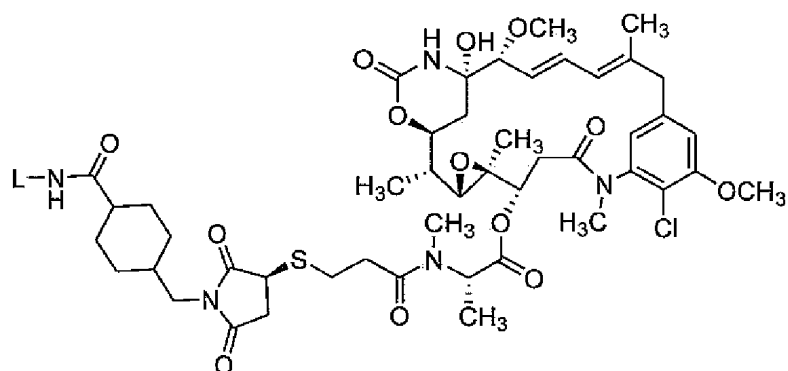
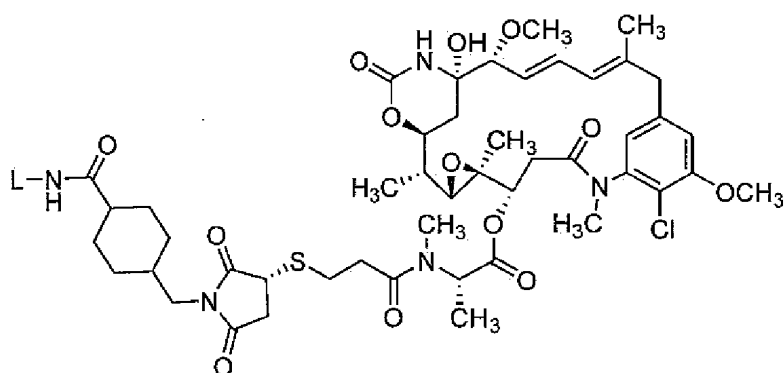


What is claimed is:

1. A composition comprising a compound of Formula IIa or IIb:



IIa



IIb

wherein:

L is an antibody or an antigen-binding fragment thereof;

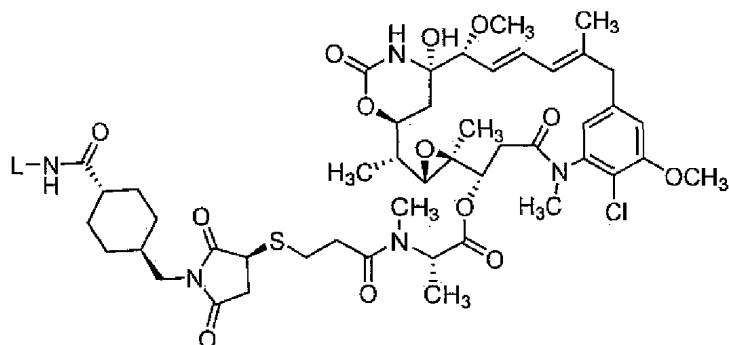
and wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb.

2. The composition of claim 1, wherein L is an antibody, or antigen-binding fragment thereof that specifically binds a tumor-associated antigen and further wherein the tumor-associated antigen is selected from the group consisting of AFP, ALK, BAGE proteins,

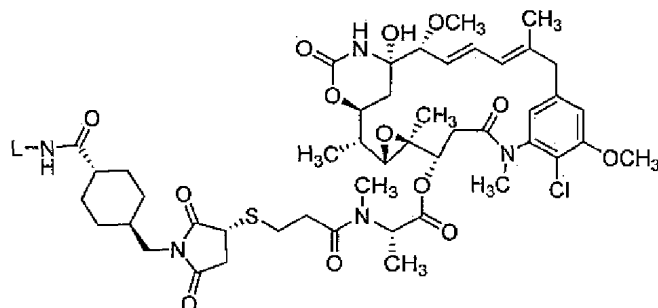
β -catenin, bcr-abl, BRCA1, BORIS, CA9, carbonic anhydrase IX, caspase-8, CD20, CD40, CDK4, CEA, CLEC12A, cMET, CTLA4, cyclin-B1, CYP1B1, EGFR, EGFRvIII, ErbB2/Her2, ErbB3, ErbB4, ETV6-AML, EphA2, Fra-1, FOLR1, GAGE proteins, GD2, GD3, GloboH, glypican-3, GM3, gp100, Her2, HLA/B-raf, HLA/k-ras, HLA/MAGE-A3, hTERT, IGF1R, LGR5, LMP2, MAGE proteins, MART-1, mesothelin, ML-IAP, Muc1, Muc16 or CA-125, MUM1, NA17, NY-BR1, NY-BR62, NY-BR85, NY-ESO1, OX40, p15, p53, PAP, PAX3, PAX5, PCTA-1, PDGFR- α , PDGFR- β , PDGF-A, PDGF-B, PDGF-C, PDGF-D, PLAC1, PRLR, PRAME, PSMA, FOLH1, RAGE proteins, Ras, RGS5, Rho, SART-1, SART-3, Steap-1, Steap-2, survivin, TAG-72, TGF- β , TMPRSS2, Tn, TNFRSF17, TRP-1, TRP-2, tyrosinase, and uroplakin-3.

3. The composition of claim 2, wherein the GAGE proteins are selected from the group consisting of GAGE-1 and GAGE-2.
4. The composition of claim 2 wherein the MAGE proteins are selected from the group consisting of MAGE-1, MAGE-2, MAGE-3, MAGE-4, MAGE-6, and MAGE-12.
5. The composition of claim 2, wherein the tumor-associated antigen is selected from the group consisting of EGFRvIII, Her2, and Muc16.
6. The composition of claim 5, wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of more than 95% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb.
7. Use of the composition of claim 1 for the manufacture of a medicament for treating cancer in a patient in need thereof.

8. The composition of any of claims 1-6, wherein the compound present in a diastereomeric excess is a compound of Formula IIa having the following structure:



9. The composition of any of claims 1-6, wherein the compound present in a diastereomeric excess is a compound of Formula IIb having the following structure:

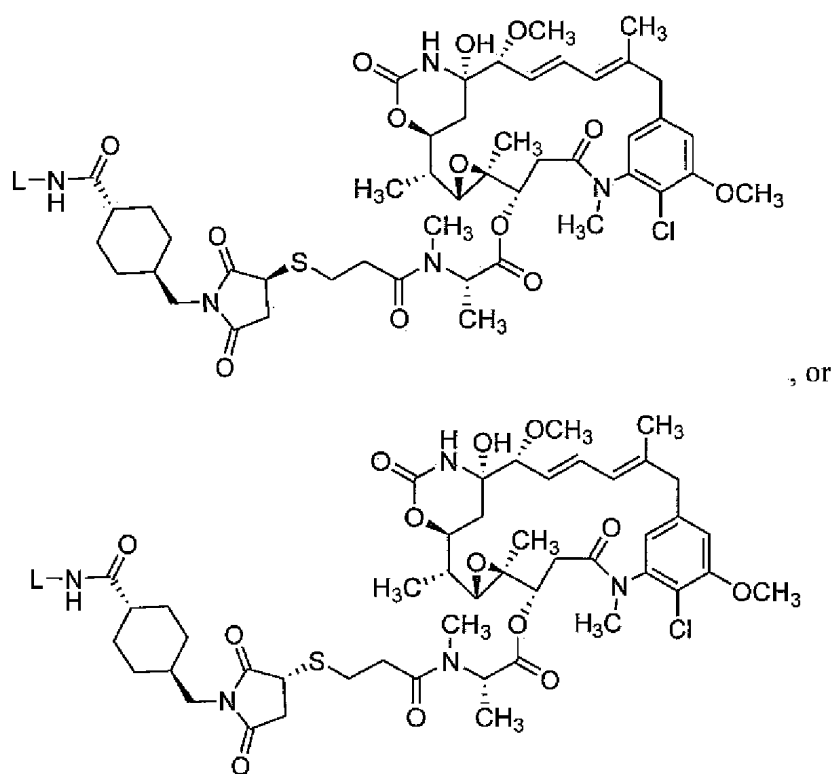


10. Use of the composition of claim 1 in the manufacture of a medicament for treating a disease or disorder associated with a tumor-associated antigen, wherein the tumor-associated antigen is selected from the group consisting of AFP, ALK, BAGE proteins, β -catenin, bcr-abl, BRCA1, BORIS, CA9, carbonic anhydrase IX, caspase-8, CD20, CD40, CDK4, CEA, CLEC12A, cMET, CTLA4, cyclin-B1, CYP1B1, EGFR, EGFRvIII, ErbB2/Her2, ErbB3, ErbB4, ETV6-AML, EphA2, Fra-1, FOLR1, GAGE proteins, GD2, GD3, GloboH, glypican-3, GM3, gp100, Her2, HLA/B-raf, HLA/k-ras, HLA/MAGE-A3, hTERT, IGF1R, LGR5, LMP2, MAGE proteins, MART-1, mesothelin, ML-IAP, Muc1, Muc16 or CA-I25, MUM1, NA17, NY-BR1, NY-BR62, NY-BR85, NY-ESO1, OX40, p15, p53, PAP, PAX3, PAX5, PCTA-1, PDGFR- α , PDGFR- β , PDGF-A, PDGF-B, PDGF-C, PDGF-D, PLAC1, PRLR, PRAME, PSMA, FOLH1, RAGE proteins, Ras, RGS5, Rho, SART-1, SART-3, Steap-1, Steap-2, survivin, TAG-72, TGF- β , TMPRSS2, Tn, TNFRSF17, TRP-1, TRP-2, tyrosinase, and uroplakin-3, said

composition comprising a therapeutically effective amount of the compound present in a diastereomeric excess.

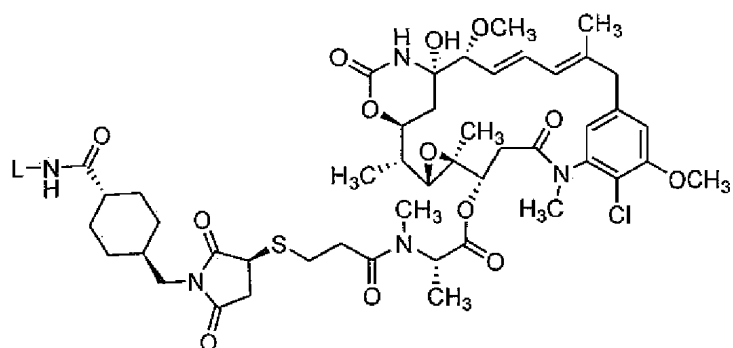
11. A pharmaceutical composition comprising the composition of claim 1, further comprising a pharmaceutically acceptable excipient.

12. The pharmaceutical composition of claim 11, wherein the compound of Formula IIa or IIb is:

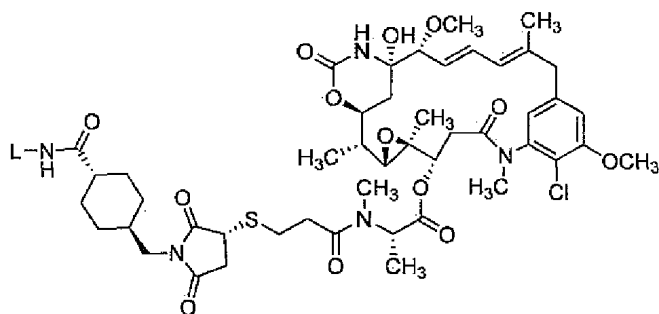


13. The pharmaceutical composition of claim 12, wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of greater than 95% wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb.

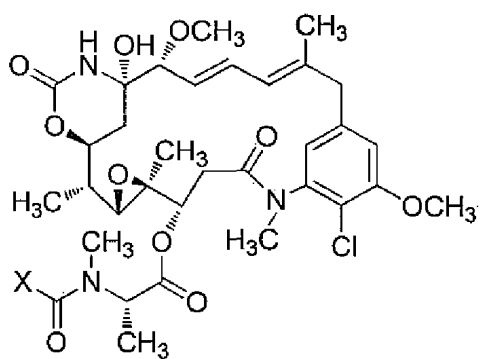
14. The pharmaceutical composition of claim 11, wherein the compound present in a diastereomeric excess is a compound of Formula IIa having the following structure:



15. The pharmaceutical composition of claim 11, wherein the compound present in a diastereomeric excess is a compound of Formula IIb having the following structure:



16. A composition comprising a compound of Formula I:



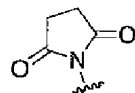
I

wherein:



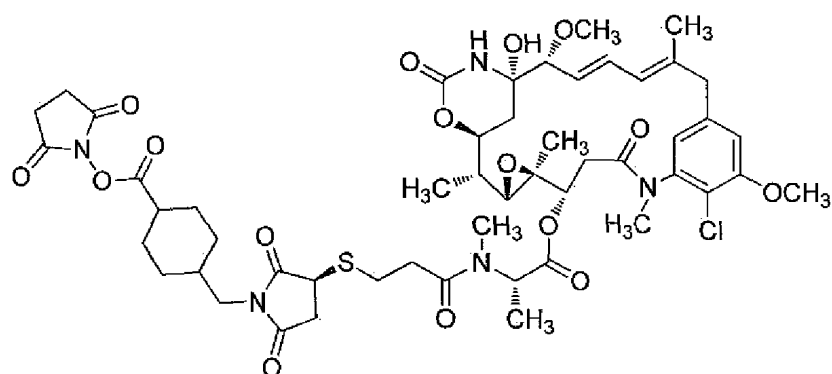
n is independently 0 or an integer from 1 to 50;

17. The composition of claim 16, wherein Y_1 is

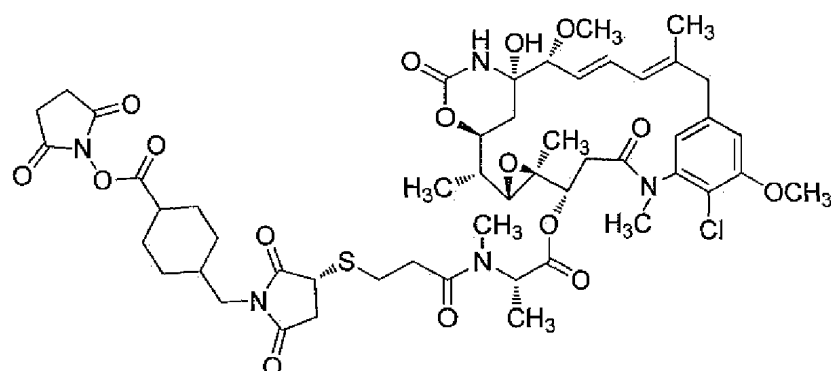


19. The composition of any of claims 16-18, wherein n is an integer from 1 to 10.

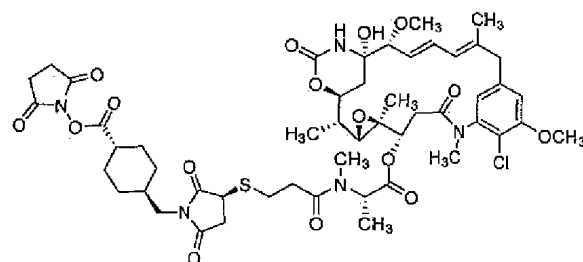
20. The composition of any of claim 16-19, wherein the compound of Formula I is



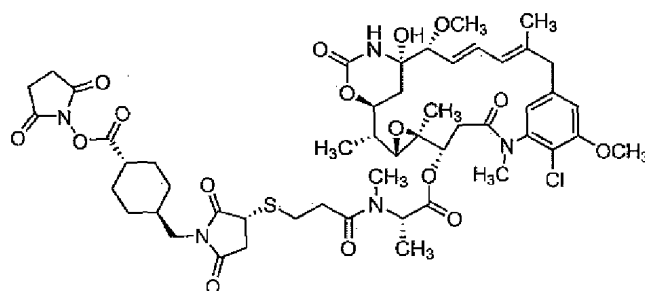
or



21. The composition of claim 20, wherein the compound of Formula I is:



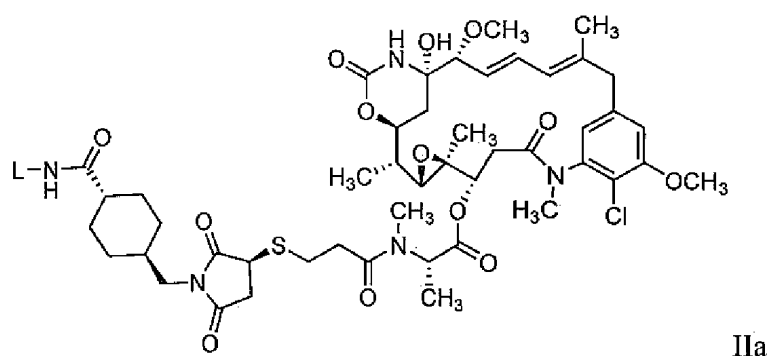
22. The composition of claim 20, wherein the compound of Formula I is:



23. The composition of any of claims 16-22, wherein the diastereomeric excess is at least 95% and wherein the diastereomers have different stereochemical configurations at the chiral carbon represented by (*) in formula X of Formula I, wherein said chiral carbon atom is a carbon atom that is bound to a sulfur atom.

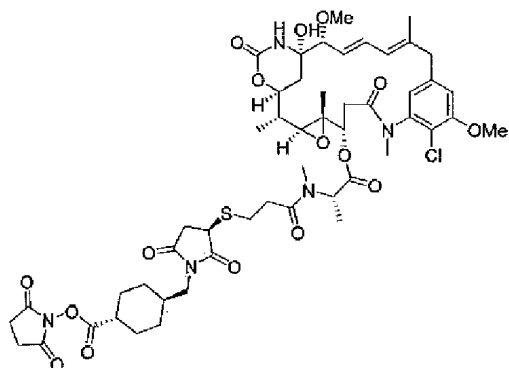
24. The composition of any of claims 16-22, wherein the compound of Formula I is characterized by a ¹HNMR spectrum substantially as shown in Figure 1.

25. An antibody-drug conjugate



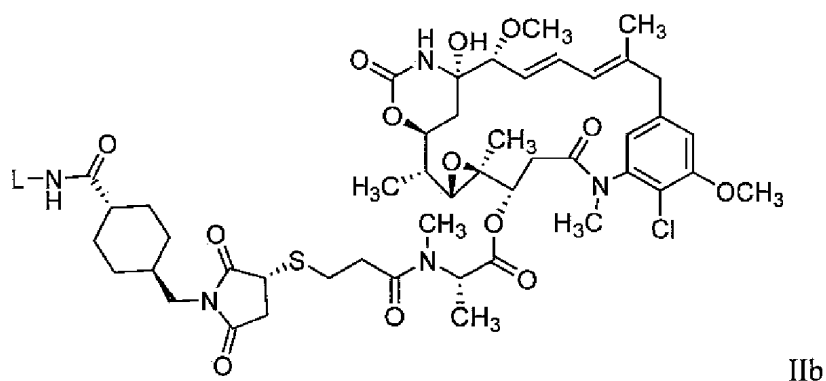
wherein:

L is an antibody or an antigen-binding fragment thereof; and wherein the antibody-drug conjugate is made by combining a compound of Formula (I) having the following structure:



with an antibody or antigen-binding fragment thereof.

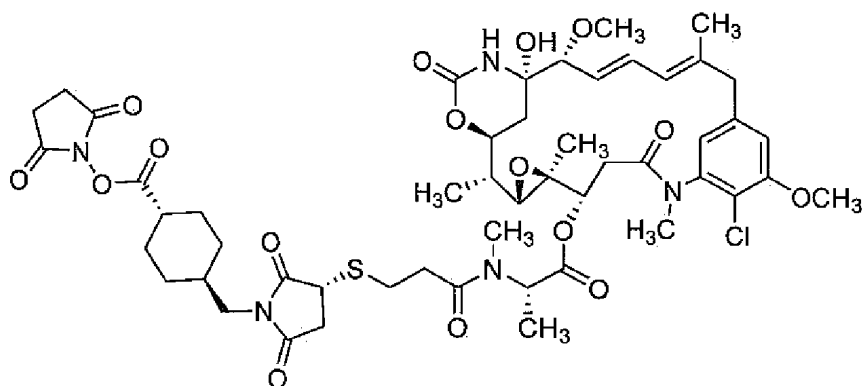
26. An antibody-drug conjugate of structure



wherein:

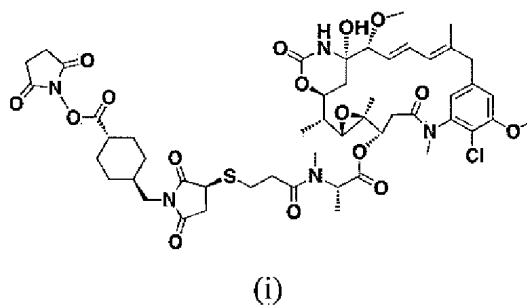
L is an antibody or an antigen-binding fragment thereof;

and wherein the antibody-drug conjugate is made by combining a compound of Formula (I) having the following structure:



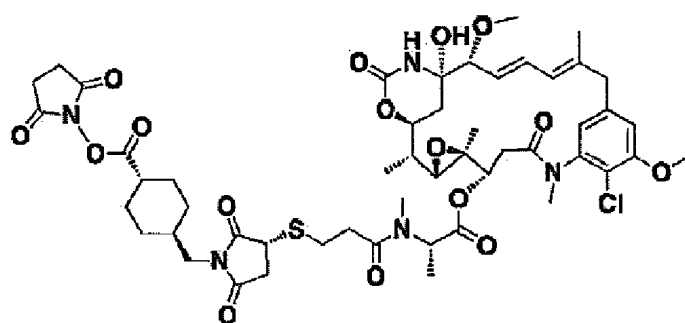
with an antibody or antigen-binding fragment thereof.

27. A compound of Formula (i):



wherein the compound is stereomerically pure.

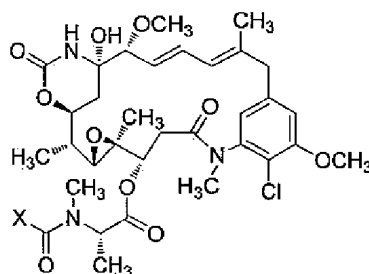
28. A compound of formula (ii)



(ii)

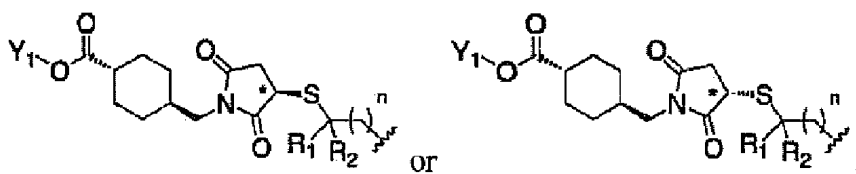
wherein the compound is stereoisomerically pure.

29. A process for preparing a compound of Formula I:

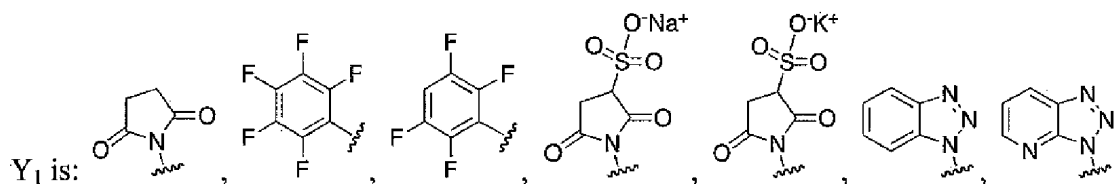
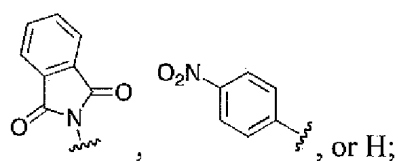


I

wherein:



X is:

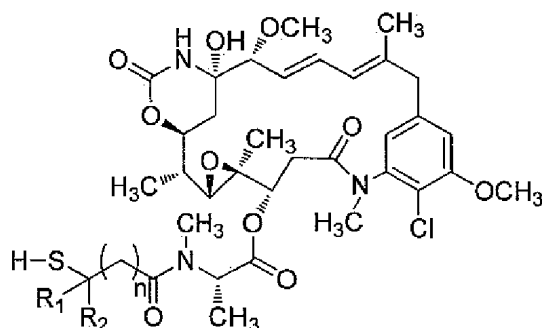


R_1 and R_2 are independently selected from H or alkyl; and

n is independently 0 or an integer from 1 to 50;
 comprising the steps of

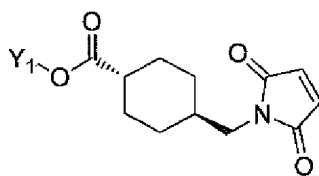
(a) contacting:

(i) a compound of Formula III:



III;

(ii) a compound of formula IV:



IV

(iii) silica gel; and

(iv) a diluent comprising an organic solvent and water; and

(b) isolating the compound of Formula I, wherein the compound of Formula I is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon represented by (*) in formula X of Formula I, wherein said chiral carbon atom is a carbon atom that is bound to a sulfur atom.

30. The process of claim 29, wherein the organic solvent comprises a polar aprotic solvent.

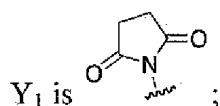
31. The process of claim 30, wherein the polar aprotic solvent comprises acetonitrile.

32. The process of claim 29, wherein the organic solvent and the water are present in volume ratio from about 1:1 to about 4:1 or from about 1:1 to about 10:1.

33. The process of claim 29, wherein the molar ratio of the compound of Formula III and the compound of formula IV is from about 1:1 to about 1:3.

34. The process of claim 29, wherein n is 1, and R₁ and R₂ are each independently hydrogen.

35. The process of claim 29, wherein:



R₁ and R₂ are H; and

n is 1.

36. The process of any of claims 29-35, wherein the contacting is performed under argon.

37. The process of any of claims 29-36, wherein components (i)-(v) are stirred.

38. The process of any of claims 29-37, wherein the contacting is performed at ambient temperature.

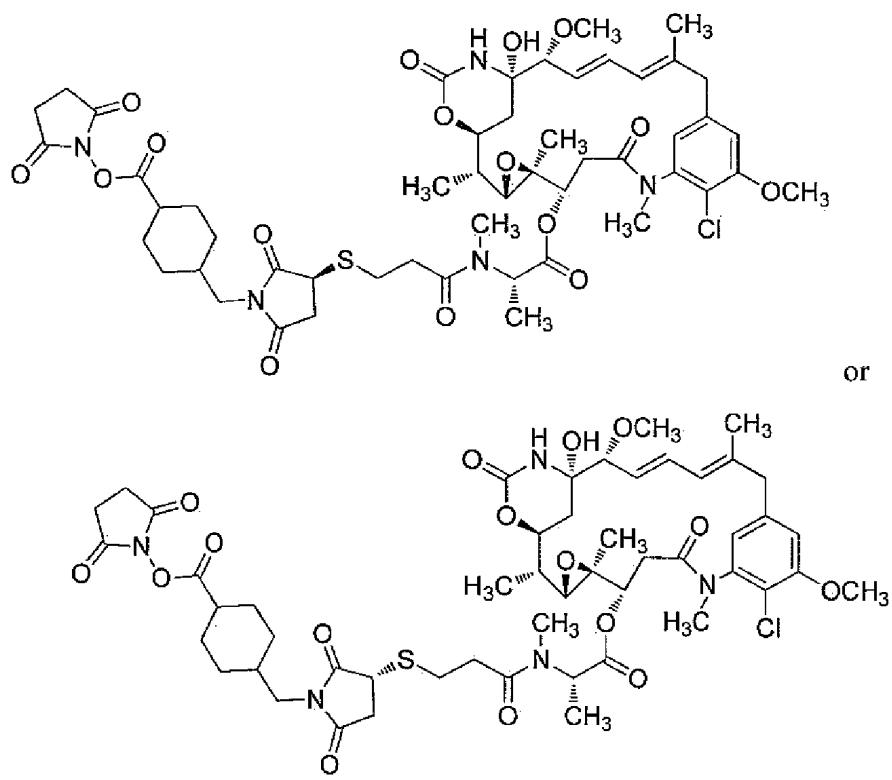
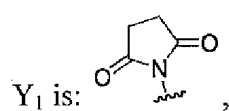
39. The process of any of claims 29-38, wherein components (i)-(v) are contacted for about 18 hours.

40. The process of any of claims 29-39, wherein the compound of Formula IV is in stoichiometric excess with respect to the compound of Formula III.

41. The process of any of claims 29-40, further comprising contacting an additional amount of a compound of Formula IV after step (a).

42. The process of any of claims 29-41, wherein the molar ratio of a compound of Formula IV to the compound of Formula III is about 2.3:1 in step (a).
43. The process of claim 29, wherein the molar ratio of the compound of Formula IV to the compound of Formula III is about 1.5:1 in step (a).
44. The process of any of claims 29-39, wherein the isolating of the compound of Formula I in step (b) is accomplished by filtration.
45. The process of claim 44, wherein the filtration is filtration through celite.
46. The process of any of claims 29-45, further comprising purifying the compound of Formula I by column chromatography on silica gel.
47. The process of claim 46 further comprising drying the compound of Formula I.
48. The process of any one of claims 29-47, further comprising combining the compound of Formula I with an antibody or antigen-binding fragment thereof to make an antibody-drug conjugate.
49. The process of any one of claims 29-48, wherein the compound of Formula I is attached to the antibody or antigen-binding fragment via an S, O, or NR₃; wherein R₃ is H or alkyl.

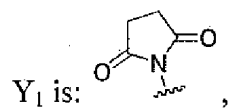
50. The process of any one of claims 29-49, wherein the compound of Formula I is:



R₁ and R₂ are H, and

n is 1.

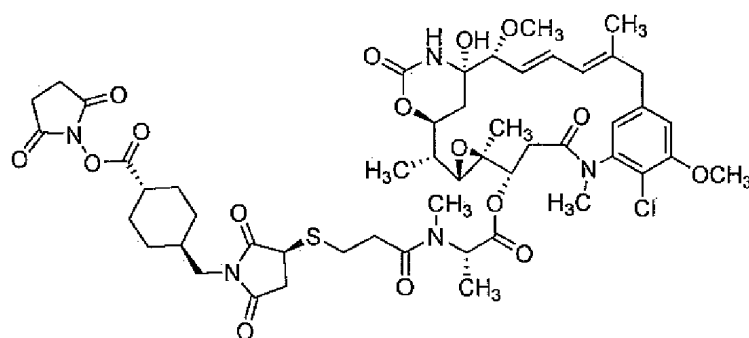
51. The process of any one of claims 29-50, wherein



R₁ and R₂ are H,

n is 1; and

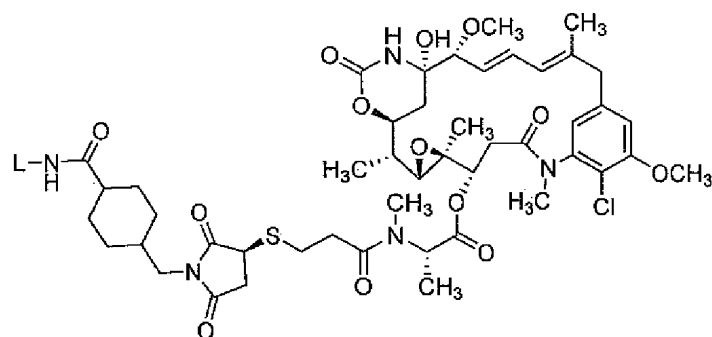
the compound of Formula 1 is:



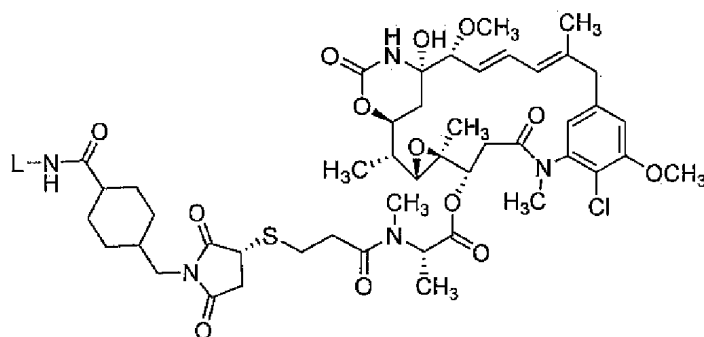
52. The process of claim 48-49, wherein the antibody or antigen-binding fragment thereof that specifically binds a tumor-associated antigen and further wherein the tumor-associated antigen is selected from the group consisting of AFP, ALK, BAGE proteins, β -catenin, bcr-abl, BRCA1, BORIS, CA9, carbonic anhydrase IX, caspase-8, CD20, CD40, CDK4, CEA, CLEC12A, cMET, CTLA4, cyclin-B1, CYP1B1, EGFR, EGFRvIII, ErbB2/Her2, ErbB3, ErbB4, ETV6-AML, EphA2, Fra-1, FOLR1, GAGE proteins, GD2, GD3, GloboH, glypican-3, GM3, gp100, Her2, HLA/B-raf, HLA/k-ras, HLA/MAGE-A3, hTERT, IGF1R, LGR5, LMP2, MAGE proteins, MART-1, mesothelin, ML-IAP, Muc1, Muc16 or CA-125, MUM1, NA17, NY-BR1, NY-BR62, NY-BR85, NY-ESO1, OX40, p15, p53, PAP, PAX3, PAX5, PCTA-1, PDGFR- α , PDGFR- β , PDGF-A, PDGF-B, PDGF-C, PDGF-D, PLAC1, PRLR, PRAME, PSMA, FOLH1, RAGE proteins, Ras, RGS5, Rho, SART-1, SART-3, Steap-1, Steap-2, survivin, TAG-72, TGF- β , TMPRSS2, Tn, TNFRSF17, TRP-1, TRP-2, tyrosinase, and uroplakin-3.
53. The process of claim 52, wherein the GAGE proteins are selected from the group consisting of GAGE-1 and GAGE-2.
54. The process of claim 52, wherein the MAGE proteins are selected from the group consisting of MAGE-1, MAGE-2, MAGE-3, MAGE-4, MAGE-6, and MAGE-12.

55. The process of claim 52, wherein the tumor-associated antigen is selected from the group consisting of EGFRvIII, Her2, and Muc16.

56. A process for preparing a compound of Formula IIa or IIb:



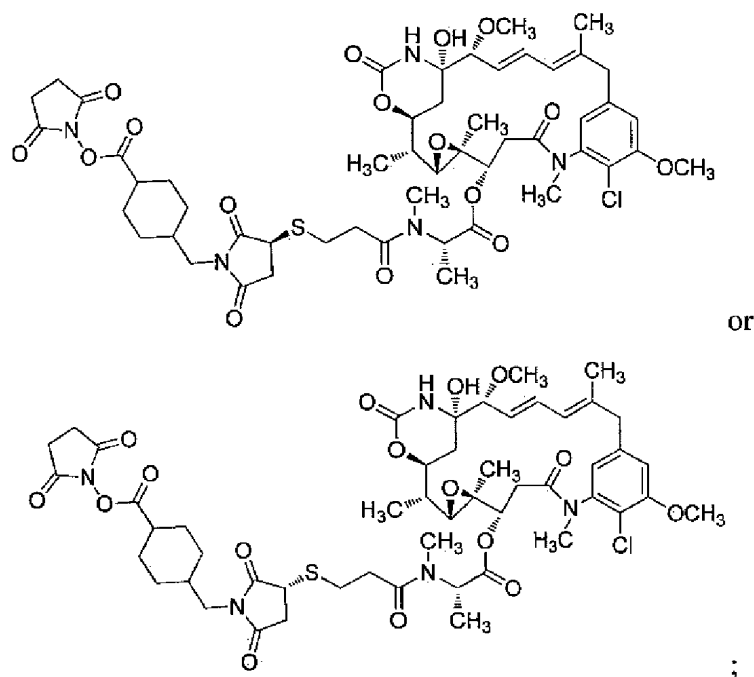
IIa



IIb

wherein L is an antibody or an antigen-binding fragment thereof; and
 wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb, comprising:

(a) reacting an antibody or antigen-binding fragment thereof with a compound of Formula I, wherein the compound is:



wherein the compound of Formula I is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula I; and

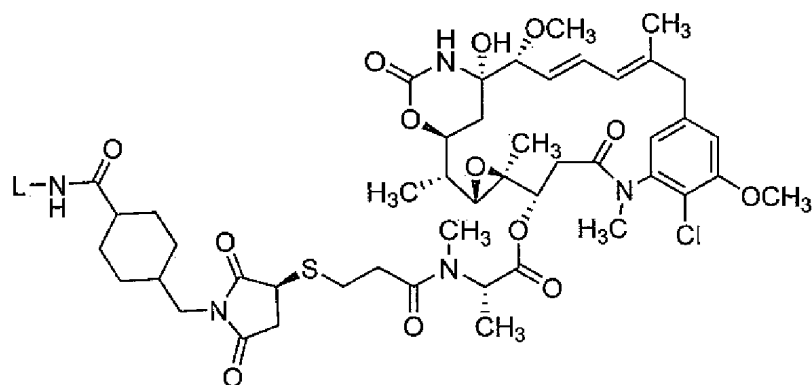
(b) purifying the compound of Formula IIa or IIb.

57. The process of claim 56, wherein L is an antibody, or antigen-binding fragment thereof that specifically binds a tumor-associated antigen and further wherein the tumor-associated antigen is selected from the group consisting of AFP, ALK, BAGE proteins, β -catenin, bcr-abl, BRCA1, BORIS, CA9, carbonic anhydrase IX, caspase-8, CD20, CD40, CDK4, CEA, CLEC12A, cMET, CTLA4, cyclin-B1, CYP1B1, EGFR, EGFRvIII, ErbB2/Her2, ErbB3, ErbB4, ETV6-AML, EphA2, Fra-1, FOLR1, GAGE proteins, GD2, GD3, GloboH, glypican-3, GM3, gp100, Her2, HLA/B-raf, HLA/k-ras, HLA/MAGE-A3, hTERT, IGF1R, LGR5, LMP2, MAGE proteins (*e.g.*, MAGE-1, -2, -3, -4, -6, and -12), MART-1, mesothelin, ML-IAP, Muc1, Muc16 or CA-125, MUM1, NA17, NY-BR1, NY-BR62, NY-BR85, NY-ESO1, OX40, p15, p53, PAP, PAX3, PAX5, PCTA-1, PDGFR- α , PDGFR- β , PDGF-A, PDGF-B, PDGF-C, PDGF-D, PLAC1, PRLR,

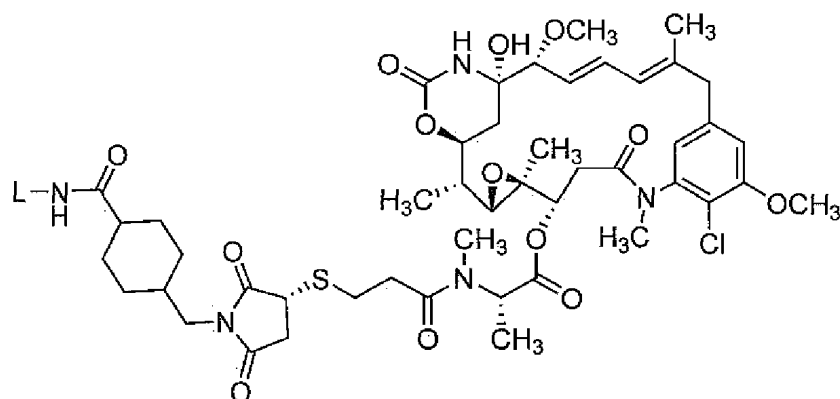
PRAME, PSMA, FOLH1, RAGE proteins, Ras, RGS5, Rho, SART-1, SART-3, Steap-1, Steap-2, survivin, TAG-72, TGF- β , TMPRSS2, Tn, TNFRSF17, TRP-1, TRP-2, tyrosinase, and uroplakin-3.

58. The process of claim 57, wherein the GAGE proteins are selected from the group consisting of GAGE-1 and GAGE-2.
59. The process of claim 57, wherein the MAGE proteins are selected from the group consisting of MAGE-1, MAGE-2, MAGE-3, MAGE-4, MAGE-6, and MAGE-12.
60. The process of claim 57, wherein the tumor-associated antigen is selected from the group consisting of EGFRvIII, Her2, and Muc16.
61. The process of claim 56, wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of more than 95% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb.
62. The process of claim 56, wherein the compound of Formula I is present in a diastereomeric excess of more than 95% and wherein the diastereomers have different stereochemical configurations at the chiral carbon represented by (*) in formula X of Formula I, wherein said chiral carbon atom is a carbon atom that is bound to a sulfur atom.

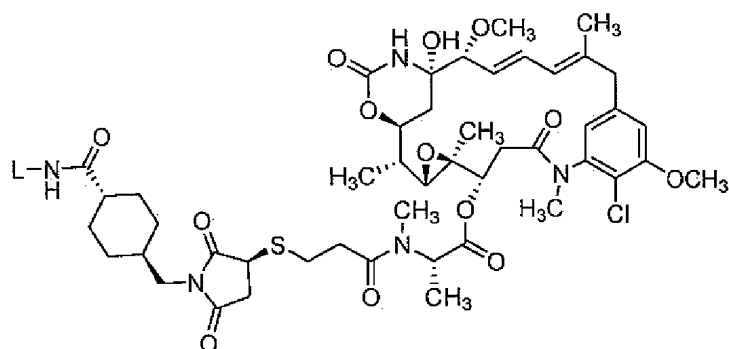
63. The process of claim 56, wherein the compound present in a diastereomeric excess is a compound of Formula IIa having the following structure:



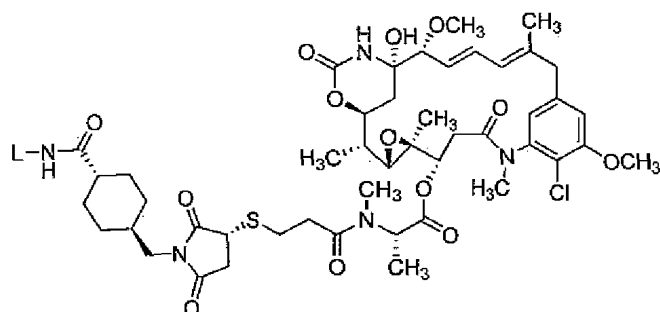
64. The process of claim 56, wherein the compound present in a diastereomeric excess is a compound of Formula IIb having the following structure:



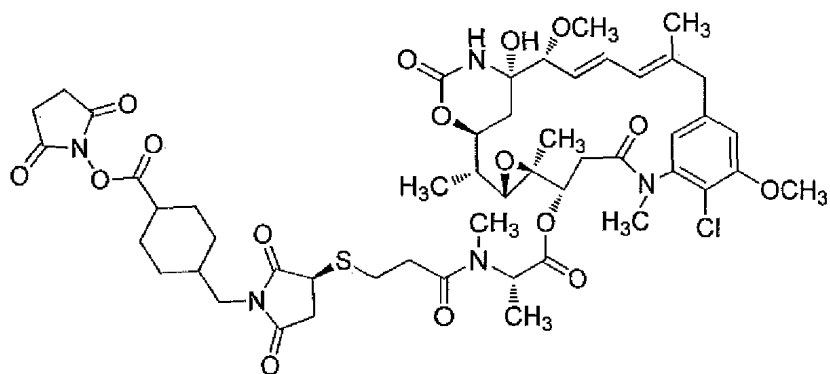
65. The process of claim 56, wherein the compound present in a diastereomeric excess is a compound of Formula IIa having the following structure:



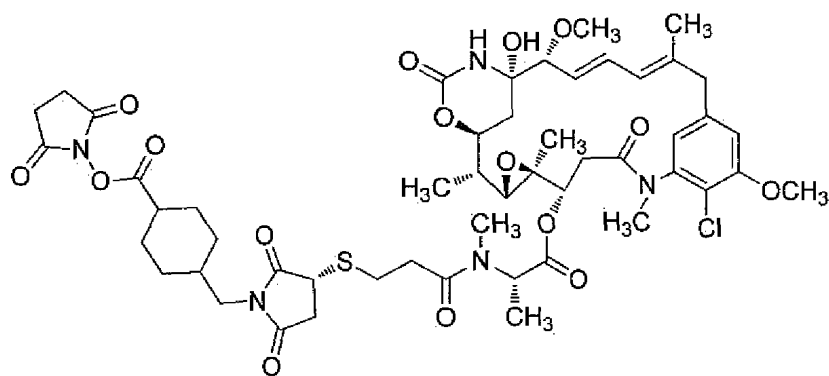
66. The process of claim 56, wherein the compound present in a diastereomeric excess is a compound of Formula IIb having the following structure:



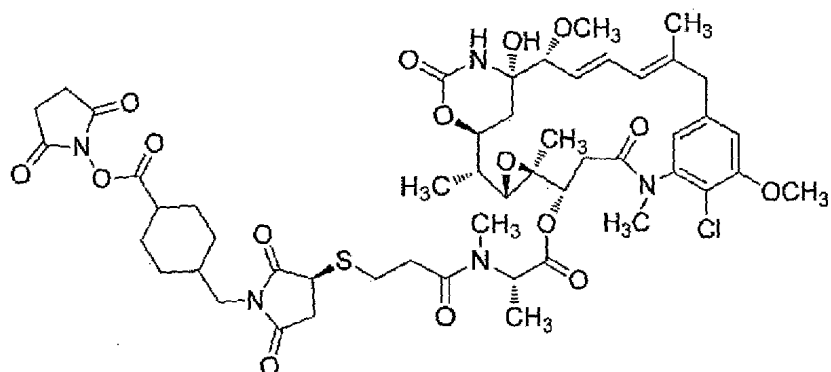
67. The process of claim 56, wherein the compound of Formula I is



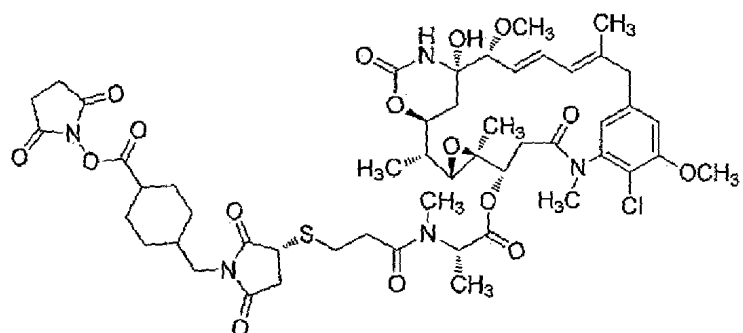
or



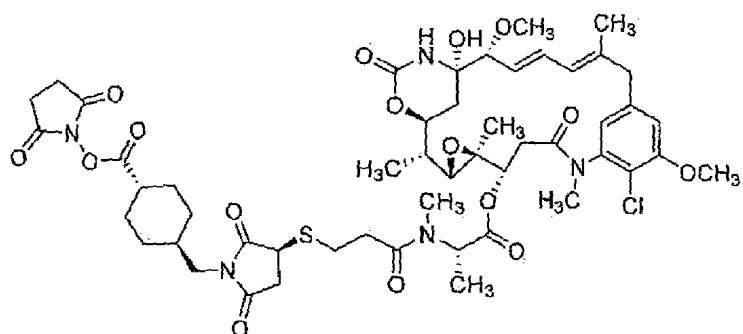
68. The process of claim 56, wherein the compound of Formula I is:



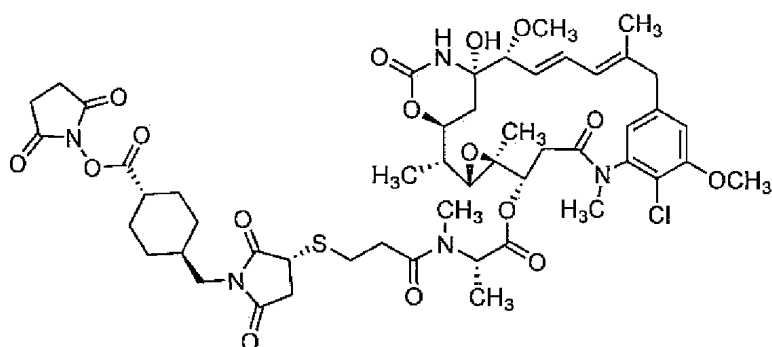
69. The process of claim 56, wherein the compound of Formula I is:



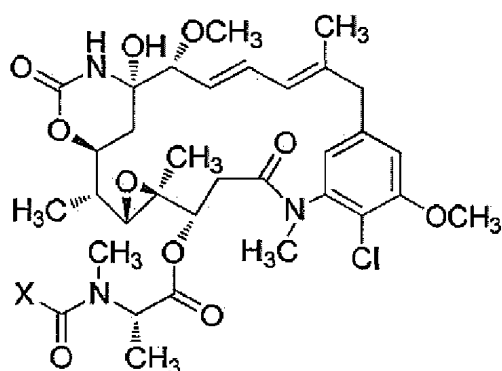
70. The process of claim 56, wherein the compound of Formula I is:



71. The process of claim 56, wherein the compound of Formula I is:

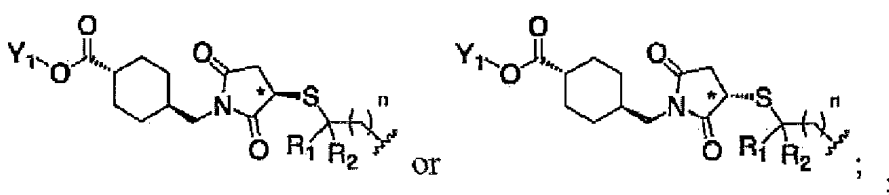


72. A compound of Formula I:

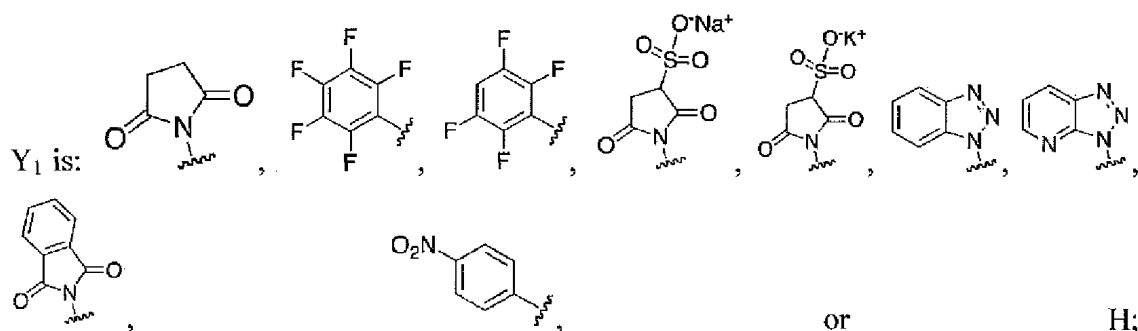


I;

wherein:



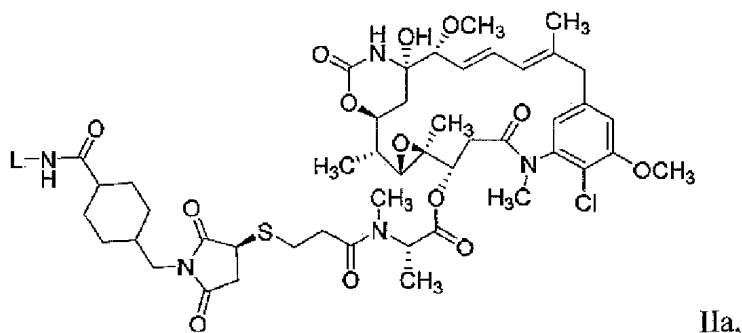
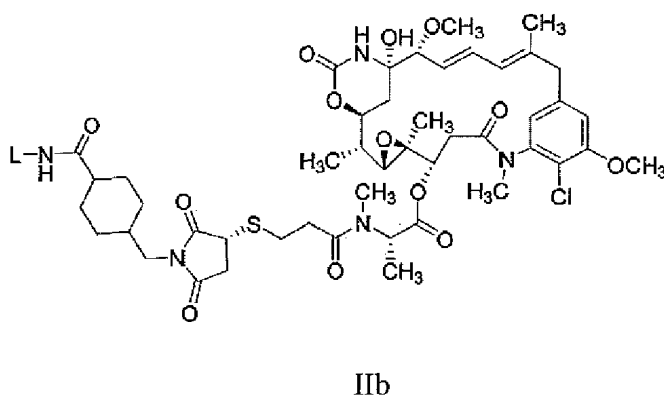
X is



R₁ and R₂ are independently selected from H or alkyl; and n is independently 0 or an integer from 1 to 50; prepared by the process of any one of claims of 29-47, or 50-51

wherein the compound of Formula I is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon represented by (*) in formula X of Formula I, wherein said chiral carbon atom is a carbon atom that is bound to a sulfur atom.

73. A compound of Formula IIa or IIb:



wherein: L is an antibody or an antigen-binding fragment thereof; and wherein the compound of Formula IIa or IIb is present in a diastereomeric excess of greater than 50% and wherein the diastereomers have different stereochemical configurations at the chiral carbon that is bound to the sulfur atom of Formula IIa or IIb; prepared by the process of any one of claims of 56-71.