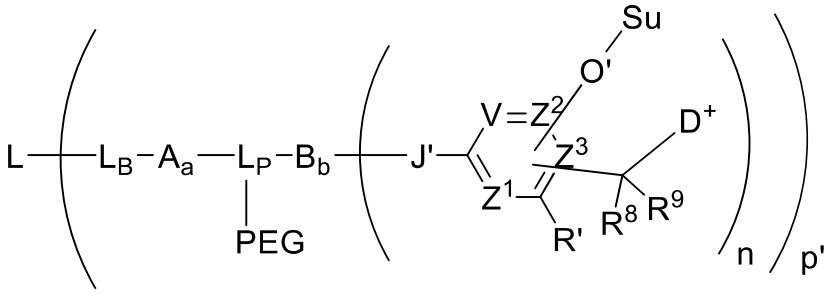
[0004] Because of the difficulty in incorporating a tubulysin compound into a LDC that will conditionally release that compound in unaltered form so as to retain its cytotoxic activity, there is a need in the art for such conjugates that use the tertiary amine nitrogen of a tubulysin's N-terminal component as the site of conjugation in order for release of fully active tubulysin compound at the targeted site of action. There is also a need to mask the hydrophobicity of a hydrophobic tubulysin compound within a LDC to allow for increased loading of the compound to the LDC's targeting Ligand Unit so as to increase the amount of tubulysin compound delivered to the desired site of action while diminishing aggregation resulting in elimination of the LDC and to rectify the loss of the acetate moiety in the tubuvaline (Tuv) component *in vivo*. Either event alone or in combination diminishes the efficacy of the administered LDC.

SUMMARY

[0005] In one aspect, the present disclosure provides a use of a Ligand Drug Conjugate (LDC) compound in the preparation of a medicament for the treatment of an autoimmune disease or condition, wherein the LDC compound is represented by the structure of Formula 1A:



(Formula 1A)

or a salt thereof, wherein

L is an antibody Ligand Unit, thereby defining an Antibody Drug Conjugate (ADC);

L_B is a Ligand Covalent Binding Unit;

L_P is a Parallel Connector Unit;

PEG is a Polyethylene Glycol Unit;

subscript a is 0 or 1;

subscript b is 0 or 1;

A is a first optional Stretcher Unit so that subscript a is 0 when A is absent or A is present so that subscript a is 1 and comprises two, three, or four independently selected subunits (A_1, A_2, A_3, A_4);

B is a Branching Unit or a second optional Stretcher Unit (A_O) so that subscript b is 0 when B is absent or B is present so that subscript b is 1 and comprises two, three, or four subunits independently of A;

subscript n is 1, 2, 3 or 4, provided that subscript b is 1 and B is a Branching when subscript n is 2, 3, or 4 and provided that B is A_O or is absent when subscript n is 1;

Su is a carbohydrate moiety;

-O'- represents an oxygen atom of an O-glycosidic bond cleavable by a glycosidase;

-J'- represents a heteroatom, optionally substituted with nitrogen from a functional group of B, when B is present, or L_P, when B is absent;

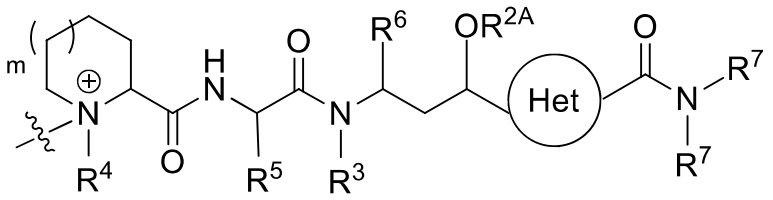
V, Z^1, Z^2 and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen or substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, or halogen, -NO_2, -CN, or other electron withdrawing group, or –OCH_3 or other electron donating group, -O'-Su, or –C(R^8)(R^9)-D^+, wherein at least at least two of V, Z^1, Z^2, and Z^3 are =C(R^{24})-,

provided, one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})- and one and only one other R^{24} is so that –O'-Su is bonded to another one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})-, and the –O'Su and –C(R^8)(R^9)-D^+ substituents are *ortho* or *para* to each other;

R^8 and R^9 independently are hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, substituted or unsubstituted aryl, or substituted or unsubstituted heteroaryl;

R' is hydrogen or is halogen, -NO_2, -CN, or other electron withdrawing group;

D^+ is a quaternized tubulysin Drug Unit preferably having the structure of:



wherein the circle represents a 5-membered nitrogen-containing heteroarylene and wherein the indicated required substituents to that heteroarylene are in a 1,3-relationship with each other with optional substitution at the remaining positions;

subscript m is 0 or 1;

R^{2A} is hydrogen or optionally substituted alkyl, or R^{2A} along with the oxygen atom to which it is attached defines an O-linked substituent;

R^3 is hydrogen or optionally substituted alkyl;

R^4, R^5, and R^6 are optionally substituted alkyl;

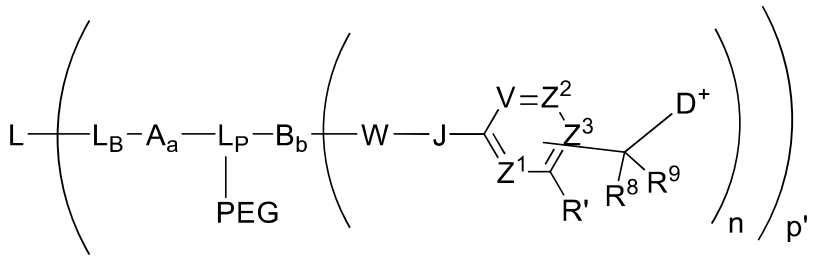
one R^7 is an optionally substituted alkyl, an optionally substituted arylalkyl, or optionally substituted heteroarylalkyl, and the other R^7 is hydrogen or an optionally substituted alkyl; and

R^{8A} is hydrogen or optionally substituted alkyl;

subscript p' is a number ranging from 1 to 24; and

wherein the wavy line indicates covalent bonding of D^+ to the remainder of the LDC compound structure and wherein each optionally substituted alkyl is independently selected, and wherein said glycosidase cleavage results in release of a tubulysin compound (D) from the LDC compound.

[0005a] In another aspect, the present disclosure provides a use of Ligand Drug Conjugate (LDC) compound in the preparation of a medicament for the treatment of an autoimmune disease or condition, wherein the LDC compound is represented by the structure of Formula 1D:



(Formula 1D)

or salt thereof, wherein

L is an antibody Ligand Unit, thereby defining an Antibody Drug Conjugate;

L_B is a Ligand Covalent Binding Unit;

L_P is a Parallel Connector Unit;

PEG is a Polyethylene Glycol Unit;

subscript a is 0 or 1;

subscript b is 0 or 1;

A is a first optional Stretcher Unit so that subscript a is 0 when A is absent or A is present so that subscript a is 1 and optionally comprises two, three, or four independently selected subunits (A_1, A_2, A_3, A_4);

B is a Branching Unit or a second optional Stretcher Unit (A_O) so that subscript b is 0 when B is absent or B is present so that subscript b is 1 and optionally comprises two, three, or four independently selected subunits of A;

subscript n is 1, 2, 3, or 4, provided that subscript b is 1 and B is a Branching when subscript n is 2, 3, or 4 and provided that B is A_O or is absent when subscript n is 1;

V, Z^1, Z^2, and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen or substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, or halogen, -NO_2, -CN, or other electron withdrawing group, or -OCH_3 or other electron donating group, or –C(R^8)(R^9)-D^+, wherein at least one of V, Z^1, and Z^3 is =C(R^{24})-, provided that one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, and Z^3 when that variable group is =C(R^{24})-;

R’ is hydrogen or –OCH_3 or other electron donating group;

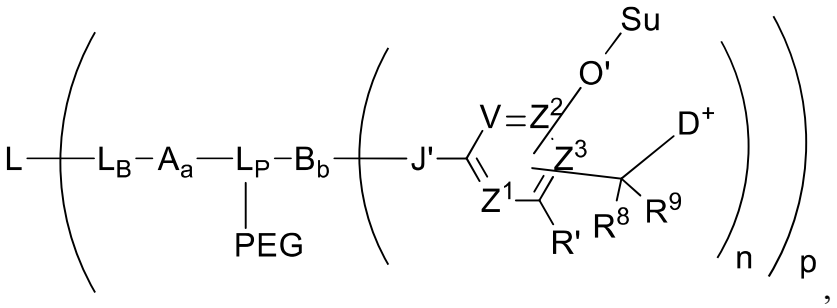
subscript p’ is a number ranging from 1 to 24;

D+ is a quaternized tubulysin Drug Unit;

J is a heteroatom, optionally substituted with nitrogen, preferably J is –N(R^{33})-, wherein R^{33} is hydrogen or methyl; and

W is a peptide comprised of an amino acid sequence covalently attached to J through an amide bond wherein that amide bond is cleavable by a protease, wherein said protease cleavage initiates release of a tubulysin compound (D) from the LDC compound.

[0005b] Principle examples of the disclosure are Ligand Drug Conjugate (LDC) compositions, wherein a LDC composition is represented by the structure of Formula 1A



,

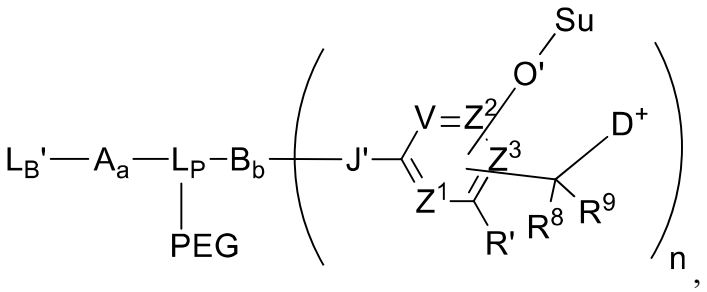
(Formula 1A)

[0006] wherein L is a Ligand Unit (L); L_B is a Ligand Covalent Binding Unit; L_P is a Parallel Connector Unit; PEG is a Polyethylene Glycol Unit; subscript a is 0 or 1; subscript b is 0 or 1; A is a first optional Stretcher Unit so that subscript a is 0 when A is absent or A is present so that subscript a is 1 and is optionally comprised of two, three or four independently selected subunits (A_1, A_2, A_3, A_4); B is an Branching Unit or a second optional Stretcher Unit (A_O) so that subscript b is 0 when B is absent or B is present so that subscript b is 1 and is optionally comprised of two, three or four subunits independently of A; subscript n is 1, 2, 3 or 4, provided that subscript b is 1 and B is a Branching when subscript n is 2, 3 or 4 and subscript b is 0 or 1 so that B is A_O when subscript b is 1 and subscript n is 1; Su is a carbohydrate moiety; -O'- represents an

oxygen atom of an O-glycosidic bond cleavable by a glycosidase; -J'- represents a heteroatom, optionally substituted when nitrogen; V, Z^1, Z^2 and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen, or alkyl, alkenyl or alkynyl, optionally substituted, or halogen, -NO_2, -CN or other electron withdrawing group, or -OCH_3 or other an electron donating group, -O'-Su, or –C(R^8)(R^9)-D^+, wherein at least two of V, Z^1, Z^2 and Z^3 are =C(R^{24})-, provided, one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})- and one and only one other R^{24} is –O'-Su so that –O'-Su is bonded to another one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})-, and the –O'-Su and –C(R^8)(R^9)-D^+ substituents are *ortho* or *para* to each other; R^8 and R^9 independently are hydrogen, alkyl, alkenyl or alkynyl, optionally substituted, or aryl or heteroaryl, optionally substituted; R' is hydrogen or is halogen, -NO_2, -CN or other electron withdrawing group; D^+ is a quaternized tubulysin Drug Unit; subscript p is a number ranging from 1 to 24; and wherein said glycosidase cleavage initiates release of a tubulysin therapeutic compound (D) from a Ligand Drug Conjugate compound of the composition.

[0007] In some examples, the Ligand Unit is that of an antibody, thereby defining an antibody drug conjugate (ADC) having an antibody Ligand Unit, and the targeted moiety to which the antibody Ligand Unit is capable of binding is an cell-surface antigen of targeted abnormal cells that is capable of cellular internalization of bound ADC.

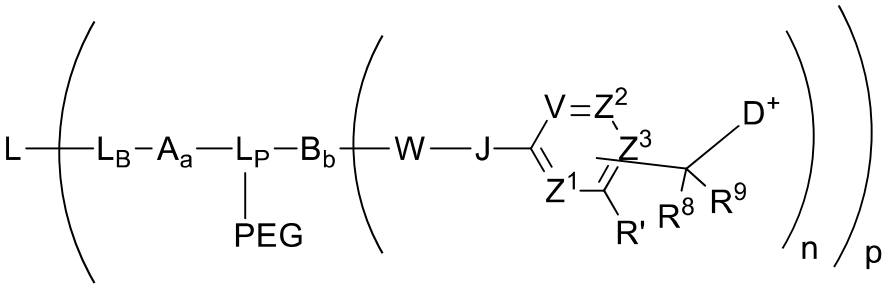
[0008] Other principle examples of the disclosure provide for Drug Linker compounds having the structure of Formula IA:



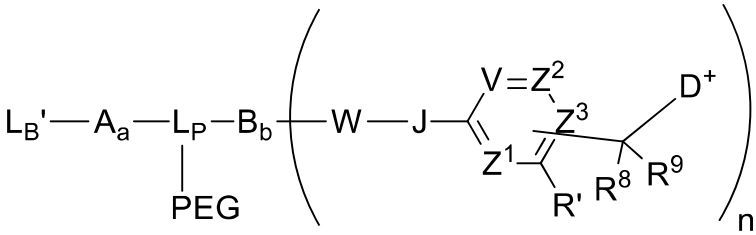
(Formula IA)

[0009] wherein L_B' is a Ligand Covalent Binding Unit precursor and the remaining variable groups are as defined for Formula 1A.

[0010] In other principle examples the disclosure provide for Ligand Drug Conjugate compositions and Drug Linker compounds having the structures of Formula 1B and Formula IB, respectively:



(Formula 1B)

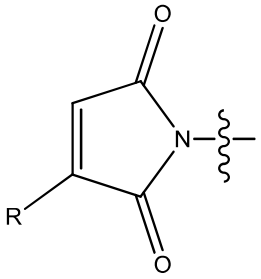
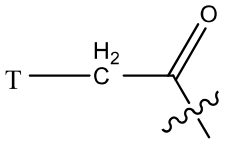
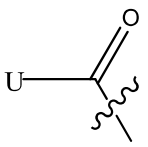


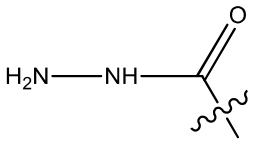
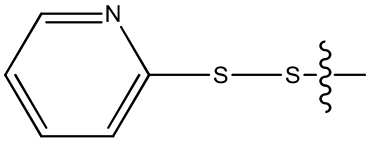
(Formula IB)

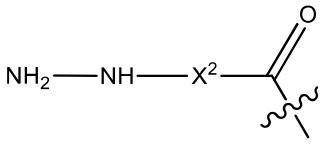
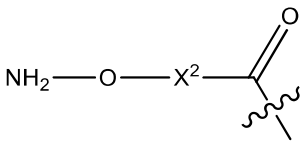
[0011] wherein V, Z^1, Z^2 and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen or alkyl, alkenyl or alkynyl, optionally substituted, or halogen, -NO_2, -CN or other electron withdrawing group, or -OCH_3 or other an electron donating group, or –C(R^8)(R^9)-D^+, wherein at least one of V, Z^1, and Z^3 is =C(R^{24})-, provided that one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, and Z^3 when that variable group is =C(R^{24})-, J represents a heteroatom, optionally substituted when nitrogen; R' is hydrogen or –OCH_3 or other electron donating group, W is a peptide comprised of an amino acid sequence covalently attached to J through an amide bond wherein that amide bond is cleavable by a protease and the other variable groups are as defined for Formula 1A and Formula IB; and wherein said protease cleavage initiates release of a tubulysin therapeutic compound (D) from a Ligand Drug Conjugate compound of the composition.

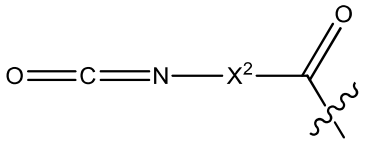
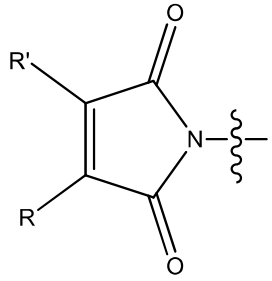
[0012] In some examples, the disclosure provides for LDC conjugate compositions prepared from contacting a Formula IA compound or Formula IB compound with a targeting moiety having a reactive sulfhydryl, amino or aldehyde moiety under suitable conditions to effect condensation of the reactive moiety with the L_B' moiety of the Formula I compound, wherein L_B' is converted to L_B covalently bonded to a Ligand Unit that corresponds to or incorporates the targeting agent as a result of said contact.

[0013] In some examples, L_B' has the structure of one of:

[0014]   

[0015]  

[0016]  

[0017]  and ,

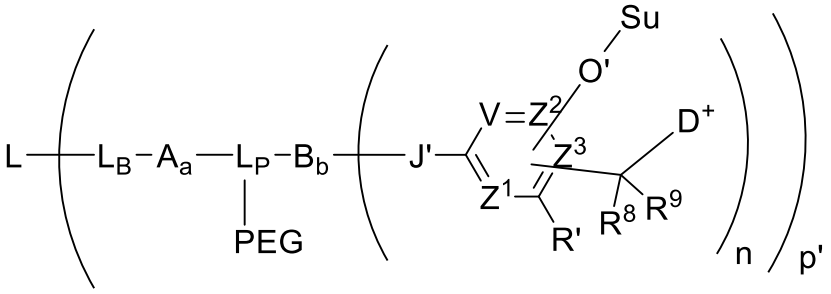
[0018] wherein R is hydrogen or C_1-C_6 optionally substituted alkyl; R' is hydrogen or halogen or R and R' are independently selected halogen; T is –Cl, -Br, -I, -O-mesyl or –O-tosyl or other sulfonate leaving group; U is –F, –Cl, -Br, -I, -O-N-succinimide, -O-(4-nitrophenyl), -O-pentafluorophenyl, -O-tetrafluorophenyl or –O-C(=O)-OR^{57}; X^2 is C_1-$_{10}$ alkylene, C_3-C_8-carbocycle,-O-(C_1-C_6 alkyl), -arylene-, C_1-C_{10} alkylene-arylene, -arylene-C_1-C_{10} alkylene, -C_1-C_{10} alkylene-(C_3-C_6-carbocycle)-, -(C_3-C_8 carbocycle)-C_1-C_{10} alkylene-, C_3-C_8-heterocycle, -C_1-C_{10} alkylene-(C_3-C_8 heterocyclo)-, -C_3-C_8-heterocyclo)-C_1-C_{10} alkylene, -$(CH_2CH_2O)_u$, or –$CH_2CH_2O)_u$-CH_2-, wherein u is an integer ranging from 1 to 10 and R^{57} is C_1-C_6 alkyl or aryl.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Figure 1. Mean tumor volume (mm^3) versus time (days) post-implant subsequent to treatment of $CD30^+$ L540cy Hodgkin lymphoma xenograft with DAR 4 quaternary amine-linked tubulysin antibody-drug conjugates having quaternized Tubulysin M Drug Units linked via a val-ala dipeptide (cAC10-**15**) protease-cleavable unit in comparison to conjugation via a β-glucuronidase-cleavable glucuronide unit (cAC10-**82**),

WHAT IS CLAIMED IS:

1. Use of a Ligand Drug Conjugate (LDC) compound in the preparation of a medicament for the treatment of an autoimmune disease or condition, wherein the LDC compound is represented by the structure of Formula 1A:



(Formula 1A)

or a salt thereof, wherein

L is an antibody Ligand Unit, thereby defining an Antibody Drug Conjugate (ADC);

L_B is a Ligand Covalent Binding Unit;

L_P is a Parallel Connector Unit;

PEG is a Polyethylene Glycol Unit;

subscript a is 0 or 1;

subscript b is 0 or 1;

A is a first optional Stretcher Unit so that subscript a is 0 when A is absent or A is present so that subscript a is 1 and comprises two, three, or four independently selected subunits (A_1, A_2, A_3, A_4);

B is a Branching Unit or a second optional Stretcher Unit (A_O) so that subscript b is 0 when B is absent or B is present so that subscript b is 1 and comprises two, three, or four subunits independently of A;

subscript n is 1, 2, 3 or 4, provided that subscript b is 1 and B is a Branching when subscript n is 2, 3, or 4 and provided that B is A_O or is absent when subscript n is 1;

Su is a carbohydrate moiety;

-O'- represents an oxygen atom of an O-glycosidic bond cleavable by a glycosidase;

-J'- represents a heteroatom, optionally substituted with nitrogen from a functional group of B, when B is present, or L_P, when B is absent;

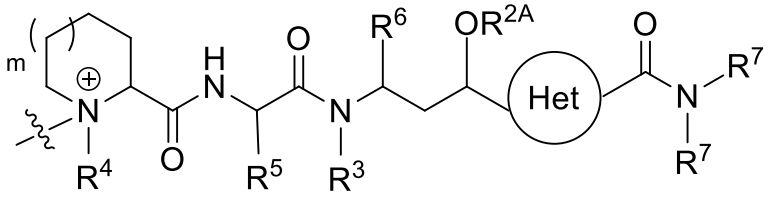
V, Z^1, Z^2 and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen or substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, or halogen, -NO_2, -CN, or other electron withdrawing group, or –OCH_3 or other electron donating group, -O'-Su, or –C(R^8)(R^9)-D^+, wherein at least at least two of V, Z^1, Z^2, and Z^3 are =C(R^{24})-,

provided, one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})- and one and only one other R^{24} is so that –O'-Su is bonded to another one of V, Z^1, Z^2, Z^3 when that variable group is =C(R^{24})-, and the –O'Su and –C(R^8)(R^9)-D^+ substituents are *ortho* or *para* to each other;

R^8 and R^9 independently are hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, substituted or unsubstituted aryl, or substituted or unsubstituted heteroaryl;

R' is hydrogen or is halogen, -NO_2, -CN, or other electron withdrawing group;

D^+ is a quaternized tubulysin Drug Unit preferably having the structure of:



wherein the circle represents a 5-membered nitrogen-containing heteroarylene and wherein the indicated required substituents to that heteroarylene are in a 1,3-relationship with each other with optional substitution at the remaining positions;

subscript m is 0 or 1;

R^{2A} is hydrogen or optionally substituted alkyl, or R^{2A} along with the oxygen atom to which it is attached defines an O-linked substituent;

R^3 is hydrogen or optionally substituted alkyl;

R^4, R^5, and R^6 are optionally substituted alkyl;

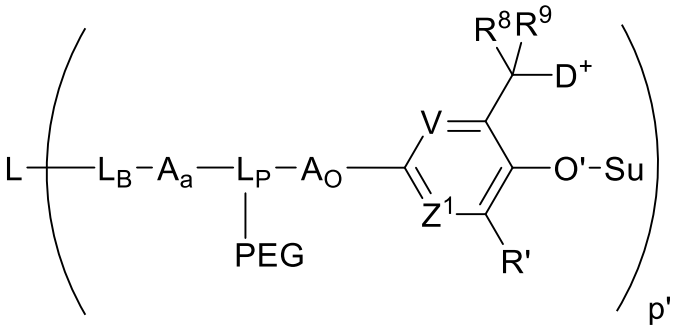
one R^7 is an optionally substituted alkyl, an optionally substituted arylalkyl, or optionally substituted heteroarylalkyl, and the other R^7 is hydrogen or an optionally substituted alkyl; and

R^{8A} is hydrogen or optionally substituted alkyl;

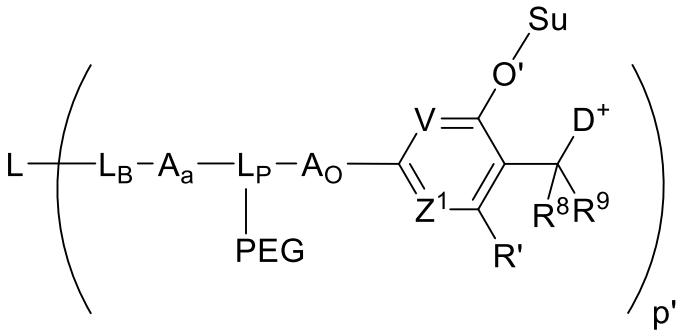
subscript p' is a number ranging from 1 to 24; and

wherein the wavy line indicates covalent bonding of D^+ to the remainder of the LDC compound structure and wherein each optionally substituted alkyl is independently selected, and wherein said glycosidase cleavage results in release of a tubulysin compound (D) from the LDC compound.

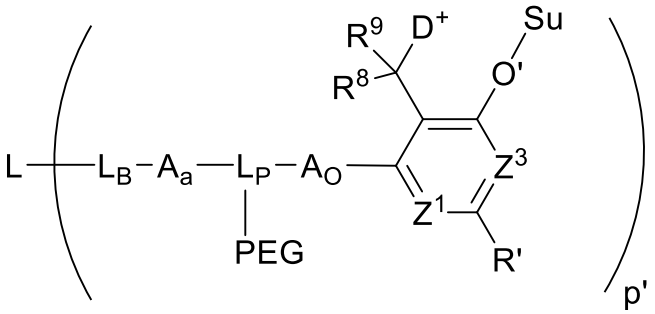
2. The use of the LDC compound according to claim **1**, wherein the LDC compound is represented by the structure of one of Formula 2A-2F:



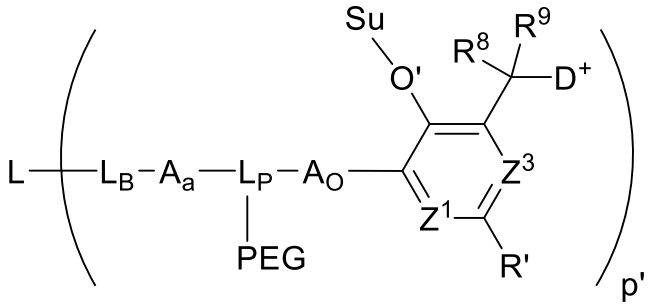
(Formula 2A)



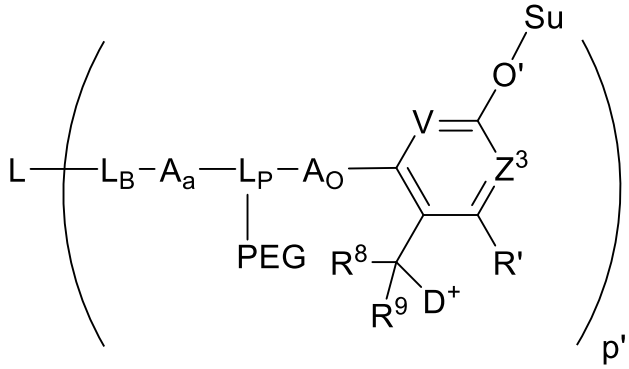
(Formula 2B)



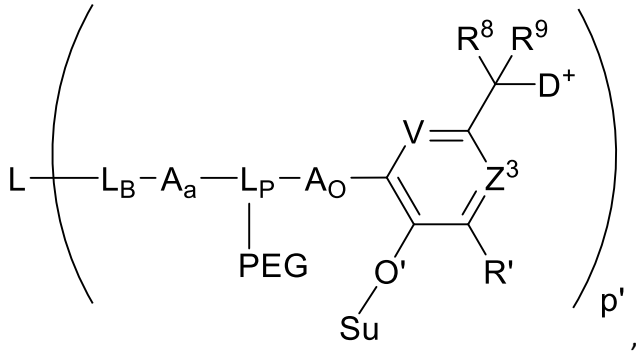
(Formula 2C)



(Formula 2D)



(Formula 2E)

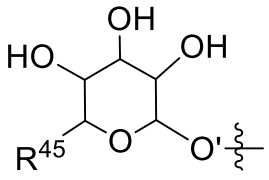


(Formula 2F)

or a salt of any of the foregoing.

3. The use of the LDC compound according to claim **1**, wherein the antibody Ligand Unit is capable of selectively binding to an accessible cell-surface antigen of abnormal cells, wherein the antigen is capable of cellular internalization of bound ADC and is preferentially present on the abnormal or other unwanted cells in comparison to normal cells.

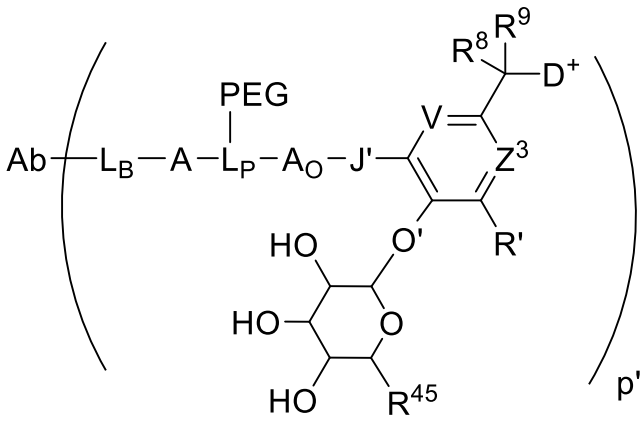
4. The use of the LDC compound according to claim **2**, wherein –O'-Su has the structure of Formula 3:



(Formula 3),

wherein the wavy line represents covalent bonding of O' to the remainder of the LDC compound structure; and R^{45} is $–CH_2OH$ or $–CO_2H$.

5. The use of the LDC compound according to claim **2**, wherein the LDC compound is represented by the structure of Formula 4:



(Formula 4),

or a salt thereof, wherein

Ab is the antibody Ligand Unit;

J' is $-N(R^{33})-$, wherein R^{33} is hydrogen or methyl;

V and Z^3 are each independently =CH- or =N-;

R' is hydrogen or an electron withdrawing group;

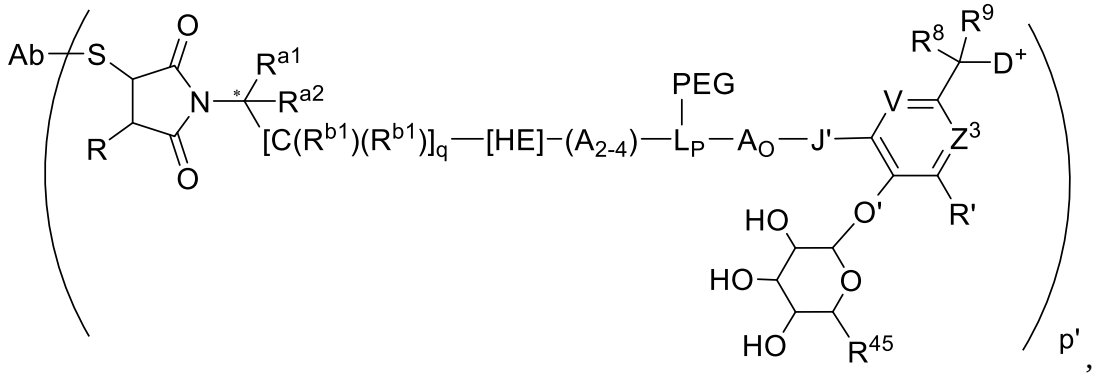
R^8 is hydrogen;

R^9 is hydrogen, optionally substituted C_1-C_6 alkyl, or optionally substituted phenyl;

R^{45} is $-CO_2H$; and

subscript p' is a number ranging from 1 to 24.

6. The use of the LDC compound according to claim **5**, wherein the LDC compound is represented by the structure of Formula 6:



,

(Formula 6)

or a salt thereof, wherein

S is a sulfur atom of the antibody Ligand Unit (Ab);

the asterisk (*) designates chirality or absence thereof at the indicated carbon;

A_{2-4} are independently selected optional subunits of A, wherein $–[C(R^{b1})(R^{b1})]_q$-[HE]- is A_1 when one or more such subunits are present;

R is hydrogen;

R' is hydrogen or an electron withdrawing group;

R^{a1} is hydrogen or a basic unit (BU), wherein BU is a Basic Unit having the structure of $–CH_2$-$N(R^{22})(R^{23})$, or an acid addition salt thereof, wherein R^{22} and R^{23} are each independently hydrogen, methyl, or ethyl, or both R^{22} and R^{23} together with the nitrogen atom to which they are attached define a 5- or 6-membered heterocycloalkyl, or one of R^{22} and R^{23} is hydrogen and the other is an acid labile carbamate protecting group;

R^{a2} is hydrogen;

subscript q is an integer ranging from 0 to 5 when HE is present or from 1 to 5 when HE is absent;

each R^{b1} is independently hydrogen or substituted or unsubstituted C_1-C_6 alkyl;

HE is absent or is –C(=O)-;

R^{45} is $–CO_2H$;

J' is –NH-;

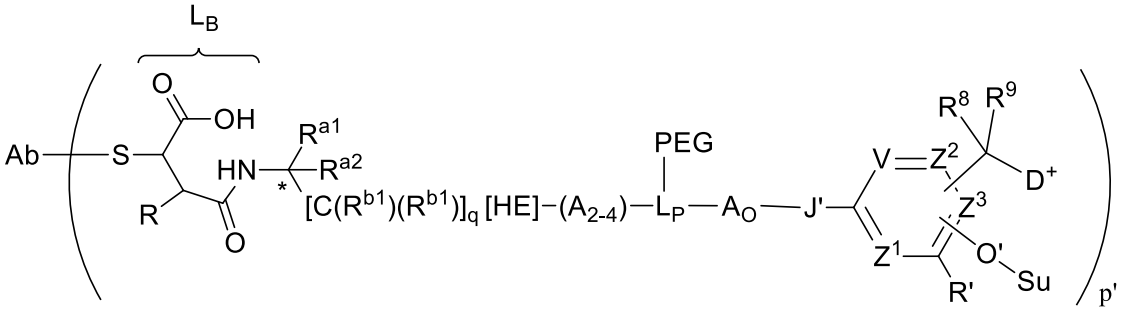
V and Z^3 are each =CH-;

R^8 is hydrogen;

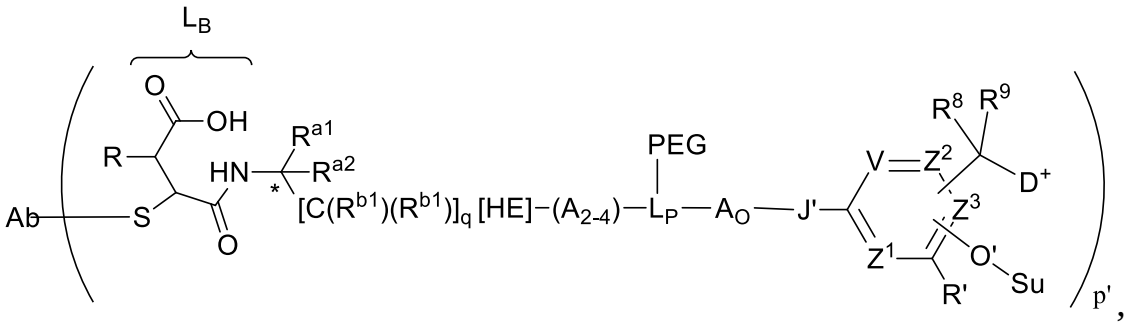
R^9 is hydrogen or methyl; and

subscript p' is a number ranging from 1 to 16.

7. The use of the LDC compound according to claim **1**, wherein the LDC compound has the structure of Formula 9A or Formula 9B:



(Formula 9A)



(Formula 9B)

or a salt thereof, wherein

S is a sulfur atom of the antibody Ligand Unit (Ab);

the asterisk (*) designates chirality or absence thereof at the indicated carbon;

A_{2-4} are independently selected optional subunits of A, wherein $–[C(R^{b1})(R^{b1})]_q$-[HE]- is A_1 when one or more such subunits are present;

R is hydrogen;

R' is hydrogen or an electron withdrawing group;

R^{a1} is –H or BU, wherein BU is a Basic Unit having the structure of $–CH_2$-$N(R^{22})(R^{23})$, or an acid addition salt thereof, wherein R^{22} and R^{23} are each independently hydrogen or methyl, or both R^{22} and R^{23} together with the nitrogen atom to which they are attached define a basic nitrogen-containing 5- or 6-membered heterocycloalkyl, or one of R^{22} and R^{23} is hydrogen and the other is an acid labile protecting group;

R^{a2} is hydrogen;

subscript q is an integer ranging from 0 to 5 when HE is present or from 1 to 5 when HE is absent;

each R^{b1} independently is hydrogen or optionally substituted C_1-C_6 alkyl;

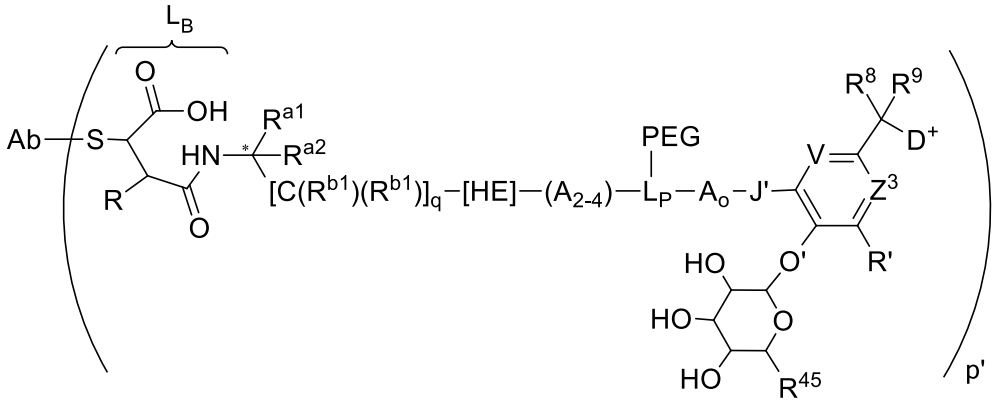
HE is absent or is –C(=O)-;

J' is –O- or –NH-;

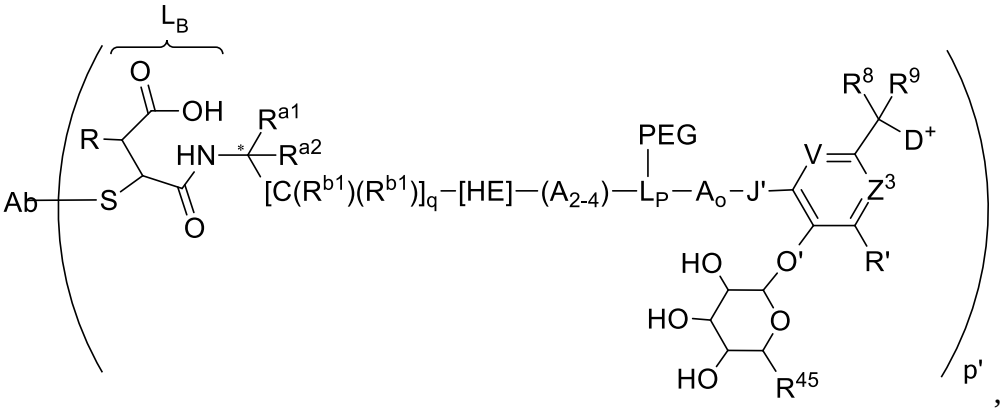
R^8 and R^9 are each independently hydrogen or substituted or unsubstituted alkyl, or both R^8 and R^9 together along with the carbon atom to which they are attached define a cycloalkyl; and

subscript p’ is an integer ranging from 1 to 24.

8. The use of the LDC compound according to claim **7**, wherein the LDC compound has the structure of Formula 10A or Formula 10B:



(Formula 10A)



(Formula 10B)

or a salt thereof, wherein

R is hydrogen;

R’ is hydrogen, -NO_2, –Cl, or -F;

HE is –C(=O)-;

R^{45} is –CO_2H;

J’ is –NH-;

V and Z^3 are each =CH-;

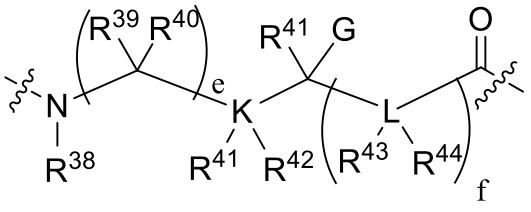
R^8 is hydrogen;

R^9 is hydrogen or methyl; and

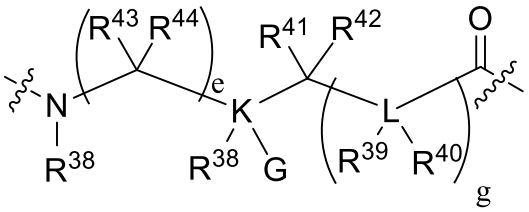
p’ is an integer ranging from 1 to 12.

9. The use of the LDC compound according to claim **6**, **7**, or **8** wherein the indicated starred (*) carbon is predominantly in the same absolute configuration as the alpha carbon of an **L**-amino acid when that indicated carbon is chiral.

10. The use of the LDC compound according to claim **1**, wherein A and A_O, independently has the structure of Formula 7 or Formula 8:



,



(Formula 7) (Formula 8)

wherein the wavy lines indicated covalent attachment within the LDC compound structure, wherein K and L independently are C, N, O, or S, provided that when K or L is O or S, R^{41} and R^{42} to K or R^{43} and R^{44} to L are absent, and when K or L are N, one of R^{41} and R^{42} to K or one of R^{42} and R^{43} to L are absent, and provided that no two adjacent L are independently selected as N, O, or S;

wherein subscripts e and f are independently selected integers that range from 0 to 12, and subscript g is an integer ranging from 1 to 12:

wherein G is hydrogen, substituted or unsubstituted C_1-C_6 alkyl, -OH, -OR^{PR}, -CO_2H, CO_2R^{PR}, wherein R^{PR} is a suitable protecting, -$N(R^{PR})(R^{PR})$, wherein R^{PR} are independently a protecting group or R^{PR} together form a suitable protecting group, or -$N(R^{45})(R^{46})$, wherein one of R^{45} and R^{46} is hydrogen or R^{PR}, wherein R^{PR} is a suitable protecting group, and the other is hydrogen or substituted or unsubstituted C_1-C_6 alkyl;

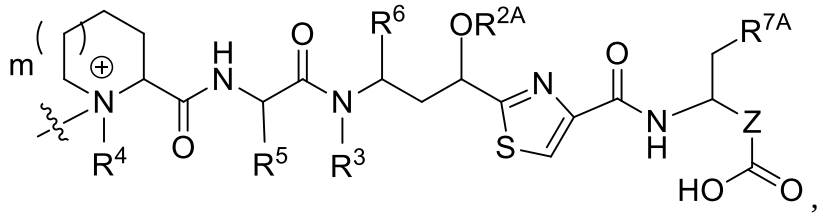
wherein R^{38} is hydrogen or substituted or unsubstituted C_1-C_6 alkyl; R^{39}-R^{44} are each independently hydrogen, substituted or unsubstituted C_1-C_6 alkyl, substituted or unsubstituted aryl, or substituted or unsubstituted heteroaryl, or both R^{39} and R^{40} together with the carbon to which they are attached comprise a C_3-C_6 cycloalkyl, or R^{41} and R^{42} together with K to which they are attached when K is C,

or R^{43} and R^{44} together with L to which they are attached when L is a carbon atom comprise a C_3-C_6 cycloalkyl, or R^{40} and R^{41}, or R^{40} and R^{43}, or R^{41} and R^{43} to together with

the carbon atom or heteroatom to which they are attached and the atoms intervening between those carbon atoms and/or heteroatoms comprise a 5- or 6-membered cycloalkyl or heterocycloalkyl, provided that when K is O or S, R^{41} and R^{42} are absent, when K is N, one of R^{41}, R^{42} is absent, when L is O or S, R^{43} and R^{44} are absent, and when L is N, one of R^{43} and R^{44} is absent, or

wherein A_O has a structure corresponding to an alpha-amino, beta-amino or another amine-containing acid.

11. The use of the LDC compound according to claim **1**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



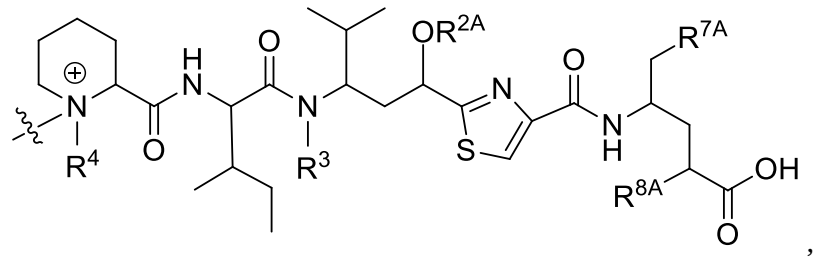
wherein

subscript m is 0 or 1;

Z is an optionally substituted alkylene or an optionally substituted alkenylene; and

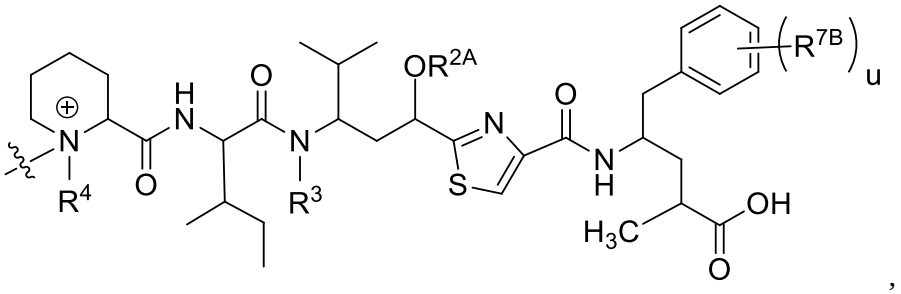
R^{7A} is optionally substituted aryl or optionally substituted heteroaryl.

12. The use of the LDC compound according to claim **11**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



wherein R^{7A} is optionally substituted phenyl and R^8 is hydrogen or methyl.

13. The use of the LDC compound according to claim **12**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



,

wherein R^4 is methyl;

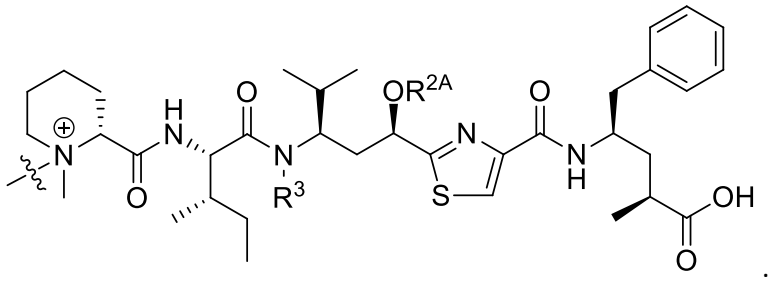
subscript u is 0, 1 or 2;

R^3 is H, methyl, ethyl, propyl, $-CH_2-OC(O)R^{3A}$, $-CH_2CH(R^{3B})C(O)R^{3A}$ or $–CH(R^{3B})C(O)NHR^{3A}$, wherein R^{3A} is C_1-C_6 alkyl and R^{3B} is H or C_1-C_6 alkyl, independently selected from R^{3A};

R^{2A} along with the oxygen atom to which it is attached is an O-linked substituent selected from the group consisting of $-OCH_2OCH_2R^{2B}$, $-OCH_2R^{2B}$, $-OC(O)R^{2B}$, $-CH_2OC(O)R^{2B}$, $–OC(O)N(R^{2B})(R^{2C})$, and $–OCH_2C(O)N(R^{2B})(R^{2C})$, wherein R^{2B} and R^{2C} are independently selected from the group consisting of H, C_1-C_6 alkyl and C_2-C_6 alkenyl; and

each R^{7B}, when present, independently is –OH or $–OCH_3$.

14. The use of the LDC compound according to claim **13**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



.

15. The use of the LDC compound according to claim **14**, wherein R^{2A} is $-CH_2CH_3$.

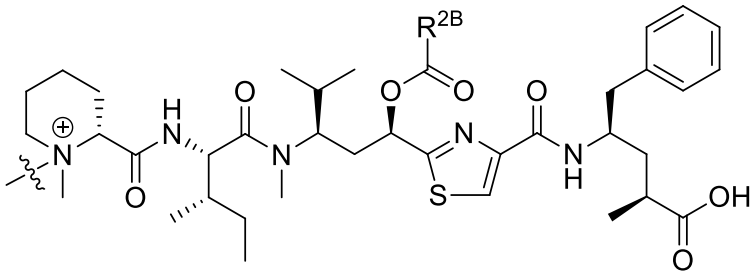
16. The use of the LDC compound according to claim **14**, wherein R^{2A} is $-CH_2-CH=CH_2$.

17. The use of the LDC compound according to claim **13**, wherein

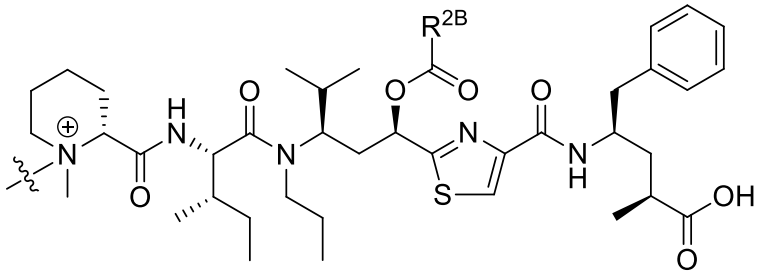
R^{2A} is $-CH_2CH_3$, $-CH_2-CH=CH_2$ or $-CH_2C(CH_3)=CH_2$, R^{2B} is $–CH_3$, R^3 is $–CH_3$ and subscript u is 0, or

R^{2A} is $-CH_2CH_3$ or $-CH_2-CH=CH_2$, or $-CH_2C(CH_3)=CH_2$, R^{2B} is $–CH_3$, R^3 is $–CH_3$ and subscript u is 1, wherein R^{7B} is -OH.

18. The use of the LDC compound according to claim **13**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



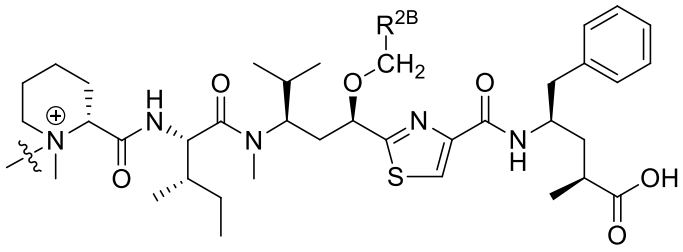
or



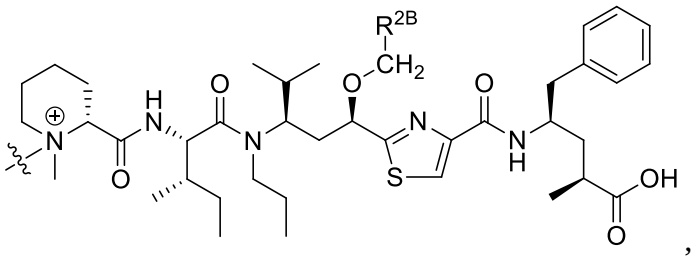
,

wherein R^{2B} is $–CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH(CH_3)_2$, or $-CH_2C(CH_3)_3$.

19. The use of the LDC compound according to claim **13**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



or

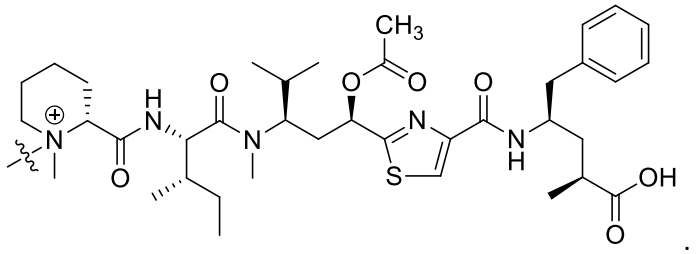


wherein

R^{2B} is hydrogen, methyl, or $–OCH_3$, or

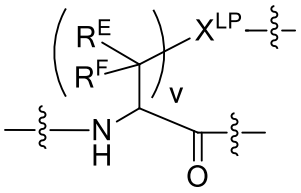
$-OCH_2R^{2B}$ is $–OCH_2CH=CH_2$ or $–OCH_2C(CH_3)=CH_2$.

20. The use of the LDC compound according to claim **13**, wherein the quaternized tubulysin Drug Unit $–D^+$ is that of tubulysin M, which has the structure of:

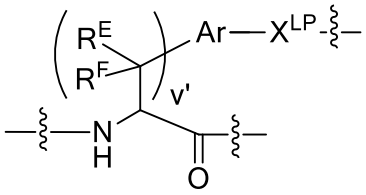


21. The use of the LDC compound according to claim **1**, or a salt thereof, wherein L_P is a aminoalkanedioic acid, a diaminoalkanoic acid, a sulfur-substituted alkanedioic acid, a sulfur-substituted aminoalkanoic acid, a diaminoalkanol, an aminoalkanediol, a hydroxyl substituted alkanedioic acid, a hydroxyl substituted aminoalkanoic acid or a sulfur-substituted aminoalkanol residue, optionally substituted, wherein the sulfur substituent is in reduced or oxidized form, or L_P is an amino acid residue of lysine, arginine, asparagine, glutamine, ornithine, citrulline, cysteine, homocysteine, penicillamine, threonine, serine, glutamic acid, aspartic acid, tyrosine, histidine or tryptophan, wherein the amino acid is in the D- or L-configuration.

22. The use of the LDC compound according to claim **21**, or a salt thereof, wherein the aminoalkanedioic acid, diaminoalkanoic acid, sulfur-substituted aminoalkanoic acid or hydroxyl substituted aminoalkanoic acid residue has the structure of Formula A or Formula B:



(Formula A)



(Formula B)

wherein

subscript v is an integer ranging from 1 to 4;

subscript v' is an integer ranging from 0 to 4;

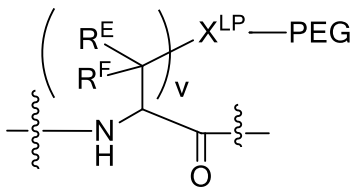
X^{LP} is selected from the group consisting of –O-, -NR^{LP}-, -S-, -S(=O)-, -$S(=O)_2$-, -C(=O)-, -C(=O)N(R^{LP})-, -N(R^{LP})C(=O)N(R^{LP})-, and -N(R^{LP})C(=NR^{LP})N(R^{LP})- wherein each R^{LP} is independently selected from the group consisting of hydrogen and optionally substituted alkyl or two of R^{LP} together along with their intervening atoms define an optionally substituted heterocycloalkyl and any remaining R^{LP} are as previously defined;

Ar is substituted or unsubstituted arylene or substituted or unsubstituted heteroarylene;

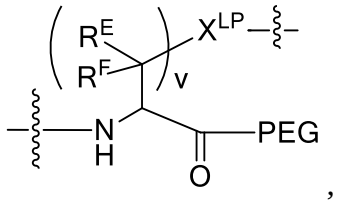
each R^E and R^F is independently selected from the group consisting of hydrogen, substituted or unsubstituted alkyl, substituted or unsubstituted aryl, and substituted or unsubstituted heteroaryl, or R^E and R^F together with the same carbon to which they are attached, or R^E and R^F from adjacent carbons together with these carbons, define an optionally substituted cycloalkyl with any remaining R^E and R^F substituents are as previously defined; and

wherein the wavy lines indicates covalent attachment of the Formula A or Formula B structure within the LDC compound structure.

23. The use of the LDC compound according to claim **1**, wherein -L_P(PEG)- has the structure of Formula A1 or A2:



(Formula A1)



(Formula A2),

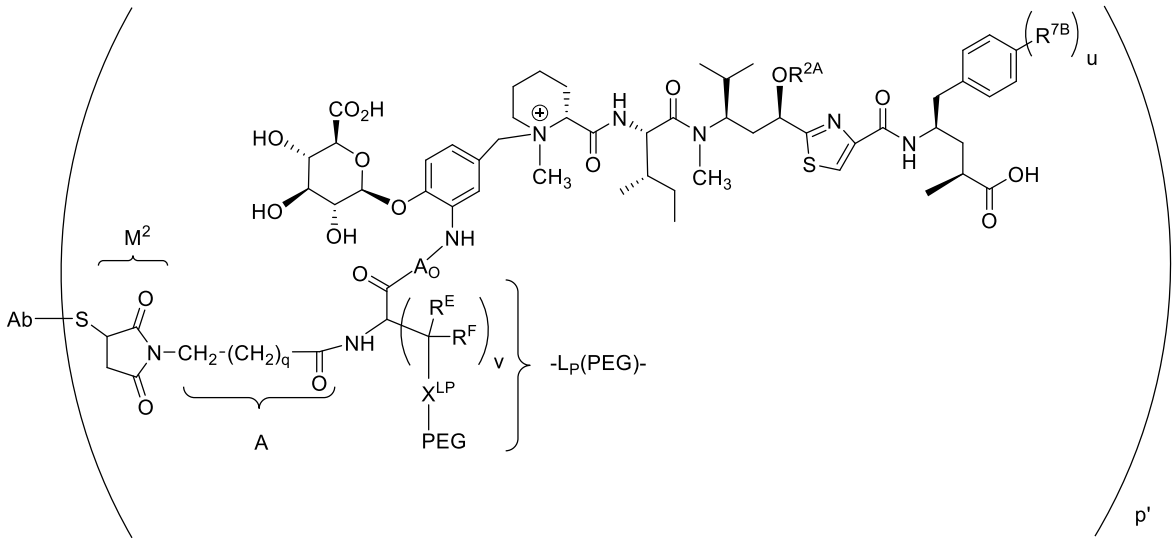
wherein

X^{LP} is selected from the group consisting of –O-, -NH, -S-, and -C(=O)-;

R^E and R^F are independently selected from the group consisting of -H, and -C_1-C_4 alkyl; and

wherein the wavy line indicates covalent attachment of Formula A1 or Formula A2 within the LDC compound structure.

24. The use of the LDC compound according to claim **1**, wherein the LDC compound is represented by the structure of:



or a salt thereof, wherein

Ab is the antibody Ligand Unit;

S is a sulfur atom of the antibody Ligand Unit;

R^{2A} is saturated C_1-C_4 alkyl, unsaturated C_2-C_4 alkyl, –C(=O)R^{2B}, wherein R^{2B} is C_1-C_4 alkyl;

A_O is absent or is an amine-containing acid residue;

subscript p’ is an integer ranging from 1 to 8;

subscript q is an integer ranging from 1 to 4;

subscript u is 0 or 1;

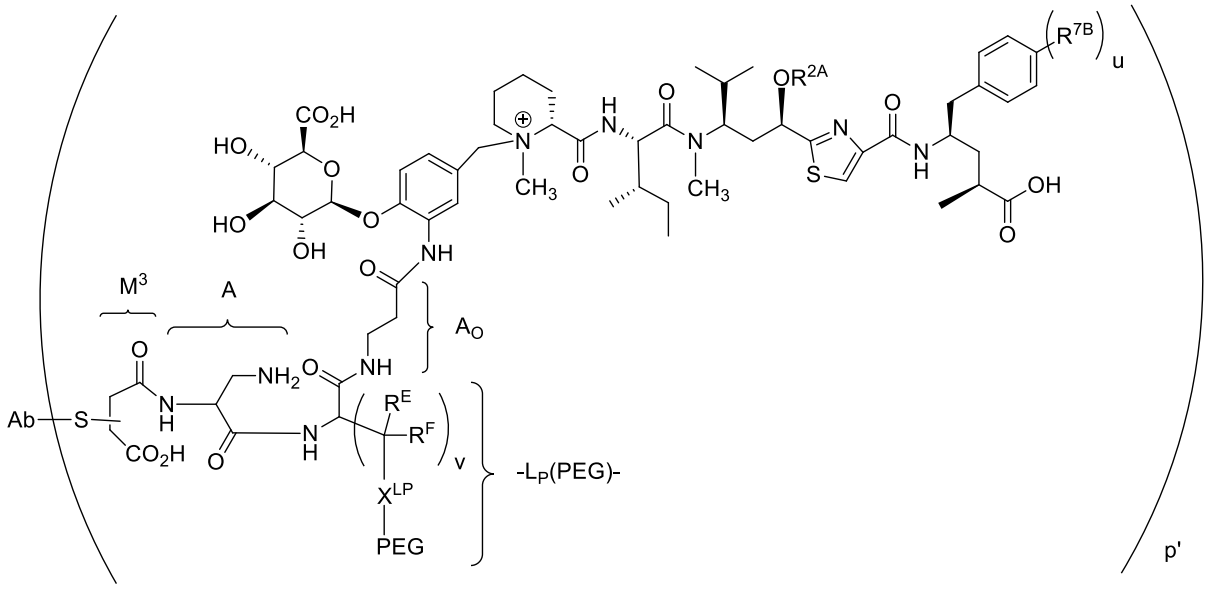
subscript v is an integer ranging from 1 to 4;

R^{7B}, when present, is –OH;

X^{LP} is selected from the group consisting of –O-, -NH, -S-, and -C(=O)-; and

R^E and R^F are independently selected from the group consisting of -H, and C_1-C_4 alkyl.

25. The use of the LDC compound according to claim **1**, wherein the LDC compound is represented by the structure of:



or a salt thereof, wherein

Ab is the antibody Ligand Unit;

S is a sulfur atom of the antibody Ligand Unit;

the Ab-S- moiety is bonded to the carbon α or β to the indicated M^3 carboxylic acid;

R^{2A} is saturated C_1-C_4 alkyl, unsaturated C_2-C_4 alkyl, or –C(=O)R^{2B}, wherein R^{2B} is C_1-C_4 alkyl;

subscript p' is an integer ranging from 1 to 8.

subscript q is an integer ranging from 1 to 4;

subscript u is 0 or 1;

subscript v is an integer ranging from 1 to 4;

R^{7B}, when present, is –OH;

X^{LP} is selected from the group consisting of –O-, -NH, -S-, and -C(=O)-; and

R^E and R^F are independently selected from the group consisting of -H, and C_1-C_4 alkyl.

26. The use of the LDC compound according to claim **24** or **25**, wherein R^{2A} is saturated C_1-C_4 alkyl or unsaturated C_3-C_4 alkyl, wherein saturated C_1-C_4 alkyl is -CH_3, -CH_2CH_3, -$CH_2CH_2CH_3$ and unsaturated C_3-C_4 alkyl is –$CH_2CH{=}CH_2$ or –$CH(CH_3)CH{=}CH_2$.

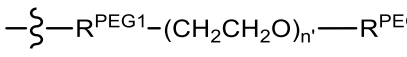
27. The use of the LDC compound according to claim **24** or **25**, wherein R^{2A} is –$C(O)CH_3$.

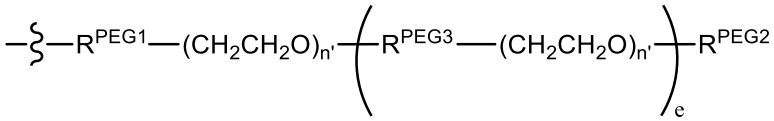
28. The use of the LDC compound according to claim **24** or **25**, wherein R^{2A} is -CH_2CH_3.

29. The use of the LDC compound according to claim **24** or **25**, wherein R^{2A} is –$CH_2CH{=}CH_2$.

30. The use of the LDC compound according to claim **1**, wherein PEG has the structure selected from the group consisting of:


,


, and



wherein the wavy line indicates site of attachment to X^{LP} of the Parallel Connector Unit (L_P),

R^{PEG1} is an optional PEG Attachment Unit,

R^{PEG2} is a PEG Capping Unit;

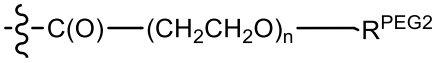
R^{PEG3} is an PEG Coupling Unit;

subscript n ranges from 2 to 72;

each subscript n' is independently selected from 1 to 72; and

subscript e ranges from 2 to 5.

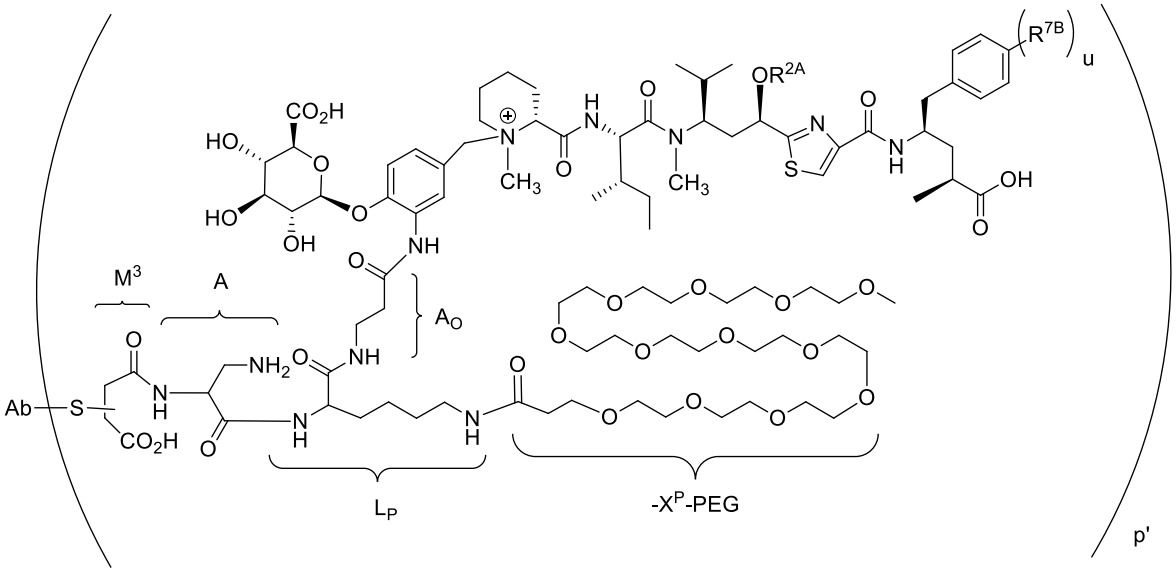
31. The use of the LDC compound according to claim **24** or **25**, wherein $–X^{LP}$-PEG has the structure of:



.

32. The use of the LDC compound according to claim **31**, wherein subscript n is 12 and R^{PEG2} is hydrogen or $–CH_3$.

33. The use of the LDC compound according to claim **1**, wherein the LDC compound is represented by the structure of:



or a salt thereof, wherein

Ab is the antibody Ligand Unit;

S is a sulfur atom of the antibody Ligand Unit;

the Ab-S- moiety is bonded to the carbon α or β to the indicated M^3 carboxylic acid;

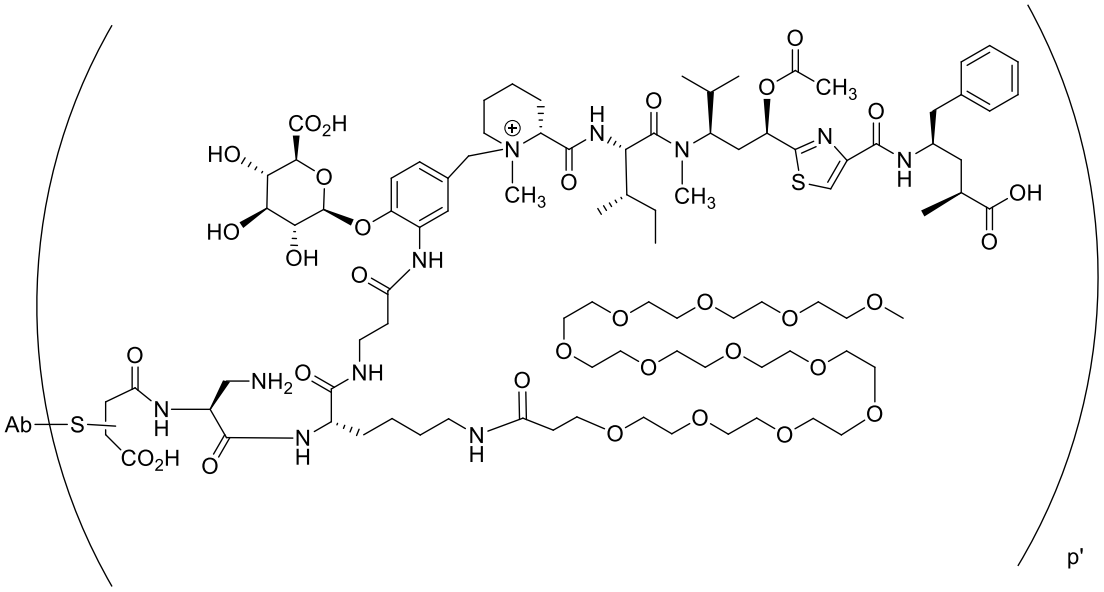
subscript p' is an integer ranging from 1 to 8;

subscript u is 0 or 1;

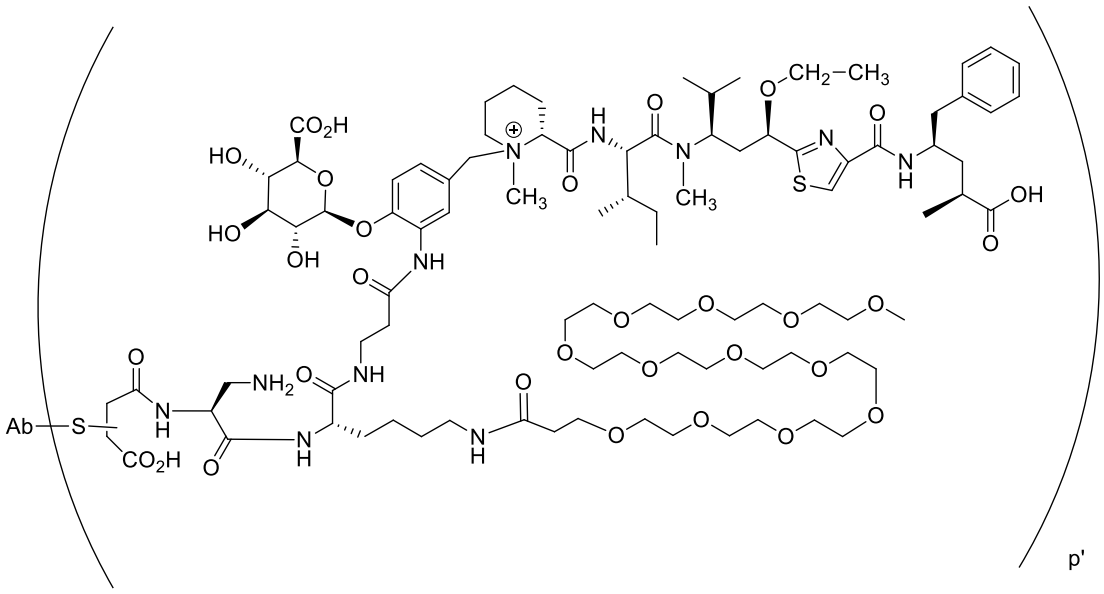
R^{7B}, when present, is –OH; and

R^{2A} along with the oxygen atom to which it is attached is $–OC(O)CH_3$, $-CH_2CH_3$, or $–CH_2CH=CH_2$.

34. The use of the LDC compound according to claim **33**, wherein the LDC compound is represented by the structure of:



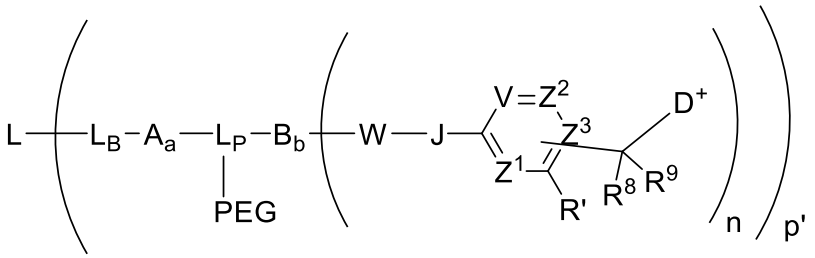
or



,

or a salt thereof.

35. Use of Ligand Drug Conjugate (LDC) compound in the preparation of a medicament for the treatment of an autoimmune disease or condition, wherein the LDC compound is represented by the structure of Formula 1D:



(Formula 1D)

or salt thereof, wherein

L is an antibody Ligand Unit, thereby defining an Antibody Drug Conjugate;

L_B is a Ligand Covalent Binding Unit;

L_P is a Parallel Connector Unit;

PEG is a Polyethylene Glycol Unit;

subscript a is 0 or 1;

subscript b is 0 or 1;

A is a first optional Stretcher Unit so that subscript a is 0 when A is absent or A is present so that subscript a is 1 and optionally comprises two, three, or four independently selected subunits (A_1, A_2, A_3, A_4);

B is a Branching Unit or a second optional Stretcher Unit (A_O) so that subscript b is 0 when B is absent or B is present so that subscript b is 1 and optionally comprises two, three, or four independently selected subunits of A;

subscript n is 1, 2, 3, or 4, provided that subscript b is 1 and B is a Branching when subscript n is 2, 3, or 4 and provided that B is A_O or is absent when subscript n is 1;

V, Z^1, Z^2, and Z^3 are =N- or =C(R^{24})-, wherein R^{24} is hydrogen or substituted or unsubstituted alkyl, substituted or unsubstituted alkenyl, or substituted or unsubstituted alkynyl, or halogen, -NO_2, -CN, or other electron withdrawing group, or -OCH_3 or other electron donating group, or –C(R^8)(R^9)-D^+, wherein at least one of V, Z^1, and Z^3 is =C(R^{24})-, provided that one any only one R^{24} is –C(R^8)(R^9)-D^+ so that –C(R^8)(R^9)-D^+ is bonded to one of V, Z^1, and Z^3 when that variable group is =C(R^{24})-;

R’ is hydrogen or –OCH_3 or other electron donating group;

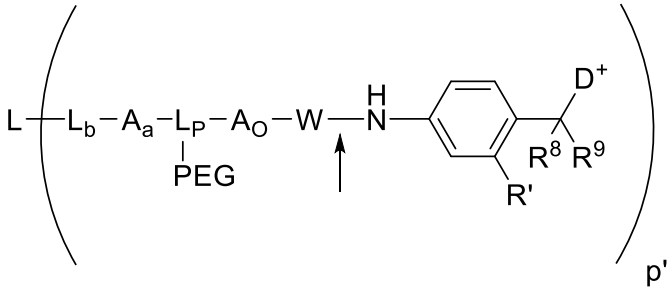
subscript p’ is a number ranging from 1 to 24;

D+ is a quaternized tubulysin Drug Unit;

J is a heteroatom, optionally substituted with nitrogen, preferably J is –N(R^{33})-, wherein R^{33} is hydrogen or methyl; and

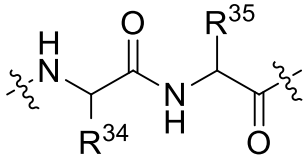
W is a peptide comprised of an amino acid sequence covalently attached to J through an amide bond wherein that amide bond is cleavable by a protease, wherein said protease cleavage initiates release of a tubulysin compound (D) from the LDC compound.

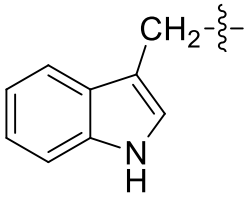
36. The use of the LDC compound according to claim **35**, wherein the LDC compound is represented by the structure of:



or a salt thereof, wherein W comprises a dipeptide, wherein the dipeptide is at the distal end of W and the indicated bond is an amide bond specifically cleavable by an intracellular protease in comparison to freely circulating serum proteases.

37. The use of the LDC compound according to claim **36**, wherein the dipeptide has the structure of;



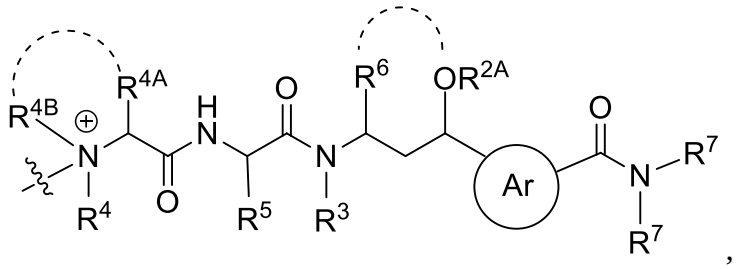
wherein R^{34} is benzyl, methyl, isopropyl, isobutyl, sec-butyl, -CH(OH)CH_3 or has the structure of 

; and

R^{35} is methyl, –$(CH_2)_4$-NH_2, -$(CH_2)_3$NH(C=O)NH_2, $(CH_2)_3$NH(C=NH)NH_2, or -$(CH_2)_2CO_2H$, wherein the wavy line at the dipeptide N-terminus indicates covalent binding to

A_O or L_P, depending on the presence or absence of A_O, respectively, and the wavy line at the dipeptide C-terminus indicates covalent binding to J.

38. The use of the LDC compound according to any one of claims **35** to **37**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



,

wherein the curved dashed lines indicate optional cyclizations;

R^{2A} is hydrogen or optionally substituted alkyl, or R^{2A} along with the oxygen atom to which it is attached defines an O-linked substituent other than –OH, or R^{2A} is absent when R^6 is bonded to that oxygen atom, as indicated by the curved dash line between R^6 and the oxygen atom, to define an oxygen-containing heterocycloalkyl;

the circled Ar represents a 5-membered nitrogen-heteroarylene, wherein the indicated required substituents to that heteroarylene are in a 1,3-relationship with each other with optional substitution at the remaining positions;

R^3 is hydrogen or optionally substituted alkyl;

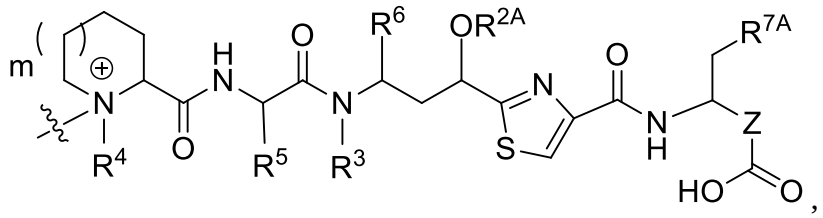
R^4, R^5 and R^6 are optionally substituted alkyl, independently selected, or R^6 is bonded to the oxygen atom of the $–OR^{2A}$ moiety in which R^{2A} is absent and R^4 and R^5 are as previously defined;

R^{4a} is hydrogen or optionally substituted alkyl and R^{4B} is optionally substituted alkyl, or both together with the nitrogen to which they are attached, as indicated by the curved dotted line between R^{4A} and R^{4B}, define a quaternized nitrogen heterocycloalkyl, optionally substituted;

one R^7 is hydrogen or optionally substituted alkyl and the other R^7 is optionally substituted aralkyl or heteroaralkyl;

wherein the wavy line indicates covalent bonding of the D^+ structure to the remainder of the LDC compound structure.

39. The use of the LDC compound according to claim **38**, wherein the quaternized tubulysin Drug Unit ($–D^+$) has the structure of:



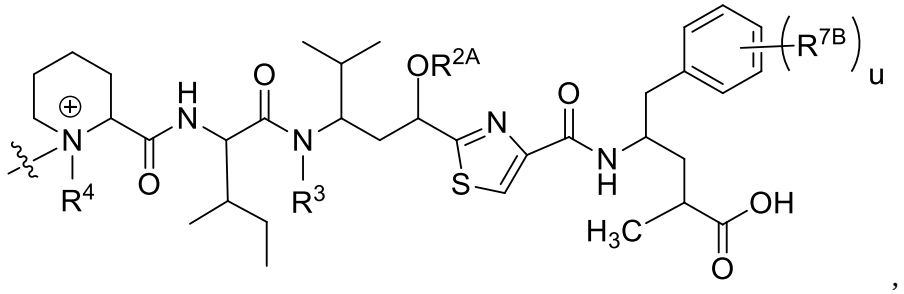
wherein

subscript m is 0 or 1;

Z is an optionally substituted alkylene or an optionally substituted alkenylene; and

R^{7A} is optionally substituted aryl or optionally substituted heteroaryl.

40. The use of the LDC compound according to claim **39**, wherein the quaternized tubulysin Drug Unit $–D^+$ has the structure of:



wherein R^4 is methyl;

subscript u is 0, 1 or 2;

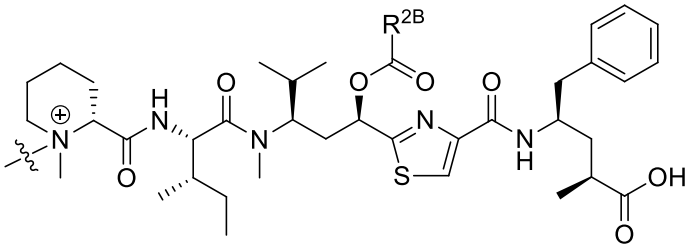
R^3 is H, methyl, ethyl, propyl, $-CH_2-OC(O)R^{3A}$, $-CH_2CH(R^{3B})C(O)R^{3A}$ or $–CH(R^{3B})C(O)NHR^{3A}$, wherein R^{3A} is C_1-C_6 alkyl and R^{3B} is H or C_1-C_6 alkyl, independently selected from R^{3A};

R^{2A} along with the oxygen atom to which it is attached is an O-linked substituent selected from the group consisting of $-OCH_2OCH_2R^{2B}$, $-OCH_2R^{2B}$, $-OC(O)R^{2B}$, $-CH_2OC(O)R^{2B}$, –

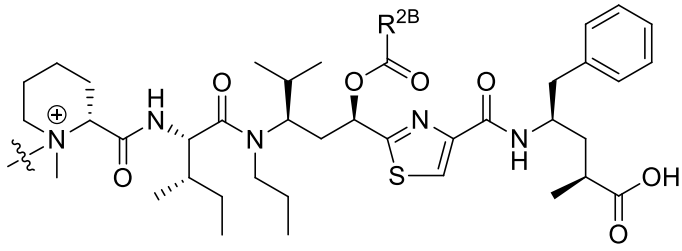
$OC(O)N(R^{2B})(R^{2C})$, and $–OCH_2C(O)N(R^{2B})(R^{2C})$, wherein R^{2B} and R^{2C} are independently selected from the group consisting of H, C_1-C_6 alkyl and C_2-C_6 alkenyl; and

each R^{7B}, when present, independently is –OH or $–OCH_3$.

41. The use of the LDC compound according to claim **39**, wherein the quaternized tubulysin Drug Unit has the structure of:



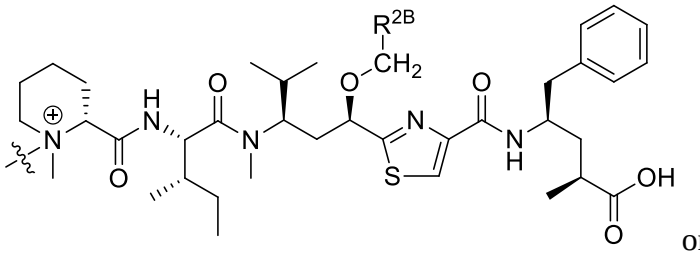
or



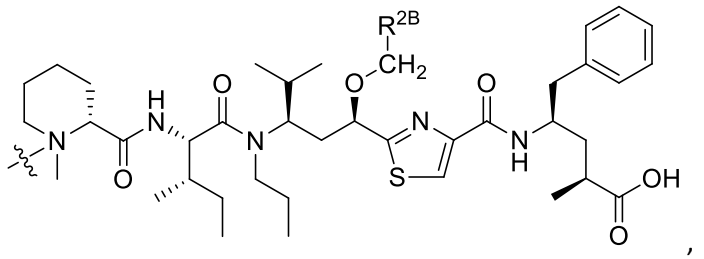
,

wherein R^{2B} is $–CH_3$, $-CH_2CH_3$, $-CH_2CH_2CH_3$, $-CH(CH_3)_2$, $-CH_2CH(CH_3)_2$, $-CH_2C(CH_3)_3$.

42. The use of the LDC compound according to claim **41**, wherein the quaternized tubulysin Drug Unit has the structure of:



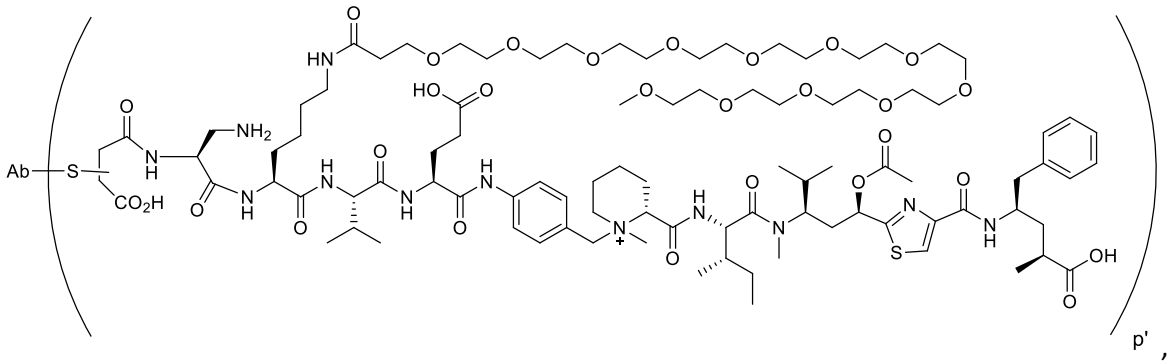
or



wherein R^{2B} is hydrogen, methyl or $–OCH_3$, or

$-OCH_2R^{2B}$ is $–OCH_2CH=CH_2$ or $–OCH_2C(CH_3)=CH_2$.

43. The use of the LDC compound according to claim **35**, wherein the LDC compound is represented by the structure of:



or a salt thereof.