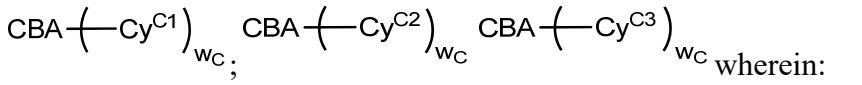
CLAIMS:

1. An immunoconjugate represented by the following formula:



wherein:

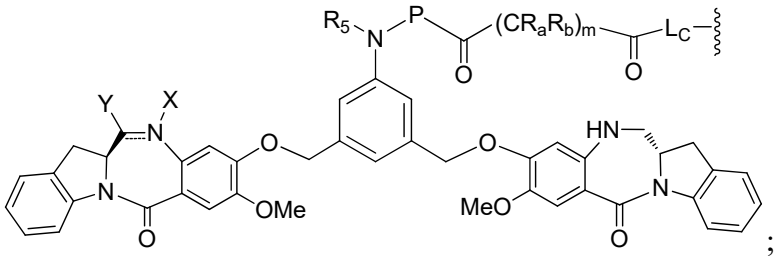
CBA is an anti-CD123 antibody or antigen-binding fragment thereof covalently linked to $Cy^{C1}$ through a cysteine residue, wherein the antibody or antigen-binding fragment thereof comprises:

i) an immunoglobulin heavy chain variable region comprising a CDR1 having an amino acid sequence set forth in SEQ ID NO: 5, a CDR2 having an amino acid sequence set forth in SEQ ID NO: 6, 7, 8, 9, or 10, and a CDR3 having an amino acid sequence set forth in SEQ ID NO: 11; and

ii) an immunoglobulin light chain variable region comprising a CDR1 having an amino acid sequence set forth in SEQ ID NO: 19 or 20, a CDR2 having an amino acid sequence set forth in SEQ ID NO: 21, and a CDR3 having an amino acid sequence set forth in SEQ ID NO: 22;

$W_C$ is 1 or 2;

$Cy^{C1}$ is represented by the following formula:



;

or a pharmaceutically acceptable salt thereof, wherein:

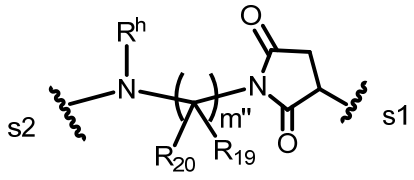
the double line == between N and C represents a single bond or a double bond, provided that when it is a double bond, X is absent and Y is -H or a ($C_1$-$C_4$)alkyl; and when it is a single bond, X is -H or an amine protecting moiety, Y is -OH or -$SO_3M$, and M is $H^+$ or a cation;

$R_5$ is -H or Me;

P is an amino acid residue or a peptide containing 2 to 5 amino acid residues;

$R_a$ and $R_b$ are both H;

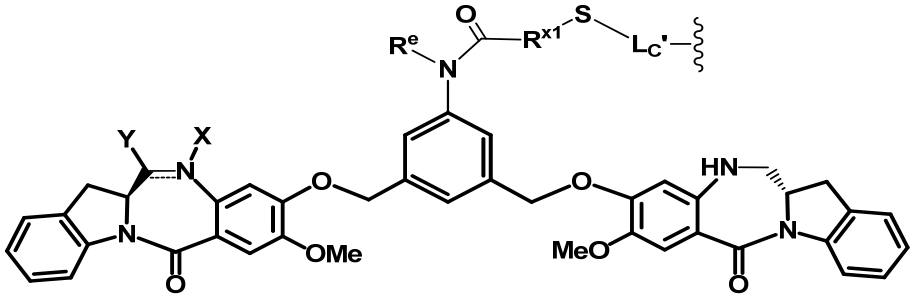
m is an integer from 1 to 6; and,

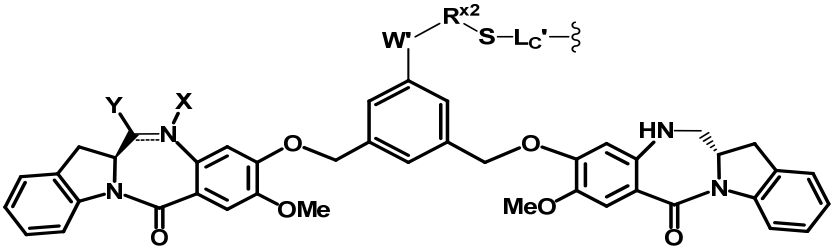
$L_C$ is represented by  , s1 is the site covalently linked to CBA, and s2 is the site covalently linked to the -C(=O)- group on $Cy^{C1}$; wherein:

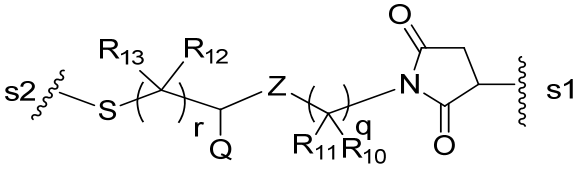
$R_{19}$ and $R_{20}$ are both H;

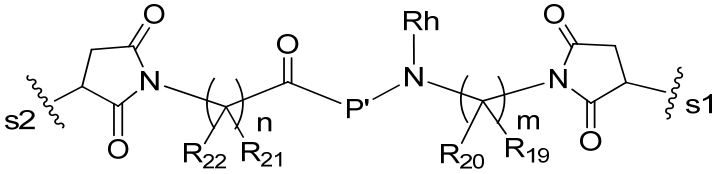
m" is an integer between 1 and 6; and

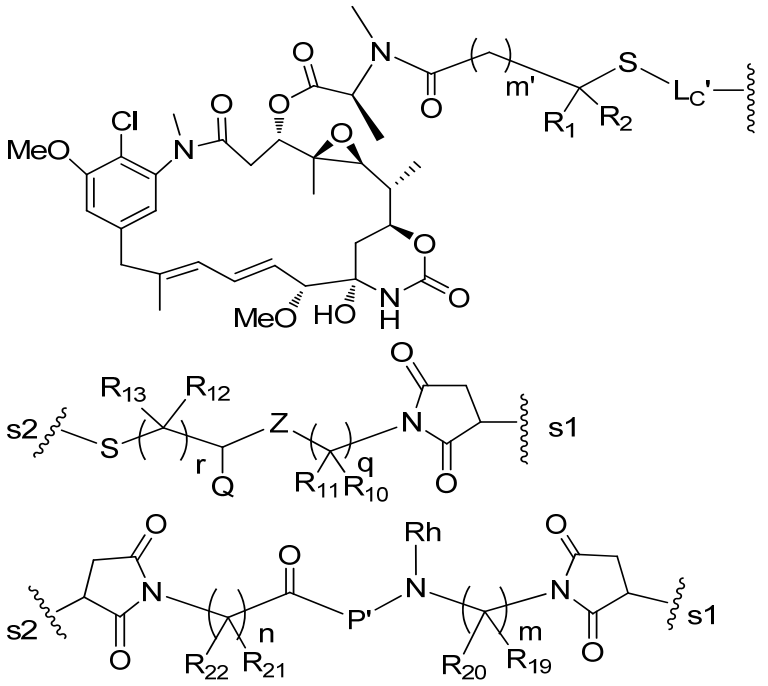
$R^h$ is -H or a ($C_1$-$C_3$)alkyl.







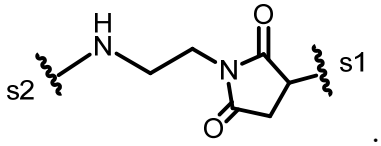




2. The immunoconjugate of claim 1, wherein P is selected from Gly-Gly-Gly, Ala-Val, Val-Ala, Val-Cit, Val-Lys, Phe-Lys, Lys-Lys, Ala-Lys, Phe-Cit, Leu-Cit, Ile-Cit, Trp, Cit, Phe-Ala, Phe-N9-tosyl-Arg, Phe-N9-nitro-Arg, Phe-Phe-Lys, D-Phe-Phe-Lys, Gly-Phe-Lys, Leu-Ala-Leu, Ile-Ala-Leu, Val-Ala-Val, Ala-Leu-Ala-Leu (SEQ ID NO: 55), β-Ala-Leu-Ala-Leu (SEQ ID NO: 57), Gly-Phe-Leu-Gly (SEQ ID NO: 73), Val-Arg, Arg-Val, Arg-Arg, Val-D-Cit, Val-D-Lys, Val-D-Arg, D-Val-Cit, D-Val-Lys, D-Val-Arg, D-Val-D-Cit, D-Val-D-Lys, D-Val-D-Arg, D-Arg-D-Arg, Ala-Ala, Ala-D-Ala, D-Ala-Ala, D-Ala-D-Ala, Ala-Met, and Met-Ala.

3. The immunoconjugate of claim 1, wherein P is Gly-Gly-Gly, Ala-Val, Ala-Ala, Ala-D-Ala, D-Ala-Ala, or D-Ala-D-Ala.

4. The immunoconjugate of any one of claims 1-3, wherein -$L_C$ is represented by the following formula:



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5. The immunoconjugate of any one of claims 1-4, wherein the antibody or antigen-binding fragment thereof comprises:

(i) an immunoglobulin heavy chain variable region comprising a CDR1 having an amino acid sequence set forth in SEQ ID NO: 5, a CDR2 having an amino acid sequence set forth in SEQ ID NO: 8, and a CDR3 having an amino acid sequence set forth in SEQ ID NO: 11; and

(ii) an immunoglobulin light chain variable region comprising a CDR1 having an amino acid sequence set forth in SEQ ID NO: 20, a CDR2 having an amino acid sequence set forth in SEQ ID NO: 21, and a CDR3 having an amino acid sequence set forth in SEQ ID NO: 22.

6. The immunoconjugate of any one of claims 1-4, wherein the antibody or the antigen-binding fragment thereof comprising:

a) an immunoglobulin heavy chain variable region having the amino acid sequence set forth in SEQ ID NO: 34; and

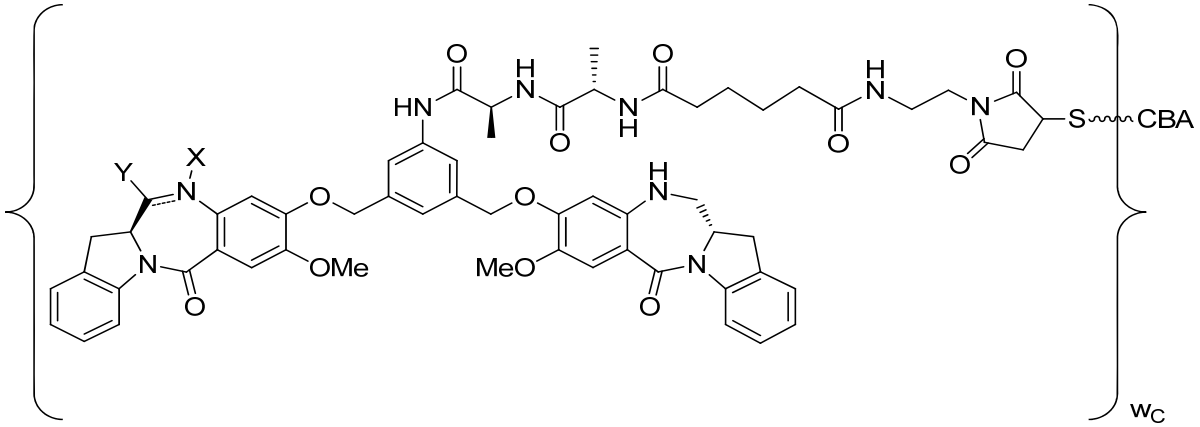
b) an immunoglobulin light chain variable region having the amino acid sequence set forth in SEQ ID NO: 35.

7. The immunoconjugate of claim 6, wherein Xaa, the second residue from the N-terminus of SEQ ID NO: 34, is Phe.

8. The immunoconjugate of claim 6, wherein Xaa, the second residue from the N-terminus of SEQ ID NO: 34, is Val.

9. The immunoconjugate of any one of claims 1-4, wherein antibody comprises an immunoglobulin heavy chain region having the amino acid sequence set forth in SEQ ID NO: 54; and an immunoglobulin light chain region having the amino acid sequence set forth in SEQ ID NO: 51.

10. The immunoconjugate of claim 9, wherein Xaa, second residue from the N-terminus of SEQ ID NO: 54 is Val.




11. A pharmaceutical composition comprising the immunoconjugate of any one of claims 1-10, and a pharmaceutically acceptable carrier.

12. An *in vitro* method for inhibiting the growth of a cell expressing CD123, comprising contacting the cell with the immunoconjugate of any one of claims 1-10, or the pharmaceutical composition of claim 11.

13. Use of the immunoconjugate of any one of claims 1-10 in the manufacture of a medicament for treating a subject having cancer, wherein cells of the cancer expresses CD123.

14. The use of claim 13, wherein said cancer is leukemia or lymphoma.

15. The use of claim 13, wherein said cancer is selected from the group consisting of: acute myeloid leukemia (AML), acute lymphoblastic leukemia (ALL), and Chronic lymphocytic leukemia (CLL).

16. The use of claim 15, wherein said cancer is acute myeloid leukemia (AML).

17. The use of claim 15, wherein said cancer is B-cell acute lymphoblastic leukemia (B-ALL).

18. Use of the immunoconjugate of any one of claims 1-10 in the manufacture of a medicament for treating a cell-proliferative disorder in a subject, wherein cells of the cell-proliferative disorder expresses CD123.

19. The use of claim 18, wherein said cell-proliferative disorder is selected from the group consisting of: acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute

lymphoblastic leukemia (ALL), B-cell lineage acute lymphoblastic leukemia (B-ALL), chronic lymphocytic leukemia (CLL), hairy cell leukemia (HCL), myelodysplastic syndrome, basic plasmacytoid DC neoplasm (BPDCN) leukemia, non-Hodgkin lymphomas (NHL), mantle cell lymphoma, and Hodgkin's leukemia (HL).