actinomycin D (dactinomycin, COSMEGEN),
- 14) aromatase inhibitors, including, but not limited to: aminoglutethimide, anastrozole (ARIMIDEX), letrozole (FEMARA), vorozole (RIVIZOR), and exemestane (AROMASIN);
- 15) angiogenesis inhibitors, including, but not limited to: genistein, sunitinib (SUTENT), and bevacizumab (AVASTIN);

- 16) anti-steroids and anti-androgens, including, but not limited to: aminoglutethimide (CYTADREN), bicalutamide (CASODEX), cyproterone, flutamide (EULEXIN), nilutamide(NILANDRON);
- 17) tyrosine kinase inhibitors, including, but not limited to: imatinib (GLEEVEC), erlotinib (TARCEVA), lapatinib (TYKERB), sorafenib (NEXAVAR), and axitinib (INLYTA);
- 18) mTOR inhibitors, including, but not limited to: everolimus, temsirolimus (TORISEL), and sirolimus;
- 19) monoclonal antibodies, including, but not limited to: trastuzumab (HERCEPTIN) and rituximab (RITUXAN);
- 20) apoptosis inducers such as cordycepin;
- 21) protein synthesis inhibitors, including, but not limited to: clindamycin, chloramphenicol, streptomycin, anisomycin, and cycloheximide;
- 22) antidiabetics, including, but not limited to: metformin and phenformin;
- 23) antibiotics, including, but not limited to:
 - a. tetracyclines, including, but not limited to: doxycycline;
 - b. erythromycins, including, but not limited to: azithromycin;
 - c. glycyglycines, including, but not limited to: tigecycline;
 - d. antiphrastic, including, but not limited to: pyrvinium pamoate;
 - e. beta-lactams, including, but not limited to the penicillins and cephalosporins;
 - f. anthracycline antibiotics, including, but not limited to: daunorubicin and doxorubicin;
 - g. other antibiotics, including, but not limited to: chloramphenicol, mitomycin C, and actinomycin;
- 24) antibody therapeutic agents, including, but not limited to: muromonab-CD3, infliximab (REMICADE), adalimumab (HUMIRA), omalizumab (XOLAIR), daclizumab (ZENAPAX), rituximab (RITUXAN), ibritumomab (ZEVALIN), tositumomab (BEXXAR), cetuximab (ERBITUX), trastuzumab (HERCEPTIN), ADCETRIS, alemtuzumab (CAMPATH-1H), Lym-1 (ONCOLYM), ipilimumab (YERVOY), vitaxin, bevacizumab (AVASTIN), and abciximab (REOPRO); and
- 25) other agents, such as Bacillus Calmette–Guérin (B-C-G) vaccine; buserelin (ETILAMIDE); chloroquine (ARALEN); clodronate, pamidronate, and other bisphosphonates; colchicine; demethoxyviridin; dichloroacetate; estramustine; filgrastim (NEUPOGEN); fludrocortisone (FLORINEF); goserelin (ZOLADEX);

interferon; leucovorin; leuprolide (LUPRON); levamisole; lonidamine; mesna; metformin; mitotane (o,p'-DDD, LYSODREN); nocodazole; octreotide (SANDOSTATIN); perifosine; porfimer (particularly in combination with photo- and radiotherapy); suramin; tamoxifen; titanocene dichloride; tretinoin; anabolic steroids such as fluoxymesterone (HALOTESTIN); estrogens such as estradiol, diethylstilbestrol (DES), and dienestrol; progestins such as medroxyprogesterone acetate (MPA) and megestrol; and testosterone.

[0367] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of a disorder associated with an inflammatory component of cellular stress. In certain embodiments, the disorder is chosen from multiple sclerosis, Neimanm-Pick disease, Alzheimers disease, Parkinson's disease, amyotrophic lateral sclerosis, Lewy body dementia, frontotemporal dementia, glutamine expansion diseases such as Huntington's disease, Kennedy's disease, and spinocerebellar ataxia

[0368] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of neuropathy. In certain embodiments, the neuropathy is chosen from diabetic neuropathy and chemotherapy induced neuropathy.

[0369] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of a retinal disease. In certain embodiments, the retinal disease is chosen from macular degeneration and retinitis.

[0370] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of an injury to the CNS. In certain embodiments, the injury is chosen from a traumatic brain injury and stroke.

[0371] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of an autoimmune disorder. In certain embodiments, the autoimmune disorder is chosen from ulcerative colitis, rheumatoid arthritis, psoriasis, lupus, inflammatory bowel disease.

[0372] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of viral infections.

[0373] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of sepsis.

[0374] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of retinal degeneration.

[0375] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of ischemic stroke.

[0376] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of intracerebral hemorrhage.

[0377] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of amyotrophic lateral sclerosis.

[0378] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of an acute kidney injury.

[0379] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of a myocardial reperfusion injury.

[0380] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of Alzheimer's disease.

[0381] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of ulcerative colitis.

[0382] In certain embodiments, the compounds, compositions, and methods disclosed herein may be useful for the treatment of osteoarthritis.

[0383] In certain embodiments, the the compounds, compositions, and methods disclosed herein may be coadministered with another therapeutic agent.

[0384] Besides being useful for human treatment, certain compounds and formulations disclosed herein may also be useful for veterinary treatment of companion animals, exotic animals and farm animals, including mammals, rodents, and the like. More preferred animals include horses, dogs, and cats.

List of abbreviations

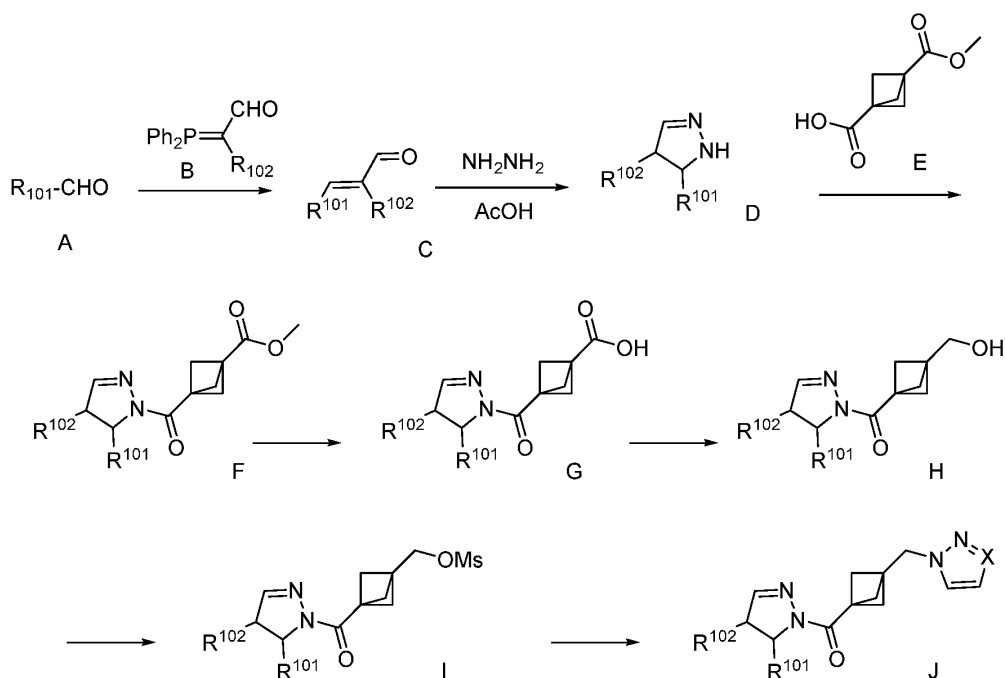
[0385] Ac₂O = acetic anhydride; AcCl = acetyl chloride; AcOH = acetic acid; AIBN = azobisisobutyronitrile; aq. = aqueous; BAST = bis(2-methoxyethyl)aminosulfur trifluoride; Bu = butyl; Bu₃SnH = tributyltin hydride; CD₃OD = deuterated methanol; CDCl₃ = deuterated chloroform; CDI = 1,1'-carbonyldiimidazole; DAST = (diethylamino)sulfur trifluoride; dba = dibenzylideneacetone DBU = 1,8-diazabicyclo[5.4.0]undec-7-ene; DCM = dichloromethane; DEAD = diethyl azodicarboxylate; DtBAD = di-t-butyl azodicarboxylate; DIBAL-H = di-iso-butyl aluminium hydride; DIEA = DIPEA = N,N-diisopropylethylamine; DMAP = 4-dimethylaminopyridine; DMF = N,N-dimethylformamide; DMSO-*d*₆ = deuterated dimethyl sulfoxide; DMSO = dimethyl sulfoxide; DPPA = diphenylphosphoryl azide; dppf = 1,1'-bis(diphenylphosphino)ferrocene; EDC•HCl = EDCI•HCl = 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide hydrochloride; Et = ethyl; Et₂O = diethyl ether; EtOAc = ethyl acetate; EtOH = ethanol; h = hour; HATU=2-(1*H*-7-azabenzotriazol-1-yl)-1,1,3,3-

tetramethyl uronium hexafluorophosphate methanaminium; HMDS = hexamethyldisilazane; HOBT = 1-hydroxybenzotriazole; iPr = i-Pr = isopropyl = 2-propyl; iPrOH = i-PrOH = isopropanol; LAH = lithium aluminiumhydride; LDA = lithium diisopropyl amide; LiHMDS = Lithium bis(trimethylsilyl)amide; MeCN = acetonitrile; MeI = methyl iodide; MeOH = methanol; MP-carbonate resin = macroporous triethylammonium methylpolystyrene carbonate resin; MsCl = mesyl chloride; MTBE = methyl tert-butyl ether; n-BuLi = n-butyllithium; NaHMDS = Sodium bis(trimethylsilyl)amide; NaOEt = sodium ethoxide; NaOMe = sodium methoxide; NaOtBu = sodium t-butoxide; NBS = N-bromosuccinimide; NCS = N-chlorosuccinimide; NIS = N-iodosuccinimide; NMP = N-Methyl-2-pyrrolidone; Pd(Ph₃)₄ = tetrakis(triphenylphosphine)palladium(0); Pd₂(dba)₃ = tris(dibenzylideneacetone)-dipalladium(0); PdCl₂(PPh₃)₂ = bis(triphenylphosphine)palladium(II) dichloride; PG = protecting group; Ph = phenyl; prep-HPLC = preparative high-performance liquid chromatography; PMBCl = para-methoxybenzyl; PMBCl = para-methoxybenzyl chloride; PMBOH = para-methoxybenzyl alcohol; PyBop = (benzotriazol-1-yloxy)tripyrrolidino-phosphonium hexafluorophosphate; Pyr = pyridine; RT = room temperature; RuPhos = 2-dicyclohexylphosphino-2',6'-diisopropoxybiphenyl; sat. = saturated; ss = saturated solution; tBu = t-Bu = tert-butyl = 1,1-dimethylethyl; TBAF = tetrabutylammonium fluoride; TBDPS = t-butyldiphenylsilyl; t-BuOH = tBuOH = tert-butanol; T₃P = Propylphosphonic Anhydride; TEA = Et₃N = triethylamine; TFA = trifluoroacetic acid; TFAA = trifluoroacetic anhydride; THF = tetrahydrofuran; TIPS = triisopropylsilyl; Tol = toluene; TsCl = tosyl chloride; Trt = trityl = (triphenyl)methyl; Xantphos = 4,5-Bis(diphenylphosphino)-9,9-dimethylxanthene; XPhos = 2-dicyclohexylphosphino-2',4',6'-triisopropylbiphenyl.

General synthetic methods for preparing compounds

[0386] The following schemes can be used to practice the present invention.

Scheme I



[0387] Certain examples disclosed herein can be synthesized by using the general synthetic procedure set forth in Scheme I.

[0388] The starting aldehyde (**A**) can be functionalized to acrolein derivative (**C**) through a Wittig type of reaction with a phosphorane reagent such as 2-(triphenyl- λ^5 -phosphanylidene)acetaldehyde (**B**). Alternatively, the unsaturated carbonyl compounds can also be synthesized from (**A**) by an aldol condensation with an acetal aldehyde (not shown). In addition compounds such as (**C**) can be made through various transformations known to one skilled in the art and that are prevalent in the literature, including but not limited to modifications of aryl halides with alkene borane species via a Suzuki type reaction or with an alkene species via a Heck type reaction, any of which can be followed by subsequent modifications if necessary.

[0389] The unsaturated carbonyl intermediate (**C**) can be cyclized with hydrazine (neat, hydrate, or solution) in protic or aprotic solvents, with or without an acid such as acetic acid, and with or without heat or cooling, to form pyrazoline compound (**D**), also referred to as a dihydropyrazole.

[0390] The pyrazoline (**D**) can undergo coupling reactions with carboxylic acids such as 3-(methoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid (**E**) using various coupling

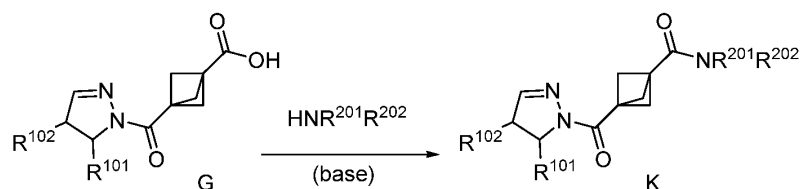
conditions like HATU or T₃P, or via the corresponding acid chloride (not shown, available via reaction with, e.g. (COCl)₂ or SOCl₂), to form amide (F).

[0391] Compound (F) may be a final compound, or may contain an orthogonally protected or functionalized moiety for further modification. For example, hydrolysis affords the carboxylic acid (G) which can be reduced to the alcohol (H), using standard conditions such as basic hydrolysis with LiOH and reduction with THF-Borane, respectively.

[0392] Compound (H) may be a final compound or may contain an orthogonally protected or functionalized moiety for further modification. For example, the primary alcohol of (H) can be converted to a leaving group with a sulfonyl chloride like mesyl or tosyl chloride. Not depicted in scheme 1 but very similarly, the alcohol of compound (H) can also be converted to a halide, such as a bromide directly, with Appel like reaction conditions using triphenyl phosphine (free or resin bound) and a bromine source like tetrabromomethane, and this alkyl bromide will be expected to react similarly as mesylate (I) or tosylate (not shown). In addition, the alcohol of compound (H) can be converted to the chloride or the fluoride using means known to those trained in the art.

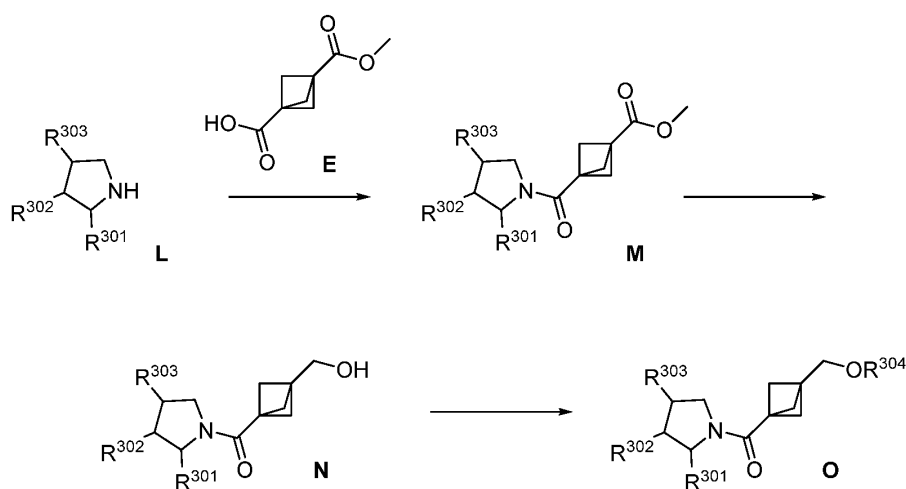
[0393] Compound (I) can be subjected to nucleophilic substitution conditions, in solvents such as DMF, in the presence of bases such as Cs₂CO₃, to form products such as the N-substituted pyrazole (J). In addition, other substitution products can be made from amines, cyanides, azides, hydrazines, hydrazones, amidines, alcohols and other heterocycles not excluding or limiting to imidazoles, indazoles, benzimidazoles, benzotriazoles. By subsequent reactions of these products, such as azides and nitriles, further compounds, including but not limited to pyrazoles, pyrimidines, triazoles and oxadiazoles may be obtained. Compound (I) can also be converted to compounds similar to compound (J) through nucleophilic substitutions, with other bases such as NaH and LiHMDS in solvents like THF or NMP.

Scheme II



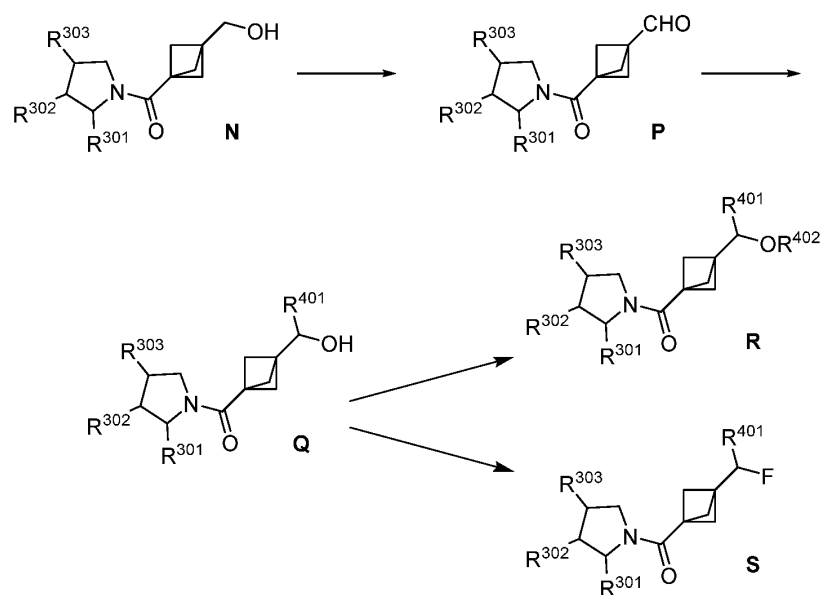
[0394] As shown in Scheme II, compound (G) can be coupled with amines via procedures disclosed in Scheme I for transformation of compound (D) to (F), or with a similar procedure known in the art, affording amide (K).

Scheme III



[0395] As shown in Scheme III, pyrrolidine compounds can be obtained through a reaction sequence similar to that disclosed in Scheme I. Pyrrolidine (L) can be coupled with carboxylic acids such as (E) via procedures disclosed in Scheme 1 for transformation of compound (D) to (F), or with a similar procedure known in the art, affording amide (M). The ester functionality of (M) can be reduced to alcohol (N), either directly or through the carboxylic acid (not shown), using reagents such as $LiBH_4$. Finally, primary alcohol (N) can be transformed via a displacement reaction to yield coupled product (O). Possible manipulations include but are not limited to: Mitsunobu coupling, nucleophilic aliphatic substitution and nucleophilic aromatic substitution of the alcohol, and nucleophilic aliphatic substitution of, e.g., a corresponding halide or sulfonate ester of the alcohol.

Scheme IV



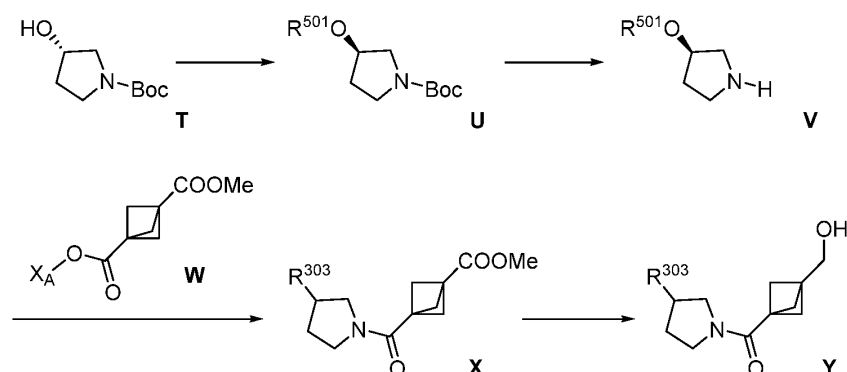
[0396] Compound **(N)** can be additionally modified as disclosed in scheme IV. In this instance the primary alcohol can be oxidized to provide aldehyde **(P)** with reactions and reagents common to the art, such as a Swern oxidation.

[0397] Compound **(O)** can be transformed further depending on orthogonal functional groups within the molecule. For example, as disclosed in this scheme, the aldehyde can be transformed to the alcohol **(Q)** through known reactions of the art, including but not limited to reaction with a Grignard reagent such as CH_3MgBr or PhMgBr .

[0398] Compound **(Q)** can be a final compound or can be transformed further depending on orthogonal functional groups within the molecule and, as in this scheme, can be transformed to the ether compound **(R)** through known reactions of the art and in the literature as as described in schemes I, II, and III.

[0399] Alternatively, compound **(Q)** can be converted to the fluoride using known reagents to the art and in the literature, DAST being one of several examples. Other manipulations of the secondary alcohol of **(Q)** are well established in the art.

Scheme V

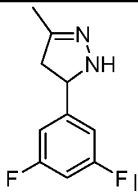
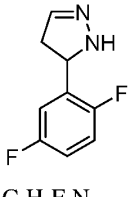
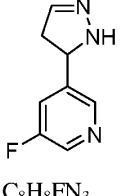
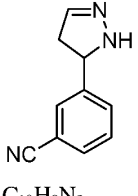
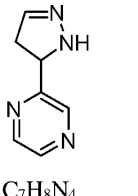


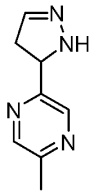
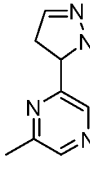
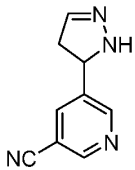
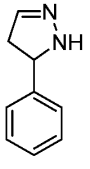
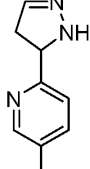
[0400] Certain compounds disclosed herein can be synthesized by using the general synthetic procedure set forth in Scheme V. Protected hydroxypyrrolidine **T** can be substituted using Mitsunobu chemistry to yield ether **U**. Deprotection provides secondary amine **V**, which can be coupled with activated ester **W** (X_A = activating group such as succinimide) to give amide **X**. Further functionalization, using procedures disclosed in the above Schemes are using techniques known in the art, will yield primary alcohol **Y** or other compounds.

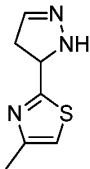
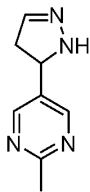
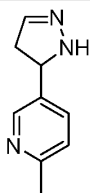
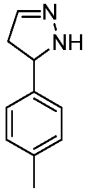
[0401] The representative pyrazolines were synthesized similar to example 1 with noted exceptions. The corresponding phenylacrylaldehyde used to make the pyrazoline was also synthesized similar to that as described in example 1 or as described in example 207.

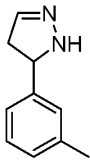
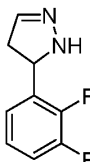
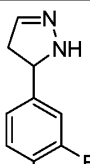
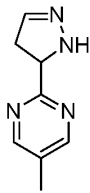
Table 1. Representative Pyrazoline (4,5-dihydro-1H-pyrazole) Intermediates.

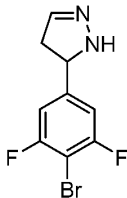
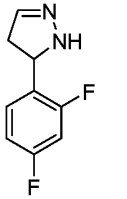
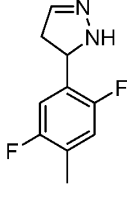
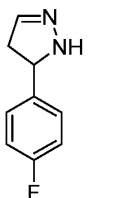
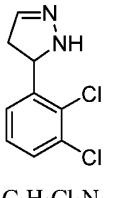
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
	(600 MHz, DMSO- <i>d</i> ₆) δ 7.30 (d, J = 4.1 Hz, 1H), 7.13 – 7.07 (m, 1H), 7.06 – 7.00 (m, 2H), 6.73 (br-s, 1H), 4.64 (td, J = 10.6, 4.1 Hz, 1H), 3.07 (ddd, J = 16.9, 10.7, 1.7 Hz, 1H), 2.49 – 2.40 (m, 1H)			1

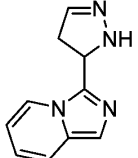
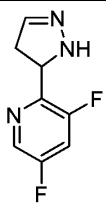
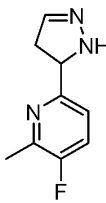
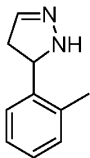
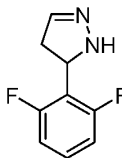
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₁₀ H ₁₀ F ₂ N ₂	(300 MHz, CDCl ₃) δ 6.95 – 6.85 (m, 1H), 6.81 – 6.64 (m, 2H), 5.39 (dd, J = 11.8, 4.7 Hz, 1H), 3.36 (dd, J = 18.3, 11.8 Hz, 1H), 3.06 (dd, J = 16.7, 10.5 Hz, 1H), 2.11 (s, 3H)			47
 C ₉ H ₈ F ₂ N ₂	(500 MHz, CD ₃ OD) δ 7.24 – 7.19 (m, 1H), 7.12 – 7.06 (m, 1H), 7.03 – 6.97 (m, 1H), 6.87 – 6.84 (m, 1H), 4.95 – 4.89 (m, 1H), 3.27 – 3.15 (m, 1H), 2.64 – 2.54 (m, 1H).			53
 C ₈ H ₈ FN ₃	(500 MHz, CD ₃ OD) δ 8.40 – 8.39 (m, 1H), 8.37 – 8.36 (m, 1H), 7.69 – 7.64 (m, 1H), 6.90 – 6.85 (m, 1H), 4.84 – 4.78 (m, 1H), 3.23 (ddd, J = 17.3, 10.8, 1.7 Hz, 1H), 2.66 (ddd, J = 17.3, 10.5, 1.6 Hz, 1H).			14
 C ₁₀ H ₉ N ₃	(500 MHz, CD ₃ OD) δ 7.74 – 7.71 (m, 1H), 7.69 – 7.66 (m, 1H), 7.64 – 7.61 (m, 1H), 7.54 – 7.49 (m, 1H), 6.87 – 6.84 (m, 1H), 4.81 – 4.73 (m, 1H), 3.20 (ddd, J = 17.3, 10.7, 1.7 Hz, 1H), 2.63 (ddd, J = 17.3, 10.4, 1.7 Hz, 1H).			82
 C ₇ H ₈ N ₄	(600 MHz, CDCl ₃) δ 8.70 (d, J = 1.4 Hz, 1H), 8.56 – 8.47 (m, 2H), 6.86 (d, J = 1.7 Hz, 1H), 4.91 (dd, J = 11.1, 8.1 Hz, 1H), 3.27 (ddd, J = 17.2, 11.1, 1.6 Hz, 1H), 2.94 (ddd, J = 17.2, 8.1, 1.6 Hz, 1H).			51

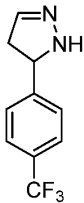
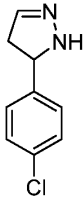
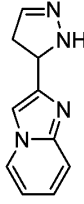
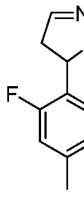
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₈ H ₁₀ N ₄	(300 MHz, CDCl ₃) δ 8.55 (d, J = 1.4 Hz, 1H), 8.40 (d, J = 1.4 Hz, 1H), 6.89 – 6.84 (m, 1H), 4.87 (dd, J = 11.0, 8.0 Hz, 1H), 3.24 (ddd, J = 17.2, 11.0, 1.6 Hz, 1H), 2.92 (ddd, J = 17.2, 8.1, 1.6 Hz, 1H), 2.57 (s, 3H).			49
 C ₈ H ₁₀ N ₄	(600 MHz, CDCl ₃) δ 8.48 (s, 1H), 8.38 (s, 1H), 6.89 – 6.81 (m, 1H), 4.86 (dd, J = 11.1, 8.0 Hz, 1H), 3.25 (ddd, J = 17.2, 11.1, 1.6 Hz, 1H), 2.93 (ddd, J = 17.2, 8.0, 1.7 Hz, 1H), 2.56 (s, 3H).			50
 C ₁₀ H ₉ N ₃	(600 MHz, CDCl ₃) δ 8.81 (d, J = 2.0 Hz, 1H), 8.79 (d, J = 2.2 Hz, 1H), 8.07 – 8.03 (m, 1H), 6.88 – 6.84 (m, 1H), 5.93 (s, 1H), 4.86 – 4.80 (m, 1H), 3.25 (ddd, J = 17.1, 10.9, 1.7 Hz, 1H), 2.65 (ddd, J = 17.1, 10.4, 1.6 Hz, 1H).			168
 C ₉ H ₁₀ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.77 – 7.53 (m, 5H), 6.77 – 6.72 (m, 1H), 4.72 – 4.62 (m, 1H), 3.09 (ddd, J = 17.0, 10.8, 1.7 Hz, 1H), 2.54 – 2.45 (m, 1H).			44
 C ₉ H ₁₁ N ₃	(600 MHz, CDCl ₃) δ 8.37 (s, 1H), 7.52 - 7.46 (m, 1H), 7.28 - 7.25 (m, 1H), 6.86 - 6.79 (m, 1H), 4.88 - 4.79 (m, 1H), 3.23 - 3.15 (m, 1H), 2.86 (ddd, J = 17.2, 7.7, 1.7 Hz, 1H), 2.32 (s, 3H).			171

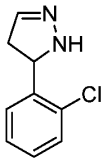
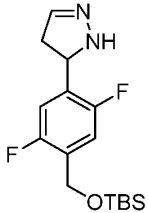
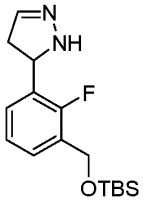
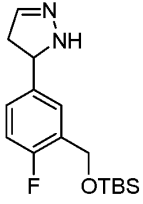
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₇ H ₉ N ₃ S	(600 MHz, DMSO- <i>d</i> ₆) δ 7.52 (d, J = 4.8 Hz, 1H), 7.14 (s, 1H), 6.79 (s, 1H), 4.84 (td, J = 10.8, 4.9 Hz, 1H), 3.17 (ddd, J = 17.1, 11.3, 1.7 Hz, 1H), 2.66 - 2.58 (m, 1H), 2.32 (s, 3H).			170
 C ₈ H ₁₀ N ₄	(500 MHz, DMSO- <i>d</i> ₆) δ 8.62 (s, 2H), 7.31 (d, J = 3.9 Hz, 1H), 6.84 - 6.77 (m, 1H), 4.62 (td, J = 10.5, 3.9 Hz, 1H), 3.08 (ddd, J = 16.9, 10.7, 1.7 Hz, 1H), 2.62 - 2.54 (m, 4H).			183
 C ₉ H ₁₁ N ₃	(600 MHz, DMSO- <i>d</i> ₆) δ 8.37 (d, J = 2.3 Hz, 1H), 7.60 (dd, J = 8.0, 2.4 Hz, 1H), 7.22 (d, J = 3.9 Hz, 1H), 7.22 - 7.18 (m, 1H), 6.75 (d, J = 1.8 Hz, 1H), 4.59 (td, J = 10.6, 3.9 Hz, 1H), 3.04 (ddd, J = 16.9, 10.7, 1.7 Hz, 1H), 2.48 - 2.45 (m, 1H), 2.43 (s, 3H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C		249
 C ₁₀ H ₁₂ N ₂	(500 MHz, DMSO- <i>d</i> ₆) δ 7.22 - 7.18 (m, 2H), 7.14 - 7.11 (m, 3H), 6.71 (d, J = 1.7 Hz, 1H), 4.54 (td, J = 10.7, 3.3 Hz, 1H), 3.00 (ddd, J = 16.8, 10.7, 1.7 Hz, 1H), 2.43 (ddd, J = 16.8, 10.6, 1.6 Hz, 1H), 2.27 (s, 3H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-60% iPrOH / EtOAc soln	198

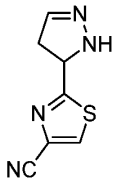
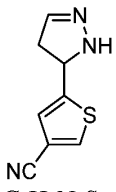
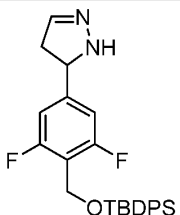
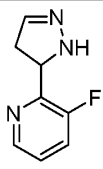
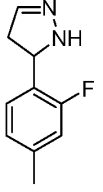
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 <chem>Cc1ccc(cc1)C2=NN=C2</chem> $C_{10}H_{12}N_2$	(600 MHz, DMSO- <i>d</i> ₆) δ 7.20 (t, J = 7.5 Hz, 1H), 7.15 – 7.12 (m, 2H), 7.10 (d, J = 7.7 Hz, 1H), 7.05 (d, J = 7.5 Hz, 1H), 6.71 (d, J = 1.8 Hz, 1H), 4.54 (td, J = 10.7, 3.4 Hz, 1H), 3.02 (ddd, J = 16.8, 10.7, 1.7 Hz, 1H), 2.45 (ddd, J = 16.8, 10.7, 1.6 Hz, 1H), 2.28 (s, 3H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C		243
 <chem>Fc1cc(F)ccc1C2=NN=C2</chem> $C_9H_8F_2N_2$	(600 MHz, DMSO- <i>d</i> ₆) δ 7.35 – 7.30 (m, 1H), 7.27 – 7.23 (m, 2H), 7.21 – 7.16 (m, 1H), 6.76 (d, J = 1.7 Hz, 1H), 4.81 (td, J = 10.5, 4.0 Hz, 1H), 3.15 – 3.08 (m, 1H), 2.55 – 2.51 (m, 1H).		0-40% EtOAc / iPrOH (5:1)	237
 <chem>Fc1cc(F)ccc1C2=NN=C2</chem> $C_9H_8F_2N_2$	(600 MHz, DMSO- <i>d</i> ₆) δ 7.55 – 7.41 (m, 1H), 7.43 – 7.29 (m, 2H), 7.26 (d, J = 4.0 Hz, 1H), 6.73 (d, J = 1.7 Hz, 1H), 4.61 (td, J = 10.7, 3.7 Hz, 1H), 3.05 (ddd, J = 16.9, 10.7, 1.7 Hz, 1H), 2.49 – 2.44 (m, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-40% EtOAc / iPrOH (5:1)	242
 <chem>Cc1ccncc1C2=NN=C2</chem> $C_7H_8N_4$	(600 MHz, DMSO- <i>d</i> ₆) δ 8.79 (d, J = 4.8 Hz, 2H), 7.42 (t, J = 4.9 Hz, 1H), 7.15 (s, 1H), 6.74 (s, 1H), 4.73 (ddd, J = 11.2, 6.4, 2.6 Hz, 1H), 3.13 (ddd, J = 17.1, 6.4, 1.7 Hz, 1H), 3.04 (ddd, J = 17.2, 11.1 Hz, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-100% DCM / MeOH (10:1)	259

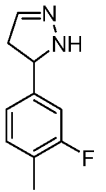
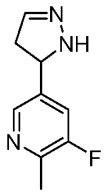
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₉ H ₇ BrF ₂ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.32 (d, J = 4.1 Hz, 1H), 7.24 – 7.21 (m, 2H), 6.73 (d, J = 1.7 Hz, 1H), 4.64 (td, J = 10.6, 4.1 Hz, 1H), 3.08 (ddd, J = 17.0, 10.9, 1.7 Hz, 1H), 2.49 – 2.45 (m, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-40% EtOAc / iPrOH (5:1)	203
 C ₉ H ₈ F ₂ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.50 – 7.43 (m, 1H), 7.24 – 7.17 (m, 2H), 7.06 (td, J = 8.6, 2.7 Hz, 1H), 6.75 (d, J = 1.8 Hz, 1H), 4.75 (td, J = 10.6, 3.9 Hz, 1H), 3.11 – 3.04 (m, 1H), 2.46 (dd, J = 17.0, 10.2 Hz, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-40% EtOAc / iPrOH (5:1)	240
 C ₁₀ H ₁₀ F ₂ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.21 (d, J = 4.0 Hz, 1H), 7.17 – 7.10 (m, 2H), 6.74 (d, J = 1.8 Hz, 1H), 4.73 (td, J = 10.5, 3.9 Hz, 1H), 3.07 (ddd, J = 17.0, 11.1, 1.6 Hz, 1H), 2.46 (dd, J = 17.0, 10.0 Hz, 1H), 2.20 (d, J = 1.9 Hz, 3H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-40% EtOAc / iPrOH (5:1)	236
 C ₉ H ₉ FN ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.88 – 7.74 (m, 1H), 7.40 – 7.34 (m, 2H), 7.30 – 7.23 (m, 2H), 6.72 (s, 1H), 4.60 (td, J = 10.7, 4.0 Hz, 1H), 3.03 (ddd, J = 16.6, 10.7, 1.6 Hz, 1H), 2.44 (dd, J = 17.0, 10.7 Hz, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-40% EtOAc / iPrOH (5:1)	244
 C ₉ H ₈ Cl ₂ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.53 (ddd, J = 21.0, 7.9, 1.6 Hz, 2H), 7.37 (t, J = 7.9 Hz, 1H), 7.30 (d, J = 4.0 Hz, 1H), 6.71 (d, J = 1.7 Hz, 1H), 4.89 (td, J = 10.4, 4.0 Hz, 1H), 3.22 (ddd, J = 17.1, 11.0, 1.7 Hz, 1H), 2.40 – 2.32 (m, 1H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C	0-30% EtOAc / iPrOH (5:1)	245

Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 <chem>C10H10N4</chem>	(500 MHz, CDCl ₃) δ 8.03 – 7.93 (m, 1H), 7.55 – 7.41 (m, 1H), 7.36 (d, J = 0.9 Hz, 1H), 7.03 – 6.89 (m, 1H), 6.76 – 6.69 (m, 1H), 6.61 – 6.52 (m, 1H), 5.99 (s, 1H), 5.27 (t, J = 10.3 Hz, 1H), 3.17 (dd, J = 10.3, 1.6 Hz, 2H).	AcOH - 1.7 eq, H ₄ N ₂ - 1.5 eq, EtOH, 80 °C		247
 <chem>C8H7F2N3</chem>	(500 MHz, DMSO- <i>d</i> ₆) δ 8.45 (d, J = 2.4 Hz, 1H), 7.97 – 7.89 (m, 1H), 7.13 (d, J = 3.2 Hz, 1H), 6.77 (d, J = 2.1 Hz, 1H), 4.94 – 4.85 (m, 1H), 3.11 – 2.95 (m, 2H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		291
 <chem>C9H10FN3</chem>	(500 MHz, DMSO- <i>d</i> ₆) δ 7.64 – 7.57 (m, 1H), 7.31 (dd, J = 8.5, 3.8 Hz, 1H), 7.25 (d, J = 3.9 Hz, 1H), 6.73 (d, J = 2.1 Hz, 1H), 4.64 (td, 1H), 3.05 (ddd, J = 17.1, 11.1, 1.7 Hz, 1H), 2.75 – 2.67 (m, 1H), 2.43 (d, J = 3.0 Hz, 3H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, iPrOH, 80 °C		315
 <chem>C10H12N2</chem>	(500 MHz, DMSO- <i>d</i> ₆) δ 7.42 – 7.37 (m, 1H), 7.20 – 7.10 (m, 4H), 6.70 (s, 1H), 4.75 (td, J = 10.6, 3.8 Hz, 1H), 3.11 (ddd, J = 16.8, 10.8, 1.7 Hz, 1H), 2.45 – 2.37 (m, 1H), 2.28 (s, 3H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		314
 <chem>C9H8F2N2</chem>	(500 MHz, DMSO- <i>d</i> ₆) δ 7.41 – 7.30 (m, 1H), 7.08 – 7.03 (m, 2H), 7.01 – 6.92 (m, 1H), 6.79 (d, J = 1.8 Hz, 1H), 4.94 – 4.85 (m, 1H), 3.11 – 3.01 (m, 1H), 2.80 – 2.71 (m, 1H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		307

Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₁₀ H ₉ F ₃ N ₂	(500 MHz, DMSO- <i>d</i> ₆) δ 7.69 (d, J = 8.1 Hz, 2H), 7.55 (d, J = 8.1 Hz, 2H), 7.33 (d, J = 4.0 Hz, 1H), 6.75 (d, J = 1.7 Hz, 1H), 4.70 (td, J = 10.7, 3.9 Hz, 1H), 3.11 (ddd, J = 16.9, 10.9, 1.7 Hz, 1H), 2.49 – 2.44 (m, 1H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80°C		307
 C ₉ H ₉ ClN ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.40 – 7.34 (m, 2H), 7.36 – 7.30 (m, 2H), 7.30 – 7.23 (m, 1H), 5.76 (s, 1H), 4.60 (td, J = 10.7, 3.9 Hz, 1H), 3.05 (ddd, J = 16.8, 10.7, 1.6 Hz, 1H), 2.45 – 2.38 (m, 1H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		311
 C ₁₀ H ₁₀ N ₄	(500 MHz, DMSO- <i>d</i> ₆) δ 8.48 (dt, J = 6.8, 1.2 Hz, 1H), 7.81 (s, 1H), 7.50 – 7.43 (m, 1H), 7.20 (ddd, J = 9.0, 6.7, 1.3 Hz, 1H), 7.07 – 7.02 (m, 1H), 6.85 (td, J = 6.8, 1.2 Hz, 1H), 6.79 – 6.75 (m, 1H), 4.75 – 4.67 (m, 1H), 3.00 (ddd, J = 16.8, 10.7, 1.6 Hz, 1H), 2.80 (ddd, J = 16.8, 8.6, 1.7 Hz, 1H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		258
 C ₁₀ H ₁₀ F ₂ N ₂	(600 MHz, DMSO- <i>d</i> ₆) δ 7.02 (d, J = 4.9 Hz, 1H), 6.89 (d, J = 9.4 Hz, 2H), 6.77 (s, 1H), 4.90 – 4.79 (m, 1H), 3.02 (dd, J = 17.1, 12.1 Hz, 1H), 2.72 (dd, J = 17.2, 10.1 Hz, 1H), 2.36 (d, J = 1.8 Hz, 3H).	AcOH - 0.3 eq, H ₄ N ₂ - 5 eq, tBuOH, 80 °C		304

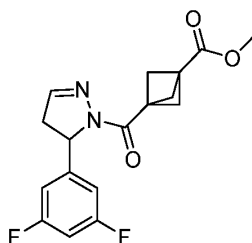
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₉ H ₉ ClN ₂	(500 MHz, DMSO- <i>d</i> ₆) δ 7.55 (dd, J = 7.6, 1.8 Hz, 1H), 7.44 (dd, J = 7.8, 1.4 Hz, 1H), 7.42 – 7.24 (m, 3H), 6.72 (d, J = 1.7 Hz, 1H), 4.87 (td, J = 10.5, 3.9 Hz, 1H), 3.19 (ddd, J = 17.0, 10.9, 1.7 Hz, 1H), 2.41 – 2.30 (m, 1H).	AcOH - 0.9 eq, H ₄ N ₂ - 2.5 eq, tBuOH, 80 °C		318
 C ₁₆ H ₂₄ F ₂ N ₂ OSi	(300 MHz, DMSO- <i>d</i> ₆) δ 7.17 (m, 2H), 7.05 (m, 1H), 6.59 – 6.53 (m, 1H), 4.65 (s, 3H), 4.59 – 4.57 (m, 1H), 0.80 (s, 6H), -0.01 (d, J = 7.6 Hz, 9H).	AcOH - 0.3 eq, H ₄ N ₂ - 2.5 eq, tBuOH, 8080 °C	(0-40%) EtOAc in hexanes	
 C ₁₆ H ₂₅ FN ₂ O ₂ Si	(600 MHz, DMSO- <i>d</i> ₆) δ 7.29 – 7.22 (m, 2H), 7.13 – 7.05 (m, 2H), 6.65 (s, 1H), 4.72 – 4.69 (m, 1H), 4.66 (s, 2H), 3.00 (dd, J = 16.9, 10.9 Hz, 1H), 2.39 – 2.32 (m, 1H), 0.82 (s, 9H), 0.02 (s, 6H).	AcOH - 0.3 eq, H ₄ N ₂ - 2.5 eq, tBuOH, 8080 °C	(0-40%) EtOAc in hexanes	344
 C ₁₆ H ₂₅ FN ₂ O ₂ Si	(600 MHz, DMSO) δ 7.44 – 7.39 (m, 1H), 7.28 – 7.23 (m, 1H), 7.18 (d, J = 4.0 Hz, 1H), 7.14 – 7.05 (m, 1H), 6.71 (s, 1H), 4.72 (s, 2H), 4.59 (td, J = 10.7, 3.9 Hz, 1H), 3.04 (ddd, J = 17.0, 10.8, 1.7 Hz, 1H), 2.46 – 2.36 (m, 1H), 0.93 – 0.85 (m, 9H), 0.12 – 0.04 (m, 6H).			207

Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₇ H ₆ N ₄ S	(500 MHz, DMSO) δ 8.76 (s, 1H), 7.73 (d, J = 5.4 Hz, 1H), 6.84 (s, 1H), 4.94 (ddd, J = 11.6, 10.1, 5.4 Hz, 1H), 3.27 (ddd, J = 17.5, 11.6, 1.7 Hz, 1H), 2.74 – 2.62 (m, 1H).			254
 C ₈ H ₇ N ₃ S	(600 MHz, DMSO) δ 7.84 (d, J = 3.8 Hz, 1H), 7.61 – 7.56 (m, 1H), 7.17 (d, J = 3.8 Hz, 1H), 6.81 (s, 1H), 4.98 – 4.89 (m, 1H), 3.17 (ddd, J = 17.0, 10.9, 1.7 Hz, 1H), 2.56 – 2.51 (m, 1H).			251
 C ₂₆ H ₂₈ F ₂ N ₂ OSi	LCMS (ES+) C ₂₆ H ₂₈ N ₂ F ₂ OSi requires: 450, found 451 [M+H] ⁺			343
 C ₈ H ₈ FN ₃	LCMS (ES+) C ₈ H ₈ FN ₃ requires: 165, found 166 [M+H] ⁺ .			303
 C ₁₀ H ₁₁ FN ₂	(500 MHz, CDCl ₃) δ 7.30 (t, J = 7.9 Hz, 1H), 6.95 – 6.92 (m, 1H), 6.88 – 6.83 (m, 2H), 5.01 – 4.95 (m, 1H), 3.19 – 3.11 (m, 1H), 2.69 – 2.60 (m, 1H), 2.33 (s, 3H).			238

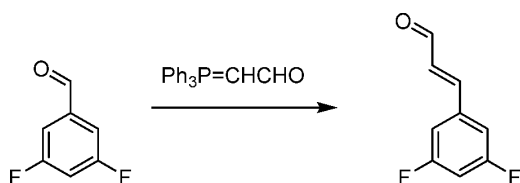
Structure / Formula	¹ H NMR	Variations to reaction conditions	Purification details	First used in example
 C ₁₀ H ₁₁ FN ₂	(500 MHz, CDCl ₃) δ 7.16 – 7.10 (m, 1H), 7.03 – 6.95 (m, 2H), 6.85 – 6.78 (m, 1H), 4.72 – 4.64 (m, 1H), 3.17 – 3.07 (m, 1H), 2.73 – 2.54 (m, 1H), 2.27 – 2.24 (m, 3H).			239
 C ₉ H ₁₀ FN ₃	(600 MHz, CDCl ₃) δ 8.25 (d, J = 1.6 Hz, 1H), 7.42 – 7.37 (m, 1H), 6.85 (d, J = 1.7 Hz, 1H), 4.79 – 4.73 (m, 1H), 3.22 – 3.14 (m, 1H), 2.71 – 2.62 (m, 1H), 2.53 – 2.49 (m, 3H).			246

[0402] The invention is further illustrated by the following examples.

EXAMPLE 1



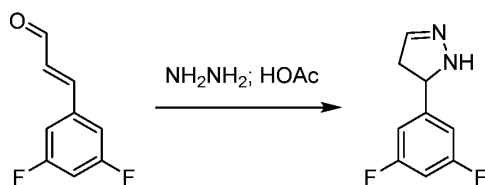
Methyl 3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate



[0403] **(E)-3-(3,5-difluorophenyl)acrylaldehyde**

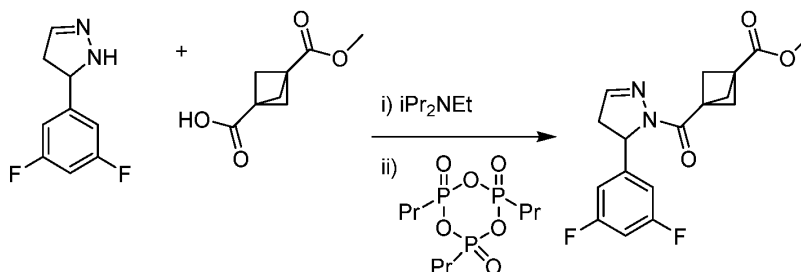
A solution of 3,5-difluorobenzaldehyde (4 g, 28 mmol) and 2-(triphenyl-λ⁵-phosphaneylidene)acetaldehyde (8.5 g, 28 mmol) in THF (15 ml) was refluxed overnight. The reaction was concentrated, and

the residue was adsorbed onto silica gel and purified via flash chromatography (0-30%, EtOAc in hexanes) to give the title compound (3.2 g, 19 mmol, 68 % yield) as a yellow solid. ^1H NMR (300 MHz, CDCl_3) δ 9.73 (d, J = 7.5 Hz, 1H), 7.39 (d, J = 16.0 Hz, 1H), 7.15 – 7.04 (m, 2H), 6.96 – 6.84 (m, 1H), 6.68 (dd, J = 16.0, 7.5 Hz, 1H).



[0404] 5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole To a solution of hydrazine hydrate (0.91 ml, 18 mmol) in ethanol (19 ml) stirred at 0 °C was added HOAc (1.1 ml, 20 mmol). The solution was then heated to 45 °C and the product from the previous step was added portion wise. The vessel was sealed and stirred at 90 °C overnight. The reaction was concentrated and the residue was adsorbed onto silica gel and purified via flash chromatography (20 - 60 %, EtOAc:MeOH (4:1) in hexanes) to give the title compound (2 g, 10 mmol, 71% yield) as a yellow oil.

[0405] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 7.30 (d, J = 4.1 Hz, 1H), 7.13 – 7.07 (m, 1H), 7.06 – 7.00 (m, 2H), 6.73 (br-s, 1H), 4.64 (td, J = 10.6, 4.1 Hz, 1H), 3.07 (ddd, J = 16.9, 10.7, 1.7 Hz, 1H), 2.49 – 2.40 (m, 1H).



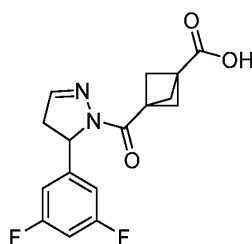
[0406] **Methyl 3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentane-1-carboxylate (Example 1)** To a solution of the product from the previous step (1.1 g, 6.0 mmol) and 3-(methoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid (1.1 g, 6.6 mmol) in DMF (20 ml) was added $i\text{Pr}_2\text{NEt}$ (3.1 ml, 18 mmol) and the reaction was stirred for 5 min. 2,4,6-Tripropyl-1,3,5,2,4,6-trioxatriphosphinane 2,4,6-trioxide (10 ml, 18 mmol, 50% in EtOAc) was then added and the reaction was stirred overnight. The reaction was diluted in EtOAc and washed with H_2O and brine. The organic layers were dried, concentrated, and filtered. The residue was adsorbed onto silica gel and purified via flash

chromatography (20 - 65 %, EtOAc in hexanes) to give the title compound (1.8 g, 5.3 mmol, 88% yield) as an off-white solid.

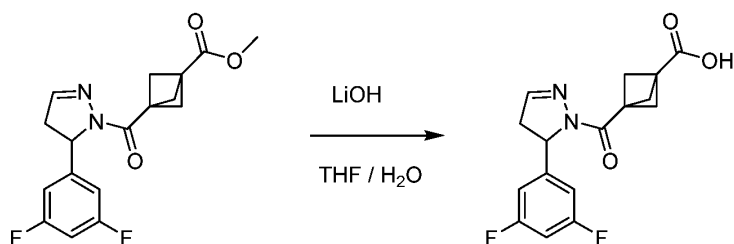
[0407] MS (ES⁺) C₁₇H₁₆F₂N₂O₃ requires: 334, found: 335 [M+H]⁺.

[0408] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.25 (m, 1H), 7.13 (m, 1H), 6.85 – 6.80 (m, 2H), 5.33 (dd, *J* = 11.9, 4.9 Hz, 1H), 3.62 (s, 3H), 3.43 (ddd, *J* = 19.0, 11.9, 1.6 Hz, 1H), 2.72 (ddd, *J* = 19.0, 5.0, 1.6 Hz, 1H), 2.31 (s, 6H).

EXAMPLE 2

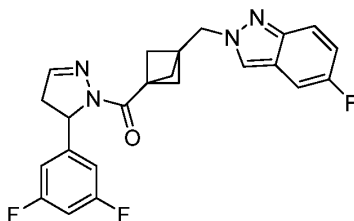


**3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-
bicyclo[1.1.1]pentane-1-carboxylic acid**



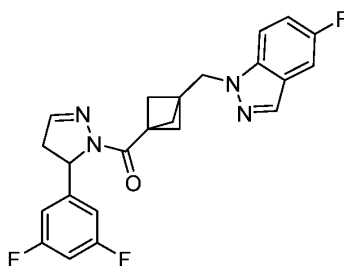
[0409] To a solution of methyl 3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate (Example 1, 0.55 g, 1.6 mmol) in THF (6.5 ml) and H₂O (1.6 ml) was added LiOH (83 mg, 3.4 mmol) at rt, and the mixture was vigorously stirred until completion, as determined by LCMS. The reaction was cooled to 0 °C and the reaction was quenched with 1M HCl (3.2 ml, 3.2 mmol, 1M) and stirred for at least 15 min. Then mixture was diluted with EtOAc and H₂O and extracted with EtOAc twice. The combined organic layers were dried and concentrated to give the title compound (0.52 g, 1.6 mmol, 99 % yield) as a yellow solid. The product was used as is without further purification. MS (ES⁺) C₁₆H₁₄F₂N₂O₃ requires: 320, found: 321 [M+H]⁺.

EXAMPLES 3 and 4

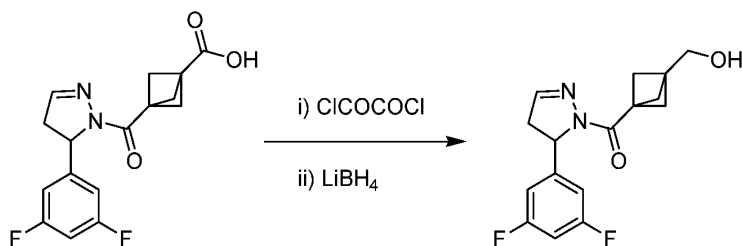


(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (3)

and



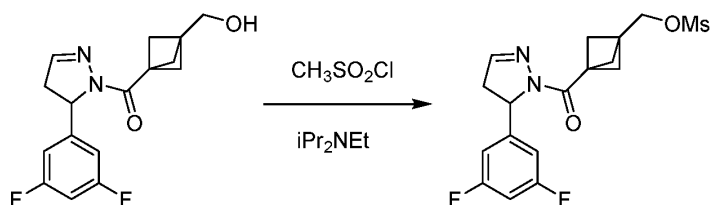
(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (4)



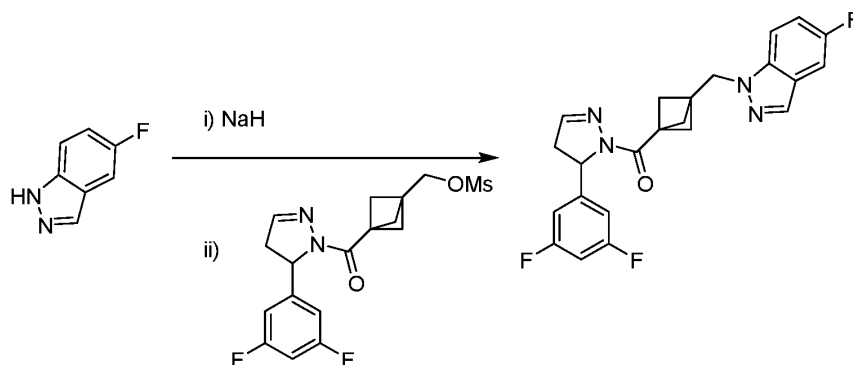
[0410] **(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(hydroxymethyl)-bicyclo[1.1.1]pentan-1-yl)methanone (Intermediate I)** To a solution of the Example 2 compound (0.57 mg, 1.7 mmol) in THF (5.9 ml) was added 3 drops of DMF and oxalyl chloride (0.16 ml, 1.9 mmol) at 0 °C. The reaction was monitored for complete consumption of acid. The mixture was concentrated and redissolved in THF (5.9 ml). LiBH₄ (86 mg, 3.9 mmol) was then added at 0 °C, and the solution was stirred for 15 min. Saturated NH₄Cl was added, the residue was partitioned between EtOAc and H₂O, and the aqueous phase was extracted with EtOAc. The combined organic layers were dried and concentrated. The residue was adsorbed onto silica gel and purified via flash chromatography (20-100%, EtOAc in hexanes) to give the title compound (0.24 g, 0.78 mmol, 43% yield) as a yellow solid.

[0411] MS (ES⁺) C₁₆H₁₆F₂N₂O₂ requires: 306, found: 307 [M+H]⁺.

[0412] ^1H NMR (500 MHz, CD_3OD) δ 7.12 (m, 1H), 6.83 (m, 1H), 6.77 – 6.71 (m, 2H), 5.35 (dd, J = 11.8, 4.8 Hz, 1H), 3.54 (s, 2H), 3.45 (ddd, J = 19.0, 11.8, 1.6 Hz, 1H), 2.74 (ddd, J = 18.9, 4.8, 1.8 Hz, 1H), 2.07 (s, 6H).



[0413] **(3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl methanesulfonate (Intermediate II)** To a solution of the product from the previous step (0.36 g, 1.1 mmol) in DCM (5.8 ml) was added methanesulfonyl chloride (0.13 ml, 1.7 mmol) and $i\text{Pr}_2\text{NEt}$ (0.30 ml, 1.7 mmol) at 0°C . The reaction was stirred for 1 h, diluted with DCM and washed twice with NaHCO_3 and H_2O . The organic layers were dried and concentrated to give the title compound as a yellow amorphous solid. The product was used as is without further purification. MS (ES^+) $\text{C}_{17}\text{H}_{18}\text{F}_2\text{N}_2\text{O}_4\text{S}$ requires: 384, found: 385 $[\text{M}+\text{H}]^+$.



[0414] **(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 3) and (5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-1H-indazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone (Example 4)** To a solution of 5-fluoro-1H-indazole (14 mg, 0.10 mmol) in DMF (0.15 ml) was added NaH (60% dispersion in mineral oil, 4.1 mg, 0.10 mmol) at 0°C and the reaction was stirred until no more bubbling occurred. Then a solution of the product from the previous step (20 mg, 0.05 mmol) in DMF (0.15 ml) was added at 0°C and the reaction was stirred for 5 minutes at 0°C . The reaction was warmed to rt, heated and stirred at 65°C 1 h. The reaction was diluted in MeOH and purified

by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give two compounds.

[0415] The first eluting product, Example **3** (2.2 mg, 5.2 μ mol, 9% yield) was assigned as the isomer shown, based on elution order.

[0416] MS (ES⁺) C₂₃H₁₉F₃N₄O requires: 424, found: 425 [M+H]⁺.

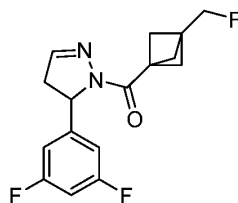
[0417] ¹H NMR (500 MHz, CD₃OD) δ 8.17 (d, *J* = 0.9 Hz, 1H), 7.66 – 7.60 (m, 1H), 7.35 – 7.30 (m, 1H), 7.16 – 7.10 (m, 1H), 7.09 – 7.06 (m, 1H), 6.85 – 6.78 (m, 1H), 6.75 – 6.68 (m, 2H), 5.31 (dd, *J* = 11.8, 4.9 Hz, 1H), 4.56 (s, 2H), 3.41 (ddd, *J* = 19.1, 11.8, 1.6 Hz, 1H), 2.71 (ddd, *J* = 19.1, 4.9, 1.8 Hz, 1H), 2.07 (s, 6H).

[0418] The second eluting product, Example **4** (1.6 mg, 3.7 μ mol, 7 % yield) was assigned as the isomer shown, based on elution order.

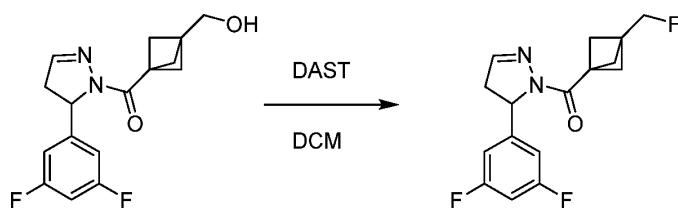
[0419] MS (ES⁺) C₂₃H₁₉F₃N₄O requires: 424, found: 425 [M+H]⁺.

[0420] ¹H NMR (500 MHz, CD₃OD) δ 7.99 (d, *J* = 0.9 Hz, 1H), 7.60 – 7.53 (m, 1H), 7.44 – 7.39 (m, 1H), 7.25 – 7.19 (m, 1H), 7.07 – 7.04 (m, 1H), 6.84 – 6.77 (m, 1H), 6.73 – 6.66 (m, 2H), 5.29 (dd, *J* = 11.8, 4.8 Hz, 1H), 4.55 (s, 2H), 3.40 (ddd, *J* = 19.1, 11.8, 1.7 Hz, 1H), 2.69 (ddd, *J* = 19.0, 4.8, 1.8 Hz, 1H), 2.00 (s, 6H).

EXAMPLE 5



(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(fluoromethyl)-bicyclo[1.1.1]pentan-1-yl)methanone



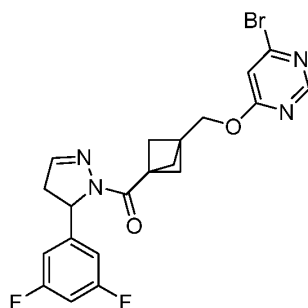
[0421] To a solution of Intermediate **I** (38 mg, 0.12 mmol) in DCM (0.20 ml) at -78 °C was added DAST (16 μ l, 0.12 mmol), and the mixture was allowed to stir and warm to RT overnight. The reaction mixture was then diluted in DCM, washed with saturated NaHCO₃ solution, dried, concentrated, and purified by mass-triggered preparative HPLC (Mobile

phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min;
Column: C18) to give the title compound (1 mg, 3.2 μ mol, 2 % yield) as an amorphous solid.

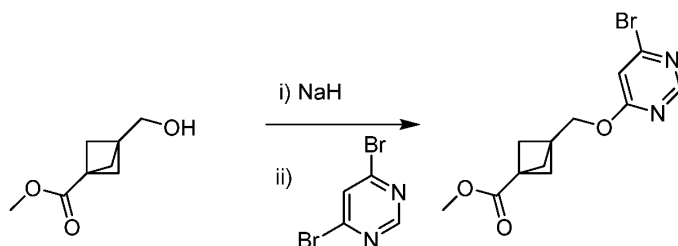
[0422] MS (ES⁺) C₁₆H₁₅F₃N₂O requires: 308, found: 309 [M+H]⁺.

[0423] ¹H NMR (500 MHz, CDCl₃) δ 6.95 – 6.93 (m, 1H), 6.72 – 6.66 (m, 3H), 5.31 (dd, *J* = 11.9, 5.0 Hz, 1H), 4.40 (d, *J* = 47.6 Hz, 2H), 3.37 (ddd, *J* = 18.7, 12.0, 1.7 Hz, 1H), 2.73 (ddd, *J* = 18.8, 5.0, 1.8 Hz, 1H), 2.18 (s, 6H).

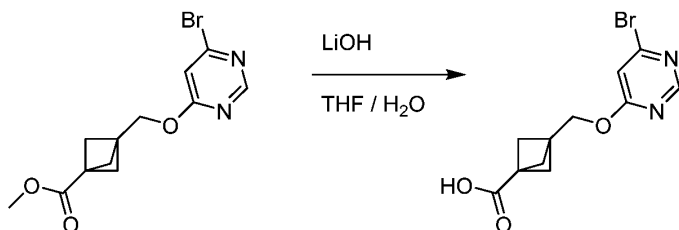
EXAMPLE 6



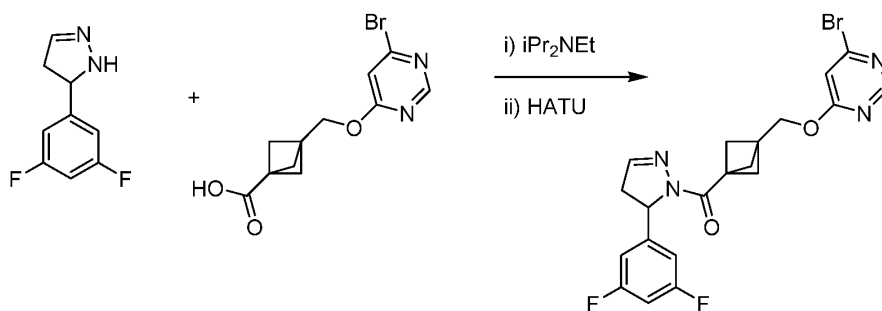
(3-(((6-bromopyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone



[0424] **Methyl 3-(((6-bromopyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylate** To a solution of methyl 3-(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate (0.13 g, 0.89 mmol) in THF (4.4 ml) at 0 °C was added NaH in one portion, and the mixture was stirred at 0 °C for 15 min. 4,6-Dibromopyrimidine (0.31 g, 1.3 mmol) was then added and reaction was stirred at 0 °C for 5 min and then warmed to RT. More NaH and 4,6-dibromopyrimidine was added at 0 °C and the reaction was allowed to proceed overnight. The reaction was cooled to 0 °C, H₂O was added, and the resulting mixture was diluted and extracted with EtOAc. The combined organic layers were dried concentrated, and purified by flash chromatography to give the title compound (60 mg, 0.19 mmol, 21% yield) as a colorless oil. ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.60 (d, *J* = 0.9 Hz, 1H), 7.35 (d, *J* = 1.0 Hz, 1H), 4.43 (s, 2H), 3.60 (s, 3H), 1.99 (s, 6H).



[0425] **3-(((6-Bromopyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid (Intermediate III)** To a solution of the product from the previous step (60 mg, 0.19 mmol) in THF (0.76 ml) was added H₂O (0.19 ml) and LiOH•H₂O (4.5 mg, 0.19 mmol) and the solution was stirred at 0 °C for 10 minutes and then warmed to RT. Once all starting material was consumed (determined by TLC), the reaction was cooled to 0 °C and 1M HCl (0.38 ml, 0.38 mmol) was added until pH was below 3. The solution was concentrated to obtain the title compound (57 mg, 0.19 mmol, 100 % yield) as a white solid which was used without further purification. MS (ES⁺) C₁₁H₁₁BrN₂O₃ requires: 298, found: 299 [M+H]⁺.

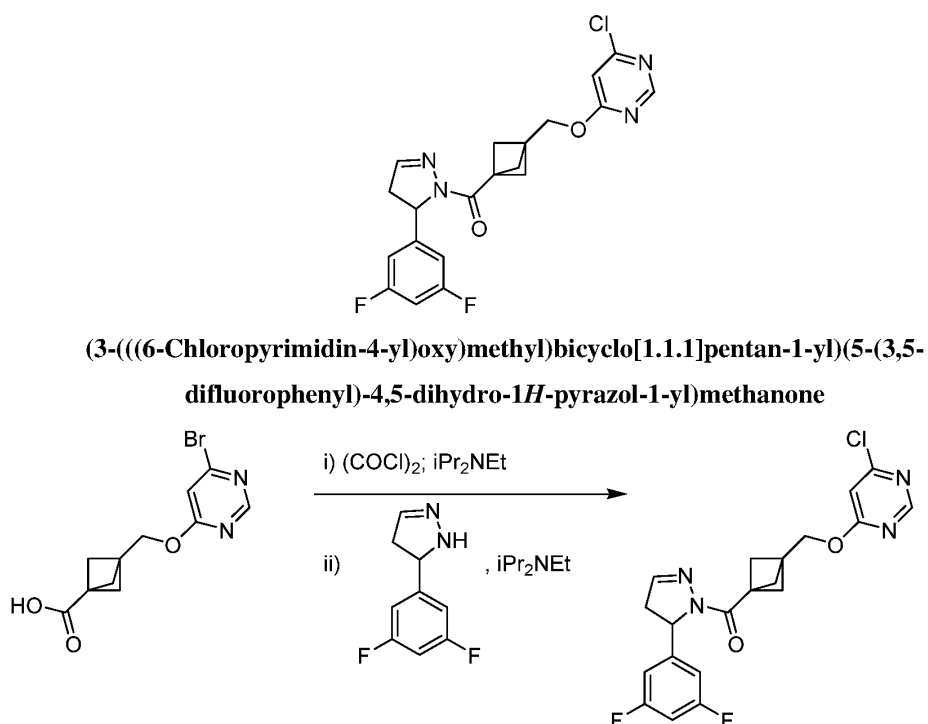


[0426] **Step 3: (3-(((6-Bromopyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone (Example 6)** To a flask containing Intermediate III (57 mg, 0.19 mmol) in DMF (0.63 ml) was added iPr₂NEt (73 μl, 0.42 mmol) and 5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole (55 mg, 0.30 mmol), and the mixture was stirred at 0 °C for 5 min. To the solution was added HATU (95 mg, 0.24 mmol) and the reaction was stirred at RT overnight. The solution was diluted in EtOAc and H₂O, partitioned, and the organic phase was washed with H₂O and brine. The aqueous phases were combined and extracted with EtOAc twice. The organic layers were combined, dried, concentrated, adsorbed onto silica gel, and purified via flash chromatography (10 - 25 %, EtOAc in hexanes) to give the title compound (29 mg, 0.06 mmol, 32% yield) as a yellow solid.

[0427] MS (ES⁺) C₂₀H₁₇BrF₂N₄O₂ requires: 462, found: 463 [M+H]⁺.

[0428] ^1H NMR (300 MHz, CD_3OD) δ 8.50 (d, $J = 0.9$ Hz, 1H), 7.17 (d, $J = 0.9$ Hz, 1H), 7.15 – 7.11 (m, 1H), 6.88 – 6.79 (m, 1H), 6.79 – 6.71 (m, 2H), 5.35 (dd, $J = 11.8, 4.8$ Hz, 1H), 4.47 (s, 2H), 3.45 (ddd, $J = 19.0, 11.8, 1.6$ Hz, 1H), 2.75 (ddd, $J = 19.0, 4.9, 1.8$ Hz, 1H), 2.17 (s, 6H).

EXAMPLE 7

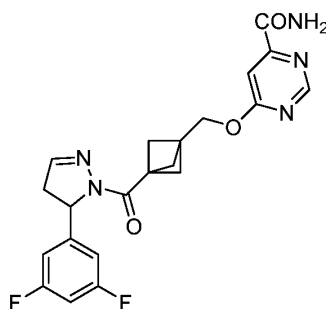


[0429] To a solution of Intermediate **III** (40 mg, 0.13 mmol) in THF (0.66 ml) was added $i\text{Pr}_2\text{NEt}$ (82 μl , 0.46 mmol) and one drop of DMF. The reaction was then cooled to 0 °C. Oxalyl chloride (50 mg, 0.40 mmol) was then added dropwise and stirred in the ice bath for 15 min. The flask was then warmed to RT and monitored by LCMS for consumption of the acid. The solution was then concentrated, redissolved in THF (0.50 ml), cooled to 0°C, $i\text{Pr}_2\text{NEt}$ (1.0 eq) and then a solution of 5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole (18 μl , 0.14 mmol) in THF was then added dropwise. The reaction was stirred for 72 h. The reaction was then diluted in EtOAc and H_2O and let stir for 5 min. The organic layers was removed and the aqueous layer was extracted with EtOAc. The organic layers were combined, dried with MgSO_4 , and concentrated. The residue was adsorbed onto silica gel and purified via flash chromatography (20-70%, EtOAc in hexanes) to give the title compound (52 mg, 0.12 mmol, 93% yield) as an orange solid.

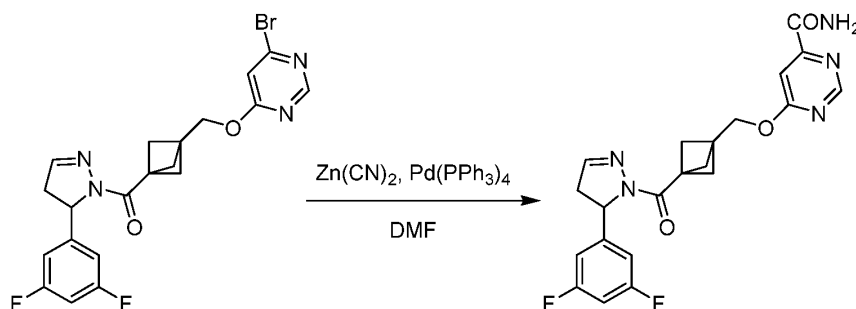
[0430] MS (ES⁺) C₂₀H₁₇ClF₂N₄O₂ required: 418, found: 419 [M+H]⁺.

[0431] ¹H NMR (500 MHz, CDCl₃) δ 8.55 (d, *J* = 0.9 Hz, 1H), 6.95 – 6.93 (m, 1H), 6.80 (d, *J* = 0.9 Hz, 1H), 6.72 – 6.64 (m, 3H), 5.31 (dd, *J* = 11.9, 4.9 Hz, 1H), 4.44 (s, 2H), 3.37 (ddd, *J* = 18.7, 11.9, 1.7 Hz, 1H), 2.73 (ddd, *J* = 18.8, 5.0, 1.8 Hz, 1H), 2.18 (s, 6H).

EXAMPLE 8



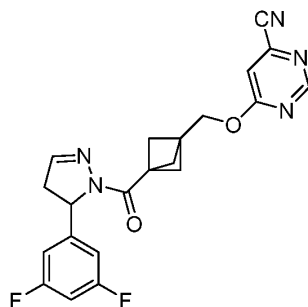
6-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrimidine-4-carboxamide



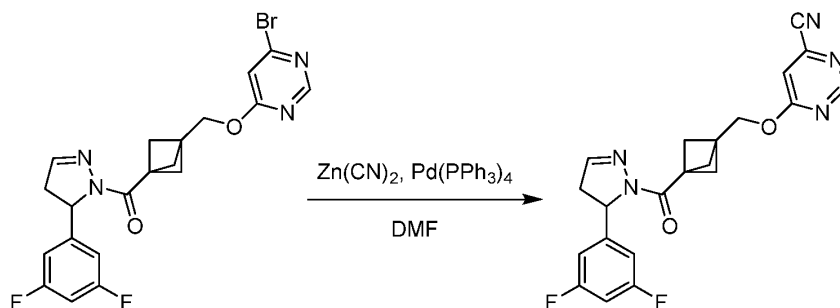
[0432] A solution of the Example 6 compound (18 mg, 0.03 mmol), Zn(CN)₂ (5.4 mg, 0.04 mmol), Pd(PPh₃)₄ (4.4 mg, 3.8 μmol), in degassed DMF (0.25 ml) was heated to 90 °C overnight. The reaction was stopped by cooling to RT and then molecular sieves were added, and 0.2 eq. of Pd(PPh₃)₄ and Zn(CN)₂ was added. The reaction was stirred at 90 °C overnight. The reaction was filtered and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (1 mg, 2.5 μmol, 6 % yield) as an orange oil.

[0433] MS (ES⁺) C₂₁H₁₉F₂N₅O₃ requires: 427, found: 428 [M+H]⁺.

[0434] ¹H NMR (500 MHz, CD₃OD) δ 8.77 (d, *J* = 1.0 Hz, 1H), 7.42 (d, *J* = 1.1 Hz, 1H), 7.15 – 7.11 (m, 1H), 6.86 – 6.79 (m, 1H), 6.78 – 6.71 (m, 2H), 5.38 – 5.32 (m, 1H), 4.51 (s, 2H), 3.45 (ddd, *J* = 19.0, 11.8, 1.6 Hz, 1H), 2.74 (ddd, *J* = 19.0, 4.8, 1.8 Hz, 1H), 2.18 (s, 6H).

EXAMPLE 9

6-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrimidine-4-carbonitrile

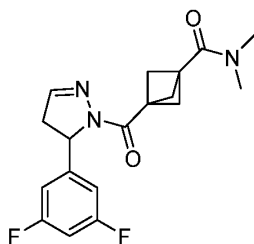


[0435] To a flask containing the Example 6 compound (30 mg, 0.06 mmol), $\text{Zn}(\text{CN})_2$ (10 mg, 0.08 mmol), and $\text{Pd}(\text{PPh}_3)_4$ (7.4 mg, 6.4 μmol) was added DMF (0.32 ml) and the reaction was degassed and stirred at 110 °C for 24 h. The mixture was diluted with EtOAc and washed with H_2O , and the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried, and concentrated. The residue was adsorbed onto silica gel and purified via flash chromatography (0 - 100 % EtOAc, in hexanes) to give the title compound (1 mg, 2.4 μmol , 3.7% yield) as a colorless solid.

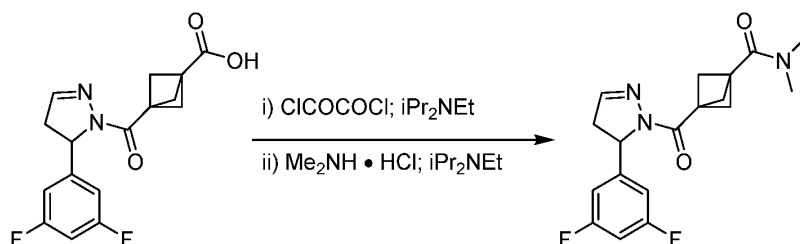
[0436] MS (ES^+) $\text{C}_{21}\text{H}_{17}\text{F}_2\text{N}_5\text{O}_2$ requires: 409, found: 410 $[\text{M}+\text{H}]^+$.

[0437] ^1H NMR (500 MHz, CD_3OD) δ 8.77 (d, $J = 1.0$ Hz, 1H), 7.42 (d, $J = 1.1$ Hz, 1H), 7.15 – 7.11 (m, 1H), 6.86 – 6.79 (m, 1H), 6.78 – 6.70 (m, 2H), 5.35 (dd, $J = 11.8, 4.8$ Hz, 1H), 4.51 (s, 2H), 3.45 (ddd, $J = 19.0, 11.8, 1.6$ Hz, 1H), 2.74 (ddd, $J = 19.0, 4.8, 1.8$ Hz, 1H), 2.18 (s, 6H).

EXAMPLE 10



3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-N,N-dimethylbicyclo[1.1.1]pentane-1-carboxamide

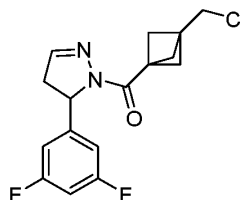


[0438] To a solution containing the Example 2 compound (12 mg, 0.03 mmol), $i\text{Pr}_2\text{NEt}$ (19 μl , 0.11 mmol) and one drop of DMF in THF (0.15 ml) at RT was added oxalyl chloride (9.6 μl , 0.11 mmol) and stirred for 30 min. The reaction was concentrated and redissolved in THF (0.15 ml). To the solution was added dimethylamine hydrochloride (7.6 mg, 0.09 mmol) and $i\text{Pr}_2\text{NEt}$ (19 μl , 0.11 mmol), and the mixture was stirred overnight. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (2.6 mg, 7.4 μmol , 19% yield) as a colorless amorphous material.

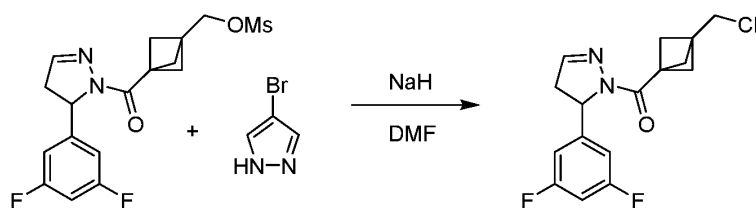
[0439] MS (ES^+) $\text{C}_{18}\text{H}_{19}\text{F}_2\text{N}_3\text{O}_2$ requires: 347, found: 348 $[\text{M}+\text{H}]^+$.

[0440] ^1H NMR (600 MHz, CD_3OD) δ 7.27 – 7.21 (m, 1H), 6.95 – 6.87 (m, 1H), 6.86 – 6.78 (m, 2H), 5.42 (dd, J = 11.8, 4.7 Hz, 1H), 3.58 – 3.48 (m, 1H), 3.21 (s, 3H), 2.99 (s, 3H), 2.87 – 2.79 (m, 1H), 2.57 (s, 6H).

EXAMPLE 11



(3-(Chloromethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone

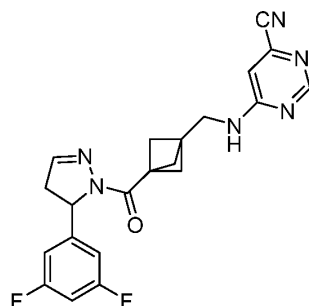


[0441] To a cooled 0 °C solution of 4-bromo-1*H*-pyrazole (38 mg, 0.26 mmol) and Intermediate **II** (50 mg, 0.13 mmol) in DMF (0.65 mL) was added NaH (60% mineral dispersion, 10 mg, 0.26 mmol), and the reaction was slowly warmed to RT. The reaction was then stirred at 65 °C for 1 h. The reaction was then concentrated, adsorbed onto silica gel, and purified via flash chromatography (0-100%, EtOAc in hexanes) to give the title compound (35 mg, 0.10 mmol, 83% yield) as a white solid.

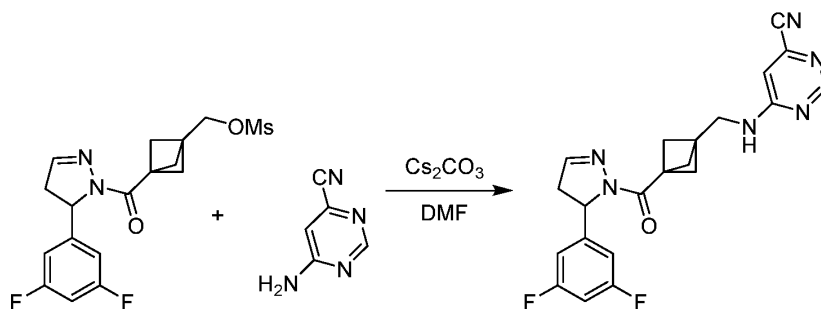
[0442] MS (ES⁺) C₁₆H₁₅ClF₂N₂O requires: 324, found: 325 [M+H]⁺.

[0443] ¹H NMR (500 MHz, CD₃OD) δ 7.16 – 7.11 (m, 1H), 6.87 – 6.78 (m, 1H), 6.78 – 6.71 (m, 2H), 5.35 (dd, *J* = 11.8, 4.8 Hz, 1H), 3.61 (s, 2H), 3.45 (ddd, *J* = 19.0, 11.8, 1.6 Hz, 1H), 2.75 (ddd, *J* = 19.0, 4.9, 1.8 Hz, 1H), 2.12 (s, 6H).

EXAMPLE 12



6-(((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1*H*-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)amino)pyrimidine-4-carbonitrile

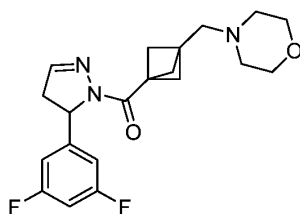


[0444] To a solution of Intermediate **II** (31 mg, 0.081 mmol) and 6-aminopyrimidine-4-carbonitrile (19 mg, 0.16 mmol) in DMF (0.40 ml) was added Cs₂CO₃ (52 mg, 0.16 mmol), and the mixture was stirred at RT until completion. The reaction was then purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (5.2 mg, 0.01 mmol, 15% yield) as a white solid.

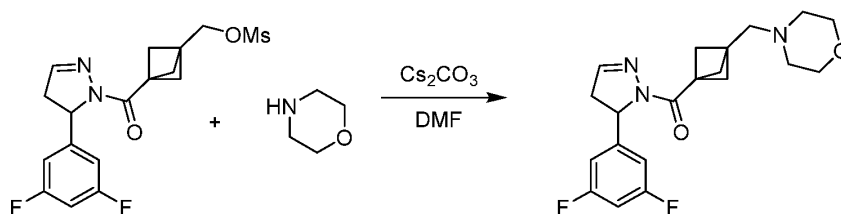
[0445] MS (ES⁺) C₂₁H₁₈F₂N₆O requires: 408, found: 409 [M+H]⁺.

[0446] ¹H NMR (500 MHz, CD₃OD) δ 8.46 – 8.38 (m, 1H), 7.16 – 7.08 (m, 1H), 6.93 – 6.88 (m, 1H), 6.85 – 6.79 (m, 1H), 6.76 – 6.70 (m, 2H), 5.34 (dd, *J* = 11.8, 4.8 Hz, 1H), 3.58 (s, 2H), 3.47 – 3.40 (m, 1H), 2.77 – 2.70 (m, 1H), 2.09 (s, 6H).

EXAMPLE 13



(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(morpholinomethyl)bicyclo[1.1.1]pentan-1-yl)methanone

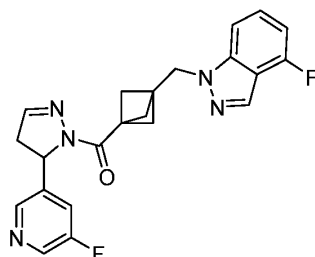


[0447] To a solution of Intermediate **II** (20 mg, 0.05 mmol) and morpholine (5.4 μl, 0.06 mmol) in DMF (0.26 ml) was added Cs₂CO₃ (33 mg, 0.10 mmol) and the reaction was stirred at 45°C overnight. The reaction mixture was filtered and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (4.9 mg, 0.01 mmol, 25% yield) as a white solid.

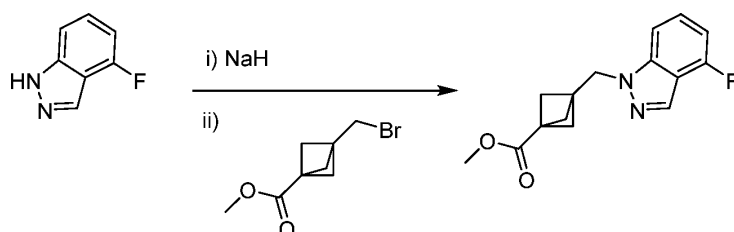
[0448] MS (ES⁺) C₂₀H₂₃F₂N₃O₂ requires: 375, found: 376 [M+H]⁺.

[0449] ¹H NMR (500 MHz, CDCl₃) δ 6.99 – 6.94 (m, 1H), 6.74 – 6.61 (m, 3H), 5.28 (dd, *J* = 11.9, 5.0 Hz, 1H), 4.04 – 3.94 (m, 4H), 3.67 – 3.58 (m, 2H), 3.38 (ddd, *J* = 18.8, 11.9, 1.6 Hz, 1H), 3.21 (s, 2H), 2.97 – 2.86 (m, 2H), 2.74 (ddd, *J* = 18.8, 4.9, 1.7 Hz, 1H), 2.33 (s, 6H).

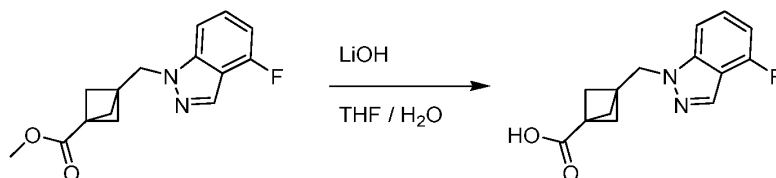
EXAMPLE 14



(3-((4-Fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazol-1-yl)methanone

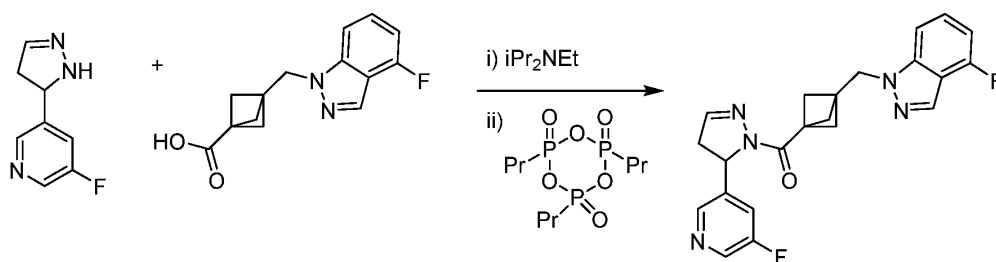


[0450] **Methyl 3-((4-fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylate** To a solution of 4-fluoro-1H-indazole (0.26 g, 1.9 mmol) in DMF (3.2 ml) was added NaH (84 mg, 2.1 mmol) at 0 °C, and the mixture was stirred until no more bubbling occurred. Then methyl 3-(bromomethyl)bicyclo[1.1.1]pentane-1-carboxylate (0.35 g, 1.6 mmol) in a solution of DMF (3.2 ml) was added to the reaction dropwise. The mixture was then stirred at 0 °C for 10 min, warmed to RT and stirred for 1 h. The reaction was quenched at 0 °C with sat NH₄Cl solution, then diluted with EtOAc. The organic layers were washed with H₂O twice and then brine. The combined organic layers were dried and concentrated. The residue was adsorbed onto silica gel and purified via flash chromatography (0-100%, EtOAc in hexanes) to give the title compound (0.12 g, 0.43 mmol, 26% yield) as the first eluting compound. Assignment as the 1-alkylated indazole isomer shown above was based on NMR comparison to Example 22. ¹H NMR (600 MHz, CDCl₃) δ 8.06 (d, *J* = 0.9 Hz, 1H), 7.33 – 7.27 (m, 1H), 7.13 (d, *J* = 8.4 Hz, 1H), 6.78 (dd, *J* = 9.9, 7.7 Hz, 1H), 4.49 (s, 2H), 3.62 (s, 3H), 1.96 (s, 6H).



[0451] **3-((4-Fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid**

To a solution of the product from the previous step (0.11 g, 0.40 mmol) in THF (1.0 ml) and H₂O (0.26 ml) was added LiOH (20 mg, 0.84 mmol). The mixture was stirred for 2 h at 0 °C and then warmed to RT. The reaction was quenched with 1 M HCl (0.40 ml, 0.40 mmol) and then the mixture was concentrated and azeotroped with MeCN to give the title compound (0.14 g, 0.53 mmol, 134% yield) as a white solid. The product was used without further purification. MS (ES⁺) C₁₄H₁₃FN₂O₂ requires: 260, found: 261 [M+H]⁺.

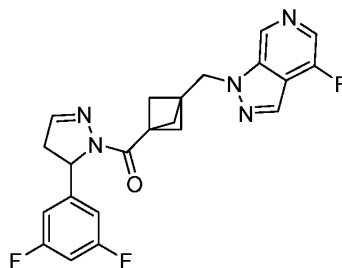
[0452] **(3-((4-Fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazol-1-yl)methanone (Example 14)**

To a solution of the product from the previous step (20 mg, 0.07 mmol) and 3-(4,5-dihydro-1H-pyrazol-5-yl)-5-fluoropyridine (12 mg, 0.077 mmol) in DMF (0.25 ml) was added iPr₂NEt (40 μl, 0.23 mmol) and the reaction was stirred for 10 minutes. 2,4,6-Tripropyl-1,3,5,2,4,6-trioxatriphosphinane 2,4,6-trioxide (0.13 ml, 0.23 mmol, 50% solution in EtOAc) was then added, and the reaction was stirred overnight. The mixture was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (13 mg, 0.03 mmol, 42% yield) as a yellow oil.

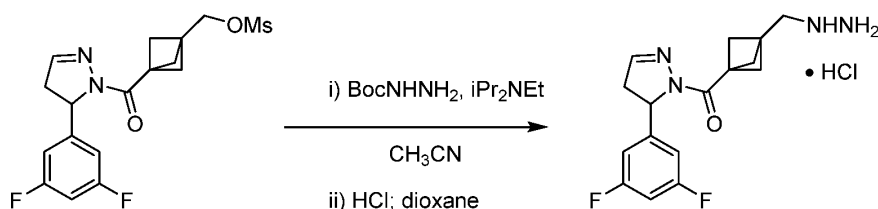
[0453] MS (ES⁺) C₂₂H₁₉F₂N₅O requires: 407, found: 408 [M+H]⁺.

[0454] ¹H NMR (500 MHz, CDCl₃) δ 8.55 – 8.50 (m, 1H), 8.51 – 8.46 (m, 1H), 8.16 (d, *J* = 0.9 Hz, 1H), 7.62 – 7.56 (m, 1H), 7.41 – 7.33 (m, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 7.05 – 6.98 (m, 1H), 6.87 – 6.80 (m, 1H), 5.45 (dd, *J* = 12.0, 5.3 Hz, 1H), 4.57 (s, 2H), 3.49 (ddd, *J* = 19.1, 12.0, 1.7 Hz, 1H), 2.83 (ddd, *J* = 19.1, 5.4, 1.8 Hz, 1H), 2.07 (s, 6H).

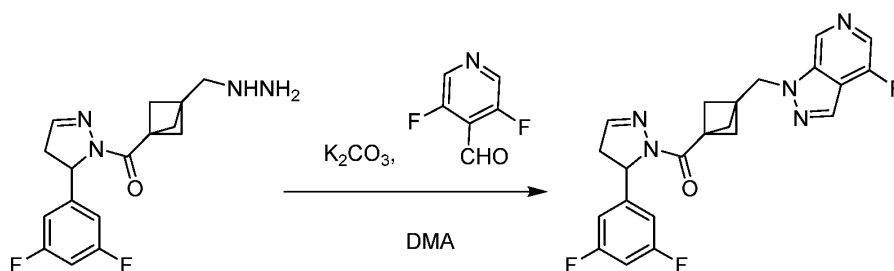
EXAMPLE 15



(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-fluoro-1H-pyrazolo[3,4-c]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone



[0455] **(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(hydrazineylmethyl)-bicyclo[1.1.1]pentan-1-yl)methanone hydrochloride (Intermediate IV)** To a solution of Intermediate **II** (80 mg, 0.20 mmol) in CH₃CN (0.20 ml) was added tert-butyl hydrazinecarboxylate (55 mg, 0.41 mmol) and iPr₂NEt (54 µl, 0.31 mmol). The reaction was stirred at 65 °C overnight. The reaction was then stirred at 85 °C for 1 h. The reaction was diluted with DCM, washed with H₂O and brine. The organic layer was dried and concentrated. The crude oil was then dissolved in 4M HCl in dioxane (0.41 ml), and the mixture was stirred overnight. The mixture was concentrated to give the title compound (90 mg, 0.25 mmol, 121% yield) as an orange solid that was used without further purification. MS (ES⁺) C₁₆H₁₈F₂N₄O requires: 320, found: 321 [M+H]⁺.



[0456] **(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-fluoro-1H-pyrazolo[3,4-c]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 15)**

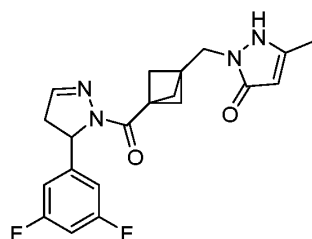
To a solution of the product from the previous step (40 mg, 0.12 mmol) and 3,5-difluoroisonicotinaldehyde (16 mg, 0.11 mmol) in DMA (0.22 ml) was added K₂CO₃ (39 mg,

0.28 mmol) and the reaction was stirred at 120 °C overnight. The reaction mixture was filtered and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (0.8 mg, 1.8 μmol, 1.6% yield) as an orange solid.

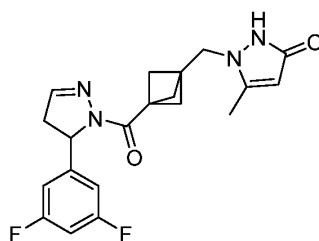
[0457] MS (ES⁺) C₂₂H₁₈F₃N₅O requires: 425, found: 426 [M+H]⁺.

[0458] ¹H NMR (500 MHz, CDCl₃) δ 8.97 (d, *J* = 1.4 Hz, 1H), 8.28 (d, *J* = 0.8 Hz, 1H), 8.19 (d, *J* = 2.1 Hz, 1H), 6.90 – 6.88 (m, 1H), 6.71 – 6.64 (m, 1H), 6.64 – 6.59 (m, 2H), 5.26 (dd, *J* = 11.9, 4.9 Hz, 1H), 4.70 (s, 2H), 3.33 (ddd, *J* = 18.8, 11.9, 1.7 Hz, 1H), 2.70 (ddd, *J* = 18.3, 4.7, 1.5 Hz, 1H), 2.10 (s, 6H).

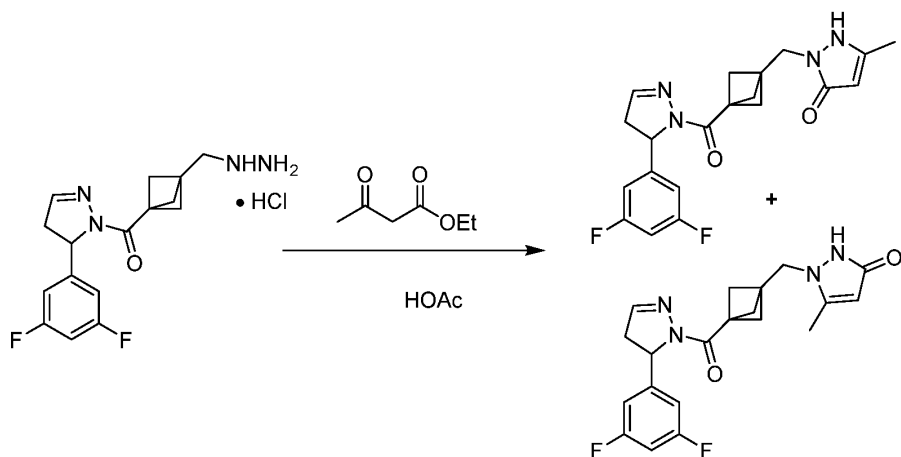
EXAMPLE 16



**2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-
bicyclo[1.1.1]pentan-1-yl)methyl)-5-methyl-1,2-dihydro-3H-pyrazol-3-one (16a)**
and

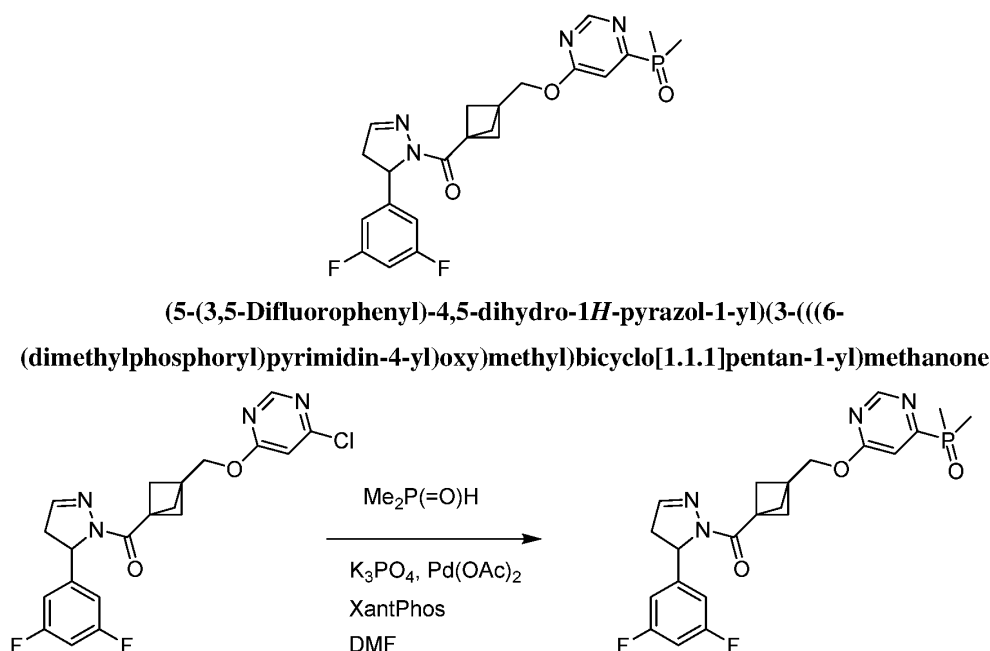


**1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-
bicyclo[1.1.1]pentan-1-yl)methyl)-5-methyl-1,2-dihydro-3H-pyrazol-3-one (16b)**



[0459] To a solution of Intermediate **IV** (93 mg, 0.26 mmol) in glacial AcOH (1.3 ml) was added ethyl 3-oxobutanoate (33 μ l, 0.26 mmol), and the resulting solution was stirred at 100 °C for 24 h. The solvent was evaporated and the residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA/MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give mixture of the title compounds as an off-white solid (8.1 mg, 0.021 mmol, 8 % yield). MS (ES⁺) C₂₀H₂₀F₂N₄O₂ requires: 386, found: 387 [M+H]⁺.

EXAMPLE 17

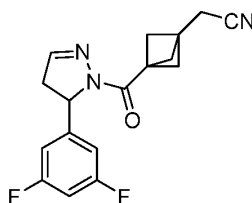


[0460] To a solution of the Example 7 compound (12 mg, 0.02 mmol) and dimethylphosphine oxide (3.4 mg, 0.04 mmol) in DMF (53 μ l) was added K_3PO_4 (7.4 mg, 0.03 mmol), $Pd(OAc)_2$ (0.65 mg, 2.9 μ mol) and XantPhos (1.6 mg, 2.9 μ mol). The reaction was purged with N_2 and stirred at 120 °C overnight. The reaction was filtered through a CELITE® plug and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (0.4 mg, 0.86 μ mol, 3.0% yield) as an amorphous solid.

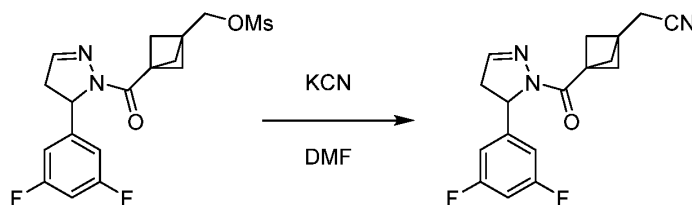
[0461] MS (ES^+) $C_{22}H_{23}F_2N_4O_3P$ requires: 460, found: 461 $[M+H]^+$.

[0462] 1H NMR (500 MHz, CD_3OD) δ 8.85 (d, J = 1.3 Hz, 1H), 7.43 – 7.36 (m, 1H), 7.15 – 7.11 (m, 1H), 6.89 – 6.79 (m, 1H), 6.78 – 6.70 (m, 2H), 5.35 (dd, J = 11.8, 4.8 Hz, 1H), 4.52 (s, 2H), 3.48 – 3.41 (m, 1H), 2.74 (ddd, J = 19.0, 4.9, 1.8 Hz, 1H), 2.18 (s, 6H), 1.81 (s, 3H), 1.78 (s, 3H).

EXAMPLE 18



2-(3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)acetonitrile

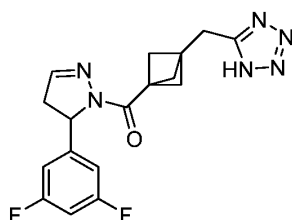


[0463] To a solution of Intermediate II (60 mg, 0.16 mmol) in DMF (0.39 ml) was added KCN (51 mg, 0.78 mmol) and the resulting mixture was stirred at 65 °C overnight. The reaction was diluted with DCM and washed with H_2O (2 x) and brine. The aqueous layers were extracted with DCM. The combined organics were dried over $MgSO_4$ and concentrated to give the title compound (40 mg, 0.12 mmol, 82 % yield) as a light brown solid that was not further purified.

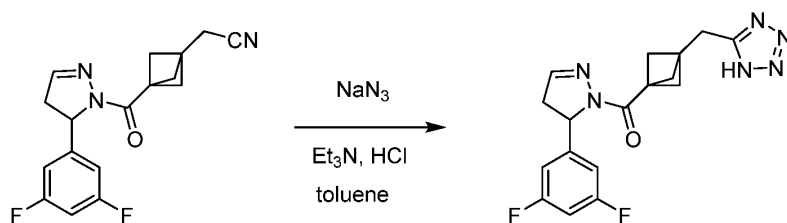
[0464] MS (ES^+) $C_{17}H_{15}F_2N_3O$ requires: 315, found: 316 $[M+H]^+$.

[0465] ^1H NMR ($\text{DMSO}-d_6$) δ : 7.20-7.27 (m, 1H), 7.04-7.17 (m, 1H), 6.74-6.87 (m, 2H), 5.25-5.40 (m, 1H), 3.38-3.49 (m, 1H), 2.80-2.90 (m, 2H), 2.66-2.77 (m, 1H), 2.02-2.12 (m, 6H).

EXAMPLE 19

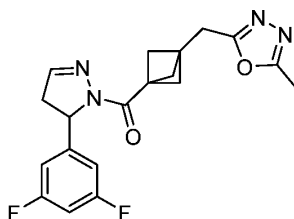


(3-((1*H*-tetrazol-5-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1*H*-pyrazol-1-yl)methanone



[0466] To a solution of the Example 18 compound (36 mg, 0.11 mmol) in toluene (0.40 ml) were added Et_3N (32 μl , 0.23 mmol), HCl (4M in dioxane, 57 μl , 0.23 mmol), and NaN_3 (15 mg, 0.23 mmol), and the resulting mixture was stirred at 120 $^\circ\text{C}$ overnight. To the reaction was added toluene (0.40 ml), and NaN_3 (15 mg), Et_3N (32 μl) and HCl (4M in dioxane, 57 μl) and the mixture was heated at 120 $^\circ\text{C}$ for an additional 7 h. The reaction was diluted with EtOAc , washed with aq. HCl (0.25 M), followed by brine, dried over MgSO_4 , and concentrated to give the title compound (34 mg, 0.10 mmol, 83 % yield) as an off white solid. MS (ES^+) $\text{C}_{17}\text{H}_{16}\text{F}_2\text{N}_6\text{O}$ requires: 358, found: 359 $[\text{M}+\text{H}]^+$.

EXAMPLE 20



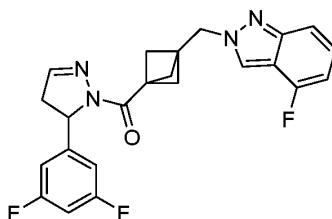
(5-(3,5-Difluorophenyl)-4,5-dihydro-1*H*-pyrazol-1-yl)(3-((5-methyl-1,3,4-oxadiazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone

[0467] A solution of the Example 19 compound (34 mg, 0.095 mmol) in Ac₂O (0.60 ml, 6.4 mmol) was stirred at 150 °C overnight. The reaction was diluted with EtOAc and washed with sat'd NaHCO₃ and brine. The aqueous layers were extracted with EtOAc. The combined organics were dried over MgSO₄ and concentrated. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (2.1 mg, 5.64 μmol, 4.94 % yield) as a yellow amorphous material semisolid.

[0468] MS (ES⁺) C₁₉H₁₈F₂N₄O₂ requires: 372, found: 373 [M+H]⁺.

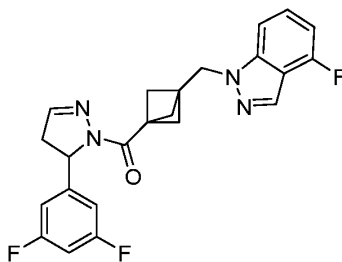
[0469] ¹H NMR (DMSO-*d*₆) δ: 7.19-7.23 (m, 1H), 7.08-7.16 (m, 1H), 6.75-6.83 (m, 2H), 5.23-5.40 (m, 1H), 3.41 (ddd, J=18.9, 12.1, 1.4 Hz, 1H), 3.03-3.12 (m, 2H), 2.69 (ddd, J=18.9, 4.9, 1.8 Hz, 1H), 2.43-2.48 (m, 3H), 2.02-2.07 (m, 6H).

EXAMPLES 21 and 22

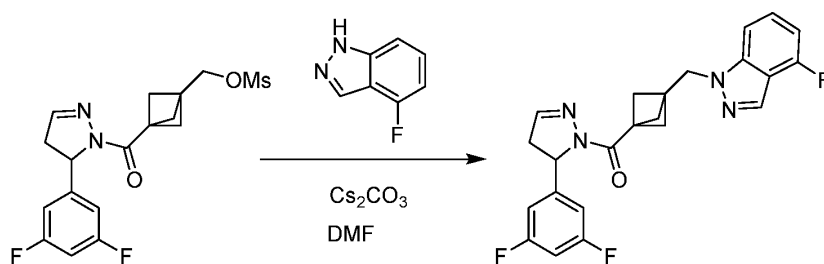


(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-fluoro-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 21)

and



(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 22)



[0470] To a suspension of Intermediate **II** (20 mg, 0.052 mmol) in DMF (0.26 ml) were added 4-fluoro-1*H*-indazole (14 mg, 0.10 mmol) and Cs₂CO₃ (34 mg, 0.10 mmol) and the resulting mixture was stirred at RT overnight. The reaction mixture was acidified with TFA and filtered through a syringe filter. The filtrate was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 50 - 90%; 12 min; Column: C18) to give two compounds.

[0471] The first eluting product, Example **21** was a brown solid (4.4 mg, 8.17 μmol, 16 % yield) assigned as the TFA salt of the isomer shown, based on elution order and ROESY NMR analysis.

[0472] MS (ES⁺) C₂₃H₁₉F₃N₄O requires: 424, found: 425 [M+H]⁺.

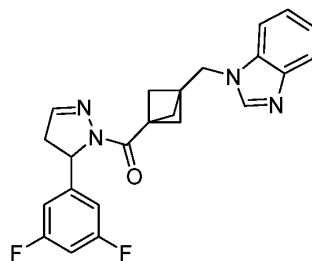
[0473] ¹H NMR (500 MHz, CDCl₃) δ 7.97 – 7.94 (m, 1H), 7.52 – 7.47 (m, 1H), 7.23 – 7.17 (m, 1H), 6.90 – 6.87 (m, 1H), 6.74 – 6.65 (m, 2H), 6.65 – 6.61 (m, 2H), 5.27 (dd, *J* = 11.9, 4.9 Hz, 1H), 4.55 (s, 2H), 3.33 (ddd, *J* = 18.8, 11.9, 1.6 Hz, 1H), 2.69 (ddd, *J* = 18.8, 4.9, 1.8 Hz, 1H), 2.14 (s, 6H).

[0474] The second eluting product, Example **22**, was a brown solid (6.3 mg, 0.012 mmol, 22 % yield) assigned as the TFA salt of the isomer shown, based on elution order.

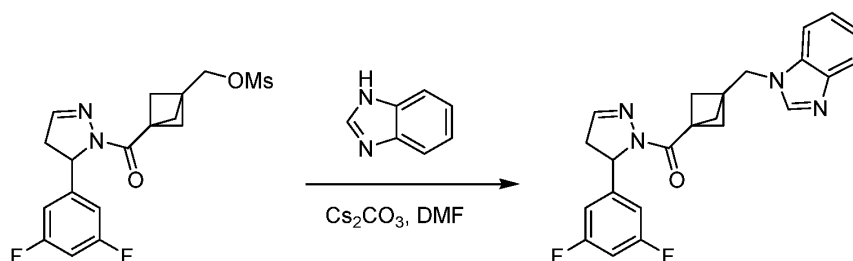
[0475] MS (ES⁺) C₂₃H₁₉F₃N₄O requires: 424, found: 425 [M+H]⁺

[0476] ¹H NMR (500 MHz, CDCl₃) δ 8.09 – 8.03 (m, 1H), 7.32 – 7.27 (m, 1H), 7.17 – 7.13 (m, 1H), 6.88 – 6.84 (m, 1H), 6.80 – 6.75 (m, 1H), 6.69 – 6.64 (m, 1H), 6.63 – 6.58 (m, 2H), 5.26 (dd, *J* = 11.9, 4.9 Hz, 1H), 4.52 (s, 2H), 3.31 (ddd, *J* = 18.8, 12.0, 1.6 Hz, 1H), 2.68 (ddd, *J* = 18.8, 5.0, 1.8 Hz, 1H), 2.07 (s, 6H).

EXAMPLE 23



(3-((1H-Benzo[d]imidazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone

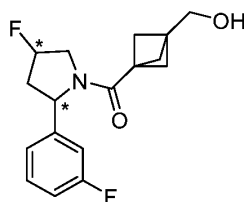


[0477] To a suspension of Intermediate **II** (20 mg, 0.052 mmol) in DMF (0.26 ml) were added 1H-benzo[d]imidazole (12 mg, 0.10 mmol) and Cs₂CO₃ (34 mg, 0.10 mmol) and the resulting mixture was stirred at 25 °C for 3 h. The reaction mixture was filtered through a syringe filter, and the filtrate was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound as a TFA salt (17 mg, 0.032 mmol, 62 % yield) as a white solid.

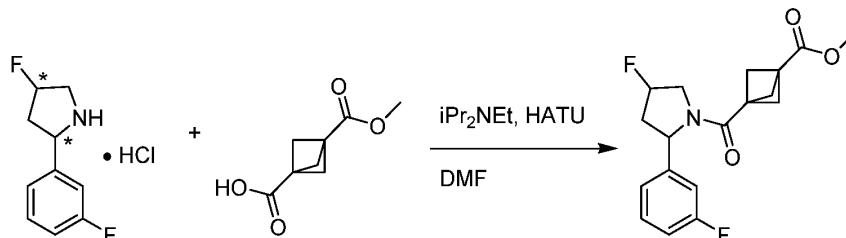
[0478] MS (ES⁺) C₂₃H₂₀F₂N₄O requires: 406, found: 407 [M+H]⁺.

[0479] ¹H NMR (600 MHz, DMSO-*d*₆) δ 9.21 (s, 1H), 7.91 (d, J = 8.0 Hz, 1H), 7.83 (d, J = 7.8 Hz, 1H), 7.61 – 7.45 (m, 2H), 7.15 (s, 1H), 7.13 – 7.07 (m, 1H), 6.76 (d, J = 7.4 Hz, 2H), 5.33 – 5.24 (m, 1H), 4.64 (s, 2H), ~3.3 (1m, 1H, under H₂O peak, implied) 2.72 – 2.61 (m, 1H), 1.99 (s, 6H).

EXAMPLE 24

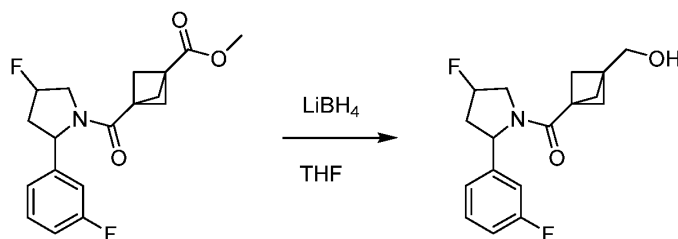


(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(hydroxymethyl)bicyclo[1.1.1]pentan-1-yl)methanone



[0480] Methyl 3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate

To a solution of 4-fluoro-2-(3-fluorophenyl)pyrrolidine hydrochloride (1.5 g, 6.8 mmol, mixture of diastereomers due to relative stereochemistry at starred chiral centers) in DMF (34 ml) were added 3-(methoxycarbonyl)-bicyclo[1.1.1]pentane-1-carboxylic acid (1.2 g, 6.8 mmol), $i\text{Pr}_2\text{NEt}$ (3.6 ml, 20 mmol) and HATU (3.9 g, 10 mmol) and the resulting mixture was stirred at 25 °C overnight. The volatiles were removed under reduced pressure. The reaction mixture was diluted with EtOAc, washed with saturated NaHCO_3 and saturated NaCl, dried over Na_2SO_4 , and concentrated under reduced pressure. The residue was adsorbed onto silica gel and purified via flash chromatography (0 - 100 %, EtOAc in hexanes) to give the title compound as an orange foam solid. MS (ES^+) $\text{C}_{18}\text{H}_{19}\text{F}_2\text{NO}_3$ requires: 335, found: 336 $[\text{M}+\text{H}]^+$.



[0481] (4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(hydroxymethyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 24)

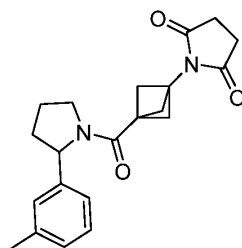
To a suspension of the product from the previous step (0.81 g, 2.4 mmol) in THF (4.0 ml) was added LiBH_4 (79 mg, 3.6 mmol), and the resulting mixture was stirred at 0 °C for 3 h. An additional 1.5 eq. of LiBH_4 was added at 0 °C and the reaction mixture was stirred for 6 h. The reaction mixture was quenched with the addition of 1 M HCl. The reaction mixture was diluted with EtOAc and washed with H_2O . The layers were separated, and the organic layer was washed with saturated NaCl, dried over Na_2SO_4 , and concentrated under reduced pressure. The residue was adsorbed onto silica gel

and purified via flash chromatography (0 - 100 % DCM in (10:1:0.1 DCM:MeOH:NH₄OH) to give the title compound (0.54 g, 1.8 mmol, 73 % yield) as a white solid.

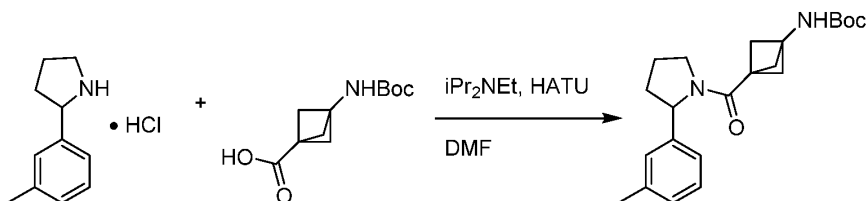
[0482] MS (ES⁺) C₁₇H₁₉F₂NO₂ requires: 307, found: 308 [M+H]⁺.

[0483] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.41 – 7.24 (m, 1H), 7.09 – 6.81 (m, 3H), 5.48 – 5.08 (m, 2H), 4.63 – 4.34 (m, 1H), 4.15 – 3.65 (m, 2H), 3.23 – 3.14 (m, 2H), 2.77 – 2.42 (m, 1H), 2.33 – 2.06 (m, 1H), 1.95 (s, 3H), 1.70 – 1.49 (m, 3H).

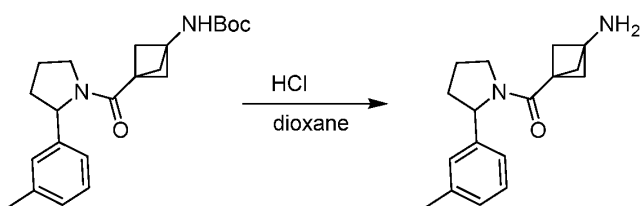
EXAMPLE 25



1-(3-(2-(m-Tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)pyrrolidine-2,5-dione

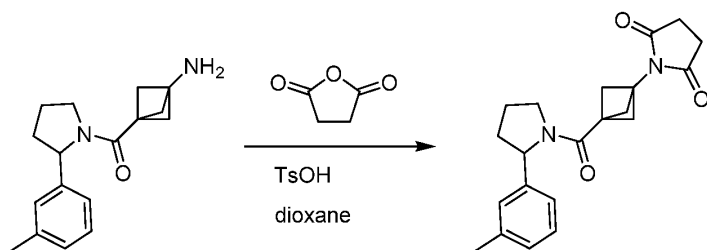


[0484] **tert-Butyl (3-(2-(m-tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)carbamate** Synthesis of the title compound was accomplished from 3-((tert-butoxycarbonyl)amino)bicyclo[1.1.1]pentane-1-carboxylic acid and 2-(m-tolyl)pyrrolidine using a procedure similar to that described for Example 24.



[0485] (3-Aminobicyclo[1.1.1]pentan-1-yl)(2-(m-tolyl)pyrrolidin-1-yl)methanone hydrochloride

To a solution of the product from the previous step (0.13 g, 0.34 mmol) in MeOH (0.69 ml) was added dropwise 4 M HCl in dioxane (0.86 ml, 3.4 mmol) at 0°C and the resulting mixture was stirred and allowed to warm to RT slowly. The volatiles were removed under reduced pressure to give the title compound as a grey solid. MS (ES⁺) C₁₇H₂₂N₂O requires: 270, found: 271 [M+H]⁺.



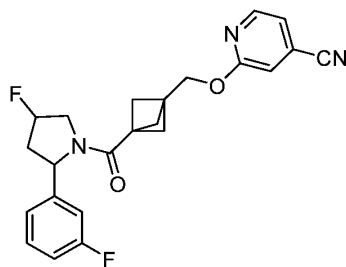
[0486] **1-(3-(2-(m-Tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)pyrrolidine-2,5-dione (Example 25)**

To a solution of the product from the previous step (20 mg, 0.074 mmol) in dioxane (0.74 ml) was added succinic anhydride (8.1 mg, 0.081 mmol) and p-toluenesulfonic acid (1.4 mg, 7.4 μ mol) and the resulting mixture was stirred at 80 °C for 6 h. The reaction mixture was concentrated under reduced pressure and the residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 20 - 60%; 12 min; Column: C18) to give the title compound (2.4 mg, 6.8 μ mol, 9 % yield) as a white solid.

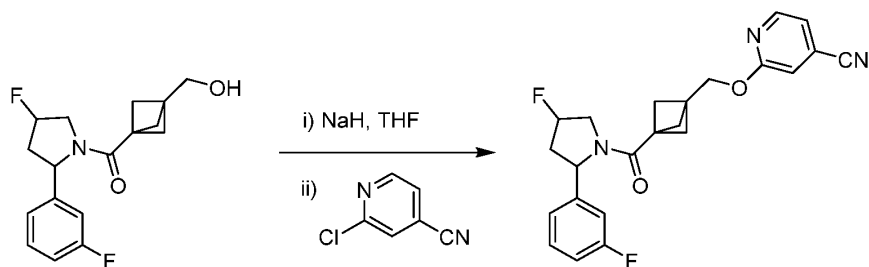
[0487] MS (ES⁺) C₂₁H₂₄N₂O₃ requires: 352, found: 353 [M+H]⁺.

[0488] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.20 (dt, *J* = 45.7, 7.6 Hz, 1H), 7.03 (dd, *J* = 38.8, 7.5 Hz, 1H), 6.96 – 6.84 (m, 2H), 5.23 – 4.98 (m, 1H), 3.83 (td, *J* = 9.0, 3.6 Hz, 1H), 3.49 – 3.42 (m, 1H), 2.58 (s, 2H), 2.53 (s, 3H), 2.47 (s, 2H), 2.36 – 2.07 (m, 7H), 1.94 – 1.74 (m, 2H), 1.69 – 1.52 (m, 1H).

EXAMPLE 26



2-((3-(4-Fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methoxy)isonicotinonitrile

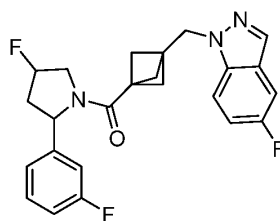


[0489] To a cooled 0 °C solution of the Example **24** compound (80 mg, 0.26 mmol) in THF (1.301 ml) was added NaH (60 % mineral oil dispersion, 11 mg, 0.29 mmol). The resulting mixture was stirred at 0 °C for 0.5 h and 2-chloroisonicotinonitrile (43.3 mg, 0.312 mmol) was added. The reaction mixture was allowed to warm to RT overnight. The reaction mixture was diluted with EtOAc and washed with H₂O. The layers were separated, and the organic layer was washed with saturated NaCl, dried over Na₂SO₄, and concentrated under reduced pressure. The residue was adsorbed onto silica gel and purified via flash chromatography (0 - 100 % DCM in (9:1:0.1 DCM:MeOH:NH₄OH). The product eluted in the void volume and was impure. The residue was repurified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 40 - 80%; 20 min; Column: C18) to give the title compound (29.8 mg, 0.073 mmol, 28.0 % yield) as a white solid.

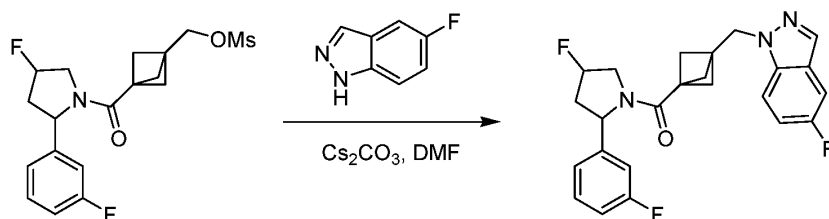
[0490] MS (ES⁺) C₂₃H₂₁F₂N₃O₂ requires: 409, found: 410 [M+H]⁺.

[0491] ¹H NMR (500 MHz, CDCl₃) δ 8.32 – 8.12 (m, 1H), 7.37 – 7.20 (m, 1H), 7.12 – 6.83 (m, 5H), 5.49 – 5.16 (m, 2H), 4.49 – 4.20 (m, 2H), 4.20 – 3.87 (m, 2H), 2.68 – 2.26 (m, 2H), 2.19 (s, 3H), 1.93 – 1.77 (m, 3H).

EXAMPLE 27



(3-((5-Fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone

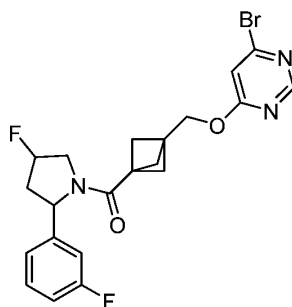


[0492] To a suspension of 3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl methyl methanesulfonate (40 mg, 0.10 mmol) in DMF (0.50 ml) were added 5-fluoro-1*H*-indazole (15 mg, 0.11 mmol) and Cs₂CO₃ (67 mg, 0.21 mmol). The resulting mixture was stirred at 25 °C for 4 h then 40 °C overnight. The volatiles were removed under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 30 - 70%; 20 min; Column: C18) to give the title compound as a TFA salt (21 mg, 0.040 mmol, 38% yield) as a white solid. The 1-*N* indazole isomer structure was confirmed by ROESY NMR and was the second product to elute.

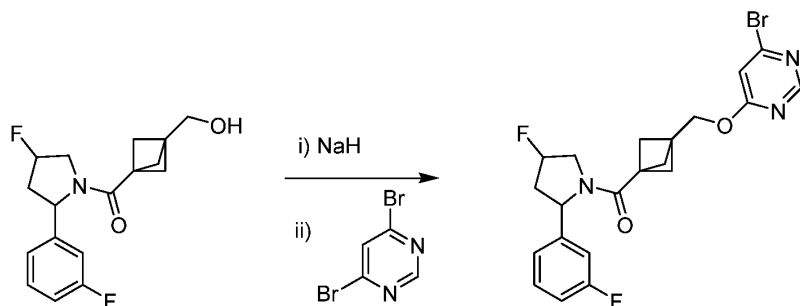
[0493] MS (ES⁺) C₂₄H₂₂F₃N₃O requires: 425, found: 426 [M+H]⁺.

[0494] ¹H NMR (500 MHz, DMSO-*d*₆) δ 8.10 – 7.93 (m, 1H), 7.74 – 7.56 (m, 1H), 7.56 – 7.47 (m, 1H), 7.36 – 7.19 (m, 2H), 7.04 – 6.82 (m, 3H), 5.41 – 5.12 (m, 2H), 4.64 – 4.37 (m, 2H), 4.08 – 3.64 (m, 2H), 2.69 – 2.34 (m, 1H), 2.27 – 2.01 (m, 1H), 1.97 – 1.88 (m, 3H), 1.63 – 1.47 (m, 3H).

EXAMPLE 28



(3-(((6-Bromopyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone

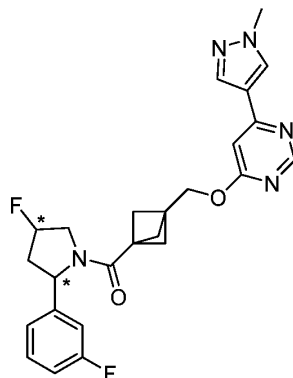


[0495] To a cooled 0 °C solution of the Example **24** compound (29 mg, 0.095 mmol) in THF (0.47 ml) under N₂ was added NaH (60% mineral oil dispersion, 4.2 mg, 0.10 mmol). The resulting mixture was stirred at 0 °C for 0.5 h, 4,6-dibromopyrimidine (27 mg, 0.11 mmol) was added and the reaction mixture was stirred and allowed to warm to RT overnight. The reaction mixture was stirred at 40 °C for 5 h. The reaction mixture was cooled to 0 °C, additional NaH (60% mineral oil dispersion 4.2 mg, 0.10 mmol) was added under an N₂ atmosphere, stirred at 0 °C for 15 min, and additional 4,6-dibromopyrimidine (27 mg, 0.11 mmol) was added at 0 °C. The reaction mixture was allowed to warm to RT, followed by stirring at 40 °C overnight. The reaction mixture was diluted with EtOAc, H₂O was added, and the layers were separated. The aqueous phase was extracted with EtOAc, and the combined organic layers were washed with H₂O, dried over Na₂SO₄, concentrated under reduced pressure, and purified by flash chromatography (0 - 50 9:1:0.1) DCM:MeOH:NH₄OH in DCM) to give the title compound (22 mg, 0.047 mmol, 50 % yield) as a yellow solid.

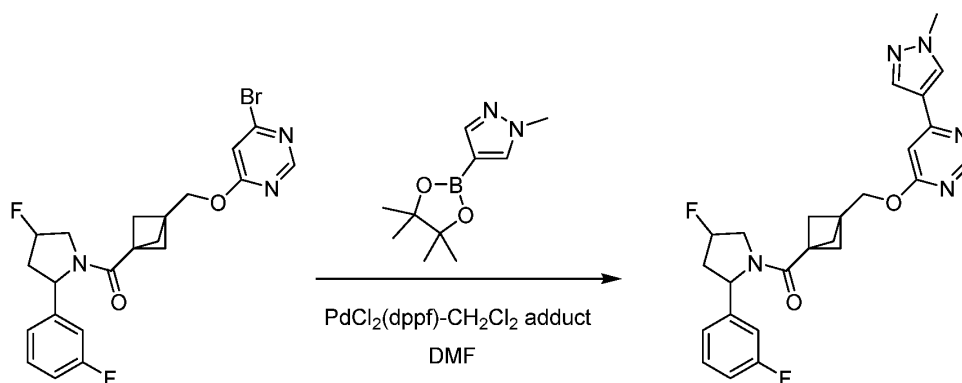
[0496] MS (ES⁺) C₂₁H₂₀BrF₂N₃O₂ requires: 463/465, found: 464/466 [M+H]⁺.

[0497] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.65 – 8.51 (m, 1H), 7.45 – 7.23 (m, 2H), 7.09 – 6.85 (m, 3H), 5.46 – 5.17 (m, 2H), 4.51 – 4.25 (m, 2H), 4.13 – 3.73 (m, 2H), 2.33 – 2.20 (m, 1H), 2.16 – 1.97 (m, 4H), 1.80 – 1.61 (m, 3H).

EXAMPLES 29 and 30



(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(((6-(1-methyl-1H-pyrazol-4-yl)pyrimidin-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone



[0498] A solution of 1-methyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole (11 mg, 0.053 mmol), Na₂CO₃ (40 µl, 0.081 mmol) and the Example **28** compound (19 mg, 0.040 mmol) in DMF (0.4 ml) was purged with N₂, PdCl₂(dppf)-CH₂Cl₂Adduct (3 mg, 4.0 µmol) was added, the mixture was purged with N₂ again, and the reaction mixture was stirred at 70 °C overnight. The reaction mixture was diluted with EtOAc and washed with saturated NaHCO₃. The layers were separated, and the organic layer was washed with saturated NaCl, dried over Na₂SO₄, concentrated under reduced pressure, and purified by flash chromatography (0 - 100 % 9:1:0.1 DCM:MeOH:NH₄OH in DCM) to give the title compound (4.2 mg, 9.0 µmol, 22 % yield) as two diastereomeric products, as white solids.

[0499] Example **29**:

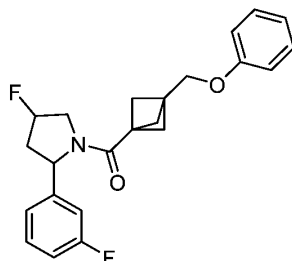
[0500] MS (ES⁺) C₂₅H₂₅F₂N₅O₂ requires: 465, found: 466 [M+H]⁺.

[0501] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.70 – 8.08 (m, 2H), 7.68 – 7.25 (m, 2H), 7.21 – 6.85 (m, 4H), 5.52 – 5.13 (m, 2H), 4.13 – 3.69 (m, 7H), 2.16 – 2.04 (m, 3H), 1.86 – 1.46 (m, 2H), 1.29 – 1.05 (m, 3H).

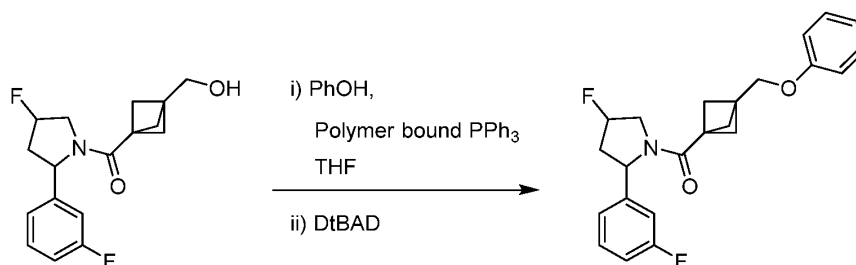
[0502] Example 30:

[0503] MS (ES⁺) C₂₅H₂₅F₂N₅O₂ requires: 465, found: 465.

EXAMPLE 31



(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(phenoxymethyl)-bicyclo[1.1.1]pentan-1-yl)methanone

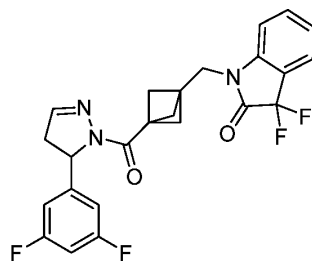


[0504] To a solution of the Example 24 compound (20 mg, 0.065 mmol) in THF (0.32 ml) were added phenol (8.0 mg, 0.085 mmol) and polymer bound PPh₃ (3 mmol/g, 43 mg, 0.13 mmol) and the resulting mixture was stirred at 25 °C for 10 min. DtBAD (19 mg, 0.085 mmol) was added and the reaction mixture was stirred at 25 °C overnight. The reaction mixture was filtered through CELITE®, and the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography (0 - 100 % EtOAc in hexanes). The crude product was repurified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (13 mg, 0.033 mmol, 51 % yield) as an orange solid.

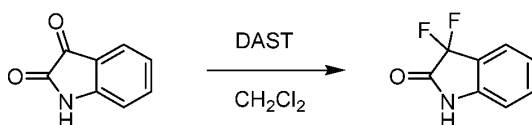
[0505] MS (ES⁺) C₂₃H₂₃F₂NO₂ requires: 383, found: 384 [M+H]⁺.

[0506] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.43 – 7.31 (m, 1H), 7.31 – 7.21 (m, 2H), 7.09 – 6.81 (m, 6H), 5.50 – 5.19 (m, 2H), 4.14 – 3.75 (m, 4H), 2.75 – 2.55 (m, 1H), 2.33 – 2.05 (m, 4H), 1.83 – 1.67 (m, 3H).

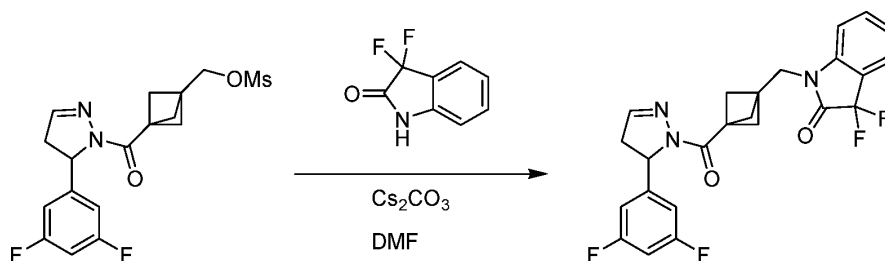
EXAMPLE 32



1-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-3,3-difluoroindolin-2-one



[0507] **3,3-Difluoroindolin-2-one** To a cooled -78°C suspension of indoline-2,3-dione (30 mg, 0.20 mmol) in DCM (1.3 ml) was added DAST (67 μl , 0.51 mmol), and the resulting mixture was stirred at -78°C for 10 min then allowed to warm to RT overnight. The reaction was quenched with saturated NaHCO_3 , diluted with DCM and H_2O , and the organic layer was separated, dried over MgSO_4 , concentrated under reduced pressure, and purified by flash chromatography (0 - 50 % EtOAc in hexanes) to give the title compound (24 mg, 0.14 mmol, 69 % yield) as a yellow solid. : ^1H NMR (500 MHz, CDCl_3) δ 7.78 (s, 1H), 7.56 (d, J = 7.3 Hz, 1H), 7.49 – 7.41 (m, 1H), 7.20 – 7.14 (m, 1H), 6.93 (d, J = 7.9 Hz, 1H).

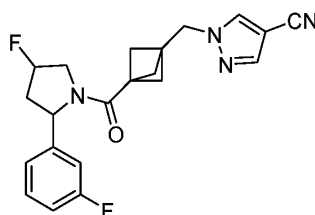


[0508] **1-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-3,3-difluoroindolin-2-one (Example 32)** To a solution of Intermediate **II** (20 mg, 0.052 mmol) in DMF (0.26 ml) were added 3,3-difluoroindolin-2-one (9.7 mg, 0.057 mmol) and Cs_2CO_3 (17 mg, 0.052 mmol) and the resulting mixture was stirred at 25°C for overnight. The reaction mixture was acidified with TFA, filtered through a syringe filter, and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 40 - 80%; 12 min; Column: C18) to give the title compound (13 mg, 0.028 mmol, 53 % yield) as a white solid.

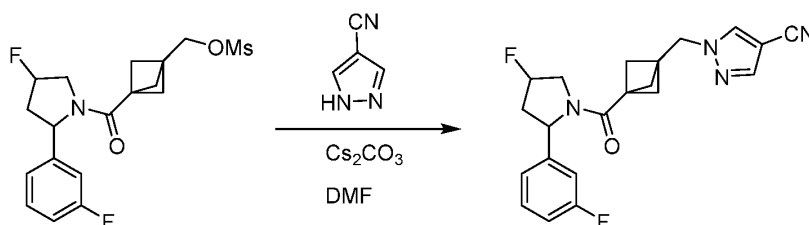
[0509] MS (ES⁺) C₂₄H₁₉F₄N₃O₂ requires: 457, found: 458 [M+H]⁺.

[0510] ¹H NMR (500 MHz, CDCl₃) δ 7.58 – 7.52 (m, 1H), 7.51 – 7.43 (m, 1H), 7.20 – 7.13 (m, 1H), 6.93 – 6.85 (m, 2H), 6.71 – 6.64 (m, 1H), 6.64 – 6.59 (m, 2H), 5.32 – 5.21 (m, 1H), 3.83 (d, *J* = 2.2 Hz, 2H), 3.40 – 3.28 (m, 1H), 2.75 – 2.65 (m, 1H), 2.15 (s, 6H).

EXAMPLE 33



1-((3-(4-Fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile

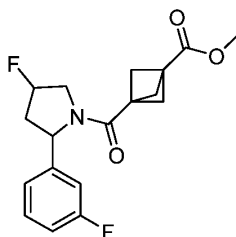


[0511] To a suspension of (3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl methanesulfonate (20 mg, 0.052 mmol) in DMF (0.50 ml) were added 1H-pyrazole-4-carbonitrile (9.6 mg, 0.10 mmol) and Cs₂CO₃ (34 mg, 0.10 mmol). The resulting mixture was stirred at 25 °C for 4 h and then at 40 °C overnight. The volatiles were removed under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 30 - 70%; 20 min; Column: C18) to give the title compound (9.1 mg, 0.024 mmol, 46 % yield) as a white solid.

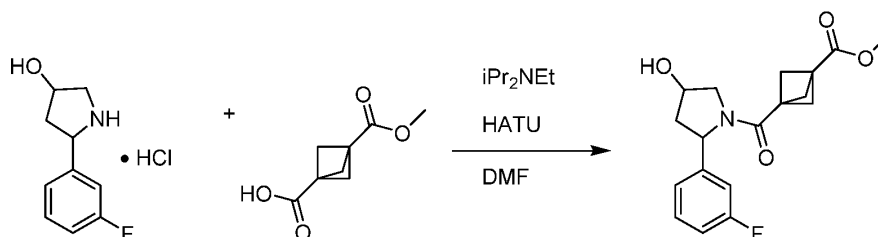
[0512] MS (ES⁺) C₂₁H₂₀F₂N₄O requires: 382, found: 383 [M+H]⁺.

[0513] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.63 – 8.38 (m, 1H), 8.15 – 7.95 (m, 1H), 7.44 – 7.23 (m, 1H), 7.08 – 6.85 (m, 3H), 5.45 – 5.14 (m, 2H), 4.39 – 4.13 (m, 2H), 4.07 – 3.70 (m, 2H), 2.78 – 2.53 (m, 1H), 2.24 – 2.02 (m, 1H), 1.97 (d, *J* = 4.1 Hz, 3H), 1.69 – 1.47 (m, 3H).

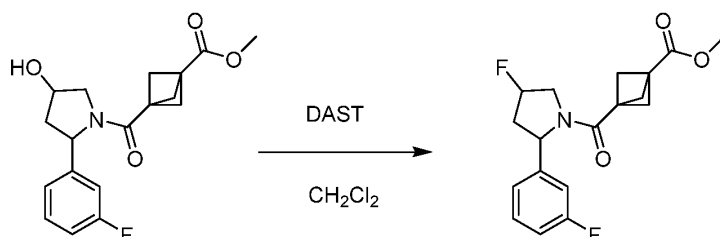
EXAMPLE 34



**Methyl 3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)-
bicyclo[1.1.1]pentane-1-carboxylate**



[0514] **Methyl 3-(2-(3-fluorophenyl)-4-hydroxypyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate** To a vial of 3-(methoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid (0.50 g, 2.9 mmol) in DMF (11.5 ml) was added 5-(3-fluorophenyl)pyrrolidin-3-ol hydrochloride (0.70 g, 3.2 mmol), $i\text{Pr}_2\text{NEt}$ (1.5 ml, 8.8 mmol), and HATU (1.7 g, 4.4 mmol). The resulting mixture was stirred at RT overnight. The reaction mixture was diluted with EtOAc and washed with H_2O and saturated NaCl, dried over Na_2SO_4 , concentrated under reduced pressure, purified by flash chromatography (0 - 100 %, EtOAc in hexanes) to give the title compound (0.58 g, 1.7 mmol, 59 % yield) as an orange foam solid. MS (ES^+) $\text{C}_{18}\text{H}_{20}\text{FNO}_4$ requires: 333, found: 334 $[\text{M}+\text{H}]^+$.



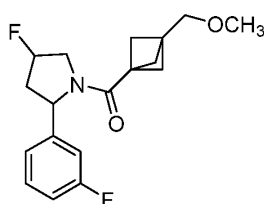
[0515] **Methyl 3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate (Example 34)** To a solution of the product from the previous step (0.58 g, 1.7 mmol) in DCM (2.5 ml) at -78°C was added DAST (0.46 ml, 3.5 mmol) and the resulting mixture was stirred at -78°C for 0.5 h then allowed to reach RT. The reaction mixture was added dropwise to a solution of saturated NaHCO_3 held at 0°C , and the layers were separated. The aqueous phase was extracted with DCM (x2), and the combined organic

layers were dried over anhydrous Na_2SO_4 and concentrated under reduced pressure. The residue was purified by flash chromatography (0 - 100 %, EtOAc in Hexanes) to give the title compound (0.19 g, 0.57 mmol, 32 % yield) as a white solid.

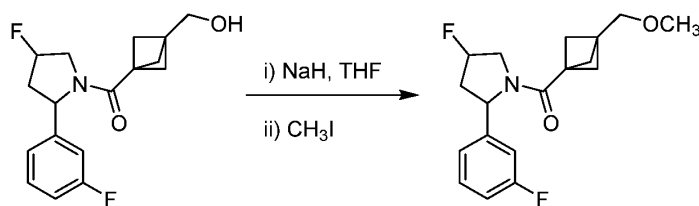
[0516] MS (ES^+) $\text{C}_{18}\text{H}_{19}\text{F}_2\text{NO}_3$ requires: 335, found: 336 $[\text{M}+\text{H}]^+$.

[0517] ^1H NMR (600 MHz, CDCl_3) δ 7.48 – 7.25 (m, 1H), 7.16 – 6.88 (m, 3H), 5.49 – 5.15 (m, 2H), 4.17 – 3.75 (m, 2H), 3.66 – 3.50 (m, 3H), 2.76 – 2.52 (m, 1H), 2.35 (s, 4H), 2.03 – 1.84 (m, 3H).

EXAMPLE 35



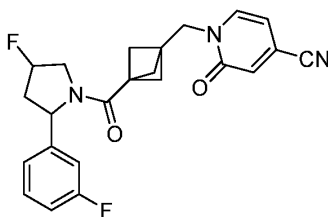
(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(methoxymethyl)-bicyclo[1.1.1]pentan-1-yl)methanone



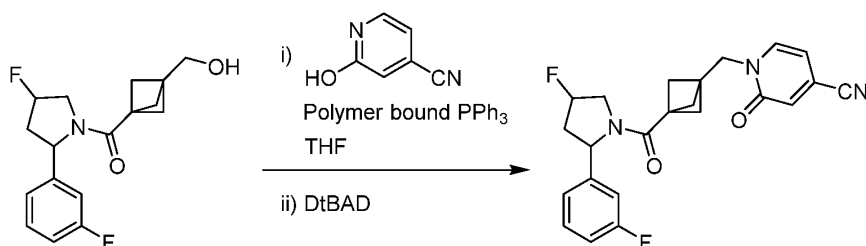
[0518] To a cooled 0 °C solution of the Example **24** compound (15 mg, 0.049 mmol) in THF (0.24 ml) under an N_2 environment was added NaH (60% mineral oil dispersion, 2.1 mg, 0.054 mmol) and the resulting mixture was stirred at 0 °C for 0.5 h. To the reaction was added MeI (3.7 μl , 0.059 mmol), stirred at 0 °C for 0.5 h, allowed to warm to RT overnight. To the reaction was added additional MeI (3.7 μl , 0.059 mmol), and stirring was continued at 40 °C for 3 h. The volatiles were removed under reduced pressure and the residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 50 - 90%; 12 min; Column: C18) to give the title compound (5.6 mg, 0.017 mmol, 36 % yield) as a brown oil.

[0519] MS (ES^+) $\text{C}_{18}\text{H}_{21}\text{F}_2\text{NO}_2$ requires: 321, found: 322 $[\text{M}+\text{H}]^+$.

[0520] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 7.43 – 7.22 (m, 1H), 7.11 – 6.81 (m, 3H), 5.51 – 5.17 (m, 2H), 4.22 – 3.73 (m, 2H), 3.27 – 3.25 (m, 2H), 3.18 – 3.10 (m, 3H), 2.76 – 2.54 (m, 1H), 2.32 – 2.06 (m, 1H), 2.02 (s, 3H), 1.71 – 1.56 (m, 3H).

EXAMPLE 36

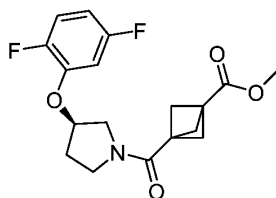
1-((3-(4-Fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2-oxo-1,2-dihydropyridine-4-carbonitrile



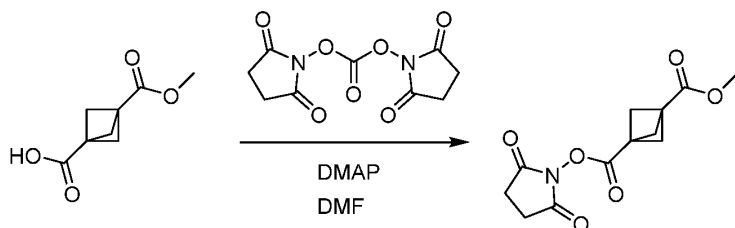
[0521] To a solution of the Example **24** compound (20 mg, 0.065 mmol) in THF (0.32 ml) were added 2-hydroxyisonicotinonitrile (7.8 mg, 0.085 mmol) and polymer bound PPh₃ (3 mmol/g) L-08 (43 mg, 0.13 mmol) and the resulting mixture was stirred at 25 °C for 10 min. DtBAD (19 mg, 0.085 mmol) was added and the reaction mixture was stirred at 25 °C overnight. The reaction mixture was filtered through CELITE®, and the filtrate was concentrated under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 50 - 90%; 20 min; Column: C18) to give the title compound (6 mg, 0.015 mmol, 22 % yield) as an off-white solid.

[0522] MS (ES⁺) C₂₃H₂₁F₂N₃O₂ requires: 409, found: 410 [M+H]⁺.

[0523] ¹H NMR (600 MHz, CDCl₃) δ 7.40 – 7.12 (m, 2H), 7.01 – 6.77 (m, 3H), 6.33 – 6.08 (m, 2H), 5.45 – 5.07 (m, 2H), 4.26 – 3.74 (m, 4H), 2.66 – 2.21 (m, 2H), 2.13 (s, 3H), 1.86 – 1.70 (m, 3H).

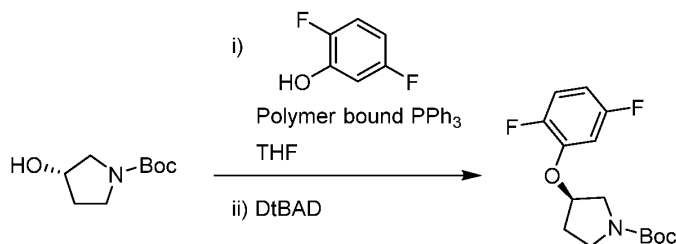
EXAMPLE 37

Methyl (*R*)-3-(3-(2,5-difluorophenoxy)pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentane-1-carboxylate

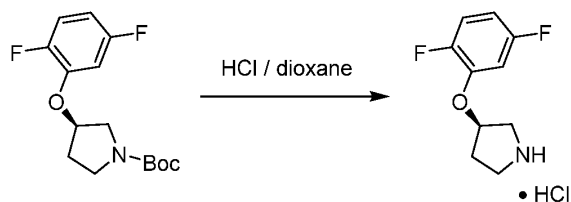


[0524] **1-(2,5-Dioxopyrrolidin-1-yl) 3-methyl bicyclo[1.1.1]pentane-1,3-dicarboxylate**

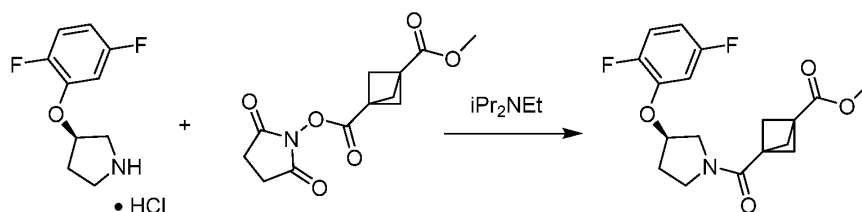
To a suspension of 3-(methoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid (4.5 g, 26 mmol) in DMF (26 mL), was added bis(2,5-dioxopyrrolidin-1-yl) carbonate (8.1 g, 32 mmol), and DMAP (0.065 g, 0.53 mmol) and the resulting mixture was stirred at RT for 48 h. The reaction mixture was poured over 100 mL ice water and stirred for 15 min. The solid that had formed was removed by filtration and washed with 0.1 M HCl (45 mL), 0.1 M NaOH (45 mL), H₂O (100 mL), and hexanes (100 mL). The solid was further dried in the lyophilizer to give the title compound (6.0 g, 22 mmol, 85 % yield) as a white solid. MS (ES⁺) C₁₂H₁₃NO₆ requires: 267, found: 290 [M+Na]⁺.



[0525] **tert-Butyl (*R*)-3-(2,5-difluorophenoxy)pyrrolidine-1-carboxylate** To a solution of tert-butyl (*S*)-3-hydroxypyrrolidine-1-carboxylate (0.15 g, 0.80 mmol) in THF (4.0 mL) were added 2,5-difluorophenol (0.13 mg, 1.0 mmol) and polymer bound PPh₃ (3 mmol/g) L-08 (0.53 g, 1.6 mmol) and the resulting mixture was stirred at RT for 10 min. DtBAD (0.24 g, 1.0 mmol) was added and the reaction mixture was stirred at RT overnight. The reaction mixture was filtered through CELITE®, the filtrate was concentrated, and the residue was adsorbed onto silica gel and purified by flash chromatography (0 - 30 %, EtOAc in hexanes) to give the title compound (0.22 g, 0.72 mmol, 90 % yield) as a white solid. MS (ES⁺) C₁₅H₁₉F₂NO₃ requires: 299, found: 322 [M+Na]⁺.



[0526] **(R)-3-(2,5-Difluorophenoxy)pyrrolidine hydrochloride** To a cooled 0 °C solution of the product from the previous step (210 mg, 0.72 mmol) in dioxane (3.6 ml) was added 4M HCl in dioxane (0.90 ml, 3.6 mmol). The resulting mixture was stirred at 0 °C for 0.5 h and allowed to warm to RT overnight. The volatiles were removed under reduced pressure to give the title compound (160 mg, 0.69 mmol, 96 % yield) as a white solid. MS (ES⁺) C₁₀H₁₁F₂NO requires: 199, found: 200 [M+H]⁺.

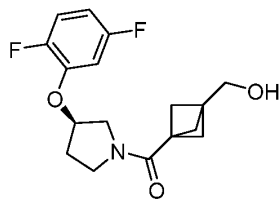


[0527] **Methyl (R)-3-(3-(2,5-difluorophenoxy)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxylate (Example 37)** To a solution of the product from the previous step (0.12 g, 0.51 mmol) in DMF (5 mL) were added 1-(2,5-difluorophenoxy)pyrrolidine-1-yl 3-methyl bicyclo[1.1.1]pentane-1,3-dicarboxylate (0.15 g, 0.56 mmol) and iPr₂NEt (0.44 mL, 2.5 mmol) and the resulting mixture was stirred at RT for 24 h. The volatiles were removed under reduced pressure. The reaction mixture was diluted with EtOAc and washed with saturated NaHCO₃ and saturated NaCl, dried over Na₂SO₄, concentrated under reduced pressure, and purified by flash chromatography (0 - 100 %, EtOAc in hexanes) to give the title compound (0.14 g, 0.40 mmol, 79 % yield) as an off-white solid.

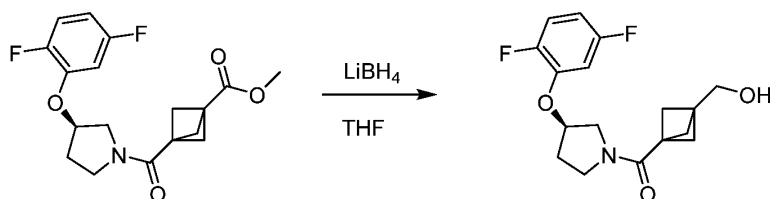
[0528] MS (ES⁺) C₁₈H₁₉F₂NO₄ requires: 351, found: 352 [M+H]⁺.

[0529] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.33 – 7.16 (m, 2H), 6.87 – 6.75 (m, 1H), 5.19 – 5.02 (m, 1H), 3.89 – 3.68 (m, 1H), 3.61 (d, J = 6.8 Hz, 3H), 3.60 – 3.50 (m, 3H), 2.33 – 2.24 (m, 6H), 2.24 – 2.14 (m, 1H), 2.12 – 1.98 (m, 1H).

EXAMPLE 38



(R)-6-((3-(2,5-Difluorophenoxy)pyrrolidin-1-yl)(3-(hydroxymethyl)-bicyclo[1.1.1]pentan-1-yl)methanone

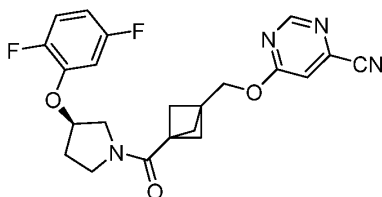


[0530] To a cooled 0 °C solution of the Example 37 compound (0.14 g, 0.39 mmol) in THF (0.66 ml) was added LiBH₄ (13 mg, 0.59 mmol). The resulting mixture was stirred at 0 °C for 3 h. To the reaction was added additional LiBH₄ (13 mg, 0.59 mmol) and the mixture was stirred at 0 °C for 3 h. The reaction was quenched with the addition of 1 M HCl (2 mL). The reaction mixture was diluted with EtOAc, washed with H₂O followed by saturated NaCl, dried over Na₂SO₄, concentrated under reduced pressure, and purified by flash chromatography (0 - 50 %, 9:1:0.1 DCM:MeOH:NH₄OH in DCM) to give the title compound (97 mg, 0.30 mmol, 75 % yield) as an off-white solid.

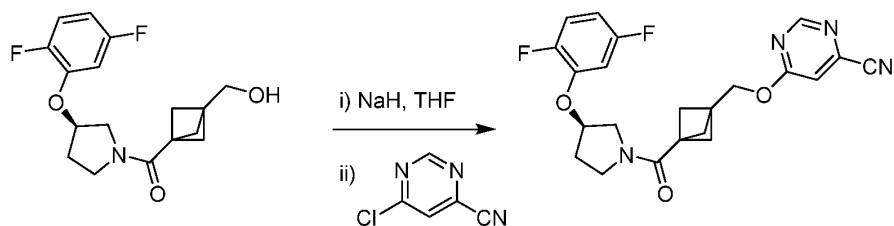
[0531] MS (ES⁺) C₁₇H₁₉F₂NO₃ requires: 323, found: 324 [M+H]⁺.

[0532] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.37 – 7.14 (m, 2H), 6.91 – 6.69 (m, 1H), 5.11 (d, *J* = 55.8 Hz, 1H), 4.67 – 4.43 (m, 1H), 3.88 – 3.69 (m, 1H), 3.62 – 3.52 (m, 2H), 3.44 – 3.37 (m, 1H), 3.27 – 3.03 (m, 2H), 2.30 – 1.99 (m, 1H), 1.97 – 1.74 (m, 7H).

EXAMPLE 39



(R)-6-((3-(2,5-difluorophenoxy)pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methoxy)pyrimidine-4-carbonitrile

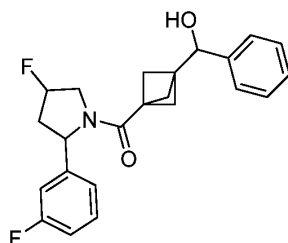


[0533] To a cooled 0 °C solution of the Example **38** compound (20 mg, 0.062 mmol) in THF (0.30 ml) was added NaH (60 % mineral oil dispersion, 1.6 mg, 0.068 mmol) and the resulting mixture was stirred at 0°C for 15 min. To the reaction was added 6-chloropyrimidine-4-carbonitrile (10 mg, 0.074 mmol), and the mixture was stirred at RT for 4 h. The volatiles were removed under reduced pressure and the residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 50 - 90%; 12 min; Column: C18) to give the title compound (8.3 mg, 0.019 mmol, 31 % yield) as an off-white solid.

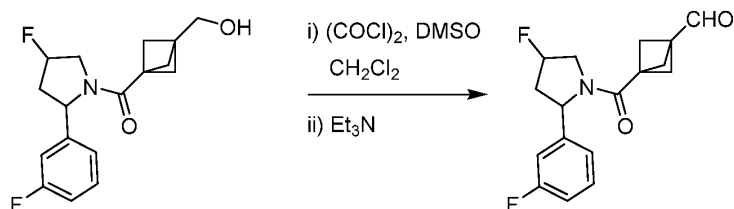
[0534] MS (ES⁺) C₂₂H₂₀F₂N₄O₃ requires: 426, found: 427 [M+H]⁺.

[0535] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.95 – 8.89 (m, 1H), 7.77 – 7.68 (m, 1H), 7.31 – 7.23 (m, 1H), 7.23 – 7.14 (m, 1H), 6.86 – 6.78 (m, 1H), 5.20 – 5.02 (m, 1H), 4.56 – 4.40 (m, 2H), 3.89 – 3.65 (m, 1H), 3.60 – 3.51 (m, 2H), 3.34 (td, *J* = 10.9, 7.5 Hz, 1H), 2.27 – 2.12 (m, 1H), 2.12 – 1.93 (m, 7H).

EXAMPLE 40

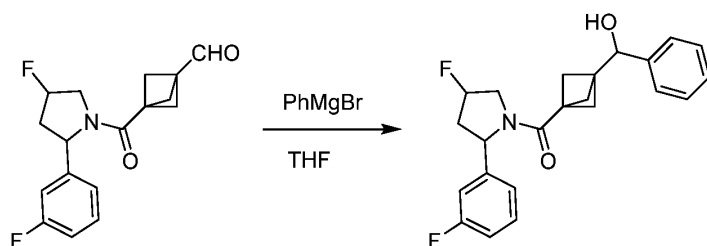


(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(hydroxy(phenyl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone



[0536] **3-(4-Fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carbaldehyde**

To a solution of oxalyl chloride (71 μ l, 0.81 mmol) in DCM (4.5 ml) was added DMSO (0.11 ml, 1.6 mmol) and the resulting mixture was stirred at -78 °C for 10 min. A solution of the Example **24** compound (50 mg, 0.16 mmol) in DCM (0.9 ml) was added followed by TEA (0.57 ml, 4.1 mmol). The resulting mixture was stirred for 1hr at -78 °C and then allowed to reach RT. The solution was poured into saturated NaHCO₃, and the layers were separated. The aqueous phase was extracted with DCM (3 x), the combined organic layers were washed with saturated NaCl, dried over Na₂SO₄, and concentrated under reduced pressure. The product was carried on to the next step without purification. MS (ES⁺) C₁₇H₁₇F₂NO₂ requires: 305, found: 306 [M+H]⁺.



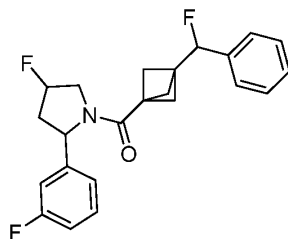
[0537] **(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(hydroxy(phenyl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone (Example 40)**

To a solution of the product from the previous step (25 mg, 0.082 mmol) in THF (0.5) at 0 °C were added phenylmagnesium bromide (55 μ l of a 3.0 M solution in Et₂O; 0.16 mmol) and the resulting mixture was stirred at 0 °C for 30 min then allowed to reach RT. Saturated NH₄Cl was added, and the layers were separated. The aqueous phase was extracted with EtOAc (3 x), the combined organic layers were washed with saturated NaCl, dried over Na₂SO₄, concentrated under reduced pressure, and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 40 - 80%; 12 min; Column: C18) to give the title compound (6.5 mg, 0.017 mmol, 21 % yield) as a white powder.

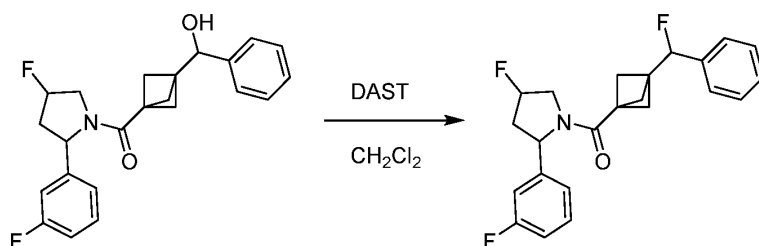
[0538] MS (ES⁺) C₂₃H₂₃F₂NO₂ requires: 383, found: 384 [M+H]⁺.

[0539] ¹H NMR (600 MHz, DMSO-*d*₆) δ 7.47-7.14 (m, 5H), 7.13-7.81 (m, 4H), 5.42-5.12 (m, 2H), 4.62-4.36 (m, 1H), 4.0-3.85 (m, 3H), 2.41-2.15 (m, 2H), 2.13-1.93 (m, 1H), 1.89-1.58 (m, 3H), 1.56-1.37 (m, 2H).

EXAMPLE 41



**(3-(Fluoro(phenyl)methyl)bicyclo[1.1.1]pentan-1-yl)-
(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone**

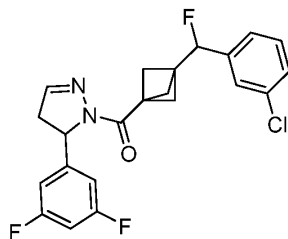


[0540] To a solution of the Example 40 compound (20 mg, 0.052 mmol) in DCM (0.5 ml) at 0 °C was added DAST (8.27 μ l, 0.063 mmol) and the resulting mixture was stirred at 0 °C for 1 h then allowed to reach RT. The mixture was cooled to 0 °C, saturated NaHCO_3 was added, and the layers were separated. The aqueous phase was extracted with DCM (3 x), and the combined organic layers were concentrated under reduced pressure and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 40 - 80%; 12 min; Column: C18) to give the title compound (2.0 mg, 5.5 μ mol, 10 % yield) as a pale yellow amorphous material.

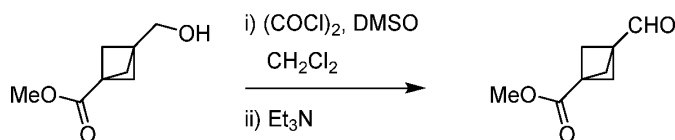
[0541] MS (ES^+) $\text{C}_{23}\text{H}_{22}\text{F}_3\text{NO}$ requires: 385, found: 386 $[\text{M}+\text{H}]^+$.

[0542] ^1H NMR (600 MHz, CDCl_3) δ 7.41-7.18 (m, 5H), 7.10 (s, 1H), 7.00-6.80 (m, 3H), 5.50-5.14 (m, 2H), 4.16-3.85 (m, 2H), 2.64-2.38 (m, 2H), 2.35-2.28 (m, 1H), 2.15-2.03 (m, 3H), 1.85-1.65 (m, 3H).

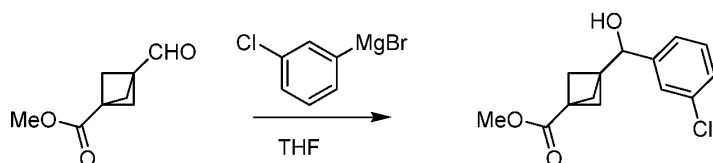
EXAMPLE 42



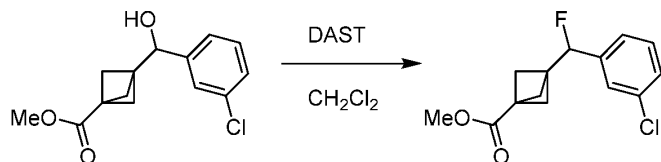
(3-((3-chlorophenyl)fluoromethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone



[0543] **Methyl 3-formylbicyclo[1.1.1]pentane-1-carboxylate** The title compound was obtained by a procedure similar to the first step of the Example **40** synthesis, using methyl 3-(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate (1g, 6.4 mmol) and Swern oxidation conditions. The resulting desired product (900 mg, 5.8 mmol, 91%) was used as is in the next step.

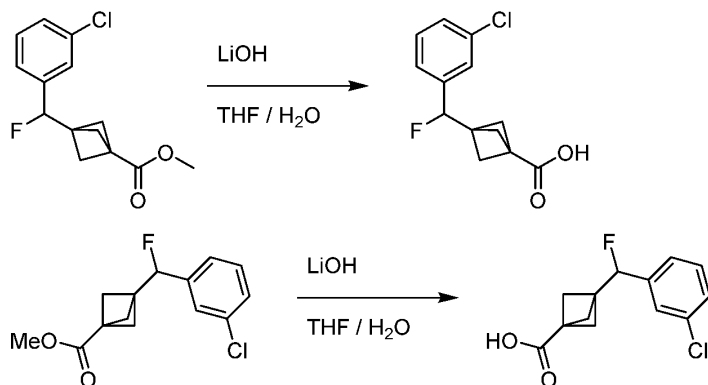


[0544] **Methyl 3-((3-chlorophenyl)(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate** The title compound was obtained by a procedure similar to the second step of the Example **40** synthesis, using methyl 3-formylbicyclo[1.1.1]pentane-1-carboxylate (100 mg, 0.65 mmol) and (3-chlorophenyl)magnesium bromide (2.6 mL, 1.3 mmol) and the desired product (114 mg, 0.43 mmol, 66%) a pale yellow liquid was used as is in the next step. MS (ES⁺) C₁₄H₁₅ClO₃ requires: 266, found: 267 [M+H]⁺

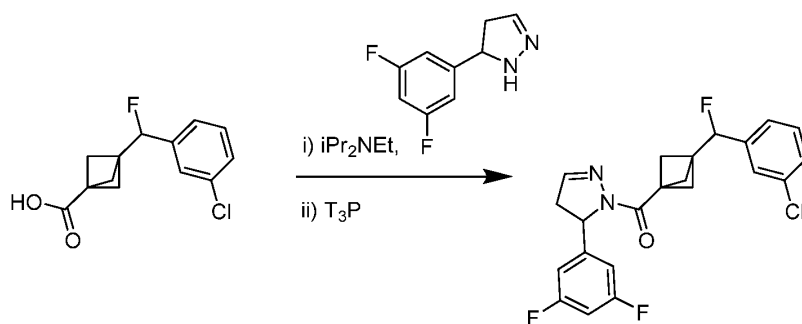


[0545] **Methyl 3-((3-chlorophenyl)fluoromethyl)bicyclo[1.1.1]pentane-1-carboxylate**

The title compound was obtained by a procedure similar to the synthesis of Example **41** from Example **40**, using methyl 3-((3-chlorophenyl)(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate (100 mg, 0.36 mmol) and DAST followed by flash chromatography to give the desired product (80 mg, 0.30 mmol, 79%). MS (ES⁺) C₁₄H₁₄ClFO₂ requires: 268, found: 269 [M+H]⁺.

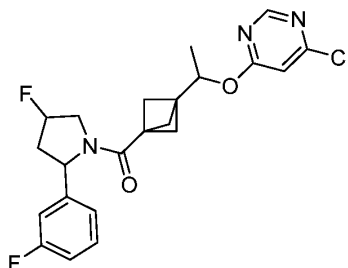


[0546] **3-((3-Chlorophenyl)fluoromethyl)bicyclo[1.1.1]pentane-1-carboxylic acid** The title compound was synthesized similar to Example 14 from methyl 3-((3-chlorophenyl)-fluoromethyl)bicyclo[1.1.1]pentane-1-carboxylate (80 mg, 0.30 mmol) and LiOH, and was used as is in the next step. MS (ES⁺) C₁₃H₁₂ClFO₂ requires: 254, found: 255 [M+H]⁺.

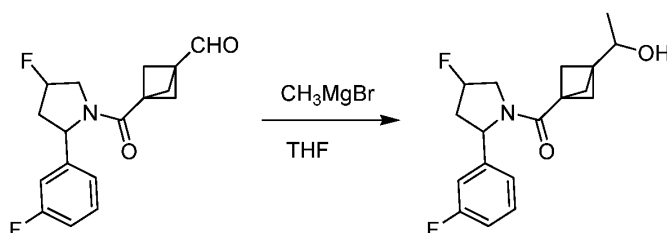


[0547] **(3-((3-Chlorophenyl)fluoromethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone** The title compound was synthesized similar to Example 14 from 5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole (77mg, 0.42 mmol) and 3-((3-chlorophenyl)fluoromethyl)bicyclo[1.1.1]pentane-1-carboxylic acid (90 mg, 0.35 mmol) using T₃P (50% wt in EtOAc) and iPr₂NEt in DMF to give the desired product (6.7 mg, 0.02 mmol, 5%) as a orange amorphous material. MS (ES⁺) C₂₂H₁₈ClF₃N₂O requires: 418, found: 419 [M+H]⁺.

EXAMPLE 43

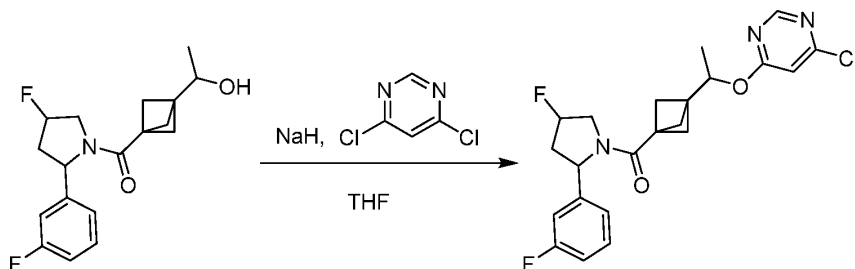


(3-(1-((6-Chloropyrimidin-4-yl)oxy)ethyl)bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone



[0548] **(4-Fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(1-hydroxyethyl)-bicyclo[1.1.1]pentan-1-yl)methanone** Synthesis of the title compound was

accomplished from 3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carbaldehyde and methylmagnesium bromide using a procedure similar to that described for Example 40.

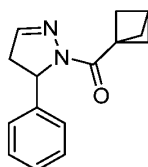


[0549] **(3-(1-((6-Chloropyrimidin-4-yl)oxy)ethyl)bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone (Example 43)** To a solution of the product from the previous step (20 mg, 0.062 mmol) in THF (0.5 ml) at 0 °C was added 4,6-dichloropyrimidine (9.55 mg, 0.068 mmol) and NaH (60% dispersion in mineral oil, 5.0 mg, 0.12 mmol) and the resulting mixture was stirred at 0 °C for 1 h. The reaction mixture at 0 °C was quenched with 1M HCl, warmed to RT, and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 40 - 80%; 12 min; Column: C18) to give the title compound (2.0 mg, 5.0 μmol, 8 % yield) as a white solid.

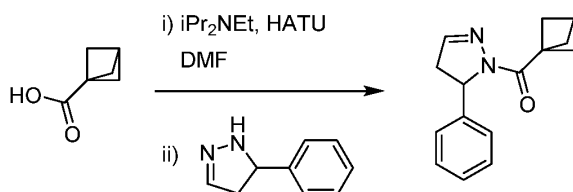
[0550] MS (ES⁺) C₂₂H₂₂ClF₂N₃O₂ requires: 433, found: 434 [M+H]⁺.

[0551] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.70-8.54 (m, 1H), 7.45-6.8 (m, 5H), 5.45-5.15 (m, 3H), 4.11-3.71 (m, 2H), 2.40-2.18 (m, 2H), 2.16-1.91 (m, 4H), 1.73-1.55 (m, 2H), 1.30-1.03 (m, 3H).

EXAMPLE 44

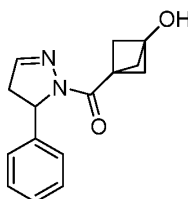


Bicyclo[1.1.1]pentan-1-yl(5-phenyl-4,5-dihydro-1H-pyrazol-1-yl)methanone

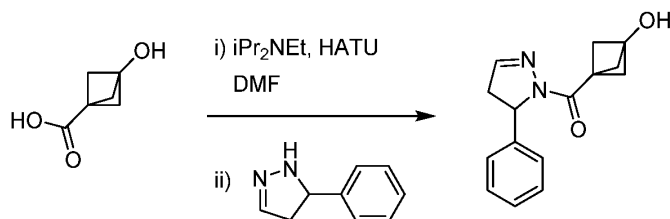


[0552] To a stirring solution of bicyclo[1.1.1]pentane-1-carboxylic acid (17 mg, 0.15 mmol) in DMF (0.5 ml) was added iPr₂NEt (0.048 ml, 0.27 mmol), then in 10 min HATU (78 mg, 0.205 mmol), then in 15 min 5-phenyl-4,5-dihydro-1H-pyrazole (20 mg, 0.137 mmol). The reaction was stirred for 2 h at RT. Saturated NaHCO₃ was then added, and the layers were separated. The aqueous phase was extracted with EtOAc (3 x) and the combined organic layers were concentrated under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 30 - 70%; 20 min; Column: C18) to give the title compound (7 mg, 0.027 mmol, 20% yield) as a yellow amorphous material. MS (ES⁺) C₁₅H₁₆N₂O requires: 240, found: 241 [M+H]⁺.

EXAMPLE 45



(3-Hydroxybicyclo[1.1.1]pentan-1-yl)(5-phenyl-4,5-dihydro-1H-pyrazol-1-yl)methanone

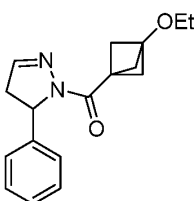


[0553] The procedure used to obtain the Example **44** compound was applied to 3-hydroxybicyclo[1.1.1]pentane-1-carboxylic acid (48 mg, 0.38 mmol) and 5-phenyl-4,5-dihydro-1*H*-pyrazole (50 mg, 0.34 mmol) to give the title compound (32 mg, 0.13 mmol, 36 % yield) as an off-white powder.

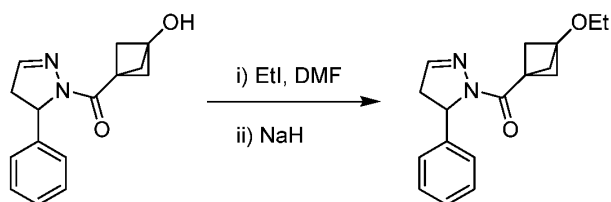
[0554] MS (ES^+) $\text{C}_{15}\text{H}_{16}\text{N}_2\text{O}_2$ requires: 256, found: 257 $[\text{M}+\text{H}]^+$.

[0555] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 7.37 – 7.29 (m, 2H), 7.28 – 7.22 (m, 1H), 7.21 – 7.16 (m, 1H), 7.11 – 7.04 (m, 2H), 6.61 – 6.25 (m, 1H), 5.30 (dd, $J = 11.9, 4.5$ Hz, 1H), 3.49 – 3.38 (m, 1H), 2.71 – 2.58 (m, 1H), 2.10 (s, 6H).

EXAMPLE 46



(3-Ethoxybicyclo[1.1.1]pentan-1-yl)(5-phenyl-4,5-dihydro-1*H*-pyrazol-1-yl)methanone

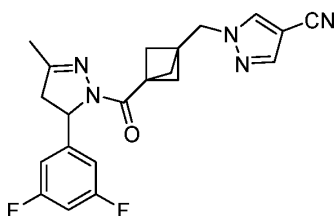


[0556] To a solution of the Example **45** compound (10 mg, 0.039 mmol) in DMF (0.3 ml) was added iodoethane (6.7 mg, 0.043 mmol) and the solution was cooled to -78°C . NaH (60% dispersion in mineral oil, 1.7 mg, 0.043 mmol) was then added, and the resulting mixture was stirred at -78°C for 1 h. The reaction at -78°C was quenched with TFA, warmed to RT, and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 30 - 70%; 12 min; Column: C18) to give the title compound (1.8 mg, 6.3 μmol , 16 % yield) as a pale yellow liquid.

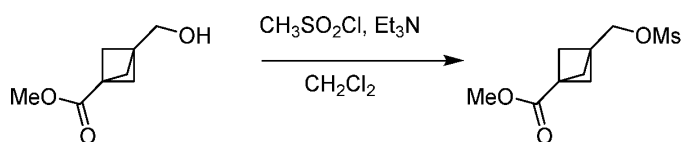
[0557] MS (ES^+) $\text{C}_{17}\text{H}_{20}\text{N}_2\text{O}_2$ requires: 284, found: 285 $[\text{M}+\text{H}]^+$.

[0558] ^1H NMR (600 MHz, $\text{DMSO-}d_6$) δ 7.36 – 7.30 (m, 2H), 7.28 – 7.21 (m, 2H), 7.17 – 7.07 (m, 2H), 5.32 (dd, J = 11.8, 4.7 Hz, 1H), 3.51 – 3.42 (m, 3H), 2.69 – 2.60 (m, 1H), 2.17 (s, 6H), 1.12 (t, J = 7.0 Hz, 3H).

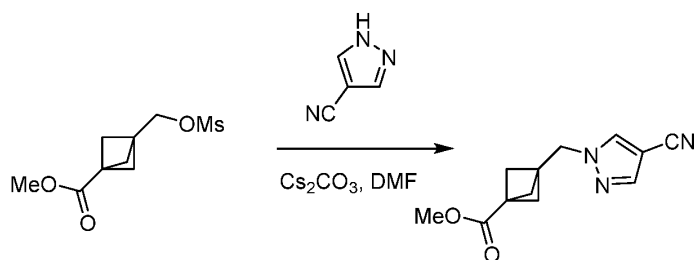
EXAMPLE 47



1-((3-(5-(3,5-difluorophenyl)-3-methyl-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile

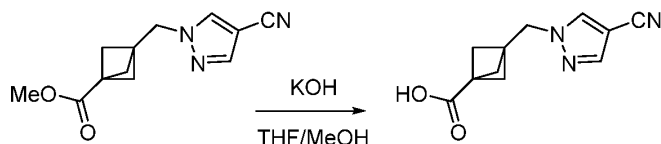


[0559] **Ethyl 3-(((methylsulfonyl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylate (Intermediate V)** To a solution of methyl 3-(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate (0.99 g, 6.3 mmol) in DCM (21 ml) at 0 °C was added Et_3N (1.9 ml, 14 mmol), followed by the dropwise addition methanesulfonyl chloride (0.59 ml, 7.6 mmol), and the resulting mixture was stirred at 0 °C for 5 min, then at rt for 3.5 h. The reaction was diluted with DCM and ice / 0.1M HCl mixture. The layers were separated, and the organic layer was washed with H_2O and brine. The aqueous layers were back-extracted with DCM, and the combined organic layers were dried over MgSO_4 and concentrated to give the title compound (1.3 g, 5.1 mmol, 92 % yield) as a clear oil. MS (ES^+) $\text{C}_9\text{H}_{14}\text{O}_5\text{S}$ requires: 234, found: 235 $[\text{M}+\text{H}]^+$.



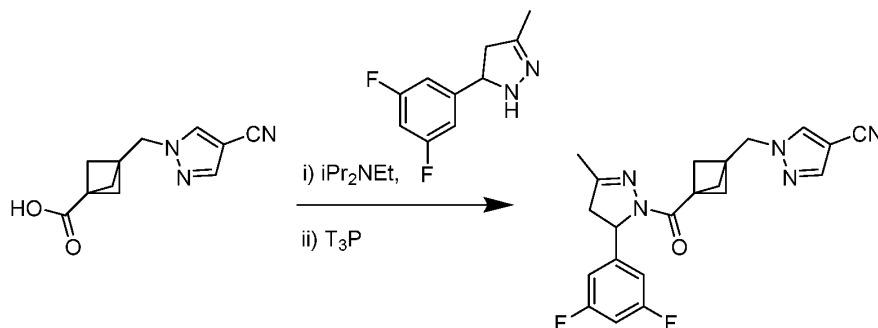
[0560] **Methyl 3-((4-cyano-1H-pyrazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylate** To a solution of Intermediate V (120 mg, 0.51 mmol) in DMF (2.5 ml) was

added 1*H*-pyrazole-4-carbonitrile (52 mg, 0.56 mmol) and Cs₂CO₃ (250 mg, 0.77 mmol), and the resulting mixture was stirred at rt overnight. The reaction was diluted with EtOAc and washed successively with H₂O and brine. Each aqueous layer was back-extracted with EtOAc (2x). The combined organic layers were dried over MgSO₄ and concentrated to give the title compound (110 mg, 0.47 mmol, 93 % yield). MS (ES⁺) C₁₂H₁₃N₃O₂ requires: 231, found: 232 [M+H]⁺.



[0561] **3-((4-Cyano-1*H*-pyrazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid**

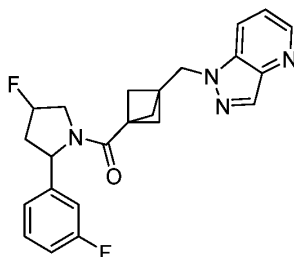
To a solution of the product from the previous step (103 mg, 0.45 mmol) in THF (2 ml) and MeOH (2 ml) was added KOH (50.0 mg, 0.89 mmol), and the resulting mixture was stirred at rt overnight. To the reaction solution was added additional KOH (25.0 mg, 0.45 mmol), and the mixture was stirred for an additional 7 h. The reaction was diluted with H₂O and washed with EtOAc. The aqueous layer was acidified with 1M HCl and extracted with EtOAc (3x). The combined organic layers were washed with brine, dried over MgSO₄, and concentrated to give the title compound (70 mg, 0.32 mmol, 72 % yield) as a white solid. MS (ES⁺) C₁₁H₁₁N₃O₂ requires: 217, found: 218 [M+H]⁺.



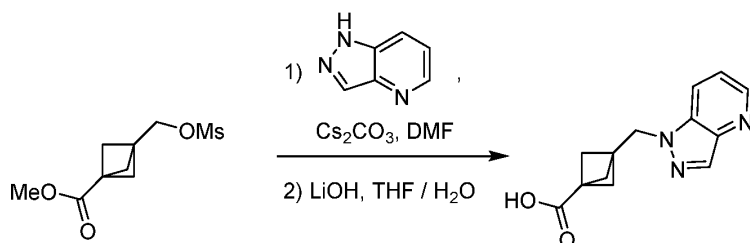
[0562] **1-((3-(5-(3,5-Difluorophenyl)-3-methyl-4,5-dihydro-1*H*-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1*H*-pyrazole-4-carbonitrile**

To a solution of the product from the previous step (15 mg, 0.069 mmol) and 5-(3,5-difluorophenyl)-3-methyl-4,5-dihydro-1*H*-pyrazole (16 mg, 0.083 mmol) in DMF (345 μl) was added iPr₂NEt (36 μl, 0.21 mmol), and the reaction stirred for 10 minutes. T₃P (123 μl, 0.21 mmol) was then added and the mixture was stirred for 48 h. The reaction was diluted with MeOH and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1%

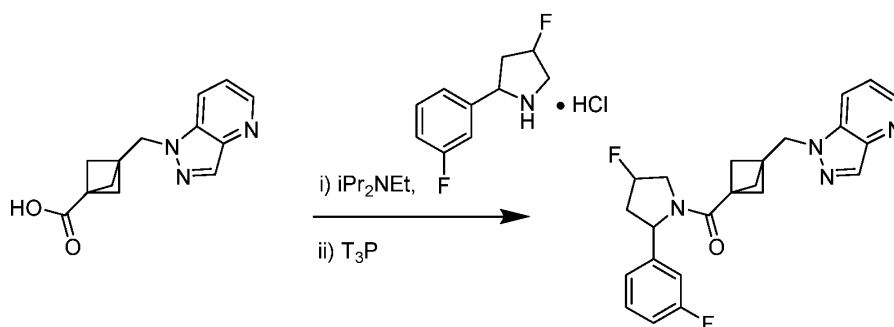
TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (3.2 mg, 8.09 μ mol, 11 % yield). MS (ES⁺) C₂₁H₁₉F₂N₅O requires: 395, found: 396 [M+H]⁺.

EXAMPLE 48

(3-((1*H*-pyrazolo[4,3-*b*]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)-(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone



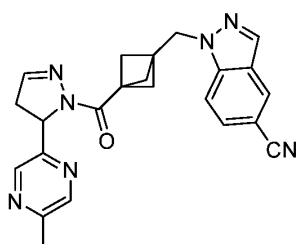
[0563] **3-((1*H*-pyrazolo[4,3-*b*]pyridin-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid** The title compound was obtained by a procedure similar to that described for Example 47, using Intermediate V (300 mg, 1.28 mmol) and 1*H*-pyrazolo[4,3-*b*]pyridine (168 mg, 1.4 mmol) with Cs₂CO₃ in DMF, purification by flash chromatography, followed by hydrolysis with LiOH in THF / H₂O to give the title compound (132 mg, 0.54 mmol, 42 % yield, two steps) as a white solid. MS (ES⁺) C₁₃H₁₃N₃O₂ requires: 243, found: 244 [M+H]⁺.



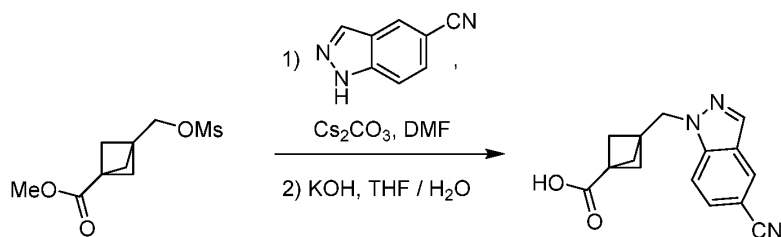
[0564] **(3-((1*H*-Pyrazolo[4,3-*b*]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)-(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone** To a suspension of the product from the previous step (20 mg, 0.082 mmol) in EtOAc (411 μ l) were added 4-fluoro-2-(3-

fluorophenyl)pyrrolidine hydrochloride (19.87 mg, 0.090 mmol), pyridine (20 μ l, 0.25 mmol), and T₃P (98 μ l, 0.16 mmol), and the resulting mixture was stirred at 60 °C overnight. H₂O was added, and the layers were separated. The aqueous phase was extracted with EtOAc (3x) and the combined organic layers were concentrated under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound as a TFA salt (23 mg, 0.045 mmol, 54 % yield) as a off-white solid. MS (ES⁺) C₂₃H₂₂F₂N₄O requires: 408, found: 409 [M+H]⁺.

EXAMPLE 49

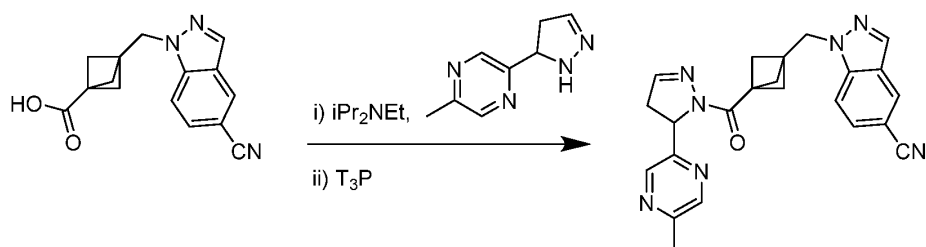


1-((3-(5-(5-Methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile



[0565] **3-((5-Cyano-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid**

The title compound was obtained by a procedure similar to that described for Example 47, using Intermediate V (600 mg, 2.6 mmol) and 1H-indazole-5-carbonitrile (403 mg, 2.8 mmol) with Cs₂CO₃ in DMF, purification by flash chromatography, and then hydrolysis with KOH in THF / MeOH to give the title compound (295 mg, 1.1 mmol, 42 % yield, 2 steps) as a white solid. MS (ES⁺) C₁₅H₁₃N₃O₂ requires: 267, found: 268 [M+H]⁺.

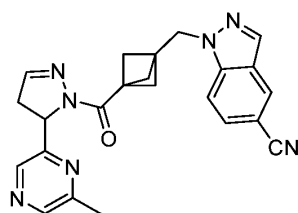


[0566] **1-((3-(5-(5-Methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile** To a solution of the product from the previous step (10 mg, 0.03 mmol) and 2-(4,5-dihydro-1H-pyrazol-5-yl)-5-methylpyrazine (6.1 mg, 0.03 mmol) in DMF (0.10 mL) was added $i\text{Pr}_2\text{NEt}$ (120 μL , 0.11 mmol), and the reaction was stirred at RT for 3 min. T_3P (50 % wt in EtOAc, 22 μL , 0.03 mmol) was then added, and the mixture was stirred overnight. The reaction was diluted in 1% TFA in MeOH and purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA / MeCN; Gradient: B = 30 - 70%; 20 min; Column: C18) to give the title compound as a TFA salt (5.8 mg, 0.01 mmol, 38% yield) yellow viscous oil.

[0567] MS (ES^+) $\text{C}_{23}\text{H}_{21}\text{N}_7\text{O}$ requires: 411 found: 412 $[\text{M}+\text{H}]^+$.

[0568] ^1H NMR (600 MHz, Chloroform- d) δ 8.51 – 8.48 (m, 1H), 8.45 – 8.41 (m, 1H), 8.15 – 8.13 (m, 1H), 8.13 – 8.10 (m, 1H), 7.59 – 7.54 (m, 1H), 7.47 – 7.42 (m, 1H), 6.96 – 6.93 (m, 1H), 5.42 (dd, J = 11.8, 5.6 Hz, 1H), 4.54 (s, 2H), 3.30 (ddd, J = 18.7, 11.8, 1.6 Hz, 1H), 3.06 (ddd, J = 18.7, 5.6, 1.8 Hz, 1H), 2.56 (s, 3H), 2.04 (s, 6H).

EXAMPLE 50



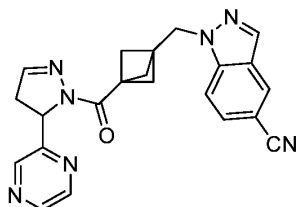
1-((3-(5-(6-methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile

[0569] The title compound was obtained by a procedure similar to that used for Example 49.

[0570] MS (ES^+) $\text{C}_{23}\text{H}_{21}\text{N}_7\text{O}$ requires: 411 found: 412 $[\text{M}+\text{H}]^+$.

[0571] ^1H NMR (600 MHz, DMSO- d_6) δ 8.42 – 8.40 (m, 1H), 8.40 (s, 1H), 8.28 – 8.27 (m, 1H), 8.26 (s, 1H), 7.90 – 7.85 (m, 1H), 7.74 – 7.69 (m, 1H), 7.17 – 7.13 (m, 1H), 5.33

(dd, $J = 11.9, 5.5$ Hz, 1H), 4.63 (s, 2H), 3.33 (ddd, $J = 18.8, 12.0, 1.7$ Hz, 1H), 2.85 (ddd, $J = 18.8, 5.5, 1.8$ Hz, 1H), 2.42 (s, 3H), 1.88 (s, 6H).

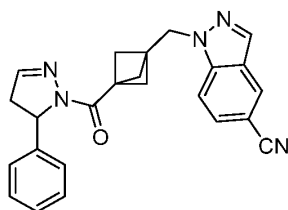
EXAMPLE 51

1-((3-(5-(pyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile

[0572] The title compound was obtained by a procedure similar to that used for Example 49.

[0573] MS (ES+) $C_{22}H_{19}N_7O$ requires: 397 found: 398 $[M+H]^+$.

[0574] 1H NMR (600 MHz, Chloroform- d) δ 8.63 – 8.61 (m, 1H), 8.60 – 8.58 (m, 1H), 8.51 – 8.48 (m, 1H), 8.15 – 8.14 (m, 1H), 8.13 – 8.12 (m, 1H), 7.59 – 7.56 (m, 1H), 7.47 – 7.43 (m, 1H), 6.98 – 6.95 (m, 1H), 5.46 (dd, $J = 11.8, 5.5$ Hz, 1H), 4.55 (s, 2H), 3.33 (ddd, $J = 18.7, 11.8, 1.6$ Hz, 1H), 3.10 (ddd, $J = 18.7, 5.6, 1.8$ Hz, 1H), 2.05 (s, 6H).

EXAMPLE 52

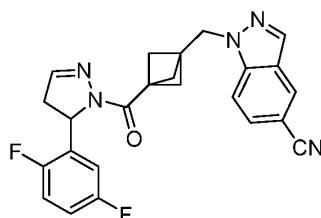
1-((3-(5-phenyl-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile

[0575] The title compound was obtained by a procedure similar to that used for Example 49.

[0576] MS (ES+) $C_{24}H_{21}N_5O$ requires: 395 found: 396 $[M+H]^+$.

[0577] 1H NMR (600 MHz, Chloroform- d) δ 8.14 (t, $J = 1.1$ Hz, 1H), 8.10 (d, $J = 1.0$ Hz, 1H), 7.59 – 7.54 (m, 1H), 7.48 – 7.43 (m, 1H), 7.29 – 7.26 (m, 2H), 7.24 – 7.19 (m, 1H), 7.10 – 7.08 (m, 1H), 7.08 – 7.07 (m, 1H), 6.88 – 6.84 (m, 1H), 5.30 (dd, $J = 11.8, 4.8$ Hz, 1H),

4.54 (s, 2H), 3.31 (ddd, $J = 18.8, 11.8, 1.6$ Hz, 1H), 2.72 (ddd, $J = 18.8, 4.8, 1.8$ Hz, 1H), 2.06 (s, 6H).

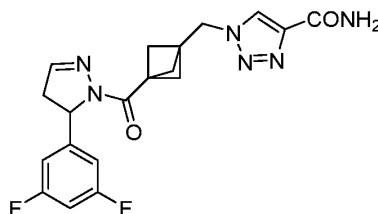
EXAMPLE 53

**1-((3-(5-(2,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-
bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile**

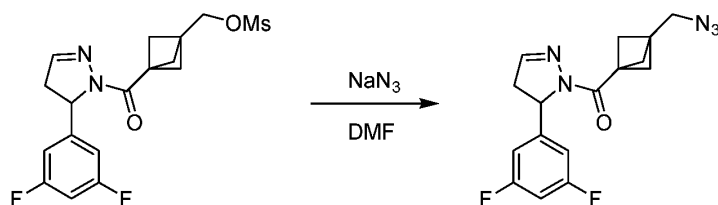
[0578] The title compound was obtained by a procedure similar to that used for Example 49.

[0579] MS (ES+) $C_{24}H_{19}F_2N_5O$ requires: 431 found: 432 $[M+H]^+$.

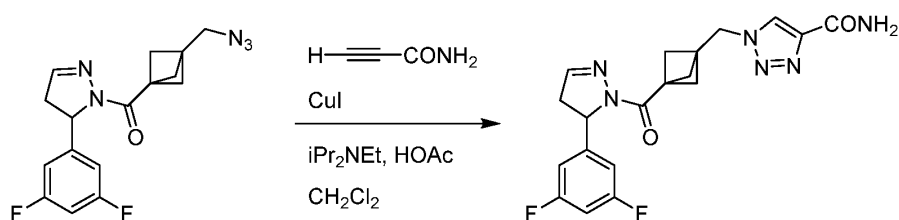
[0580] 1H NMR (600 MHz, Chloroform- d) δ 8.16 – 8.13 (m, 1H), 8.11 – 8.11 (m, 1H), 7.60 – 7.55 (m, 1H), 7.48 – 7.44 (m, 1H), 7.01 – 6.94 (m, 1H), 6.92 – 6.85 (m, 2H), 6.68 – 6.62 (m, 1H), 5.47 (dd, $J = 12.0, 5.2$ Hz, 1H), 4.56 (s, 2H), 3.33 (ddd, $J = 18.8, 12.0, 1.6$ Hz, 1H), 2.70 (dddd, $J = 18.8, 5.3, 1.8, 0.9$ Hz, 1H), 2.08 (s, 6H).

EXAMPLE 54

**1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-
bicyclo[1.1.1]pentan-1-yl)methyl)-1H-1,2,3-triazole-4-carboxamide**

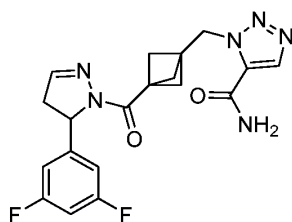


[0581] **(3-(Azidomethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone** To a suspension of Intermediate **II** (40 mg, 0.10 mmol) in DMF (520 μ l) was added NaN₃ (20 mg, 0.31 mmol), and the resulting mixture was stirred at 80° C for 2.5 h. The reaction mixture was diluted with EtOAc, H₂O was added, and the layers were separated. The aqueous phase was extracted with EtOAc, and the combined organic layers were washed with saturated NaCl, dried over MgSO₄, and concentrated under reduced pressure to give the title compound (36 mg, 0.11 mmol, 104 % yield) as a yellow oil. The residue was carried forward without further purification. MS (ES⁺) C₁₆H₁₅F₂N₅O requires: 331, found: 332 [M+H]⁺.

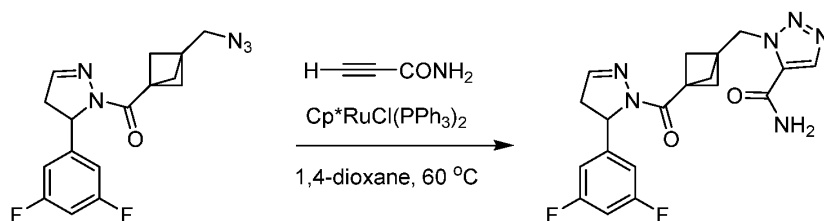


[0582] **1-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-1,2,3-triazole-4-carboxamide** To a solution of the product from the previous step (9 mg, 0.027 mmol) in DCM (150 μ l) were added an aliquot (100 μ l) from a DCM solution of AcOH and iPr₂NEt (40 μ mol/ml), propiolamide (1.9 mg, 0.027 mmol), and copper(I) iodide (0.26 mg, 1.4 μ mol) and the resulting mixture was stirred at rt overnight. The reaction mixture turned yellow overnight. The volatiles were removed under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H₂O, B = 0.1% TFA / MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (5.9 mg, 0.015 mmol, 54 % yield) as a white solid. MS (ES⁺) C₁₉H₁₈F₂N₆O₂ requires: 400, found: 401 [M+H]⁺.

EXAMPLE 55



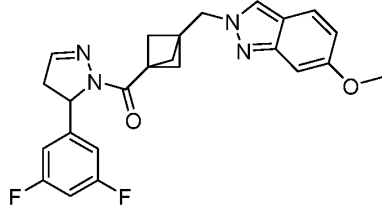
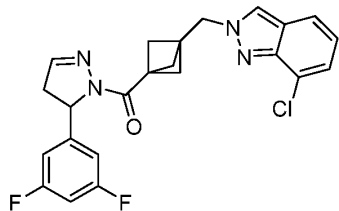
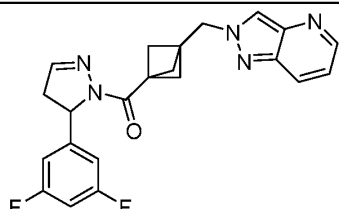
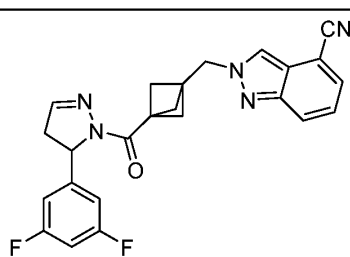
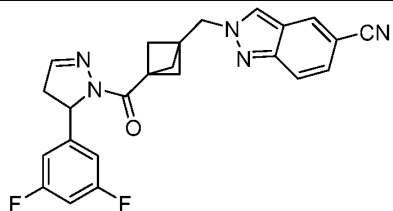
1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-1,2,3-triazole-5-carboxamide

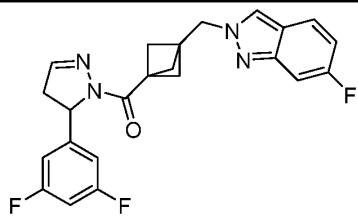
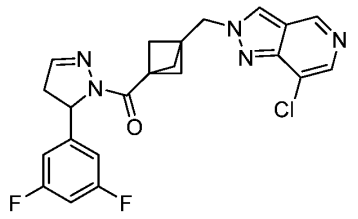
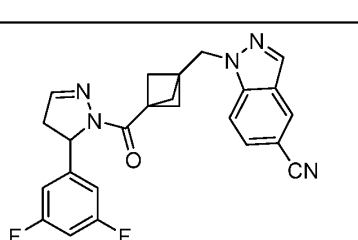
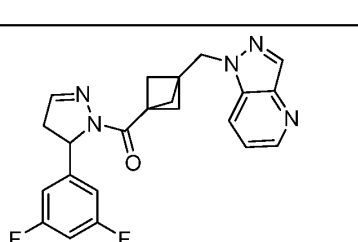
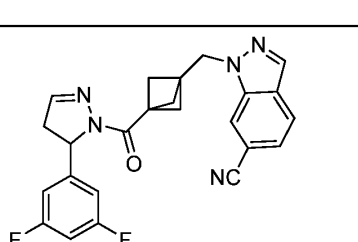


[0583] **1-((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-1,2,3-triazole-5-carboxamide** To a solution of propiolamide (7.3 mg, 0.11 mmol) and (3-(azidomethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone (32 mg, 0.096 mmol) in 1,4-dioxane (362 μ l) was added $\text{Cp}^*\text{RuCl}(\text{PPh}_3)_2$ (1.3 mg, 3.8 μ mol) and the resulting mixture was stirred at 60 °C for 48 hrs. The combined mixture was concentrated under reduced pressure. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA / H_2O , B = 0.1% TFA/MeCN; Gradient: B = 20 - 60%; 20 min; Column: C18) to give the title compound product as an off-white solid (9.0 mg, 0.015 mmol, 18.37 % yield). MS (ES^+) $\text{C}_{19}\text{H}_{18}\text{F}_2\text{N}_6\text{O}_2$ requires: 400, found: 401 $[\text{M}+\text{H}]^+$. The isolated material is a 2:1 mixture (determined by NMR) of the desired head-to-head cycloaddition product **55** and the head-to-tail cycloaddition product **54**. MS (ES^+) $\text{C}_{19}\text{H}_{18}\text{F}_2\text{N}_6\text{O}_2$ requires: 400, found: 401 $[\text{M}+\text{H}]^+$.

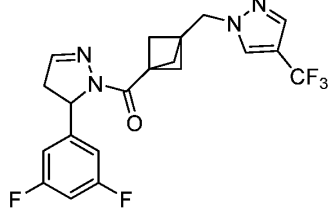
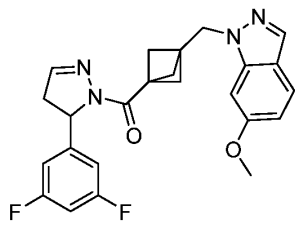
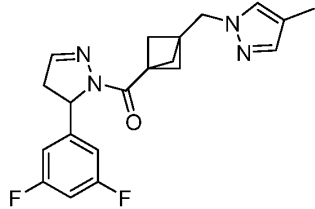
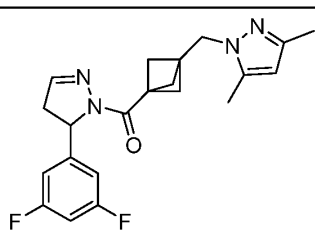
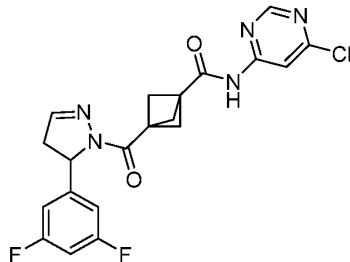
Table 2. Examples 56 – 183.

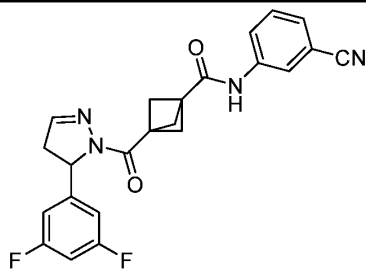
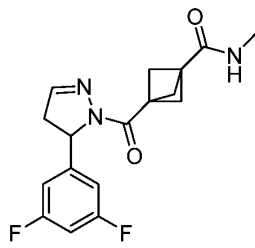
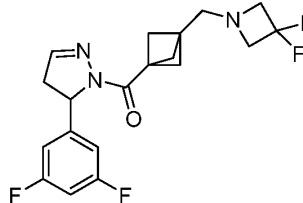
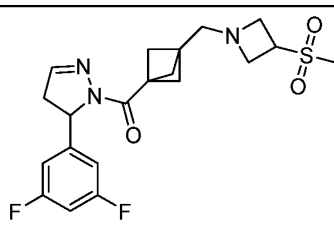
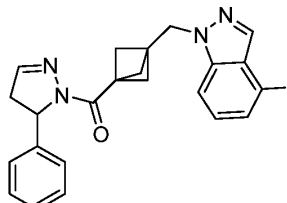
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
56		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2H-indazole-6-carbonitrile	431 / 432	3

57		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-methoxy-2H-indazol-2-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	436 / 437	3
58		(3-((7-chloro-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	440 / 441	3
59		(3-((2H-pyrazolo[4,3-b]pyridin-2-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	407 / 408	3
60		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2H-indazole-4-carbonitrile	431 / 432	3
61		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2H-indazole-5-carbonitrile	431 / 432	3

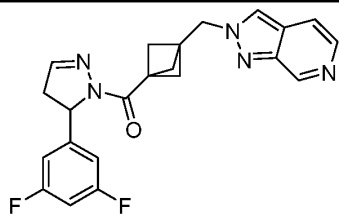
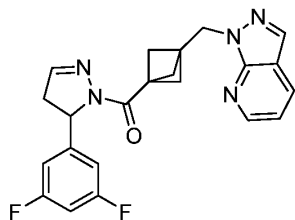
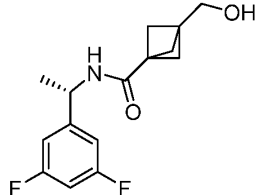
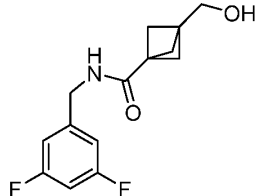
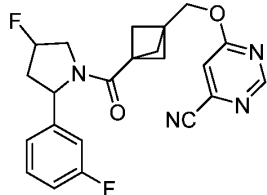
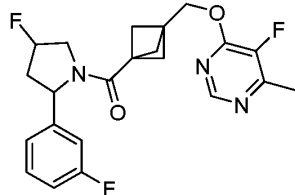
62		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-fluoro-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	424 / 425	3
63		(3-((7-chloro-2H-pyrazolo[4,3-c]pyridin-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	441 / 442	3
64		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	431 / 432	4
65		(3-((1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	407 / 408	4
66		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-6-carbonitrile	431 / 432	4

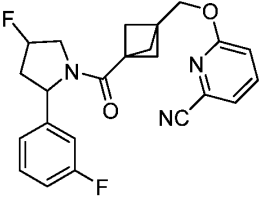
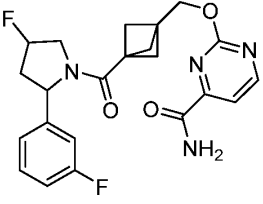
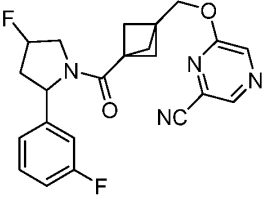
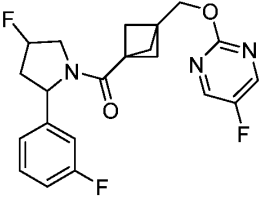
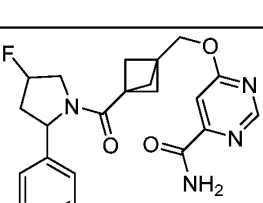
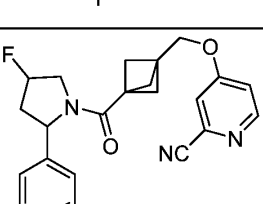
67		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-4-carbonitrile	431 / 432	4
68		(3-((7-chloro-1H-pyrazolo[4,3-c]pyridin-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	441 / 442	4
69		(3-((7-chloro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	440 / 441	4
70		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-fluoro-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	424 / 425	4
71		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	381 / 382	4

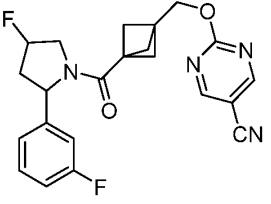
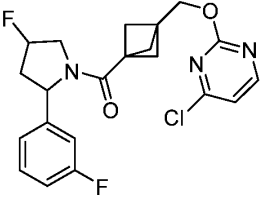
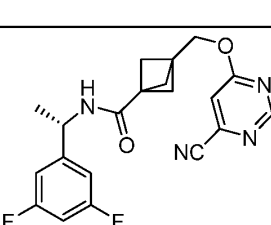
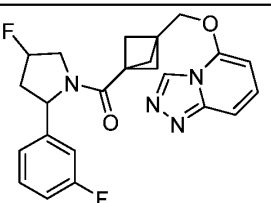
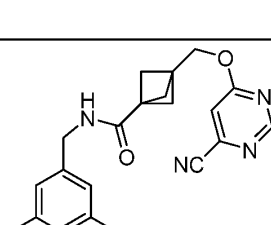
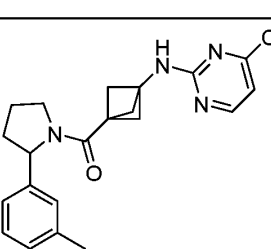
72		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((4-(trifluoromethyl)-1 <i>H</i> -pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)-methanone	424 / 425	4
73		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((6-methoxy-1 <i>H</i> -indazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	436 / 437	4
74		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((4-methyl-1 <i>H</i> -pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	370 / 371	4
75		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((3,5-dimethyl-1 <i>H</i> -pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	384 / 385	4
76		<i>N</i> -(6-chloropyrimidin-4-yl)-3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxamide	431 / 432	10

77		<i>N</i> -(3-cyanophenyl)-3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentane-1-carboxamide	420 / 421	10
78		3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)- <i>N</i> -methylbicyclo[1.1.1]pentane-1-carboxamide	333 / 334	10
79		(3-((3,3-difluoroazetidin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	381 / 382	13
80		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((3-(methylsulfonyl)azetidin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	423 / 424	13
81		(3-((4-fluoro-1 <i>H</i> -indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-phenyl-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	388 / 389	14

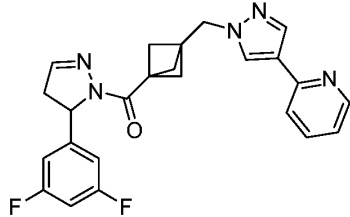
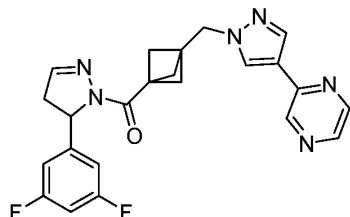
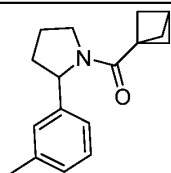
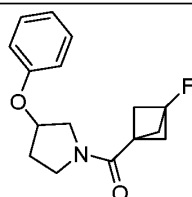
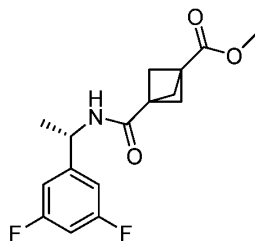
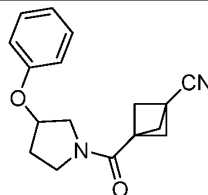
82		3-(1-(3-((4-fluoro-1 <i>H</i> -indazol-1-yl)methyl)-bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1 <i>H</i> -pyrazol-5-yl)benzonitrile	413 / 414	14
83		(3-((4-fluoro-1 <i>H</i> -indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone	425 / 426	14
84		(5-(2,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((4-fluoro-1 <i>H</i> -indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	424 / 424	14
85		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-fluoro-2 <i>H</i> -benzo[<i>d</i>][1,2,3]triazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	425 / 426	22
86		(3-((2 <i>H</i> -benzo[<i>d</i>][1,2,3]triazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	407 / 408	22
87		(3-((1 <i>H</i> -pyrazolo[3,4- <i>c</i>]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	407 / 408	22

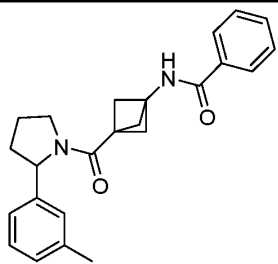
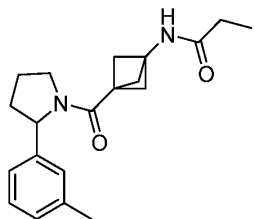
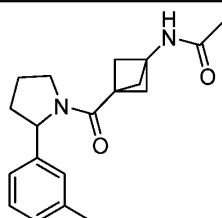
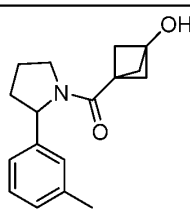
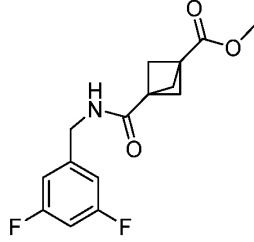
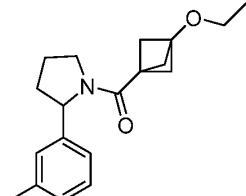
88		(3-((2 <i>H</i> -pyrazolo[3,4- <i>c</i>]-pyridin-2-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	407 / 408	22
89		(3-((1 <i>H</i> -pyrazolo[3,4- <i>b</i>]-pyridin-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	407 / 408	22
90		(<i>S</i>)- <i>N</i> -(1-(3,5-difluorophenyl)ethyl)-3-(hydroxymethyl)-bicyclo[1.1.1]pentane-1-carboxamide	281 / 282	24
91		<i>N</i> -(3,5-difluorobenzyl)-3-(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxamide	267 / 268	24
92		6-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrimidine-4-carbonitrile	410 / 411	26
93		(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(((5-fluoro-6-methylpyrimidin-4-yl)oxy)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	417 / 418	26

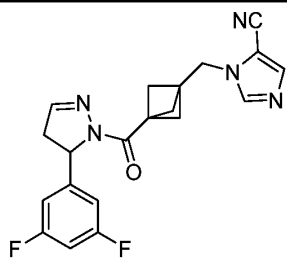
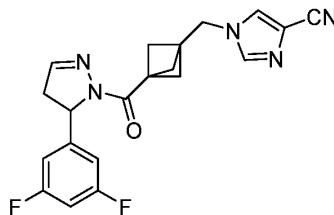
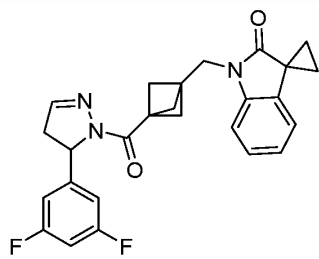
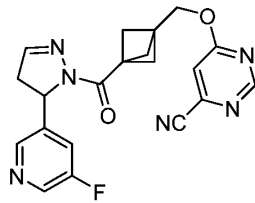
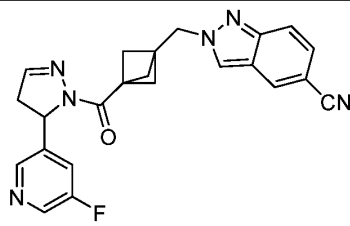
94		6-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-picolinonitrile	409 / 410	26
95		2-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-pyrimidine-4-carboxamide	428 / 429	26
96		6-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	410 / 411	26
97		(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-(((5-fluoropyrimidin-2-yl)oxy)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	403 / 404	26
98		6-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-pyrimidine-4-carboxamide	428 / 429	26
99		4-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-picolinonitrile	409 / 410	26

100		2-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrimidine-5-carbonitrile	410 / 411	26
101		(3-(((4-chloropyrimidin-2-yl)oxy)methyl)-bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone	419 / 420	26
102		(S)-3-(((6-cyanopyrimidin-4-yl)oxy)methyl)-N-(1-(3,5-difluorophenyl)ethyl)-bicyclo[1.1.1]pentane-1-carboxamide	384 / 385	26
103		(3-(((1,2,4-triazolo[4,3-a]pyridin-5-yl)oxy)methyl)-bicyclo[1.1.1]pentan-1-yl)(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)methanone	424 / 425	26
104		3-(((6-cyanopyrimidin-4-yl)oxy)methyl)-N-(3,5-difluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	370 / 371	26
105		2-((3-(2-(m-tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)amino)-pyrimidine-4-carbonitrile	373 / 374	26

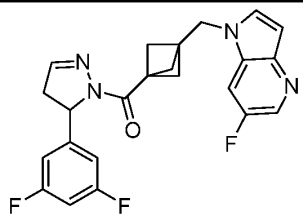
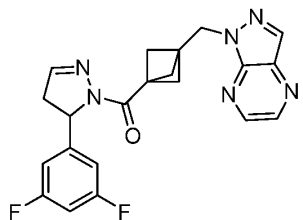
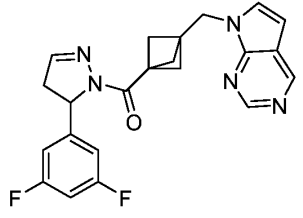
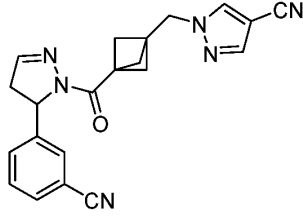
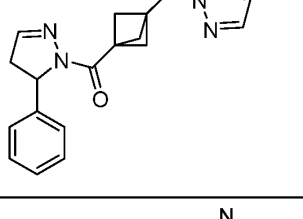
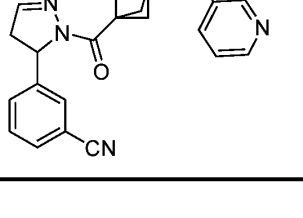
106		(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-((5-fluoro-2 <i>H</i> -indazol-2-yl)methyl)bicyclo[1.1.1]-pentan-1-yl)methanone	425 / 426	27
107		3-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methoxy)-benzonitrile	408 / 409	31
108		(4-fluoro-2-(3-fluorophenyl)pyrrolidin-1-yl)(3-((<i>m</i> -tolxy)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	397 / 398	31
109		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methyl)-1,3-dihydro-2 <i>H</i> -benzo[<i>d</i>]-imidazol-2-one	422 / 423	32
110		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methyl)-3-methyl-1,3-dihydro-2 <i>H</i> -benzo[<i>d</i>]imidazol-2-one	436 / 437	32

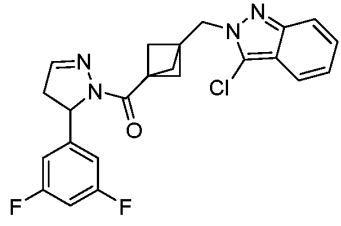
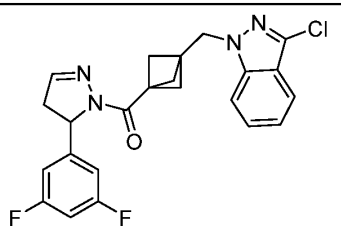
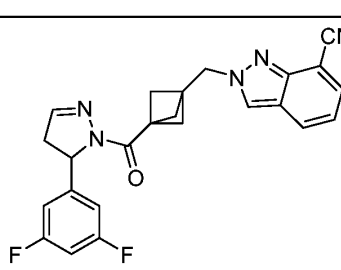
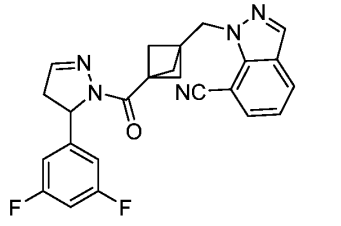
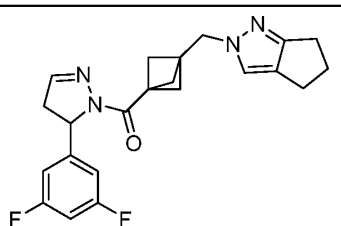
111		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-(pyridin-2-yl)-1H-pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	433 / 434	33
112		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-(pyrazin-2-yl)-1H-pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)-methanone	434 / 435	33
113		bicyclo[1.1.1]pentan-1-yl(2-(m-tolyl)pyrrolidin-1-yl)methanone	255 / 256	44
114		(3-fluorobicyclo[1.1.1]pentan-1-yl)(3-phenoxy-pyrrolidin-1-yl)methanone	275 / 276	44
115		methyl (S)-3-((1-(3,5-difluorophenyl)ethyl)-carbamoyl)bicyclo[1.1.1]pentane-1-carboxylate	309 / 310	44
116		3-(3-phenoxy-pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentane-1-carbonitrile	282 / 283	44

117		<i>N</i> -(3-(2-(m-tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)benzamide	374 / 375	44
118		<i>N</i> -(3-(2-(m-tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)propionamide	326 / 327	44
119		<i>N</i> -(3-(2-(m-tolyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)acetamide	312 / 313	44
120		(3-hydroxybicyclo[1.1.1]pentan-1-yl)(2-(m-tolyl)pyrrolidin-1-yl)methanone	271 / 272	44
121		methyl 3-((3,5-difluorobenzyl)carbamoyl)bicyclo[1.1.1]pentane-1-carboxylate	295 / 296	44
122		(3-ethoxybicyclo[1.1.1]pentan-1-yl)(2-(m-tolyl)pyrrolidin-1-yl)methanone	299 / 300	46

123		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-imidazole-5-carbonitrile	381 / 382	23
124		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-imidazole-4-carbonitrile	381 / 382	23
125		1'-(3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-spiro[cyclopropane-1,3'-indolin]-2'-one	447 / 448	32
126		6-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrimidine-4-carbonitrile	392 / 393	39
127		2-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-2H-indazole-5-carbonitrile	414 / 415	3

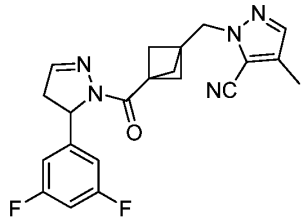
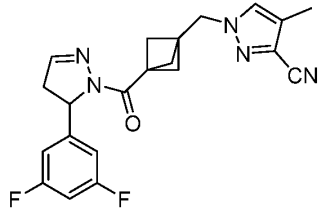
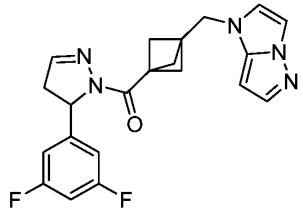
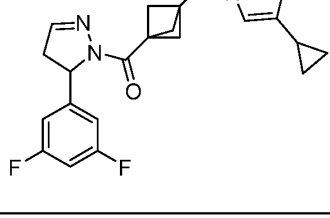
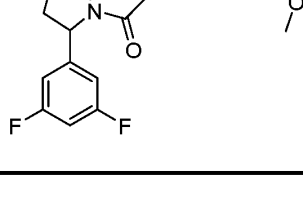
128		1-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	414 / 415	4
129		2-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-3-methyl-2H-indazole-5-carbonitrile	428 / 429	3
130		1-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-3-methyl-1H-indazole-5-carbonitrile	428 / 429	4
131		1-((3-(5-(5-methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	361 / 362	47
132		(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-methyl-1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	404 / 405	4
133		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-1H-indol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	423 / 424	4

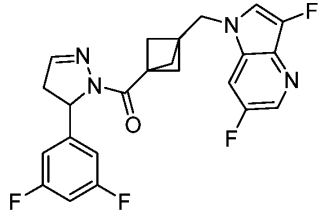
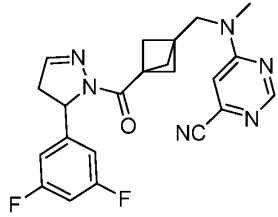
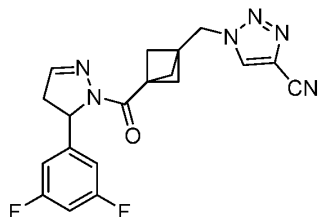
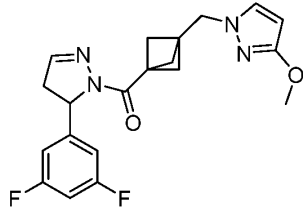
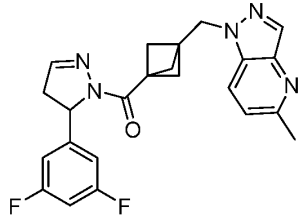
134		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-fluoro-1H-pyrrolo[3,2-b]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	424 / 425	4
135		(3-((1H-pyrazolo[3,4-b]pyrazin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	408 / 409	4
136		(3-((7H-pyrrolo[2,3-d]pyrimidin-7-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	407 / 408	4
137		1-((3-(5-(3-cyanophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	370 / 371	47
138		1-((3-(5-phenyl-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	345 / 346	47
139		3-(1-(3-((1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1H-pyrazol-5-yl)benzonitrile	396 / 397	48

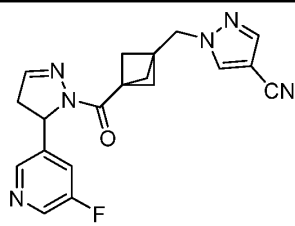
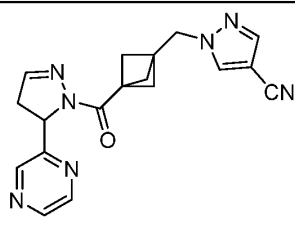
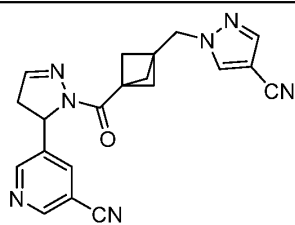
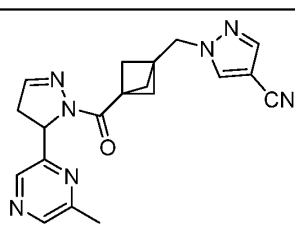
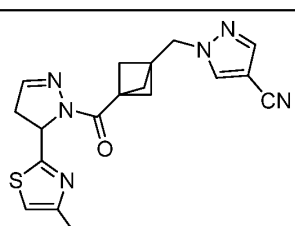
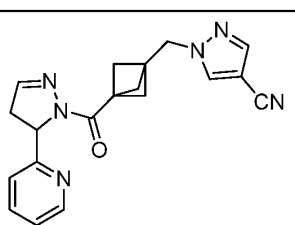
140		(3-((3-chloro-2 <i>H</i> -indazol-2-yl)methyl)bicyclo[1.1.1]-pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	440 / 441	3
141		(3-((3-chloro-1 <i>H</i> -indazol-1-yl)methyl)bicyclo[1.1.1]-pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	440 / 441	4
142		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2 <i>H</i> -indazole-7-carbonitrile	431 / 432	3
143		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methyl)-1 <i>H</i> -indazole-7-carbonitrile	431 / 432	4
144		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5,6-dihydrocyclopenta[<i>c</i>]-pyrazol-2(4 <i>H</i>)-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	396 / 397	3

145		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5,6-dihydrocyclopenta[c]-pyrazol-1(4H)-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	396 / 397	4
146		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-imidazo[1,2-b]pyrazole-7-carbonitrile	420 / 421	3
147		(3-((1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-phenyl-4,5-dihydro-1H-pyrazol-1-yl)methanone	371 / 372	48
148		(3-((1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	421 / 422	48
149		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-(methoxymethyl)-1H-1,2,3-triazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	401 / 402	54

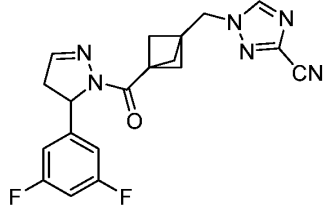
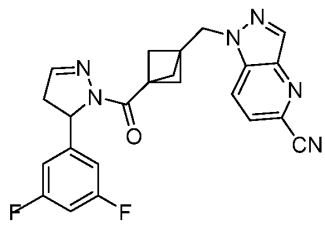
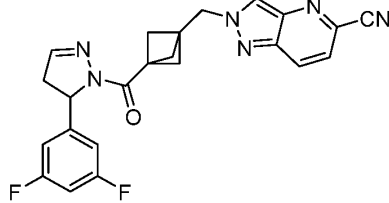
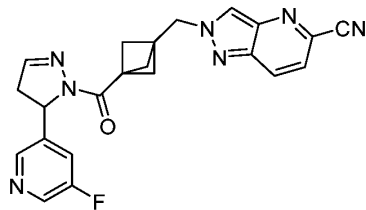
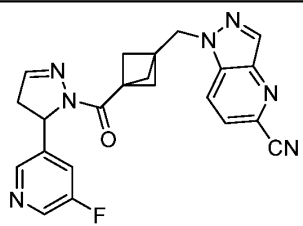
150		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-(hydroxymethyl)-1H-1,2,3-triazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	387 / 388	54
151		(3-((1H-pyrazolo[4,3-b]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(5-methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	387 / 388	48
152		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((3-methyl-2H-indazol-2-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	420 / 421	3
153		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((3-methyl-1H-indazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	420 / 421	4
154		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((3-phenylazetidin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	421 / 422	13
155		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)pyrrolidine-3-carbonitrile	384 / 385	13

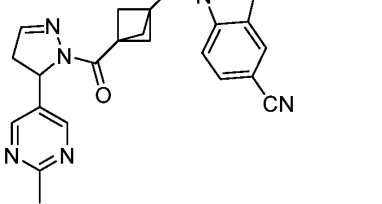
156		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-4-methyl-1H-pyrazole-5-carbonitrile	395 / 396	3
157		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-4-methyl-1H-pyrazole-3-carbonitrile	395 / 396	4
158		(3-((1H-imidazo[1,2-b]pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	395 / 396	3
159		(3-((4-cyclopropyl-1H-1,2,3-triazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	397 / 398	54
160		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((4-methoxy-1H-pyrazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	386 / 387	4

161		(3-((3,6-difluoro-1 <i>H</i> -pyrrolo[3,2- <i>b</i>]pyridin-1-yl)methyl)bicyclo[1.1.1]-pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	442 / 443	4
162		6-(((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methyl)(methyl)amino)pyrimidine-4-carbonitrile	422 / 423	26
163		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]-pentan-1-yl)methyl)-1 <i>H</i> -1,2,3-triazole-4-carbonitrile	382 / 383	54
164		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((3-methoxy-1 <i>H</i> -pyrazol-1-yl)-methyl)bicyclo[1.1.1]-pentan-1-yl)methanone	386 / 387	4
165		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-methyl-1 <i>H</i> -pyrazolo[4,3- <i>b</i>]pyridin-1-yl)methyl)bicyclo[1.1.1]-pentan-1-yl)methanone	421 / 422	4

166		1-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	364 / 365	47
167		1-((3-(5-(pyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	347 / 348	47
168		5-(1-(3-((4-cyano-1H-pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1H-pyrazol-5-yl)nicotinonitrile	371 / 372	47
169		1-((3-(5-(6-methylpyrazin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	361 / 362	47
170		1-((3-(5-(4-methylthiazol-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	366 / 367	47
171		1-((3-(5-(5-methylpyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	360 / 361	47

172		1-((3-(2-(3-fluorophenyl)-4-methylpyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazole-4-carbonitrile	378 / 379	49
173		1-((3-(5-(5-cyanopyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	421 / 422	49
174		1-((3-(5-(5-methylpyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	410 / 411	49
175		1-((3-(5-(3-cyanophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	420 / 421	49
176		1-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	432 / 433	49
177		1-((3-(2-phenylazetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	382 / 383	49

178		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-1,2,4-triazole-3-carbonitrile	382 / 383	3
179		1-((3-(5-(3-fluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazolo[4,3-b]pyridine-5-carbonitrile	432 / 433	4
180		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-2H-pyrazolo[4,3-b]pyridine-5-carbonitrile	432 / 433	3
181		2-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-2H-pyrazolo[4,3-b]pyridine-5-carbonitrile	415 / 416	3
182		1-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazolo[4,3-b]pyridine-5-carbonitrile	415 / 416	4

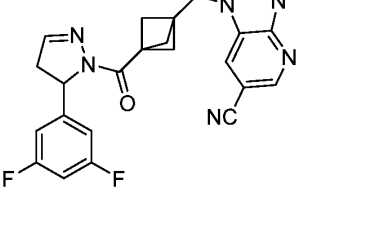
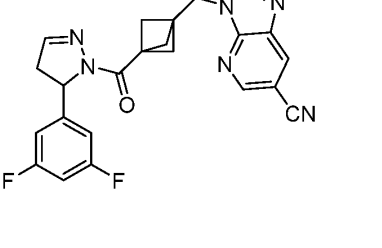
183		1-((3-(5-(2-methylpyrimidin-5-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	411 / 412	49
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(a) MS is reported as exact mass / observed MS⁺

(b) synthesis is similar to procedure used for the cited example

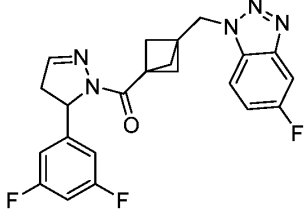
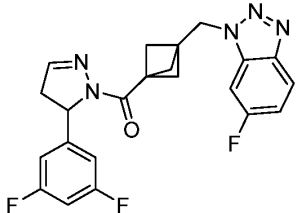
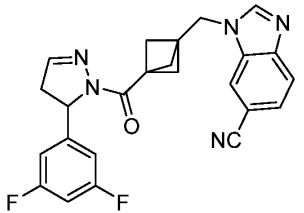
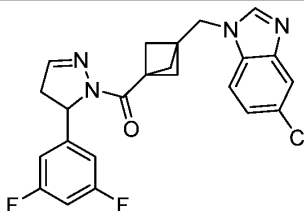
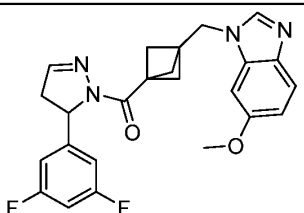
[0584] The compound disclosed in Table 3 was formed as a single regioisomerically pure compound; assignment as either of the two regioisomeric structures has not been established.

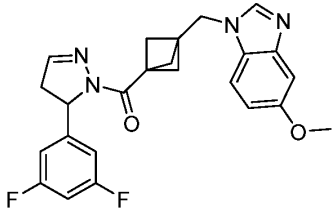
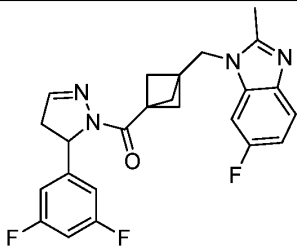
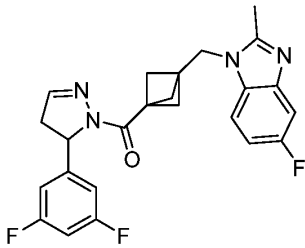
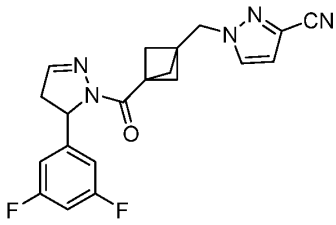
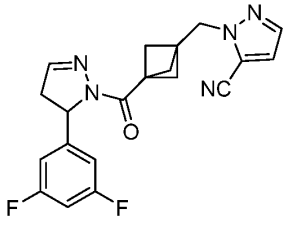
Table 3. Example 184.

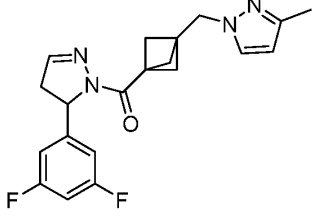
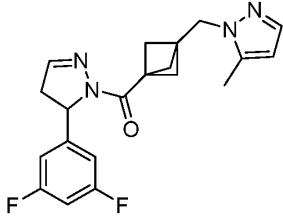
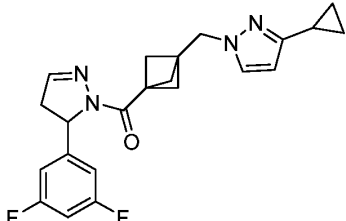
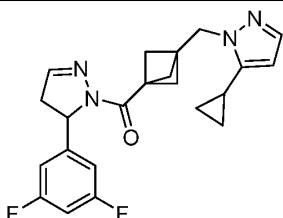
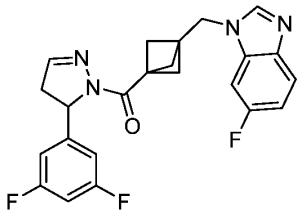
Ex. No	Structure	Name	MS	Proc. Ex. No.
184		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -imidazo[4,5- <i>b</i>]pyridine-6-carbonitrile	432 / 433	23
		3-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-3 <i>H</i> -imidazo[4,5- <i>b</i>]pyridine-6-carbonitrile		

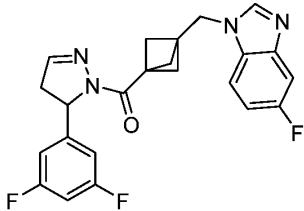
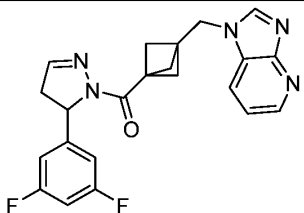
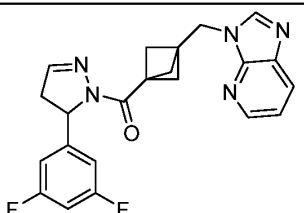
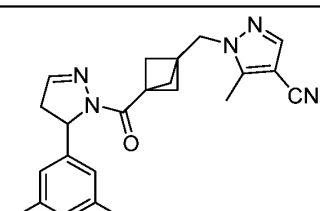
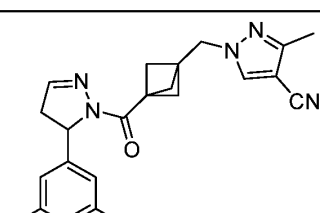
[0585] The compounds disclosed in Table 4 were formed as regioisomeric mixtures.

Table 4. Examples 185 – 194.

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
185		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((5-fluoro-1H-benzo[d][1,2,3]triazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	425 / 426	22
		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-fluoro-1H-benzo[d][1,2,3]triazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone		
186		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-benzo[d]imidazole-6-carbonitrile	431 / 432	23
		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-benzo[d]imidazole-5-carbonitrile		
187		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((6-methoxy-1H-benzo[d]imidazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	436 / 438	23

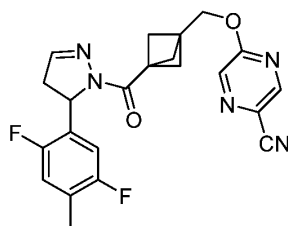
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-methoxy-1 <i>H</i> -benzo[<i>d</i>]imidazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone		
188		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((6-fluoro-2-methyl-1 <i>H</i> -benzo[<i>d</i>]imidazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	438 / 439	23
		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-fluoro-2-methyl-1 <i>H</i> -benzo[<i>d</i>]imidazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone		
189		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -pyrazole-3-carbonitrile	381 / 382	33
		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -pyrazole-5-carbonitrile		

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
190		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((3-methyl-1 <i>H</i> -pyrazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	370 / 371	33
		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-methyl-1 <i>H</i> -pyrazol-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone		
191		(3-((3-cyclopropyl-1 <i>H</i> -pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	396 / 397	33
		(3-((5-cyclopropyl-1 <i>H</i> -pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone		
192		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((6-fluoro-1 <i>H</i> -benzo[<i>d</i>]imidazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	424 / 425	4

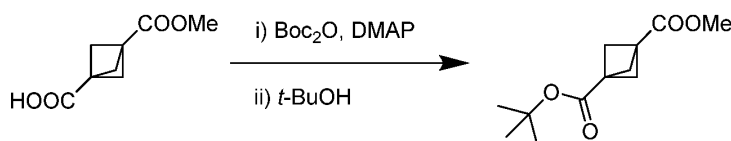
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-fluoro-1 <i>H</i> -benzo[<i>d</i>]imidazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone		
193		(3-((1 <i>H</i> -imidazo[4,5- <i>b</i>]pyridin-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	408 / 409	23
		(3-((3 <i>H</i> -imidazo[4,5- <i>b</i>]pyridin-3-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone		
194		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-5-methyl-1 <i>H</i> -pyrazole-4-carbonitrile	395 / 396	3 / 4
		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-3-methyl-1 <i>H</i> -pyrazole-4-carbonitrile		

(a) MS is reported as exact mass / observed MS⁺

(b) synthesis is similar to procedure used for the cited example

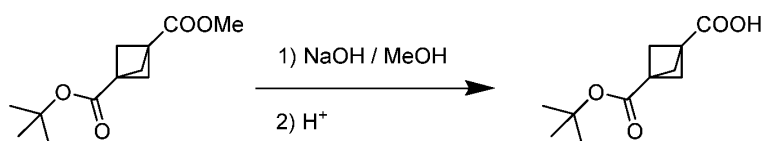
EXAMPLE 195

5-((3-(5-(2,5-Difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile



[0586] **1-(*tert*-Butyl) 3-methyl bicyclo[1.1.1]pentane-1,3-dicarboxylate** To a flask containing 3-(methoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid (24.7 g, 145 mmol), DMAP (5.32 g, 43.5 mmol) and Boc₂O (67.4 ml, 290 mmol) was added tBuOH (97 ml), and the mixture was stirred at rt. The reaction was vented under a stream of N₂, and after the evolution of gas abated, the reaction was stirred for 3 d, by which time material solidified. The reaction was diluted with CH₂Cl₂ and concentrated, then diluted with Et₂O (100 ml) and washed with aqueous citric acid (250 ml, 10%), aqueous NaOH (250 ml, 0.1 M), and brine. Each aqueous layer was extracted with the same Et₂O (2 x 125 ml). The organic layers were combined, dried over MgSO₄, and concentrated, and residual tBuOH was azeotroped from CH₂Cl₂/Hexanes to give the title compound (42.7 g, 181 mmol, 125 % yield) as a white waxy solid that contained 11 mole % tBuOH, and the title compound 96 % pure. The material was carried on to the next step without further purification.

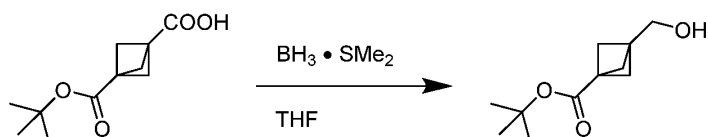
[0587] ¹H NMR (500 MHz, DMSO-*d*₆) δ 3.61 (s, 3H), 2.19 (s, 6H), 1.40 (s, 9H).



[0588] **3-(*tert*-Butoxycarbonyl)bicyclo[1.1.1]pentane-1-carboxylic acid** To a solution of the product from the previous step (13.3 g, 58.8 mmol) in MeOH (147 ml) was added NaOH (64.7 ml, 64.7 mmol), and the resulting mixture was stirred at rt until complete consumption of starting material was achieved. The reaction mixture was partially concentrated, diluted with water, and wash with E₂O. The aqueous layer acidified with citric

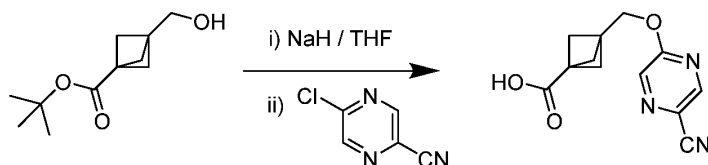
acid to pH 3. The resulting precipitate was filtered and washed with water. Additional precipitate that formed in filtrate was filtered over the first precipitate. Additional solid that formed in the second filtrate was filtered over the mixture of the first and second precipitates. The final combined solid was washed with more water and hexanes to give the title compound (8.94 g, 42.1 mmol, 71 % yield).

[0589] MS (ES^-) $\text{C}_{11}\text{H}_{16}\text{O}_4$ requires: 212, found: 211 $[\text{M}-\text{H}]^-$.



[0590] ***tert*-Butyl 3-(hydroxymethyl)bicyclo[1.1.1]pentane-1-carboxylate** To a cooled 0 °C solution of the product from the previous step (25.5 g, 120 mmol) in THF (240 ml) was added $\text{BH}_3 \cdot \text{SMe}_2$ (2M in THF, 66 ml, 130 mmol) dropwise and the resulting mixture was stirred at 0 °C, allowed to warm to rt and stirred for 2 d. The reaction mixture was then cooled to 0 °C and water (11 mL) added dropwise, during which period gas was evolved, followed by solid K_2CO_3 (~30 g). The reaction mixture was partially concentrated, diluted with water and extracted with EtOAc (2 x 300 ml). Each organic layer was washed with brine, combined, dried over MgSO_4 , and concentrated to give the title compound (24 g, 121 mmol, 101 % yield) as a clear liquid that hardened over time to a partial opaque solid.

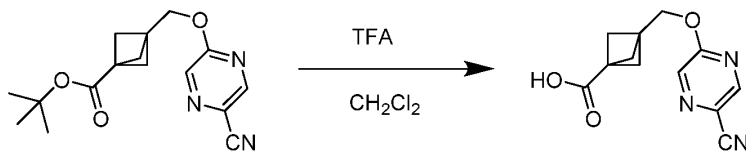
[0591] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 4.49 (t, $J = 5.6$ Hz, 1H), 3.31 (d, $J = 5.6$ Hz, 2H), 1.74 (s, 6H), 1.34 (s, 9H).



[0592] ***tert*-Butyl 3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylate** To a cooled 0 °C suspension of the product from the previous step (2.66 g, 13.4 mmol) in THF (33.5 ml) was added NaH (0.590 g, 14.8 mmol, 60 % dispersion in mineral oil) and reaction was stirred at 0 °C for 15 min. To the reaction was added dropwise 5-chloropyrazine-2-carbonitrile (2.43 g, 17.4 mmol) in THF (33.5 ml). The mixture was stirred at 0 °C, and allowed to warmed to rt overnight. The reaction was poured into mixture of ice and saturated NH_4Cl and stirred until the ice melted. The mixture was extracted with EtOAc (3 x 50 ml). Each organic layer was washed with the same brine, combined, dried over MgSO_4 , concentrated, and purified by flash chromatography on silica gel; eluent (0 to 20 %

8:2 EtOAc:IPA in hexanes) to give the title compound (2.92 g, 9.69 mmol, 72 % yield) as a white solid.

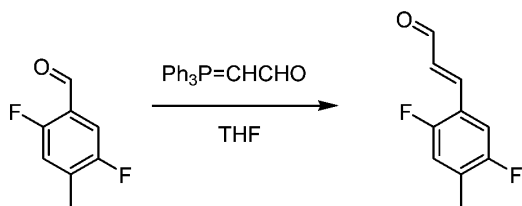
[0593] MS (ES⁺) C₁₆H₁₉N₃O₃ requires: 301, found: 302[M+H]⁺.



[0594] **3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid**

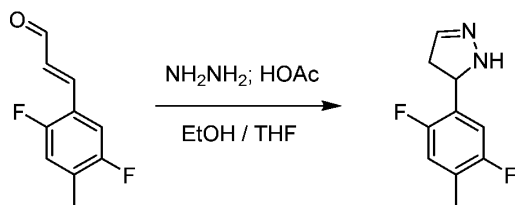
To a solution of the product from the previous step (1.18 g, 3.92 mmol) in CH₂Cl₂ (12 ml) cooled at 0 °C was added TFA (4.0 ml, 52 mmol), and the resulting mixture was stirred and allowed to warm to rt. After 4 h the reaction was concentrated, and residual solvent was azeotroped with toluene and CH₂Cl₂/Hexanes. The residue was diluted with EtOAc and water, and the phases were separated. The aqueous layer was extracted with EtOAc (3x). Each organic layer was washed with the same brine, combined, dried over MgSO₄, and concentrated to give the title compound (0.84 g, 3.43 mmol, 87 % yield).

[0595] MS (ES⁻) C₁₂H₁₁N₃O₃ requires: 245, found: 244 [M-H]⁻.



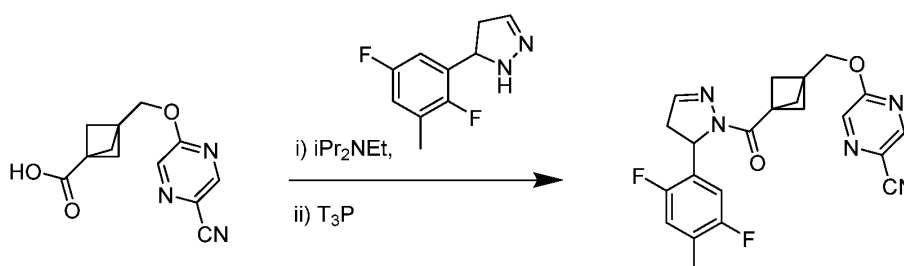
[0596] **(E)-3-(2,5-Difluoro-4-methylphenyl)acrylaldehyde** To a flask containing 2,5-difluoro-4-methylbenzaldehyde (1 g, 6.4 mmol) in THF (3 mL) was added 2-(triphenyl-λ⁵-phosphaneylidene)acetaldehyde (1.9 g, 6.4 mmol), and the reaction was heated at 80 °C overnight. The reaction turned dark brown. The reaction was then adsorbed onto silica gel and purified by flash chromatography (0 - 15 % EtOAc in hexanes) to give the title compound (406.5 mg, 2.231 mmol, 34.8 % yield) as a yellow solid.

[0597] MS (ES⁺) C₁₀H₈F₂O requires: 182, found: 183 [M+H]⁺.



[0598] **5-(2,5-Difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole** To a solution of hydrazine hydrate (205 μ l, 3.35 mmol) in ethanol (3570 μ l) at 0 °C was added HOAc (217 μ l, 3.79 mmol) dropwise over 5 min. The reaction was heated to 45 °C, and to the reaction mixture was added a solution of the product from the previous step (406.5 mg, 2.231 mmol) in THF (893 μ l). The reaction vessel was then sealed and stirred at 90 °C overnight. The reaction mixture became yellow. The reaction was cooled, absorbed onto silica gel, and purified by flash chromatography on silica gel; eluent (0 - 40 % EtOAc:iPrOH (4:1) in hexanes) to give the title compound (355 mg, 1.81 mmol, 81 % yield) as a yellow oil.

[0599] MS (ES⁺) C₁₀H₁₀F₂N₂ requires: 196, found: 197 [M+H]⁺.

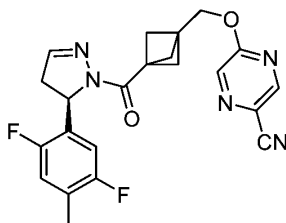


[0600] **5-((3-(5-(2,5-Difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile** To a solution of 3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid in DMF (2.0 mL) were added the product from the previous step (84 mg, 0.43 mmol), iPr₂NEt (213 μ l, 1.22 mmol) and T3P (50 % in EtOAc, 728 μ l, 1.22 mmol) and the resulting mixture was stirred at rt overnight. The reaction mixture was diluted with water and saturated NaHCO₃ and extracted twice with EtOAc. The combined organic layers were washed with brine, dried over MgSO₄, concentrated, and purified twice by flash chromatography on silica gel, eluent (0 - 20% 80:20 EA:IPA in hexanes 25 min), followed by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA/H₂O, B = 0.1% TFA/MeCN; Gradient: B = 10 - 90%; 20 min; Column: C18). The collected fractions were combined, concentrated, diluted with EtOAc, and made basic with saturated NaHCO₃. The phases were separated, and organic phase was washed with H₂O, then brine. The aqueous layers were extracted once with EtOAc. The combined organic layers were dried over MgSO₄, and concentrated to give (15.9 mg, 0.038 mmol, 9.21 % yield) as a white solid.

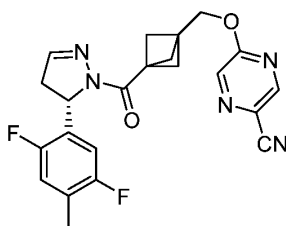
[0601] MS (ES⁺) C₂₂H₁₉F₂N₅O₂ requires: 423, found: 424 [M+H]⁺.

[0602] ¹H NMR (500 MHz, DMSO-*d*₆) δ 8.83 (d, *J* = 1.3 Hz, 1H), 8.50 (d, *J* = 1.3 Hz, 1H), 7.27 – 7.21 (m, 1H), 7.17 (dd, *J* = 10.5, 6.1 Hz, 1H), 6.74 (dd, *J* = 9.7, 6.2 Hz, 1H), 5.36

(dd, $J = 12.1, 5.2$ Hz, 1H), 4.49 (s, 2H), 3.43 (ddd, $J = 18.9, 12.1, 1.6$ Hz, 1H), 2.70 (ddd, $J = 18.8, 5.3, 1.8$ Hz, 1H), 2.25 – 2.16 (m, 3H), 2.07 (s, 6H).

EXAMPLE 196

(R)-5-((3-(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile
and

EXAMPLE 197

(S)-5-((3-(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile

[0603] Example **196**: The title compound was obtained by SFC purification of Example **195** using the following conditions: DAICEL CHIRALPAK AD (250mm*30mm,10um); mobile phase: B: 0.1 %NH₃•H₂O MEOH; B%: 60%-60%, gradient time(min): 4.5;100; flow rate (mL/min): 70. The elution was concentrated (ACN was added after concentrated first time) to give the title compound as the first eluting and less potent isomer. The compound was assigned as the (*R*) enantiomer due to the observed potency, and consideration of the known binding mode of similar molecules for which RIPK1 protein-inhibitor co-crystal structures have been obtained.

[0604] MS (ES⁺) C₂₂H₁₉F₂N₅O₂ requires:423, found: 424 [M+H]⁺.

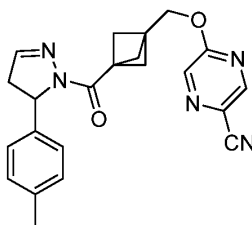
[0605] ¹H NMR (400 MHz, CDCl₃) δ = 8.44 (d, $J = 1.4$ Hz, 1H), 8.30 (d, $J = 1.4$ Hz, 1H), 6.95 (t, $J = 1.6$ Hz, 1H), 6.87 (dd, $J = 6.1, 10.0$ Hz, 1H), 6.67 (dd, $J = 6.1, 9.4$ Hz, 1H), 5.48 (dd, $J = 5.2, 12.0$ Hz, 1H), 4.47 (s, 2H), 3.37 (ddd, $J = 1.5, 12.0, 18.7$ Hz, 1H), 2.74 (ddd, $J = 0.9, 5.2, 18.7$ Hz, 1H), 2.22 (d, $J = 1.8$ Hz, 3H), 2.20 (s, 6H)

[0606]

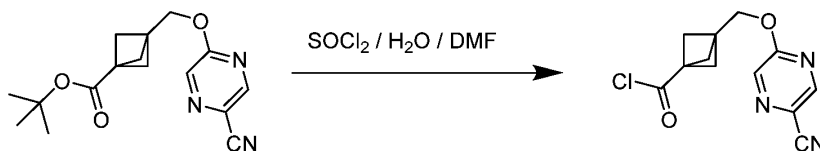
[0607] Example **197**: The title compound was obtained by SFC purification of Example **195** as described for example **196** as the second eluting and more potent isomer. The compound was assigned as the (*S*) enantiomer due to the observed potency, and consideration of the known binding mode of similar molecules for which the RIPK1 protein-inhibitor co-crystal structures have been obtained.

[0608] MS (ES⁺) C₂₂H₁₉F₂N₅O₂ requires: 423, found: 424 [M+H]⁺.

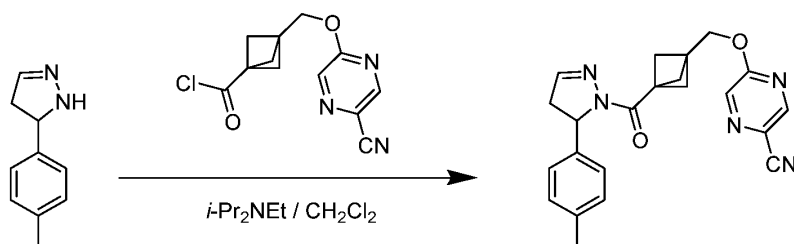
[0609] ¹H NMR (400 MHz, CDCl₃) δ = 8.44 (d, *J* = 1.4 Hz, 1H), 8.30 (d, *J* = 1.3 Hz, 1H), 6.95 (t, *J* = 1.6 Hz, 1H), 6.90 - 6.84 (m, 1H), 6.70 - 6.65 (m, 1H), 5.52 - 5.44 (m, 1H), 4.47 (s, 2H), 3.44 - 3.31 (m, 1H), 2.80 - 2.70 (m, 1H), 2.23 - 2.21 (m, 3H), 2.20 (s, 6H)..

EXAMPLE 198

5-((3-(5-(*p*-Tolyl)-4,5-dihydro-1*H*-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile



[0610] **3-(((5-Cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carbonyl chloride** To a solution of *tert*-butyl 3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylate (100 mg, 0.332 mmol) in SOCl₂ (240 μl, 3.3 mmol) was added H₂O (6.0 μl, 0.33 mmol), and the resulting mixture was stirred at rt for 2 h. To the reaction was added DMF (1.3 μl, 0.017 mmol), and the reaction stirred at rt for 3 h. The reaction was concentrated, and residual solvent was azeotroped with toluene and CH₂Cl₂/Hexanes to give the title compound as a white semi-solid. An aliquot in MeOH analyzed by LCMS gives the methyl ester, MS (ES⁺) C₁₃H₁₃N₃O₃ requires: 259, found 260 [M+H]⁺. The material was taken to the next step without further purification.

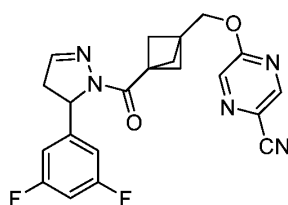


[0611] **5-((3-(5-(p-tolyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile** An aliquot from a solution of the product from the previous step (22 mg, 0.083 mmol) in CH₂Cl₂ (200 μ L) was dripped into a solution of 5-(p-tolyl)-4,5-dihydro-1H-pyrazole (14.70 mg, 0.092 mmol) and iPr₂NEt (72.9 μ L, 0.417 mmol) dissolved in CH₂Cl₂ (200 μ L) and cooled in an ice bath, with stirring under N₂. The resulting mixture was stirred at 0 °C for 30 min then at rt overnight. The reaction was loaded directly onto a dry 12 RediSep® column and purified by flash chromatography on silica gel; eluent (0 to 20% of EtOAc:IPA(4:1) in hexanes) to give the the title compound (13 mg, 0.034 mmol, 40 % yield) as a light yellow semi-solid.

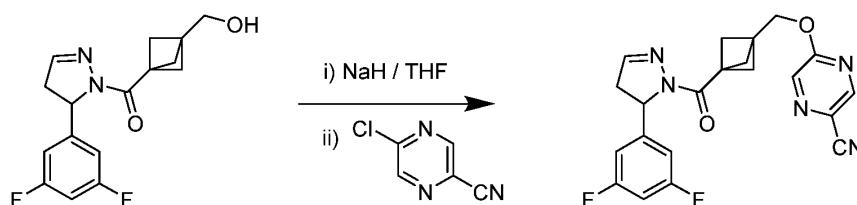
[0612] MS (ES⁺) C₂₂H₂₁N₅O₂ requires: 387, found: 388 [M+H]⁺.

[0613] ¹H NMR (500 MHz, DMSO-*d*₆) δ 8.83 (d, *J* = 1.3 Hz, 1H), 8.50 (d, *J* = 1.3 Hz, 1H), 7.24 – 7.18 (m, 1H), 7.12 (d, *J* = 7.7 Hz, 2H), 7.01 – 6.94 (m, 2H), 5.25 (dd, *J* = 11.8, 4.5 Hz, 1H), 4.49 (s, 2H), 3.47 – 3.37 (m, 1H), 2.62 (ddd, *J* = 18.9, 4.6, 1.8 Hz, 1H), 2.26 (s, 3H), 2.07 (s, 6H).

EXAMPLE 199



5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile

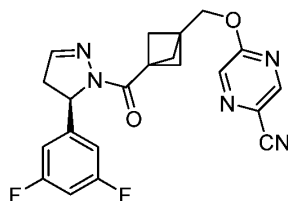


[0614] To a cooled 0 °C suspension of (5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(hydroxymethyl)bicyclo[1.1.1]pentan-1-yl)methanone (990 mg, 3.23 mmol) in THF (8 mL) was added NaH (dispersion in mineral oil, 60%) (142 mg, 3.56 mmol), and the reaction was stirred at 0 °C for 15 min. To the reaction was added dropwise 5-chloropyrazine-2-carbonitrile (586 mg, 4.20 mmol) in THF (8 mL), and the mixture was stirred at 0 °C and then allowed to warm to rt overnight. The reaction was poured into a mixture of ice and saturated NH₄Cl and stirred until the ice melted. The mixture was extracted with EtOAc (3 x 50 ml). Each organic layer was washed with the same brine, combined, dried over MgSO₄, concentrated, and purified by flash chromatography on silica gel; eluent (0 to 20 % 8:2 EtOAc:IPA in hexanes) to give the title compound (1060 mg, 2.59 mmol, 80 % yield) as a white solid.

[0615] (ES⁺) C₂₁H₁₇F₂N₅O₂ requires: 409, found: 4104 [M+H]⁺.

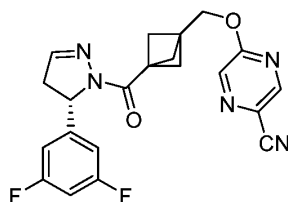
[0616] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.83 (d, *J* = 1.3 Hz, 1H), 8.50 (d, *J* = 1.3 Hz, 1H), 7.21 (d, *J* = 1.6 Hz, 1H), 7.16 – 7.09 (m, 1H), 6.84 – 6.76 (m, 2H), 5.33 (dd, *J* = 11.9, 4.9 Hz, 1H), 4.49 (s, 2H), 3.47 – 3.37 (m, 1H), 2.75 – 2.67 (m, 1H), 2.09 (s, 6H).

EXAMPLE 200



(*R*)-5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile
and

EXAMPLE 201



(*S*)-5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile

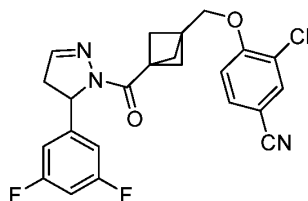
[0617] Example **200**: The title compound was obtained by SFC purification of Example **199** as the first eluting and less potent isomer. The compound was assigned as the (*R*) enantiomer due to the observed potency, and consideration of the known binding mode of similar molecules for which RIPK1 protein-inhibitor co-crystal structures have been obtained.

[0618] Example **201**: The title compound was obtained by SFC purification of Example **199** as the second eluting and more potent isomer. The compound was assigned as the (*S*) enantiomer due to the observed potency, and consideration of the known binding mode of similar molecules for which RIPK1 protein-inhibitor co-crystal structures have been obtained.

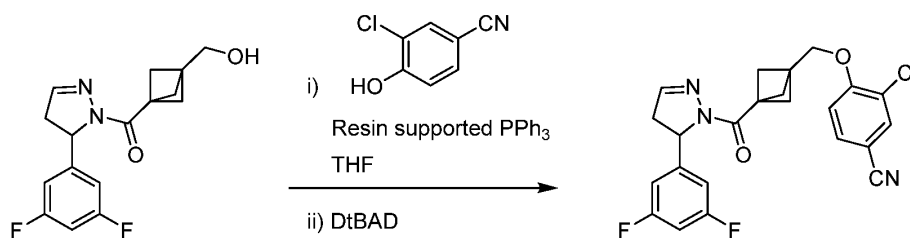
[0619] (ES^+) $\text{C}_{21}\text{H}_{17}\text{F}_2\text{N}_5\text{O}_2$ requires: 409, found: 4104 $[\text{M}+\text{H}]^+$.

[0620] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 8.83 (d, $J = 1.3$ Hz, 1H), 8.50 (d, $J = 1.3$ Hz, 1H), 7.21 (d, $J = 1.8$ Hz, 1H), 7.18 – 7.09 (m, 1H), 6.84 – 6.76 (m, 2H), 5.33 (dd, $J = 11.9$, 4.9 Hz, 1H), 4.49 (s, 2H), 3.41 (ddd, $J = 19.0$, 11.9, 1.6 Hz, 1H), 2.70 (ddd, $J = 18.9$, 4.9, 1.7 Hz, 1H), 2.09 (s, 6H).

EXAMPLE 202



3-Chloro-4-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-yl)carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)benzonitrile



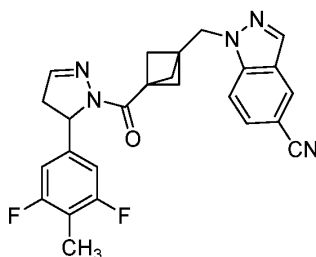
[0621] To a solution of (5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(hydroxymethyl)bicyclo[1.1.1]pentan-1-yl)methanone (20 mg, 0.065 mmol) in THF (320 μl) were added 3-chloro-4-hydroxybenzonitrile (13 mg, 0.085 mmol) and resin-supported PPh_3 (0.3 mmol/g, 44 mg, 0.13 mmol), and the resulting mixture was stirred at rt for 10 min. To the reaction was added DtBAD (20 mg, 0.085 mmol) and the reaction stirred at rt overnight.

To the reaction was added CELITE®, and the mixture was diluted with CH₂Cl₂, filtered over a bed of CELITE®, and rinsed with CH₂Cl₂. To the filtrate was added TFA (50 uL), and the reaction mixture was concentrated. The residue was dissolved in DMSO (200 ul) and filtered, and the precipitate was rinsed with MeOH (2 x 150 ul). The combined organic solution was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA/H₂O, B = 0.1% TFA/MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (0.8 mg, 1.840 μmol, 2.8 % yield) as a white solid.

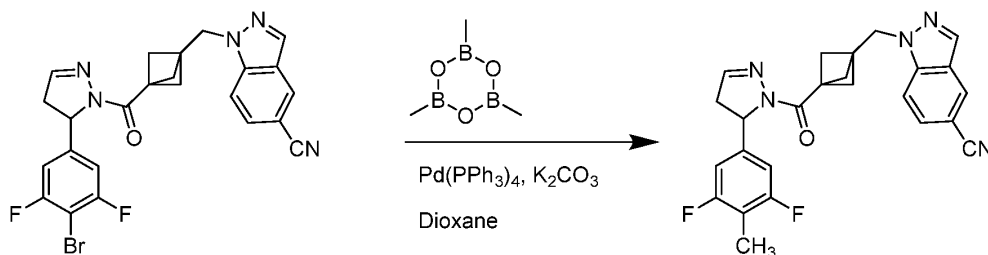
[0622] MS (ES⁺) C₂₃H₁₈ClF₂N₃O₂ requires: 441, found: 442 [M+H]⁺.

[0623] ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.03 (d, *J* = 2.2 Hz, 1H), 7.81 (dd, *J* = 8.7, 2.2 Hz, 1H), 7.33 (d, *J* = 8.7 Hz, 1H), 7.23 (t, *J* = 1.7 Hz, 1H), 7.13 (tt, *J* = 9.3, 2.3 Hz, 1H), 6.86 – 6.78 (m, 2H), 5.34 (dd, *J* = 12.0, 4.9 Hz, 1H), 4.28 (s, 2H), 3.43 (ddd, *J* = 18.7, 11.9, 1.6 Hz, 1H), 2.71 (ddd, *J* = 19.0, 4.9, 1.8 Hz, 1H), 2.11 (s, 6H).

EXAMPLE 203



1-((3-(5-(3,5-Difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile

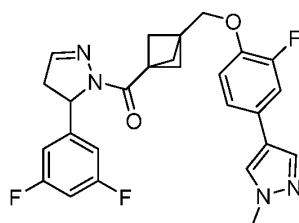


[0624] To a vial equipped with a stir bar, and containing 2,4,6-trimethyl-1,3,5,2,4,6-trioxatriborinane (4.2 mg, 0.033 mmol), K₂CO₃ (5.8 mg, 0.042 mmol), and Pd(PPh₃)₄ (1.6 mg, 1.4 μmol) was added a solution of 1-((3-(5-(4-bromo-3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile (Example **241**, 14 mg, 0.028 mmol) in N₂-degassed dioxane (50 μl). The reaction mixture was degassed with N₂, sealed, and then heated at 100 °C overnight. The reaction mixture was

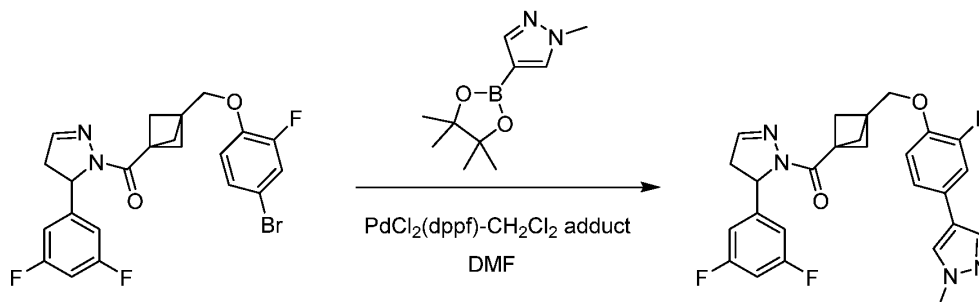
allowed to cool to rt, diluted with 10% TFA in MeOH (300 μ L), and filtered through a cotton plug. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA/H₂O, B = 0.1% TFA/MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (2.6 mg, 5.8 μ mol, 20 % yield) as a white solid.

[0625] MS (ES⁺) C₂₅H₂₁F₂N₅O requires: 445 found: 446 [M+H]⁺.

EXAMPLE 204



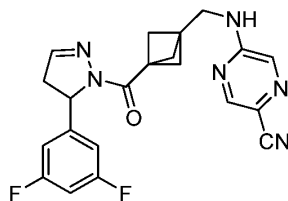
(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((2-fluoro-4-(1-methyl-1H-pyrazol-4-yl)phenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone



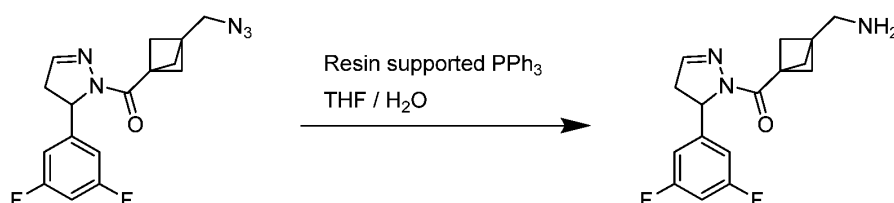
[0626] To a solution of (3-((4-bromo-2-fluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone (Example **331**, 4.1 mg, 8.6 μ mol) in N₂-degassed DMF (86 μ l) in a vial was added 1-methyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole (2.3 mg, 0.011 mmol), and Na₂CO₃ (2M, 8.6 μ l, 0.017 mmol), and the resulting mixture was stirred and purged with N₂. To this mixture was added PdCl₂(dppf)-CH₂Cl₂ adduct (1 mg, 0.9 μ mol). The vial was sealed and stirred at 80 °C overnight. The reaction mixture was allowed to cool to rt. The residue was purified by mass-triggered preparative HPLC (Mobile phase: A = 0.1% TFA/H₂O, B = 0.1% TFA/MeCN; Gradient: B = 10 - 90%; 12 min; Column: C18) to give the title compound (1.6 mg, 3.33 μ mol, 38 % yield) as a white solid.

[0627] MS (ES⁺) C₂₆H₂₃F₃N₄O₂ requires: 480, found: 481 [M+H]⁺.

EXAMPLE 205



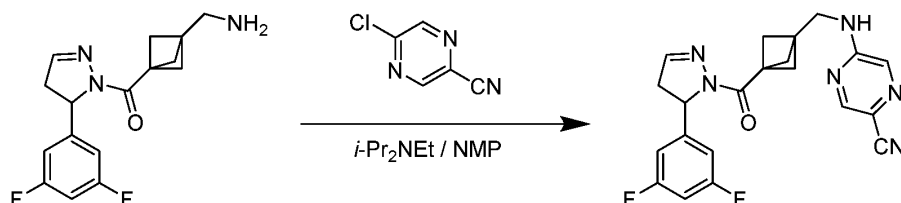
5-(((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)amino)pyrazine-2-carbonitrile



[0628] **(3-(Aminomethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone** To a solution of (3-

(azidomethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone (140 mg, 0.42 mmol) in THF (2 ml) and H₂O (10 µl) was added resin-supported PPh₃ (0.3 mmol/g, 210 mg, 0.63 mmol) and the resulting mixture was stirred at rt for 3 d. To the mixture was added CH₂Cl₂ and CELITE®, and the mixture was filtered through a plug of CELITE®. The filtrate was concentrated to give 132 mg (0.432 mmol, 102 % yield) as a white solid.

[0629] MS (ES⁺) C₁₆H₁₇F₂N₃O requires: 305, found: 306 [M+H]⁺.



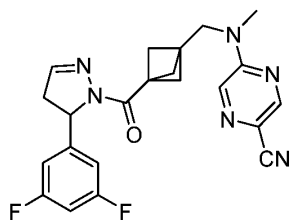
[0630] **5-(((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)amino)pyrazine-2-carbonitrile** A microwave vial was

charged with the product from the previous step (21 mg, 0.069 mmol), 5-chloropyrazine-2-carbonitrile (14 mg, 0.10 mmol), iPr₂NEt (48 µl, 0.28 mmol), and NMP (344 µl). The vial was sealed and the reaction mixture was heated at 150 °C in a microwave reactor for 30 min. The reaction mixture was diluted with EtOAc (4 mL), H₂O (4 mL) was added, and the layers were separated. The aqueous phase was extracted with EtOAc (2 x 3 mL), and the combined organic layers were washed with saturated NaCl, dried over MgSO₄, filtered and

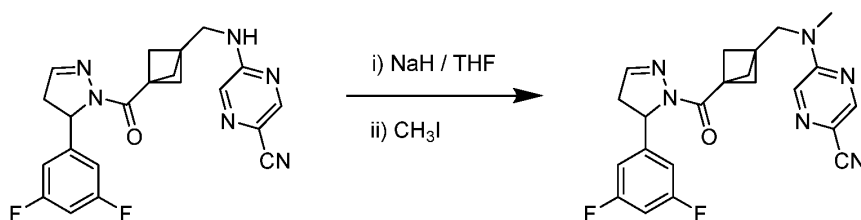
concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel; eluent (0 - 50 % EA:IPA 4:1 in hexanes) to give (13.9 mg, 0.034 mmol, 49 % yield) as a white solid.

[0631] MS (ES^+) $\text{C}_{21}\text{H}_{18}\text{F}_2\text{N}_6\text{O}$ requires: 408, found: 409 $[\text{M}+\text{H}]^+$.

EXAMPLE 206



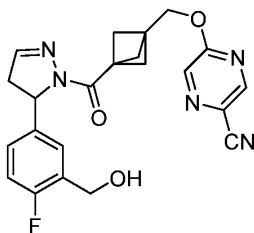
5-(((3-(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)(methyl)amino)pyrazine-2-carbonitrile



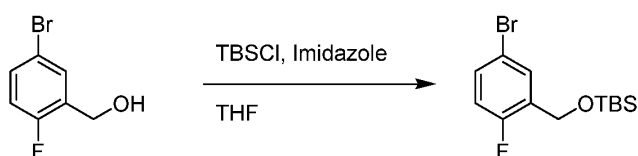
[0632] To a solution of 5-(((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)amino)pyrazine-2-carbonitrile (Example **205**, 12 mg, 0.029 mmol) in THF (500 μL) at 0 $^{\circ}\text{C}$ was added NaH (4 mg, 0.09 mmol, 60 % mineral oil dispersion), and the mixture was stirred for 10 min. To the reaction mixture was added MeI (2 μL , 0.032 mmol), and the reaction mixture was stirred in an ice bath and allowed to warm to rt over 2 h. The reaction was cooled again in the ice bath, additional MeI (2 μL , 0.032 mmol) was added, and the reaction allowed to warm to rt. The reaction was quenched with saturated NH_4Cl and extracted with EtOAc (2 x). The combined organic layers were washed with saturated NaCl, dried over MgSO_4 , concentrated under reduced pressure, and purified by flash chromatography on silica gel; eluent (0 - 50 % EA:IPA 4:1 in hexanes) to give (9.0 mg, 0.021 mmol, 74 % yield) as a white solid.

[0633] MS (ES^+) $\text{C}_{22}\text{H}_{20}\text{F}_2\text{N}_6\text{O}$ requires: 422, found: 423 $[\text{M}+\text{H}]^+$.

[0634] ^1H NMR (600 MHz, $\text{DMSO}-d_6$) δ 8.53 (s, 1H), 8.27 (s, 1H), 7.20 – 7.16 (m, 1H), 7.11 (tt, J = 9.3, 2.4 Hz, 1H), 6.83 – 6.72 (m, 2H), 5.31 (dd, J = 12.0, 4.9 Hz, 1H), 3.79 (s, 2H), 3.45 – 3.34 (m, 1H), 3.16 (s, 3H), 2.68 (ddd, J = 18.9, 4.9, 1.8 Hz, 1H), 2.01 (s, 6H).

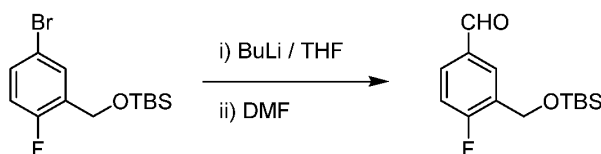
EXAMPLE 207

5-((3-(5-(4-Fluoro-3-(hydroxymethyl)phenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile



[0635] **((5-Bromo-2-fluorobenzyl)oxy)(tert-butyl)dimethylsilane** To a solution of (5-bromo-2-fluorophenyl)methanol (5.0 g, 24 mmol) in THF (120 ml) were added tert-butylchlorodimethylsilane (4.4 g, 29 mmol) and imidazole (4.2 g, 61 mmol), and the resulting mixture was stirred overnight. The reaction mixture was dilute with ice water (300 ml) and extracted with EtOAc (150ml/3x). Each organic layer was washed with aqueous citric acid (~10%) and brine. The organic layers were combined, dried over MgSO_4 , and concentrated to give the title compound (7.6 g, 23 mmol, 98 % yield) as an opaque liquid.

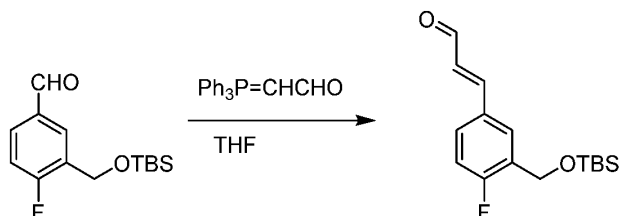
[0636] ^1H NMR (300 MHz, $\text{DMSO}-d_6$) δ 7.48 (dd, $J = 6.4, 2.1, 1.3$ Hz, 1H), 7.45 - 7.38 (m, 1H), 7.09 (dd, $J = 9.9, 8.7$ Hz, 1H), 4.64 (s, 2H), 0.80 (s, 9H), 0.00 (s, 6H).



[0637] **3-(((tert-Butyldimethylsilyl)oxy)methyl)-4-fluorobenzaldehyde** To a solution of the product from the previous step (1.0 g, 3.1 mmol) in THF (31 ml) at -78°C was added BuLi (2.5M in hexanes, 1.4 ml, 3.5 mmol), and the mixture was stirred in the bath for 25 min. To the reaction was added DMF (1.3 ml, 17 mmol), and the mixture was stirred at -78°C 1 h. The reaction was removed from the bath and diluted with CH_2Cl_2 and saturated NaHCO_3 . The layers were separated. The aqueous phase was extracted once with CH_2Cl_2 . The combined organic layers were washed with the same brine, combined, dried over

MgSO₄, concentrated, and purified by flash chromatography on silica gel; eluent (0 - 15 % EtOAc in hexanes) to give the title compound (0.48 g, 1.8 mmol, 57 % yield) as a clear oil.

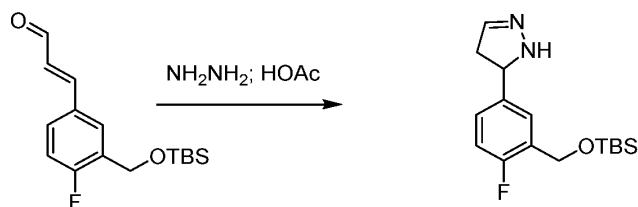
[0638] ¹H NMR (300 MHz, DMSO-*d*₆) δ 9.88 (s, 1H), 7.95 – 7.88 (m, 1H), 7.85 – 7.78 (m, 1H), 7.37 – 7.28 (m, 1H), 4.71 (s, 2H), 0.80 (s, 9H), 0.00 (s, 6H).



[0639] **(E)-3-(3-(((tert-Butyldimethylsilyl)oxy)methyl)-4-fluorophenyl)acrylaldehyde**

To a solution of the product from the previous step (0.48 g, 1.788 mmol) in THF (1.788 ml) was added 2-(triphenyl-λ⁵-phosphaneylidene)acetaldehyde (0.544 g, 1.788 mmol), and the resulting mixture was stirred at 75 °C overnight. The reaction was adsorbed onto silica gel and purified by flash chromatography on silica gel; eluent (0 - 20 % EtOAc in Hexanes) to give the title compound (0.2 g, 0.679 mmol, 38 % yield) as a clear oil.

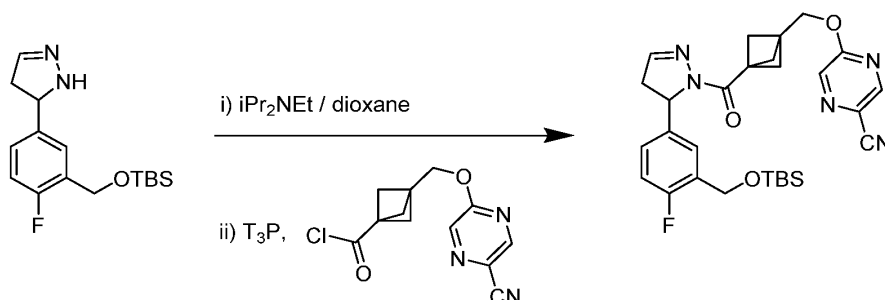
[0640] ¹H NMR (600 MHz, DMSO-*d*₆) δ 9.56 (d, *J* = 7.8 Hz, 1H), 7.73 – 7.63 (m, 3H), 7.23 – 7.15 (m, 1H), 6.67 (dd, *J* = 15.9, 7.7 Hz, 1H), 4.67 (s, 2H), 0.80 (s, 9H), 0.00 (d, *J* = 1.4 Hz, 6H).



[0641] **5-(3-(3-(((tert-Butyldimethylsilyl)oxy)methyl)-4-fluorophenyl)-4,5-dihydro-1H-pyrazole**

To a solution of the product from the previous step (0.2 g, 0.7 mmol) in tBuOH (2 ml) was added hydrazine hydrate (0.20 ml, 3.4 mmol) in HOAc (0.012 ml, 0.20 mmol). The reaction vessel was then sealed and heated at 80 °C overnight. The volatiles were removed under reduced pressure. The residue was adsorbed onto silica gel and purified by flash chromatography; eluent (0 - 40 % EA in hexanes) to give (133.2 mg, 0.432 mmol, 64 % yield) as a yellow liquid.

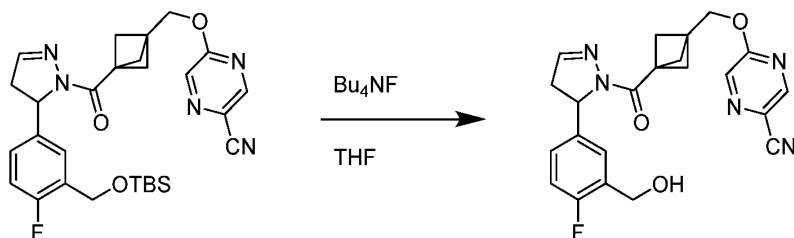
[0642] MS (ES⁺) C₁₆H₂₅FN₂OSi requires: 308, found: 309 [M+H]⁺.



[0643] **5-((3-(5-(3-(((*tert*-Butyldimethylsilyl)oxy)methyl)-4-fluorophenyl)-4,5-dihydro-1*H*-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile**

To a solution of the product from the previous step (214 μ L, 0.214 mmol) in dioxane (800 μ L) was added *i*Pr₂NEt (143 μ L, 0.823 mmol). To the reaction mixture was added a solution of 3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carbonyl chloride (330 μ L, 0.165 mmol) in Dioxane/ CH₂Cl₂ and T3P (50 % in EtOAc, 98 μ L, 0.17 mmol), and the reaction was stirred at rt overnight under N₂. The reaction was diluted with EtOAc and washed with water and brine. The aqueous layers were extracted with EtOAc (2x). The organic layers were combined, dried over MgSO₄, concentrated, and purified by flash chromatography (0 - 50% EtOAc in hexanes) to give the title compound (33.9 mg, 0.063 mmol, 38 % yield) as a yellow solid.

[0644] MS (ES⁺) C₂₈H₃₄FN₅O₃Si requires: 535, found: 536 [M+H]⁺.

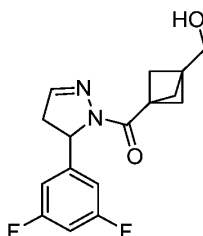


[0645] **5-((3-(5-(4-Fluoro-3-(hydroxymethyl)phenyl)-4,5-dihydro-1*H*-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile**

To a solution of the product from the previous step (30 mg, 0.056 mmol) in THF (280 μ L) at 0 °C was added TBAF (1M in THF, 84 μ L, 0.084 mmol), and the resulting mixture was stirred and allowed to warm to rt overnight. The mixture was concentrated and purified by flash chromatography on silica gel; eluent (0 to 100% EtOAc in Hexanes) to give the title compound (8 mg, 0.02 mmol, 33 % yield) as a white solid.

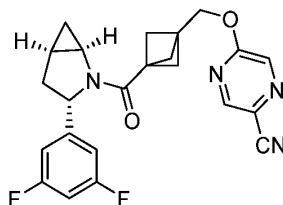
[0646] MS (ES⁺) C₂₂H₂₀FN₅O₃ requires: 421, found: 422[M+H]⁺. ¹H NMR (600 MHz, DMSO-*d*₆) δ 8.83 (s, 1H), 8.50 (s, 1H), 7.24 – 7.18 (m, 2H), 7.10 – 7.05 (m, 1H), 7.02 – 6.97

(m, 1H), 5.30 (dd, $J = 11.8, 4.6$ Hz, 1H), 5.27 (t, $J = 5.6$ Hz, 1H), 4.51 (d, $J = 5.6$ Hz, 2H), 4.49 (s, 2H), 3.42 (dd, $J = 18.9, 11.8$ Hz, 1H), 2.62 (dd, $J = 18.8, 4.4$ Hz, 1H), 2.07 (s, 6H).

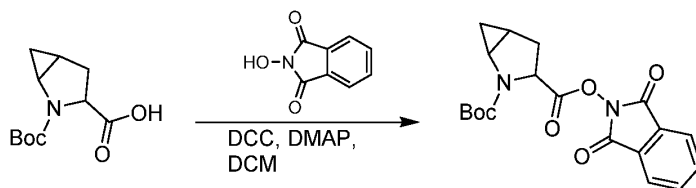
EXAMPLE 208

(5-(3,5-Difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(hydroxymethyl)bicyclo[1.1.1]pentan-1-yl)methanone

[0647] This compound is identical to Intermediate **I**, described in the synthesis of Examples **3** and **4**.

EXAMPLE 209

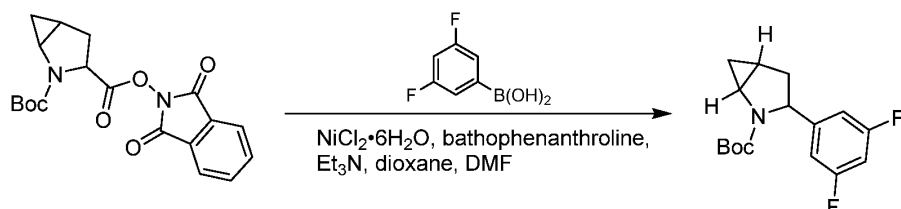
5-((3-((1R,3S,5R)-3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane-2-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile



[0648] **2-(Tert-Butyl) 3-(1,3-dioxoisindolin-2-yl) 2-azabicyclo[3.1.0]hexane-2,3-dicarboxylate** A round-bottom flask was charged with 2-(tert-butoxycarbonyl)-2-azabicyclo[3.1.0]hexane-3-carboxylic acid (1.8 g, 7.9 mmol, 1 **eq**), DMAP (97 mg, 79 μ mol, 0.1 **eq**) and 2-hydroxyisoindoline-1,3-dione (1.29 g, 7.92 mmol, 1 **eq**). DCM (30 mL) was added and the mixture was stirred vigorously. Then DCC (1.80 g, 8.71 mmol, 1.76 mL, 1.1 **eq**) was added, and the mixture was stirred at 20 °C for 3 h. The mixture was diluted with H₂O (100 mL) and extracted with EtOAc (100 mL x 2). The combined organic layers were

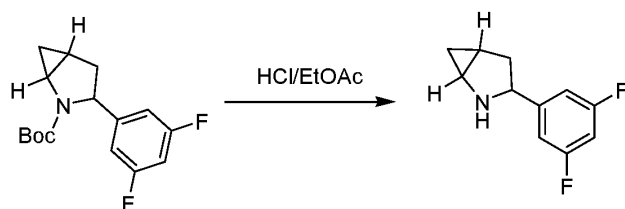
concentrated as a yellow oil which was purified by column chromatography on silica (PE:EA=1:1) to afford the title compound (2.8 g, 6.8 mmol, 86 % yield, 91% purity) as a white solid. In separate reactions, both available diastereomers produced the desired product with assumed retention of chirality.

[0649] MS(ES⁺) C₁₉H₂₀N₂O₆ requires:372, found 273 [M+H-Boc]⁺.

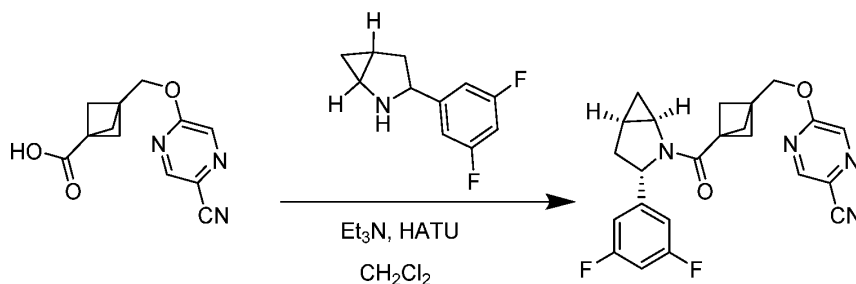


[0650] ***Tert*-Butyl 3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane-2-carboxylate.** To a solution of 2-(*tert*-butyl) 3-(1,3-dioxoisindolin-2-yl) 2-azabicyclo[3.1.0]hexane-2,3-dicarboxylate (2.8 g, 7.52 mmol, 1 **eq**) in dioxane (150 mL) was added (3,5-difluorophenyl)boronic acid (3.56 g, 22.6 mmol, 3 **eq**). The mixture was stirred at 20 °C for 5 min. Then to the mixture was added Et₃N (7.61 g, 75.2 mmol, 10.5 mL, 10 **eq**) and the solution was stirred at 20 °C for 5 min. Then a solution of NiCl₂·6H₂O (357 mg, 1.50 mmol, 0.2 **eq**) and bathophenanthroline (500 mg, 1.50 mmol, 0.2 **eq**) in DMF (15 mL) was added to the mixture, the tube was immediately placed in a preheated 75 °C oil bath for 12 h under stirring. The mixture was concentrated in vacuum and diluted with H₂O (100 mL), then extracted with EtOAc (100 mL x 2). The combined organic layer was concentrated as a yellow oil which was purified by prep-HPLC (column: Waters Xbridge C18 150 x 50mm x 10 μm; mobile phase: [water (0.05% NH₄OH v/v)-ACN]; B%: 52%-82%, 11min) and freeze-dried to title compound (313 mg, 1.06 mmol, 14 % yield) as a yellow solid. In separate reactions, each diastereomers produced the desired product with assumed inversion of chirality at the 3 carbon. MS(ES⁺) C₁₆H₁₉NO₂F₂ requires:295, found 240 [M+H-tBu]⁺.

[0651] ¹H NMR (400 MHz, METHANOL-d₄) δ = 6.92 - 6.72 (m, 3H), 4.70 - 4.50 (m, 1H), 3.52 (t, *J* = 4.9 Hz, 1H), 2.51 (dd, *J*₁ = 13.4 Hz, *J*₂ = 8.8 Hz, 1H), 2.15 - 1.98 (m, 1H), 1.72 - 1.63 (m, 1H), 1.48 - 1.08 (m, 9H), 0.90 - 0.82 (m, 1H), 0.60 - 0.51 (m, 1H).



[0652] **3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane** A solution of tert-butyl 3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane-2-carboxylate (100 mg, 338.61 μ mol, 1 *eq*) in HCl/EtOAc (4 mL) was stirred at 15 °C for 1 h. The product was carried on to the next step without purification. (1*S*, 3*S*, 5*S*)-3-(3, 5-difluorophenyl)-2-azabicyclo[3.1.0]hexane (66 mg, 338.10 μ mol, 99.85% yield) was obtained as a white solid. In separate reactions, each diastereomers produced the desired product with assumed retention of chirality.



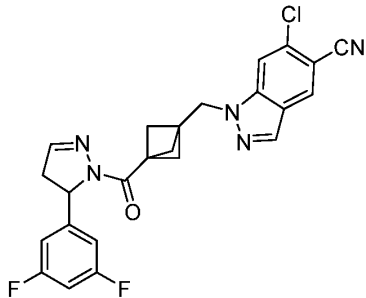
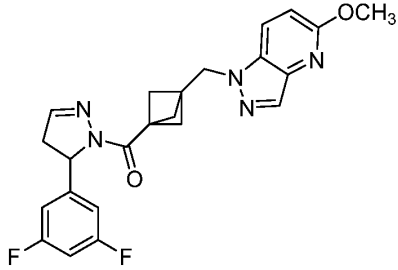
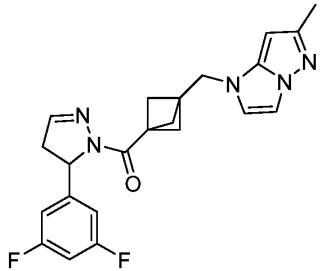
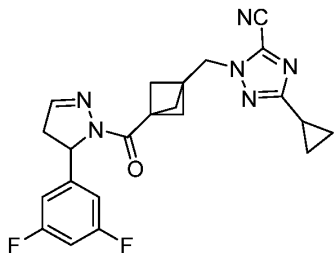
[0653] **5-((3-((1*R*,3*S*,5*R*)-3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane-2-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile** To a solution of (1*R*,3*S*,5*R*)-3-(3,5-difluorophenyl)-2-azabicyclo[3.1.0]hexane (13 mg, 0.067 mmol) in CH₂Cl₂ (333 μ l) were added 3-(((5-cyanopyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carboxylic acid (18 mg, 0.073 mmol), TEA (18 μ l, 0.13 mmol) and HATU (25 mg, 0.67 mmol) and the resulting mixture was stirred at 25°C for 16 h. The volatiles were removed under reduced pressure. The residue was purified via silica gel chromatography; eluent (0 - 100 % EtOAc in hexanes) to give the title compound (8 mg, 0.019 mmol, 28 % yield) as a tan solid. In separate reactions, each diastereomer was carried through to the final compound and tested. The one described here in gave the observed potency and the proposed orientation of the diastereomer was interpreted from 2012D NMR experiments of the final compound. The exact structure was not confirmed. The other diastereomer (conformation not determined) was greater than 10,000 nM.

[0654] MS (ES⁺) C₂₃H₂₀F₂N₄O₂ requires: 422, found: 421 [M+H]⁺.

[0655] ¹H NMR (500 MHz, DMSO-*d*₆) δ 8.82 (d, *J* = 1.3 Hz, 1H), 8.48 (d, *J* = 1.3 Hz, 1H), 7.09 – 7.01 (m, 1H), 6.93 – 6.85 (m, 2H), 5.03 – 4.99 (m, 1H), 4.49 (s, 2H), 3.68 – 3.61 (m, 1H), 2.31 – 2.22 (m, 1H), 2.11 (s, 6H), 2.02 – 1.92 (m, 1H), 1.87 – 1.79 (m, 1H), 1.06 – 0.98 (m, 1H), 0.61 – 0.54 (m, 1H).

Table 5. Examples 210 – 345.

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
210		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrrolo[3,2- <i>b</i>]pyridine-5-carbonitrile	431 / 432	21 / 22
211		5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-5H-pyrrolo[2,3- <i>b</i>]pyrazine-2-carbonitrile	432 / 433	21 / 22
212		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrrolo[2,3- <i>b</i>]pyridine-5-carbonitrile	431 / 432	21 / 22
213		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-pyrazolo[3,4- <i>c</i>]pyridine-5-carbonitrile	432 / 433	21 / 22

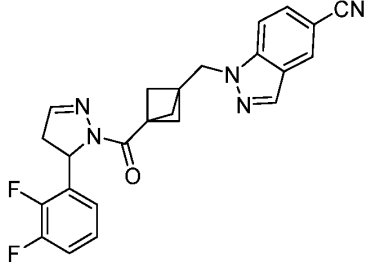
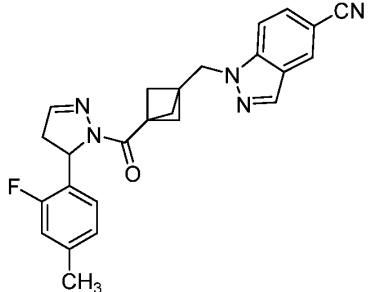
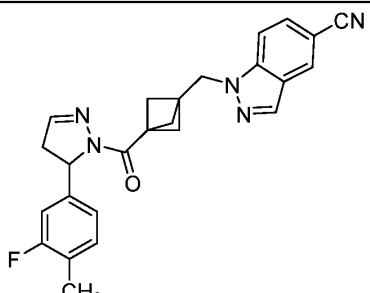
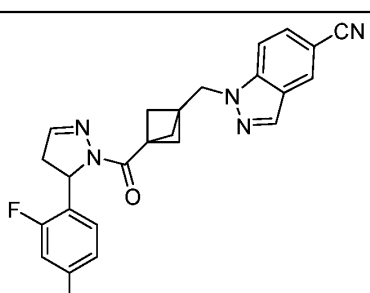
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
214		6-chloro-1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1 <i>H</i> -indazole-5-carbonitrile	465 / 466	21 / 22
215		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((5-methoxy-1 <i>H</i> -pyrazolo[4,3- <i>b</i>]pyridin-1-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	437 / 438	21 / 22
216		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-((6-methyl-1 <i>H</i> -imidazo[1,2- <i>b</i>]pyrazol-1-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)-methanone	409 / 410	21 / 22
217		3-cyclopropyl-1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1 <i>H</i> -1,2,4-triazole-5-carbonitrile	422 / 423	21 / 22

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
218		1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-pyrazolo[4,3- <i>b</i>]pyridine-6-carbonitrile	432 / 433	21 / 22
219		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-2H-pyrazolo[3,4- <i>c</i>]pyridine-5-carbonitrile	432 / 433	21 / 22
220		6-chloro-2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-2H-indazole-5-carbonitrile	465 / 466	21 / 22
221		5-cyclopropyl-1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-1,2,4-triazole-3-carbonitrile	422 / 423	21 / 22
222		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-2H-pyrazolo[4,3- <i>b</i>]pyridine-6-carbonitrile	432 / 433	21 / 22

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
223		2-(1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-5-methyl-1H-1,2,4-triazol-3-yl)acetonitrile	410 / 411	21 / 22
224		5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)picolinonitrile	408 / 409	26
225		6-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)-5-methyl-nicotinonitrile	422 / 423	26
226		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(fluoro(3-methoxyphenyl)-methyl)bicyclo[1.1.1]pentan-1-yl)methanone	414 / 415	26
227		(3-((3-chloro-5-fluorophenyl)-fluoromethyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	436 / 437	Exemplified, 42

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
228		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-(fluoro(4-methoxyphenyl)-methyl)bicyclo[1.1.1]pentan-1-yl)methanone	414 / 415	42
229		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-(fluoro(6-methoxypyrimidin-4-yl)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	416 / 417	42
230		(3-((3-chlorophenyl)-(hydroxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	416 / 417	42
231		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-(hydroxy(4-methoxyphenyl)-methyl)bicyclo[1.1.1]pentan-1-yl)methanone	413 / 414	42
232		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-(hydroxy(6-methoxypyrimidin-4-yl)methyl)-bicyclo[1.1.1]pentan-1-yl)-methanone	414 / 415	42

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
233		1-((3-(2-(4-chlorophenyl)-azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	416 / 417	49
234		1-((3-(2-(4-fluorophenyl)-azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	400 / 401	49
235		1-((3-(5-(5-methylpyrazin-2-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -pyrazolo[4,3- <i>b</i>]pyridine-5-carbonitrile	412 / 413	49
236		1-((3-(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	445 / 446	49

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
237		1-((3-(5-(2,3-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	431 / 432	49
238		1-((3-(5-(2-fluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	427 / 428	49
239		1-((3-(5-(3-fluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	427 / 428	49
240		1-((3-(5-(2,4-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	431 / 432	49

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
241		1-((3-(5-(4-bromo-3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1 <i>H</i> -indazole-5-carbonitrile	509 / 510, 512	49
242		1-((3-(5-(3,4-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1 <i>H</i> -indazole-5-carbonitrile	431 / 431	49
243		1-((3-(5-(m-tolyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	409 / 410	49
244		1-((3-(5-(4-fluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	413 / 414	49

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
245		1-((3-(5-(2,3-dichlorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	463 / 464	49
246		1-((3-(5-(5-fluoro-6-methylpyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1H-indazole-5-carbonitrile	428 / 429	49
247		1-((3-(5-(imidazo[1,5-a]pyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	435 / 436	49
248		1-((3-(2-(2-fluorophenyl)-azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	400 / 401	49

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
249		1-((3-(5-(6-methylpyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	410 / 411	49
250		1-((3-(5-(4-methylthiazol-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	416 / 417	49
251		1-((3-(5-(5-cyanothiophen-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	426 / 427	49
252		1-((3-(2-(3-fluorophenyl)-azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	400 / 401	49
253		(S)-1-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	432 / 433	49

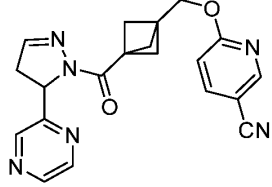
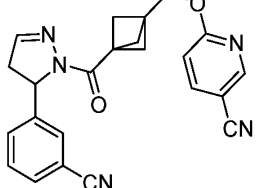
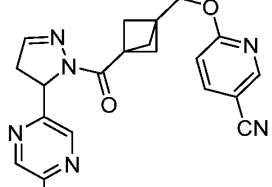
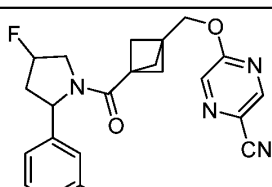
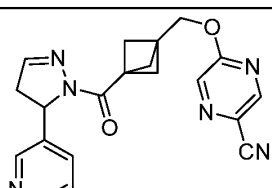
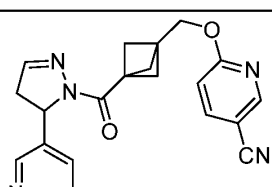
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
254		2-(1-(3-((5-cyano-1 <i>H</i> -indazol-1-yl)methyl)bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1 <i>H</i> -pyrazol-5-yl)thiazole-4-carbonitrile	427 / 428	49
255		1-((3-(2-(thiophen-2-yl)-azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	388 / 389	49
256		(<i>S</i>)- <i>N</i> -(1-(2-chloro-6-fluorophenyl)ethyl)-3-((5-cyano-1 <i>H</i> -indazol-1-yl)methyl)-bicyclo[1.1.1]pentane-1-carboxamide	422 / 423	49
257		1-((3-(2-(3-fluorophenyl)-4-methylpyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	428 / 429	49
258		1-((3-(5-(imidazo[1,2-a]pyridin-6-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	435 / 436	49

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
259		1-((3-(5-(pyrimidin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	397 / 398	49
260		1-((3-(2-(2,3-dichlorophenyl)azetidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	450 / 451	49
261		3-((5-cyano-1H-indazol-1-yl)methyl)-N-(3,5-difluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	392 / 393	49
262		1-((3-((2S,4S)-2-(3-fluorophenyl)-4-hydroxy-pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	430 / 431	49, first eluting isomer.
263		1-((3-((2S,4R)-2-(3-fluorophenyl)-4-hydroxy-pyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methyl)-1H-indazole-5-carbonitrile	430 / 431	49, second eluting isomer.

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
264		6-((3-(5-(3,5-difluoro-4-methylphenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	422 / 423	203
265		(<i>S</i>)-6-((3-(5-(3,5-difluoro-4-methylphenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	422 / 423	197
266		(<i>R</i>)-6-((3-(5-(3,5-difluoro-4-methylphenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	405 / 406	SFC
267		5-((3-(5-(2-fluoro-4-methylphenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)-pyrazine-2-carbonitrile	422 / 423	195
268		5-((3-(5-(2,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	409 / 410	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
269		5-((3-(5-(3-fluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	405 / 406	195
270		6-((3-(5-(2,3-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	408 / 409	195
271		6-((3-(5-(2-fluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	404 / 405	195
272		6-((3-(5-(3-fluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	404 / 405	195
273		6-((3-(5-(p-tolyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	386 / 387	195

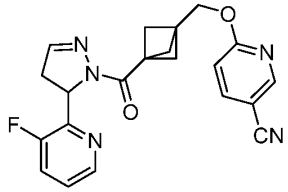
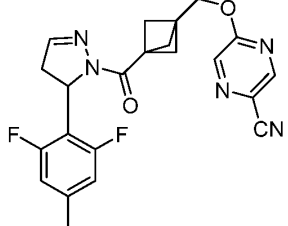
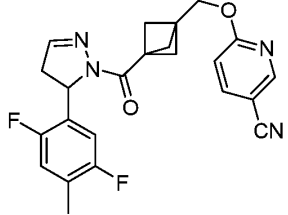
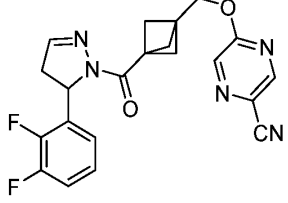
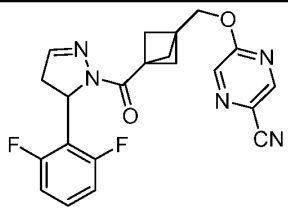
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
274		5-((3-(5-(pyrazin-2-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	375 / 376	195
275		6-((3-(5-(4-bromo-3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	486 / 487	195
276		6-((3-(5-phenyl-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	372 / 373	195
277		5-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	392 / 393	195
278		5-((3-(5-(5-methylpyridin-2-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	388 / 389	195
279		6-((3-(5-(m-tolyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	386 / 387	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
280		6-((3-(5-(pyrazin-2-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	374 / 375	195
281		6-((3-(5-(3-cyanophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	397 / 398	195
282		6-((3-(5-(5-methylpyrazin-2-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	388 / 389	195
283		5-((3-(5-(3-fluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	410 / 411	195
284		5-((3-(5-(5-cyanopyridin-3-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-pyrazine-2-carbonitrile	399 / 400	195
285		6-((3-(5-(5-fluoropyridin-3-yl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	391 / 392	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
286		5-(1-(3-(((5-cyanopyridin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1H-pyrazol-5-yl)nicotinonitrile	398 / 399	195
287		6-(1-(3-(((5-methylpyridin-2-yl)oxy)methyl)bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1H-pyrazol-5-yl)nicotinonitrile	387 / 388	195
288		6-((3-(4-fluoro-2-(3-fluorophenyl)pyrrolidine-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	409 / 410	195
289		5-((3-(5-(6-methylpyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	388 / 389	195
290		6-((3-(5-(2,3-dichlorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	440 / 441	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
291		6-((3-(5-(3,5-difluoropyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	409 / 410	195
292		(S)-3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(1-(2,6-difluorophenyl)ethyl)-N-methylbicyclo[1.1.1]pentane-1-carboxamide	398 / 399	195
293		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(2-fluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	366 / 367	195
294		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(2,6-difluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	370 / 371	195
295		(S)-3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(1-(2-fluorophenyl)ethyl)-N-methylbicyclo[1.1.1]pentane-1-carboxamide	380 / 381	195
296		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(2,3-difluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	370 / 371	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
297		(S)-3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(1-(2,5-difluorophenyl)ethyl)bicyclo[1.1.1]pentane-1-carboxamide	384 / 385	195
298		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(2,5-difluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	370 / 371	195
299		N-(2-chlorophenyl)-3-(((5-cyano-1H-indazol-1-yl)-methyl)-N-methylbicyclo[1.1.1]pentane-1-carboxamide	390 / 391	195
300		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(2-fluorobenzyl)bicyclo[1.1.1]pentane-1-carboxamide	352 / 353	195
301		3-(((5-cyanopyrazin-2-yl)oxy)methyl)-N-(1-(2,5-difluorophenyl)ethyl)-N-methylbicyclo[1.1.1]pentane-1-carboxamide	398 / 399	195
302		5-((3-(3-methyl-2-phenylpyrrolidine-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	388 / 389	195

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
303		6-((3-(5-(3-fluoropyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	391 / 392	195
304		5-((3-(5-(2,6-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	423 / 424	198
305		6-((3-(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	422 / 423	198
306		5-((3-(5-(2,3-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	409 / 410	198
307		5-((3-(5-(2,6-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	409 / 410	198

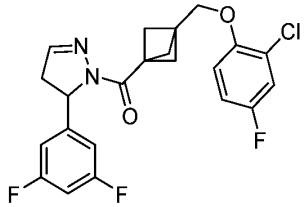
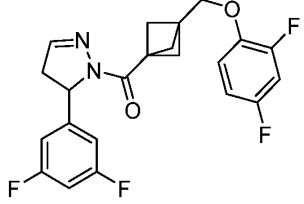
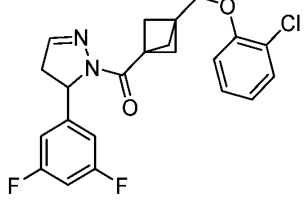
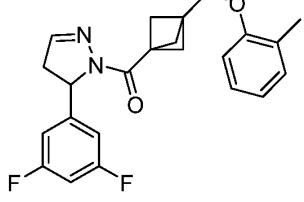
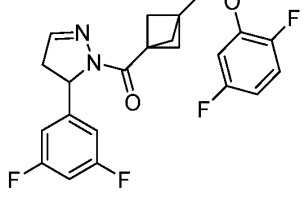
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
308		6-((3-(5-(2,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	408 / 409	198
309		1-((3-(5-(p-tolyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methyl)-1 <i>H</i> -indazole-5-carbonitrile	409 / 410	198
310		5-((3-(5-(4-chlorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	407 / 408	198
311		5-((3-(5-(2,3-dichlorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	441 / 442	198
312		5-((3-(5-(4-(trifluoromethyl)phenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	441 / 442	198

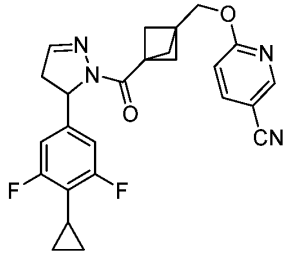
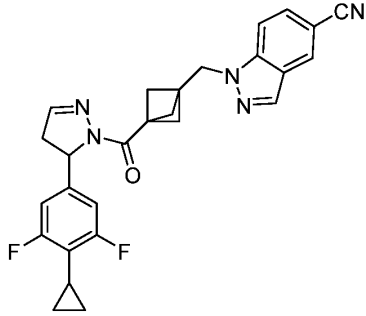
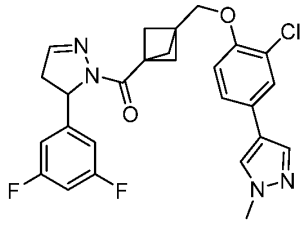
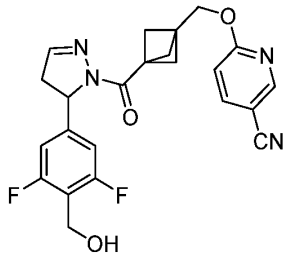
Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
313		5-(1-(3-(((5-fluoro-6-methylpyridin-2-yl)oxy)-methyl)bicyclo[1.1.1]pentane-1-carbonyl)-4,5-dihydro-1H-pyrazol-5-yl)pyrazine-2-carbonitrile	406 / 407	198
314		6-((3-(5-(o-tolyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	386 / 387	198
315		6-((3-(5-(5-fluoro-6-methylpyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	405 / 406	198
316		5-((3-(5-(imidazo[1,5-a]pyridin-3-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	413 / 414	198
317		5-((3-(5-(imidazo[1,2-a]pyridin-2-yl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	413 / 414	198

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
318		5-((3-(5-(2-chlorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	407 / 408	198
319		5-chloro-6-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	442 / 443	199
320		6-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	408 / 409	199
321		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((3,5-difluoropyridin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	419 / 420	199
322		(3-(((5-chloropyrimidin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	418 / 419	199
323		6-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyridazine-3-carbonitrile	409 / 410	199

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
324		2-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrimidine-5-carbonitrile	409 / 410	199
325		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((5-fluoropyrimidin-2-yl)-oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	402 / 403	199
326		5-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	409 / 410	199
327		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((4-methoxypyrimidin-2-yl)-oxy)methyl)bicyclo[1.1.1]pentan-1-yl)-methanone	414 / 415	199
328		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((2,5-difluoropyridin-3-yl)-oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	419 / 420	199

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
329		(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)(3-(((5-methoxypyridazin-3-yl)-oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	414 / 415	199
330		(3-((4-bromo-2-chlorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	494 / 495, 497	202
331		(3-((4-bromo-2-fluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	478 / 479	202
332		(3-((2-chloro-3-fluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	434 / 435	202
333		4-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-3-fluorobenzonitrile	425 / 426	202

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
334		(3-((2-chloro-4-fluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	434 / 435	202
335		(3-((2,4-difluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	418 / 419	202
336		(3-((2-chlorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	416 / 417	202
337		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((o-tolyloxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	396 / 397	202
338		(3-((2,5-difluorophenoxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	418 / 419	202

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
339		6-((3-(5-(4-cyclopropyl-3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	448 / 449	203
340		1-((3-(5-(4-cyclopropyl-3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methyl)-1 <i>H</i> -indazole-5-carbonitrile	471 / 472	203
341		(3-((2-chloro-4-(1-methyl-1 <i>H</i> -pyrazol-4-yl)phenoxy)-methyl)bicyclo[1.1.1]pentan-1-yl)(5-(3,5-difluorophenyl)-4,5-dihydro-1 <i>H</i> -pyrazol-1-yl)methanone	496 / 497	204
342		6-((3-(5-(3,5-difluoro-4-(hydroxymethyl)phenyl)-4,5-dihydro-1 <i>H</i> -pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-nicotinonitrile	438 / 439	207

Ex. No	Structure	Name	MS ^(a)	Proc. Ex. No. ^(b)
343		5-((3-(5-(2-fluoro-3-(hydroxymethyl)phenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)pyrazine-2-carbonitrile	C ₂₂ H ₂₀ F N ₅ O ₃ 421.16 / 422	207
344		(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((5-(1-methyl-1H-pyrazol-4-yl)pyrazin-2-yl)oxy)methyl)-bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₄ H ₂₂ F N ₆ O ₂ 464.18	204
345		(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((5-(1-methyl-1H-pyrazol-4-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₅ H ₂₄ F N ₆ O ₂ 478.19	204

(a) MS is reported as exact mass / observed MS⁺

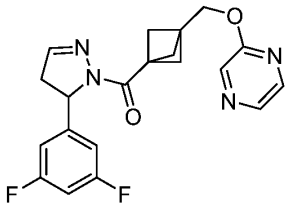
(b) synthesis is similar to procedure used for the cited example

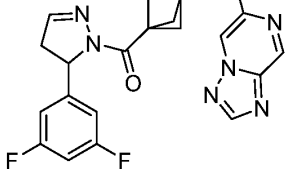
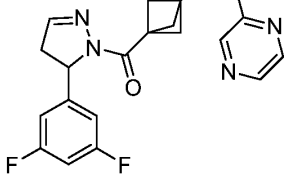
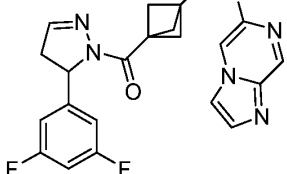
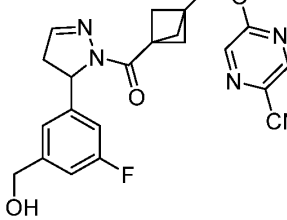
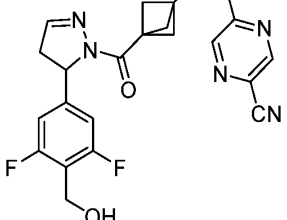
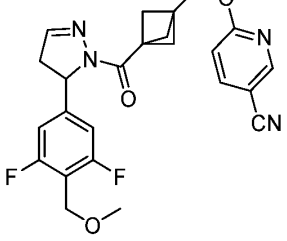
Table 6. Selected ¹H NMR data.

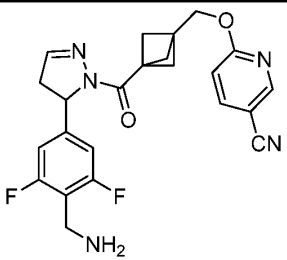
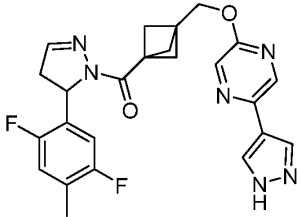
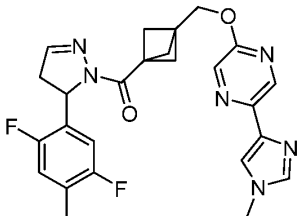
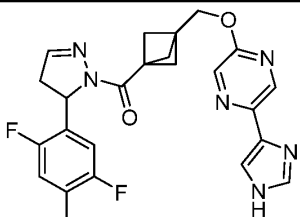
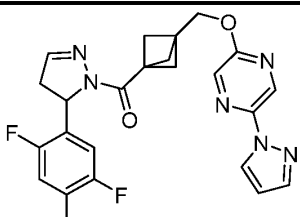
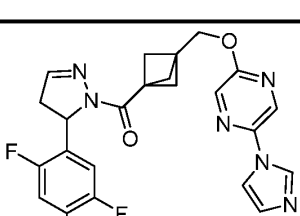
Ex. No.	¹ H NMR (600 MHz, DMSO- <i>d</i> ₆)
226	δ 7.33 (t, <i>J</i> = 7.9 Hz, 1H), 7.18 (d, <i>J</i> = 1.9 Hz, 1H), 7.15 – 7.08 (m, 1H), 6.96 – 6.90 (m, 1H), 6.83 (d, <i>J</i> = 7.6 Hz, 1H), 6.81 – 6.77 (m, 3H), 5.61 – 5.51 (m, 1H), 5.31 (dd, <i>J</i> = 11.9, 4.9 Hz, 1H), 3.76 (s, 3H), 3.42 – 3.35 (m, 1H), 2.75 – 2.64 (m, 1H), 2.05 – 1.89 (m, 6H).

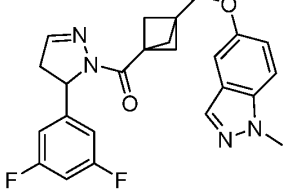
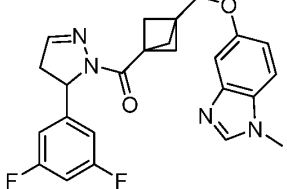
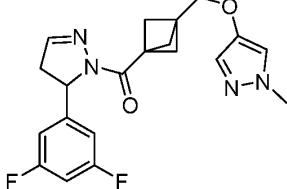
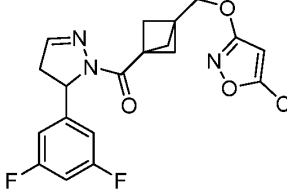
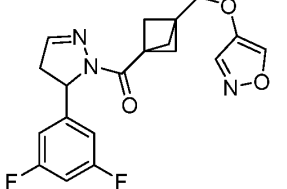
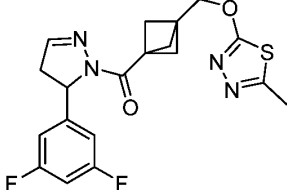
Ex. No.	¹ H NMR (600 MHz, DMSO- <i>d</i> ₆)
227	δ 7.48 – 7.43 (m, 1H), 7.21 – 7.15 (m, 2H), 7.11 (t, <i>J</i> = 9.2 Hz, 2H), 6.81 – 6.76 (m, 2H), 5.74 – 5.63 (m, 1H), 5.31 (dd, <i>J</i> = 11.9, 4.9 Hz, 1H), 3.44 – 3.38 (m, 1H), 2.72 – 2.65 (m, 1H), 2.01 – 1.92 (m, 6H).
228	δ 7.16 – 7.10 (m, 4H), 6.92 – 6.85 (m, 2H), 6.76 (dt, <i>J</i> = 8.4, 2.0 Hz, 2H), 5.32 – 5.27 (m, 1H), 4.52 (s, 1H), 3.74 (s, 3H), 2.70 – 2.61 (m, 1H), 1.92 – 1.81 (m, 4H), 1.81 – 1.73 (m, 3H).
233	δ 8.40 (d, <i>J</i> = 16.5 Hz, 1H), 8.29 – 8.17 (m, 1H), 7.88 (d, <i>J</i> = 8.7 Hz, 1H), 7.76 – 7.69 (m, 1H), 7.40 – 7.32 (m, 2H), 7.29 – 7.22 (m, 2H), 5.41 – 5.15 (m, 1H), 4.64 – 4.42 (m, 2H), 4.18 (t, <i>J</i> = 7.8 Hz, 1H), 3.95 – 3.83 (m, 1H), 2.69 (s, 1H), 1.85 (s, 5H), 1.47 – 1.34 (m, 2H).
234	δ 8.44 – 8.37 (m, 1H), 8.29 – 8.18 (m, 1H), 7.91 – 7.69 (m, 2H), 7.33 – 7.25 (m, 2H), 7.17 – 7.08 (m, 2H), 5.40 – 5.15 (m, 1H), 4.63 – 4.41 (m, 2H), 4.22 – 4.13 (m, 1H), 3.95 – 3.83 (m, 1H), 2.69 – 2.58 (m, 1H), 2.01 – 1.90 (m, 1H), 1.85 (s, 4H), 1.47 – 1.43 (m, 1H), 1.38 – 1.33 (m, 1H).
235	δ 8.55 (s, 1H), 8.47 – 8.41 (m, 2H), 8.37 (s, 1H), 7.98 (d, <i>J</i> = 8.7 Hz, 1H), 7.15 (d, <i>J</i> = 2.0 Hz, 1H), 5.37 – 5.31 (m, 1H), 4.68 (s, 2H), 3.35 – 3.28 (m, 1H), 2.88 – 2.81 (m, 1H), 2.44 (s, 3H), 1.87 (s, 6H).

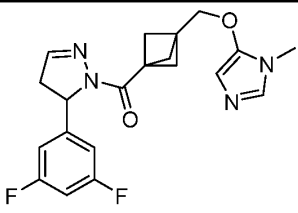
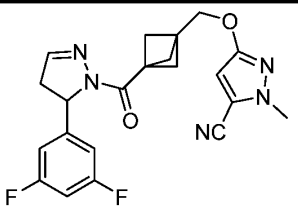
[0656] The following compounds can generally be made using the methods described above. It is expected that these compounds when made will have activity similar to those that have been made in the examples disclosed herein.

Structure	Name	Formula / Exact Mass, amu
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((pyrazin-2-yloxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₀ H ₁₈ F ₂ N ₄ O ₂ 384.14

	(3-((1,2,4)triazolo[1,5-a]pyrazin-6-yloxy)methyl)bicyclo[1.1.1]pentan-1-yl(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	C ₂₁ H ₁₈ F ₂ N ₆ O ₂ 424.15
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((pyrazin-2-yloxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₀ H ₁₈ F ₂ N ₄ O ₂ 384.14
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((imidazo[1,2-a]pyrazin-6-yloxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₂ H ₁₉ F ₂ N ₅ O ₂ 423.15
	5-((3-(5-(3-fluoro-5-(hydroxymethyl)phenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	C ₂₂ H ₂₀ FN ₅ O ₃ 421.16
	5-((3-(5-(3,5-difluoro-4-(hydroxymethyl)phenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)pyrazine-2-carbonitrile	C ₂₂ H ₁₉ F ₂ N ₅ O ₃ 439.15
	6-((3-(5-(3,5-difluoro-4-(methoxymethyl)phenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)nicotinonitrile	C ₂₄ H ₂₂ F ₂ N ₄ O ₃ 452.17

	6-((3-(5-(4-(aminomethyl)-3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)-bicyclo[1.1.1]pentan-1-yl)-methoxy)nicotinonitrile	C ₂₃ H ₂₁ F ₂ N ₅ O ₂ 437.17
	(3-(((5-(1H-pyrazol-4-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₆ O ₂ 464.18
	(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((5-(1-methyl-1H-imidazol-4-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₅ H ₂₄ F ₂ N ₆ O ₂ 478.19
	(3-(((5-(1H-imidazol-4-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₆ O ₂ 464.18
	(3-(((5-(1H-pyrazol-1-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₆ O ₂ 464.18
	(3-(((5-(1H-imidazol-1-yl)pyrazin-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)(5-(2,5-difluoro-4-methylphenyl)-4,5-dihydro-1H-pyrazol-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₆ O ₂ 464.18

	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((1-methyl-1H-indazol-5-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₄ O ₂ 436.17
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((1-methyl-1H-benzo[d]imidazol-5-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₄ H ₂₂ F ₂ N ₄ O ₂ 436.17
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((1-methyl-1H-pyrazol-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₀ H ₂₀ F ₂ N ₄ O 386.16
	3-((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)isoxazole-5-carbonitrile	C ₂₀ H ₁₆ F ₂ N ₄ O ₃ 398.12
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-((isoxazol-4-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₁₉ H ₁₇ F ₂ N ₃ O ₃ 373.12
	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((5-methyl-1,3,4-thiadiazol-2-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₁₉ H ₁₈ F ₂ N ₄ O ₂ S 404.11

	(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazol-1-yl)(3-(((1-methyl-1H-imidazol-5-yl)oxy)methyl)bicyclo[1.1.1]pentan-1-yl)methanone	C ₂₀ H ₂₀ F ₂ N ₄ O ₂ 386.16
	3-(((3-(5-(3,5-difluorophenyl)-4,5-dihydro-1H-pyrazole-1-carbonyl)bicyclo[1.1.1]pentan-1-yl)methoxy)-1-methyl-1H-pyrazole-5-carbonitrile	C ₂₁ H ₁₉ F ₂ N ₅ O ₂ 411.15

[0657] The activity of the compounds of Examples 1-343 as RIPK1 inhibitors is illustrated in the following assays.

Biological Activity Assays

[0658] Compounds described herein have been shown to bind RIPK1 *in vitro*, and to inhibit phosphorylation of a downstream molecular target in a cellular assay.

ADP-Glo Kinase Assay

[0659] In order to measure RIPK1 activity the ADP-Glo kinase assay (Promega, Catalog #V7002) was used to measure the conversion of ATP to ADP. This enzymatic assay was performed in a 384-well white, Optiplate (Perkin Elmer, Catalog #6007299) with assay buffer consisting of 50mM HEPES pH 7.5 (Gibco, Catalog #15630-080), 50mM NaCl (Teknova, Catalog #S0252), 30mM MgCl₂ (Ambion, Catalog #AM9530G), 1mM DTT (Santa Cruz Biotechnology, Catalog #sc-29089), 0.05% BSA (Sigma, Catalog #A3059-50G) and 0.02% CHAPS (Sigma, Catalog #C5070-5G). Stock solutions of the test compounds were prepared in 100% DMSO (Sigma, Catalog #D2650) and serially diluted 1:3 using 100% DMSO. Compounds were additionally diluted 1:40 in assay buffer, and 2μL / well were transferred to the assay plate. 4μL / well (final concentration of 5nM) of RIPK1 protein (SignalChem, Catalog #R07-11G-05) diluted in assay buffer and added to the assay plate followed by a 10 minute preincubation at rt. 4μL / well of ATP (Promega, Catalog #V7002) (final concentration of 50μM) diluted in assay buffer were then added to the assay plate followed by a 6 h reaction time. Final concentrations of RIPK1 and ATP refer to a 10μL volume. Luminescence was measured using a BioTek SynergyTM NEO plate reader. IC₅₀ values were

calculated using a four-parameter logistic curve fit using Genedata Screener software. Results are shown below in Table 2, where the average value across multiple runs is given.

Table 7. RIPK1 activity

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
1	40
2	21190
3	51
4	19
5	17
6	23
7	21
8	28
9	16
10	2912
11	20
12	243
13	1510
14	12
15	22
16	12857
17	570
18	70
19	363
20	1114
21	70
22	11
23	30
24	38845
25	(a)
26	59
27	14
28	32

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
29	213
30	124
31	55
32	196
33	466
34	1073
35	4630
36	19254
37	(a)
38	(a)
39	(a)
40	4451
41	31
42	31
43	1702
44	38
45	8593
46	157
47	93
48	186
49	22
50	16
51	22
52	24
53	24
54	409
55	896
56	19

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
57	32
58	34
59	43
60	44
61	45
62	46
63	104
64	10
65	11
66	16
67	19
68	20
69	22
70	34
71	39
72	78
73	111
74	124
75	323
76	5387
77	7114
78	12951
79	425
80	24732
81	11
82	11
83	16
84	22

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
85	18
86	19
87	21
88	24
89	25
90	(a)
91	(a)
92	56
93	79
94	109
95	151
96	162
97	219
98	240
99	280
100	284
101	486
102	1996
103	2661
104	3046
105	(a)
106	371
107	183
108	206
109	42
110	134
111	43
112	73

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
113	4232
114	>16667, 8899
115	(a)
116	(a)
117	(a)
118	(a)
119	(a)
120	(a)
121	(a)
122	998
123	501
124	156
125	2798
126	49
127	158
128	17
129	515
130	238
131	375
132	139
133	20
134	24
135	18
136	20
137	379
138	113
139	95
140	49

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
141	34
142	79
143	122
144	145
145	169
146	324
147	30
148	80
149	3933
150	5455
151	242
152	98
153	204
154	4860
155	814
156	38
157	42
158	24
159	1123
160	82
161	50
162	46
163	114
164	57
165	27
166	308
167	306
168	865

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
169	343
170	4672
171	670
172	4347
173	9.1
174	48
175	16
176	19
177	54
178	103
179	9.6
180	392
184	136
185	32
186	113
187	447
188	454
189	27
190	30
191	74

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
192	80
193	292
194	32
199	8.3
202	32
208	2268
210	9.4
212	11
213	33
218	25
219	47
222	220
226	35
228	433
230	93
233	223
234	211
248	23
252	43
253	51

Ex. No.	RIPK1 Enzyme Avg IC50 (nM)
255	49
258	1013
260	528
261	4522
320	19
321	18
325	21
326	37
327	75
328	116
330	11
331	13
332	19
333	16
334	18
335	18
336	31
337	24
338	26

(a) > 50,000

Human U937 Cellular Necroptosis Assay

[0660] The human monocytic cell line U937 (CRL-1593.2) was purchased from ATCC. The cells were routinely maintained in RPMI-1640 Medium (Gibco, Catalog #11875-093) supplemented with 10% heat inactivated fetal bovine serum (Gibco, Catalog #16140-071), 100 units / mL penicillin and 100µg / mL streptomycin (Gibco, Catalog #15140-122), in a humidified incubator (37°C, 5% CO₂). For the assay, cells were resuspended in RPMI-1640 phenol red free Media (Gibco, Catalog # 11835-030) supplemented with 10% fetal bovine

serum (Sigma, Catalog #F2442), 100units / mL penicillin and 100ug / mL streptomycin. Cells were stimulated with 25ng / mL human TNFalpha (Cell Sciences, Catalog #CSI15659B) and 25μM z-VAD-FMK (R&D Systems, Catalog #FMK001) followed by seeding 5000 cells per well in a volume of 40μL to a white, CulturPlate-384 (Perkin Elmer, Catalog #6007680). Stock solutions of the test compounds were prepared in 100% DMSO (Sigma, Catalog #D2650) and serially diluted 1:3 using 100% DMSO. Compounds were additionally diluted 1:40 in assay medium, and 10μL / well was transferred to the plate. Following the compound addition the plate was incubated at 37°C and 5% CO₂ for 22 h. After 22 h, viability was assessed with the addition of 20μL of Cell Titer-Glo 2.0 (Promega, Catalog #G9243). The tissue culture plate was shaken on an orbital shaker at 300RPM for 15 minutes at rt in the dark. Luminescence was measured using a PerkinElmer Envision™ plate reader. IC₅₀ values were calculated using a four-parameter logistic curve fit using Genedata Screener software. Results are shown below in Table 3, where the average value across multiple runs is given.

Table 8. hU937 activity

Ex. No.	hU937 Avg IC ₅₀ (nM)
3	112
4	9
5	20
6	20
7	18
8	51
9	62
11	18
12	887
14	24
16	>10000
18	284
21	114
22	5

Ex. No.	hU937 Avg IC ₅₀ (nM)
23	158
26	472
27	167
28	193
29	647
30	708
31	462
41	272
42	51
43	4208
47	1112
48	1295
49	67
50	36

Ex. No.	hU937 Avg IC ₅₀ (nM)
51	40
52	16
54	2641
55	8926
56	63
57	110
58	160
59	226
60	178
61	211
62	133
63	238
64	7
65	44

Ex. No.	hU937 Avg IC ₅₀ (nM)
67	54
68	34
69	44
70	26
71	134
72	98
73	527
74	514
81	12
82	31
83	67
84	3
85	24
87	33
88	94
89	137
92	518
93	398
94	994
101	1343
106	1467
109	470
110	734
111	249
112	285
124	751
126	440
127	1256
128	48

Ex. No.	hU937 Avg IC ₅₀ (nM)
129	3858
130	1240
131	1925
132	826
133	10
134	46
135	53
136	58
137	2687
138	417
139	493
140	53
141	58
142	750
143	495
144	1184
145	701
146	1916
147	142
148	912
151	1189
152	363
153	553
155	5294
156	159
157	170
158	62
159	3611
160	404

Ex. No.	hU937 Avg IC ₅₀ (nM)
161	157
162	210
163	730
164	214
165	193
166	1971
167	1878
168	6188
169	3313
170	9890
171	3699
172	>10000
173	53
174	63
175	47
176	87
177	536
178	228
184	1243
185	77
186	682
192	197
193	1392
194	155
195	1.5
196	631
197	0.77
198	7.4
199	9.3

Ex. No.	hU937 Avg IC ₅₀ (nM)
200	8558
201	7.1
202	18
203	5.5
204	22
205	436
206	109
207	633
208	4300
209	362
210	10
211	16
212	19
213	63
214	71
215	80
216	92
217	99
218	113
219	292
220	312.
221	992
222	1100
223	9745
224	51
225	92
226	51
227	133
228	2405

Ex. No.	hU937 Avg IC ₅₀ (nM)
229	5058
230	407
231	3040
232	8108
233	1194
234	1969
235	339
236	3.8
237	7.8
238	8.4
239	10
240	13
241	18
242	20
243	31
244	37
245	43
246	73
247	81
248	186
249	299
250	267
251	397
252	436
253	479
254	503
255	550
256	895
257	2075

Ex. No.	hU937 Avg IC ₅₀ (nM)
258	3825
259	5452
260	5605
261	9471
262	4672
263	9497
264	12
265	8.3
266	1800
267	3.8
268	3.9
269	5.4
270	16
271	20
272	24
273	30
274	61
275	73
276	76
277	81
278	97
279	104
280	106
281	148
282	153
283	160
284	161
285	164
286	218

Ex. No.	hU937 Avg IC ₅₀ (nM)
287	257
288	276
289	281
290	445
291	620
292	956
293	1497
294	5613
295	5681
296	5854
297	6059
298	6700
299	7012
300	7419
301	7739
302	9872
303	500
304	6.0
305	6.5
306	6.6

Ex. No.	hU937 Avg IC ₅₀ (nM)
307	8.7
308	11
309	13
310	22
311	40
312	62
313	251
314	475
315	666
316	694
317	8508
318	55
319	21
320	30
321	45
322	60
323	153
324	166
325	193
326	204

Ex. No.	hU937 Avg IC ₅₀ (nM)
327	381
328	409
329	1289
330	21
331	28
332	33
333	36
334	45
335	46
336	55
337	140
338	165
339	453
340	54
341	23
342	380
344	56
345	61
346	16

[0661] All references, patents or applications, U.S. or foreign, cited in the application are hereby incorporated by reference as if written herein in their entireties. Where any inconsistencies arise, material literally disclosed herein controls.

[0662] From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention, and without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.