WHAT IS CLAIMED IS:

1. A compound comprising

a tumor targeting domain comprising a moiety capable of recognizing or interacting with a molecular target on the surface of tumor cells;

a blood-protein binding domain; and

a sarcophagine-containing domain; wherein the moiety of the tumor targeting domain is distal to and sterically unimpeded by the blood-protein binding domain.

2. The compound of claim 1, wherein the tumor targeting domain binds to a tumor associated molecular target selected from one or more of a tumor-specific cell surface protein, prostate specific membrane antigen (PSMA), somatostatin peptide receptor-2 (SSTR2), alphavbeta3 (αvβ3), alphavbeta6, a gastrin-releasing peptide receptor, a seprase, fibroblast activation protein alpha (FAP-alpha), an incretin receptor, a glucose-dependent insulinotropic polypeptide receptor, VIP-1, NPY, a folate receptor, LHRH, a neuronal transporter (*e.g.*, noradrenaline transporter (NET)), EGFR, HER-2, VGFR, MUC-1, CEA, MUC-4, ED2,TF-antigen, an endothelial specific marker, neuropeptide Y, uPAR, TAG-72, a claudin, a CCK analog, VIP, bombesin, VEGFR, a tumor-specific cell surface protein, GLP-1, CXCR4, Hepsin, TMPRSS2, a caspace, cMET, or an overexpressed peptide receptor.

3. The compound of claim 1 or claim 2, wherein the tumor targeting domain comprises a modified antibody, modified antibody fragment, a modified binding peptide, a prostate specific membrane antigen ("PSMA") binding peptide, a somatostatin receptor agonist, a bombesin receptor agonist, a seprase binding compound, or binding fragement of any one or more thereof.

4. The compound of any one of claims 1-3, wherein the tumor targeting domain comprises belimumab, Mogamulizumab, Blinatumomab, Ibritumomab tiuxetan, Obinutuzumab, Ofatumumab, Rituximab, Inotuzumab ozogamicin, Moxetumomab pasudotox, Brentuximab vedotin, Daratumumab, Ipilimumab, Cetuximab, Necitumumab, Panitumumab, Dinutuximab, Pertuzumab, Trastuzumab, Trastuzumab emtansine, Siltuximab, Cemiplimab, Nivolumab, Pembrolizumab, Olaratumab, Atezolizumab, Avelumab, Durvalumab, Capromab pendetide, Elotuzumab, Denosumab, Ziv-aflibercept, Bevacizumab, Ramucirumab, Tositumomab, Gemtuzumab ozogamicin,

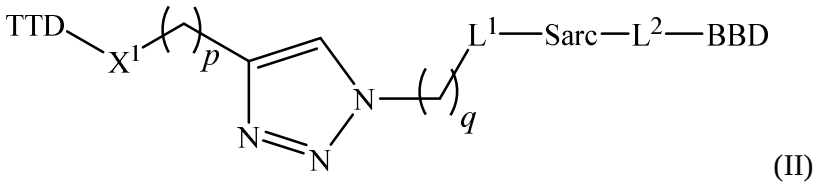
Alemtuzumab, Cixutumumab, Girentuximab, Nimotuzumab, Catumaxomab, or Etaracizumab.

5. The compound of any one of claims 1-3, wherein the tumor targeting domain comprises an antigen-binding fragment of belimumab, Mogamulizumab, Blinatumomab, Ibritumomab tiuxetan, Obinutuzumab, Ofatumumab, Rituximab, Inotuzumab ozogamicin, Moxetumomab pasudotox, Brentuximab vedotin, Daratumumab, Ipilimumab, Cetuximab, Necitumumab, Panitumumab, Dinutuximab, Pertuzumab, Trastuzumab, Trastuzumab emtansine, Siltuximab, Cemiplimab, Nivolumab, Pembrolizumab, Olaratumab, Atezolizumab, Avelumab, Durvalumab, Capromab pendetide, Elotuzumab, Denosumab, Ziv-aflibercept, Bevacizumab, Ramucirumab, Tositumomab, Gemtuzumab ozogamicin, Alemtuzumab, Cixutumumab, Girentuximab, Nimotuzumab, Catumaxomab, or Etaracizumab.

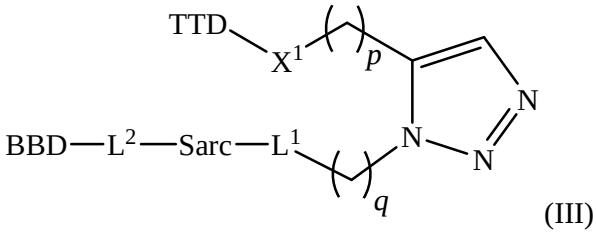
6. The compound of any one of claims 1-5, wherein the compound is of any one of Formulas I-V:



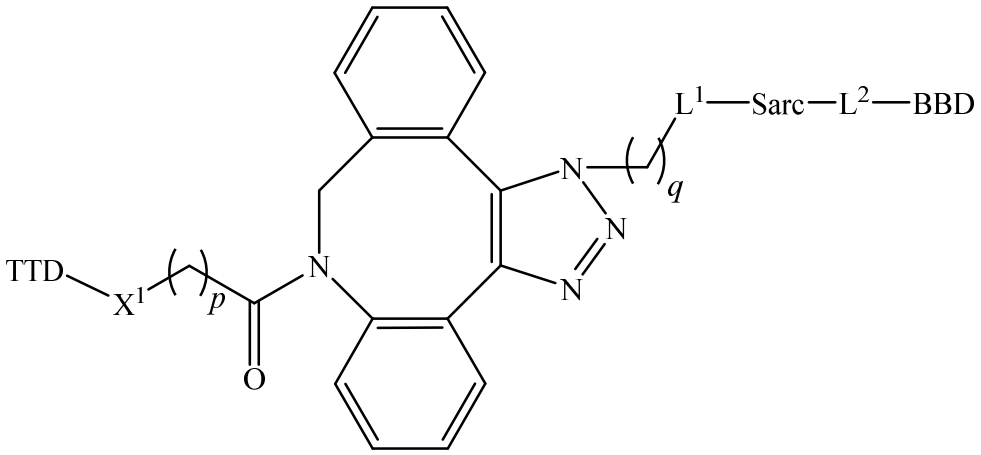
(I)



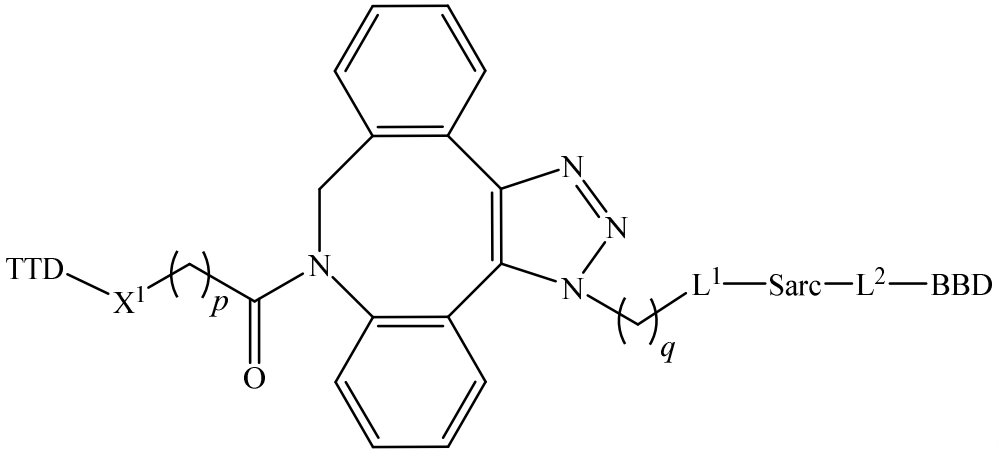
(II)



(III)



(IV)



(V)

or a pharmaceutically acceptable salt and/or solvate thereof, wherein

TTD is the tumor targeting domain;

BBD is the blood-protein binding domain;

Sarc is the sarcophagine-containing domain;

X^1 is independently at each occurrence absent, O, S, NH, -C(O)-, -C(O)-NR^1-, –NR^2-C(O)-, -C(O)-NR^3-C_1-C_{12} alkylene-,-C_1-C_{12} alkylene-C(O)-, -C(O)-NR^4-C_1-C_{12} alkylene-C(O)-, -arylene-, -heterocyclene-, –$O(CH_2CH_2O)_a$–, –CH_2CH_2–$O(CH_2CH_2O)_b$–, –CH_2CH_2–$O(CH_2CH_2O)_c$–CH_2CH_2–, –$O(CH_2CH_2O)_d$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_e$–, –$O(CH_2CH_2O)_f$–$CH_2CH_2C(O)$–,–C(O)–$O(CH_2CH_2O)_g$–, –C(O)–$O(CH_2CH_2O)_h$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_i$–$CH_2CH_2C(O)$–, –CH_2CH_2–$O(CH_2CH_2O)_j$–$CH_2CH_2C(O)$ –, –C(O)–NR^5–$CH_2CH_2O(CH_2CH_2O)_k$–, –C(O)–NR^6–$CH_2CH_2O(CH_2CH_2O)_l$–CH_2CH_2–, –C(O)–NR^7–$CH_2CH_2O(CH_2CH_2O)_m$–$CH_2CH_2C(O)$–, an amino acid, a peptide of 2, 3, 4, 5, 6, 7, 8, 9, or 10 amino acids, or a combination of any two or more

thereof, where *a*, *b*, *c*,*d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, and *m* are independently at each occurrence 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 ,16, 17, 18, or 19, and where R^1, R^2, R^3, R^4, R^5, R^6, and R^7 are independently at each occurrence H, alkyl, or aryl;

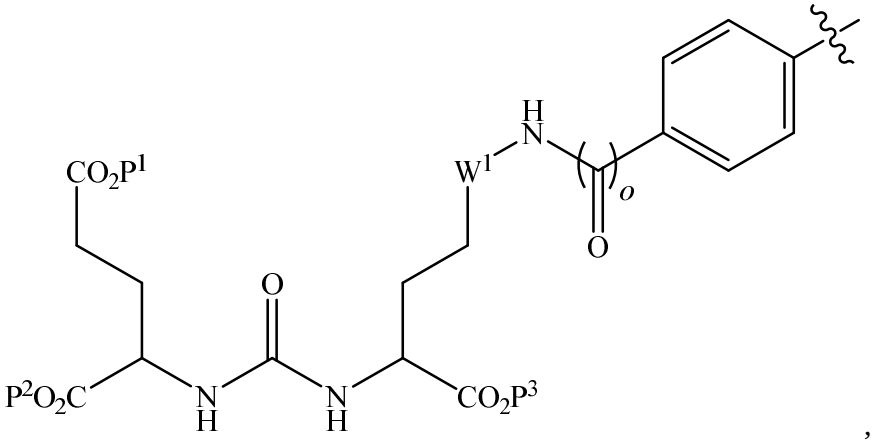
L^1 is independently at each occurrence absent, O, S, NH, -C(O)-, -C(O)-NR^8-, –NR^9-C(O)-, -C(O)-NR^{10}-C_1-C_{12} alkylene-,-C_1-C_{12} alkylene-C(O)-, -C(O)-NR^{11}-C_1-C_{12} alkylene-C(O)-, -arylene-, -heterocyclene-, –$O(CH_2CH_2O)_{a'}$–, –CH_2CH_2–$O(CH_2CH_2O)_{b'}$–, –CH_2CH_2–$O(CH_2CH_2O)_{c'}$–CH_2CH_2–, –$O(CH_2CH_2O)_{d'}$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_{e'}$–, –$O(CH_2CH_2O)_{f'}$–$CH_2CH_2C(O)$–, –C(O)–$O(CH_2CH_2O)_{g'}$–, –C(O)–$O(CH_2CH_2O)_{h'}$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_{i'}$–$CH_2CH_2C(O)$–, –CH_2CH_2–$O(CH_2CH_2O)_{j'}$–$CH_2CH_2C(O)$–, –C(O)–NR^{12}–$CH_2CH_2O(CH_2CH_2O)_{k'}$–, –C(O)–$NR^{13}$–$CH_2CH_2O(CH_2CH_2O)_{l'}$–$CH_2CH_2$–, –C(O)–$NR^{14}$–$CH_2CH_2O(CH_2CH_2O)_{m'}$–$CH_2CH_2C(O)$–, an amino acid, a peptide of 2, 3, 4, 5, 6, 7, 8, 9, or 10 amino acids, or a combination of any two or more thereof, where *a'*, *b'*, *c'*, *d'*, *e'*, *f'*, *g'*, *h'*, *i'*, *j'*, *k'*, *l'*, and *m'* are independently at each occurrence 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 ,16, 17, 18, or 19, and where R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, and R^{14} are independently at each occurrence H, alkyl, or aryl;

L^2 is independently at each occurrence absent, O, S, NH, -C(O)-, -C(O)-NR^{15}-, –NR^{16}-C(O)-, -C(O)-NR^{17}-C_1-C_{12} alkylene-,-C_1-C_{12} alkylene-C(O)-, -C(O)-NR^{18}-C_1-C_{12} alkylene-C(O)-, -arylene-, -heterocyclene-, –$O(CH_2CH_2O)_{a''}$–, –CH_2CH_2–$O(CH_2CH_2O)_{b''}$–, –CH_2CH_2–$O(CH_2CH_2O)_{c''}$–CH_2CH_2–, –$O(CH_2CH_2O)_{d''}$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_{e''}$–, –$O(CH_2CH_2O)_{f''}$–$CH_2CH_2C(O)$–, –C(O)–$O(CH_2CH_2O)_{g''}$–, –C(O)–$O(CH_2CH_2O)_{h''}$–CH_2CH_2–, –C(O)–$O(CH_2CH_2O)_{i''}$–$CH_2CH_2C(O)$–, –CH_2CH_2–$O(CH_2CH_2O)_{j''}$–$CH_2CH_2C(O)$ –, –C(O)–NR^{19}–$CH_2CH_2O(CH_2CH_2O)_{k''}$–, –C(O)–$NR^{20}$–$CH_2CH_2O(CH_2CH_2O)_{l''}$–$CH_2CH_2$–, –C(O)–$NR^{21}$–$CH_2CH_2O(CH_2CH_2O)_{m''}$–$CH_2CH_2C(O)$–, an amino acid, a peptide of 2, 3, 4, 5, 6, 7, 8, 9, or 10 amino acids, or a combination of any two or more thereof, where *a''*, *b''*, *c''*, *d''*, *e''*, *f''*, *g''*, *h''*, *i''*, *j''*, *k''*, *l''*, and *m''* are independently at each occurrence 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 ,16, 17, 18, or 19, and where R^{15}, R^{16}, R^{17}, R^{18}, R^{19}, R^{20}, and R^{21} are independently at each occurrence H, alkyl, or aryl;

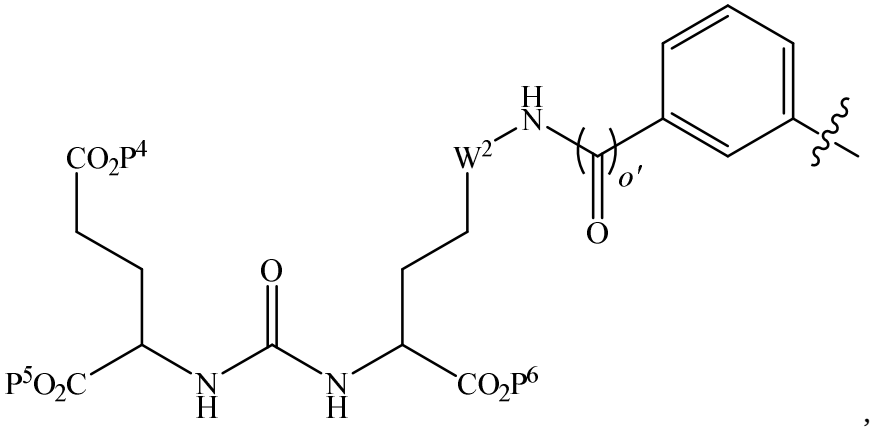
p is independently at each occurrence 0, 1, 2, 3, 4, or 5; and

q is independently at each occurrence 1 or 2.

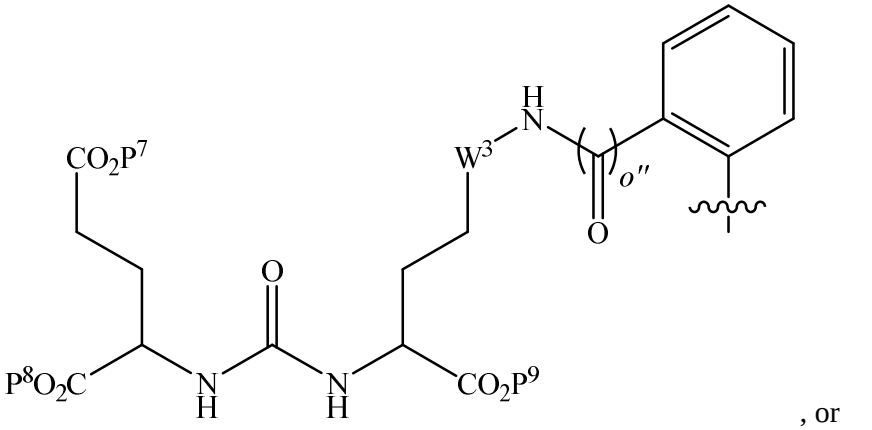
7. The compound of any one of claims 1-6, wherein the tumor targeting domain is



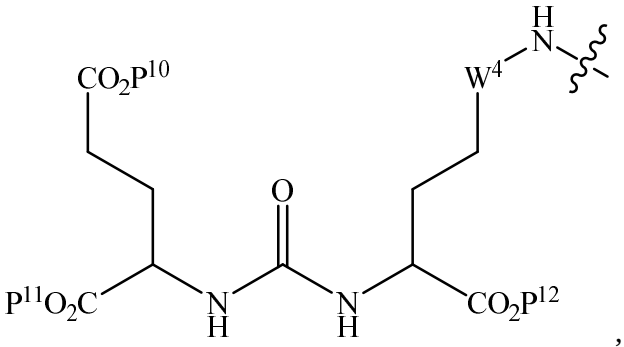
,



,



, or



, wherein

W^1, W^2, W^3, and W^4 are each independently –C(O)–, $–(CH_2)_r–$, or $–(CH_2)_s–$NH-C(O)–;

r is independently at each occurrence 1 or 2;

s is independently at each occurrence 1 or 2;

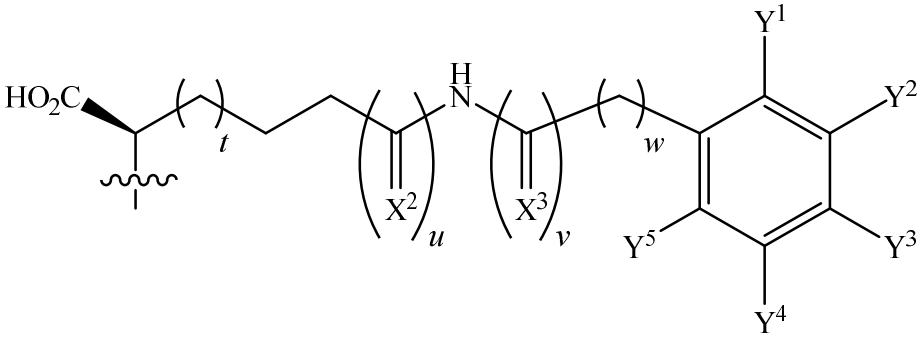
P^1, P^2, P^3, P^4, P^5, P^6, P^7, P^8, P^9, P^{10}, P^{11}, and P^{12} are each independently H, methyl, benzyl, 4-methoxybenzyl, or *tert*-butyl; and

o, *o'*, and *o''* are each independently 0 or 1.

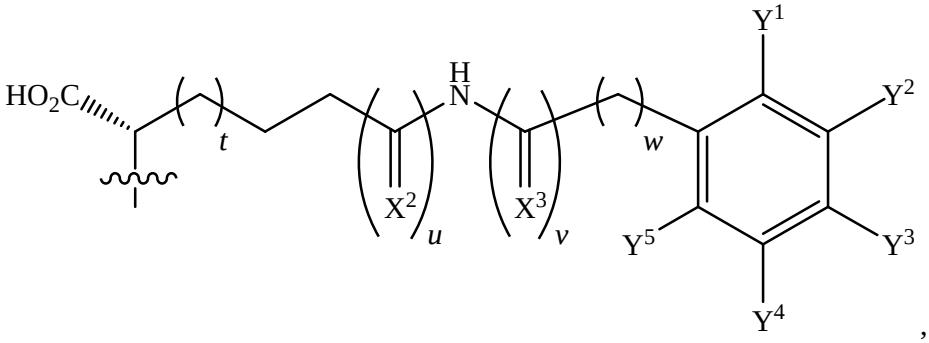
8. The compound of claim 7, wherein P^1, P^2, P^3, P^4, P^5, P^6, P^7, P^8, P^9, P^{10}, P^{11}, and P^{12} are each independently H or *tert*-butyl.

9. The compound of claim 7 or claim 8, wherein P^1, P^2, P^3, P^4, P^5, P^6, P^7, P^8, P^9, P^{10}, P^{11}, and P^{12} are each independently H.

10. The compound of any one of claims 1-9, wherein the blood-protein binding domain is



or



, wherein

Y^1, Y^2, Y^3, Y^4, and Y^5 are independently at each occurrence H, halo, or alkyl;

X^2 and X^3 are each independently O or S

t is independently at each occurrence 0, 1, or 2;

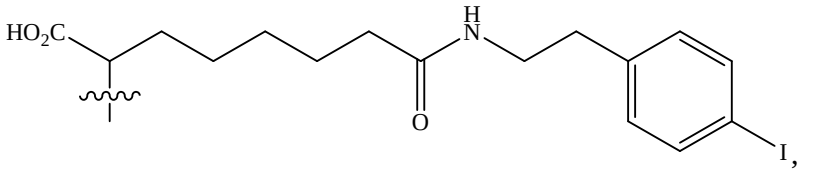
u is independently at each occurrence 0 or 1;

v is independently at each occurrence 0 or 1; and

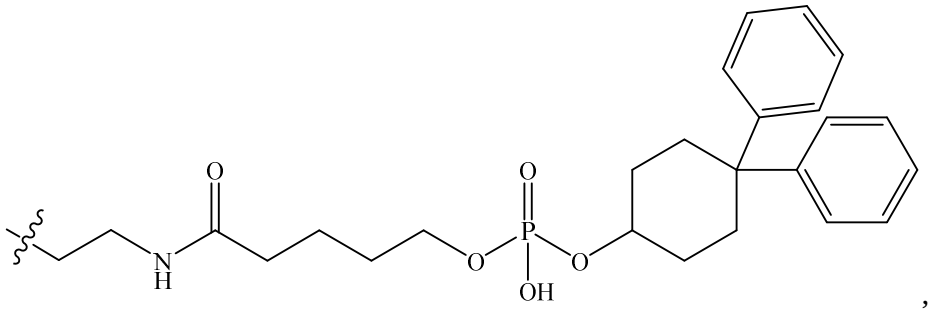
w is independently at each occurrence 0, 1, 2, 3, or 4, optionally wherein *u* and *v* cannot be the same value.

11. The compound of any one of claims 1-9, wherein the blood-protein binding domain comprises myristic acid, a substituted or unsubstituted indole-2-carboxylic acid, a substituted or unsubstituted thioamide, a substituted or unsubstituted 4-oxo-4-(5,6,7,8-tetrahydronaphthalen-2-yl)butanoic acid, a substituted or unsubstituted naphthalene acylsulfonamide, a substituted or unsubstituted diphenylcyclohexanol phosphate ester, a substituted or unsubstituted 4-iodophenylalkanoic acid, a substituted or unsubstituted 3-(4-iodophenyl)propionic acid, a substituted or unsubstituted 2-(4-iodophenyl)acetic acid, or a substituted or unsubstituted 4-(4-iodophenyl)butanoic acid.

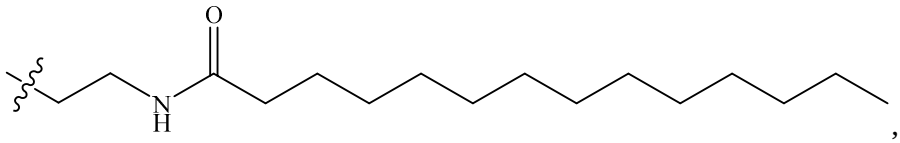
12. The compound of any one of claims 1-9, wherein the blood-protein binding domain is



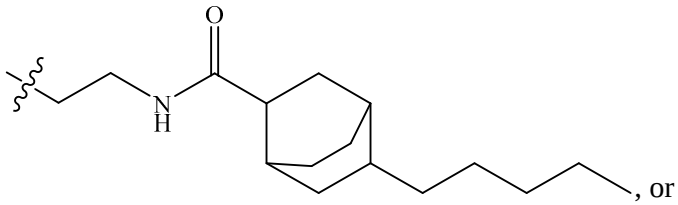
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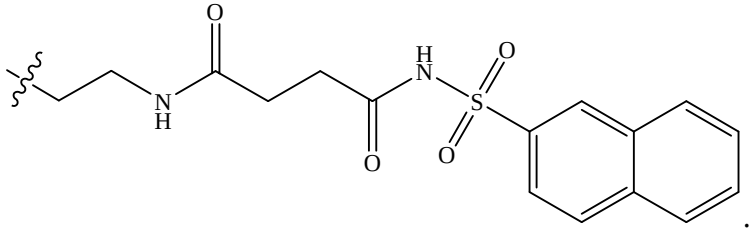
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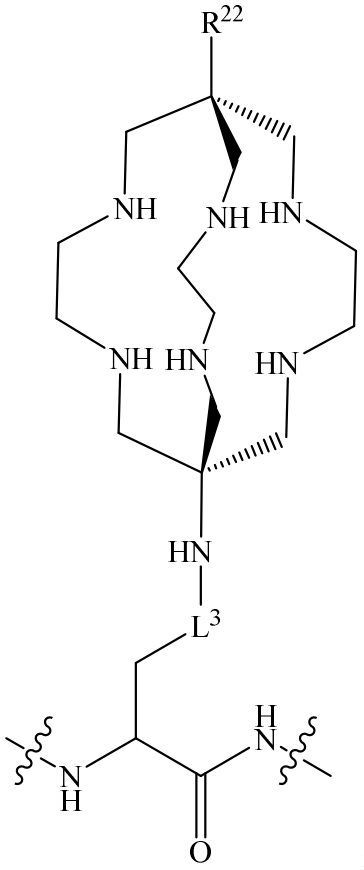


, or



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13. The compound of any one of claims 1-12, wherein the sarcophagine-containing domain is



; wherein

R^{22} is H, alkyl, aryl, or $NR^{23}R^{24}$;

R^{23} and R^{24} are each independently H, alkyl, aryl, alkanoyl, or aryloyl;

L^3 is absent, -C(O)-, -C_1-C_{12} alkylene-,-C_1-C_{12} alkylene-C(O)-, -NR^{25}C(O)-C_1-C_{12} alkylene-C(O)-, -C_1-C_{12} alkylene-NR^{25}C(O)-C_1-C_{12} alkylene-C(O)-,

-arylene-, -C_1-C_{12} alkylene-C(O)NR^{25}-CH_2-phenylene-CH_2-,

-C_1-C_{12} alkylene-C(O)NR^{25}-CH_2-phenylene-C(O)-, -C_1-C_{12} alkylene-NR^{25}C(O)-C_1-C_{12} alkylene-C(O)-C(O)NR^{25}-CH_2-phenylene-CH_2-, or -C_1-C_{12} alkylene-NR^{25}C(O)-C_1-C_{12} alkylene-C(O)-C(O)NR^{25}-CH_2-phenylene-C(O)-; and

R^{25} is independently at each occurrence H, alkyl, or aryl.

14. The compound of claim 13, wherein R^{22} is H, methyl, or NH_2.

15. The compound of any one of claims 1-14, wherein the sarcophagine-containing domain chelates $^{64}Cu^{+2}$ or $^{67}Cu^{+2}$.

16. A composition comprising a compound of any one of claims 1-15 and a pharmaceutically acceptable carrier.

17. A pharmaceutical composition, the composition comprising

an effective amount of a compound of claim 15 for imaging and/or detecting one or more of non-small cell lung cancer, small cell carcinoma of the lung, bladder cancer, colon cancer, gallbladder cancer, pancreatic cancer, esophageal cancer, melanoma, liver cancer, primary gastric adenocarcinoma, primary colorectal adenocarcinoma, renal cell carcinoma, prostate cancer, a neuroendocrine tumor, a pituitary tumor, a vasoactive intestinal peptide-secreting tumor, a glioma, breast cancer, an adrenal cortical cancer, a cervical carcinoma, a vulvar carcinoma, an endometrial carcinoma, a primary ovarian carcinoma, a metastatic ovarian carcinoma, and a metastatic cancer; and

a pharmaceutically acceptable carrier.

18. A method comprising

administering to a subject an effective amount of a compound of claim 15 for imaging and/or detecting a cancer; and

subsequent to the administering, detecting one or more of positron emission, gamma rays from positron emission and annihilation, and Cerenkov radiation due to positron emission.

19. The method of claim 18, wherein the cancer comprises one or more of non-small cell lung cancer, small cell carcinoma of the lung, bladder cancer, colon cancer, gallbladder cancer, pancreatic cancer, esophageal cancer, melanoma, liver cancer, primary gastric adenocarcinoma, primary colorectal adenocarcinoma, renal cell carcinoma, prostate cancer, a neuroendocrine tumor, a pituitary tumor, a vasoactive intestinal peptide-secreting tumor, a glioma, breast cancer, an adrenal cortical cancer, a cervical carcinoma, a vulvar carcinoma, an endometrial carcinoma, a primary ovarian carcinoma, a metastatic ovarian carcinoma, and a metastatic cancer.

20. The method of claim 18 or claim 19, wherein the subject is suspected of suffering from a mammalian tissue overexpressing prostate specific membrane antigen ("PSMA").

21. The method of any one of claims 18-20, wherein the mammalian tissue comprises one or more of non-small cell lung cancer, small cell carcinoma of the lung, bladder cancer, colon cancer, gallbladder cancer, pancreatic cancer, esophageal cancer, melanoma, liver cancer, primary gastric adenocarcinoma, primary colorectal adenocarcinoma, renal cell carcinoma, prostate cancer, a neuroendocrine tumor, a pituitary tumor, a vasoactive intestinal peptide-secreting tumor, a glioma, breast cancer, an adrenal cortical cancer, a cervical carcinoma, a vulvar carcinoma, an endometrial carcinoma, a primary ovarian carcinoma, a metastatic ovarian carcinoma, and a metastatic cancer.

22. The method of claim 21, the compound to be administered comprises parenteral administration or intravenous administration.

23. A pharmaceutical composition comprising

an effective amount of a compound of claim 15 for treating one or more of non-small cell lung cancer, small cell carcinoma of the lung, bladder cancer, colon cancer, gallbladder cancer, pancreatic cancer, esophageal cancer, melanoma, liver cancer, primary gastric adenocarcinoma, primary colorectal adenocarcinoma, renal cell carcinoma, prostate cancer, a neuroendocrine tumor, a pituitary tumor, a vasoactive intestinal peptide-secreting tumor, a glioma, breast cancer, an adrenal cortical cancer, a cervical carcinoma, a vulvar carcinoma, an endometrial carcinoma, a primary ovarian carcinoma, a metastatic ovarian carcinoma, and a metastatic cancer; and

a pharmaceutically acceptable carrier.

24. Use of an effective amount of a compound of claim 15 in the manufacture of a medicament for the treatment of a cancer, wherein said medicament is to be administered to a subject.

25. The use of claim 24, wherein the cancer comprises one or more of non-small cell lung cancer, small cell carcinoma of the lung, bladder cancer, colon cancer, gallbladder cancer, pancreatic cancer, esophageal cancer, melanoma, liver cancer, primary gastric

adenocarcinoma, primary colorectal adenocarcinoma, renal cell carcinoma, prostate cancer, a neuroendocrine tumor, a pituitary tumor, a vasoactive intestinal peptide-secreting tumor, a glioma, breast cancer, an adrenal cortical cancer, a cervical carcinoma, a vulvar carcinoma, an endometrial carcinoma, a primary ovarian carcinoma, a metastatic ovarian carcinoma, and a metastatic cancer.

26. The use of claim 24 or claim 25, wherein the compound to be administered comprises parenteral administration or intravenous administration.

27. An effective amount of a compound of claim 15 for use as a medicament.