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(71) Applicant: **CYTOMX THERAPEUTICS, INC.** [US/US]; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US).

(72) Inventors: **HUMPHREY, Rachel**; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US). **CARMAN, Lori**; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US). **WILL, Matthias**; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US). **ZHENG, Beiyao**; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US). **BALINSKI, Kathe**; 151 Oyster Point Blvd., Suite 400, South San Francisco, California 94080 (US).

(74) Agent: **ELRIFI, Ivor** et al.; Cooley LLP, 1299 Pennsylvania Avenue, NW, Suite 700, Washington, District of Columbia 20004-2400 (US).

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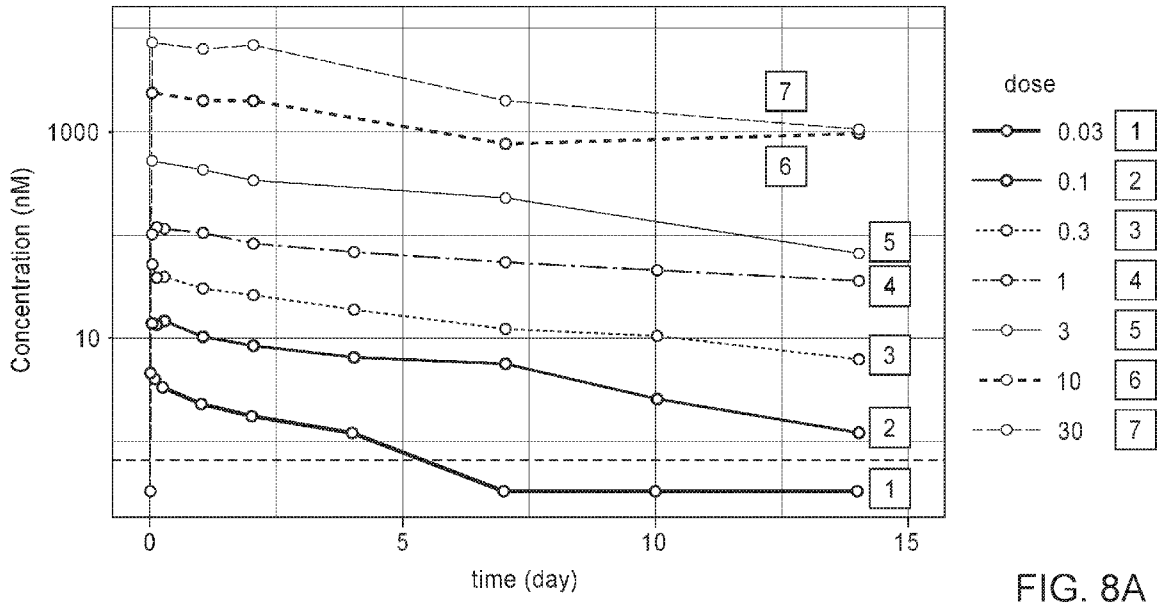

FIG. 8A

(57) Abstract: The invention relates generally to activatable antibodies that specifically bind to PDL1 and methods of making and using these anti-PDL1 activatable antibodies in a variety of therapeutic, diagnostic and prophylactic indications.

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[Continued on next page]

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ACTIVATABLE ANTI-PDL1 ANTIBODIES, AND METHODS OF USE THEREOF

Related Applications

[0001] This application claims the benefit of U.S. Provisional Application No. 62/513,937, filed June 1, 2017, U.S. Provisional Application No. 62/534,950, filed July 20, 2017, U.S. Provisional Application No. 62/555,598, filed September 7, 2017, and U.S. Provisional Application No. 62/657,567, filed April 13, 2018, the contents of each of which are incorporated herein by reference in its entirety.

Field of the Invention

[0002] This invention generally relates to specific dosing regimens for administering anti-PDL1 activatable antibodies for the treatment of cancer.

Background of the Invention

[0003] Antibody-based therapies have proven effective treatments for several diseases but in some cases, toxicities due to broad target expression have limited their therapeutic effectiveness. In addition, antibody-based therapeutics have exhibited other limitations such as rapid clearance from the circulation following administration.

[0004] In the realm of small molecule therapeutics, strategies have been developed to provide prodrugs of an active chemical entity. Such prodrugs are administered in a relatively inactive (or significantly less active) form. Once administered, the prodrug is metabolized *in vivo* into the active compound. Such prodrug strategies can provide for increased selectivity of the drug for its intended target and for a reduction of adverse effects.

[0005] Accordingly, there is a continued need in the field of antibody-based therapeutics for antibodies that mimic the desirable characteristics of the small molecule prodrug.

Summary of the Invention

[0006] In various aspect the invention provides methods of treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, by administering intravenously at a dose of about between 0.3 mg/kg to 30 mg/kg of an activatable anti-PDL1 antibody to the subject. The activatable antibody has an antibody (AB) that specifically binds to human PDL1, The AB has a heavy chain variable region having a complementarity

determining region 1 (CDRH1) having the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence or SEQ ID NO:235; and a light chain variable region having a light chain complementarity determining region 1 (CDRL1) having the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228; a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and a masking moiety (MM) linked to the CM.

[0007] Also included in the invention are methods of treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, by administering intravenously at a fixed dose of about between 24 and 2400 mg of an activatable anti-PDL1 antibody to the subject, wherein the activatable antibody has an antibody (AB) that specifically binds to human PDL1, wherein the AB comprises a heavy chain variable region having a complementarity determining region 1 (CDRH1) having the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence or SEQ ID NO:235; and a light chain variable region having a light chain complementarity determining region 1 (CDRL1) having the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228; a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and a masking moiety (MM) linked to the AB.

[0008] In another aspect the invention provides an activatable anti-PDL1 antibody hving an antibody (AB) that specifically binds to human PDL1. Thehe AB hasa heavy chain variable region having a complementarity determining region 1 (CDRH1) having the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence or SEQ ID NO:235; and a light chain variable

region having a light chain complementarity determining region 1 (CDRL1) having the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228; a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and a masking moiety (MM) linked to the CM, for use in treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, and wherein the activatable antibody is administered intravenously at a dose of about between 0.3 mg/kg to 30 mg/kg

[0009] In a further apect the invention provides an activatable anti-PDL1 antibody having an antibody (AB) that specifically binds to human PDL1. The AB has a heavy chain variable region having a complementarity determining region 1 (CDRH1) having the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence or SEQ ID NO:235; and a light chain variable region having a light chain complementarity determining region 1 (CDRL1) having the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228, a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and a masking moiety (MM) linked to the CM, for use in treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, and wherein the activatable antibody is administered intravenously at a fixed dose of about between 24 and 2400 mg.

[0010] The MM inhibits the binding of the AB to human PDL1 when the activatable antibody is in an uncleaved state. In some aspects the MM had the amino acid sequence of SEQ ID NO: 63.

[0011] In some aspects the CM has the amino acid sequence of SEQ ID NO: 377.

[0012] The AB has a heavy chain variable region (VH) having the amino acid sequence of SEQ ID NO: 46 and a light chain variable (VL) having the amino acid sequence of SEQ ID NO: 58 or SEQ ID NO: 137.

[0013] In further aspects the activatable antibody has a light chain having the amino acid sequence of SEQ ID NO: 1008 and a heavy chain having the amino acid sequence of SEQ ID NO: 432.

[0014] Alternatively, the activatable antibody having a light chain having the amino acid sequence of SEQ ID NO: 428 and a heavy chain having the amino acid sequence of SEQ ID NO: 432.

[0015] The dose is about between 3 mg/kg to 10 mg/kg. The dose is about between 3 mg/kg to 15 mg/kg. The dose is 0.3 mg/kg, 1 mg/kg, 3 mg/kg, 6 mg/kg, 10 mg/kg, 15 mg/kg, or 30 mg/kg.

[0016] The fixed dose is 240 mg, 480 mg, 800 mg, 1200 mg, 2400 mg.

[0017] The activatable antibody is administered on a schedule of one dose every 7-28 days, For example activatable antibody is administered on a schedule the one dose every 14 days or 21 days.

[0018] The activatable antibody is administrated as a monotherapy. Alternatively, activatable antibody is administrated as a component of a combination therapy. The combination therapy includes administering a dose of an anti-CTLA-4 antibody or a B-RAF inhibitor

[0019] The anti-CTLA-4 antibody is for example, ipilimumab. The anti-CTLA-4 antibody is administered intravenously. The anti-CTLA-4 antibody is administered at a dose of 3 mg/kg, 6 mg/kg or 10 mg/kg. Alternatively, the anti-CTLA-4 antibody is administered at a fixed dose 240 mg, 480 mg or 800 mg.

[0020] The B-RAF inhibitor is vemurafenib. The B-RAF inhibitor is administered orally. The B-RAF inhibitor is administered at a dose of 960 mg or at a dose of 875 mg. The activatable antibody and the B-RAF inhibitor are administered over a same period of time.

[0021] In some aspects the dose of the B-RAF inhibitor is administered twice daily. In other aspects at least 4 doses each of the activatable antibody and the B-RAF inhibitor are administered.

[0022] In some aspects multiple doses of the activatable antibody and the anti-CTLA-4 antibody are administerd over a first period of time, followed by administration of multiple doses of the activatable antibody as a monotherapy over a second period of time.

[0023] In further aspects, the activatable antibody and a dose of the anti-CTLA-4 antibody are administered concomitantly as a combination therapy every 21 days for 4 doses, followed by administration of a dose of the activatable antibody as a monotherapy every 14 days.

[0024] In yet another aspect multiple doses of the activatable antibody as a monotherapy are administered over a first period of time, followed by concomitant administration of multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy are administered over a second period of time.

[0025] In a yet a further aspect multiple doses of the activatable antibodyare administered as a monotherapy over a first period of time, multiple doses of the activatable antibody and the anti-CTLA-4 antibody are subsequently administered as a combination therapy over a second period of time, and multiple doses of the activatable antibody as a monotherapy are administered over a third period of time.

[0026] In other aspects, the activatable antibody is administered as a monotherapy every 14 days for 4 doses, followed by administration of a dose of activatable antibody and a dose of anti-CTLA-4 antibody as a combination therapy every 21 days, for 4 doses, followed by administration of a dose an activatable antibody as a monotherapy every 14 days.

[0027] The the cancer is an advanced, unresectable solid tumor or lymphoma. For example, the advanced unresectable tumor is a PDL1-responsive tumor type.

[0028] The cancer is a carcinoma such as carcinoma squamous cell carcinoma.

[0029] The cancer is for example, an anal squamous cell carcinoma, basal cell carcinoma, bladder cancer, bone cancer, bowel carcinoma, breast cancer, carcinoid, castration-resistant prostate cancer (CRPC), cervical carcinoma, colorectal cancer (CRC), colon cancer cutaneous squamous cell carcinoma, endometrial cancer, esophageal cancer, gastric carcinoma, gastroesophageal junction cancer, glioblastoma/ mixed glioma, glioma, head and neck cancer, hepatocellular carcinoma, hematologic malignancy. liver cancer, lung cancer, melanoma, Merkel cell carcinoma, multiple myeloma, nasopharyngeal cancer, osteosarcoma, ovarian cancer, pancreatic cancer, peritoneal carcinoma, undifferentiated pleomorphic sarcoma, prostate cancer, rectal carcinoma, renal cancer, sarcoma, salivary gland carcinoma, squamous cell carcinoma, stomach cancer, testicular cancer, thymic carcinoma, thymic epithelial tumor,

thymoma, thyroid cancer, urogenital cancer, urothelial cancer, uterine carcinoma , or uterine sarcoma.

[0030] The cancer is a High Tumor Mutational Burden (hTMB) cancer.

[0031] The breast cancer is triple negative breast cancer or estrogen receptor positive breast cancer.

[0032] The hematologic malignancy is a lymphoma or a leukemia. The lymphoma is for example, a B-cell lymphoma, a T-cell lymphoma, Hodgkin's lymphoma, or an EBV lymphoma, primary mediastinal B-cell lymphoma.

[0033] The cancer is melanoma.

[0034] The bowel carcinoma is for example small bowel carcinoma or small bowel adenocarcinoma. The colon cancer is colon adenocarcinoma,

[0035] The lung cancer is for example non-small cell lung cancer (NSCLC) or small cell lung cancer. The NSCLC is non-squamous NSCLC or squamous NSCLC.

[0036] The prostate cancer is small cell neuroendocrine prostate cancer.

[0037] The renal cancer is renal cell carcinoma or renal sarcoma.

[0038] Preferably, the cancer is undifferentiated pleomorphic sarcoma, small bowel adenocarcinoma, Merkel cell carcinoma, thymic carcinoma, anal squamous cell carcinoma, cutaneous squamous cell carcinoma or triple negative breast cancer.

[0039] The subject exhibits one or more of the following characteristicsPD-1/PDL1 inhibitor-naïve, CTLA-4 inhibitor-naïve, *BRAF*^{V600E} mutation positive, BRAF inhibitor-naïve, PDL1 positive, PDL1 unknown, been previously treated with a PD1/PDL1 inhibitor has no further standard of care available the PD1/PDL1 inhibitor therapy is not approved for the subject's cancer, t has been previously treated with a PD-1/PDL1 inhibitor, wherein treatment with the PD-1/PDL1 inhibitor was discontinued for reasons other than toxicity, and wherein the subject is CTLA-4 inhibitor-naïve, is immunotherapy naïve.

[0040] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. In the specification, the singular forms also include the plural unless the context clearly dictates otherwise. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. In the case of conflict, the present specification,

including definitions, will control. In addition, the materials, methods and examples are illustrative only and are not intended to be limiting.

[0041] Other features and advantages of the invention will be apparent from the following detailed description and claims.

Brief Description of the Drawings

[0042] FIG. 1A is a schematic representation of the study design for a study in Example 2, where "AA" represents the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2, which comprises the heavy chain sequence of SEQ ID NO: 432 and the light chain sequence of SEQ ID NO: 428.

[0043] FIG. 1B is a schematic representation of a study design for the study in Example 2, where "AA" represents the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2, which comprises the heavy chain sequence of SEQ ID NO: 432 and the light chain sequence of SEQ ID NO: 428. As compared to FIG. 1A, this schematic representation includes a further optional Part A2 in the study design.

[0044] FIG. 2 shows a series of graphs depicting detection of cleaved and intact anti-PD-L1 activatable antibodies in tumor and plasma samples determined using the WES system (ProteinSimple, San Jose, CA) under conditions similar to those described in the WES instrumentation manual.

[0045] FIGS. 3A and 3B are a series of graphs depicting screening of PL07-2001-C5H9v2 anti-idiotypic (anti-id) clones against 37% one-armed activated activatable antibody at 0.11, 0.33 and 1 ug/ml in human plasma at 1:100. FIG. 3A is an electropherogram showing 17G1 detection of decreasing concentration of one arm activated PL07-2001-C5H9v2 (1, 0.33, and 0.11 ug/ml, referred to in the FIG. as AA MIX). FIG. 3B demonstrates relative activation percent for the top 6 clones of one arm activated activatable antibody. The relative activation rate is preserved at different concentrations. 21H10 and 27C1 clones have lower affinity resulting in no data for the 0.11 ug/ml concentration.

[0046] FIGS. 4A, 4B, 4C, and 4D are a series of graphs depicting that the antibody referred to herein as 17G1 has high specificity to the activatable antibody (AA) PL07-2001-C5H9v2. 17G1 was assessed on the Wes for specificity by spiking 160 ng/ml of one arm activated PL07-2001-C5H9v2 (activated AA) into either human plasma (FIG. 4C) or lung tumor lysates (FIG. 4D).

[0047] FIGS. 5A and 5B are a series of graphs depicting specific detection of activatable antibody (AA) therapeutics by selective anti-idiotypic antibodies. FIG. 5A demonstrates detection of the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2 in plasma of mice treated with 10 mg/kg of PL07-2001-C5H9v2 using A110UK (Goat Anti-Human IgG (H&L) adsorbed against monkey unlabeled) from American Qualex (available on the web at aqsp.com/). FIG. 5B demonstrates detection of PL07-2001-C5H9v2 in plasma of mice treated with 0.1 mg/kg of PL07-2001-C5H9v2 using an anti-idiotypic 17G1 antibody.

[0048] FIG. 6A and FIG. 6B are a series of graphs depicting preferential activation of activatable antibody (AA) therapeutics in tumor versus plasma detected in xenograft tumor model. MDA-MB-231 xenograft mice were treated with 1 mg/ml of the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2. Tumor and plasma samples were collected on day 4. FIGS. 6A and 6B demonstrate the analysis of tumor homogenate and plasma samples by a Wes (ProteinSimple) based capillary electrophoresis immunoassay method of the disclosure.

[0049] FIGS. 7A and 7B are a series of graphs depicting preferential activation of activatable antibody therapeutics in tumor versus plasma detected in another xenograft tumor model. SAS xenograft mice were treated with 0.1 mg/kg of the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2. FIGS. 7A and 7B demonstrate the analysis of tumor homogenate and plasma samples by a Wes (ProteinSimple) based capillary electrophoresis immunoassay method of the disclosure.

[0050] FIGS. 8A and 8B are graphs of median plasma concentration of intact (uncleaved) and total (i.e., intact and cleaved) PL07-2001-C5H9v2 (nM), respectively, versus time (day) following administration of up to 30 mg/Kg q2W to Cohorts A and A2 Cycle 1 Dose 1. The dashed line represents the limit of quantitation (LLOOQ) for the assay, and in this representation, only below LOQ (BLOQ) data are assigned a value of LOQ/2.

[0051] FIG. 9A depicts the best percentage change from baseline in target lesions after administration of PL07-2001-C5H9v2. FIG. 9B is a spider plot depicting the change in target lesion (%) vs. time after administration of PL07-2001-C5H9v2. Abbreviations: CR, castration-resistant; ER + BC, estrogen receptor-positive breast cancer; HNSCC, head and neck

squamous cell carcinoma; PD, progressive disease; PR, partial response; RECIST, Response Evaluation Criteria in Solid Tumors; SD, stable disease; TNBC, triple-negative breast cancer.

[0052] FIG. 10A depicts the best percentage change from baseline in target lesions after administration of the combination of PL07-2001-C5H9v2 + ipilimumab. FIG 10B is a spider plot depicting the change in target lesion (%) vs. time after administration of PL07-2001-C5H9v2. Abbreviations: CR, complete response; ER+BC, estrogen receptor-positive breast cancer; HNSCC, head and neck squamous cell carcinoma; PD, progressive disease; PR, partial response, RECIST, Response Evaluation Criteria in Solid Tumors; SCC, squamous cell carcinoma; SCLC, small cell lung cancer; SD, stable disease; TNBC, triple-negative breast cancer.

Detailed Description of the Invention

[0053] The present disclosure provides methods of treating cancer by administering an activatable anti-PDL1 antibody. Specifcally, the invention is based upon the results of the first ever human safety and efficacy study of an activatable antibody. A dose escalation study was performed to evaluate the safety and efficacy of PL07-2001-C5H9v2 as a monotherapy or in combination with ipilimumab PL07-2001-C5H9v2 is protease activated anti-PDL1 antibody. PL07-2001-C5H9v2 is activated by tumor associated proteases and has been shown to be inactive in circulation.

[0054] Patients, with metastatic, or advanced unresectable solid tumors or lymphoma were intravenously administered 0.03mg/kg -30 mg/kg PL07-2001-C5H9v2 every three weeks. Among patients with evaluable data (n = 19), target lesions decreased from baseline in 8 patients (42%)Target lesions decreased from baseline at dose levels ≥3 mg/kg in 6/10 patients (60%).

[0055] The disease control rates was 45% for patients in all patienst dosed between 0.03 to 30 mg/kg PL07-2001-C5H9v2. For patients dosed with at least 10 mg/kg, disease control rates were over 66%. Surprisingly, pharmacokinetic (PK) analysis demomsted that the PL07-2001-C5H9v2 circulates in plasma primarily in the unactivated form and the PK is only minimally reduced by targeted mediated drug disposition..

[0056] The activatable anti-PDL1 antibodies described herein overcome a limitation of antibody therapeutics, particularly antibody therapeutics that are known to be toxic to at least some degree *in vivo*. Target-mediated toxicity constitutes a major limitation for the

development of therapeutic antibodies. The activatable anti-PDL1 antibodies provided herein are designed to address the toxicity associated with the inhibition of the target in normal tissues by traditional therapeutic antibodies. Importantly, these activatable anti-PDL1 antibodies remain masked until proteolytically activated at the site of disease.

[0057] **ACTIVATABLE ANTI-PDL1 ANTIBODIES**

[0058] The activatable antibodies used in the compositions and methods of the disclosure were generated and characterized using the methods disclosed in PCT Publication No. WO 2016/149201, the contents of which are incorporated by reference herein in their entirety.

[0059] The activatable anti-PDL1 antibodies include an antibody that specifically binds PDL1 coupled to a masking moiety (MM), such that coupling of the MM reduces the ability of the antibody or antigen-binding fragment thereof to bind PDL1. The MM is coupled via a sequence that includes a substrate for a protease, for example, a protease that is co-localized with PDL1 at a treatment site in a subject.

[0060] In some embodiments, the activatable antibodies include an antibody (AB) that is modified by an MM and also includes one or more cleavable moieties (CM). Such activatable antibodies exhibit activatable/switchable binding, to the AB's target. Activatable antibodies generally include an antibody or antibody fragment (AB), modified by or coupled to a masking moiety (MM) and a modifiable or cleavable moiety (CM). In some embodiments, the CM contains an amino acid sequence that serves as a substrate for at least one protease. In pprefered embodimenst the he AB has two heavy chains and two light chains.

[0061] The elements of the activatable antibodies are arranged so that the MM and CM are positioned such that in a cleaved (or relatively active) state and in the presence of a target, the AB binds a target while the activatable antibody is in an uncleaved (or relatively inactive) state in the presence of the target, specific binding of the AB to its target is reduced or inhibited. The specific binding of the AB to its target can be reduced due to the inhibition or masking of the AB's ability to specifically bind its target by the MM.

[0062] Activatable antibodies can be provided in a variety of structural configurations. Exemplary formulae for activatable antibodies are provided below. It is specifically contemplated that the N- to C-terminal order of the AB, MM and CM may be reversed within an activatable antibody. It should be noted that although MM and CM are indicated as distinct

components in the formulae below, in all exemplary embodiments (including formulae) disclosed herein it is contemplated that the amino acid sequences of the MM and the CM could overlap, *e.g.*, such that the CM is completely or partially contained within the MM.

[0063] For example, activatable antibodies can be represented by the following formula (in order from an amino (N) terminal region to carboxyl (C) terminal region:

(MM)-(CM)-(AB)

(AB)-(CM)-(MM)

where MM is a masking moiety, CM is a cleavable moiety, and AB is an antibody. In addition, the formulae above provide for additional amino acid sequences that may be positioned N-terminal or C-terminal to the activatable antibodies elements.

[0064] In many embodiments it may be desirable to insert one or more linkers, *e.g.*, flexible linkers, into the activatable antibody construct so as to provide for flexibility at one or more of the MM-CM junction, the CM-AB junction, or both. For example, the AB, MM, and/or CM may not contain a sufficient number of residues (*e.g.*, Gly, Ser, Asp, Asn, especially Gly and Ser, particularly Gly) to provide the desired flexibility. As such, the switchable phenotype of such activatable antibody constructs may benefit from introduction of one or more amino acids to provide for a flexible linker. In addition, as described below, where the activatable antibody is provided as a conformationally constrained construct, a flexible linker can be operably inserted to facilitate formation and maintenance of a cyclic structure in the uncleaved activatable antibody.

[0065] For example, in certain embodiments an activatable antibody comprises one of the following formulae (where the formula below represent an amino acid sequence in either N- to C-terminal direction or C- to N-terminal direction):

(MM)-L1-(CM)-(AB)

(MM)-(CM)-L2-(AB)

(MM)-L1-(CM)-L2-(AB)

wherein MM, CM, and AB are as defined above; wherein L1 and L2 are each independently and optionally present or absent, are the same or different flexible linkers that include at least 1 flexible amino acid (*e.g.*, Gly). In addition, the formulae above provide for additional amino acid sequences that may be positioned N-terminal or C-terminal to the activatable antibodies elements. Examples include, but are not limited to, targeting moieties (*e.g.*, a ligand for a

receptor of a cell present in a target tissue) and serum half-life extending moieties (*e.g.*, polypeptides that bind serum proteins, such as immunoglobulin (*e.g.*, IgG) or serum albumin (*e.g.*, human serum albumin (HAS)).

[0066] When the AB is modified with a MM and is in the presence of the target specific binding of the AB to its target is reduced or inhibited, as compared to the specific binding of the AB not modified with an MM or the specific binding of the parental AB to the target. When compared to the binding of the AB not modified with an MM or the binding of the parental AB to the target the AB's ability to bind the target when modified with an MM can be reduced by at least 50%, 60%, 70%, 80%, 90%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% and even 100% for at least 2, 4, 6, 8, 12, 28, 24, 30, 36, 48, 60, 72, 84, or 96 hours, or 5, 10, 15, 30, 45, 60, 90, 120, 150, or 180 days, or 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12 months or more when measured *in vivo* or in an *in vitro* assay.

[0067] Conversely, the binding affinity of the AB modified with a MM and a CM towards the target is at least 5, 10, 25, 50, 100, 250, 500, 1,000, 2,500, 5,000, 10,000, 50,000, 100,000, 500,000, 1,000,000, 5,000,000, 10,000,000, 50,000,000 or greater, or between 5-10, 10-100, 10-1,000, 10-10,000, 10-100,000, 10-1,000,000, 10-10,000,000, 100-1,000, 100-10,000, 100-100,000, 100-1,000,000, 100-10,000,000, 1,000-10,000, 1,000-100,000, 1,000-1,000,000, 1000-10,000,000, 10,000-100,000, 10,000-1,000,000, 10,000-10,000,000, 100,000-1,000,000, or 100,000-10,000,000 times lower than the binding affinity of the AB not modified with an MM and a CM or of the parental AB towards the target.

[0068] As used herein, the term cleaved state refers to the condition of the activatable antibodies following modification of the CM by at least one protease. The term uncleaved state, as used herein, refers to the condition of the activatable antibodies in the absence of cleavage of the CM by a protease. As discussed above, the term "activatable antibodies" is used herein to refer to an activatable antibody in both its uncleaved (native) state, as well as in its cleaved state. It will be apparent to the ordinarily skilled artisan that in some embodiments a cleaved activatable antibody may lack an MM due to cleavage of the CM by protease, resulting in release of at least the MM .

[0069] By activatable or switchable is meant that the activatable antibody exhibits a first level of binding to a target when the activatable antibody is in a inhibited, masked or uncleaved state (*i.e.*, a first conformation), and a second level of binding to the target in the

uninhibited, unmasked and/or cleaved state (*i.e.*, a second conformation), where the second level of target binding is greater than the first level of binding. In general, the access of target to the AB of the activatable antibody is greater in the presence of a cleaving agent capable of cleaving the CM, i.e., a protease, than in the absence of such a cleaving agent. Thus, when the activatable antibody is in the uncleaved state, the AB is inhibited from target binding and can be masked from target binding (*i.e.*, the first conformation is such the AB cannot bind the target), and in the cleaved state the AB is not inhibited or is unmasked to target binding.

[0070] The CM and AB of the activatable antibodies are selected so that the AB represents a binding moiety for a given target, and the CM represents a substrate for a protease. In some embodiments, the protease is co-localized with the target at a treatment site in a subject. As used herein, co-localized refers to being at the same site or relatively close nearby. In some embodiments, a protease cleaves a CM yielding an activated antibody that binds to a target located nearby the cleavage site. The activatable antibodies disclosed herein find particular use where, for example, a protease capable of cleaving a site in the CM, i.e., a protease, is present at relatively higher levels in or in close proximity to target-containing tissue of a treatment site or diagnostic site than in tissue of non-treatment sites (for example in healthy tissue). In some embodiments, a CM of the disclosure is also cleaved by one or more other proteases. In some embodiments, it is the one or more other proteases that is co-localized with the target and that is responsible for cleavage of the CM *in vivo*.

[0071] In some embodiments activatable antibodies provide for reduced toxicity and/or adverse side effects that could otherwise result from binding of the AB at non-treatment sites if the AB were not masked or otherwise inhibited from binding to the target.

[0072] In general, an activatable antibody can be designed by selecting an AB of interest and constructing the remainder of the activatable antibody so that, when conformationally constrained, the MM provides for masking of the AB or reduction of binding of the AB to its target. Structural design criteria can be to be taken into account to provide for this functional feature.

[0073] For specific cleavage by an enzyme, contact between the enzyme and CM is made. When the activatable antibody comprising an AB coupled to a MM and a CM is in the presence of target and sufficient enzyme activity, the CM can be cleaved. Sufficient enzyme activity can refer to the ability of the enzyme to make contact with the CM and effect cleavage.

It can readily be envisioned that an enzyme may be in the vicinity of the CM but unable to cleave because of other cellular factors or protein modification of the enzyme.

[0074] In some embodiments, the serum half-life of the activatable antibody is longer than that of the corresponding antibody; e.g., the pK of the activatable antibody is longer than that of the corresponding antibody. In some embodiments, the serum half-life of the activatable antibody is at least 15 days when administered to an organism. In some embodiments, the serum half-life of the activatable antibody is at least 12 days when administered to an organism. In some embodiments, the serum half-life of the activatable antibody is at least 11 days when administered to an organism. In some embodiments, the serum half-life of the activatable antibody is at least 10 days when administered to an organism.

[0075] An exemplary activatable antibody includes an antibody (AB) that specifically binds to human PDL1, having a heavy chain variable region having a complementarity determining region 1 (CDRH1) comprising the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence or SEQ ID NO:235; and a light chain variable region having a light chain complementarity determining region 1 (CDRL1) having the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228; a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and a masking moiety (MM) linked to the CM. The CM is for example, ISSGLLSGRSDNH , (SEQ ID NO: 377). The MM is for example, GIALCPSHFCQLPQT (SEQ ID NO: 63).

[0076] An exemplary activatable anti PDLantibody includes an antibody (AB) that specifically binds to human PDL1. The AB includes two antibody heavy chains each having a heavy chain variable region having a complementarity determining region 1 (CDRH1) having the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) having the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) having the amino acid sequence ofor SEQ ID NO:235; and two antibody light chains each having a light chain variable region having a light chain complementarity determining region 1 (CDR1L) having the amino acid sequence of SEQ ID

NO:209, a lalight chain complementarity determining region 2 (CDRL2) having the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) having the amino acid sequence of SEQ ID NO:228; two masking moiety peptides (MM1s); and two cleavable moiety peptides (CM1s), each CM1 being a substrate for a protease. Each MM1 is linked in an N- to C-terminal direction to a CM1, to form two MM1-CM1 peptides where the carboxyl terminus of each MM1-CM1 peptide is linked to the amino terminus of each AB light chain. The CM is for example, ISSGLLSGRSDNH (SEQ ID NO: 377). The MM is for example, GIALCPSHFCQLPQT (SEQ ID NO: 63).

[0077] In some embodiments the activatable anti-PDL1 antibody has a heavy chain variable regon of SEQ ID NO: 46 and a light chain variable region of SEQ ID NO: 137 (which includesa CM of SEQ ID NO: 377, ana MM of SEQ ID NO: 63, and a VL of SEQ ID NO:58)..

[0078] In other embodiments the activatable anti-PDL1 antibody has a a heavy chain of SEQ ID NO: 432 and a light chain of SEQ ID NO: 428, (which includes a CM of SEQ ID NO: 377, ana MM of SEQ ID NO: 63, a VL of SEQ ID NO:58, and a Kappa constant domain)..

[0079] A prefered activatable anti-PDL1 antibodys useful in the methods of the invention include PL07-2001-C5H9v2 which includes a heavy chain variable regon of SEQ ID NO: 46 and a light chain variable region of SEQ ID NO: 137. Full lenghthlenghth heavy and light chain of PL07-2001-C5H9v2 includes SEQ ID NO; 432 and SEQ ID NO: 428, respectively.

[0080] An additional activatable anti-PDL1 antibody useful in the methods of the invention include PL07-2001-C5H9v2-WO which includes a heavy chain variable regionregon of SEQ ID NO: 46 and a light chain variable region of SEQ ID NO: 58 Full length heavy and light chain of PL07-2001-C5H9v2-WO includes SEQ ID NO: 432 and SEQ ID NO: 1008, respectively.

[0081] PL07-2001-C5H9v2 Heavy Chain Variable Sequence

EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADSV KGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSS (SEQ ID NO: 46)

[0082] PL07-2001-C5H9v2 Light Chain Variable Sequence

QGQSGSGIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSAS
VGDRVTITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSL
QPEDFATYYCQQDNGYPSTFGGGTKVEIKR (SEQ ID NO: 137)

[0083] PL07-2001-C5H9v2-W0 Light Chain Variable Sequence

GIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVT
ITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFA
TYYCQQDNGYPSTFGGGTKVEIKR (SEQ ID NO:)

[0084] PL07-2001-C5H9v2 Heavy Chain Sequence

EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADSV
KGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSSASTKGPSVFPLA
PCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSL
GTKTYTCNVDHKPSNTKVDKRVESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVT
CVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKEYKCKVS
NKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPE
NNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLSLG (SEQ
ID NO: 432)

[0085] PL07-2001-C5H9v2 Light Chain Sequence

QGQSGSGIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVT
ITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQ
DNGYPSTFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQ
ESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC (SEQ ID
NO: 428)

[0086] PL07-2001-C5H9v2-WO Light Chain Sequence (without linker)

GIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVTITCRAS
QSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQDNGYPS
TFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQ
DSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC (SEQ ID NO: 1008)

[0087] In some embodiments, activatable anti-PDL1 antibody includes an amino acid sequence that is at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to an amino acid sequence of SEQ ID NOs: 46, 137, XX, 432, 428 and 1008.

[0088] Anti-PDL1 Antibodies

[0089] Exemplary anti-PDL1 antibodies useful in the construction of an activatable anti-PDL1 antibody desecibed herein include antibodies C5H9 v2, C5H9, C5B10, C5E10, and G12H9. The VH and VL CDRs of C5H9 v2, C5H9, C5B10, C5E10, and G12H9 are shown below shown in a single row in Table 1

[0090] Table 1

	VL			VH		
AB Name	CDR1 (SEQ ID NO)	CDR2 (SEQ ID NO)	CDR3 (SEQ ID NO)	CDR1 (SEQ ID NO)	CDR2 (SEQ ID NO)	CDR3 (SEQ ID NO)
C5H9	RASQSISSYLN (209)	YASTLQS (227)	DNGYPST (228)	SYAMS (212)	SSIWRNGIVTVYADS (246)	WSAAFDY (235)
C5B10	RASQSISSYLN (209)	YASTLQS (227)	DNGYPST (228)	SYAMS (212)	SSIWRNGIVTVYADS (246)	WSAGYDY (236)
C5E10	RASQSISSYLN (209)	YASTLQS (227)	DNGYPST (228)	SYAMS (212)	SSIWRNGIVTVYADS (246)	WSKGFDY (237)
G12H9	RASQSISSYLN (209)	YASTLQS (227)	DNGYPST (228)	SYAMS (212)	SSIWYQGLVTVYADS (247)	WSAAFDY (235)
C5H9 v2	RASQSISSYLN (209)	AASSLQS (215)	DNGYPST (228)	SYAMS (212)	SSIWRNGIVTVYADS (246)	WSAAFDY (235)

[0091] Variable heavy and light chainamino acid sequences for anti-PDL1 antibodies C5H9 v2, C5H9, C5B10, C5E10, and G12H9 are shown below.

[0092] Anti-PDL1 Light Chain Variable Sequence of C5H9v2

DIQMTQSPSSLSASVGDRVTITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFS GSGSGTDFTLTISSLQPEDFATYYCQQDNGYPSTFG*G*GTKVEIKR (SEQ ID NO: 58)

[0093] Anti-PDL1 Heavy Chain Variable Sequence of C5H9 and C5H9v2

EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADS VKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSS (SEQ ID NO: 46)

[0094] Anti-PDL1 Light Chain Variable Sequence of C5H9,C5B10,C5E10 and G12H9

[0095] DIQMTQSPSSLSASVGDRVTITCRASQSISSYLNWYQQKPGKAPKLLIYYAST LQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQDNGYPSTFGQGTKVEIKR (SEQ ID NO: 12)

[0096] Anti-PDL1 Heavy Chain Variable Sequence C5B10

[0097] EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWR NGIVTVYADSVKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAGYDYWGQGTLVTVSS (SEQ ID NO: 48)

[0098] Anti-PDL1 Heavy Chain Variable Sequence C5E10

[0099] EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWR NGIVTVYADSVKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKWSKGFDYWGQGTLVTVSS (SEQ ID NO: 50)

[00100] Anti-PDL1 Heavy Chain Variable Sequence G12H9

[00101] EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMetSWVRQAPGKGLEWVSSI WYQGLVTVYADSVKGRFTISRDNSKNTLYLQMetNSLRAEDTAVYYCAKWSAAFDYWGQGTLV TVSS (SEQ ID NO: 52)

[00102] In some embodiments, anti-PDL1 antibody includes an amino acid sequence that is at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to an amino acid sequence of SEQ ID NOs: 58, 46, 12, 48, 50 and 52.

[00103] Masking Moieties

[00104] The activatable anti-PDL1 antibodies provided herein include a masking moiety (MM). In some embodiments, the masking moiety is an amino acid sequence (i.e. peptide) that is coupled or otherwise attached to the anti-PDL1 antibody and is positioned within the activatable anti-PDL1 antibody construct such that the masking moiety reduces the ability of the anti-PDL1 antibody to specifically bind PDL1. Suitable masking moieties are identified using any of a variety of known techniques. For example, peptide masking moieties are identified using the methods described in PCT Publication No. WO 2009/025846 by Daugherty et al., the contents of which are hereby incorporated by reference in their entirety.

[00105] The MM is a polypeptide of about 2 to 40 amino acids in length. Preferably, the MM is a polypeptide of up to about 40 amino acids in length.

[00106] In some embodiments, the MM polypeptide sequence is different from that of PDL1. In some embodiments, the MM polypeptide sequence is no more than 50% identical to any PDL1. In some embodiments, the MM polypeptide sequence is no more than 40%, 30%, 25%, 20%, 15%, or 10% identical to PDL1.

[00107] Exemplary MM include: YCEVSELFVLPWCMG (SEQ ID NO: 208), SCLMHPHYAHDYCYV (SEQ ID NO: 426), LCEVLMLLQHPWCMG (SEQ ID NO: 59), IACRHFMEQLPFCHH (SEQ ID NO: 60), FGPRCGEASTCVPYE (SEQ ID NO: 61), ILYCDSWGAGCLTRP (SEQ ID NO: 62), GIALCPSHFCQLPQT (SEQ ID NO: 63), DGPRCFVSGECSPIG (SEQ ID NO: 64), LCYKLDYDDRSYCHI (SEQ ID NO: 65), PCHPHPYDARPYCNV (SEQ ID NO: 66), PCYWHPFFAYRYCNT (SEQ ID NO: 67), VCYYMDWLGRNWCSS (SEQ ID NO: 68), LCDLFKLREFPYCMG (SEQ ID NO: 69), YLPCHFVPIGACNNK (SEQ ID NO: 70), IFCHMGVVVPQCANY (SEQ ID NO: 71), ACHPHPYDARPYCNV (SEQ ID NO: 72), PCHPAPYDARPYCNV (SEQ ID NO: 73), PCHPHAYDARPYCNV (SEQ ID NO: 74), PCHPHPADARPYCNV (SEQ ID NO: 75), PCHPHPYAARPYCNV (SEQ ID NO: 76), PCHPHPYDAAPYCNV (SEQ ID NO: 77), PCHPHPYDARPACNV (SEQ ID NO: 78), PCHPHPYDARPYCAV (SEQ ID NO: 79), PCHAHPYDARPYCNV (SEQ ID NO: 80), and PCHPHPYDARAYCNV (SEQ ID NO: 81).

[00108] An prefered MM includes GIALCPSHFCQLPQT (SEQ ID NO: 63).).

[00109] In some embodiments, the MM comprises an amino acid sequence that is at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to an amino acid sequence of SEQ ID NOs: 59-81, 208, and 426.

[00110] Cleavable Moieties

[00111] The activatable anti-PDL1 antibodies provided herein include a cleavable moiety (CM) . In some embodiments, the cleavable moiety includes an amino acid sequence that is a substrate for a protease, usually an extracellular protease. Suitable substrates are identified using any of a variety of known techniques. For example, peptide substrates are identified using the methods described in U.S. Patent No. 7,666,817 by Daugherty et al.; in U.S. Patent No. 8,563,269 by Stagliano et al.; and in PCT Publication No. WO 2014/026136 by La Porte et al., the contents of each of which are hereby incorporated by reference in their entirety. (*See also* Boulware et al. "Evolutionary optimization of peptide substrates for proteases that exhibit rapid hydrolysis kinetics." Biotechnol Bioeng. 106.3 (2010): 339-46).

[00112] In some embodiments, the protease that cleaves the CM is active, e.g., up-regulated, in diseased tissue, and the protease cleaves the CM in the activatable antibody when the activatable antibody is exposed to the protease.

[00113] In some embodiments, the protease is co-localized with PDL1 in a tissue, and the protease cleaves the CM in the activatable antibody when the activatable antibody is exposed to the protease.

[00114] In some embodiments, the protease is present at relatively higher levels in or in close proximity to target-containing tissue of a treatment site or diagnostic site than in tissue of non-treatment sites (for example in healthy tissue), and the protease cleaves the CM in the activatable antibody when the activatable antibody is exposed to the protease.

[00115] Exemplary CMs include: LSGRSDNH , (SEQ ID NO: 341), TGRGPSWV , (SEQ ID NO: 338), PLTGRSGG , (SEQ ID NO: 344), TARGPSFK , (SEQ ID NO: 340), NTLSGRSENHSG, (SEQ ID NO: 435), NTLSGRSGNHGS, (SEQ ID NO: 436), TSTSGRSANPRG, (SEQ ID NO: 437), TSGRSANP , (SEQ ID NO: 438), VHMPLGFLGP , (SEQ ID NO: 352), AVGLLAPP , (SEQ ID NO: 372), AQNLLGMV , (SEQ ID NO: 360), QNQALRMA , (SEQ ID NO: 359), LAAPLGLL , (SEQ ID NO: 371), STFPFGMF , (SEQ ID NO: 361), ISSGLLSS , (SEQ ID NO: 364), PAGLWLDP , (SEQ ID NO: 374), VAGRSMRP , (SEQ ID NO: 439), VVPEGRRS , (SEQ ID NO: 440), ILPRSPAF , (SEQ ID NO: 441), MVLGRSLL , (SEQ ID NO: 442), QGRAITFI , (SEQ ID NO: 443), SPRSIMLA , (SEQ ID NO: 444), SMLRSMPL , (SEQ ID NO: 445), ISSGLLSGRSDNH , (SEQ ID NO: 377), AVGLLAPPGGLSGRSDNH, (SEQ ID NO: 383), ISSGLLSSGGSGGSLSGRSDNH, (SEQ ID NO: 378), LSGRSGNH, (SEQ ID NO: 883), SGRSANPRG, (SEQ ID NO: 884), LSGRSDDH, (SEQ ID NO: 885), LSGRSDIH, (SEQ ID NO: 886), LSGRSDQH, (SEQ ID NO: 887), LSGRSDTH, (SEQ ID NO: 888), LSGRSDYH, (SEQ ID NO: 889), LSGRSDNP, (SEQ ID NO: 890), LSGRSANP, (SEQ ID NO: 891), LSGRSANI, (SEQ ID NO: 892), LSGRSDNI, (SEQ ID NO: 893), MIAPVAYR, (SEQ ID NO: 894), RPSPMWAY, (SEQ ID NO: 895), WATPRPMR, (SEQ ID NO: 896), FRLLDWQW, (SEQ ID NO: 897), ISSGL, (SEQ ID NO: 898), ISSGLLS, (SEQ ID NO: 899), ISSGLL, (SEQ ID NO: 900), ISSGLLSGRSANPRG, (SEQ ID NO: 901), AVGLLAPPTSGRSANPRG, (SEQ ID NO: 902), AVGLLAPPSGRSANPRG, (SEQ ID NO: 903), ISSGLLSGRSDDH, (SEQ ID NO: 904), ISSGLLSGRSDIH, (SEQ ID NO: 905), ISSGLLSGRSDQH, (SEQ ID NO: 906),

ISSGLLSGRSDTH, (SEQ ID NO: 907), ISSGLLSGRSDYH, (SEQ ID NO: 908), ISSGLLSGRSDNP, (SEQ ID NO: 909), ISSGLLSGRSANP, (SEQ ID NO: 910), ISSGLLSGRSANI, (SEQ ID NO: 911), AVGLLAPPGGLSGRSDDH, (SEQ ID NO: 912), AVGLLAPPGGLSGRSDIH, (SEQ ID NO: 913), AVGLLAPPGGLSGRSDQH, (SEQ ID NO: 914), AVGLLAPPGGLSGRSDTH, (SEQ ID NO: 915), AVGLLAPPGGLSGRSDYH, (SEQ ID NO: 916), AVGLLAPPGGLSGRSDNP, (SEQ ID NO: 917), AVGLLAPPGGLSGRSANP, (SEQ ID NO: 918), AVGLLAPPGGLSGRSANI, (SEQ ID NO: 919), ISSGLLSGRSDNI, (SEQ ID NO: 920), AVGLLAPPGGLSGRSDNI, (SEQ ID NO: 921), GLSGRSDNHGGAVGLLAPP (SEQ ID NO: 1009), and GLSGRSDNHGGVHMPLGFLGP (SEQ ID NO: 1010).

[00116] A prefered CM includes ISSGLLSGRSDNH , (SEQ ID NO: 377).

[00117] Spacers and Linkers

[00118] Linkers suitable for use in compositions described herein are generally ones that provide flexibility of the modified AB or the activatable antibodies to facilitate the inhibition of the binding of the AB to the target. Such linkers are generally referred to as flexible linkers. Suitable linkers can be readily selected and can be of any of a suitable of different lengths, such as from 1 amino acid (*e.g.*, Gly) to 20 amino acids, from 2 amino acids to 15 amino acids, from 3 amino acids to 12 amino acids, including 4 amino acids to 10 amino acids, 5 amino acids to 9 amino acids, 6 amino acids to 8 amino acids, or 7 amino acids to 8 amino acids, and may be 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, or 20 amino acids in length.

[00119] Exemplary flexible linkers include glycine polymers (G)n, glycine-serine polymers ncluding, for example, (GS)n, (GSGGS)n (SEQ ID NO: 191) and (GGGS)n (SEQ ID NO: 192), where n is an integer of at least one, Gly-Gly-Ser-Gly (SEQ ID NO: 193), Gly-Gly-Ser-Gly-Gly (SEQ ID NO: 194), Gly-Ser-Gly-Ser-Gly (SEQ ID NO: 195), Gly-Ser-Gly-Gly-Gly (SEQ ID NO: 196), Gly-Gly-Gly-Ser-Gly (SEQ ID NO: 197), Gly-Ser-Ser-Ser-Gly (SEQ ID NO: 198), and the like. GlycineGlycine-alanine polymers, alanine-serine polymers, and other flexible linkers known in the art. Glycine and glycine-serine polymers are relatively unstructured, and therefore may be able to serve as a neutral tether between components. Glycine accesses significantly more phi-psi space than even alanine, and is much less restricted than residues with longer side chains (see Scheraga, Rev. Computational Chem. 11173-142

(1992)). The ordinarily skilled artisan will recognize that design of an activatable antibodies can include linkers that are all or partially flexible, such that the linker can include a flexible linker as well as one or more portions that confer less flexible structure to provide for a desired activatable antibodies structure.

[00120] In some embodiments, at least one of L1 or L2 comprises an amino acid sequence selected from the group consisting of $(GS)_n$, $(GGS)_n$, $(GSGGS)_n$ (SEQ ID NO: 191) and $(GGGS)_n$ (SEQ ID NO: 192), where n is an integer of at least one.

[00121] In some embodiments, at least one of L1 or L2 comprises an amino acid sequence selected from the group consisting of GGSG (SEQ ID NO: 193), GGSGG (SEQ ID NO: 194), GSGSG (SEQ ID NO: 195), GSGGG (SEQ ID NO: 196), GGGSG (SEQ ID NO: 197), and GSSSG (SEQ ID NO: 198).

[00122] In some embodiments, L1 comprises the amino acid sequence GSSGGSGGSGGSG (SEQ ID NO: 199), GSSGGSGGSGG (SEQ ID NO: 200), GSSGGSGGSGGS (SEQ ID NO: 201), GSSGGSGGSGGSGGGS (SEQ ID NO: 202), GSSGGSGGSG (SEQ ID NO: 203), or GSSGGSGGSGS (SEQ ID NO: 204).

[00123] In some embodiments, L2 comprises the amino acid sequence GSS, GGS, GGGS (SEQ ID NO: 205), GSSGT (SEQ ID NO: 206) or GSSG (SEQ ID NO: 207).

[00124]

[00125] In some embodiments, the activatable antibody also includes a signal peptide. In some embodiments, the signal peptide is conjugated to the activatable antibody via a spacer. In some embodiments, the spacer is conjugated to the activatable antibody in the absence of a signal peptide. In some embodiments, the spacer is joined directly to the MM of the activatable antibody. In some embodiments, the spacer is joined directly to the MM of the activatable antibody in the structural arrangement from N-terminus to C-terminus of spacer-MM-CM-AB. An example of a spacer joined directly to the N-terminus of MM of the activatable antibody is forfor example QGQSGS (SEQ ID NO: 923); GQSGS (SEQ ID NO: 1192); QSGS (SEQ ID NO: 1193); SGS (SEQ ID NO: 1194); GS (SEQ ID NO: 1195); S; QGQSGQG (SEQ ID NO: 924); GQSGQG (SEQ ID NO: 395); QSGQG (SEQ ID NO: 925); SGQG (SEQ ID NO: 926); GQG (SEQ ID NO: 927); QG (SEQ ID NO: 928); G; QGQSGQ (SEQ ID NO: 1196); GQSGQ (SEQ ID NO: 1197); QSGQ (SEQ ID NO: 1198); SGQ (SEQ ID NO: 1198); GQ (SEQ ID NO: 1199); and Q.

[00126] A preferredprefered spacer includes QGQSGS (SEQ ID NO: 923).

[00127] In some embodiments, the activatable antibody does not include a spacer sequence.

[00128] **METHOD OF TREATMENT**

[00129] The invention provides methods of preventing, delaying the progression of, treating, alleviating a symptom of, or otherwise ameliorating an PDL1 mediated disease in a subject by administering a therapeutically effective amount of activatable anti-PDL1 antibody described herein to a subject in need thereof. The invention provides uses the activatable anti-PDL1 antibody described herein in delaying the progression of, treating, alleviating a symptom of, or otherwise ameliorating an PDL1 mediated disease in a subject by administering a therapeutically effective amount of activatable anti-PDL1 antibody. A therapeutically effective amount is decribed *infra* in the section entitled Dosage and Administration.

[00130] PDL1 is known to be expressed in a variety of cancers.(See. e.g., Chen et al., "Molecular Pathways: Next-Generation Immunotherapy – Inhibiting Programmed Death-Ligand 1 and Programmed Death-1," Clin. Can. Res., vol. 18: 6580-6587 (2012), the contents of which are hereby incorporated by reference in their entirety).

[00131] Cancers suitable for delaying the progression of, treating, alleviating a symptom of in accordeance to the methods of the invention include for example, but are not limited to

[00132] is anal squamous cell carcinoma, basal cell carcinoma, bladder cancer, bone cancer, bowel carcinoma, breast cancer, carcinoid, castration-resistant prostate cancer (CRPC), cervical carcinoma, colorectal cancer (CRC), colon cancer cutaneous squamous cell carcinoma, endometrial cancer, esophageal cancer, gastric carcinoma, gastroesophageal junction cancer, glioblastoma/ mixed glioma, glioma, head and neck cancer, hepatocellular carcinoma, hematologic malignancy, liver cancer, lung cancer, melanoma, Merkel cell carcinoma, multiple myeloma, nasopharyngeal cancer, osteosarcoma, ovarian cancer, pancreatic cancer, peritoneal carcinoma, undifferentiated pleomorphic sarcoma, prostate cancer, rectal carcinoma, renal cancer, sarcoma, salivary gland carcinoma, squamous cell carcinoma, stomach cancer, testicular cancer, thymic carcinoma, thymic epithelial tumor, thymoma, thyroid cancer, urogenital cancer, urothelial cancer, uterine carcinoma , or uterine sarcoma.

[00133] In some embodimenst, the cancer is a High Tumor Mutational Burden (hTMB) cancer.

[00134] In othere embodiemnst breast cancer is triple negative breast cancer or estrogen receptor positive breast cancer.The hematologic malignancy is a lymphoma, a leukemia or multiple myeloma. Lymphoma include a B-cell lymphoma, a T-cell lymphoma, Hodgkin's lymphoma, or an EBV lymphoma, primary mediastinal B-cell lymphoma. In some embodiments, the Hodgkin lymphoma is post allo-HSCT.

[00135] The bowel carcinoma is for example small bowel carcinoma or small bowel adenocarcinoma.

[00136] A head and neck cancer includes for example a head and neck squamous cell carcinoma. The espheageal cancer is for ecample espohogeanl carcinoma.

[00137] The colon cancer is for example is colon adenocarcinoma,

[00138] The lung cancer is for example, non-small cell lung cancer (NSCLC) or small cell lung cancer.

[00139] The NSCLC is non-squamous NSCLC or squamous NSCLC.

[00140] The prostate cancer is for example small cell neuroendocrine prostate cancer.

[00141] In some embodimenst the cancer is a carcinoma such as for example, squamous cell carcinoma.

[00142] In other embodiments the cancer is renal cancer such as renal cell carcinoma or renal sarcoma

[00143] Cancers particualry suitable in the practice of the methods and uses of the invention include undifferentiated pleomorphic sarcoma, small bowel adenocarcinoma, Merkel cell carcinoma, thymic carcinoma, anal squamous cell carcinoma, cutaneous squamous cell carcinoma and triple negative breast cancer.

[00144] In some embodiments, the cancer is gastric cancer or gastroesophageal junction cancer.

[00145] In some embodiments, the gastric cancer or gastroesophageal cancer is an advanced unresectable cancer with a Siewert classification of II/III for those with a significant esophageal component.

[00146] In some embodiments, the cancer is a thymoma or thymic cancer. The thymic cancer is a thymicepithelial tumor.

[00147] In some embodiments, the cancer is a melanoma. In some embodiments, the cancer is an ocular melanoma.

[00148] B-cell lymphoma, T-cell lymphoma, Hodgkin's lymphoma/primary mediastinal B-cell lymphoma, and chronic myelogenous leukemia.

[00149] In some embodiments, the cancer is due to a PDL1-expressing tumor.

[00150] The cancer is an advanced, unresectable solid tumor or lymphoma. The advanced unresectable tumor is a PDL1-responsive tumor type.

[00151] In some embodiments, the subject has an unresectable solid tumor with no further standard of care available. In some embodiments, the subject has a lymphoma with no further standard of care available. In some embodiments, the subject is immunotherapy naïve. In some embodiments, PDL1/PD1 inhibitor therapy is not approved for the subject's cancer.

[00152] In some embodiments, the PDL1 status of the subject and/or tumor is unknown. In some embodiments, the subject and/or tumor is PDL1 positive (PDL1+), e.g., the subject has a tumor proportion score of at least 1% membranous staining.

[00153] An activatable anti-PDL1 antibody used in any of the embodiments of these methods and uses can be administered at any stage of the disease. For example, such an activatable anti-PDL1 antibody can be administered to a patient suffering cancer of any stage, from early to metastatic. In some embodiments, the cancer comprises advanced or recurrent solid tumors or lymphomas. In some embodiments, the subject has an unresectable solid tumor..

[00154] The invention also provides methods of treating cancer patients with an autoimmune or inflammatory disease by administering a therapeutically effective amount of an activatable anti-PDL1 antibody described herein to a subject in need thereof. In some embodiments, the autoimmune disease is colitis, RA, pancreatitis, diabetes, or pneumonitis.

[00155] In some embodiments, the subject is a mammal, such as a human, non-human primate, companion animal (*e.g.*, cat, dog, horse), farm animal, work animal, or zoo animal. In some embodiments, the subject is a human. In some embodiments, the subject is a companion animal. In some embodiments, the subject is an animal in the care of a veterinarian. Preferably, the subject is a human.

[00156] In various embodiments the subjects exhibits one or more of the following characteristics: is PD-1/PDL1 inhibitor-naïve, is CTLA-4 inhibitor-naïve, is $BRAF^{V600E}$ mutation positive, is BRAF inhibitor-naïve, or is immunotherapy naïve.

is PDL1 positive, is PDL1 unknown or has been previously treated with a PD1/PDL1 inhibitor.

[00157] In some embodiments the the subject has no further standard of care available.

[00158] In other embodimenst the the subject has been previously treated with a PD-1/PDL1 inhibitor, and the treatment with the PD-1/PDL1 inhibitor was discontinued for reasons other than toxicity.

[00159] The method of any one of the preceding claims, wherein the subject is immunotherapy naïve.

[00160] The activatable anti-PDL1 antibody and therapeutic formulations thereof are administered to a subject suffering from or susceptible to a disease or disorder associated with aberrant PDL1 expression and/or activity. A subject suffering from or susceptible to a disease or disorder associated with aberrant PDL1 expression and/or activity is identified using any of a variety of methods known in the art. For example, subjects suffering from cancer or other neoplastic condition are identified using any of a variety of clinical and/or laboratory tests such as, physical examination and blood, urine and/or stool analysis to evaluate health status. For example, subjects suffering from inflammation and/or an inflammatory disorder are identified using any of a variety of clinical and/or laboratory tests such as physical examination and/or bodily fluid analysis, e.g., blood, urine and/or stool analysis, to evaluate health status.

[00161] Administration of an activatable anti-PDL1 antibody to a patient suffering from a disease or disorder associated with aberrant PDL1 expression and/or activity is considered successful if any of a variety of laboratory or clinical objectives is achieved. For example, administration of an activatable anti-PDL1 antibody to a patient suffering from a disease or disorder associated with aberrant PDL1 expression and/or activity is considered successful if one or more of the symptoms associated with the disease or disorder is alleviated, reduced, inhibited or does not progress to a further, *i.e.*, worse, state. Administration of an activatable anti-PDL1 antibody to a patient suffering from a disease or disorder associated with aberrant PDL1 expression and/or activity is considered successful if the disease or disorder enters remission or does not progress to a further, *i.e.*, worse, state.

[00162] **DOSAGE AND ADMINISTRATION**

[00163] The cancer therapy provided herein, containing an activatable anti-PDL1 antibody, is administered in an amount sufficient to exert a therapeutically useful effect. Typically, the active agents are administered in an amount that does not result in undesirable side effects of the patient being treated, or that minimizes or reduces the observed side effects.

[00164] It is within the level of one of skill in the art to determine the precise amounts of active agents, including activatable anti-PDL1 antibodies to be administered to a subject. For example, such agents and uses for treating solid tumors and lymphomas, are well-known in the art. Thus, dosages of such agents can be chosen based on standard dosing regimens for that agent under a given route of administration.

[00165] It is understood that the precise dosage and duration of treatment is a function of the tissue or tumor being treated and may be determined empirically using known testing protocols or by extrapolation from in vivo or in vitro test data and/or can be determined from known dosing regimens of the particular agent. It is to be noted that concentrations and dosage values may also vary with the age of the individual treated, the weight of the individual, the route of administration and/or the extent or severity of the disease and other factors that are within the level of a skilled medical practitioner to consider. Generally, dosage regimens are chosen to limit toxicity. It should be noted that the attending physician would know how to and when to terminate, interrupt or adjust therapy to lower dosage due to toxicity, or bone marrow, liver or kidney or other tissue dysfunctions. Conversely, the attending physician would also know how to and when to adjust treatment to higher levels if the clinical response is not adequate (precluding toxic side effects). It is to be further understood that for any particular subject, specific dosage regimens should be adjusted over time according to the individual need and the professional judgment of the person administering or supervising the administration of the formulations, and that the concentration ranges set forth herein are exemplary only and are not intended to limit the scope thereof.

[00166] For example, activatable anti-PDL1 antibodies, is administered in a therapeutically effective amount to decrease the tumor volume.

[00167] The amount of an activatable anti-PDL1 antibodies is administered for the treatment of a disease or condition,can be determined by standard clinical techniques. In addition, in vitro assays and animal models can be employed to help identify optimal dosage ranges. The precise dosage, which can be determined empirically, can depend on the route of administration, the type of disease to be treated and the seriousness of the disease.

[00168] The activatable anti-PDL1 antibodies provided herein are administered intravenously. For intravenous administration, the conjugate can be administered by push or bolus, by infusion, or via a combination thereof. The infusion time can be about 1 minute to

three hours, such as about 1 minute to about two hours, or about 1 minute to about 60 minutes, or at least 10 minutes, 40 minutes, or 60 minutes.

[00169] The dosage amount is between 0.03 mg/kg and 30 mg/kg. In other embodiments, the dosage amount is between 0.3 mg/kg and 30 mg/kg. In further embodiments, the dosage amount is between 3 mg/kg and 30 mg/kg; 3 mg/kg and 20 mg/kg; 3 mg/kg and 15 mg/kg, or 3 mg/kg and 10 mg/kg. In some embodiments, the dosage amount is between 5 mg/kg and 30 mg/kg; 5 mg/kg and 30 mg/kg; 5 mg/kg and 20 mg/kg; 5 mg/kg and 15 mg/kg; or 5 mg/kg and 10 mg/kg. In other embodiments, thedosage amount is between 10mg/kg and 30 mg/kg; 10mg/kg and 20 mg/kg; or 10 mg/kg and 15 mg/kg.

[00170] For example, the dosage amount is 0.03 mg/kg, 0.10 mg/kg, 0.3 mg/kg, 1.0 mg/kg, 3.0 mg/kg, 10.0 mg/kg, or 30.0 mg/kg. The dosage amount is 1 mg/kg, 3 mg/kg, 6 mg/kg, or 15.0 mg/kg. Preferably, the dosage amount is 10 mg/kg.

[00171] The activatable anti-PDL1 antibodies provided herein are administered at a fixed dose A fixed dosage is based for example upon a 65 kg human, a 70 kg human, a 75 kg human or an 80 kg human and the mg/kg dosages decribed herein. For example, when the fixed dose is bases upon an 80 kg human and the desired mg/kg doses is 10 mg/ kg then the fixed dose is 800 mg.

[00172] A fixed dosage is between 240 mg and 2400 mg. exemplary fixed dosages include 240 mg, 480 mg, 800 mg, 1200 mg and 2400 mg.

[00173] The frequency and timing of administration, and the dosage amounts, can be administered periodically over a cycle of administration to maintain a continuous and/or long term effect of the active agents for a desired length of time. The provided compositions of activatable anti-PDL1 antibodies can be administered hourly, daily, weekly, bi-weekly, monthly, yearly or once. The length of time of the cycle of administration can be empirically determined, and is dependent on the disease to be treated, the severity of the disease, the particular patient, and other considerations within the level of skill of the treating physician. The length of time of treatment with a combination therapy provided herein can be one week, two weeks, one months, several months, one year, several years or more.

[00174] The frequency of administration of the activatable anti-PDL1 antibodies is between once a day and every 28 day; between once a day and once a month, between once a week and once a month; between once a week and once every two months.

[00175] For example, the frequency of administration of the activatable anti-PDL1 antibodies is once a day, every other day, twice weekly, once weekly, once every 2 weeks, once every 3 weeks,, once every 4 weeks, once every 5 weeks, once every six weeks, once every seven weeks, once every eight weeks . Put another way the frequency of administration of the activatable anti-PDL1 antibodies is once a day, every other day, twice weekly, once every 7 days, once every 14 days, once every 21 days, once every 28 days once every 35 days, once every 42 days, once every 49 days, once every 56 days. The dosages can be divided into a plurality of cycles of administration during the course of treatment. For example, the activatable anti-PDL1 antibodies can be administered at the frequency over a period of about a month, 2 months, 3 months, 4 months, 5 months, 6 months, a year or more. The frequency of administration can be the same throughout the period of the cycle or can differ. For example, an exemplary dosage frequency is two times a week at least for a first week of a cycle of administration. After the first week, the frequency can continue at twice a week, can increase to more than twice a week, or can be reduced to no more than once a week. It is within the level of a skilled person to determine the particular dosage frequency and cycle of administration based on the particular dosage being administered, the disease or condition being treated, the severity of the disease or condition, the age of the subject and other similar factors.

[00176] If disease symptoms persist in the absence of discontinued treatment, treatment can be continued for an additional length of time. Over the course of treatment, evidence of disease and/or treatment-related toxicity or side effects can be monitored.

[00177] The cycle of administration of the activatable anti-PDL1 antibodies can be tailored to add periods of discontinued treatment in order to provide a rest period from exposure to the agents. The length of time for the discontinuation of treatment can be for a predetermined time or can be empirically determined depending on how the patient is responding or depending on observed side effects. For example, the treatment can be discontinued for one week, two weeks, three weeks, one month or several months. Generally, the period of discontinued treatment is built into a cycle of dosing regimen for a patient.

[00178] An exemplary dosing regimen is a treatment cycle or cycle of administration of 14 days. The activatable anti-PDL1 antibodies disclosed herein, is administered on day 1,

followed by 13 days without dosing. It is within the level of one of skill in the art to determine the precise cycle of administration and dosing schedule.

[00179] As noted above, the cycle of administration can be for any desired length of time. Hence, the 14-day cycle of administration can be repeated for any length of time. It is within the level of skill of the treating physician to adopt a cycle of administration and dosing regimen that meets the needs of the patient depending on personal considerations specific to the patient and disease to be treated.

[00180] In some embodiments, activatable anti-PDL1 antibodies described herein are used as sole active agents, i.e., monotherapy. Alternativley the activatable anti-PDL1 antibodies described herein are used in conjunction with one or more additional agents or a combination of additional agents, i.e. combination therapapy or co-therapy Suitable additional agents include current pharmaceutical and/or surgical therapies for an intended application, such as, for example, cancer. For example, the activatable anti-PDL1 antibodies can be used in conjunction with an additional chemotherapeuticanti-neoplastic agent or radiation.

[00181] In some embodiments, activatable anti-PDL1 antibody is administered before and/or during and/or after treatment in combination with one or more additional agent (s) (e.g., combination therapy)

[00182] Non-limiting examples, of additional agents include a chemotherapeutic agent, radiation, a checkpoint inhibitor, a kinase inhibitor, an anti-inflammatory agent, an immunosuppressive agent, a T cell agonist, a NK cell agonist, an agent targeting inhibitors in the tumor microenvironment agent effects regulatory T cell depletion an anti-angiogenic agent, agent targeting inhibitors in the tumor microenvironment, a proteosome inhibitor, an anti-metabolite, an anti-microtubule agent, a topoisomerase inhibitor, a vaccine, an oncovirus, a DC-activating agent a cytotoxic antibiotic, and/or any other nucleic acid damaging agent.

[00183] In some embodiments, the additional agent(s) is a tumor-targeted antibody designed to kill the tumor via ADCC or via direct conjugation to a toxin (e.g., an antibody drug conjugate (ADC). In some embodiments, the additional agent(s) stimulates co-stimulatory molecules. In some embodiments, the additional agent(s) is an adoptive T cell therapeutic agent that effects adoptive T cell transfer.

[00184] In some embodiments, the agent inhibits adenosine A2aR. In some embodiments, the agent inhibits arginase. In some embodiments, the agent inhibits CD39. In some embodiments, the agent inhibits CD73. In some embodiments, the agent inhibits CD47.

[00185] In some embodiments the additional agent chemotherapeutic agent. Chemotherapeutic agents include for example an alkylating agents, taxanes Alkylating agents include for example, platinum-based chemotherapy, such as carboplatin or cisplatin, oxaliplatin,

[00186] Taxanes include for example, docetaxel, paclitaxel, Abraxane®). (i.e., albumin-conjugated paclitaxel). Other chemotherapeutic agents include, doxorubicin, , irinotecan, gemcitabine and any chemotherapeutic agents know to those skilled in the art.

[00187] A tumor microenvironment inhibitor includes for example an IDO inhibitor, an α-CSF1R inhibitor, an α-CCR4 inhibitor, TGF-beta blockade, a myeloid-derived suppressor cell, or a T-regulatory cell.

[00188] In some embodiments, the agonist is selected from the group consisting of Ox40, GITR, CD137, ICOS, CD27, and HVEM.

[00189] In some embodiments, the DC-activating agent includes, by way of non-limiting example, a toll-like receptor (TLR) agonist and/or α-CD40.

[00190] A checkpoint inhibitor inhibits (e.g. blocks) immune checkpoint proteins. Immune checkpoints include for example, CTLA-4, LAG-3, PD1 (also referred to as PD-1), PDL1, TIGIT, TIM-3, B7H4, and Vista.

[00191] Kinase inhibitors inhibits kinases such as B-RAFi, MEKi, and Btk.

[00192] Exemplary kinase inhibitors include pazopanib, osimertinib, crizotinib. sorafenib or erlotinib

[00193] A B-RAFi inhibitor includes for example, vemurafenib. A Btk inhibitor includes for example, ibrutinib. Inhibitor MEKi kinase inhibitors include for example, trametinib, cobimetinib or selumetinib.

[00194] In some embodiments, the additional agent is an immune modulating agent, such as lenolidominde or IL-2.

[00195] In some embodiments, the additional agent is a proteosome inhibitor, such as bortezomib or carfilzomib.

[00196] In some embodiments, the additional agent is an agent considered standard of care by those skilled in the art

[00197] In some embodiments, the additional agent is a targeted agent, such as another antibody, e.g., a monoclonal antibody (e.g., ipilimumab or bevacizumab), a bispecific antibody, or a multispecific antibody.

[00198] dditional agents are administered simultaneously or at different times during a treatment regimen. For example, the activatable anti-PDL1 antibody is administered concurrently with the addition agent, prior to the administration of the additional agent, t or subsequent to the administration of the additional agent, or in an alternating fashion. T he additional agent is administered in single dose or in multiple dose.

[00199] In some embodiments, the additional agent is a targeted agent, such as another antibody, e.g., a monoclonal antibody (e.g., bevacizumab), a bispecific antibody, or a multispecific antibody. In some embodiments, the additional agent is a proteosome inhibitor, such as bortezomib or carfilzomib. In some embodiments, the additional agent is an immune modulating agent, such as lenolidominde or IL-2. In some embodiments, the additional agent is radiation. In some embodiments, the additional agent is an agent considered standard of care by those skilled in the art. In some embodiments, the additional agent is a chemotherapeutic agent well known to those skilled in the art.

[00200] In some embodiments, the additional agent is another antibody or antigen-binding fragment thereof, another conjugated antibody or antigen-binding fragment thereof, another activatable antibody or antigen-binding fragment thereof and/or another conjugated activatable antibody or antigen-binding fragment thereof. In some embodiments the additional agent is another antibody or antigen-binding fragment thereof, another conjugated antibody or antigen-binding fragment thereof, another activatable antibody or antigen-binding fragment thereof and/or another conjugated activatable antibody or antigen-binding fragment thereof against the same target as the first antibody or antigen-binding fragment thereof, the first conjugated antibody or antigen-binding fragment thereof, activatable antibody or antigen-binding fragment thereof and/or a conjugated activatable antibody or antigen-binding fragment thereof, e.g., against PDL1. In some embodiments the additional agent is another antibody or antigen-binding fragment thereof, another conjugated antibody or antigen-binding fragment

thereof, another activatable antibody or antigen-binding fragment thereof and/or another conjugated activatable antibody or antigen-binding fragment thereof against a target different than the target of the first antibody or antigen-binding fragment thereof, the first conjugated antibody or antigen-binding fragment thereof, activatable antibody or antigen-binding fragment thereof and/or a conjugated activatable antibody or antigen-binding fragment thereof (i.e., target other than PDL1). In some embodiments, the additional agent is a multispecific antibody, such as a bispecific antibody. In some embodiments, the additional agent is a multispecific activatable antibody, such as a bispecific activatable antibody.

[00201] In some embodiments that additional agent is ipilimumab, a CTLA4-binding fragment of ipilimumab, and/or an ipilimumab activatable antibody.

CD51	CYR61	hGH

[00202] As a non-limiting example, the additional agent is or is derived from an antibody listed in Table 23.

Table 22: Exemplary sources for Additional Agenst

Antibody Trade Name (antibody name)	Target
Avastin™ (bevacizumab)	VEGF
Lucentis™ (ranibizumab)	VEGF
Erbitux™ (cetuximab)	EGFR
Vectibix™ (panitumumab)	EGFR
Remicade™ (infliximab)	TNFα
Humira™ (adalimumab)	TNFα
Tysabri™ (natalizumab)	Integrinα4
Simulect™ (basiliximab)	IL2R
Soliris™ (eculizumab)	Complement C5
Raptiva™ (efalizumab)	CD11a
Bexxar™ (tositumomab)	CD20
Zevalin™ (ibritumomab tiuxetan)	CD20
Rituxan™ (rituximab)	CD20
(Ocrelizumab)	CD20
Arzerra™ (ofatumumab)	CD20
Gazyva™ (Obinutuzumab)	CD20
Zenapax™ (daclizumab)	CD25
Adcetris™ (brentuximab vedotin)	CD30
Myelotarg™ (gemtuzumab)	CD33
Mylotarg™ (gemtuzumab ozogamicin)	CD33
Campath™ (alemtuzumab)	CD52
ReoPro™ (abiciximab)	Glycoprotein receptor IIb/IIIa
Xolair™ (omalizumab)	IgE

Herceptin™ (trastuzumab)	Her2
Kadcyla™ (trastuzumab emtansine)	Her2
Synagis™ (palivizumab)	F protein of RSV
(ipilimumab)	CTLA-4
(tremelimumab)	CTLA-4
Hu5c8	CD40L
(pertuzumab)	Her2-neu
(ertumaxomab)	CD3/Her2-neu
Orencia™ (abatacept)	CTLA-4
(tanezumab)	NGF
(bavituximab)	Phosphatidylserine
(zalutumumab)	EGFR
(mapatumumab)	EGFR
(matuzumab)	EGFR
(nimotuzumab)	EGFR
ICR62	EGFR
mAb 528	EGFR
CH806	EGFR
MDX-447	EGFR/CD64
(edrecolomab)	EpCAM
RAV12	RAAG12
huJ591	PSMA
Enbrel™ (etanercept)	TNF-R
Amevive™ (alefacept)	1-92-LFA-3
Antril™, Kineret™ (ankinra)	IL-1Ra
GC1008	TGFbeta
	Notch, e.g., Notch 1
	Jagged 1 or Jagged 2
(adecatumumab)	EpCAM
(figitumumab)	IGF1R
(tocilizumab)	IL-6 receptor
Stelara™ (ustekinumab)	IL-12/IL-23
Prolia™ (denosumab)	RANKL
Opdivo® (nivolumab)	PD1
Keytruda® (pembrolizumab)	PD1
pidilizumab	PD1
MEDI0680	PD1
PDR001	PD1
REGN2810	PD1
BGB-A317	PD1
BI-754091	PD1
JNJ-63723283	PD1
MGA012	PD1
TSR042	PD1
AGEN2034	PD1

INCSHR-1210	PD1
JS001	PD1
Imfinzi™ (durvalumab)	PD-L1
Tecentriq® (atezolizumab)	PD-L1
Bavencio® (avelumab)	PD-L1
FAZ053	PD-L1
LY-3300054	PD-L1
KN035	PD-L1

[00203] Additional agents are administered simultaneously or at different times during a treatment regimen. For example, the activatable anti-PDL1 antibody is administered concurrently with the addition agent, prior to the administration of the additional agent, tor subsequent to the administration of the additional agent, or in an alternating fashion. The additional agent is administered in single dose or in multiple dose.

[00204] In some embodiments, activatable anti-PDL1 antibody of the disclosure is used in combination with an inhibitor of CTLA-4. In some embodiments, activatable anti-PDL1 antibody of the disclosure is used in combination with an anti-CTLA-4 antibody, such as for example ipilimumab.

[00205] The inhibitor of CTLA-4 such as ipilimumab is administered at a dose between 1 mg/kg to 20 mg/kg, between 3 mg/kg to 15 mg/kg, between 3 mg/kg to 10 mg/kg . For example, inhibitor of CTLA-4such as ipilimumab is administered at a dosage of 1, mg/kg, 2 mg/kg, 3 mg/kg, 4, mg/kg, 5 mg/kg, 6 mg/kg, 7, mg/kg, 8 mg/kg, 9, mg/kg, or 10 mg/kg.

[00206] In various embodimenst the anti-CTLA-4 antibody, *e.g.*, ipilimumab is administered at a fixed dose A fixed dosage is based for example upon a 65kg human, a 70 kg human, a 75 kg human or an 80 kg human and the mg/kg dosaages decribed herein. For example, when the fixed dose is bases upon an 80 kg human and the desired mg/kg dose is 10 mg/ kg then the fixes dose is 800 mg. If desired mg/kg dose is 6 mg/ kg then the fixes dose is 480 mg. . If desired mg/kg dose is 3 mg/ kg then the fixed dose is 240 mg. A fixed dosage of the anti-CTLA-4 antibody, *e.g.*, ipilimumab is between 140 mg and 1000 mg. 1xemplary fixed dosages include 240 mg, 480 mg, and 800 mg,

[00207] In some embodimenst, ipilimumab is administered at a higher dose than ist maxium tolerated dose for a given indication. Alternatively, ipilimumab is administered at a lower dose than its maxium tolerated dose for a given indication.

[00208] In otherembodimenst, ipilimumab is administered at a higher dose than its recommended dose for a given indication. Alternatively, ipilimumab is administered at a lower dose than recomended dose for a given indication.

[00209] In some embodiments, the activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered intravenously (IV).

[00210] The frequency of administration of the anti-CTLA-4 antibody, *e.g.*, ipilimumab is between once a day and every 28 day; between once a day and once a month, between once a week and once a month; between once a week and once every two months. For example, the frequency of administration of the anti-CTLA-4 antibody, *e.g.*, ipilimumab is once a day, every other day, twice weekly, once weekly, once every 2 weeks, once every 3 weeks, once every 4 weeks, once every 5 weeks, once every six weeks, once every seven weeks, once every eight weeks . Put another way the frequency of administration of the activatable anti-CTLA-4 antibody, *e.g.*, ipilimumab is once a day, every other day, twice weekly, once every 7 days, once every 14 days, once every 21 days, once every 28 days once every 35 days, once every 42 days, once every 49 days, once every 56 days.

[00211] The activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV at a regular interval. The activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV at the same regular interval. Alternatively , he activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV at different regular intervals.

[00212] In some embodiments, the frequency of administration of the activatable anti-PDL1 antibodies is between once a day and every 28 day; between once a day and once a month, between once a week and once a month; between once a week and once every two months and the frequency of administration anti-CTLA-4 antibody, *e.g.*, ipilimumab is evry 7 days, every 14 days or every 28 days.

[00213] For example, the frequency of administration of the activatable anti-PDL1 antibodies is once a day, every other day, twice weekly, once weekly, once every 2 weeks, once every 3 weeks, once every 4 weeks, once every 5 weeks, once every six weeks, once every seven weeks, once every eight weeks the frequency of administration anti-CTLA-4 antibody, *e.g.*, ipilimumab is evry 7 days, every 14 days or every 28 days.

[00214] Alternatively, the frequency of administration of the activatable anti-PDL1 antibodiesantibodies is once a day, every other day, twice weekly, once every 7 days, once every 14 days, once every 21 days, once every 28 days once every 35 days, once every 42 days, once every 49 days, once every 56 days. the frequency of administration anti-CTLA-4 antibody, *e.g.*, ipilimumab is evry 7 days, every 14 days or every 28 days.

[00215] For example, in some embodiments, the activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV every 21 days for multiple doses.

[00216] For example, in some embodiments, the activatable anti-PDL1 antibody and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV every 14 days for multiple doses.

[00217]

[00218] In some embodiments, activatable anti-PDL1 antibody the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV every 21 days for at least two or more doses, *e.g.*, at least four or more doses. In some embodiments, activatable anti-PDL1 antibodyand the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV every 21 days for four doses.

[00219] In some embodiments, the anti-PDL1 antibody, conjugated anti-PDL1 antibody, activatable anti-PDL1 antibody and/or conjugated activatable anti-PDL1 antibody of the disclosure and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered IV every 21 days for at least two or more doses, *e.g.*, at least four doses, followed by administration of the activatable anti-PDL1 antibody as a monotherapy for a desired period of time

[00220] In some embodiments, the anti-PDL1 antibody, conjugated anti-PDL1 antibody, activatable anti-PDL1 antibody and/or conjugated activatable anti-PDL1 antibody of the disclosure is administered IV at a a dosasge or 0.3 mg/kg, 1.0 mg/kg, 3.0 mg/kg, 10.0 mg/kg, and 30.0 mg/kg, and the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, is administered IV at a dose of 3 mg/kg. In some embodiments, activatable anti-PDL1 antibody is administered IV at a dose 10.0 mg/kg, and, 6 mg/kg. or 10 mg/kg 10a dosasge or , 6 mg/kg or 10 mg/kg In some embodiments, the activatable anti-PDL1 antibodyand the CTLA-4 inhibitor, *e.g.*, an anti-CTLA-4 antibody, *e.g.*, ipilimumab, are administered according to the dosing

and/or administration schedule shown in FIG. 1, Part B1 or Part B2 and described in Example 2. In any of these embodiments described herein, an anti-PDL1 activatable antibody of the disclosure is used. In an exemplary embodiment, the activatable anti-PDL1 antibody is PL07-2001-C5H9v2.

[00221] For example multiple doses of the activatable antibody and the anti-CTLA-4 antibody are administered over a first period of time, followed by administration of multiple doses of the activatable anti-PDL1 antibody as a monotherapy over a second period of time.

[00222] For example, a dose of the activatable antibody and a dose of the anti-CTLA-4 antibody are administered concomitantly as a combination therapy every 21 days for 4 doses, followed by administration of a dose of the activatable anti-PDL1 antibody as a monotherapy every 14 days.

[00223] In some embodiemnts, multiple doses of the activatable anti-PDL1 antibody as a monotherapy is administerd over a first period of time, followed by concomitant administration of multiple doses of the activatable anti-PDL1 antibody and the anti-CTLA-4 antibody as a combination therapy over a second period of time.

[00224] For example multiple doses of the activatable antibody are administers as a monotherapy over a first period of time and subsequently multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy are administeerd over a second period of time, followed by administering multiple doses of the activatable antibody as a monotherapy over a third period of time.

[00225] In some embodimenst the activatable antibody is administered as a monotherapy every 14 days for 4 doses, followed by administration of a dose of activatable antibody and a dose of anti-CTLA-4 antibody as a combination therapy every 21 days, for 4 doses, followed by administration of a dose an activatable antibody as a monotherapy every 14 days.

[00226] In some embodiments, activatable anti-PDL1 antibody is used in combination with a B-RAF inhibitor. In some embodiments, activatable anti-PDL1 antibody of the disclosure is used in combination with vemurafenib

[00227] In some embodiments, t activatable anti-PDL1 antibodyis administered intravenously (IV), and the B-RAF inhibitor, *e.g.*, vemurafenib, is administered by mouth (PO). In some embodiments, the activatable anti-PDL1 antibodyis administered IV, and

multiple doses, *e.g.*, two or more doses, of the B-RAF inhibitor, *e.g.*, vemurafenib, are administered PO daily. In some embodiments, activatable anti-PDL1 antibodyis administered IV, and two doses of the B-RAF inhibitor, *e.g.*, vemurafenib, are administered PO daily. In some embodiments, activatable anti-PDL1 antibody is administered IV every 14 days, and two doses of the B-RAF inhibitor, *e.g.*, vemurafenib, are administered PO daily.

[00228] In some embodiments, the B-RAF inhibitor, *e.g.*, vemurafenib, is administered PO at a dose of 960 mg -. In some embodiments, the B-RAF inhibitor, *e.g.*, vemurafenib, is administered twice daily PO at a dose of 960 mg.

[00229] In some embodiments, the BB-RAF inhibitor, *e.g.*, vemurafenib, is administered PO at a dose of 875 mg -. In some embodiments, the B-RAF inhibitor, *e.g.*, vemurafenib, is administered twice daily PO at a dose of 875 mg

[00230] In some embodiments, activatable anti-PDL1 antibody is administered IV at a dosage of 1.0 mg/kg, 3.0 mg/kg, 10.0 mg/kg, and 30.0 mg/kg, and the B-RAF inhibitor, *e.g.*, vemurafenib, is administered PO at a dose of 960 mg. other , anti-PDL1 In other embodiments, activatable anti-PDL1 antibody is administered IV at a dosage of 1.0 mg/kg, 3.0 mg/kg, 10.0 mg/kg, and 30.0 mg/kg, and the BB-RAF inhibitor, *e.g.*, vemurafenib, is administeredadministered PO at a dose of 875 mg.

[00231] In some embodiments, activatable anti-PDL1 antibody is administered IV at a a dosage of 10.0 mg/kg, , and the B-RAF inhibitor, *e.g.*, vemurafenib, is administered PO at a dose of 960 mg.

[00232] In other embodiments, activatable anti-PDL1 antibody is administered IV at a a dosage of 10.0 mg/kg and the B-RAF inhibitor, *e.g.*, vemurafenib, is administered PO at a dose of 875 mg.

[00233] a dosage of other, anti-PDL1 administered IV at a a dosage of 10.0 mg/kg and the B-RAF inhibitor, *e.g.*, vemurafenib,administered PO at a dose of 875 mg

[00234] In some embodiments, activatable anti-PDL1 antibodyand the B-RAF inhibitor, *e.g.*, vemurafenib, are administered according to the dosing and/or administration schedule shown in FIG. 1, Part C and described in Example 1.

[00235] **ACTIVATABLE ANTI-PDL1 ANTIBODY- DRUGCONJUGATES**

[00236] The compositions and methods provided herein enable the attachment of one or more agents to one or more cysteine residues in the AB without compromising the activity

(e.g., the masking, activating or binding activity) of the activatable anti-PDL1 antibody. In some embodiments, the compositions and methods provided herein enable the attachment of one or more agents to one or more cysteine residues in the AB without reducing or otherwise disturbing one or more disulfide bonds within the MM. The compositions and methods provided herein produce an activatable anti-PDL1 antibody that is conjugated to one or more agents, *e.g.*, any of a variety of therapeutic, diagnostic and/or prophylactic agents, for example, in some embodiments, without any of the agent(s) being conjugated to the MM of the activatable anti-PDL1 antibody. The compositions and methods provided herein produce conjugated activatable anti-PDL1 antibodies in which the MM retains the ability to effectively and efficiently mask the AB of the activatable antibody in an uncleaved state. The compositions and methods provided herein produce conjugated activatable anti-PDL1 antibodies in which the activatable antibody is still activated, *i.e.*, cleaved, in the presence of a protease that can cleave the CM.

[00237] In some embodiments, the activatable antibodies described herein also include an agent conjugated to the activatable antibody. In some embodiments, the conjugated agent is a therapeutic agent, such as an anti-inflammatory and/or an antineoplastic agent. In such embodiments, the agent is conjugated to a carbohydrate moiety of the activatable antibody, for example, in some embodiments, where the carbohydrate moiety is located outside the antigen-binding region of the antibody or antigen-binding fragment in the activatable antibody. In some embodiments, the agent is conjugated to a sulfhydryl group of the antibody or antigen-binding fragment in the activatable antibody.

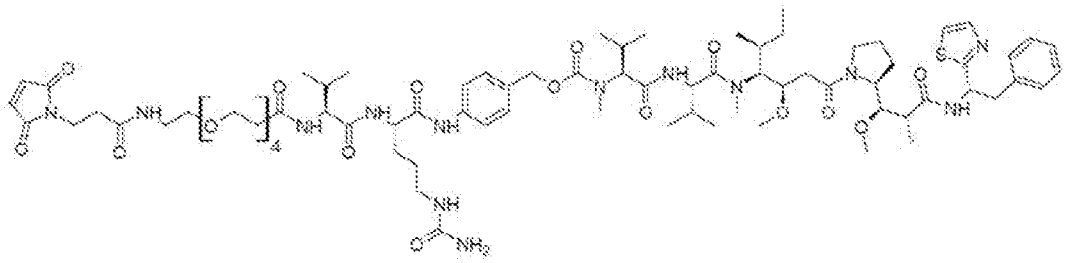
[00238] In some embodiments, the agent is a cytotoxic agent such as a toxin (*e.g.*, an enzymatically active toxin of bacterial, fungal, plant, or animal origin, or fragments thereof), or a radioactive isotope (*i.e.*, a radioconjugate).

[00239] In some embodiments, the agent is a detectable moiety such as, for example, a label or other marker. For example, the agent is or includes a radiolabeled amino acid, one or more biotinyl moieties that can be detected by marked avidin (*e.g.*, streptavidin containing a fluorescent marker or enzymatic activity that can be detected by optical or calorimetric methods), one or more radioisotopes or radionuclides, one or more fluorescent labels, one or more enzymatic labels, and/or one or more chemiluminescent agents. In some embodiments, detectable moieties are attached by spacer molecules.

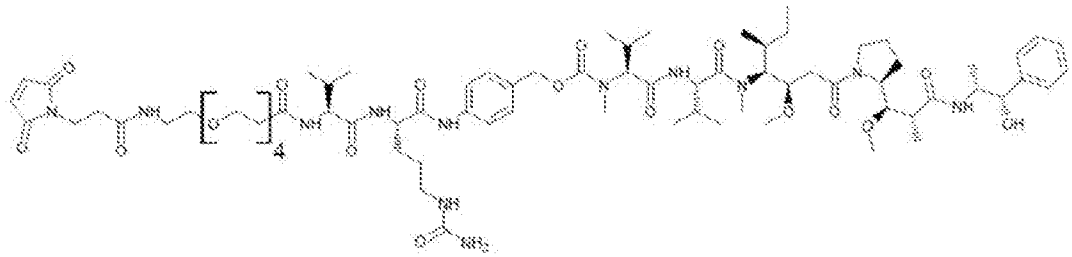
[00240] The disclosure also pertains to immunoconjugates comprising an antibody conjugated to a cytotoxic agent such as a toxin (*e.g.*, an enzymatically active toxin of bacterial, fungal, plant, or animal origin, or fragments thereof), or a radioactive isotope (*i.e.*, a radioconjugate). Suitable cytotoxic agents include, for example, dolastatins and derivatives thereof (*e.g.* auristatin E, AFP, MMAF, MMAE, MMAD, DMAF, DMAE). For example, the agent is monomethyl auristatin E (MMAE) or monomethyl auristatin D (MMAD). In some embodiments, the agent is an agent selected from the group listed in Table 11. In some embodiments, the agent is a dolastatin. In some embodiments, the agent is an auristatin or derivative thereof. In some embodiments, the agent is auristatin E or a derivative thereof. In some embodiments, the agent is monomethyl auristatin E (MMAE). In some embodiments, the agent is monomethyl auristatin D (MMAD). In some embodiments, the agent is a maytansinoid or maytansinoid derivative. In some embodiments, the agent is DM1 or DM4. In some embodiments, the agent is a duocarmycin or derivative thereof. In some embodiments, the agent is a calicheamicin or derivative thereof. In some embodiments, the agent is a pyrrolobenzodiazepine. In some embodiments, the agent is a pyrrolobenzodiazepine dimer.

[00241] In some embodiments, the agent is linked to the AB using a maleimide caproyl-valine-citrulline linker or a maleimide PEG-valine-citrulline linker. In some embodiments, the agent is linked to the AB using a maleimide caproyl-valine-citrulline linker. In some embodiments, the agent is linked to the AB using a maleimide PEG-valine-citrulline linker In some embodiments, the agent is monomethyl auristatin D (MMAD) linked to the AB using a maleimide PEG-valine-citrulline-para-aminobenzyloxycarbonyl linker, and this linker payload construct is referred to herein as "vc-MMAD." In some embodiments, the agent is monomethyl auristatin E (MMAE) linked to the AB using a maleimide PEG-valine-citrulline-para-aminobenzyloxycarbonyl linker, and this linker payload construct is referred to herein as "vc-MMAE." The structures of vc-MMAD and vc-MMAE are shown below:

vc-MMAD:



vc-MMAE:



[00242] The disclosure also provides conjugated activatable antibodies that include an activatable antibody linked to monomethyl auristatin D (MMAD) payload, wherein the activatable antibody includes an antibody or an antigen binding fragment thereof (AB) that specifically binds to a target, a masking moiety (MM) that inhibits the binding of the AB of the activatable antibody in an uncleaved state to the target, and cleavable moiety (CM) coupled to the AB, and the CM is a polypeptide that functions as a substrate for at least one MMP protease.

[00243] In some embodiments, the MMAD-conjugated activatable antibody can be conjugated using any of several methods for attaching agents to ABs: (a) attachment to the carbohydrate moieties of the AB, or (b) attachment to sulfhydryl groups of the AB, or (c) attachment to amino groups of the AB, or (d) attachment to carboxylate groups of the AB.

[00244] In some embodiments, the polyethylene glycol (PEG) component of a linker of the present disclosure is formed from 2 ethylene glycol monomers, 3 ethylene glycol monomers, 4 ethylene glycol monomers, 5 ethylene glycol monomers, 6 ethylene glycol monomers, 7 ethylene glycol monomers 8 ethylene glycol monomers, 9 ethylene glycol monomers, or at least 10 ethylene glycol monomers. In some embodiments of the present disclosure, the PEG component is a branched polymer. In some embodiments of the present disclosure, the PEG component is an unbranched polymer. In some embodiments, the PEG polymer component is functionalized with an amino group or derivative thereof, a carboxyl

group or derivative thereof, or both an amino group or derivative thereof and a carboxyl group or derivative thereof.

[00245] In some embodiments, the PEG component of a linker of the present disclosure is an amino-tetra-ethylene glycol-carboxyl group or derivative thereof. In some embodiments, the PEG component of a linker of the present disclosure is an amino-tri-ethylene glycol-carboxyl group or derivative thereof. In some embodiments, the PEG component of a linker of the present disclosure is an amino-di-ethylene glycol-carboxyl group or derivative thereof. In some embodiments, an amino derivative is the formation of an amide bond between the amino group and a carboxyl group to which it is conjugated. In some embodiments, a carboxyl derivative is the formation of an amide bond between the carboxyl group and an amino group to which it is conjugated. In some embodiments, a carboxyl derivative is the formation of an ester bond between the carboxyl group and an hydroxyl group to which it is conjugated.

[00246] Enzymatically active toxins and fragments thereof that can be used include diphtheria A chain, nonbinding active fragments of diphtheria toxin, exotoxin A chain (from Pseudomonas aeruginosa), ricin A chain, abrin A chain, modeccin A chain, alpha-sarcin, Aleurites fordii proteins, dianthin proteins, Phytolaca americana proteins (PAPI, PAPII, and PAP-S), momordica charantia inhibitor, curcin, crotin, sapaonaria officinalis inhibitor, gelonin, mitogellin, restrictocin, phenomycin, enomycin, and the tricothecenes. A variety of radionuclides are available for the production of radioconjugated antibodies. Examples include ^{212}Bi, ^{131}I, ^{131}In, ^{90}Y, and ^{186}Re. In some embodiments, the isotope is zirconium.

[00247] Those of ordinary skill in the art will recognize that a large variety of possible moieties can be coupled to the resultant activatable antibodies of the disclosure. (*See, for example*, "Conjugate Vaccines", Contributions to Microbiology and Immunology, J. M. Cruse and R. E. Lewis, Jr (eds), Carger Press, New York, (1989), the entire contents of which are incorporated herein by reference).

[00248] **PHARMACEUTICAL COMPOSITIONS**

[00249] The antibodies, conjugated antibodies, activatable antibodies and/or conjugated activatable antibodies of the disclosure (also referred to herein as “active compounds”), and derivatives, fragments, analogs and homologs thereof, can be incorporated into pharmaceutical compositions suitable for administration. Such compositions typically comprise the antibody, the conjugated antibody, activatable antibody and/or conjugated activatable antibody and a

pharmaceutically acceptable carrier. As used herein, the term "pharmaceutically acceptable carrier" is intended to include any and all solvents, dispersion media, coatings, antibacterial and antifungal agents, isotonic and absorption delaying agents, and the like, compatible with pharmaceutical administration. Suitable carriers are described in the most recent edition of Remington's Pharmaceutical Sciences, a standard reference text in the field, which is incorporated herein by reference. Suitable examples of such carriers or diluents include, but are not limited to, water, saline, ringer's solutions, dextrose solution, and 5% human serum albumin. Liposomes and non-aqueous vehicles such as fixed oils may also be used. The use of such media and agents for pharmaceutically active substances is well known in the art. Except insofar as any conventional media or agent is incompatible with the active compound, use thereof in the compositions is contemplated. Supplementary active compounds can also be incorporated into the compositions.

[00250] A pharmaceutical composition of the disclosure is formulated to be compatible with its intended route of administration. Examples of routes of administration include parenteral, *e.g.*, intravenous, intradermal, subcutaneous, oral (*e.g.*, inhalation), transdermal (*i.e.*, topical), transmucosal, and rectal administration. Solutions or suspensions used for parenteral, intradermal, or subcutaneous application can include the following components: a sterile diluent such as water for injection, saline solution, fixed oils, polyethylene glycols, glycerine, propylene glycol or other synthetic solvents; antibacterial agents such as benzyl alcohol or methyl parabens; antioxidants such as ascorbic acid or sodium bisulfite; chelating agents such as ethylenediaminetetraacetic acid (EDTA); buffers such as acetates, citrates or phosphates, and agents for the adjustment of tonicity such as sodium chloride or dextrose. The pH can be adjusted with acids or bases, such as hydrochloric acid or sodium hydroxide. The parenteral preparation can be enclosed in ampoules, disposable syringes or multiple dose vials made of glass or plastic.

[00251] Pharmaceutical compositions suitable for injectable use include sterile aqueous solutions (where water soluble) or dispersions and sterile powders for the extemporaneous preparation of sterile injectable solutions or dispersion. For intravenous administration, suitable carriers include physiological saline, bacteriostatic water, Cremophor EL™ (BASF, Parsippany, N.J.) or phosphate buffered saline (PBS). In all cases, the composition must be sterile and should be fluid to the extent that easy syringeability exists. It must be stable under the

conditions of manufacture and storage and must be preserved against the contaminating action of microorganisms such as bacteria and fungi. The carrier can be a solvent or dispersion medium containing, for example, water, ethanol, polyol (for example, glycerol, propylene glycol, and liquid polyethylene glycol, and the like), and suitable mixtures thereof. The proper fluidity can be maintained, for example, by the use of a coating such as lecithin, by the maintenance of the required particle size in the case of dispersion and by the use of surfactants. Prevention of the action of microorganisms can be achieved by various antibacterial and antifungal agents, for example, parabens, chlorobutanol, phenol, ascorbic acid, thimerosal, and the like. In some embodiments, it will be desirable to include isotonic agents, for example, sugars, polyalcohols such as manitol, sorbitol, sodium chloride in the composition. Prolonged absorption of the injectable compositions can be brought about by including in the composition an agent that delays absorption, for example, aluminum monostearate and gelatin.

[00252] Sterile injectable solutions can be prepared by incorporating the active compound in the required amount in an appropriate solvent with one or a combination of ingredients enumerated above, as required, followed by filtered sterilization. Generally, dispersions are prepared by incorporating the active compound into a sterile vehicle that contains a basic dispersion medium and the required other ingredients from those enumerated above. In the case of sterile powders for the preparation of sterile injectable solutions, methods of preparation are vacuum drying and freeze-drying that yields a powder of the active ingredient plus any additional desired ingredient from a previously sterile-filtered solution thereof.

[00253] Oral compositions generally include an inert diluent or an edible carrier. They can be enclosed in gelatin capsules or compressed into tablets. For the purpose of oral therapeutic administration, the active compound can be incorporated with excipients and used in the form of tablets, troches, or capsules. Oral compositions can also be prepared using a fluid carrier for use as a mouthwash, wherein the compound in the fluid carrier is applied orally and swished and expectorated or swallowed. Pharmaceutically compatible binding agents, and/or adjuvant materials can be included as part of the composition. The tablets, pills, capsules, troches and the like can contain any of the following ingredients, or compounds of a similar nature: a binder such as microcrystalline cellulose, gum tragacanth or gelatin; an excipient such as starch or lactose, a disintegrating agent such as alginic acid, Primogel, or

corn starch; a lubricant such as magnesium stearate or Sterotes; a glidant such as colloidal silicon dioxide; a sweetening agent such as sucrose or saccharin; or a flavoring agent such as peppermint, methyl salicylate, or orange flavoring.

[00254] For administration by inhalation, the compounds are delivered in the form of an aerosol spray from pressured container or dispenser that contains a suitable propellant, *e.g.*, a gas such as carbon dioxide, or a nebulizer.

[00255] Systemic administration can also be by transmucosal or transdermal means. For transmucosal or transdermal administration, penetrants appropriate to the barrier to be permeated are used in the formulation. Such penetrants are generally known in the art, and include, for example, for transmucosal administration, detergents, bile salts, and fusidic acid derivatives. Transmucosal administration can be accomplished through the use of nasal sprays or suppositories. For transdermal administration, the active compounds are formulated into ointments, salves, gels, or creams as generally known in the art.

[00256] The compounds can also be prepared in the form of suppositories (*e.g.*, with conventional suppository bases such as cocoa butter and other glycerides) or retention enemas for rectal delivery.

[00257] In one embodiment, the active compounds are prepared with carriers that will protect the compound against rapid elimination from the body, such as a controlled release formulation, including implants and microencapsulated delivery systems. Biodegradable, biocompatible polymers can be used, such as ethylene vinyl acetate, polyanhydrides, polyglycolic acid, collagen, polyorthoesters, and polylactic acid. Methods for preparation of such formulations will be apparent to those skilled in the art. The materials can also be obtained commercially from Alza Corporation and Nova Pharmaceuticals, Inc. Liposomal suspensions (including liposomes targeted to infected cells with monoclonal antibodies to viral antigens) can also be used as pharmaceutically acceptable carriers. These can be prepared according to methods known to those skilled in the art, for example, as described in U.S. Patent No. 4,522,811.

[00258] It is especially advantageous to formulate oral or parenteral compositions in dosage unit form for ease of administration and uniformity of dosage. Dosage unit form as used herein refers to physically discrete units suited as unitary dosages for the subject to be treated; each unit containing a predetermined quantity of active compound calculated to

produce the desired therapeutic effect in association with the required pharmaceutical carrier. The specification for the dosage unit forms of the disclosure are dictated by and directly dependent on the unique characteristics of the active compound and the particular therapeutic effect to be achieved, and the limitations inherent in the art of compounding such an active compound for the treatment of individuals.

[00259] The pharmaceutical compositions can be included in a container, pack, or dispenser together with instructions for administration.

DEFINITIONS:

[00260] Unless otherwise defined, scientific and technical terms used in connection with the present disclosure shall have the meanings that are commonly understood by those of ordinary skill in the art. The term "a" entity or "an" entity refers to one or more of that entity. For example, a compound refers to one or more compounds. As such, the terms "a", "an", "one or more" and "at least one" can be used interchangeably. Further, unless otherwise required by context, singular terms shall include pluralities and plural terms shall include the singular. Generally, nomenclatures utilized in connection with, and techniques of, cell and tissue culture, molecular biology, and protein and oligo- or polynucleotide chemistry and hybridization described herein are those well-known and commonly used in the art. Standard techniques are used for recombinant DNA, oligonucleotide synthesis, and tissue culture and transformation (*e.g.*, electroporation, lipofection). Enzymatic reactions and purification techniques are performed according to manufacturer's specifications or as commonly accomplished in the art or as described herein. The foregoing techniques and procedures are generally performed according to conventional methods well known in the art and as described in various general and more specific references that are cited and discussed throughout the present specification. *See e.g.,* Sambrook *et al.* Molecular Cloning: A Laboratory Manual (2d ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y. (1989)). The nomenclatures utilized in connection with, and the laboratory procedures and techniques of, analytical chemistry, synthetic organic chemistry, and medicinal and pharmaceutical chemistry described herein are those well-known and commonly used in the art. Standard techniques are used for chemical syntheses, chemical analyses, pharmaceutical preparation, formulation, and delivery, and treatment of patients.

[00261] As utilized in accordance with the present disclosure, the following terms, unless otherwise indicated, shall be understood to have the following meanings:

[00262] As used herein, the term "antibody" refers to immunoglobulin molecules and immunologically active portions of immunoglobulin (Ig) molecules, *i.e.*, molecules that contain an antigen binding site that specifically binds (immunoreacts with) an antigen. By "specifically bind" or "immunoreacts with" or "immunospecifically bind" is meant that the antibody reacts with one or more antigenic determinants of the desired antigen and does not react with other polypeptides or binds at much lower affinity ($K_d > 10^{-6}$). Antibodies include, but are not limited to, polyclonal, monoclonal, chimeric, domain antibody, single chain, Fab, and $F(ab')_2$ fragments, scFvs, and an Fab expression library.

[00263] The basic antibody structural unit is known to comprise a tetramer. Each tetramer is composed of two identical pairs of polypeptide chains, each pair having one "light" (about 25 kDa) and one "heavy" chain (about 50-70 kDa). The amino-terminal portion of each chain includes a variable region of about 100 to 110 or more amino acids primarily responsible for antigen recognition. The carboxy-terminal portion of each chain defines a constant region primarily responsible for effector function. In general, antibody molecules obtained from humans relate to any of the classes IgG, IgM, IgA, IgE and IgD, which differ from one another by the nature of the heavy chain present in the molecule. Certain classes have subclasses as well, such as IgG_1, IgG_2, and others. Furthermore, in humans, the light chain may be a kappa chain or a lambda chain.

[00264] The term "monoclonal antibody" (mAb) or "monoclonal antibody composition", as used herein, refers to a population of antibody molecules that contain only one molecular species of antibody molecule consisting of a unique light chain gene product and a unique heavy chain gene product. In particular, the complementarity determining regions (CDRs) of the monoclonal antibody are identical in all the molecules of the population. MAbs contain an antigen binding site capable of immunoreacting with a particular epitope of the antigen characterized by a unique binding affinity for it.

[00265] The term "antigen-binding site" or "binding portion" refers to the part of the immunoglobulin molecule that participates in antigen binding. The antigen binding site is formed by amino acid residues of the N-terminal variable ("V") regions of the heavy ("H") and light ("L") chains. Three highly divergent stretches within the V regions of the heavy and light

chains, referred to as "hypervariable regions," are interposed between more conserved flanking stretches known as "framework regions," or "FRs". Thus, the term "FR" refers to amino acid sequences that are naturally found between, and adjacent to, hypervariable regions in immunoglobulins. In an antibody molecule, the three hypervariable regions of a light chain and the three hypervariable regions of a heavy chain are disposed relative to each other in three dimensional space to form an antigen-binding surface. The antigen-binding surface is complementary to the three-dimensional surface of a bound antigen, and the three hypervariable regions of each of the heavy and light chains are referred to as "complementarity-determining regions," or "CDRs." The assignment of amino acids to each domain is in accordance with the definitions of Kabat Sequences of Proteins of Immunological Interest (National Institutes of Health, Bethesda, Md. (1987 and 1991)), or Chothia & Lesk J. Mol. Biol. 196:901-917 (1987), Chothia *et al.* Nature 342:878-883 (1989).

[00266] As used herein, the term "epitope" includes any protein determinant capable of specific binding to an immunoglobulin, an scFv, or a T-cell receptor. The term "epitope" includes any protein determinant capable of specific binding to an immunoglobulin or T-cell receptor. Epitopic determinants usually consist of chemically active surface groupings of molecules such as amino acids or sugar side chains and usually have specific three dimensional structural characteristics, as well as specific charge characteristics. For example, antibodies may be raised against N-terminal or C-terminal peptides of a polypeptide. An antibody is said to specifically bind an antigen when the dissociation constant is ≤ 1 μM; in some embodiments, ≤ 100 nM and in some embodiments, ≤ 10 nM.

[00267] As used herein, the terms "specific binding," "immunological binding," and "immunological binding properties" refer to the non-covalent interactions of the type which occur between an immunoglobulin molecule and an antigen for which the immunoglobulin is specific. The strength, or affinity of immunological binding interactions can be expressed in terms of the dissociation constant (K_d) of the interaction, wherein a smaller K_d represents a greater affinity. Immunological binding properties of selected polypeptides can be quantified using methods well known in the art. One such method entails measuring the rates of antigen-binding site/antigen complex formation and dissociation, wherein those rates depend on the concentrations of the complex partners, the affinity of the interaction, and geometric parameters that equally influence the rate in both directions. Thus, both the "on rate constant"

(K_{on}) and the "off rate constant" (K_{off}) can be determined by calculation of the concentrations and the actual rates of association and dissociation. (*See* Nature 361:186-87 (1993)). The ratio of K_{off} /K_{on} enables the cancellation of all parameters not related to affinity, and is equal to the dissociation constant K_d. (*See, generally*, Davies et al. (1990) Annual Rev Biochem 59:439-473). An antibody of the present disclosure is said to specifically bind to the target, when the binding constant (K_d) is ≤1 μM, in some embodiments ≤ 100 nM, in some embodiments ≤ 10 nM, and in some embodiments ≤ 100 pM to about 1 pM, as measured by assays such as radioligand binding assays or similar assays known to those skilled in the art.

[00268] The term "isolated polynucleotide" as used herein shall mean a polynucleotide of genomic, cDNA, or synthetic origin or some combination thereof, which by virtue of its origin the "isolated polynucleotide" (1) is not associated with all or a portion of a polynucleotide in which the "isolated polynucleotide" is found in nature, (2) is operably linked to a polynucleotide which it is not linked to in nature, or (3) does not occur in nature as part of a larger sequence. Polynucleotides in accordance with the disclosure include the nucleic acid molecules encoding the heavy chain immunoglobulin molecules shown herein, and nucleic acid molecules encoding the light chain immunoglobulin molecules shown herein.

[00269] The term "isolated protein" referred to herein means a protein of cDNA, recombinant RNA, or synthetic origin or some combination thereof, which by virtue of its origin, or source of derivation, the "isolated protein" (1) is not associated with proteins found in nature, (2) is free of other proteins from the same source, *e.g.*, free of murine proteins, (3) is expressed by a cell from a different species, or (4) does not occur in nature.

[00270] The term "polypeptide" is used herein as a generic term to refer to native protein, fragments, or analogs of a polypeptide sequence. Hence, native protein fragments, and analogs are species of the polypeptide genus. Polypeptides in accordance with the disclosure comprise the heavy chain immunoglobulin molecules shown herein, and the light chain immunoglobulin molecules shown herein, as well as antibody molecules formed by combinations comprising the heavy chain immunoglobulin molecules with light chain immunoglobulin molecules, such as kappa light chain immunoglobulin molecules, and vice versa, as well as fragments and analogs thereof.

[00271] The term "naturally-occurring" as used herein as applied to an object refers to the fact that an object can be found in nature. For example, a polypeptide or polynucleotide

sequence that is present in an organism (including viruses) that can be isolated from a source in nature and that has not been intentionally modified by man in the laboratory or otherwise is naturally-occurring.

[00272] The term "operably linked" as used herein refers to positions of components so described are in a relationship permitting them to function in their intended manner. A control sequence "operably linked" to a coding sequence is ligated in such a way that expression of the coding sequence is achieved under conditions compatible with the control sequences.

[00273] The term "control sequence" as used herein refers to polynucleotide sequences that are necessary to effect the expression and processing of coding sequences to which they are ligated. The nature of such control sequences differs depending upon the host organism in prokaryotes, such control sequences generally include promoter, ribosomal binding site, and transcription termination sequence in eukaryotes, generally, such control sequences include promoters and transcription termination sequence. The term "control sequences" is intended to include, at a minimum, all components whose presence is essential for expression and processing, and can also include additional components whose presence is advantageous, for example, leader sequences and fusion partner sequences. The term "polynucleotide" as referred to herein means nucleotides of at least 10 bases in length, either ribonucleotides or deoxynucleotides or a modified form of either type of nucleotide. The term includes single and double stranded forms of DNA.

[00274] The term oligonucleotide referred to herein includes naturally occurring, and modified nucleotides linked together by naturally occurring, and non-naturally occurring oligonucleotide linkages. Oligonucleotides are a polynucleotide subset generally comprising a length of 200 bases or fewer. In some embodiments, oligonucleotides are 10 to 60 bases in length and in some embodiments, 12, 13, 14, 15, 16, 17, 18, 19, or 20 to 40 bases in length. Oligonucleotides are usually single stranded, *e.g.,* for probes, although oligonucleotides may be double stranded, *e.g.,* for use in the construction of a gene mutant. Oligonucleotides of the disclosure are either sense or antisense oligonucleotides.

[00275] The term "naturally occurring nucleotides" referred to herein includes deoxyribonucleotides and ribonucleotides. The term "modified nucleotides" referred to herein includes nucleotides with modified or substituted sugar groups and the like. The term "oligonucleotide linkages" referred to herein includes oligonucleotide linkages such as

phosphorothioate, phosphorodithioate, phosphoroselerloate, phosphorodiselenoate, phosphoroanilothioate, phoshoraniladate, phosphoronmidate, and the like. *See e.g.*, LaPlanche *et al.* Nucl. Acids Res. 14:9081 (1986); Stec *et al.* J. Am. Chem. Soc. 106:6077 (1984), Stein *et al.* Nucl. Acids Res. 16:3209 (1988), Zon *et al.* Anti Cancer Drug Design 6:539 (1991); Zon *et al.* Oligonucleotides and Analogues: A Practical Approach, pp. 87-108 (F. Eckstein, Ed., Oxford University Press, Oxford England (1991)); Stec *et al.* U.S. Patent No. 5,151,510; Uhlmann and Peyman Chemical Reviews 90:543 (1990). An oligonucleotide can include a label for detection, if desired.

[00276] As used herein, the twenty conventional amino acids and their abbreviations follow conventional usage. *See* Immunology - A Synthesis (2nd Edition, E.S. Golub and D.R. Green, Eds., Sinauer Associates, Sunderland, Mass. (1991)). Stereoisomers (*e.g.*, D- amino acids) of the twenty conventional amino acids, unnatural amino acids such as α-, α-disubstituted amino acids, N-alkyl amino acids, lactic acid, and other unconventional amino acids may also be suitable components for polypeptides of the present disclosure. Examples of unconventional amino acids include: 4 hydroxyproline, γ-carboxyglutamate, ε-N,N,N-trimethyllysine, ε -N-acetyllysine, O-phosphoserine, N- acetylserine, N-formylmethionine, 3-methylhistidine, 5-hydroxylysine, σ-N-methylarginine, and other similar amino acids and imino acids (*e.g.*, 4- hydroxyproline). In the polypeptide notation used herein, the left-hand direction is the amino terminal direction and the right-hand direction is the carboxy-terminal direction, in accordance with standard usage and convention.

[00277] Similarly, unless specified otherwise, the left-hand end of single- stranded polynucleotide sequences is the 5' end the left-hand direction of double-stranded polynucleotide sequences is referred to as the 5' direction. The direction of 5' to 3' addition of nascent RNA transcripts is referred to as the transcription direction sequence regions on the DNA strand having the same sequence as the RNA and that are 5' to the 5' end of the RNA transcript are referred to as "upstream sequences", sequence regions on the DNA strand having the same sequence as the RNA and that are 3' to the 3' end of the RNA transcript are referred to as "downstream sequences".

[00278] As applied to polypeptides, the term "substantial identity" means that two peptide sequences, when optimally aligned, such as by the programs GAP or BESTFIT using default gap weights, share at least 80 percent sequence identity, in some embodiments, at least

90 percent sequence identity, in some embodiments, at least 95 percent sequence identity, and in some embodiments, at least 99 percent sequence identity.

[00279] In some embodiments, residue positions that are not identical differ by conservative amino acid substitutions.

[00280] As discussed herein, minor variations in the amino acid sequences of antibodies or immunoglobulin molecules are contemplated as being encompassed by the present disclosure, providing that the variations in the amino acid sequence maintain at least 75%, in some embodiments, at least 80%, 90%, 95%, and in some embodiments, 99%. In particular, conservative amino acid replacements are contemplated. Conservative replacements are those that take place within a family of amino acids that are related in their side chains. Genetically encoded amino acids are generally divided into families: (1) acidic amino acids are aspartate, glutamate; (2) basic amino acids are lysine, arginine, histidine; (3) non-polar amino acids are alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan, and (4) uncharged polar amino acids are glycine, asparagine, glutamine, cysteine, serine, threonine, tyrosine. The hydrophilic amino acids include arginine, asparagine, aspartate, glutamine, glutamate, histidine, lysine, serine, and threonine. The hydrophobic amino acids include alanine, cysteine, isoleucine, leucine, methionine, phenylalanine, proline, tryptophan, tyrosine and valine. Other families of amino acids include (i) serine and threonine, which are the aliphatic-hydroxy family; (ii) asparagine and glutamine, which are the amide containing family; (iii) alanine, valine, leucine and isoleucine, which are the aliphatic family; and (iv) phenylalanine, tryptophan, and tyrosine, which are the aromatic family. For example, it is reasonable to expect that an isolated replacement of a leucine with an isoleucine or valine, an aspartate with a glutamate, a threonine with a serine, or a similar replacement of an amino acid with a structurally related amino acid will not have a major effect on the binding or properties of the resulting molecule, especially if the replacement does not involve an amino acid within a framework site. Whether an amino acid change results in a functional peptide can readily be determined by assaying the specific activity of the polypeptide derivative. Assays are described in detail herein. Fragments or analogs of antibodies or immunoglobulin molecules can be readily prepared by those of ordinary skill in the art. Suitable amino- and carboxy-termini of fragments or analogs occur near boundaries of functional domains. Structural and functional domains can be identified by comparison of the nucleotide and/or amino acid sequence data to

public or proprietary sequence databases. In some embodiments, computerized comparison methods are used to identify sequence motifs or predicted protein conformation domains that occur in other proteins of known structure and/or function. Methods to identify protein sequences that fold into a known three-dimensional structure are known. Bowie *et al.* Science 253:164 (1991). Thus, the foregoing examples demonstrate that those of skill in the art can recognize sequence motifs and structural conformations that may be used to define structural and functional domains in accordance with the disclosure.

[00281] Suitable amino acid substitutions are those that: (1) reduce susceptibility to proteolysis, (2) reduce susceptibility to oxidation, (3) alter binding affinity for forming protein complexes, (4) alter binding affinities, and (5) confer or modify other physicochemical or functional properties of such analogs. Analogs can include various muteins of a sequence other than the naturally-occurring peptide sequence. For example, single or multiple amino acid substitutions (for example, conservative amino acid substitutions) may be made in the naturally- occurring sequence (for example, in the portion of the polypeptide outside the domain(s) forming intermolecular contacts. A conservative amino acid substitution should not substantially change the structural characteristics of the parent sequence (*e.g.*, a replacement amino acid should not tend to break a helix that occurs in the parent sequence, or disrupt other types of secondary structure that characterizes the parent sequence). Examples of art-recognized polypeptide secondary and tertiary structures are described in Proteins, Structures and Molecular Principles (Creighton, Ed., W. H. Freeman and Company, New York (1984)); Introduction to Protein Structure (C. Branden and J. Tooze, eds., Garland Publishing, New York, N.Y. (1991)); and Thornton et at. Nature 354:105 (1991).

[00282] The term "polypeptide fragment" as used herein refers to a polypeptide that has an amino terminal and/or carboxy-terminal deletion and/or one or more internal deletion(s), but where the remaining amino acid sequence is identical to the corresponding positions in the naturally-occurring sequence deduced, for example, from a full length cDNA sequence. Fragments typically are at least 5, 6, 8 or 10 amino acids long, in some embodiments, at least 14 amino acids long, in some embodiments, at least 20 amino acids long, usually at least 50 amino acids long, and in some embodiments, at least 70 amino acids long. The term "analog" as used herein refers to polypeptides that are comprised of a segment of at least 25 amino acids that has substantial identity to a portion of a deduced amino acid sequence and that has specific

binding to the target, under suitable binding conditions. Typically, polypeptide analogs comprise a conservative amino acid substitution (or addition or deletion) with respect to the naturally- occurring sequence. Analogs typically are at least 20 amino acids long, in some embodiments, at least 50 amino acids long or longer, and can often be as long as a full-length naturally-occurring polypeptide.

[00283] The term "agent" is used herein to denote a chemical compound, a mixture of chemical compounds, a biological macromolecule, or an extract made from biological materials.

[00284] As used herein, the terms "label" or "labeled" refers to incorporation of a detectable marker, *e.g.,* by incorporation of a radiolabeled amino acid or attachment to a polypeptide of biotinyl moieties that can be detected by marked avidin (*e.g.,* streptavidin containing a fluorescent marker or enzymatic activity that can be detected by optical or calorimetric methods). In certain situations, the label or marker can also be therapeutic. Various methods of labeling polypeptides and glycoproteins are known in the art and may be used. Examples of labels for polypeptides include, but are not limited to, the following: radioisotopes or radionuclides (*e.g.,* ^{3}H, ^{14}C, ^{15}N, ^{35}S, ^{90}Y, ^{99}Tc, ^{111}In, ^{125}I, ^{131}I), fluorescent labels (*e.g.,* FITC, rhodamine, lanthanide phosphors), enzymatic labels (*e.g.,* horseradish peroxidase, p-galactosidase, luciferase, alkaline phosphatase), chemiluminescent, biotinyl groups, predetermined polypeptide epitopes recognized by a secondary reporter (*e.g.*, leucine zipper pair sequences, binding sites for secondary antibodies, metal binding domains, epitope tags). In some embodiments, labels are attached by spacer arms of various lengths to reduce potential steric hindrance. The term "pharmaceutical agent or drug" as used herein refers to a chemical compound or composition capable of inducing a desired therapeutic effect when properly administered to a patient.

[00285] Other chemistry terms herein are used according to conventional usage in the art, as exemplified by The McGraw-Hill Dictionary of Chemical Terms (Parker, S., Ed., McGraw-Hill, San Francisco (1985)).

[00286] As used herein, "substantially pure" means an object species is the predominant species present (*i.e.,* on a molar basis it is more abundant than any other individual species in the composition), and in some embodiments, a substantially purified fraction is a composition

wherein the object species comprises at least about 50 percent (on a molar basis) of all macromolecular species present.

[00287] Generally, a substantially pure composition will comprise more than about 80 percent of all macromolecular species present in the composition, in some embodiments, more than about 85%, 90%, 95%, and 99%. In some embodiments, the object species is purified to essential homogeneity (contaminant species cannot be detected in the composition by conventional detection methods) wherein the composition consists essentially of a single macromolecular species.

[00288] The term patient includes human and veterinary subjects.

[00289] The terms subject and patient are used interchangeably herein.

[00290] Antibodies and/or activatable antibodies of the disclosure specifically bind a given target, e.g., a human target protein such as human PDL1. Also included in the disclosure are antibodies and/or activatable antibodies that bind to the same epitope as the antibodies and/or activatable antibodies described herein. Also included in the disclosure are antibodies and/or antibodies activatable antibodies that compete with an anti-PDL1 antibody and/or an anti-PDL1 activatable antibody described herein for binding to PDL1, e.g., human PDL1. Also included in the disclosure are antibodies and/or antibodies activatable antibodies that cross-compete with an anti-PDL1 antibody and/or an anti-PDL1 activatable antibody described herein for binding to PDL1, e.g., human PDL1.

[00291] Those skilled in the art will recognize that it is possible to determine, without undue experimentation, if a monoclonal antibody (*e.g.*, a murine monoclonal or humanized antibody) has the same specificity as a monoclonal antibody used in the methods described herein by ascertaining whether the former prevents the latter from binding to the target. If the monoclonal antibody being tested competes with the monoclonal antibody of the disclosure, as shown by a decrease in binding by the monoclonal antibody of the disclosure, then the two monoclonal antibodies bind to the same, or a closely related, epitope. An alternative method for determining whether a monoclonal antibody has the specificity of a monoclonal antibody of the disclosure is to pre-incubate the monoclonal antibody of the disclosure with the target and then add the monoclonal antibody being tested to determine if the monoclonal antibody being tested is inhibited in its ability to bind the target. If the monoclonal antibody being tested is

inhibited then, in all likelihood, it has the same, or functionally equivalent, epitopic specificity as the monoclonal antibody of the disclosure.

[00292] The invention will be further described in the following examples, which do not limit the scope of the invention described in the claims.

EXAMPLES

EXAMPLE 1. Assessment of Tolerability of Anti-PDL1 Antibodies in Solid Tumors and Lymphomas

[00293] This Example evaluates the safety, tolerability, pharmacokinetics (PK), pharmacodynamics (PD), and preliminary antitumor activity of one of more doses, e.g., a single dose or multiple doses, of an anti-PDL1 activatable antibody as a monotherapy or in combination with ipilimumab (also known as Yervoy®), an anti-CTLA-4 antibody, or vemurafenib (also known as Zelboraf®), a B-Raf enzyme inhibitor, in patients with advanced, unresectable solid tumors or lymphoma.

[00294] This Example used the anti-PDL1 activatable antibody referred to herein as anti-PDL1 activatable antibody PL07-2001-C5H9v2, which comprises the following heavy and light chain variable region sequences:

PL07-2001-C5H9v2 Heavy Chain Variable Sequence
EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADSVKGRFTI
SRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSS (SEQ ID NO: 46)

PL07-2001-C5H9v2 Light Chain Variable Sequence
QGQSGSGIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVT
ITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQ
DNGYPSTFGGGTKVEIKR (SEQ ID NO: 137)

[00295] Anti-PDL1 activatable antibody PL07-2001-C5H9v2 comprises the following heavy and light chain sequences:

PL07-2001-C5H9v2 Heavy Chain Sequence
EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADSVKGRFTI
SRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSSASTKGPSVFPLAPCSRSTSESTAA

LGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKV
DKRVESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEV
HNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPS
QEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEGNVFS
CSVMHEALHNHYTQKSLSLSLG (SEQ ID NO: 432)

PL07-2001-C5H9v2 Light Chain Sequence
QGQSGSGIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVT
ITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQ
DNGYPSTFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQ
ESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC (SEQ ID
NO: 428)

[00296] It is known that tumors can evade host immunity by expression of programmed death ligand 1 (PD-L1), a ligand that negatively regulates programmed cell death 1 (PD-1), an inhibitory receptor expressed on activated T cells (Herbst RS et al., Nature. vol. 515: 563-67 (2014)). Antibodies targeting PD-L1 have shown activity against a variety of cancers and are being tested in combination with other immunotherapies in an effort to improve response rates and durability of response (Iwai Y et al., J Biomed Sci., vol. 24:26 (2017). However, significant, life-threatening immune-related toxicities (irAEs) are known toxicities of antibodies that block the PD1/PDL1 axis, especially when used in a wide variety of combinations with other immunotherapies, including with ipilimumab, (Wolchok JD et al. , N Engl J Med., vol. 369:122-33 (2013); Larkin J et al., N Engl J Med., vol. 373:23-34 (2015), vemurafenib, cobimetinib, vemurafenib/cobimetinib, pazopanib, or osimertinib (Ahn MJ et al., Expert Opin Drug Saf, vol. 16:465-469 (2017); Hwu P et al., Ann Oncol, vol. 27:379-400 (2016)).

[00297] More than 90% of tumor samples from 200 patients with a variety of malignancies demonstrated activation of the PL07-2001-C5H9v2 activatable antibody in *in situ* studies (see PCT International Publication Number WO/2014/107599, published 10 July 2014, by Vasiljeva O, et al. for representative assay techniques), a finding that corroborates the presence of tumor microenvironment proteases in the overwhelming majority of tumors necessary to ensure activation of the activatable antibody *in vivo*. In addition, preclinical results

have demonstrated equivalent efficacy for a mouse surrogate of the PL07-2001-C5H9v2 activatable antibody compared with the mouse surrogate parental antibody while minimizing induction of systemic autoimmunity in diabetes-susceptible non-obese diabetic mice (Wong C. et al., Presented at CRI-CIMT-EATI-AACR; 16 Sep 2015; New York, NY). The mouse surrogate of the PL07-2001-C5H9v2 activatable antibody also exhibited reduced peripheral binding to circulating T cells in tumor-bearing mice compared with the parental antibody (Wong C. et al., *ibid.*).

[00298] The study described herein is an open-label, multicenter, dose-escalation, phase 1/2 study that is conducted in multiple parts as shown in FIGS. 1A and 1B, where "AA" represents the anti-PDL1 PL07-2001-C5H9v2 activatable antibody.

[00299] The study includes dose escalation groups receiving activatable antibodies: monotherapy groups (Part A and A2), one combination therapy with ipilimumab group but two distinct schedules (Parts B1 and B2), one combination therapy with vemurafenib group (Part C), and one monotherapy group in a dose expansion phase (FIG. 1A does not include Part A2; FIG. 1B includes Part A2). Within each part, dose escalation followed a 3+3 design. Not all subjects in the study were necessarily enrolled in Part A2, but for those who are, in some embodiments, the enrollment in Part A2 requires successful completion of the monotherapy dose level in Part A. For those subjects who enroll in Part A2, this Part A2 refines the selection of the MTD/maximum achieved dose by assessing the relationship between dose/exposure with safety and efficacy and with the levels of activated PL07-2001-C5H9v2 in the tumor microenvironment and in plasma in patients with PD-L1+ tumors. Initiation of cohort enrollment in Parts B1, B2, and C requires successful completion of the subsequent monotherapy dose level tested in at least Part A. Enrollment for Part D, the expansion phase, is initiated after dose escalation for Part A is complete and the maximum tolerated dose (MTD) has been determined. Treatment continues for up to 2 years or until disease progression is confirmed or toxicity becomes unacceptable.

[00300] In Part A, the PL07-2001-C5H9v2 activatable antibody monotherapy was administered at the indicated dose (i.e., 0.03, 0.1, 0.3, 1, 3, 10, 30 mg/kg) IV every 14 days. For those subjects that enroll in Part A2, Part A2, PL07-2001-C5H9v2 activatable antibody monotherapy is administered at the indicated dose IV every 14 days to study biomarkers and efficacy in PD-L1+ tumors. In Part B1, the concomitant schedule was PL07-2001-C5H9v2

activatable antibody at the indicated dose plus ipilimumab at 3 mg/kg, administered IV every 21 days for 4 doses, followed by PL07-2001-C5H9v2 activatable antibody monotherapy administered IV every 14 days. In Part B2, the phased schedule is PL07-2001-C5H9v2 activatable antibody monotherapy administered IV every 14 days for 4 doses, followed by PL07-2001-C5H9v2 activatable antibody at the indicated dose plus ipilimumab administered IV every 21 days for 4 doses, followed by PL07-2001-C5H9v2 activatable antibody monotherapy administered IV every 14 days. In Part C, PL07-2001-C5H9v2 activatable antibody at the indicated dose was administered IV every 14 days plus vemurafenib at 960 mg/kg PO administered twice daily. In Part D, PL07-2001-C5H9v2 activatable antibody is administered at the MTD (determined from Part A) IV every 14 days. If 30 mg/kg PL07-2001-C5H9v2 activatable antibody plus 3 mg/kg ipilimumab is judged to be safe, escalation of PL07-2001-C5H9v2 activatable antibody with 10 mg/kg ipilimumab can be initiated, starting with 10 mg/kg PL07-2001-C5H9v2 activatable antibody and proceeding, as tolerated, to 30 mg/kg PL07-2001-C5H9v2 activatable antibody. If no MTD is established for the combination of 3 mg/kg ipilimumab, the 10 mg/kg and 30 mg/kg dose levels of PL07-2001-C5H9v2 activatable antibody can be evaluated in combination with 10 mg/kg ipilimumab.

[00301] In FIGS. 1A and 1B, IV represents intravenous administration, PO represents oral administration, and MTD refers to the maximum tolerated dose level.

[00302] The PL07-2001-C5H9v2 activatable antibody in Part A was dosed as follows: a first cohort was administered 0.03 mg/kg, a second cohort was administered 0.10 mg/kg, a third cohort was administered 0.3 mg/kg, a fourth cohort was administered 1.0 mg/kg, a fifth cohort was administered 3.0 mg/kg, a sixth cohort was administered at 10.0 mg/kg, and a seventh cohort was administered at 30.0 mg/kg.

[00303] For those subjects that enroll in part A2, the PL07-2001-C5H9v2 activatable antibody in Part A2 is dosed as follows: a first cohort is administered 0.3 mg/kg, a second cohort is administered 1.0 mg/kg, a third cohort is administered 3.0 mg/kg, and a fourth cohort is administered 10.0 mg/kg.

[00304] Subjects in Part B1 were dosed as follows: ipilimumab is administered 3 mg/kg IV and the PL07-2001-C5H9v2 activatable antibody was dosed such that a first cohort was administered 0.3 mg/kg, a second cohort was administered at 1.0 mg/kg, a third cohort was

administered at 3.0 mg/kg, a fourth cohort was administered at 10.0 mg/kg, and a fifth cohort is administered at 30.0 mg/kg.

[00305] Subjects in Part B2 are dosed as follows: ipilimumab is administered 3 mg/kg IV and the PL07-2001-C5H9v2 activatable antibody is dosed such that a first cohort is administered 3.0 mg/kg, a second cohort is administered at 10.0 mg/kg, and a third cohort is administered at 30.0 mg/kg, a fourth cohort is administered at 10.0 mg/kg, and a fifth cohort is administered at 30.0 mg/kg.

[00306] Subjects in Part C are dosed as follows: vermurafenib is delivered 960 mg/kg PO and PL07-2001-C5H9v2 activatable antibody is dosed such that a first cohort is administered 1.0 mg/kg, a second cohort is administered at 3.0 mg/kg, and a third cohort is administered at 10.0 mg/kg, and a fourth cohort is administered 30.0 mg/kg.

[00307] Subjects in Part D are dosed as follows: the PL07-2001-C5H9v2 activatable antibody is administered at the MTD .

[00308] Within each part of the study, dose escalation of the administered anti-PDL1 activatable antibody follows a 3+3 design, which is a rule-based design in which the lowest dose level is allocated to the first cohort, the dose is adaptively escalated or de-escalated based on observed dose-limiting toxicities (DLTs), and the adaptive escalation or de-escalation is repeated until the maximum tolerated dose (MTD) is achieved. In Part A, one subject each is enrolled in the 0.03, 0.1, and 0.3 mg/kg dosing cohorts, and subsequent dose levels will follow the 3+3 design.

[00309] In this study, enrollment in Part A2 as depicted in FIG. 1B requires successful completion of the monotherapy dose level in Part A. Part A2 will enroll at least an additional six patients with PD-L1+ cancer at each indicated dose, including a minimum of 2 subjects per cohort with thymoma, thymic carcinoma, or a thymic epithelial tumor. Part A2 will refine the MTD/ maximum achieved dose (MAD), to evaluate the relationship between dose/exposure and safety, efficacy and pharmacodynamics biomarkers, and the levels of activated antibody in the tumor microenvironment and in plasma.

[00310] In this study, initiation of cohort enrollment in Parts B1, B2, and C of FIGS. 1A or 1B requires successful completion of the subsequent monotherapy dose level tested in at least Part A. Enrollment for Part D is initiated after dose escalation is complete for Part A and

the maximum tolerated dose has been determined. Treatment is continued for up to 2 years or until confirmed disease progression or unacceptable toxicity.

[00311] In this study when Part A2 is included, up to 175 patients are enrolled in the dose escalation cohorts (1-6 patients per dose cohort in Part A, approximately 6 patients per dose cohort in Part A2, and 3-6 patients per dose cohort in Parts B1, B2, and C). Approximately 20 patients are enrolled for the dose expansion cohort (Part D). If Part A2 is not included, up to 150 patients are enrolled as set forth immediately above, omitting Part A2. The key eligibility criteria for enrolled patients is shown in the Table A below.

Table A. Key eligibility criteria.

All parts	• Age ≥18 years • ECOG performance status 0-1
Part A	• Advanced, unresectable solid tumor or lymphoma with no further standard of care available • Immunotherapy naïve (including PD-1/PD-L1 and CTLA-4 inhibitor therapy) • Immunotherapy unavailable for patient's disease
Part A2 (Optional)	• Same requirements as for Part A, and must be PD-L1+ (tumor proportion score at least 1% membranous staining) • Must agree to participate in biomarker analysis and have a tumor site that is safe to biopsy
Part B1	• Advanced, unresectable solid tumor or lymphoma with no further standard of care available • Immunotherapy naïve • Immunotherapy unavailable for patient's disease
Part B2	• Advanced, unresectable solid tumor or lymphoma with no further standard of care available • Previously treated with a PD-1/PD-L1 inhibitor (discontinued for reasons other than toxicity) • CTLA-4 inhibitor-naïve

Part C	• Advanced, unresectable melanoma • *BRAF*^{V600E} mutation positive • BRAF inhibitor-naïve • PD-1/PD-L1 inhibitor-naïve and/or immunotherapy naïve • Immunotherapy naïve • Immunotherapy unavailable for patient's disease
Part D	• Advanced, unresectable PDL1-responsive tumor types • Measurable disease • PD-L1 positive or unknown status (not known to be PD-L1 negative) • Immunotherapy naïve • Immunotherapy unavailable for patient's disease
Exclusion Criteria that may apply in certain embodiments	• Prior therapy with a chimeric antigen receptor (CAR) T-cell containing regimen. • History of severe allergic or anaphylactic reactions to human monoclonal antibody therapy or known hypersensitivity to any Probody therapeutic. • Active or history of uveal, mucosal, or ocular melanoma. Human immunodeficiency virus (HIV) or acquired immune deficiency syndrome (AIDS)-related illness, chronic hepatitis B or C. • History of or current active autoimmune diseases, including but not limited to inflammatory bowel diseases, rheumatoid arthritis, autoimmune thyroiditis, autoimmune hepatitis, systemic sclerosis, systemic lupus erythematosus, autoimmune vasculitis, autoimmune neuropathies, or type 1 insulin dependent diabetes mellitus. • History of syndrome or medical condition(s) that requires systemic steroids (> 10 mg daily prednisone equivalents) or immunosuppressive medications.

	• History of allogeneic tissue/solid organ transplant, prior stem cell or bone marrow transplant. • Chemotherapy, biochemotherapy, radiation or immunotherapy or any investigational treatment within 30 days prior to receiving any study drug. • Major surgery (requiring general anesthesia) within 3 months or minor surgery (excluding biopsies conducted with local/topical anesthesia) or gamma knife treatment within 14 days (with adequate healing) of administration of any study drug.

Abbreviations: CTLA-4, cytotoxic T-lymphocyte-associated antigen 4; ECOG, Eastern Cooperative Oncology Group; PD-1, programmed death 1 receptor; PD-L1, programmed death ligand 1.

In some embodiments, as a cohort assignment occurs, patients with known PD-L1 status are assigned to Part A, but PD-L1 status is not an inclusion/exclusion criterion.

[00312] The primary endpoints for this study are: (i) safety and tolerability of the PL07-2001-C5H9v2 activatable antibody alone or in combination with ipilimumab or vemurafenib, and/or (ii) maximum tolerated dose and dose-limiting toxicities of the PL07-2001-C5H9v2 activatable antibody alone or in combination with ipilimumab or vemurafenib.

[00313] Secondary endpoints of this study can include any of the following, or any combination thereof: objective response according to Response Evaluation Criteria in Solid Tumors version 1.1 (RECIST v 1.1), immune-related RECIST, or modified Cheson/Lugano Classification for lymphomas; time to response; duration of response; progression-free survival; incidence of anti-drug antibodies; single and multiple dose pharmacokinetic profile of the PL07-2001-C5H9v2 activatable antibody alone, and of PL07-2001-C5H9v2 activatable antibody in combination with ipilimumab, or vemurafenib; and/or overall survival.

[00314] Additional endpoints/objectives of this study can include any one or more of the following, or any combination thereof: potential predictive markers of PL07-2001-C5H9v2 activatable antibody activity; protease activity and degree of PL07-2001-C5H9v2 activatable

antibody cleavage in tumor and peripheral blood; and/or immunomodulatory activity of PL07-2001-C5H9v2 activatable antibody in on-treatment biopsies.

[00315] The following assessments are exemplary and not intended to be limiting. They are performed, in some embodiments, at each study visit: adverse events, physical examination, vital signs, hematology, serum chemistry, B symptoms (lymphoma patients), Eastern Cooperative Oncology Group (ECOG) performance status, and concomitant medications. Imaging for tumor response assessment are performed every 8 weeks for the first 12 months, then every 12 weeks thereafter. Blood samples for pharmacokinetic, pharmacodynamic, and biomarker analyses are obtained at pre-specified time points. After the last dose of study medication, patients are evaluated every 3 months for disease progression and overall survival until study withdrawal or death. In some embodiments, biopsies are collected. In some embodiments, archival tissue or fresh biopsy samples are provided at baseline. In some embodiments, patients in Part A2 undergo at least one on-treatment tumor biopsy. In some embodiments, patients in Part B2 undergo at least one on-treatment tumor biopsy. In some embodiments, these patients have measurable disease.

[00316] Several translational strategies/methods are used to investigate for example, presence of activatable antibody-activating protease activity, activatable antibody activation, e.g., protease-dependent activatable antibody activation, presence of target (PDL1), target engagement, PDL1 inhibition or other PD-1 pathway inhibition, immune response pattern in the tumor, and other biological effects. Such strategies/methods can include any one or more of the following, or any combination thereof: (a) activatable antibody activation in, for example, biopsies or blood samples, e.g., plasma, using, for example, (i) a WES assay, which comprises capillary electrophoresis with immunodetection; see, e.g., ProteinSimple's Simple Western WES brochure, and/or (ii) an assay that detects protease activation of activatable antibodies, such as one of the assays disclosed in WO/2014/107599, *ibid.*; (b) pharmacodynamic biomarker assessment by, for example, (i) NANOSTRING gene expression panel of, e.g., a biopsy, (ii) IHC, e.g., of a biopsy, to detect immune cell infiltration, and/or (iii) LUMINEX cytokine panel evaluation of, e.g., plasma; and/or (c) PD-L1 expression assessment of, e.g., a biopsy, by, e.g., IHC. In some embodiments, immunoPET imaging will be used.

[00317] An example of a WES assay comparing the amount of cleaved and intact PL07-2001-C5H9v2 activatable antibody in preclinical tumor and plasma samples is shown in FIG. 2.

[00318] In the above-described dose-escalation segment of the trial, the pharmacokinetics (PK) in patients receiving a single dose of PL07-2001-C5H9v2 monotherapy was assessed. The PK samples were collected intensively following the first dose of PL07-2001-C5H9v2, with sparse collection thereafter. Analytes quantified in plasma samples were intact (uncleaved) activatable antibody (i.e., the prodrug form), and the total sum of prodrug/intact and cleaved forms of PL07-2001-C5H9v2 (representing the sum of intact and activated species). Preliminary single-dose PK data was collected for patients enrolled in the dose-escalation segment of the above-described studies receiving a single dose of 0.03-30.0 mg/kg PL07-2001-C5H9v2 as a single agent.

[00319] Both intact and total (intact plus activated) PL07-2001-C5H9v2 concentrations were determined in plasma samples using a validated high performance liquid chromatography tandem mass spectrometry (HPLC MS/MS) method with a lower limit of quantification for each analyte of 0.657 nM. Magnetic beads coated with protein A were used to enrich for immunoglobulin (including intact and activated PL07-2001-C5H9v2) in K_2EDTA plasma samples. The bound proteins were digested with trypsin, and two peptide fragments unique to PL07-2001-C5H9v2 were monitored: one peptide from the heavy chain that is present in both the intact and activated forms of PL07-2001-C5H9v2 (for quantitation of total PL07-2001-C5H9v2) and one peptide that is present in the intact (activatable form) of PL07-2001-C5H9v2 but not in the activated form of PL07-2001-C5H9v2 (for quantitation of intact PL07-2001-C5H9v2). Following the immunocapture and digestion steps, the final extract was analyzed via HPLC with MS/MS detection using positive ion electrospray. The results are shown in Figures 8A and 8B, which show the median plasma concentration of intact PL07-2001-C5H9v2 (nM) (Figure 8A) and total PL07-2001-C5H9v2 (i.e., intact and activated (nM), Figure 8B), respectively, versus time (day) following administration of up to 30 mg/kg q2w for cohorts A and A2 Cycle 1 Dose 1.

[00320] Preliminary single-dose PK data suggests that PL07-2001-C5H9v2 circulates predominantly as the intact, prodrug species. There does not appear to be monotonic trending of the estimates of clearance and the volume of distribution across the 0.1 to 30 mg/kg dose

levels. A mechanistic PK model suggests target-mediated drug disposition (TMDD) may not be an important contributor to the clearance of intact, protected PL07-2001-C5H9v2 across the dose range evaluated.

[00321] With respect to the evaluation of PL07-2001-C5H9v2 as a monotherapy in a dose escalation cohort in patients with advanced, heavily pretreated solid tumors, eligible patients include those who are PD-1, PD-L1, and CTLA-4 inhibitor naïve with immunotherapy (IMT) unavailable as a standard of care for their disease. PL07-2001-C5H9v2 was given every 14 days in cohorts of doses in the range of from 0.03 to 30 mg/kg IV. Twenty two patients with a median age of 65 years (range, 32-81) were enrolled having a median of 3 prior anticancer treatments (range of 1-13).

[00322] The following preliminary results were observed: 1 dose-limiting toxicity (DLT) was observed (Grade 3 febrile neutropenia; 3 mg/kg); the maximum tolerated dose (MTD) was not reached. Grade 3-4 treatment-related events were observed in 2 patients, respectively: febrile neutropenia/thrombocytonpenia (3 mg/kg) and elevated AST/ALT (30 mg/kg). Across all dose levels, the best response based on change in target lesions from baseline in 17 evaluable patients included 2 PR (thymoma and PD-L1 negative TNBC), 11 SD, and 4 PD. 7/17 (41%) evaluable patients had target lesions decrease from baseline as per RECIST v1.1. At dose levels $\geq$ 3 mg/kg, 5/8 subjects (63%) had target lesions decrease from baseline. Thus, the preliminary data suggests that PL07-2001-C5H9v2 in heavily pretreated patients with IMT-naïve solid tumors where checkpoint blockade is unavailable as SOC for their disease show a manageable safety profile with signals of antitumor activity.

[00323] After approximately four months, a further data cut was made after the above results were obtained. As of the date of the later data cutoff, Part A had enrolled 22 patients, including 2 patients still receiving treatment. Twenty patients discontinued treatment for the following reasons: radiological or clinical disease progression (n=16), voluntary withdrawal (n=2), or adverse event (n=2). The subjects had any one of a number of different cancer types, including, for example, uterine carcinoma, esophageal carcinoma, pancreatic carcinoma, castration resistant prostate carcinoma, rectal carcinoma, thymoma or thymic cancers, and triple negative breast cancer. The baseline characteristics for patients treated with PL07-2001-C5H9v2 are provided in Table **3**

Table 3. Baseline Characteristics for Patients Treated with PL07-2001-C5H9v2

	All Patients N = 22
Median age, years (range)	65 (32-81)
Sex, n (%)	
Female	13 (59.1)
Male	9 (40.9)
Race, n (%)	
White	18 (81.8)
African American	1 (4.5)
Not reported/unknown/other	3 (13.6)
Eastern Cooperative Oncology Group (ECOG) performance status score, n (%)	
0	9 (40.9)
1	13 (59.1)
No. of previous cancer treatments, median (range)	3 (1-13)
Cancer type,[a] n (%)	
Uterine carcinoma	3 (13.6)
Esophageal carcinoma	2 (9.1)
Pancreatic carcinoma	2 (9.1)
Castration-resistant prostate cancer	2 (9.1)
Rectal carcinoma	2 (9.1)
Thymoma or thymic cancers	2 (9.1)
Triple-negative breast cancer	2 (9.1)
Other[a]	7 (31.8)
PD-L1 expression status,[b] n (%)	
None (<1%)	10 (45.5)
Low (1-49%)	7 (31.8)
High (≥50%)	2 (9.1)
Unknown	3 (13.6)

[a]One patient each had breast (estrogen receptor positive (ER+)) carcinoma, cervical carcinoma, colon carcinoma, peritoneal carcinoma, salivary gland carcinoma, head and neck squamous cell carcinoma, and uterine sarcoma.

[b]Assessed with clone 22c3 (Dako PDL-1 IHC 22c3 pharmDx) using archival tissue

[00324] The mean (range) durations of treatment are provided in Table **4**.

[00325] Table 4. Duration of PL07-2001-C5H9v2 Treatment

PL07-2001-C5H9v2 Dose, mg/kg	0.03 n = 2	0.1 n = 2	0.3 n = 2	1.0 n = 3	3.0 n = 7	10.0 n = 3	30.0 n = 3	All Patients N = 22
Treatment duration, mean (range), months	5.6 (4-7)	3.5 (1-6)	1.8 (2-2)	4.4 (4-6)	2.5 (0-9)	5.9 (2-8)	2.5 (2-4)	3.5 (0-9)

Pharmacokinetic Analysis

[00326] Preliminary single-agent, single-dose PL07-2001-C5H9v2 pharmacokinetic data suggest that PL07-2001-C5H9v2: (a) circulates predominantly as the intact prodrug species (96% intact at 30 mg/kg); and (b) is likely only minimally influenced by target-mediated drug disposition at low doses. By comparison, the PD-L1 inhibitor atezolizumab appears to exhibit nonlinear PK below the 1 mg/kg dose level. See, R.S. Herbst, et al., "Predictive correlates of response to the anti-PD-L1 antibody MPDL3280A in cancer patients," Nature (2014 November 27) 515(7528): 563-567Tumor response rates among evaluable patients (n=20) are provided in Table **5**

[00327] Table 5. Best Tumor Response in Evaluable Patients[a] per RECIST[1] v1.1, n(%)

PL07-2001-C5H9v2 Dose, mg/kg	0.03 n = 2	0.1 n = 2	0.3 n = 2	1.0 n = 3	3.0 n = 5	10.0 n = 3	30.0 n = 3	All Evaluable Patients N = 20
Best overall response, n (%)								
Partial response[b]	0	0	0	0	1 (20.0)	2 (66.7)	0	3 (15.0)
Stable disease	1 (50.0)	1 (50.0)	1 (50.0)	1 (33.3)	2 (40.0)[c]	0	2 (66.7)	8 (40.0)
Progressive disease	1 (50.0)	1 (50.0)	1 (50.0)	2 (66.7)	1 (20.0)	1 (33.3)	0	7 (35.0)
Not evaluable	0	0	0	0	1 (20.0)	0	1 (33.3)	2 (10.0)

[1]RECIST: Response Evaluation Criteria in Solid Tumors.

[a]Evaluable patients are those with an adequate disease assessment at baseline and ≥ 1 postbaseline tumor assessment.

[b]Includes 2 patients with unconfirmed partial response.

[c]Includes 1 patient with incomplete response/nonprogressive disease who did not have measurable disease at baseline.

[00328] Escalation to 30 mg/kg was completed and maximum tolerated dose (MTD) was not reached. Target lesions decreased from baseline in 8 of 19 patients (42%) with measurable disease at baseline, as shown in Figure 9A. Target lesions decreased from baseline at dose levels ≥ 3 mg/kg in 6 of 10 patients (60%). The percentage change in tumor burden over time is presented in Figure 9B.

Sample Case Studies

[00329] Patient A has thymic cancer with high baseline PD-L1 expression and received treatment with PL07-2001-C5H9v2 at a dose of 3 mg/kg. The patient experienced a response to treatment after 2 weeks and had a 48% reduction in mediastinal mass. The patient discontinued treatment because of neutropenia.

[00330] Patient B has triple-negative breast cancer with microsatellite-stable low tumor mutation burden (4 mutations/megabase) and negative PD-L1 and received treatment with PL07-2001-C5H9v2 at a dose of 10 mg/kg. Follow-up staging revealed a confirmed partial response. The results are shown in Table **6**.

[00331] Table 6.

Node	Screening Aug 14, 2017	C2D56 Dec 5, 2017	C4D56 Mar 27, 2018
Right axillary	30 mm	12 mm	9 mm
Precarinal lymph	17 mm	9 mm	6 mm
Subcutaneous	25 mm	14 mm	19 mm

[00332] Biomarker analysis of tumor biopsy pairs from Patient C (esophogeal cancer; PL07-2001-C5H9v2, 30 mg/kg) demonstrated a 3-fold increase in CD8+ T-cell infiltration after 4 weeks of treatment.

Conclusions

[00333] MTD was not determined with doses up to 30 mg/kg. PL07-2001-C5H9v2 is activated in vivo and exerts biological activity as evidenced by: (a) 3 objective responses in 20 evaluable patients (15%), including those with negative PD-L1 expression; (b) a 3-fold increase in $CD8^+$ T-cell infiltration after 4 weeks of treatment. PL07-2001-C5H9v2 exhibited reduced binding in peripheral issue, as suggested by predominant circulation as the intact

prodrug species (96% intact at 30 mg/kg); and a favorable safety profile, with only 2 patients experiencing a grade 3 treatment-related AE..

[00334] The primary objectives of Part B1 of the study are to assess the safety and tolerability and to determine the maximum tolerated dose (MTD) and the dose-limiting toxicity (DLT) of PL07-2001-C5H9v2 when administered in a concomitant combination schedule with ipilimumab. Secondary objectives are to obtain preliminary evidence of anticancer activity in patients treated with PL07-001-C5H9v2 combined with ipilimumab using response rate (Response Evaluation Criteria in Solid Tumors (RECIST) v 1.1, time to response and duration of response, and progression-free survival. Patients are ≥ 18 years of age with Eastern Cooperative Oncology Group performance status 0-1. To be included in Part B1, patients (n≤ 42) are required: (a) to have any metastatic or advanced unresectable solid tumor or lymphoma (excluding thymic epithelial tumor, thymoma, or thymic carcinoma) (measurable or nonmeasurable disease): and (b) to be naïve to immunotherapy, including to PD-1/PD-L1 and CTLA-4 inhibitor therapy, and to have a tumor type not approved for immune checkpoint inhibitors. PL07-2001-C5H9v2 (0.3, 1.0, 3.0, and 10 mg/kg) in combination with ipilimumab (3.0 mg/kg or 10 mg/kg for the highest PL07-2001-C5H9v2 dose level) is administered intravenously every 21 days for 4 cycles, followed by PL07-2001-C5H9v2 monotherapy every 14 days.

[00335] Patients with advanced solid tumors received PL07-2001-C5H9v2 + ipilimumab in a concomitant schedule (study Part B1). Eligible patients were PD-1, PD-L1, and CTLA-4 inhibitor naïve. Imaging for tumor response assessment is performed every 8 weeks for the first 12 months, then every 12 weeks thereafter. After the last dose of study medication, patients will be evaluated every 3 months for disease progression and overall survival until study withdrawal or death. Archival tissue or fresh biopsy samples are provided at baseline. Serial blood samples for pharmacokinetic (PK) analysis are collected to characterize the PK profile of PL07-2001-C5H9v2, in combination with ipilimumab. Participating patients provide serial blood samples for measurement of exploratory biomarkers of immune modulation.

[00336] Planned doses: PL07-2001-C5H9v2 0.3-30 mg/kg intravenously (IV) every 21 days + ipilimumab 3 mg/kg or 10 mg/kg IV every 21 days for 4 cycles, followed by PL07-2001-C5H9v2 monotherapy every 14 days. In preliminary results, Part B1 enrolled 9 patients. Median age was 44 years (range, 28-70); 6 patients (67%) were male. Median number of prior

anti-cancer treatments was 4 (range, 2-18). At the time of data cut, 6 patients remained on treatment. Median number of doses of PL07-2001-C5H9v2 (0.3 and 1 mg/kg) and ipilimumab (3 mg/kg) was 2 (range, 2-10) and 2 (range, 2-4), respectively. 1 DLT (grade 3 dyspnea, 0.3 mg/kg PL07-2001-C5H9v2 + 3 mg/kg ipilimumab) was observed. MTD has not been reached and dose escalation continues. Grade 1-2 treatment-related adverse events (TRAEs) occurred in 6 patients (67%). Four grade 3 TRAEs were experienced by 2 patients (22%) and included colitis, pneumonitis, and AST and ALT increases (0.3 mg/kg PL07-2001-C5H9v2) + 3 mg/kg ipilimumab). At the data cutoff date, 1 of 4 evaluable patients showed target lesion reduction of 31% from baseline (0.3 mg/kg PL07-2001-C5H9v2, anal SCC, MSI stable, and intermediate tumor mutation burden). A few days later, this patient had a confirmed PR with 56% reduction in target lesion. Preliminary data suggests that PL07-2001-C5H9v2 + ipilimumab shows a manageable safety profile and signals of antitumor activity.

[00337] A further data cut was made after the above preliminary results were obtained. At this later data cut, N=16 individuals received the following doses of PL07-2001-C5H9v2 + ipilimumab, 3.0 mg/kg. 0.3, n=6, 1.0, n=3, 3.0, n=3, 10, n=4. The baseline characteristics are present in Table 7.

[00338] Table 7. Baseline Characteristics

	All Patients N = 16
Median age, years (range)	60 (28-70)
Sex, n (%) Male Female	 8 (50.0) 8 (50.0)
Race, n (%) White Asian Not reported/unknown/other	 13 (81.3) 1 (6.3) 2 (12.5)
ECOG performance status, n (%) 0 1	 6 (37.5) 10 (62.5)
No. of previous cancer treatment, median (range)	3 (1-12)
Cancer types,[a] n (%)	

Pancreatic carcinoma	2 (12.5)
Other[a]	14 (87.5)

[a]One patient each had anal squamous cell carcinoma, breast (ER+) carcinoma, cervix carcinoma, colon carcinoma, gastric cancer, glioblastoma, osteosarcoma, salivary gland carcinoma, cancer of unknown primary origin (CUP), small cell lung cancer, small cell neuroendocrine prostate cancer, testicular carcinoma, triple-negative breast cancer, and head and nene ck squamous cell carcinoma.

[00339] At the time of analysis, 4 patients (25.0%) were still receiving treatment. 12 patients discontinued treatment because of disease progression (n=8), symptomatic deterioration (n=3), or death n=1)

[00340] The mean (range) durations of treatment are provided in Table 8.

Table 8 Duration of PL07-2001-C5H9v2.

PL07-2001-C5H9v2 (mg/kg) + Ipilimumab 3.0 mg/kg Dose	0.3 n = 6	1.0 n = 3	3.0 n = 3	10.0 n = 4	All Patients N = 16
Time on Treatment, mean (range), months	3.0 (1-10)	4.6 (3-6)	3.4 (1-4)	1.8 (1-3)	3.1 (1-10)

Tumor Response

[00341] The best tumor responses are set forth in Table 9.

[00342] Table99. Best Tumor Response in Evaluable Patients[a] per RECIST v1.1, n (%)

PL07-2001-C5H9v2 (mg/kg) + Ipilimumab (mg/kg) Dose	0.3 + 3.0 n = 5	1.0 + 3.0 n = 3	3.0 + 3.0 n = 2	10.0 + 3.0 n = 2	All Evaluable Patients N = 12
Objective response rate[b]	1 (20.0)	1 (33.3)	1 (50.0)	0	3 (25.0)
Complete response	1 (20.0)	0	0	0	1 (8.3)
Partial response	0	1 (33.3)	1 (50.0)	0	2 (16.7)

Stable disease	0	1 (33.3)	0	0	1 (8.3)
Progressive disease	4 (80.0)	1 (33.3)	1 (50.0)	2 (100.0)	8 (66.7)

[a]Evaluable patients are those with an adequate disease assessment at baseline and ≥1 postbaseline tumor assessment.

[b]Includes patients with unconfirmed response.

[00343] Among evaluable patients (n=12), best tumor response was:
(a) Complete response (n=1): anal cell Squamous cell carcinoma (0.3 mg/kg PL07-2001-C5H9v2, 3 mg/kg ipilimumab); PD-L1 negative, MSS, low TMB, HPV-pos; and
(b) Partial response (n=2): testicular cancer and unknown primary (likely small bowel). Target lesions decreased from baseline in 3 of 10 (30%) patients with measurable disease at baseline as shown in Figure 10A. The percentage change in tumor burden over time is presented in Figure 10B.

Sample Case Studies

[00344] Patient A has anal squamous cell carcinoma with intermediate tumor mutation burden (9 mutations/ megabase), microsatellite-stable, HPV-positive, and PD-L1 status unknown. Patient was treated with PL07-2001-C5H9v2, 0.3 mg/kg + ipilimumab, 3 mg/kg and had unconfirmed complete response at follow-up staging.

[00345] Patient B has small bowel carcinoma and negative PD-L1 status. Patient was treated with PL07-2001-C5H9v2, 3 mg/kg + ipilimumab, 3 mg/kg, and had an unconfirmed partial response at follow-up staging.

Conclusions

[00346] Early safety observations in this dose-escalation study of the combination of the anti-PD-L1 activatable antibody, PL07-2001-C5H9v2 and ipilimumab, 3 mg/kg, report a treatment-related AE rate trending below the level reported for other PD-1 pathway inhibitors in combination with ipilimumab. No new safety signals were observed with the combination

of the anti-PD-L1 activatable antibody, PL07-2001-C5H9v2 + ipilimumab, 3 mg/kg. Preliminary efficacy results show 1 complete response and 2 partial responses (3/12, 25%).

EXAMPLE 2. Generation of Antibodies that Bind Activated and Intact anti-PDL1 Activatable Antibodies

[00347] The studies provided herein were designed to generate and evaluate antibodies that bind anti-PDL1 activatable antibodies of the disclosure.

[00348] The studies presented herein used the anti-PDL1 activatable antibody referred to herein as PL07-2001-C5H9v2, which comprises the heavy chain sequence of SEQ ID NO: 432 and the light chain sequence of SEQ ID NO: 428, as shown below.

PL07-2001-C5H9v2 Heavy Chain Amino Acid Sequence (SEQ ID NO: 432)

EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYAMSWVRQAPGKGLEWVSSIWRNGIVTVYADSVKGRFTI
SRDNSKNTLYLQMNSLRAEDTAVYYCAKWSAAFDYWGQGTLVTVSSASTKGPSVFPLAPCSRSTSESTAA
LGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKV
DKRVESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEV
HNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPS
QEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEGNVFS
CSVMHEALHNHYTQKSLSLSLG

PL07-2001-C5H9v2 Light Chain Amino Acid Sequence (SEQ ID NO: 428)

QGQSGSGIALCPSHFCQLPQTGGGSSGGSGGSGGISSGLLSGRSDNHGGSDIQMTQSPSSLSASVGDRVT
ITCRASQSISSYLNWYQQKPGKAPKLLIYAASSLQSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQ
DNGYPSTFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQ
ESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC

[00349] Mice were immunized by GenScript Biotech Corporation with peptide antigen CQQDNGYPSTFGGGT (SEQ ID NO: 1203), comprising the VL CDR3 of anti-PDL1 activatable antibody PL07-2001-C5H9v2, that was conjugated to the carrier protein Keyhole Limpet Hemocyanin (KLH) using the procedure shown below in Table 3. Six three-month old (3 Balb/c and 3 C56) mice were immunized according to the protocol listed below. At the time

of each injection, the antigen aliquot was thawed and combined with Complete Freund's Adjuvant (CFA) for the first injection or with incomplete Freund's Adjuvant (IFA) for subsequent injections.

Table 10. Immunization Schedule

Procedure	Schedule	Dosage and route
Pre-Immune Bleed	T= -4 days	
Primary immunization	T= 0 days	50 μg /animal, s.c
Boost 1	T= 14 days	25 μg /animal, s.c
Test Bleed 1	T= 21 days	
Boost 2	T= 28 days	25 μg /animal, s.c
Test Bleed 2	T= 35 days	
Final Boost	T= 50±7 days	25 μg /animal, i.v.
Cell Fusion	4 days after final boost	

[00350] Serum titers against the free peptide as well as counter screen antigen (human IgG) were evaluated in test bleeds using a standard ELISA procedure. Leads were evaluated against full length activatable antibody in human plasma by Western blot. The results indicated that all mice had comparable titers against the respective immunogen. Antisera were tested against activatable antibody PL07-2001-C5H9v2 on the Wes™ system (ProteinSimple), and two mice were chosen for cell fusion.

[00351] Mouse monoclonal antibodies were generated as follows: Lymphocytes from the two mice were used for hybridoma fusion and plated on forty 96-well plates (400 million lymphocytes per mouse). The plates were kept in tissue culture incubators under standard conditions.

EXAMPLE 3. Screening of Hybridoma Clones and Antibody Characterization

[00352] This Example describes the screening and characterization of hybridoma clones and resultant antibodies generated against anti-PDL1 activatable antibody PL07-2001-C5H9v2.

[00353] Hybridoma supernatant from parental clones were screened by GenScript against a short peptide containing the VL CDR3 of activatable antibody PL07-2001-C5H9v2 by indirect ELISA. Briefly, GenScript high binding plates were coated with peptide-BSA at 1 ug/mL concentration, 100 uL/well. Supernatant was used without dilution. Anti-serum at

1:1000 dilution was used as positive control. Peroxidase-AffiniPure Goat Anti-Mouse IgG, Fcγ Fragment Specific (minimum cross-reactive with human, bovine or horse serum albumin, also referred to as min X Hu,Bov,Hrs Sr Prot) was used as secondary. Twenty clones with positive signals were further screened against anti-PDL1 antibody C5H9v2, the parental antibody of activatable antibody PL07-2001-C5H9v2, and 5 ug/mL of human IgG. Anti-PDL1 antibody C5H9v2 was coated onto high binding plates at 1 ug/mL concentration, 100 uL/well. Human IgG was coated onto high-binding plates at 5 ug/mL concentration, 100 uL/well. Western blot analysis was also performed on these 20 clones using 200 ng of denatured and reduced anti-PDL1 antibody C5H9v2 as target. As a final screen, supernatants from the 20 clones were also assessed on the Wes system. Briefly, all 20 clones were tested against 1 ug/mL of one-arm activated activatable antibody PL07-2001-C5H9v2 in 0.1X sample buffer and 1 ug/mL of one-arm activated activatable antibody PL07-2001-C5H9v2 in 1:100 human plasma. The top 6 clones as assessed by intensity and specificity of binding to activatable antibody PL07-2001-C5H9v2, referred to as 17G1, 18F1, 19H12, and 23H6, 21H10 and 27C1, were further screened against one-arm activated activatable antibody PL07-2001-C5H9v2 at 0.11 and 0.33 ug/mL concentrations in 1:100 human plasma. Results are shown in FIG. 3A and FIG. 3B, which shows screening of activatable antibody PL07-2001-C5H9v2 anti-idiotypic (anti-id) clones against 37% one-arm activated activatable antibody PL07-2001-C5H9v2 at 0.11, 0.33 and 1 ug/ml in human plasma at 1:100. FIG. 3A is an electropherogram showing 17G1 detection of decreasing concentrations of one-arm activated activatable antibody PL07-2001-C5H9v2 (1, 0.33, and 0.11 ug/ml). FIG. 3B portrays the relative activation percent for the top 6 clones of one-arm activated activatable antibody PL07-2001-C5H9v2. The relative activation rate is preserved at different concentrations. Clones 21H10 and 27C1 have lower affinity resulting in no data for the 0.11 ug/ml concentration.

EXAMPLE 4. Binding Specificity of Antibodies that Bind anti-PDL1 Activatable Antibody

[00354] This Example describes the ability of antibodies of the disclosure to bind anti-PDL1 activatable antibody PL07-2001-C5H9v2.

[00355] To test for specificity of antibody 17G1 binding to anti-PDL1 activatable antibody PL07-2001-C5H9v2, 160 ng/mL of one-arm activated anti-PDL1 activatable antibody PL07-2001-C5H9v2 were spiked into either human plasma (1 to 100 dilution in PBS) or lung tumor lysate. Briefly, tumor homogenates were prepared in Thermo Scientific Pierce™ IP Lysis Buffer (Catalog #87788) with added Thermo Scientific Halt™ Protease Inhibitor Single Use Cocktail Kit (Catalog #78430) using Barocycler (Pressure Biosciences). Antibody 17G1 was also tested against the same plasma and tumor that were not spiked with one-arm activated anti-PDL1 activatable antibody PL07-2001-C5H9v2. The test samples were then analyzed by the Wes capillary electrophoresis immunoassay-based method, wherein separation was effected by SDS-based electrophoresis (Protein Simple), also referred to as the Wes system. FIGS. 4A-4D demonstrate high binding specificity of antibody 17G1 to anti-PDL1 activatable antibody PL07-2001-C5H9v2 spiked into human plasma (FIG. 4C) and lung tumor lysate samples (FIG. 4D). FIGS. 4A and 4B demonstrate background binding of antibody 17G1 in human plasma and lung tumor lysate samples, respectively, in the absence of anti-PDL1 activatable antibody PL07-2001-C5H9v2.

EXAMPLE 5. Quantification of Activated and Intact anti-PDL1 Activatable Antibodies in Biological Samples

[00356] This Example describes the ability of antibody 17G1 to detect activated and intact anti-PDL1 activatable antibody PL07-2001-C5H9v2 in plasma and xenograft tumor samples of mice administered anti-PDL1 activatable antibody PL07-2001-C5H9v2.

[00357] Anti-PDL1 activatable antibody PL07-2001-C5H9v2 is designed to be cleaved (i.e., activated) by a number of serine proteases and matrix metalloproteinases (MMPs) which are generally associated with human tumors (LeBeau et al, Imaging a functional tumorigenic biomarker in the transformed epithelium. Proc Natl Acad Sci 2013 ;110: 93–98; Overall & Kleifeld, 2006, Validating Matrix Metalloproteinases as Drug Targets and Anti-Targets for Cancer Therapy. Nature Review Cancer, 6, 227-239), and which have low activity in blood or in normal tissues. To evaluate and measure activatable antibody activation in tumor and plasma

samples, samples were analyzed by the Wes system that enables detection of intact and activated anti-PDL1 activatable antibody PL07-2001-C5H9v2 as described herein. Using this system, it was shown that the activatable antibodies remain mostly intact (i.e., inactivated) in circulation, but are activated in mouse xenograft tumors.

[00358] In general, the following protocol was used: a mouse xenograft tumor model was developed by SC implantation of $3x10^6$ MDA-MB-231-luc2-4D3LN cells in 30 uL serum-free medium containing matrigel (1:1) to 7-8 weeks old female nude mice. Body weights and tumor measurements were measured and recorded twice weekly for the duration of the study. After tumors achieved volume of 200-500 mm^3, mice were randomized into 3 groups of equivalent average tumor volume and dosed with anti-PDL1 activatable antibody PL07-2001-C5H9v2. Four days after treatment, tumor and plasma (heparin) were collected and stored at -80ºC prior to analysis. Tumor homogenates (i.e., lysates) were prepared in Thermo Scientific Pierce™ IP Lysis Buffer (Catalog #87788) with added Thermo Scientific Halt™ Protease Inhibitor Single Use Cocktail Kit (Catalog #78430) using Barocycler (Pressure Biosciences). Approximately 0.8mg/mL of protein lysate in IP lysis buffer with HALT protease inhibitor/EDTA and plasma samples diluted 1 in 100 in PBS were analyzed by the Wes system as described herein.

[00359] Samples were analyzed using a protocol similar to that described by ProteinSimple in the Simple Western Size Assay Development Guide (http://www.proteinsimple.com/documents/042-889_Rev1_Size_Assay_Development_Guide.pdf), as long as that method enables separation of intact and activated species. In some embodiments, varying any one more of the following using the methods can be used to facilitate separate of intact and activated species: varying, e.g., increasing or decreasing, stacking time, varying, e.g., increasing or decreasing, sample time, and/or varying, e.g., increasing or decreasing, separation time.

[00360] In general, one part (e.g., 1 µL) 5X Fluorescent Master Mix (ProteinSimple) was combined with 4 parts (e.g., 4 µL) lysate to be tested in a microcentrifuge tube. A 1 ng to 5 ug range of anti-PDL1 activatable antibody PL07-2001-C5H9v2 was used for antibody screening and characterization. For biological samples comprising tumor tissue, 0.8 mg/mL of protein lysate in IP lysis buffer with HALT protease inhibitor/EDTA was used. Plasma samples were diluted 1 in 100 in PBS. Primary antibodies were used at a concentration of 1.7 ng/mL (diluted

in Antibody diluent 2 (ProteinSimple Cat# 042-203). Mouse secondary antibody (ProteinSimple) was used neat. Plates with samples prepared according to the Simple Western Size Assay Development Guide were centrifuged for 5 minutes at 2500 rpm (~1000 x *g*) at room temperature before analyzing on the Wes system (ProteinSimple).

[00361] FIGS. 5A and 5B compare specific detection of intact and activated anti-PDL1 activatable antibody PL07-2001-C5H9v2 by anti-idiotypic antibody 17G1 of the disclosure and commercial anti-human IgG A110UK (cynomolgus monkey adsorbed goat anti-human IgG) from American Qualex. Antibody 17G1 of the disclosure was able to detect anti-PDL1 activatable antibody PL07-2001-C5H9v2 in plasma of mice treated with only 0.1 mg/kg of anti-PDL1 activatable antibody PL07-2001-C5H9v2 (FIG. 5B) as compared to the commercial human IgG antibody only being able to minimally detect anti-PDL1 activatable antibody PL07-2001-C5H9v2 in plasma of mice treated with 10 mg/kg anti-PDL1 activatable antibody PL07-2001-C5H9v2 (FIG. 5A).

[00362] FIGS. 6A and 6B show preferential activation of anti-PDL1 activatable antibody PL07-2001-C5H9v2 in tumor versus plasma samples. In this study, MDA-MD-231 xenograft mice were treated with 1 mg/kg of anti-PDL1 activatable antibody PL07-2001-C5H9v2. Tumor and plasma samples were collected on day 4 (96 hours). Tumor homogenate and plasma samples were analyzed in the Wes system using the 17G1 antibody for detection. Plasma samples exhibited intact anti-PDL1 activatable antibody PL07-2001-C5H9v2 (FIG. 6B) whereas the tumor microenvironment activated at least a portion of the anti-PDL1 activatable antibody PL07-2001-C5H9v2 (FIG. 6A).

EXAMPLE 6. Quantification of Activated and Intact anti-PDL1 Activatable Antibodies in Biological Samples

[00363] This Example demonstrates that the Wes system can be applied to different xenograft tumor types and different dosing concentrations.

[00364] Briefly, a mouse xenograft tumor model was developed by SC implantation of $5x10^6$ SAS cells in 100 uL serum-free medium to 7-8 week old female nude mice. Body weights and tumor measurements were measured and recorded twice weekly for the duration of the study. After tumors achieved volume of 450-550 mm^3, mice were randomized into 3 groups of equivalent average tumor volume and dosed with 0.1 mg/kg of anti-PDL1 activatable antibody PL07-2001-C5H9v2. Four days after treatment, tumor and plasma (heparin) samples

were collected and stored at -80°C prior to analysis. Tumor homogenates (i.e., lysates) were prepared in Thermo Scientific Pierce™ IP Lysis Buffer (Catalog #87788) with added Thermo Scientific Halt™ Protease Inhibitor Single Use Cocktail Kit (Catalog #78430) using Barocycler (Pressure Biosciences). Approximately 0.8 mg/mL of protein lysate in IP lysis buffer with HALT protease inhibitor/EDTA and plasma samples diluted 1 in 250 in PBS were analyzed by the Wes system using the 17G1 antibody for detection. FIGS. 7A and 7B indicate the preferential activation of activatable antibody therapeutics in tumor versus plasma samples.

Other Embodiments

[00365] While the invention has been described in conjunction with the detailed description thereof, the foregoing description is intended to illustrate and not limit the scope of the invention, which is defined by the scope of the appended claims. Other aspects, advantages, and modifications are within the scope of the following.

Claims

What is claimed:

1. An activatable anti-PDL1 antibody comprising:
    a. an antibody (AB) that specifically binds to human PDL1, wherein the AB comprises:
        i. a heavy chain variable region comprising a complementarity determining region 1 (CDRH1) comprising the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) comprising the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) comprising the amino acid sequence or SEQ ID NO:235; and
        ii. a light chain variable region comprising a light chain complementarity determining region 1 (CDRL1) comprising the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) comprising the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) comprising the amino acid sequence of SEQ ID NO:228;
    b. a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and
    c. a masking moiety (MM) linked to the CM,

    for use in treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, and wherein the activatable antibody is administered intravenously at a dose of about between 0.3 mg/kg to 30 mg/kg

2. An activatable anti-PDL1 antibody comprising:
    a. an antibody (AB) that specifically binds to human PDL1, wherein the AB comprises:
        i. a heavy chain variable region comprising a complementarity determining region 1 (CDRH1) comprising the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) comprising the amino acid sequence of SEQ ID NO:246, and a complementarity

determining region 3 (CDRH3) comprising the amino acid sequence or SEQ ID NO:235; and

ii. a light chain variable region comprising a light chain complementarity determining region 1 (CDRL1) comprising the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) comprising the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) comprising the amino acid sequence of SEQ ID NO:228;

b. a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and

c. a masking moiety (MM) linked to the CM,

for use in treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, and wherein the activatable antibody is administered intravenously at a fixed dose of about between 24 and 2400 mg.

3. The activatable anti-PDL1 antibody of claim 1 or 2, wherein the MM inhibits the binding of the AB to human PDL1 when the activatable antibody is in an uncleaved state.

4. The activatable anti-PDL1 antibody any one of claims 1-3, wherein the MM comprises the amino acid sequence of SEQ ID NO: 63.

5. The activatable anti-PDL1 antibody of any of claims 1-4, wherein the CM comprises the amino acid sequence of SEQ ID NO: 377.

6. The activatable anti-PDL1 antibody of any one claims 1-5, wherein the AB comprises a heavy chain variable region (VH) comprising the amino acid sequence of SEQ ID NO: 46 and a light chain variable (VL) comprising the amino acid sequence of SEQ ID NO: 58 or SEQ ID NO: 137.

7. The activatable anti-PDL1 antibody of claim 1 or 2, wherein the activatable antibody comprises a light chain comprising the amino acid sequence of SEQ ID NO: 1008 and a heavy chain comprising the amino acid sequence of SEQ ID NO: 432.

8. The activatable anti-PDL1 antibody of claim 1 or 2, wherein the activatable antibody comprises a light chain comprising the amino acid sequence of SEQ ID NO: 428 and a heavy chain comprising the amino acid sequence of SEQ ID NO: 432.

9. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein the dose is about between 3 mg/kg to 10 mg/kg.
10. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein the dose is about between 3 mg/kg to 15 mg/kg.
11. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 0.3 mg/kg.
12. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 1 mg/kg.
13. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 3 mg/kg.
14. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 6 mg/kg.
15. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 10 mg/kg.
16. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 15 mg/kg.
17. The activatable anti-PDL1 antibody of any of claims 1 and 3-8, wherein dose is 30 mg/kg.
18. The activatable anti-PDL1 antibody of claim 2-8, wherein the fixed dose is 240 mg
19. The activatable anti-PDL1 antibody of claim 2-8, wherein the fixed dose is 480 mg.
20. The activatable anti-PDL1 antibody of claim 2-8, wherein the fixed dose is 800 mg.
21. The activatable anti-PDL1 antibody of claim 2-8, wherein the fixed dose is 1200 mg.
22. The activatable anti-PDL1 antibody of claim 2-8, wherein the fixed dose is 2400 mg.
23. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the activatable antibody is administered on a schedule of one dose every 7-30 days.
24. The activatable anti-PDL1 antibody claim 23, wherein the wherein the activatable antibody is administered on a schedule of one dose every 14 days.
25. The activatable anti-PDL1 antibody claim 23, wherein the wherein the activatable antibody is administered on a schedule of one dose every 21 days.
26. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the activatable antibody is administrated as a monotherapy.
27. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the activatable antibody is administrated as a component of a combination therapy.

28. The activatable anti-PDL1 antibody claim 27, wherein the combination therapy comprises administering a dose of an anti-CTLA-4 antibody or a B-RAF inhibitor
29. The activatable anti-PDL1 antibody of claim 28 wherein the anti-CTLA-4 antibody is ipilimumab.
30. The activatable anti-PDL1 antibody of 27 or 28, wherein the anti-CTLA-4 antibody is administered intravenously.
31. The activatable anti-PDL1 antibody of any one of claims 28-30 wherein the anti-CTLA-4 antibody is administered at a dose of 3 mg/kg, 6 mg/kg or 10 mg/kg.
32. The activatable anti-PDL1 antibody of any one of claims 28-30 wherein the an anti-CTLA-4 antibody is administered at a fixed dose 240 mg, 480 mg or 800 mg.
33. The activatable anti-PDL1 antibody of claim 28, wherein the B-RAF inhibitor is vemurafenib.
34. The activatable anti-PDL1 antibody of claim 28 or 33wherein the B-RAF inhibitor is administered orally.
35. The activatable anti-PDL1 antibody of claim 28, 33 or 34, wherein B-RAF inhibitor is administered at a dose of 960 mg.
36. The activatable anti-PDL1 antibody of claim 28, 33 or 34, wherein B-RAF inhibitor is administered at a dose of 875 mg.
37. The activatable anti-PDL1 antibody of claim 28, 33-36 wherein the administering step comprises administering the activatable antibody and the B-RAF inhibitor over a same period of time.
38. The activatable anti-PDL1 antibody of any of claims 28, 33-37, wherein a dose of the B-RAF inhibitor is administered twice daily.
39. The activatable anti-PDL1 antibody of any of claims 28, 33-38, wherein at least 4 doses each of the activatable antibody and the B-RAF inhibitor are administered.
40. The activatable anti-PDL1 antibody of any of claims 28-32, wherein the administering steps comprise administering multiple doses of the activatable antibody and the anti-CTLA-4 antibody over a first period of time, followed by administration of multiple doses of the activatable antibody as a monotherapy over a second period of time.
41. The activatable anti-PDL1 antibody any of claims 28-32, wherein a dose of the activatable antibody and a dose of the anti-CTLA-4 antibody are administered

concomitantly as a combination therapy every 21 days for 4 doses, followed by administration of a dose of the activatable antibody as a monotherapy every 14 days.

42. The activatable anti-PDL1 antibody of any of claims 28-32, wherein the administering steps comprise administering multiple doses of the activatable antibody as a monotherapy over a first period of time, followed by concomitant administration of multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy over a second period of time.

43. The activatable anti-PDL1 antibody of any of claims 28-32, wherein the administering step comprises (i) administering multiple doses of the activatable antibody as a monotherapy over a first period of time, (ii) subsequently administering multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy over a second period of time, and (iii) subsequently administering multiple doses of the activatable antibody as a monotherapy over a third period of time.

44. The activatable anti-PDL1 antibody of any of claims 28-32, wherein a dose of activatable antibody is administered as a monotherapy every 14 days for 4 doses, followed by administration of a dose of activatable antibody and a dose of anti-CTLA-4 antibody are administered as a combination therapy every 21 days, for 4 doses, followed by administration of a dose an activatable antibody as a monotherapy every 14 days.

45. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the cancer is an advanced, unresectable solid tumor or lymphoma.

46. The activatable anti-PDL1 antibody of claim 45. wherein the advanced unresectable tumor is a PDL1-responsive tumor type.

47. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the cancer is a carcinoma.

48. The activatable anti-PDL1 antibody of claim 47, wherein the carcinoma squamous cell carcinoma.

49. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the cancer is anal squamous cell carcinoma, basal cell carcinoma, bladder cancer, bone cancer, bowel carcinoma, breast cancer, carcinoid, castration-resistant prostate cancer (CRPC), cervical carcinoma, colorectal cancer (CRC), colon cancer cutaneous squamous cell carcinoma, endometrial cancer, esophageal cancer, gastric carcinoma,

gastroesophageal junction cancer, glioblastoma/ mixed glioma, glioma, head and neck cancer, hepatocellular carcinoma, hematologic malignancy. liver cancer, lung cancer, melanoma, Merkel cell carcinoma, multiple myeloma, nasopharyngeal cancer, osteosarcoma, ovarian cancer, pancreatic cancer, peritoneal carcinoma, undifferentiated pleomorphic sarcoma, prostate cancer, rectal carcinoma, renal cancer, sarcoma, salivary gland carcinoma, squamous cell carcinoma, stomach cancer, testicular cancer, thymic carcinoma, thymic epithelial tumor, thymoma, thyroid cancer, urogenital cancer, urothelial cancer, uterine carcinoma , or uterine sarcoma.

50. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the cancer is a High Tumor Mutational Burden (hTMB) cancer,

51. The activatable anti-PDL1 antibody of claim 49, wherein the breast cancer is triple negative breast cancer or estrogen receptor positive breast cancer.

52. The activatable anti-PDL1 antibody of claim 49, wherein the hematologic malignancy is a lymphoma or a leukemia.

53. The activatable anti-PDL1 antibody of claim 53, wherein the lymphoma is a B-cell lymphoma, a T-cell lymphoma, Hodgkin's lymphoma, or an EBV lymphoma, primary mediastinal B-cell lymphoma.

54. The activatable anti-PDL1 antibody of claim 49, wherein the cancer is melanoma

55. The activatable anti-PDL1 antibody of claim 49, wherein the bowel carcinoma is small bowel carcinoma or small bowel adenocarcinoma.

56. The activatable anti-PDL1 antibody of claim 49, the colon cancer is colon adenocarcinoma,

57. The activatable anti-PDL1 antibody of claim 49, the lung cancer is non-small cell lung cancer (NSCLC) or small cell lung cancer.

58. The activatable anti-PDL1 antibody of claim 57, wherein the NSCLC is non-squamous NSCLC or squamous NSCLC.

59. The activatable anti-PDL1 antibody of claim 49, wherein the prostate cancer is small cell neuroendocrine prostate cancer.

60. The activatable anti-PDL1 antibody of claim 49, wherein the renal cancer, renal cell carcinoma or renal sarcoma

61. The activatable anti-PDL1 antibody of claim 49 wherein the cancer is undifferentiated pleomorphic sarcoma, small bowel adenocarcinoma, Merkel cell carcinoma, thymic carcinoma, anal squamous cell carcinoma, cutaneous squamous cell carcinoma or triple negative breast cancer.

62. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the subject exhibits one or more of the following characteristics:
    a. PD-1/PDL1 inhibitor-naïve,
    b. CTLA-4 inhibitor-naïve,
    c. *BRAF*^{V600E} mutation positive,
    d. BRAF inhibitor-naïve,
    e. PDL1 positive,
    f. PDL1 unknown, and
    g. been previously treated with a PD1/PDL1 inhibitor.

63. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the subject has no further standard of care available.

64. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein PD1/PDL1 inhibitor therapy is not approved for the subject's cancer.

65. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the subject has been previously treated with a PD-1/PDL1 inhibitor, wherein treatment with the PD-1/PDL1 inhibitor was discontinued for reasons other than toxicity, and wherein the subject is CTLA-4 inhibitor-naïve.

66. The activatable anti-PDL1 antibody of any one of the preceding claims, wherein the subject is immunotherapy naïve.

67. A method of treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, comprising administering intravenously at a dose of about between 0.3 mg/kg to 30 mg/kg of an activatable anti-PDL1 antibody to the subject, wherein the activatable antibody comprises:
    a. an antibody (AB) that specifically binds to human PDL1, wherein the AB comprises:
        i. a heavy chain variable region comprising a complementarity determining region 1 (CDRH1) comprising the amino acid sequence of SEQ ID

NO:212, a complementarity determining region 2 (CDRH2) comprising the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) comprising the amino acid sequence or SEQ ID NO:235; and

ii. a light chain variable region comprising a light chain complementarity determining region 1 (CDRL1) comprising the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) comprising the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) comprising the amino acid sequence of SEQ ID NO:228;

b. a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and

c. a masking moiety (MM) linked to the CM.

68. A method of treating, alleviating a symptom of, or delaying the progression of a cancer in a subject, comprising administering intravenously at a fixed dose of about between 24 and 2400 mg of an activatable anti-PDL1 antibody to the subject, wherein the activatable antibody comprises:

a. an antibody (AB) that specifically binds to human PDL1, wherein the AB comprises:

i. a heavy chain variable region comprising a complementarity determining region 1 (CDRH1) comprising the amino acid sequence of SEQ ID NO:212, a complementarity determining region 2 (CDRH2) comprising the amino acid sequence of SEQ ID NO:246, and a complementarity determining region 3 (CDRH3) comprising the amino acid sequence or SEQ ID NO:235; and

ii. a light chain variable region comprising a light chain complementarity determining region 1 (CDRL1) comprising the amino acid sequence of SEQ ID NO:209, a light chain complementarity determining region 2, (CDRL2) comprising the amino acid sequence of SEQ ID NO:215, a light chain complementarity determining region 3 (CDRL3) comprising the amino acid sequence of SEQ ID NO:228;

b. a cleavable moiety (CM) linked to the AB, wherein the CM is a polypeptide that functions as a substrate for a protease; and
c. a masking moiety (MM) linked to the AB.

69. The method of claim 67 or 68 wherein the MM inhibits the binding of the AB to human PDL1 when the activatable antibody is in an uncleaved state.

70. The method any one of claims 67-69, wherein the MM comprises the amino acid sequence of SEQ ID NO: 63.

71. The method of any of claims 67-70, wherein the CM comprises the amino acid sequence of SEQ ID NO: 377.

72. The method of any one claims 67-71, wherein the AB comprises a heavy chain variable region (VH) comprising the amino acid sequence of SEQ ID NO: 46 and a light chain variable (VL) comprising the amino acid sequence of SEQ ID NO: 58 or SEQ ID NO: 137.

73. The method of claim 67 or 68, wherein the activatable antibody comprises a light chain comprising the amino acid sequence of SEQ ID NO: 1008 and a heavy chain comprising the amino acid sequence of SEQ ID NO: 432.

74. The method of claim 67 or 68, wherein the activatable antibody comprises a light chain comprising the amino acid sequence of SEQ ID NO: 428 and a heavy chain comprising the amino acid sequence of SEQ ID NO: 432.

75. The method of any of claims 67 and 69-74, wherein the dose is about between 3 mg/kg to 10 mg/kg.

76. The method of any of claims 67 and 69-74, wherein the dose is about between 3 mg/kg to 15 mg/kg.

77. The method of any of claims 67 and 69-74, wherein dose is 0.3 mg/kg.

78. The method of any of claims 67 and 69-74, wherein dose is 1 mg/kg.

79. The method of any of claims 67 and 69-74, wherein dose is 3 mg/kg.

80. The method of any of claims 67 and 69-74, wherein dose is 6 mg/kg.

81. The method of any of claims 67 and 69-74, wherein dose is 10 mg/kg.

82. The method of any of claims 67 and 69-74, wherein dose is 15 mg/kg.

83. The method of any of claims 67 and 69-74, wherein dose is 30 mg/kg.

84. The method of claim 68-74, wherein the fixed dose is 240 mg

85. The method of claim 68-74, wherein the fixed dose is 480 mg.
86. The method of claim 68-74, wherein the fixed dose is 800 mg.
87. The method of claim 68-74, wherein the fixed dose is 1200 mg.
88. The method of claim 68-74, wherein the fixed dose is 2400 mg.
89. The method of any one of the preceding claims, wherein the activatable antibody is administered on a schedule of one dose every 7-30 days.
90. The method claim 89, wherein the wherein the activatable antibody is administered on a schedule of one dose every 14 days.
91. The method claim 89, wherein the wherein the activatable antibody is administered on a schedule of one dose every 21 days.
92. The method of any one of the preceding claims, wherein the activatable antibody is administrated as a monotherapy.
93. The method of any one of the preceding claims, wherein the activatable antibody is administrated as a component of a combination therapy.
94. The method claim 93, wherein the combination therapy comprises administering a dose of an anti-CTLA-4 antibody or a B-RAF inhibitor
95. The method of claim 94 wherein the anti-CTLA-4 antibody is ipilimumab.
96. The method of 93 or 94, wherein the anti-CTLA-4 antibody is administered intravenously.
97. The method of any one of claims 94-96 wherein the anti-CTLA-4 antibody is administered at a dose of 3 mg/kg, 6 mg/kg or 10 mg/kg.
98. The method of any one of claims 94-96 ,wherein the an anti-CTLA-4 antibody is administered at a fixed dose 240 mg, 480 mg or 800 mg.
99. The method of claim 94, wherein the B-RAF inhibitor is vemurafenib.
100. The method of claim 94 or 99 wherein the B-RAF inhibitor is administered orally.
101. The method of claim 94, 99 or 100, wherein B-RAF inhibitor is administered at a dose of 960 mg.
102. The method of claim 94, 99 or 100, wherein B-RAF inhibitor is administered at a dose of 875 mg.
103. The method of claim 94, 99-102, wherein the administering step comprises administering the activatable antibody and the B-RAF inhibitor over a same period of time.

104. The method of any of claims 94, 99-102, wherein a dose of the B-RAF inhibitor is administered twice daily.

105. The method of any of claims 94, 99-102, wherein at least 4 doses each of the activatable antibody and the B-RAF inhibitor are administered.

106. The method of any of claims 94-98, wherein the administering steps comprise administering multiple doses of the activatable antibody and the anti-CTLA-4 antibody over a first period of time, followed by administration of multiple doses of the activatable antibody as a monotherapy over a second period of time.

107. The method any of claims 94-98, wherein a dose of the activatable antibody and a dose of the anti-CTLA-4 antibody are administered concomitantly as a combination therapy every 21 days for 4 doses, followed by administration of a dose of the activatable antibody as a monotherapy every 14 days.

108. The method of any of claims 94-98, wherein the administering steps comprise administering multiple doses of the activatable antibody as a monotherapy over a first period of time, followed by concomitant administration of multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy over a second period of time.

109. The method of any of claims 94-98, wherein the administering step comprises (i) administering multiple doses of the activatable antibody as a monotherapy over a first period of time, (ii) subsequently administering multiple doses of the activatable antibody and the anti-CTLA-4 antibody as a combination therapy over a second period of time, and (iii) subsequently administering multiple doses of the activatable antibody as a monotherapy over a third period of time.

110. The method of any of claims 94-98, wherein a dose of activatable antibody is administered as a monotherapy every 14 days for 4 doses, followed by administration of a dose of activatable antibody and a dose of anti-CTLA-4 antibody are administered as a combination therapy every 21 days, for 4 doses, followed by administration of a dose an activatable antibody as a monotherapy every 14 days.

111. The method of any one of the preceding claims, wherein the cancer is an advanced, unresectable solid tumor or lymphoma.

112. The method of claim 111, wherein the advanced unresectable tumor is a PDL1-responsive tumor type.
113. The method of any one of the preceding claims, wherein the cancer is a carcinoma.
114. The method of claim 113, wherein the carcinoma squamous cell carcinoma.
115. The method of any one of the preceding claims, wherein the cancer is anal squamous cell carcinoma, basal cell carcinoma, bladder cancer, bone cancer, bowel carcinoma, breast cancer, carcinoid, castration-resistant prostate cancer (CRPC), cervical carcinoma, colorectal cancer (CRC), colon cancer cutaneous squamous cell carcinoma, endometrial cancer, esophageal cancer, gastric carcinoma, gastroesophageal junction cancer, glioblastoma/ mixed glioma, glioma, head and neck cancer, hepatocellular carcinoma, hematologic malignancy. liver cancer, lung cancer, melanoma, Merkel cell carcinoma, multiple myeloma, nasopharyngeal cancer, osteosarcoma, ovarian cancer, pancreatic cancer, peritoneal carcinoma, undifferentiated pleomorphic sarcoma, prostate cancer, rectal carcinoma, renal cancer, sarcoma, salivary gland carcinoma, squamous cell carcinoma, stomach cancer, testicular cancer, thymic carcinoma, thymic epithelial tumor, thymoma, thyroid cancer, urogenital cancer, urothelial cancer, uterine carcinoma , or uterine sarcoma.
116. The method of any one of the preceding claims, wherein the cancer is a High Tumor Mutational Burden (hTMB) cancer,
117. The method of claim 115, wherein the breast cancer is triple negative breast cancer or estrogen receptor positive breast cancer.
118. The method of claim 115, wherein the hematologic malignancy is a lymphoma or a leukemia.
119. The method of claim 118, wherein the lymphoma is a B-cell lymphoma, a T-cell lymphoma, Hodgkin's lymphoma, or an EBV lymphoma, primary mediastinal B-cell lymphoma.
120. The method of claim 115, wherein the cancer is melanoma
121. The method of claim 115, wherein the bowel carcinoma is small bowel carcinoma or small bowel adenocarcinoma.
122. The method of claim 115, the colon cancer is colon adenocarcinoma,

123. The method of claim 115, the lung cancer is non-small cell lung cancer (NSCLC) or small cell lung cancer.

124. The method of claim 123, wherein the NSCLC is non-squamous NSCLC or squamous NSCLC.

125. The method of claim 115, wherein the prostate cancer is small cell neuroendocrine prostate cancer.

126. The method of claim 115, wherein the renal cancer is renal cell carcinoma or renal sarcoma.

127. The method of claim 115, wherein the cancer is undifferentiated pleomorphic sarcoma, small bowel adenocarcinoma, Merkel cell carcinoma, thymic carcinoma, anal squamous cell carcinoma, cutaneous squamous cell carcinoma or triple negative breast cancer.

128. The method of any one of the preceding claims, wherein the subject exhibits one or more of the following characteristics:

a. PD-1/PDL1 inhibitor-naïve,
b. CTLA-4 inhibitor-naïve,
c. *BRAF*^{V600E} mutation positive,
d. BRAF inhibitor-naïve,
e. PDL1 positive,
f. PDL1 unknown, and
g. been previously treated with a PD1/PDL1 inhibitor.

129. The method of any one of the preceding claims, wherein the subject has no further standard of care available.

130. The method of any one of the preceding claims, wherein PD1/PDL1 inhibitor therapy is not approved for the subject's cancer.

131. The method of any one of the preceding claims, wherein the subject has been previously treated with a PD-1/PDL1 inhibitor, wherein treatment with the PD-1/PDL1 inhibitor was discontinued for reasons other than toxicity, and wherein the subject is CTLA-4 inhibitor-naïve.

132. The method of any one of the preceding claims, wherein the subject is immunotherapy naïve.

FIG. 1A

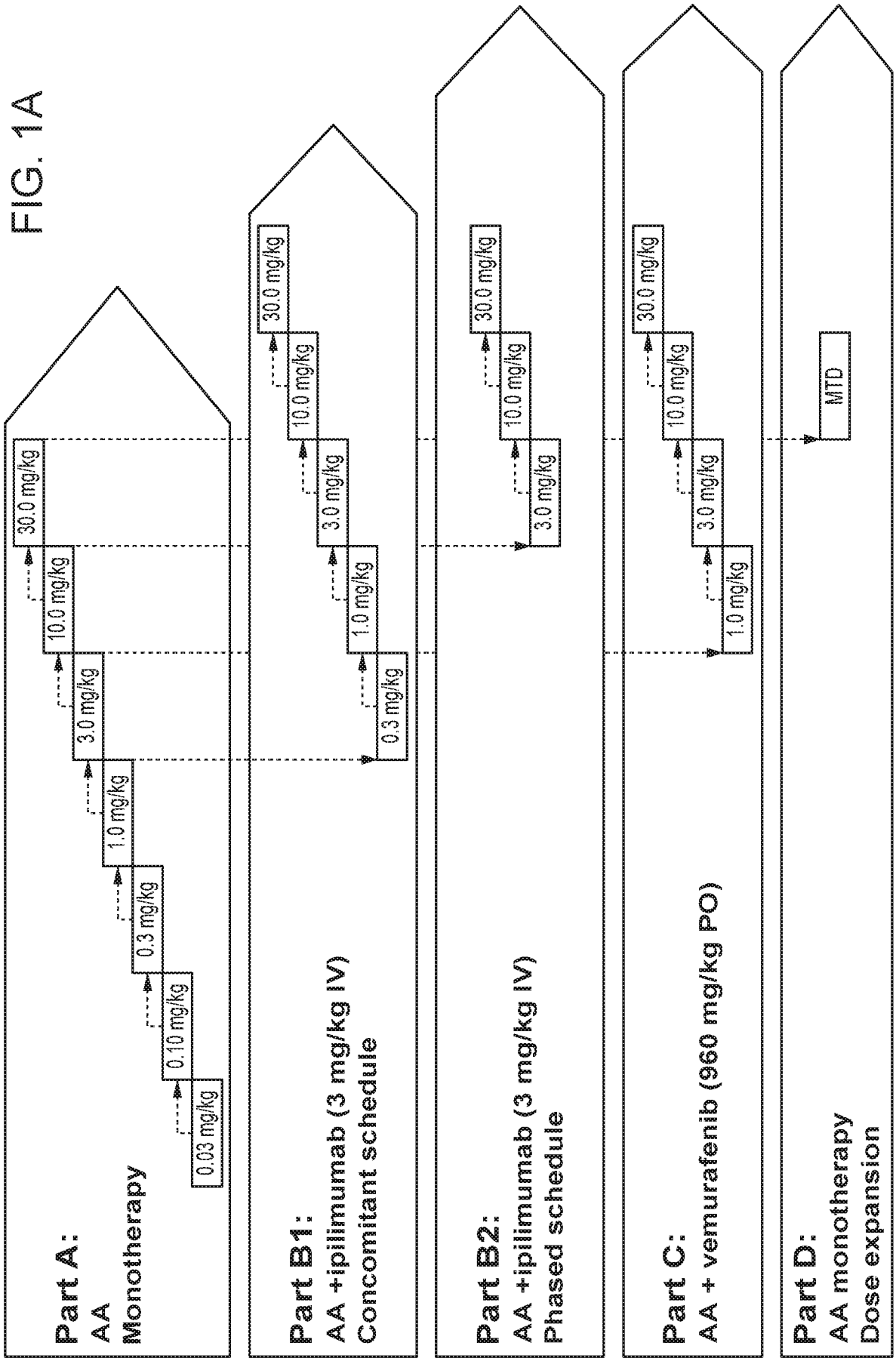

Part A:
AA
Monotherapy
0.03 mg/kg
0.10 mg/kg
0.3 mg/kg
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part B1:
AA +ipilimumab (3 mg/kg IV)
Concomitant schedule
0.3 mg/kg
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part B2:
AA +ipilimumab (3 mg/kg IV)
Phased schedule
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part C:
AA + vemurafenib (960 mg/kg PO)
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part D:
AA monotherapy
Dose expansion
MTD

FIG. 1B

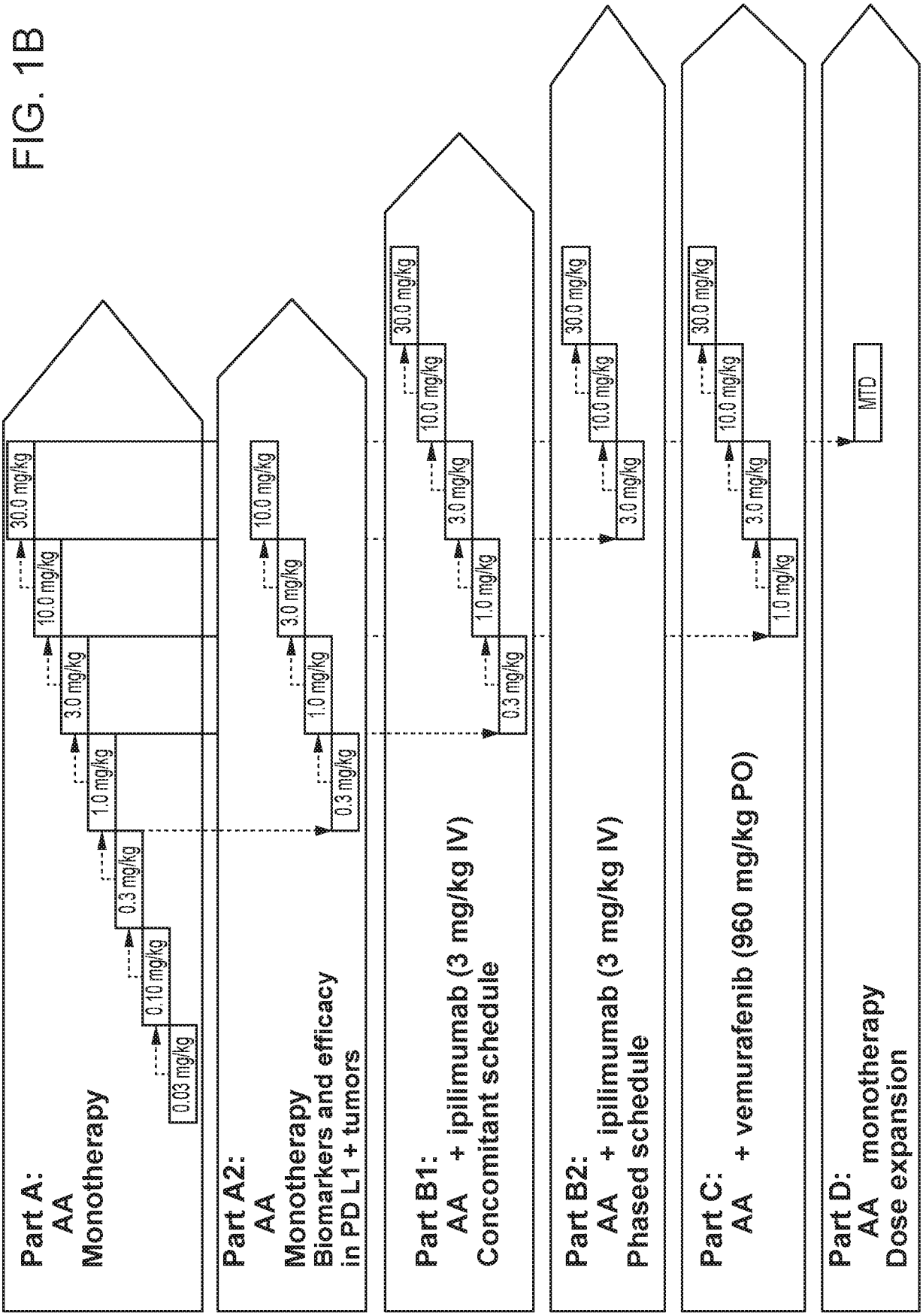

Part A:
AA
Monotherapy
0.03 mg/kg
0.10 mg/kg
0.3 mg/kg
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part A2:
AA
Monotherapy
Biomarkers and efficacy
in PD L1 + tumors
0.3 mg/kg
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
Part B1:
AA + ipilimumab (3 mg/kg IV)
Concomitant schedule
0.3 mg/kg
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part B2:
AA + ipilimumab (3 mg/kg IV)
Phased schedule
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part C:
AA + vemurafenib (960 mg/kg PO)
1.0 mg/kg
3.0 mg/kg
10.0 mg/kg
30.0 mg/kg
Part D:
AA monotherapy
Dose expansion
MTD

FIG. 2

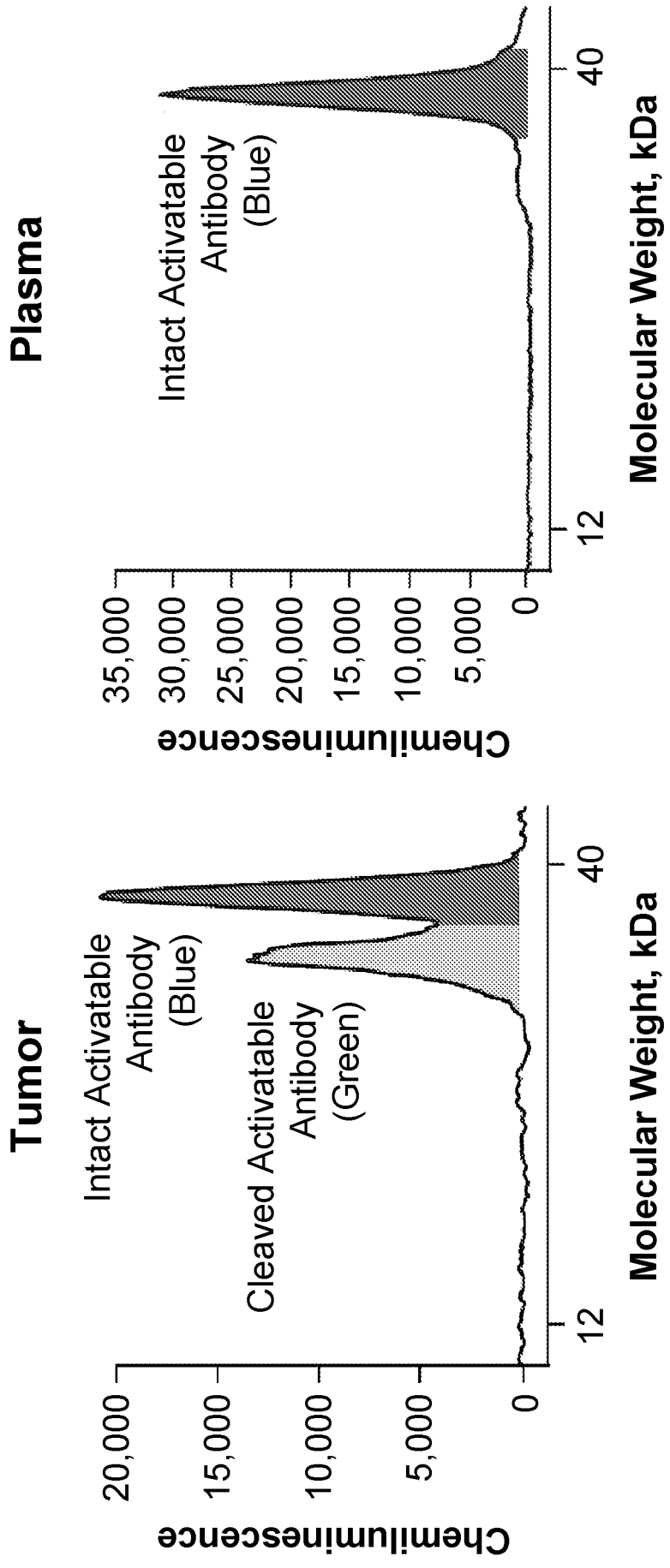

Tumor
Intact Activatable Antibody (Blue)
Cleaved Activatable Antibody (Green)
Chemiluminescence
20,000
15,000
10,000
5,000
0
12
40
Molecular Weight, kDa
Plasma
Intact Activatable Antibody (Blue)
Chemiluminescence
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
12
40
Molecular Weight, kDa

FIG. 3A

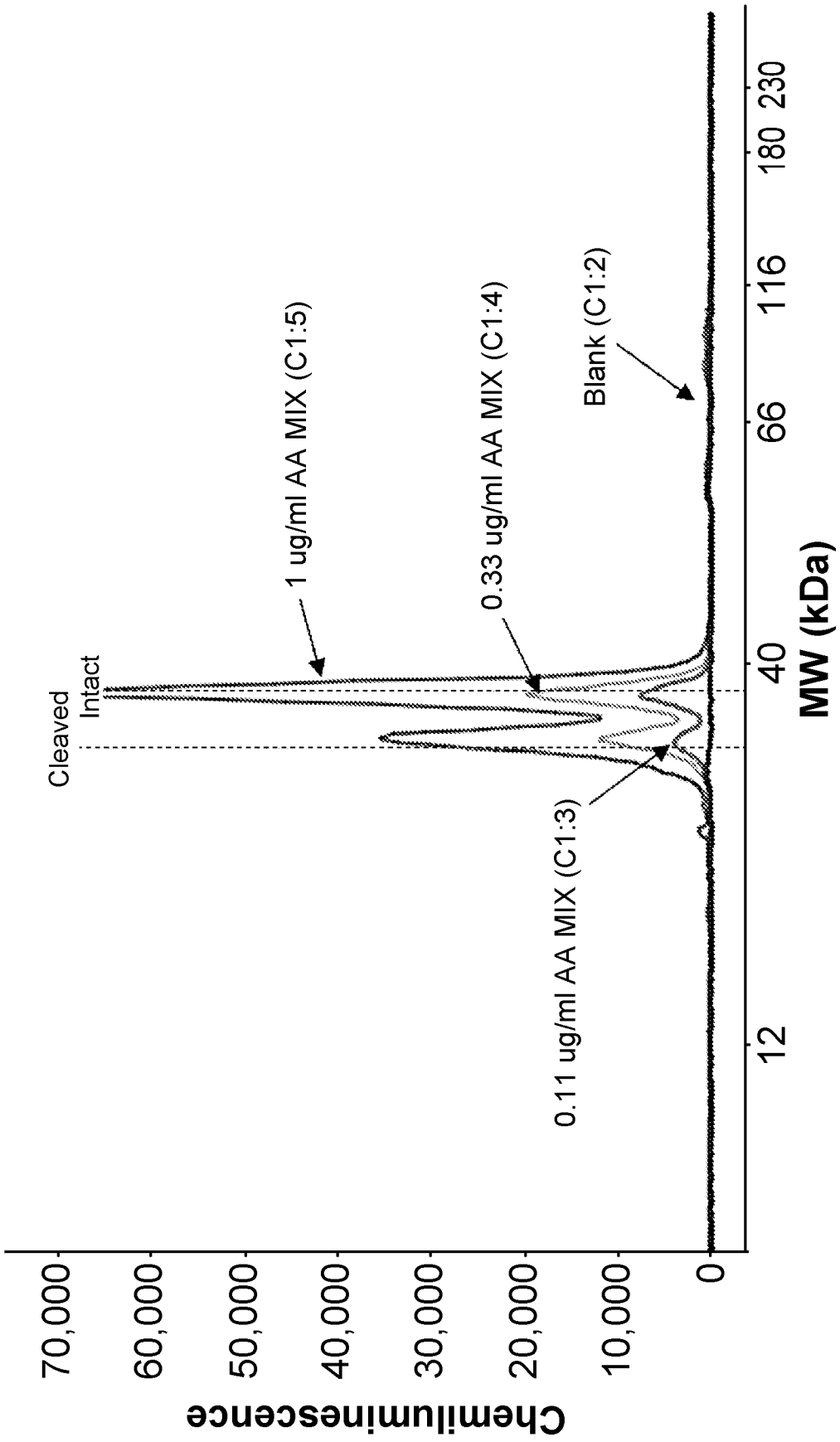
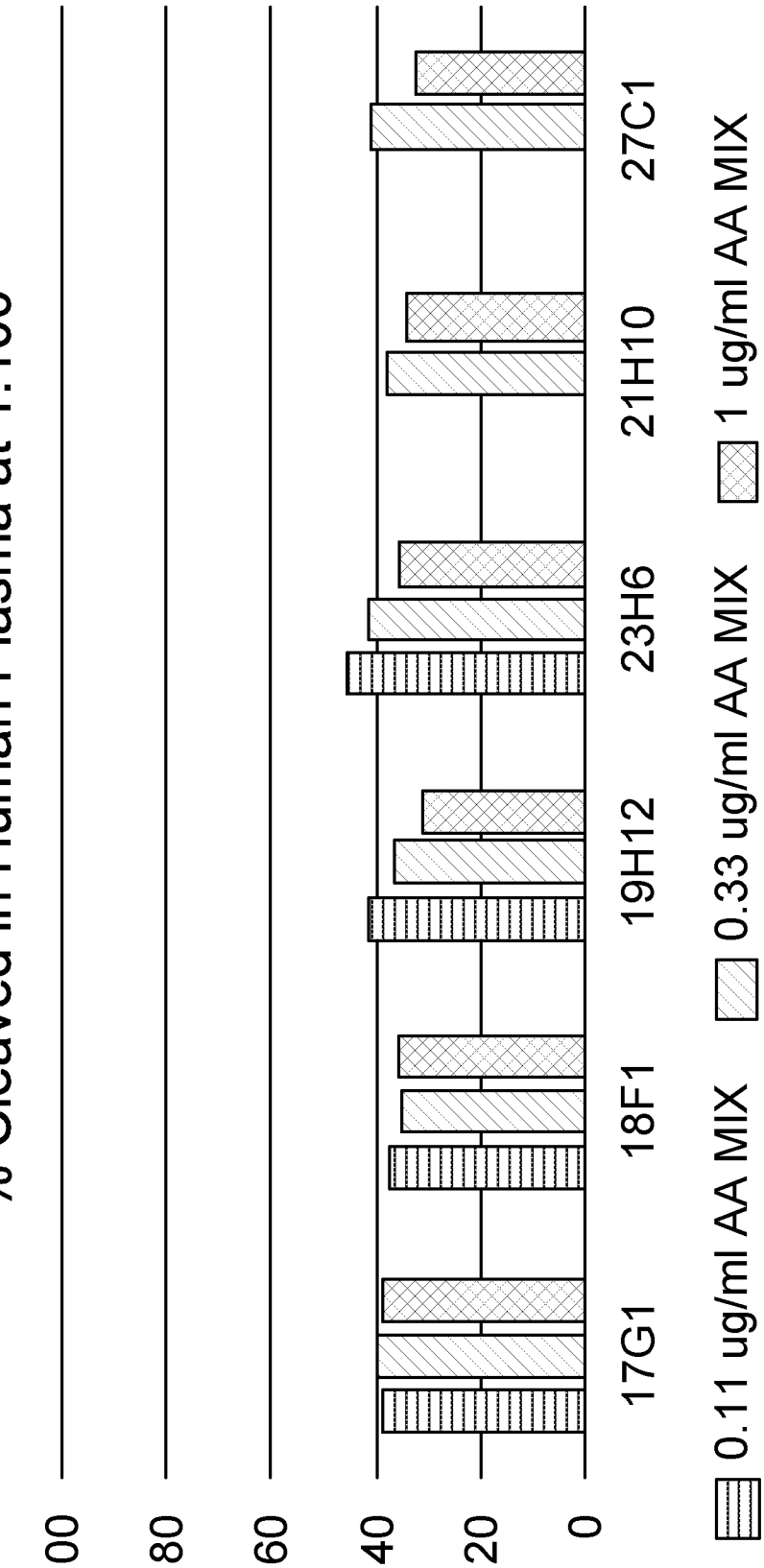

17G1
Cleaved
Intact
1 ug/ml AA MIX (C1:5)
0.33 ug/ml AA MIX (C1:4)
Blank (C1:2)
0.11 ug/ml AA MIX (C1:3)
Chemiluminescence
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
12
40
66
116
180
230
MW (kDa)

FIG. 3B


% Cleaved in Human Plasma at 1:100
100
80
60
40
20
0
17G1
18F1
19H12
23H6
21H10
27C1
0.11 ug/ml AA MIX
0.33 ug/ml AA MIX
1 ug/ml AA MIX

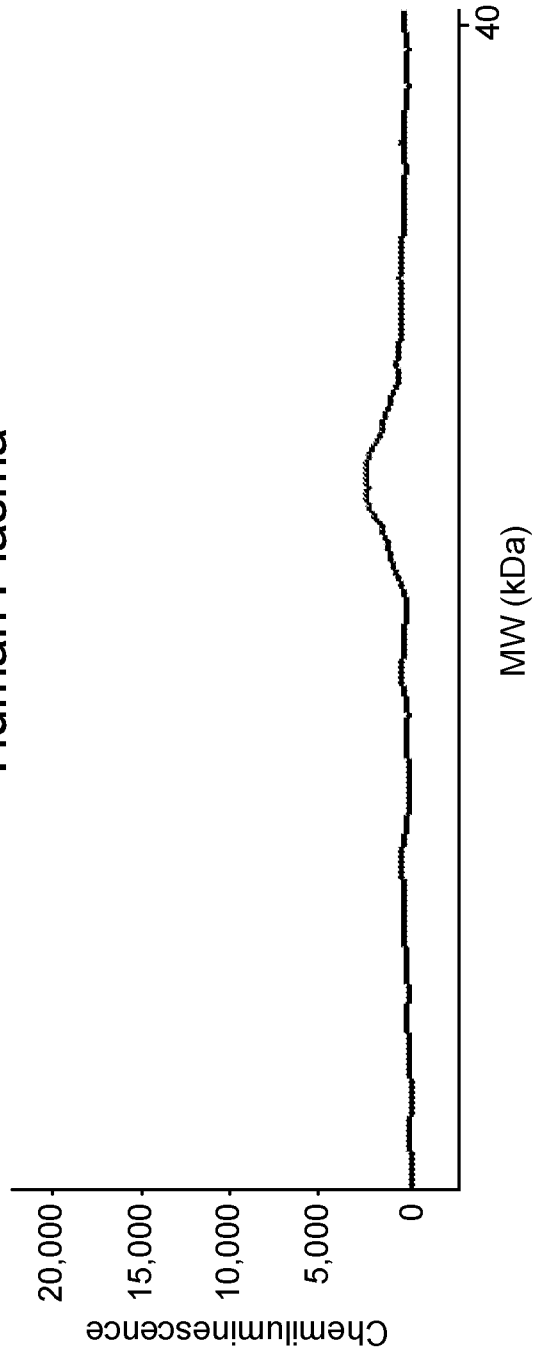

Human Plasma
Chemiluminescence
20,000
15,000
10,000
5,000
0
40
MW (kDa)

FIG. 4A

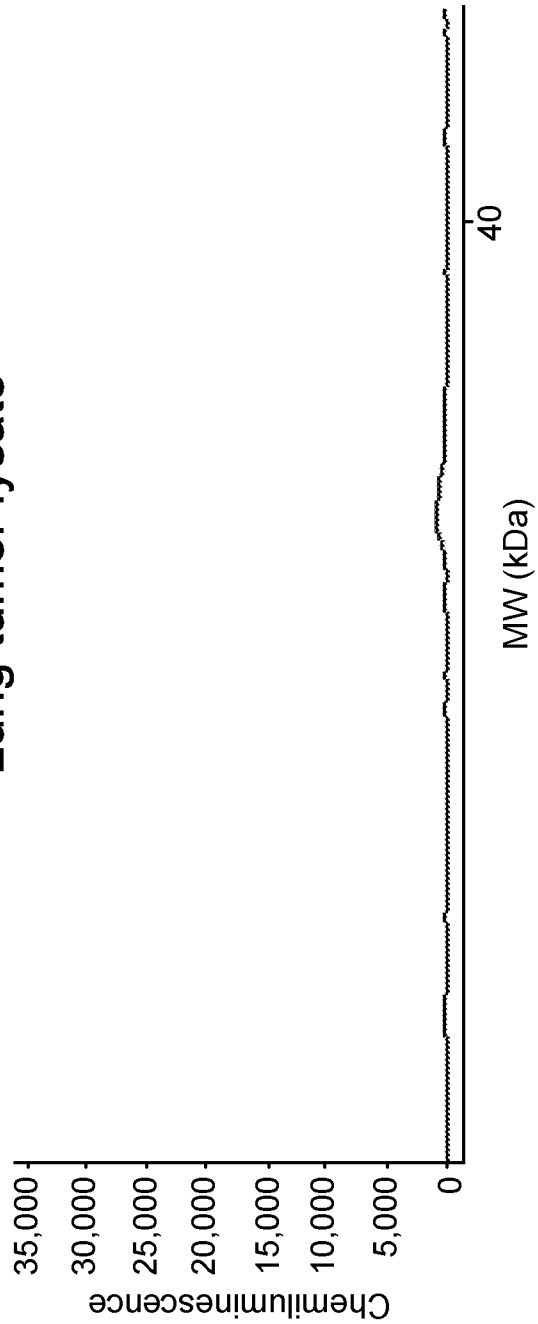

Lung tumor lysate
Chemiluminescence
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
40
MW (kDa)

FIG. 4B

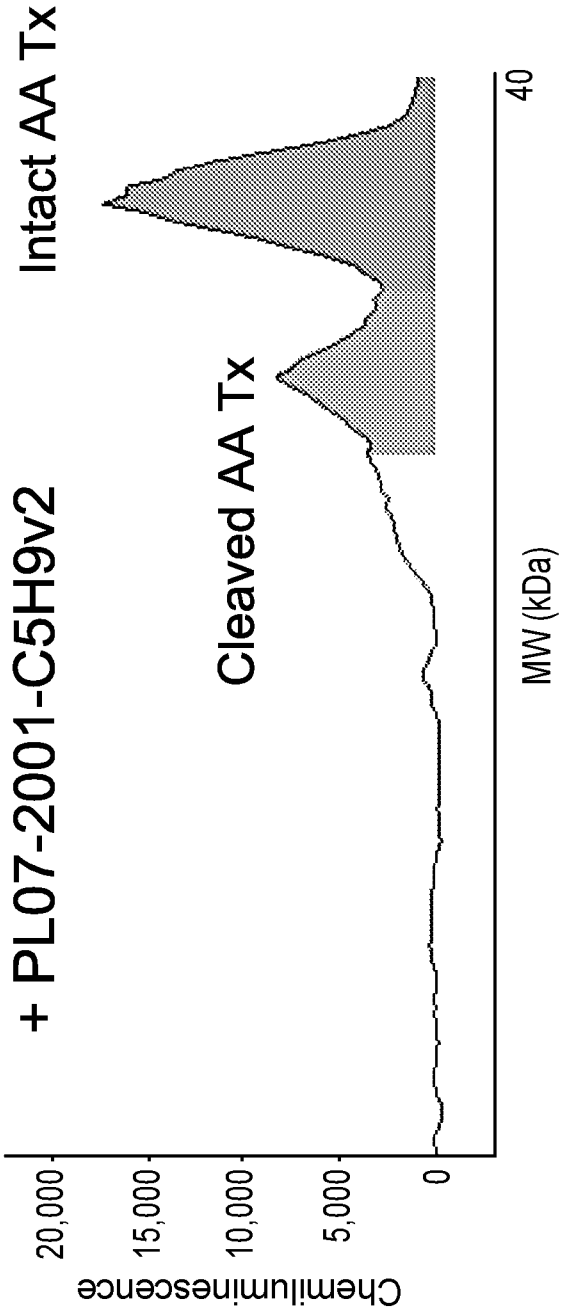

+ PL07-2001-C5H9v2
Intact AA Tx
Cleaved AA Tx
Chemiluminescence
20,000
15,000
10,000
5,000
0
40
MW (kDa)

FIG. 4C

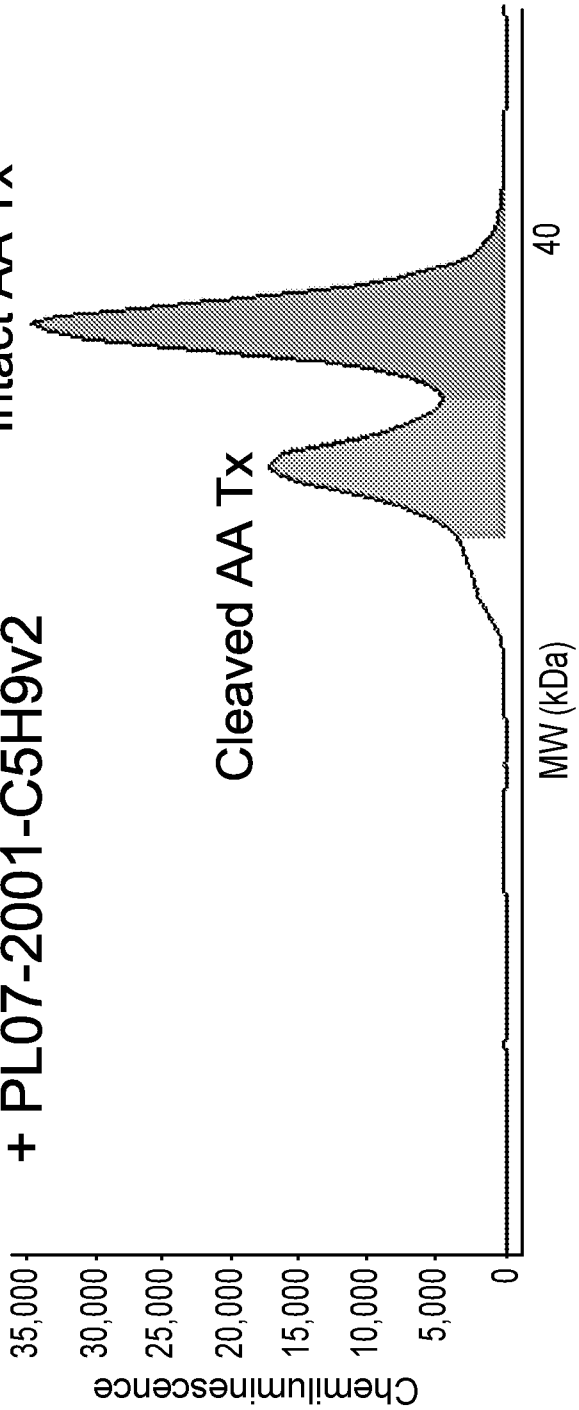

+ PL07-2001-C5H9v2
Intact AA Tx
Cleaved AA Tx
Chemiluminescence
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
40
MW (kDa)

FIG. 4D

FIG. 5A

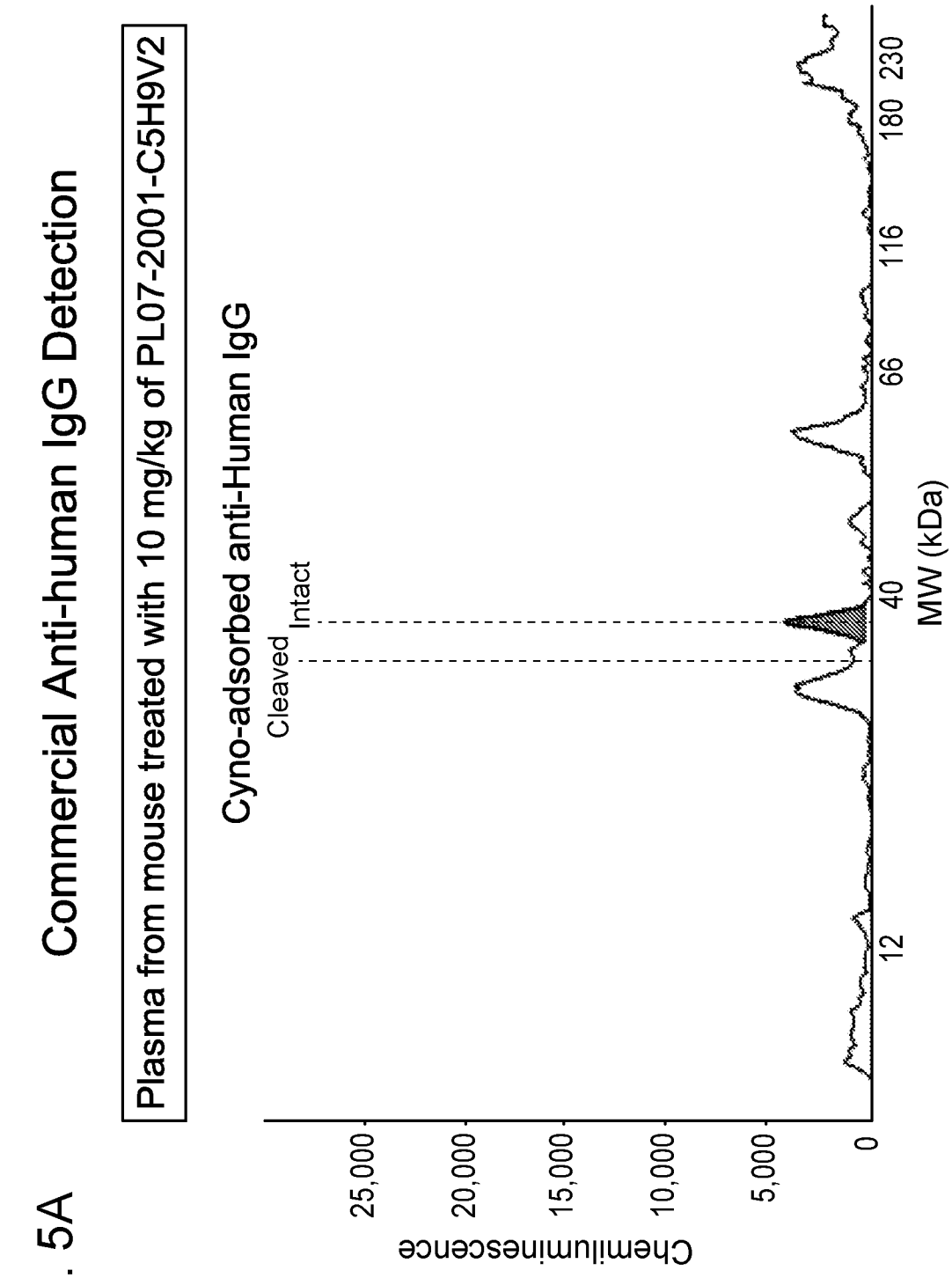
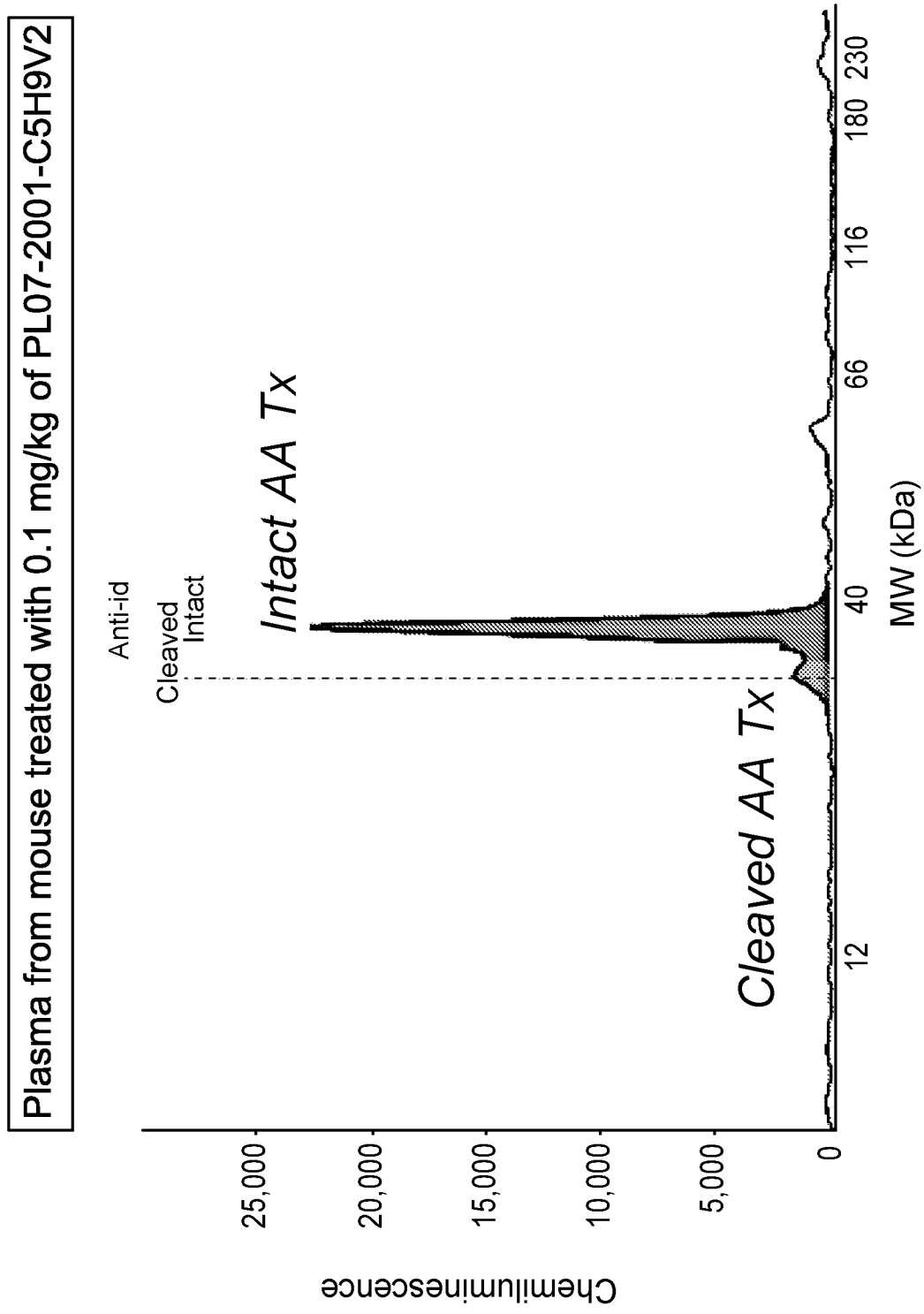

Commercial Anti-human IgG Detection
Plasma from mouse treated with 10 mg/kg of PL07-2001-C5H9V2
Cyno-adsorbed anti-Human IgG
Cleaved
Intact
Chemiluminescence
25,000
20,000
15,000
10,000
5,000
0
12
40
66
116
180
230
MW (kDa)

FIG. 5B


Anti-idiotypic Ab Detection
Plasma from mouse treated with 0.1 mg/kg of PL07-2001-C5H9V2
Anti-id
Cleaved
Intact
Intact AA Tx
Cleaved AA Tx
Chemiluminescence
25,000
20,000
15,000
10,000
5,000
0
12
40
66
116
180
230
MW (kDa)

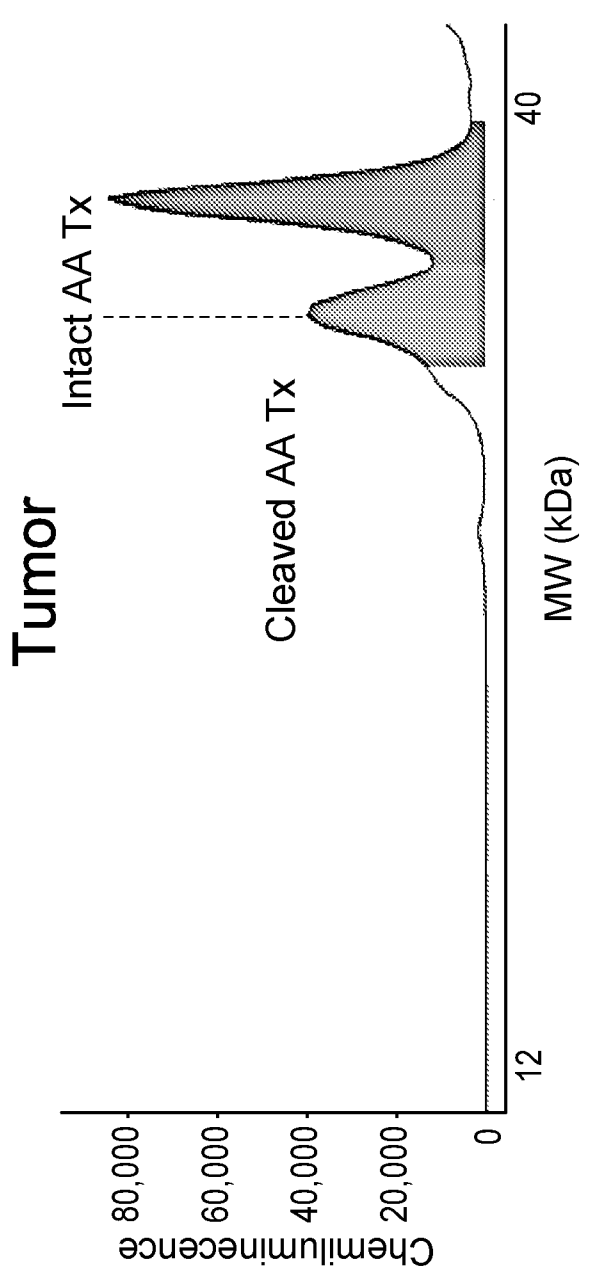

Tumor
Intact AA Tx
Cleaved AA Tx
Chemiluminescence
80,000
60,000
40,000
20,000
0
12
40
MW (kDa)

FIG. 6A

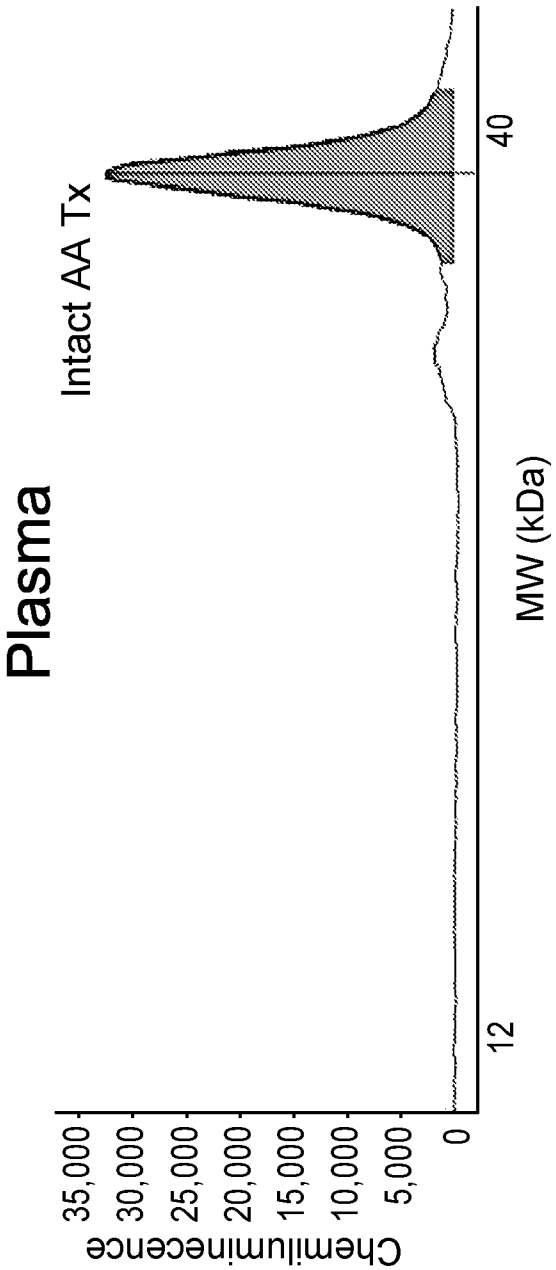

Plasma
Intact AA Tx
Chemiluminescence
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
12
40
MW (kDa)

FIG. 6B

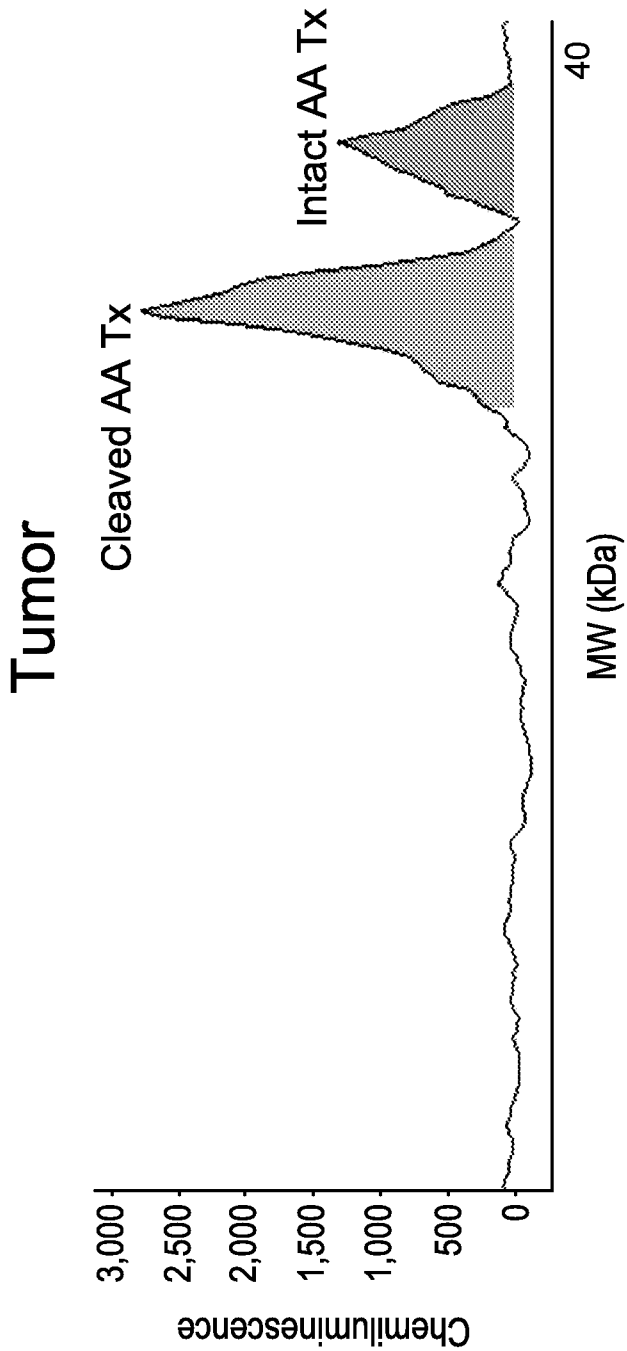

Tumor
Cleaved AA Tx
Intact AA Tx
Chemiluminescence
3,000
2,500
2,000
1,500
1,000
500
0
40
MW (kDa)

FIG. 7A

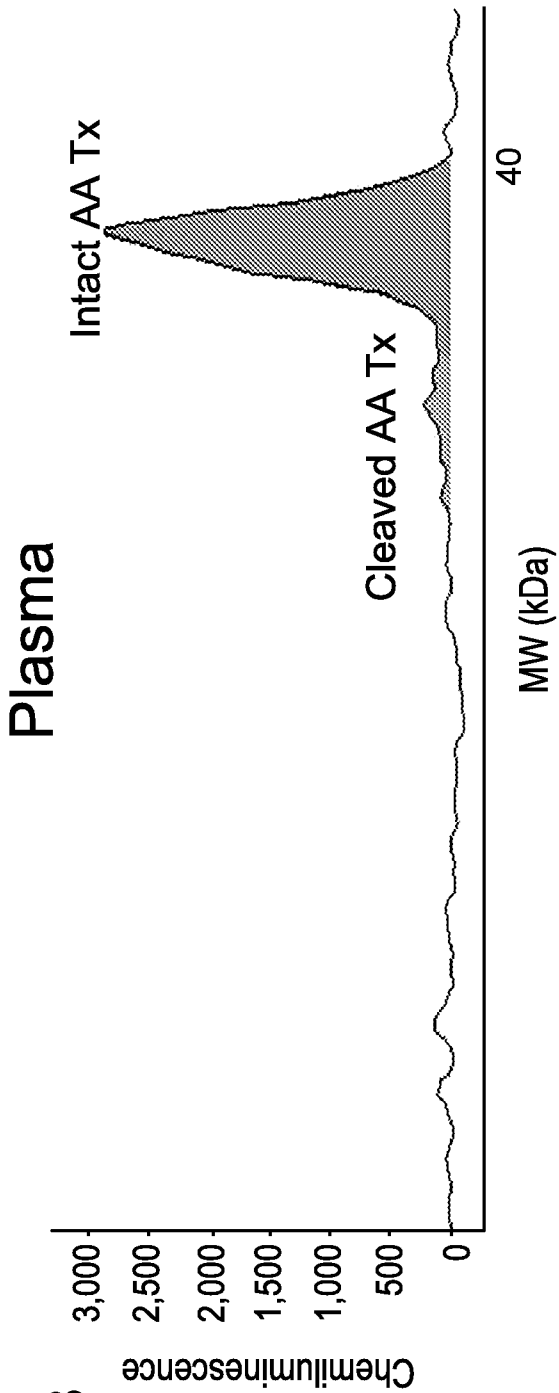

Plasma
Intact AA Tx
Cleaved AA Tx
Chemiluminescence
3,000
2,500
2,000
1,500
1,000
500
0
40
MW (kDa)

FIG. 7B

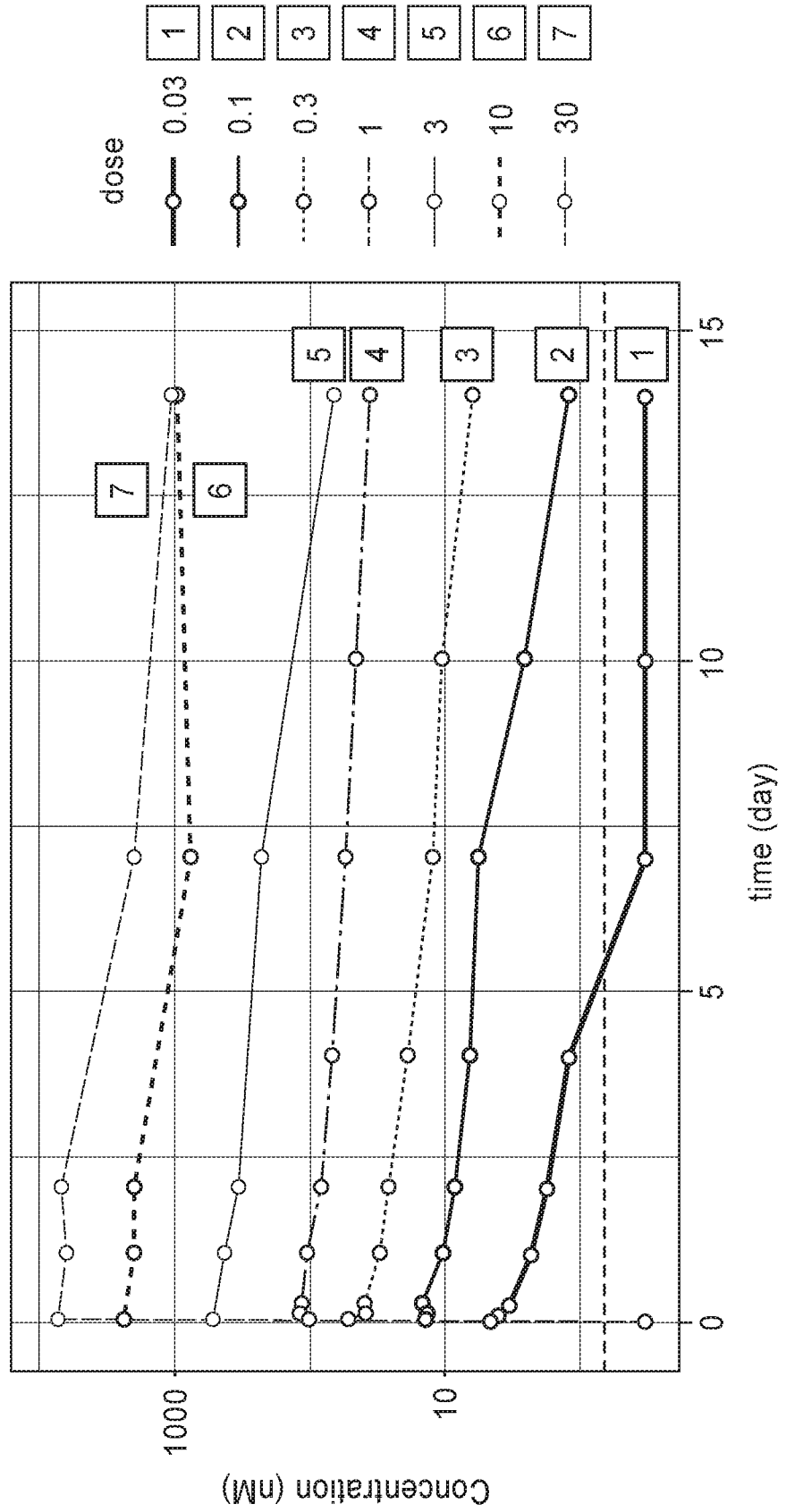

dose
0.03
0.1
0.3
1
3
10
30
1
2
3
4
5
6
7
Concentration (nM)
1000
10
time (day)
0
5
10
15

FIG. 8A

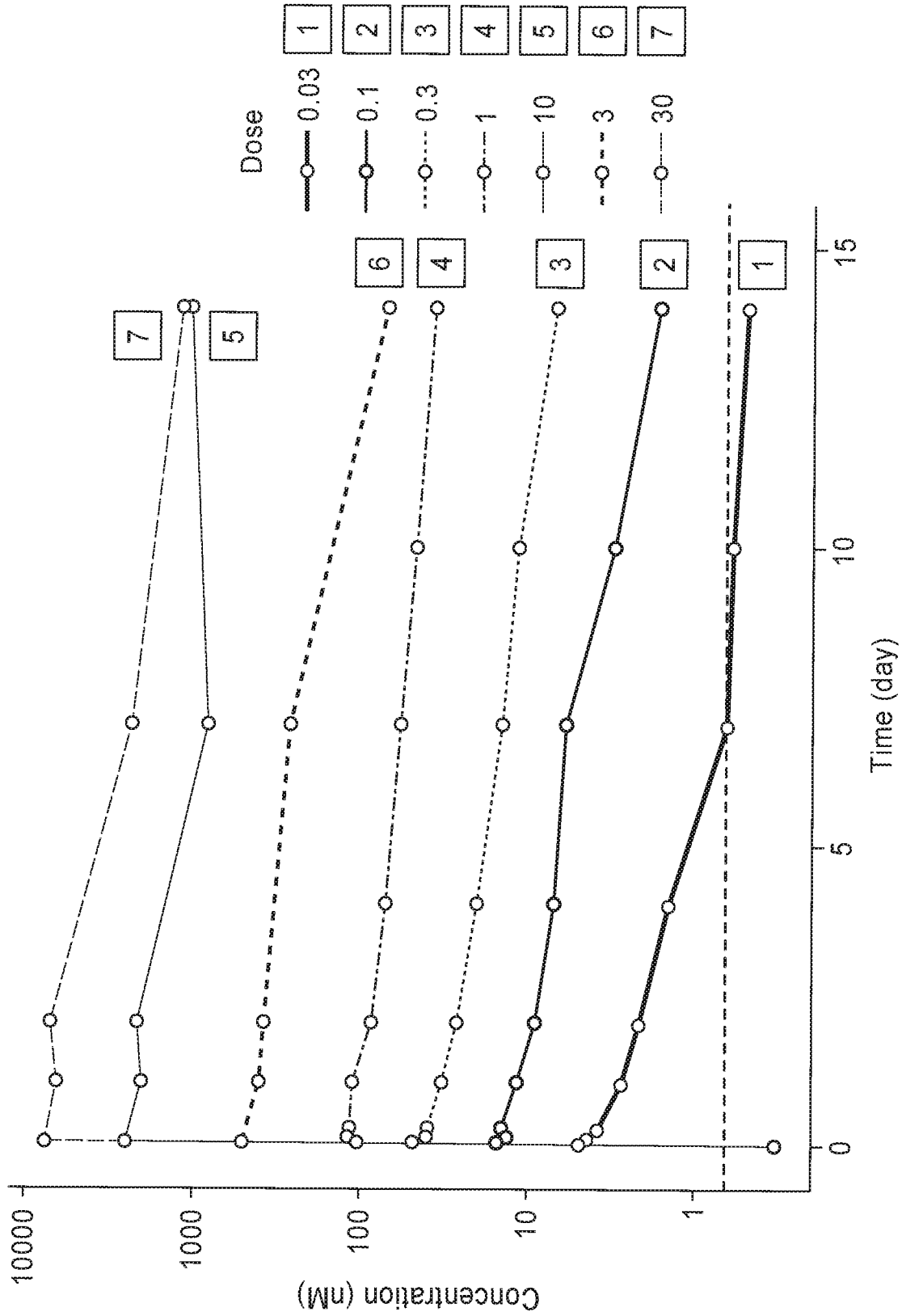
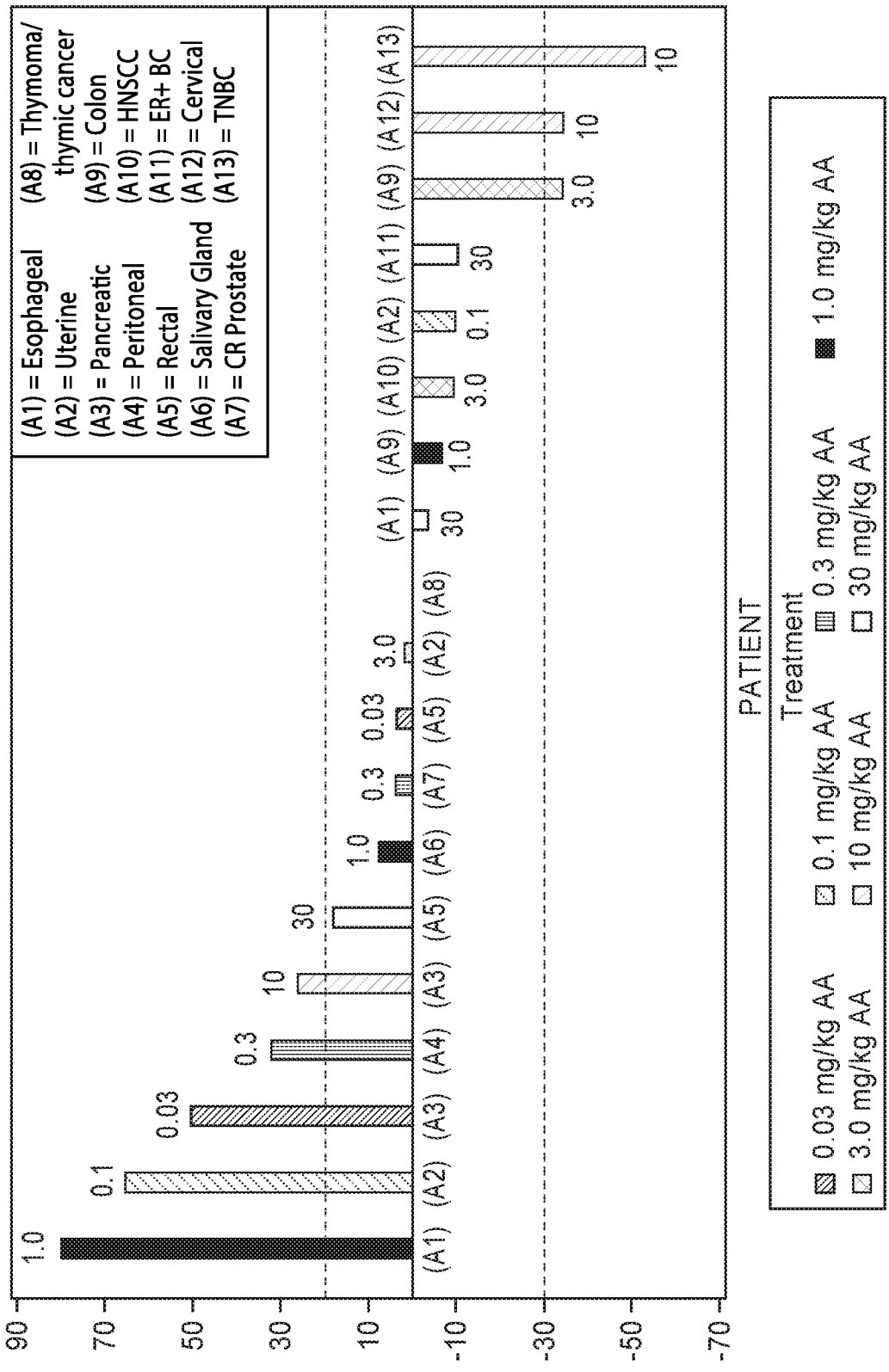

Dose
0.03
0.1
0.3
1
10
3
30
1
2
3
4
5
6
7
Concentration (nM)
10000
1000
100
10
1
0
5
10
15
Time (day)

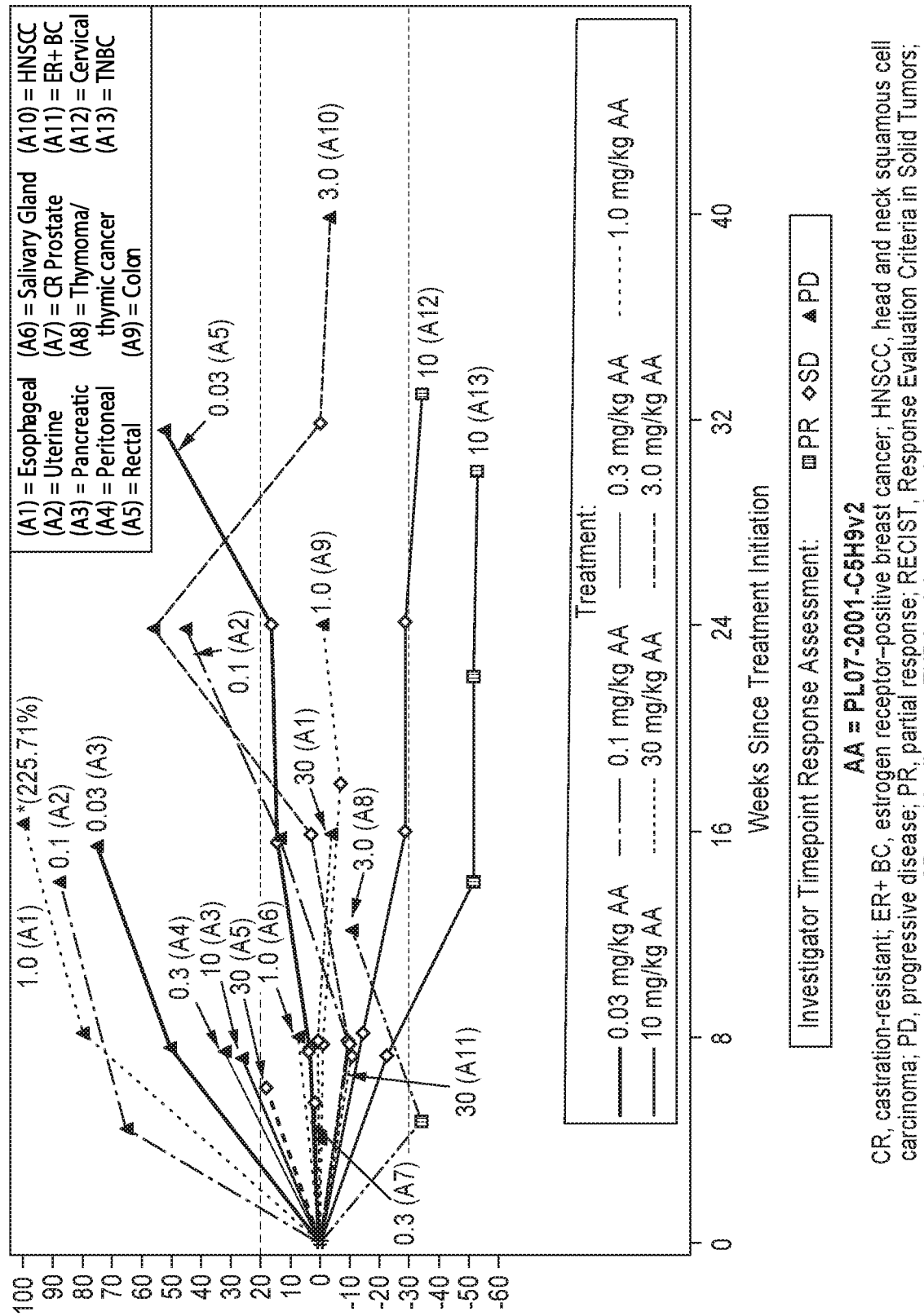
FIG. 8B

FIG. 9A



CR, castration-resistant; ER+ BC, estrogen receptor–positive breast cancer; HNSCC, head and neck squamous cell carcinoma; PD, progressive disease; PR, partial response; RECIST, Response Evaluation Criteria in Solid Tumors; SD, stable disease; TNBC, triple-negative breast cancer.

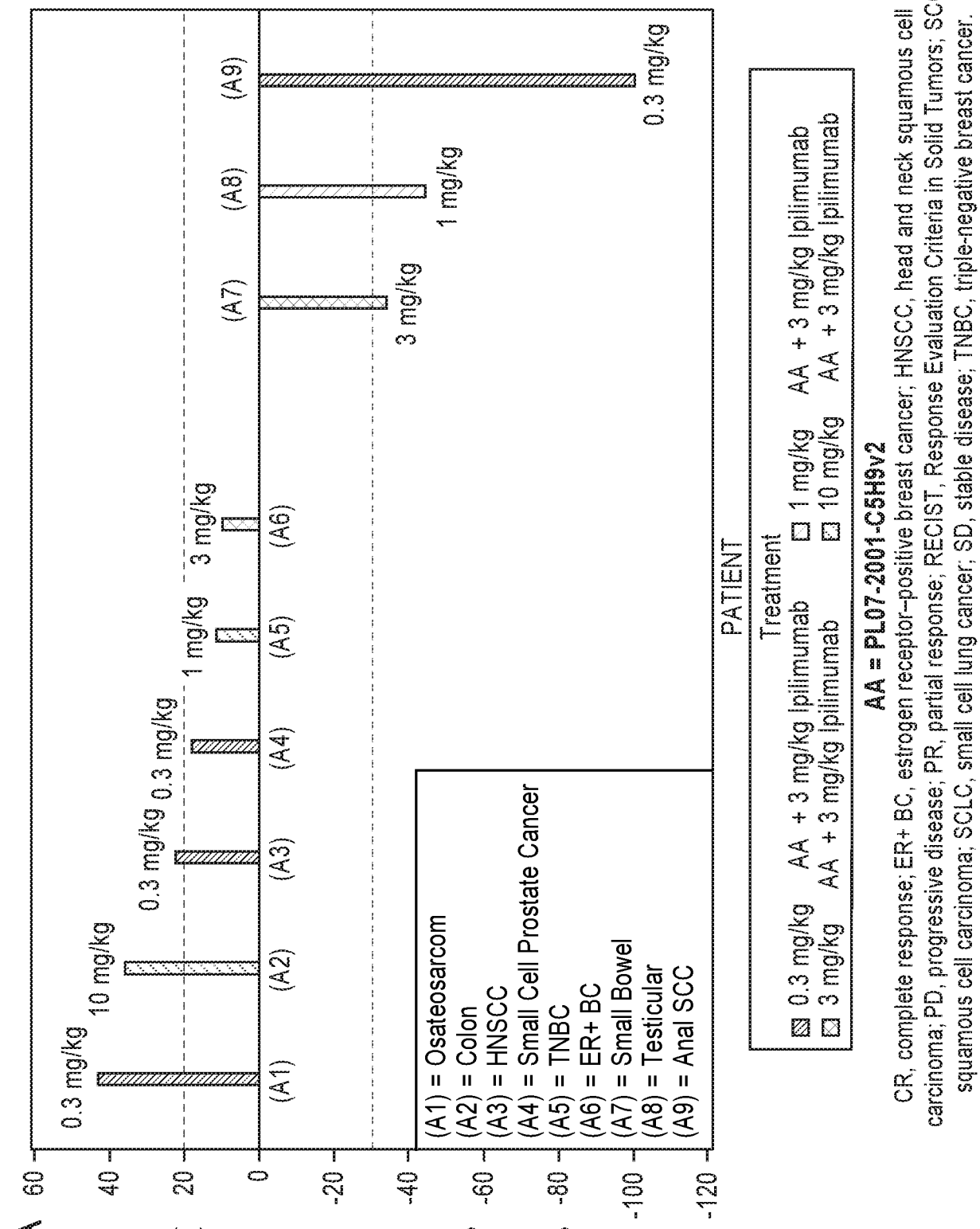
FIG. 9B



AA = PL07-2001-C5H9v2

CR, castration-resistant; ER+ BC, estrogen receptor–positive breast cancer; HNSCC, head and neck squamous cell carcinoma; PD, progressive disease; PR, partial response; RECIST, Response Evaluation Criteria in Solid Tumors; SD, stable disease; TNBC, triple-negative breast cancer.

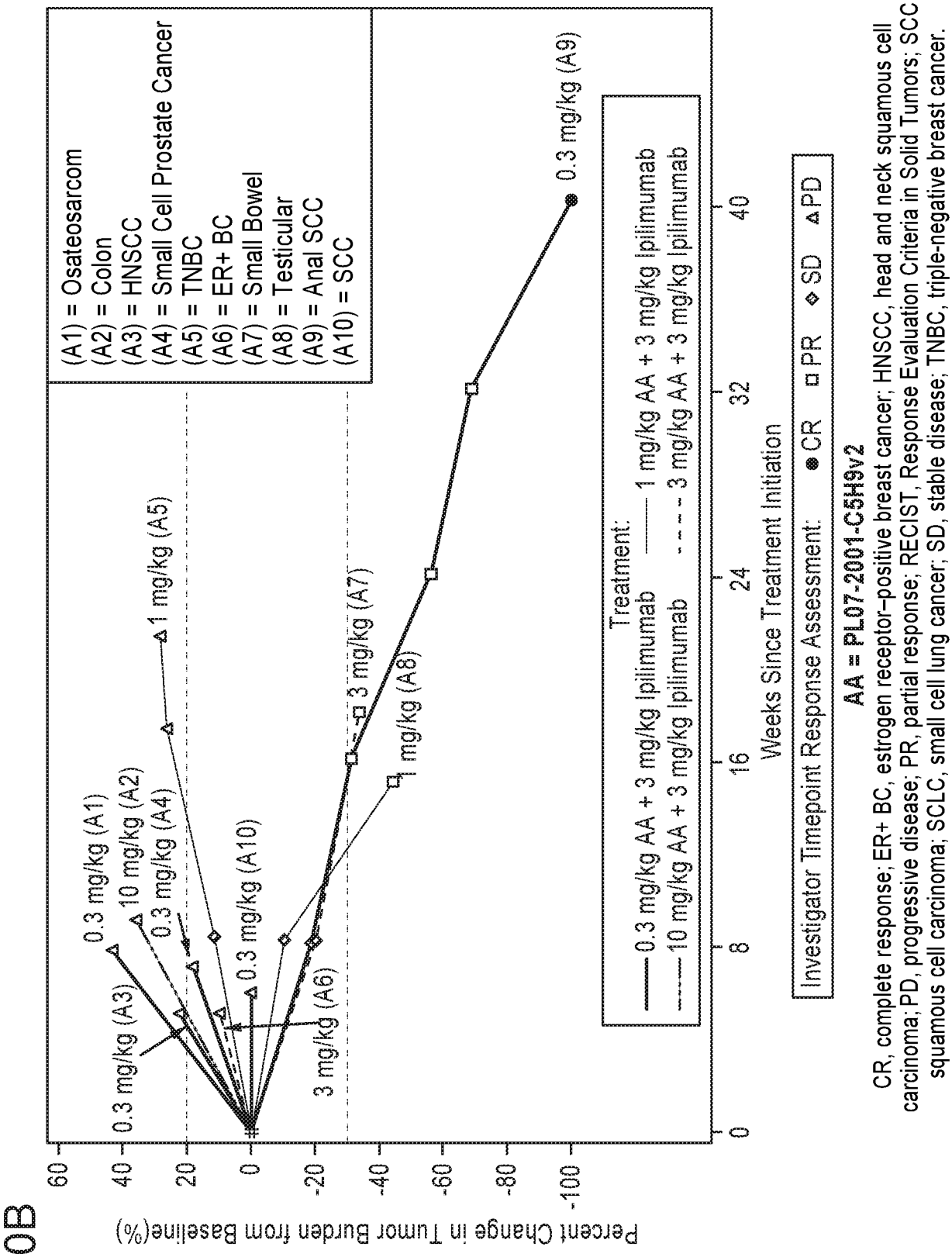
FIG. 10A



AA = PL07-2001-C5H9v2

CR, complete response; ER+ BC, estrogen receptor–positive breast cancer; HNSCC, head and neck squamous cell carcinoma; PD, progressive disease; PR, partial response; RECIST, Response Evaluation Criteria in Solid Tumors; SCC, squamous cell carcinoma; SCLC, small cell lung cancer; SD, stable disease; TNBC, triple-negative breast cancer.

FIG. 10B



CR, complete response; ER+ BC, estrogen receptor–positive breast cancer; HNSCC, head and neck squamous cell carcinoma; PD, progressive disease; PR, partial response; RECIST, Response Evaluation Criteria in Solid Tumors; SCC, squamous cell carcinoma; SCLC, small cell lung cancer; SD, stable disease; TNBC, triple-negative breast cancer.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/035508

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07K16/28 A61P35/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07K A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2016/149201 A2 (CYTOMX THERAPEUTICS INC [US]) 22 September 2016 (2016-09-22) cited in the application the whole document in particular, pages 4-17 and 166-167 -----	1-132
Y	Anonymous: "NCT03013491: PROCLAIM-CX-072: A Trial to Find Safe and Active Doses of an Investigational Drug CX-072 for Patients with Solid Tumors or Lymphomas", , 18 May 2017 (2017-05-18), XP055506501, Retrieved from the Internet: URL:https://clinicaltrials.gov/ct2/history/NCT03013491?V_9=View#StudyPageTop [retrieved on 2018-09-12] the whole document ----- -/--	1-132

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 September 2018	27/09/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pérez-Mato, Isabel

2

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/035508

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	RONG DENG ET AL: "Preclinical pharmacokinetics, pharmacodynamics, tissue distribution, and tumor penetration of anti-PD-L1 monoclonal antibody, an immune checkpoint inhibitor", MABS, vol. 8, no. 3, 26 February 2016 (2016-02-26), pages 593-603, XP055504015, US ISSN: 1942-0862, DOI: 10.1080/19420862.2015.1136043 the whole document in particular, abstract and page 594	9-22, 75-88
Y	WO 2015/069770 A1 (COGNATE BIOSERVICES INC [US]; NORTHWEST BIOTHERAPEUTICS [US]; UNIV CAL) 14 May 2015 (2015-05-14) the whole document in particular, pages 3-7 and 14-17	27-61, 93-127
Y	WO 2017/087851 A1 (GENENTECH INC [US]; COLBURN DAWN [US]; RICHIE NICOLE [US]; F HOFFMANN-) 26 May 2017 (2017-05-26) the whole document in particular, pages 3-4, 9-15 and 35	9-44, 75-110
Y	US 2015/125463 A1 (COGSWELL JOHN P [US] ET AL) 7 May 2015 (2015-05-07) the whole document in particular, pages 4-5 and 26-35	62-66, 128-132

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2018/035508

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		EA 201690912 A1	31-10-2016
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		WO 2017087851 A1	26-05-2017
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