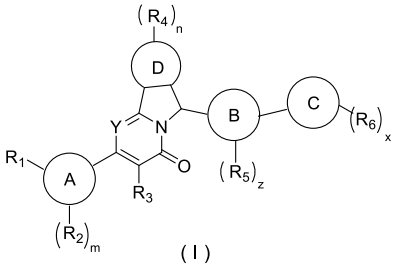
Claims

1. A compound represented by formula (I), an optical isomer thereof and a pharmaceutically acceptable salt thereof,



(I)

wherein,

ring A is selected from phenyl and 5-6 membered heteroaryl;

ring B is selected from 5-6 membered heteroaryl;

ring C is selected from phenyl, 5-10 membered heteroaryl, benzo 5-9 membered heterocycloalkyl, pyrido 5-9 membered heterocycloalkyl and benzo 5-9 membered heterocycloalkenyl;

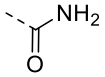
ring D is selected from C_{3-5} cycloalkyl and 3-5 membered heterocycloalkyl;

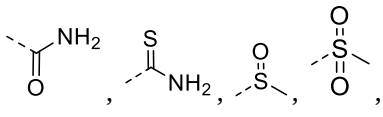
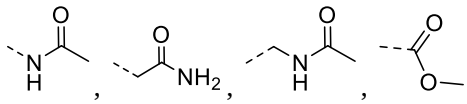
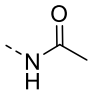
R_1 is selected from H, C_{1-6} alkyl, C_{1-6} heteroalkyl and 5-6 membered heteroaryl, and the C_{1-6} alkyl, C_{1-6} heteroalkyl or 5-6 membered heteroaryl is optionally substituted by 1, 2 or 3 R;

R_2 is independently selected from H, halogen, OH, NH_2, CN, C_{1-6} alkyl and C_{1-6} heteroalkyl, and the C_{1-6} alkyl or C_{1-6} heteroalkyl is optionally substituted by 1, 2 or 3 R;

R_3 is selected from H, F, Cl, Br, I, OH, NH_2, CN and Me;

R_4 is selected from H, F, Cl, Br, I, OH, NH_2, CN, COOH, CH_2OH and C_{1-6} alkyl;

R_5 is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl and C_{1-6} heteroalkyl, and the C_{1-6} alkyl or C_{1-6} heteroalkyl is optionally substituted by 1, 2 or 3 R;

R_6 is independently selected from H, halogen, OH, NH_2, CN, COOH, , , C_{1-6} alkyl and C_{1-6} heteroalkyl, and the C_{1-6} alkyl, C_{1-6} heteroalkyl or  is optionally substituted by 1, 2 or 3 R;

Y is selected from N and C(R_7);

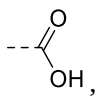
R_7 is selected from H, F, Cl, Br, I, OH, NH_2, CN, C_{1-6} alkyl and C_{1-6} heteroalkyl, and the C_{1-6} alkyl or C_{1-6} heteroalkyl is optionally substituted by 1, 2 or 3 R;

m is selected from 0, 1, 2 and 3;

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

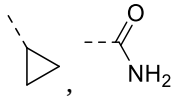
x is selected from 0, 1, 2 and 3;

z is selected from 0, 1 and 2;

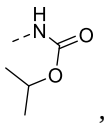
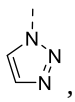
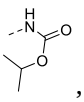
R is independently selected from H, halogen, OH, NH_2, CN, , , C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkylthio, C_{1-6} alkylamino, C_{3-6} cycloalkyl, and the C_{1-6} alkyl, C_{1-6} alkoxy, C_{1-6} alkylthio, C_{1-6} alkylamino, or C_{3-6} cycloalkyl is optionally substituted by 1, 2, or 3 R';

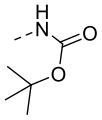
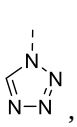
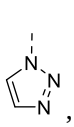
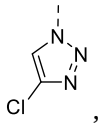
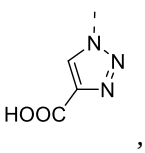
R' is selected from H, F, Cl, Br, I, OH, NH_2 and CH_3;

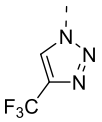
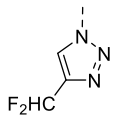
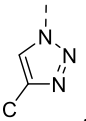
the 3-5 membered heterocycloalkyl, 5-6 membered heterocycloalkyl, 5-9 membered heterocycloalkenyl, 5-9 membered heterocycloalkyl, 5-6 membered heteroaryl, 5-10 membered heteroaryl, C_{1-6} heteroalkyl or C_{1-6} heterocycloalkyl contains 1, 2 or 3 heteroatoms or heteroatom groups independently selected from -O-, -NH-, -S-, -C(=O)-, -C(=O)O-, -S(=O)-, -S(=O)$_2$- and N.

2. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R is selected from H, F, Cl, Br, I, OH, NH_2, COOH, CF_3, CF_2H, CN, CH_3O, CH_3CH_2O,  and Me.

3. The compound according to claim 1 or 2, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_1 is selected from H, C_{1-3} alkyl, C_{1-3} heteroalkyl, tetrazolyl and 1,2,3-triazolyl, and the tetrazolyl or 1,2,3-triazolyl is optionally substituted by R, the C_{1-3} alkyl or C_{1-3} heteroalkyl is optionally substituted by 1, 2 or 3 R.

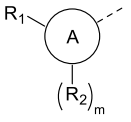
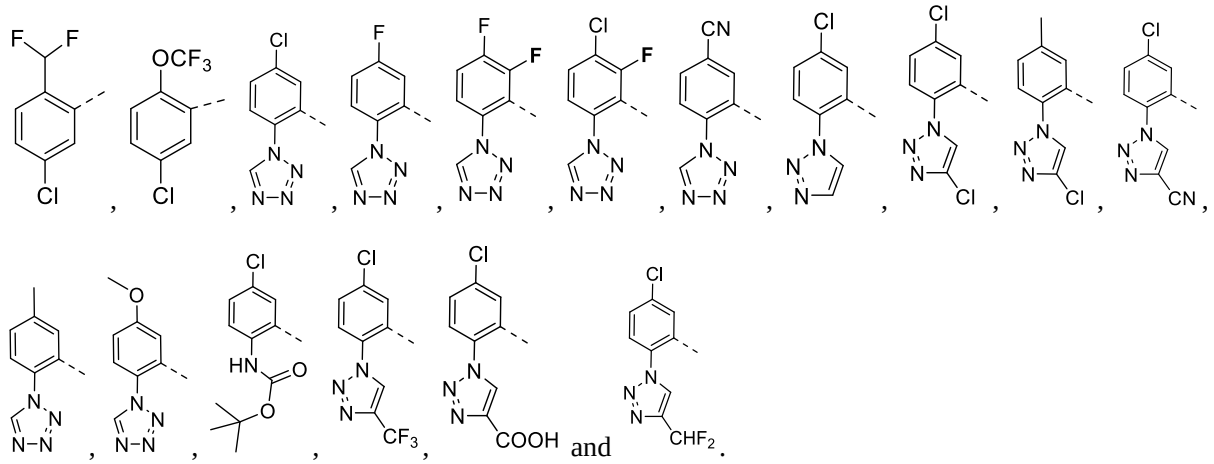
4. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_1 is selected from H, C_{1-3} alkyl, C_{1-3} alkoxy, ,  and , the ,  or  is optionally substituted by R, the C_{1-3} alkyl or C_{1-3} alkoxy is optionally substituted by 1, 2 or 3 R.

5. The compound according to claim 4, the optical isomer thereof and the pharmaceutically acceptable salts thereof, wherein, R_1 is selected from H, -CHF_2, -OCF_3, , , , , ,

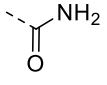

,  and .

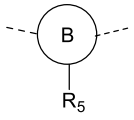
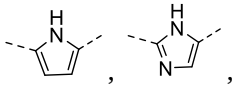
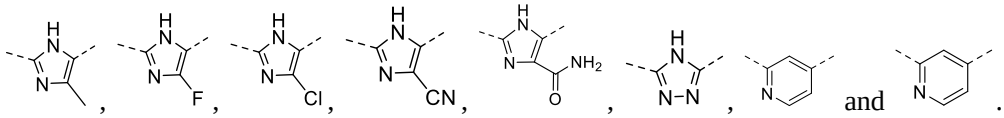
6. The compound according to claim 1 or 2, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_2 is independently selected from H, halogen, OH, NH_2, CN, C_{1-3} alkyl and C_{1-3} alkoxy, and the C_{1-3} alkyl or C_{1-3} alkoxy is optionally substituted by 1, 2 or 3 R.

7. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein R_2 is independently selected from H, F, Cl, Br, I, OH, NH_2, CN, Me and .

8. The compound according to any one of claim 1, 5 or 7, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from .

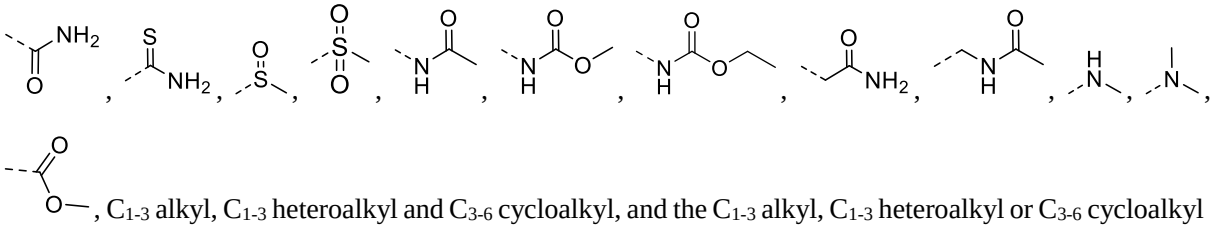
9. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, ring B is selected from pyrrolyl, imidazolyl, 1,2,4-triazolyl and pyridyl.

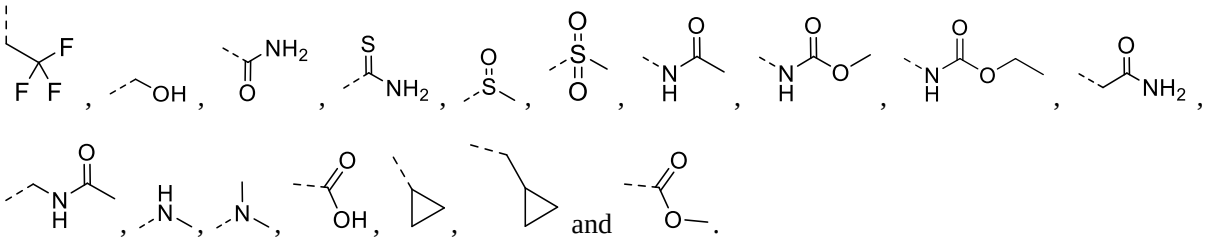
10. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_5 is independently selected from H, F, Cl, Br, OH, NH_2, Me, CN and .

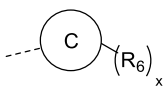
11. The compound according to claim 9 or 10, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from ,  and .

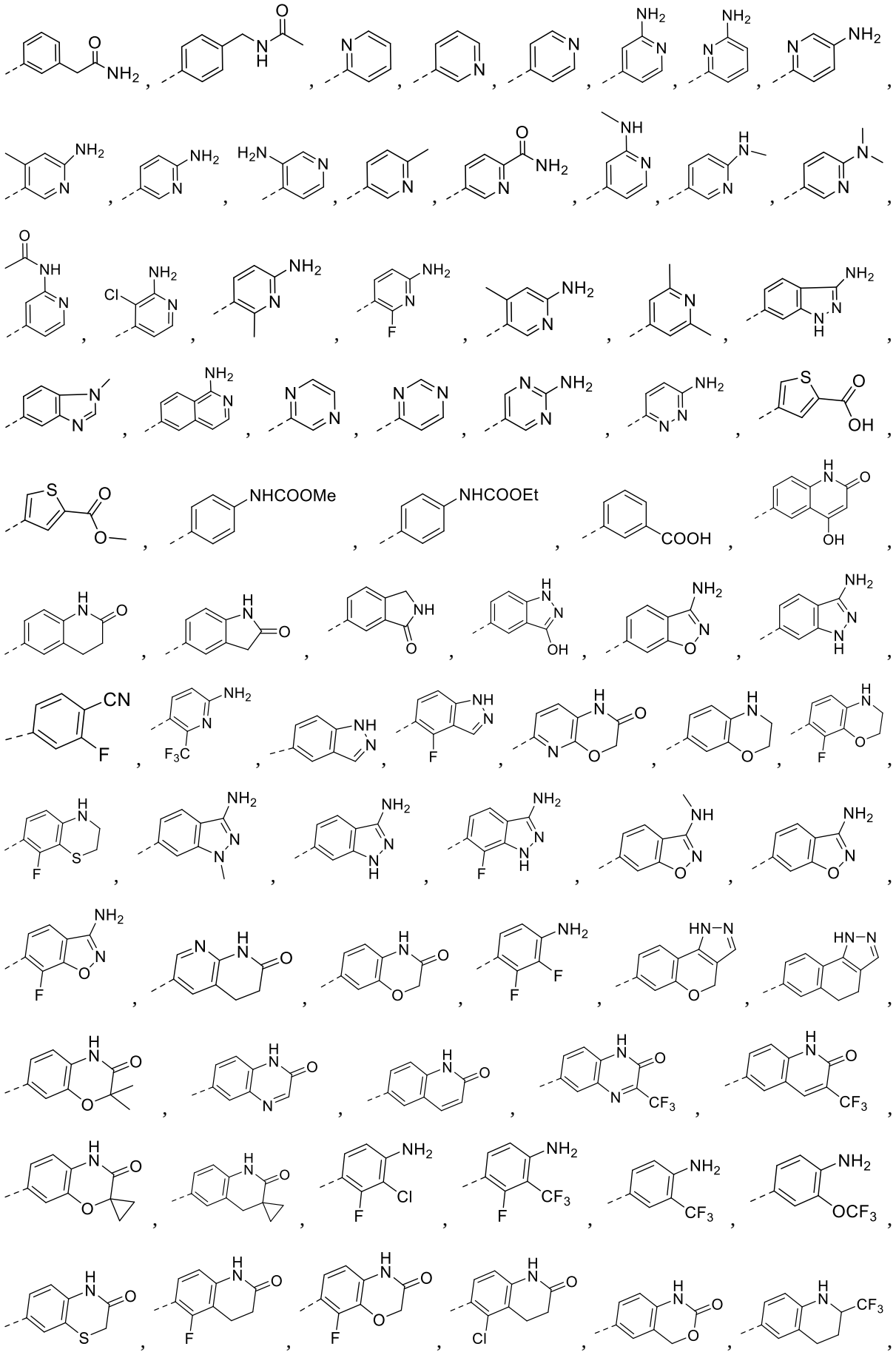
12. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable

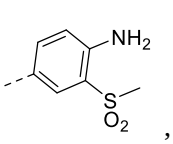
salt thereof, wherein, ring C is selected from thienyl, phenyl, pyridyl, pyrimidinyl, pyridazinyl, pyrazinyl, indazolyl, isoindolin-1-one, quinolinyl, isoquinolinyl, 1,2,3,4-tetrahydroquinolinyl, quinolin-2(1*H*)-one, benzoisoxazolyl, 1*H*-benzo[*d*]imidazolyl, dihydroindol-2-one, dihydroindol-1-one, 3, 4-dihydroquinolin-2(1*H*)-one, quinolin-2(1*H*)-one, 1*H*-pyrido[2,3-*b*][1,4]oxazin-2(3*H*)-one, 3,4-dihydro-2*H*-benzo[*b*][1,4]oxazinyl, 3,4-dihydro-2*H*-benzo[*b*][1,4]thiazinyl-2*H*-benzo[*b*][1,4]oxazin-3(4*H*)-one, 3,4-dihydro-1,8-naphthyridin-2(1*H*)-one, quinoxalin-2(1*H*)-one, spiro[benzo[*b*][1,4]oxazin-2,1'-cyclopropane]-3(4*H*)-one, 1,4-dihydro-2*H*-benzo[*d*][1,3]oxazin-2-one, 2*H*-benzo[*b*][1,4]thiazin-3(4*H*)-one, 3,4-dihydro-2*H*-benzo[*b*][1,4]thiazin-1,1-dioxide, 1,4-dihydrochromeno[4,3-*c*]pyrazolyl and 4,5-dihydro-1*H*-benzo[*g*]indazolyl.

13. The compound according to claim 1 or 2, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_6 is independently selected from H, halogen, OH, NH_2, CN, COOH, , C_{1-3} alkyl, C_{1-3} heteroalkyl and C_{3-6} cycloalkyl, and the C_{1-3} alkyl, C_{1-3} heteroalkyl or C_{3-6} cycloalkyl is optionally substituted by 1, 2 or 3 R.

14. The compound according to claim 13, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, R_6 is independently selected from H, F, Cl, Br, I, OH, NH_2, CN, Me, ,  and .

15. The compound according to claim 12 or 14, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from

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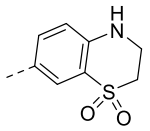
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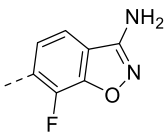
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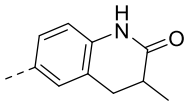
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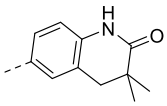
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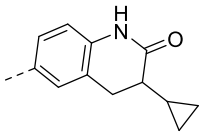
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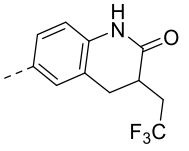
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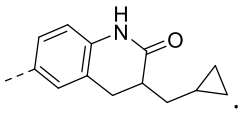
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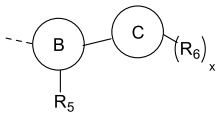
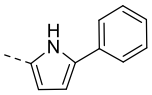
16. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from 
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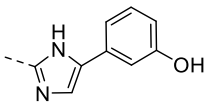
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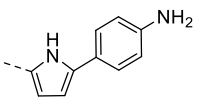
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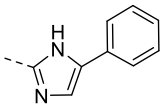
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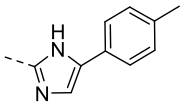
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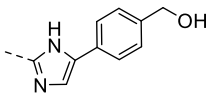
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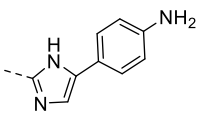
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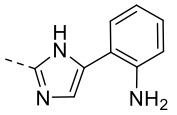
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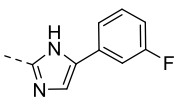
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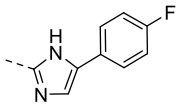
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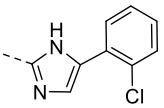
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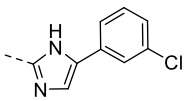
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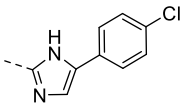
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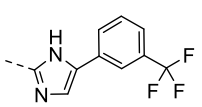
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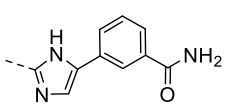
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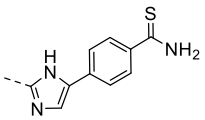
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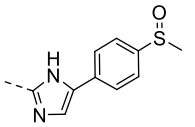
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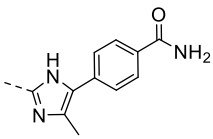
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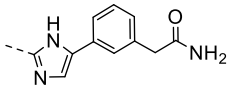
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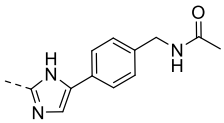
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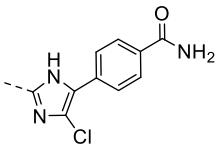
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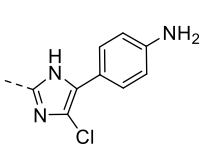
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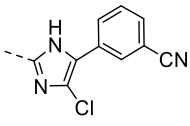
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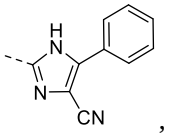
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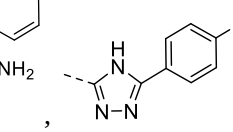
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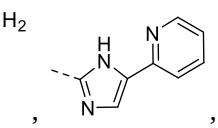
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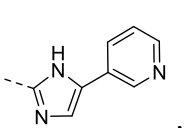
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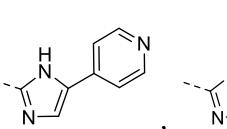
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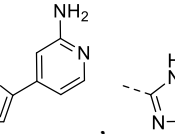
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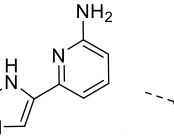
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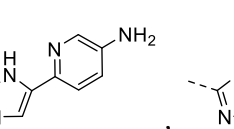
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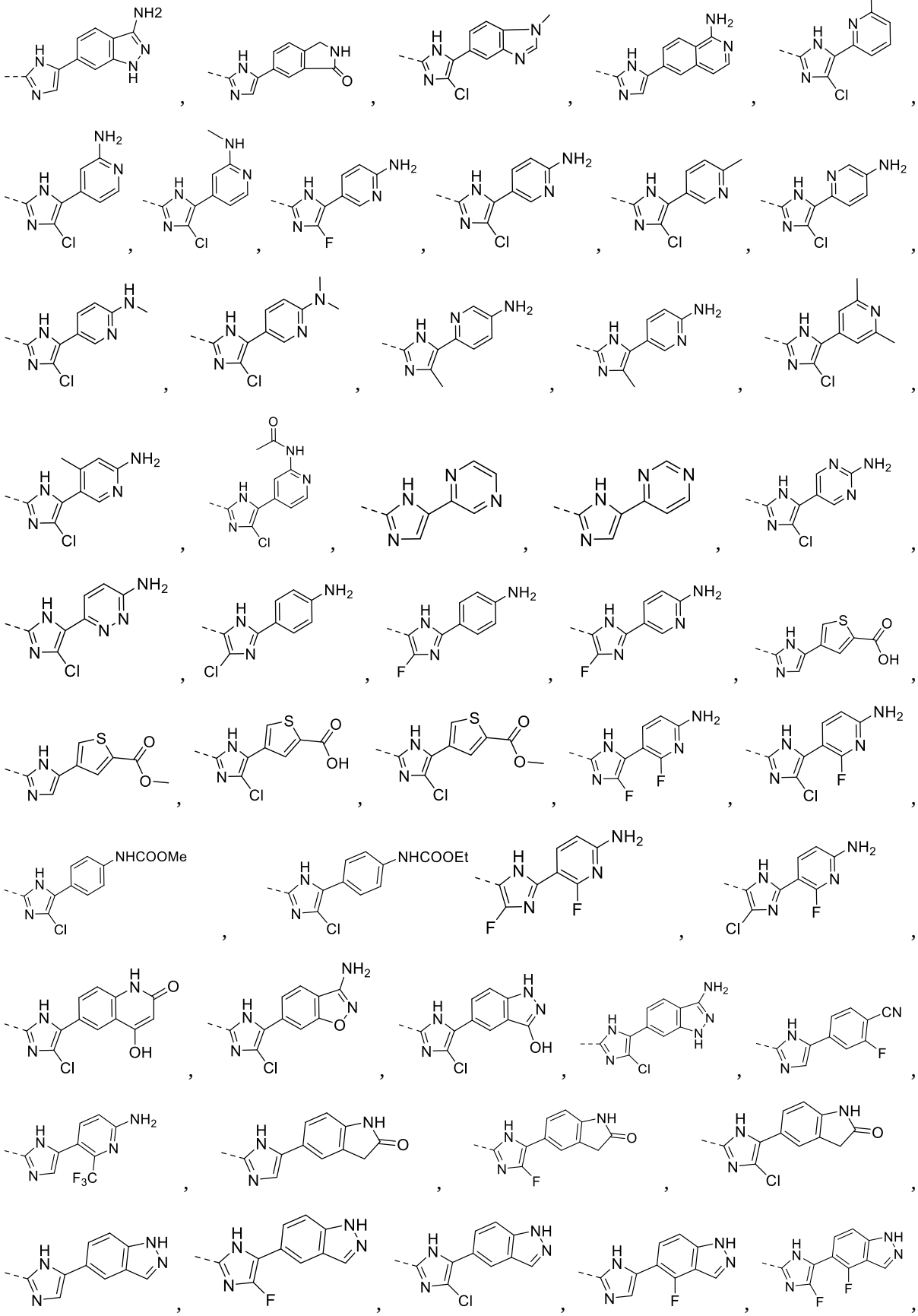

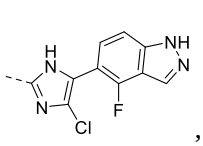
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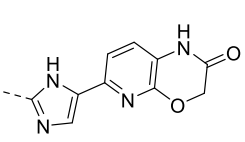
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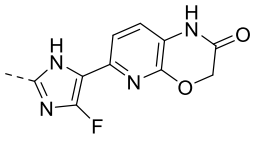
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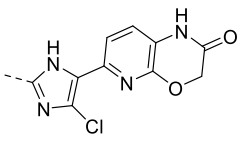
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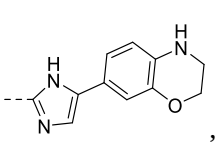
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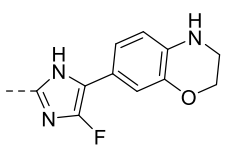
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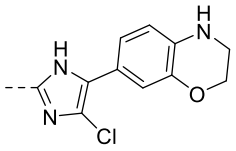
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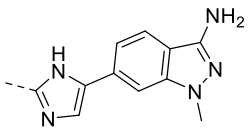
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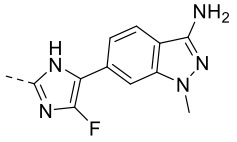
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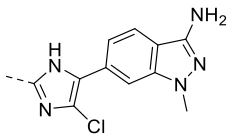
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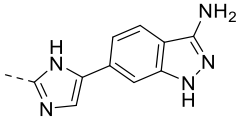
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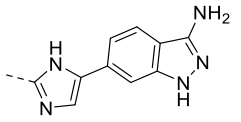
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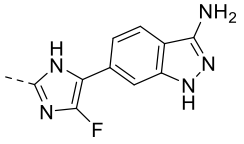
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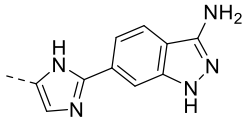
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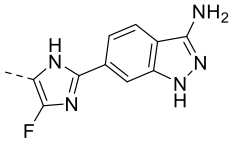
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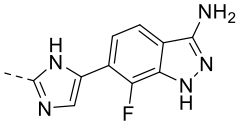
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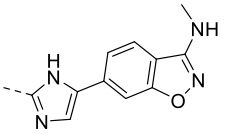
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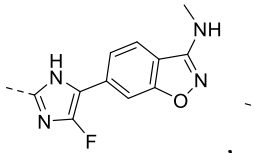
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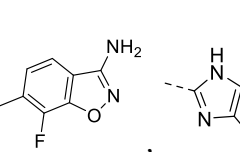
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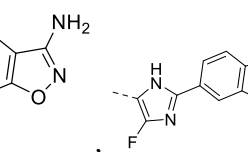
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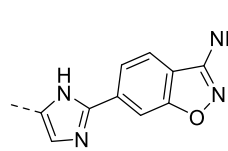
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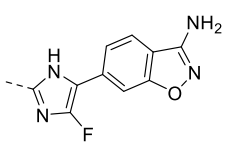
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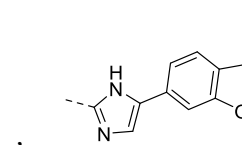
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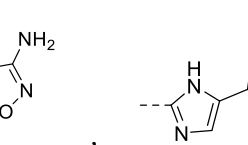
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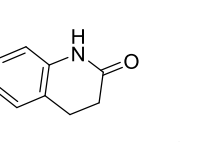
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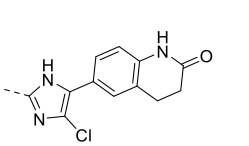
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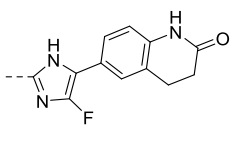
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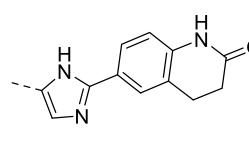
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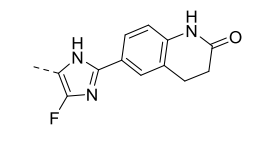
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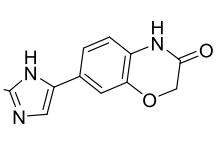
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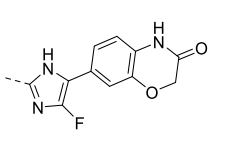
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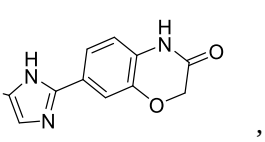
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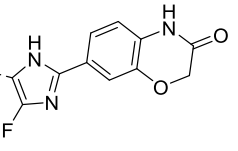
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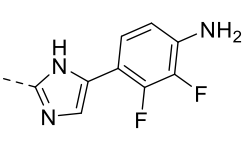
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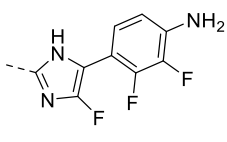
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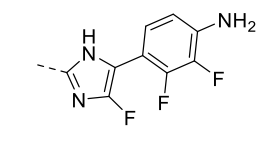
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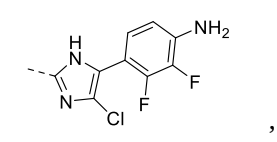
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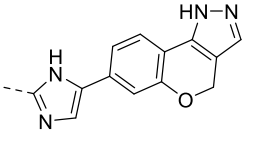
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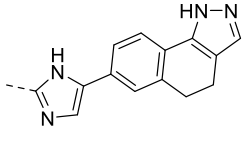
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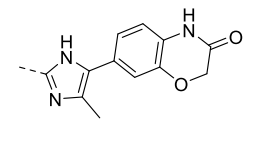
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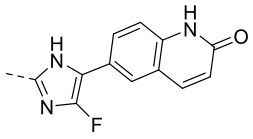
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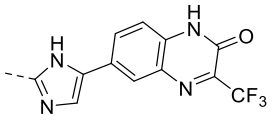
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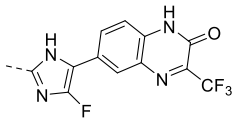
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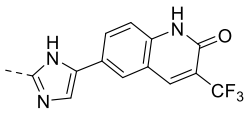
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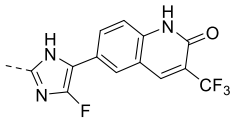
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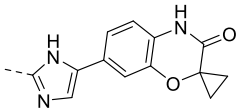
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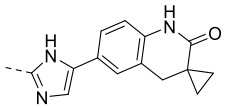
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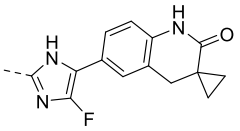
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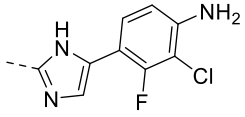
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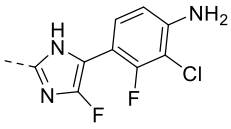
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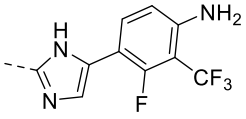
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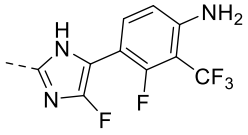
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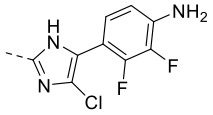
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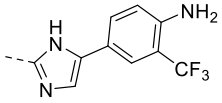
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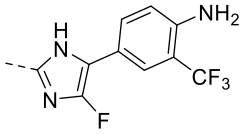
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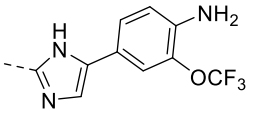
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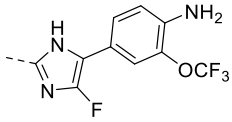
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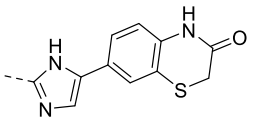
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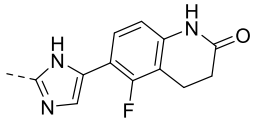
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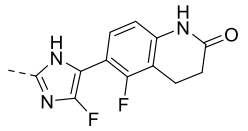
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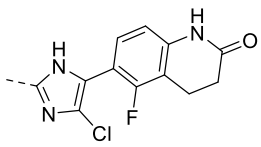
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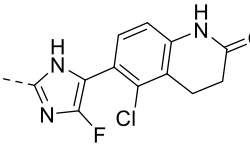
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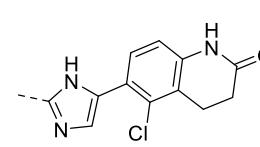
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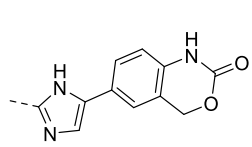
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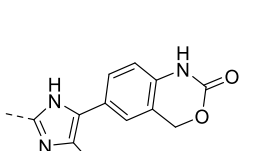
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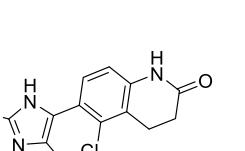
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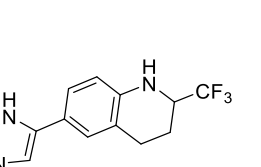
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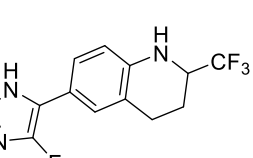
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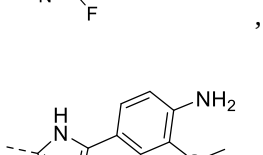
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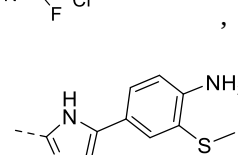
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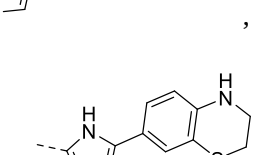
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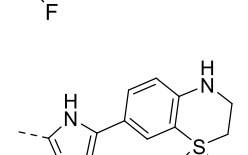
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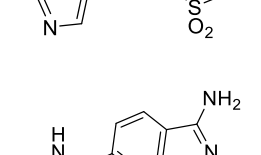
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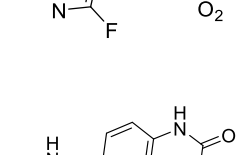
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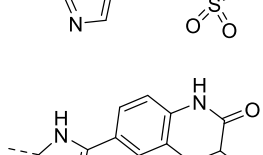
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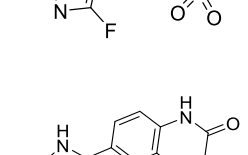
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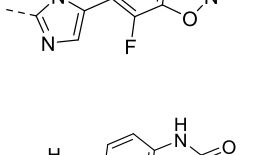
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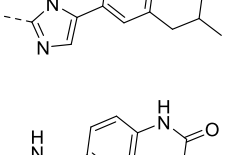
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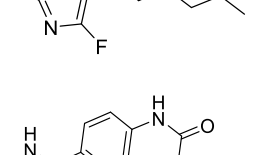
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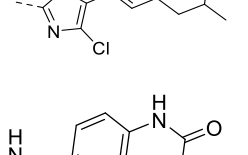
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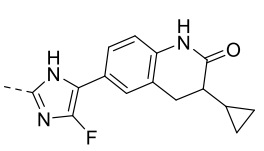
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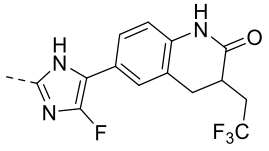
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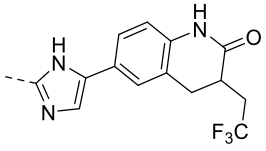
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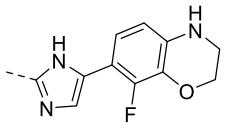
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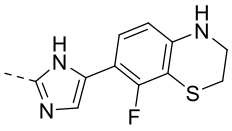
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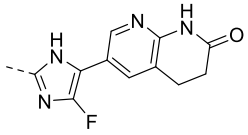
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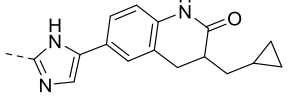
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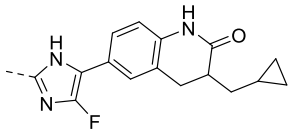
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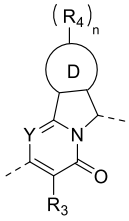
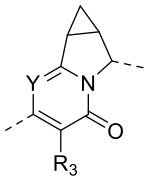
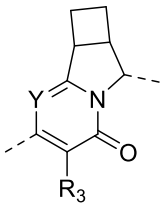
17. The compound according to claim 1, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, ring D is selected from cyclopropyl, cyclobutyl, azetidinyl, oxetanyl and pyrrolidinyl.

18. The compound according to claim 17, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from ,

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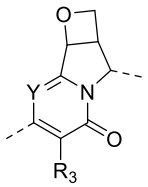
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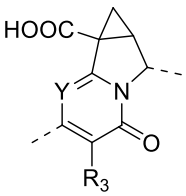
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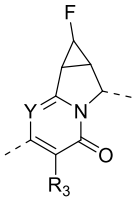
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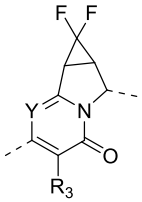
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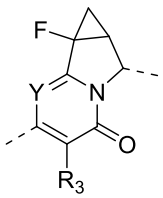
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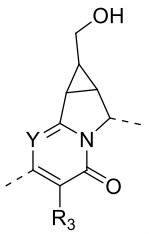
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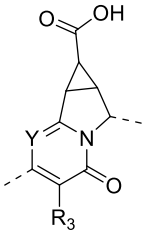
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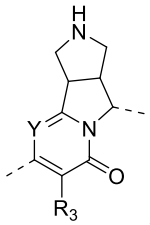
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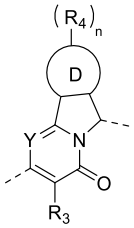
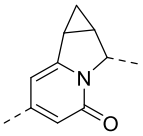
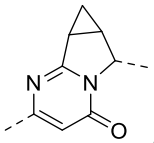
19. The compound according to claim 18, the optical isomer thereof, and the pharmaceutically acceptable salt thereof, wherein, the structural moiety  is selected from  and

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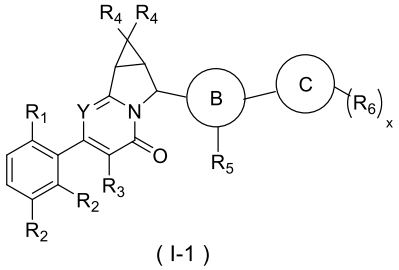
20. The compound according to any one of claims 1-7, 10-16, the optical isomer thereof, and the

pharmaceutically acceptable salt thereof, wherein, selected from



(I-1)

wherein,

R_1 is as defined in claims 1-5;

R_2 is as defined in claims 1, 6 and 7;

R_3 is as defined in claim 1;

R_4 is as defined in claim 1;

R_5 is as defined in claims 1, 10, 11 and 16;

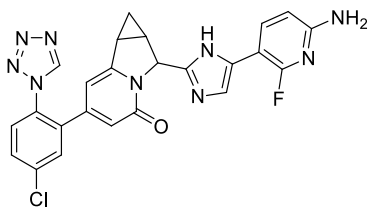
R_6 is as defined in claims 1, 13-16;

x, Y are as defined in claim 1;

ring B is as defined in claims 1, 9, 11 and 16;

ring C is as defined in claims 1, 12, 15 and 16.

21. A compound of the following formula, an optical isomer thereof and a pharmaceutically acceptable salt thereof, selected from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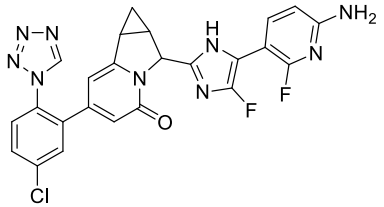
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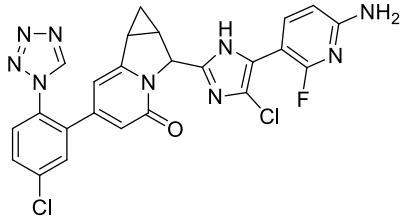
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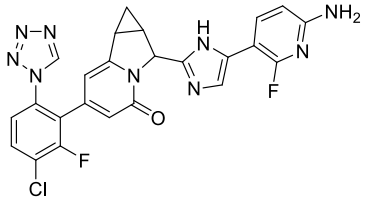
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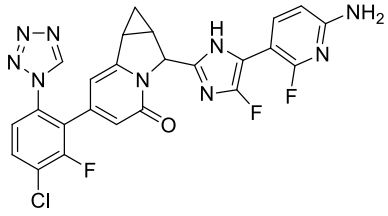
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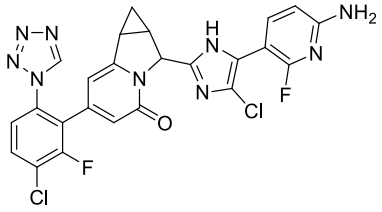
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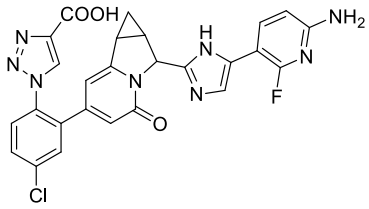
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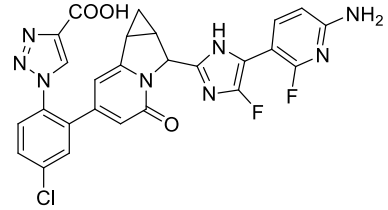
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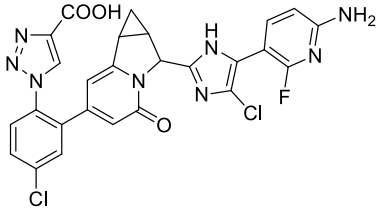
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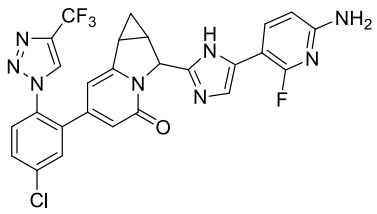
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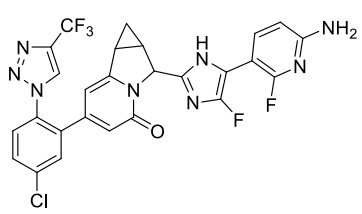
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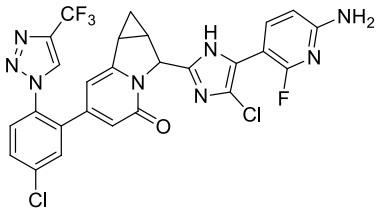
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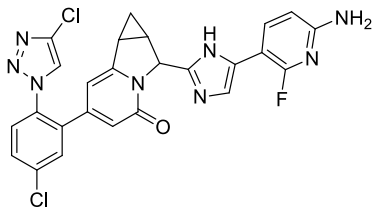
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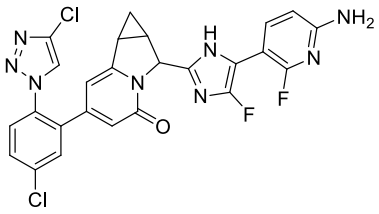
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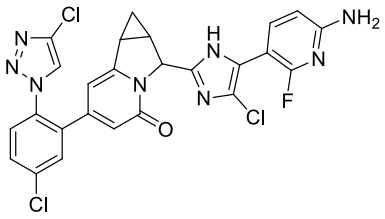
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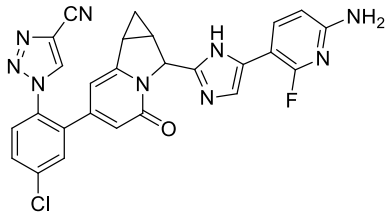
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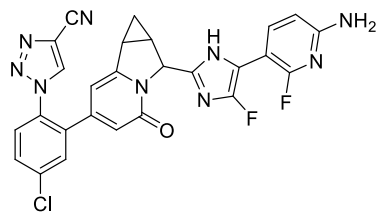
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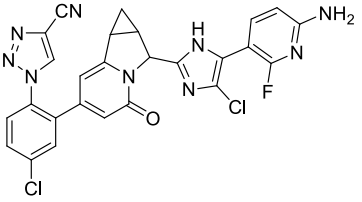
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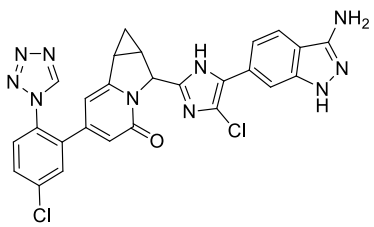
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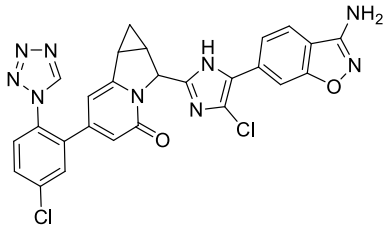
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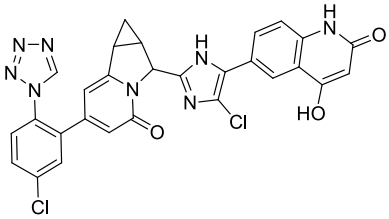
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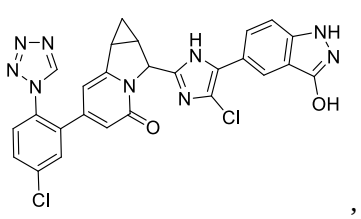
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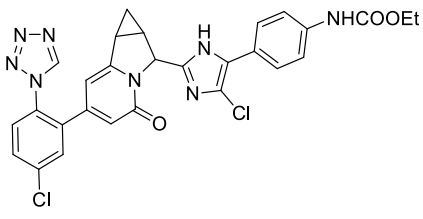
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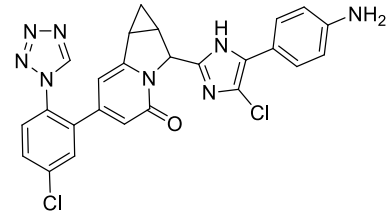
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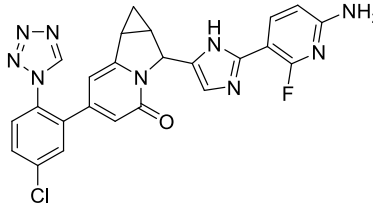
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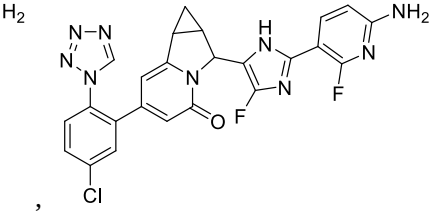
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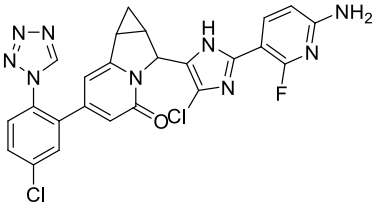
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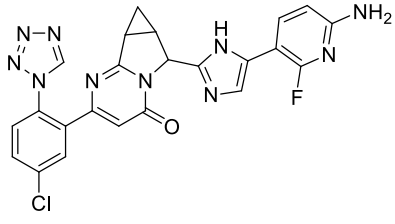
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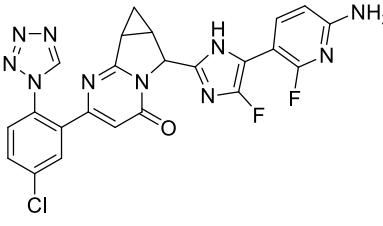
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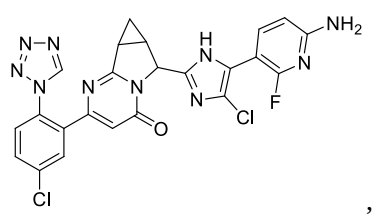
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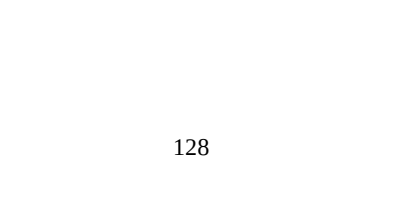
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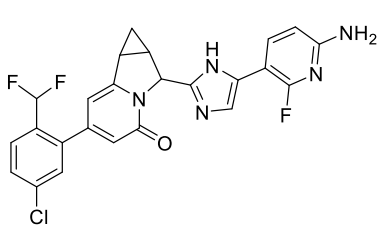
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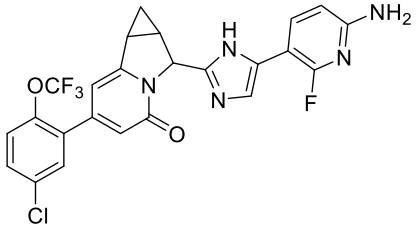
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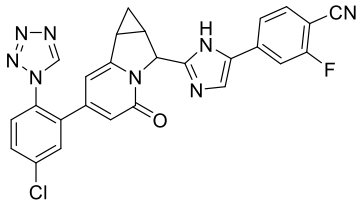
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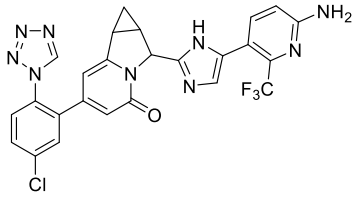
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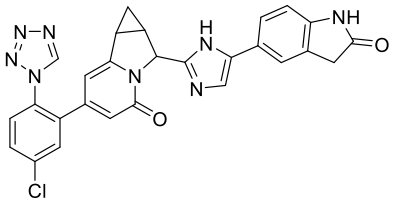
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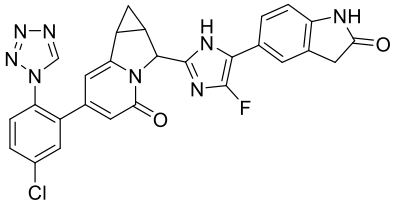
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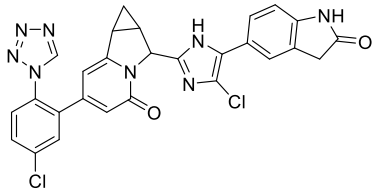
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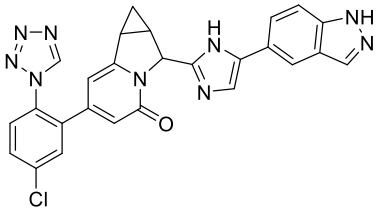
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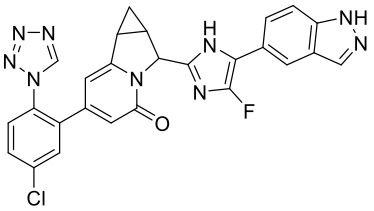
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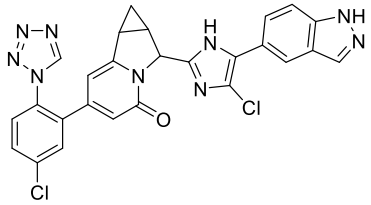
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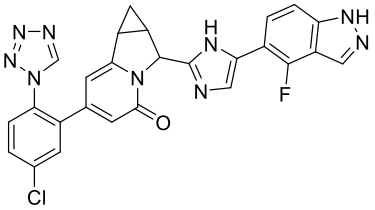
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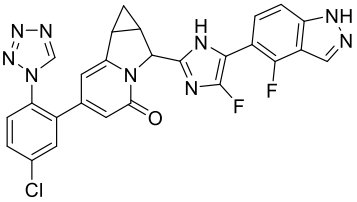
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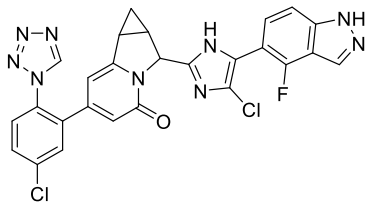
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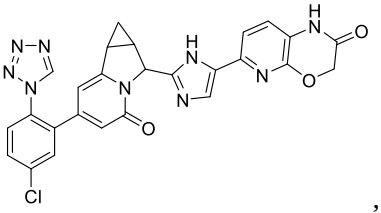
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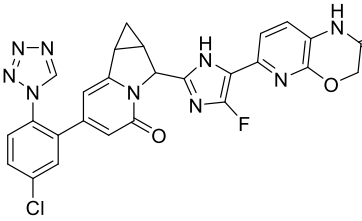
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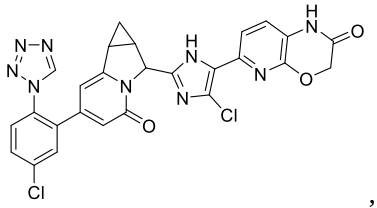
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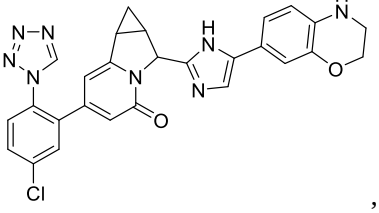
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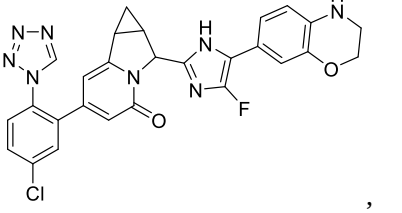
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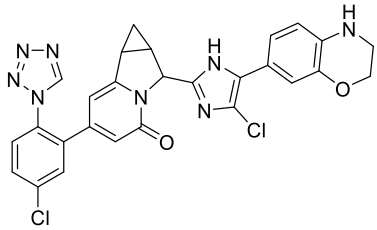
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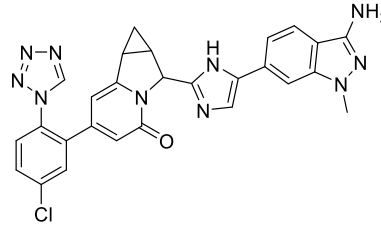
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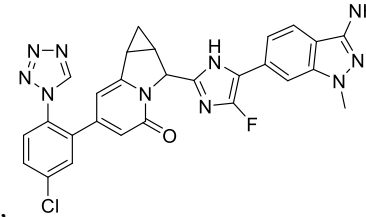
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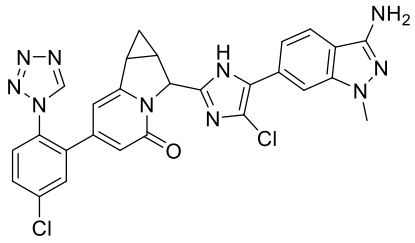
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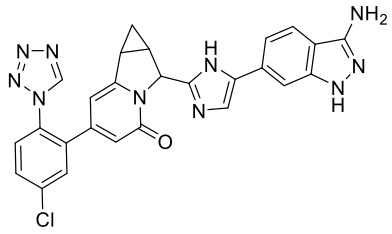
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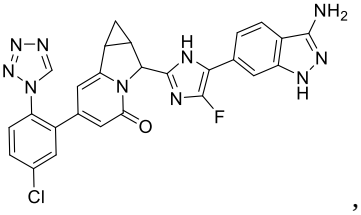
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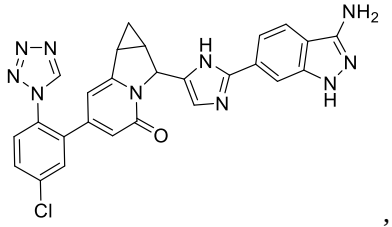
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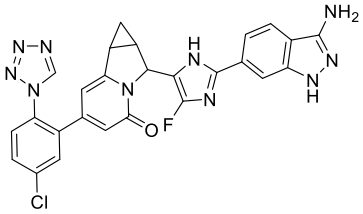
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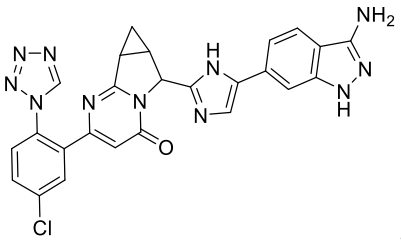
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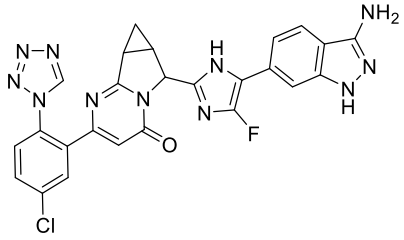
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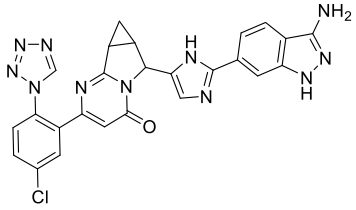
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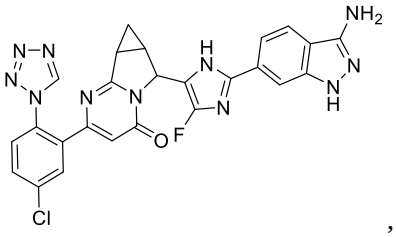
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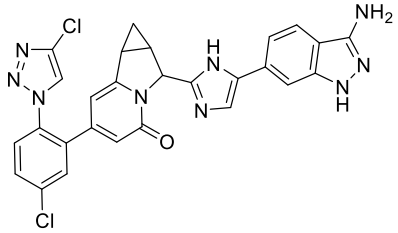
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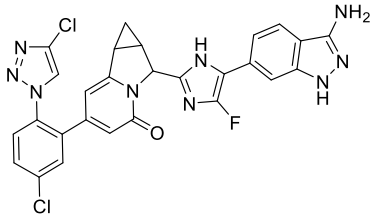
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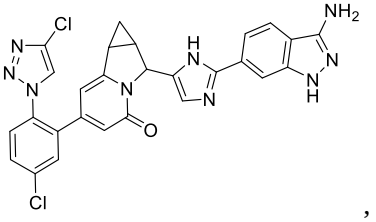
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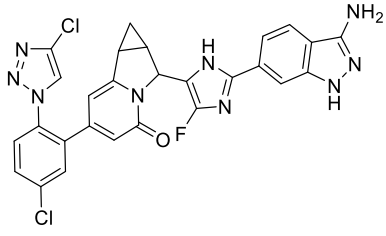
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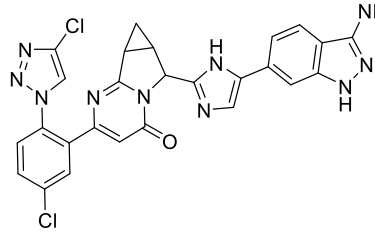
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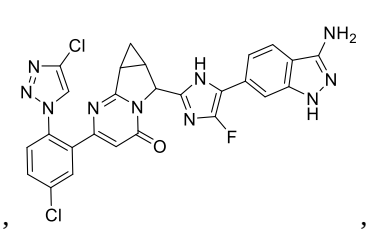
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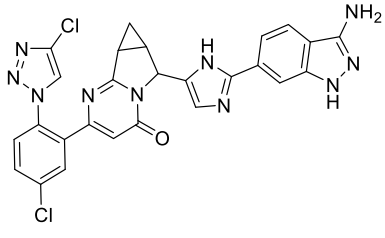
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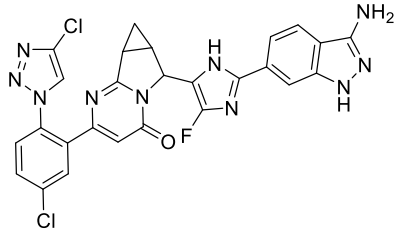
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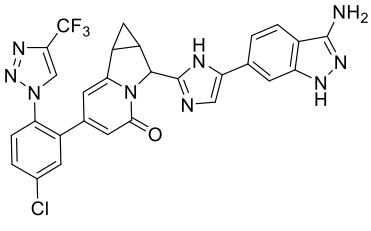
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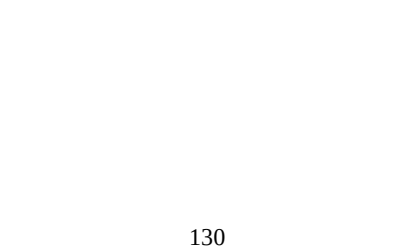
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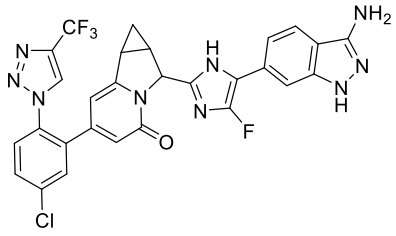
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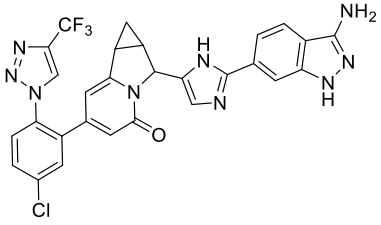
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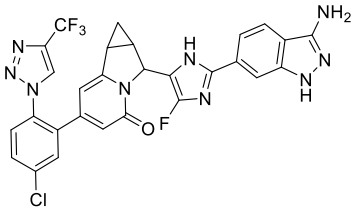
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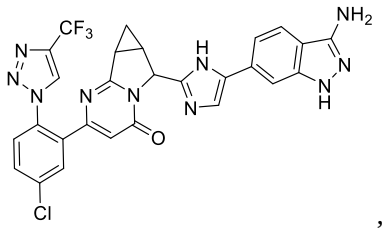
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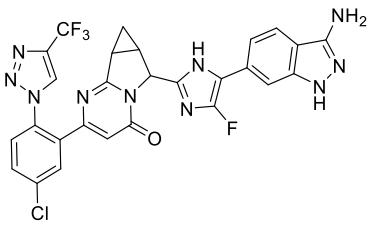
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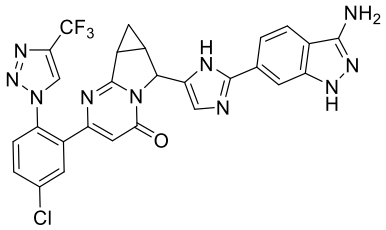
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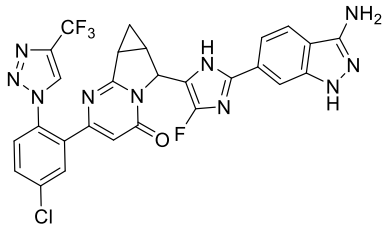
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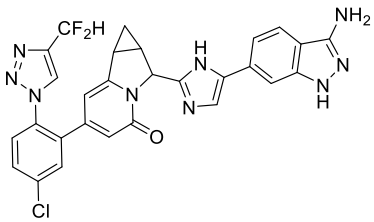
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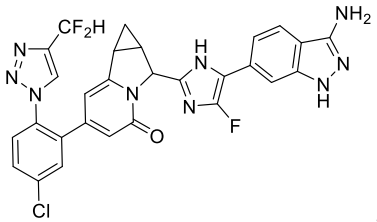
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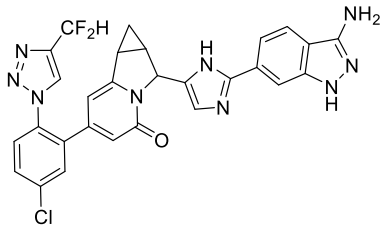
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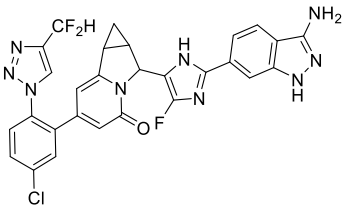
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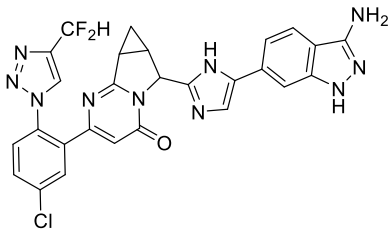
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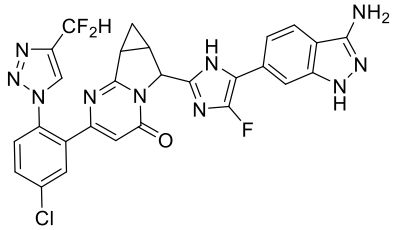
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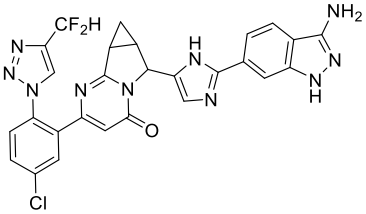
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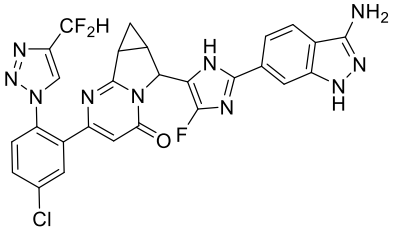
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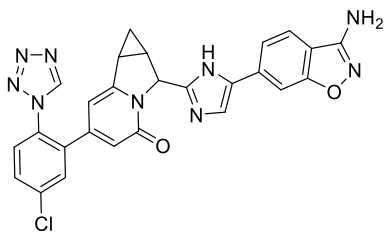
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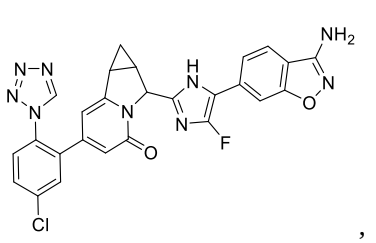
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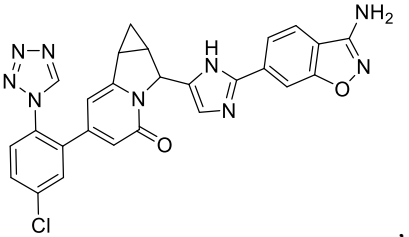
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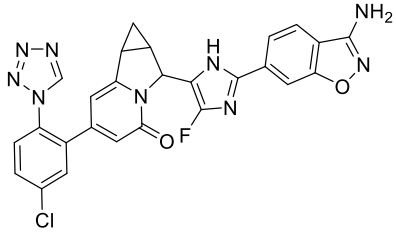
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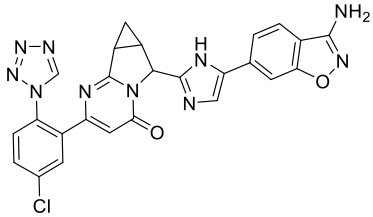
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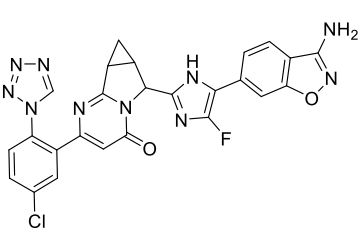
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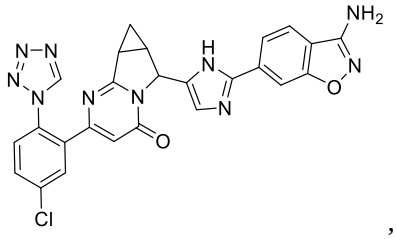
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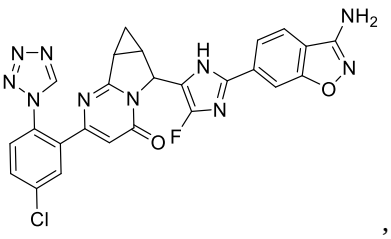
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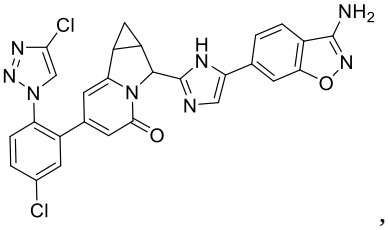
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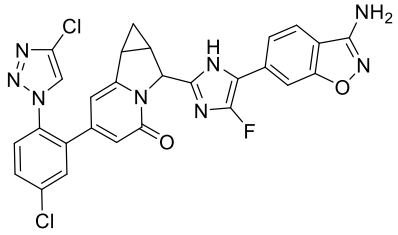
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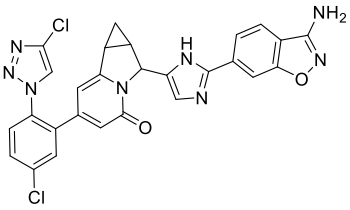
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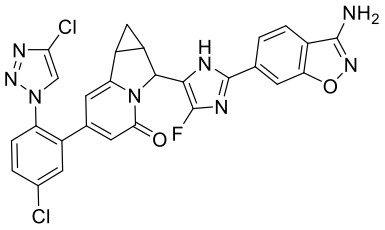
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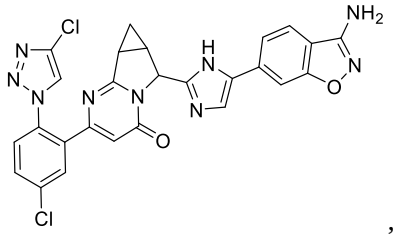
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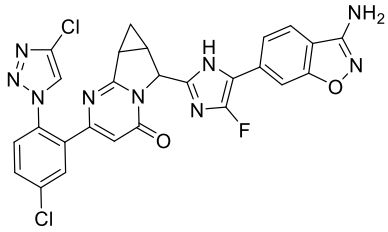
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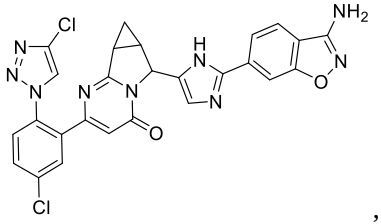
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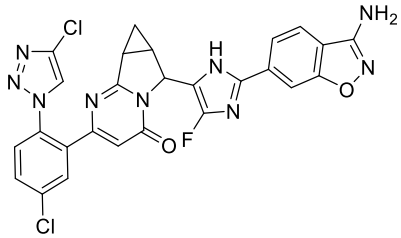
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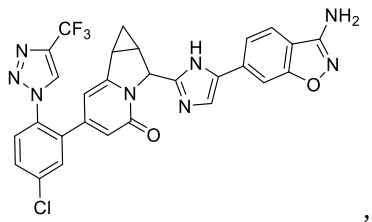
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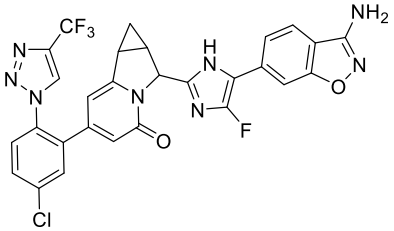
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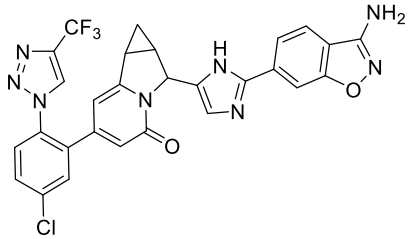
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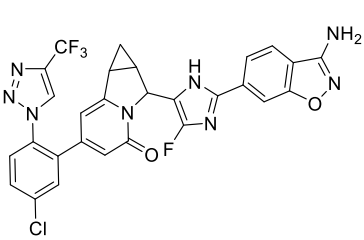
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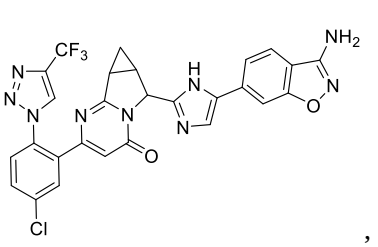
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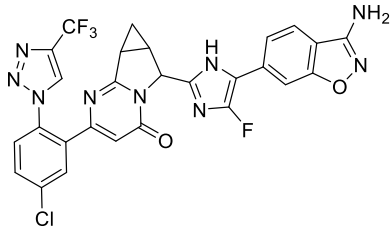
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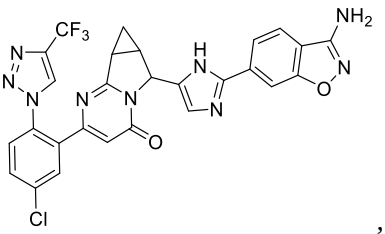
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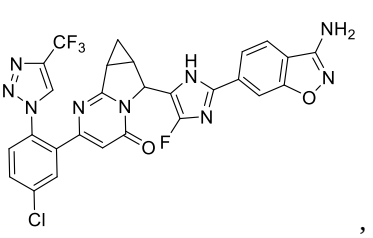
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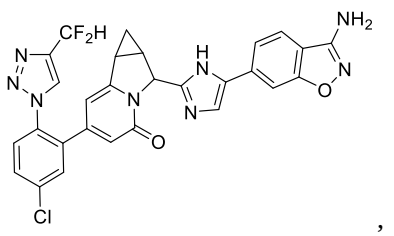
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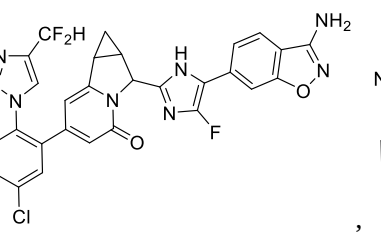
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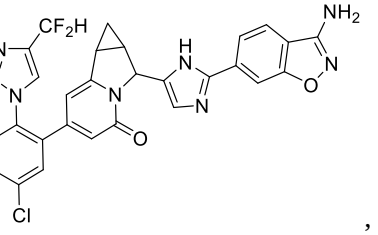
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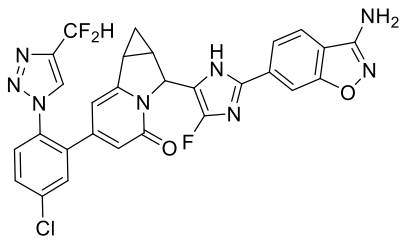
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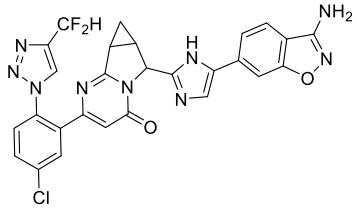
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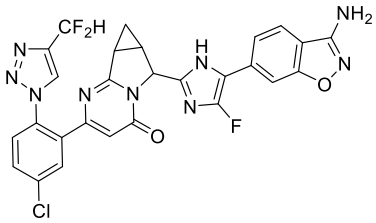
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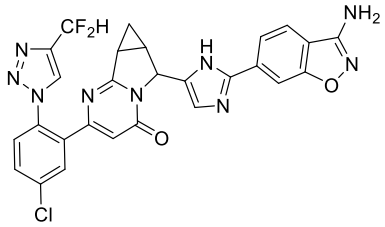
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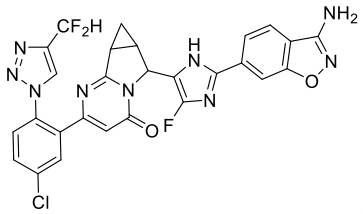
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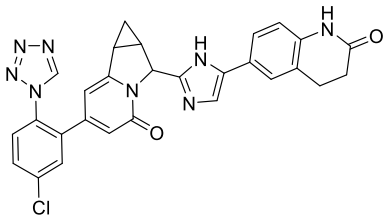
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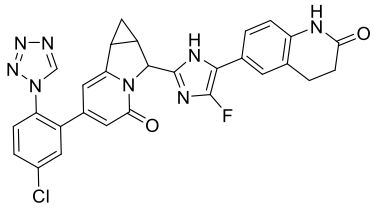
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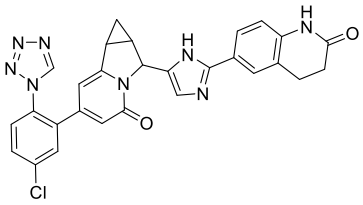
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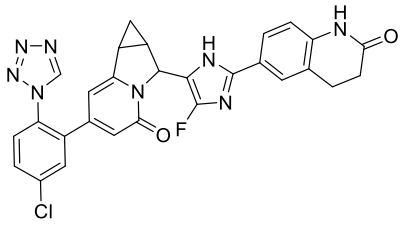
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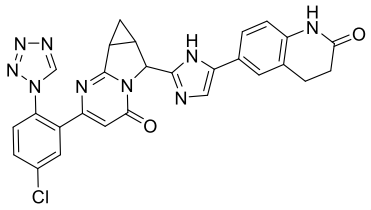
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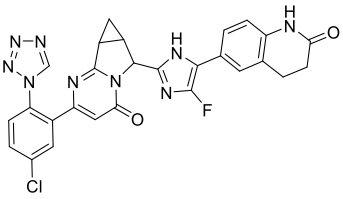
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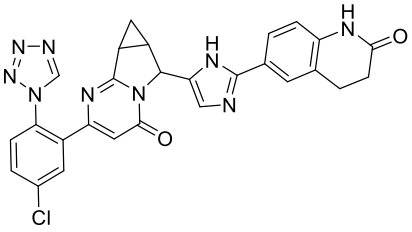
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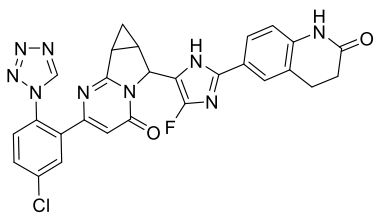
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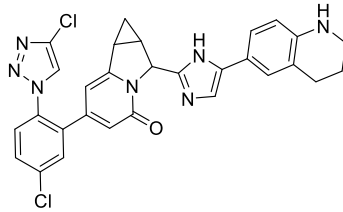
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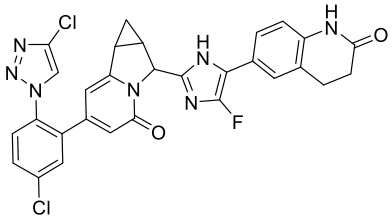
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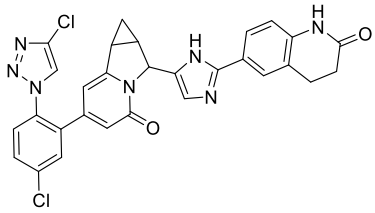
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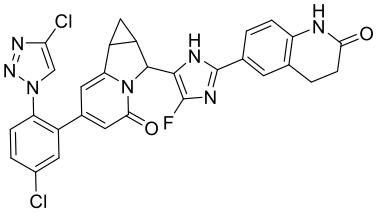
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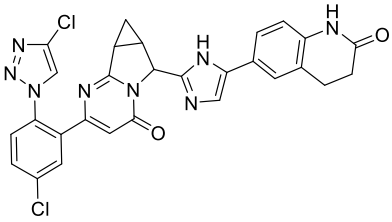
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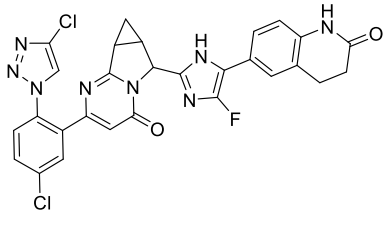
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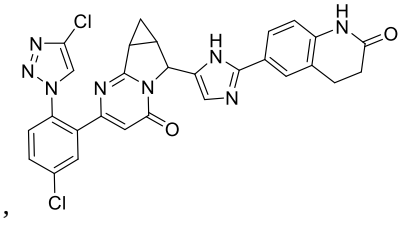
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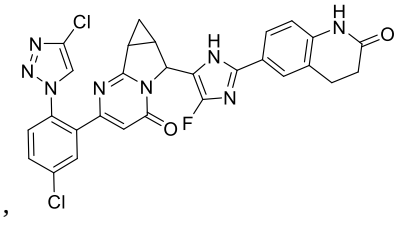
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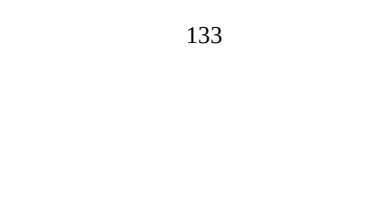
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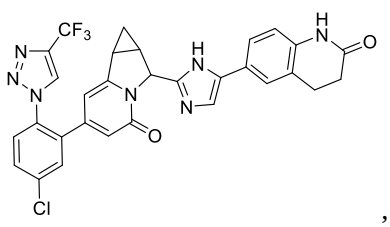
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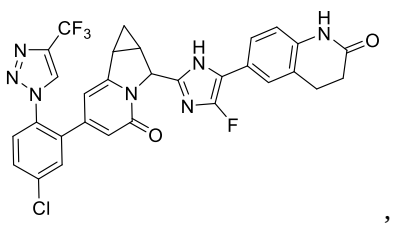
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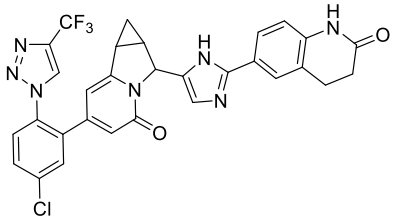
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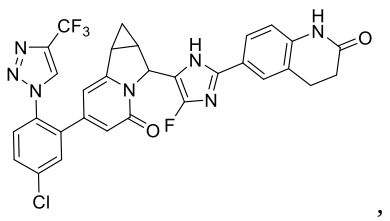
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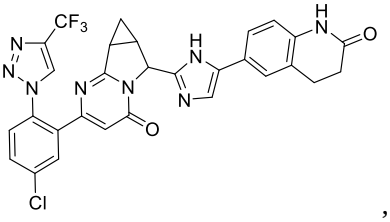
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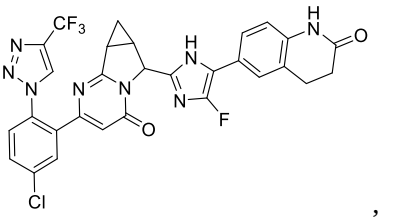
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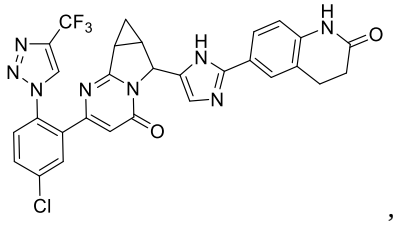
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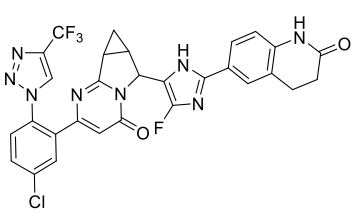
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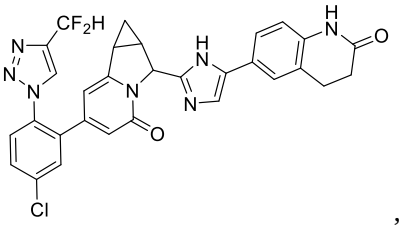
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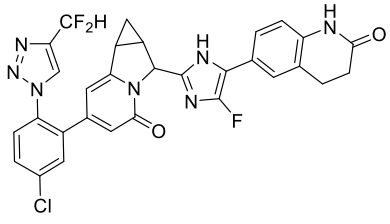
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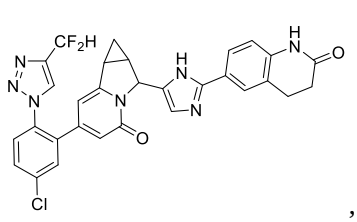
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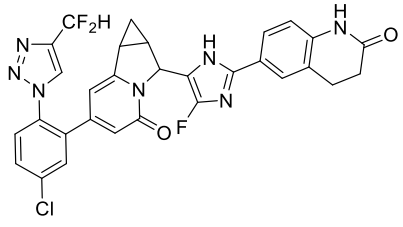
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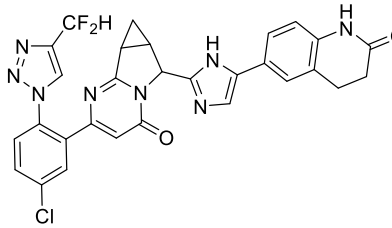
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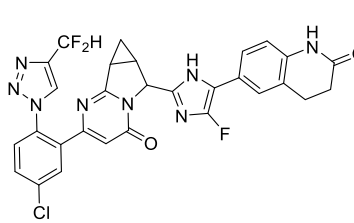
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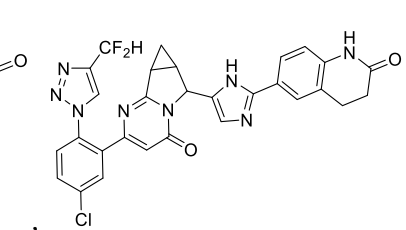
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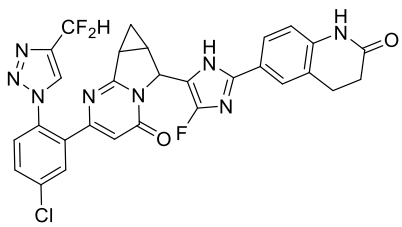
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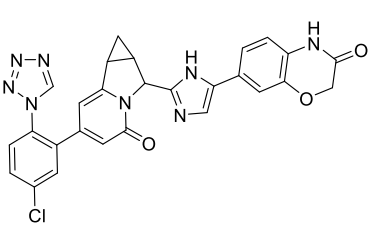
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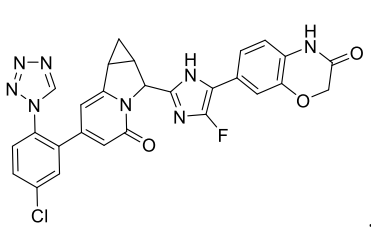
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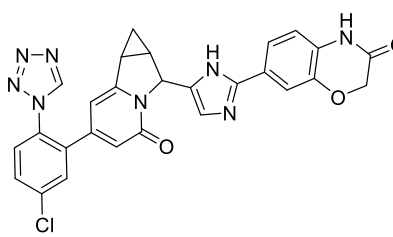
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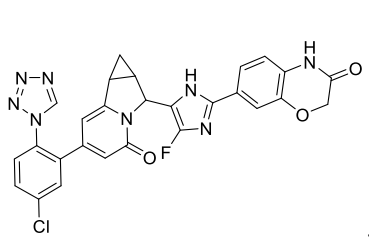
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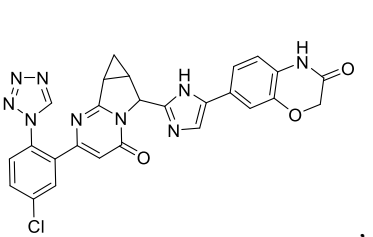
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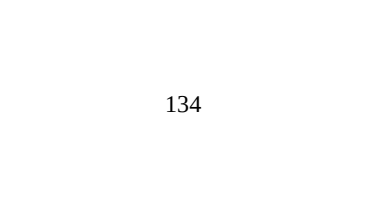
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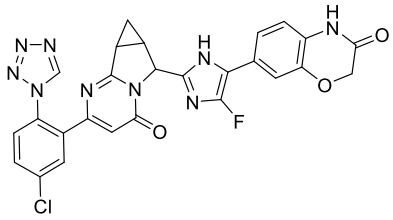
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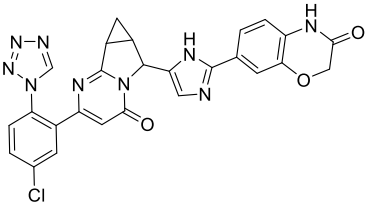
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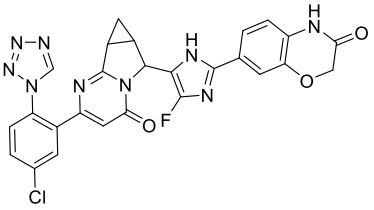
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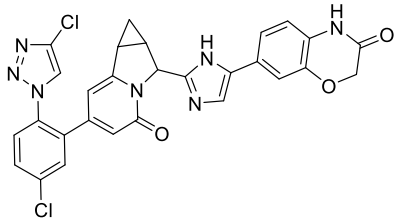
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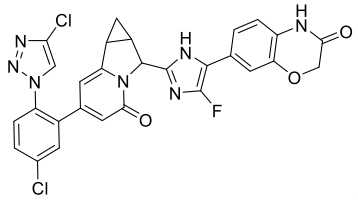
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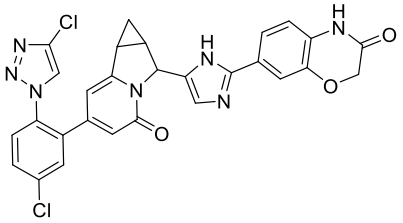
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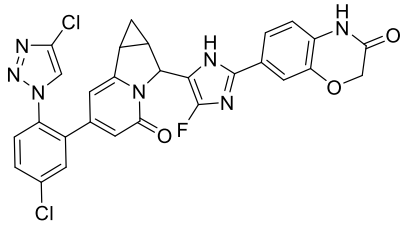
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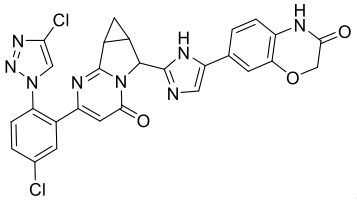
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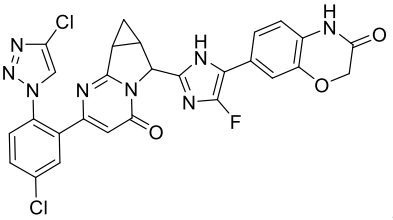
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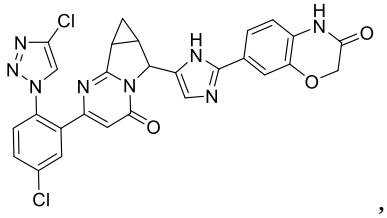
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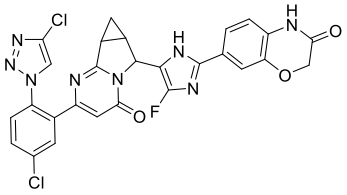
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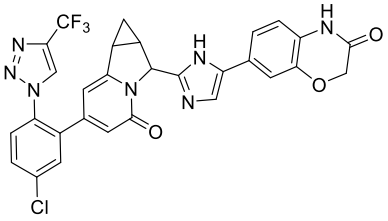
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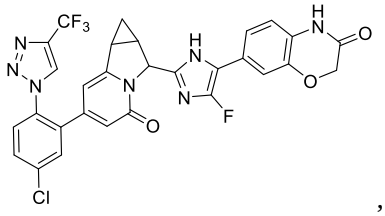
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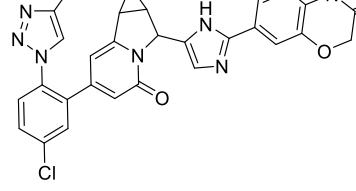
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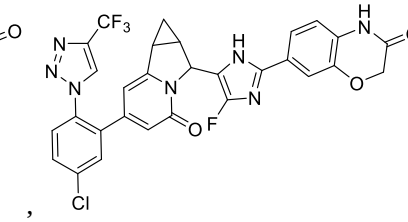
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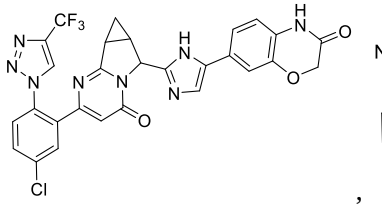
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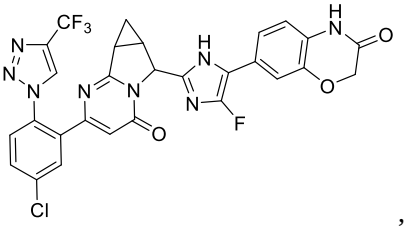
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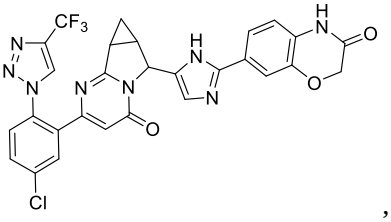
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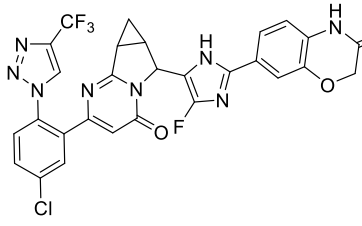
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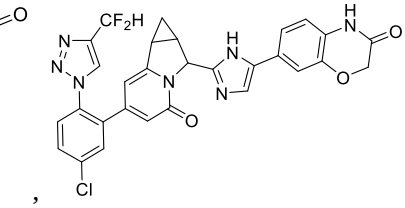
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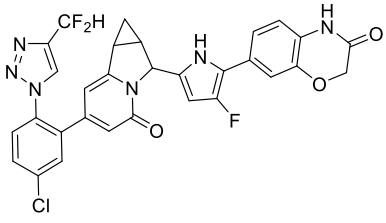
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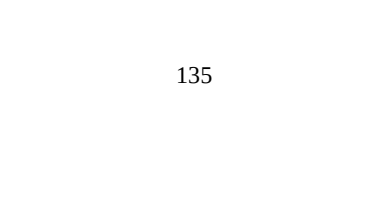
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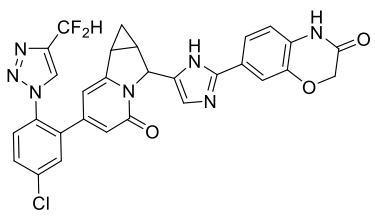
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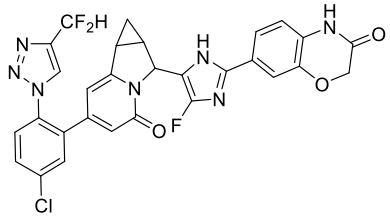
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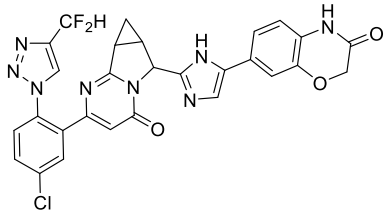
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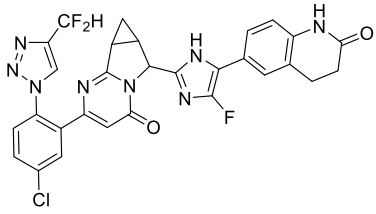
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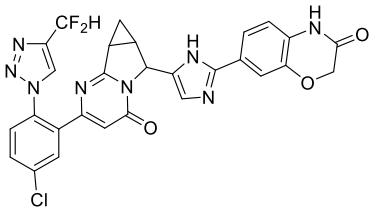
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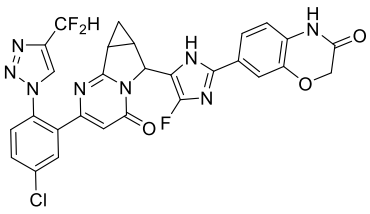
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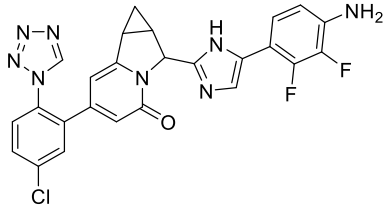
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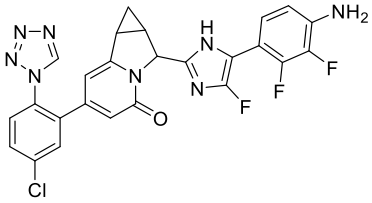
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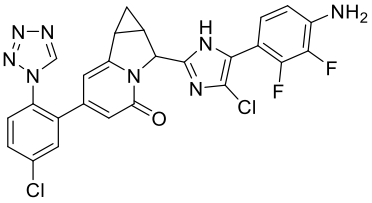
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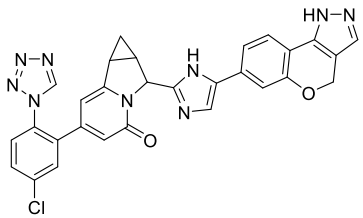
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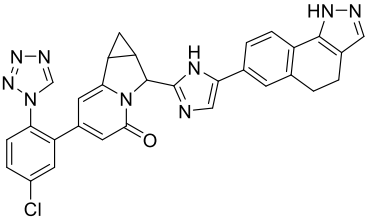
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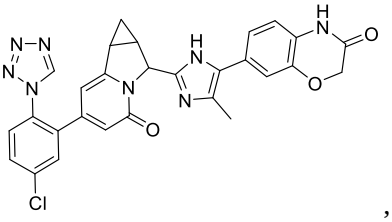
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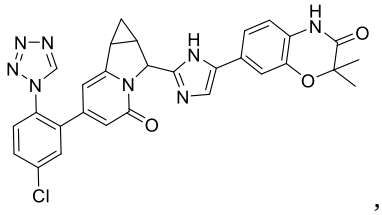
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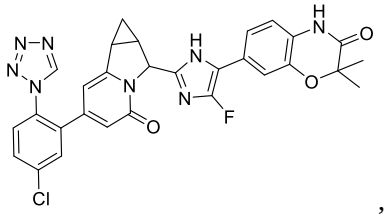
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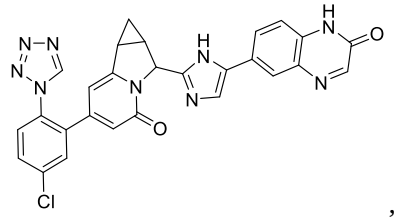
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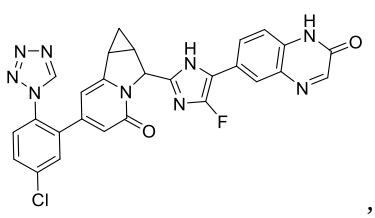
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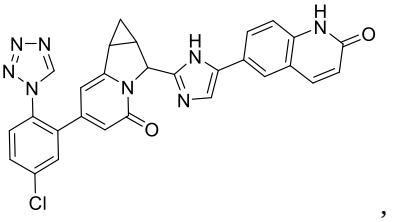
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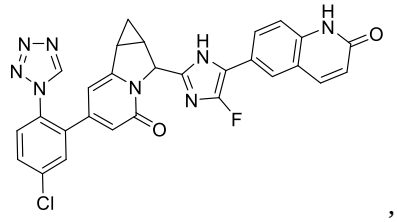
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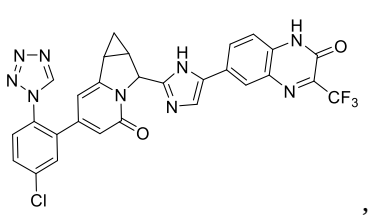
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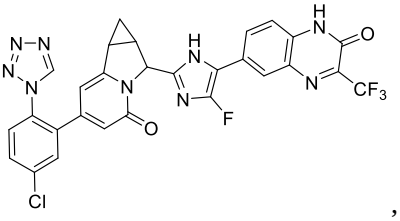
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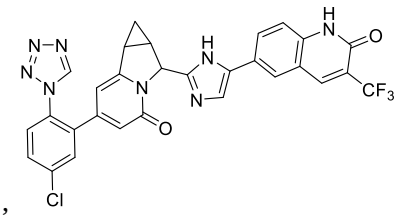
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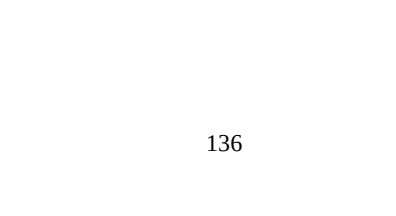
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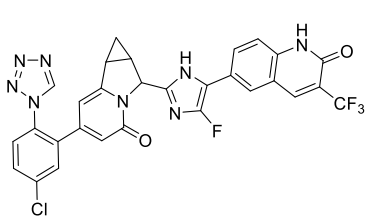
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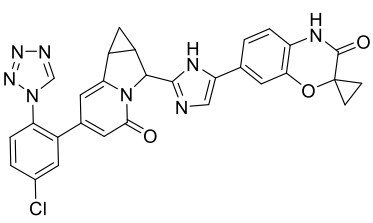
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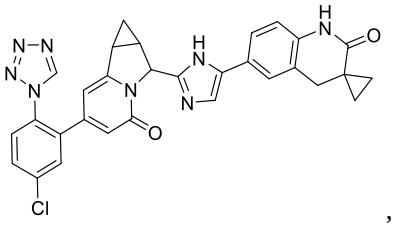
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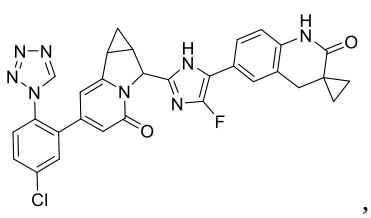
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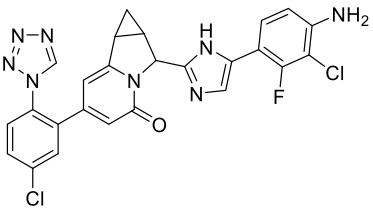
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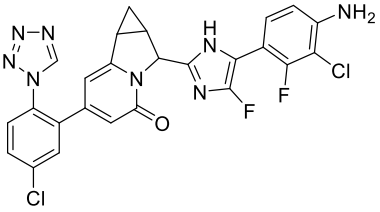
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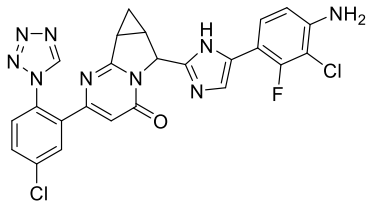
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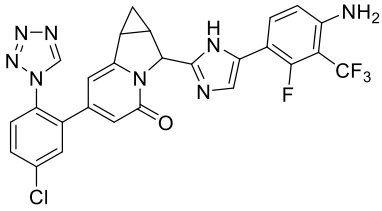
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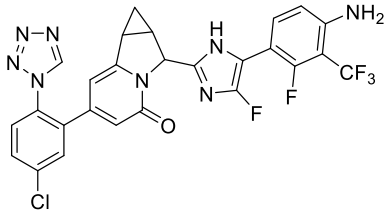
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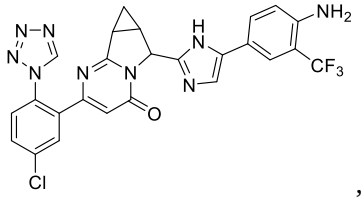
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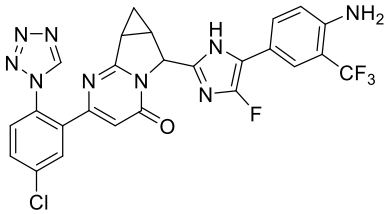
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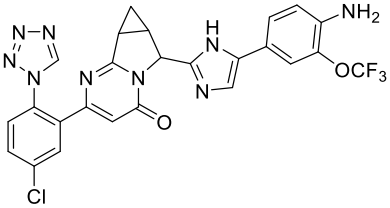
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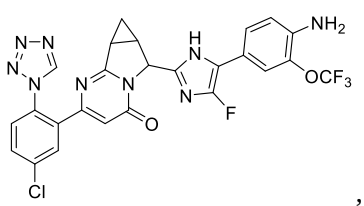
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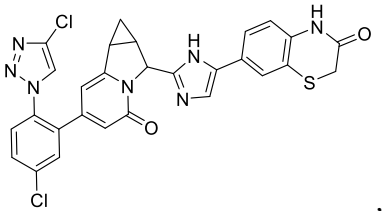
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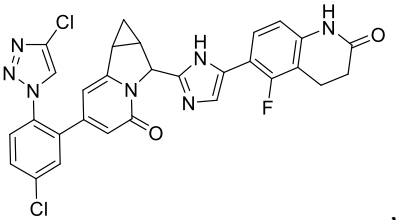
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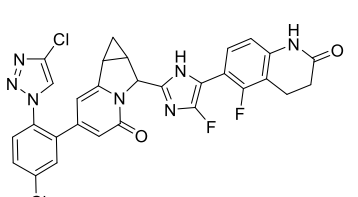
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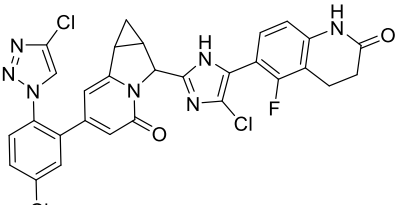
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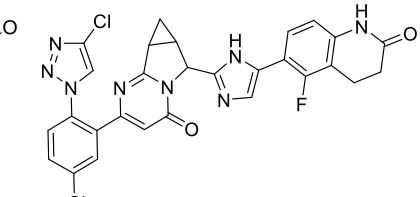
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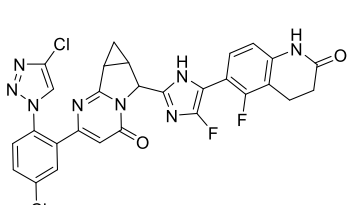
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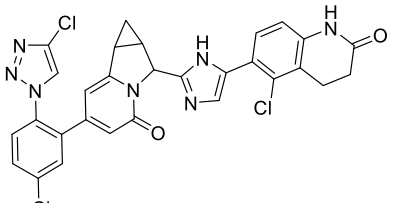
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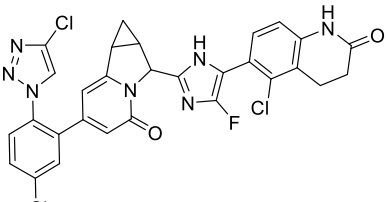
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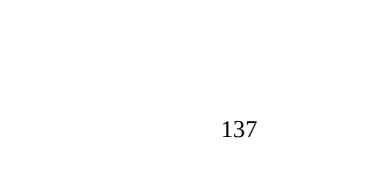
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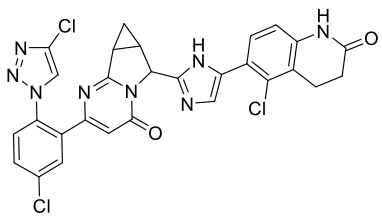
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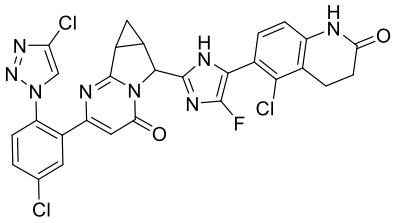
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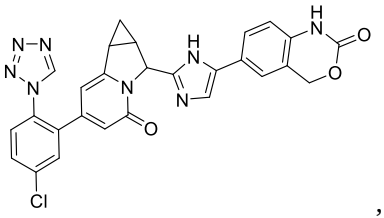
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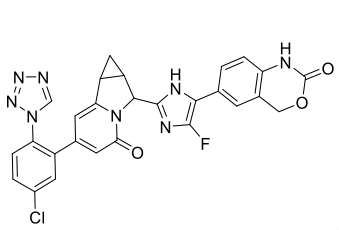
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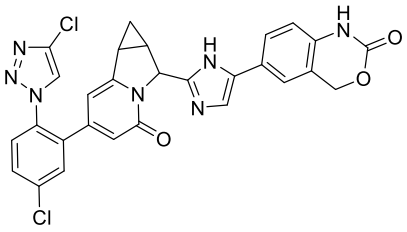
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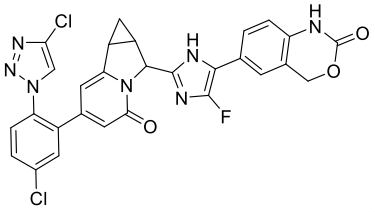
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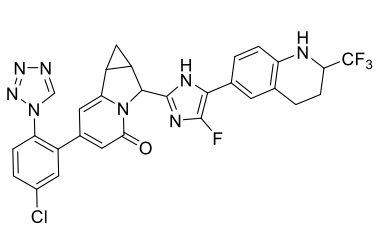
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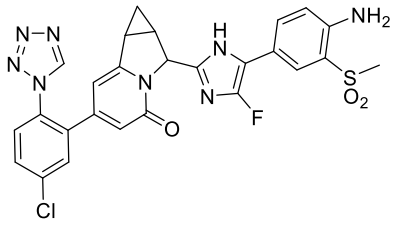
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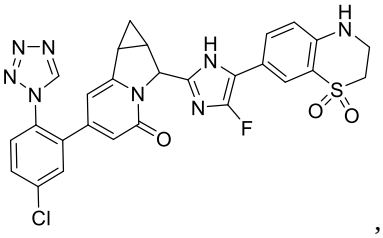
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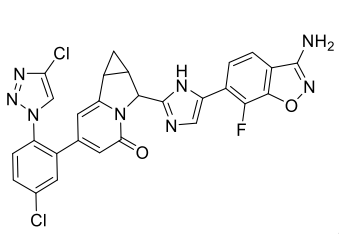
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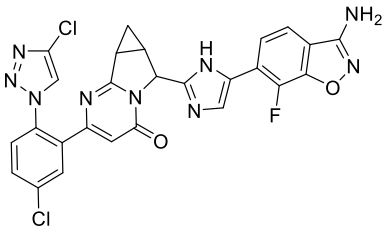
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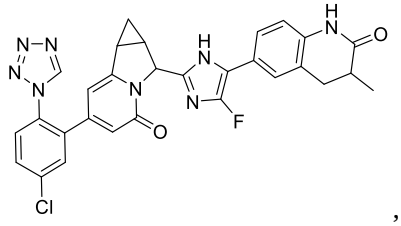
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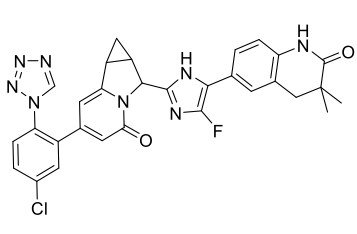
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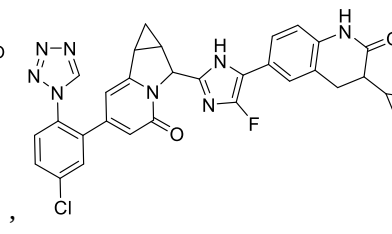
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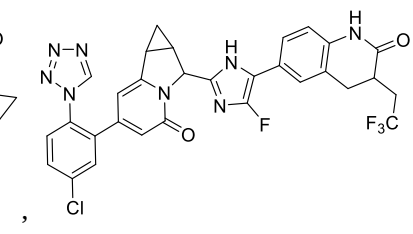
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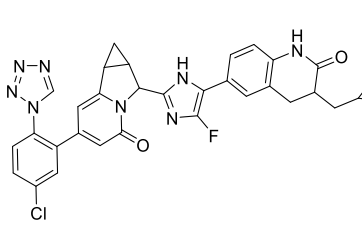
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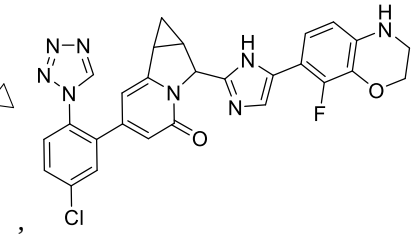
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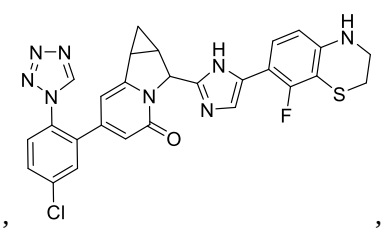
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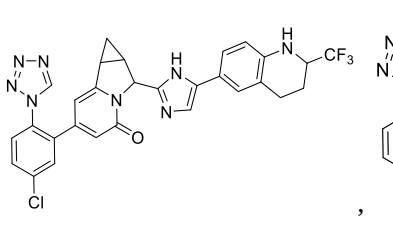
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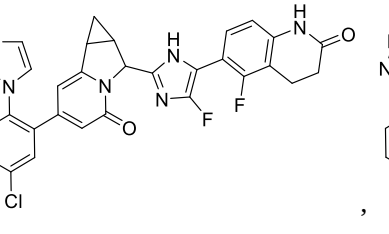
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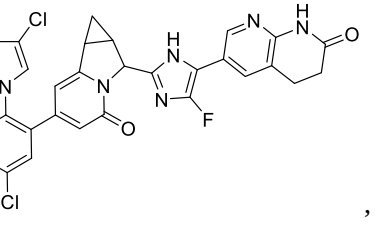
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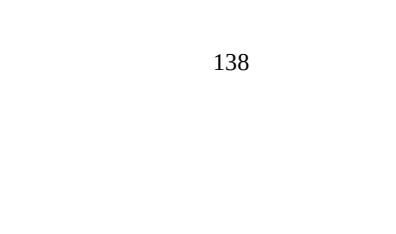
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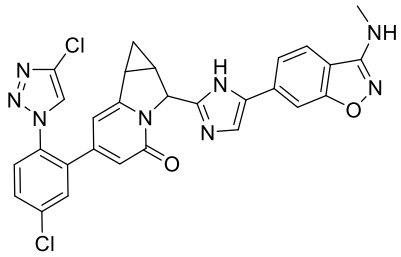
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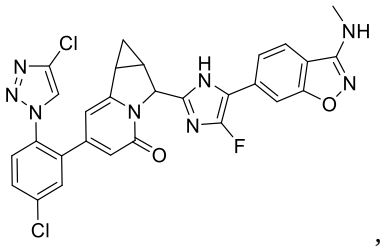
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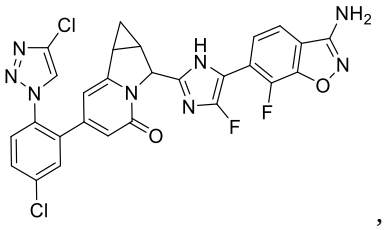
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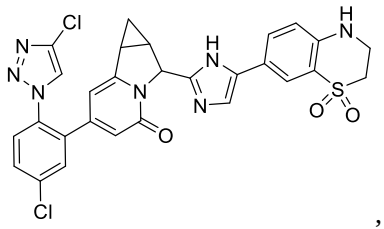
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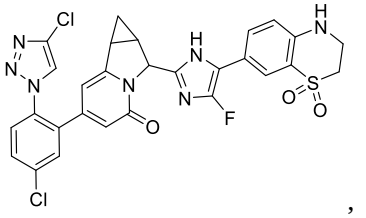
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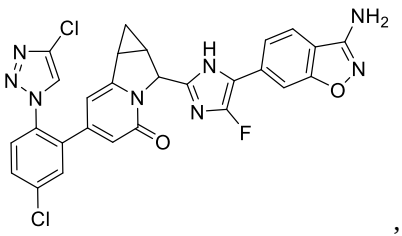
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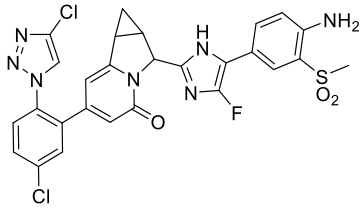
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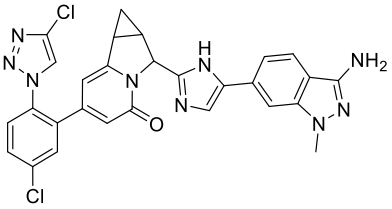
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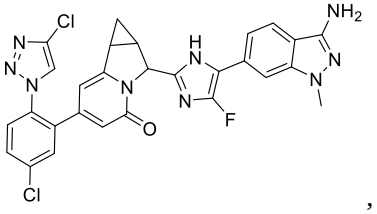
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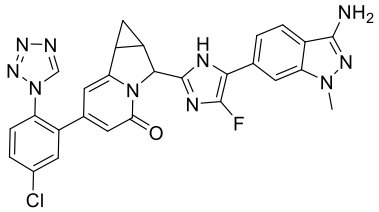
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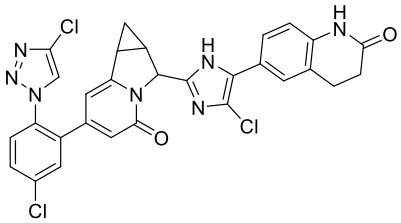
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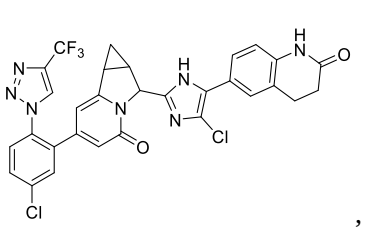
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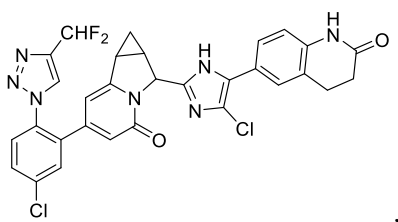
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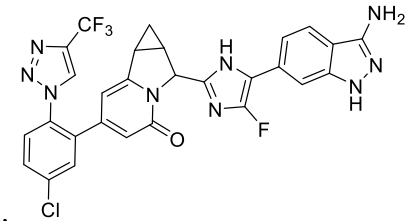
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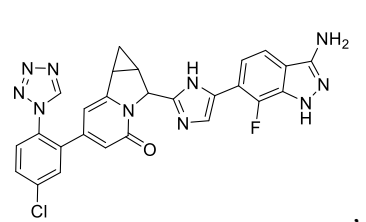
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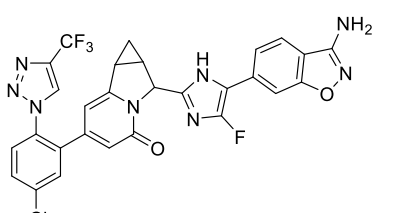
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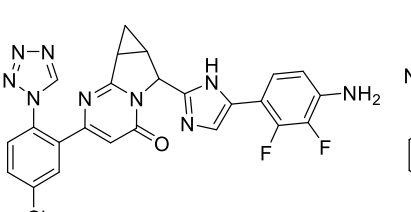
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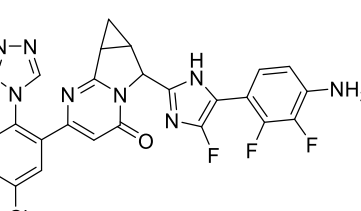
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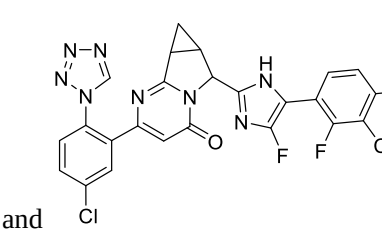
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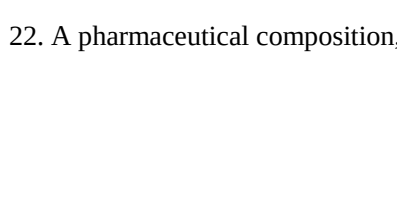
and .

22. A pharmaceutical composition, wherein, the pharmaceutical composition comprises the compound

according to any one of claims 1-20 or the pharmaceutically available salt thereof.

23. The pharmaceutical composition according to claim 22, the pharmaceutical composition further comprises one or more pharmaceutically acceptable carriers, diluents, or excipients.

24. A use of the compound according to any one of claims 1-20 or the pharmaceutically acceptable salt thereof or the pharmaceutical composition according to claim 22 or 23 in the preparation of a FXIa inhibitor.

25. A use of the compound according to any one of claims 1-20 or the pharmaceutically acceptable salt thereof or the pharmaceutical composition according to claim 22 or 23 in the preparation of a medicament for the prevention and/or treatment of FXIa factor-mediated diseases.

26. The use according to claim 25, wherein the FXIa factor-mediated diseases are selected from cardiovascular and cerebrovascular diseases;

optionally, the cardiovascular and cerebrovascular diseases are selected from thromboembolic diseases;

optionally, the thromboembolic diseases are selected from hereditary angioneurotic edema, advanced diabetic macular edema, myocardial infarction, angina pectoris, reobstruction and restenosis after angioplasty or aortocoronary bypass, diffuse intravascular coagulation, stroke, transient local ischemic attack, peripheral arterial occlusive disease, pulmonary embolism, or deep venous thrombosis.