prostate cancer are usually curable, but the patients diagnosed with asymptomatic or mildly-symptomatic metastatic castration-resistant prostate cancer (mCRPC) have no clinically curative options.

Oral drugs currently approved for treating the metastatic castration-resistant prostate cancer mainly comprise abiraterone and enzalutamide. Therein, abiraterone is a novel androgen biosynthesis inhibitor, which can block synthesis of androgen in the environment within testis, adrenal gland or tumor cells. However, enzalutamide is an androgen receptor inhibitor that can competitively inhibit the binding of androgen to a receptor. After binding to AR, the enzalutamide can further inhibit the nuclear transport of AR, thereby blocking the interaction between AR and DNA.

Despite being castration-refractory, CRPC still relies on an AR signaling axis for continuous growth. The mutation of AR reduces the small molecule antagonistic activity of a targeted AR, and even converts it into an AR agonist, which is clinically manifested as drug resistance. Therefore, a selective androgen receptor degrader (SARD) can not only inhibit the androgen receptor and block the process of androgen receptor signaling, but also degrade the receptor itself, thus bringing more benefits.

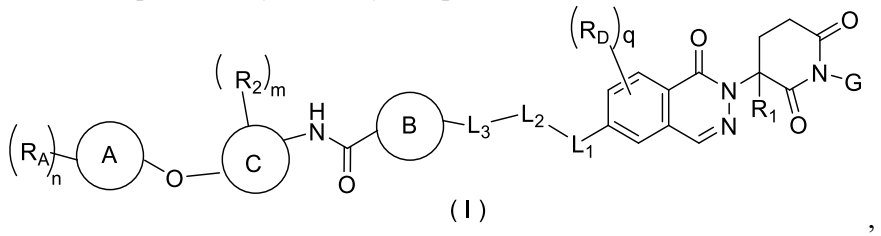
The present invention mainly relies on the proteolysis targeting chimeras (PROTAC) technology to afford a type of selective AR degraders (SARDs). The PROTAC technology mainly relies on an intracellular ubiquitin-proteasome system. The system is an intracellular "cleaner", and a main role of a ubiquitination system is to ubiquitinate the denatured, mutated or harmful proteins in the cells. The ubiquitinated proteins are degraded by the proteasome system inside the cells. The design idea of the PROTAC lies in that: one end of a molecule is an AR interaction fragment, and the other end is a ubiquitin-proteasome interaction fragment, and the two ends are linked to form a chimeric molecule by means of intermediate junction. PROTAC interacts with a target protein (AR) and the proteasome system at the same time, so that the proteasome and AR proteins are spatially close to each other, and thus the AR is degraded by ubiquitination.

The small molecule PROTAC technology was reported in 2008. Currently, only a small molecule drug ARV-110 (currently unknown in structure) based on AR degradation from Arvinas is in the Phase I clinical development. PROTAC technology belongs to the frontier field. In recent years, as shown in a large number of literature reports, PROTAC works by binding a degradation target and the ubiquitination system simultaneously. The action mechanism thereof is much more complicated than that of a traditional small molecule drug: the action mode of such molecules involves three-body binding kinetics, and is affected by PROTAC's own catalyst characteristics (and potential hook effect issues). Therefore, the molecular design idea of PROTAC is completely different from a small molecule design idea, and there is no obvious regularity at all. Common drug-chemical strategies, such as equivalent replacement of effective fragments, are not necessarily applicable in the design of such molecules.

At present, there is still a need to develop PROTAC molecules with a novel structure and used for AR degradation.

SUMMARY

In a first aspect of the present disclosure, there is provided a compound as represented by formula (I), an optical isomer thereof, or a pharmacodynamically acceptable salt thereof,



(I)

,

wherein

R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring B is selected from phenyl and 5- to 6-membered heteroaryl, and the phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R;

ring C is C_{4-6} cycloalkyl;

R_2 is selected from H and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring A is selected from 6- to 12-membered aryl and 5- to 12-membered heteroaryl;

R_A is selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_D is selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl, and the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

L_1, L_2 and L_3 are independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5- to 9-membered heteroaryl, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3;

n is 0, 1, 2, 3 or 4;

m is 0, 1, 2, 3 or 4;

q is 1, 2, 3 or 4; and

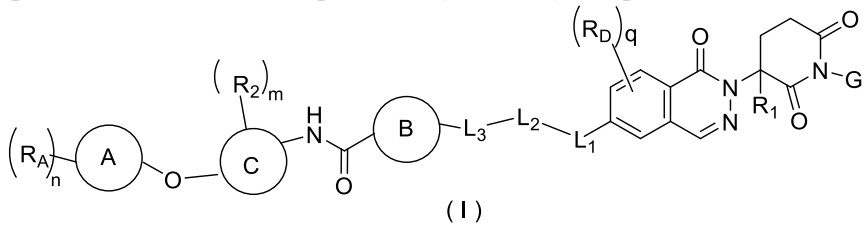
the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl, 5- to 12-membered heteroaryl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 1, 2 or 3 heteroatoms or heteroatom groups independently selected from O, NH, S, C(=O), C(=O)O, S(=O), $S(=O)_2$ and N.

In another aspect of the present disclosure, there is provided a use of the compound as disclosed herein, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, in the manufacture of a medicament for treating cancer.

In yet another aspect of the present disclosure, there is provided a use of the compound as disclosed herein, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, in the manufacture of a medicament for prophylaxis and/or treatment of Kennedy's disease.

In a further aspect of the present disclosure, there is provided the compound as disclosed herein, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, for use in therapy.

In an example of the present disclosure, the present disclosure proposes a compound as represented by formula (I), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(I)

,

wherein R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring B is selected from phenyl and 5- to 6-membered heteroaryl, and the phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R;

ring C is selected from C_{4-6} cycloalkyl;

R_2 is selected from H and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring A is selected from 6- to 12-membered aryl and 5- to 12-membered heteroaryl;

R_A is selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_D is selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl, and the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl respectively, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

each L_1, L_2 and L_3 is independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5- to 9-membered heteroaryl respectively, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino respectively, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3 respectively;

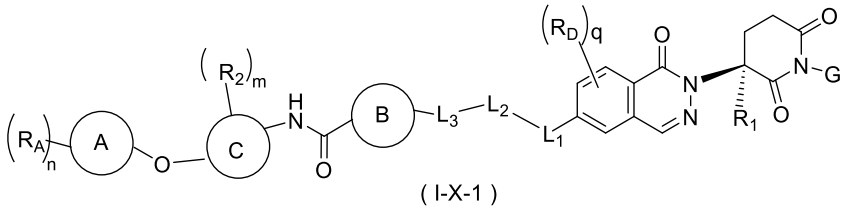
n is 0, 1, 2, 3 or 4;

m is 0, 1, 2, 3 or 4;

q is 1, 2, 3 or 4;

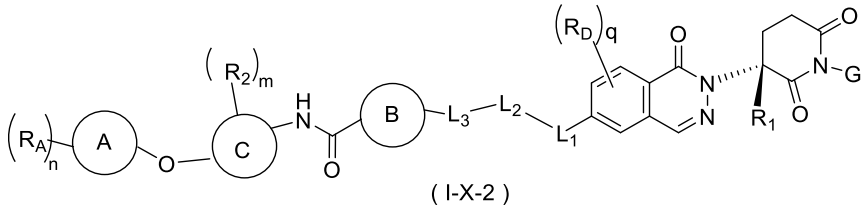
the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl, 5- to 12-membered heteroaryl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 1, 2 or 3 heteroatoms or heteroatom groups independently selected from O, NH, S, C(=O), C(=O)O, S(=O), $S(=O)_2$ and N.

In another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (I-X-1) or formula (I-X-2), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(I-X-1)

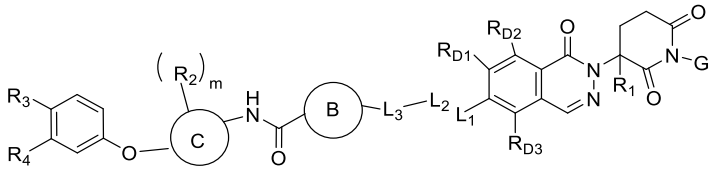
,



(I-X-2)

, wherein ring A, ring B, ring C, R_1, R_2, R_A, R_D, G, L_1, L_2, L_3, m, n and q are as defined in the present disclosure.

In another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (II), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(II)

,

wherein R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring B is selected from phenyl and 5- to 6-membered heteroaryl, and the phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R;

ring C is selected from C_{4-6} cycloalkyl;

R_2 is selected from H and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

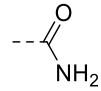
each R_3 and R_4 is independently selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

each R_{D1}, R_{D2} and R_{D3} is independently selected from H, CN, halogen, C_{1-6} alkyl and C_{1-6} alkoxy respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl respectively, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

each L_1, L_2 and L_3 is independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5-

to 9-membered heteroaryl respectively, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

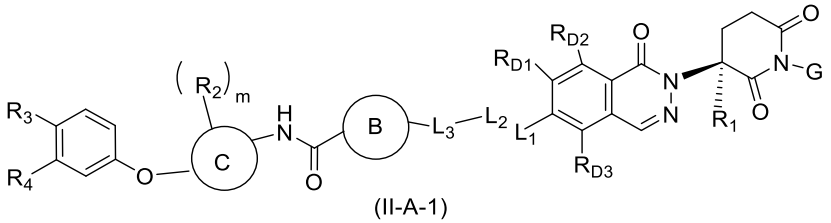
R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino respectively, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3 respectively;

m is 0, 1, 2, 3 or 4;

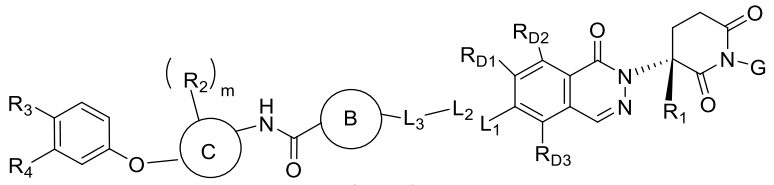
the above-mentioned 3- to 10-membered heterocycloalkyl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 1, 2 or 3 heteroatoms or heteroatom groups independently selected from O, NH, S, C(=O), C(=O)O, S(=O), $S(=O)_2$ and N.

In another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (II-A-1) or formula (II-A-2), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(II-A-1)

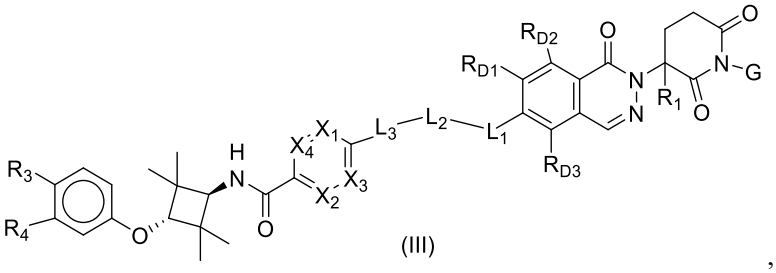
,



(II-A-2)

, wherein ring B, ring C, R_1, R_2, R_3, R_4, R_{D1}, R_{D2}, R_{D3}, G, L_1, L_2, L_3 and m are as defined in the present disclosure.

In another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (III), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(III)

,

wherein R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

each R_3 and R_4 is independently selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy

respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

each X_1, X_2, X_3 and X_4 is independently selected from C(R) and N respectively;

each R_{D1}, R_{D2} and R_{D3} is independently selected from H, CN, halogen, C_{1-6} alkyl and C_{1-6} alkoxy respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

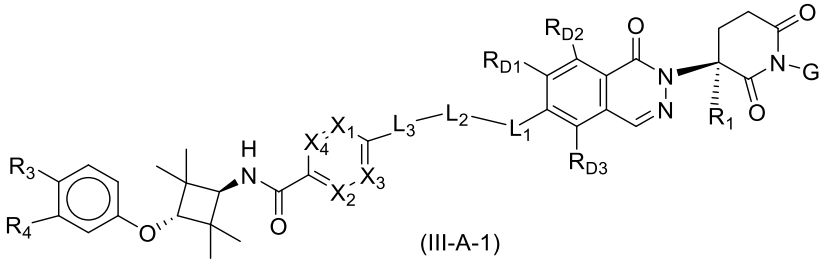
R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl respectively, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

each L_1, L_2 and L_3 is independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5- to 9-membered heteroaryl respectively, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

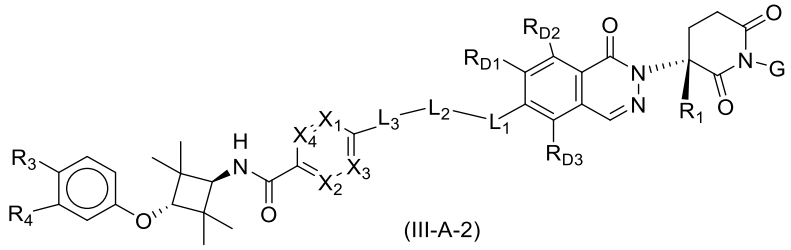
R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino respectively, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3 respectively;

the above-mentioned 3- to 10-membered heterocycloalkyl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 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.

In yet another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (III-A-1) or formula (III-A-2), an optical isomer thereof and a pharmacodynamically acceptable salt thereof, 

(III-A-1)

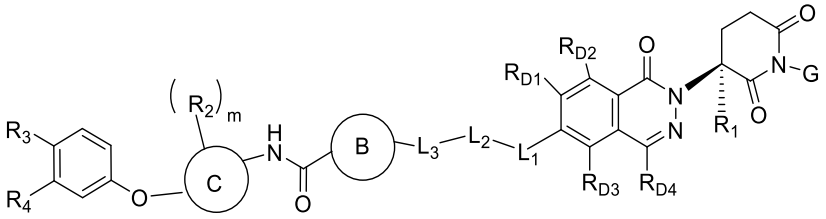
, 

(III-A-2)

, wherein R_1, R_3, R_4, R_{D1}, R_{D2}, R_{D3}, G, L_1, L_2, L_3, X_1, X_2, X_3 and X_4 are as defined in the present disclosure.

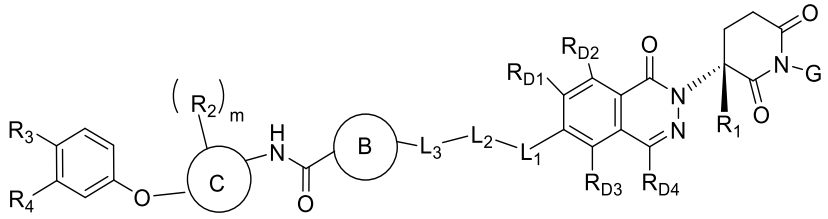
In yet another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (I-A), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,

In yet another example of the present disclosure, the present disclosure further provides a compound represented by formula (I-A-1) or formula (I-A-2), an optical isomer thereof and a pharmacodynamically



(I-A-1)

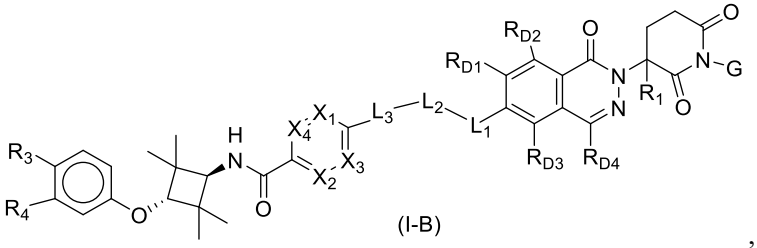
acceptable salt thereof, ,



(I-A-2)

, wherein ring B, ring C, R_1, R_2, R_3, R_4, R_{D1}, R_{D2}, R_{D3}, R_{D4}, G, L_1, L_2, L_3 and m are as defined in the present disclosure.

In yet another example of the present disclosure, the present disclosure further proposes a compound as represented by formula (I-B), an optical isomer thereof and a pharmacodynamically acceptable salt thereof,



(I-B)

,

wherein R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

each R_3 and R_4 is independently selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

each X_1, X_2, X_3 and X_4 is independently selected from C(R) and N respectively;

each R_{D1}, R_{D2} and R_{D3} is independently selected from H, CN, halogen, C_{1-6} alkyl and C_{1-6} alkoxy respectively, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_{D4} is independently selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl respectively, and the C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl respectively, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

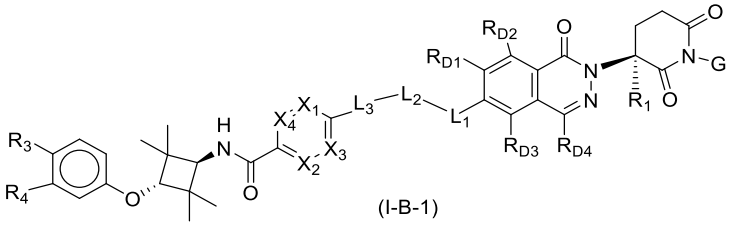
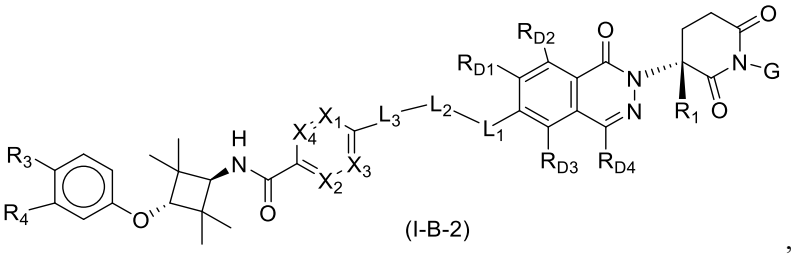
each L_1, L_2 and L_3 is independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5-

to 9-membered heteroaryl respectively, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino respectively, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3 respectively;

the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl or 5- to 9-membered heteroaryl comprises 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.

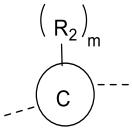
In yet another example of the present disclosure, the present disclosure further provides a compound as represented by formula (I-B-1) or formula (I-B-2), an optical isomer thereof and a pharmacodynamically acceptable salt thereof, 
(I-B-1)
, 
(I-B-2)
, wherein R_1, R_3, R_4, R_{D1}, R_{D2}, R_{D3}, R_{D4}, L_1, L_2, L_3, X_1, X_2, X_3, X_4 and G are as defined previously.

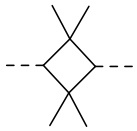
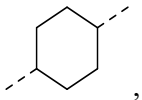
In some schemes of the present disclosure, the above-mentioned ring A is selected from phenyl, and other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned each R_3 and R_4 is independently selected from H, NO_2, F, Cl, Br, I, NH_2, CN, CF_3, methyl, ethyl, n-propyl, isopropyl, methoxy and ethoxy respectively, and other variables are as defined in the present disclosure.

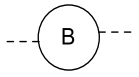
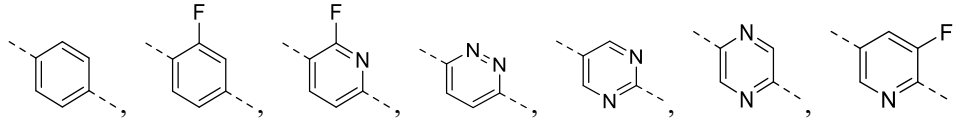
In some schemes of the present disclosure, the above-mentioned R_2 is selected from H, methyl and ethyl, and other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned ring C is selected from cyclobutyl and cyclohexanyl, and other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned building block  is selected

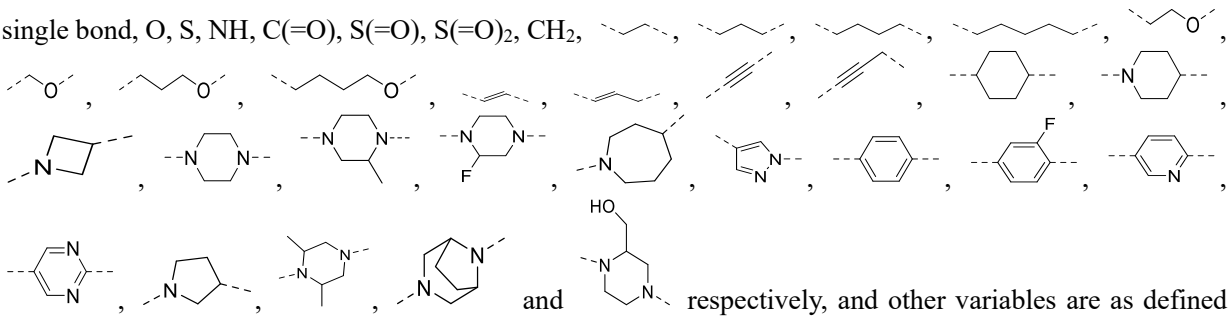
from  and , and other variables are as defined in the present disclosure.

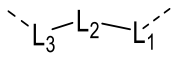
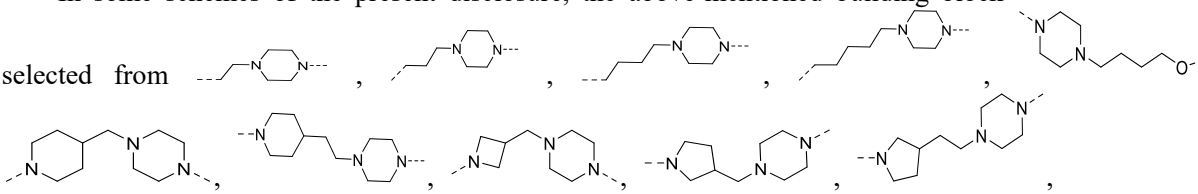
In some schemes of the present disclosure, the above-mentioned ring B is selected from phenyl, pyridyl, pyridazinyl, pyrimidinyl and pyrazinyl, and the phenyl, pyridyl, pyridazinyl, pyrimidinyl or pyrazinyl is optionally substituted with 1, 2 or 3 R, and other variables are as defined in the present disclosure.

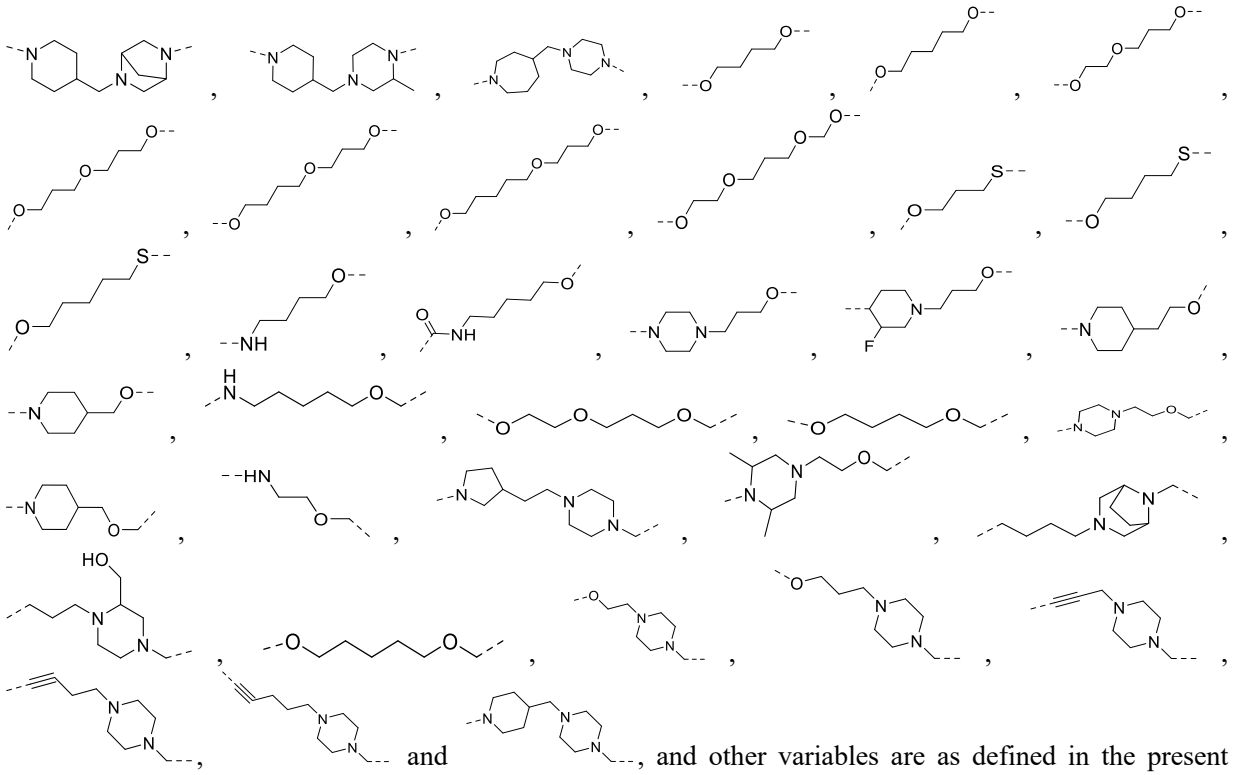
In some schemes of the present disclosure, the above-mentioned building block  is selected from  and , and other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned each L_1, L_2 and L_3 are independently a single bond, O, S, NH, C(=O), S(=O), S(=O)$_2$, C_{1-3} alkyl, -C_{1-3} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-6} cycloalkyl, 4- to 8-membered heterocycloalkyl, phenyl and 5- to 6-membered heteroaryl respectively, and the C_{1-3} alkyl, -C_{1-3} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-6} cycloalkyl, 4- to 8-membered heterocycloalkyl, phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L; other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-3} alkyl, C_{3-6} cycloalkyl, C_{1-3} alkyl-C(=O)-, C_{1-3} alkoxy, C_{1-3} alkylthio and C_{1-3} alkylamino respectively, and the C_{1-3} alkyl, C_{3-6} cycloalkyl, C_{1-3} alkyl-C(=O)-, C_{1-3} alkoxy, C_{1-3} alkylthio or C_{1-3} alkylamino is optionally substituted with 1, 2 or 3 R'; other variables are as defined in the present disclosure.

In some schemes of the present disclosure, the above-mentioned each L_1, L_2 and L_3 are independently a single bond, O, S, NH, C(=O), S(=O), S(=O)$_2$, CH_2,  and respectively, and other variables are as defined in the present disclosure.

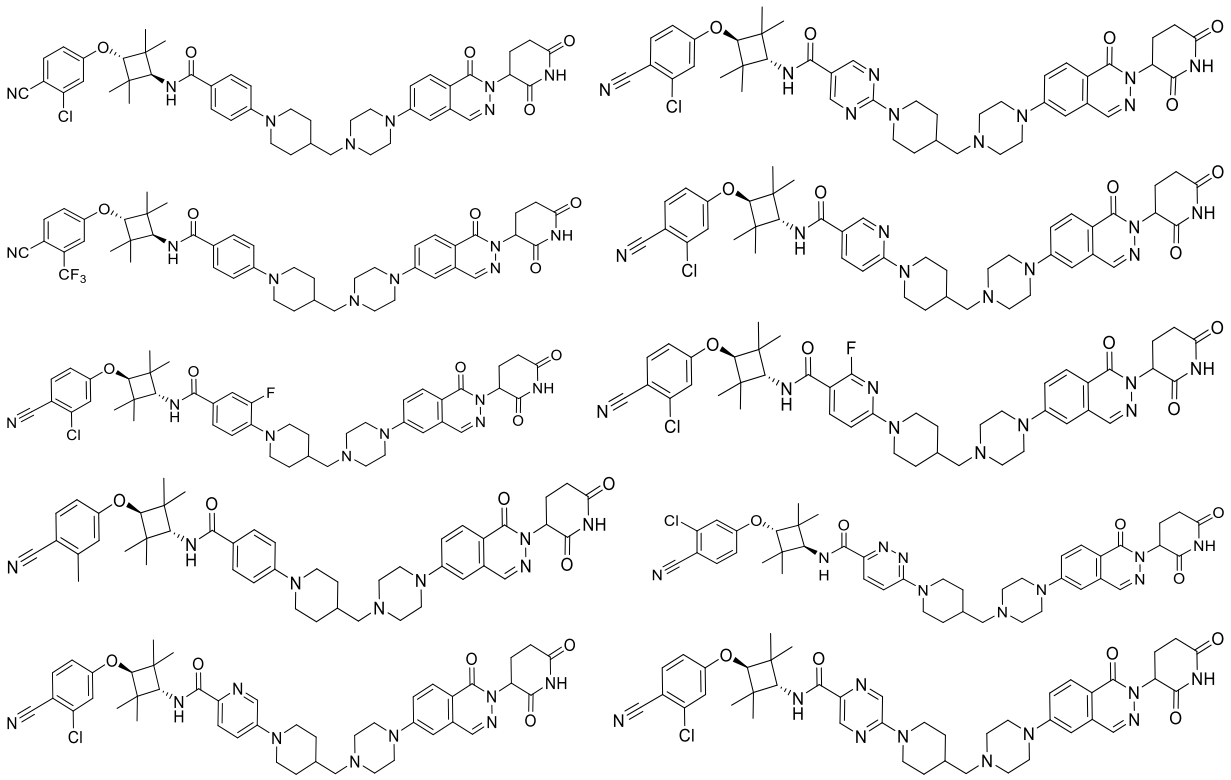
In some schemes of the present disclosure, the above-mentioned building block  is selected from , and other variables are as defined in the present disclosure.

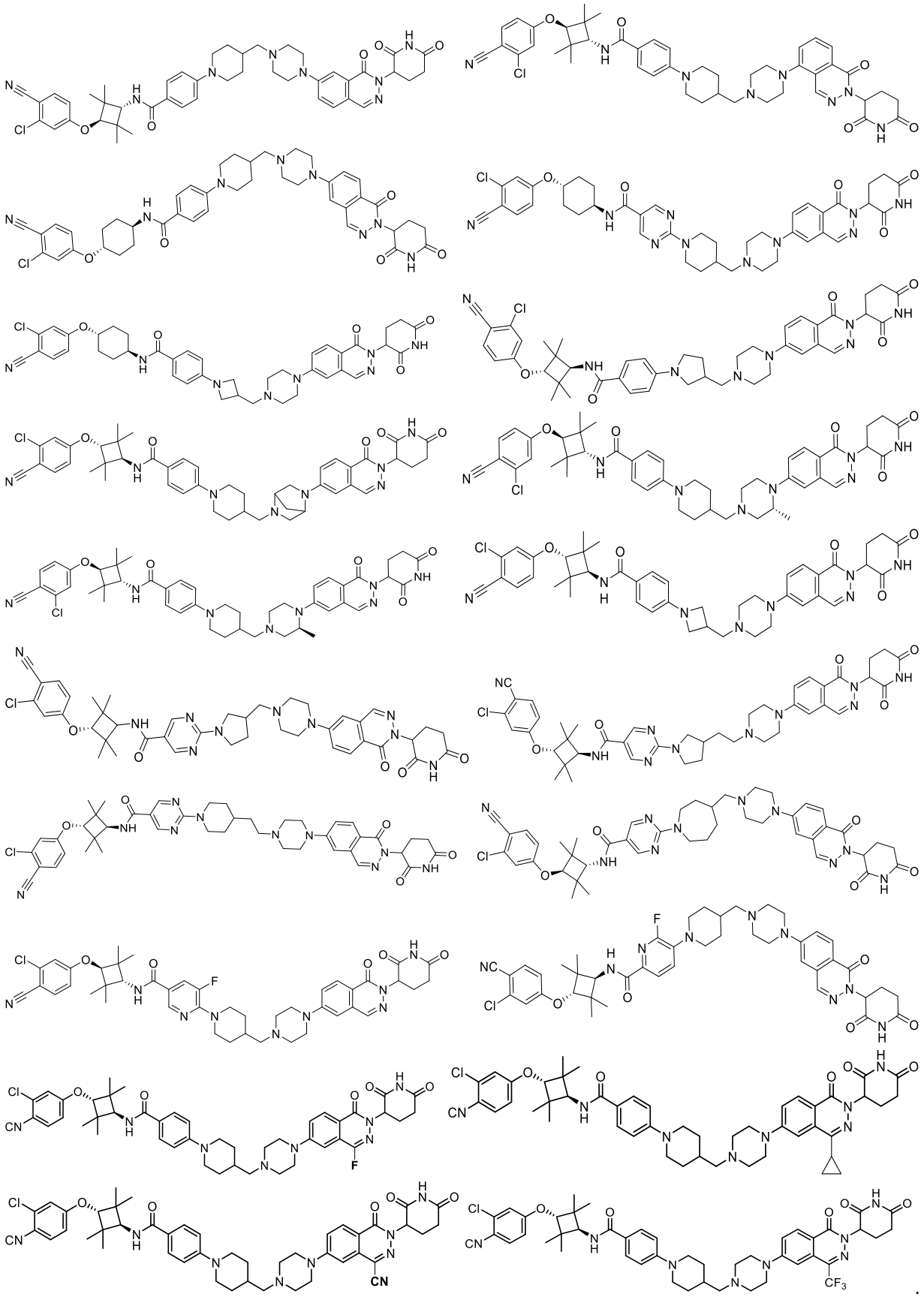


and other variables are as defined in the present disclosure.

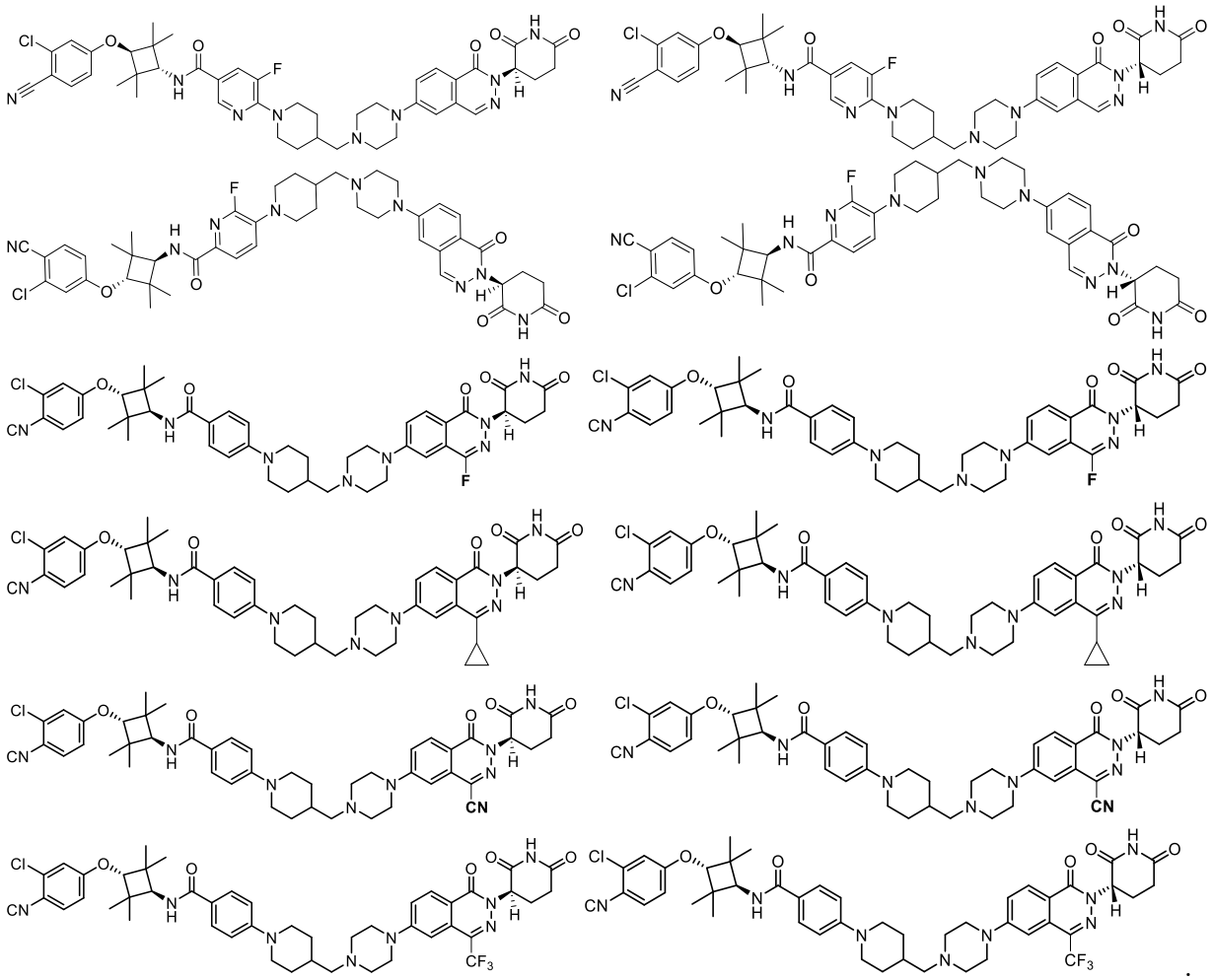
In some schemes of the present disclosure, the above-mentioned R_{D4} is independently selected from H, CN, F, Cl, Br, I, CF_3, CH_3, CH_2CH_3 and cyclopropyl respectively, and other variables are as defined in the present disclosure.

In yet another example of the present disclosure, the present disclosure further proposes compounds of the following formulae, optical isomers thereof and pharmacodynamically acceptable salts thereof, which are selected from





In yet another example of the present disclosure, the present disclosure further proposes compounds of the following formulae, optical isomers thereof and pharmacodynamically acceptable salts thereof, which are selected from



In yet another example of the present disclosure, the present disclosure further proposes use of the aforementioned compounds, optical isomers thereof and pharmacodynamically acceptable salts thereof in the preparation of a medicament for preventing and/or treating a cancer or Kennedy's disease.

In some schemes of the present disclosure, the above-mentioned cancer is an AR-related cancer, such as prostate cancer, breast cancer, and the like.

In yet another example of the present disclosure, the present disclosure further proposes a method for treating a cancer (e.g., the prostate cancer, the breast cancer, etc.) or Kennedy's disease. The method comprises administering the aforementioned compound, an optical isomer thereof and a pharmacodynamically acceptable salt thereof to a patient.

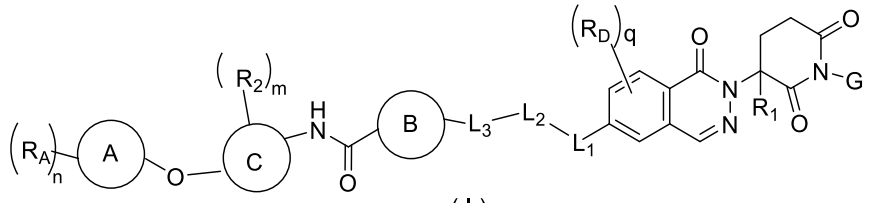
Definition and explanation

Unless otherwise specified, the following terms and phrases used herein are intended to have the following meanings. A specific term or phrase should not be considered to be indeterminate or unclear without specific definitions, but should be understood in its ordinary meaning. When a trade name appears herein, it is intended to refer to a corresponding commercial product or an active ingredient thereof.

As used in the present invention, it should be appreciated that the phrase "at least one", when referring to a list of one or more elements, is intended to mean at least one element selected from any one or more elements in the list of elements, but does not necessarily include at least one of each element specifically

CLAIMS

1. A compound as represented by formula (I), an optical isomer thereof, or a pharmacodynamically acceptable salt thereof,



(I)

,

wherein

R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring B is selected from phenyl and 5- to 6-membered heteroaryl, and the phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R;

ring C is C_{4-6} cycloalkyl;

R_2 is selected from H and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring A is selected from 6- to 12-membered aryl and 5- to 12-membered heteroaryl;

R_A is selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_D is selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl, and the C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

L_1, L_2 and L_3 are independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5- to 9-membered heteroaryl, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3;

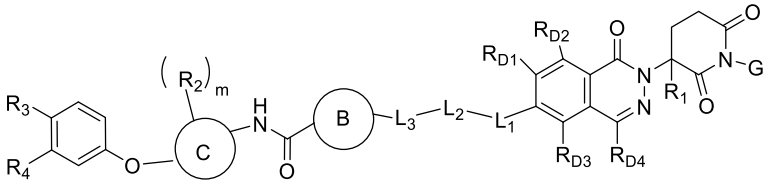
n is 0, 1, 2, 3 or 4;

m is 0, 1, 2, 3 or 4;

q is 1, 2, 3 or 4; and

the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl, 5- to 12-membered heteroaryl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 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 of claim 1, wherein the compound is represented by formula (I-A), an optical isomer thereof, or a pharmacodynamically acceptable salt thereof,



(I-A)

,

wherein

R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

ring B is selected from phenyl and 5- to 6-membered heteroaryl, and the phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R;

ring C is C_{4-6} cycloalkyl;

R_2 is selected from H and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

R_3 and R_4 are each independently selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_{D1}, R_{D2} and R_{D3} are each independently selected from H, CN, halogen, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_{D4} is independently selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl, and the C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

L_1, L_2 and L_3 are each independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl and 5- to 9-membered heteroaryl, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1,

2 or 3 R_L;

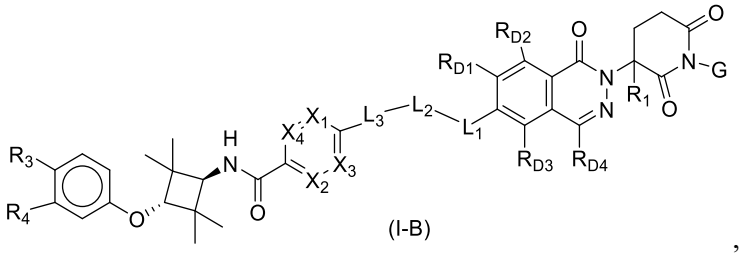
R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3;

m is 0, 1, 2, 3 or 4; and

the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl, 5- to 6-membered heteroaryl or 5- to 9-membered heteroaryl comprises 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.

3. The compound of claim 2, wherein the compound is represented by formula (I-B), an optical isomer thereof, or a pharmacodynamically acceptable salt thereof,



(I-B) ,

wherein

R_1 is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

G is selected from H, F, Cl, Br, I and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R;

R_3 and R_4 are each independently selected from H, NO_2, halogen, NH_2, CN, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

X_1, X_2, X_3 and X_4 are each independently selected from C(R) and N;

R_{D1}, R_{D2} and R_{D3} are each independently selected from H, CN, halogen, C_{1-6} alkyl and C_{1-6} alkoxy, and the C_{1-6} alkyl or C_{1-6} alkoxy is optionally substituted with 1, 2 or 3 R;

R_{D4} is independently selected from H, CN, halogen, C_{1-6} alkyl, C_{1-6} alkoxy, C_{3-6} cycloalkyl and 3- to 6-membered heterocycloalkyl, and the C_{1-6} alkyl, C_{3-6} cycloalkyl or 3- to 6-membered heterocycloalkyl is optionally substituted with 1, 2 or 3 R;

R is independently selected from H, F, Cl, Br, I, OH, NH_2 and C_{1-6} alkyl, and the C_{1-6} alkyl is optionally substituted with 1, 2 or 3 R';

L_1, L_2 and L_3 are each independently selected from a single bond, O, S, NH, C(=O), S(=O), $S(=O)_2$, C_{1-6} alkyl, -C_{1-6} alkyl-O-,C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl

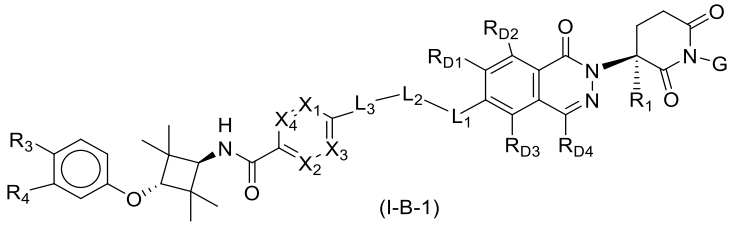
and 5- to 9-membered heteroaryl, and the C_{1-6} alkyl, -C_{1-6} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocycloalkyl, phenyl or 5- to 9-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L;

R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio and C_{1-6} alkylamino, and the C_{1-6} alkyl, C_{3-6} cycloalkyl, C_{1-6} alkyl-C(=O)-, C_{1-6} alkoxy, C_{1-6} alkylthio or C_{1-6} alkylamino is optionally substituted with 1, 2 or 3 R';

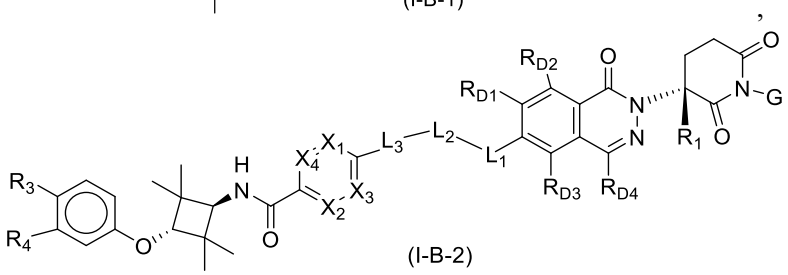
R' is independently selected from H, halogen, C_{1-6} alkyl, OH, NH_2, , , CH_3, CH_2F, CHF_2 and CF_3; and

the 3- to 10-membered heterocycloalkyl, 3- to 6-membered heterocycloalkyl or 5- to 9-membered heteroaryl comprises 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.

4. The compound of claim 3, wherein the compound is represented by formula (I-B-1) or formula (I-B-2), an optical isomer thereof, or a pharmacodynamically acceptable salt thereof,



,



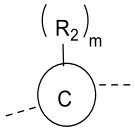
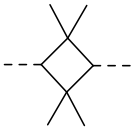
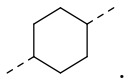
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5. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein ring A is selected from phenyl.

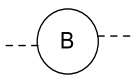
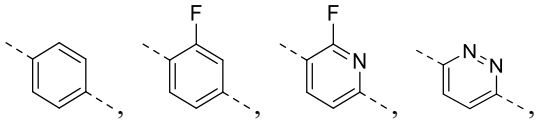
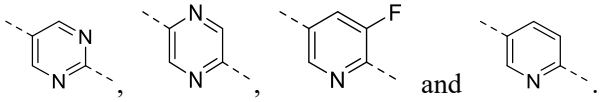
6. The compound according to claim 2, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein each R_3 and R_4 is independently selected from H, NO_2, F, Cl, Br, I, NH_2, CN, CF_3, methyl, ethyl, n-propyl, isopropyl, methoxy, and ethoxy.

7. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein R_2 is selected from H, methyl, and ethyl.

8. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein ring C is selected from cyclobutyl and cyclohexanyl.

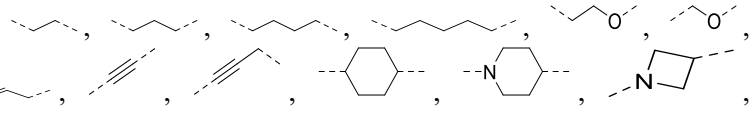
9. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein  is selected from  and .

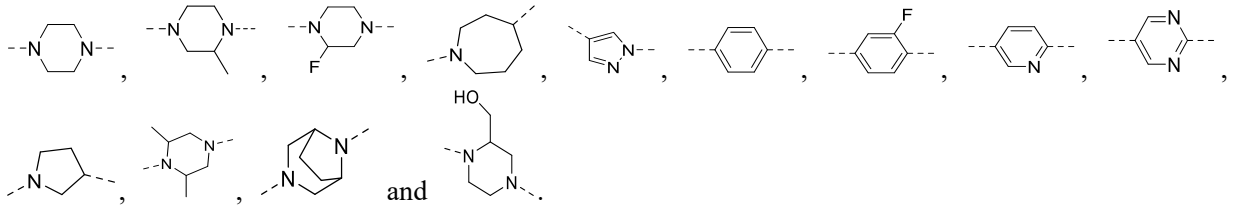
10. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein ring B is selected from phenyl, pyridyl, pyridazinyl, pyrimidinyl and pyrazinyl, and the phenyl, pyridyl, pyridazinyl, pyrimidinyl or pyrazinyl is optionally substituted with 1, 2 or 3 R.

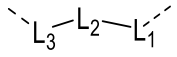
11. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein  is selected from   and .

12. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein each L_1, L_2 and L_3 is independently selected from the group consisting of a single bond, O, S, NH, C(=O), S(=O), S(=O)$_2$, C_{1-3} alkyl, -C_{1-3} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-6} cycloalkyl, 4- to 8-membered heterocycloalkyl, phenyl and 5- to 6-membered heteroaryl, and the C_{1-3} alkyl, -C_{1-3} alkyl-O-, C_{2-3} alkenyl, C_{2-3} alkynyl, C_{3-6} cycloalkyl, 4- to 8-membered heterocycloalkyl, phenyl or 5- to 6-membered heteroaryl is optionally substituted with 1, 2 or 3 R_L.

13. The compound according to claim 12, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein R_L is independently selected from H, halogen, OH, NH_2, CN, , C_{1-3} alkyl, C_{3-6} cycloalkyl, C_{1-3} alkyl-C(=O)-, C_{1-3} alkoxy, C_{1-3} alkylthio and C_{1-3} alkylamino, and the C_{1-3} alkyl, C_{3-6} cycloalkyl, C_{1-3} alkyl-C(=O)-, C_{1-3} alkoxy, C_{1-3} alkylthio or C_{1-3} alkylamino is optionally substituted with 1, 2 or 3 R'.

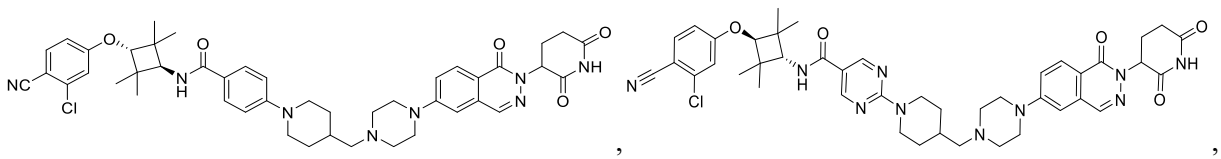
14. The compound according to claim 12, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein each L_1, L_2 and L_3 is independently selected from the group consisting of a single bond, O, S, NH, C(=O), S(=O), S(=O)$_2$, CH_2, 

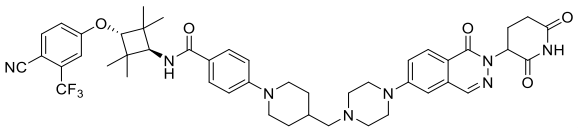
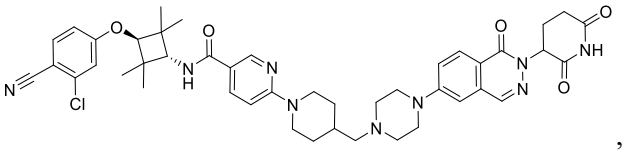
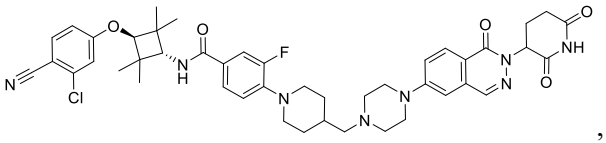
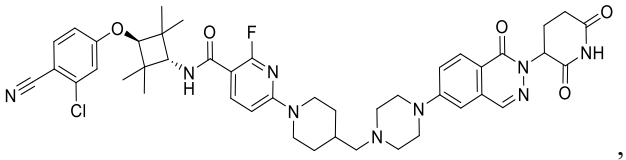
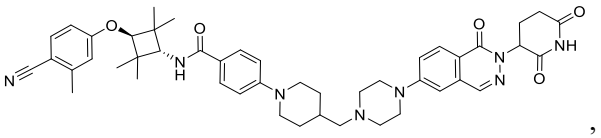
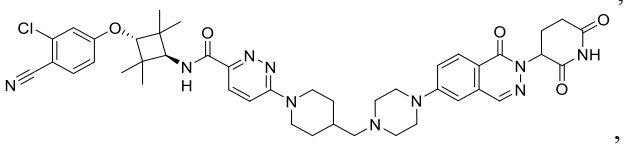
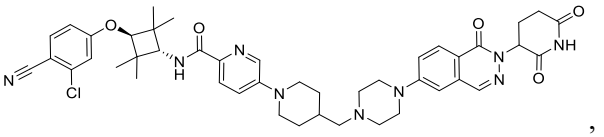
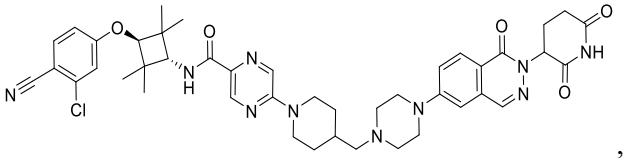
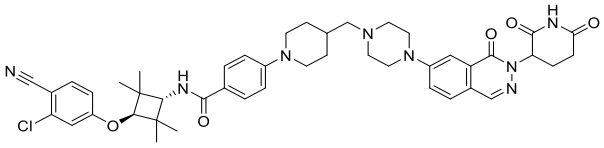
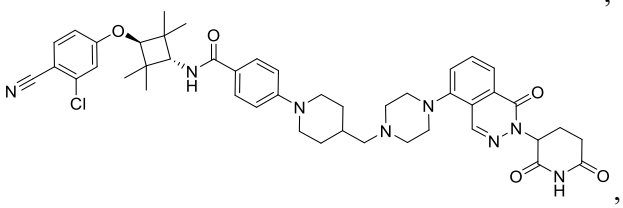
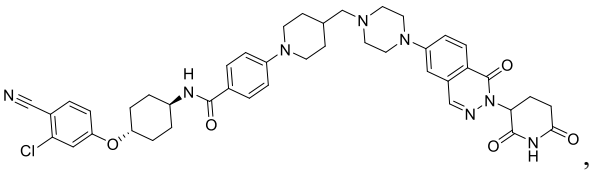
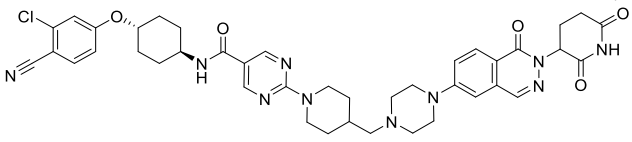
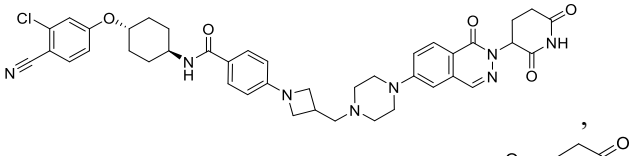
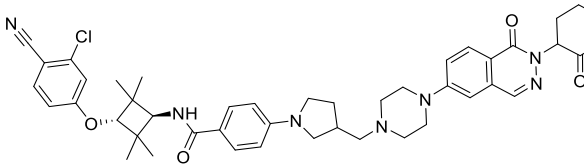
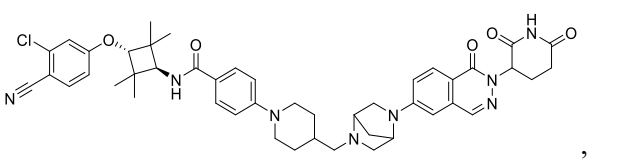
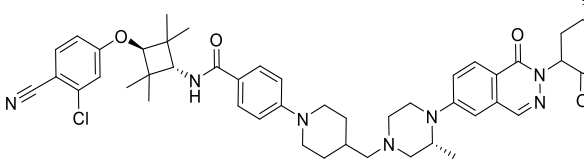


15. The compound according to claim 1, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein  is selected from

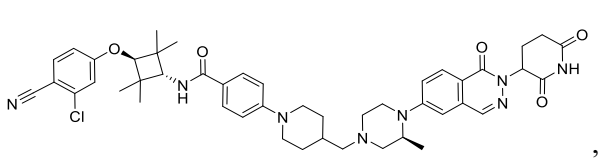
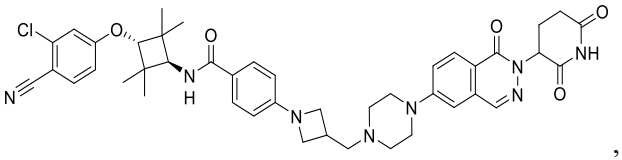
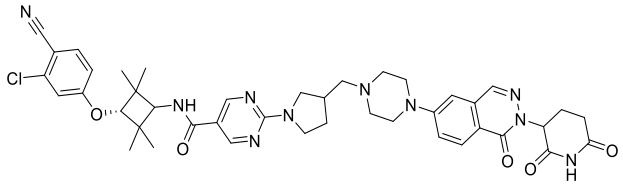
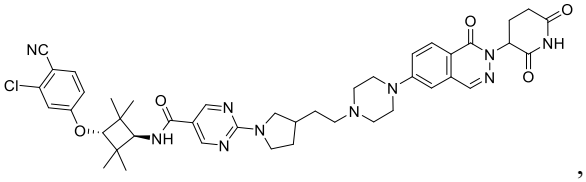
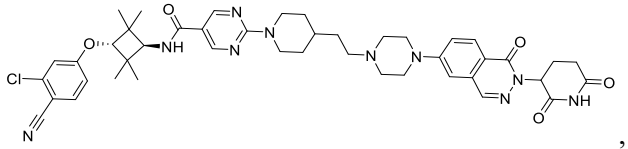
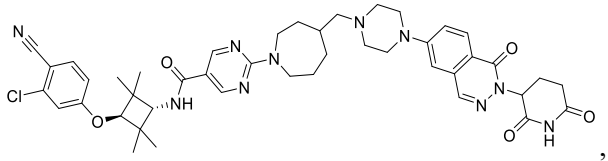
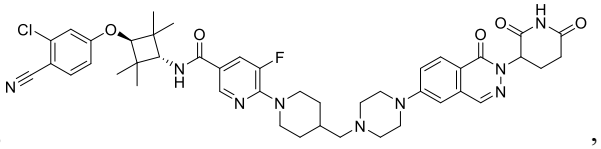
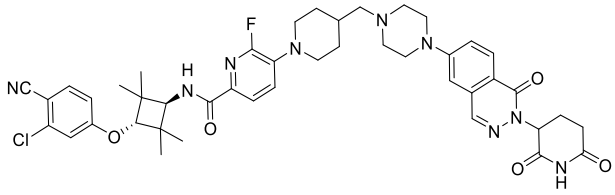
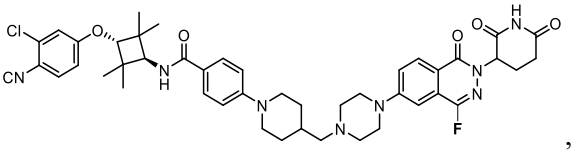
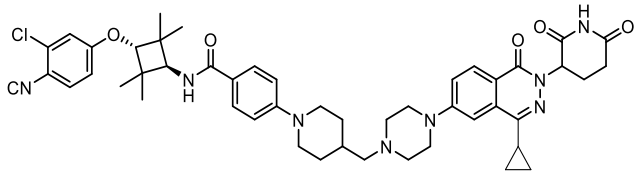
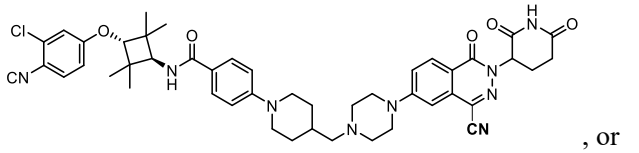
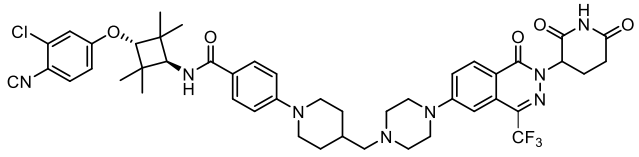
16. The compound according to claim 2, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, wherein R_{D4} is independently selected from H, CN, F, Cl, Br, I, CF_3, CH_3, CH_2CH_3 and cyclopropyl.

17. The compound according to claim 1, or the pharmacodynamically acceptable salt thereof, having the formula:

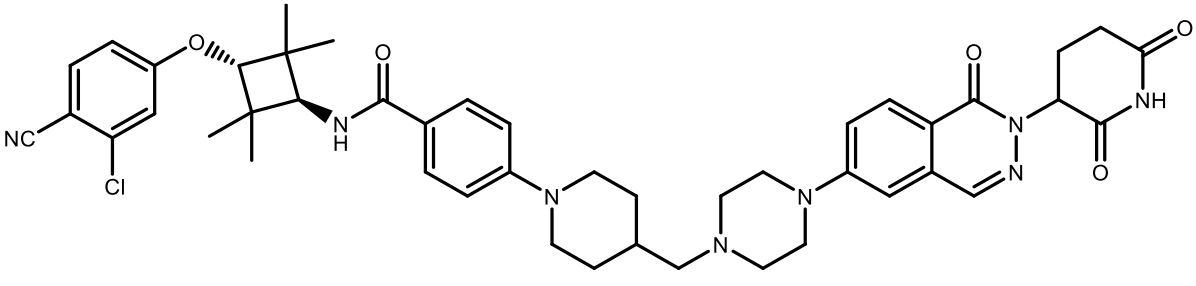



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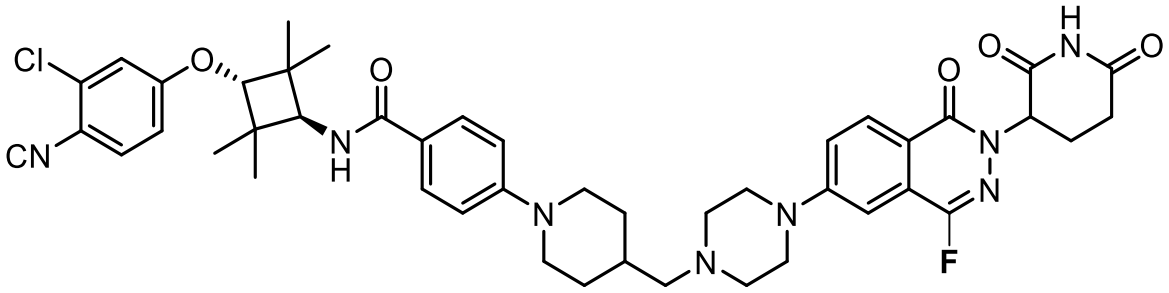
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18. The compound according to claim 17, or the pharmacodynamically acceptable salt thereof, having the formula:

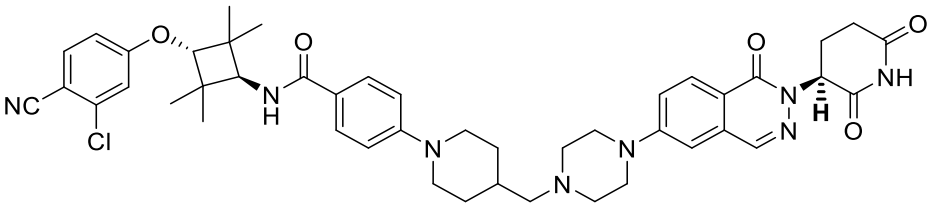

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19. The compound according to claim 17, or the pharmacodynamically acceptable salt thereof, having the formula:

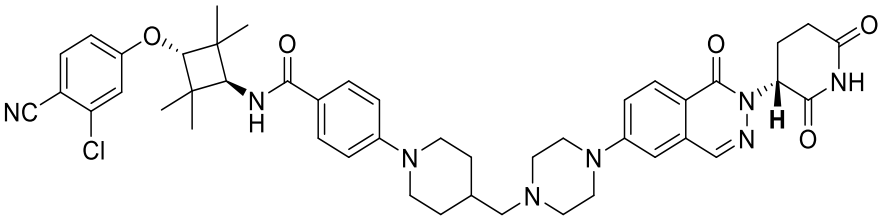


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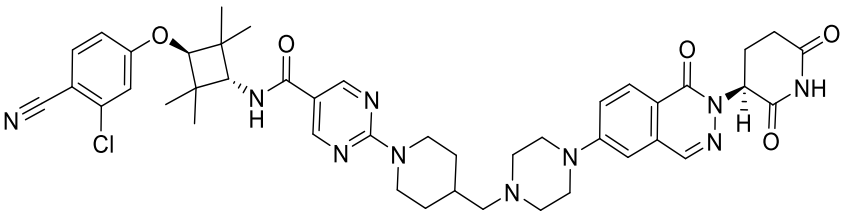
20. The compound according to claim 1, or the pharmacodynamically acceptable salt thereof, having the formula:



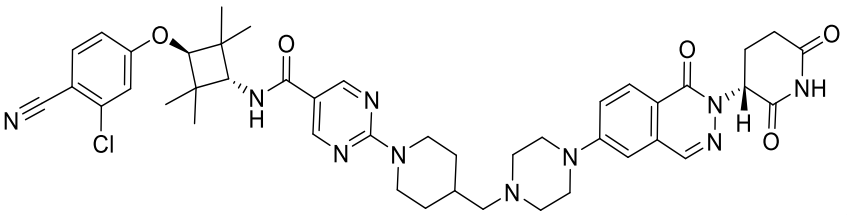
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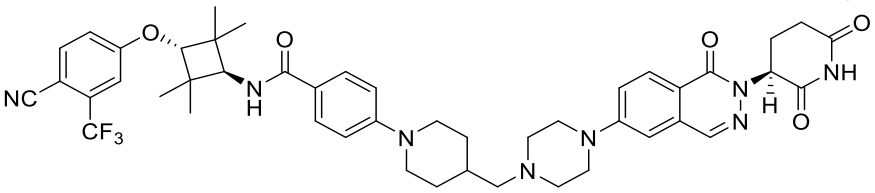
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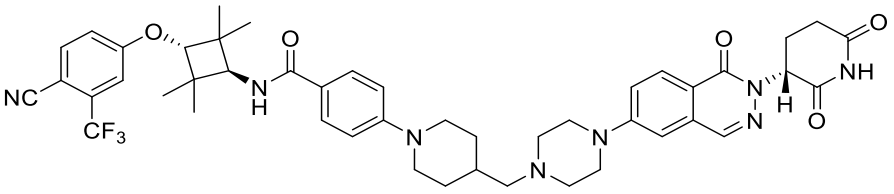
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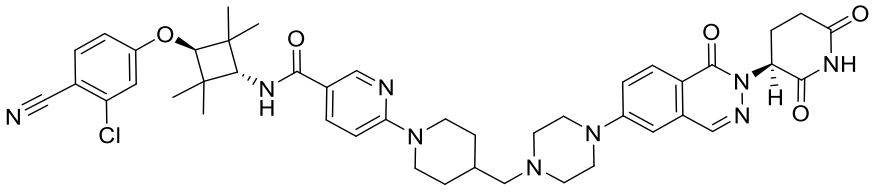
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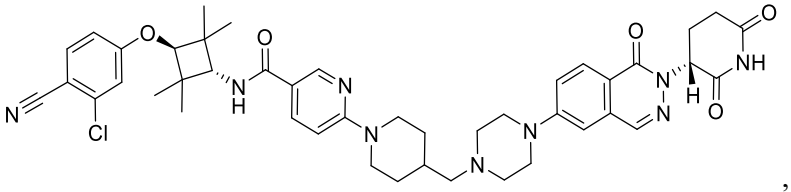


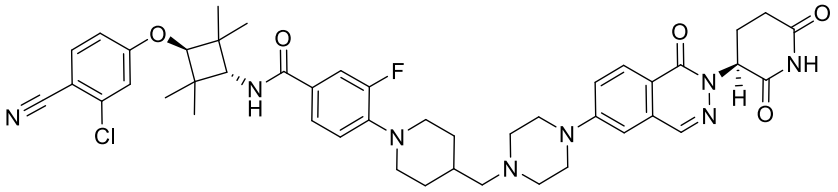
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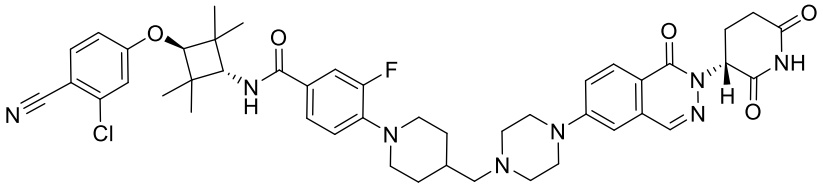


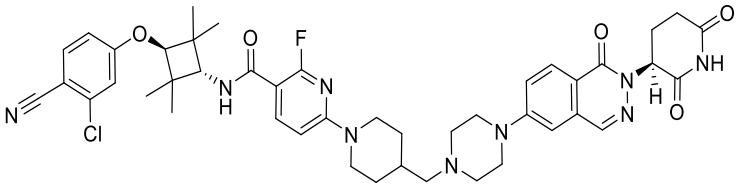
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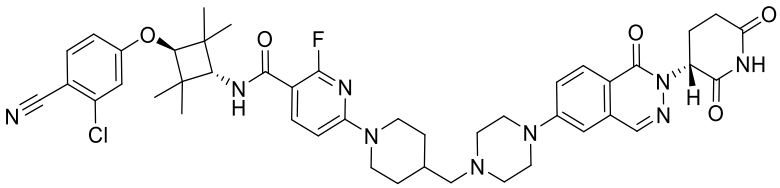

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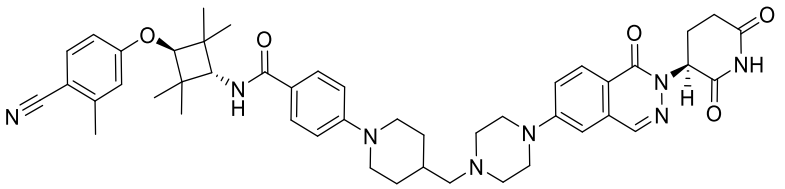

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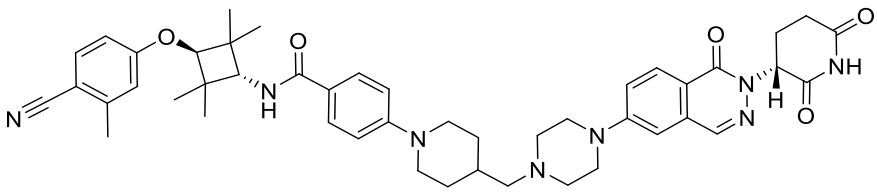

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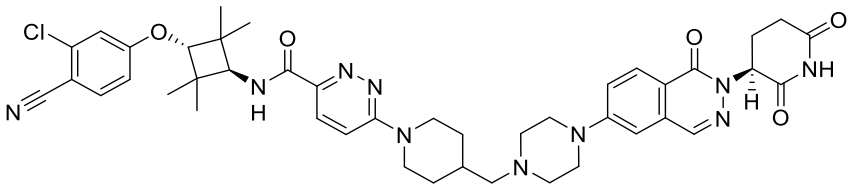

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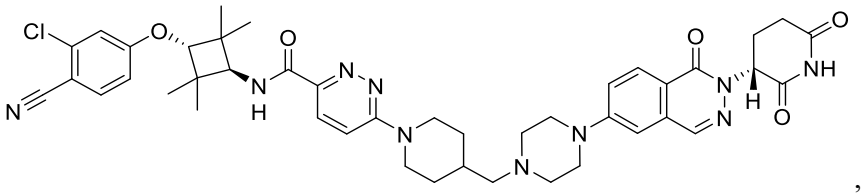

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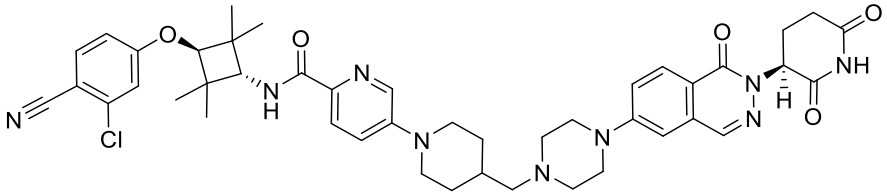

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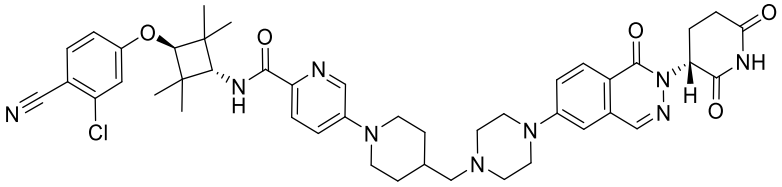

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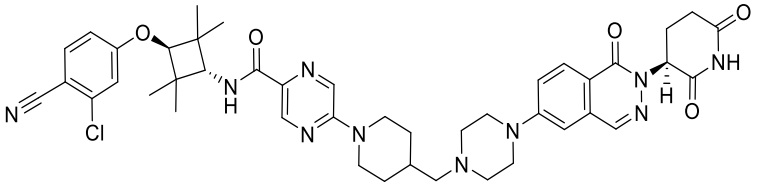

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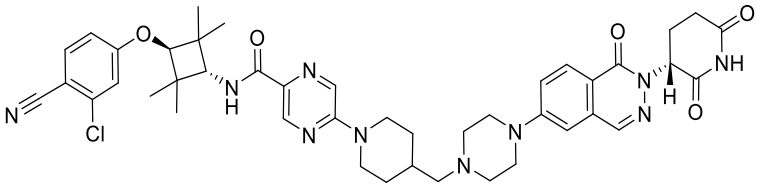

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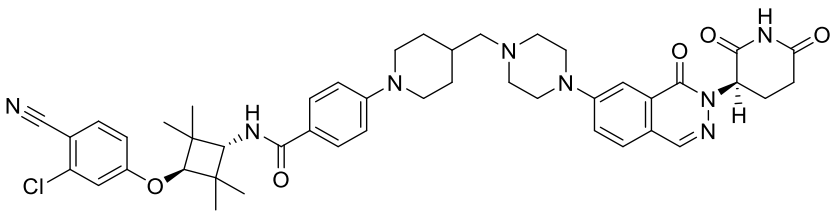

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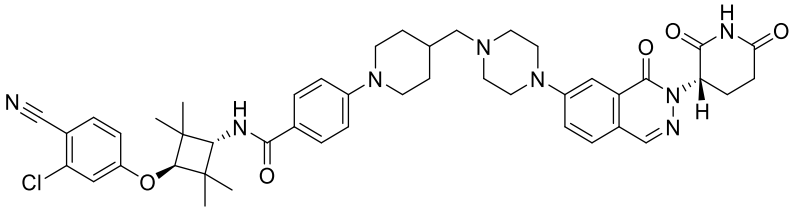

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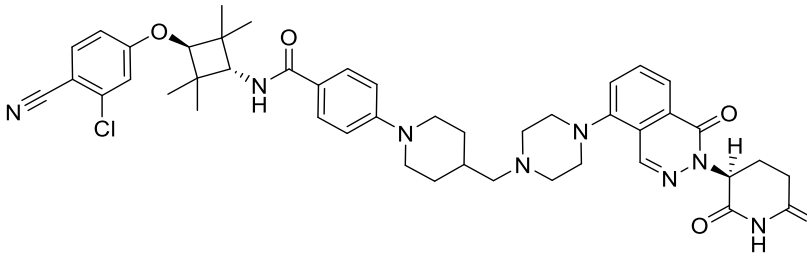

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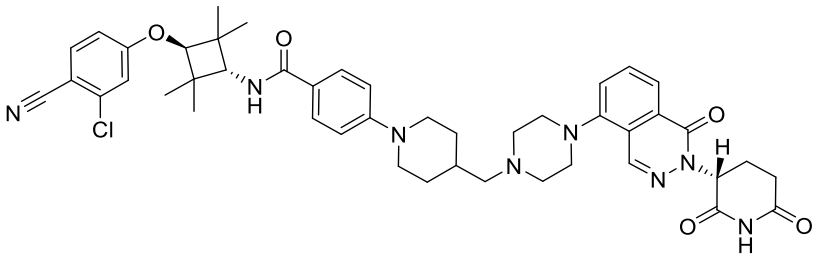

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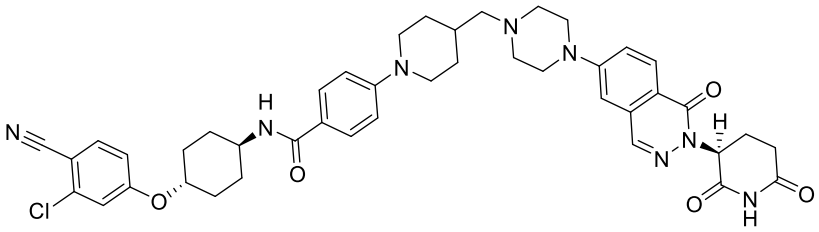

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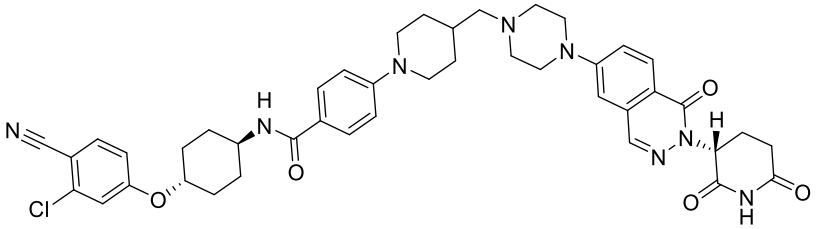

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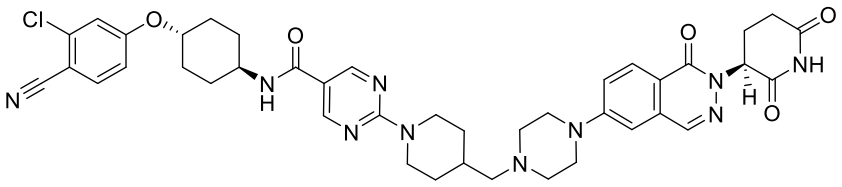

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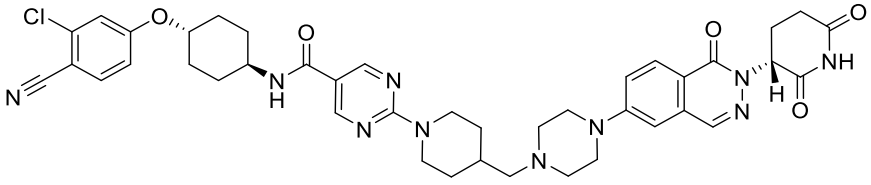

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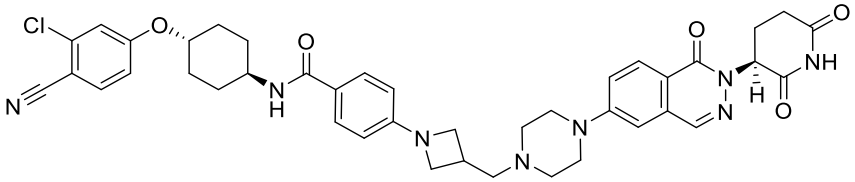

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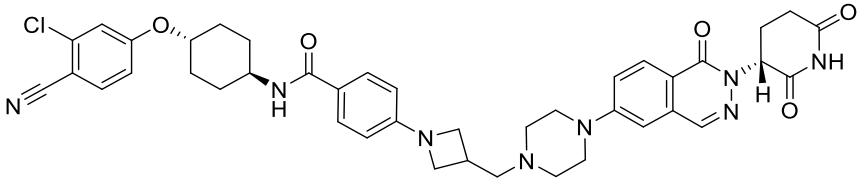

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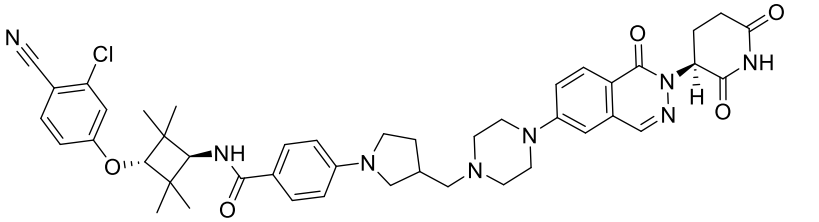

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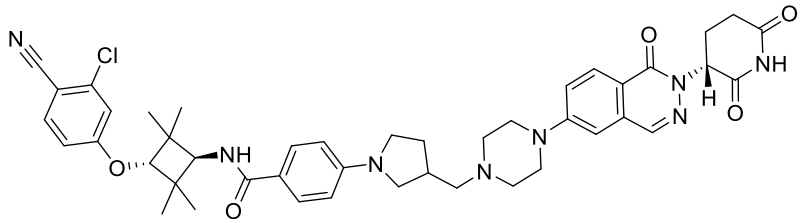

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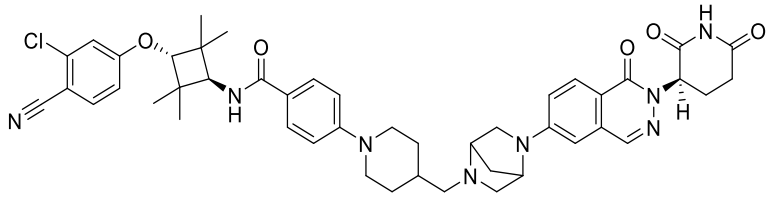

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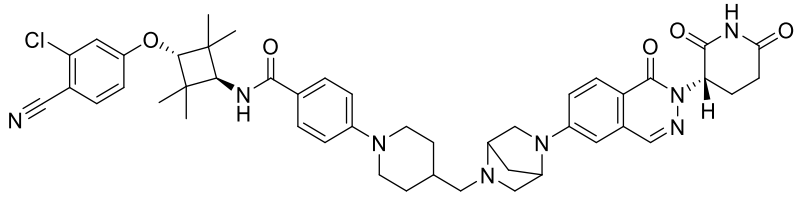

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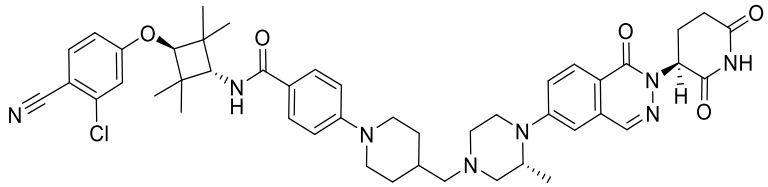
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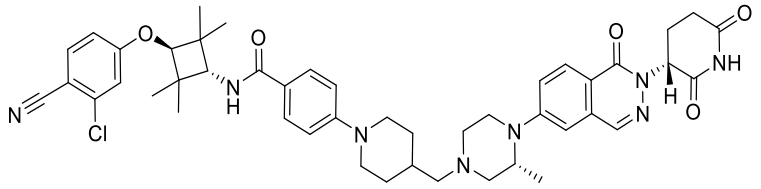
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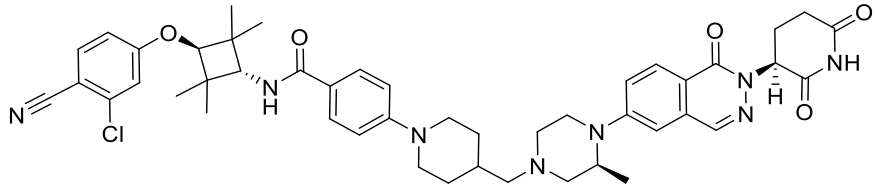
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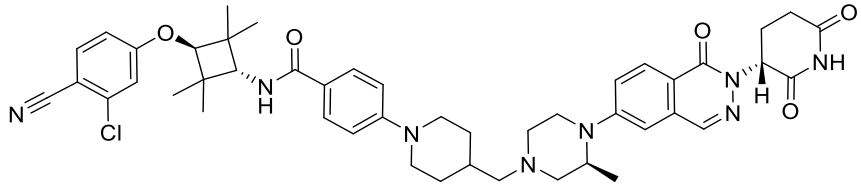
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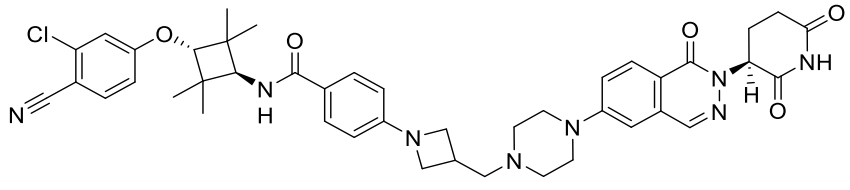
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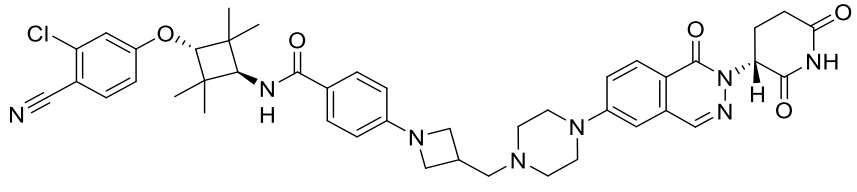
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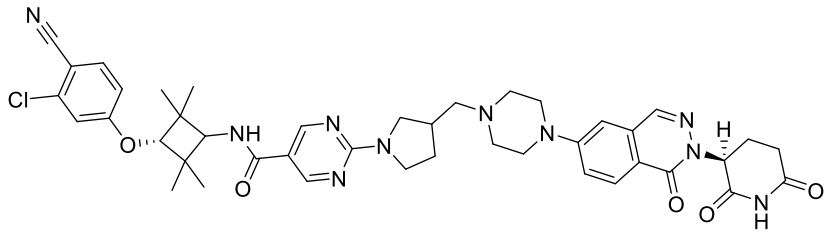
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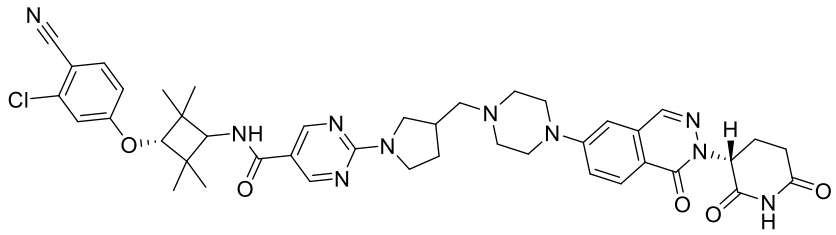


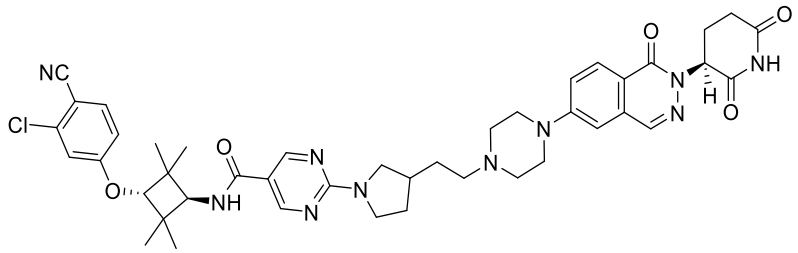
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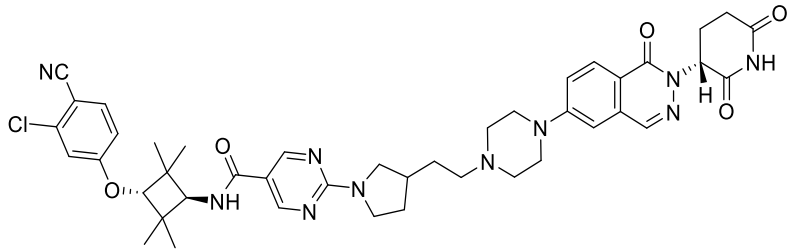


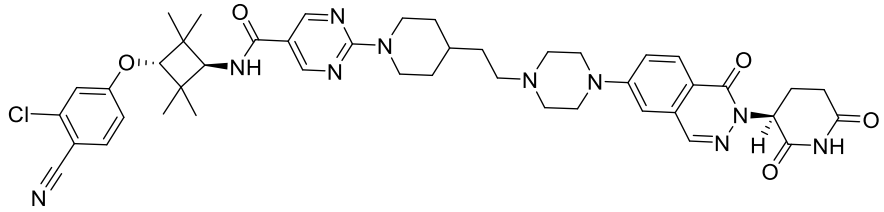
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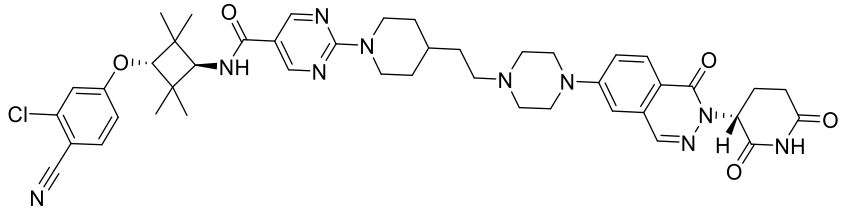

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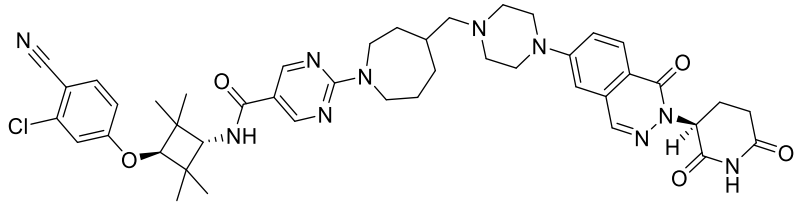

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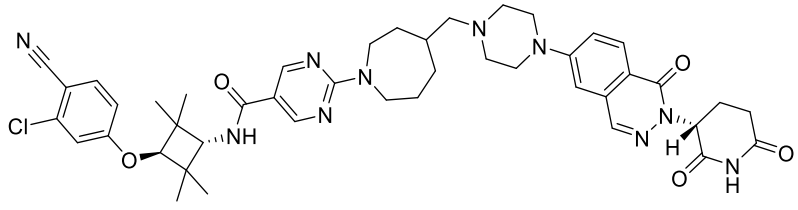

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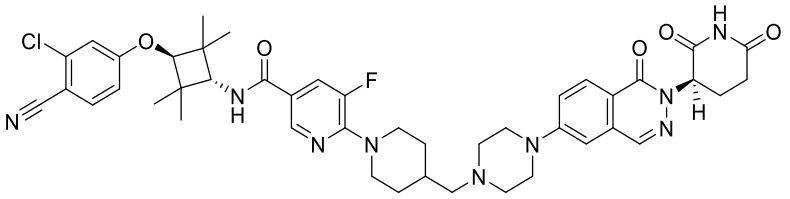

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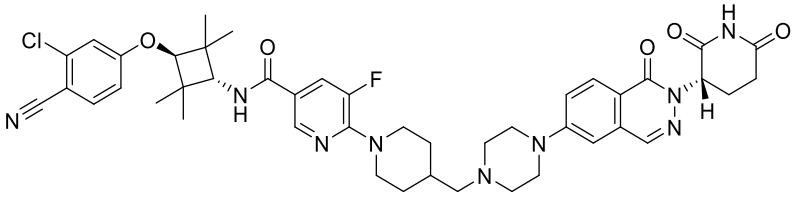

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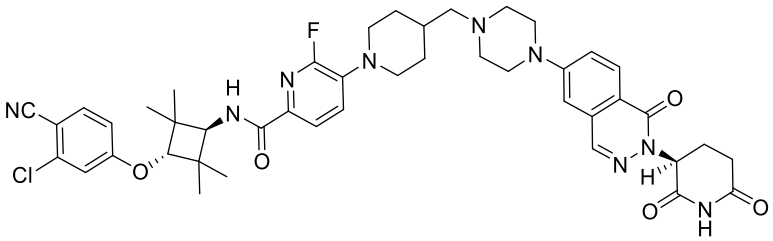

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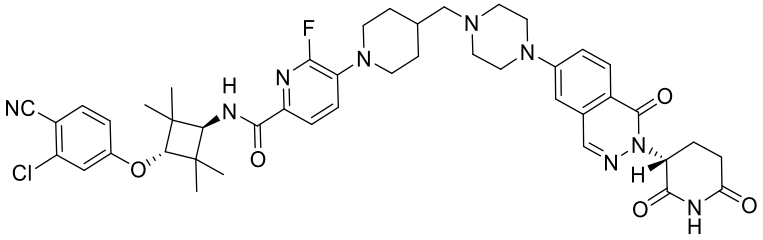

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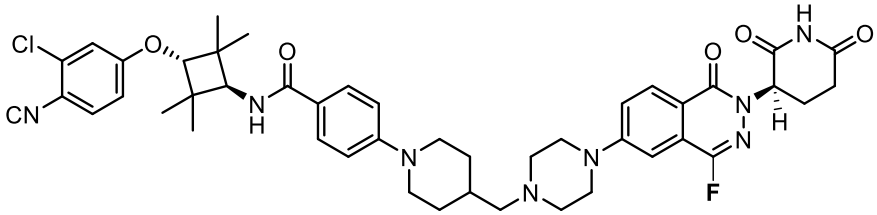

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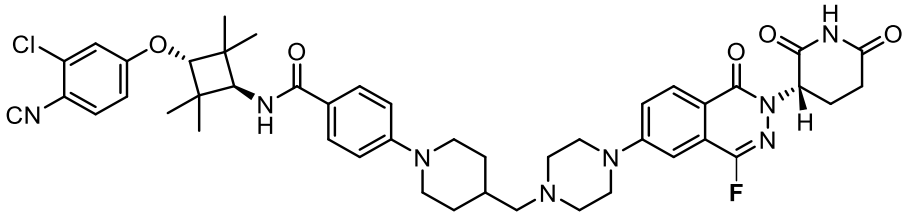

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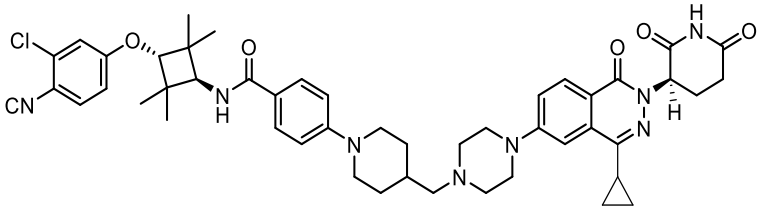

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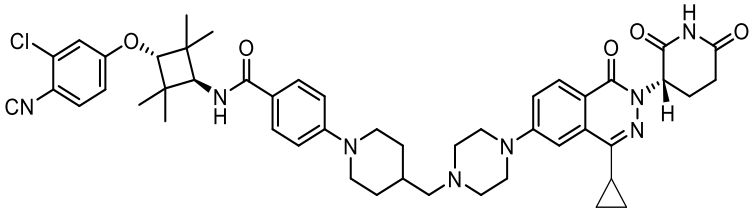

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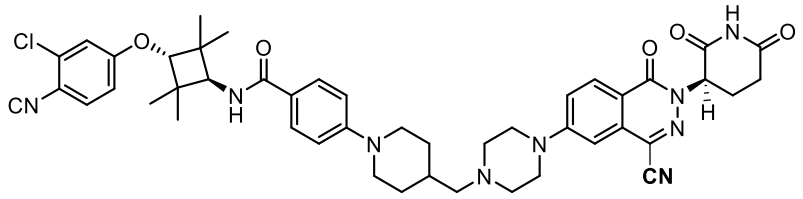

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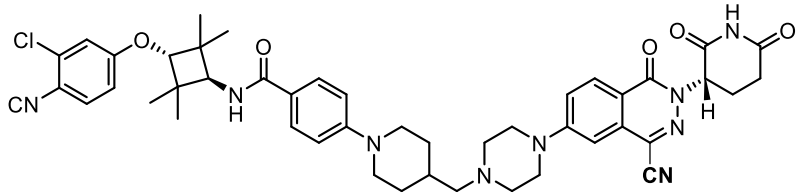

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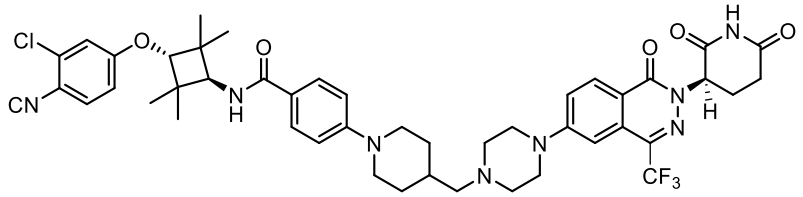

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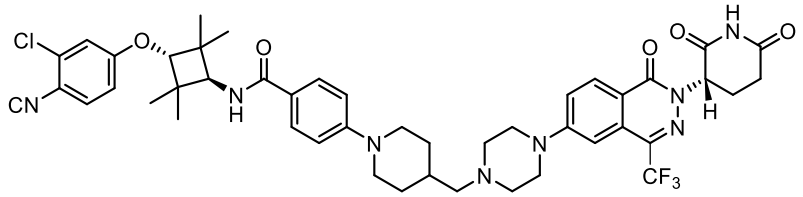

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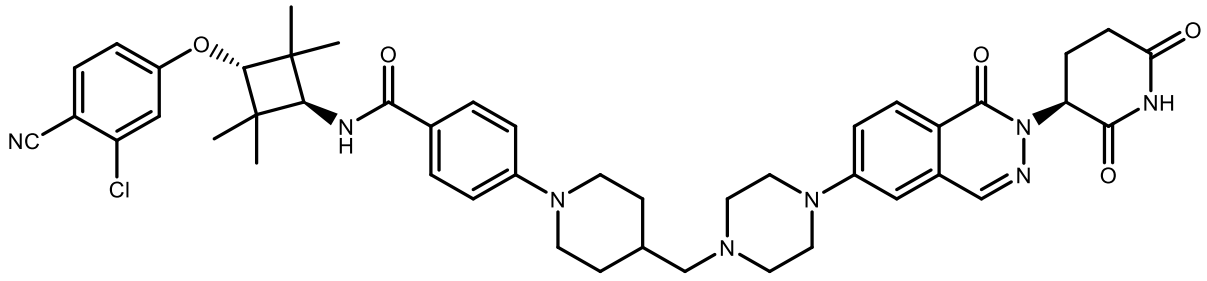

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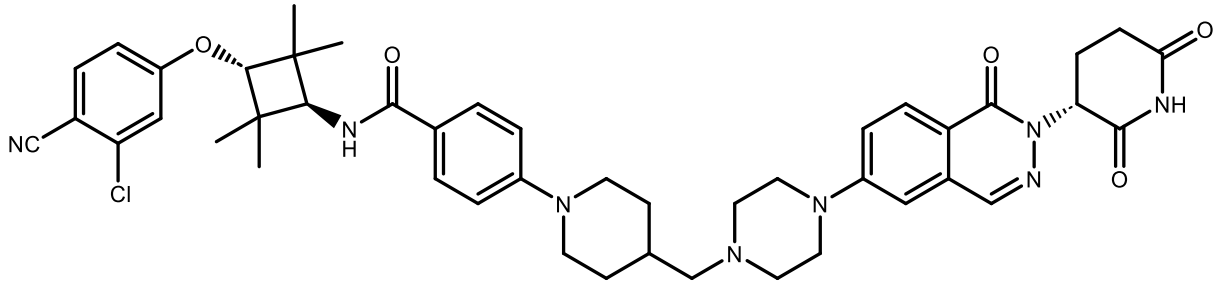

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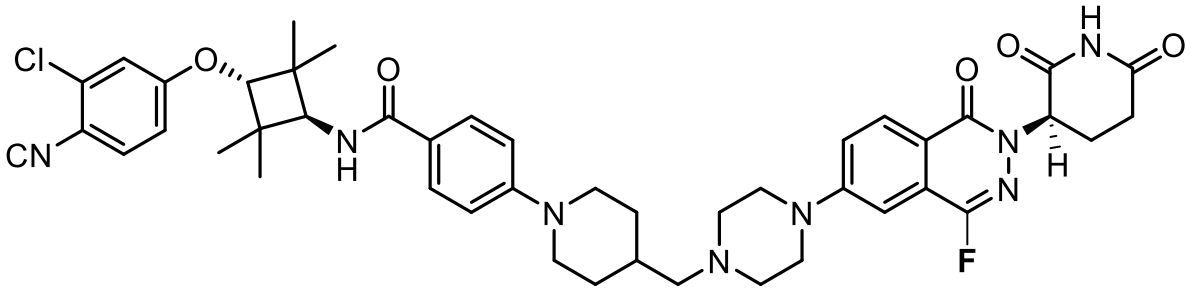
21. The compound according to claim 20, or the pharmacodynamically acceptable salt thereof, having the formula:


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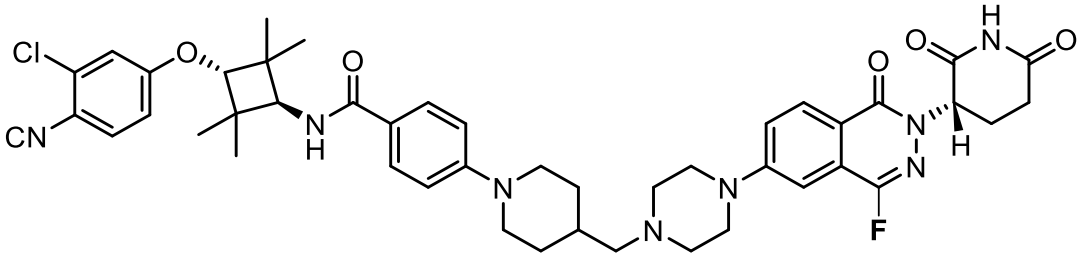
22. The compound according to claim 20, or the pharmacodynamically acceptable salt thereof, having the formula:


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23. The compound according to claim 20, or the pharmacodynamically acceptable salt thereof, having the formula:



24. The compound according to claim 20, or the pharmacodynamically acceptable salt thereof, having the formula:



25. Use of the compound of any one of claims 1–24, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, in the manufacture of a medicament for treating cancer.

26. The use according to claim 25, wherein the cancer is prostate cancer.

27. The use according to claim 25, wherein the cancer is breast cancer.

28. Use of the compound of any one of claims 1–24, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, in the manufacture of a medicament for prophylaxis and/or treatment of Kennedy's disease.

29. The compound of any one of claims 1 to 24, the optical isomer thereof, or the pharmacodynamically acceptable salt thereof, for use in therapy.