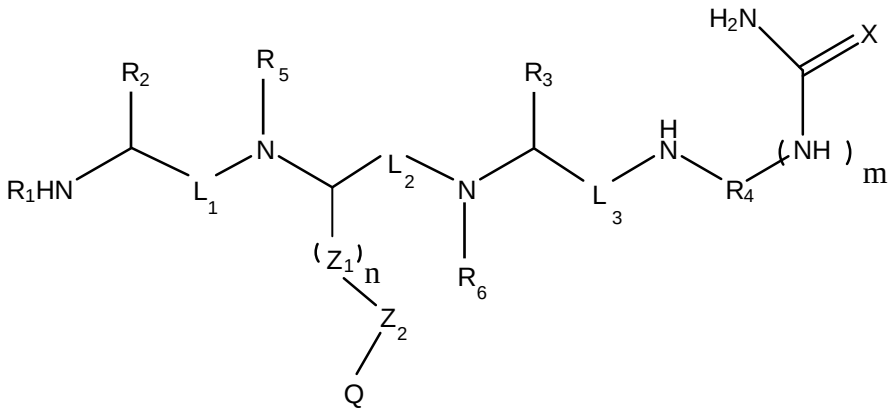
Claims:

1. A compound of the formula (I)



(I)

wherein

L_1 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

L_2 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

L_3 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

R_1 represents hydrogen, acyl, carbamoyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylcarbonyl, cycloalkylcarbonyl or heterocyclylcarbonyl;

R_2 represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_3 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_4 represents optionally substituted alkandiyl, alkendiyl, alkyndiyl, cycloalkyldiyl, alkylcycloalkyldiyl, alkylcycloalkylalkyldiyl, aryldiyl, alkylaryldiyl, alkylarylalkyldiyl;

R_5 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_6 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

provided that at least two of the substituents R_2, R_3, R_5 and R_6 are aralkyl or heteroaralkyl;

wherein at least one of R_2 or R_3 is an optionally substituted biphenyl-C_1-C_4-alkyl;

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

m is 0 or 1;

Q is $-NH_2$, -NH-C(NH)-NH_2 or -NH-C(N-alkyl)-NH-alkyl;

X is NH, O or S;

Z_1 is $–CH_2$-;

Z_2 is a direct bond, alkandiyl, cycloalkyldiyl or aryldiyl;

or a salt, isomer, solvate of such compound and a mixture thereof.

2. A compound of formula (I) according to claim 1, wherein

L_1 represents –CO-, C_1-C_3-alkandiyl, -C_1-C_2-alkyl-CO- or -CO-C_1-C_2-alkyl-;

L_2 represents –CO-, C_1-C_3-alkandiyl, -C_1-C_2-alkyl-CO- or -CO-C_1-C_2-alkyl-;

L_3 represents –CO-, C_1-C_3-alkandiyl, -C_1-C_2-alkyl-CO- or -CO-C_1-C_2-alkyl-;

R^1 represents hydrogen, C_1-C_{20}-alkyl-CO-, C_2-C_{20}-alkenyl-CO-, C_1-C_{20}-alkyl-NH-CO-, (C_1-C_{20}-alkyl)$_2$-N-CO-, arylcarbonyl having 6 or 10 carbon atoms in the aryl moiety, C_3-C_7-cycloalkylcarbonyl or heterocyclylcarbonyl having 1 to 3 hetero atoms selected from N,O and S in the 3 to 6 membered ring;

R^2 represents optionally substituted C_1-C_{12}-alkyl, phenyl-C_1-C_4-alkyl, biphenyl-C_1-C_4-alkyl or naphthyl-C_1-C_4-alkyl;

R^3 represents hydrogen or represents optionally substituted C_1-C_{12}-alkyl, phenyl-C_1-C_4-alkyl, biphenyl-C_1-C_4-alkyl or naphthyl-C_1-C_4-alkyl;

R^4 represents optionally substituted C_1-C_{12}-alkandiyl, C_2-C_{12}-alkendiyl, C_2-C_{12}-alkyndiyl, C_3-C_7-cycloalkyldiyl, -C_1-C_6-alkyl-C_3-C_7-cycloalkyl-, -C_1-C_6-alkyl-C_3-C_7-cycloalkyl-C_1-C_6-alkyl-, -C_1-C_6-alkyl-phenyl- or -C_1-C_6-alkyl-naphtyl-;

R^5 represents hydrogen or represents optionally substituted C_1-C_{12}-alkyl, phenyl-C_1-C_4-alkyl, biphenyl-C_1-C_4-alkyl or naphtyl-C_1-C_4-alkyl;

R^6 represents hydrogen or represents optionally substituted C_1-C_{12}-alkyl, phenyl-C_1-C_4-alkyl, biphenyl-C_1-C_4-alkyl or naphtyl-C_1-C_4-alkyl;

wherein at least one of R_2 or R_3 is an optionally substituted biphenyl-C_1-C_4-alkyl;

n is 0, 1, 2 or 3;

m is 0 or 1;

Q is -NH_2, -NH-C(NH)-NH_2 or -NH-C(N-C_1-C_2-alkyl)-NH-C_1-C_2-alkyl;

X is NH or O;

Z_1 is –CH_2-;

Z_2 is a direct bond, C_1-C_3-alkandiyl, cyclohexyldiyl or phenyldiyl;

or a pharmaceutically acceptable salt, isomer, solvate of such compound and a mixture thereof.

3. A compound of formula (I) according to claim 1, wherein

L_1 represents –CO-, -CH_2-, -CH_2-CH_2-, -CH_2-CO- or -CO-CH_2-;

L_2 represents –CO-, -CH_2-, -CH_2-CH_2-,-CH_2-CO- or -CO-CH_2-;

L_3 represents –CO-, -CH_2-, -CH_2-CH_2-, -CH_2-CO- or -CO-CH_2-;

R^1 represents hydrogen, C_1-C_{16}-alkyl-CO-, C_2-C_{16}-alkenyl-CO-, C_1-C_{16}-alkyl-NH-CO-, (C_1-C_{16}-alkyl)$_2$-N-CO-; phenylcarbonyl or heterocyclylcarbonyl having 1 to 2 hetero atoms selected from N, O and S in the 3 to 6 membered ring;

R^2 represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^3 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^4 represents C_2-C_6-alkandiyl, C_2-C_6-alkendiyl, C_2-C_6-alkyndiyl, C_3-C_7-cycloalkyldiyl, -C_1-C_6-alkyl-C_3-C_7-cycloalkyl-, -C_1-C_6-alkyl-C_3-C_7-cycloalkyl-C_1-C_6-alkyl-, -CH(COOH)-C_1-C_6-alkyl-, -CH($CONH_2$)-C_3H_6- or -C_1-C_6-alkyl-phenyl-;

R^5 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^6 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

wherein at least one of R_2 or R_3 is an optionally halogen or C_1-C_4-alkyl substituted biphenyl-C_1-C_2-alkyl;

n is 0, 1, 2 or 3;

m is 0 or 1;

Q is -NH_2, -NH-C(NH)-NH_2 or -NH-C(N-CH_3)-NH-CH_3;

X is NH or O;

Z_1 is –CH_2-;

Z_2 is a direct bond, -CH_2-, cyclohexyldiyl or phenyldiyl; or a salt, isomer, solvate of such compound and a mixture thereof.

4. A compound of formula (I) according to claim 1, wherein

L_1 represents –CO- or -CH_2-;

L_2 represents –CO-, -CH_2- or -CH_2-CO-;

L_3 represents –CO- or -CH_2-;

R^1 represents hydrogen, methylcarbonyl, ethylcarbonyl, nonylcarbonyl or heterocyclylcarbonyl having 1 to 2 hetero atoms selected from N and O in the 3 to 6 membered ring;

R^2 represents optionally halogen or C_1-C_4-alkyl substituted benzyl, biphenylmethyl or naphtylmethyl;

R^3 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted benzyl, biphenylmethyl or naphthylylmethyl;

R^4 represents propandiyl, butandiyl, pentandiyl, butendiyl, butyndiyl, cyclohexyldiyl, -CH(COOH)-C_3H_6-, -CH($CONH_2$)-C_3H_6- or –CH_2-phenyl;

R^5 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted benzyl, biphenylmethyl or naphthylmethyl;

R^6 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted methyl, benzyl, biphenylmethyl or naphthylmethyl;

wherein at least one of R_2 or R_3 is an optionally halogen or C_1-C_4-alkyl substituted biphenylmethyl;

n is 0, 1, 2 or 3;

m is 0 or 1;

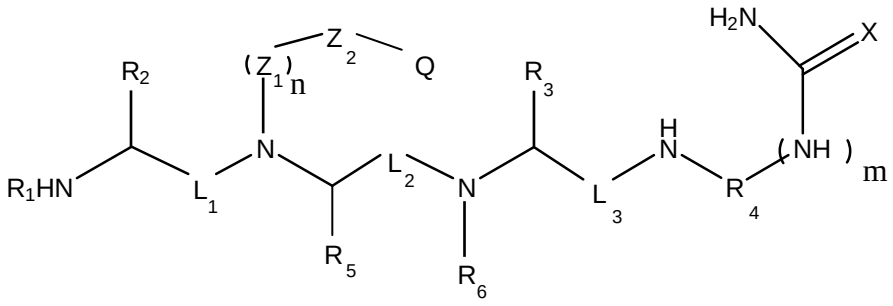
Q is -NH_2, -NH-C(NH)-NH_2 or -NH-C(N-CH_3)-NH-CH_3;

X is NH or O;

Z_1 is –CH_2-;

Z_2 is a direct bond, -CH_2- or phenyldiyl; or a salt, isomer, solvate of such compound and a mixture thereof.

5. A compound of formula (Ic)



wherein

L_1 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

L_2 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

L_3 represents –CO-, alkandiyl, -alkyl-CO- or -CO-alkyl-;

R_1 represents hydrogen, acyl, carbamoyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylcarbonyl, cycloalkylcarbonyl or heterocyclylcarbonyl;

R_2 represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_3 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_4 represents optionally substituted alkandiyl, alkendiyl, alkyndiyl, cycloalkyldiyl, alkylcycloalkyl, alkylcycloalkylalkyl, aryl, alkylaryl, alkylarylalkyl;

R_5 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R_6 represents hydrogen, or represents optionally substituted alkyl, aralkyl or heteroaralkyl;

provided that at least two of the substituents R_2, R_3, R_5 and R_6 are optionally substituted aralkyl or heteroaralkyl;

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

m is 0 or 1;

Q is $-NH_2$, -NH-C(NH)-NH_2 or -NH-C(N-alkyl)-NH-alkyl;

X is NH, O or S;

Z_1 is $–CH_2$-;

Z_2 is a direct bond, alkandiyl, cycloalkyldiyl or aryldiyl;

or a salt, isomer, solvate of such compound and a mixture thereof.

6. A compound of formula (Ic) according to claim 5, wherein

L_1 represents –CO-, $-CH_2$-, $-CH_2-CH_2$-, $-CH_2$-CO- or -CO-CH_2-;

L_2 represents –CO-, $-CH_2$-, $-CH_2-CH_2$-,$-CH_2$-CO- or -CO-CH_2-;

L_3 represents –CO-, $-CH_2$-, $-CH_2-CH_2$-, $-CH_2$-CO- or -CO-CH_2-;

R^1 represents hydrogen, C_1-C_{16}-alkyl-CO-, C_2-C_{16}-alkenyl-CO-, C_1-C_{16}-alkyl-NH-CO-, (C_1-C_{16}-alkyl)$_2$-N-CO-; phenylcarbonyl or heterocyclylcarbonyl having 1 to 2 hetero atoms selected from N,O and S in the 3 to 6 membered ring;

R^2 represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^3 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^4 represents C_2-C_6-alkandiyl, C_2-C_6-alkendiyl, C_2-C_6-alkyndiyl, C_3-C_7-cycloalkyldiyl, C_1-C_6-alkyl-C_3-C_7-cycloalkyl, C_1-C_6-alkyl-C_3-C_7-cycloalkyl-C_1-C_6-alkyl, -CH(COOH)-C_1-C_6-alkyl-, -CH($CONH_2$)-C_3H_6- or C_1-C_6-alkyl-phenyl;

R^5 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

R^6 represents hydrogen or represents optionally halogen or C_1-C_4-alkyl substituted C_1-C_{12}-alkyl, phenyl-C_1-C_2-alkyl, biphenyl-C_1-C_2-alkyl or naphthyl-C_1-C_2-alkyl;

n is 0, 1, 2 or 3;

m is 0 or 1;

Q is $-NH_2$, $-NH-C(NH)-NH_2$ or $-NH-C(N-CH_3)-NH-CH_3$;

X is NH or O;

Z_1 is $-CH_2-$;

Z_2 is a direct bond, $-CH_2-$, cyclohexyldiyl or phenyldiyl; or a salt, isomer, solvate of such compound and a mixture thereof.

7. A compound of formula (I) according to claim 1, wherein

L_1 represents $-CO-$;

L_2 represents $-CO-$;

L_3 represents $-CO-$;

R^1 represents hydrogen;

R^2 represents optionally halogen or C_1-C_4-alkyl substituted biphenyl-C_1-C_2-alkyl;

R^3 represents optionally halogen or C_1-C_4-alkyl substituted biphenyl-C_1-C_2-alkyl;

R^4 represents $-CH(CONH_2)-C_3H_6-$;

R^5 represents hydrogen;

R^6 represents hydrogen;

n is 2;

m is 1;

Q is -NH-C(NH)-NH_2;

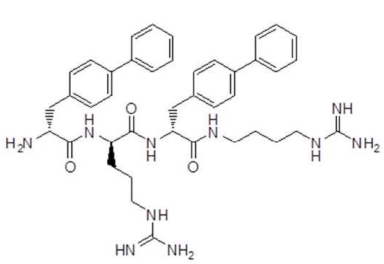
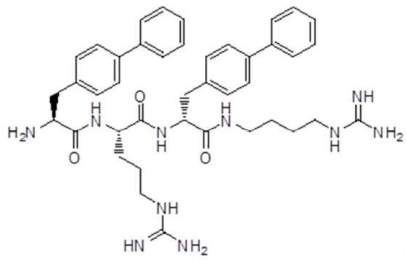
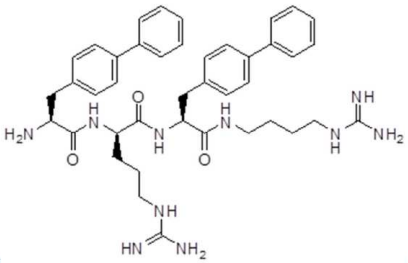
X is NH;

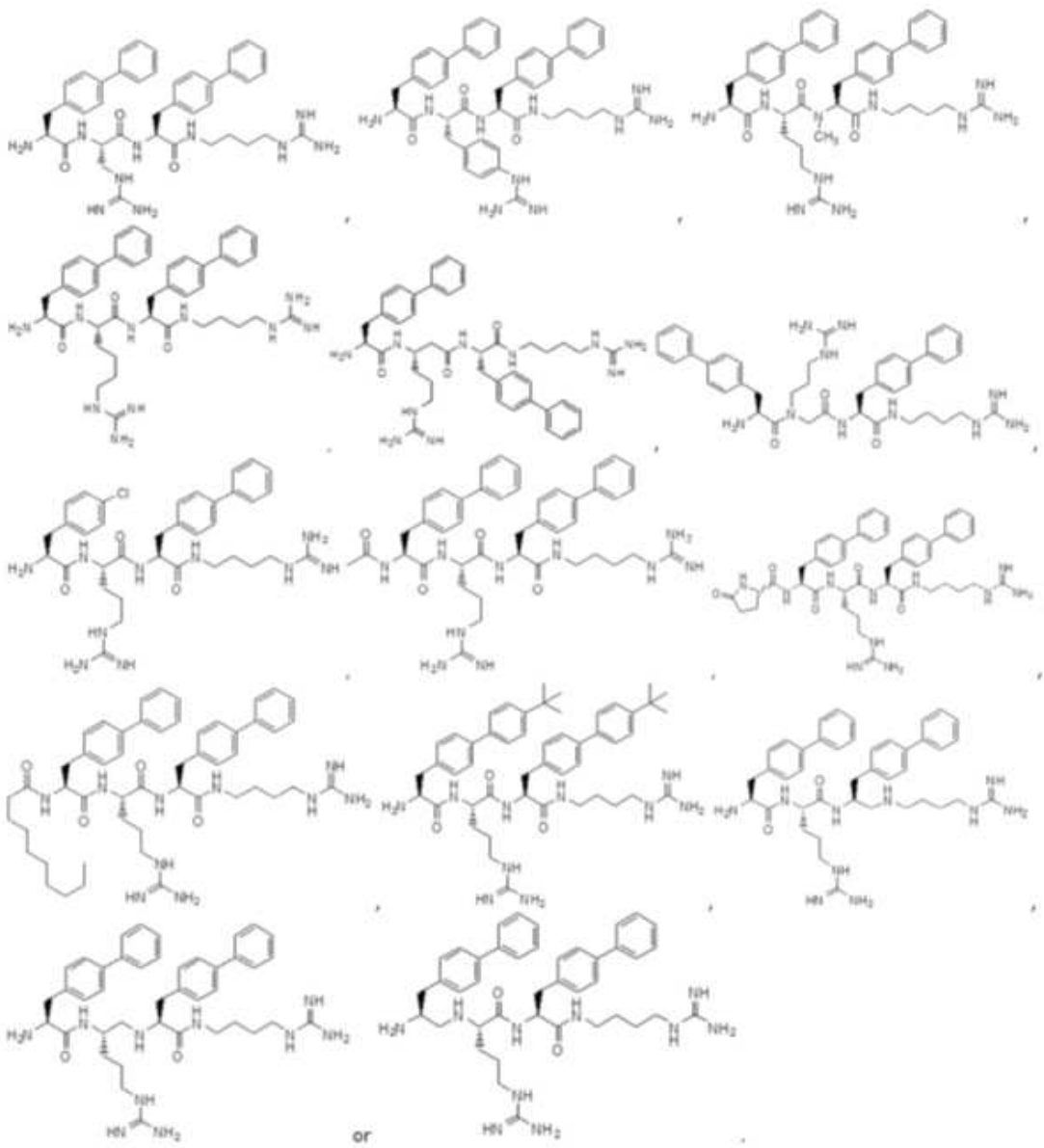
Z_1 is –CH_2-; and

Z_2 is –CH_2-;

or a salt, isomer, solvate of such compound and a mixture thereof.

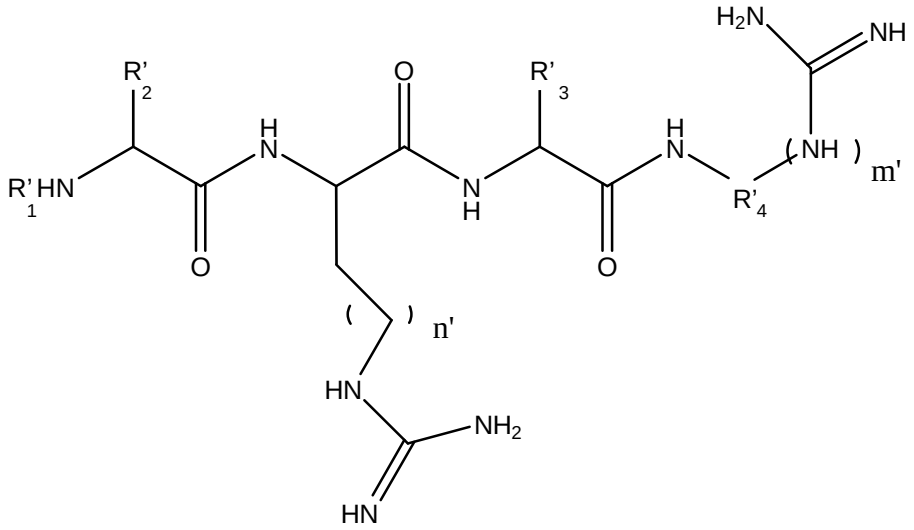
8. A compound of formula (I) according to claim 1, wherein the compound is:


,

,

,



9. A process for making compounds of the formula (I’)

5



(I’)

wherein

R'_1 represents hydrogen, acyl, carbamoyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylcarbonyl, cycloalkylcarbonyl or heterocyclylcarbonyl;

R'_2 represents optionally substituted alkyl, aralkyl or heteroaralkyl;

R'_3 represents optionally substituted alkyl, aralkyl or heteroaralkyl;

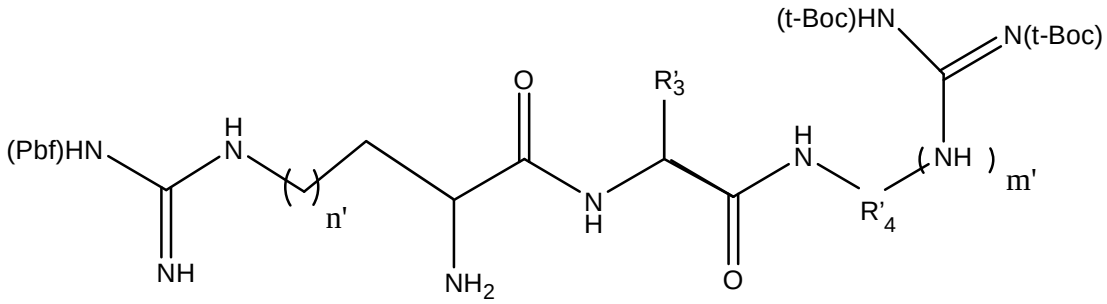
R'_4 represents optionally substituted alkandiyl, alkendiyl, alkyndiyl, cycloalkyldiyl, alkylcycloalkyl, alkylcycloalkylalkyl or alkylaryl;

wherein least one of R'_2 or R'_3 is an optionally substituted biphenyl-C_1-C_4-alkyl;

n’ is 0, 1, 2, 3 or 4; and

m’ is 0 or 1; or a salt, isomer, solvate of such compound and a mixture thereof;

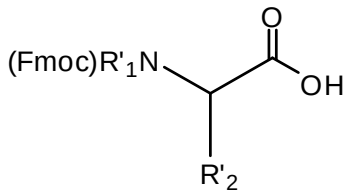
by reacting compounds of the formula (II’)



(II')

in which R'_3, R'_4, m and n have the meaning given above

in the presence of an amide/peptide coupling reagent with compounds of the formula (III')



(III')

wherein R'_1 and R'_2 are defined as mentioned above,

and deprotection with an acid.

10. A compound of formula (I) or (Ic) according to any of claims 1 to 8 or pharmaceutically acceptable salts, isomers, solvates, or mixtures thereof for use as a medicament.

11. A compound of formula (I) or (Ic) according to any of claims 1 to 8 or pharmaceutically acceptable salts, isomers, solvates, or mixtures thereof for use in the treatment of a disease, a disorder or a condition that is selected from the group consisting of a skin infection, a respiratory disease and food poisoning.

12. The compound of claim 11 wherein the disease, disorder or condition is caused by bacteria that have gained a resistance against the penicillin-type antibiotics or vancomycin.

13. The compound of claim 11 wherein the disease, disorder or condition is to be treated by topical use of the compound.

14. Use of a compound of formula (I) or (Ic) according to any of claims 1 to 8 or pharmaceutically acceptable salts, isomers, solvates or mixtures thereof in the manufacture of a medicament for the treatment of a disease, a disorder or a condition that is selected from the group consisting of a skin infection, a respiratory disease and food poisoning.

15. The use according to claim 14 wherein the disease, disorder or condition is caused by bacteria that have gained a resistance against the penicillin-type antibiotics or vancomycin.

16. The use according to claim 14 wherein the disease, disorder or condition is to be treated by topical application of a compound of the formula (I) or (Ic).

17. A pharmaceutical composition comprising a compound of formula (I) or (Ic) according to any of claims 1 to 8 or pharmaceutically acceptable salts, isomers, solvates and mixtures thereof and a pharmaceutical acceptable excipient.

18. A pharmaceutical composition comprising a compound of formula (I) or (Ic) according to any of claims 1 to 8 or pharmaceutically acceptable salts, isomers, solvates and mixtures thereof and a pharmaceutical acceptable excipient for use in the treatment of a disease, a disorder or a condition that is selected from the group consisting of a skin infection, a respiratory disease and food poisoning.