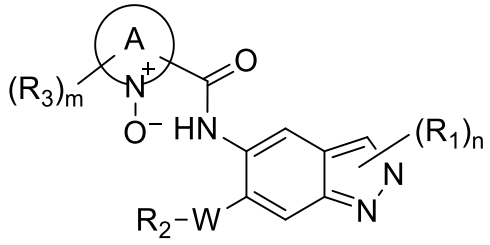
CLAIMS

1. A compound of formula I or a stereoisomer, a racemate, a tautomer, an isotopically labeled compound ~~, a prodrug~~ or a pharmaceutically acceptable salt thereof,



Formula I

wherein,

ring A is 5-14 membered heteroaryl or 5-12 heterocyclyl containing at least one of N;

R_1~~, R_2~~ and R_3 are each independently selected from hydrogen, halogen, CN, OH and the following groups optionally substituted with one, two or more R: (C_1-C_{12})aliphatic hydrocarbyl, (C_1-C_{12})aliphatic hydrocarbyl optionally comprising one, two or more heteroatoms, C_{3-12} cycloalkyl, 3-12 membered heterocyclyl, C_{6-20} aryl or 5-14 membered heteroaryl, and -NR_aR_b;

R_2 is selected from halogen, CN, OH and the following groups optionally substituted with one, two or more R: (C_1-C_{12})aliphatic hydrocarbyl, (C_1-C_{12})aliphatic hydrocarbyl optionally comprising one, two or more heteroatoms, C_{3-12} cycloalkyl, 3-12 membered heterocyclyl, C_{6-20} aryl or 5-14 membered heteroaryl, and -NR_aR_b;

W is selected from O, S, NH and is a single bond;

R_a and R_b are each independently selected from H and (C_1-C_{12})aliphatic hydrocarbyl;

each R is independently selected from halogen, CN, OH, SH, NR_aR_b and the following groups optionally substituted with one, two or more R': (C_1-C_{12})aliphatic hydrocarbyl, (C_1-C_{12})aliphatic hydrocarbyl optionally comprising one, two or more heteroatoms, C_{3-12} cycloalkyl, 3-12 membered heterocyclyl, and C_{6-20} aryl or 5-14 membered heteroaryl;

each R' is independently selected from halogen, CN, OH, SH and NR_aR_b; and

n is selected from 1, 2 and 3; and m is selected from 1, 2, 3, 4, 5 and 6.

2. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to claim 1, wherein the "(C_1-C_{12})aliphatic hydrocarbyl optionally comprising one, two or more heteroatoms" ~~may be~~is selected from (C_1-C_{12})aliphatic hydrocarbyloxy, (C_1-C_{12})aliphatic hydrocarbylthio, (C_1-C_6)aliphatic hydrocarbyloxy(C_1-C_6)aliphatic hydrocarbyl, (C_1-C_6)aliphatic

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hydrocarbylthio(C_1-C_6)aliphatic hydrocarbyl, *N*-(C_1-C_3)aliphatic hydrocarbylamino(C_1-C_6)aliphatic hydrocarbyl, and *N*,*N*-di-(C_1-C_3)aliphatic hydrocarbylamino(C_1-C_6)aliphatic hydrocarbyl;

the "5-14 membered heteroaryl or 5-12 membered heterocyclyl containing at least one N" is selected from pyridine, pyrrole, piperidine and tetrahydropyrrole;

the (C_1-C_{12})aliphatic hydrocarbyl ~~may be~~is selected from (C_1-C_{12})alkyl, (C_2-C_{12})alkenyl and (C_2-C_{12})alkynyl~~, and preferably, the (C_1-C_{12})aliphatic hydrocarbyl may be selected from (C_1-C_6)alkyl, (C_2-C_6)alkenyl and (C_2-C_6)alkynyl~~;

the "halogen" is selected from F, Cl, Br and I; and

the "C_{3-12} cycloalkyl" ~~may be~~is selected from cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl.

3. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to claim 1, wherein, the (C_1-C_{12})aliphatic hydrocarbyl is selected from (C_1-C_6)alkyl, (C_2-C_6)alkenyl and (C_2-C_6)alkynyl.~~,~~

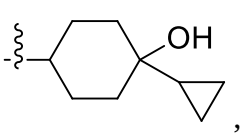
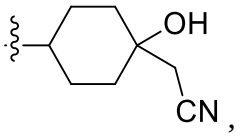
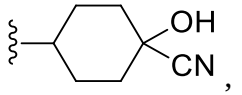
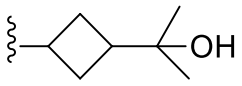
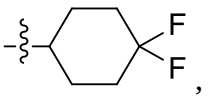
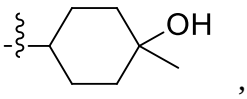
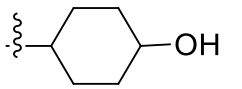
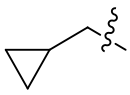
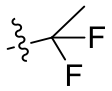
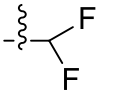
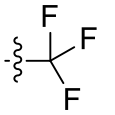
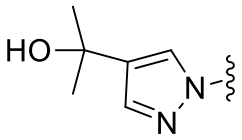
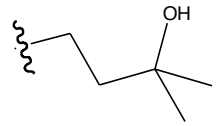
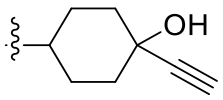
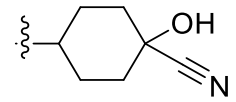
4. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to claim 1, wherein, ring A is 5-14 membered heteroaryl or 5-12 heterocyclyl having one N.

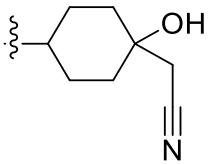
~~3~~5. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound~~, the prodrug~~ or the pharmaceutically acceptable salt thereof according to claim 1 or 2, wherein

the R_1, R_2 and R_3 ~~may be~~are each independently selected from the following groups optionally substituted with one, two or more R: methyl, ethyl, *n*-propyl, isopropyl, *n*-butyl, isobutyl, *tert*-butyl, *n*-pentyl, isopentyl, neopentyl, *n*-hexyl, ethenyl, 1-propenyl, 2-propenyl, 1-methylethenyl, 1-butenyl, 1-ethylethenyl, 1-methyl-2-propenyl, 2-butenyl, 3-butenyl, 2-methyl-1-propenyl, 2-methyl-2-propenyl, 1-pentenyl, 1-hexenyl, ethynyl, 1-propynyl, 2-propynyl, 1-butynyl, 1-methyl-2-propynyl, 3-butynyl, 1-pentynyl, 1-hexynyl, cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, methoxy, ethoxyl, propoxy, butoxy, pentyloxy, methoxymethyl, ethoxylmethyl, propoxymethyl, methoxyethyl, ethoxylethyl, propoxyethyl, methoxypropyl, ethoxylpropyl, propoxypropyl, *N*-methylaminomethyl, *N*-methylaminoethyl, *N*-ethylaminoethyl, *N*,*N*-dimethylaminomethyl, *N*,*N*-dimethylaminoethyl, *N*,*N*-diethylaminoethyl, amino, *N*,*N*-dimethylamino, *N*,*N*-diethylamino, tetrahydropyrrolyl, piperidinyl, pyridyl, pyrazinyl, pyrrolyl, imidazolyl, pyrazolyl, oxazolyl,

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isoxazolyl,

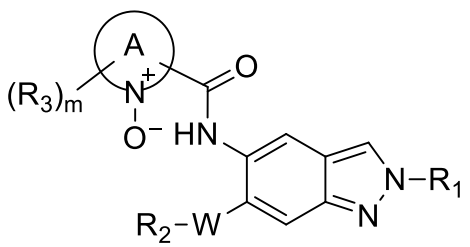















and

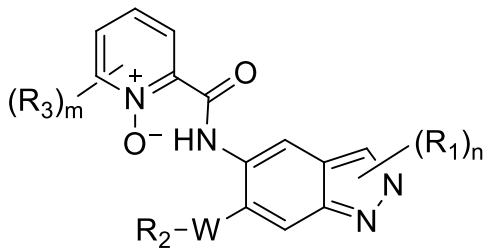

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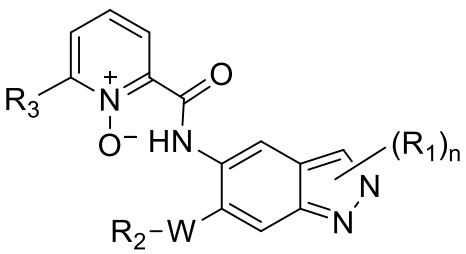
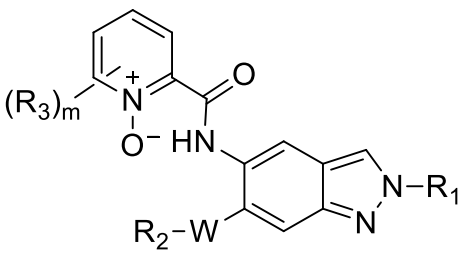
the "" denotes the connection site of the group.

~~4~~6. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to any one of claims 1-3, wherein

in the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof, the compound of formula I ~~may be~~ is selected from the following structures of formula Ia, formula Ib, formula Ic, formula Id and formula Ie:

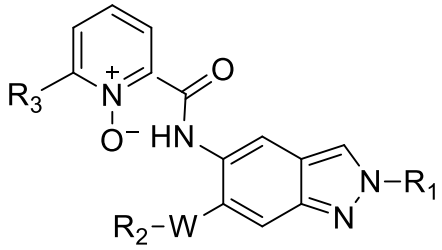

formula Ia


formula Ib

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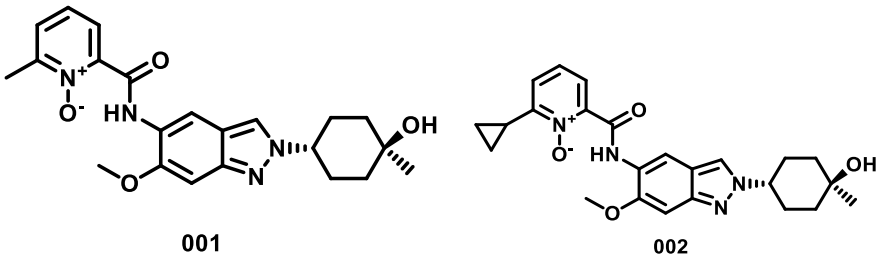
formula Ic formula Id



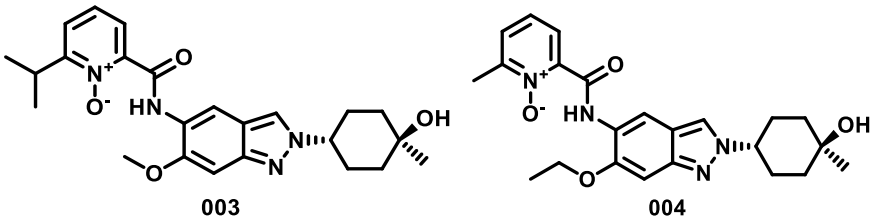
formula Ie

in the formula Ia, formula Ib, formula Ic, formula Id and formula Ie, R_1, R_2, R_3, m, n and W are as defined in formula I.

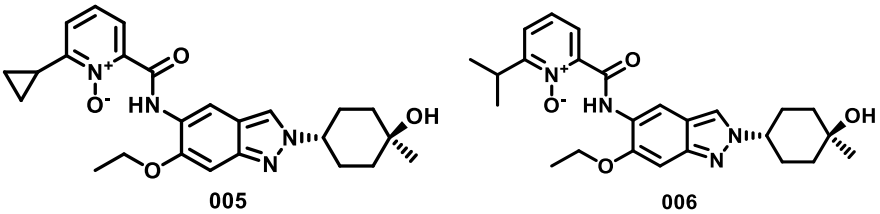
~~5~~7. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to claim 1, wherein the compound of formula I is selected from the following structures:



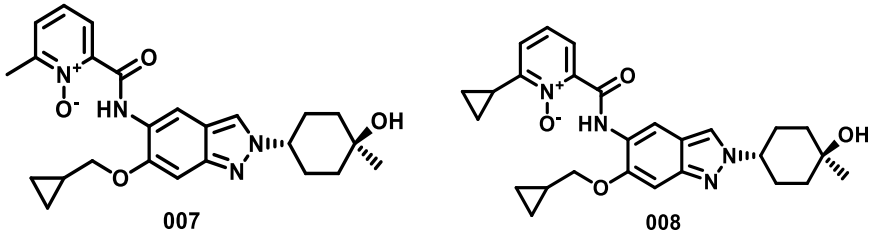
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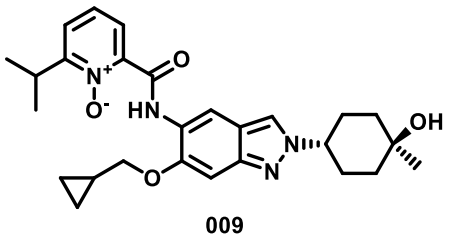


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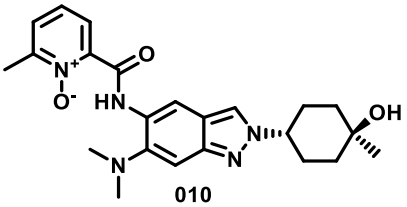


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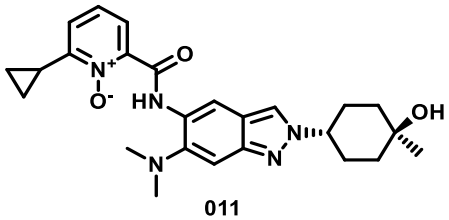
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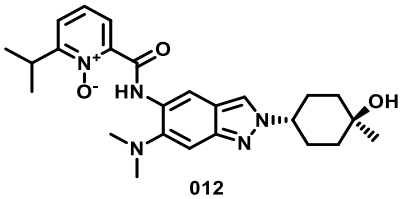
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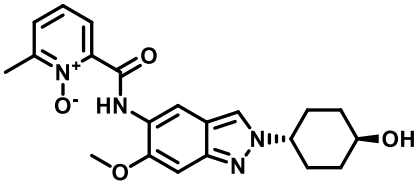
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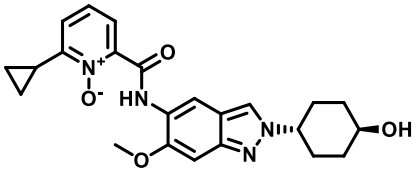
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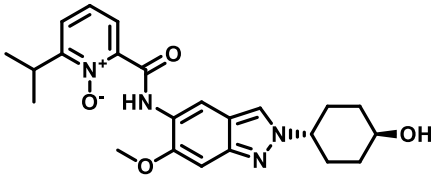
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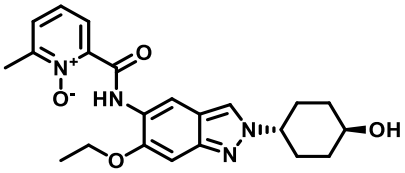
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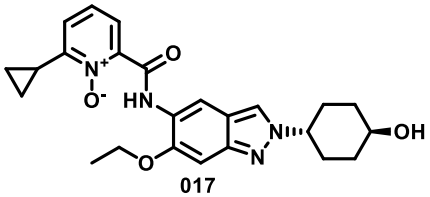
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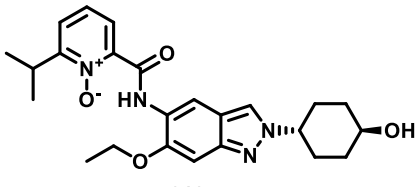
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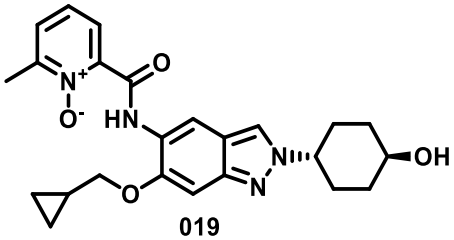
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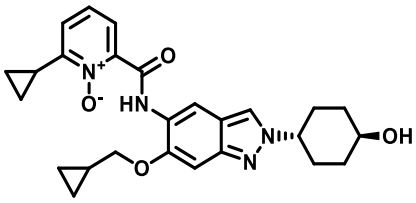
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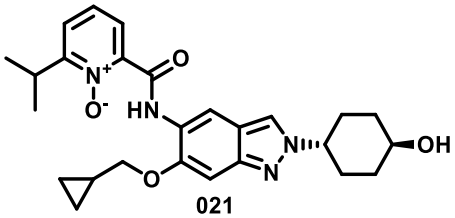
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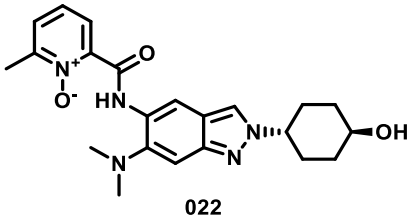
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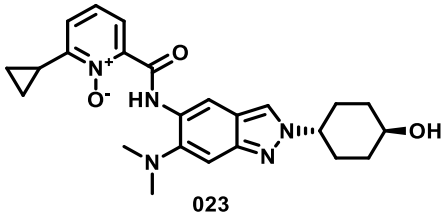
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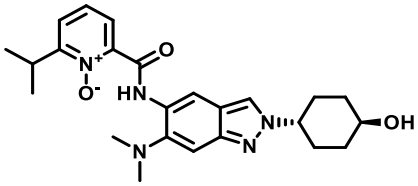
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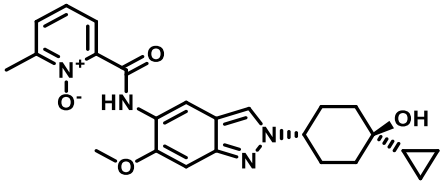
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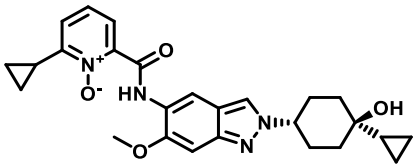
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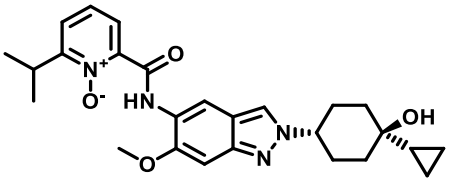
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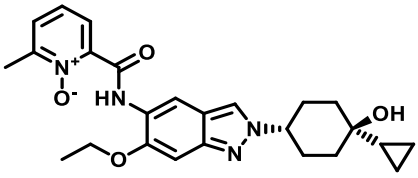
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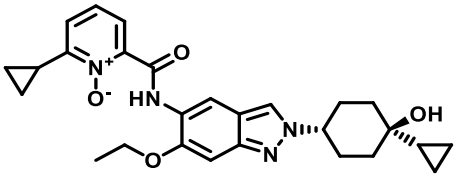
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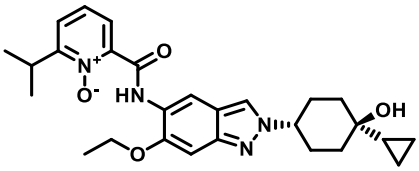
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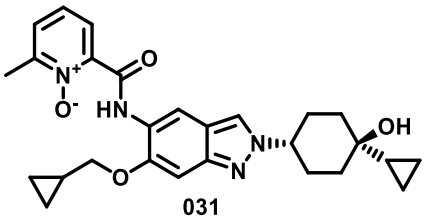
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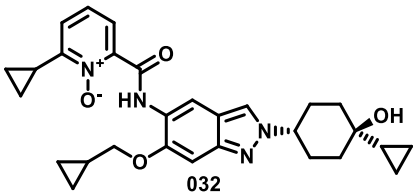
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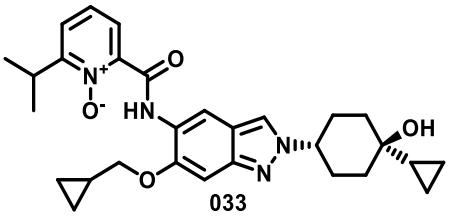
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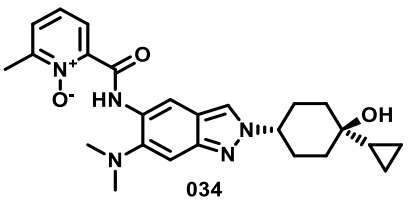
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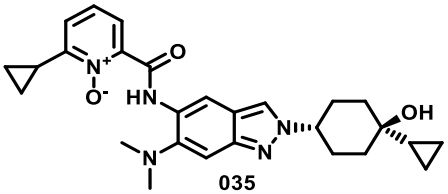
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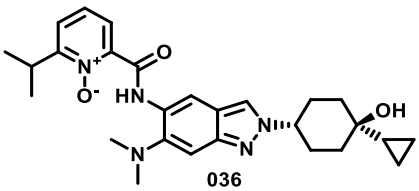
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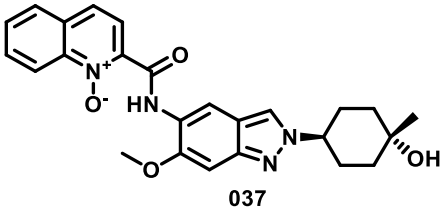
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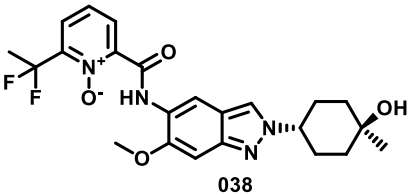
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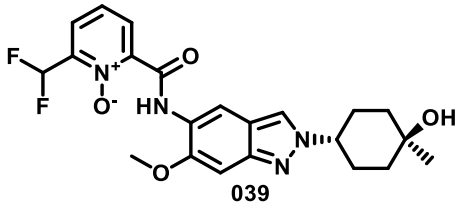
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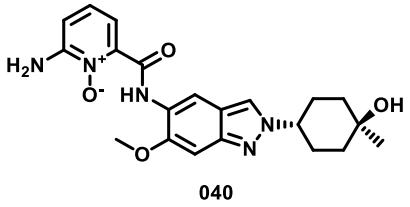
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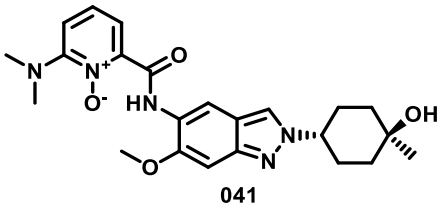
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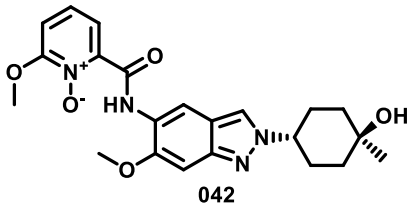
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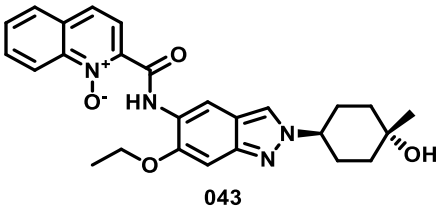
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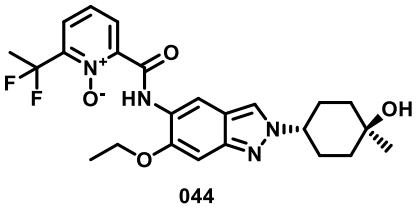
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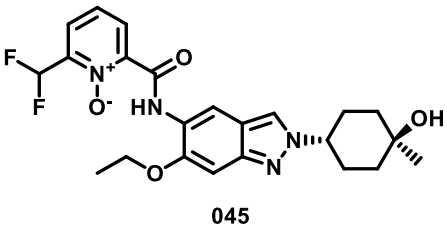
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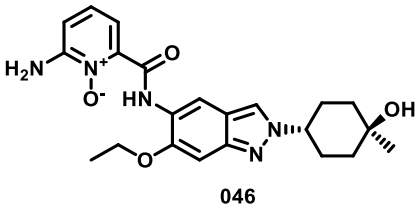
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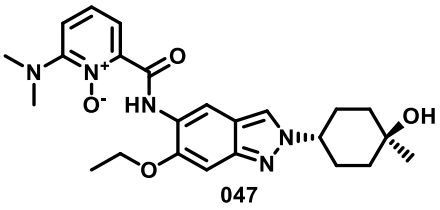
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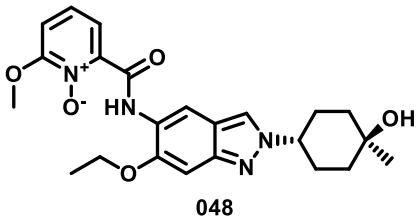
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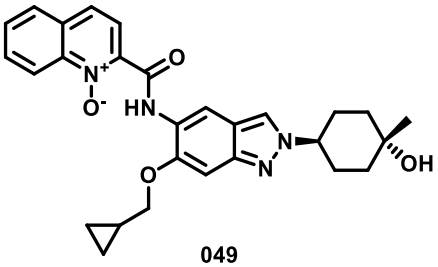
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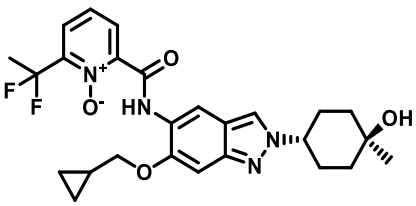
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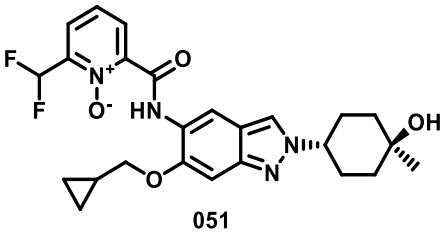
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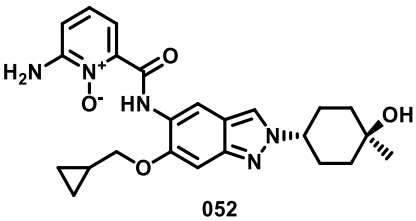
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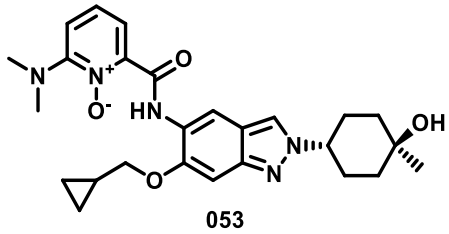


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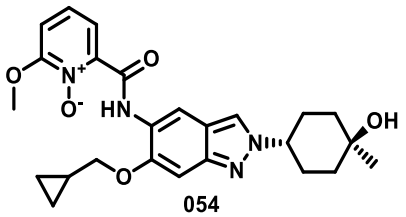


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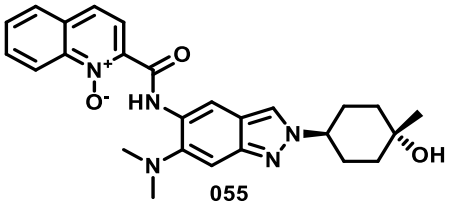
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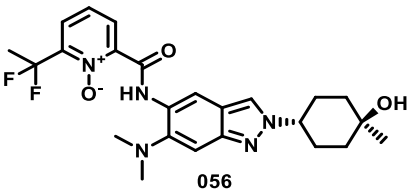
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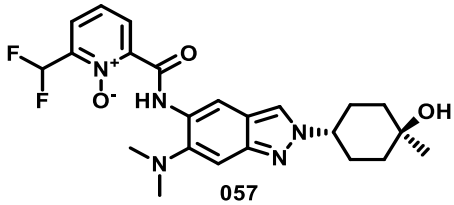
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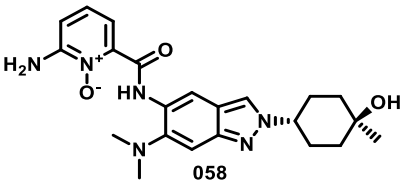
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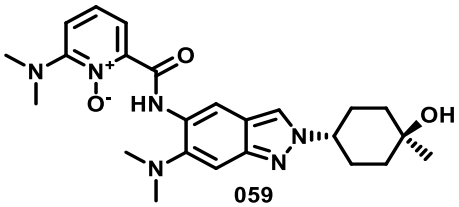
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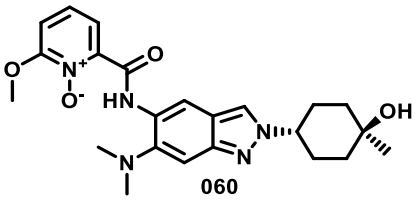
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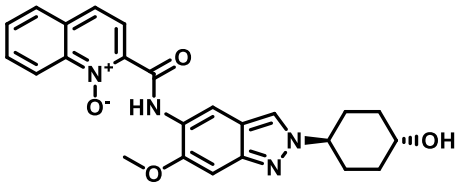
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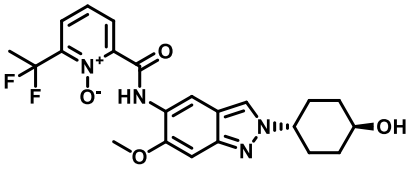
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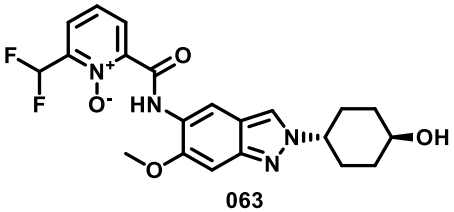
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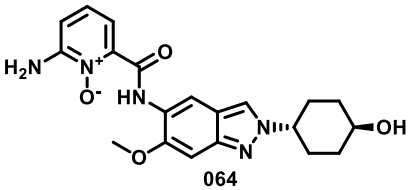
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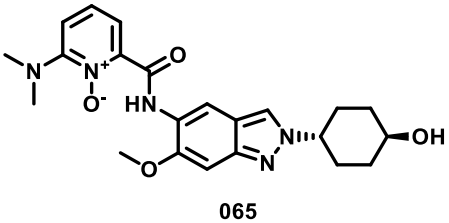
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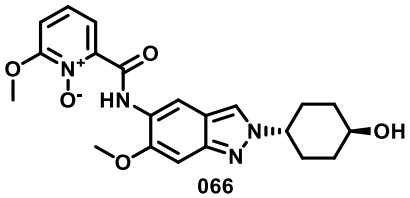
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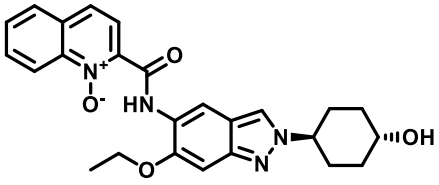


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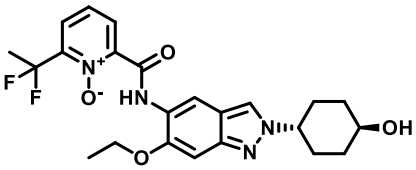


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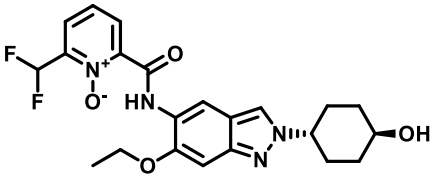
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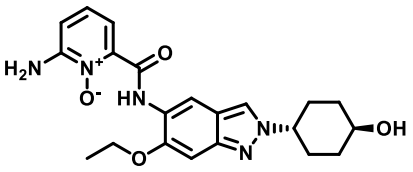
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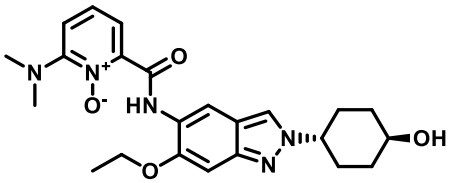
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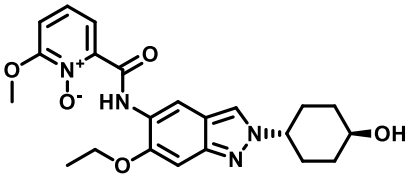
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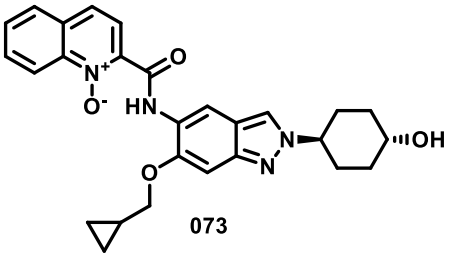
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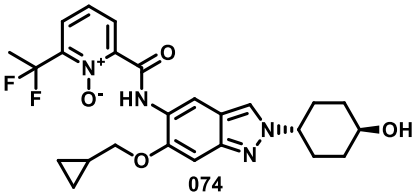
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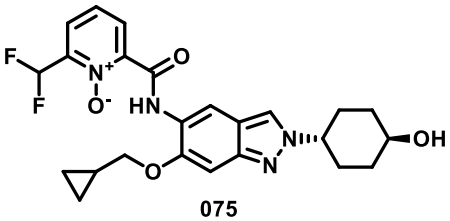
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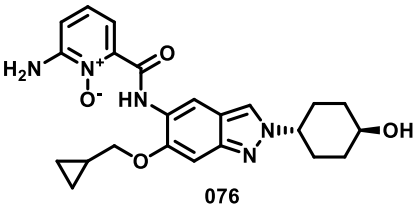
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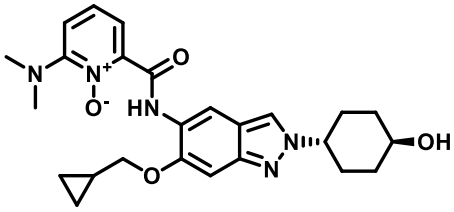
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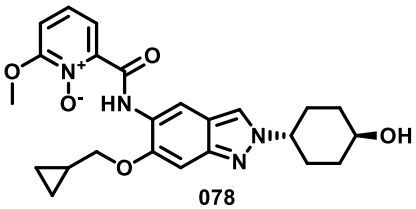
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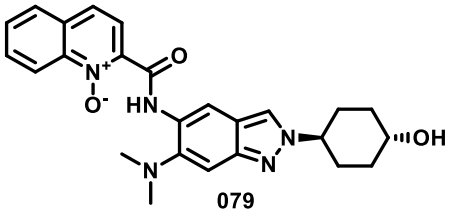
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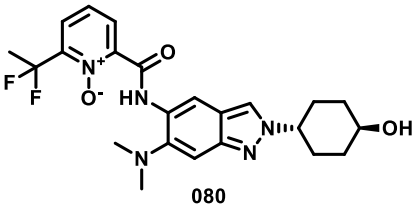
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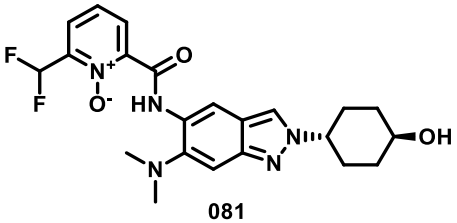
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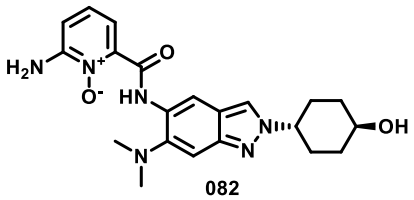
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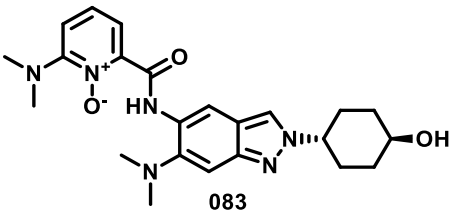
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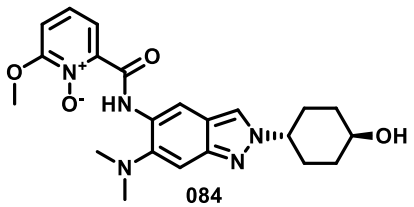
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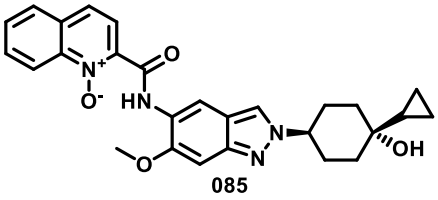
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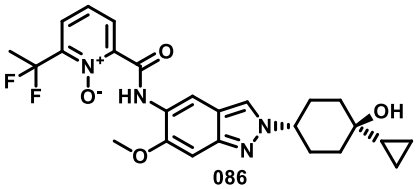
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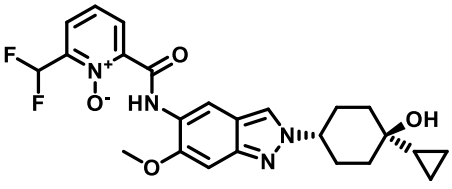
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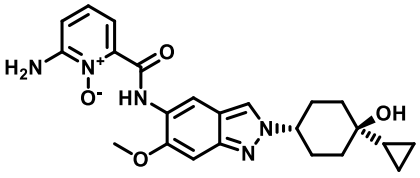
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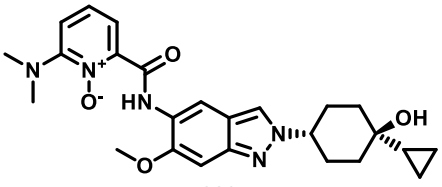
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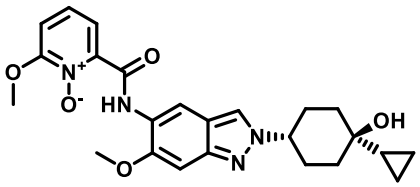
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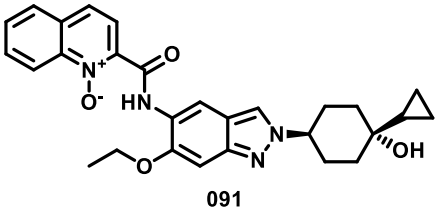
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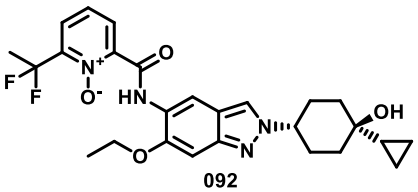
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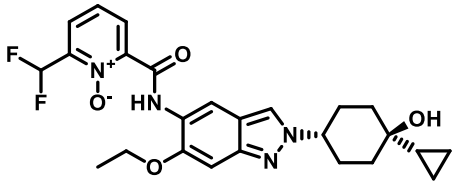
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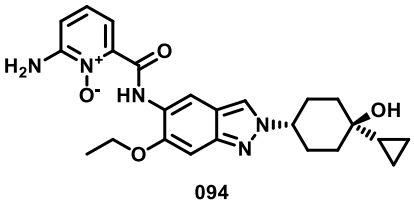
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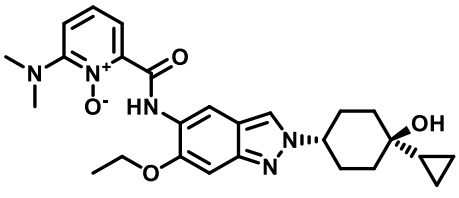
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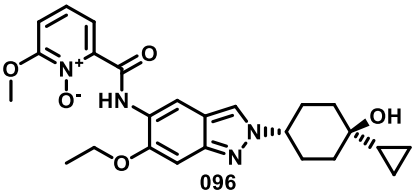
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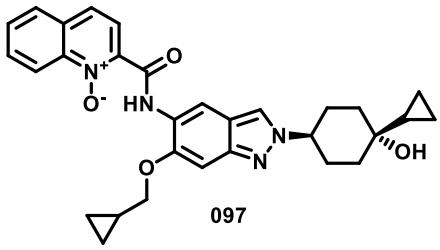


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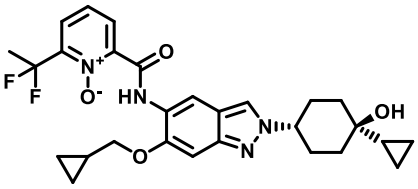


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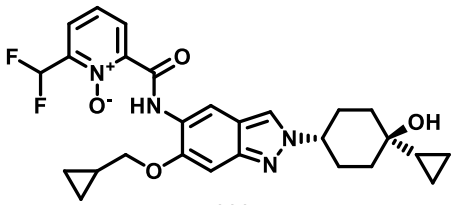
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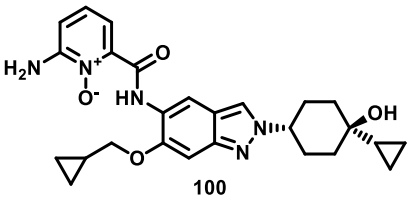
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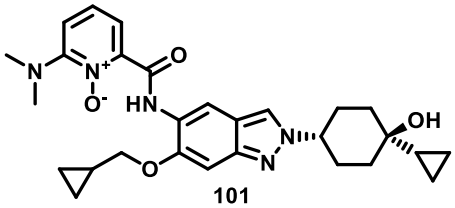
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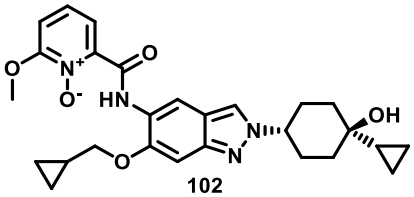
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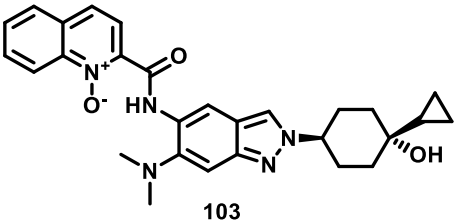
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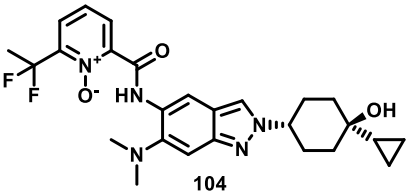
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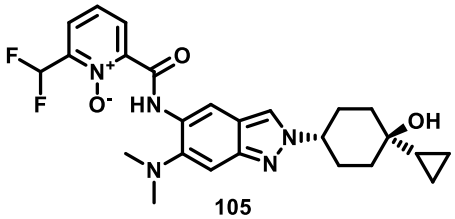
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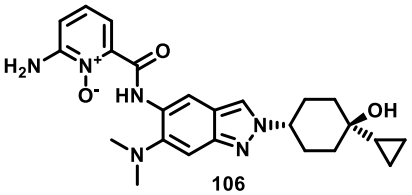
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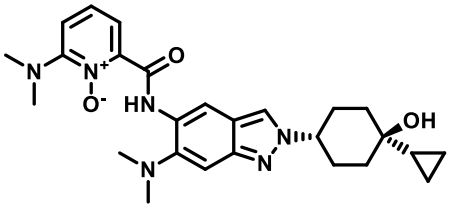
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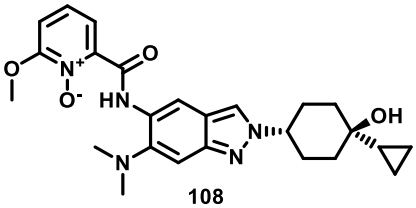
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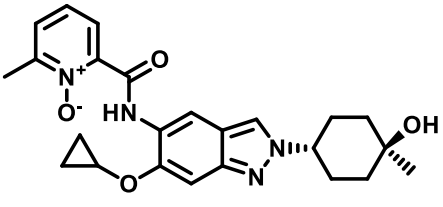
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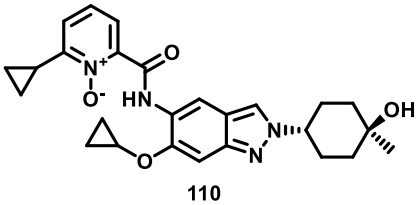
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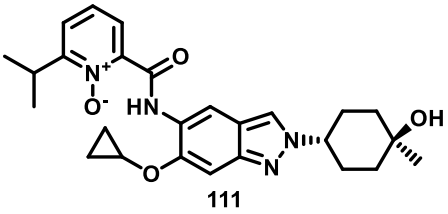


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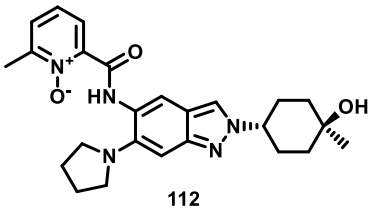


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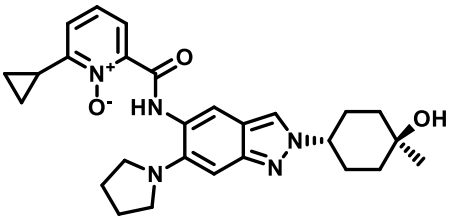
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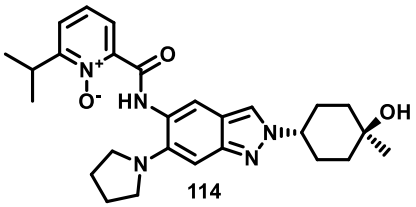
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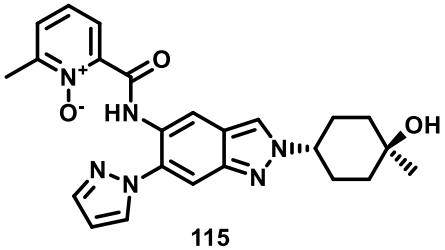
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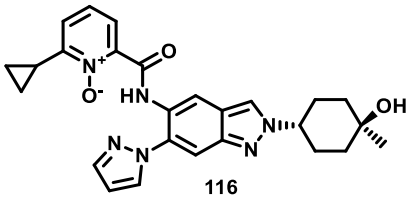
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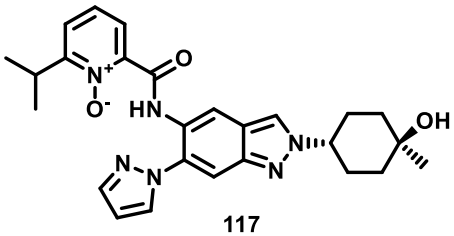
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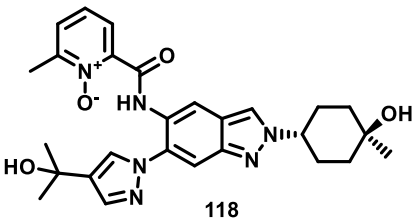
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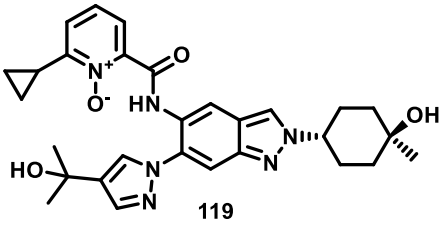
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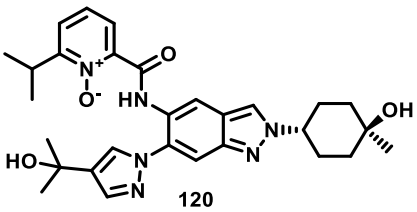
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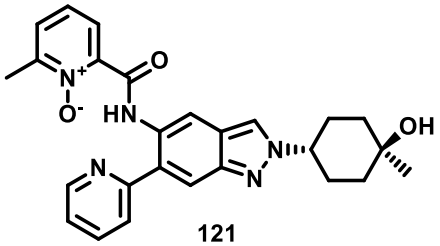
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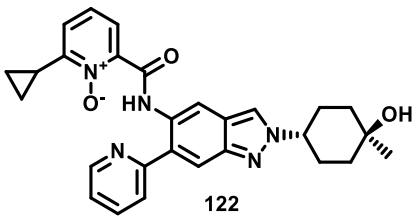
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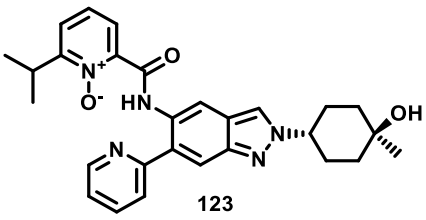
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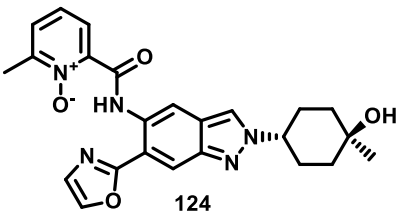
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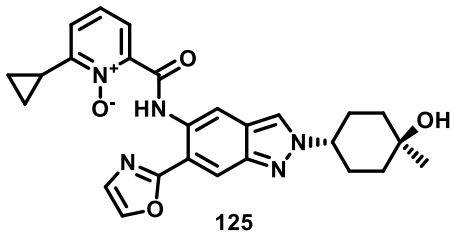
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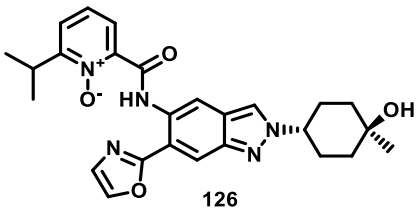


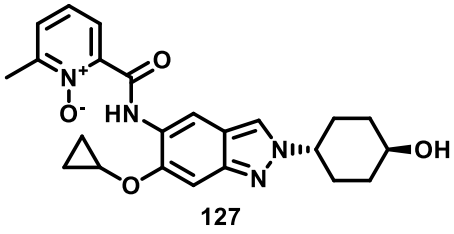
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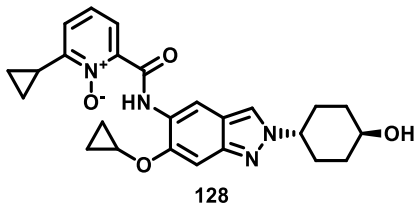
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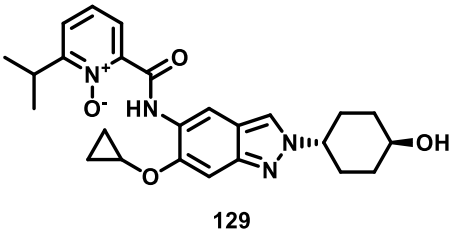
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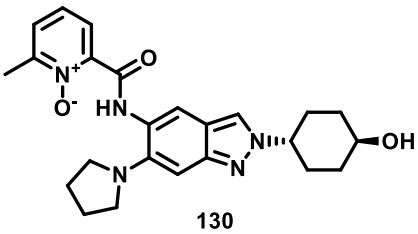

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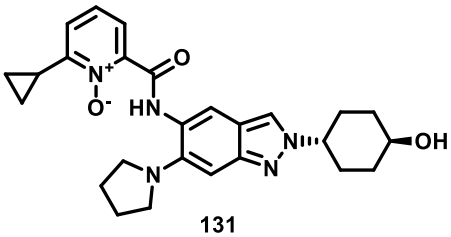

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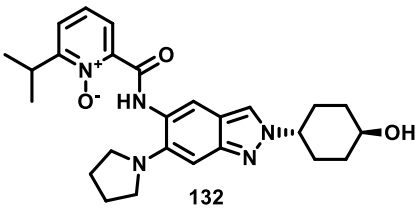

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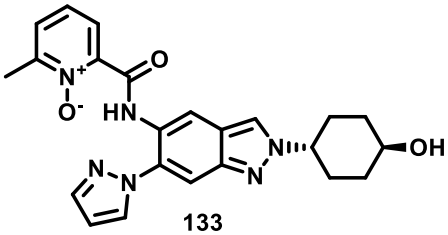

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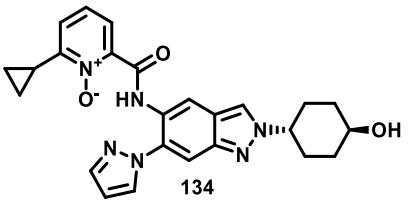

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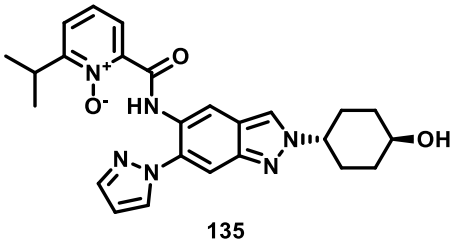

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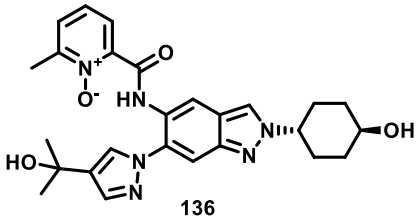

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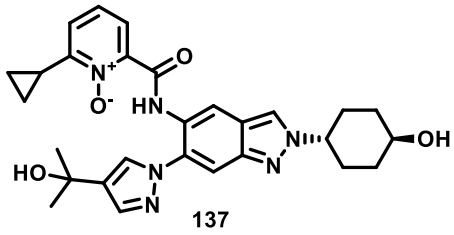

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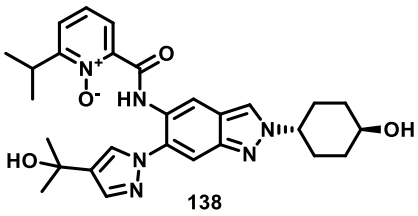

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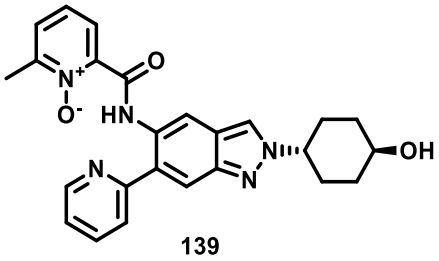

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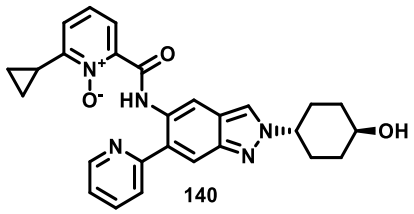

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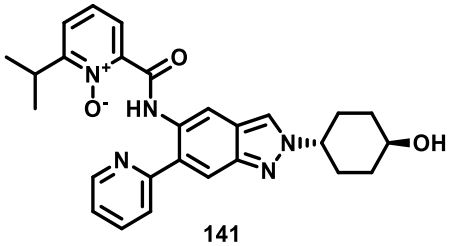
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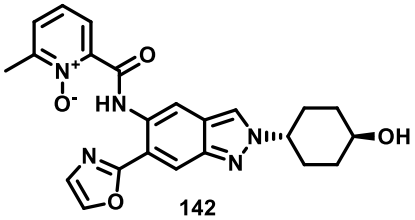
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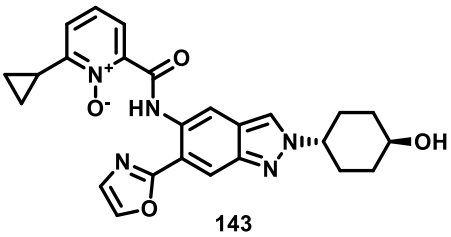
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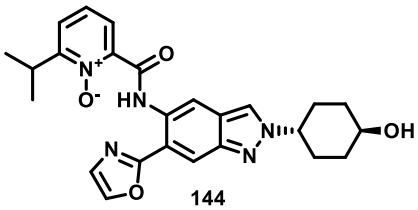
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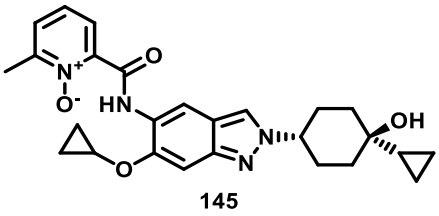
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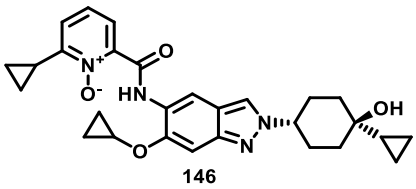
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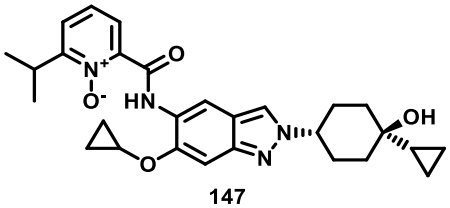
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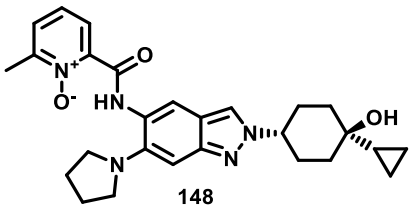
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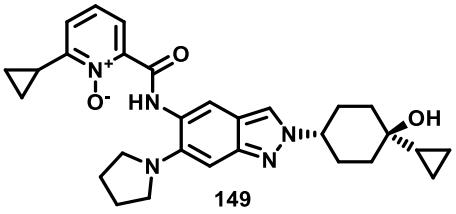
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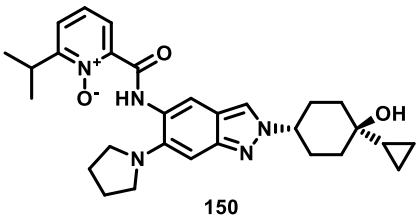
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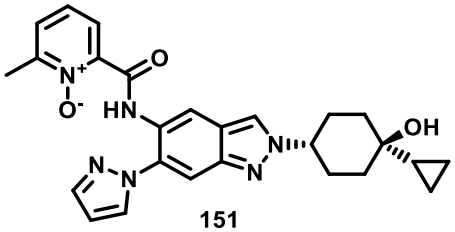
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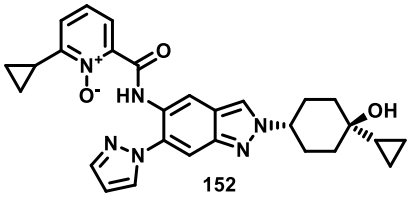
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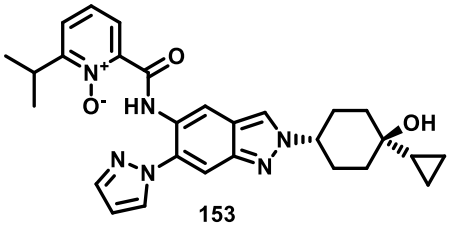


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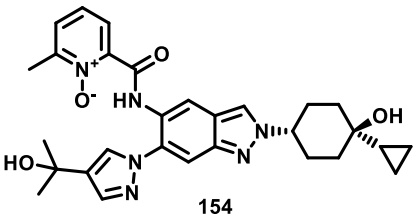


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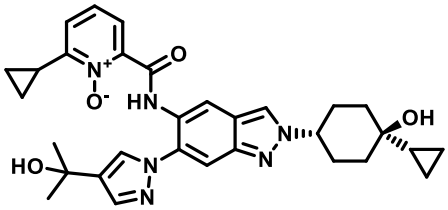
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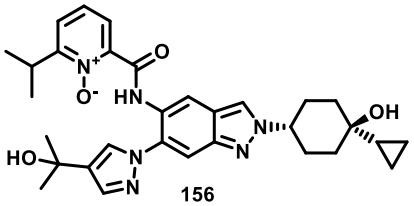
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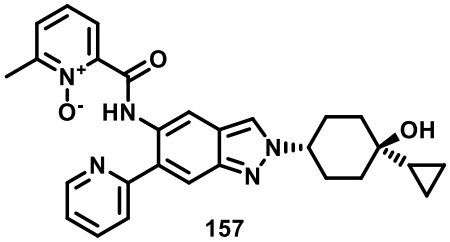
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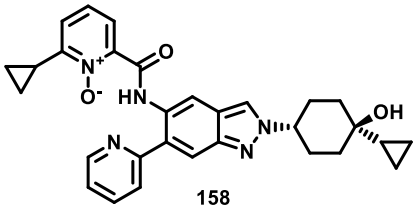
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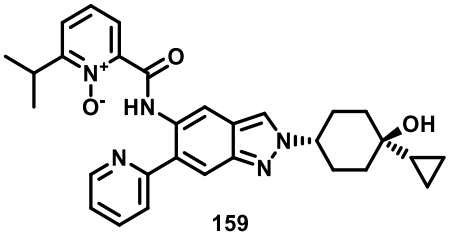
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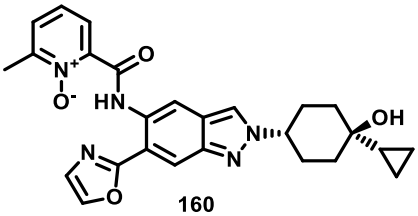
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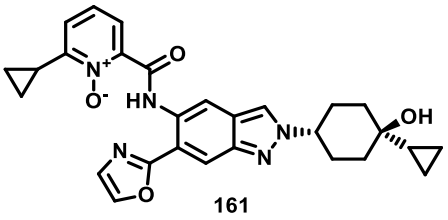
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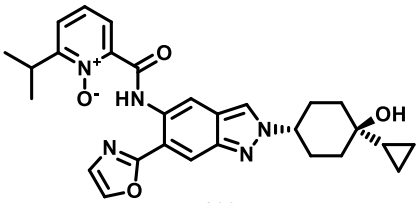
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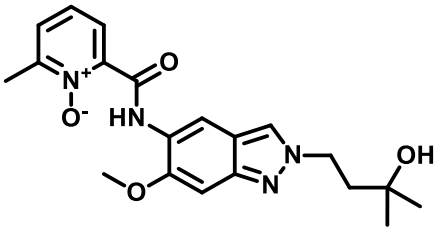
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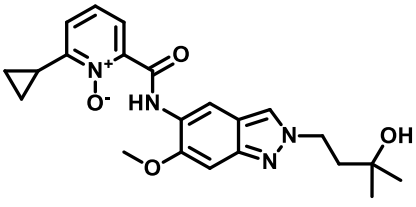
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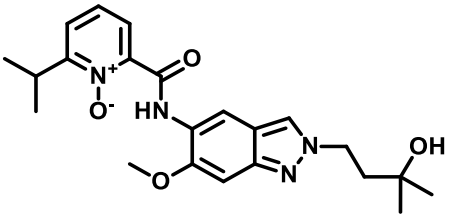
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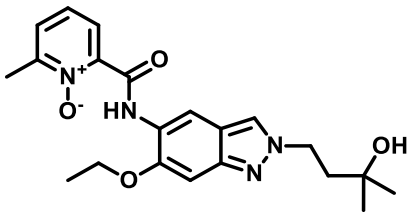
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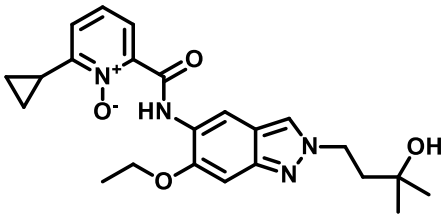
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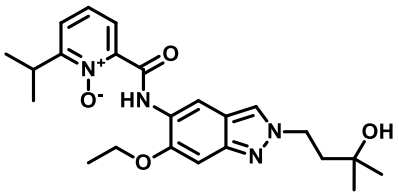
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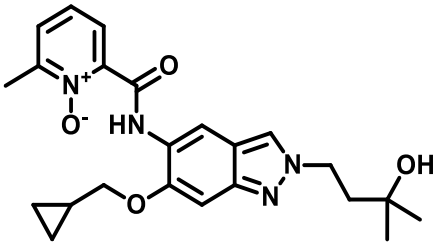
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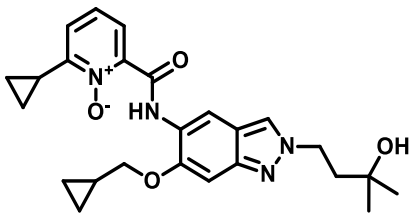
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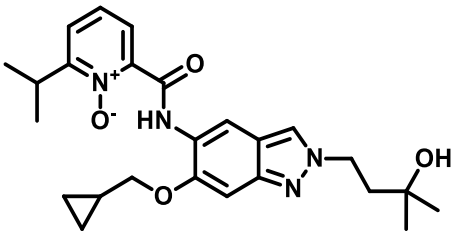
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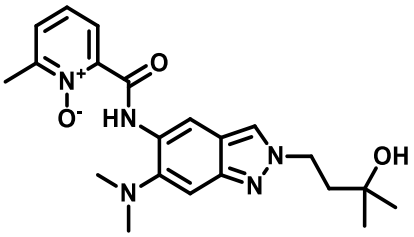
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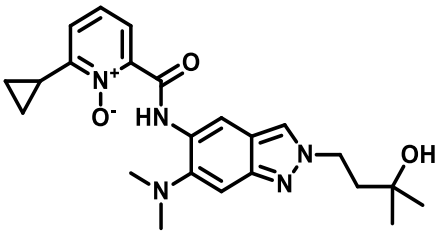
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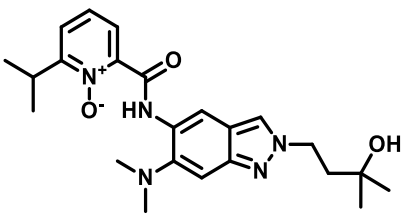
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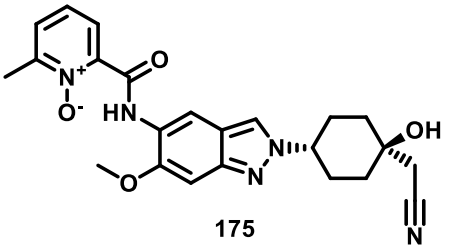
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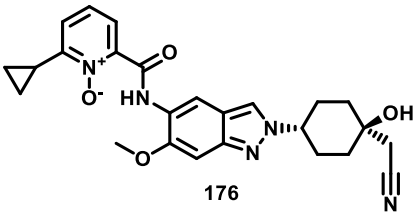


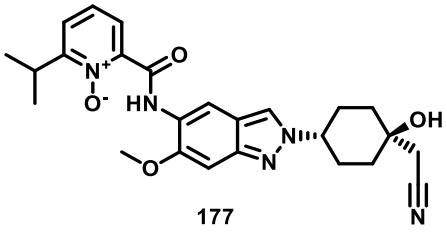
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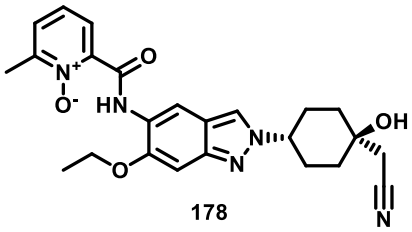
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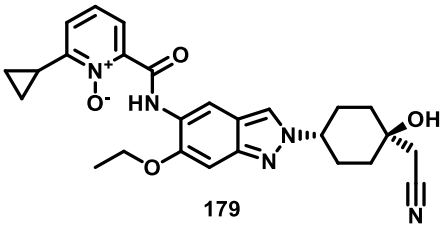
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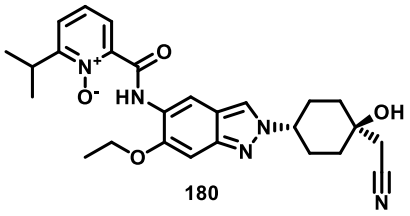

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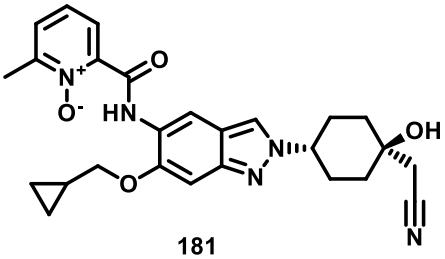

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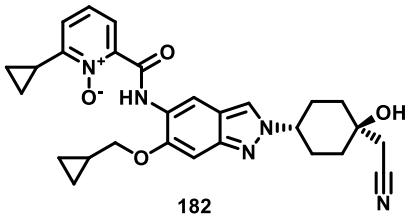

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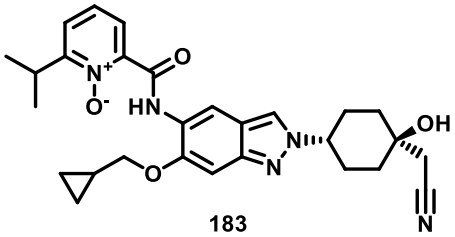

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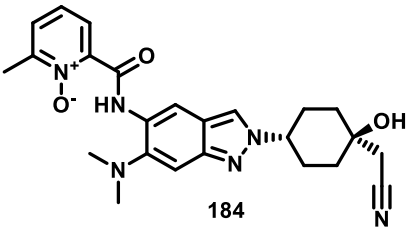

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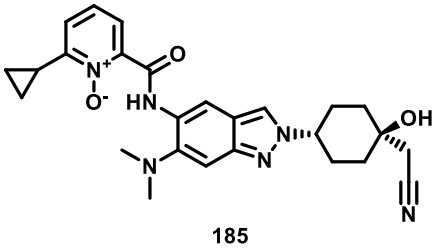

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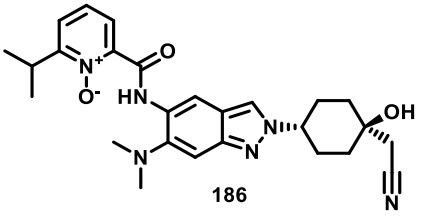

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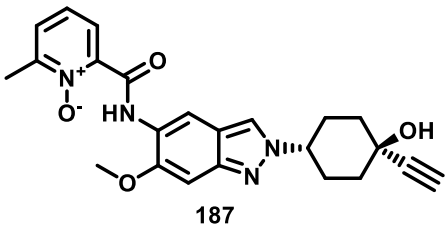

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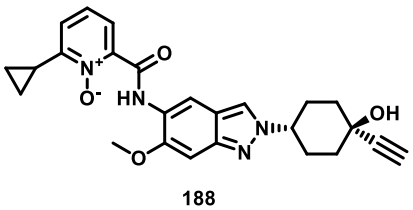

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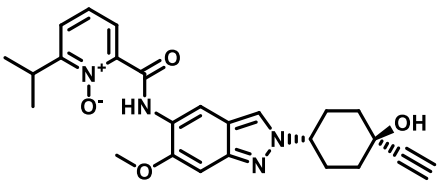

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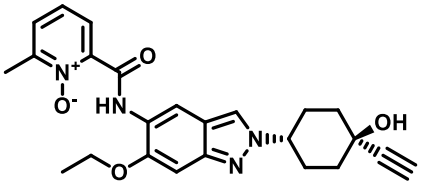

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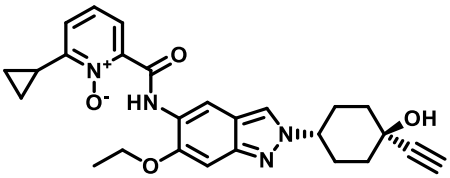
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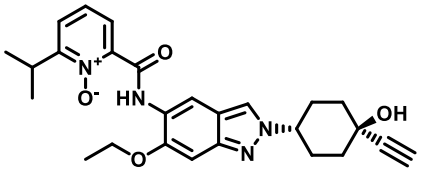
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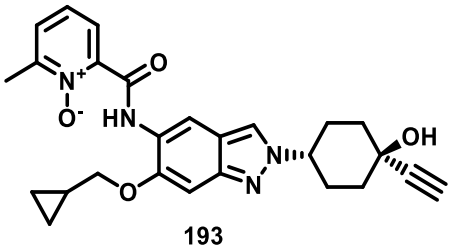
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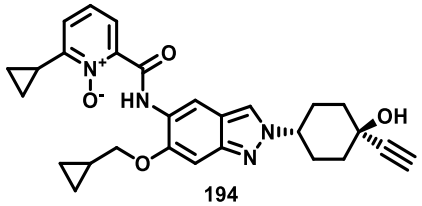
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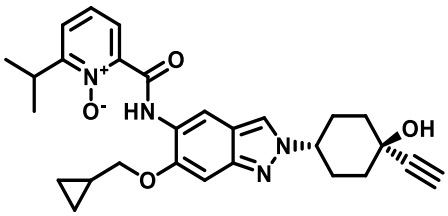
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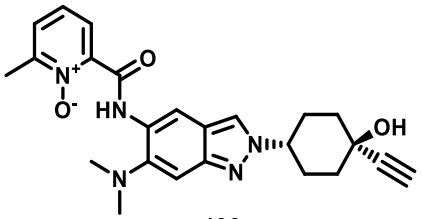
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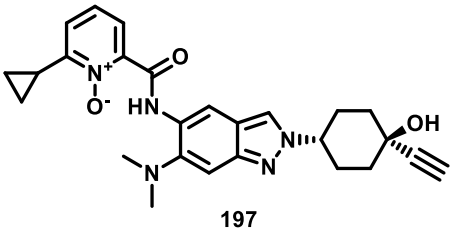
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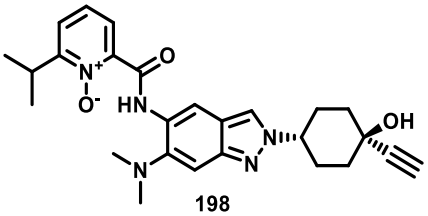
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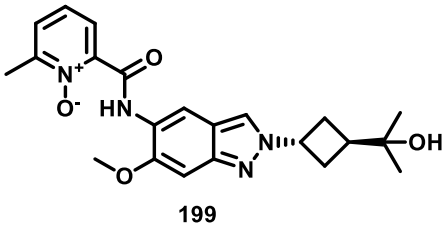
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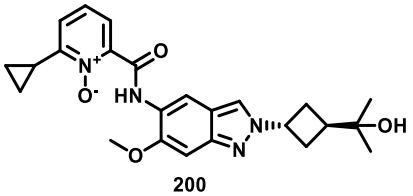
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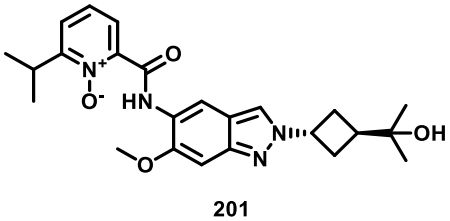
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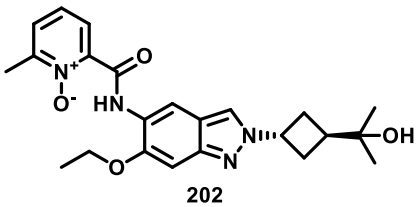
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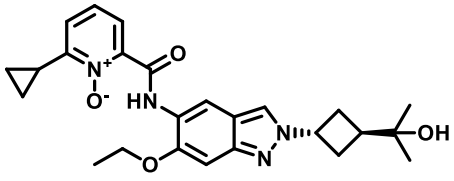
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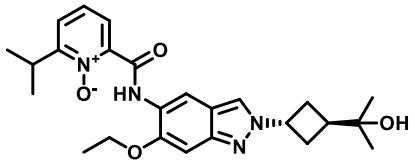
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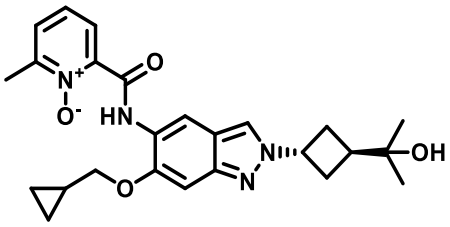
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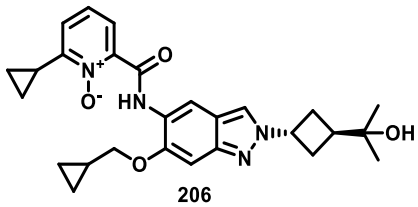
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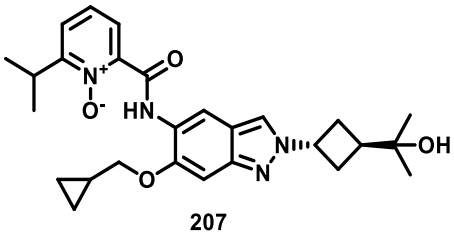
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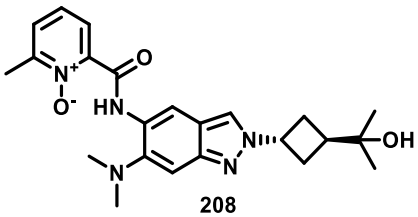
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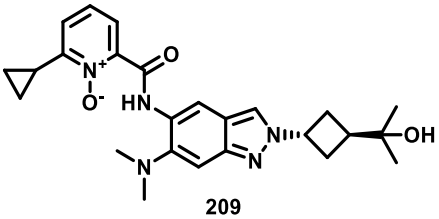
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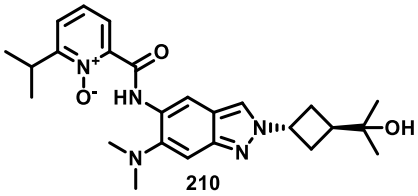
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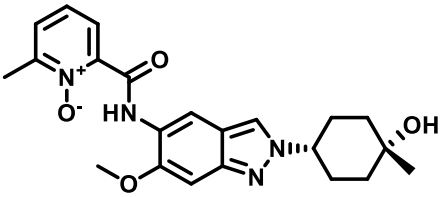
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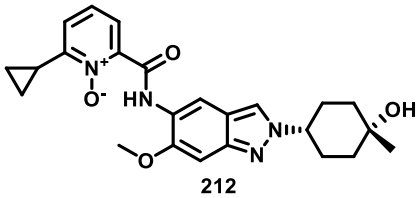
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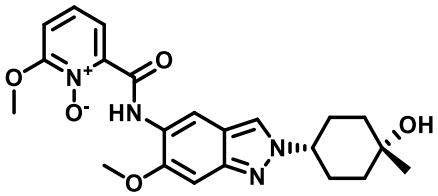
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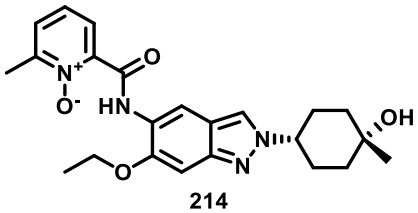
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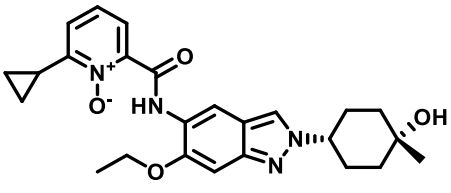
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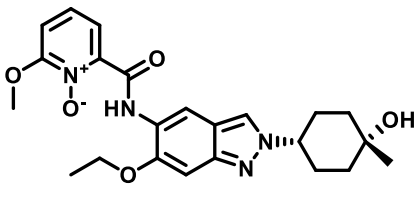
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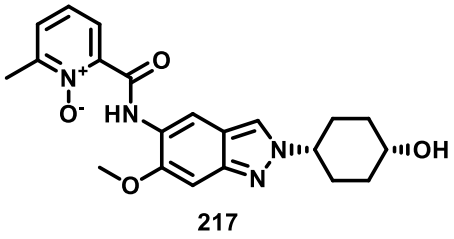


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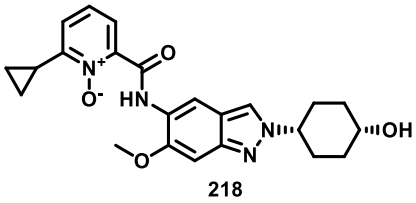


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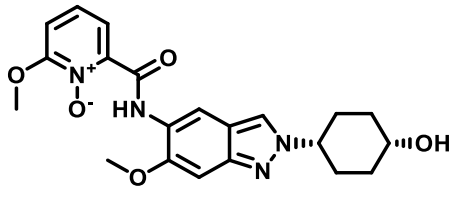
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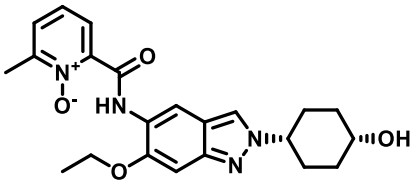
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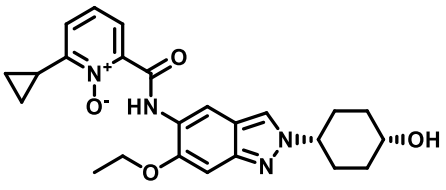
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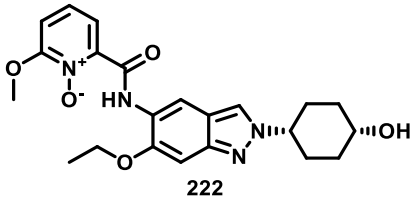
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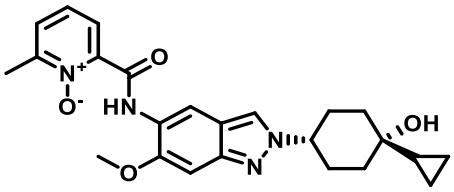
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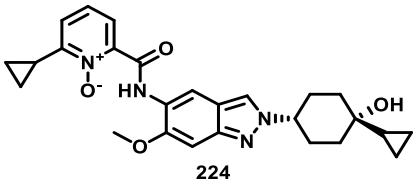
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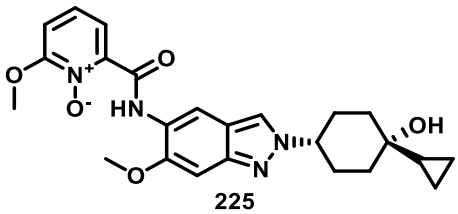
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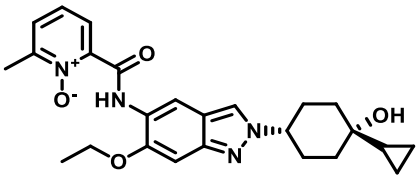
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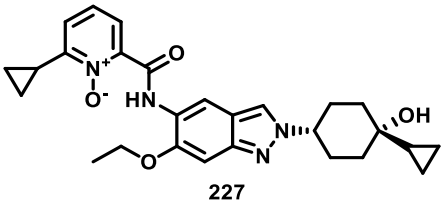
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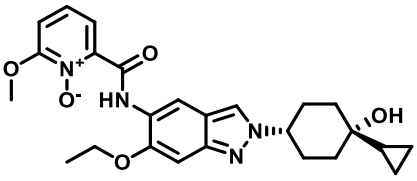
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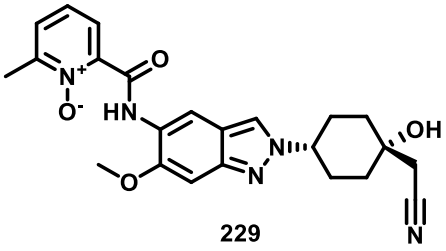
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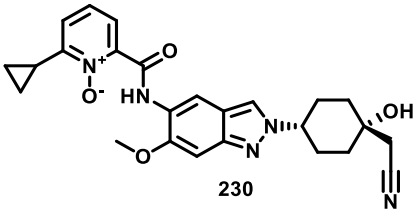
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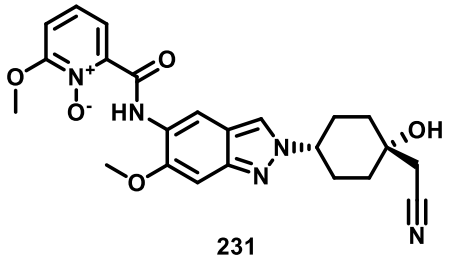


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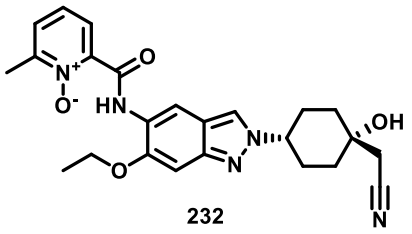


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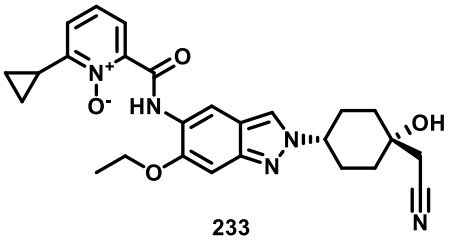
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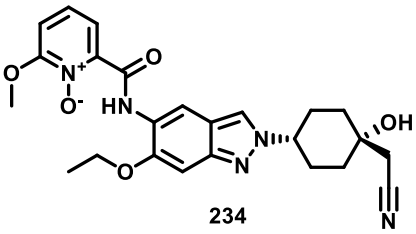
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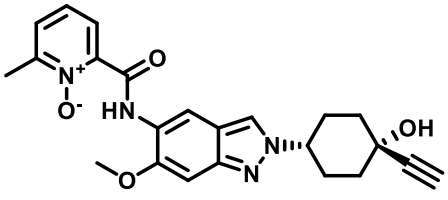
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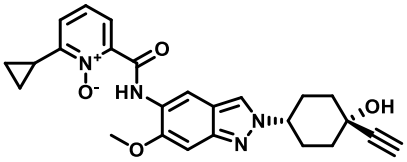
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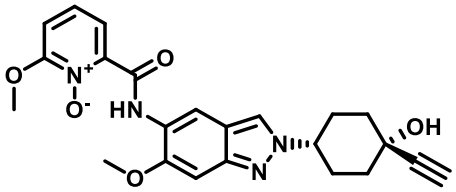
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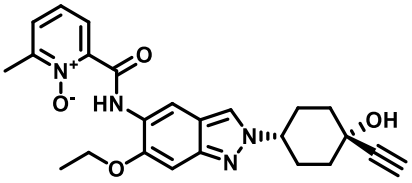
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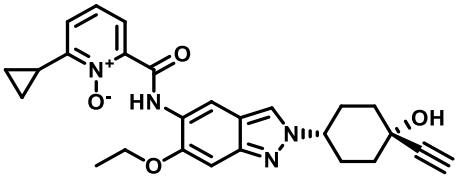
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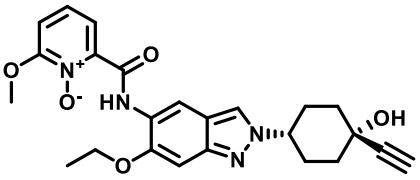
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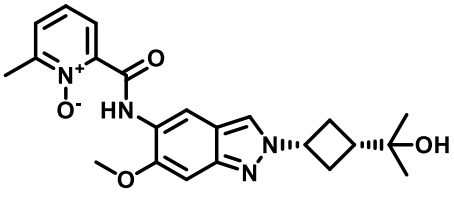
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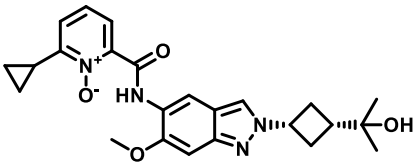
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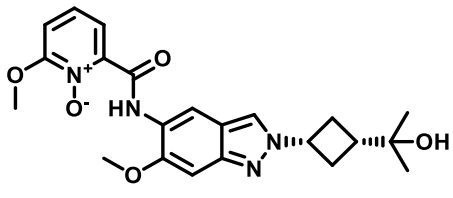
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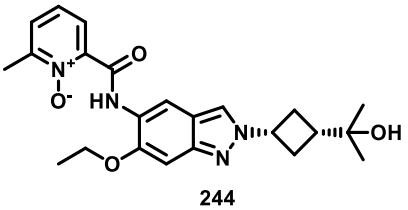
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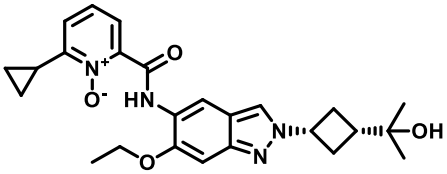


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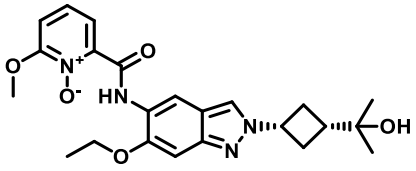


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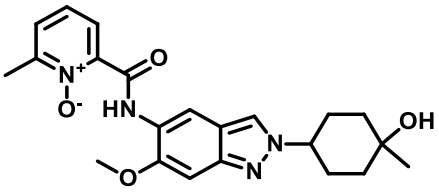
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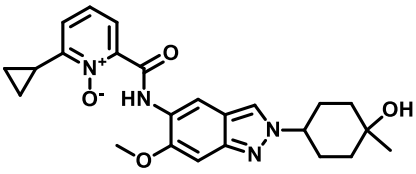
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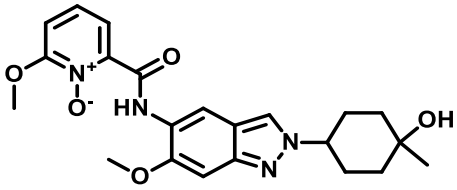
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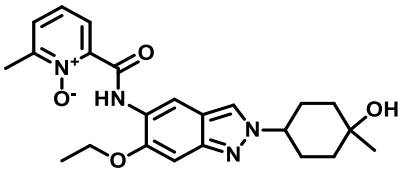
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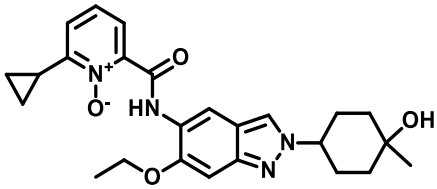
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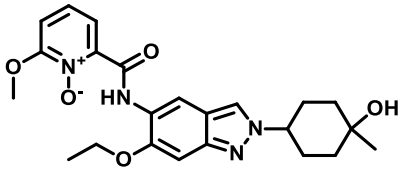
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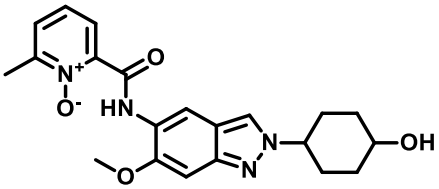
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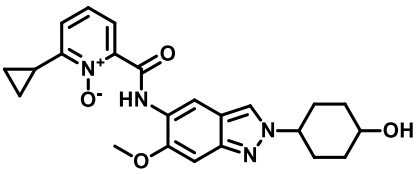
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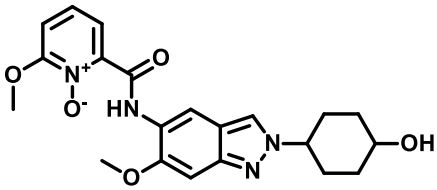
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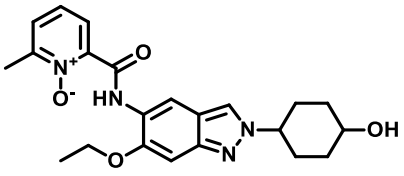
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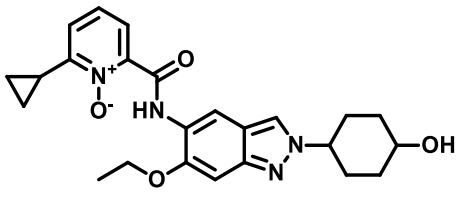


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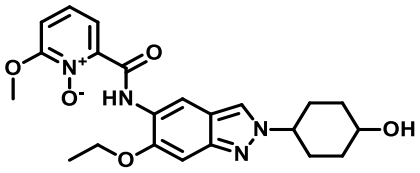


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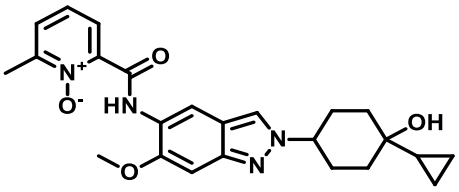
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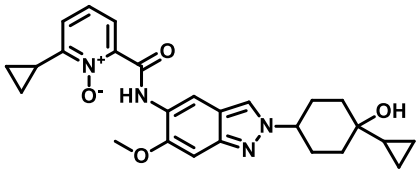
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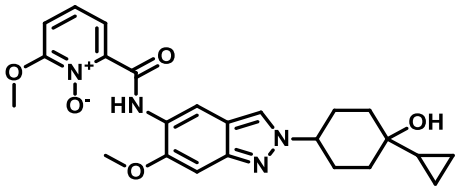
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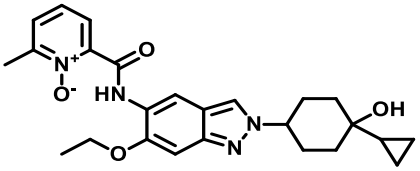
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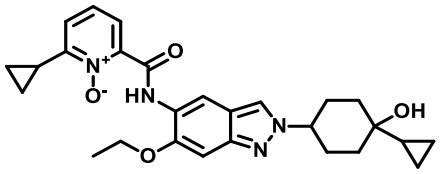
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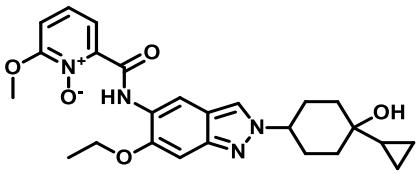
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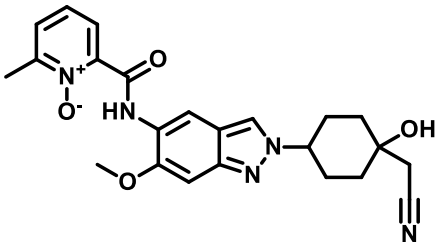
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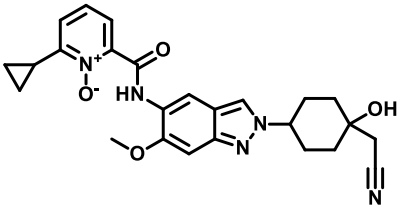
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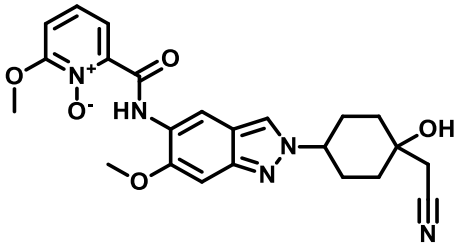
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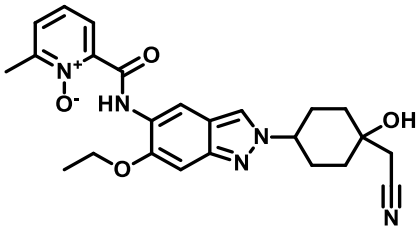
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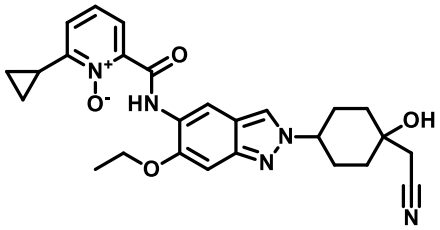
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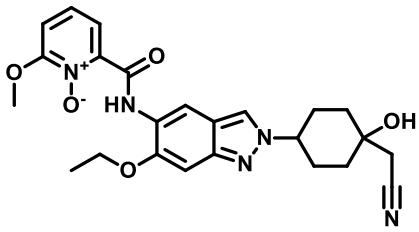
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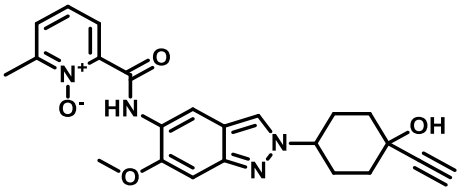
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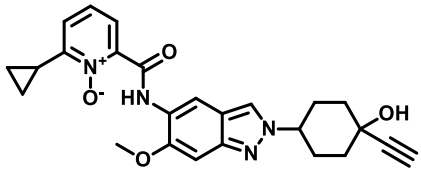
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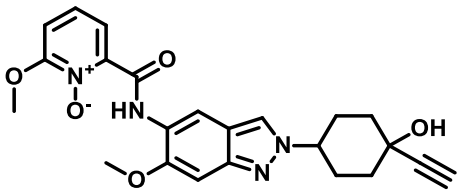
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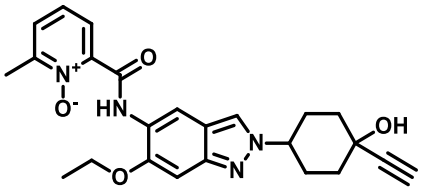
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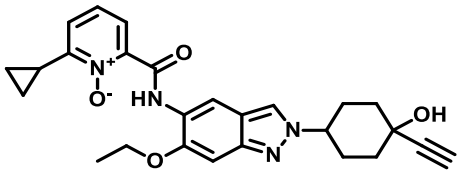
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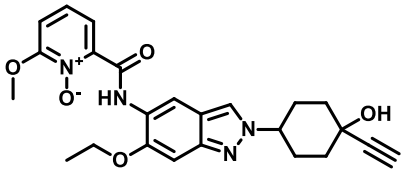
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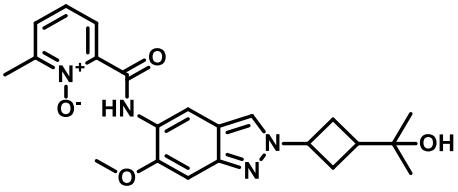
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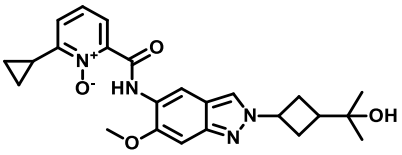
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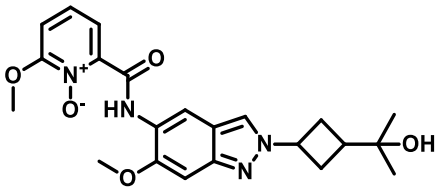
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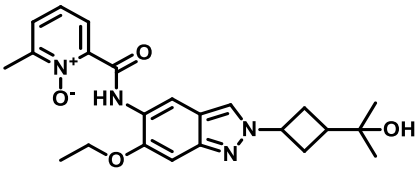
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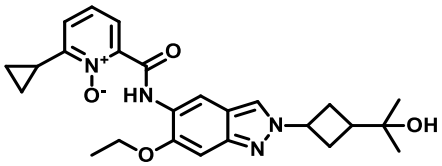
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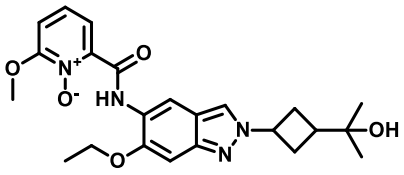
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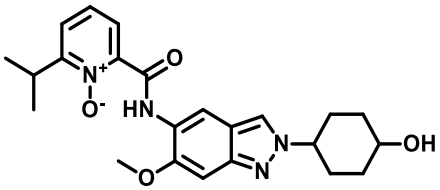
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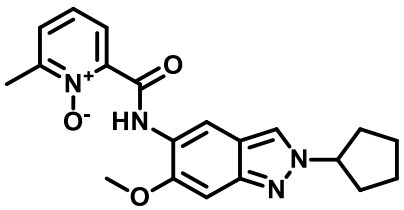
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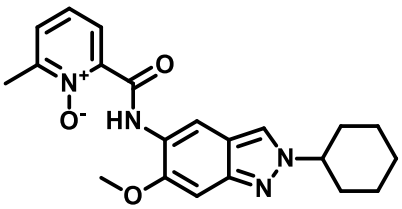
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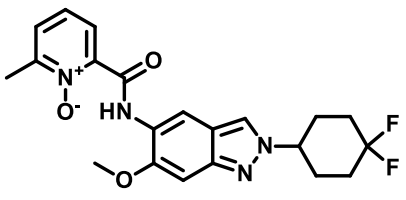
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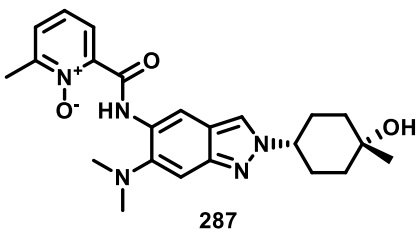
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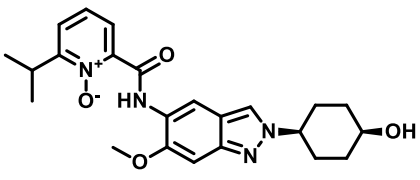
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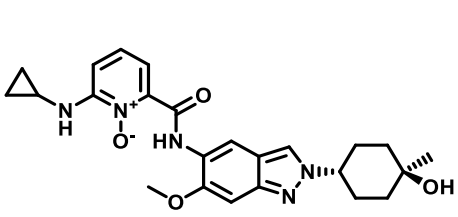


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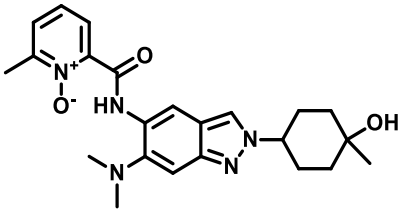


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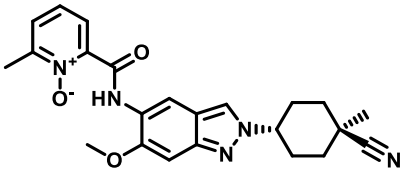
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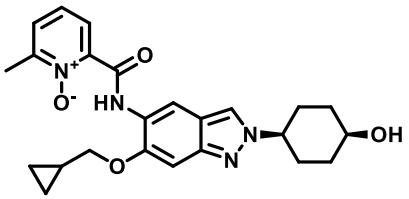
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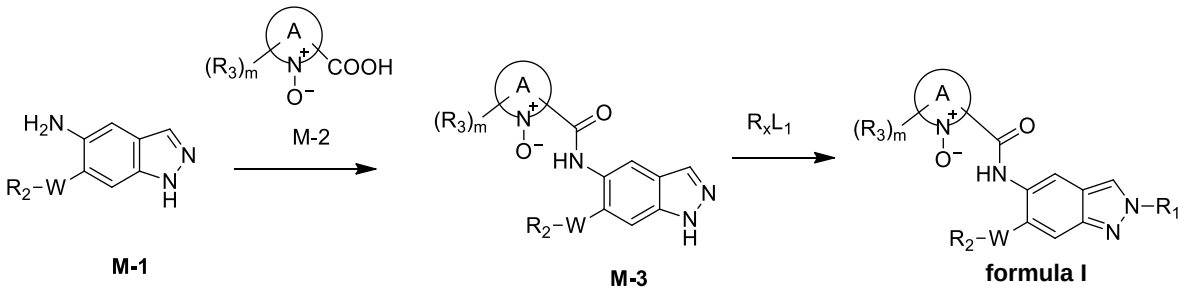
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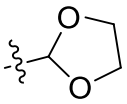
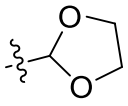
.

~~6~~8. A preparation method for the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to any one of claims 1-~~5~~7, wherein the preparation method comprises:



M-1 M-2 M-3 formula I

(a1) reacting M-1 and M-2 to give M-3, wherein the reaction ~~may be~~is performed in the presence of EDCl.HCl and pyridine; and

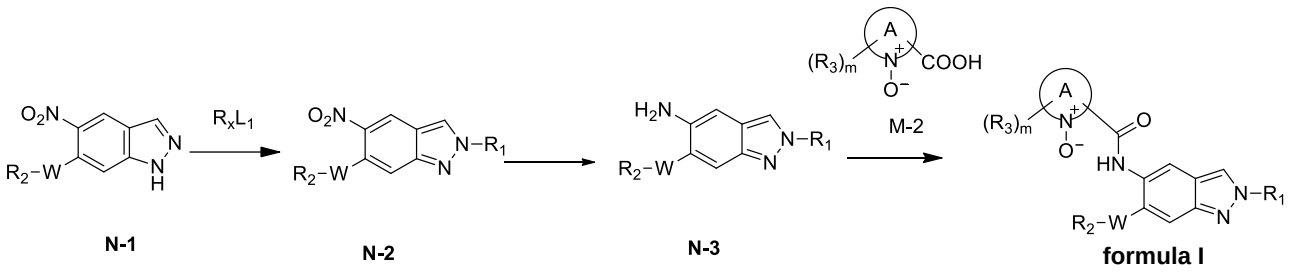
(a2) reacting M-3 and R_xL_1, wherein R_x is selected from R_1 and a group of R_1 having hydroxyl with the hydroxyl substituted with ; when R_x is a group of R_1 having hydroxyl with the hydroxyl substituted with , the reaction requires to be performed in the presence of an acid and a reductant ro give the formula I, wherein the acid ~~may be~~is HCl, and the reductant ~~may be~~is sodium borohydride;

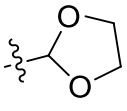
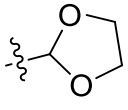
R_1, R_2, R_3, m and W in the above steps are as defined in formula I, provided R_1 is not H~~,~~; and the L_1 is a leaving group ~~and may be~~ selected from halogen and -OTs.

~~7~~9. A preparation method for the compound of formula I or the stereoisomer, the racemate, the

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tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to any one of claims 1-~~5~~7, wherein the preparation method comprises:



(b1) reacting N-1 and R_xL_1, wherein R_x is selected from R_1 and a group of R_1 having hydroxyl with the hydroxyl substituted with  ; when R_x is a group of R_1 having hydroxyl with the hydroxyl substituted with  , the reaction requires to be performed in the presence of an acid and a reductant to give N-2, wherein the acid ~~may be~~is HCl, and the reductant ~~may be~~is sodium borohydride;

(b2) reducing the N-2 obtained in the above step to give N-3, wherein a reductant ~~may be~~is Pd/C; and

(b3) reacting the N-3 and M-2 to give the formula I.

R_1, R_2, R_3, m and W in the above steps are as defined in formula I, provided R_1 is not H; and the L_1 is a leaving group and ~~may be~~is selected from halogen and -OTs.

~~8~~10. A pharmaceutical composition comprising the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to any one of claims 1-~~5~~7.

~~9~~11. Use of the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, ~~the prodrug~~ or the pharmaceutically acceptable salt thereof according to any one of claims 1-~~5~~ 7 or the pharmaceutical composition according to claim ~~8~~ 10 in preparing a medicament for preventing and/or treating diseases or disorders mediated by IRAK.

~~10~~12. The use according to claim ~~9~~11, wherein the diseases or disorders are selected from tumors, gout, systemic lupus erythematosus, multiple sclerosis, metabolic syndrome, atherosclerosis,

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myocardial infarction, sepsis, inflammatory bowel disease, asthma, rheumatoid arthritis, allergy~~, and the like~~.