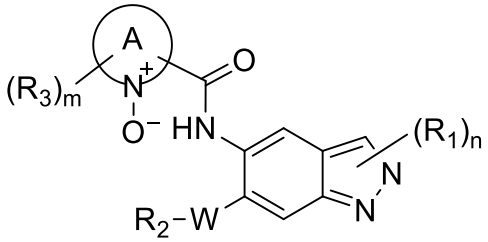
CLAIMS

1. A compound of formula I or a stereoisomer, a racemate, a tautomer, an isotopically labeled compound 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 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, 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" 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 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 is selected from (C_1-C_{12})alkyl, (C_2-C_{12})alkenyl and (C_2-C_{12})alkynyl;

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

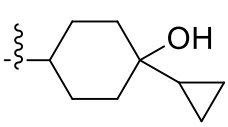
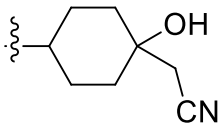
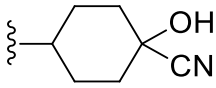
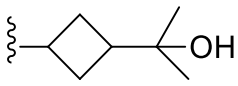
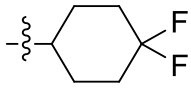
the "C_{3-12} cycloalkyl" is selected from cyclopropyl, cyclobutyl, cyclopentyl and cyclohexyl.

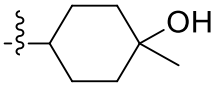
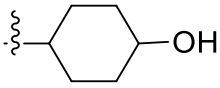
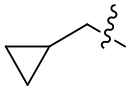
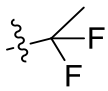
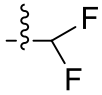
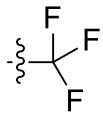
3. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to claim 1, wherein, the (C_1-C_{12})aliphatic hydrocarbyl is selected from (C_1-C_6)alkyl, (C_2-C_6)alkenyl and (C_2-C_6)alkynyl.

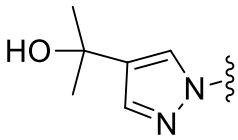
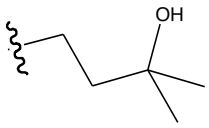
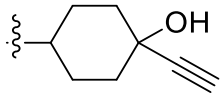
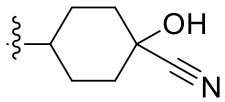
4. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to claim 1, wherein, ring A is 5-14 membered heteroaryl or 5-12 heterocyclyl having one N.

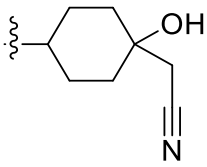
5. The compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to claim 1 or 2, wherein

the R_1, R_2 and R_3 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, isoxazolyl,

 ,  ,  ,  ,  ,

 ,  ,  ,  ,  ,  ,

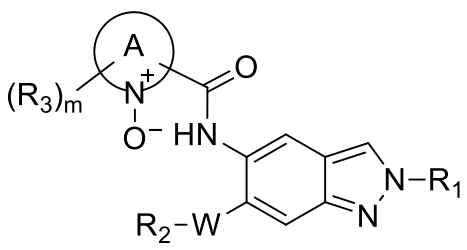
 ,  ,  ,  , and

 ; and

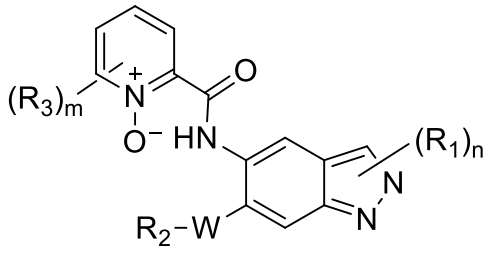
the "" denotes the connection site of the group.

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

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



formula Ia



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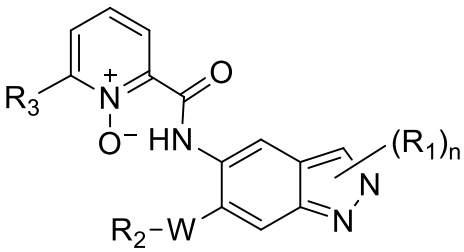
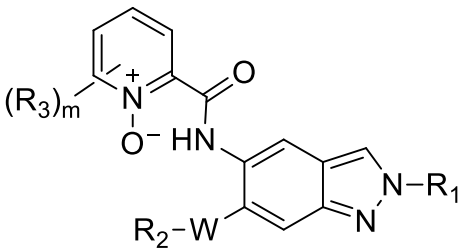
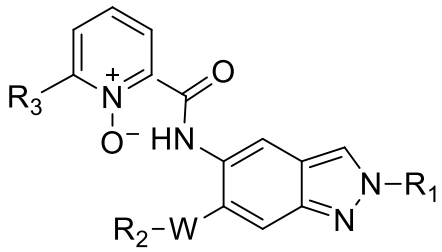




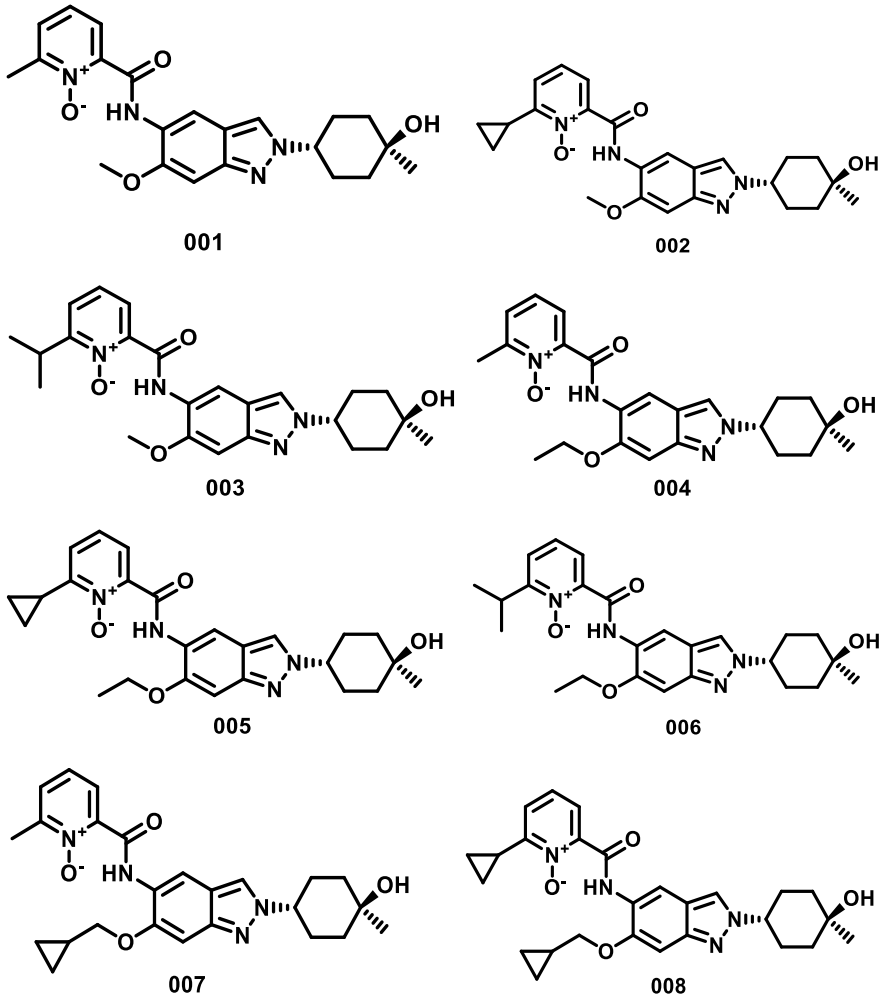
formula Ic formula Id

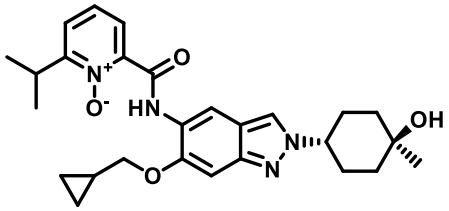


formula Ie

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.

7. 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 compound of formula I is selected from the following structures:





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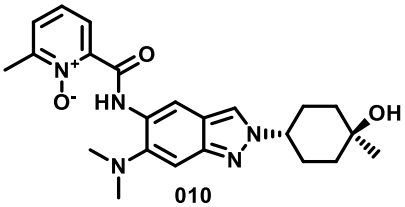

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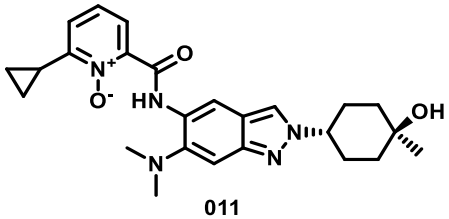

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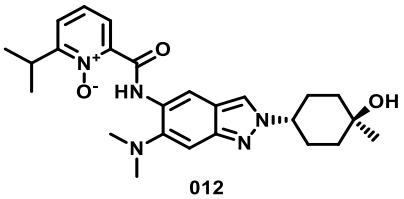

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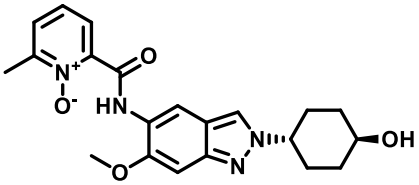

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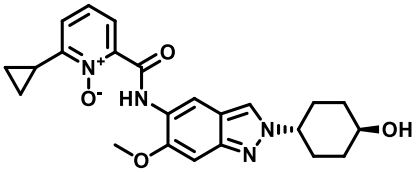

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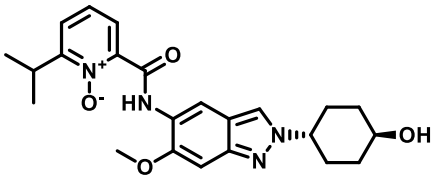

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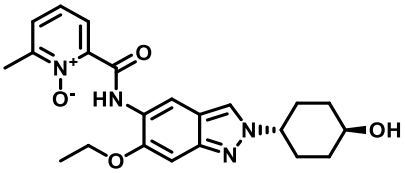

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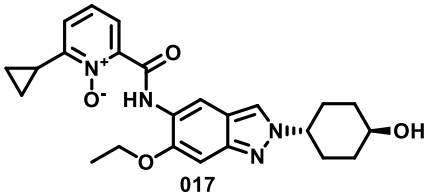

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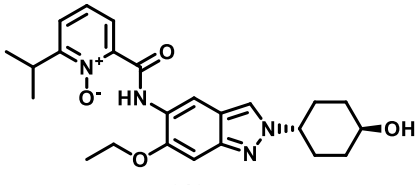

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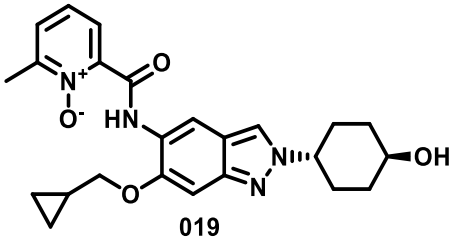

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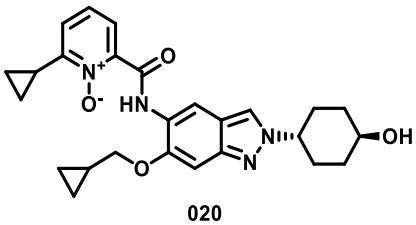

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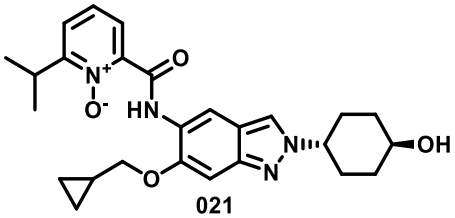

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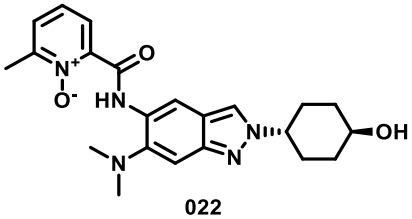

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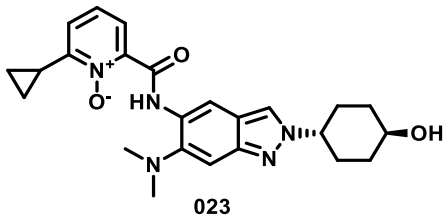

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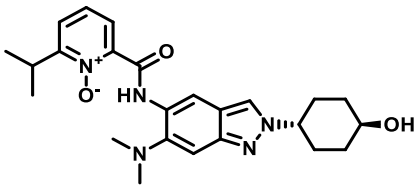

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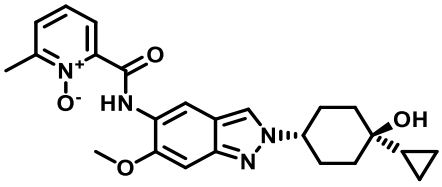

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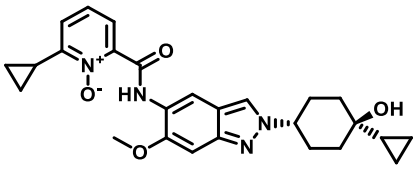

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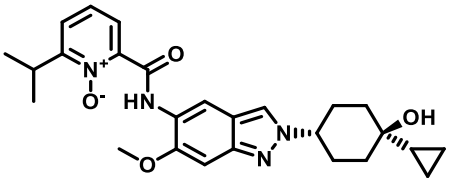

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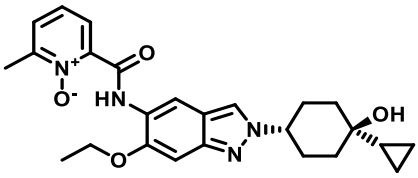

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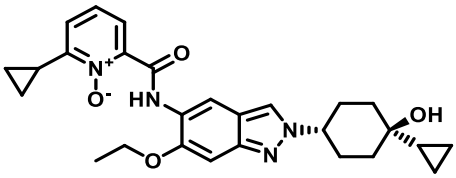

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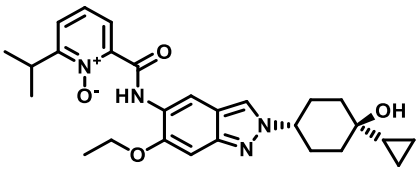

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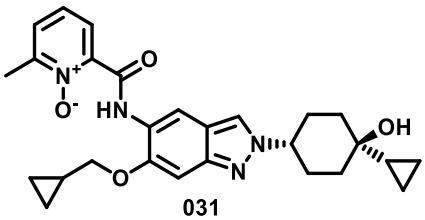

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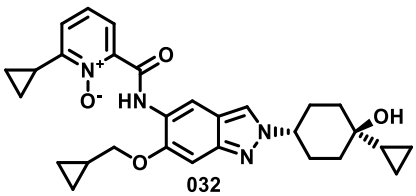

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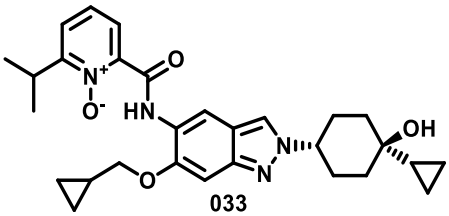

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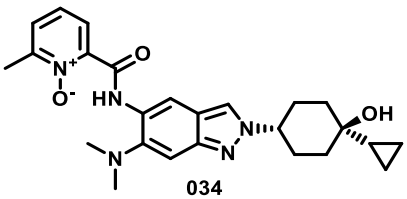

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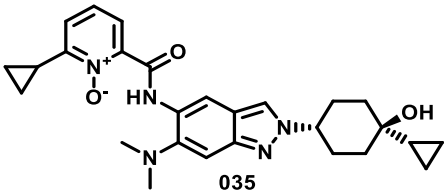

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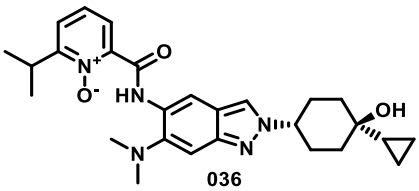

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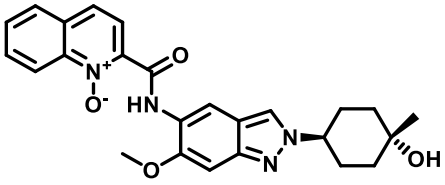

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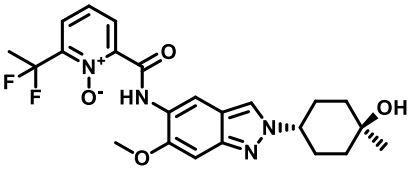

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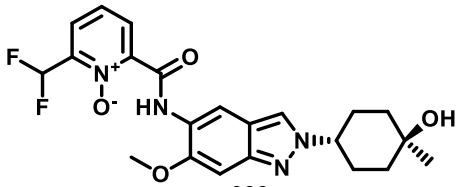

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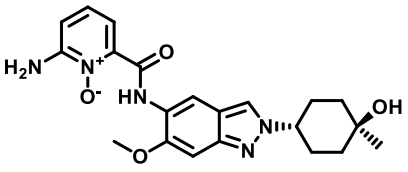

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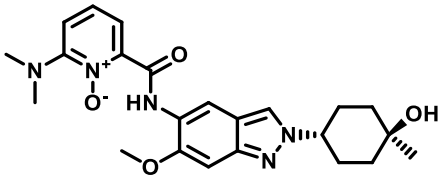

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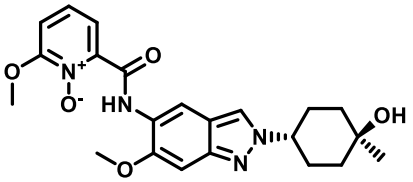

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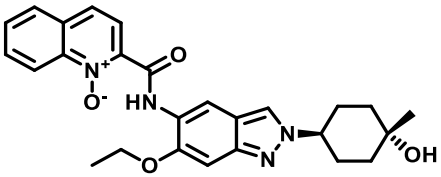

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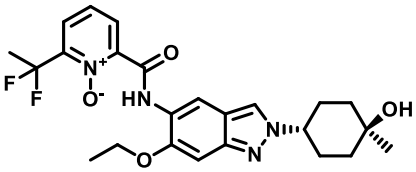

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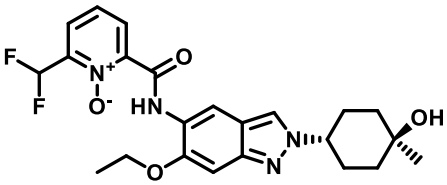

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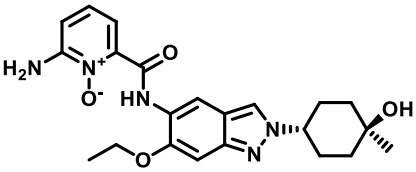

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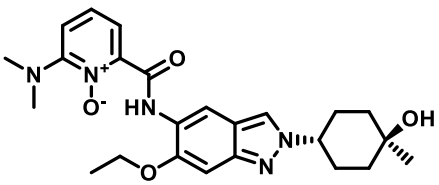

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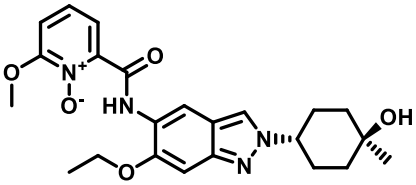

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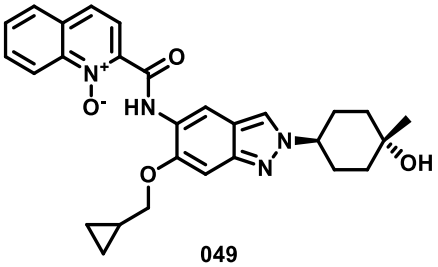

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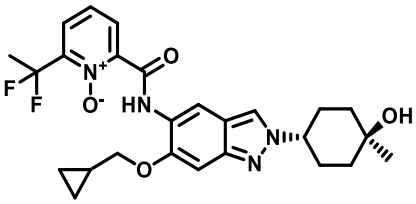

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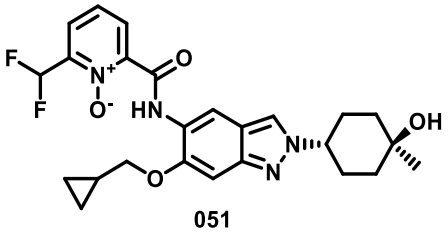

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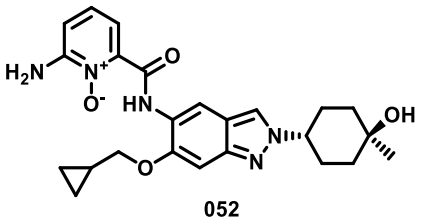

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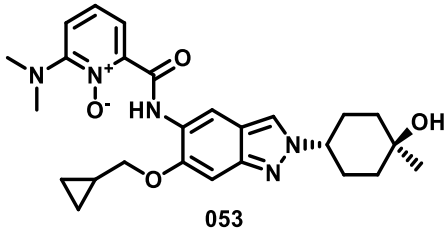

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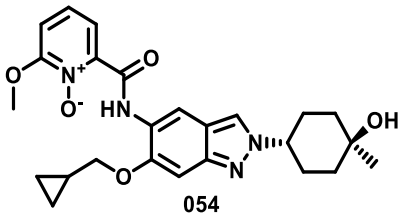

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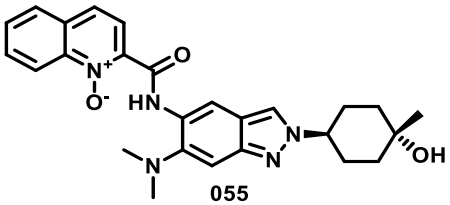

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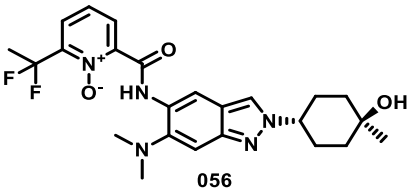

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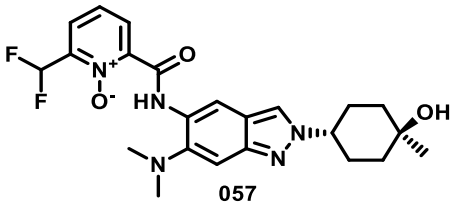

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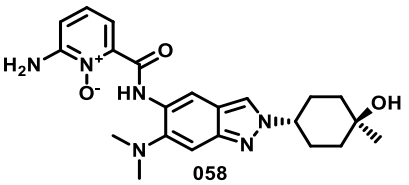

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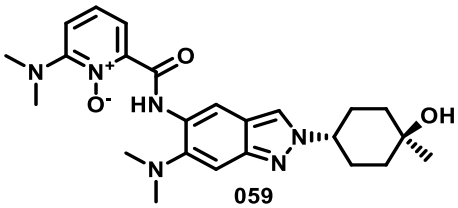

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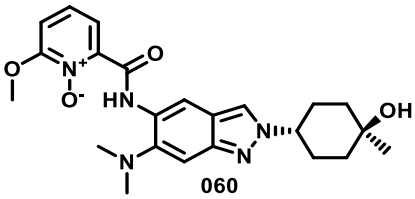

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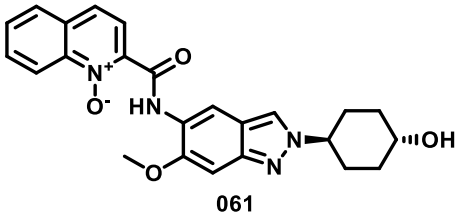

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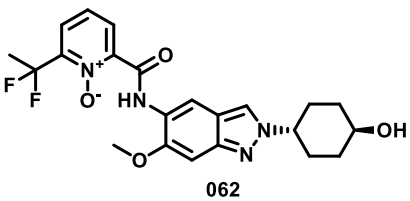

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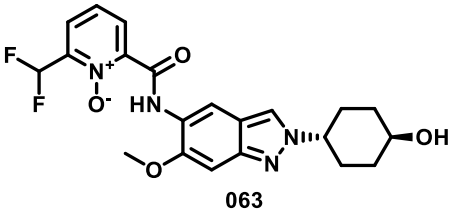

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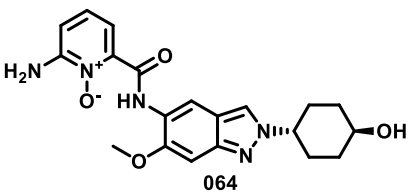

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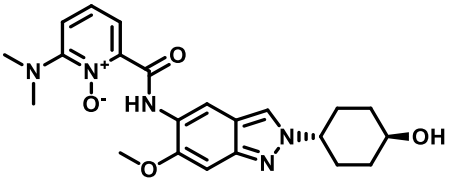

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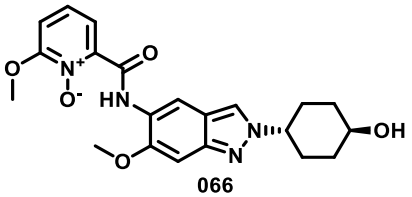

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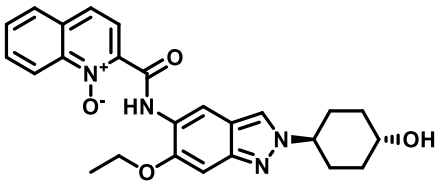

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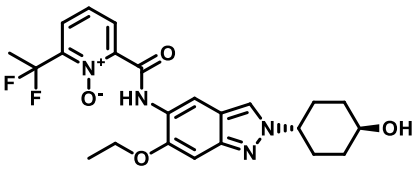

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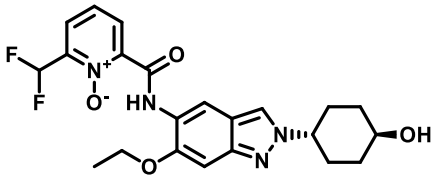

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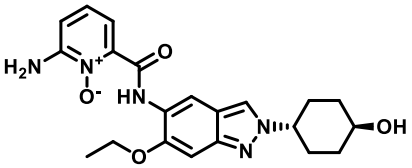

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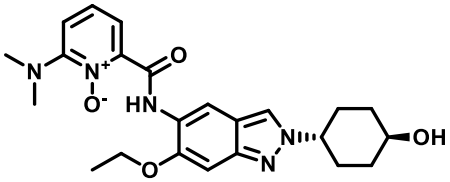

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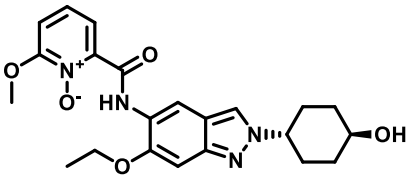

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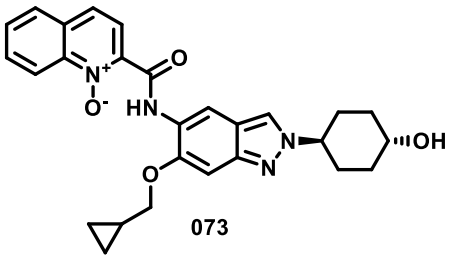

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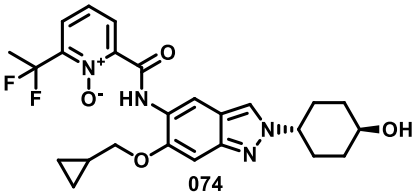

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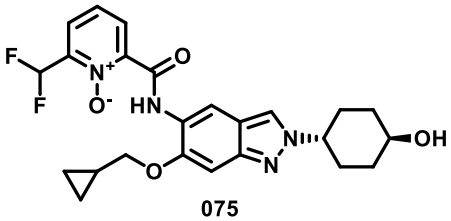

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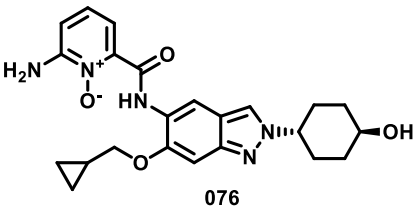

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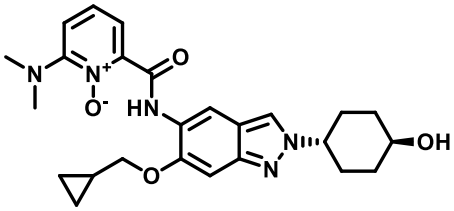

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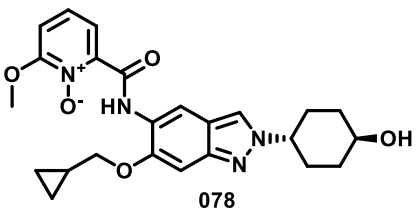

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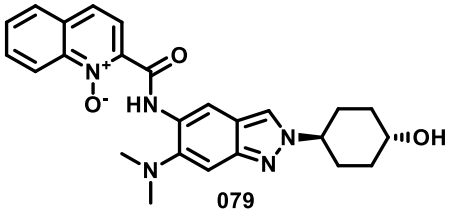

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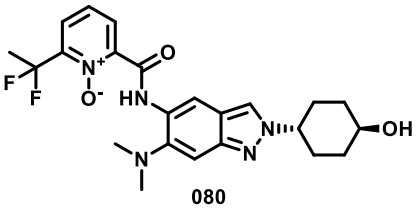

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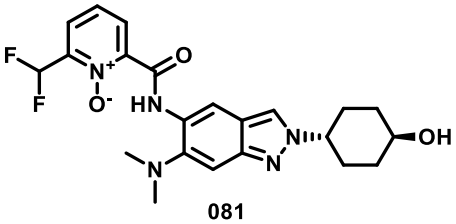

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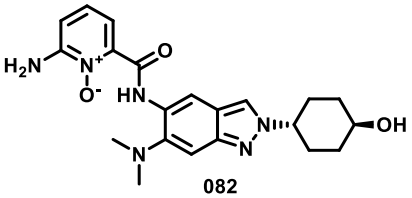

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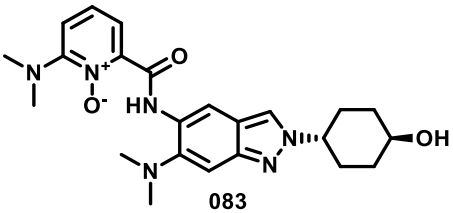

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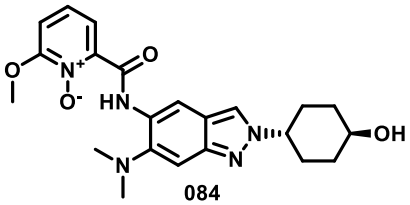

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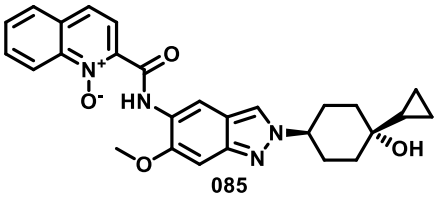

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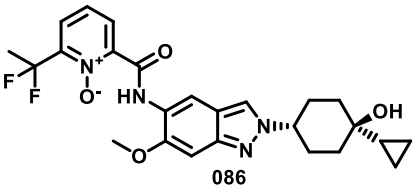

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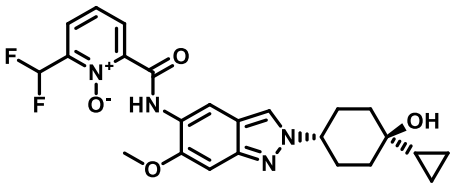

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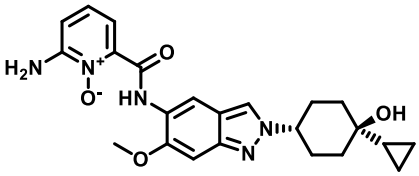

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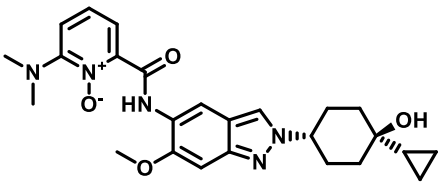

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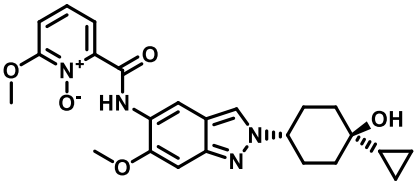

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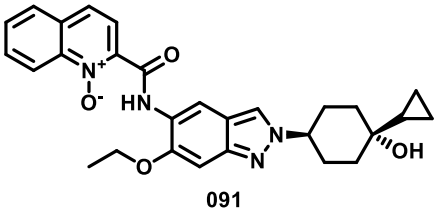

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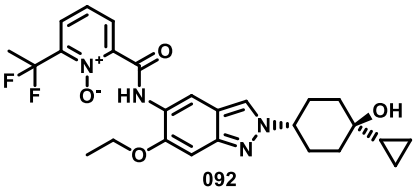

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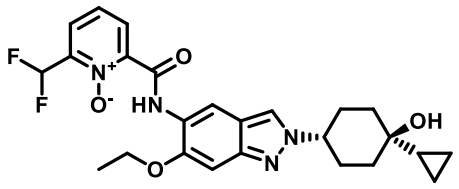

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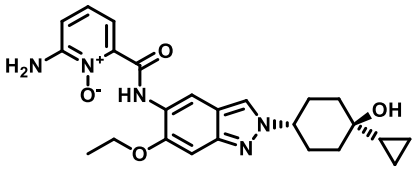

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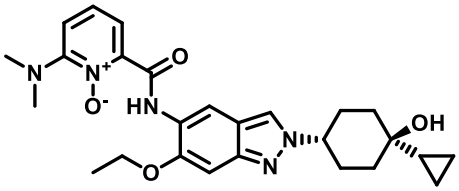

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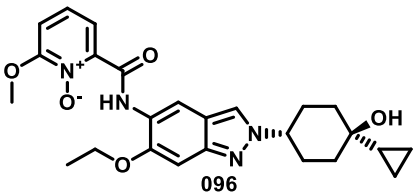

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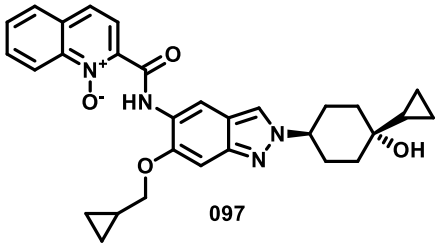

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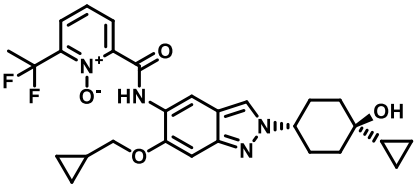

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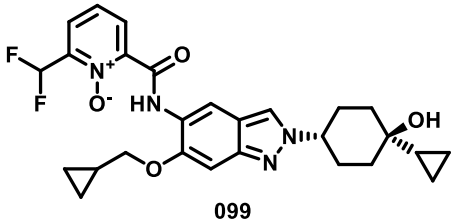

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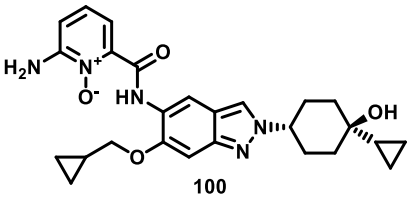

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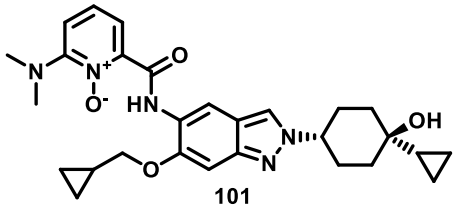

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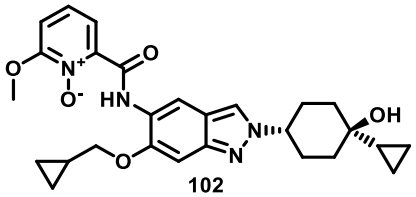

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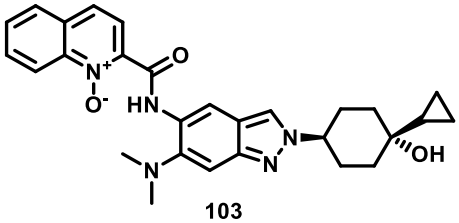

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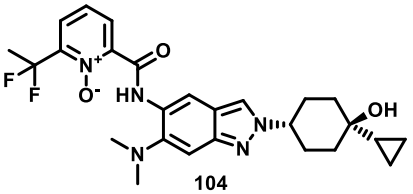

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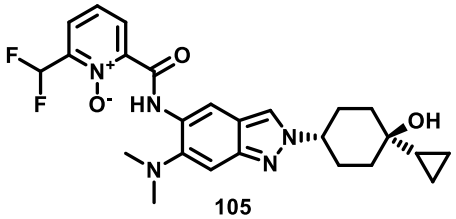

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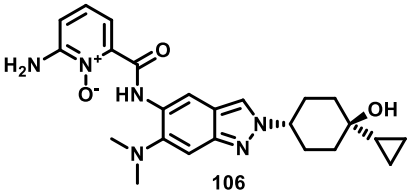

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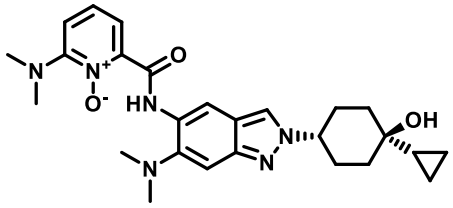

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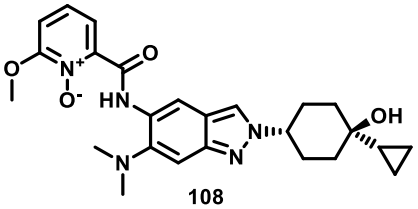

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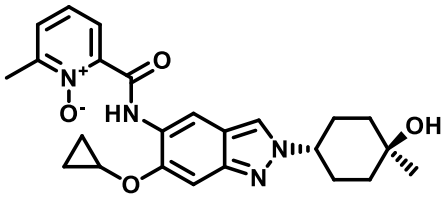

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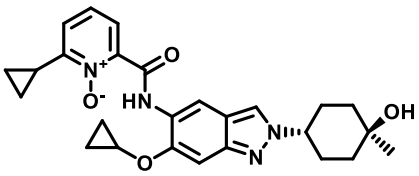

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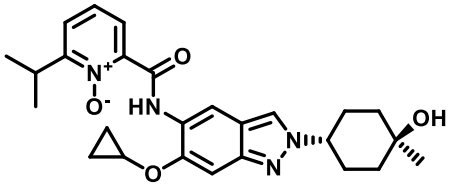

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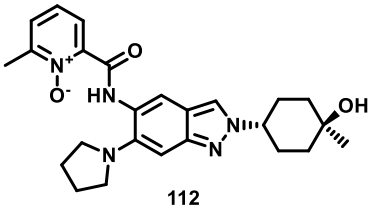

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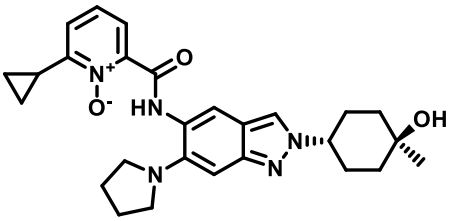

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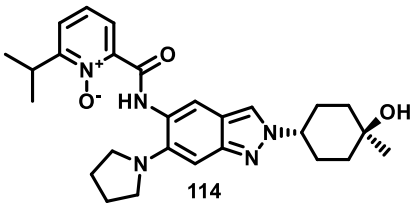

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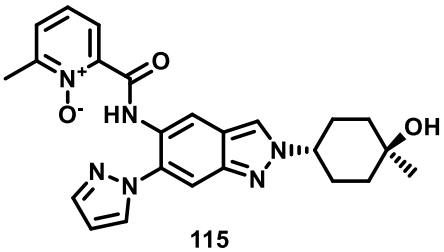

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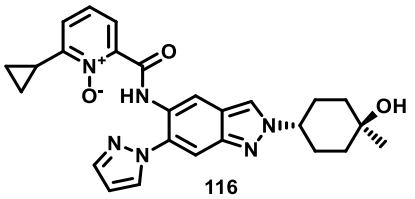

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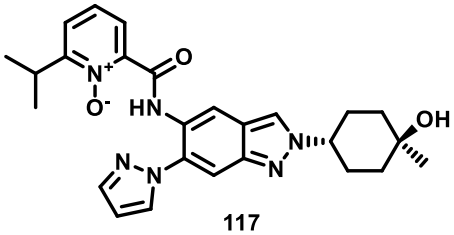

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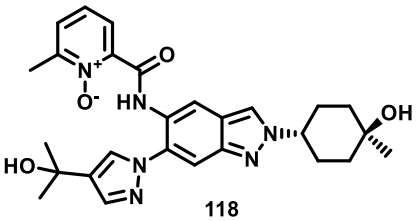

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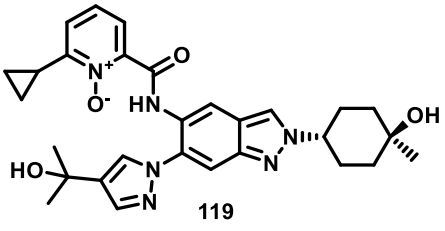

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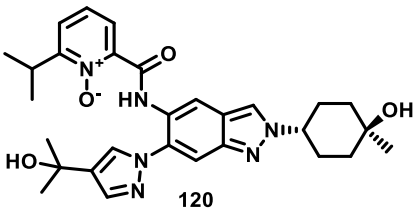

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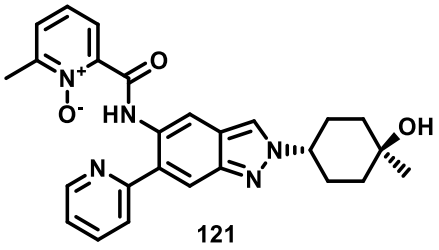

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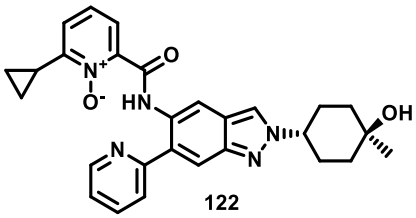

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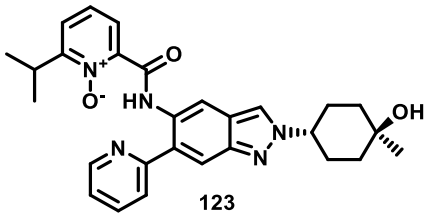

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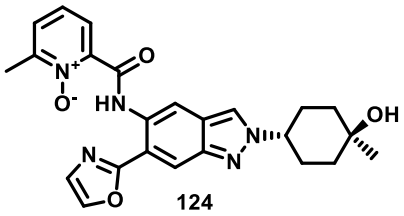

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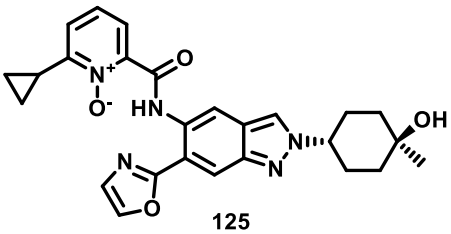

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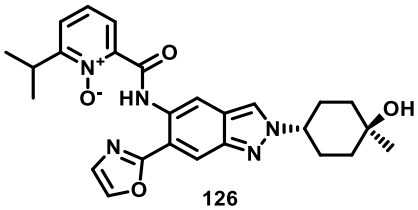

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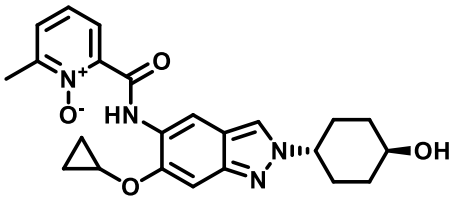

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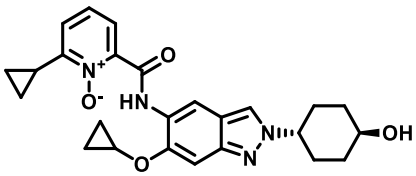

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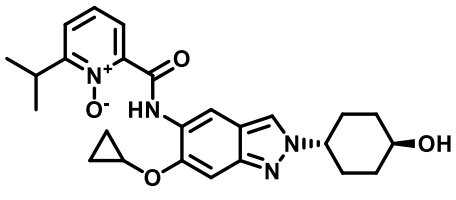

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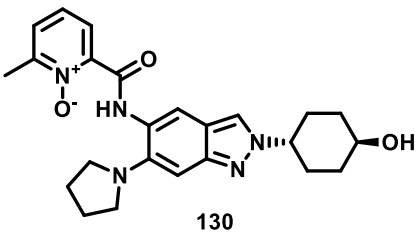

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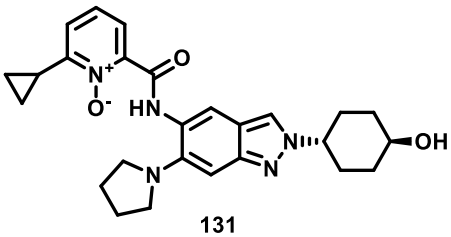

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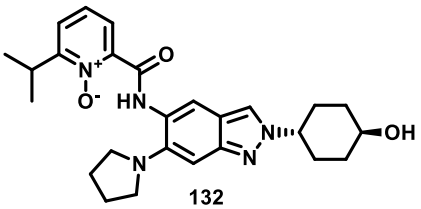

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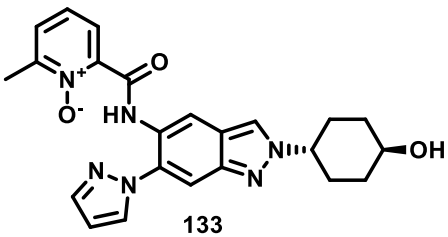

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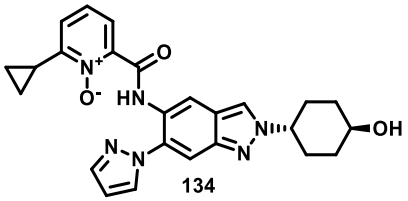

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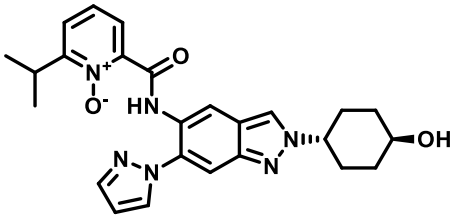

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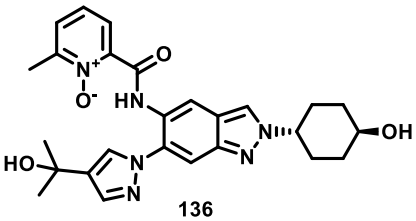

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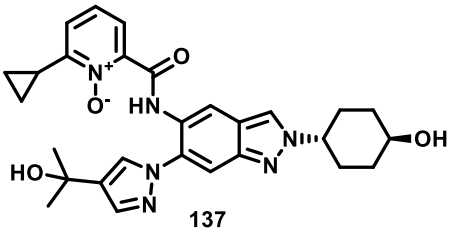

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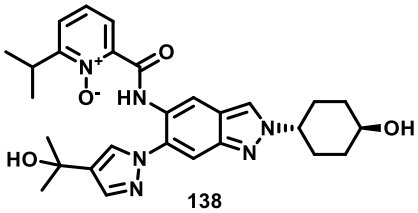

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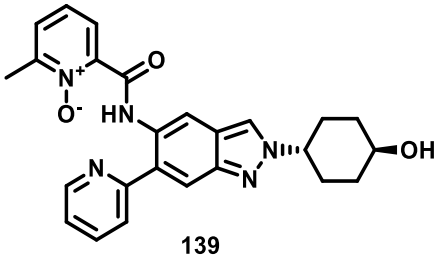

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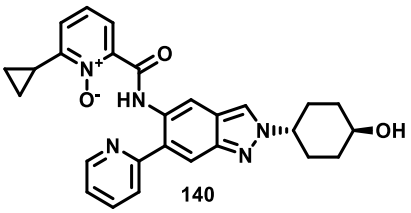

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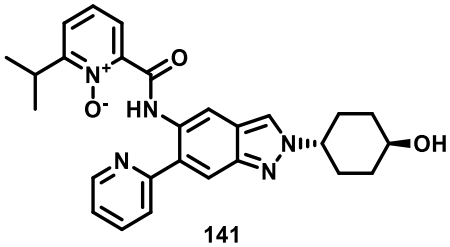

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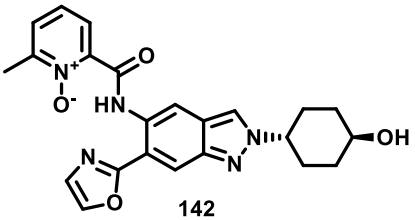

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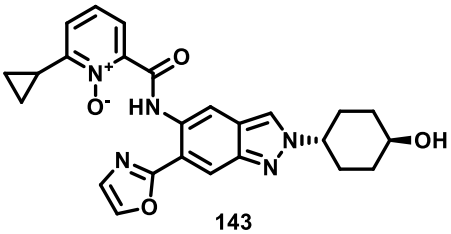

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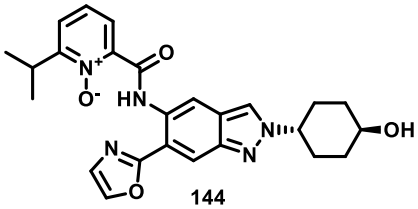

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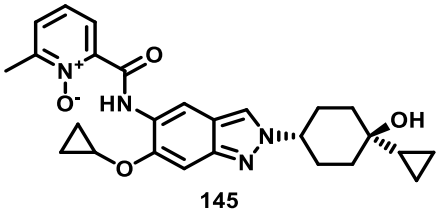

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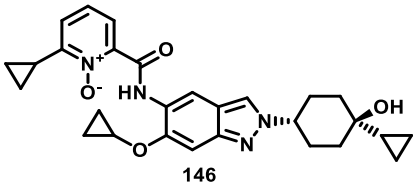

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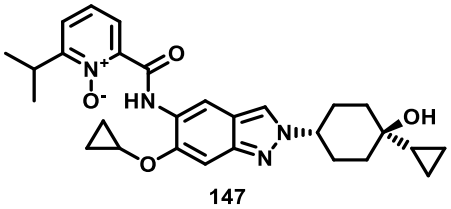

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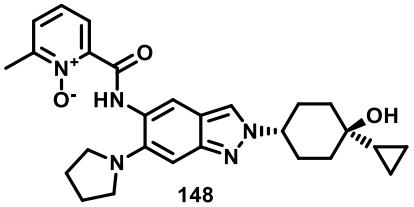

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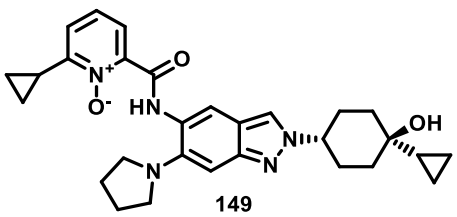

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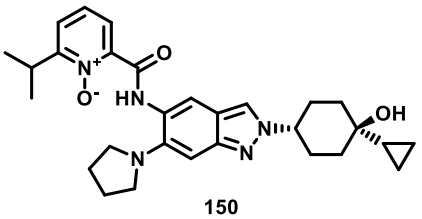

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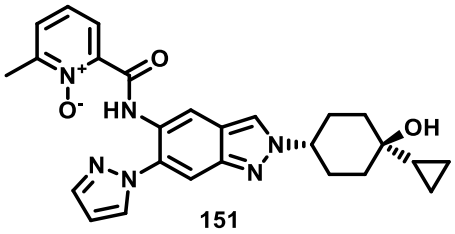

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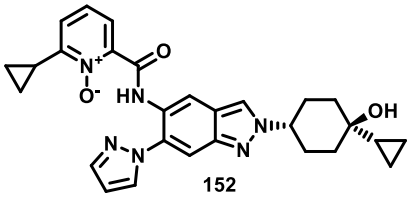

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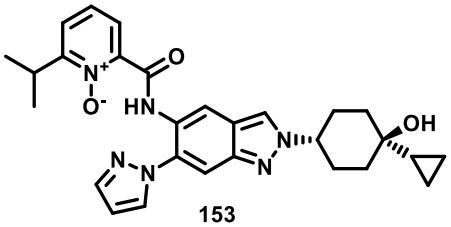

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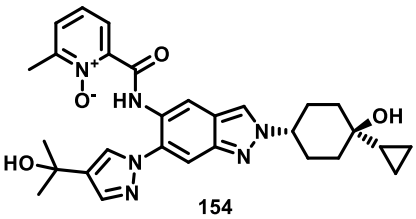

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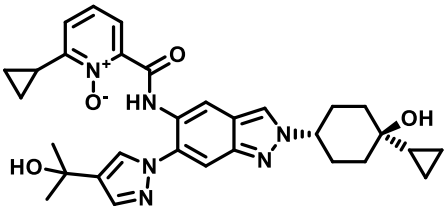

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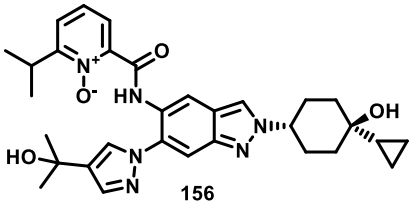

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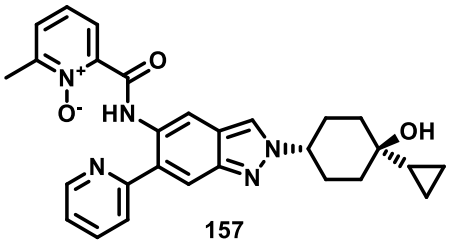

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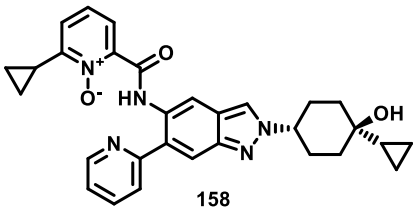

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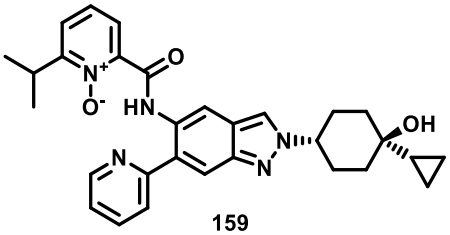

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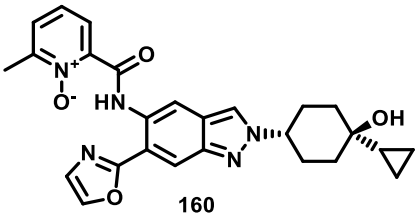

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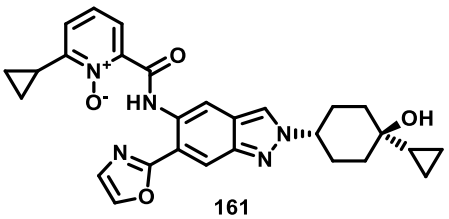

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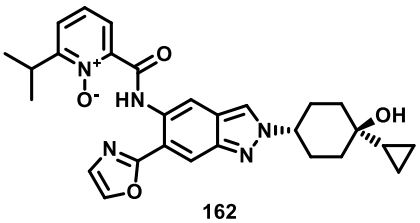

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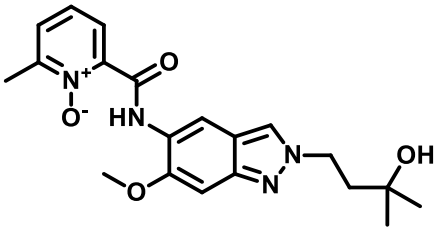

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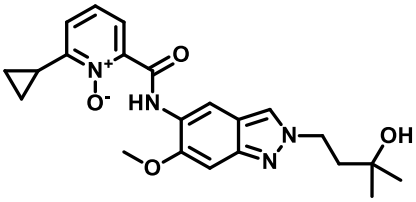

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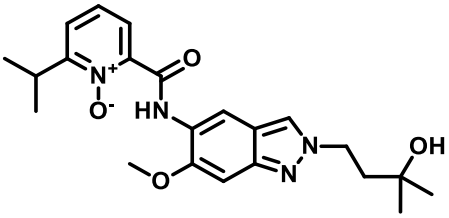

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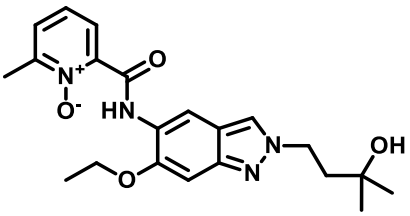

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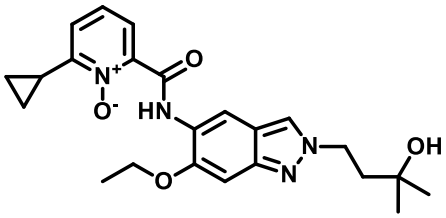

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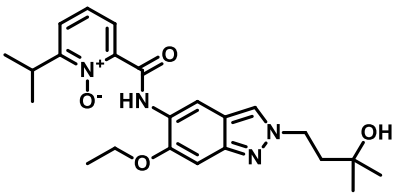

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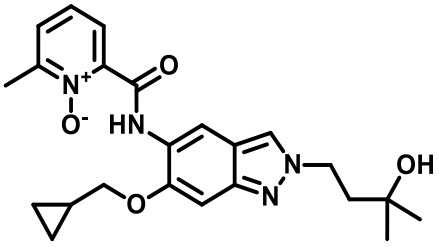

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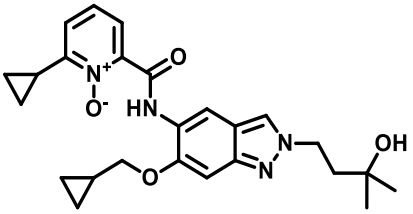

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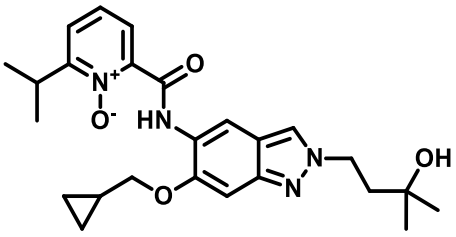

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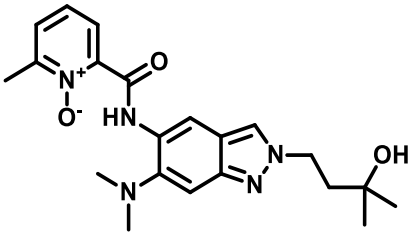

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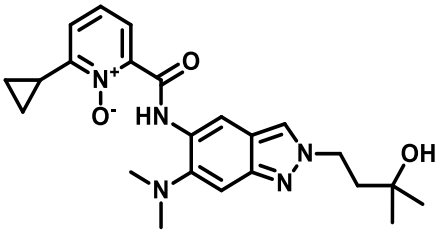

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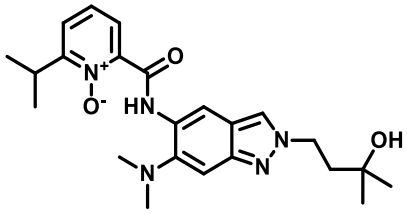

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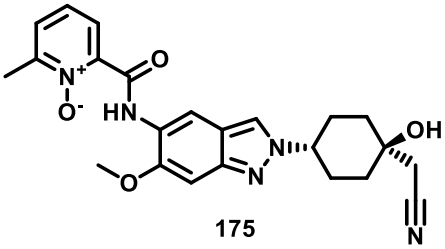

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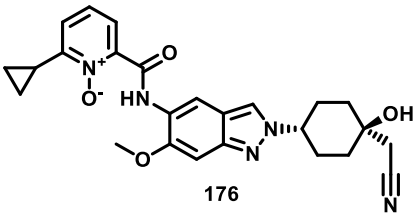

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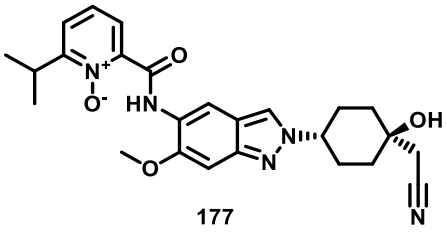

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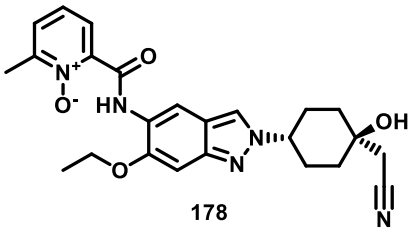

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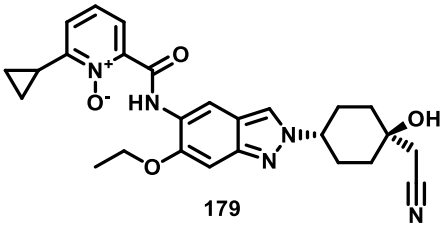

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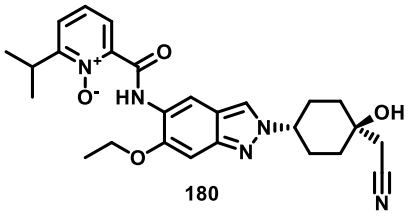

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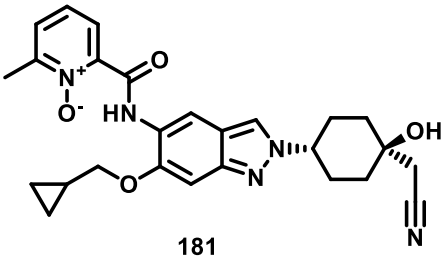

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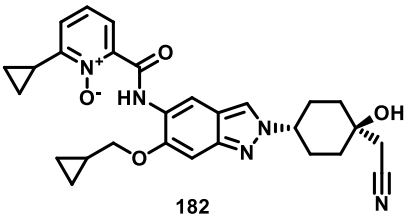

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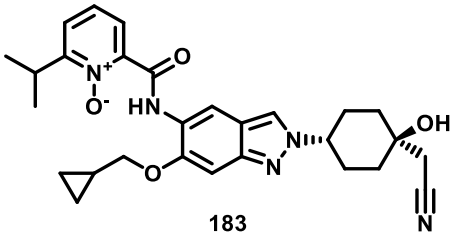

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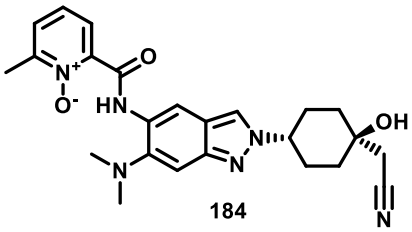

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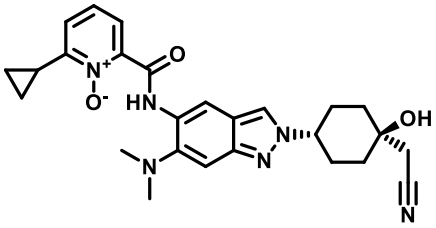

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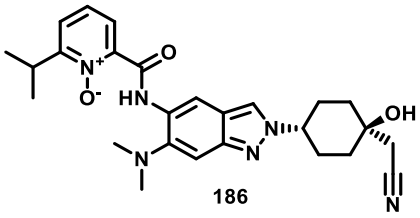

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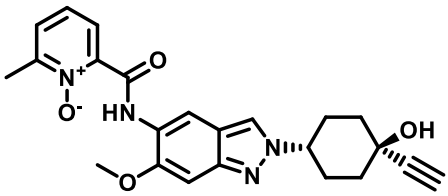

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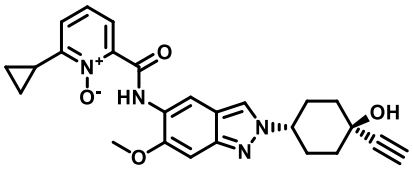

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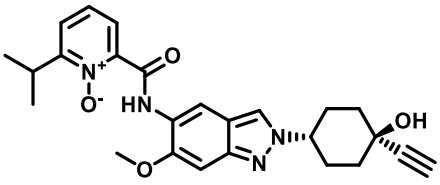

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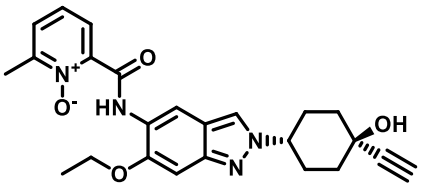

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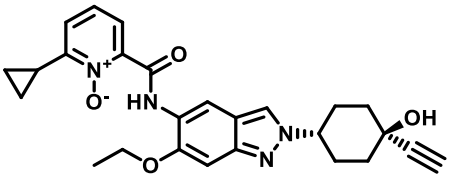

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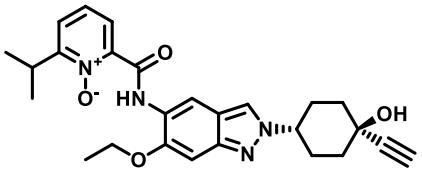

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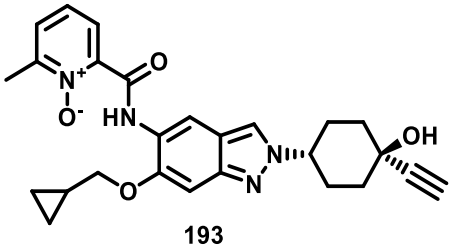

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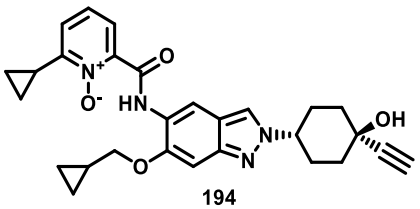

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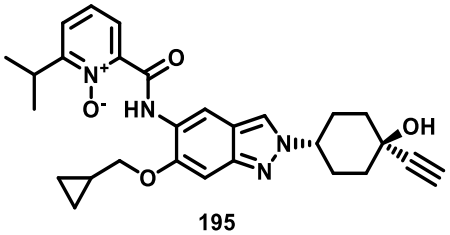

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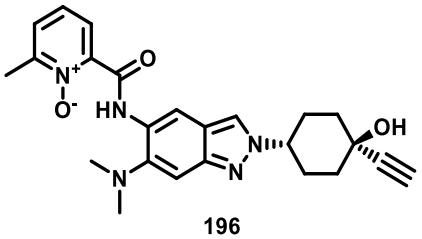

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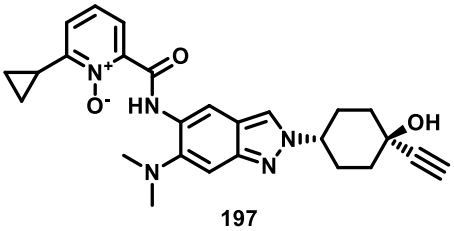

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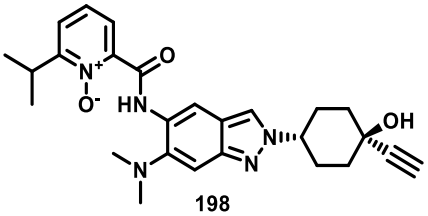

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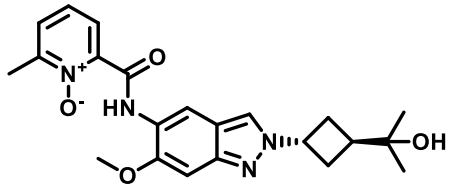

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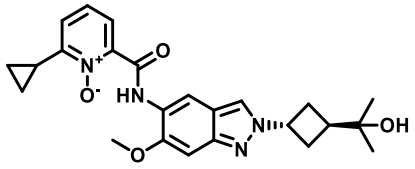

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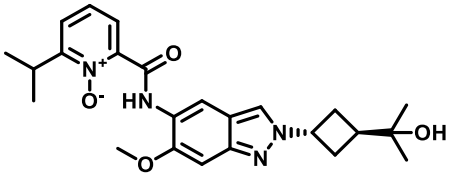

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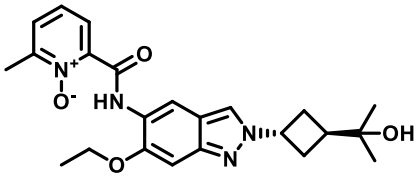

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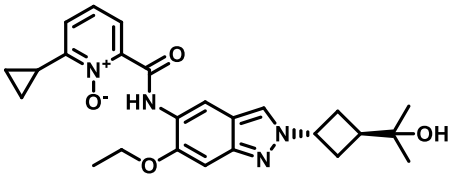

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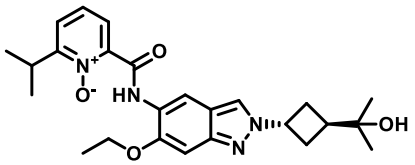

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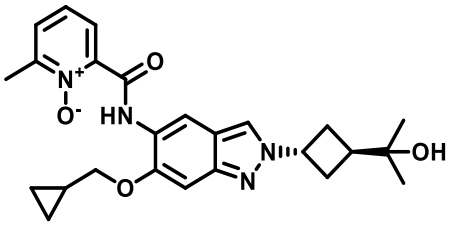

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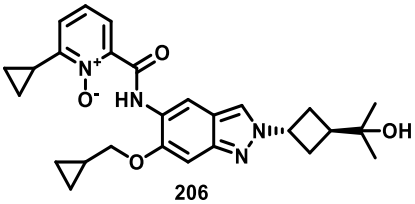

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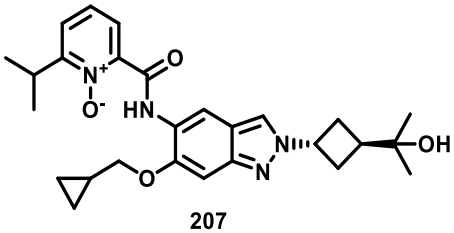

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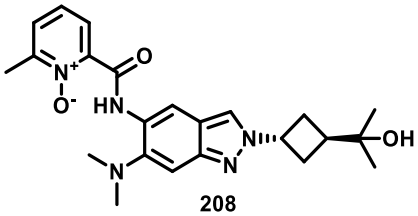

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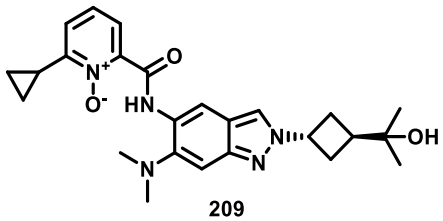

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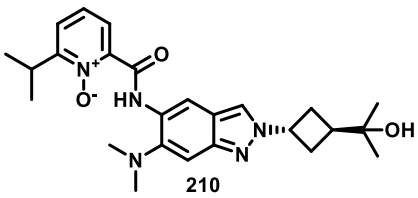

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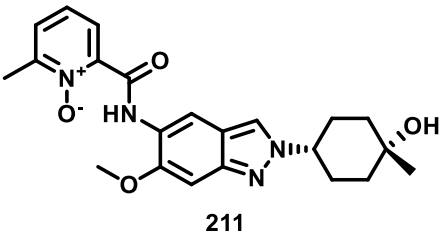

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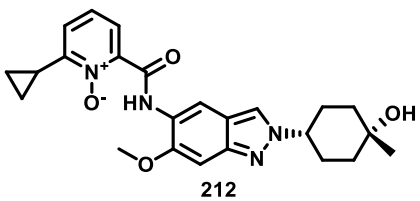

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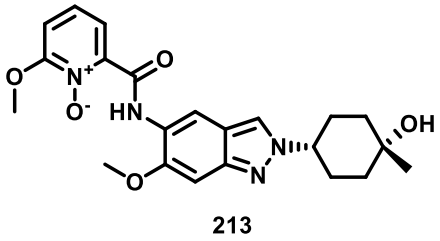

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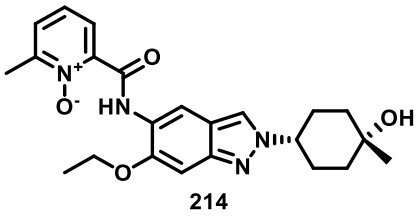

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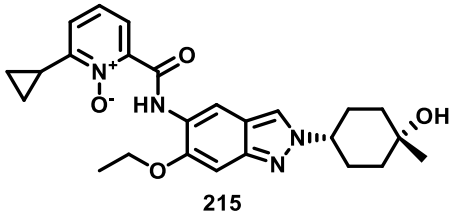

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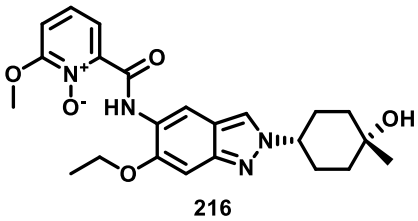

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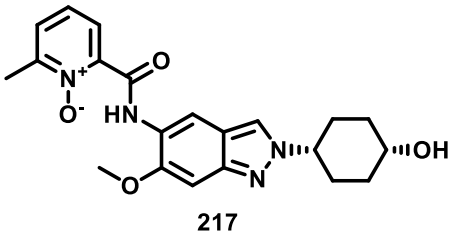

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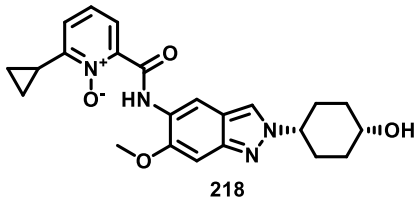

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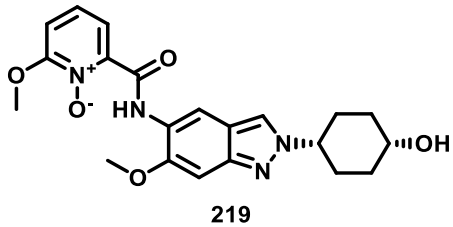

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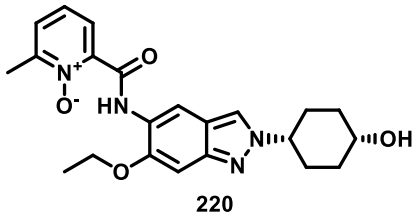

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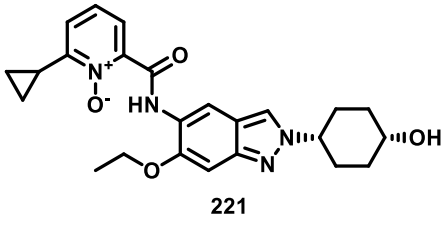

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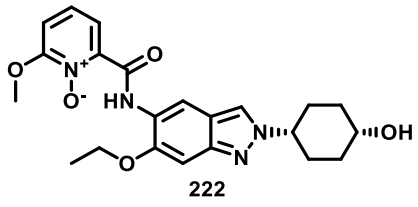

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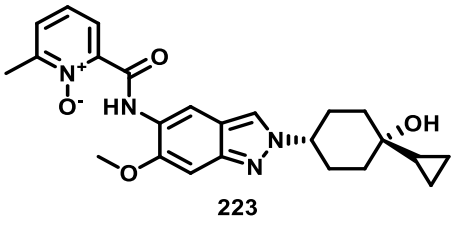

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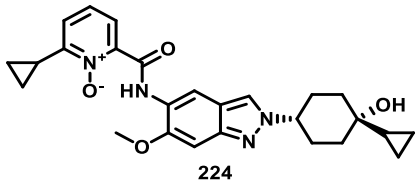

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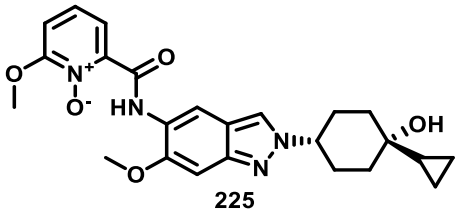

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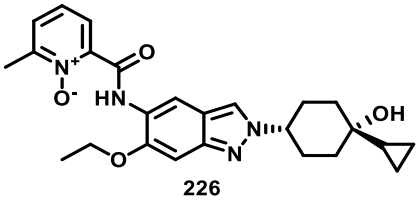

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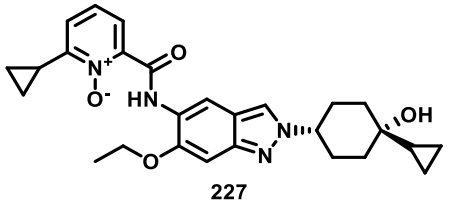

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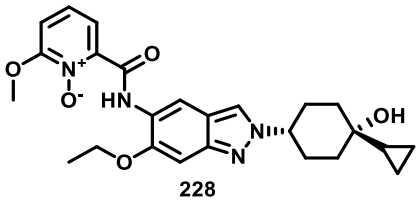

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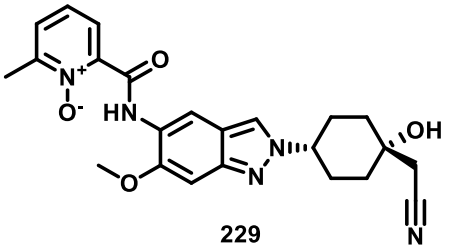

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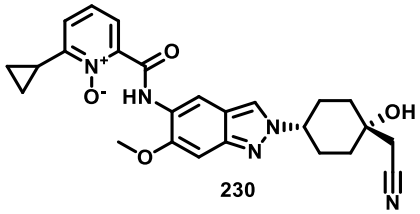

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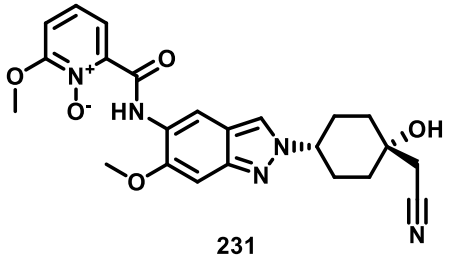

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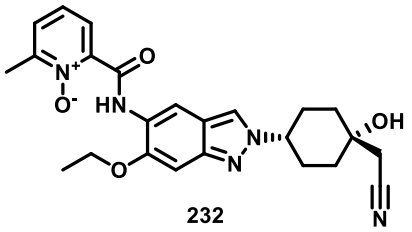

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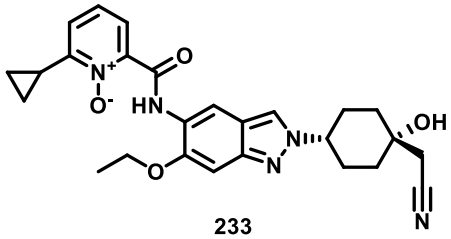

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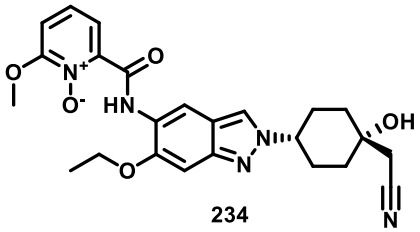

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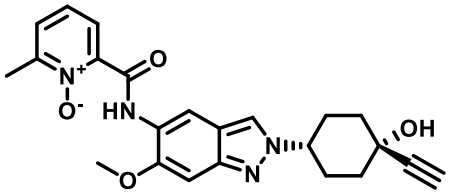

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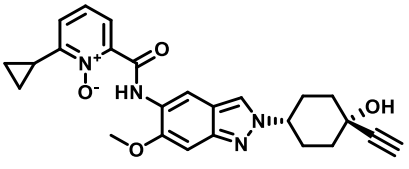

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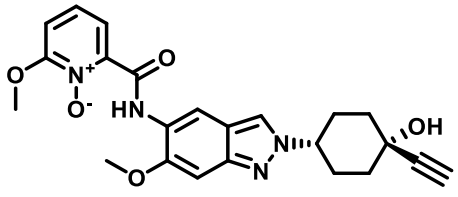

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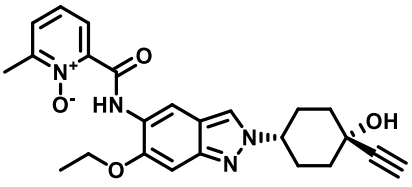

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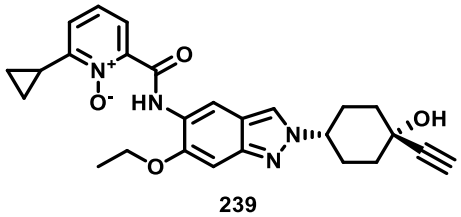

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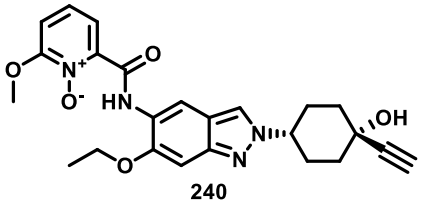

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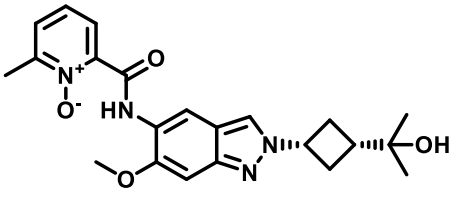

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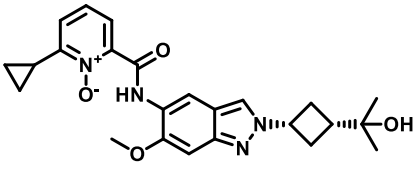

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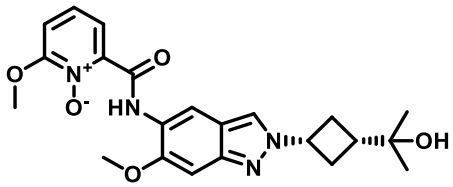

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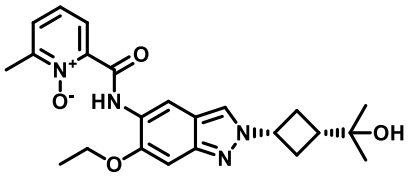

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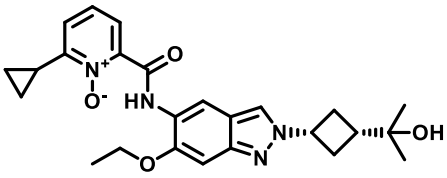

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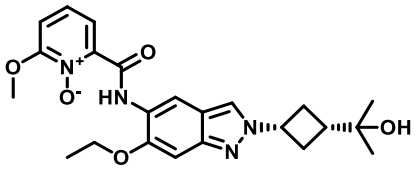

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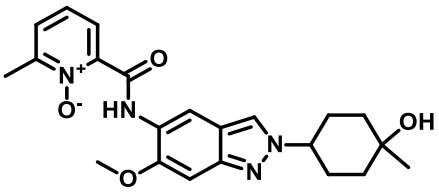

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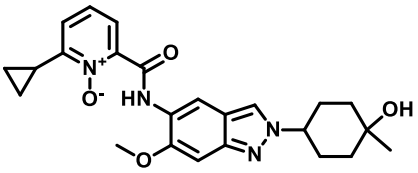

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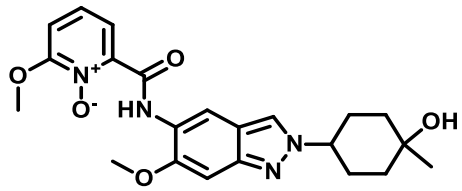

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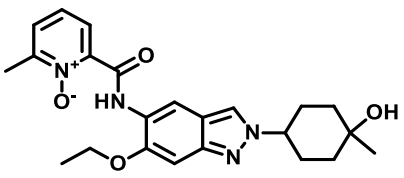

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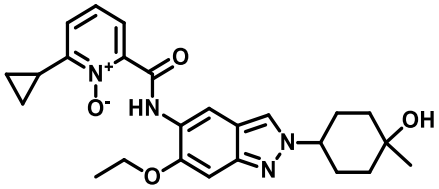

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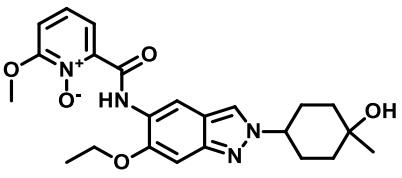

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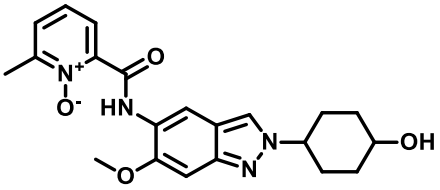

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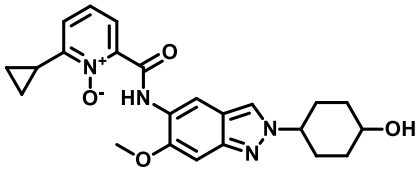

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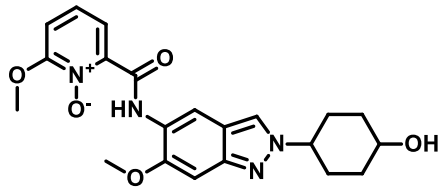

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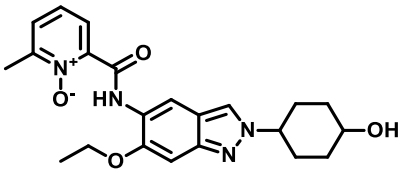

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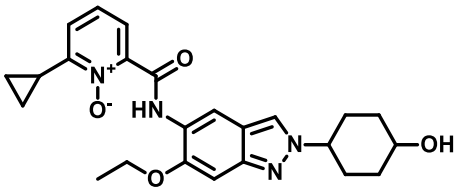

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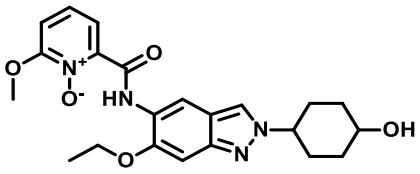

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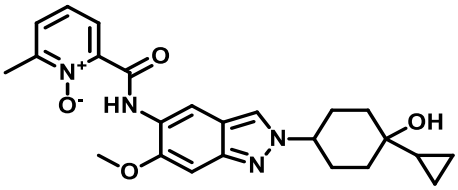

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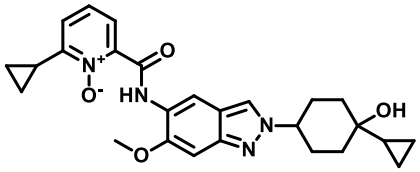

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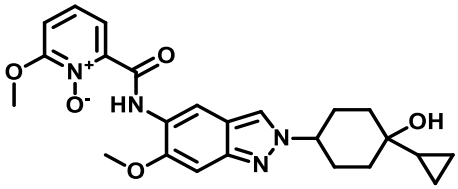

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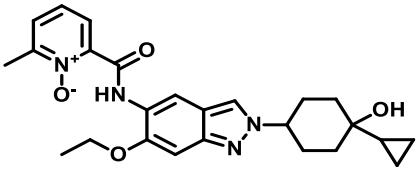

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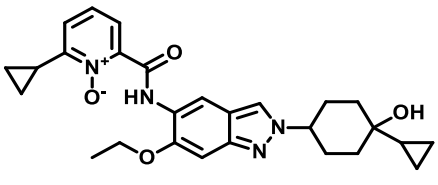

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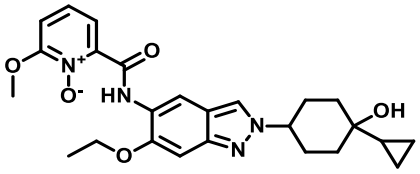

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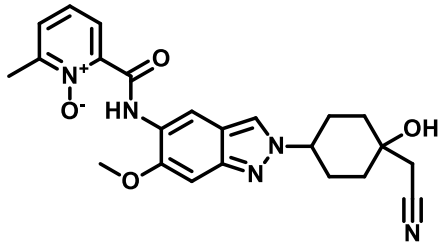

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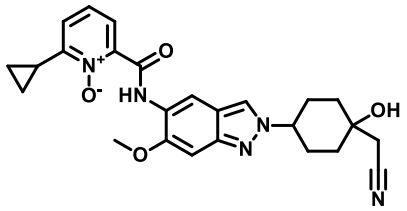

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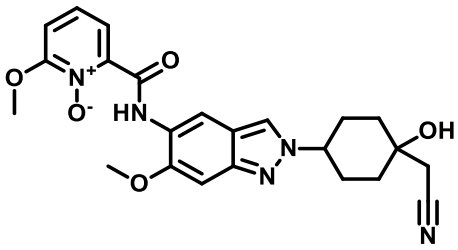

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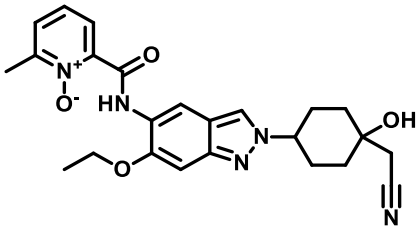

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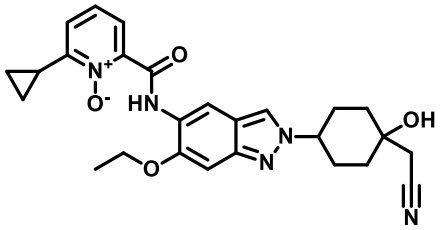

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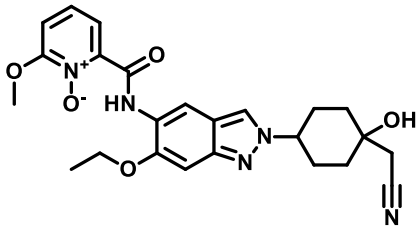

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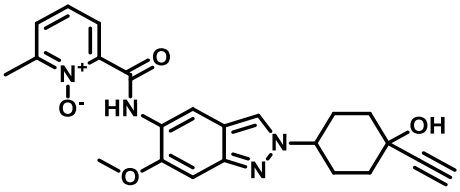

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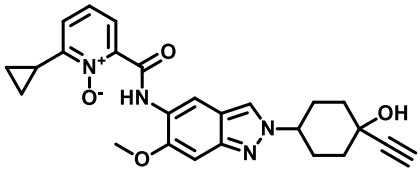

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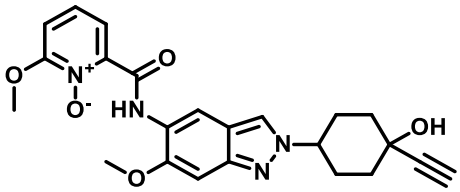

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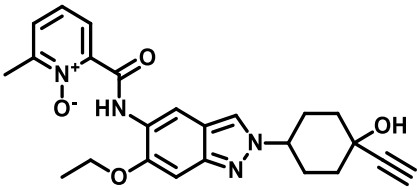

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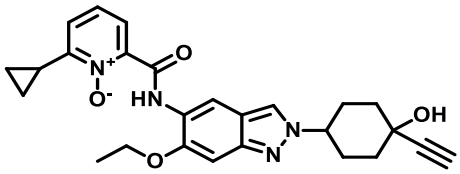

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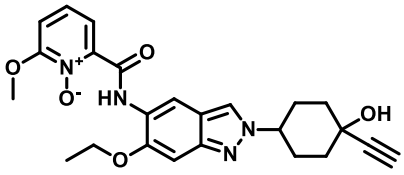

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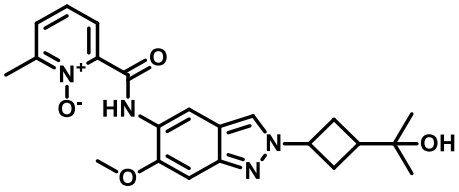

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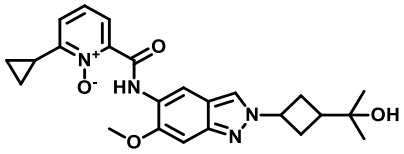

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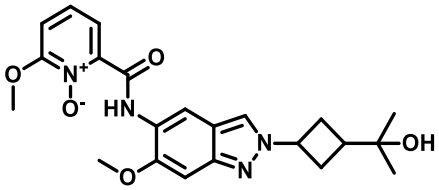

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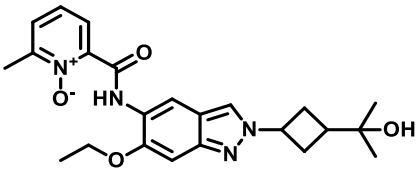

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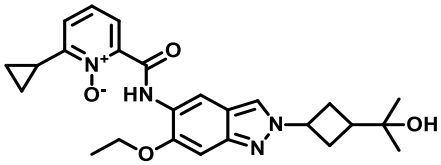

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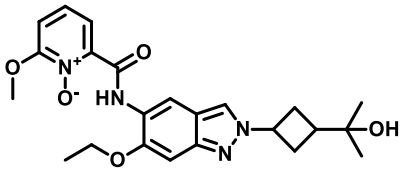

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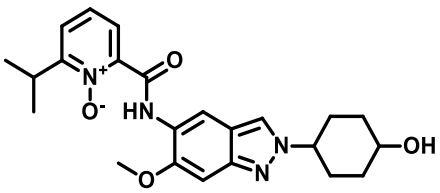

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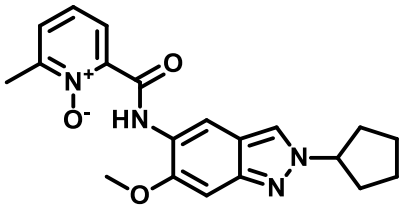

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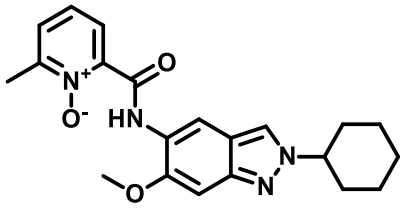

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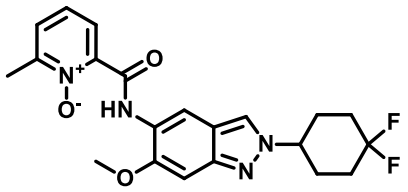

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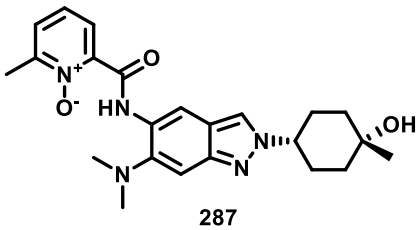

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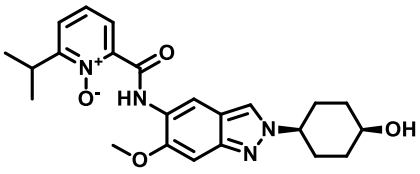

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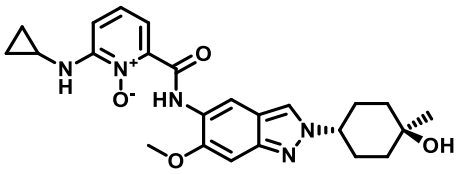

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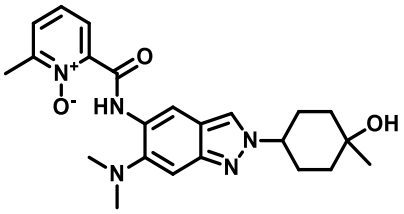

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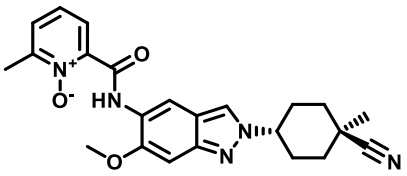

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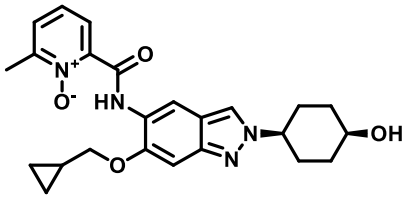

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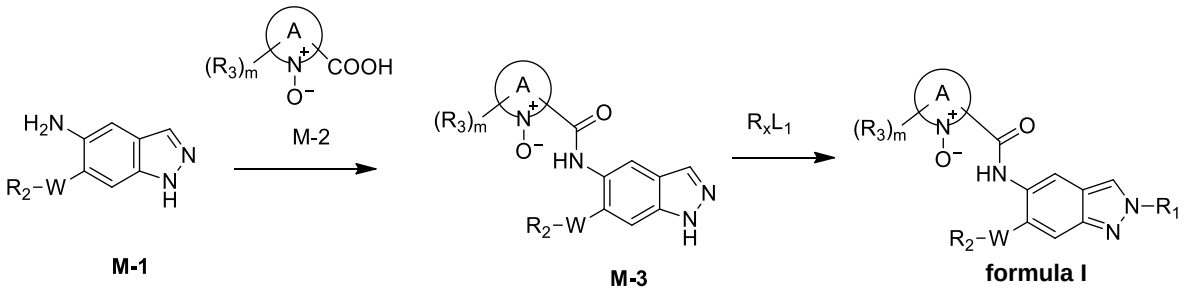
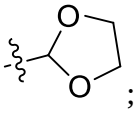
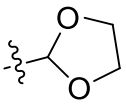
8. A preparation method for the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to any one of claims 1-7, wherein the preparation method comprises:



M-1 M-2 M-3 formula I

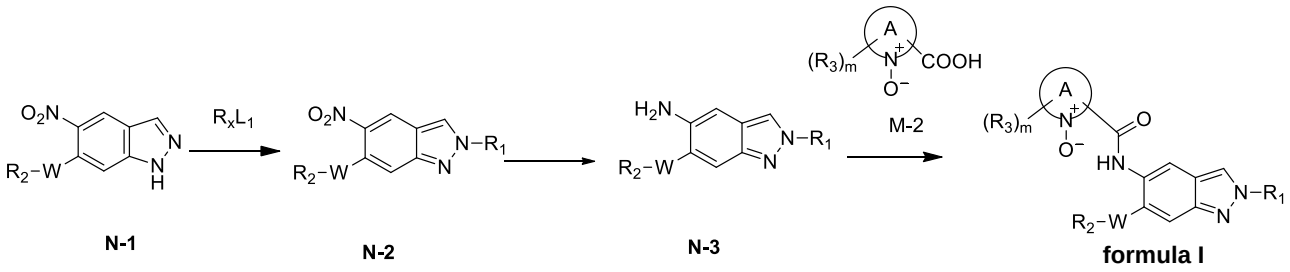
(a1) reacting M-1 and M-2 to give M-3, wherein the reaction is performed in the presence of EDCl.HCl and pyridine; and

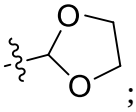
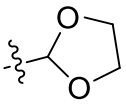
(a2) reacting M-3 and R_xL_1, wherein R_x is selected from R_1 and a group of R_1 having hydroxyl

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 is HCl, and the reductant 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 selected from halogen and -OTs.

9. A preparation method for the compound of formula I or the stereoisomer, the racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to any one of claims 1-7, 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 is HCl, and the reductant is sodium borohydride;

(b2) reducing the N-2 obtained in the above step to give N-3, wherein a reductant 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 is selected from halogen and -OTs.

10. A pharmaceutical composition comprising the compound of formula I or the stereoisomer, the

racemate, the tautomer, the isotopically labeled compound, or the pharmaceutically acceptable salt thereof according to any one of claims 1-7.

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

12. The use according to claim 11, wherein the diseases or disorders are selected from tumors, gout, systemic lupus erythematosus, multiple sclerosis, metabolic syndrome, atherosclerosis, myocardial infarction, sepsis, inflammatory bowel disease, asthma, rheumatoid arthritis, allergy.