

Claims

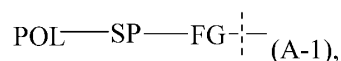
1. An IL-2 conjugate or a pharmaceutically acceptable salt thereof of formula (Ia) or (Ib)

$$Z-\left(L^2-L^1-D\right)_x \quad \text{(Ia)}$$

$$D-\left(L^1-L^2-Z\right)_y \quad \text{(Ib)},$$
 wherein
 - D is a biased IL-2 moiety, which biased IL-2 moiety comprises an IL-2 moiety and for which biased IL-2 moiety the ratio of the K_D of said biased IL-2 to IL-2R $\alpha\beta$ to the K_D of said biased IL-2 to IL-2R β is larger than the ratio of the K_D of aldesleukin to IL-2R $\alpha\beta$ to the K_D of aldesleukin to IL-2R β ;
 - L¹- is a linker moiety covalently and reversibly attached to -D;
 - L²- is a chemical bond or is a spacer moiety;
 - Z is a polymeric moiety or a substituted fatty acid moiety;
 - x is an integer selected from the group consisting of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 or 16; and
 - y is an integer selected from the group consisting of 2, 3, 4 and 5.
2. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of claim 1, wherein the biased IL-2 moiety -D is an IL-2 moiety, comprising
 - (a) at least one stable attachment of a modifying moiety M_{mod}, which may be the same or different; or
 - (b) at least one amino acid mutations; or
 - (c) at least one deletion; or
 - any combination of (a), (b) and (c).
3. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of claim 1 or 2, wherein the IL-2 moiety comprises at least one amino acid mutation at position K34, R37, M38, T40, F41, K42, F43, Y44, E61 or L71, based on SEQ ID NO:2.
4. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 3, wherein the IL-2 moiety comprises at least one amino acid mutation

selected from the group consisting of K34C, R37C, M38C, T40C, F41C, K42C, F43C, Y44C, E61C, and L71C, based on SEQ ID NO:2.

5. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 4, wherein the IL-2 moiety has the sequence of SEQ ID NO:2 and comprises the R37C mutation.
6. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 5, wherein the IL-2 moiety comprises a combination of at least one stable attachment of a modifying moiety M_{mod} and at least one amino acid mutation.
7. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 2 to 6, wherein the moiety M_{mod} is attached to a cysteine.
8. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 2 to 7, wherein the IL-2 moiety has the sequence of SEQ ID NO:2 and comprises the R37C mutation and wherein a moiety M_{mod} is conjugated to the sulfur of the cysteine at position R37C.
9. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 8, wherein the IL-2 conjugate is of formula (Ia) with x being 1.
10. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 2 to 9, wherein M_{mod} is a polymeric moiety.
11. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 2 to 10, wherein M_{mod} is of formula (A-1)



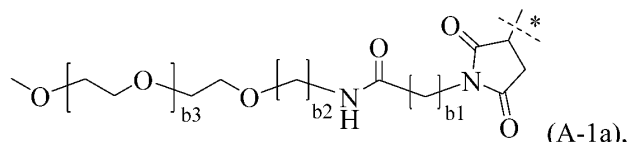
wherein

-FG- is a linkage;

-SP- is a spacer moiety; and

-POL is a polymer.

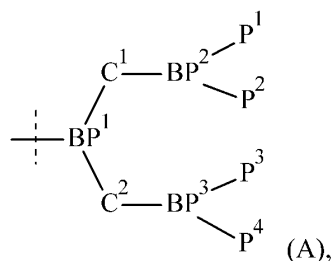
12. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 2 to 11, wherein M_{mod} is of formula (A-1a)



wherein

- 5 the dashed line marked with the asterisk indicates attachment to the sulfur of a side chain of an amino acid residue of the IL-2 moiety;
- b1 is an integer selected from the group consisting of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20;
- b2 is an integer selected from the group consisting of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 10 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20; and
- b3 is an integer ranging from 12 to 22700.

13. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 12, wherein -Z is a polymeric moiety.
- 15 14. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 13, wherein -Z comprises a moiety of formula (A)



wherein

- 20 -BP¹<, -BP²<, -BP³< are independently of each other selected from the group consisting of -N< and -C(R⁸)<;
- R⁸ is selected from the group consisting of H, C₁₋₆ alkyl, C₂₋₆ alkenyl and C₂₋₆ alkynyl;
- P¹, -P², -P³, -P⁴ are independently of each other a PEG-based chain comprising at 25 least 40% PEG and having a molecular weight ranging from 3 to 40 kDa;
- C¹-, -C²- are independently of each other selected from the group consisting of C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl; wherein C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl,

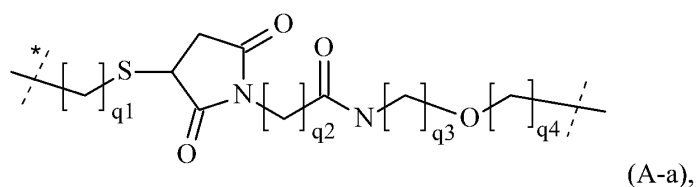
and C₂₋₅₀ alkynyl are optionally substituted with one or more R⁹, which are the same or different and wherein C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl are optionally interrupted by one or more groups selected from the group consisting of -T-, -C(O)O-, -O-, -C(O)-, -C(O)N(R¹⁰)-, -S(O)₂N(R¹⁰)-, -S(O)N(R¹⁰)-, -S(O)₂-,
 5 -S(O)-, -N(R¹⁰)S(O)₂N(R^{10a})-, -S-, -N(R¹⁰)-, -OC(OR¹⁰)(R^{10a})-, -N(R¹⁰)C(O)N(R^{10a})-, and -OC(O)N(R¹⁰)-;

each T is independently selected from the group consisting of phenyl, naphthyl, indenyl, indanyl, tetralinyl, C₃₋₁₀ cycloalkyl, 3- to 10-membered heterocyclyl, 8- to 11-membered heterobicycyl, 8- to 30-membered carbopolycyclyl, and 8- to 30-membered heteropolycyclyl; wherein each T is independently optionally substituted with one or more R⁹, which are the same or different;

each R⁹ is independently selected from the group consisting of halogen, -CN, oxo (=O), -COOR¹¹, -OR¹¹, -C(O)R¹¹, -C(O)N(R¹¹R^{11a}), -S(O)₂N(R¹¹R^{11a}), -S(O)N(R¹¹R^{11a}), -S(O)₂R¹¹, -S(O)R¹¹, -N(R¹¹)S(O)₂N(R^{11a}R^{11b}), -SR¹¹,
 15 -N(R¹¹R^{11a}), -NO₂, -OC(O)R¹¹, -N(R¹¹)C(O)R^{11a}, -N(R¹¹)S(O)₂R^{11a}, -N(R¹¹)S(O)R^{11a}, -N(R¹¹)C(O)OR^{11a}, -N(R¹¹)C(O)N(R^{11a}R^{11b}), -OC(O)N(R¹¹R^{11a}), and C₁₋₆ alkyl; wherein C₁₋₆ alkyl is optionally substituted with one or more halogen, which are the same or different; and

each R¹⁰, R^{10a}, R¹¹, R^{11a} and R^{11b} is independently selected from the group consisting of -H, and C₁₋₆ alkyl, wherein C₁₋₆ alkyl is optionally substituted with one or more halogen, which are the same or different.

15. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of claim 14, wherein C¹ and C² of formula (A) are of formula (A-a)



wherein

the dashed line marked with the asterisk indicates attachment to BP¹;

the unmarked dashed line indicates attachment to BP² or BP³, respectively;

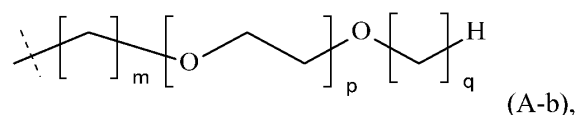
q1 is selected from the group consisting of 1, 2, 3, 4, 5, 6, 7 and 8;

q2 is selected from the group consisting of 1, 2, 3, 4, and 5;

q3 is selected from the group consisting of 1, 2, 3, 4, 5, 6, 7 and 8; and

q4 is selected from the group consisting of 1, 2 and 3.

16. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of claim 14 or 15, wherein P¹, P², P³ and P⁴ of formula (A) are independently of each other of formula (A-b)



wherein

the dashed line indicates attachment to the remainder of -Z;

m is 0 or 1;

10 p is an integer ranging from 70 to 900; and

q is selected from the group consisting of 1, 2, 3, 4, 5, and 6.

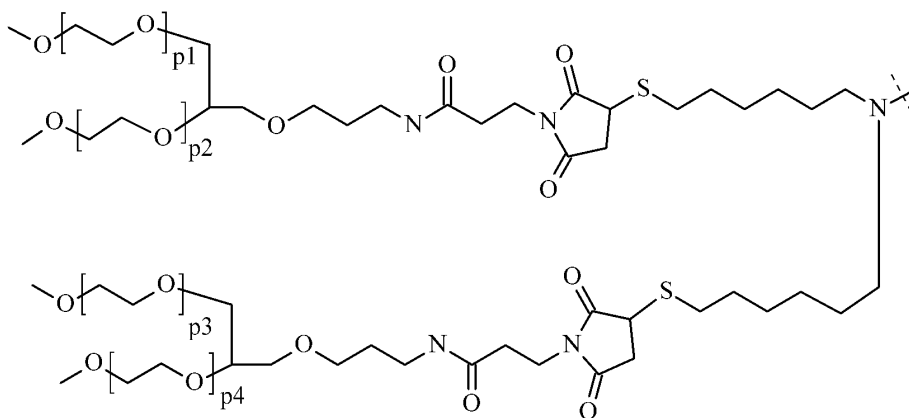
17. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 14 to 16, wherein BP¹ of formula (A) is -N<.

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18. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 14 to 17, wherein BP² and BP² of formula (A) are both -CH<.

19. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 18, wherein -Z comprises a moiety of formula (A-c):

20



(A-c),

wherein

p1, p2, p3, p4 are independently of each other an integer ranging from 70 to 900.

20. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 19, wherein $-L^1$ is attached to an amino acid residue of the IL-2 moiety.

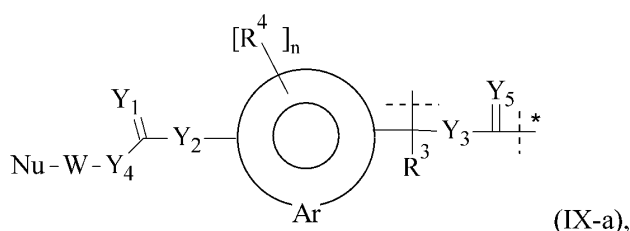
5 21. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 20, wherein $-L^1$ is attached to an amino acid residue of the IL-2 moiety selected from the group consisting of cysteine, methionine, histidine, lysine, tryptophan, serine, threonine, tyrosine, aspartic acid, glutamic acid, glutamine and arginine.

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22. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 21, wherein L^1 is attached to a lysine residue selected from the group consisting of K7, K8, K31, K34, K42, K47, K48, K53, K63, K75 and K96, based on SEQ ID NO:2.

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23. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 22, wherein $-L^1$ is of formula (IX-a):



wherein

20 the dashed line marked with the asterisk indicates attachment to a nitrogen of -D and the unmarked dashed line indicates attachment to $-L^2-Z$;

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

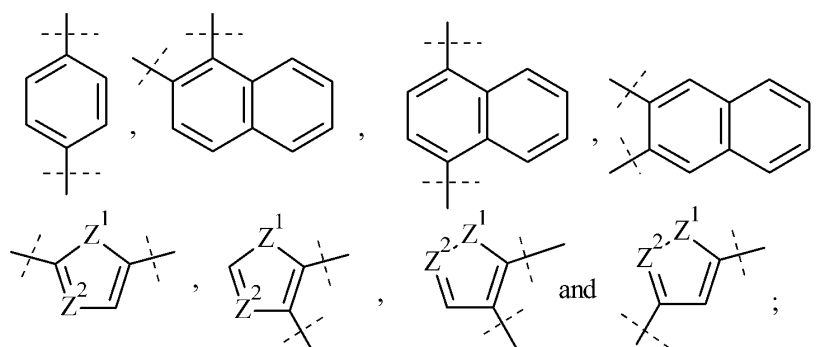
$=Y_1$ is selected from the group consisting of $=O$ and $=S$;

$-Y_2-$ is selected from the group consisting of $-O-$ and $-S-$;

25 $-Y_3-$, $-Y_5-$ are independently of each other selected from the group consisting of $-O-$ and $-S-$;

$-Y_4-$ is selected from the group consisting of $-O-$, $-NR^5-$ and $-C(R^6R^{6a})-$;

$-R^3$, $-R^5$, $-R^6$, $-R^{6a}$ are independently of each other selected from the group consisting of $-H$, methyl, ethyl, n -propyl, isopropyl, n -butyl, isobutyl, sec-butyl,



wherein

dashed lines indicate attachment to the remainder of $-L^1$ -,

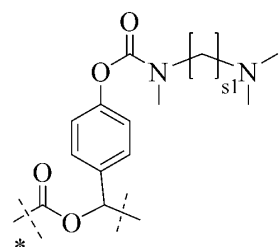
$-Z^1$ is selected from the group consisting of $-O$ -, $-S$ - and $-N(R^7)$ -, and

5 $-Z^2$ is $-N(R^7)$ -; and

$-R^7$, $-R^{7a}$, $-R^{7b}$ are independently of each other selected from the group consisting of $-H$, C_{1-6} alkyl, C_{2-6} alkenyl and C_{2-6} alkynyl;

wherein $-L^1$ is optionally further substituted.

- 10 24. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any of claims 1 to 23, wherein $-L^1$ is of formula (IX-c)



(IX-c),

wherein

the dashed line marked with the asterisk indicates attachment to a nitrogen of $-D$;

15 the unmarked dashed line indicates attachment to $-L^2-Z$; and

s_1 is an integer selected from the group consisting of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

- 20 25. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 24, wherein $-L^2$ is selected from the group consisting of $-T$ -, $-C(O)O$ -, $-O$ -, $-C(O)$ -, $-C(O)N(R^{y1})$ -, $-S(O)_2N(R^{y1})$ -, $-S(O)N(R^{y1})$ -, $-S(O)_2$ -, $-S(O)$ -, $-N(R^{y1})S(O)_2N(R^{y1a})$ -, $-S$ -, $-N(R^{y1})$ -, $-OC(OR^{y1})(R^{y1a})$ -, $-N(R^{y1})C(O)N(R^{y1a})$ -, $-OC(O)N(R^{y1})$ -, C_{1-50} alkyl, C_{2-50} alkenyl, and C_{2-50} alkynyl; wherein $-T$ -, C_{1-50} alkyl,

C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl are optionally substituted with one or more -R^{y2}, which are the same or different and wherein C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl are optionally interrupted by one or more groups selected from the group consisting of -T-, -C(O)O-, -O-, -C(O)-, -C(O)N(R^{y3})-, -S(O)₂N(R^{y3})-, -S(O)N(R^{y3})-, -S(O)₂-,
 5 -S(O)-, -N(R^{y3})S(O)₂N(R^{y3a})-, -S-, -N(R^{y3})-, -OC(OR^{y3})(R^{y3a})-, -N(R^{y3})C(O)N(R^{y3a})-, and -OC(O)N(R^{y3})-;

-R^{y1} and -R^{y1a} are independently of each other selected from the group consisting of -H, -T, C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl; wherein -T, C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl are optionally substituted with one or more -R^{y2}, which are the same or different, and wherein C₁₋₅₀ alkyl, C₂₋₅₀ alkenyl, and C₂₋₅₀ alkynyl are optionally interrupted by one or more groups selected from the group consisting of -T-, -C(O)O-, -O-, -C(O)-, -C(O)N(R^{y4})-, -S(O)₂N(R^{y4})-, -S(O)N(R^{y4})-, -S(O)₂-,
 10 -S(O)-, -N(R^{y4})S(O)₂N(R^{y4a})-, -S-, -N(R^{y4})-, -OC(OR^{y4})(R^{y4a})-, -N(R^{y4})C(O)N(R^{y4a})-, and -OC(O)N(R^{y4})-;

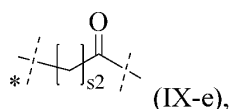
each T is independently selected from the group consisting of phenyl, naphthyl, indenyl, indanyl, tetralinyl, C₃₋₁₀ cycloalkyl, 3- to 10-membered heterocyclyl, 8- to 11-membered heterobicyclyl, 8-to 30-membered carbopolycyclyl, and 8- to 30-membered heteropolycyclyl; wherein each T is independently optionally substituted with one or more -R^{y2}, which are the same or different;

each -R^{y2} is independently selected from the group consisting of halogen, -CN, oxo (=O), -COOR^{y5}, -OR^{y5}, -C(O)R^{y5}, -C(O)N(R^{y5}R^{y5a}), -S(O)₂N(R^{y5}R^{y5a}),
 25 -S(O)N(R^{y5}R^{y5a}), -S(O)₂R^{y5}, -S(O)R^{y5}, -N(R^{y5})S(O)₂N(R^{y5a}R^{y5b}), -SR^{y5}, -N(R^{y5}R^{y5a}), -NO₂, -OC(O)R^{y5}, -N(R^{y5})C(O)R^{y5a}, -N(R^{y5})S(O)₂R^{y5a}, -N(R^{y5})S(O)R^{y5a}, -N(R^{y5})C(O)OR^{y5a}, -N(R^{y5})C(O)N(R^{y5a}R^{y5b}), -OC(O)N(R^{y5}R^{y5a}), and C₁₋₆ alkyl; wherein C₁₋₆ alkyl is optionally substituted with one or more halogen, which are the same or different; and

30 each -R^{y3}, -R^{y3a}, -R^{y4}, -R^{y4a}, -R^{y5}, -R^{y5a} and -R^{y5b} is independently selected from the group consisting of -H, and C₁₋₆ alkyl, wherein C₁₋₆ alkyl is optionally substituted with one or more halogen, which are the same or different.

26. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 25, wherein $-L^2-$ is a C_{1-20} alkyl chain, which is optionally interrupted by one or more groups independently selected from $-O-$, $-T-$ and $-C(O)N(R^{y1})-$; and which C_{1-20} alkyl chain is optionally substituted with one or more groups independently selected from $-OH$, $-T$ and $-C(O)N(R^{y6}R^{y6a})$; wherein $-R^{y1}$, $-R^{y6}$, $-R^{y6a}$ are independently selected from the group consisting of H and C_{1-4} alkyl and wherein T is selected from the group consisting of phenyl, naphthyl, indenyl, indanyl, tetralinyl, C_{3-10} cycloalkyl, 3- to 10-membered heterocyclyl, 8- to 11-membered heterobicyclyl, 8- to 30-membered carbopolycyclyl, and 8- to 30-membered heteropolycyclyl.

27. The IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 26, wherein $-L^2-$ is of formula (IX-e)



- wherein
the dashed line marked with the asterisk indicates attachment to $-L^1-$;
the unmarked dashed line indicates attachment to $-Z-$; and
 $s2$ is an integer selected from the group consisting of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20.

28. A pharmaceutical composition comprising at least one IL-2 conjugate or the pharmaceutically acceptable salt thereof of any one of claims 1 to 27 and at least one excipient.
29. The IL-2 conjugate or a pharmaceutically acceptable salt thereof of any one of claims 1 to 27 or the pharmaceutical composition of claim 28 for use as a medicament.
30. The IL-2 conjugate or a pharmaceutically acceptable salt thereof of any one of claims 1 to 27 or the pharmaceutical composition of claim 28 for use in the treatment of a disease which can be treated with IL-2.
31. The IL-2 conjugate or a pharmaceutically acceptable salt thereof or the pharmaceutical composition for use of claim 30, wherein the disease which can be treated with IL-2 is

- selected from the group consisting of sarcoma, chordoma, colon cancer, rectal cancer, colorectal cancer, pancreatic cancer, breast cancer, ovarian cancer, prostate cancer, squamous cell cancer, basal cell cancer, adenocarcinoma, sweat gland cancer, sebaceous gland cancer, papillary cancer, papillary adenocarcinomas, cystadenocarcinoma, medullary cancer, bronchogenic cancer, renal cell cancer, hepatoma, bile duct cancer, choriocarcinoma, seminoma, embryonal cancer, Wilms' tumor, cervical cancer, testicular cancer, gastric cancer, non-small cell lung cancer, small cell lung cancer, bladder cancer, renal cell carcinoma, urothelial cancer, epithelial cancer, glioma, astrocytoma, medulloblastoma, craniopharyngioma, ependymoma, pinealoma, hemangioblastoma, acoustic neuroma, oligodendroglioma, meningioma, melanoma, neuroblastoma, retinoblastoma, non-Hodgkin's lymphoma, cutaneous T-cell lymphoma, acute myeloid leukemia and leukemias.
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32. A method of treating, controlling, delaying or preventing in a mammalian patient, preferably a human patient, in need of the treatment of one or more diseases which can be treated with IL-2, comprising the step of administering to said patient in need thereof a therapeutically effective amount of the IL-2 conjugate or a pharmaceutically acceptable salt thereof of any one of claims 1 to 27 or the pharmaceutical composition of claim 28.
33. The method of claim 32, wherein the disease is selected from the group consisting of sarcoma, chordoma, colon cancer, rectal cancer, colorectal cancer, pancreatic cancer, breast cancer, ovarian cancer, prostate cancer, squamous cell cancer, basal cell cancer, adenocarcinoma, sweat gland cancer, sebaceous gland cancer, papillary cancer, papillary adenocarcinomas, cystadenocarcinoma, medullary cancer, bronchogenic cancer, renal cell cancer, hepatoma, bile duct cancer, choriocarcinoma, seminoma, embryonal cancer, Wilms' tumor, cervical cancer, testicular cancer, gastric cancer, non-small cell lung cancer, small cell lung cancer, bladder cancer, renal cell carcinoma, urothelial cancer, epithelial cancer, glioma, astrocytoma, medulloblastoma, craniopharyngioma, ependymoma, pinealoma, hemangioblastoma, acoustic neuroma, oligodendroglioma, meningioma, melanoma, neuroblastoma, retinoblastoma, non-Hodgkin's lymphoma, cutaneous T-cell lymphoma, acute myeloid leukemia and leukemias.