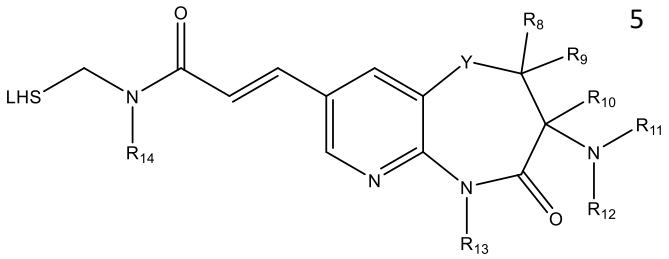
Claims

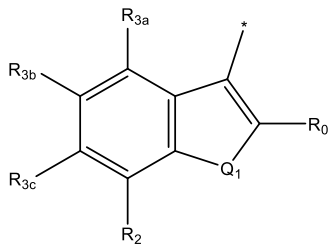
1. A compound of formula (I)



(I)

or a pharmaceutically acceptable prodrug, salt and/or solvate thereof, wherein

LHS is



wherein, the asterisk (*) marks the point of attachment;

Y is selected from the group consisting of CH_2, NH, and NR_d;

Q_1 is selected from the group consisting of O, S, NH and N-C_{1-4}-alkyl;

R_0 is selected from the group consisting of F, CH_2F, CH_3 and Cl, or alternatively R_0 together with R_{14} form a heterocycle comprising the N to which R_{14} is attached and having 5 to 8 ring members, wherein preferably the only heteroatom in said ring is the N to which R_{14} is attached;

R_2 is selected from the group consisting of H, F, Cl, Br, I, C_{1-4}-alkyl, , C_{1-4}-alkylene-OR_5, NR_5R_6, CO-NR_5R_6, C_{1-4}-alkylene-NR_5R_6, C_{3-6}-cycloalkyl, phenyl, and a heterocyclic group having 5 or 6 ring members and 1, 2 or 3 heteroatoms independently selected from N, O and S, wherein said C_{1-4}-alkyl, cycloalkyl, phenyl, or heterocyclic group may optionally be substituted with 1-3 R_7 groups;

R_{3a}, R_{3b} and R_{3c} are independently selected from the group consisting of H, F, Cl, Br, I, OH, NH_2, CH_3;

R_5 and R_6 are independently selected from the group consisting of H, C_{1-4}-alkyl, C_{3-6}-cycloalkyl, phenyl, and a heterocyclic group having 5 or 6 ring members and 1, 2 or 3 heteroatoms independently selected from N, O and S, wherein said cycloalkyl, phenyl, or heterocyclic group may optionally be substituted with 1-3 R_7 groups;

R_7 is selected from the group consisting of H, F, I, Br, Cl, O, C_{1-4}-alkyl, $CONH_2$, OH, NH_2, O-C_{1-4}-alkyl, NH-C_{1-4}-alkyl, N(C_{1-4}-alkyl)$_2$, C_{1-4}-alkylene-OH, and C_{1-4}-alkylene-NH_2, NO_2, CN, C_{2-4}-alkenyl, C_{2-4}-alkynyl, C_{2-4}-alkynylene-OH, C_{2-4}-alkynylene-NH_2, SO_2CH_3, and O-C_{1-4}-alkylene-OH;

R_{10} is H or methyl;

R_{13} is selected from the group consisting of H or R_d;

R_{14} is CH_3, or alternatively R_{14} together with R_0 of LHS form a heterocycle comprising the N to which R_{14} is attached and having 5 to 8 ring members, wherein preferably the only heteroatom in said ring is the N to which R_{14} is attached;

and,

R_d is selected from the group consisting of -PO_3R_{e2}, -CH_2-OPO_3R_{e2}, wherein R_e is selected from the group consisting of H and a cation suitable for forming a pharmaceutically acceptable salt,

wherein the pharmaceutically acceptable prodrug is preferably a compound based on formula (I) and modified by attaching a methylene phosphate moiety or a phosphoramidate moiety;

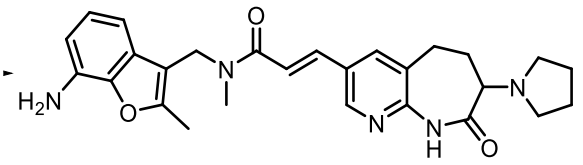
wherein the compound of formula (I) is further characterized according to one of the following embodiments (A) or (B):

(A) R_8 is H or F, preferably H, and R_9 is selected from the group consisting of H, F, methyl, ethyl, CN, OH, NH_2 and CH_2-OH; preferably H, F, methyl, CN, OH, or CH_2-OH;

R_{11} and R_{12} are independently selected from the group consisting of H, R_d, optionally substituted C_{1-4}-alkyl, wherein each of the optionally substituted C_{1-4}-alkyl groups may carry a substituent selected from F, OH, OMe and NH_2, NHMe, NMe_2, or alternatively, R_{11} and R_{12} together with the N to which they are attached form a heterocyclic group having 4, 5 or 6 ring members optionally comprising an oxygen atom or nitrogen atom in addition to the nitrogen atom bonded to the bicyclic group and carrying the R_{11} and R_{12} groups, wherein

said heterocyclic group may carry one or two substituents indepentently selected from F, methyl, OH and NH_2, preferably a single substituent selected from F, methyl, OH and NH_2 or two methyl group substituents, which may be in geminal or different positions;

wherein the compound of formula (I), embodiment (A), is none of the following compounds



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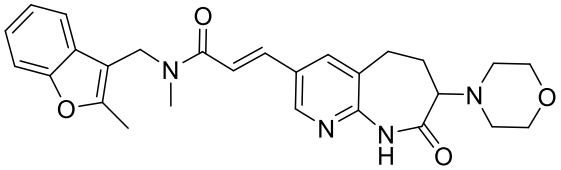

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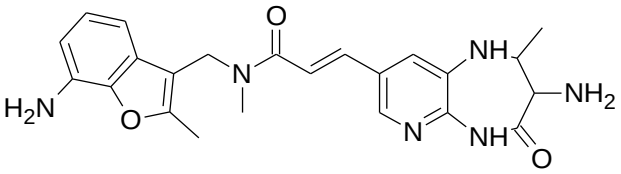

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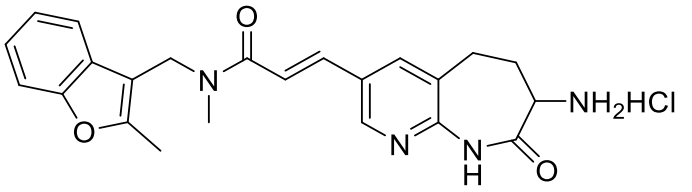

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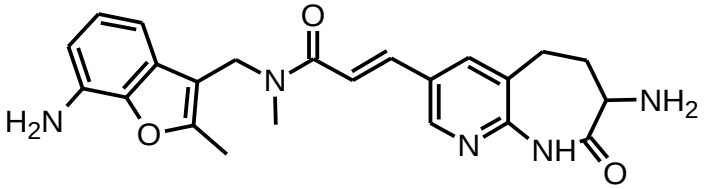

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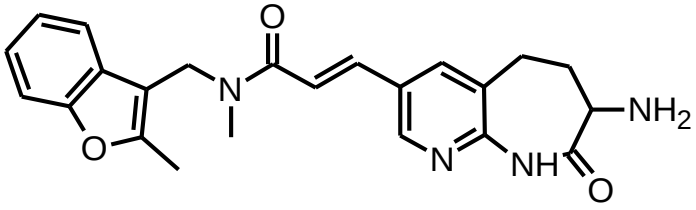

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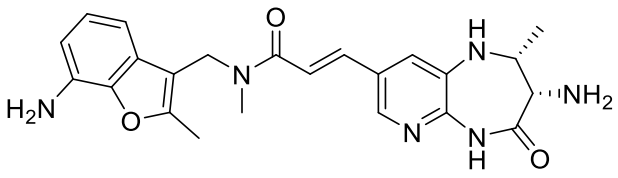
and neither any of the stereoisomers of these compounds such as



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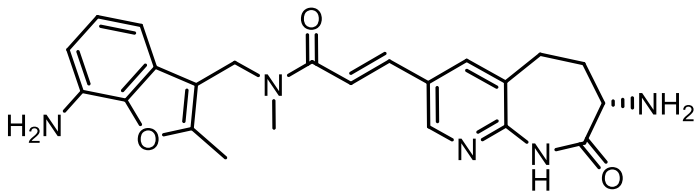

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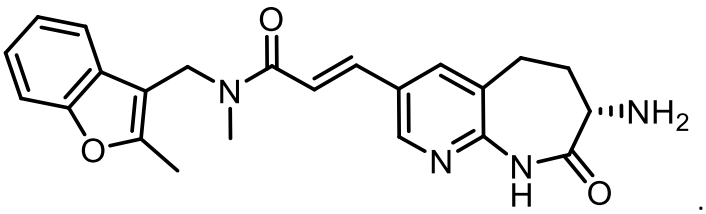

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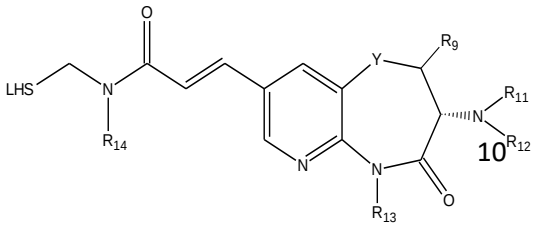
(B) the compound of formula (I) is characterized by formula (Ia)



(Ia)

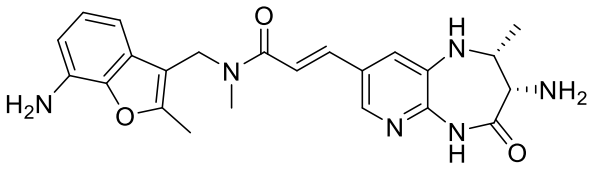
wherein R_9 is a methyl group, hydroxyl group or nitrile group;

R_{11} and R_{12} are independently selected from the group consisting of H, R_d, C_{1-4}-alkyl, CO-C_{1-4}-alkyl, $SO_2(C_{1-4}\text{-alkyl})_1$, C_{1-4}-alkyl-F, C_{1-4}-alkylene-OH, and C_{1-4}-alkylene-NH_2, or alternatively, R_{11} and R_{12} together with the N to which they are attached form a heterocyclic group having 4 to 9 ring members and 1, 2 or 3 heteroatoms independently selected from N, O and S or R_{11} and R_{12} form a heterocyclic spiro group having 7 to 11 ring members and 1, 2 or 3 heteroatoms independently selected from N, O and S, wherein said heterocyclic or heterocyclic spiro group may be substituted with 1-3 R_7 groups, wherein the heterocyclic group formed by R_{11} and R_{12} together with the N to which they are attached is preferably an optionally substituted heterocyclic group having 4, 5 or 6 ring members optionally comprising an oxygen atom or NH group in addition to the nitrogen atom carrying the R_{11} and R_{12} groups, wherein said

optionally substituted heterocyclic group may carry one or two substituents indepentently selected from F, methyl, OH and NH_2, preferably a single substituent selected from F, methyl, OH and NH_2 or two methyl,

wherein the compound is diastereomerically pure in relation to the chiral carbon atom carrying R_9 and the chiral carbon atom carrying $NR_{11}R_{12}$;

wherein the compound of formula (Ia) in embodiment (B) is not



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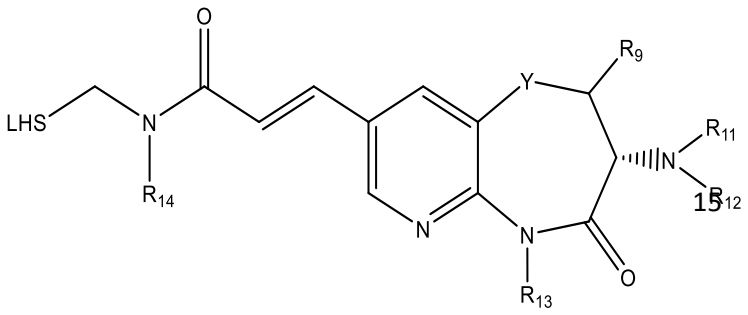
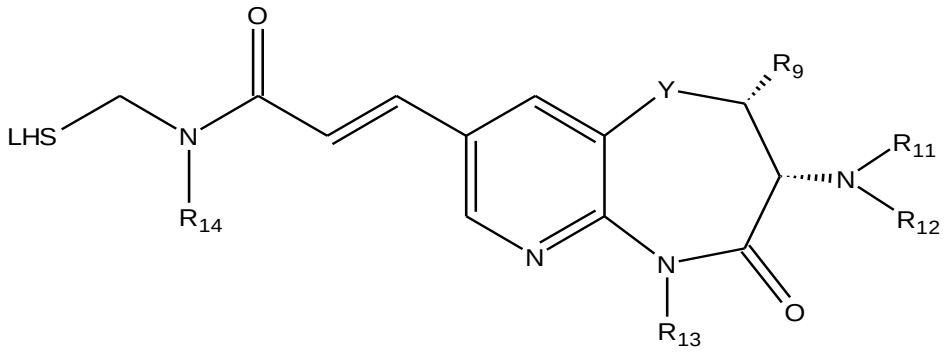
2. A compound according to claim 1, embodiment (A), wherein the compound is a compound of formula (Ia)



(Ia)

wherein LHS, Y, R_9, R_{11}, R_{12}, R_{13} and R_{14} are as specified in claim 1, embodiment (A), and wherein the compound is diastereomerically pure in relation to the chiral carbon atom carrying R_9 and the chiral carbon atom carrying $NR_{11}R_{12}$.

3. The compound according to claim 1, embodiment (B), or claim 2, wherein the chiral carbon atom carrying the R_9 group is beneath the plane of the heterocycle such that the compound is characterized by general formula (1b)



(1b).

4. The compound according to any of claims 1 to 3, R_{11} and R_{12} are selected such that the nitrogen, to which R_{11} and R_{12} are attached, exhibits a pKa in the range of from 6.0 to 8.5, preferably 6.2 to 7.5 and more preferably 6.4 to 7.0.

5. A compound according to any one of claims 1 to 4 wherein Q_1 is O, R_0 is CH_3 and/or R_{14} is CH_3.

6. A compound according to any one of claims 1 to 5 wherein R_{3a} is H, R_{3b} is H, R_{3c} is H and/or R_2 is selected from the group consisting of H, F, Cl. Br, I and NR_5R_6.

7. A compound according to any one of claim 1, embodiment (A), or claims 2 to 6, wherein R_9 is selected from H, F, OH, CN, CH_2-OH, or a methyl group.

8. A compound according to any one of claims 1 to 7 wherein R_{11} and R_{12} are independently selected from H, methyl, ethyl, 2-hydroxyethyl, 2-aminoethyl, or R_{11} and R_{12} together with the adjacent nitrogen atom form a heterocycle selected from an azetidine group, a pyrrolidine group, a piperidine group, a morpholine group and a piperazine group, wherein each of these heterocycles may be substituted by a group selected from F, OH, NH_2 and methyl or substituted by two methyl groups, which may be in geminal or different positions.

9. A compound according to any one of claims 1 to 8 wherein Y is CH_2.

10. A compound according to any one of claims 1 or 8 wherein Y is NH.

11. A compound according to anyone of claims 1 to 10 wherein

Y is CH_2 or NH;

Q_1 is O;

R_0 is CH_3;

R_{13} is H or R_d;

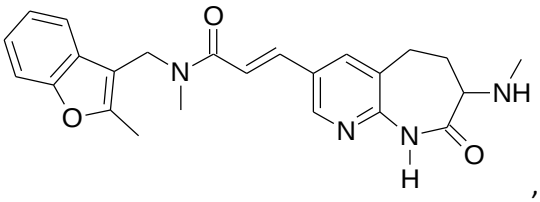
R_{14} is CH_3;

R_2 is selected from H, F, Cl, Br, I and NR_5R_6;

R_{3a} is H, R_{3b} is H and R_{3c} is H; and

R_{11} and R_{12} are independently selected from H, methyl, ethyl, 2-hydroxyethyl, 2-aminoethyl, or R_{11} and R_{12} together with the adjacent nitrogen atom form a heterocycle selected from an azetidine group, a pyrrolidine group, a piperidine group, a morpholine group and a piperazine group, wherein each of these heterocycles may be substituted by a group selected from F, OH, NH_2 and methyl or substituted by two methyl groups, which may be in geminal or different positions.

12. A compound according to any one of the preceding claims, which is selected from the group consisting of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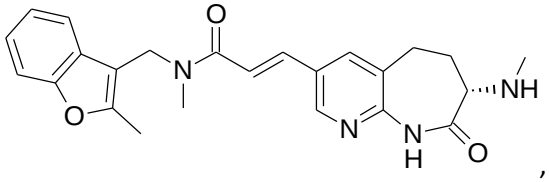
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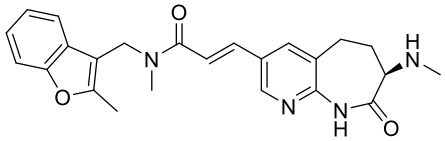
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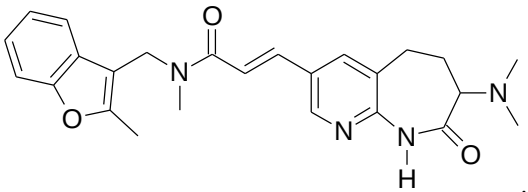
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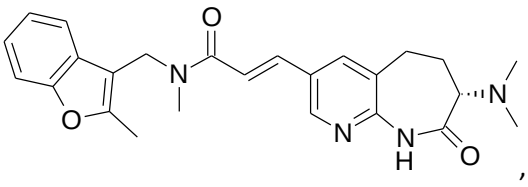
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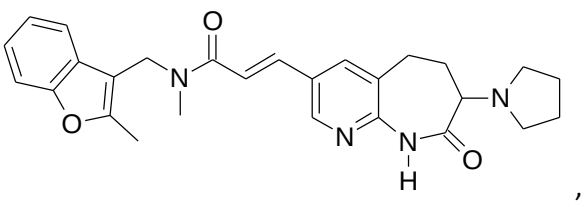
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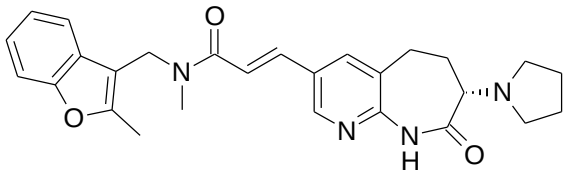
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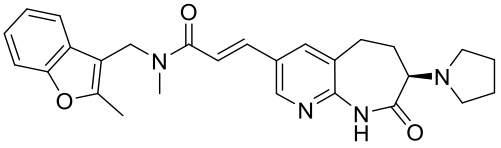
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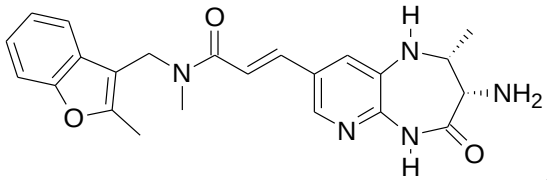
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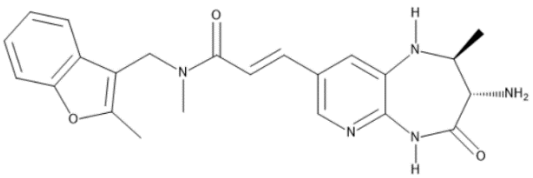
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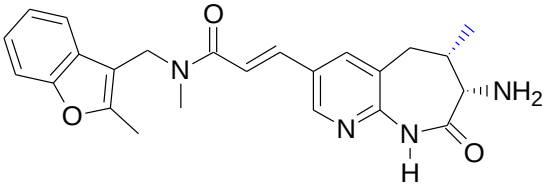
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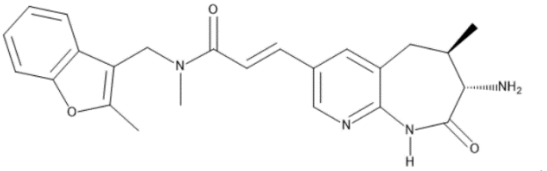
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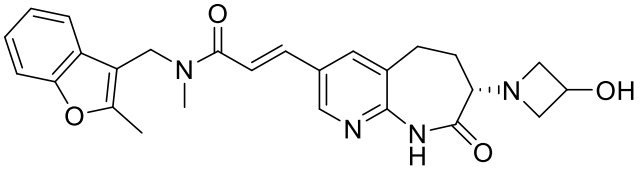
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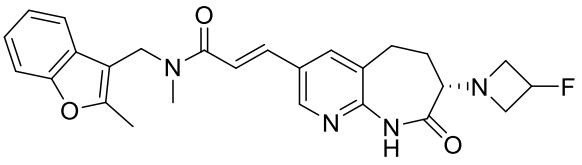
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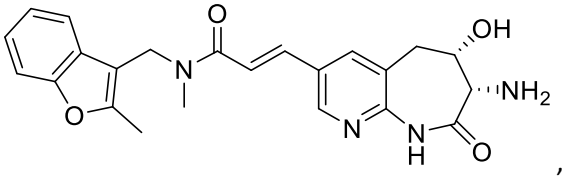
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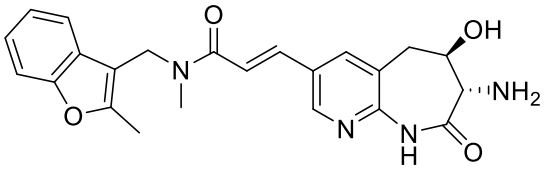
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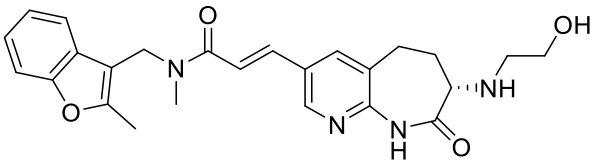
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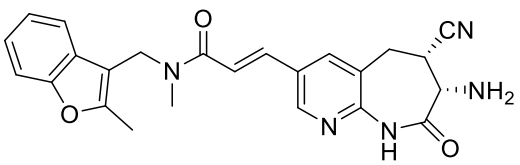
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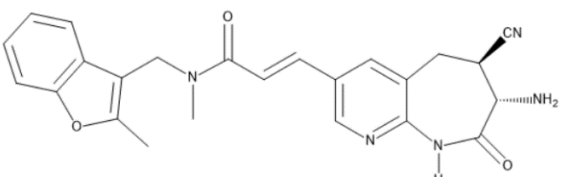
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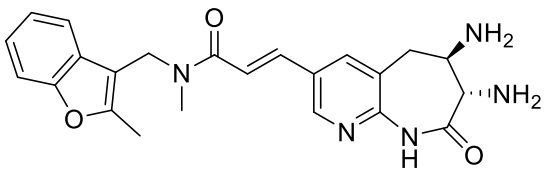

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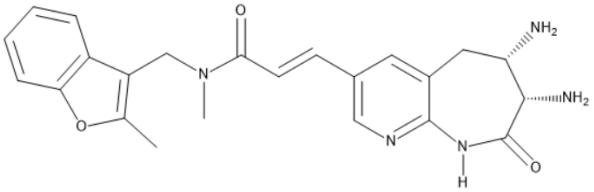

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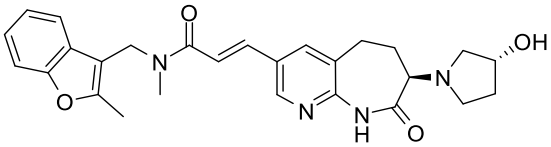

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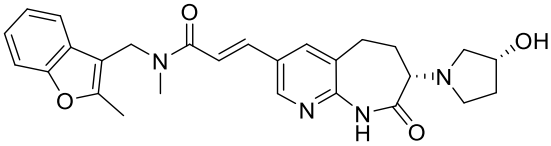

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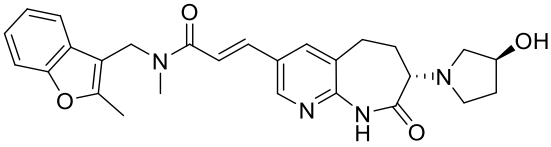

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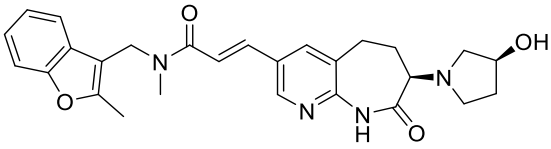

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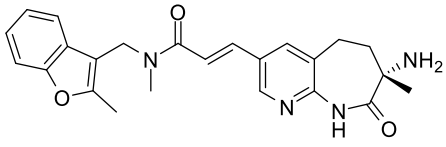

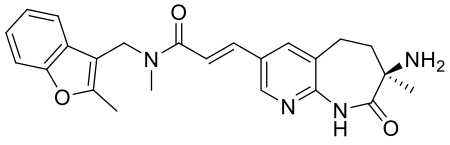

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and any pharmaceutically acceptable prodrugs, salts and/or solvates thereof.

13. A pharmaceutical composition comprising a compound according to any preceding claim.

14. A compound or composition according to any preceding claims for use in treating a bacterial infection and wherein preferably the bacterial infection is associated with one or more bacteria selected from the group consisting of: *S. aureus, E. coli, Klebsiella pneumoniae and A. baumannii and most preferably wherein* the bacterial infection is associated with *A. baumannii* and is preferably pneumonia and most preferably nosocomial pneumonia.

15. A compound or composition according to any one of claims 1 to 13 for use in therapy.

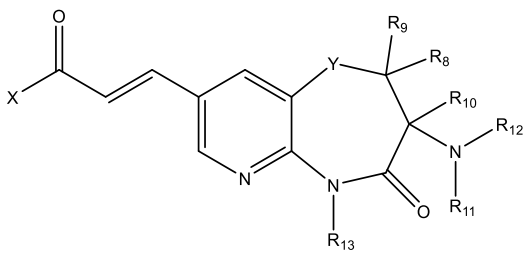
16. Use of a compound according to claims 1-12 or composition according to claim 13, in the manufacture of a medicament for treating a bacterial infection.

17. The use according to claim 16, wherein the bacterial infection is associated with one or more bacteria selected from the group consisting of: *S. aureus, E. coli, Klebsiella pneumoniae and A. baumannii.*

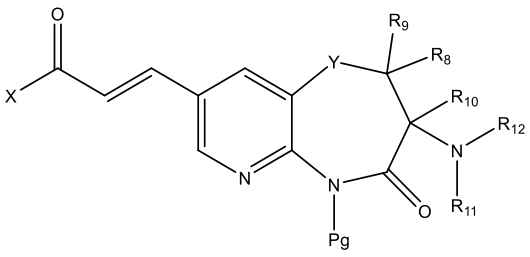
18. The use according to claim 16, wherein the bacterial infection is associated with pneumonia.

19. The use according to claim 16, wherein the bacterial infection is associated with nosocomial pneumonia.

20. A method for producing a compound as defined in anyone of claims 1 to 12, wherein said method is selected from a first variant that comprises the step of coupling a precursor compound of formula M1 or M1'



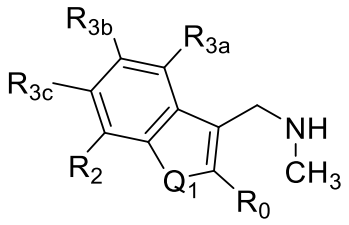
M1



M1'

wherein X represents a leaving group, which is preferably selected from a hydroxyl group, a tosylate group, a triflate group, a mesylate group, iodide, bromide, chloride, methoxy, and ethoxy, and Pg represents a protective group, which is preferably selected from the Boc group, PMB group, and DMB group,

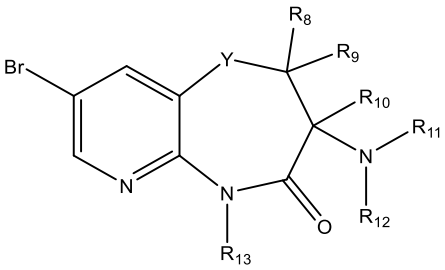
with an amine compound of formula M2b



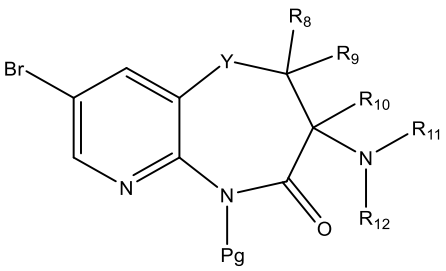
M2b

wherein Y, Q_1, and all R groups have the same meanings as specified in claims 1 to 12 and R_{11} and/or R_{12} in addition of being defined as specified hereinabove may also comprise a protective group, which is preferably selected from the Boc group, PMB group, and DMB group;

and a second variant that comprises the step of coupling a compound of formula M6 or M6'

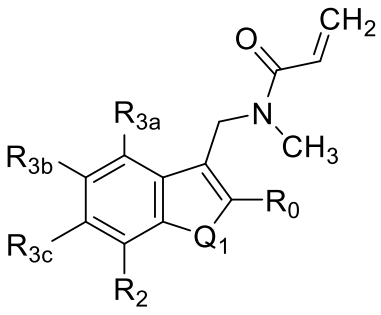


M6



M6'

with a compound of formula M7b



M7b

wherein Pg represents a protective group, which is preferably selected from the Boc group, PMB group, and DMB group, wherein Y, Q_1 and all R groups have the same meaning as specified in claims 1 to 12, wherein R_{11} and R_{12} may be a group as defined in any of claims 1 to 12 or may be such a defined group that also comprises a protective group, which is preferably selected from the Boc group, PMB group, and DMB group.