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(54) Title: DOSAGE REGIMENS OF ANTI-LAG-3 ANTIBODIES AND USES THEREOF

(57) Abstract: Dosage regimens for antibody molecules that specifically bind to LAG-3 are disclosed. The antibody molecules can be used to treat or prevent cancerous or infectious conditions and disorders.

DOSAGE REGIMENS OF ANTI-LAG-3 ANTIBODIES AND USES THEREOF

Cross Reference to Related Applications

This application claims the benefit of U.S. Provisional Application No. 62/534,798, filed July 20, 2017, and U.S. Provisional Application No. 62/643,992, filed March 16, 2018. The contents of the aforementioned applications are hereby incorporated by reference in their entirety.

SEQUENCE LISTING

The instant application contains a Sequence Listing which has been submitted electronically in ASCII format and is hereby incorporated by reference in its entirety. Said ASCII copy, created on, July 17, 2018, is named C2160-7019WO_SL.txt and is 233,727 bytes in size.

BACKGROUND

Lymphocyte Activation Gene-3, or LAG-3 (also known as CD223), is a member of the immunoglobulin supergene family, and is expressed on activated T cells (Huard *et al.* (1994) *Immunogenetics* 39:213), NK cells (Triebel *et al.* (1990) *J. Exp. Med.* 171:1393-1405), regulatory T cells (Huang *et al.* (2004) *Immunity* 21:503-513; Camisaschi *et al.* (2010) *J Immunol.* 184:6545-6551; Gagliani *et al.* (2013) *Nat Med* 19:739-746), and plasmacytoid dendritic cells (DCs) (Workman *et al.* (2009) *J Immunol* 182:1885-1891). LAG-3 is a membrane protein encoded by a gene located on chromosome 12, and is structurally and genetically related to CD4.

Similar to CD4, LAG-3 can interact with MHC class II molecules on the cell surface (Baixeras *et al.* (1992) *J. Exp. Med.* 176:327-337; Huard *et al.* (1996) *Eur. J. Immunol.* 26:1180-1186). It has been suggested that the direct binding of LAG-3 to MHC class II plays a role in down-regulating antigen-dependent stimulation of $CD4^+$ T lymphocytes (Huard *et al.* (1994) *Eur. J. Immunol.* 24:3216-3221) and LAG-3 blockade has also been shown to reinvigorate $CD8^+$ lymphocytes in both tumor or self-antigen (Gross *et al.* (2007) *J Clin Invest.* 117:3383-3392) and viral models (Blackburn *et al.* (2009) *Nat. Immunol.* 10:29-37). Further, the intra-cytoplasmic region of LAG-3 can interact with LAP (LAG-3-associated protein), which is a signal transduction molecule involved in the downregulation of the CD3/TCR activation pathway (Iouzalen *et al.* (2001) *Eur. J. Immunol.* 31:2885-2891). Moreover, $CD4^+CD25^+$ regulatory T cells (T_{reg}) have been shown to express LAG-3 upon activation, which contributes to the suppressor activity of T_{reg} cells (Huang, C. *et al.* (2004) *Immunity* 21:503-513). LAG-3 can also negatively regulate T cell homeostasis by T_{reg} cells in both T cell-dependent and independent mechanisms (Workman, C. J. and Vignali, D. A. (2005) *J. Immunol.* 174:688-695).

Therefore, the need exits for novel therapeutic approaches that regulate LAG-3 functions and the functions of LAG-3 expressing cells, including dosage regimens and formulations for anti-LAG-3 antibody molecules to treat diseases, such as cancer.

SUMMARY

Disclosed herein, at least in part, are antibody molecules (*e.g.*, humanized antibody molecules) that bind to Lymphocyte Activation Gene-3 (LAG-3) with high affinity and specificity. Pharmaceutical compositions and dose formulations comprising the anti-LAG-3 antibody molecules are also provided. The anti- LAG-3 antibody molecules disclosed herein can be used (alone or in combination with other therapeutic agents, procedures, or modalities) to treat or prevent disorders, such as cancerous disorders (*e.g.*, solid tumors and hematological cancers), as well as infectious diseases (*e.g.*, chronic infectious disorders or sepsis). Thus, methods, including dosage regimens, for treating various disorders using the anti- LAG-3 antibody molecules are disclosed herein. In certain embodiments, the anti-LAG-3 antibody molecule is administered or used at a flat or fixed dose.

Accordingly, in one aspect, the disclosure features a method of treating (*e.g.*, inhibiting, reducing, ameliorating, or preventing) a disorder, *e.g.*, a hyperproliferative condition or disorder (*e.g.*, a cancer) in a subject.

In certain embodiments, the method includes administering to the subject an anti-LAG-3 antibody molecule, *e.g.*, an anti-LAG-3 antibody molecule described herein, at a dose of about 300 mg to about 500 mg, about 500 mg to about 700 mg, or about 700 mg to about 900 mg, once every three weeks or once every four weeks.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg once every three weeks or once every four weeks. In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to about 700 mg once every three weeks or once every four weeks. In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 700 mg to about 900 mg once every three weeks or once every four weeks. In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg, about 500 mg to about 700 mg, or about 700 mg to about 900 mg, once every three weeks. In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg, about 500 mg to about 700 mg, or about 700 mg to about 900 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg, *e.g.*, about 350 mg to about 450 mg, about 300 mg to about 400 mg, or about 400 mg to about 500 mg, *e.g.*, about 300 mg, about 350 mg, about 400 mg, about 450 mg, or about 500 mg, once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 350 mg to about 450 mg, *e.g.*, about 400 mg, once every three weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to about 700 mg, *e.g.*, about 550 mg to about 650 mg, about 500 mg to about 600 mg, or

about 600 mg to about 700 mg, *e.g.*, about 500 mg, about 533 mg, about 550 mg, about 600 mg, about 650 mg, or about 700 mg, once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to about 650 mg, *e.g.*, about 533 mg or about 600 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 700 mg to about 900 mg, *e.g.*, about 750 mg to about 850 mg, about 700 mg to about 800 mg, or about 800 mg to about 900 mg, *e.g.*, about 700 mg, about 750 mg, about 800 mg, about 850 mg, or about 900 mg, once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 750 mg to about 850 mg, *e.g.*, about 800 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results in one or both of the following:

(a) 50% or more (*e.g.*, 60% or more, 70% or more, 80% or more, 85% or more, 90% or more, 95% or more, 99% or more) of the soluble LAG-3 in the subject (*e.g.*, in the blood) is bound by the anti-LAG-3 antibody molecule; or

(b) 50% or more (*e.g.*, 60% or more, 70% or more, 80% or more, 85% or more, 90% or more, 95% or more, 99% or more) of the membrane-bound LAG-3 in the subject (*e.g.*, in the cancer) is bound by the anti-LAG-3 antibody molecule.

In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3 is determined in a blood sample (*e.g.*, a serum sample or a plasma sample). In some embodiments, the binding of the anti-LAG-3 antibody molecule to membrane-bound LAG-3 is determined in the cancer (*e.g.*, a cancer sample).

In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3, the binding of the anti-LAG-3 antibody molecule to membrane-bound LAG-3, or both, is determined when the subject has a steady state trough level of the anti-LAG-3 antibody molecule. In some embodiments, the trough level is the concentration of the anti-LAG-3 antibody molecule about 24 weeks after the administration, or the lowest concentration that the anti-LAG-3 antibody molecule reaches before the next dose is administered. In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3, the binding of the anti-LAG-3 antibody molecule to membrane-bound LAG-3, or both, is determined, *e.g.*, measured *in vitro* (*e.g.*, by ELISA or a cell-based assay) or *in vivo* (*e.g.*, by imaging), or predicted from a PK/PD model, *e.g.*, a PK/PD model described herein.

In some embodiments, 60% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 80% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 85% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 95% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 70% or more, 80% or more, or 90% or more, of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 85% or more, 90% or more, or 95% or more, of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 70% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 80% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 800 mg, *e.g.*, about 300 mg to about 500 mg (*e.g.*, about 400 mg) or about 600 mg to about 800 mg (*e.g.*, about 700 mg), once every three weeks. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks.

In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 1600 mg, *e.g.*, about 600 mg to about 1000 mg (*e.g.*, about 800 mg) or about 1200 mg to about 1600 mg (*e.g.*, about 1400 mg), once every four weeks. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 1000 mg (*e.g.*, about 800 mg) once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that reduces one or both of:

(a) the level of free soluble LAG-3 in the subject (*e.g.*, blood), *e.g.*, to 50% or less (*e.g.*, 40% or less, 30% or less, 20% or less, 15% or less, 10% or less, 5% or less, or 1% or less) of a reference level of free soluble LAG-3; or

(b) the level of free membrane-bound LAG-3 in the subject (*e.g.*, cancer), *e.g.*, to 50% or less (*e.g.*, 40% or less, 30% or less, 20% or less, 15% or less, 10% or less, 5% or less, or 1% or less) of a reference level of membrane-bound LAG-3.

In some embodiments, the level of free soluble LAG-3 is determined in a blood sample (*e.g.*, a serum sample or a plasma sample). In some embodiments, the reference level of free soluble LAG-3 is the baseline level of free soluble LAG-3 in the subject, *e.g.*, prior to administration of the anti-LAG-3 antibody molecule, *e.g.*, in accordance with the dosage schedule.

In some embodiments, the level of free membrane-bound LAG-3 is determined in the cancer (*e.g.*, a cancer sample). In some embodiments, the reference level of free membrane-bound LAG-3 is the baseline level of free membrane-bound LAG-3 in the subject, *e.g.*, prior to administration of the anti-LAG-3 antibody molecule, *e.g.*, in accordance with the dosage schedule.

In some embodiments, the level of free soluble LAG-3, the level of free membrane-bound LAG-3, or both, is determined when the subject has a steady state trough level of the anti-LAG-3 antibody molecule. In some embodiments, the trough level is the concentration of the anti-LAG-3 antibody molecule about 24 weeks after the administration, or the lowest concentration that the anti-LAG-3 antibody molecule reaches before the next dose is administered. In some embodiments, the level of free soluble LAG-3, the level of free membrane-bound LAG-3, or both, is determined, *e.g.*, measured *in vitro* (*e.g.*, by ELISA or a cell-based assay) or *in vivo* (*e.g.*, by imaging), or predicted from a PK/PD model, *e.g.*, a PK/PD model described herein.

In some embodiments, the level of free soluble LAG-3 is reduced to 30% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 20% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 10% or less of a reference level of free soluble LAG-3 in a serum sample from the subject.

In some embodiments, the level of free membrane-bound LAG-3 is reduced to 15% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 5% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In some embodiments, the level of free soluble LAG-3 is reduced to 30% or less, 20% or less, or 10% or less, of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 15% or less, 10% or less, or 5% or less, of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In some embodiments, the level of free soluble LAG-3 is reduced to 30% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound

LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 20% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 10% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 800 mg, *e.g.*, about 300 mg to about 500 mg (*e.g.*, about 400 mg) or about 600 mg to about 800 mg (*e.g.*, about 700 mg) once every three weeks. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks.

In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 1600 mg, *e.g.*, about 600 mg to about 1000 mg (*e.g.*, about 800 mg) or about 1200 mg to about 1600 mg (*e.g.*, about 1400 mg), once every four weeks. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 1000 mg (*e.g.*, about 800 mg), once every four weeks.

In some embodiments, the disorder is a cancer, *e.g.,* a cancer described herein. In certain embodiments, the cancer is a solid tumor. In some embodiments, the cancer is brain tumor, *e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor. In some embodiments, the cancer is a pancreatic cancer, *e.g.*, an advanced pancreatic cancer. In some embodiments, the cancer is a skin cancer, *e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma. In some embodiments, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma). In some embodiments, the cancer is a breast cancer, *e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the cancer is a virus-associated cancer. In some embodiments, the cancer is an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal). In some embodiments, the cancer is a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix). In some embodiments, the cancer is a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma). In some embodiments, the cancer is a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)). In some embodiments, the cancer is a nasopharyngeal cancer (NPC). In some embodiments, the cancer is a penile cancer (*e.g.*, a squamous cell carcinoma of the penile). In some embodiments, the cancer is a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some

embodiments, the cancer is a colorectal cancer, *e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer (NSCLC). In certain embodiments, the cancer is a hematological cancer. In some embodiments, the cancer is a leukemia. In some embodiments, the cancer is a lymphoma, *e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL) (*e.g.*, a relapsed or refractory HL or DLBCL). In some embodiments, the cancer is a myeloma.

In other embodiments, the cancer is an MSI-high cancer. In some embodiments, the cancer is a metastatic cancer. In other embodiments, the cancer is an advanced cancer. In other embodiments, the cancer is a relapsed or refractory cancer. In other embodiments, the cancer is a recurrent cancer.

In some embodiments, the anti-LAG-3 antibody molecule is administered by injection (*e.g.*, intravenously or subcutaneously) at a dose (*e.g.*, a flat dose) of about 300 mg to about 500 mg (*e.g.*, about 400 mg), about 500 mg to about 700 mg (*e.g.*, about 533 mg or about 600 mg), or about 700 mg to about 900 mg (*e.g.*, about 800 mg). The dosing schedule (*e.g.*, flat dosing schedule) can vary from *e.g.*, once every three weeks to once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose from about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose from about 500 mg to 700 mg (*e.g.*, about 533 mg or about 600 mg) once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose from about 700 mg to 900 mg (*e.g.*, about 800 mg) once every four weeks.

In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose about 400 mg once every three weeks to treat a cancer disclosed herein. In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose about 533 mg or 600 mg once every four weeks to treat a cancer disclosed herein. In one embodiment, the anti-LAG-3 antibody molecule is administered intravenously at a dose about 800 mg once every four weeks to treat a cancer disclosed herein.

In one embodiment, the method further comprises administering to the subject a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) or a PD-L1 inhibitor (*e.g.*, an anti-PD-L1 antibody molecule described herein). In one embodiment, the PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) is administered intravenously at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In certain embodiments, the subject is administered an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) with an anti-PD-1 antibody molecule at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) is administered at a dose of about 300 mg to about

500 mg (*e.g.*, about 400 mg) once every three weeks and the PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In other embodiments, the subject is administered an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) with an anti-PD-1 antibody molecule at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) is administered at a dose of about 600 mg to about 1000 mg (*e.g.*, about 800 mg) once every four weeks and the PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks. In one embodiment, the method comprises administering to the subject an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) and a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). In one embodiment, the chemotherapeutic agent (*e.g.*, a platinum agent, *e.g.*, carboplatin) is administered intravenously at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks and the chemotherapeutic agent (*e.g.*, a platinum agent, *e.g.*, carboplatin) is administered at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks.

In one embodiment, the method comprises administering to the subject an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein), a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein), and a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks, the PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks, and the chemotherapeutic agent (*e.g.*, a platinum agent, *e.g.*, carboplatin) is administered at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks.

In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein), or the combination comprising the anti-LAG-3 antibody molecule (*e.g.*, the anti-LAG-3 antibody molecule in combination with one or both of a PD-1 inhibitor or a

chemotherapeutic agent), is used to treat a breast cancer, *e.g.*, a triple negative breast cancer (TNBC), *e.g.*, in accordance with a dosing schedule described herein.

In certain embodiments, the subject has not been treated with a PD-1 or PD-L1 therapy prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with a PD-1 or PD-L1 therapy prior to receiving the anti-LAG-3 antibody molecule.

In certain embodiments, the subject has not been treated with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)) prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)) prior to receiving the anti-LAG-3 antibody molecule.

In other embodiments, the subject has, or is identified as having, LAG-3 expression in tumor-infiltrating lymphocytes (TILs).

In another aspect, the disclosure features a method of reducing an activity (*e.*g., growth, survival, or viability, or all), of a hyperproliferative (*e.g.*, a cancer) cell. The method includes contacting the cell with an anti-LAG-3 antibody molecule, *e.g.*, an anti-LAG-3 antibody molecule described herein. The method can be performed in a subject, *e.g.*, as part of a therapeutic protocol, *e.g.,* at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg), about 500 mg to about 700 mg (*e.g.*, about 533 mg or about 600 mg), or about 700 mg to about 900 mg (*e.g.*, about 800 mg) of an anti-LAG-3 antibody molecule once every three weeks or once every four weeks. In certain embodiments, the dose is about 300 mg to about 500 mg (*e.g.*, about 400 mg) of an anti-LAG-3 antibody molecule once every three weeks. In other embodiments, the dose is about 500 mg to about 700 mg (*e.g.*, about 533 mg or about 600 mg) of an anti-LAG-3 antibody molecule once every four weeks. In other embodiments, the dose is about 700 mg to about 900 mg (*e.g.*, about 800 mg) of an anti-LAG-3 antibody molecule once every four weeks.

The cancer cell can be, *e.g.*, a cell from a cancer described herein, such as a solid tumor or a hematological cancer, *e.g.*, a brain tumor (*e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor), a pancreatic cancer (*e.g.*, an advanced pancreatic cancer), a skin cancer (*e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma), a renal cancer (*e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma)), a breast cancer (*e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC)), a virus-associated cancer, an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal), a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix), a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma), a head and neck cancer (*e.g.*, an HPV

positive and negative squamous cell cancer of the head and neck (SCCHN)), a nasopharyngeal cancer (NPC), a penile cancer (*e.g.*, a squamous cell carcinoma of the penile), a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva), a colorectal cancer (*e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer), a lung cancer (*e.g.*, a non-small cell lung cancer (NSCLC)), a leukemia, a lymphoma (*e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL), *e.g.*, a relapsed or refractory HL or DLBCL), or a myeloma.

In certain embodiments, the cancer is a solid tumor. In some embodiments, the cancer is brain tumor, *e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor. In some embodiments, the cancer is a pancreatic cancer, *e.g.*, an advanced pancreatic cancer. In some embodiments, the cancer is a skin cancer, *e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma. In some embodiments, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma). In some embodiments, the cancer is a breast cancer, *e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the cancer is a virus-associated cancer. In some embodiments, the cancer is an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal). In some embodiments, the cancer is a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix). In some embodiments, the cancer is a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma). In some embodiments, the cancer is a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)). In some embodiments, the cancer is a nasopharyngeal cancer (NPC). In some embodiments, the cancer is a penile cancer (*e.g.*, a squamous cell carcinoma of the penile). In some embodiments, the cancer is a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the cancer is a colorectal cancer, *e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer (NSCLC). In certain embodiments, the cancer is a hematological cancer. In some embodiments, the cancer is a leukemia. In some embodiments, the cancer is a lymphoma, *e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL) (*e.g.*, a relapsed or refractory HL or DLBCL). In some embodiments, the cancer is a myeloma.

In certain embodiments, the method further includes contacting the cell with one or both of a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) or a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). The method can be performed in a subject, *e.g.*, as part of a

therapeutic protocol, *e.g.,* at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) of an anti-LAG-3 antibody molecule once every three weeks and at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) of a PD-1 inhibitor once every three weeks. The method can be performed in a subject, *e.g.*, as part of a therapeutic protocol, *e.g.,* at a dose of about 600 mg to about 1000 mg (*e.g.*, about 800 mg) of an anti-LAG-3 antibody molecule once every four weeks and at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) of a PD-1 inhibitor once every four weeks. The method can be performed in a subject, *e.g.*, as part of a therapeutic protocol, *e.g.,* at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) of an anti-LAG-3 antibody molecule once every three weeks and at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) of a chemotherapeutic agent once every three weeks. The method can be performed in a subject, *e.g.*, as part of a therapeutic protocol, *e.g.,* at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) of an anti-LAG-3 antibody molecule once every three weeks, at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) of a PD-1 inhibitor once every three weeks, and at a dose of a chemotherapeutic agent to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks. In some embodiments, the cancer cell can be, *e.g.*, a breast cancer cell, *e.g.*, a TNBC cell. In certain embodiments of the methods disclosed herein, the method further includes determining the level of LAG-3 expression in tumor infiltrating lymphocytes (TILs) in the subject. In other embodiments, the level of LAG-3 expression is determined in a sample (*e.g.*, a tumor biopsy) acquired from the subject (*e.g.*, using immunohistochemistry). In certain embodiments, when there is a detectable level, or an elevated level, of LAG-3 in the subject, the anti-LAG-3 antibody molecule is administered (*e.g.*, the anti-LAG-3 antibody molecule is administered responsive to a detectable level, or an elevated level, of LAG-3 in the subject). The detection steps can also be used, *e.g.*, to monitor the effectiveness of a therapeutic agent described herein. For example, the detection step can be used to monitor the effectiveness of the anti-LAG-3 antibody molecule.

In another aspect, the disclosure features a composition (*e.g.*, one or more compositions or dosage forms), that includes an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein). Formulations, *e.g.*, dosage formulations, and kits, *e.g.*, therapeutic kits, that include an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein), are also described herein. In certain embodiments, the composition or formulation comprises about 300 mg to about 500 mg (*e.g.*, about 400 mg), about 500 mg to about 700 mg (*e.g.,* about 533 mg or about 600 mg), or about 700 mg to about 900 mg (*e.g.*, about 800 mg) of an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein). In some embodiments, the composition or formulation is administered or used once every three weeks or once every four weeks. In some embodiments, the composition or formulation comprises about 400 mg of an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein), and is

administered or used once every three weeks. In some embodiments, the composition or formulation comprises about 533 mg or 600 mg of an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein), and is administered or used once every four weeks. In some embodiments, the composition or formulation comprises about 800 mg of an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule as described herein), and is administered or used once every four weeks. In certain embodiments, the composition or formulation is used to treat a cancer, *e.g.*, a cancer disclosed herein.

Additional features or embodiments of the methods, compositions, dosage formulations, and kits described herein include one or more of the following.

Antibody Molecules to LAG-3

In one embodiment, the anti-LAG-3 antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 5 (*e.g.*, from the heavy and light chain variable region sequences of BAP050-Clone I or BAP050-Clone J disclosed in Table 5), or encoded by a nucleotide sequence shown in Table 5. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 5). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 5). In some embodiments, the CDRs are according to the combined CDR definitions of both Kabat and Chothia (*e.g.*, as set out in Table 5). In one embodiment, the combination of Kabat and Chothia CDR of VH CDR1 comprises the amino acid sequence GFTLTNYGMN (SEQ ID NO: 766). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.*, conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 5, or encoded by a nucleotide sequence shown in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 701, a VHCDR2 amino acid sequence of SEQ ID NO: 702, and a VHCDR3 amino acid sequence of SEQ ID NO: 703; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 710, a VLCDR2 amino acid sequence of SEQ ID NO: 711, and a VLCDR3 amino acid sequence of SEQ ID NO: 712, each disclosed in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 736 or 737, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 738 or 739, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 740 or 741; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 746 or 747, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 748 or 749, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 750 or 751, each

disclosed in Table 5. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 758 or 737, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 759 or 739, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 760 or 741; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 746 or 747, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 748 or 749, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 750 or 751, each disclosed in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 706, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 706. In one embodiment, the anti-LAG-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 718, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 718. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 724, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 724. In one embodiment, the anti-LAG-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 730, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 730. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 706 and a VL comprising the amino acid sequence of SEQ ID NO: 718. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 724 and a VL comprising the amino acid sequence of SEQ ID NO: 730.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 707 or 708, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 707 or 708. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 719 or 720, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 719 or 720. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 725 or 726, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 725 or 726. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 731 or 732, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 731 or 732. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 707 or 708 and a VL encoded by the nucleotide sequence of SEQ ID NO: 719 or 720. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 725 or 726 and a VL encoded by the nucleotide sequence of SEQ ID NO: 731 or 732.

In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 709, or an amino acid sequence at least 85%, 90%, 95%, or

99% identical or higher to SEQ ID NO: 709. In one embodiment, the anti-LAG-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 721, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 721. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 727, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 727. In one embodiment, the anti-LAG-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 733, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 733. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 709 and a light chain comprising the amino acid sequence of SEQ ID NO: 721. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 727 and a light chain comprising the amino acid sequence of SEQ ID NO: 733.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 716 or 717, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 716 or 717. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 722 or 723, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 722 or 723. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 728 or 729, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 728 or 729. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 734 or 735, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 734 or 735. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 716 or 717 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 722 or 723. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 728 or 729 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 734 or 735.

Other Exemplary LAG-3 Inhibitors

In one embodiment, the anti-LAG-3 antibody molecule is BMS-986016 (Bristol-Myers Squibb), also known as BMS986016. BMS-986016 and other anti-LAG-3 antibodies are disclosed in WO 2015/116539 and US 9,505,839, incorporated by reference in their entirety. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of BMS-986016, *e.g.*, as disclosed in Table 6.

In one embodiment, the anti-LAG-3 antibody molecule is TSR-033 (Tesaro). In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or

collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of TSR-033.

In one embodiment, the anti-LAG-3 antibody molecule is IMP731 or GSK2831781 (GSK and Prima BioMed). IMP731 and other anti-LAG-3 antibodies are disclosed in WO 2008/132601 and US 9,244,059, incorporated by reference in their entirety. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of IMP731, *e.g.*, as disclosed in Table 6. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of GSK2831781.

In one embodiment, the anti-LAG-3 antibody molecule is IMP761 (Prima BioMed). In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of IMP761.

Further known anti-LAG-3 antibodies include those described, *e.g.*, in WO 2008/132601, WO 2010/019570, WO 2014/140180, WO 2015/116539, WO 2015/200119, WO 2016/028672, US 9,244,059, US 9,505,839, incorporated by reference in their entirety.

In one embodiment, the anti-LAG-3 antibody is an antibody that competes for binding with, and/or binds to the same epitope on LAG-3 as, one of the anti-LAG-3 antibodies described herein.

In one embodiment, the anti-LAG-3 inhibitor is a soluble LAG-3 protein, *e.g.*, IMP321 (Prima BioMed), *e.g.*, as disclosed in WO 2009/044273, incorporated by reference in its entirety.

Formulations

The anti-LAG-3 antibody molecules described herein can be formulated into a formulation (*e.g.*, a dose formulation or dosage form) suitable for administration (*e.g.*, intravenous administration) to a subject as described herein. The formulation described herein can be a liquid formulation, a lyophilized formulation, or a reconstituted formulation.

In certain embodiments, the formulation is a liquid formulation. In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) and a buffering agent.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 25 mg/mL to 250 mg/mL, *e.g.*, 50 mg/mL to 200 mg/mL, 60 mg/mL to 180 mg/mL, 70 mg/mL to 150 mg/mL, 80 mg/mL to 120 mg/mL, 90 mg/mL to 110 mg/mL, 50 mg/mL to 150 mg/mL, 50 mg/mL to 100 mg/mL, 150 mg/mL to 200 mg/mL, or 100 mg/mL to 200 mg/mL, *e.g.*, 50 mg/mL, 60 mg/mL, 70 mg/mL, 80 mg/mL, 90 mg/mL, 100 mg/mL,

110 mg/mL, 120 mg/mL, 130 mg/mL, 140 mg/mL, or 150 mg/mL. In certain embodiments, the anti-LAG-3 antibody molecule is present at a concentration of 80 mg/mL to 120 mg/mL, *e.g.,* 100 mg/mL.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises a buffering agent comprising histidine (*e.g.,* a histidine buffer). In certain embodiments, the buffering agent (*e.g.,* histidine buffer) is present at a concentration of 1 mM to 100 mM, *e.g.*, 2 mM to 50 mM, 5 mM to 40 mM, 10 mM to 30 mM, 15 to 25 mM, 5 mM to 40 mM, 5 mM to 30 mM, 5 mM to 20 mM, 5 mM to 10 mM, 40 mM to 50 mM, 30 mM to 50 mM, 20 mM to 50 mM, 10 mM to 50 mM, or 5 mM to 50 mM, *e.g.,* 2 mM, 5 mM, 10 mM, 15 mM, 20 mM, 25 mM, 30 mM, 35 mM, 40 mM, 45 mM, or 50 mM. In some embodiments, the buffering agent (*e.g.*, histidine buffer) is present at a concentration of 15 mM to 25 mM, *e.g.,* 20 mM. In other embodiments, the buffering agent (*e.g.,* a histidine buffer) or the formulation has a pH of 4 to 7, *e.g.,* 5 to 6, *e.g.,* 5, 5.5, or 6. In some embodiments, the buffering agent (*e.g.,* histidine buffer) or the formulation has a pH of 5 to 6, *e.g.,* 5.5. In certain embodiments, the buffering agent comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.,* 5.5). In certain embodiments, the buffering agent comprises histidine and histidine-HCl.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.,* 100 mg/mL; and a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM), at a pH of 5 to 6 (*e.g.,* 5.5).

In some embodiments, the formulation (*e.g.*, liquid formulation) further comprises a carbohydrate. In certain embodiments, the carbohydrate is sucrose. In some embodiments, the carbohydrate (*e.g.,* sucrose) is present at a concentration of 50 mM to 500 mM, *e.g.,* 100 mM to 400 mM, 150 mM to 300 mM, 180 mM to 250 mM, 200 mM to 240 mM, 210 mM to 230 mM, 100 mM to 300 mM, 100 mM to 250 mM, 100 mM to 200 mM, 100 mM to 150 mM, 300 mM to 400 mM, 200 mM to 400 mM, or 100 mM to 400 mM, *e.g.,* 100 mM, 150 mM, 180 mM, 200 mM, 220 mM, 250 mM, 300 mM, 350 mM, or 400 mM. In some embodiments, the formulation comprises a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.,* 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM); and a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM, at a pH of 5 to 6 (*e.g.*, 5.5).

In some embodiments, the formulation (*e.g.*, liquid formulation) further comprises a surfactant. In certain embodiments, the surfactant is polysorbate 20. In some embodiments, the surfactant or polysorbate 20) is present at a concentration of 0.005 % to 0.1% (w/w), *e.g.,* 0.01% to 0.08%, 0.02% to 0.06%, 0.03% to 0.05%, 0.01% to 0.06%, 0.01% to 0.05%, 0.01% to 0.03%, 0.06% to 0.08%, 0.04% to 0.08%, or 0.02% to 0.08% (w/w), *e.g.*, 0.01%, 0.02%, 0.03%, 0.04%, 0.05%,

0.06%, 0.07%, 0.08%, 0.09%, or 0.1% (w/w). In some embodiments, the formulation comprises a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.*, 0.04% (w/w).

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.*, 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM); a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.*, 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.*, 0.04% (w/w), at a pH of 5 to 6 (*e.g.*, 5.5).

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 100 mg/mL; a buffering agent that comprises a histidine buffer (*e.g.*, histidine/histidine-HCL) at a concentration of 20 mM); a carbohydrate or sucrose present at a concentration of 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.04% (w/w), at a pH of 5 to 6 (*e.g.*, 5.5).

A formulation described herein can be stored in a container. The container used for any of the formulations described herein can include, *e.g.*, a vial, and optionally, a stopper, a cap, or both. In certain embodiments, the vial is a glass vial, *e.g.*, a 6R white glass vial. In other embodiments, the stopper is a rubber stopper, *e.g.*, a grey rubber stopper. In other embodiments, the cap is a flip-off cap, *e.g.*, an aluminum flip-off cap. In some embodiments, the container comprises a 6R white glass vial, a grey rubber stopper, and an aluminum flip-off cap. In some embodiments, the container (*e.g.*, vial) is for a single-use container. In certain embodiments, 25 mg/mL to 250 mg/mL, *e.g.*, 50 mg/mL to 200 mg/mL, 60 mg/mL to 180 mg/mL, 70 mg/mL to 150 mg/mL, 80 mg/mL to 120 mg/mL, 90 mg/mL to 110 mg/mL, 50 mg/mL to 150 mg/mL, 50 mg/mL to 100 mg/mL, 150 mg/mL to 200 mg/mL, or 100 mg/mL to 200 mg/mL, *e.g.*, 50 mg/mL, 60 mg/mL, 70 mg/mL, 80 mg/mL, 90 mg/mL, 100 mg/mL, 110 mg/mL, 120 mg/mL, 130 mg/mL, 140 mg/mL, or 150 mg/mL, of the anti-LAG-3 antibody molecule, is present in the container (*e.g.*, vial).

In another aspect, the disclosure features therapeutic kits that include the anti-LAG-3 antibody molecules, compositions, or formulations described herein, and instructions for use, *e.g.*, in accordance with dosage regimens described herein.

Therapeutic Use

The anti-LAG-3 antibody molecules described herein can inhibit, reduce, or neutralize one or more activities of LAG-3, resulting in blockade or reduction of an immune checkpoint. Thus, the anti-LAG-3 antibody molecules described herein can be used to treat or prevent disorders (*e.g.*, cancer), where enhancing an immune response in a subject is desired.

Accordingly, in another aspect, a method of modulating an immune response in a subject is provided. The method comprises administering to the subject an anti-LAG-3 antibody molecule described herein in accordance with a dosage regimen described herein, alone or in combination with

one or more therapeutic agents, procedures, or modalities, such that the immune response in the subject is modulated. In one embodiment, the antibody molecule enhances, stimulates or increases the immune response in the subject. The subject can be a mammal, *e.g.*, a primate, preferably a higher primate, *e.g.*, a human (*e.g.*, a patient having, or at risk of having, a disorder described herein). In one embodiment, the subject is in need of enhancing an immune response. In one embodiment, the subject has, or is at risk of, having a disorder described herein, *e.g.*, a cancer or an infectious disorder as described herein. In certain embodiments, the subject is, or is at risk of being, immunocompromised. For example, the subject is undergoing or has undergone a chemotherapeutic treatment and/or radiation therapy. Alternatively, or in combination, the subject is, or is at risk of being, immunocompromised as a result of an infection.

In one aspect, a method of treating (*e.g.*, one or more of reducing, inhibiting, or delaying progression) a cancer or a tumor in a subject is provided. The method comprises administering to the subject an anti-LAG-3 antibody molecule described herein in accordance with a dosage regimen described herein, alone or in combination with one or more therapeutic agents, procedures, or modalities.

In certain embodiments, the cancer treated with the anti-LAG-3 antibody molecule, includes but is not limited to, a solid tumor, a hematological cancer (*e.g.*, leukemia, lymphoma, myeloma, *e.g.*, multiple myeloma), and a metastatic lesion. In one embodiment, the cancer is a solid tumor. Examples of solid tumors include malignancies, *e.g.*, sarcomas and carcinomas, *e.g.*, adenocarcinomas of the various organ systems, such as those affecting the lung, breast, ovarian, lymphoid, gastrointestinal (*e.g.*, colon), anal, genitals and genitourinary tract (*e.g.*, renal, urothelial, bladder cells, prostate), pharynx, CNS (*e.g.*, brain, neural or glial cells), head and neck, skin (*e.g.*, melanoma), and pancreas, as well as adenocarcinomas which include malignancies such as colon cancers, rectal cancer, renal cancer (*e.g.*, renal-cell carcinoma (clear cell or non-clear cell renal cell carcinoma)), liver cancer, lung cancer (*e.g.*, non-small cell lung cancer (squamous or non-squamous non-small cell lung cancer)), cancer of the small intestine and cancer of the esophagus. The cancer may be at an early, intermediate, late stage or metastatic cancer.

In one embodiment, the cancer is chosen from a lung cancer (*e.g.*, a non-small cell lung cancer (NSCLC) (*e.g.*, a NSCLC with squamous and/or non-squamous histology, or a NSCLC adenocarcinoma), or a small cell lung cancer (SCLC)), a skin cancer (*e.g.*, a Merkel cell carcinoma or a melanoma (*e.g.*, an advanced melanoma)), an ovarian cancer, a mesothelioma, a bladder cancer, a soft tissue sarcoma (*e.g.*, a hemangiopericytoma (HPC)), a bone cancer (a bone sarcoma), a kidney cancer (*e.g.*, a renal cancer (*e.g.*, a renal cell carcinoma)), a liver cancer (*e.g.*, a hepatocellular carcinoma), a cholangiocarcinoma, a sarcoma, a myelodysplastic syndrome (MDS), a prostate cancer, a breast cancer (*e.g.*, a breast cancer that does not express one, two or all of estrogen receptor, progesterone receptor, or Her2/neu, *e.g.*, a triple negative breast cancer), a colorectal cancer, a nasopharyngeal cancer, a duodenal cancer, an endometrial cancer, a pancreatic cancer, a head and

neck cancer (*e.g.*, head and neck squamous cell carcinoma (HNSCC)), an anal cancer, a gastro-esophageal cancer, a thyroid cancer (*e.g.*, anaplastic thyroid carcinoma), a cervical cancer, a neuroendocrine tumor (NET) (*e.g.*, an atypical pulmonary carcinoid tumor), a lymphoproliferative disease (*e.g.*, a post-transplant lymphoproliferative disease), a lymphoma (*e.g.*, T-cell lymphoma, B-cell lymphoma, or a non-Hogdkin lymphoma), a myeloma (*e.g.*, a multiple myeloma), or a leukemia (*e.g.*, a myeloid leukemia or a lymphoid leukemia).

In certain embodiments, the cancer is a solid tumor. In some embodiments, the cancer is brain tumor, *e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor. In some embodiments, the cancer is a pancreatic cancer, *e.g.*, an advanced pancreatic cancer. In some embodiments, the cancer is a skin cancer, *e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma. In some embodiments, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma). In some embodiments, the cancer is a breast cancer, *e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the cancer is a virus-associated cancer. In some embodiments, the cancer is an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal). In some embodiments, the cancer is a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix). In some embodiments, the cancer is a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma). In some embodiments, the cancer is a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)). In some embodiments, the cancer is a nasopharyngeal cancer (NPC). In some embodiments, the cancer is a penile cancer (*e.g.*, a squamous cell carcinoma of the penile). In some embodiments, the cancer is a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the cancer is a colorectal cancer, *e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer (NSCLC).

In certain embodiments, the cancer is a hematological cancer. In some embodiments, the cancer is a leukemia. In some embodiments, the cancer is a lymphoma, *e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL) (*e.g.*, a relapsed or refractory HL or DLBCL). In some embodiments, the cancer is a myeloma

In another embodiment, the cancer is chosen form a carcinoma (*e.g.*, advanced or metastatic carcinoma), melanoma or a lung carcinoma, *e.g.*, a non-small cell lung carcinoma. In one embodiment, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer or small cell lung cancer. In some embodiments, the non-small cell lung cancer is a stage I (*e.g.*, stage Ia or Ib), stage II (*e.g.*, stage IIa or IIb), stage III (*e.g.*, stage IIIa or IIIb), or stage IV, non-small cell lung cancer. In one embodiment, the cancer is a melanoma, *e.g.*, an advanced melanoma. In one embodiment, the cancer

is an advanced or unresectable melanoma that does not respond to other therapies. In other embodiments, the cancer is a melanoma with a BRAF mutation (*e.g.*, a BRAF V600 mutation). In another embodiment, the cancer is a hepatocarcinoma, *e.g.*, an advanced hepatocarcinoma, with or without a viral infection, *e.g.*, a chronic viral hepatitis. In another embodiment, the cancer is a prostate cancer, *e.g.*, an advanced prostate cancer. In yet another embodiment, the cancer is a myeloma, *e.g.*, multiple myeloma. In yet another embodiment, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic RCC, a non-clear cell renal cell carcinoma (nccRCC), or clear cell renal cell carcinoma (CCRCC)).

In one embodiment, the cancer microenvironment has an elevated level of LAG-3 expression. In one embodiment, the cancer microenvironment has an elevated level of PD-L1 expression. Alternatively, or in combination, the cancer microenvironment can have increased IFNγ and/or CD8 expression.

In some embodiments, the subject has, or is identified as having, a tumor that has one or more of high PD-L1 level or expression, or as being Tumor Infiltrating Lymphocyte (TIL)+ (*e.g.*, as having an increased number of TILs), or both. In certain embodiments, the subject has, or is identified as having, a tumor that has high PD-L1 level or expression and that is TIL+. In some embodiments, the methods described herein further include identifying a subject based on having a tumor that has one or more of high PD-L1 level or expression, or as being TIL+, or both. In certain embodiments, the methods described herein further include identifying a subject based on having a tumor that has high PD-L1 level or expression and as being TIL+. In some embodiments, tumors that are TIL+ are positive for CD8 and IFNγ. In some embodiments, the subject has, or is identified as having, a high percentage of cells that are positive for one, two or more of PD-L1, CD8, and/or IFNγ. In certain embodiments, the subject has or is identified as having a high percentage of cells that are positive for all of PD-L1, CD8, and IFNγ.

In some embodiments, the methods described herein further include identifying a subject based on having a high percentage of cells that are positive for one, two or more of PD-L1, CD8, and/or IFNγ. In certain embodiments, the methods described herein further include identifying a subject based on having a high percentage of cells that are positive for all of PD-L1, CD8, and IFNγ. In some embodiments, the subject has, or is identified as having, one, two or more of PD-L1, CD8, and/or IFNγ, and one or more of a lung cancer, *e.g.*, squamous cell lung cancer or lung adenocarcinoma (*e.g.*, an NSCLC); a head and neck cancer; a squamous cell cervical cancer; a stomach cancer; an esophageal cancer; a thyroid cancer (*e.g.*, anaplastic thyroid carcinoma); a skin cancer (*e.g.*, a Merkel cell carcinoma or a melanoma), a breast cancer (*e.g.*, a TNBC), and/or a nasopharyngeal cancer (NPC). In certain embodiments, the methods described herein further describe identifying a subject based on having one, two or more of PD-L1, CD8, and/or IFNγ, and one or more of a lung cancer, *e.g.*, squamous cell lung cancer or lung adenocarcinoma (*e.g.*, an NSCLC); a head and neck cancer; a squamous cell cervical cancer; a stomach cancer; a thyroid cancer (*e.g.*, anaplastic

thyroid carcinoma); a skin cancer (*e.g.*, a Merkel cell carcinoma or a melanoma), an neuroendocrine tumor, a breast cancer (*e.g.*, a TNBC), and/or a nasopharyngeal cancer.

Methods, compositions, and formulations disclosed herein are useful for treating metastatic lesions associated with the aforementioned cancers.

In a further aspect, the disclosure provides a method of treating an infectious disease (*e.g.*, an infectious disease described herein) in a subject, comprising administering to the subject an anti-LAG-3 antibody molecule described herein in accordance with a dosage regimen described herein.

Still further, the invention provides a method of enhancing an immune response to an antigen in a subject, comprising administering to the subject: (i) the antigen; and (ii) an anti-LAG-3 antibody molecule described herein, in accordance with a dosage regimen described herein, such that an immune response to the antigen in the subject is enhanced. The antigen can be, for example, a tumor antigen, a viral antigen, a bacterial antigen or an antigen from a pathogen.

The anti-LAG-3 antibody molecule described herein can be administered to the subject systemically (*e.g.*, orally, parenterally, subcutaneously, intravenously, rectally, intramuscularly, intraperitoneally, intranasally, transdermally, or by inhalation or intracavitary installation), topically, or by application to mucous membranes, such as the nose, throat and bronchial tubes. In certain embodiments, the anti-LAG-3 antibody molecule is administered intravenously at a flat dose described herein.

Combination Therapies

The anti-LAG-3 antibody molecules described herein can be used in combination with other therapeutic agents, procedures or modalities.

In one embodiment, the methods described herein include administering to the subject a combination comprising an anti-LAG-3 antibody molecule described herein, in combination with a therapeutic agent, procedure, or modality, in an amount effective to treat or prevent a disorder. In certain embodiments, the anti-LAG-3 antibody molecule is administered or used in accordance with a dosage regimen described herein. In other embodiments, the antibody molecule is administered or used as a composition or formulation described herein.

The anti-LAG-3 antibody molecule and the therapeutic agent, procedure, or modality can be administered or used simultaneously or sequentially in any order. Any combination and sequence of the anti-LAG-3 antibody molecule and the therapeutic agent, procedure, or modality (*e.g.*, as described herein) can be used. The antibody molecule and/or the therapeutic agent, procedure or modality can be administered or used during periods of active disorder, or during a period of remission or less active disease. The antibody molecule can be administered before, concurrently with, or after the treatment with the therapeutic agent, procedure or modality.

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with one or more of other antibody molecules, chemotherapy, other anti-cancer

therapy (*e.g.*, targeted anti-cancer therapies, gene therapy, viral therapy, RNA therapy bone marrow transplantation, nanotherapy, or oncolytic drugs), cytotoxic agents, immune-based therapies (*e.g.*, cytokines or cell-based immune therapies), surgical procedures (*e.g.*, lumpectomy or mastectomy) or radiation procedures, or a combination of any of the foregoing. The additional therapy may be in the form of adjuvant or neoadjuvant therapy. In some embodiments, the additional therapy is an enzymatic inhibitor (*e.g.*, a small molecule enzymatic inhibitor) or a metastatic inhibitor. Exemplary cytotoxic agents that can be administered in combination include antimicrotubule agents, topoisomerase inhibitors, anti-metabolites, mitotic inhibitors, alkylating agents, anthracyclines, vinca alkaloids, intercalating agents, agents capable of interfering with a signal transduction pathway, agents that promote apoptosis, proteasome inhibitors, and radiation (*e.g.*, local or whole body irradiation (*e.g.*, gamma irradiation)). In other embodiments, the additional therapy is surgery or radiation, or a combination thereof. In other embodiments, the additional therapy is a therapy targeting one or more of PI3K/AKT/mTOR pathway, an HSP90 inhibitor, or a tubulin inhibitor.

Alternatively, or in combination with the aforesaid combinations, the anti-LAG-3 antibody described herein can be administered or used in combination with, one or more of: an immunomodulator (*e.g.*, an activator of a costimulatory molecule or an inhibitor of an inhibitory molecule, *e.g.*, an immune checkpoint molecule); a vaccine, *e.g.*, a therapeutic cancer vaccine; or other forms of cellular immunotherapy.

In certain embodiments, the anti-LAG-3 molecule described herein is administered or used in combination with a modulator of a costimulatory molecule or an inhibitory molecule, *e.g.*, a co-inhibitory ligand or receptor.

In one embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a modulator, *e.g.*, agonist, of a costimulatory molecule. In one embodiment, the agonist of the costimulatory molecule is chosen from an agonist (*e.g.*, an agonistic antibody or antigen-binding fragment thereof, or a soluble fusion) of OX40, CD2, CD27, CDS, ICAM-1, LFA-1 (CD11a/CD18), ICOS (CD278), 4-1BB (CD137), GITR, CD30, CD40, BAFFR, HVEM, CD7, LIGHT, NKG2C, SLAMF7, NKp80, CD160, B7-H3 or CD83 ligand.

In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a GITR agonist, *e.g.*, an anti-GITR antibody molecule.

In one embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with an inhibitor of an inhibitory (or immune checkpoint) molecule chosen from PD-1, PD-L1, PD-L2, CTLA-4, TIM-3, LAG-3, CEACAM (*e.g.*, CEACAM-1, CEACAM-3, and/or CEACAM-5), VISTA, BTLA, TIGIT, LAIR1, CD160, 2B4 and/or TGF beta. In one embodiment, the inhibitor is a soluble ligand (*e.g.*, a CTLA-4-Ig), or an antibody or antibody fragment that binds to PD-1, LAG-3, PD-L1, PD-L2, or CTLA-4.

In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a PD-1 inhibitor, *e.g.*, an anti-PD-1 antibody molecule. In another

embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a TIM-3 inhibitor, *e.g.*, an anti-TIM-3 antibody molecule. In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a PD-L1 inhibitor, *e.g.*, an anti-PD-L1 antibody molecule.

In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a chemotherapeutic agent. In certain embodiments, the chemotherapeutic agent comprises a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin). In certain embodiments, the chemotherapeutic agent comprises cisplatin, permetrexed, or both. Cisplatin is also known as cisplatinum, platamin, neoplatin, cismaplat, or cis-diamminedichloridoplatinum(II) (CDDP). Permetrxed is also known as (S)-2-(4-(2-(2-amino-4-oxo-4,7-dihydro-3H-pyrrolo[2,3-d]pyrimidin-5-yl)ethyl)benzamido)pentanedioic acid. In certain embodiments, the chemotherapeutic agent comprises a nucleotide analog or precursor analog (*e.g.*, capecitabine, azacitidine, azathioprine, cytarabine, doxifluridine, fluorouracil, gemcitabine, hydroxyurea, mercaptopurine, methotrexate, or tioguanine (thioguanine)). In certain embodiments, the chemotherapeutic agent comprises a hypomethylating agent (*e.g.*, decitabine). In one embodiment, the chemotherapeutic agent comprises nab-paclitaxel.

Other exemplary chemotherapeutic agents that can be used in combination with the anti-LAG-3 antibody molecule include, but are not limited to, an alkylating agent (*e.g.*, a bifunctional alkylator (*e.g.*, cyclophosphamide, a mechlorethamine, chlorambucil, or melphalan)), a monofunctional alkylator (*e.g.*, dacarbazine (DTIC), nitrosoureas, or temozolomide (oral dacarbazine)), an anthracycline (*e.g.*, daunorubicin, doxorubicin, epirubicin, idarubicin, mitoxantrone, or valrubicin), a cytoskeletal disruptor or taxane (*e.g.*, paclitaxel, docetaxel, abraxane, or taxotere), an epothilone, a histone deacetylase inhibitor (*e.g.*, vorinostat or romidepsin), an inhibitor of topoisomerase I (*e.g.*, irinotecan or topotecan), an inhibitor of topoisomerase II (*e.g.*, etoposide, teniposide, or tafluposide), a kinase inhibitor (*e.g.*, bortezomib, erlotinib, gefitinib, imatinib, vemurafenib, or vismodegib), a peptide antibiotic (*e.g.*, bleomycin or actinomycin), a retinoid (*e.g.*, tretinoin, alitretinoin, or bexarotene), or a vinca alkaloid or derivative thereof (*e.g.*, vinblastine, vincristine, vindesine, or vinorelbine).

In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule) and a TIM-3 inhibitor (*e.g.*, an anti-TIM-3 antibody molecule). In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule) and a PD-L1 inhibitor (*e.g.*, an anti-PD-L1 antibody molecule). In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a TIM-3 inhibitor (*e.g.*, an anti-TIM-3 antibody molecule) and a PD-L1 inhibitor (*e.g.*, an anti-PD-L1 antibody molecule). In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a PD-1 inhibitor (*e.g.*, an anti-PD-1

antibody molecule) and a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). In another embodiment, the anti-LAG-3 antibody molecule described herein is administered or used in combination with a CEACAM inhibitor (*e.g.*, CEACAM-1, CEACAM-3, and/or CEACAM-5 inhibitor), *e.g.*, an anti- CEACAM antibody molecule. In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with a CEACAM-1 inhibitor, *e.g.*, an anti-CEACAM-1 antibody molecule. In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with a CEACAM-3 inhibitor, *e.g.*, an anti-CEACAM-3 antibody molecule. In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with a CEACAM-5 inhibitor, *e.g.*, an anti-CEACAM-5 antibody molecule.

The combination of antibody molecules disclosed herein can be administered separately, *e.g.*, as separate antibody molecules, or linked, *e.g.*, as a bispecific or trispecific antibody molecule. In one embodiment, a bispecific antibody that includes an anti-LAG-3 antibody molecule and an anti-PD-1, anti-CEACAM (*e.g.*, anti-CEACAM-1, CEACAM-3, and/or anti-CEACAM-5), anti-PD-L1, or anti-TIM-3 antibody molecule, is administered. In certain embodiments, the combination of antibodies disclosed herein is used to treat a cancer, *e.g.*, a cancer as described herein (*e.g.*, a solid tumor or a hematologic malignancy).

In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with an anti-PD-1 antibody molecule, *e.g.*, to treat a brain cancer (*e.g.*, a glioblastoma), a melanoma, a renal cancer (*e.g.*, a renal cell carcinoma), a virus-associated cancer (*e.g.*, an anal canal cancer, a cervical cancer, a gastric cancer, a head and neck cancer, a nasopharyngeal cancer (NPC), a penile cancer, or a vaginal or vulvar cancer), a colorectal cancer, or a lung cancer (*e.g.*, a non-small cell lung cancer (NSCLC)). In certain embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an anti-PD-1 antibody molecule, *e.g.*, to treat a breast cancer, *e.g.*, a triple negative breast cancer (TNBC).

In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with a chemotherapeutic agent (*e.g.*, gemcitabine, paclitaxel), *e.g.*, to treat a pancreatic cancer or a breast cancer.

In another embodiment, the anti-LAG-3 antibody molecule is administered or used in combination with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)), *e.g.*, to treat a breast cancer, *e.g.*, a TNBC. In certain embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an anti-PD-1 antibody molecule and a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)), *e.g.*, to treat a breast cancer, *e.g.*, a TNBC. In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with a cytokine. The cytokine can be administered as a fusion molecule to the anti-LAG-3 antibody

molecule, or as separate compositions. In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with one, two, three or more cytokines, *e.g.*, as a fusion molecule or as separate compositions. In one embodiment, the cytokine is an interleukin (IL) chosen from one, two, three or more of IL-1, IL-2, IL-12, IL-15 or IL-21. In one embodiment, a bispecific antibody molecule has a first binding specificity to a first target (*e.g.*, to LAG-3), a second binding specificity to a second target (*e.g.*, PD-1, TIM-3, or PD-L1), and is optionally linked to an interleukin (*e.g.*, IL-12) domain *e.g.*, full length IL-12 or a portion thereof. In certain embodiments, the combination of anti-LAG-3 antibody molecule and the cytokine described herein is used to treat a cancer, *e.g.*, a cancer as described herein (*e.g.*, a solid tumor).

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an antibody specific against an HLA C, *e.g.*, an antibody specific to Killer-cell Immunoglobulin-like Receptors (also referred to herein as an "anti-KIR antibody"). In certain embodiments, the combination of anti-LAG-3 antibody molecule and anti-KIR antibody is used to treat a cancer, *e.g.*, a cancer as described herein (*e.g.*, a solid tumor, *e.g.*, an advanced solid tumor).

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with a cellular immunotherapy (*e.g.*, PROVENGE® (*e.g.*, Sipuleucel-T)), and optionally in combination with cyclophosphamide. In certain embodiments, the combination of anti-LAG-3 antibody molecule, PROVENGE® and/or cyclophosphamide is used to treat a cancer, *e.g.*, a cancer as described herein (*e.g.*, a prostate cancer, *e.g.*, an advanced prostate cancer).

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with a vaccine, *e.g.*, a cancer vaccine, (*e.g.*, a dendritic cell renal carcinoma (DC-RCC) vaccine). In one embodiment, the vaccine is peptide-based, DNA-based, RNA-based, or antigen-based, or a combination thereof. In embodiments, the vaccine comprises one or more peptides, nucleic acids (*e.g.*, DNA or RNA), antigens, or a combination thereof. In certain embodiments, the combination of anti-TIM-3 antibody molecule and the DC-RCC vaccine is used to treat a cancer, *e.g.*, a cancer as described herein (*e.g.*, a renal carcinoma, *e.g.*, metastatic renal cell carcinoma (RCC) or clear cell renal cell carcinoma (CCRCC)).

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an adjuvant.

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with chemotherapy, and/or immunotherapy. For example, the anti-LAG-3 antibody molecule can be used to treat a myeloma, alone or in combination with one or more of: chemotherapy or other anti-cancer agents (*e.g.*, thalidomide analogs, *e.g.*, lenalidomide), an anti-PD-1 antibody molecule, tumor antigen-pulsed dendritic cells, fusions (*e.g.*, electrofusions) of tumor cells and dendritic cells, or vaccination with immunoglobulin idiotype produced by malignant plasma cells. In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an anti-PD-1 antibody molecule to treat a myeloma, *e.g.*, a multiple myeloma.

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with chemotherapy to treat a lung cancer, *e.g.*, non-small cell lung cancer. In other embodiments, the anti-LAG-3 antibody molecule is administered or used with standard lung, *e.g.*, NSCLC, chemotherapy, *e.g.*, platinum doublet therapy, to treat lung cancer. In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with an indoleamine-pyrrole 2,3-dioxygenase (IDO) inhibitor (*e.g.*, (4E)-4-[(3-chloro-4-fluoroanilino)-nitrosomethylidene]-1,2,5-oxadiazol-3-amine (also known as INCB24360), indoximod (1-methyl-D-tryptophan), α-cyclohexyl-5H-Imidazo[5,1-a]isoindole-5-ethanol (also known as NLG919), etc.) in a subject with advanced or metastatic cancer (*e.g.*, a patient with metastatic and recurrent NSCL cancer).

In yet other embodiments, In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with one or more of: an immune-based strategy (*e.g.*, interleukin-2 or interferon-α), a targeting agent (*e.g.*, a VEGF inhibitor such as a monoclonal antibody to VEGF); a VEGF tyrosine kinase inhibitor such as sunitinib, sorafenib, axitinib and pazopanib; an RNAi inhibitor; or an inhibitor of a downstream mediator of VEGF signaling, *e.g.*, an inhibitor of the mammalian target of rapamycin (mTOR), *e.g.*, everolimus and temsirolimus. Any of such combinations can be used to treat a renal cancer, *e.g.*, renal cell carcinoma (RCC) (*e.g.*, clear cell renal cell carcinoma (CCRCC) or a non-clear cell renal cell carcinoma (nccRCC) or metastatic RCC), or a liver cancer (*e.g.*, a hepatocellular carcinoma).

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with a MEK inhibitor (*e.g.*, a MEK inhibitor as described herein). In some embodiments, the combination of the anti-LAG-3 antibody molecule and the MEK inhibitor is used to treat a cancer (*e.g.*, a cancer described herein). In some embodiments, the cancer treated with the combination is chosen from a melanoma, a colorectal cancer, a non-small cell lung cancer, an ovarian cancer, a breast cancer, a prostate cancer, a pancreatic cancer, a hematological malignancy or a renal cell carcinoma. In certain embodiments, the cancer includes a BRAF mutation (*e.g.*, a BRAF V600E mutation), a BRAF wildtype, a KRAS wildtype or an activating KRAS mutation. The cancer may be at an early, intermediate or late stage.

In other embodiments, the anti-LAG-3 antibody molecule is administered or used in combination with one, two or all of a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, oxaliplatin, cisplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)), leucovorin or 5-FU (*e.g.*, a FOLFOX co-treatment). Alternatively or in combination, combination further includes a VEGF inhibitor (*e.g.*, a VEGF inhibitor as disclosed herein). In some embodiments, the combination of the anti-LAG-3 antibody molecule, the FOLFOX co-treatment, and the VEGF inhibitor is used to treat a cancer (*e.g.*, a cancer described herein). In some embodiments, the cancer treated with the combination is chosen from a melanoma, a colorectal cancer, a non-small cell lung cancer, an ovarian cancer, a breast cancer, a prostate cancer, a pancreatic cancer, a

hematological malignancy or a renal cell carcinoma. The cancer may be at an early, intermediate or late stage.

In other embodiments, the anti-LAG-3 antibody molecule is administered or used with a tyrosine kinase inhibitor (*e.g.*, axitinib) to treat renal cell carcinoma and other solid tumors.

In other embodiments, the anti-LAG-3 antibody molecule is administered or used with a 4-1BB receptor targeting agent (*e.g.*, an antibody that stimulates signaling through 4-1BB (CD-137), *e.g.*, PF-2566). In other embodiments, the anti-TIM-3 antibody molecule is administered or used in combination with a tyrosine kinase inhibitor (*e.g.*, axitinib) and a 4-1BB receptor targeting agent.

The anti-LAG-3 antibody molecule can be bound to a substance, *e.g.*, a cytotoxic agent or moiety (*e.g.*, a therapeutic drug; a compound emitting radiation; molecules of plant, fungal, or bacterial origin; or a biological protein (*e.g.*, a protein toxin) or particle (*e.g.*, a recombinant viral particle, *e.g.*, via a viral coat protein). For example, the antibody can be coupled to a radioactive isotope such as an α-, β-, or γ-emitter, or a β-and γ-emitter.

Immunomodulators

The anti-LAG-3 antibody molecules described herein can be used in combination with one or more immunomodulators.

In certain embodiments, the immunomodulator is an inhibitor of an immune checkpoint molecule. In one embodiment, the immunomodulator is an inhibitor of PD-1, PD-L1, PD-L2, CTLA-4, TIM-3, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), VISTA, BTLA, TIGIT, LAIR1, CD160, 2B4 and/or TGF beta. In one embodiment, the inhibitor of an immune checkpoint molecule inhibits PD-1, PD-L1, TIM-3, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), CTLA-4, or any combination thereof.

Inhibition of an inhibitory molecule can be performed at the DNA, RNA or protein level. In embodiments, an inhibitory nucleic acid (*e.g.*, a dsRNA, siRNA or shRNA), can be used to inhibit expression of an inhibitory molecule. In other embodiments, the inhibitor of an inhibitory signal is, a polypeptide *e.g.*, a soluble ligand (*e.g.*, PD-1-Ig or CTLA-4 Ig), or an antibody molecule that binds to the inhibitory molecule; *e.g.*, an antibody molecule that binds to PD-1, PD-L1, PD-L2, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), CTLA-4, TIM-3, VISTA, BTLA, TIGIT, LAIR1, CD160, 2B4 and/or TGF beta, or a combination thereof.

In certain embodiments, the anti-LAG-3 antibody molecule is in the form of a bispecific or multispecific antibody molecule. In one embodiment, the bispecific antibody molecule has a first binding specificity to LAG-3 and a second binding specificity, *e.g.*, a second binding specificity to, PD-1, PD-L1, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), TIM-3, or PD-L2. In one embodiment, the bispecific antibody molecule binds to (i) PD-1 or PD-L1 (ii) and LAG-3. In another embodiment, the bispecific antibody molecule binds to LAG-3 and TIM-3. In another embodiment, the bispecific antibody molecule binds to LAG-3 and CEACAM (*e.g.*, CEACAM-1, -3 and/or -5). In another embodiment, the bispecific antibody molecule binds to LAG-3 and CEACAM-1. In still another

embodiment, the bispecific antibody molecule binds to LAG-3 and CEACAM-3. In yet another embodiment, the bispecific antibody molecule binds to LAG-3 and CEACAM-5.

In other embodiments, the anti-LAG-3 antibody molecule is used in combination with a bispecific or multispecific antibody molecule. In another embodiment, the bispecific antibody molecule binds to PD-1 or PD-L1. In yet another embodiment, the bispecific antibody molecule binds to PD-1 and PD-L2. In another embodiment, the bispecific antibody molecule binds to CEACAM (*e.g.*, CEACAM-1, -3 and/or -5) and TIM-3.

Any combination of the aforesaid molecules can be made in a multispecific antibody molecule, *e.g.*, a trispecific antibody that includes a first binding specificity to LAG-3, and a second and third binding specificities to two or more of: PD-1, PD-L1, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), TIM-3, or PD-L2.

In certain embodiments, the immunomodulator is an inhibitor of PD-1, *e.g.*, human PD-1. In another embodiment, the immunomodulator is an inhibitor of PD-L1, *e.g.*, human PD-L1. In one embodiment, the inhibitor of PD-1 or PD-L1 is an antibody molecule to PD-1 or PD-L1 (*e.g.*, an anti-PD-1 or anti-PD-L1 antibody molecule as described herein).

The combination of the PD-1 or PD-L1 inhibitor with the anti-LAG-3 antibody molecule can further include one or more additional immunomodulators, *e.g.*, in combination with an inhibitor of TIM-3, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5) or CTLA-4. In one embodiment, the inhibitor of PD-1 or PD-L1 (*e.g.*, the anti-PD-1 or PD-L1 antibody molecule) is administered in combination with the anti-LAG-3 antibody molecule and a TIM-3 inhibitor (*e.g.*, an anti-TIM-3 antibody molecule). In another embodiment, the inhibitor of PD-1 or PD-L1 (*e.g.*, the anti-PD-1 or PD-L1 antibody molecule) is administered in combination with the anti-LAG-3 antibody molecule and a CEACAM inhibitor (*e.g.*, CEACAM-1, -3 and/or -5 inhibitor), *e.g.*, an anti-CEACAM antibody molecule. In another embodiment, the inhibitor of PD-1 or PD-L1 (*e.g.*, the anti-PD-1 or PD-L1 antibody molecule) is administered in combination with the anti-LAG-3 antibody molecule and a CEACAM-1 inhibitor (*e.g.*, an anti-CEACAM-1 antibody molecule). In another embodiment, the inhibitor of PD-1 or PD-L1 (*e.g.*, the anti-PD-1 or PD-L1 antibody molecule) is administered in combination with the anti-LAG-3 antibody molecule and a CEACAM-5 inhibitor (*e.g.*, an anti-CEACAM-5 antibody molecule). In yet other embodiments, the inhibitor of PD-1 or PD-L1 (*e.g.*, the anti-PD-1 or PD-L1 antibody molecule) is administered in combination with the anti-LAG-3 antibody molecule and a TIM-3 inhibitor (*e.g.*, an anti-TIM-3 antibody molecule). Other combinations of immunomodulators with the anti-LAG-3 antibody molecule and a PD-1 inhibitor including, *e.g.*, one or more of PD-L2, CTLA-4, LAG-3, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), VISTA, BTLA, TIGIT, LAIR1, CD160, 2B4 and/or TGF beta) are also within the present invention. Any of the antibody molecules known in the art or disclosed herein can be used in the aforesaid combinations of inhibitors of checkpoint molecule.

In other embodiments, the immunomodulator is an inhibitor of CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), *e.g.*, human CEACAM (*e.g.*, CEACAM-1, -3 and/or -5). In one embodiment, the immunomodulator is an inhibitor of CEACAM-1, *e.g.*, human CEACAM-1. In another embodiment, the immunomodulator is an inhibitor of CEACAM-3, *e.g.*, human CEACAM-3. In another embodiment, the immunomodulator is an inhibitor of CEACAM-5, *e.g.*, human CEACAM-5. In one embodiment, the inhibitor of CEACAM (*e.g.*, CEACAM-1, -3 and/or -5) is an antibody molecule to CEACAM (*e.g.*, CEACAM-1, -3 and/or -5). The combination of the CEACAM (*e.g.*, CEACAM-1, -3 and/or -5) inhibitor and the anti-LAG-3 antibody molecule can further include one or more additional immunomodulators, *e.g.*, in combination with an inhibitor of TIM-3, PD-1, PD-L1 or CTLA-4.

In other embodiments, the immunomodulator is an inhibitor of TIM-3, *e.g.*, human TIM-3. In one embodiment, the inhibitor of TIM-3 is an antibody molecule to TIM-3. The combination of the TIM-3 inhibitor and the anti-LAG-3 antibody molecule can further include one or more additional immunomodulators, *e.g.*, in combination with an inhibitor of CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), PD-1, PD-L1 or CTLA-4.

In certain embodiments, the immunomodulator used in the combinations disclosed herein (*e.g.*, in combination with a therapeutic agent chosen from an antigen-presentation combination) is an activator or agonist of a costimulatory molecule. In one embodiment, the agonist of the costimulatory molecule is chosen from an agonist (*e.g.*, an agonistic antibody or antigen-binding fragment thereof, or a soluble fusion) of OX40, CD2, CD27, CD28, CDS, ICAM-1, LFA-1 (CD11a/CD18), ICOS (CD278), 4-1BB (CD137), GITR, CD30, CD40, BAFFR, HVEM, CD7, LIGHT, NKG2C, SLAMF7, NKp80, CD160, B7-H3, or CD83 ligand.

In other embodiments, the immunomodulator is a GITR agonist. In one embodiment, the GITR agonist is an antibody molecule to GITR. The anti-GITR antibody molecule and the anti-LAG-3 antibody molecule may be in the form of separate antibody composition, or as a bispecific antibody molecule. The combination of the GITR agonist with the anti-LAG-3 antibody molecule can further include one or more additional immunomodulators, *e.g.*, in combination with an inhibitor of PD-1, PD-L1, CTLA-4, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), or TIM-3. In some embodiments, the anti-GITR antibody molecule is a bispecific antibody that binds to GITR and PD-1, PD-L1, CTLA-4, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), or TIM-3. In other embodiments, a GITR agonist can be administered in combination with one or more additional activators of costimulatory molecules, *e.g.*, an agonist of OX40, CD2, CD27, CD28, CDS, ICAM-1, LFA-1 (CD11a/CD18), ICOS (CD278), 4-1BB (CD137), CD30, CD40, BAFFR, HVEM, CD7, LIGHT, NKG2C, SLAMF7, NKp80, CD160, B7-H3, or CD83 ligand.

In other embodiments, the immunomodulator is an OX40 agonist. In one embodiment, the OX40 agonist is an antibody molecule to OX40. The OX40 antibody molecule and the anti-LAG-3 antibody molecule may be in the form of separate antibody composition, or as a bispecific antibody

molecule. The combination of the OX40 agonist with the anti-LAG-3 antibody molecule can further include one or more additional immunomodulators, *e.g.*, in combination with an inhibitor of PD-1, PD-L1, CTLA-4, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), or TIM-3. In some embodiments, the anti-OX40 antibody molecule is a bispecific antibody that binds to OX40 and PD-1, PD-L1, CTLA-4, CEACAM (*e.g.*, CEACAM-1, -3 and/or -5), or TIM-3. In other embodiments, the OX40 agonist can be administered in combination with other costimulatory molecule, *e.g.*, an agonist of GITR, CD2, CD27, CD28, CDS, ICAM-1, LFA-1 (CD11a/CD18), ICOS (CD278), 4-1BB (CD137), CD30, CD40, BAFFR, HVEM, CD7, LIGHT, NKG2C, SLAMF7, NKp80, CD160, B7-H3, or CD83 ligand.

It is noted that only exemplary combinations of inhibitors of checkpoint inhibitors or agonists of costimulatory molecules are provided herein. Additional combinations of these agents are within the scope of the present invention.

Biomarkers

In certain embodiments, any of the methods disclosed herein further includes evaluating or monitoring the effectiveness of a therapy (*e.g.*, a monotherapy or a combination therapy) described herein, in a subject (*e.g.*, a subject having a cancer, *e.g.*, a cancer described herein). The method includes acquiring a value of effectiveness to the therapy, wherein said value is indicative of the effectiveness of the therapy.

In embodiments, the value of effectiveness to the therapy comprises a measure of one, two, three, four, five, six, seven, eight, nine or more (*e.g.*, all) of the following:

(i) a parameter of a tumor infiltrating lymphocyte (TIL) phenotype;

(ii) a parameter of a myeloid cell population;

(iii) a parameter of a surface expression marker;

(iv) a parameter of a biomarker of an immunologic response;

(v) a parameter of a systemic cytokine modulation;

(vi) a parameter of circulating free DNA (cfDNA);

(vii) a parameter of systemic immune-modulation;

(viii) a parameter of microbiome;

(ix) a parameter of a marker of activation in a circulating immune cell; or

(x) a parameter of a circulating cytokine.

In some embodiments, the parameter of a TIL phenotype comprises the level or activity of one, two, three, four or more (*e.g.*, all) of Hematoxylin and eosin (H&E) staining for TIL counts, CD8, FOXP3, CD4, or CD3, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a tumor sample).

In some embodiments, the parameter of a myeloid cell population comprises the level or activity of one or both of CD68 or CD163, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a tumor sample).

In some embodiments, the parameter of a surface expression marker comprises the level or activity of one, two, three or more (*e.g.*, all) of TIM-3, PD-1, PD-L1, or LAG-3, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a tumor sample). In certain embodiments, the level of TIM-3, PD-1, PD-L1, or LAG-3 is determined by immunohistochemistry (IHC). In certain embodiments, the level of TIM-3 is determined.

In some embodiments, the parameter of a biomarker of an immunologic response comprises the level or sequence of one or more nucleic acid-based markers, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a tumor sample).

In some embodiments, the parameter of systemic cytokine modulation comprises the level or activity of one, two, three, four, five, six, seven, eight, or more (*e.g.*, all) of IL-18, IFN-γ, ITAC (CXCL11), IL-6, IL-10, IL-4, IL-17, IL-15, or TGF-beta, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a blood sample, *e.g.*, a plasma sample).

In some embodiments, the parameter of cfDNA comprises the sequence or level of one or more circulating tumor DNA (cfDNA) molecules, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a blood sample, *e.g.*, a plasma sample).

In some embodiments, the parameter of systemic immune-modulation comprises phenotypic characterization of an activated immune cell, *e.g.*, a CD3-expressing cell, a CD8-expressing cell, or both, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a blood sample, *e.g.*, a PBMC sample).

In some embodiments, the parameter of microbiome comprises the sequence or expression level of one or more genes in the microbiome, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a stool sample).

In some embodiments, the parameter of a marker of activation in a circulating immune cell comprises the level or activity of one, two, three, four, five or more (*e.g.*, all) of circulating CD8+, HLA-DR+Ki67+, T cells, IFN-γ, IL-18, or CXCL11 (IFN-γ induced CCK) expressing cells, in a sample (*e.g.*, a blood sample, *e.g.*, a plasma sample).

In some embodiments, the parameter of a circulating cytokine comprises the level or activity of IL-6, in the subject, *e.g.*, in a sample from the subject (*e.g.*, a blood sample, *e.g.*, a plasma sample).

In some embodiments of any of the methods disclosed herein, the therapy comprises a combination of an anti-TIM-3 antibody molecule described herein and a second inhibitor of an immune checkpoint molecule, *e.g.*, an inhibitor of PD-1 (*e.g.*, an anti-PD-1 antibody molecule) or an inhibitor of PD-L1 (*e.g.*, an anti-PD-L1 antibody molecule).

In some embodiments of any of the methods disclosed herein, the measure of one or more of (i)-(x) is obtained from a sample acquired from the subject. In some embodiments, the sample is chosen from a tumor sample, a blood sample (*e.g.*, a plasma sample or a PBMC sample), or a stool sample.

In some embodiments of any of the methods disclosed herein, the subject is evaluated prior to receiving, during, or after receiving, the therapy.

In some embodiments of any of the methods disclosed herein, the measure of one or more of (i)-(x) evaluates a profile for one or more of gene expression, flow cytometry or protein expression.

In some embodiments of any of the methods disclosed herein, the presence of an increased level or activity of one, two, three, four, five, or more (*e.g.*, all) of circulating CD8+, HLA-DR+Ki67+, T cells, IFN-γ, IL-18, or CXCL11 (IFN-γ induced CCK) expressing cells, and/or the presence of an decreased level or activity of IL-6, in the subject or sample, is a positive predictor of the effectiveness of the therapy.

Alternatively, or in combination with the methods disclosed herein, responsive to said value, performing one, two, three, four or more (*e.g.*, all) of:

(i) administering to the subject the therapy;

(ii) administered an altered dosing of the therapy;

(iii) altering the schedule or time course of the therapy;

(iv) administering to the subject an additional agent (*e.g.*, a therapeutic agent described herein) in combination with the therapy; or

(v) administering to the subject an alternative therapy.

Additional Embodiments

In certain embodiments, any of the methods disclosed herein further includes identifying in a subject or a sample (*e.g.*, a subject's sample comprising cancer cells and/or immune cells such as TILs) the presence of LAG-3, thereby providing a value for LAG-3. The method can further include comparing the LAG-3 value to a reference value, *e.g.*, a control value. If the LAG-3 value is greater than the reference value, *e.g.*, the control value, administering a therapeutically effective amount of an anti-LAG-3 antibody molecule described herein to the subject, and optionally, in combination with a second therapeutic agent, procedure, or modality described herein, thereby treating a cancer.

In other embodiments, any of the methods disclosed herein further includes identifying in a subject or a sample (*e.g.*, a subject's sample comprising cancer cells and/or immune cells such as TILs) the presence of PD-L1, thereby providing a value for PD-L1. The method can further include comparing the PD-L1 value to a reference value, *e.g.*, a control value. If the PD-L1 value is greater than the reference value, *e.g.*, the control value, administering a therapeutically effective amount of an anti-LAG-3 antibody molecule described herein to the subject, and optionally, in combination with a second therapeutic agent, procedure, or modality described herein, thereby treating a cancer.

In other embodiments, any of the methods disclosed herein further includes identifying in a subject or a sample (*e.g.*, a subject's sample comprising cancer cells and optionally immune cells such as TILs) the presence of one, two or all of PD-L1, CD8, or IFN-γ, thereby providing a value for one, two or all of PD-L1, CD8, and IFN-γ. The method can further include comparing the PD-L1, CD8, and/or IFN-γ values to a reference value, *e.g.*, a control value. If the PD-L1, CD8, and/or IFN-γ values are greater than the reference value, *e.g.*, the control values, administering a therapeutically

effective amount of an anti-LAG-3 antibody molecule described herein to the subject, and optionally, in combination with a second therapeutic agent, procedure, or modality described herein, thereby treating a cancer.

The subject may have a cancer described herein, such as a solid tumor or a hematological cancer, *e.g.*, a brain tumor (*e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor), a pancreatic cancer (*e.g.*, an advanced pancreatic cancer), a skin cancer (*e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma), a renal cancer (*e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma)), a breast cancer (*e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC)), a virus-associated cancer, an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal), a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix), a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma), a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)), a nasopharyngeal cancer (NPC), a penile cancer (*e.g.*, a squamous cell carcinoma of the penile), a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva), a colorectal cancer (*e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer), a lung cancer (*e.g.*, a non-small cell lung cancer (NSCLC)), a leukemia, a lymphoma (*e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL), *e.g.*, a relapsed or refractory HL or DLBCL), a myeloma, or a metastatic lesion of the cancer.

All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety.

Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

DETAILED DESCRIPTION

LAG-3 (CD223) is an immune checkpoint inhibitor that binds MHC II, LSECtin, and Galectin-3. LAG-3 is expressed on the surface of immune cells including CD4+ and CD8+ T effector cells, regulatory T cells (Tregs), natural killer (NK) cells, and plasmacytoid dendritic cells. LAG-3 engagement has been shown to negatively regulate T cell signaling and to increase the suppressive function of Tregs, which is expected to then reduce T-cell activity against tumor cells. Blockade of LAG-3 has been shown to activate T cells by increasing T cell proliferation and cytokine secretion (IFN-γ).

Accordingly, disclosed herein are, at least in part, are antibody molecules (*e.g.*, humanized antibody molecules) that bind LAG-3 with high affinity and specificity. Pharmaceutical compositions and dose formulations comprising the anti-LAG-3 antibody molecules are also provided. The anti-LAG-3 antibody molecules disclosed herein can be used (alone or in combination with other therapeutic agents, procedures, or modalities) to treat or prevent disorders, such as cancerous disorders (*e.g.*, solid tumors and hematological cancers), as well as infectious diseases (*e.g.*, chronic infectious disorders or sepsis). For example, the anti-LAG-3 antibody molecules described herein can be used in combination with other therapeutic agents (*e.g.*, one or both of a PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) or a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine))), *e.g.*, to treat or prevent a cancer (*e.g.*, a cancer described herein), *e.g.*, a breast cancer, *e.g.* a triple negative breast cancer (TNBC). Thus, methods, including dosage regimens, for treating various disorders using the anti-LAG-3 antibody molecules are disclosed herein. In certain embodiments, the anti-LAG-3 antibody molecule is administered or used at a flat or fixed dose.

Definitions

Additional terms are defined below and throughout the application.

As used herein, the articles "a" and "an" refer to one or to more than one (*e.g.*, to at least one) of the grammatical object of the article.

The term "or" is used herein to mean, and is used interchangeably with, the term "and/or," unless context clearly indicates otherwise.

"About" and "approximately" shall generally mean an acceptable degree of error for the quantity measured given the nature or precision of the measurements. Exemplary degrees of error are within 20 percent (%), typically, within 10%, and more typically, within 5% of a given value or range of values.

By "a combination" or "in combination with," it is not intended to imply that the therapy or the therapeutic agents must be administered at the same time and/or formulated for delivery together, although these methods of delivery are within the scope described herein. The therapeutic agents in the combination can be administered concurrently with, prior to, or subsequent to, one or more other additional therapies or therapeutic agents. The therapeutic agents or therapeutic protocol can be administered in any order. In general, each agent will be administered at a dose and/or on a time schedule determined for that agent. In will further be appreciated that the additional therapeutic agent utilized in this combination may be administered together in a single composition or administered separately in different compositions. In general, it is expected that additional therapeutic agents utilized in combination be utilized at levels that do not exceed the levels at which they are utilized individually. In some embodiments, the levels utilized in combination will be lower than those utilized individually.

In embodiments, the additional therapeutic agent is administered at a therapeutic or lower-than therapeutic dose. In certain embodiments, the concentration of the second therapeutic agent that is required to achieve inhibition, *e.g.*, growth inhibition, is lower when the second therapeutic agent is administered in combination with the first therapeutic agent, *e.g.*, the anti-LAG-3 antibody molecule, than when the second therapeutic agent is administered individually. In certain embodiments, the concentration of the first therapeutic agent that is required to achieve inhibition, *e.g.*, growth inhibition, is lower when the first therapeutic agent is administered in combination with the second therapeutic agent than when the first therapeutic agent is administered individually. In certain embodiments, in a combination therapy, the concentration of the second therapeutic agent that is required to achieve inhibition, *e.g.*, growth inhibition, is lower than the therapeutic dose of the second therapeutic agent as a monotherapy, *e.g.*, 10-20%, 20-30%, 30-40%, 40-50%, 50-60%, 60-70%, 70-80%, or 80-90% lower. In certain embodiments, in a combination therapy, the concentration of the first therapeutic agent that is required to achieve inhibition, *e.g.*, growth inhibition, is lower than the therapeutic dose of the first therapeutic agent as a monotherapy, *e.g.*, 10-20%, 20-30%, 30-40%, 40-50%, 50-60%, 60-70%, 70-80%, or 80-90% lower.

The term "inhibition," "inhibitor," or "antagonist" includes a reduction in a certain parameter, *e.g.*, an activity, of a given molecule, *e.g.*, an immune checkpoint inhibitor. For example, inhibition of an activity, *e.g.*, a PD-1 or PD-L1 activity, of at least 5%, 10%, 20%, 30%, 40% or more is included by this term. Thus, inhibition need not be 100%.

The term "activation," "activator," or "agonist" includes an increase in a certain parameter, *e.g.*, an activity, of a given molecule, *e.g.*, a costimulatory molecule. For example, increase of an activity, *e.g.*, a costimulatory activity, of at least 5%, 10%, 25%, 50%, 75% or more is included by this term.

The term "anti-cancer effect" refers to a biological effect which can be manifested by various means, including but not limited to, *e.g.,* a decrease in tumor volume, a decrease in the number of cancer cells, a decrease in the number of metastases, an increase in life expectancy, decrease in cancer cell proliferation, decrease in cancer cell survival, or amelioration of various physiological symptoms associated with the cancerous condition. An "anti-cancer effect" can also be manifested by the ability of the peptides, polynucleotides, cells and antibodies in prevention of the occurrence of cancer in the first place.

The term "anti-tumor effect" refers to a biological effect which can be manifested by various means, including but not limited to, *e.g.,* a decrease in tumor volume, a decrease in the number of tumor cells, a decrease in tumor cell proliferation, or a decrease in tumor cell survival.

The term "cancer" refers to a disease characterized by the rapid and uncontrolled growth of aberrant cells. Cancer cells can spread locally or through the bloodstream and lymphatic system to other parts of the body. Examples of various cancers are described herein and include but are not limited to, solid tumors, *e.g.,* lung cancer, breast cancer, prostate cancer, ovarian cancer, cervical

cancer, skin cancer, pancreatic cancer, colorectal cancer, renal cancer, liver cancer, and brain cancer, and hematologic malignancies, *e.g.,* lymphoma and leukemia, and the like. The terms "tumor" and "cancer" are used interchangeably herein, *e.g.,* both terms encompass solid and liquid, *e.g.,* diffuse or circulating, tumors. As used herein, the term "cancer" or "tumor" includes premalignant, as well as malignant cancers and tumors.

The term "antigen presenting cell" or "APC" refers to an immune system cell such as an accessory cell (*e.g.,* a B-cell, a dendritic cell, and the like) that displays a foreign antigen complexed with major histocompatibility complexes (MHC's) on its surface. T-cells may recognize these complexes using their T-cell receptors (TCRs). APCs process antigens and present them to T-cells.

The term "costimulatory molecule" refers to the cognate binding partner on a T cell that specifically binds with a costimulatory ligand, thereby mediating a costimulatory response by the T cell, such as, but not limited to, proliferation. Costimulatory molecules are cell surface molecules other than antigen receptors or their ligands that are required for an efficient immune response. Costimulatory molecules include, but are not limited to, an MHC class I molecule, TNF receptor proteins, Immunoglobulin-like proteins, cytokine receptors, integrins, signalling lymphocytic activation molecules (SLAM proteins), activating NK cell receptors, BTLA, a Toll ligand receptor, OX40, CD2, CD7, CD27, CD28, CD30, CD40, CDS, ICAM-1, LFA-1 (CD11a/CD18), 4-1BB (CD137), B7-H3, CDS, ICAM-1, ICOS (CD278), GITR, BAFFR, LIGHT, HVEM (LIGHTR), KIRDS2, SLAMF7, NKp80 (KLRF1), NKp44, NKp30, NKp46, CD19, CD4, CD8alpha, CD8beta, IL2R beta, IL2R gamma, IL7R alpha, ITGA4, VLA1, CD49a, ITGA4, IA4, CD49D, ITGA6, VLA-6, CD49f, ITGAD, CD11d, ITGAE, CD103, ITGAL, CD11a, LFA-1, ITGAM, CD11b, ITGAX, CD11c, ITGB1, CD29, ITGB2, CD18, LFA-1, ITGB7, NKG2D, NKG2C, TNFR2, TRANCE/RANKL, DNAM1 (CD226), SLAMF4 (CD244, 2B4), CD84, CD96 (Tactile), CEACAM1, CRTAM, Ly9 (CD229), CD160 (BY55), PSGL1, CD100 (SEMA4D), CD69, SLAMF6 (NTB-A, Ly108), SLAM (SLAMF1, CD150, IPO-3), BLAME (SLAMF8), SELPLG (CD162), LTBR, LAT, GADS, SLP-76, PAG/Cbp, CD19a, and a ligand that specifically binds with CD83.

"Immune effector cell," or "effector cell" as that term is used herein, refers to a cell that is involved in an immune response, *e.g.,* in the promotion of an immune effector response. Examples of immune effector cells include T cells, *e.g.,* alpha/beta T cells and gamma/delta T cells, B cells, natural killer (NK) cells, natural killer T (NKT) cells, mast cells, and myeloid-derived phagocytes.

"Immune effector" or "effector" "function" or "response," as that term is used herein, refers to function or response, *e.g.,* of an immune effector cell, that enhances or promotes an immune attack of a target cell. *E.g.,* an immune effector function or response refers a property of a T or NK cell that promotes killing or the inhibition of growth or proliferation, of

a target cell. In the case of a T cell, primary stimulation and co-stimulation are examples of immune effector function or response.

The term "effector function" refers to a specialized function of a cell. Effector function of a T cell, for example, may be cytolytic activity or helper activity including the secretion of cytokines.

As used herein, the terms "treat," "treatment" and "treating" refer to the reduction or amelioration of the progression, severity and/or duration of a disorder, *e.g.,* a proliferative disorder, or the amelioration of one or more symptoms (preferably, one or more discernible symptoms) of the disorder resulting from the administration of one or more therapies. In specific embodiments, the terms "treat," "treatment" and "treating" refer to the amelioration of at least one measurable physical parameter of a proliferative disorder, such as growth of a tumor, not necessarily discernible by the patient. In other embodiments the terms "treat," "treatment" and "treating" refer to the inhibition of the progression of a proliferative disorder, either physically by, *e.g.,* stabilization of a discernible symptom, physiologically by, *e.g.,* stabilization of a physical parameter, or both. In other embodiments the terms "treat," "treatment" and "treating" refer to the reduction or stabilization of tumor size or cancerous cell count.

The compositions, formulations, and methods of the present invention encompass polypeptides and nucleic acids having the sequences specified, or sequences substantially identical or similar thereto, *e.g.*, sequences at least 85%, 90%, 95% identical or higher to the sequence specified. In the context of an amino acid sequence, the term "substantially identical" is used herein to refer to a first amino acid that contains a sufficient or minimum number of amino acid residues that are i) identical to, or ii) conservative substitutions of aligned amino acid residues in a second amino acid sequence such that the first and second amino acid sequences can have a common structural domain and/or common functional activity. For example, amino acid sequences that contain a common structural domain having at least about 85%, 90%. 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identity to a reference sequence, *e.g.*, a sequence provided herein.

In the context of nucleotide sequence, the term "substantially identical" is used herein to refer to a first nucleic acid sequence that contains a sufficient or minimum number of nucleotides that are identical to aligned nucleotides in a second nucleic acid sequence such that the first and second nucleotide sequences encode a polypeptide having common functional activity, or encode a common structural polypeptide domain or a common functional polypeptide activity. For example, nucleotide sequences having at least about 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identity to a reference sequence, *e.g.*, a sequence provided herein.

The term "functional variant" refers to polypeptides that have a substantially identical amino acid sequence to the naturally-occurring sequence, or are encoded by a substantially identical nucleotide sequence, and are capable of having one or more activities of the naturally-occurring sequence.

Calculations of homology or sequence identity between sequences (the terms are used interchangeably herein) are performed as follows.

To determine the percent identity of two amino acid sequences, or of two nucleic acid sequences, the sequences are aligned for optimal comparison purposes (*e.g.*, gaps can be introduced in one or both of a first and a second amino acid or nucleic acid sequence for optimal alignment and non-homologous sequences can be disregarded for comparison purposes). In a preferred embodiment, the length of a reference sequence aligned for comparison purposes is at least 30%, preferably at least 40%, more preferably at least 50%, 60%, and even more preferably at least 70%, 80%, 90%, 100% of the length of the reference sequence. The amino acid residues or nucleotides at corresponding amino acid positions or nucleotide positions are then compared. When a position in the first sequence is occupied by the same amino acid residue or nucleotide as the corresponding position in the second sequence, then the molecules are identical at that position (as used herein amino acid or nucleic acid "identity" is equivalent to amino acid or nucleic acid "homology").

The percent identity between the two sequences is a function of the number of identical positions shared by the sequences, taking into account the number of gaps, and the length of each gap, which need to be introduced for optimal alignment of the two sequences.

The comparison of sequences and determination of percent identity between two sequences can be accomplished using a mathematical algorithm. In a preferred embodiment, the percent identity between two amino acid sequences is determined using the Needleman and Wunsch ((1970) *J. Mol. Biol.* 48:444-453) algorithm which has been incorporated into the GAP program in the GCG software package (available at www.gcg.com), using either a Blossum 62 matrix or a PAM250 matrix, and a gap weight of 16, 14, 12, 10, 8, 6, or 4 and a length weight of 1, 2, 3, 4, 5, or 6. In yet another preferred embodiment, the percent identity between two nucleotide sequences is determined using the GAP program in the GCG software package (available at www.gcg.com), using a NWSgapdna.CMP matrix and a gap weight of 40, 50, 60, 70, or 80 and a length weight of 1, 2, 3, 4, 5, or 6. A particularly preferred set of parameters (and the one that should be used unless otherwise specified) are a Blossum 62 scoring matrix with a gap penalty of 12, a gap extend penalty of 4, and a frameshift gap penalty of 5.

The percent identity between two amino acid or nucleotide sequences can be determined using the algorithm of E. Meyers and W. Miller ((1989) *CABIOS*, 4:11-17) which has been incorporated into the ALIGN program (version 2.0), using a PAM120 weight residue table, a gap length penalty of 12 and a gap penalty of 4.

The nucleic acid and protein sequences described herein can be used as a "query sequence" to perform a search against public databases, for example, to identify other family members or related sequences. Such searches can be performed using the NBLAST and XBLAST programs (version 2.0) of Altschul, *et al.* (1990) *J. Mol. Biol.* 215:403-10. BLAST nucleotide searches can be performed with the NBLAST program, score = 100, wordlength = 12 to obtain nucleotide sequences homologous

to a nucleic acid (SEQ ID NO: 1) molecules of the invention. BLAST protein searches can be performed with the XBLAST program, score = 50, wordlength = 3 to obtain amino acid sequences homologous to protein molecules of the invention. To obtain gapped alignments for comparison purposes, Gapped BLAST can be utilized as described in Altschul *et al.*, (1997) *Nucleic Acids Res.* 25:3389-3402. When utilizing BLAST and Gapped BLAST programs, the default parameters of the respective programs (*e.g.*, XBLAST and NBLAST) can be used. *See* www.ncbi.nlm.nih.gov.

As used herein, the term "hybridizes under low stringency, medium stringency, high stringency, or very high stringency conditions" describes conditions for hybridization and washing. Guidance for performing hybridization reactions can be found in *Current Protocols in Molecular Biology*, John Wiley & Sons, N.Y. (1989), 6.3.1-6.3.6, which is incorporated by reference. Aqueous and nonaqueous methods are described in that reference and either can be used. Specific hybridization conditions referred to herein are as follows: 1) low stringency hybridization conditions in 6X sodium chloride/sodium citrate (SSC) at about 45°C, followed by two washes in 0.2X SSC, 0.1% SDS at least at 50°C (the temperature of the washes can be increased to 55°C for low stringency conditions); 2) medium stringency hybridization conditions in 6X SSC at about 45□C, followed by one or more washes in 0.2X SSC, 0.1% SDS at 60°C; 3) high stringency hybridization conditions in 6X SSC at about 45°C, followed by one or more washes in 0.2X SSC, 0.1% SDS at 65°C; and preferably 4) very high stringency hybridization conditions are 0.5M sodium phosphate, 7% SDS at 65°C, followed by one or more washes at 0.2X SSC, 1% SDS at 65°C. Very high stringency conditions (4) are the preferred conditions and the ones that should be used unless otherwise specified.

It is understood that the molecules of the present invention may have additional conservative or non-essential amino acid substitutions, which do not have a substantial effect on their functions.

The term "amino acid" is intended to embrace all molecules, whether natural or synthetic, which include both an amino functionality and an acid functionality and capable of being included in a polymer of naturally-occurring amino acids. Exemplary amino acids include naturally-occurring amino acids; analogs, derivatives and congeners thereof; amino acid analogs having variant side chains; and all stereoisomers of any of any of the foregoing. As used herein the term "amino acid" includes both the D- or L- optical isomers and peptidomimetics.

A "conservative amino acid substitution" is one in which the amino acid residue is replaced with an amino acid residue having a similar side chain. Families of amino acid residues having similar side chains have been defined in the art. These families include amino acids with basic side chains (*e.g.*, lysine, arginine, histidine), acidic side chains (*e.g.*, aspartic acid, glutamic acid), uncharged polar side chains (*e.g.*, glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine), nonpolar side chains (*e.g.*, alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan), beta-branched side chains (*e.g.*, threonine, valine, isoleucine) and aromatic side chains (*e.g.*, tyrosine, phenylalanine, tryptophan, histidine).

The terms “polypeptide,” “peptide” and “protein” (if single chain) are used interchangeably herein to refer to polymers of amino acids of any length. The polymer may be linear or branched, it may comprise modified amino acids, and it may be interrupted by non-amino acids. The terms also encompass an amino acid polymer that has been modified; for example, disulfide bond formation, glycosylation, lipidation, acetylation, phosphorylation, or any other manipulation, such as conjugation with a labeling component. The polypeptide can be isolated from natural sources, can be a produced by recombinant techniques from a eukaryotic or prokaryotic host, or can be a product of synthetic procedures.

The terms "nucleic acid," "nucleic acid sequence," "nucleotide sequence," or "polynucleotide sequence," and "polynucleotide" are used interchangeably. They refer to a polymeric form of nucleotides of any length, either deoxyribonucleotides or ribonucleotides, or analogs thereof. The polynucleotide may be either single-stranded or double-stranded, and if single-stranded may be the coding strand or non-coding (antisense) strand. A polynucleotide may comprise modified nucleotides, such as methylated nucleotides and nucleotide analogs. The sequence of nucleotides may be interrupted by non-nucleotide components. A polynucleotide may be further modified after polymerization, such as by conjugation with a labeling component. The nucleic acid may be a recombinant polynucleotide, or a polynucleotide of genomic, cDNA, semisynthetic, or synthetic origin which either does not occur in nature or is linked to another polynucleotide in a nonnatural arrangement.

The term “isolated,” as used herein, refers to material that is removed from its original or native environment (*e.g.*, the natural environment if it is naturally occurring). For example, a naturally-occurring polynucleotide or polypeptide present in a living animal is not isolated, but the same polynucleotide or polypeptide, separated by human intervention from some or all of the co-existing materials in the natural system, is isolated. Such polynucleotides could be part of a vector and/or such polynucleotides or polypeptides could be part of a composition, and still be isolated in that such vector or composition is not part of the environment in which it is found in nature.

Various aspects of the invention are described in further detail below. Additional definitions are set out throughout the specification.

Dosage Regimens

The anti-LAG-3 antibody molecules described herein can be administered according to a dosage regimen described herein to treat (*e.g.*, inhibit, reduce, ameliorate, or prevent) a disorder, *e.g.*, a hyperproliferative condition or disorder (*e.g.*, a cancer) in a subject. In certain embodiments, the anti-LAG-3 antibody molecule is administered to the subject at a dose of about 200 mg to about 2000 mg, *e.g.*, once every two, three, or four weeks.

In some aspect, the disclosure features a method of treating a cancer in a subject, the method comprising administering to the subject an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) at a dose or dosage schedule described herein.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results in binding, *e.g.*, saturates, soluble LAG-3 in the subject. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results in at least 50%, 60%, 70%, 80%, 85%, 90%, 95%, 98%, or 99% binding, *e.g.*, saturation, of soluble LAG-3 in the subject, *e.g.*, within 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, or 12, 24, 36, or 48 weeks of administration.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results in at least 50%, 60%, 70%, 80%, 90%, 95%, 98%, or 99% binding, *e.g.*, occupancy, of LAG-3 in a tumor in the subject, *e.g.*, within 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 24, 36, or 48 weeks of administration.

In other embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results in at least 50%, 60%, 70%, 80%, 85%, 90%, 95%, 98%, or 99% binding, *e.g.*, saturation, of soluble LAG-3 in the subject; and that results in at least 50%, 60%, 70%, 80%, 85%, 90%, 95%, 98%, or 99% binding, *e.g.*, occupancy, of LAG-3 in a tumor in the subject. In embodiments, the saturation and/or occupancy occurs, *e.g.*, within 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 24, 36, or 48 weeks of administration.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that results one or both of the following:

(a) 40% or more (*e.g.*, 50% or more, 60% or more, 70% or more, 80% or more, 85% or more, 90% or more, 95% or more, 99% or more) of the soluble LAG-3 in the subject (*e.g.*, blood) is bound by the anti-LAG-3 antibody molecule; or

(b) 50% or more (*e.g.*, 60% or more, 70% or more, 80% or more, 85% or more, 90% or more, 95% or more, 99% or more) of the membrane-bound LAG-3 in the subject (*e.g.*, cancer) is bound by the anti-LAG-3 antibody molecule.

In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3 is determined in a blood sample (*e.g.*, a serum sample or a plasma sample). In some embodiments, the binding of the anti-LAG-3 antibody molecule to membrane-bound LAG-3 is determined in the cancer (*e.g.*, a cancer sample).

In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3, the binding of the anti-LAG-3 antibody molecule to membrane-bound LAG-3, or both, is determined when the subject has a steady state trough level of the anti-LAG-3 antibody molecule. In some embodiments, the trough level is the concentration of the anti-LAG-3 antibody molecule about 24 weeks after the administration, or the lowest concentration that the anti-LAG-3 antibody molecule reaches before the next dose is administered. In some embodiments, the binding of the anti-LAG-3 antibody molecule to soluble LAG-3, the binding of the anti-LAG-3 antibody molecule to membrane-

bound LAG-3, or both, is determined, *e.g.,* measured *in vitro* (*e.g.*, by ELISA or a cell-based assay) or *in vivo* (*e.g.*, by imaging), or predicted from a PK/PD model, *e.g.*, a PK/PD model described herein.

In some embodiments, 50% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 60% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 70% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 80% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 85% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 95% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 50% or more, 60% or more, 70% or more, 80% or more, or 90% or more, of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 85% or more, 90% or more, or 95% or more, of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In some embodiments, 50% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 60% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 70% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 80% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule. In some embodiments, 90% or more of the soluble LAG-3 in a serum sample from the subject is bound by the anti-LAG-3 antibody molecule, and 90% or more of the membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject, is bound by the anti-LAG-3 antibody molecule.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose or dosage schedule that reduces one or both of:

(a) the level of free soluble LAG-3 in the subject, *e.g.*, to 40% or less (*e.g.*, 50% or less, 40% or less, 30% or less, 20% or less, 15% or less, 10% or less, 5% or less, or 1% or less) of a reference level of free soluble LAG-3; or

(b) the level of free membrane-bound LAG-3 in the subject, *e.g.*, to 50% or less (*e.g.*, 40% or less, 30% or less, 20% or less, 15% or less, 10% or less, 5% or less, or 1% or less) of a reference level of membrane-bound LAG-3.

In some embodiments, the level of free soluble LAG-3 is determined in a blood sample (*e.g.*, a serum sample or a plasma sample). In some embodiments, the reference level of free soluble LAG-3 is the baseline level of free soluble LAG-3 in the subject, *e.g.*, prior to administration of the anti-LAG-3 antibody molecule, *e.g.*, in accordance with the dosage schedule.

In some embodiments, the level of free membrane-bound LAG-3 is determined in the cancer (*e.g.*, a cancer sample). In some embodiments, the reference level of free membrane-bound LAG-3 is the baseline level of free membrane-bound LAG-3 in the subject, *e.g.*, prior to administration of the anti-LAG-3 antibody molecule, *e.g.*, in accordance with the dosage schedule.

In some embodiments, the level of free soluble LAG-3, the level of free membrane-bound LAG-3, or both, is determined when the subject has a steady state trough level of the anti-LAG-3 antibody molecule. In some embodiments, the trough level is the concentration of the anti-LAG-3 antibody molecule about 24 weeks after the administration, or the lowest concentration that the anti-LAG-3 antibody molecule reaches before the next dose is administered. In some embodiments, the level of free soluble LAG-3, the level of free membrane-bound LAG-3, or both, is determined, *e.g.*, measured *in vitro* (*e.g.*, by ELISA or a cell-based assay) or *in vivo* (*e.g.*, by imaging), or predicted from a PK/PD model, *e.g.*, a PK/PD model described herein.

In some embodiments, the level of free soluble LAG-3 is reduced to 50% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 40% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 30% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 20% or less of a reference level of free soluble LAG-3 in a serum sample from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 10% or less of a reference level of free soluble LAG-3 in a serum sample from the subject.

In some embodiments, the level of free membrane-bound LAG-3 is reduced to 15% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 5% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In some embodiments, the level of free soluble LAG-3 is reduced to 50% or less, 40% or less, 30% or less, 20% or less, or 10% or less, of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 15% or less, 10% or less, or 5% or less, of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In some embodiments, the level of free soluble LAG-3 is reduced to 50% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 40% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 30% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 20% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject. In some embodiments, the level of free soluble LAG-3 is reduced to 10% or less of a reference level of free soluble LAG-3 in a serum sample from the subject, and the level of free membrane-bound LAG-3 is reduced to 10% or less of a reference level of free membrane-bound LAG-3 in the cancer, or a cancer sample, from the subject.

In certain embodiments, the dose or dosage schedule results in a trough level (*e.g.*, a steady state trough level) of the anti-LAG-3 antibody molecule that is above a C_{crit} (*e.g.*, as described in Example 1). In some embodiments, the C_{crit} is a concentration below which non-linear PK is observed. In some embodiments, the C_{crit} is about 60 nM.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dosage regimen disclosed herein.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 200 mg to about 1600 mg, about 300 mg to about 1500 mg, about 400 mg to about 1400 mg, about 500 mg to about 1300 mg, about 600 mg to about 1200 mg, about 700 mg to about 1100 mg, about 800 mg to about 1000 mg, about 200 mg to about 1400 mg, about 200 mg to about 1200 mg, about 200 mg to about 1000 mg, about 200 mg to about 800 mg, about 200 mg to about 600 mg, about 200 mg to about 400 mg, about 1400 mg to about 1600 mg, about 1200 mg to about 1600 mg, about 1000 mg to about 1600 mg, about 800 mg to about 1600 mg, about 600 mg to about 1600 mg, about 400 mg to about 1600 mg, about 200 mg to about 600 mg, about 300 mg to about 700 mg, about 400 mg

to about 800 mg, about 500 mg to about 900 mg, about 600 mg to about 1000 mg, about 700 mg to about 1100 mg, about 800 mg to about 1200 mg, about 900 mg to about 1300 mg, about 1000 mg to about 1400 mg, about 1100 mg to about 1500 mg, or about 1200 mg to about 1600 mg, *e.g.*, once every two weeks, once every three weeks, or once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 200 mg to about 600 mg, about 250 mg to about 550 mg, about 300 mg to about 500 mg, about 350 mg to about 450 mg, about 200 mg to about 400 mg, about 400 mg to about 600 mg, *e.g.*, about 200 mg, about 250 mg, about 300 mg, about 350 mg, about 400 mg, about 450 mg, about 500 mg, about 550 mg, about 600 mg, *e.g.*, once every three weeks or once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg, *e.g.*, about 300 mg, about 320 mg, about 340 mg, about 360 mg, about 380 mg, about 400 mg, about 420 mg, about 440 mg, about 460 mg, about 480 mg, or about 500 mg, once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 350 mg to about 450 mg, *e.g.*, about 400 mg, once every three weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 1000 mg, about 650 mg to about 950 mg, about 700 mg to about 900 mg, about 750 mg to about 950 mg, about 600 mg to about 800 mg, about 800 mg to about 1000 mg, *e.g.*, about 600 mg, about 650 mg, about 700 mg, about 750 mg, about 800 mg, about 850 mg, about 900 mg, about 950 mg, about 1000 mg, *e.g.*, once every three weeks or once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 900 mg to about 1100 mg, *e.g.*, about 900 mg, about 920 mg, about 940 mg, about 960 mg, about 980 mg, about 900 mg, about 920 mg, about 940 mg, about 960 mg, about 980 mg, or about 1000 mg, once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 950 mg to about 1050 mg, *e.g.*, about 1000 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to about 900 mg, about 550 mg to about 850 mg, about 600 mg to about 800 mg, about 650 mg to about 750 mg, *e.g.*, about 500 mg, about 550mg, about 600 mg, about 650 mg, about 700 mg, about 750 mg, about 800 mg, about 850 mg, about 900 mg, *e.g.*, once every three weeks or once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 600 mg to about 800 mg, *e.g.*, about 600 mg, about 620 mg, about 640 mg, about 660 mg, about 680 mg, about 700 mg, about 720 mg, about 740 mg, about 760 mg, about 780 mg, or about 800 mg, once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 650 mg to about 750 mg, *e.g.*, about 700 mg, once every three weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 1200 mg to about 1600 mg, about 1250 mg to about 1550 mg, about 1300 mg to about 1500 mg, about 1350 mg to about 1450 mg, *e.g.*, about 1200 mg, about 1250 mg, about 1300 mg, about 1350 mg, about 1400 mg, about 1450 mg, about 1500 mg, about 1550 mg, about 1600 mg, *e.g.*, once every

three weeks or once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 1300 mg to about 1500 mg, *e.g.*, about 1300 mg, about 1320 mg, about 1340 mg, about 1360 mg, about 1380 mg, about 1400 mg, about 1420 mg, about 1440 mg, about 1460 mg, about 1480 mg, or about 1500 mg, once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 1350 mg to about 1450 mg, *e.g.*, about 1400 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 400 mg to about 700 mg, about 450 mg to about 650 mg, about 500 mg to about 600 mg, about 450 mg to about 550 mg, about 500 mg to about 600 mg, about 550 mg to about 650 mg, about 600 mg to about 700 mg, about 500 mg to about 550 mg, about 550 mg to about 600 mg, about 600 mg to about 650 mg, *e.g.*, about 400 mg, about 450 mg, about 500 mg, about 533 mg, about 550 mg, about 600 mg, about 650 mg, about 700 mg, *e.g.*, once four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 450 mg to about 650 mg, *e.g.*, about 450 mg, about 500 mg, about 533 mg, about 550 mg, about 600 mg, or about 650 mg, once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to about 650 mg, *e.g.*, about 533 mg or about 600 mg, once every four weeks.

In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 2000 mg or less, about 1900 mg or less, about 1800 mg or less, about 1700 mg or less, about 1600 mg or less, about 1500 mg or less, about 1400 mg or less, about 1300 mg or less, about 1200 mg or less, about 1100 mg or less, about 1000 mg or less, about 900 mg or less, about 800 mg or less, about 700 mg or less, about 600 mg or less, about 533 mg or less, about 500 mg or less, about 400 mg or less, about 300 mg or less, about 250 mg or less, or about 200 mg or less, once every two weeks, once every three weeks, or once every four weeks.

In some embodiments, the disorder is a cancer, *e.g.*, a cancer described herein. In certain embodiments, the cancer is a solid tumor. In some embodiments, the cancer is brain tumor, *e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor. In some embodiments, the cancer is a pancreatic cancer, *e.g.*, an advanced pancreatic cancer. In some embodiments, the cancer is a skin cancer, *e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma. In some embodiments, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma). In some embodiments, the cancer is a breast cancer, *e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the cancer is a virus-associated cancer. In some embodiments, the cancer is an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal). In some embodiments, the cancer is a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix). In some embodiments, the cancer is a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma). In some embodiments, the cancer is a head and neck cancer (*e.g.*, an

HPV positive and negative squamous cell cancer of the head and neck (SCCHN)). In some embodiments, the cancer is a nasopharyngeal cancer (NPC). In some embodiments, the cancer is a penile cancer (*e.g.*, a squamous cell carcinoma of the penile). In some embodiments, the cancer is a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the cancer is a colorectal cancer, *e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer (NSCLC). In certain embodiments, the cancer is a hematological cancer. In some embodiments, the cancer is a leukemia. In some embodiments, the cancer is a lymphoma, *e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL) (*e.g.*, a relapsed or refractory HL or DLBCL). In some embodiments, the cancer is a myeloma.

In other embodiments, the cancer is an MSI-high cancer. In some embodiments, the cancer is a metastatic cancer. In other embodiments, the cancer is an advanced cancer. In other embodiments, the cancer is a relapsed or refractory cancer. In other embodiments, the cancer is an unresectable cancer.

In one embodiment, the cancer is a Merkel cell carcinoma. In other embodiments, the cancer is a melanoma. In other embodiments, the cancer is a breast cancer, *e.g.*, a triple negative breast cancer (TNBC) or a HER2-negative breast cancer. In other embodiments, the cancer is a renal cell carcinoma (*e.g.*, a clear cell renal cell carcinoma (CCRCC) or a non-clear cell renal cell carcinoma (nccRCC)). In other embodiments, the cancer is a thyroid cancer, *e.g.*, an anaplastic thyroid carcinoma (ATC). In other embodiments, the cancer is a neuroendocrine tumor (NET), *e.g.*, an atypical pulmonary carcinoid tumor or an NET in pancreas, gastrointestinal (GI) tract, or lung. In certain embodiments, the cancer is a non-small cell lung cancer (NSCLC) (*e.g.*, a squamous NSCLC or a non-squamous NSCLC). In certain embodiments, the cancer is a fallopian tube cancer. In certain embodiments, the cancer is a microsatellite instability-high colorectal cancer (MSI-high CRC) or a microsatellite stable colorectal cancer (MSS CRC).

In some embodiments, the anti-LAG-3 antibody molecule is administered in combination with an anti-PD-1 antibody molecule (*e.g.*, an anti-PD-1 antibody molecule described herein). Without wishing to be bound by theory, it is believed that in some embodiments, anti-LAG-3 therapy is expected to have an additive effect in combination with anti-PD-1 therapy, as has been observed in mice (Woo *et al. Cancer Research* 72: 917-927 (2012)). The anti-PD-1 antibody molecule can be administered with or without a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). Without wishing to be bound by theory, it is believed that in some embodiments, addition of a chemotherapeutic agent will further enhance the efficacy of anti-LAG-3 immunotherapy, singly or in

combination with anti-PD-1 immunotherapy, by making the tumor more immuno-reactive and/or by altering the tumor microenvironment to achieve an optimal anti-tumor immune response.

In certain embodiments, the anti-PD-1 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks or about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In some embodiments, the anti-PD-1 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks. In some embodiments, the anti-PD-1 antibody molecule is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks and the anti-PD-1 antibody molecule is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks and the anti-PD-1 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 700 mg to 900 mg (*e.g.*, about 800 mg) once every four weeks and the anti-PD-1 antibody molecule is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 700 mg to 900 mg (*e.g.*, about 800 mg) once every four weeks and the anti-PD-1 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to 650 mg (*e.g.*, about 533 mg or about 600 mg) once every four weeks and the anti-PD-1 antibody molecule is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 500 mg to 650 mg (*e.g.*, about 533 mg or about 600 mg) once every four weeks and the anti-PD-1 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks.

In some embodiments, the anti-TIM-3 antibody molecule is administered in combination with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)). In some embodiments, the chemotherapeutic agent is a platinum agent. In certain embodiments, the platinum agent is carboplatin. In certain embodiments, the platinum agent is cisplatin. In certain embodiments, the platinum agent is oxaliplatin. In certain embodiments, the platinum agent is tetraplatin.

In some embodiments, the chemotherapeutic agent is a nucleotide analog or precursor analog. In certain embodiments, the nucleotide analog or precursor analog is capecitabine.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks and the chemotherapeutic agent (*e.g.*,

a platinum agent, *e.g.*, carboplatin) is administered at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks.

In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks, the anti-PD-1 antibody molecule is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks, and the chemotherapeutic agent (*e.g.*, a platinum agent, *e.g.*, carboplatin) is administered at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks.

In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the anti-PD-1 antibody molecule is PDR001 (spartalizumab).

In some embodiments, the anti-LAG-3 antibody molecule is LAG525 and the chemotherapeutic agent is a platinum agent. In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the platinum agent is carboplatin. In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the platinum agent is cisplatin. In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the platinum agent is oxaliplatin. In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the platinum agent is tetraplatin.

In some embodiments, the anti-LAG-3 antibody molecule is LAG525, the chemotherapeutic agent is a platinum agent, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-LAG-3 antibody molecule is LAG525, the platinum agent is carboplatin, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-LAG-3 antibody molecule is LAG525, the platinum agent is cisplatin, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-LAG-3 antibody molecule is LAG525, the platinum agent is oxaliplatin, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-LAG-3 antibody molecule is LAG525, the platinum agent is tetraplatin, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab).

In some embodiments, the anti-LAG-3 antibody molecule is LAG525 and the chemotherapeutic agent is a nucleotide analog or precursor analog. In certain embodiments, the anti-LAG-3 antibody molecule is LAG525 and the nucleotide analog or precursor analog is capecitabine.

In some embodiments, the anti-LAG-3 antibody molecule is LAG525, the chemotherapeutic agent is a nucleotide analog or precursor analog, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-LAG-3 antibody molecule is LAG525, the nucleotide analog or precursor analog is capecitabine, and the anti-PD-1 antibody molecule is PDR001 (spartalizumab).

Any of the doses disclosed herein can be repeat once, twice, three times, four times, five time, six time, seven time, eight times, nine times, ten times, or more.

Antibody Molecules

Disclosed herein methods, compositions, and formulations that include an antibody molecule that binds to a mammalian, *e.g.*, human, LAG-3. For example, the antibody molecule binds specifically to an epitope, *e.g.*, linear or conformational epitope, (*e.g.*, an epitope as described herein) on LAG-3.

As used herein, the term "antibody molecule" refers to a protein, *e.g.*, an immunoglobulin chain or fragment thereof, comprising at least one immunoglobulin variable domain sequence. The term "antibody molecule" includes, for example, a monoclonal antibody (including a full length antibody which has an immunoglobulin Fc region). In an embodiment, an antibody molecule comprises a full length antibody, or a full length immunoglobulin chain. In an embodiment, an antibody molecule comprises an antigen binding or functional fragment of a full length antibody, or a full length immunoglobulin chain. In an embodiment, an antibody molecule is a multispecific antibody molecule, *e.g.,* it comprises a plurality of immunoglobulin variable domain sequences, wherein a first immunoglobulin variable domain sequence of the plurality has binding specificity for a first epitope and a second immunoglobulin variable domain sequence of the plurality has binding specificity for a second epitope. In an embodiment, a multispecific antibody molecule is a bispecific antibody molecule.

In an embodiment, an antibody molecule is a monospecific antibody molecule and binds a single epitope. For example, a monospecific antibody molecule can have a plurality of immunoglobulin variable domain sequences, each of which binds the same epitope.

In an embodiment, an antibody molecule is a multispecific antibody molecule, *e.g.*, it comprises a plurality of immunoglobulin variable domains sequences, wherein a first immunoglobulin variable domain sequence of the plurality has binding specificity for a first epitope and a second immunoglobulin variable domain sequence of the plurality has binding specificity for a second epitope. In an embodiment, the first and second epitopes are on the same antigen, *e.g.*, the same protein (or subunit of a multimeric protein). In an embodiment, the first and second epitopes overlap. In an embodiment, the first and second epitopes do not overlap. In an embodiment, the first and second epitopes are on different antigens, *e.g.*, the different proteins (or different subunits of a multimeric protein). In an embodiment, a multispecific antibody molecule comprises a third, fourth or fifth immunoglobulin variable domain. In an embodiment, a multispecific antibody molecule is a bispecific antibody molecule, a trispecific antibody molecule, or tetraspecific antibody molecule,

In an embodiment, a multispecific antibody molecule is a bispecific antibody molecule. A bispecific antibody has specificity for no more than two antigens. A bispecific antibody molecule is characterized by a first immunoglobulin variable domain sequence which has binding specificity for a first epitope and a second immunoglobulin variable domain sequence that has binding specificity for a second epitope. In an embodiment, the first and second epitopes are on the same antigen, *e.g.*, the same protein (or subunit of a multimeric protein). In an embodiment, the first and second epitopes

overlap. In an embodiment the first and second epitopes do not overlap. In an embodiment, the first and second epitopes are on different antigens, *e.g.*, the different proteins (or different subunits of a multimeric protein). In an embodiment, a bispecific antibody molecule comprises a heavy chain variable domain sequence and a light chain variable domain sequence which have binding specificity for a first epitope and a heavy chain variable domain sequence and a light chain variable domain sequence which have binding specificity for a second epitope. In an embodiment, a bispecific antibody molecule comprises a half antibody having binding specificity for a first epitope and a half antibody having binding specificity for a second epitope. In an embodiment, a bispecific antibody molecule comprises a half antibody, or fragment thereof, having binding specificity for a first epitope and a half antibody, or fragment thereof, having binding specificity for a second epitope. In an embodiment, a bispecific antibody molecule comprises a scFv, or fragment thereof, have binding specificity for a first epitope and a scFv, or fragment thereof, have binding specificity for a second epitope. In an embodiment, the first epitope is located on LAG-3 and the second epitope is located on a PD-1, TIM-3, CEACAM (*e.g.*, CEACAM-1 and/or CEACAM-5), PD-L1, or PD-L2.

Protocols for generating multi-specific (*e.g.*, bispecific or trispecific) or heterodimeric antibody molecules are known in the art; including but not limited to, for example, the "knob in a hole" approach described in, *e.g.*, US5731168; the electrostatic steering Fc pairing as described in, *e.g.*, WO 09/089004, WO 06/106905 and WO 2010/129304; Strand Exchange Engineered Domains (SEED) heterodimer formation as described in, *e.g.*, WO 07/110205; Fab arm exchange as described in, *e.g.*, WO 08/119353, WO 2011/131746, and WO 2013/060867; double antibody conjugate, *e.g.*, by antibody cross-linking to generate a bi-specific structure using a heterobifunctional reagent having an amine-reactive group and a sulfhydryl reactive group as described in, *e.g.*, US4433059; bispecific antibody determinants generated by recombining half antibodies (heavy-light chain pairs or Fabs) from different antibodies through cycle of reduction and oxidation of disulfide bonds between the two heavy chains, as described in, *e.g.*, US 4444878; trifunctional antibodies, *e.g.*, three Fab' fragments cross-linked through sulfhdryl reactive groups, as described in, *e.g.*, US5273743; biosynthetic binding proteins, *e.g.*, pair of scFvs cross-linked through C-terminal tails preferably through disulfide or amine-reactive chemical cross-linking, as described in, *e.g.*, US5534254; bifunctional antibodies, *e.g.*, Fab fragments with different binding specificities dimerized through leucine zippers (*e.g.*, c-fos and c-jun) that have replaced the constant domain, as described in, *e.g.*, US5582996; bispecific and oligospecific mono-and oligovalent receptors, *e.g.*, VH-CH1 regions of two antibodies (two Fab fragments) linked through a polypeptide spacer between the CH1 region of one antibody and the VH region of the other antibody typically with associated light chains, as described in, *e.g.*, US5591828; bispecific DNA-antibody conjugates, *e.g.*, crosslinking of antibodies or Fab fragments through a double stranded piece of DNA, as described in, *e.g.*, US5635602; bispecific fusion proteins, *e.g.*, an expression construct containing two scFvs with a hydrophilic helical peptide linker between them and a full constant region, as described in, *e.g.*, US5637481; multivalent and multispecific binding

proteins, *e.g.*, dimer of polypeptides having first domain with binding region of Ig heavy chain variable region, and second domain with binding region of Ig light chain variable region, generally termed diabodies (higher order structures are also disclosed creating bispecific, trispecific, or tetraspecific molecules, as described in, *e.g.*, US5837242; minibody constructs with linked VL and VH chains further connected with peptide spacers to an antibody hinge region and CH3 region, which can be dimerized to form bispecific/multivalent molecules, as described in, *e.g.*, US5837821; VH and VL domains linked with a short peptide linker (*e.g.*, 5 or 10 amino acids) or no linker at all in either orientation, which can form dimers to form bispecific diabodies; trimers and tetramers, as described in, *e.g.*, US5844094; String of VH domains (or VL domains in family members) connected by peptide linkages with crosslinkable groups at the C-terminus further associated with VL domains to form a series of FVs (or scFvs), as described in, *e.g.*, US5864019; and single chain binding polypeptides with both a VH and a VL domain linked through a peptide linker are combined into multivalent structures through non-covalent or chemical crosslinking to form, *e.g.*, homobivalent, heterobivalent, trivalent, and tetravalent structures using both scFV or diabody type format, as described in, *e.g.*, US5869620. Additional exemplary multispecific and bispecific molecules and methods of making the same are found, for example, in US5910573, US5932448, US5959083, US5989830, US6005079, US6239259, US6294353, US6333396, US6476198, US6511663, US6670453, US6743896, US6809185, US6833441, US7129330, US7183076, US7521056, US7527787, US7534866, US7612181, US2002/004587A1, US2002/076406A1, US2002/103345A1, US2003/207346A1, US2003/211078A1, US2004/219643A1, US2004/220388A1, US2004/242847A1, US2005/003403A1, US2005/004352A1, US2005/069552A1, US2005/079170A1, US2005/100543A1, US2005/136049A1, US2005/136051A1, US2005/163782A1, US2005/266425A1, US2006/083747A1, US2006/120960A1, US2006/204493A1, US2006/263367A1, US2007/004909A1, US2007/087381A1, US2007/128150A1, US2007/141049A1, US2007/154901A1, US2007/274985A1, US2008/050370A1, US2008/069820A1, US2008/152645A1, US2008/171855A1, US2008/241884A1, US2008/254512A1, US2008/260738A1, US2009/130106A1, US2009/148905A1, US2009/155275A1, US2009/162359A1, US2009/162360A1, US2009/175851A1, US2009/175867A1, US2009/232811A1, US2009/234105A1, US2009/263392A1, US2009/274649A1, EP346087A2, WO00/06605A2, WO02/072635A2, WO04/081051A1, WO06/020258A2, WO2007/044887A2, WO2007/095338A2, WO2007/137760A2, WO2008/119353A1, WO2009/021754A2, WO2009/068630A1, WO91/03493A1, WO93/23537A1, WO94/09131A1, WO94/12625A2, WO95/09917A1, WO96/37621A2, WO99/64460A1. The contents of the above-referenced applications are incorporated herein by reference in their entireties.

In other embodiments, the anti-LAG-3 antibody molecule (*e.g.*, a monospecific, bispecific, or multispecific antibody molecule) is covalently linked, *e.g.*, fused, to another partner *e.g.*, a protein *e.g.*, one, two or more cytokines, *e.g.*, as a fusion molecule for example a fusion protein. In other embodiments, the fusion molecule comprises one or more proteins, *e.g.*, one, two or more cytokines. In one embodiment, the cytokine is an interleukin (IL) chosen from one, two, three or more of IL-1,

IL-2, IL-12, IL-15 or IL-21. In one embodiment, a bispecific antibody molecule has a first binding specificity to a first target (*e.g.*, to LAG-3), a second binding specificity to a second target (*e.g.*, PD-1 or TIM-3), and is optionally linked to an interleukin (*e.g.*, IL-12) domain *e.g.*, full length IL-12 or a portion thereof.

A "fusion protein" and a "fusion polypeptide" refer to a polypeptide having at least two portions covalently linked together, where each of the portions is a polypeptide having a different property. The property may be a biological property, such as activity *in vitro* or *in vivo*. The property can also be simple chemical or physical property, such as binding to a target molecule, catalysis of a reaction, etc. The two portions can be linked directly by a single peptide bond or through a peptide linker, but are in reading frame with each other.

In an embodiment, an antibody molecule comprises a diabody, and a single-chain molecule, as well as an antigen-binding fragment of an antibody (*e.g.*, Fab, F(ab')$_2$, and Fv). For example, an antibody molecule can include a heavy (H) chain variable domain sequence (abbreviated herein as VH), and a light (L) chain variable domain sequence (abbreviated herein as VL). In an embodiment an antibody molecule comprises or consists of a heavy chain and a light chain (referred to herein as a half antibody. In another example, an antibody molecule includes two heavy (H) chain variable domain sequences and two light (L) chain variable domain sequence, thereby forming two antigen binding sites, such as Fab, Fab', F(ab')$_2$, Fc, Fd, Fd', Fv, single chain antibodies (scFv for example), single variable domain antibodies, diabodies (Dab) (bivalent and bispecific), and chimeric (*e.g.*, humanized) antibodies, which may be produced by the modification of whole antibodies or those synthesized de novo using recombinant DNA technologies. These functional antibody fragments retain the ability to selectively bind with their respective antigen or receptor. Antibodies and antibody fragments can be from any class of antibodies including, but not limited to, IgG, IgA, IgM, IgD, and IgE, and from any subclass (*e.g.*, IgG1, IgG2, IgG3, and IgG4) of antibodies. The preparation of antibody molecules can be monoclonal or polyclonal. An antibody molecule can also be a human, humanized, CDR-grafted, or *in vitro* generated antibody. The antibody can have a heavy chain constant region chosen from, *e.g.*, IgG1, IgG2, IgG3, or IgG4. The antibody can also have a light chain chosen from, *e.g.*, kappa or lambda. The term "immunoglobulin" (Ig) is used interchangeably with the term "antibody" herein.

Examples of antigen-binding fragments of an antibody molecule include: (i) a Fab fragment, a monovalent fragment consisting of the VL, VH, CL and CH1 domains; (ii) a F(ab')2 fragment, a bivalent fragment comprising two Fab fragments linked by a disulfide bridge at the hinge region; (iii) a Fd fragment consisting of the VH and CH1 domains; (iv) a Fv fragment consisting of the VL and VH domains of a single arm of an antibody, (v) a diabody (dAb) fragment, which consists of a VH domain; (vi) a camelid or camelized variable domain; (vii) a single chain Fv (scFv), *see, e.g.*, Bird *et al.* (1988) *Science* 242:423-426; and Huston *et al.* (1988) *Proc. Natl. Acad. Sci. USA* 85:5879-5883); (viii) a single domain antibody. These antibody fragments are obtained using conventional techniques

known to those with skill in the art, and the fragments are screened for utility in the same manner as are intact antibodies.

The term "antibody" includes intact molecules as well as functional fragments thereof. Constant regions of the antibodies can be altered, *e.g.*, mutated, to modify the properties of the antibody (*e.g.*, to increase or decrease one or more of: Fc receptor binding, antibody glycosylation, the number of cysteine residues, effector cell function, or complement function).

Antibody molecules can also be single domain antibodies. Single domain antibodies can include antibodies whose complementary determining regions are part of a single domain polypeptide. Examples include, but are not limited to, heavy chain antibodies, antibodies naturally devoid of light chains, single domain antibodies derived from conventional 4-chain antibodies, engineered antibodies and single domain scaffolds other than those derived from antibodies. Single domain antibodies may be any of the art, or any future single domain antibodies. Single domain antibodies may be derived from any species including, but not limited to mouse, human, camel, llama, fish, shark, goat, rabbit, and bovine. According to another aspect of the invention, a single domain antibody is a naturally occurring single domain antibody known as heavy chain antibody devoid of light chains. Such single domain antibodies are disclosed in WO 94/04678, for example. For clarity reasons, this variable domain derived from a heavy chain antibody naturally devoid of light chain is known herein as a VHH or nanobody to distinguish it from the conventional VH of four chain immunoglobulins. Such a VHH molecule can be derived from antibodies raised in *Camelidae* species, for example in camel, llama, dromedary, alpaca and guanaco. Other species besides *Camelidae* may produce heavy chain antibodies naturally devoid of light chain; such VHHs are within the scope of the invention.

The VH and VL regions can be subdivided into regions of hypervariability, termed "complementarity determining regions" (CDR), interspersed with regions that are more conserved, termed "framework regions" (FR or FW).

The extent of the framework region and CDRs has been precisely defined by a number of methods (*see*, Kabat, E. A., *et al.* (1991) Sequences of Proteins of Immunological Interest, Fifth Edition, U.S. Department of Health and Human Services, NIH Publication No. 91-3242; Chothia, C. *et al.* (1987) *J. Mol. Biol.* 196:901-917; and the AbM definition used by Oxford Molecular's AbM antibody modeling software. *See*, generally, *e.g.*, *Protein Sequence and Structure Analysis of Antibody Variable Domains.* In: Antibody Engineering Lab Manual (Ed.: Duebel, S. and Kontermann, R., Springer-Verlag, Heidelberg).

The terms "complementarity determining region," and "CDR," as used herein refer to the sequences of amino acids within antibody variable regions which confer antigen specificity and binding affinity. In general, there are three CDRs in each heavy chain variable region (HCDR1, HCDR2, and HCDR3) and three CDRs in each light chain variable region (LCDR1, LCDR2, and LCDR3).

The precise amino acid sequence boundaries of a given CDR can be determined using any of a number of well-known schemes, including those described by Kabat *et al.* (1991), "Sequences of Proteins of Immunological Interest," 5th Ed. Public Health Service, National Institutes of Health, Bethesda, MD ("Kabat" numbering scheme), Al-Lazikani *et al.*, (1997) *JMB* 273,927-948 ("Chothia" numbering scheme). As used herein, the CDRs defined according the "Chothia" number scheme are also sometimes referred to as "hypervariable loops."

For example, under Kabat, the CDR amino acid residues in the heavy chain variable domain (VH) are numbered 31-35 (HCDR1), 50-65 (HCDR2), and 95-102 (HCDR3); and the CDR amino acid residues in the light chain variable domain (VL) are numbered 24-34 (LCDR1), 50-56 (LCDR2), and 89-97 (LCDR3). Under Chothia the CDR amino acids in the VH are numbered 26-32 (HCDR1), 52-56 (HCDR2), and 95-102 (HCDR3); and the amino acid residues in VL are numbered 26-32 (LCDR1), 50-52 (LCDR2), and 91-96 (LCDR3). By combining the CDR definitions of both Kabat and Chothia, the CDRs consist of amino acid residues 26-35 (HCDR1), 50-65 (HCDR2), and 95-102 (HCDR3) in human VH and amino acid residues 24-34 (LCDR1), 50-56 (LCDR2), and 89-97 (LCDR3) in human VL.

Generally, unless specifically indicated, the anti-LAG-3 antibody molecules can include any combination of one or more Kabat CDRs and/or Chothia hypervariable loops. In one embodiment, the following definitions are used for the anti-LAG-3 antibody molecules: HCDR1 according to the combined CDR definitions of both Kabat and Chothia, and HCCDRs 2-3 and LCCDRs 1-3 according the CDR definition of Kabat. Under all definitions, each VH and VL typically includes three CDRs and four FRs, arranged from amino-terminus to carboxy-terminus in the following order: FR1, CDR1, FR2, CDR2, FR3, CDR3, FR4.

As used herein, an "immunoglobulin variable domain sequence" refers to an amino acid sequence which can form the structure of an immunoglobulin variable domain. For example, the sequence may include all or part of the amino acid sequence of a naturally-occurring variable domain. For example, the sequence may or may not include one, two, or more N- or C-terminal amino acids, or may include other alterations that are compatible with formation of the protein structure.

The term "antigen-binding site" refers to the part of an antibody molecule that comprises determinants that form an interface that binds to the LAG-3 polypeptide, or an epitope thereof. With respect to proteins (or protein mimetics), the antigen-binding site typically includes one or more loops (of at least four amino acids or amino acid mimics) that form an interface that binds to the LAG-3 polypeptide. Typically, the antigen-binding site of an antibody molecule includes at least one or two CDRs and/or hypervariable loops, or more typically at least three, four, five or six CDRs and/or hypervariable loops.

The terms "compete" or "cross-compete" are used interchangeably herein to refer to the ability of an antibody molecule to interfere with binding of an anti-LAG-3 antibody molecule, *e.g.*, an anti-LAG-3 antibody molecule provided herein, to a target, *e.g.*, human LAG-3. The interference

with binding can be direct or indirect (*e.g.*, through an allosteric modulation of the antibody molecule or the target). The extent to which an antibody molecule is able to interfere with the binding of another antibody molecule to the target, and therefore whether it can be said to compete, can be determined using a competition binding assay, for example, a FACS assay, an ELISA or BIACORE assay. In some embodiments, a competition binding assay is a quantitative competition assay. In some embodiments, a first anti-LAG-3 antibody molecule is said to compete for binding to the target with a second anti-LAG-3 antibody molecule when the binding of the first antibody molecule to the target is reduced by 10% or more, *e.g.*, 20% or more, 30% or more, 40% or more, 50% or more, 55% or more, 60% or more, 65% or more, 70% or more, 75% or more, 80% or more, 85% or more, 90% or more, 95% or more, 98% or more, 99% or more in a competition binding assay (*e.g.*, a competition assay described herein).

The terms "monoclonal antibody" or "monoclonal antibody composition" as used herein refer to a preparation of antibody molecules of single molecular composition. A monoclonal antibody composition displays a single binding specificity and affinity for a particular epitope. A monoclonal antibody can be made by hybridoma technology or by methods that do not use hybridoma technology (*e.g.*, recombinant methods).

An "effectively human" protein is a protein that does not evoke a neutralizing antibody response, *e.g.*, the human anti-murine antibody (HAMA) response. HAMA can be problematic in a number of circumstances, *e.g.*, if the antibody molecule is administered repeatedly, *e.g.*, in treatment of a chronic or recurrent disease condition. A HAMA response can make repeated antibody administration potentially ineffective because of an increased antibody clearance from the serum (*see, e.g.,* Saleh *et al.*, *Cancer Immunol. Immunother.* 32:180-190 (1990)) and also because of potential allergic reactions (*see, e.g.,* LoBuglio *et al., Hybridoma*, 5:5117-5123 (1986)).

The antibody molecule can be a polyclonal or a monoclonal antibody. In other embodiments, the antibody can be recombinantly produced, *e.g.,* produced by phage display or by combinatorial methods.

Phage display and combinatorial methods for generating antibodies are known in the art (as described in, *e.g.,* Ladner *et al.* U.S. Patent No. 5,223,409; Kang *et al.* International Publication No. WO 92/18619; Dower *et al.* International Publication No. WO 91/17271; Winter *et al.* International Publication WO 92/20791; Markland *et al.* International Publication No. WO 92/15679; Breitling *et al.* International Publication WO 93/01288; McCafferty *et al.* International Publication No. WO 92/01047; Garrard *et al.* International Publication No. WO 92/09690; Ladner *et al.* International Publication No. WO 90/02809; Fuchs *et al.* (1991) *Bio/Technology* 9:1370-1372; Hay *et al.* (1992) *Hum Antibody Hybridomas* 3:81-85; Huse *et al.* (1989) *Science* 246:1275-1281; Griffths *et al.* (1993) *EMBO J* 12:725-734; Hawkins *et al.* (1992) *J Mol Biol* 226:889-896; Clackson *et al.* (1991) *Nature* 352:624-628; Gram *et al.* (1992) *PNAS* 89:3576-3580; Garrad *et al.* (1991) *Bio/Technology* 9:1373-

1377; Hoogenboom *et al.* (1991) *Nuc Acid Res* 19:4133-4137; and Barbas *et al.* (1991) *PNAS* 88:7978-7982, the contents of all of which are incorporated by reference herein).

In one embodiment, the antibody is a fully human antibody (*e.g.*, an antibody made in a mouse which has been genetically engineered to produce an antibody from a human immunoglobulin sequence), or a non-human antibody, *e.g.*, a rodent (mouse or rat), goat, primate (*e.g.*, monkey), camel antibody. Preferably, the non-human antibody is a rodent (mouse or rat antibody). Methods of producing rodent antibodies are known in the art.

Human monoclonal antibodies can be generated using transgenic mice carrying the human immunoglobulin genes rather than the mouse system. Splenocytes from these transgenic mice immunized with the antigen of interest are used to produce hybridomas that secrete human mAbs with specific affinities for epitopes from a human protein (*see*, *e.g.*, Wood *et al.* International Application WO 91/00906, Kucherlapati *et al.* PCT publication WO 91/10741; Lonberg *et al.* International Application WO 92/03918; Kay *et al.* International Application 92/03917; Lonberg, N. *et al.* 1994 *Nature* 368:856-859; Green, L.L. *et al.* 1994 *Nature Genet.* 7:13-21; Morrison, S.L. *et al.* 1994 *Proc. Natl. Acad. Sci. USA* 81:6851-6855; Bruggeman *et al.* 1993 *Year Immunol* 7:33-40; Tuaillon *et al.* 1993 *PNAS* 90:3720-3724; Bruggeman *et al.* 1991 *Eur J Immunol* 21:1323-1326).

An antibody can be one in which the variable region, or a portion thereof, *e.g.*, the CDRs, are generated in a non-human organism, *e.g.*, a rat or mouse. Chimeric, CDR-grafted, and humanized antibodies are within the invention. Antibodies generated in a non-human organism, *e.g.*, a rat or mouse, and then modified, *e.g.*, in the variable framework or constant region, to decrease antigenicity in a human are within the invention.

Chimeric antibodies can be produced by recombinant DNA techniques known in the art (*see* Robinson *et al.*, International Patent Publication PCT/US86/02269; Akira, *et al.*, European Patent Application 184,187; Taniguchi, M., European Patent Application 171,496; Morrison *et al.*, European Patent Application 173,494; Neuberger *et al.*, International Application WO 86/01533; Cabilly *et al.* U.S. Patent No. 4,816,567; Cabilly *et al.*, European Patent Application 125,023; Better *et al.* (1988 *Science* 240:1041-1043); Liu *et al.* (1987) *PNAS* 84:3439-3443; Liu *et al.*, 1987, *J. Immunol.* 139:3521-3526; Sun *et al.* (1987) *PNAS* 84:214-218; Nishimura *et al.*, 1987, *Canc. Res.* 47:999-1005; Wood *et al.* (1985) *Nature* 314:446-449; and Shaw *et al.*, 1988, *J. Natl Cancer Inst.* 80:1553-1559).

A humanized or CDR-grafted antibody will have at least one or two but generally all three recipient CDRs (of heavy and or light immunoglobulin chains) replaced with a donor CDR. The antibody may be replaced with at least a portion of a non-human CDR or only some of the CDRs may be replaced with non-human CDRs. It is only necessary to replace the number of CDRs required for binding of the humanized antibody to PD-1. Preferably, the donor will be a rodent antibody, *e.g.*, a rat or mouse antibody, and the recipient will be a human framework or a human consensus framework. Typically, the immunoglobulin providing the CDRs is called the "donor" and the immunoglobulin providing the framework is called the "acceptor." In one embodiment, the donor immunoglobulin is a

non-human (*e.g.*, rodent). The acceptor framework is a naturally-occurring (*e.g.*, a human) framework or a consensus framework, or a sequence about 85% or higher, preferably 90%, 95%, 99% or higher identical thereto.

As used herein, the term "consensus sequence" refers to the sequence formed from the most frequently occurring amino acids (or nucleotides) in a family of related sequences (*see, e.g.*, Winnaker, From Genes to Clones (Verlagsgesellschaft, Weinheim, Germany 1987). In a family of proteins, each position in the consensus sequence is occupied by the amino acid occurring most frequently at that position in the family. If two amino acids occur equally frequently, either can be included in the consensus sequence. A "consensus framework" refers to the framework region in the consensus immunoglobulin sequence.

An antibody can be humanized by methods known in the art (*see, e.g.*, Morrison, S. L., 1985, *Science* 229:1202-1207, by Oi *et al.*, 1986, *BioTechniques* 4:214, and by Queen *et al.* US 5,585,089, US 5,693,761 and US 5,693,762, the contents of all of which are hereby incorporated by reference).

Humanized or CDR-grafted antibodies can be produced by CDR-grafting or CDR substitution, wherein one, two, or all CDRs of an immunoglobulin chain can be replaced. *See, e.g.*, U.S. Patent 5,225,539; Jones *et al.* 1986 *Nature* 321:552-525; Verhoeyan *et al.* 1988 *Science* 239:1534; Beidler *et al.* 1988 *J. Immunol.* 141:4053-4060; Winter US 5,225,539, the contents of all of which are hereby expressly incorporated by reference. Winter describes a CDR-grafting method which may be used to prepare the humanized antibodies of the present invention (UK Patent Application GB 2188638A, filed on March 26, 1987; Winter US 5,225,539), the contents of which is expressly incorporated by reference.

Also within the scope of the invention are humanized antibodies in which specific amino acids have been substituted, deleted or added. Criteria for selecting amino acids from the donor are described in US 5,585,089, *e.g.*, columns 12-16 of US 5,585,089, *e.g.*, columns 12-16 of US 5,585,089, the contents of which are hereby incorporated by reference. Other techniques for humanizing antibodies are described in Padlan *et al.* EP 519596 A1, published on December 23, 1992.

The antibody molecule can be a single chain antibody. A single-chain antibody (scFV) may be engineered (*see*, for example, Colcher, D. *et al.* (1999) *Ann N Y Acad Sci* 880:263-80; and Reiter, Y. (1996) *Clin Cancer Res* 2:245-52). The single chain antibody can be dimerized or multimerized to generate multivalent antibodies having specificities for different epitopes of the same target protein.

In yet other embodiments, the antibody molecule has a heavy chain constant region chosen from, *e.g.*, the heavy chain constant regions of IgG1, IgG2, IgG3, IgG4, IgM, IgA1, IgA2, IgD, and IgE; particularly, chosen from, *e.g.*, the (*e.g.*, human) heavy chain constant regions of IgG1, IgG2, IgG3, and IgG4. In another embodiment, the antibody molecule has a light chain constant region chosen from, *e.*g., the (*e.g.*, human) light chain constant regions of kappa or lambda. The constant region can be altered, *e.g.*, mutated, to modify the properties of the antibody (*e.g.*, to increase or decrease one or more of: Fc receptor binding, antibody glycosylation, the number of cysteine residues,

effector cell function, and/or complement function). In one embodiment the antibody has: effector function; and can fix complement. In other embodiments the antibody does not; recruit effector cells; or fix complement. In another embodiment, the antibody has reduced or no ability to bind an Fc receptor. For example, it is a isotype or subtype, fragment or other mutant, which does not support binding to an Fc receptor, *e.g.*, it has a mutagenized or deleted Fc receptor binding region.

Methods for altering an antibody constant region are known in the art. Antibodies with altered function, *e.g.* altered affinity for an effector ligand, such as FcR on a cell, or the C1 component of complement can be produced by replacing at least one amino acid residue in the constant portion of the antibody with a different residue (*see, e.g.,* EP 388,151 A1, U.S. Pat. No. 5,624,821 and U.S. Pat. No. 5,648,260, the contents of all of which are hereby incorporated by reference). Similar type of alterations could be described which if applied to the murine, or other species immunoglobulin would reduce or eliminate these functions.

An antibody molecule can be derivatized or linked to another functional molecule (*e.g.*, another peptide or protein). As used herein, a "derivatized" antibody molecule is one that has been modified. Methods of derivatization include but are not limited to the addition of a fluorescent moiety, a radionucleotide, a toxin, an enzyme or an affinity ligand such as biotin. Accordingly, the antibody molecules of the invention are intended to include derivatized and otherwise modified forms of the antibodies described herein, including immunoadhesion molecules. For example, an antibody molecule can be functionally linked (by chemical coupling, genetic fusion, noncovalent association or otherwise) to one or more other molecular entities, such as another antibody (*e.g.*, a bispecific antibody or a diabody), a detectable agent, a cytotoxic agent, a pharmaceutical agent, and/or a protein or peptide that can mediate association of the antibody or antibody portion with another molecule (such as a streptavidin core region or a polyhistidine tag).

One type of derivatized antibody molecule is produced by crosslinking two or more antibodies (of the same type or of different types, *e.g.,* to create bispecific antibodies). Suitable crosslinkers include those that are heterobifunctional, having two distinctly reactive groups separated by an appropriate spacer (*e.g.*, m-maleimidobenzoyl-N-hydroxysuccinimide ester) or homobifunctional (*e.g.*, disuccinimidyl suberate). Such linkers are available from Pierce Chemical Company, Rockford, Ill.

Useful detectable agents with which an antibody molecule of the invention may be derivatized (or labeled) to include fluorescent compounds, various enzymes, prosthetic groups, luminescent materials, bioluminescent materials, fluorescent emitting metal atoms, *e.g.*, europium (Eu), and other anthanides, and radioactive materials (described below). Exemplary fluorescent detectable agents include fluorescein, fluorescein isothiocyanate, rhodamine, 5dimethylamine-1-napthalenesulfonyl chloride, phycoerythrin and the like. An antibody may also be derivatized with detectable enzymes, such as alkaline phosphatase, horseradish peroxidase, β-galactosidase, acetylcholinesterase, glucose oxidase and the like. When an antibody is derivatized with a detectable

enzyme, it is detected by adding additional reagents that the enzyme uses to produce a detectable reaction product. For example, when the detectable agent horseradish peroxidase is present, the addition of hydrogen peroxide and diaminobenzidine leads to a colored reaction product, which is detectable. An antibody molecule may also be derivatized with a prosthetic group (*e.g.*, streptavidin/biotin and avidin/biotin). For example, an antibody may be derivatized with biotin, and detected through indirect measurement of avidin or streptavidin binding. Examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, dansyl chloride or phycoerythrin; an example of a luminescent material includes luminol; and examples of bioluminescent materials include luciferase, luciferin, and aequorin.

Labeled antibody molecule can be used, for example, diagnostically and/or experimentally in a number of contexts, including (i) to isolate a predetermined antigen by standard techniques, such as affinity chromatography or immunoprecipitation; (ii) to detect a predetermined antigen (*e.g.*, in a cellular lysate or cell supernatant) in order to evaluate the abundance and pattern of expression of the protein; (iii) to monitor protein levels in tissue as part of a clinical testing procedure, *e.g.*, to determine the efficacy of a given treatment regimen.

An antibody molecules may be conjugated to another molecular entity, typically a label or a therapeutic (*e.g.*, a cytotoxic or cytostatic) agent or moiety. Radioactive isotopes can be used in diagnostic or therapeutic applications.

The invention provides radiolabeled antibody molecules and methods of labeling the same. In one embodiment, a method of labeling an antibody molecule is disclosed. The method includes contacting an antibody molecule, with a chelating agent, to thereby produce a conjugated antibody.

As is discussed above, the antibody molecule can be conjugated to a therapeutic agent. Therapeutically active radioisotopes have already been mentioned. Examples of other therapeutic agents include taxol, cytochalasin B, gramicidin D, ethidium bromide, emetine, mitomycin, etoposide, tenoposide, vincristine, vinblastine, colchicine, doxorubicin, daunorubicin, dihydroxy anthracin dione, mitoxantrone, mithramycin, actinomycin D, 1-dehydrotestosterone, glucocorticoids, procaine, tetracaine, lidocaine, propranolol, puromycin, maytansinoids, *e.g.*, maytansinol (*see, e.g.*, U.S. Pat. No. 5,208,020), CC-1065 (*see, e.g.*, U.S. Pat. Nos. 5,475,092, 5,585,499, 5,846, 545) and analogs or homologs thereof. Therapeutic agents include, but are not limited to, antimetabolites (*e.g.*, methotrexate, 6-mercaptopurine, 6-thioguanine, cytarabine, 5-fluorouracil decarbazine), alkylating agents (*e.g.*, mechlorethamine, thioepa chlorambucil, CC-1065, melphalan, carmustine (BSNU) and lomustine (CCNU), cyclothosphamide, busulfan, dibromomannitol, streptozotocin, mitomycin C, and cis-dichlorodiamine platinum (II) (DDP) cisplatin), anthracyclinies (*e.g.*, daunorubicin (formerly daunomycin) and doxorubicin), antibiotics (*e.g.*, dactinomycin (formerly actinomycin), bleomycin, mithramycin, and anthramycin (AMC)), and anti-mitotic agents (*e.g.*, vincristine, vinblastine, taxol and maytansinoids).

In one aspect, the disclosure provides a method of providing a target binding molecule that specifically binds to a target disclosed herein, *e.g.,* LAG-3. For example, the target binding molecule is an antibody molecule. The method includes: providing a target protein that comprises at least a portion of non-human protein, the portion being homologous to (at least 70, 75, 80, 85, 87, 90, 92, 94, 95, 96, 97, 98% identical to) a corresponding portion of a human target protein, but differing by at least one amino acid (*e.g.,* at least one, two, three, four, five, six, seven, eight, or nine amino acids); obtaining an antibody molecule that specifically binds to the antigen; and evaluating efficacy of the binding agent in modulating activity of the target protein. The method can further include administering the binding agent (*e.g.*, antibody molecule) or a derivative (*e.g.*, a humanized antibody molecule) to a human subject.

This disclosure provides an isolated nucleic acid molecule encoding the above antibody molecule, vectors and host cells thereof. The nucleic acid molecule includes but is not limited to RNA, genomic DNA and cDNA.

Exemplary Anti-LAG-3 Antibody Molecules

In one embodiment, the LAG-3 inhibitor is an anti-LAG-3 antibody molecule as disclosed in US 2015/0259420, published on September 17, 2015, entitled "Antibody Molecules to LAG-3 and Uses Thereof," incorporated by reference in its entirety.

In one embodiment, the anti-LAG-3 antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 5 (*e.g.*, from the heavy and light chain variable region sequences of BAP050-Clone I or BAP050-Clone J disclosed in Table 5), or encoded by a nucleotide sequence shown in Table 5. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 5). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 5). In some embodiments, the CDRs are according to the combined CDR definitions of both Kabat and Chothia (*e.g.*, as set out in Table 5). In one embodiment, the combination of Kabat and Chothia CDR of VH CDR1 comprises the amino acid sequence GFTLTNYGMN (SEQ ID NO: 766). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.,* conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 5, or encoded by a nucleotide sequence shown in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 701, a VHCDR2 amino acid sequence of SEQ ID NO: 702, and a VHCDR3 amino acid sequence of SEQ ID NO: 703; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 710, a VLCDR2 amino acid sequence of SEQ ID NO: 711, and a VLCDR3 amino acid sequence of SEQ ID NO: 712, each disclosed in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 736 or 737, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 738 or 739, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 740 or 741; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 746 or 747, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 748 or 749, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 750 or 751, each disclosed in Table 5. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 758 or 737, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 759 or 739, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 760 or 741; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 746 or 747, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 748 or 749, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 750 or 751, each disclosed in Table 5.

In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 706, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 706. In one embodiment, the anti-LAG-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 718, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 718. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 724, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 724. In one embodiment, the anti-LAG-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 730, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 730. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 706 and a VL comprising the amino acid sequence of SEQ ID NO: 718. In one embodiment, the anti-LAG-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 724 and a VL comprising the amino acid sequence of SEQ ID NO: 730.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 707 or 708, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 707 or 708. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 719 or 720, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 719 or 720. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 725 or 726, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 725 or 726. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 731 or 732, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 731 or 732. In one embodiment, the antibody molecule comprises a VH

encoded by the nucleotide sequence of SEQ ID NO: 707 or 708 and a VL encoded by the nucleotide sequence of SEQ ID NO: 719 or 720. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 725 or 726 and a VL encoded by the nucleotide sequence of SEQ ID NO: 731 or 732.

In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 709, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 709. In one embodiment, the anti-LAG-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 721, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 721. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 727, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 727. In one embodiment, the anti-LAG-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 733, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 733. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 709 and a light chain comprising the amino acid sequence of SEQ ID NO: 721. In one embodiment, the anti-LAG-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 727 and a light chain comprising the amino acid sequence of SEQ ID NO: 733.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 716 or 717, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 716 or 717. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 722 or 723, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 722 or 723. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 728 or 729, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 728 or 729. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 734 or 735, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 734 or 735. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 716 or 717 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 722 or 723. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 728 or 729 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 734 or 735.

The antibody molecules described herein can be made by vectors, host cells, and methods described in US 2015/0259420, incorporated by reference in its entirety.

Table 5. Amino acid and nucleotide sequences of exemplary anti-LAG-3 antibody molecules

BAP050-Clone I HC		
SEQ ID NO: 701 (Kabat)	HCDR1	NYGMN
SEQ ID NO: 702 (Kabat)	HCDR2	WINTDTGEPTYADDFKG
SEQ ID NO: 703 (Kabat)	HCDR3	NPPYYYGTNNAEAMDY
SEQ ID NO: 704 (Chothia)	HCDR1	GFTLTNY
SEQ ID NO: 705 (Chothia)	HCDR2	NTDTGE
SEQ ID NO: 703 (Chothia)	HCDR3	NPPYYYGTNNAEAMDY
SEQ ID NO:706	VH	QVQLVQSGAEVKKPGASVKVSCKASGFTLTNYGMNWVRQARGQ RLEWIGWINTDTGEPTYADDFKGRFVFSLDTSVSTAYLQISSLKAE DTAVYYCARNPPYYYGTNNAEAMDYWGQGTTVTVSS
SEQ ID NO: 707	DNA VH	CAAGTGCAGCTGGTGCAGTCGGGAGCCGAAGTGAAGAAGCCTG GAGCCTCGGTGAAGGTGTCGTGCAAGGCATCCGGATTCACCCT CACCAATTACGGGATGAACTGGGTCAGACAGGCCCGGGGTCAA CGGCTGGAGTGGATCGGATGGATTAACACCGACACCGGGGAGC CTACCTACGCGGACGATTTCAAGGGACGGTTCGTGTTCTCCCTC GACACCTCCGTGTCCACCGCCTACCTCCAAATCTCCTCACTGAA AGCGGAGGACACCGCCGTGTACTATTGCGCGAGGAACCCGCCC TACTACTACGGAACCAACAACGCCGAAGCCATGGACTACTGGG GCCAGGGCACCACTGTGACTGTGTCCAGC
SEQ ID NO: 708	DNA VH	CAGGTGCAGCTGGTGCAGTCTGGCGCCGAAGTGAAGAAACCTG GCGCCTCCGTGAAGGTGTCCTGCAAGGCCTCTGGCTTCACCCTG ACCAACTACGGCATGAACTGGGTGCGACAGGCCAGGGGCCAGC GGCTGGAATGGATCGGCTGGATCAACACCGACACCGGCGAGCC TACCTACGCCGACGACTTCAAGGGCAGATTCGTGTTCTCCCTGG ACACCTCCGTGTCCACCGCCTACCTGCAGATCTCCAGCCTGAAG GCCGAGGATACCGCCGTGTACTACTGCGCCCGGAACCCCCCTT ACTACTACGGCACCAACAACGCCGAGGCCATGGACTATTGGGG CCAGGGCACCACCGTGACCGTGTCCTCT
SEQ ID NO: 709	Heavy chain	QVQLVQSGAEVKKPGASVKVSCKASGFTLTNYGMNWVRQARGQ RLEWIGWINTDTGEPTYADDFKGRFVFSLDTSVSTAYLQISSLKAE DTAVYYCARNPPYYYGTNNAEAMDYWGQGTTVTVSSASTKGPS VFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTF PAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRV ESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVD VSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVL HQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPS QEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLD SDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLS LG
SEQ ID NO: 716	DNA heavy chain	CAAGTGCAGCTGGTGCAGTCGGGAGCCGAAGTGAAGAAGCCTG GAGCCTCGGTGAAGGTGTCGTGCAAGGCATCCGGATTCACCCT CACCAATTACGGGATGAACTGGGTCAGACAGGCCCGGGGTCAA CGGCTGGAGTGGATCGGATGGATTAACACCGACACCGGGGAGC CTACCTACGCGGACGATTTCAAGGGACGGTTCGTGTTCTCCCTC GACACCTCCGTGTCCACCGCCTACCTCCAAATCTCCTCACTGAA

		AGCGGAGGACACCGCCGTGTACTATTGCGCGAGGAACCCGCCC TACTACTACGGAACCAACAACGCCGAAGCCATGGACTACTGGG GCCAGGGCACCACTGTGACTGTGTCCAGCGCGTCCACTAAGGG CCCGTCCGTGTTCCCCCTGGCACCTTGTAGCCGGAGCACTAGCG AATCCACCGCTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCG GAGCCCGTGACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCG GAGTGCACACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTAC TCGCTGTCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTAC CAAGACCTACACTTGCAACGTGGACCACAAGCCTTCCAACACT AAGGTGGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTGCC CGCCTTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTCTTT CTGTTCCCACCGAAGCCCAAGGACACTTTGATGATTTCCCGCAC CCCTGAAGTGACATGCGTGGTCGTGGACGTGTCACAGGAAGAT CCGGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCGAGGTGC ACAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTCAACTCCAC TTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATCAGGACTGGC TGAACGGGAAGGAGTACAAGTGCAAAGTGTCCAACAAGGGAC TTCCTAGCTCAATCGAAAAGACCATCTCGAAAGCCAAGGGACA GCCCCGGGAACCCCAAGTGTATACCCTGCCACCGAGCCAGGAA GAAATGACTAAGAACCAAGTCTCATTGACTTGCCTTGTGAAGG GCTTCTACCCATCGGATATCGCCGTGGAATGGGAGTCCAACGG CCAGCCGGAAAACAACTACAAGACCACCCCTCCGGTGCTGGAC TCAGACGGATCCTTCTTCCTCTACTCGCGGCTGACCGTGGATAA GAGCAGATGGCAGGAGGGAAATGTGTTCAGCTGTTCTGTGATG CATGAAGCCCTGCACAACCACTACACTCAGAAGTCCCTGTCCCT CTCCCTGGGA
SEQ ID NO: 717	DNA heavy chain	CAGGTGCAGCTGGTGCAGTCTGGCGCCGAAGTGAAGAAACCTG GCGCCTCCGTGAAGGTGTCCTGCAAGGCCTCTGGCTTCACCCTG ACCAACTACGGCATGAACTGGGTGCGACAGGCCAGGGGCCAGC GGCTGGAATGGATCGGCTGGATCAACACCGACACCGGCGAGCC TACCTACGCCGACGACTTCAAGGGCAGATTCGTGTTCTCCCTGG ACACCTCCGTGTCCACCGCCTACCTGCAGATCTCCAGCCTGAAG GCCGAGGATACCGCCGTGTACTACTGCGCCCGGAACCCCCCTT ACTACTACGGCACCAACAACGCCGAGGCCATGGACTATTGGGG CCAGGGCACCACCGTGACCGTGTCCTCTGCTTCTACCAAGGGGC CCAGCGTGTTCCCCCTGGCCCCCTGCTCCAGAAGCACCAGCGA GAGCACAGCCGCCCTGGGCTGCCTGGTGAAGGACTACTTCCCC GAGCCCGTGACCGTGTCCTGGAACAGCGGAGCCCTGACCAGCG GCGTGCACACCTTCCCCGCCGTGCTGCAGAGCAGCGGCCTGTA CAGCCTGAGCAGCGTGGTGACCGTGCCCAGCAGCAGCCTGGGC ACCAAGACCTACACCTGTAACGTGGACCACAAGCCCAGCAACA CCAAGGTGGACAAGAGGGTGGAGAGCAAGTACGGCCCACCCT GCCCCCCCTGCCCAGCCCCCGAGTTCCTGGGCGGACCCAGCGT GTTCCTGTTCCCCCCCAAGCCCAAGGACACCCTGATGATCAGCA GAACCCCCGAGGTGACCTGTGTGGTGGTGGACGTGTCCCAGGA GGACCCCGAGGTCCAGTTCAACTGGTACGTGGACGGCGTGGAG GTGCACAACGCCAAGACCAAGCCCAGAGAGGAGCAGTTTAACA GCACCTACCGGGTGGTGTCCGTGCTGACCGTGCTGCACCAGGA CTGGCTGAACGGCAAAGAGTACAAGTGTAAGGTCTCCAACAAG GGCCTGCCAAGCAGCATCGAAAAGACCATCAGCAAGGCCAAG GGCCAGCCTAGAGAGCCCCAGGTCTACACCCTGCCACCCAGCC AAGAGGAGATGACCAAGAACCAGGTGTCCCTGACCTGTCTGGT

		GAAGGGCTTCTACCCAAGCGACATCGCCGTGGAGTGGGAGAGC AACGGCCAGCCCGAGAACAACTACAAGACCACCCCCCCAGTGC TGGACAGCGACGGCAGCTTCTTCCTGTACAGCAGGCTGACCGT GGACAAGTCCAGATGGCAGGAGGGCAACGTCTTTAGCTGCTCC GTGATGCACGAGGCCCTGCACAACCACTACACCCAGAAGAGCC TGAGCCTGTCCCTGGGC
BAP050-Clone I LC		
SEQ ID NO: 710 (Kabat)	LCDR1	SSSQDISNYLN
SEQ ID NO: 711 (Kabat)	LCDR2	YTSTLHL
SEQ ID NO: 712 (Kabat)	LCDR3	QQYYNLPWT
SEQ ID NO: 713 (Chothia)	LCDR1	SQDISNY
SEQ ID NO: 714 (Chothia)	LCDR2	YTS
SEQ ID NO: 715 (Chothia)	LCDR3	YYNLPW
SEQ ID NO: 718	VL	DIQMTQSPSSLSASVGDRVTITCSSSQDISNYLNWYLQKPGQSPQL LIYYTSTLHLGVPSRFSGSGSGTEFTLTISSLQPDDFATYYCQQYYN LPWTFGQGTKVEIK
SEQ ID NO: 719	DNA VL	GATATTCAGATGACTCAGTCACCTAGTAGCCTGAGCGCTAGTGT GGGCGATAGAGTGACTATCACCTGTAGCTCTAGTCAGGATATCT CTAACTACCTGAACTGGTATCTGCAGAAGCCCGGTCAATCACCT CAGCTGCTGATCTACTACACTAGCACCCTGCACCTGGGCGTGCC CTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGAGTTCACCCTGA CTATCTCTAGCCTGCAGCCCGACGACTTCGCTACCTACTACTGT CAGCAGTACTATAACCTGCCCTGGACCTTCGGTCAAGGCACTA AGGTCGAGATTAAG
SEQ ID NO: 720	DNA VL	GACATCCAGATGACCCAGTCCCCCTCCAGCCTGTCTGCTTCCGT GGGCGACAGAGTGACCATCACCTGTTCCTCCAGCCAGGACATC TCCAACTACCTGAACTGGTATCTGCAGAAGCCCGGCCAGTCCCC TCAGCTGCTGATCTACTACACCTCCACCCTGCACCTGGGCGTGC CCTCCAGATTTTCCGGCTCTGGCTCTGGCACCGAGTTTACCCTG ACCATCAGCTCCCTGCAGCCCGACGACTTCGCCACCTACTACTG CCAGCAGTACTACAACCTGCCCTGGACCTTCGGCCAGGGCACC AAGGTGGAAATCAAG
SEQ ID NO: 721	Light chain	DIQMTQSPSSLSASVGDRVTITCSSSQDISNYLNWYLQKPGQSPQL LIYYTSTLHLGVPSRFSGSGSGTEFTLTISSLQPDDFATYYCQQYYN LPWTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNF YPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKA DYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 722	DNA light chain	GATATTCAGATGACTCAGTCACCTAGTAGCCTGAGCGCTAGTGT GGGCGATAGAGTGACTATCACCTGTAGCTCTAGTCAGGATATCT CTAACTACCTGAACTGGTATCTGCAGAAGCCCGGTCAATCACCT CAGCTGCTGATCTACTACACTAGCACCCTGCACCTGGGCGTGCC CTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGAGTTCACCCTGA CTATCTCTAGCCTGCAGCCCGACGACTTCGCTACCTACTACTGT CAGCAGTACTATAACCTGCCCTGGACCTTCGGTCAAGGCACTA AGGTCGAGATTAAGCGTACGGTGGCCGCTCCCAGCGTGTTCAT CTTCCCCCCCCAGCGACGAGCAGCTGAAGAGCGGCACCGCCAGC GTGGTGTGCCTGCTGAACAACTTCTACCCCCGGGAGGCCAAGG TGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCAACAGCCA

		GGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCACCTACAGC CTGAGCAGCACCCTGACCCTGAGCAAGGCCGACTACGAGAAGC ATAAGGTGTACGCCTGCGAGGTGACCCACCAGGGCCTGTCCAG CCCCGTGACCAAGAGCTTCAACAGGGGCGAGTGC
SEQ ID NO: 723	DNA light chain	GACATCCAGATGACCCAGTCCCCCTCCAGCCTGTCTGCTTCCGT GGGCGACAGAGTGACCATCACCTGTTCCTCCAGCCAGGACATC TCCAACTACCTGAACTGGTATCTGCAGAAGCCCGGCCAGTCCCC TCAGCTGCTGATCTACTACACCTCCACCCTGCACCTGGGCGTGC CCTCCAGATTTTCCGGCTCTGGCTCTGGCACCGAGTTTACCCTG ACCATCAGCTCCCTGCAGCCCGACGACTTCGCCACCTACTACTG CCAGCAGTACTACAACCTGCCCTGGACCTTCGGCCAGGGCACC AAGGTGGAAATCAAGCGTACGGTGGCCGCTCCCAGCGTGTTCA TCTTCCCCCCAAGCGACGAGCAGCTGAAGAGCGGCACCGCCAG CGTGGTGTGTCTGCTGAACAACTTCTACCCCAGGGAGGCCAAG GTGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCAACAGCC AGGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCACCTACA GCCTGAGCAGCACCCTGACCCTGAGCAAGGCCGACTACGAGAA GCACAAGGTGTACGCCTGTGAGGTGACCCACCAGGGCCTGTCC AGCCCCGTGACCAAGAGCTTCAACAGGGGCGAGTGC
BAP050-Clone J HC		
SEQ ID NO: 701 (Kabat)	HCDR1	NYGMN
SEQ ID NO: 702 (Kabat)	HCDR2	WINTDTGEPTYADDFKG
SEQ ID NO: 703 (Kabat)	HCDR3	NPPYYYGTNNAEAMDY
SEQ ID NO: 704 (Chothia)	HCDR1	GFTLTNY
SEQ ID NO: 705 (Chothia)	HCDR2	NTDTGE
SEQ ID NO: 703 (Chothia)	HCDR3	NPPYYYGTNNAEAMDY
SEQ ID NO: 724	VH	QVQLVQSGAEVKKPGASVKVSCKASGFTLTNYGMNWVRQAPGQ GLEWMGWINTDTGEPTYADDFKGRFVFSLDTSVSTAYLQISSLKA EDTAVYYCARNPPYYYGTNNAEAMDYWGQGTTVTVSS
SEQ ID NO: 725	DNA VH	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCCG GCGCTAGTGTGAAAGTCAGCTGTAAAGCTAGTGGCTTCACCCT GACTAACTACGGGATGAACTGGGTCCGCCAGGCCCCAGGTCAA GGCCTCGAGTGGATGGGCTGGATTAACACCGACACCGGCGAGC CTACCTACGCCGACGACTTTAAGGGCAGATTCGTGTTTAGCCTG GACACTAGTGTGTCTACCGCCTACCTGCAGATCTCTAGCCTGAA GGCCGAGGACACCGCCGTCTACTACTGCGCTAGAAACCCCCCC TACTACTACGGCACTAACAACGCCGAGGCTATGGACTACTGGG GTCAAGGCACTACCGTGACCGTGTCTAGC
SEQ ID NO: 726	DNA VH	CAGGTGCAGCTGGTGCAGTCTGGCGCCGAAGTGAAGAAACCTG GCGCCTCCGTGAAGGTGTCCTGCAAGGCCTCTGGCTTCACCCTG ACCAACTACGGCATGAACTGGGTGCGACAGGCCCCTGGACAGG GCCTGGAATGGATGGGCTGGATCAACACCGACACCGGCGAGCC TACCTACGCCGACGACTTCAAGGGCAGATTCGTGTTCTCCCTGG ACACCTCCGTGTCCACCGCCTACCTGCAGATCTCCAGCCTGAAG GCCGAGGATACCGCCGTGTACTACTGCGCCCGGAACCCCCCTT ACTACTACGGCACCAACAACGCCGAGGCCATGGACTATTGGGG CCAGGGCACCACCGTGACCGTGTCCTCT
SEQ ID NO: 727	Heavy	QVQLVQSGAEVKKPGASVKVSCKASGFTLTNYGMNWVRQAPGQ

	chain	GLEWMGWINTDTGEPTYADDFKGRFVFSLDTSVSTAYLQISSLKA EDTAVYYCARNPPYYYGTNNAEAMDYWGQGTTVTVSSASTKGP SVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHT FPAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRV ESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVD VSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVL HQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPS QEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLD SDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLS LG
SEQ ID NO: 728	DNA heavy chain	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCCG GCGCTAGTGTGAAAGTCAGCTGTAAAGCTAGTGGCTTCACCCT GACTAACTACGGGATGAACTGGGTCCGCCAGGCCCCAGGTCAA GGCCTCGAGTGGATGGGCTGGATTAACACCGACACCGGCGAGC CTACCTACGCCGACGACTTTAAGGGCAGATTCGTGTTTAGCCTG GACACTAGTGTGTCTACCGCCTACCTGCAGATCTCTAGCCTGAA GGCCGAGGACACCGCCGTCTACTACTGCGCTAGAAACCCCCCC TACTACTACGGCACTAACAACGCCGAGGCTATGGACTACTGGG GTCAAGGCACTACCGTGACCGTGTCTAGCGCTAGCACTAAGGG CCCGTCCGTGTTCCCCCTGGCACCTTGTAGCCGGAGCACTAGCG AATCCACCGCTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCG GAGCCCGTGACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCG GAGTGCACACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTAC TCGCTGTCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTAC CAAGACCTACACTTGCAACGTGGACCACAAGCCTTCCAACACT AAGGTGGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTGCC CGCCTTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTCTTT CTGTTCCCACCGAAGCCCAAGGACACTTTGATGATTTCCCGCAC CCCTGAAGTGACATGCGTGGTCGTGGACGTGTCACAGGAAGAT CCGGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCGAGGTGC ACAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTCAACTCCAC TTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATCAGGACTGGC TGAACGGGAAGGAGTACAAGTGCAAAGTGTCCAACAAGGGAC TTCCTAGCTCAATCGAAAAGACCATCTCGAAAGCCAAGGGACA GCCCCGGGAACCCCAAGTGTATACCCTGCCACCGAGCCAGGAA GAAATGACTAAGAACCAAGTCTCATTGACTTGCCTTGTGAAGG GCTTCTACCCATCGGATATCGCCGTGGAATGGGAGTCCAACGG CCAGCCGGAAAACAACTACAAGACCACCCCTCCGGTGCTGGAC TCAGACGGATCCTTCTTCCTCTACTCGCGGCTGACCGTGGATAA GAGCAGATGGCAGGAGGGAAATGTGTTCAGCTGTTCTGTGATG CATGAAGCCCTGCACAACCACTACACTCAGAAGTCCCTGTCCCT CTCCCTGGGA
SEQ ID NO: 729	DNA heavy chain	CAGGTGCAGCTGGTGCAGTCTGGCGCCGAAGTGAAGAAACCTG GCGCCTCCGTGAAGGTGTCCTGCAAGGCCTCTGGCTTCACCCTG ACCAACTACGGCATGAACTGGGTGCGACAGGCCCCTGGACAGG GCCTGGAATGGATGGGCTGGATCAACACCGACACCGGCGAGCC TACCTACGCCGACGACTTCAAGGGCAGATTCGTGTTCTCCCTGG ACACCTCCGTGTCCACCGCCTACCTGCAGATCTCCAGCCTGAAG GCCGAGGATACCGCCGTGTACTACTGCGCCCGGAACCCCCCTT ACTACTACGGCACCAACAACGCCGAGGCCATGGACTATTGGGG CCAGGGCACCACCGTGACCGTGTCCTCTGCTTCTACCAAGGGGC CCAGCGTGTTCCCCCTGGCCCCCTGCTCCAGAAGCACCAGCGA

		GAGCACAGCCGCCCTGGGCTGCCTGGTGAAGGACTACTTCCCC GAGCCCGTGACCGTGTCCTGGAACAGCGGAGCCCTGACCAGCG GCGTGCACACCTTCCCCGCCGTGCTGCAGAGCAGCGGCCTGTA CAGCCTGAGCAGCGTGGTGACCGTGCCCAGCAGCAGCCTGGGC ACCAAGACCTACACCTGTAACGTGGACCACAAGCCCAGCAACA CCAAGGTGGACAAGAGGGTGGAGAGCAAGTACGGCCCACCCT GCCCCCCCTGCCCAGCCCCCGAGTTCCTGGGCGGACCCAGCGT GTTCCTGTTCCCCCCCAAGCCCAAGGACACCCTGATGATCAGCA GAACCCCCGAGGTGACCTGTGTGGTGGTGGACGTGTCCCAGGA GGACCCCGAGGTCCAGTTCAACTGGTACGTGGACGGCGTGGAG GTGCACAACGCCAAGACCAAGCCCAGAGAGGAGCAGTTTAACA GCACCTACCGGGTGGTGTCCGTGCTGACCGTGCTGCACCAGGA CTGGCTGAACGGCAAAGAGTACAAGTGTAAGGTCTCCAACAAG GGCCTGCCAAGCAGCATCGAAAAGACCATCAGCAAGGCCAAG GGCCAGCCTAGAGAGCCCCAGGTCTACACCCTGCCACCCAGCC AAGAGGAGATGACCAAGAACCAGGTGTCCCTGACCTGTCTGGT GAAGGGCTTCTACCCAAGCGACATCGCCGTGGAGTGGGAGAGC AACGGCCAGCCCGAGAACAACTACAAGACCACCCCCCCAGTGC TGGACAGCGACGGCAGCTTCTTCCTGTACAGCAGGCTGACCGT GGACAAGTCCAGATGGCAGGAGGGCAACGTCTTTAGCTGCTCC GTGATGCACGAGGCCCTGCACAACCACTACACCCAGAAGAGCC TGAGCCTGTCCCTGGGC
BAP050-Clone J LC		
SEQ ID NO: 710 (Kabat)	LCDR1	SSSQDISNYLN
SEQ ID NO: 711 (Kabat)	LCDR2	YTSTLHL
SEQ ID NO: 712 (Kabat)	LCDR3	QQYYNLPWT
SEQ ID NO: 713 (Chothia)	LCDR1	SQDISNY
SEQ ID NO: 714 (Chothia)	LCDR2	YTS
SEQ ID NO: 715 (Chothia)	LCDR3	YYNLPW
SEQ ID NO: 730	VL	DIQMTQSPSSLSASVGDRVTITCSSSQDISNYLNWYQQKPGKAPKL LIYYTSTLHLGIPPRFSGSGYGTDFTLTINNIESEDAAYYFCQQYYN LPWTFGQGTKVEIK
SEQ ID NO: 731	DNA VL	GATATTCAGATGACTCAGTCACCTAGTAGCCTGAGCGCTAGTGT GGGCGATAGAGTGACTATCACCTGTAGCTCTAGTCAGGATATCT CTAACTACCTGAACTGGTATCAGCAGAAGCCCGGTAAAGCCCC TAAGCTGCTGATCTACTACACTAGCACCCTGCACCTGGGAATCC CCCCTAGGTTTAGCGGTAGCGGCTACGGCACCGACTTCACCCTG ACTATTAACAATATCGAGTCAGAGGACGCCGCCTACTACTTCTG TCAGCAGTACTATAACCTGCCCTGGACCTTCGGTCAAGGCACTA AGGTCGAGATTAAG
SEQ ID NO: 732	DNA VL	GACATCCAGATGACCCAGTCCCCCTCCAGCCTGTCTGCTTCCGT GGGCGACAGAGTGACCATCACCTGTTCCTCCAGCCAGGACATC TCCAACTACCTGAACTGGTATCAGCAGAAGCCCGGCAAGGCCC CCAAGCTGCTGATCTACTACACCTCCACCCTGCACCTGGGCATC CCCCCTAGATTCTCCGGCTCTGGCTACGGCACCGACTTCACCCT GACCATCAACAACATCGAGTCCGAGGACGCCGCCTACTACTTC TGCCAGCAGTACTACAACCTGCCCTGGACCTTCGGCCAGGGCA CCAAGGTGGAAATCAAG

SEQ ID NO: 733	Light chain	DIQMTQSPSSLSASVGDRVTITCSSSQDISNYLNWYQQKPGKAPKL LIYYTSTLHLGIPPRFSGSGYGTDFTLTINNIESEDAAYYFCQQYYN LPWTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNF YPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKA DYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 734	DNA light chain	GATATTCAGATGACTCAGTCACCTAGTAGCCTGAGCGCTAGTGT GGGCGATAGAGTGACTATCACCTGTAGCTCTAGTCAGGATATCT CTAACTACCTGAACTGGTATCAGCAGAAGCCCGGTAAAGCCCC TAAGCTGCTGATCTACTACACTAGCACCCTGCACCTGGGAATCC CCCCTAGGTTTAGCGGTAGCGGCTACGGCACCGACTTCACCCTG ACTATTAACAATATCGAGTCAGAGGACGCCGCCTACTACTTCTG TCAGCAGTACTATAACCTGCCCTGGACCTTCGGTCAAGGCACTA AGGTCGAGATTAAGCGTACGGTGGCCGCTCCCAGCGTGTTCAT CTTCCCCCCCAGCGACGAGCAGCTGAAGAGCGGCACCGCCAGC GTGGTGTGCCTGCTGAACAACTTCTACCCCCGGGAGGCCAAGG TGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCAACAGCCA GGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCACCTACAGC CTGAGCAGCACCCTGACCCTGAGCAAGGCCGACTACGAGAAGC ATAAGGTGTACGCCTGCGAGGTGACCCACCAGGGCCTGTCCAG CCCCGTGACCAAGAGCTTCAACAGGGGCGAGTGC
SEQ ID NO: 735	DNA light chain	GACATCCAGATGACCCAGTCCCCCTCCAGCCTGTCTGCTTCCGT GGGCGACAGAGTGACCATCACCTGTTCCTCCAGCCAGGACATC TCCAACTACCTGAACTGGTATCAGCAGAAGCCCGGCAAGGCCC CCAAGCTGCTGATCTACTACACCTCCACCCTGCACCTGGGCATC CCCCCTAGATTCTCCGGCTCTGGCTACGGCACCGACTTCACCCT GACCATCAACAACATCGAGTCCGAGGACGCCGCCTACTACTTC TGCCAGCAGTACTACAACCTGCCCTGGACCTTCGGCCAGGGCA CCAAGGTGGAAATCAAGCGTACGGTGGCCGCTCCCAGCGTGTT CATCTTCCCCCCAAGCGACGAGCAGCTGAAGAGCGGCACCGCC AGCGTGGTGTGTCTGCTGAACAACTTCTACCCCAGGGAGGCCA AGGTGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCAACA GCCAGGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCACCTA CAGCCTGAGCAGCACCCTGACCCTGAGCAAGGCCGACTACGAG AAGCACAAGGTGTACGCCTGTGAGGTGACCCACCAGGGCCTGT CCAGCCCCGTGACCAAGAGCTTCAACAGGGGCGAGTGC
BAP050-Clone I HC		
SEQ ID NO: 736 (Kabat)	HCDR1	AATTACGGGATGAAC
SEQ ID NO: 737 (Kabat)	HCDR1	AACTACGGCATGAAC
SEQ ID NO: 738 (Kabat)	HCDR2	TGGATTAACACCGACACCGGGGAGCCTACCTACGCGGACGATT TCAAGGGA
SEQ ID NO: 739 (Kabat)	HCDR2	TGGATCAACACCGACACCGGCGAGCCTACCTACGCCGACGACT TCAAGGGC
SEQ ID NO: 740 (Kabat)	HCDR3	AACCCGCCCTACTACTACGGAACCAACAACGCCGAAGCCATGG ACTAC
SEQ ID NO: 741 (Kabat)	HCDR3	AACCCCCCTTACTACTACGGCACCAACAACGCCGAGGCCATGG ACTAT
SEQ ID NO: 742 (Chothia)	HCDR1	GGATTCACCCTCACCAATTAC
SEQ ID NO: 743 (Chothia)	HCDR1	GGCTTCACCCTGACCAACTAC
SEQ ID NO: 744	HCDR2	AACACCGACACCGGGGAG

(Chothia)		
SEQ ID NO: 745 (Chothia)	HCDR2	AACACCGACACCGGCGAG
SEQ ID NO: 740 (Chothia)	HCDR3	AACCCGCCCTACTACTACGGAACCAACAACGCCGAAGCCATGG ACTAC
SEQ ID NO: 741 (Chothia)	HCDR3	AACCCCCCTTACTACTACGGCACCAACAACGCCGAGGCCATGG ACTAT
BAP050-Clone I LC		
SEQ ID NO: 746 (Kabat)	LCDR1	AGCTCTAGTCAGGATATCTCTAACTACCTGAAC
SEQ ID NO: 747 (Kabat)	LCDR1	TCCTCCAGCCAGGACATCTCCAACTACCTGAAC
SEQ ID NO: 748 (Kabat)	LCDR2	TACACTAGCACCCTGCACCTG
SEQ ID NO: 749 (Kabat)	LCDR2	TACACCTCCACCCTGCACCTG
SEQ ID NO: 750 (Kabat)	LCDR3	CAGCAGTACTATAACCTGCCCTGGACC
SEQ ID NO: 751 (Kabat)	LCDR3	CAGCAGTACTACAACCTGCCCTGGACC
SEQ ID NO: 752 (Chothia)	LCDR1	AGTCAGGATATCTCTAACTAC
SEQ ID NO: 753 (Chothia)	LCDR1	AGCCAGGACATCTCCAACTAC
SEQ ID NO: 754 (Chothia)	LCDR2	TACACTAGC
SEQ ID NO: 755 (Chothia)	LCDR2	TACACCTCC
SEQ ID NO: 756 (Chothia)	LCDR3	TACTATAACCTGCCCTGG
SEQ ID NO: 757 (Chothia)	LCDR3	TACTACAACCTGCCCTGG
BAP050-Clone J HC		
SEQ ID NO: 758 (Kabat)	HCDR1	AACTACGGGATGAAC
SEQ ID NO: 737 (Kabat)	HCDR1	AACTACGGCATGAAC
SEQ ID NO: 759 (Kabat)	HCDR2	TGGATTAACACCGACACCGGCGAGCCTACCTACGCCGACGACT TTAAGGGC
SEQ ID NO: 739 (Kabat)	HCDR2	TGGATCAACACCGACACCGGCGAGCCTACCTACGCCGACGACT TCAAGGGC
SEQ ID NO: 760 (Kabat)	HCDR3	AACCCCCCCTACTACTACGGCACTAACAACGCCGAGGCTATGG ACTAC
SEQ ID NO: 741 (Kabat)	HCDR3	AACCCCCCTTACTACTACGGCACCAACAACGCCGAGGCCATGG ACTAT
SEQ ID NO: 761 (Chothia)	HCDR1	GGCTTCACCCTGACTAACTAC
SEQ ID NO: 743 (Chothia)	HCDR1	GGCTTCACCCTGACCAACTAC
SEQ ID NO: 744 (Chothia)	HCDR2	AACACCGACACCGGGGAG
SEQ ID NO: 745 (Chothia)	HCDR2	AACACCGACACCGGCGAG
SEQ ID NO: 760 (Chothia)	HCDR3	AACCCCCCCTACTACTACGGCACTAACAACGCCGAGGCTATGG ACTAC
SEQ ID NO: 741 (Chothia)	HCDR3	AACCCCCCTTACTACTACGGCACCAACAACGCCGAGGCCATGG ACTAT

BAP050-Clone J LC		
SEQ ID NO: 746 (Kabat)	LCDR1	AGCTCTAGTCAGGATATCTCTAACTACCTGAAC
SEQ ID NO: 747 (Kabat)	LCDR1	TCCTCCAGCCAGGACATCTCCAACTACCTGAAC
SEQ ID NO: 748 (Kabat)	LCDR2	TACACTAGCACCCTGCACCTG
SEQ ID NO: 749 (Kabat)	LCDR2	TACACCTCCACCCTGCACCTG
SEQ ID NO: 750 (Kabat)	LCDR3	CAGCAGTACTATAACCTGCCCTGGACC
SEQ ID NO: 751 (Kabat)	LCDR3	CAGCAGTACTACAACCTGCCCTGGACC
SEQ ID NO: 752 (Chothia)	LCDR1	AGTCAGGATATCTCTAACTAC
SEQ ID NO: 753 (Chothia)	LCDR1	AGCCAGGACATCTCCAACTAC
SEQ ID NO: 754 (Chothia)	LCDR2	TACACTAGC
SEQ ID NO: 755 (Chothia)	LCDR2	TACACCTCC
SEQ ID NO: 756 (Chothia)	LCDR3	TACTATAACCTGCCCTGG
SEQ ID NO: 757 (Chothia)	LCDR3	TACTACAACCTGCCCTGG

In one embodiment, the anti-LAG-3 antibody molecule includes at least one or two heavy chain variable domain (optionally including a constant region), at least one or two light chain variable domain (optionally including a constant region), or both, comprising the amino acid sequence of any of BAP050-hum01, BAP050-hum02, BAP050-hum03, BAP050-hum04, BAP050-hum05, BAP050-hum06, BAP050-hum07, BAP050-hum08, BAP050-hum09, BAP050-hum10, BAP050-hum11, BAP050-hum12, BAP050-hum13, BAP050-hum14, BAP050-hum15, BAP050-hum16, BAP050-hum17, BAP050-hum18, BAP050-hum19, BAP050-hum20, huBAP050(Ser) (*e.g.,* BAP050-hum01-Ser, BAP050-hum02-Ser, BAP050-hum03-Ser, BAP050-hum04-Ser, BAP050-hum05-Ser, BAP050-hum06-Ser, BAP050-hum07-Ser, BAP050-hum08-Ser, BAP050-hum09-Ser, BAP050-hum10-Ser, BAP050-hum11-Ser, BAP050-hum12-Ser, BAP050-hum13-Ser, BAP050-hum14-Ser, BAP050-hum15-Ser, BAP050-hum18-Ser, BAP050-hum19-Ser, or BAP050-hum20-Ser), BAP050-Clone-F, BAP050-Clone-G, BAP050-Clone-H, BAP050-Clone-I, or BAP050-Clone-J; or as described in Table 1 of US 2015/0259420, or encoded by the nucleotide sequence in Table 1; or a sequence substantially identical (*e.g.*, at least 80%, 85%, 90%, 92%, 95%, 97%, 98%, 99% or higher identical) to any of the aforesaid sequences.

In yet another embodiment, the anti- LAG-3 antibody molecule includes at least one, two, or three complementarity determining regions (CDRs) from a heavy chain variable region and/or a light chain variable region of an antibody described herein, *e.g.*, an antibody chosen from any of BAP050-hum01, BAP050-hum02, BAP050-hum03, BAP050-hum04, BAP050-hum05, BAP050-hum06, BAP050-hum07, BAP050-hum08, BAP050-hum09, BAP050-hum10, BAP050-hum11, BAP050-hum12, BAP050-hum13, BAP050-hum14, BAP050-hum15, BAP050-hum16, BAP050-hum17,

BAP050-hum18, BAP050-hum19, BAP050-hum20, huBAP050(Ser) (*e.g.*, BAP050-hum01-Ser, BAP050-hum02-Ser, BAP050-hum03-Ser, BAP050-hum04-Ser, BAP050-hum05-Ser, BAP050-hum06-Ser, BAP050-hum07-Ser, BAP050-hum08-Ser, BAP050-hum09-Ser, BAP050-hum10-Ser, BAP050-hum11-Ser, BAP050-hum12-Ser, BAP050-hum13-Ser, BAP050-hum14-Ser, BAP050-hum15-Ser, BAP050-hum18-Ser, BAP050-hum19-Ser, or BAP050-hum20-Ser), BAP050-Clone-F, BAP050-Clone-G, BAP050-Clone-H, BAP050-Clone-I, or BAP050-Clone-J; or as described in Table 1 of US 2015/0259420, or encoded by the nucleotide sequence in Table 1; or a sequence substantially identical (*e.g.*, at least 80%, 85%, 90%, 92%, 95%, 97%, 98%, 99% or higher identical) to any of the aforesaid sequences.

In yet another embodiment, the anti- LAG-3 antibody molecule includes at least one, two, or three CDRs (or collectively all of the CDRs) from a heavy chain variable region comprising an amino acid sequence shown in Table 1 of US 2015/0259420, or encoded by a nucleotide sequence shown in Table 1. In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions or deletions, relative to the amino acid sequence shown in Table 1, or encoded by a nucleotide sequence shown in Table 1. In yet another embodiment, the anti-LAG-3 antibody molecule includes at least one, two, or three CDRs (or collectively all of the CDRs) from a light chain variable region comprising an amino acid sequence shown in Table 1 of US 2015/0259420, or encoded by a nucleotide sequence shown in Table 1. In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions or deletions, relative to the amino acid sequence shown in Table 1, or encoded by a nucleotide sequence shown in Table 1. In certain embodiments, the anti-PD-L1 antibody molecule includes a substitution in a light chain CDR, *e.g.*, one or more substitutions in a CDR1, CDR2 and/or CDR3 of the light chain.

In another embodiment, the anti- LAG-3 antibody molecule includes at least one, two, three, four, five or six CDRs (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 1, or encoded by a nucleotide sequence shown in Table 1 of US 2015/0259420. In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions or deletions, relative to the amino acid sequence shown in Table 1, or encoded by a nucleotide sequence shown in Table 1.

Other Exemplary Anti-LAG-3 Antibody Molecules

In one embodiment, the anti-LAG-3 antibody molecule is BMS-986016 (Bristol-Myers Squibb), also known as BMS986016. BMS-986016 and other anti-LAG-3 antibodies are disclosed in WO 2015/116539 and US 9,505,839, incorporated by reference in their entirety. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all

of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of BMS-986016, *e.g.*, as disclosed in Table 6.

In one embodiment, the anti-LAG-3 antibody molecule is TSR-033 (Tesaro). In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of TSR-033.

In one embodiment, the anti-LAG-3 antibody molecule is IMP731 or GSK2831781 (GSK and Prima BioMed). IMP731 and other anti-LAG-3 antibodies are disclosed in WO 2008/132601 and US 9,244,059, incorporated by reference in their entirety. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of IMP731, *e.g.*, as disclosed in Table 6. In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of GSK2831781.

In one embodiment, the anti-LAG-3 antibody molecule is IMP761 (Prima BioMed). In one embodiment, the anti-LAG-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of IMP761.

Further known anti-LAG-3 antibodies include those described, *e.g.*, in WO 2008/132601, WO 2010/019570, WO 2014/140180, WO 2015/116539, WO 2015/200119, WO 2016/028672, US 9,244,059, US 9,505,839, incorporated by reference in their entirety.

In one embodiment, the anti-LAG-3 antibody is an antibody that competes for binding with, and/or binds to the same epitope on LAG-3 as, one of the anti-LAG-3 antibodies described herein.

In one embodiment, the anti-LAG-3 inhibitor is a soluble LAG-3 protein, *e.g.*, IMP321 (Prima BioMed), *e.g.*, as disclosed in WO 2009/044273, incorporated by reference in its entirety.

Table 6. Amino acid sequences of other exemplary anti-LAG-3 antibody molecules

BMS-986016		
SEQ ID NO: 762	Heavy chain	QVQLQQWGAGLLKPSETLSLTCAVYGGSFSDYYWNWIRQPPGKGLE WIGEINHRGSTNSNPSLKSRVTLSLDTSKNQFSLKLRSVTAADTAVYYC AFGYSDYEYNWFDPWGQGTLVTVSSASTKGPSVFPLAPCSRSTSESTA ALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTV PSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPPCPAPEFLGGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNA KTKPREEQFNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKT ISKAKGQPREPQVYTLPPSQEEMTKNQVSLTCLVKGFYPSDIAVEWES NGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEGNVFSCSVMHE ALHNHYTQKSLSLSLGK
SEQ ID NO: 763	Light chain	EIVLTQSPATLSLSPGERATLSCRASQSISSYLAWYQQKPGQAPRLLIYD

		ASNRATGIPARFSGSGSGTDFTLTISSLEPEDFAVYYCQQRSNWPLTFG QGTNLEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQW KVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACE VTHQGLSSPVTKSFNRGEC
IMP731		
SEQ ID NO: 764	Heavy chain	QVQLKESGPGLVAPSQSLSITCTVSGFSLTAYGVNWVRQPPGKGLEWL GMIWDDGSTDYNSALKSRLSISKDNSKSQVFLKMNSLQTDDTARYYC AREGDVAFDYWGQGTTLTVSSASTKGPSVFPLAPSSKSTSGGTAALGC LVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSL GTQTYICNVNHKPSNTKVDKKVEPKSCDKTHTCPPCPAPELLGGPSVF LFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAK TKPREEQYNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTI SKAKGQPREPQVYTLPPSRDELTKNQVSLTCLVKGFYPSDIAVEWESN GQPENNYKTTPPVLDSDGSFFLYSKLTVDKSRWQQGNVFSCSVMHEA LHNHYTQKSLSLSPGK
SEQ ID NO: 765	Light chain	DIVMTQSPSSLAVSVGQKVTMSCKSSQSLLNGSNQKNYLAWYQQKPG QSPKLLVYFASTRDSGVPDRFIGSGSGTDFTLTISSVQAEDLADYFCLQ HFGTPPTFGGGTKLEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFY PREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYE KHKVYACEVTHQGLSSPVTKSFNRGEC

PD-1 Inhibitors

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with a PD-1 inhibitor. In some embodiments, the PD-1 inhibitor is chosen from PDR001 or Spartalizumab (Novartis), Nivolumab (Bristol-Myers Squibb), Pembrolizumab (Merck & Co), Pidilizumab (CureTech), MEDI0680 (Medimmune), REGN2810 (Regeneron), TSR-042 (Tesaro), PF-06801591 (Pfizer), BGB-A317 (Beigene), BGB-108 (Beigene), INCSHR1210 (Incyte), or AMP-224 (Amplimmune).

Exemplary PD-1 Inhibitors

In one embodiment, the PD-1 inhibitor is an anti-PD-1 antibody molecule. In one embodiment, the PD-1 inhibitor is an anti-PD-1 antibody molecule as described in US 2015/0210769, published on July 30, 2015, entitled "Antibody Molecules to PD-1 and Uses Thereof," incorporated by reference in its entirety.

In one embodiment, the anti-PD-1 antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 1 (*e.g.*, from the heavy and light chain variable region sequences of BAP049-Clone-E or BAP049-Clone-B disclosed in Table 1), or encoded by a nucleotide sequence shown in Table 1. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 1). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 1). In some embodiments, the CDRs are according to the combined CDR definitions of both Kabat and Chothia (*e.g.*, as set out

in Table 1). In one embodiment, the combination of Kabat and Chothia CDR of VH CDR1 comprises the amino acid sequence GYTFTTYWMH (SEQ ID NO: 541). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.,* conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 1, or encoded by a nucleotide sequence shown in Table 1.

In one embodiment, the anti-PD-1 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 501, a VHCDR2 amino acid sequence of SEQ ID NO: 502, and a VHCDR3 amino acid sequence of SEQ ID NO: 503; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 510, a VLCDR2 amino acid sequence of SEQ ID NO: 511, and a VLCDR3 amino acid sequence of SEQ ID NO: 512, each disclosed in Table 1.

In one embodiment, the antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 524, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 525, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 526; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 529, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 530, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 531, each disclosed in Table 1.

In one embodiment, the anti-PD-1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 506, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 506. In one embodiment, the anti-PD-1 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 520, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 520. In one embodiment, the anti-PD-1 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 516, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 516. In one embodiment, the anti-PD-1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 506 and a VL comprising the amino acid sequence of SEQ ID NO: 520. In one embodiment, the anti-PD-1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 506 and a VL comprising the amino acid sequence of SEQ ID NO: 516.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 507, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 507. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 521 or 517, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 521 or 517. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 507 and a VL encoded by the nucleotide sequence of SEQ ID NO: 521 or 517.

In one embodiment, the anti-PD-1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 508, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 508. In one embodiment, the anti-PD-1 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 522, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 522. In one embodiment, the anti-PD-1 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 518, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 518. In one embodiment, the anti-PD-1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 508 and a light chain comprising the amino acid sequence of SEQ ID NO: 522. In one embodiment, the anti-PD-1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 508 and a light chain comprising the amino acid sequence of SEQ ID NO: 518.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 509, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 509. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 523 or 519, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 523 or 519. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 509 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 523 or 519.

The antibody molecules described herein can be made by vectors, host cells, and methods described in US 2015/0210769, incorporated by reference in its entirety.

Table 1. Amino acid and nucleotide sequences of exemplary anti-PD-1 antibody molecules

BAP049-Clone-B HC		
SEQ ID NO: 501 (Kabat)	HCDR1	TYWMH
SEQ ID NO: 502 (Kabat)	HCDR2	NIYPGTGGSNFDEKFKN
SEQ ID NO: 503 (Kabat)	HCDR3	WTTGTGAY
SEQ ID NO: 504 (Chothia)	HCDR1	GYTFTTY
SEQ ID NO: 505 (Chothia)	HCDR2	YPGTGG
SEQ ID NO: 503 (Chothia)	HCDR3	WTTGTGAY
SEQ ID NO: 506	VH	EVQLVQSGAEVKKPGESLRISCKGSGYTFTTYWMHWVRQATGQG LEWMGNIYPGTGGSNFDEKFKNRVTITADKSTSTAYMELSSLRSE DTAVYYCTRWTTGTGAYWGQGTTVTVSS
SEQ ID NO: 507	DNA VH	GAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAGCCCG GCGAGTCACTGAGAATTAGCTGTAAAGGTTCAGGCTACACCTT CACTACCTACTGGATGCACTGGGTCCGCCAGGCTACCGGTCAA GGCCTCGAGTGGATGGGTAATATCTACCCCGGCACCGGCGGCT CTAACTTCGACGAGAAGTTTAAGAATAGAGTGACTATCACCGC

		CGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCCTGA GATCAGAGGACACCGCCGTCTACTACTGCACTAGGTGGACTAC CGGCACAGGCGCCTACTGGGGTCAAGGCACTACCGTGACCGTG TCTAGC
SEQ ID NO: 508	Heavy chain	EVQLVQSGAEVKKPGESLRISCKGSGYTFTTYWMHWVRQATGQG LEWMGNIYPGTGGSNFDEKFKNRVTITADKSTSTAYMELSSLRSE DTAVYYCTRWTTGTGAYWGQGTTVTVSSASTKGPSVFPLAPCSRS TSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGL YSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPP CPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQF NWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKE YKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTKNQVS LTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRL TVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLSLG
SEQ ID NO: 509	DNA heavy chain	GAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAGCCCG GCGAGTCACTGAGAATTAGCTGTAAAGGTTCAGGCTACACCTT CACTACCTACTGGATGCACTGGGTCCGCCAGGCTACCGGTCAA GGCCTCGAGTGGATGGGTAATATCTACCCCGGCACCGGCGGCT CTAACTTCGACGAGAAGTTTAAGAATAGAGTGACTATCACCGC CGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCCTGA GATCAGAGGACACCGCCGTCTACTACTGCACTAGGTGGACTAC CGGCACAGGCGCCTACTGGGGTCAAGGCACTACCGTGACCGTG TCTAGCGCTAGCACTAAGGGCCCGTCCGTGTTCCCCCTGGCACC TTGTAGCCGGAGCACTAGCGAATCCACCGCTGCCCTCGGCTGCC TGGTCAAGGATTACTTCCCGGAGCCCGTGACCGTGTCCTGGAAC AGCGGAGCCCTGACCTCCGGAGTGCACACCTTCCCCGCTGTGCT GCAGAGCTCCGGGCTGTACTCGCTGTCGTCGGTGGTCACGGTGC CTTCATCTAGCCTGGGTACCAAGACCTACACTTGCAACGTGGAC CACAAGCCTTCCAACACTAAGGTGGACAAGCGCGTCGAATCGA AGTACGGCCCACCGTGCCCGCCTTGTCCCGCGCCGGAGTTCCTC GGCGGTCCCTCGGTCTTTCTGTTCCCACCGAAGCCCAAGGACAC TTTGATGATTTCCCGCACCCCTGAAGTGACATGCGTGGTCGTGG ACGTGTCACAGGAAGATCCGGAGGTGCAGTTCAATTGGTACGT GGATGGCGTCGAGGTGCACAACGCCAAAACCAAGCCGAGGGA GGAGCAGTTCAACTCCACTTACCGCGTCGTGTCCGTGCTGACGG TGCTGCATCAGGACTGGCTGAACGGGAAGGAGTACAAGTGCAA AGTGTCCAACAAGGGACTTCCTAGCTCAATCGAAAAGACCATC TCGAAAGCCAAGGGACAGCCCCGGGAACCCCAAGTGTATACCC TGCCACCGAGCCAGGAAGAAATGACTAAGAACCAAGTCTCATT GACTTGCCTTGTGAAGGGCTTCTACCCATCGGATATCGCCGTGG AATGGGAGTCCAACGGCCAGCCGGAAAACAACTACAAGACCA CCCCTCCGGTGCTGGACTCAGACGGATCCTTCTTCCTCTACTCG CGGCTGACCGTGGATAAGAGCAGATGGCAGGAGGGAAATGTGT TCAGCTGTTCTGTGATGCATGAAGCCCTGCACAACCACTACACT CAGAAGTCCCTGTCCCTCTCCCTGGGA
BAP049-Clone-B LC		
SEQ ID NO: 510 (Kabat)	LCDR1	KSSQSLLDSGNQKNFLT
SEQ ID NO: 511 (Kabat)	LCDR2	WASTRES
SEQ ID NO: 512 (Kabat)	LCDR3	QNDYSYPYT
SEQ ID NO: 513 (Chothia)	LCDR1	SQSLLDSGNQKNF

SEQ ID NO: 514 (Chothia)	LCDR2	WAS
SEQ ID NO: 515 (Chothia)	LCDR3	DYSYPY
SEQ ID NO: 516	VL	EIVLTQSPATLSLSPGERATLSCKSSQSLLDSGNQKNFLTWYQQKP GKAPKLLIYWASTRESGVPSRFSGSGSGTDFTFTISSLQPEDIATYY CQNDYSYPYTFGQGTKVEIK
SEQ ID NO: 517	DNA VL	GAGATCGTCCTGACTCAGTCACCCGCTACCCTGAGCCTGAGCCC TGGCGAGCGGGCTACACTGAGCTGTAAATCTAGTCAGTCACTG CTGGATAGCGGTAATCAGAAGAACTTCCTGACCTGGTATCAGC AGAAGCCCGGTAAAGCCCCTAAGCTGCTGATCTACTGGGCCTC TACTAGAGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCTTCACTATCTCTAGCCTGCAGCCCGA GGATATCGCTACCTACTACTGTCAGAACGACTATAGCTACCCCT ACACCTTCGGTCAAGGCACTAAGGTCGAGATTAAG
SEQ ID NO: 518	Light chain	EIVLTQSPATLSLSPGERATLSCKSSQSLLDSGNQKNFLTWYQQKP GKAPKLLIYWASTRESGVPSRFSGSGSGTDFTFTISSLQPEDIATYY CQNDYSYPYTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVV CLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSST LTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 519	DNA light chain	GAGATCGTCCTGACTCAGTCACCCGCTACCCTGAGCCTGAGCCC TGGCGAGCGGGCTACACTGAGCTGTAAATCTAGTCAGTCACTG CTGGATAGCGGTAATCAGAAGAACTTCCTGACCTGGTATCAGC AGAAGCCCGGTAAAGCCCCTAAGCTGCTGATCTACTGGGCCTC TACTAGAGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCTTCACTATCTCTAGCCTGCAGCCCGA GGATATCGCTACCTACTACTGTCAGAACGACTATAGCTACCCCT ACACCTTCGGTCAAGGCACTAAGGTCGAGATTAAGCGTACGGT GGCCGCTCCCAGCGTGTTCATCTTCCCCCCCAGCGACGAGCAGC TGAAGAGCGGCACCGCCAGCGTGGTGTGCCTGCTGAACAACTT CTACCCCCGGGAGGCCAAGGTGCAGTGGAAGGTGGACAACGCC CTGCAGAGCGGCAACAGCCAGGAGAGCGTCACCGAGCAGGAC AGCAAGGACTCCACCTACAGCCTGAGCAGCACCCTGACCCTGA GCAAGGCCGACTACGAGAAGCATAAGGTGTACGCCTGCGAGGT GACCCACCAGGGCCTGTCCAGCCCCGTGACCAAGAGCTTCAAC AGGGGCGAGTGC
BAP049-Clone-E HC		
SEQ ID NO: 501 (Kabat)	HCDR1	TYWMH
SEQ ID NO: 502 (Kabat)	HCDR2	NIYPGTGGSNFDEKFKN
SEQ ID NO: 503 (Kabat)	HCDR3	WTTGTGAY
SEQ ID NO: 504 (Chothia)	HCDR1	GYTFTTY
SEQ ID NO: 505 (Chothia)	HCDR2	YPGTGG
SEQ ID NO: 503 (Chothia)	HCDR3	WTTGTGAY
SEQ ID NO: 506	VH	EVQLVQSGAEVKKPGESLRISCKGSGYTFTTYWMHWVRQATGQG LEWMGNIYPGTGGSNFDEKFKNRVTITADKSTSTAYMELSSLRSE DTAVYYCTRWTTGTGAYWGQGTTVTVSS
SEQ ID NO: 507	DNA VH	GAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAGCCCG GCGAGTCACTGAGAATTAGCTGTAAAGGTTCAGGCTACACCTT

		CACTACCTACTGGATGCACTGGGTCCGCCAGGCTACCGGTCAA GGCCTCGAGTGGATGGGTAATATCTACCCCGGCACCGGCGGCT CTAACTTCGACGAGAAGTTTAAGAATAGAGTGACTATCACCGC CGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCCTGA GATCAGAGGACACCGCCGTCTACTACTGCACTAGGTGGACTAC CGGCACAGGCGCCTACTGGGGTCAAGGCACTACCGTGACCGTG TCTAGC
SEQ ID NO: 508	Heavy chain	EVQLVQSGAEVKKPGESLRISCKGSGYTFTTYWMHWVRQATGQG LEWMGNIYPGTGGSNFDEKFKNRVTITADKSTSTAYMELSSLRSE DTAVYYCTRWTTGTGAYWGQGTTVTVSSASTKGPSVFPLAPCSRS TSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGL YSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPP CPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQF NWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKE YKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTKNQVS LTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRL TVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLSLG
SEQ ID NO: 509	DNA heavy chain	GAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAGCCCG GCGAGTCACTGAGAATTAGCTGTAAAGGTTCAGGCTACACCTT CACTACCTACTGGATGCACTGGGTCCGCCAGGCTACCGGTCAA GGCCTCGAGTGGATGGGTAATATCTACCCCGGCACCGGCGGCT CTAACTTCGACGAGAAGTTTAAGAATAGAGTGACTATCACCGC CGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCCTGA GATCAGAGGACACCGCCGTCTACTACTGCACTAGGTGGACTAC CGGCACAGGCGCCTACTGGGGTCAAGGCACTACCGTGACCGTG TCTAGCGCTAGCACTAAGGGCCCGTCCGTGTTCCCCCTGGCACC TTGTAGCCGGAGCACTAGCGAATCCACCGCTGCCCTCGGCTGCC TGGTCAAGGATTACTTCCCGGAGCCCGTGACCGTGTCCTGGAAC AGCGGAGCCCTGACCTCCGGAGTGCACACCTTCCCCGCTGTGCT GCAGAGCTCCGGGCTGTACTCGCTGTCGTCGGTGGTCACGGTGC CTTCATCTAGCCTGGGTACCAAGACCTACACTTGCAACGTGGAC CACAAGCCTTCCAACACTAAGGTGGACAAGCGCGTCGAATCGA AGTACGGCCCACCGTGCCCGCCTTGTCCCGCGCCGGAGTTCCTC GGCGGTCCCTCGGTCTTTCTGTTCCCACCGAAGCCCAAGGACAC TTTGATGATTTCCCGCACCCCTGAAGTGACATGCGTGGTCGTGG ACGTGTCACAGGAAGATCCGGAGGTGCAGTTCAATTGGTACGT GGATGGCGTCGAGGTGCACAACGCCAAAACCAAGCCGAGGGA GGAGCAGTTCAACTCCACTTACCGCGTCGTGTCCGTGCTGACGG TGCTGCATCAGGACTGGCTGAACGGGAAGGAGTACAAGTGCAA AGTGTCCAACAAGGGACTTCCTAGCTCAATCGAAAAGACCATC TCGAAAGCCAAGGGACAGCCCCGGGAACCCCAAGTGTATACCC TGCCACCGAGCCAGGAAGAAATGACTAAGAACCAAGTCTCATT GACTTGCCTTGTGAAGGGCTTCTACCCATCGGATATCGCCGTGG AATGGGAGTCCAACGGCCAGCCGGAAAACAACTACAAGACCA CCCCTCCGGTGCTGGACTCAGACGGATCCTTCTTCCTCTACTCG CGGCTGACCGTGGATAAGAGCAGATGGCAGGAGGGAAATGTGT TCAGCTGTTCTGTGATGCATGAAGCCCTGCACAACCACTACACT CAGAAGTCCCTGTCCCTCTCCCTGGGA
BAP049-Clone-E LC		
SEQ ID NO: 510 (Kabat)	LCDR1	KSSQSLLDSGNQKNFLT
SEQ ID NO: 511 (Kabat)	LCDR2	WASTRES

SEQ ID NO: 512 (Kabat)	LCDR3	QNDYSYPYT
SEQ ID NO: 513 (Chothia)	LCDR1	SQSLLDSGNQKNF
SEQ ID NO: 514 (Chothia)	LCDR2	WAS
SEQ ID NO: 515 (Chothia)	LCDR3	DYSYPY
SEQ ID NO: 520	VL	EIVLTQSPATLSLSPGERATLSCKSSQSLLDSGNQKNFLTWYQQKP GQAPRLLIYWASTRESGVPSRFSGSGSGTDFTFTISSLEAEDAATYY CQNDYSYPYTFGQGTKVEIK
SEQ ID NO: 521	DNA VL	GAGATCGTCCTGACTCAGTCACCCGCTACCCTGAGCCTGAGCCC TGGCGAGCGGGCTACACTGAGCTGTAAATCTAGTCAGTCACTG CTGGATAGCGGTAATCAGAAGAACTTCCTGACCTGGTATCAGC AGAAGCCCGGTCAAGCCCCTAGACTGCTGATCTACTGGGCCTCT ACTAGAGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGTA GTGGCACCGACTTCACCTTCACTATCTCTAGCCTGGAAGCCGAG GACGCCGCTACCTACTACTGTCAGAACGACTATAGCTACCCCTA CACCTTCGGTCAAGGCACTAAGGTCGAGATTAAG
SEQ ID NO: 522	Light chain	EIVLTQSPATLSLSPGERATLSCKSSQSLLDSGNQKNFLTWYQQKP GQAPRLLIYWASTRESGVPSRFSGSGSGTDFTFTISSLEAEDAATYY CQNDYSYPYTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVV CLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSST LTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 523	DNA light chain	GAGATCGTCCTGACTCAGTCACCCGCTACCCTGAGCCTGAGCCC TGGCGAGCGGGCTACACTGAGCTGTAAATCTAGTCAGTCACTG CTGGATAGCGGTAATCAGAAGAACTTCCTGACCTGGTATCAGC AGAAGCCCGGTCAAGCCCCTAGACTGCTGATCTACTGGGCCTCT ACTAGAGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGTA GTGGCACCGACTTCACCTTCACTATCTCTAGCCTGGAAGCCGAG GACGCCGCTACCTACTACTGTCAGAACGACTATAGCTACCCCTA CACCTTCGGTCAAGGCACTAAGGTCGAGATTAAGCGTACGGTG GCCGCTCCCAGCGTGTTCATCTTCCCCCCCAGCGACGAGCAGCT GAAGAGCGGCACCGCCAGCGTGGTGTGCCTGCTGAACAACTTC TACCCCCGGGAGGCCAAGGTGCAGTGGAAGGTGGACAACGCCC TGCAGAGCGGCAACAGCCAGGAGAGCGTCACCGAGCAGGACA GCAAGGACTCCACCTACAGCCTGAGCAGCACCCTGACCCTGAG CAAGGCCGACTACGAGAAGCATAAGGTGTACGCCTGCGAGGTG ACCCACCAGGGCCTGTCCAGCCCCGTGACCAAGAGCTTCAACA GGGGCGAGTGC
BAP049-Clone-B HC		
SEQ ID NO: 524 (Kabat)	HCDR1	ACCTACTGGATGCAC
SEQ ID NO: 525 (Kabat)	HCDR2	AATATCTACCCCGGCACCGGCGGCTCTAACTTCGACGAGAAGT TTAAGAAT
SEQ ID NO: 526 (Kabat)	HCDR3	TGGACTACCGGCACAGGCGCCTAC
SEQ ID NO: 527 (Chothia)	HCDR1	GGCTACACCTTCACTACCTAC
SEQ ID NO: 528 (Chothia)	HCDR2	TACCCCGGCACCGGCGGC
SEQ ID NO: 526 (Chothia)	HCDR3	TGGACTACCGGCACAGGCGCCTAC
BAP049-Clone-B LC		

SEQ ID NO: 529 (Kabat)	LCDR1	AAATCTAGTCAGTCACTGCTGGATAGCGGTAATCAGAAGAACT TCCTGACC
SEQ ID NO: 530 (Kabat)	LCDR2	TGGGCCTCTACTAGAGAATCA
SEQ ID NO: 531 (Kabat)	LCDR3	CAGAACGACTATAGCTACCCCTACACC
SEQ ID NO: 532 (Chothia)	LCDR1	AGTCAGTCACTGCTGGATAGCGGTAATCAGAAGAACTTC
SEQ ID NO: 533 (Chothia)	LCDR2	TGGGCCTCT
SEQ ID NO: 534 (Chothia)	LCDR3	GACTATAGCTACCCCTAC
BAP049-Clone-E HC		
SEQ ID NO: 524 (Kabat)	HCDR1	ACCTACTGGATGCAC
SEQ ID NO: 525 (Kabat)	HCDR2	AATATCTACCCCGGCACCGGCGGCTCTAACTTCGACGAGAAGT TTAAGAAT
SEQ ID NO: 526 (Kabat)	HCDR3	TGGACTACCGGCACAGGCGCCTAC
SEQ ID NO: 527 (Chothia)	HCDR1	GGCTACACCTTCACTACCTAC
SEQ ID NO: 528 (Chothia)	HCDR2	TACCCCGGCACCGGCGGC
SEQ ID NO: 526 (Chothia)	HCDR3	TGGACTACCGGCACAGGCGCCTAC
BAP049-Clone-E LC		
SEQ ID NO: 529 (Kabat)	LCDR1	AAATCTAGTCAGTCACTGCTGGATAGCGGTAATCAGAAGAACT TCCTGACC
SEQ ID NO: 530 (Kabat)	LCDR2	TGGGCCTCTACTAGAGAATCA
SEQ ID NO: 531 (Kabat)	LCDR3	CAGAACGACTATAGCTACCCCTACACC
SEQ ID NO: 532 (Chothia)	LCDR1	AGTCAGTCACTGCTGGATAGCGGTAATCAGAAGAACTTC
SEQ ID NO: 533 (Chothia)	LCDR2	TGGGCCTCT
SEQ ID NO: 534 (Chothia)	LCDR3	GACTATAGCTACCCCTAC

Other Exemplary PD-1 Inhibitors

In one embodiment, the anti-PD-1 antibody molecule is Nivolumab (Bristol-Myers Squibb), also known as MDX-1106, MDX-1106-04, ONO-4538, BMS-936558, or OPDIVO®. Nivolumab (clone 5C4) and other anti-PD-1 antibodies are disclosed in US 8,008,449 and WO 2006/121168, incorporated by reference in their entirety. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Nivolumab, *e.g.*, as disclosed in Table 2.

In one embodiment, the anti-PD-1 antibody molecule is Pembrolizumab (Merck & Co), also known as Lambrolizumab, MK-3475, MK03475, SCH-900475, or KEYTRUDA®. Pembrolizumab and other anti-PD-1 antibodies are disclosed in Hamid, O. *et al.* (2013) *New England Journal of Medicine* 369 (2): 134–44, US 8,354,509, and WO 2009/114335, incorporated by reference in their

entirety. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Pembrolizumab, *e.g.*, as disclosed in Table 2.

In one embodiment, the anti-PD-1 antibody molecule is Pidilizumab (CureTech), also known as CT-011. Pidilizumab and other anti-PD-1 antibodies are disclosed in Rosenblatt, J. *et al.* (2011) *J Immunotherapy* 34(5): 409-18, US 7,695,715, US 7,332,582, and US 8,686,119, incorporated by reference in their entirety. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Pidilizumab, *e.g.*, as disclosed in Table 2.

In one embodiment, the anti-PD-1 antibody molecule is MEDI0680 (Medimmune), also known as AMP-514. MEDI0680 and other anti-PD-1 antibodies are disclosed in US 9,205,148 and WO 2012/145493, incorporated by reference in their entirety. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of MEDI0680.

In one embodiment, the anti-PD-1 antibody molecule is REGN2810 (Regeneron). In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of REGN2810.

In one embodiment, the anti-PD-1 antibody molecule is PF-06801591 (Pfizer). In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of PF-06801591.

In one embodiment, the anti-PD-1 antibody molecule is BGB-A317 or BGB-108 (Beigene). In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of BGB-A317 or BGB-108.

In one embodiment, the anti-PD-1 antibody molecule is INCSHR1210 (Incyte), also known as INCSHR01210 or SHR-1210. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of INCSHR1210.

In one embodiment, the anti-PD-1 antibody molecule is TSR-042 (Tesaro), also known as ANB011. In one embodiment, the anti-PD-1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of TSR-042.

Further known anti-PD-1 antibodies include those described, *e.g.*, in WO 2015/112800, WO 2016/092419, WO 2015/085847, WO 2014/179664, WO 2014/194302, WO 2014/209804, WO 2015/200119, US 8,735,553, US 7,488,802, US 8,927,697, US 8,993,731, and US 9,102,727, incorporated by reference in their entirety.

In one embodiment, the anti-PD-1 antibody is an antibody that competes for binding with, and/or binds to the same epitope on PD-1 as, one of the anti-PD-1 antibodies described herein.

In one embodiment, the PD-1 inhibitor is a peptide that inhibits the PD-1 signaling pathway, *e.g.*, as described in US 8,907,053, incorporated by reference in its entirety. In one embodiment, the PD-1 inhibitor is an immunoadhesin (*e.g.*, an immunoadhesin comprising an extracellular or PD-1 binding portion of PD-L1 or PD-L2 fused to a constant region (*e.g.*, an Fc region of an immunoglobulin sequence). In one embodiment, the PD-1 inhibitor is AMP-224 (B7-DCIg (Amplimmune), *e.g.*, disclosed in WO 2010/027827 and WO 2011/066342, incorporated by reference in their entirety).

Table 2. Amino acid sequences of other exemplary anti-PD-1 antibody molecules

Nivolumab		
SEQ ID NO: 535	Heavy chain	QVQLVESGGGVVQPGRSLRLDCKASGITFSNSGMHWVRQAPGKGLEWVAV IWYDGSKRYYADSVKGRFTISRDNSKNTLFLQMNSLRAEDTAVYYCATND DYWGQGTLVTVSSASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTV SWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSN TKVDKRVESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVV DVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLHQDW LNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTKNQVSL TCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSR WQEGNVFSCSVMHEALHNHYTQKSLSLSLGK
SEQ ID NO: 536	Light chain	EIVLTQSPATLSLSPGERATLSCRASQSVSSYLAWYQQKPGQAPRLLIYDASN RATGIPARFSGSGSGTDFTLTISSLEPEDFAVYYCQQSSNWPRTFGQGTKVEI KRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSG NSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSF NRGEC
Pembrolizumab		
SEQ ID NO: 537	Heavy chain	QVQLVQSGVEVKKPGASVKVSCKASGYTFTNYYMYWVRQAPGQGLEWM GGINPSNGGTNFNEKFKNRVTLTTDSSTTTAYMELKSLQFDDTAVYYCARR DYRFDMGFDYWGQGTTVTVSSASTKGPSVFPLAPCSRSTSESTAALGCLVK DYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTKTYT CNVDHKPSNTKVDKRVESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISR TPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSV LTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEE MTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYS RLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLSLGK
SEQ ID NO: 538	Light chain	EIVLTQSPATLSLSPGERATLSCRASKGVSTSGYSYLHWYQQKPGQAPRLLI YLASYLESGVPARFSGSGSGTDFTLTISSLEPEDFAVYYCQHSRDLPLTFGGG TKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNA LQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPV TKSFNRGEC

Pidilizumab		
SEQ ID NO: 539	Heavy chain	QVQLVQSGSELKKPGASVKISCKASGYTFTNYGMNWVRQAPGQGLQWMG WINTDSGESTYAEEFKGRFVFSLDTSVNTAYLQITSLTAEDTGMYFCVRVGY DALDYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEP VTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNVNHK PSNTKVDKRVEPKSCDKTHTCPPCPAPELLGGPSVFLFPPKPKDTLMISRTPE VTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYNSTYRVVSVLT VLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSREEM TKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKL TVDKSRWQQGNVFSCSVMHEALHNHYTQKSLSLSPGK
SEQ ID NO: 540	Light chain	EIVLTQSPSSLSASVGDRVTITCSARSSVSYMHWFQQKPGKAPKLWIYRTSN LASGVPSRFSGSGSGTSYCLTINSLQPEDFATYYCQQRSSFPLTFGGGTKLEIK RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGN SQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFN RGEC

PD-L1 Inhibitors

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with a PD-L1 inhibitor. In some embodiments, the PD-L1 inhibitor is chosen from FAZ053 (Novartis), Atezolizumab (Genentech/Roche), Avelumab (Merck Serono and Pfizer), Durvalumab (MedImmune/AstraZeneca), or BMS-936559 (Bristol-Myers Squibb).

Exemplary PD-L1 Inhibitors

In one embodiment, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule. In one embodiment, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule as disclosed in US 2016/0108123, published on April 21, 2016, entitled "Antibody Molecules to PD-L1 and Uses Thereof," incorporated by reference in its entirety.

In one embodiment, the anti-PD-L1 antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 3 (*e.g.*, from the heavy and light chain variable region sequences of BAP058-Clone O or BAP058-Clone N disclosed in Table 3), or encoded by a nucleotide sequence shown in Table 3. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 3). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 3). In some embodiments, the CDRs are according to the combined CDR definitions of both Kabat and Chothia (*e.g.*, as set out in Table 3). In one embodiment, the combination of Kabat and Chothia CDR of VH CDR1 comprises the amino acid sequence GYTFTSYWMY (SEQ ID NO: 647). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.*, conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 3, or encoded by a nucleotide sequence shown in Table 3.

In one embodiment, the anti-PD-L1 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 601, a VHCDR2 amino acid sequence of SEQ ID NO: 602, and a VHCDR3 amino acid sequence of SEQ ID NO: 603; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 609, a VLCDR2 amino acid sequence of SEQ ID NO: 610, and a VLCDR3 amino acid sequence of SEQ ID NO: 611, each disclosed in Table 3.

In one embodiment, the anti-PD-L1 antibody molecule comprises a VH comprising a VHCDR1 encoded by the nucleotide sequence of SEQ ID NO: 628, a VHCDR2 encoded by the nucleotide sequence of SEQ ID NO: 629, and a VHCDR3 encoded by the nucleotide sequence of SEQ ID NO: 630; and a VL comprising a VLCDR1 encoded by the nucleotide sequence of SEQ ID NO: 633, a VLCDR2 encoded by the nucleotide sequence of SEQ ID NO: 634, and a VLCDR3 encoded by the nucleotide sequence of SEQ ID NO: 635, each disclosed in Table 3.

In one embodiment, the anti-PD-L1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 606, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 606. In one embodiment, the anti-PD-L1 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 616, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 616. In one embodiment, the anti-PD-L1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 620, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 620. In one embodiment, the anti-PD-L1 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 624, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 624. In one embodiment, the anti-PD-L1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 606 and a VL comprising the amino acid sequence of SEQ ID NO: 616. In one embodiment, the anti-PD-L1 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 620 and a VL comprising the amino acid sequence of SEQ ID NO: 624.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 607, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 607. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 617, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 617. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 621, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 621. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 625, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 625. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 607 and a VL encoded by the nucleotide sequence of SEQ ID NO: 617. In one embodiment, the

antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 621 and a VL encoded by the nucleotide sequence of SEQ ID NO: 625.

In one embodiment, the anti-PD-L1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 608, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 608. In one embodiment, the anti-PD-L1 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 618, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 618. In one embodiment, the anti-PD-L1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 622, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 622. In one embodiment, the anti-PD-L1 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 626, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 626. In one embodiment, the anti-PD-L1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 608 and a light chain comprising the amino acid sequence of SEQ ID NO: 618. In one embodiment, the anti-PD-L1 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 622 and a light chain comprising the amino acid sequence of SEQ ID NO: 626.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 615, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 615. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 619, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 619. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 623, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 623. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 627, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 627. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 615 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 619. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 623 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 627.

The antibody molecules described herein can be made by vectors, host cells, and methods described in US 2016/0108123, incorporated by reference in its entirety.

Table 3. Amino acid and nucleotide sequences of exemplary anti-PD-L1 antibody molecules

BAP058-Clone O HC		
SEQ ID NO: 601 (Kabat)	HCDR1	SYWMY
SEQ ID NO: 602 (Kabat)	HCDR2	RIDPNSGSTKYNEKFKN

SEQ ID NO: 603 (Kabat)	HCDR3	DYRKGLYAMDY
SEQ ID NO: 604 (Chothia)	HCDR1	GYTFTSY
SEQ ID NO: 605 (Chothia)	HCDR2	DPNSGS
SEQ ID NO: 603 (Chothia)	HCDR3	DYRKGLYAMDY
SEQ ID NO: 606	VH	EVQLVQSGAEVKKPGATVKISCKVSGYTFTSYWMYWVRQARGQ RLEWIGRIDPNSGSTKYNEKFKNRFTISRDNSKNTLYLQMNSLRA EDTAVYYCARDYRKGLYAMDYWGQGTTVTVSS
SEQ ID NO: 607	DNA VH	GAAGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCC GGCGCTACCGTGAAGATTAGCTGTAAAGTCTCAGGCTACACCT TCACTAGCTACTGGATGTACTGGGTCCGACAGGCTAGAGGGCA AAGACTGGAGTGGATCGGTAGAATCGACCCTAATAGCGGCTC TACTAAGTATAACGAGAAGTTTAAGAATAGGTTCACTATTAGT AGGGATAACTCTAAGAACACCCTGTACCTGCAGATGAATAGC CTGAGAGCCGAGGACACCGCCGTCTACTACTGCGCTAGAGACT ATAGAAAGGGCCTGTACGCTATGGACTACTGGGGTCAAGGCA CTACCGTGACCGTGTCTTCA
SEQ ID NO: 608	Heavy chain	EVQLVQSGAEVKKPGATVKISCKVSGYTFTSYWMYWVRQARGQ RLEWIGRIDPNSGSTKYNEKFKNRFTISRDNSKNTLYLQMNSLRA EDTAVYYCARDYRKGLYAMDYWGQGTTVTVSSASTKGPSVFPL APCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAV LQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESK YGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVS QEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLH QDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQ EEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLD SDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSL SLG
SEQ ID NO: 615	DNA heavy chain	GAAGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCC GGCGCTACCGTGAAGATTAGCTGTAAAGTCTCAGGCTACACCT TCACTAGCTACTGGATGTACTGGGTCCGACAGGCTAGAGGGCA AAGACTGGAGTGGATCGGTAGAATCGACCCTAATAGCGGCTC TACTAAGTATAACGAGAAGTTTAAGAATAGGTTCACTATTAGT AGGGATAACTCTAAGAACACCCTGTACCTGCAGATGAATAGC CTGAGAGCCGAGGACACCGCCGTCTACTACTGCGCTAGAGACT ATAGAAAGGGCCTGTACGCTATGGACTACTGGGGTCAAGGCA CTACCGTGACCGTGTCTTCAGCTAGCACTAAGGGCCCGTCCGT GTTCCCCCTGGCACCTTGTAGCCGGAGCACTAGCGAATCCACC GCTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCGGAGCCCG TGACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCGGAGTGCA CACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTACTCGCTG TCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTACCAAGA CCTACACTTGCAACGTGGACCACAAGCCTTCCAACACTAAGGT GGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTGCCCGCC TTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTCTTTCTGT TCCCACCGAAGCCCAAGGACACTTTGATGATTTCCCGCACCCC TGAAGTGACATGCGTGGTCGTGGACGTGTCACAGGAAGATCC GGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCGAGGTGCA CAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTCAACTCCAC TTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATCAGGACTGG CTGAACGGGAAGGAGTACAAGTGCAAAGTGTCCAACAAGGGA CTTCCTAGCTCAATCGAAAAGACCATCTCGAAAGCCAAGGGA CAGCCCCGGGAACCCCAAGTGTATACCCTGCCACCGAGCCAG GAAGAAATGACTAAGAACCAAGTCTCATTGACTTGCCTTGTGA AGGGCTTCTACCCATCGGATATCGCCGTGGAATGGGAGTCCAA CGGCCAGCCGGAAAACAACTACAAGACCACCCCTCCGGTGCT GGACTCAGACGGATCCTTCTTCCTCTACTCGCGGCTGACCGTG

		GATAAGAGCAGATGGCAGGAGGGAAATGTGTTCAGCTGTTCT GTGATGCATGAAGCCCTGCACAACCACTACACTCAGAAGTCCC TGTCCCTCTCCCTGGGA
BAP058-Clone O LC		
SEQ ID NO: 609 (Kabat)	LCDR1	KASQDVGTAVA
SEQ ID NO: 610 (Kabat)	LCDR2	WASTRHT
SEQ ID NO: 611(Kabat)	LCDR3	QQYNSYPLT
SEQ ID NO: 612 (Chothia)	LCDR1	SQDVGTA
SEQ ID NO: 613 (Chothia)	LCDR2	WAS
SEQ ID NO: 614 (Chothia)	LCDR3	YNSYPL
SEQ ID NO: 616	VL	AIQLTQSPSSLSASVGDRVTITCKASQDVGTAVAWYLQKPGQSPQ LLIYWASTRHTGVPSRFSGSGSGTDFTFTISSLEAEDAATYYCQQY NSYPLTFGQGTKVEIK
SEQ ID NO: 617	DNA VL	GCTATTCAGCTGACTCAGTCACCTAGTAGCCTGAGCGCTAGTG TGGGCGATAGAGTGACTATCACCTGTAAAGCCTCTCAGGACGT GGGCACCGCCGTGGCCTGGTATCTGCAGAAGCCTGGTCAATCA CCTCAGCTGCTGATCTACTGGGCCTCTACTAGACACACCGGCG TGCCCTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGACTTCAC CTTCACTATCTCTTCACTGGAAGCCGAGGACGCCGCTACCTAC TACTGTCAGCAGTATAATAGCTACCCCCTGACCTTCGGTCAAG GCACTAAGGTCGAGATTAAG
SEQ ID NO: 618	Light chain	AIQLTQSPSSLSASVGDRVTITCKASQDVGTAVAWYLQKPGQSPQ LLIYWASTRHTGVPSRFSGSGSGTDFTFTISSLEAEDAATYYCQQY NSYPLTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLN NFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTL SKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 619	DNA light chain	GCTATTCAGCTGACTCAGTCACCTAGTAGCCTGAGCGCTAGTG TGGGCGATAGAGTGACTATCACCTGTAAAGCCTCTCAGGACGT GGGCACCGCCGTGGCCTGGTATCTGCAGAAGCCTGGTCAATCA CCTCAGCTGCTGATCTACTGGGCCTCTACTAGACACACCGGCG TGCCCTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGACTTCAC CTTCACTATCTCTTCACTGGAAGCCGAGGACGCCGCTACCTAC TACTGTCAGCAGTATAATAGCTACCCCCTGACCTTCGGTCAAG GCACTAAGGTCGAGATTAAGCGTACGGTGGCCGCTCCCAGCGT GTTCATCTTCCCCCCCAGCGACGAGCAGCTGAAGAGCGGCACC GCCAGCGTGGTGTGCCTGCTGAACAACTTCTACCCCCGGGAGG CCAAGGTGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCA ACAGCCAGGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCA CCTACAGCCTGAGCAGCACCCTGACCCTGAGCAAGGCCGACT ACGAGAAGCATAAGGTGTACGCCTGCGAGGTGACCCACCAGG GCCTGTCCAGCCCCGTGACCAAGAGCTTCAACAGGGGCGAGT GC
BAP058-Clone N HC		
SEQ ID NO: 601 (Kabat)	HCDR1	SYWMY
SEQ ID NO: 602 (Kabat)	HCDR2	RIDPNSGSTKYNEKFKN
SEQ ID NO: 603 (Kabat)	HCDR3	DYRKGLYAMDY
SEQ ID NO: 604 (Chothia)	HCDR1	GYTFTSY
SEQ ID NO: 605 (Chothia)	HCDR2	DPNSGS
SEQ ID NO: 603 (Chothia)	HCDR3	DYRKGLYAMDY
SEQ ID NO: 620	VH	EVQLVQSGAEVKKPGATVKISCKVSGYTFTSYWMYWVRQATGQ

		GLEWMGRIDPNSGSTKYNEKFKNRVTITADKSTSTAYMELSSLRS EDTAVYYCARDYRKGLYAMDYWGQGTTVTVSS
SEQ ID NO: 621	DNA VH	GAAGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCC GGCGCTACCGTGAAGATTAGCTGTAAAGTCTCAGGCTACACCT TCACTAGCTACTGGATGTACTGGGTCCGACAGGCTACCGGTCA AGGCCTGGAGTGGATGGGTAGAATCGACCCTAATAGCGGCTC TACTAAGTATAACGAGAAGTTTAAGAATAGAGTGACTATCACC GCCGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCC TGAGATCAGAGGACACCGCCGTCTACTACTGCGCTAGAGACTA TAGAAAGGGCCTGTACGCTATGGACTACTGGGGTCAAGGCAC TACCGTGACCGTGTCTTCA
SEQ ID NO: 622	Heavy chain	EVQLVQSGAEVKKPGATVKISCKVSGYTFTSYWMYWVRQATGQ GLEWMGRIDPNSGSTKYNEKFKNRVTITADKSTSTAYMELSSLRS EDTAVYYCARDYRKGLYAMDYWGQGTTVTVSSASTKGPSVFPL APCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAV LQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESK YGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVVDVS QEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLH QDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQ EEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLD SDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSL SLG
SEQ ID NO: 623	DNA heavy chain	GAAGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACCC GGCGCTACCGTGAAGATTAGCTGTAAAGTCTCAGGCTACACCT TCACTAGCTACTGGATGTACTGGGTCCGACAGGCTACCGGTCA AGGCCTGGAGTGGATGGGTAGAATCGACCCTAATAGCGGCTC TACTAAGTATAACGAGAAGTTTAAGAATAGAGTGACTATCACC GCCGATAAGTCTACTAGCACCGCCTATATGGAACTGTCTAGCC TGAGATCAGAGGACACCGCCGTCTACTACTGCGCTAGAGACTA TAGAAAGGGCCTGTACGCTATGGACTACTGGGGTCAAGGCAC TACCGTGACCGTGTCTTCAGCTAGCACTAAGGGCCCGTCCGTG TTCCCCCTGGCACCTTGTAGCCGGAGCACTAGCGAATCCACCG CTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCGGAGCCCGT GACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCGGAGTGCA CACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTACTCGCTG TCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTACCAAGA CCTACACTTGCAACGTGGACCACAAGCCTTCCAACACTAAGGT GGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTGCCCGCC TTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTCTTTCTGT TCCCACCGAAGCCCAAGGACACTTTGATGATTTCCCGCACCCC TGAAGTGACATGCGTGGTCGTGGACGTGTCACAGGAAGATCC GGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCGAGGTGCA CAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTCAACTCCAC TTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATCAGGACTGG CTGAACGGGAAGGAGTACAAGTGCAAAGTGTCCAACAAGGGA CTTCCTAGCTCAATCGAAAAGACCATCTCGAAAGCCAAGGGA CAGCCCCGGGAACCCCAAGTGTATACCCTGCCACCGAGCCAG GAAGAAATGACTAAGAACCAAGTCTCATTGACTTGCCTTGTGA AGGGCTTCTACCCATCGGATATCGCCGTGGAATGGGAGTCCAA CGGCCAGCCGGAAAACAACTACAAGACCACCCCTCCGGTGCT GGACTCAGACGGATCCTTCTTCCTCTACTCGCGGCTGACCGTG GATAAGAGCAGATGGCAGGAGGGAAATGTGTTCAGCTGTTCT GTGATGCATGAAGCCCTGCACAACCACTACACTCAGAAGTCCC TGTCCCTCTCCCTGGGA
BAP058-Clone N LC		
SEQ ID NO: 609 (Kabat)	LCDR1	KASQDVGTAVA
SEQ ID NO: 610 (Kabat)	LCDR2	WASTRHT
SEQ ID NO: 611(Kabat)	LCDR3	QQYNSYPLT

SEQ ID NO: 612 (Chothia)	LCDR1	SQDVGTA
SEQ ID NO: 613 (Chothia)	LCDR2	WAS
SEQ ID NO: 614 (Chothia)	LCDR3	YNSYPL
SEQ ID NO: 624	VL	DVVMTQSPLSLPVTLGQPASISCKASQDVGTAVAWYQQKPGQAP RLLIYWASTRHTGVPSRFSGSGSGTEFTLTISSLQPDDFATYYCQQ YNSYPLTFGQGTKVEIK
SEQ ID NO: 625	DNA VL	GACGTCGTGATGACTCAGTCACCCCTGAGCCTGCCCGTGACCC TGGGGCAGCCCGCCTCTATTAGCTGTAAAGCCTCTCAGGACGT GGGCACCGCCGTGGCCTGGTATCAGCAGAAGCCAGGGCAAGC CCCTAGACTGCTGATCTACTGGGCCTCTACTAGACACACCGGC GTGCCCTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGAGTTCA CCCTGACTATCTCTTCACTGCAGCCCGACGACTTCGCTACCTAC TACTGTCAGCAGTATAATAGCTACCCCCTGACCTTCGGTCAAG GCACTAAGGTCGAGATTAAG
SEQ ID NO: 626	Light chain	DVVMTQSPLSLPVTLGQPASISCKASQDVGTAVAWYQQKPGQAP RLLIYWASTRHTGVPSRFSGSGSGTEFTLTISSLQPDDFATYYCQQ YNSYPLTFGQGTKVEIKRTVAAPSVFIFPPSDEQLKSGTASVVCLL NNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLT LSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 627	DNA light chain	GACGTCGTGATGACTCAGTCACCCCTGAGCCTGCCCGTGACCC TGGGGCAGCCCGCCTCTATTAGCTGTAAAGCCTCTCAGGACGT GGGCACCGCCGTGGCCTGGTATCAGCAGAAGCCAGGGCAAGC CCCTAGACTGCTGATCTACTGGGCCTCTACTAGACACACCGGC GTGCCCTCTAGGTTTAGCGGTAGCGGTAGTGGCACCGAGTTCA CCCTGACTATCTCTTCACTGCAGCCCGACGACTTCGCTACCTAC TACTGTCAGCAGTATAATAGCTACCCCCTGACCTTCGGTCAAG GCACTAAGGTCGAGATTAAGCGTACGGTGGCCGCTCCCAGCGT GTTCATCTTCCCCCCCAGCGACGAGCAGCTGAAGAGCGGCACC GCCAGCGTGGTGTGCCTGCTGAACAACTTCTACCCCCGGGAGG CCAAGGTGCAGTGGAAGGTGGACAACGCCCTGCAGAGCGGCA ACAGCCAGGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCA CCTACAGCCTGAGCAGCACCCTGACCCTGAGCAAGGCCGACT ACGAGAAGCATAAGGTGTACGCCTGCGAGGTGACCCACCAGG GCCTGTCCAGCCCCGTGACCAAGAGCTTCAACAGGGGCGAGT GC
BAP058-Clone O HC		
SEQ ID NO: 628 (Kabat)	HCDR1	AGCTACTGGATGTAC
SEQ ID NO: 629 (Kabat)	HCDR2	AGAATCGACCCTAATAGCGGCTCTACTAAGTATAACGAGAAG TTTAAGAAT
SEQ ID NO: 630 (Kabat)	HCDR3	GACTATAGAAAGGGCCTGTACGCTATGGACTAC
SEQ ID NO: 631 (Chothia)	HCDR1	GGCTACACCTTCACTAGCTAC
SEQ ID NO: 632 (Chothia)	HCDR2	GACCCTAATAGCGGCTCT
SEQ ID NO: 630 (Chothia)	HCDR3	GACTATAGAAAGGGCCTGTACGCTATGGACTAC
BAP058-Clone O LC		
SEQ ID NO: 633 (Kabat)	LCDR1	AAAGCCTCTCAGGACGTGGGCACCGCCGTGGCC
SEQ ID NO: 634 (Kabat)	LCDR2	TGGGCCTCTACTAGACACACC
SEQ ID NO: 635 (Kabat)	LCDR3	CAGCAGTATAATAGCTACCCCCTGACC
SEQ ID NO: 636 (Chothia)	LCDR1	TCTCAGGACGTGGGCACCGCC
SEQ ID NO: 637 (Chothia)	LCDR2	TGGGCCTCT

SEQ ID NO: 638 (Chothia)	LCDR3	TATAATAGCTACCCCCTG
BAP058-Clone N HC		
SEQ ID NO: 628 (Kabat)	HCDR1	AGCTACTGGATGTAC
SEQ ID NO: 629 (Kabat)	HCDR2	AGAATCGACCCTAATAGCGGCTCTACTAAGTATAACGAGAAG TTTAAGAAT
SEQ ID NO: 630 (Kabat)	HCDR3	GACTATAGAAAGGGCCTGTACGCTATGGACTAC
SEQ ID NO: 631 (Chothia)	HCDR1	GGCTACACCTTCACTAGCTAC
SEQ ID NO: 632 (Chothia)	HCDR2	GACCCTAATAGCGGCTCT
SEQ ID NO: 630 (Chothia)	HCDR3	GACTATAGAAAGGGCCTGTACGCTATGGACTAC
BAP058-Clone N LC		
SEQ ID NO: 633 (Kabat)	LCDR1	AAAGCCTCTCAGGACGTGGGCACCGCCGTGGCC
SEQ ID NO: 634 (Kabat)	LCDR2	TGGGCCTCTACTAGACACACC
SEQ ID NO: 635 (Kabat)	LCDR3	CAGCAGTATAATAGCTACCCCCTGACC
SEQ ID NO: 636 (Chothia)	LCDR1	TCTCAGGACGTGGGCACCGCC
SEQ ID NO: 637 (Chothia)	LCDR2	TGGGCCTCT
SEQ ID NO: 638 (Chothia)	LCDR3	TATAATAGCTACCCCCTG

Other Exemplary PD-L1 Inhibitors

In one embodiment, the anti-PD-L1 antibody molecule is Atezolizumab (Genentech/Roche), also known as MPDL3280A, RG7446, RO5541267, YW243.55.S70, or TECENTRIQ™.

Atezolizumab and other anti-PD-L1 antibodies are disclosed in US 8,217,149, incorporated by reference in its entirety. In one embodiment, the anti-PD-L1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Atezolizumab, *e.g.*, as disclosed in Table 4.

In one embodiment, the anti-PD-L1 antibody molecule is Avelumab (Merck Serono and Pfizer), also known as MSB0010718C. Avelumab and other anti-PD-L1 antibodies are disclosed in WO 2013/079174, incorporated by reference in its entirety. In one embodiment, the anti-PD-L1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Avelumab, *e.g.*, as disclosed in Table 4.

In one embodiment, the anti-PD-L1 antibody molecule is Durvalumab (MedImmune/AstraZeneca), also known as MEDI4736. Durvalumab and other anti-PD-L1 antibodies are disclosed in US 8,779,108, incorporated by reference in its entirety. In one embodiment, the anti-PD-L1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of Durvalumab, *e.g.*, as disclosed in Table 4.

In one embodiment, the anti-PD-L1 antibody molecule is BMS-936559 (Bristol-Myers Squibb), also known as MDX-1105 or 12A4. BMS-936559 and other anti-PD-L1 antibodies are disclosed in US 7,943,743 and WO 2015/081158, incorporated by reference in their entirety. In one embodiment, the anti-PD-L1 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of BMS-936559, *e.g.*, as disclosed in Table 4.

Further known anti-PD-L1 antibodies include those described, *e.g.*, in WO 2015/181342, WO 2014/100079, WO 2016/000619, WO 2014/022758, WO 2014/055897, WO 2015/061668, WO 2013/079174, WO 2012/145493, WO 2015/112805, WO 2015/109124, WO 2015/195163, US 8,168,179, US 8,552,154, US 8,460,927, and US 9,175,082, incorporated by reference in their entirety.

In one embodiment, the anti-PD-L1 antibody is an antibody that competes for binding with, and/or binds to the same epitope on PD-L1 as, one of the anti-PD-L1 antibodies described herein.

Table 4. Amino acid sequences of other exemplary anti-PD-L1 antibody molecules

Atezolizumab		
SEQ ID NO: 639	Heavy chain	EVQLVESGGGLVQPGGSLRLSCAASGFTFSDSWIHWVRQAPGKGLEWVAWI SPYGGSTYYADSVKGRFTISADTSKNTAYLQMNSLRAEDTAVYYCARRHWP GGFDYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEP VTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNVNHKP SNTKVDKKVEPKSCDKTHTCPPCPAPELLGGPSVFLFPPKPKDTLMISRTPEVT CVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYASTYRVVSVLTVLH QDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSREEMTKNQ VSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKS RWQQGNVFSCSVMHEALHNHYTQKSLSLSPGK
SEQ ID NO: 640	Light chain	DIQMTQSPSSLSASVGDRVTITCRASQDVSTAVAWYQQKPGKAPKLLIYSASF LYSGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQYLYHPATFGQGTKVEIK RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNS QESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNR GEC
Avelumab		
SEQ ID NO: 641	Heavy chain	EVQLLESGGGLVQPGGSLRLSCAASGFTFSSYIMMWVRQAPGKGLEWVSSIY PSGGITFYADTVKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCARIKLGTV TTVDYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEP VTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNVNHKP SNTKVDKKVEPKSCDKTHTCPPCPAPELLGGPSVFLFPPKPKDTLMISRTPEVT CVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYNSTYRVVSVLTVLH QDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRDELTKNQ VSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKS RWQQGNVFSCSVMHEALHNHYTQKSLSLSPGK
SEQ ID NO: 642	Light chain	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQHPGKAPKLMIYD VSNRPSGVSNRFSGSKSGNTASLTISGLQAEDEADYYCSSYTSSSTRVFGTGT KVTVLGQPKANPTVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADGS PVKAGVETTKPSKQSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKT VAPTECS

Durvalumab		
SEQ ID NO: 643	Heavy chain	EVQLVESGGGLVQPGGSLRLSCAASGFTFSRYWMSWVRQAPGKGLEWVANI KQDGSEKYYVDSVKGRFTISRDNAKNSLYLQMNSLRAEDTAVYYCAREGG WFGELAFDYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGCLVKDY FPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNV NHKPSNTKVDKRVEPKSCDKTHTCPPCPAPEFEGGPSVFLFPPKPKDTLMISR TPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYNSTYRVVSV LTVLHQDWLNGKEYKCKVSNKALPASIEKTISKAKGQPREPQVYTLPPSREE MTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSK LTVDKSRWQQGNVFSCSVMHEALHNHYTQKSLSLSPGK
SEQ ID NO: 644	Light chain	EIVLTQSPGTLSLSPGERATLSCRASQRVSSSYLAWYQQKPGQAPRLLIYDAS SRATGIPDRFSGSGSGTDFTLTISRLEPEDFAVYYCQQYGSLPWTFGQGTKVEI KRTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGN SQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNR GEC
BMS-936559		
SEQ ID NO: 645	VH	QVQLVQSGAEVKKPGSSVKVSCKTSGDTFSTYAISWVRQAPGQGLEWMGGII PIFGKAHYAQKFQGRVTITADESTSTAYMELSSLRSEDTAVYFCARKFHFVSG SPFGMDVWGQGTTVTVSS
SEQ ID NO: 646	VL	EIVLTQSPATLSLSPGERATLSCRASQSVSSYLAWYQQKPGQAPRLLIYDASN RATGIPARFSGSGSGTDFTLTISSLEPEDFAVYYCQQRSNWPTFGQGTKVEIK

TIM-3 Inhibitors

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with a TIM-3 inhibitor. In some embodiments, the TIM-3 inhibitor is MGB453 (Novartis) or TSR-022 (Tesaro).

Exemplary TIM-3 Inhibitors

In one embodiment, the TIM-3 inhibitor is an anti-TIM-3 antibody molecule. In one embodiment, the TIM-3 inhibitor is an anti-TIM-3 antibody molecule as disclosed in US 2015/0218274, published on August 6, 2015, entitled "Antibody Molecules to TIM-3 and Uses Thereof," incorporated by reference in its entirety.

In one embodiment, the anti-TIM-3 antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 7 (*e.g.*, from the heavy and light chain variable region sequences of ABTIM3-hum11 or ABTIM3-hum03 disclosed in Table 7), or encoded by a nucleotide sequence shown in Table 7. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 7). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 7). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.*, conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 7, or encoded by a nucleotide sequence shown in Table 7.

In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 801, a VHCDR2 amino acid sequence of SEQ ID NO: 802, and a VHCDR3 amino acid sequence of SEQ ID NO: 803; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 810, a VLCDR2 amino acid sequence of SEQ ID NO: 811, and a VLCDR3 amino acid sequence of SEQ ID NO: 812, each disclosed in Table 7. In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 801, a VHCDR2 amino acid sequence of SEQ ID NO: 820, and a VHCDR3 amino acid sequence of SEQ ID NO: 803; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 810, a VLCDR2 amino acid sequence of SEQ ID NO: 811, and a VLCDR3 amino acid sequence of SEQ ID NO: 812, each disclosed in Table 7.

In one embodiment, the anti-TIM-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 806, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 806. In one embodiment, the anti-TIM-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 816, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 816. In one embodiment, the anti-TIM-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 822, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 822. In one embodiment, the anti-TIM-3 antibody molecule comprises a VL comprising the amino acid sequence of SEQ ID NO: 826, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 826. In one embodiment, the anti-TIM-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 806 and a VL comprising the amino acid sequence of SEQ ID NO: 816. In one embodiment, the anti-TIM-3 antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 822 and a VL comprising the amino acid sequence of SEQ ID NO: 826.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 807, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 807. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 817, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 817. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 823, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 823. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 827, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 827. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 807 and a VL encoded by the nucleotide sequence of SEQ ID NO: 817. In one embodiment, the

antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 823 and a VL encoded by the nucleotide sequence of SEQ ID NO: 827.

In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 808, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 808. In one embodiment, the anti-TIM-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 818, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 818. In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 824, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 824. In one embodiment, the anti-TIM-3 antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 828, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 828. In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 808 and a light chain comprising the amino acid sequence of SEQ ID NO: 818. In one embodiment, the anti-TIM-3 antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 824 and a light chain comprising the amino acid sequence of SEQ ID NO: 828.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 809, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 809. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 819, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 819. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 825, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 825. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 829, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 829. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 809 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 819. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 825 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 829.

The antibody molecules described herein can be made by vectors, host cells, and methods described in US 2015/0218274, incorporated by reference in its entirety.

Table 7. Amino acid and nucleotide sequences of exemplary anti-TIM-3 antibody molecules

ABTIM3-hum11		
SEQ ID NO: 801 (Kabat)	HCDR1	SYNMH
SEQ ID NO: 802 (Kabat)	HCDR2	DIYPGNGDTSYNQKFKG
SEQ ID NO: 803 (Kabat)	HCDR3	VGGAFPMDY

SEQ ID NO: 804 (Chothia)	HCDR1	GYTFTSY
SEQ ID NO: 805 (Chothia)	HCDR2	YPGNGD
SEQ ID NO: 803 (Chothia)	HCDR3	VGGAFPMDY
SEQ ID NO: 806	VH	QVQLVQSGAEVKKPGSSVKVSCKASGYTFTSYNMHWVRQAPG QGLEWMGDIYPGNGDTSYNQKFKGRVTITADKSTSTVYMELSS LRSEDTAVYYCARVGGAFPMDYWGQGTTVTVSS
SEQ ID NO: 807	DNA VH	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACC CGGCTCTAGCGTGAAAGTTTCTTGTAAAGCTAGTGGCTACAC CTTCACTAGCTATAATATGCACTGGGTTCGCCAGGCCCCAGG GCAAGGCCTCGAGTGGATGGGCGATATCTACCCCGGGAACGG CGACACTAGTTATAATCAGAAGTTTAAGGGTAGAGTCACTAT CACCGCCGATAAGTCTACTAGCACCGTCTATATGGAACTGAG TTCCCTGAGGTCTGAGGACACCGCCGTCTACTACTGCGCTAG AGTGGGCGGAGCCTTCCCTATGGACTACTGGGGTCAAGGCAC TACCGTGACCGTGTCTAGC
SEQ ID NO: 808	Heavy chain	QVQLVQSGAEVKKPGSSVKVSCKASGYTFTSYNMHWVRQAPG QGLEWMGDIYPGNGDTSYNQKFKGRVTITADKSTSTVYMELSS LRSEDTAVYYCARVGGAFPMDYWGQGTTVTVSSASTKGPSVFP LAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFP AVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRV ESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVV DVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLT VLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTL PPSQEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTP PVLDSDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQ KSLSLSLG
SEQ ID NO: 809	DNA heavy chain	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACC CGGCTCTAGCGTGAAAGTTTCTTGTAAAGCTAGTGGCTACAC CTTCACTAGCTATAATATGCACTGGGTTCGCCAGGCCCCAGG GCAAGGCCTCGAGTGGATGGGCGATATCTACCCCGGGAACGG CGACACTAGTTATAATCAGAAGTTTAAGGGTAGAGTCACTAT CACCGCCGATAAGTCTACTAGCACCGTCTATATGGAACTGAG TTCCCTGAGGTCTGAGGACACCGCCGTCTACTACTGCGCTAG AGTGGGCGGAGCCTTCCCTATGGACTACTGGGGTCAAGGCAC TACCGTGACCGTGTCTAGCGCTAGCACTAAGGGCCCGTCCGT GTTCCCCCTGGCACCTTGTAGCCGGAGCACTAGCGAATCCAC CGCTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCGGAGCC CGTGACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCGGAGT GCACACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTACTC GCTGTCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTACC AAGACCTACACTTGCAACGTGGACCACAAGCCTTCCAACACT AAGGTGGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTG CCCGCCTTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTC TTTCTGTTCCCACCGAAGCCCAAGGACACTTTGATGATTTCCC GCACCCCTGAAGTGACATGCGTGGTCGTGGACGTGTCACAGG AAGATCCGGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCG AGGTGCACAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTC AACTCCACTTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATC AGGACTGGCTGAACGGGAAGGAGTACAAGTGCAAAGTGTCC AACAAGGGACTTCCTAGCTCAATCGAAAAGACCATCTCGAAA GCCAAGGGACAGCCCCGGGAACCCCAAGTGTATACCCTGCCA CCGAGCCAGGAAGAAATGACTAAGAACCAAGTCTCATTGACT TGCCTTGTGAAGGGCTTCTACCCATCGGATATCGCCGTGGAA TGGGAGTCCAACGGCCAGCCGGAAAACAACTACAAGACCAC CCCTCCGGTGCTGGACTCAGACGGATCCTTCTTCCTCTACTCG CGGCTGACCGTGGATAAGAGCAGATGGCAGGAGGGAAATGT GTTCAGCTGTTCTGTGATGCATGAAGCCCTGCACAACCACTA CACTCAGAAGTCCCTGTCCCTCTCCCTGGGA
SEQ ID NO: 810 (Kabat)	LCDR1	RASESVEYYGTSLMQ
SEQ ID NO: 811 (Kabat)	LCDR2	AASNVES

SEQ ID NO: 812 (Kabat)	LCDR3	QQSRKDPST
SEQ ID NO: 813 (Chothia)	LCDR1	SESVEYYGTSL
SEQ ID NO: 814 (Chothia)	LCDR2	AAS
SEQ ID NO: 815 (Chothia)	LCDR3	SRKDPS
SEQ ID NO: 816	VL	AIQLTQSPSSLSASVGDRVTITCRASESVEYYGTSLMQWYQQKP GKAPKLLIYAASNVESGVPSRFSGSGSGTDFTLTISSLQPEDFATY FCQQSRKDPSTFGGGTKVEIK
SEQ ID NO: 817	DNA VL	GCTATTCAGCTGACTCAGTCACCTAGTAGCCTGAGCGCTAGT GTGGGCGATAGAGTGACTATCACCTGTAGAGCTAGTGAATCA GTCGAGTACTACGGCACTAGCCTGATGCAGTGGTATCAGCAG AAGCCCGGGAAAGCCCCTAAGCTGCTGATCTACGCCGCCTCT AACGTGGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCCTGACTATCTCTAGCCTGCAGCCC GAGGACTTCGCTACCTACTTCTGTCAGCAGTCTAGGAAGGAC CCTAGCACCTTCGGCGGAGGCACTAAGGTCGAGATTAAG
SEQ ID NO: 818	Light chain	AIQLTQSPSSLSASVGDRVTITCRASESVEYYGTSLMQWYQQKP GKAPKLLIYAASNVESGVPSRFSGSGSGTDFTLTISSLQPEDFATY FCQQSRKDPSTFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTAS VVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYS LSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 819	DNA light chain	GCTATTCAGCTGACTCAGTCACCTAGTAGCCTGAGCGCTAGT GTGGGCGATAGAGTGACTATCACCTGTAGAGCTAGTGAATCA GTCGAGTACTACGGCACTAGCCTGATGCAGTGGTATCAGCAG AAGCCCGGGAAAGCCCCTAAGCTGCTGATCTACGCCGCCTCT AACGTGGAATCAGGCGTGCCCTCTAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCCTGACTATCTCTAGCCTGCAGCCC GAGGACTTCGCTACCTACTTCTGTCAGCAGTCTAGGAAGGAC CCTAGCACCTTCGGCGGAGGCACTAAGGTCGAGATTAAGCGT ACGGTGGCCGCTCCCAGCGTGTTCATCTTCCCCCCCAGCGAC GAGCAGCTGAAGAGCGGCACCGCCAGCGTGGTGTGCCTGCTG AACAACTTCTACCCCCGGGAGGCCAAGGTGCAGTGGAAGGTG GACAACGCCCTGCAGAGCGGCAACAGCCAGGAGAGCGTCAC CGAGCAGGACAGCAAGGACTCCACCTACAGCCTGAGCAGCA CCCTGACCCTGAGCAAGGCCGACTACGAGAAGCATAAGGTGT ACGCCTGCGAGGTGACCCACCAGGGCCTGTCCAGCCCCGTGA CCAAGAGCTTCAACAGGGGCGAGTGC
ABTIM3-hum03		
SEQ ID NO: 801 (Kabat)	HCDR1	SYNMH
SEQ ID NO: 820 (Kabat)	HCDR2	DIYPGQGDTSYNQKFKG
SEQ ID NO: 803 (Kabat)	HCDR3	VGGAFPMDY
SEQ ID NO: 804 (Chothia)	HCDR1	GYTFTSY
SEQ ID NO: 821 (Chothia)	HCDR2	YPGQGD
SEQ ID NO: 803 (Chothia)	HCDR3	VGGAFPMDY
SEQ ID NO: 822	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYNMHWVRQAPG QGLEWIGDIYPGQGDTSYNQKFKGRATMTADKSTSTVYMELSS LRSEDTAVYYCARVGGAFPMDYWGQGTLVTVSS
SEQ ID NO: 823	DNA VH	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACC CGGCGCTAGTGTGAAAGTTAGCTGTAAAGCTAGTGGCTATAC TTTCACTTCTTATAATATGCACTGGGTCCGCCAGGCCCCAGGT CAAGGCCTCGAGTGGATCGGCGATATCTACCCCGGTCAAGGC GACACTTCCTATAATCAGAAGTTTAAGGGTAGAGCTACTATG ACCGCCGATAAGTCTACTTCTACCGTCTATATGGAACTGAGTT CCCTGAGGTCTGAGGACACCGCCGTCTACTACTGCGCTAGAG TGGGCGGAGCCTTCCCAATGGACTACTGGGGTCAAGGCACCC TGGTCACCGTGTCTAGC
SEQ ID NO: 824	Heavy chain	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYNMHWVRQAPG QGLEWIGDIYPGQGDTSYNQKFKGRATMTADKSTSTVYMELSS LRSEDTAVYYCARVGGAFPMDYWGQGTLVTVSSASTKGPSVFP LAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFP

		AVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRV ESKYGPPCPPCPAPEFLGGPSVFLFPPKPKDTLMISRTPEVTCVVV DVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLT VLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTL PPSQEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTP PVLDSDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQ KSLSLSLG
SEQ ID NO: 825	DNA heavy chain	CAGGTGCAGCTGGTGCAGTCAGGCGCCGAAGTGAAGAAACC CGGCGCTAGTGTGAAAGTTAGCTGTAAAGCTAGTGGCTATAC TTTCACTTCTTATAATATGCACTGGGTCCGCCAGGCCCCAGGT CAAGGCCTCGAGTGGATCGGCGATATCTACCCCGGTCAAGGC GACACTTCCTATAATCAGAAGTTTAAGGGTAGAGCTACTATG ACCGCCGATAAGTCTACTTCTACCGTCTATATGGAACTGAGTT CCCTGAGGTCTGAGGACACCGCCGTCTACTACTGCGCTAGAG TGGGCGGAGCCTTCCCAATGGACTACTGGGGTCAAGGCACCC TGGTCACCGTGTCTAGCGCTAGCACTAAGGGCCCGTCCGTGT TCCCCCTGGCACCTTGTAGCCGGAGCACTAGCGAATCCACCG CTGCCCTCGGCTGCCTGGTCAAGGATTACTTCCCGGAGCCCGT GACCGTGTCCTGGAACAGCGGAGCCCTGACCTCCGGAGTGCA CACCTTCCCCGCTGTGCTGCAGAGCTCCGGGCTGTACTCGCTG TCGTCGGTGGTCACGGTGCCTTCATCTAGCCTGGGTACCAAG ACCTACACTTGCAACGTGGACCACAAGCCTTCCAACACTAAG GTGGACAAGCGCGTCGAATCGAAGTACGGCCCACCGTGCCCG CCTTGTCCCGCGCCGGAGTTCCTCGGCGGTCCCTCGGTCTTTC TGTTCCCACCGAAGCCCAAGGACACTTTGATGATTTCCCGCA CCCCTGAAGTGACATGCGTGGTCGTGGACGTGTCACAGGAAG ATCCGGAGGTGCAGTTCAATTGGTACGTGGATGGCGTCGAGG TGCACAACGCCAAAACCAAGCCGAGGGAGGAGCAGTTCAAC TCCACTTACCGCGTCGTGTCCGTGCTGACGGTGCTGCATCAGG ACTGGCTGAACGGGAAGGAGTACAAGTGCAAAGTGTCCAAC AAGGGACTTCCTAGCTCAATCGAAAAGACCATCTCGAAAGCC AAGGGACAGCCCCGGGAACCCCAAGTGTATACCCTGCCACCG AGCCAGGAAGAAATGACTAAGAACCAAGTCTCATTGACTTGC CTTGTGAAGGGCTTCTACCCATCGGATATCGCCGTGGAATGG GAGTCCAACGGCCAGCCGGAAAACAACTACAAGACCACCCC TCCGGTGCTGGACTCAGACGGATCCTTCTTCCTCTACTCGCGG CTGACCGTGGATAAGAGCAGATGGCAGGAGGGAAATGTGTT CAGCTGTTCTGTGATGCATGAAGCCCTGCACAACCACTACAC TCAGAAGTCCCTGTCCCTCTCCCTGGGA
SEQ ID NO: 810 (Kabat)	LCDR1	RASESVEYYGTSLMQ
SEQ ID NO: 811 (Kabat)	LCDR2	AASNVES
SEQ ID NO: 812 (Kabat)	LCDR3	QQSRKDPST
SEQ ID NO: 813 (Chothia)	LCDR1	SESVEYYGTSL
SEQ ID NO: 814 (Chothia)	LCDR2	AAS
SEQ ID NO: 815 (Chothia)	LCDR3	SRKDPS
SEQ ID NO: 826	VL	DIVLTQSPDSLAVSLGERATINCRASESVEYYGTSLMQWYQQKP GQPPKLLIYAASNVESGVPDRFSGSGSGTDFTLTISSLQAEDVAV YYCQQSRKDPSTFGGGTKVEIK
SEQ ID NO: 827	DNA VL	GATATCGTCCTGACTCAGTCACCCGATAGCCTGGCCGTCAGC CTGGGCGAGCGGGCTACTATTAACTGTAGAGCTAGTGAATCA GTCGAGTACTACGGCACTAGCCTGATGCAGTGGTATCAGCAG AAGCCCGGTCAACCCCCTAAGCTGCTGATCTACGCCGCCTCT AACGTGGAATCAGGCGTGCCCGATAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCCTGACTATTAGTAGCCTGCAGGCC GAGGACGTGGCCGTCTACTACTGTCAGCAGTCTAGGAAGGAC CCTAGCACCTTCGGCGGAGGCACTAAGGTCGAGATTAAG
SEQ ID NO: 828	Light chain	DIVLTQSPDSLAVSLGERATINCRASESVEYYGTSLMQWYQQKP GQPPKLLIYAASNVESGVPDRFSGSGSGTDFTLTISSLQAEDVAV YYCQQSRKDPSTFGGGTKVEIKRTVAAPSVFIFPPSDEQLKSGTA

		SVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTY SLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
SEQ ID NO: 829	DNA light chain	GATATCGTCCTGACTCAGTCACCCGATAGCCTGGCCGTCAGC CTGGGCGAGCGGGCTACTATTAACTGTAGAGCTAGTGAATCA GTCGAGTACTACGGCACTAGCCTGATGCAGTGGTATCAGCAG AAGCCCGGTCAACCCCCTAAGCTGCTGATCTACGCCGCCTCT AACGTGGAATCAGGCGTGCCCGATAGGTTTAGCGGTAGCGGT AGTGGCACCGACTTCACCCTGACTATTAGTAGCCTGCAGGCC GAGGACGTGGCCGTCTACTACTGTCAGCAGTCTAGGAAGGAC CCTAGCACCTTCGGCGGAGGCACTAAGGTCGAGATTAAGCGT ACGGTGGCCGCTCCCAGCGTGTTCATCTTCCCCCCCAGCGAC GAGCAGCTGAAGAGCGGCACCGCCAGCGTGGTGTGCCTGCTG AACAACTTCTACCCCCGGGAGGCCAAGGTGCAGTGGAAGGTG GACAACGCCCTGCAGAGCGGCAACAGCCAGGAGAGCGTCAC CGAGCAGGACAGCAAGGACTCCACCTACAGCCTGAGCAGCA CCCTGACCCTGAGCAAGGCCGACTACGAGAAGCATAAGGTGT ACGCCTGCGAGGTGACCCACCAGGGCCTGTCCAGCCCCGTGA CCAAGAGCTTCAACAGGGGCGAGTGC

Other Exemplary TIM-3 Inhibitors

In one embodiment, the anti-TIM-3 antibody molecule is TSR-022 (AnaptysBio/Tesaro). In one embodiment, the anti-TIM-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of TSR-022. In one embodiment, the anti-TIM-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of APE5137 or APE5121, *e.g.*, as disclosed in Table 8. APE5137, APE5121, and other anti-TIM-3 antibodies are disclosed in WO 2016/161270, incorporated by reference in its entirety.

In one embodiment, the anti-TIM-3 antibody molecule is the antibody clone F38-2E2. In one embodiment, the anti-TIM-3 antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of F38-2E2.

Further known anti-TIM-3 antibodies include those described, *e.g.*, in WO 2016/111947, WO 2016/071448, WO 2016/144803, US 8,552,156, US 8,841,418, and US 9,163,087, incorporated by reference in their entirety.

In one embodiment, the anti-TIM-3 antibody is an antibody that competes for binding with, and/or binds to the same epitope on TIM-3 as, one of the anti-TIM-3 antibodies described herein.

Table 8. Amino acid sequences of other exemplary anti-TIM-3 antibody molecules

APE5137		
SEQ ID NO: 830	VH	EVQLLESGGGLVQPGGSLRLSCAAASGFTFSSYDMSWVRQAPGKGLDWVS TISGGGTYTYYQDSVKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCASMD YWGQGTTVTVSSA
SEQ ID NO: 831	VL	DIQMTQSPSSLSASVGDRVTITCRASQSIRRYLNWYHQKPGKAPKLLIYGAS TLQSGVPSRFSGSGSGTDFTLTISSLQPEDFAVYYCQQSHSAPLTFGGGTKVE

		IKR
APE5121		
SEQ ID NO: 832	VH	EVQVLESGGGLVQPGGSLRLYCVASGFTFSGSYAMSWVRQAPGKGLEWVS AISGSGGSTYYADSVKGRFTISRDNSKNTLYLQMNSLRAEDTAVYYCAKKY YVGPADYWGQGTLVTVSSG
SEQ ID NO: 833	VL	DIVMTQSPDSLAVSLGERATINCKSSQSVLYSSNNKNYLAWYQHKPGQPPK LLIYWASTRESGVPDRFSGSGSGTDFTLTISSLQAEDVAVYYCQQYYSSPLTF GGGTKIEVK

GITR Agonists

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with a GITR agonist. In some embodiments, the GITR agonist is GWN323 (NVS), BMS-986156, MK-4166 or MK-1248 (Merck), TRX518 (Leap Therapeutics), INCAGN1876 (Incyte/Agenus), AMG 228 (Amgen) or INBRX-110 (Inhibrx).

Exemplary GITR Agonists

In one embodiment, the GITR agonist is an anti-GITR antibody molecule. In one embodiment, the GITR agonist is an anti-GITR antibody molecule as described in WO 2016/057846, published on April 14, 2016, entitled "Compositions and Methods of Use for Augmented Immune Response and Cancer Therapy," incorporated by reference in its entirety.

In one embodiment, the anti-GITR antibody molecule comprises at least one, two, three, four, five or six complementarity determining regions (CDRs) (or collectively all of the CDRs) from a heavy and light chain variable region comprising an amino acid sequence shown in Table 9 (*e.g.*, from the heavy and light chain variable region sequences of MAB7 disclosed in Table 9), or encoded by a nucleotide sequence shown in Table 9. In some embodiments, the CDRs are according to the Kabat definition (*e.g.*, as set out in Table 9). In some embodiments, the CDRs are according to the Chothia definition (*e.g.*, as set out in Table 9). In one embodiment, one or more of the CDRs (or collectively all of the CDRs) have one, two, three, four, five, six or more changes, *e.g.*, amino acid substitutions (*e.g.*, conservative amino acid substitutions) or deletions, relative to an amino acid sequence shown in Table 9, or encoded by a nucleotide sequence shown in Table 9.

In one embodiment, the anti-GITR antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 909, a VHCDR2 amino acid sequence of SEQ ID NO: 911, and a VHCDR3 amino acid sequence of SEQ ID NO: 913; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 914, a VLCDR2 amino acid sequence of SEQ ID NO: 916, and a VLCDR3 amino acid sequence of SEQ ID NO: 918, each disclosed in Table 9.

In one embodiment, the anti-GITR antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 901, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 901. In one embodiment, the anti-GITR antibody molecule

comprises a VL comprising the amino acid sequence of SEQ ID NO: 902, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 902. In one embodiment, the anti-GITR antibody molecule comprises a VH comprising the amino acid sequence of SEQ ID NO: 901 and a VL comprising the amino acid sequence of SEQ ID NO: 902.

In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 905, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 905. In one embodiment, the antibody molecule comprises a VL encoded by the nucleotide sequence of SEQ ID NO: 906, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 906. In one embodiment, the antibody molecule comprises a VH encoded by the nucleotide sequence of SEQ ID NO: 905 and a VL encoded by the nucleotide sequence of SEQ ID NO: 906.

In one embodiment, the anti-GITR antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 903, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 903. In one embodiment, the anti-GITR antibody molecule comprises a light chain comprising the amino acid sequence of SEQ ID NO: 904, or an amino acid sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 904. In one embodiment, the anti-GITR antibody molecule comprises a heavy chain comprising the amino acid sequence of SEQ ID NO: 903 and a light chain comprising the amino acid sequence of SEQ ID NO: 904.

In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 907, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 907. In one embodiment, the antibody molecule comprises a light chain encoded by the nucleotide sequence of SEQ ID NO: 908, or a nucleotide sequence at least 85%, 90%, 95%, or 99% identical or higher to SEQ ID NO: 908. In one embodiment, the antibody molecule comprises a heavy chain encoded by the nucleotide sequence of SEQ ID NO: 907 and a light chain encoded by the nucleotide sequence of SEQ ID NO: 908.

The antibody molecules described herein can be made by vectors, host cells, and methods described in WO 2016/057846, incorporated by reference in its entirety.

Table 9: Amino acid and nucleotide sequences of exemplary anti-GITR antibody molecule

MAB7		
SEQ ID NO: 901	VH	EVQLVESGGGLVQSGGSLRLSCAASGFSLSSYGVDWVRQAP GKGLEWVGVIWGGGGTYYASSLMGRFTISRDNSKNTLYLQ MNSLRAEDTAVYYCARHAYGHDGGFAMDYWGQGTLVTVS S
SEQ ID NO: 902	VL	EIVMTQSPATLSVSPGERATLSCRASESVSSNVAWYQQRPGQ APRLLIYGASNRATGIPARFSGSGSGTDFTLTISRLEPEDFAVY YCGQSYSYPFTFGQGTKLEIK

SEQ ID NO: 903	Heavy Chain	EVQLVESGGGLVQSGGSLRLSCAASGFSLSSYGVDWVRQAP GKGLEWVGVIWGGGGTYYASSLMGRFTISRDNSKNTLYLQ MNSLRAEDTAVYYCARHAYGHDGGFAMDYWGQGTLVTVS SASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSW NSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICN VNHKPSNTKVDKRVEPKSCDKTHTCPPCPAPELLGGPSVFLF PPKPKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEV HNAKTKPREEQYNSTYRVVSVLTVLHQDWLNGKEYKCKVS NKALPAPIEKTISKAKGQPREPQVYTLPPSREEMTKNQVSLTC LVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSK LTVDKSRWQQGNVFSCSVMHEALHNHYTQKSLSLSPGK
SEQ ID NO: 904	Light Chain	EIVMTQSPATLSVSPGERATLSCRASESVSSNVAWYQQRPGQ APRLLIYGASNRATGIPARFSGSGSGTDFTLTISRLEPEDFAVY YCGQSYSYPFTFGQGTKLEIKRTVAAPSVFIFPPSDEQLKSGT ASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSK DSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNR GEC
SEQ ID NO: 905	DNA VH	GAGGTGCAGCTGGTGGAATCTGGCGGCGGACTGGTGCAG TCCGGCGGCTCTCTGAGACTGTCTTGCGCTGCCTCCGGCTT CTCCCTGTCCTCTTACGGCGTGGACTGGGTGCGACAGGCC CCTGGCAAGGGCCTGGAATGGGTGGGAGTGATCTGGGGC GGAGGCGGCACCTACTACGCCTCTTCCCTGATGGGCCGGT TCACCATCTCCCGGGACAACTCCAAGAACACCCTGTACCT GCAGATGAACTCCCTGCGGGCCGAGGACACCGCCGTGTAC TACTGCGCCAGACACGCCTACGGCCACGACGGCGGCTTCG CCATGGATTATTGGGGCCAGGGCACCCTGGTGACAGTGTC CTCC
SEQ ID NO: 906	DNA VL	GAGATCGTGATGACCCAGTCCCCCGCCACCCTGTCTGTGT CTCCCGGCGAGAGAGCCACCCTGAGCTGCAGAGCCTCCGA GTCCGTGTCCTCCAACGTGGCCTGGTATCAGCAGAGACCT GGTCAGGCCCCTCGGCTGCTGATCTACGGCGCCTCTAACC GGGCCACCGGCATCCCTGCCAGATTCTCCGGCTCCGGCAG CGGCACCGACTTCACCCTGACCATCTCCCGGCTGGAACCC GAGGACTTCGCCGTGTACTACTGCGGCCAGTCCTACTCAT ACCCCTTCACCTTCGGCCAGGGCACCAAGCTGGAAATCAA G

SEQ ID NO: 907	DNA Heavy Chain	GAGGTGCAGCTGGTGGAATCTGGCGGCGGACTGGTGCAG TCCGGCGGCTCTCTGAGACTGTCTTGCGCTGCCTCCGGCTT CTCCCTGTCCTCTTACGGCGTGGACTGGGTGCGACAGGCC CCTGGCAAGGGCCTGGAATGGGTGGGAGTGATCTGGGGC GGAGGCGGCACCTACTACGCCTCTTCCCTGATGGGCCGGT TCACCATCTCCCGGGACAACTCCAAGAACACCCTGTACCT GCAGATGAACTCCCTGCGGGCCGAGGACACCGCCGTGTAC TACTGCGCCAGACACGCCTACGGCCACGACGGCGGCTTCG CCATGGATTATTGGGGCCAGGGCACCCTGGTGACAGTGTC CTCCGCTAGCACCAAGGGCCCAAGTGTGTTTCCCCTGGCC CCCAGCAGCAAGTCTACTTCCGGCGGAACTGCTGCCCTGG GTTGCCTGGTGAAGGACTACTTCCCCGAGCCCGTGACAGT GTCCTGGAACTCTGGGGCTCTGACTTCCGGCGTGCACACC TTCCCCGCCGTGCTGCAGAGCAGCGGCCTGTACAGCCTGA GCAGCGTGGTGACAGTGCCCTCCAGCTCTCTGGGAACCCA GACCTATATCTGCAACGTGAACCACAAGCCCAGCAACACC AAGGTGGACAAGAGAGTGGAGCCCAAGAGCTGCGACAAG ACCCACACCTGCCCCCCCTGCCCAGCTCCAGAACTGCTGG GAGGGCCTTCCGTGTTCCTGTTCCCCCCCAAGCCCAAGGA CACCCTGATGATCAGCAGGACCCCCGAGGTGACCTGCGTG GTGGTGGACGTGTCCCACGAGGACCCAGAGGTGAAGTTC AACTGGTACGTGGACGGCGTGGAGGTGCACAACGCCAAG ACCAAGCCCAGAGAGGAGCAGTACAACAGCACCTACAGG GTGGTGTCCGTGCTGACCGTGCTGCACCAGGACTGGCTGA ACGGCAAAGAATACAAGTGCAAAGTCTCCAACAAGGCCC TGCCAGCCCCAATCGAAAAGACAATCAGCAAGGCCAAGG GCCAGCCACGGGAGCCCCAGGTGTACACCCTGCCCCCCAG CCGGGAGGAGATGACCAAGAACCAGGTGTCCCTGACCTG TCTGGTGAAGGGCTTCTACCCCAGCGATATCGCCGTGGAG TGGGAGAGCAACGGCCAGCCCGAGAACAACTACAAGACC ACCCCCCCAGTGCTGGACAGCGACGGCAGCTTCTTCCTGT ACAGCAAGCTGACCGTGGACAAGTCCAGGTGGCAGCAGG GCAACGTGTTCAGCTGCAGCGTGATGCACGAGGCCCTGCA CAACCACTACACCCAGAAGTCCCTGAGCCTGAGCCCCGGC AAG
SEQ ID NO: 908	DNA Light Chain	GAGATCGTGATGACCCAGTCCCCCGCCACCCTGTCTGTGT CTCCCGGCGAGAGAGCCACCCTGAGCTGCAGAGCCTCCGA GTCCGTGTCCTCCAACGTGGCCTGGTATCAGCAGAGACCT GGTCAGGCCCCTCGGCTGCTGATCTACGGCGCCTCTAACC GGGCCACCGGCATCCCTGCCAGATTCTCCGGCTCCGGCAG CGGCACCGACTTCACCCTGACCATCTCCCGGCTGGAACCC GAGGACTTCGCCGTGTACTACTGCGGCCAGTCCTACTCAT ACCCCTTCACCTTCGGCCAGGGCACCAAGCTGGAAATCAA GCGTACGGTGGCCGCTCCCAGCGTGTTCATCTTCCCCCCC AGCGACGAGCAGCTGAAGAGCGGCACCGCCAGCGTGGTG TGCCTGCTGAACAACTTCTACCCCCGGGAGGCCAAGGTGC AGTGGAAGGTGGACAACGCCCTGCAGAGCGGCAACAGCC AGGAGAGCGTCACCGAGCAGGACAGCAAGGACTCCACCT ACAGCCTGAGCAGCACCCTGACCCTGAGCAAGGCCGACT ACGAGAAGCATAAGGTGTACGCCTGCGAGGTGACCCACC AGGGCCTGTCCAGCCCCGTGACCAAGAGCTTCAACAGGG GCGAGTGC
SEQ ID NO: 909 (KABAT)	HCDR1	SYGVD
SEQ ID NO: 910 (CHOTHIA)	HCDR1	GFSLSSY
SEQ ID NO: 911 (KABAT)	HCDR2	VIWGGGGTYYASSLMG
SEQ ID NO: 912 (CHOTHIA)	HCDR2	WGGGG
SEQ ID NO: 913 (KABAT)	HCDR3	HAYGHDGGFAMDY
SEQ ID NO: 913 (CHOTHIA)	HCDR3	HAYGHDGGFAMDY
SEQ ID NO: 914 (KABAT)	LCDR1	RASESVSSNVA
SEQ ID NO: 915 (CHOTHIA)	LCDR1	SESVSSN

SEQ ID NO: 916 (KABAT)	LCDR2	GASNRAT
SEQ ID NO: 917 (CHOTHIA)	LCDR2	GAS
SEQ ID NO: 918 (KABAT)	LCDR3	GQSYSYPFT
SEQ ID NO: 919 (CHOTHIA)	LCDR3	SYSYPF

Other Exemplary GITR Agonists

In one embodiment, the anti-GITR antibody molecule is BMS-986156 (Bristol-Myers Squibb), also known as BMS 986156 or BMS986156. BMS-986156 and other anti-GITR antibodies are disclosed, *e.g.*, in US 9,228,016 and WO 2016/196792, incorporated by reference in their entirety. In one embodiment, the anti-GITR antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of BMS-986156, *e.g.,* as disclosed in Table 10.

In one embodiment, the anti-GITR antibody molecule is MK-4166 or MK-1248 (Merck). MK-4166, MK-1248, and other anti-GITR antibodies are disclosed, *e.g.*, in US 8,709,424, WO 2011/028683, WO 2015/026684, and Mahne *et al. Cancer Res.* 2017; 77(5):1108-1118, incorporated by reference in their entirety. In one embodiment, the anti-GITR antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of MK-4166 or MK-1248.

In one embodiment, the anti-GITR antibody molecule is TRX518 (Leap Therapeutics). TRX518 and other anti-GITR antibodies are disclosed, *e.g.*, in US 7,812,135, US 8,388,967, US 9,028,823, WO 2006/105021, and Ponte J *et al.* (2010) *Clinical Immunology*; 135:S96, incorporated by reference in their entirety. In one embodiment, the anti-GITR antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of TRX518.

In one embodiment, the anti-GITR antibody molecule is INCAGN1876 (Incyte/Agenus). INCAGN1876 and other anti-GITR antibodies are disclosed, *e.g.*, in US 2015/0368349 and WO 2015/184099, incorporated by reference in their entirety. In one embodiment, the anti-GITR antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of INCAGN1876.

In one embodiment, the anti-GITR antibody molecule is AMG 228 (Amgen). AMG 228 and other anti-GITR antibodies are disclosed, *e.g.*, in US 9,464,139 and WO 2015/031667, incorporated by reference in their entirety. In one embodiment, the anti-GITR antibody molecule comprises one or more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of AMG 228.

In one embodiment, the anti-GITR antibody molecule is INBRX-110 (Inhibrx). INBRX-110 and other anti-GITR antibodies are disclosed, *e.g.*, in US 2017/0022284 and WO 2017/015623, incorporated by reference in their entirety. In one embodiment, the GITR agonist comprises one or

more of the CDR sequences (or collectively all of the CDR sequences), the heavy chain or light chain variable region sequence, or the heavy chain or light chain sequence of INBRX-110.

In one embodiment, the GITR agonist (*e.g.*, a fusion protein) is MEDI 1873 (MedImmune), also known as MEDI1873. MEDI 1873 and other GITR agonists are disclosed, *e.g.*, in US 2017/0073386, WO 2017/025610, and Ross *et al. Cancer Res* 2016; 76(14 Suppl): Abstract nr 561, incorporated by reference in their entirety. In one embodiment, the GITR agonist comprises one or more of an IgG Fc domain, a functional multimerization domain, and a receptor binding domain of a glucocorticoid-induced TNF receptor ligand (GITRL) of MEDI 1873.

Further known GITR agonists (*e.g.*, anti-GITR antibodies) include those described, *e.g.*, in WO 2016/054638, incorporated by reference in its entirety.

In one embodiment, the anti-GITR antibody is an antibody that competes for binding with, and/or binds to the same epitope on GITR as, one of the anti-GITR antibodies described herein.

In one embodiment, the GITR agonist is a peptide that activates the GITR signaling pathway. In one embodiment, the GITR agonist is an immunoadhesin binding fragment (*e.g.*, an immunoadhesin binding fragment comprising an extracellular or GITR binding portion of GITRL) fused to a constant region (*e.g.*, an Fc region of an immunoglobulin sequence).

Table 10: Amino acid sequence of other exemplary anti-GITR antibody molecules

BMS-986156		
SEQ ID NO: 920	VH	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGL EWVAVIWYEGSNKYYADSVKGRFTISRDNSKNTLYLQMNSLRAED TAVYYCARGGSMVRGDYYYGMDVWGQGTTVTVSS
SEQ ID NO: 921	VL	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLI YDASSLESGVPSRFSGSGSGTDFTLTISSLQPEDFATYYCQQFNSYPY TFGQGTKLEIK

IL15/IL-15Ra complexes

In certain embodiments, the anti-LAG-3 antibody molecule described herein is administered in combination with an IL-15/IL-15Ra complex. In some embodiments, the IL-15/IL-15Ra complex is chosen from NIZ985 (Novartis), ATL-803 (Altor) or CYP0150 (Cytune).

Exemplary IL-15/IL-15Ra complexes

In one embodiment, the IL-15/IL-15Ra complex comprises human IL-15 complexed with a soluble form of human IL-15Ra. The complex may comprise IL-15 covalently or noncovalently bound to a soluble form of IL-15Ra. In a particular embodiment, the human IL-15 is noncovalently bonded to a soluble form of IL-15Ra. In a particular embodiment, the human IL-15 of the composition comprises an amino acid sequence of SEQ ID NO: 1001 in Table 11 and the soluble form of human IL-15Ra comprises an amino acid sequence of SEQ ID NO:1002 in Table 11, as described in WO 2014/066527, incorporated by reference in its entirety. The molecules described

herein can be made by vectors, host cells, and methods described in WO 2007/084342, incorporated by reference in its entirety.

Table 11. Amino acid and nucleotide sequences of exemplary IL-15/IL-15Ra complexes

NIZ985		
SEQ ID NO: 1001	Human IL-15	NWVNVISDLKKIEDLIQSMHIDATLYTESDVHPSCKVTAMKCFLLEL QVISLESGDASIHDTVENLIILANNSLSSNGNVTESGCKECEELEEKNI KEFLQSFVHIVQMFINTS
SEQ ID NO: 1002	Human Soluble IL-15Ra	ITCPPPMSVEHADIWVKSYSLYSRERYICNSGFKRKAGTSSLTECVLN KATNVAHWTTPSLKCIRDPALVHQRPAPPSTVTTAGVTPQPESLSPSG KEPAASSPSSNNTAATTAAIVPGSQLMPSKSPSTGTTEISSHESSHGTPS QTTAKNWELTASASHQPPGVYPQG

Other Exemplary IL-15/IL-15Ra Complexes

In one embodiment, the IL-15/IL-15Ra complex is ALT-803, an IL-15/IL-15Ra Fc fusion protein (IL-15N72D:IL-15RaSu/Fc soluble complex). ALT-803 is disclosed in WO 2008/143794, incorporated by reference in its entirety. In one embodiment, the IL-15/IL-15Ra Fc fusion protein comprises the sequences as disclosed in Table 12.

In one embodiment, the IL-15/IL-15Ra complex comprises IL-15 fused to the sushi domain of IL-15Ra (CYP0150, Cytune). The sushi domain of IL-15Ra refers to a domain beginning at the first cysteine residue after the signal peptide of IL-15Ra, and ending at the fourth cysteine residue after said signal peptide. The complex of IL-15 fused to the sushi domain of IL-15Ra is disclosed in WO 2007/04606 and WO 2012/175222, incorporated by reference in their entirety. In one embodiment, the IL-15/IL-15Ra sushi domain fusion comprises the sequences as disclosed in Table 12.

Table 12. Amino acid sequences of other exemplary IL-15/IL-15Ra complexes

ALT-803 (Altor)		
SEQ ID NO: 1003	IL-15N72D	NWVNVISDLKKIEDLIQSMHIDATLYTESDVHPSCKVTAMKCFLLEL QVISLESGDASIHDTVENLIILANDSLSSNGNVTESGCKECEELEEKNI KEFLQSFVHIVQMFINTS
SEQ ID NO: 1004	IL-15RaSu/ Fc	ITCPPPMSVEHADIWVKSYSLYSRERYICNSGFKRKAGTSSLTECVLN KATNVAHWTTPSLKCIREPKSCDKTHTCPPCPAPELLGGPSVFLFPPK PKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPR EEQYNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKA KGQPREPQVYTLPPSRDELTKNQVSLTCLVKGFYPSDIAVEWESNGQ PENNYKTTPPVLDSDGSFFLYSKLTVDKSRWQQGNVFSCSVMHEAL HNHYTQKSLSLSPGK
IL-15 / IL-15Ra sushi domain fusion (Cytune)		
SEQ ID NO:1005	Human IL-15	NWVNVISDLKKIEDLIQSMHIDATLYTESDVHPSCKVTAMKCFLLEL QVISLESGDASIHDTVENLIILANNSLSSNGNVTESGCKECEELEXKNI KEFLQSFVHIVQMFINTS Where X is E or K
SEQ ID NO:1006	Human IL-15Ra sushi and hinge domains	ITCPPPMSVEHADIWVKSYSLYSRERYICNSGFKRKAGTSSLTECVLN KATNVAHWTTPSLKCIRDPALVHQRPAPP

Pharmaceutical Compositions, Formulations, and Kits

In another aspect, the disclosure provides compositions, *e.g.*, pharmaceutically acceptable compositions, which include an anti-LAG-3 antibody molecule described herein, formulated together with a pharmaceutically acceptable carrier. As used herein, "pharmaceutically acceptable carrier" includes any and all solvents, dispersion media, isotonic and absorption delaying agents, and the like that are physiologically compatible. The carrier can be suitable for intravenous, intramuscular, subcutaneous, parenteral, rectal, spinal or epidermal administration (*e.g.* by injection or infusion).

The compositions described herein may be in a variety of forms. These include, for example, liquid, semi-solid and solid dosage forms, such as liquid solutions (*e.g.*, injectable and infusible solutions), dispersions or suspensions, liposomes and suppositories. The preferred form depends on the intended mode of administration and therapeutic application. Typical preferred compositions are in the form of injectable or infusible solutions. The preferred mode of administration is parenteral (*e.g.*, intravenous, subcutaneous, intraperitoneal, intramuscular). In a preferred embodiment, the antibody is administered by intravenous infusion or injection. In another preferred embodiment, the antibody is administered by intramuscular or subcutaneous injection.

The phrases "parenteral administration" and "administered parenterally" as used herein means modes of administration other than enteral and topical administration, usually by injection, and includes, without limitation, intravenous, intramuscular, intraarterial, intrathecal, intracapsular, intraorbital, intracardiac, intradermal, intraperitoneal, transtracheal, subcutaneous, subcuticular, intraarticular, subcapsular, subarachnoid, intraspinal, epidural and intrasternal injection and infusion.

Therapeutic compositions typically should be sterile and stable under the conditions of manufacture and storage. The composition can be formulated as a solution, microemulsion, dispersion, liposome, or other ordered structure suitable to high antibody concentration. Sterile injectable solutions can be prepared by incorporating the active compound (*e.g.,* antibody or antibody portion) 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, the preferred 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. The proper fluidity of a solution 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. Prolonged absorption of injectable compositions can be brought about by including in the composition an agent that delays absorption, for example, monostearate salts and gelatin.

An anti-LAG-3 antibody molecule or a composition described herein can be formulated into a formulation (*e.g.*, a dose formulation or dosage form) suitable for administration (*e.g.*, intravenous administration) to a subject as described herein. The formulation described herein can be a liquid formulation, a lyophilized formulation, or a reconstituted formulation.

In certain embodiments, the formulation is a liquid formulation. In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) and a buffering agent.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 25 mg/mL to 250 mg/mL, *e.g.*, 50 mg/mL to 200 mg/mL, 60 mg/mL to 180 mg/mL, 70 mg/mL to 150 mg/mL, 80 mg/mL to 120 mg/mL, 90 mg/mL to 110 mg/mL, 50 mg/mL to 150 mg/mL, 50 mg/mL to 100 mg/mL, 150 mg/mL to 200 mg/mL, or 100 mg/mL to 200 mg/mL, *e.g.*, 50 mg/mL, 60 mg/mL, 70 mg/mL, 80 mg/mL, 90 mg/mL, 100 mg/mL, 110 mg/mL, 120 mg/mL, 130 mg/mL, 140 mg/mL, or 150 mg/mL. In certain embodiments, the anti-LAG-3 antibody molecule is present at a concentration of 80 mg/mL to 120 mg/mL, *e.g.*, 100 mg/mL.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises a buffering agent comprising histidine (*e.g.*, a histidine buffer). In certain embodiments, the buffering agent (*e.g.*, histidine buffer) is present at a concentration of 1 mM to 100 mM, *e.g.*, 2 mM to 50 mM, 5 mM to 40 mM, 10 mM to 30 mM, 15 to 25 mM, 5 mM to 40 mM, 5 mM to 30 mM, 5 mM to 20 mM, 5 mM to 10 mM, 40 mM to 50 mM, 30 mM to 50 mM, 20 mM to 50 mM, 10 mM to 50 mM, or 5 mM to 50 mM, *e.g.*, 2 mM, 5 mM, 10 mM, 15 mM, 20 mM, 25 mM, 30 mM, 35 mM, 40 mM, 45 mM, or 50 mM. In some embodiments, the buffering agent (*e.g.*, histidine buffer) is present at a concentration of 15 mM to 25 mM, *e.g.*, 20 mM. In other embodiments, the buffering agent (*e.g.*, a histidine buffer) has a pH of 4 to 7, *e.g.*, 5 to 6, *e.g.*, 5, 5.5, or 6. In some embodiments, the buffering agent (*e.g.*, histidine buffer) has a pH of 5 to 6, *e.g.*, 5.5. In certain embodiments, the buffering agent comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.*, 5.5). In certain embodiments, the buffering agent comprises histidine and histidine-HCl.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.*, 100 mg/mL; and a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.*, 5.5).

In some embodiments, the formulation (*e.g.*, liquid formulation) further comprises a carbohydrate. In certain embodiments, the carbohydrate is sucrose. In some embodiments, the carbohydrate (*e.g.*, sucrose) is present at a concentration of 50 mM to 500 mM, *e.g.*, 100 mM to 400 mM, 150 mM to 300 mM, 180 mM to 250 mM, 200 mM to 240 mM, 210 mM to 230 mM, 100 mM to 300 mM, 100 mM to 250 mM, 100 mM to 200 mM, 100 mM to 150 mM, 300 mM to 400 mM, 200 mM to 400 mM, or 100 mM to 400 mM, *e.g.*, 100 mM, 150 mM, 180 mM, 200 mM, 220 mM, 250

mM, 300 mM, 350 mM, or 400 mM. In some embodiments, the formulation comprises a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM.

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.,* 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.,* 5.5); and a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM.

In some embodiments, the formulation (*e.g.*, liquid formulation) further comprises a surfactant. In certain embodiments, the surfactant is polysorbate 20. In some embodiments, the surfactant or polysorbate 20) is present at a concentration of 0.005 % to 0.1% (w/w), *e.g.,* 0.01% to 0.08%, 0.02% to 0.06%, 0.03% to 0.05%, 0.01% to 0.06%, 0.01% to 0.05%, 0.01% to 0.03%, 0.06% to 0.08%, 0.04% to 0.08%, or 0.02% to 0.08% (w/w), *e.g.*, 0.01%, 0.02%, 0.03%, 0.04%, 0.05%, 0.06%, 0.07%, 0.08%, 0.09%, or 0.1% (w/w). In some embodiments, the formulation comprises a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.*, 0.04% (w/w).

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.*, 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.*, 5.5); a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.*, 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.,* 0.04% (w/w).

In some embodiments, the formulation (*e.g.*, liquid formulation) comprises an anti-LAG-3 antibody molecule present at a concentration of 100 mg/mL; a buffering agent that comprises a histidine buffer (*e.g.*, histidine/histidine-HCL) at a concentration of 20 mM) and has a pH of 5.5; a carbohydrate or sucrose present at a concentration of 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.04% (w/w).

In some embodiments, the liquid formulation is prepared by diluting a formulation comprising an anti-LAG-3 antibody molecule described herein. For example, a drug substance formulation can be diluted with a solution comprising one or more excipients (*e.g.,* concentrated excipients). In some embodiments, the solution comprises one, two, or all of histidine, sucrose, or polysorbate 20. In certain embodiments, the solution comprises the same excipient(s) as the drug substance formulation. Exemplary excipients include, but are not limited to, an amino acid (*e.g.,* histidine), a carbohydrate (*e.g.,* sucrose), or a surfactant (*e.g.,* polysorbate 20). In certain embodiments, the liquid formulation is not a reconstituted lyophilized formulation. In other embodiments, the liquid formulation is a reconstituted lyophilized formulation. In some embodiments, the formulation is stored as a liquid. In other embodiments, the formulation is prepared as a liquid and then is dried, *e.g.,* by lyophilization or spray-drying, prior to storage.

In certain embodiments, 0.5 mL to 10 mL (*e.g.*, 0.5 mL to 8 mL, 1 mL to 6 mL, or 2 mL to 5 mL, *e.g.*, 1 mL, 1.2 mL, 1.5 mL, 2 mL, 3 mL, 4 mL, 4.5 mL, or 5 mL) of the liquid formulation is filled per container (*e.g.*, vial). In other embodiments, the liquid formulation is filled into a container (*e.g.*, vial) such that an extractable volume of at least 1 mL (*e.g.*, at least 1.2 mL, at least 1. 5 mL, at least 2 mL, at least 3 mL, at least 4 mL, or at least 5 mL) of the liquid formulation can be withdrawn per container (*e.g.*, vial). In certain embodiments, the liquid formulation is extracted from the container (*e.g.*, vial) without diluting at a clinical site. In certain embodiments, the liquid formulation is diluted from a drug substance formulation and extracted from the container (*e.g.*, vial) at a clinical site. In certain embodiments, the formulation (*e.g.*, liquid formulation) is injected to an infusion bag, *e.g.*, within 1 hour (*e.g.*, within 45 minutes, 30 minutes, or 15 minutes) before the infusion starts to the patient.

A formulation described herein can be stored in a container. The container used for any of the formulations described herein can include, *e.g.*, a vial, and optionally, a stopper, a cap, or both. In certain embodiments, the vial is a glass vial, *e.g.*, a 6R white glass vial. In other embodiments, the stopper is a rubber stopper, *e.g.*, a grey rubber stopper. In other embodiments, the cap is a flip-off cap, *e.g.*, an aluminum flip-off cap. In some embodiments, the container comprises a 6R white glass vial, a grey rubber stopper, and an aluminum flip-off cap. In some embodiments, the container (*e.g.*, vial) is for a single-use container. In certain embodiments, 25 mg/mL to 250 mg/mL, *e.g.*, 50 mg/mL to 200 mg/mL, 60 mg/mL to 180 mg/mL, 70 mg/mL to 150 mg/mL, 80 mg/mL to 120 mg/mL, 90 mg/mL to 110 mg/mL, 50 mg/mL to 150 mg/mL, 50 mg/mL to 100 mg/mL, 150 mg/mL to 200 mg/mL, or 100 mg/mL to 200 mg/mL, *e.g.*, 50 mg/mL, 60 mg/mL, 70 mg/mL, 80 mg/mL, 90 mg/mL, 100 mg/mL, 110 mg/mL, 120 mg/mL, 130 mg/mL, 140 mg/mL, or 150 mg/mL, of the anti-LAG-3 antibody molecule, is present in the container (*e.g.*, vial).

In some embodiments, the formulation is a lyophilized formulation. In certain embodiments, the lyophilized formulation is lyophilized or dried from a liquid formulation comprising an anti-LAG-3 antibody molecule described herein. For example, 1 to 5 mL, *e.g.*, 1 to 2 mL, of a liquid formulation can be filled per container (*e.g.*, vial) and lyophilized.

In some embodiments, the formulation is a reconstituted formulation. In certain embodiments, the reconstituted formulation is reconstituted from a lyophilized formulation comprising an anti-LAG-3 antibody molecule described herein. For example, a reconstituted formulation can be prepared by dissolving a lyophilized formulation in a diluent such that the protein is dispersed in the reconstituted formulation. In some embodiments, the lyophilized formulation is reconstituted with 1 mL to 5 mL, *e.g.*, 1 mL to 2 mL, *e.g.*, 1.2 mL, of water or buffer for injection. In certain embodiments, the lyophilized formulation is reconstituted with 1 mL to 2 mL of water for injection, *e.g.*, at a clinical site.

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) and a buffering agent.

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule present at a concentration of 25 mg/mL to 250 mg/mL, *e.g.,* 50 mg/mL to 200 mg/mL, 60 mg/mL to 180 mg/mL, 70 mg/mL to 150 mg/mL, 80 mg/mL to 120 mg/mL, 90 mg/mL to 110 mg/mL, 50 mg/mL to 150 mg/mL, 50 mg/mL to 100 mg/mL, 150 mg/mL to 200 mg/mL, or 100 mg/mL to 200 mg/mL, *e.g.,* 50 mg/mL, 60 mg/mL, 70 mg/mL, 80 mg/mL, 90 mg/mL, 100 mg/mL, 110 mg/mL, 120 mg/mL, 130 mg/mL, 140 mg/mL, or 150 mg/mL. In certain embodiments, the anti-LAG-3 antibody molecule is present at a concentration of 80 mg/mL to 120 mg/mL, *e.g.,* 100 mg/mL.

In some embodiments, the reconstituted formulation comprises a buffering agent comprising histidine (*e.g.,* a histidine buffer). In certain embodiments, the buffering agent (*e.g.,* histidine buffer) is present at a concentration of 1 mM to 100 mM, *e.g.*, 2 mM to 50 mM, 5 mM to 40 mM, 10 mM to 30 mM, 15 to 25 mM, 5 mM to 40 mM, 5 mM to 30 mM, 5 mM to 20 mM, 5 mM to 10 mM, 40 mM to 50 mM, 30 mM to 50 mM, 20 mM to 50 mM, 10 mM to 50 mM, or 5 mM to 50 mM, *e.g.,* 2 mM, 5 mM, 10 mM, 15 mM, 20 mM, 25 mM, 30 mM, 35 mM, 40 mM, 45 mM, or 50 mM. In some embodiments, the buffering agent (*e.g.*, histidine buffer) is present at a concentration of 15 mM to 25 mM, *e.g.,* 20 mM. In other embodiments, the buffering agent (*e.g.,* a histidine buffer) has a pH of 4 to 7, *e.g.,* 5 to 6, *e.g.,* 5, 5.5, or 6. In some embodiments, the buffering agent (*e.g.,* histidine buffer) has a pH of 5 to 6, *e.g.,* 5.5. In certain embodiments, the buffering agent comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.,* 5.5). In certain embodiments, the buffering agent comprises histidine and histidine-HCl.

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.,* 100 mg/mL; and a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.,* 5.5).

In some embodiments, the reconstituted formulation further comprises a carbohydrate. In certain embodiments, the carbohydrate is sucrose. In some embodiments, the carbohydrate (*e.g.,* sucrose) is present at a concentration of 50 mM to 500 mM, *e.g.,* 100 mM to 400 mM, 150 mM to 300 mM, 180 mM to 250 mM, 200 mM to 240 mM, 210 mM to 230 mM, 100 mM to 300 mM, 100 mM to 250 mM, 100 mM to 200 mM, 100 mM to 150 mM, 300 mM to 400 mM, 200 mM to 400 mM, or 100 mM to 400 mM, *e.g.,* 100 mM, 150 mM, 180 mM, 200 mM, 220 mM, 250 mM, 300 mM, 350 mM, or 400 mM. In some embodiments, the formulation comprises a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM.

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.,* 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.,* 5.5); and a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.,* 220 mM.

In some embodiments, the reconstituted formulation further comprises a surfactant. In certain embodiments, the surfactant is polysorbate 20. In some embodiments, the surfactant or polysorbate 20 is present at a concentration of 0.005 % to 0.1% (w/w), *e.g.,* 0.01% to 0.08%, 0.02% to 0.06%, 0.03% to 0.05%, 0.01% to 0.06%, 0.01% to 0.05%, 0.01% to 0.03%, 0.06% to 0.08%, 0.04% to 0.08%, or 0.02% to 0.08% (w/w), *e.g.*, 0.01%, 0.02%, 0.03%, 0.04%, 0.05%, 0.06%, 0.07%, 0.08%, 0.09%, or 0.1% (w/w). In some embodiments, the formulation comprises a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.*, 0.04% (w/w).

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule present at a concentration of 80 to 120 mg/mL, *e.g.*, 100 mg/mL; a buffering agent that comprises a histidine buffer at a concentration of 15 mM to 25 mM (*e.g.*, 20 mM) and has a pH of 5 to 6 (*e.g.*, 5.5); a carbohydrate or sucrose present at a concentration of 200 mM to 250 mM, *e.g.*, 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.03% to 0.05%, *e.g.,* 0.04% (w/w).

In some embodiments, the reconstituted formulation comprises an anti-LAG-3 antibody molecule present at a concentration of 100 mg/mL; a buffering agent that comprises a histidine buffer (*e.g.*, histidine/histidine-HCL) at a concentration of 20 mM and has a pH of 5.5; a carbohydrate or sucrose present at a concentration of 220 mM; and a surfactant or polysorbate 20 present at a concentration of 0.04% (w/w).

In some embodiments, the formulation is reconstituted such that an extractable volume of at least 1 mL (*e.g.,* at least 1.2 mL, 1.5 mL, 2 mL, 2.5 mL, or 3 mL) of the reconstituted formulation can be withdrawn from the container (*e.g.,* vial) containing the reconstituted formulation. In certain embodiments, the formulation is reconstituted and/or extracted from the container (*e.g.,* vial) at a clinical site. In certain embodiments, the formulation (*e.g.,* reconstituted formulation) is injected to an infusion bag, *e.g.,* within 1 hour (*e.g.,* within 45 minutes, 30 minutes, or 15 minutes) before the infusion starts to the patient.

Other exemplary buffering agents that can be used in the formulation described herein include, but are not limited to, an arginine buffer, a citrate buffer, or a phosphate buffer. Other exemplary carbohydrates that can be used in the formulation described herein include, but are not limited to, trehalose, mannitol, sorbitol, or a combination thereof. The formulation described herein may also contain a tonicity agent, *e.g.,* sodium chloride, and/or a stabilizing agent, *e.g.,* an amino acid (*e.g.,* glycine, arginine, methionine, or a combination thereof).

The antibody molecules can be administered by a variety of methods known in the art, although for many therapeutic applications, the preferred route/mode of administration is intravenous injection or infusion. For example, the antibody molecules can be administered by intravenous infusion at a rate of more than 20 mg/min, *e.g.*, 20-40 mg/min, and typically greater than or equal to 40 mg/min to reach a dose of about 35 to 440 mg/m^2, typically about 70 to 310 mg/m^2, and more typically, about 110 to 130 mg/m^2. In embodiments, the antibody molecules can be administered by

intravenous infusion at a rate of less than 10mg/min; preferably less than or equal to 5 mg/min to reach a dose of about 1 to 100 mg/m ^{2}, preferably about 5 to 50 mg/m^2, about 7 to 25 mg/m^2 and more preferably, about 10 mg/m^2. As will be appreciated by the skilled artisan, the route and/or mode of administration will vary depending upon the desired results. In certain embodiments, the active compound may be prepared with a carrier that will protect the compound against rapid release, such as a controlled release formulation, including implants, transdermal patches, and microencapsulated delivery systems. Biodegradable, biocompatible polymers can be used, such as ethylene vinyl acetate, polyanhydrides, polyglycolic acid, collagen, polyorthoesters, and polylactic acid. Many methods for the preparation of such formulations are patented or generally known to those skilled in the art. *See, e.g., Sustained and Controlled Release Drug Delivery Systems*, J. R. Robinson, ed., Marcel Dekker, Inc., New York, 1978.

In certain embodiments, an antibody molecule can be orally administered, for example, with an inert diluent or an assimilable edible carrier. The compound (and other ingredients, if desired) may also be enclosed in a hard or soft shell gelatin capsule, compressed into tablets, or incorporated directly into the subject's diet. For oral therapeutic administration, the compounds may be incorporated with excipients and used in the form of ingestible tablets, buccal tablets, troches, capsules, elixirs, suspensions, syrups, wafers, and the like. To administer a compound of the invention by other than parenteral administration, it may be necessary to coat the compound with, or co-administer the compound with, a material to prevent its inactivation. Therapeutic compositions can also be administered with medical devices known in the art.

Dosage regimens are adjusted to provide the optimum desired response (*e.g.*, a therapeutic response). For example, a single bolus may be administered, several divided doses may be administered over time or the dose may be proportionally reduced or increased as indicated by the exigencies of the therapeutic situation. It is especially advantageous to formulate 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 subjects to be treated; each unit contains 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 invention are dictated by and directly dependent on (a) the unique characteristics of the active compound and the particular therapeutic effect to be achieved, and (b) the limitations inherent in the art of compounding such an active compound for the treatment of sensitivity in individuals.

An exemplary, non-limiting range for a therapeutically or prophylactically effective amount of an antibody molecule is 50 mg to 1500 mg, typically 80 mg to 1200 mg. In certain embodiments, the anti-LAG-3 antibody molecule is administered by injection (*e.g.*, subcutaneously or intravenously) at a dose (*e.g.*, a flat dose) of about 60 mg to about 100 mg (*e.g.*, about 80 mg), about 200 mg to about 300 mg (*e.g.*, about 240 mg), or about 1000 mg to about 1500 mg (*e.g.*, about 1200 mg). The dosing

schedule (*e.g.*, flat dosing schedule) can vary from *e.g.*, once a week to once every 2, 3, 4, 5, or 6 weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 60 mg to 100 mg (*e.g.*, about 80 mg) once every two weeks or once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 200 mg to about 300 mg (*e.g.*, about 240 mg) once every two weeks or once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 1000 mg to about 1500 mg (*e.g.*, about 1200 mg) once every two weeks or once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose about 80 mg once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose about 240 mg once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose about 1200 mg once every four weeks. While not wishing to be bound by theory, in some embodiments, flat or fixed dosing can be beneficial to patients, for example, to save drug supply and to reduce pharmacy errors.

The antibody molecule can be administered by intravenous infusion at a rate of more than 20 mg/min, *e.g.*, 20-40 mg/min, and typically greater than or equal to 40 mg/min to reach a dose of about 35 to 440 mg/m^2, typically about 70 to 310 mg/m^2, and more typically, about 110 to 130 mg/m^2. In embodiments, the infusion rate of about 110 to 130 mg/m^2 achieves a level of about 3 mg/kg. In other embodiments, the antibody molecule can be administered by intravenous infusion at a rate of less than 10 mg/min, *e.g.*, less than or equal to 5 mg/min to reach a dose of about 1 to 100 mg/m^2, *e.g.*, about 5 to 50 mg/m^2, about 7 to 25 mg/m^2, or, about 10 mg/m^2. In some embodiments, the antibody is infused over a period of about 30 min. It is to be noted that dosage values may vary with the type and severity of the condition to be alleviated. 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 compositions, and that dosage ranges set forth herein are exemplary only and are not intended to limit the scope or practice of the claimed composition.

The pharmaceutical compositions of the invention may include a "therapeutically effective amount" or a "prophylactically effective amount" of an antibody or antibody portion of the invention. A "therapeutically effective amount" refers to an amount effective, at dosages and for periods of time necessary, to achieve the desired therapeutic result. A therapeutically effective amount of the modified antibody or antibody fragment may vary according to factors such as the disease state, age, sex, and weight of the individual, and the ability of the antibody or antibody portion to elicit a desired response in the individual. A therapeutically effective amount is also one in which any toxic or detrimental effects of the modified antibody or antibody fragment is outweighed by the therapeutically beneficial effects. A "therapeutically effective dosage" preferably inhibits a measurable parameter, *e.g.*, tumor growth rate by at least about 20%, more preferably by at least about 40%, even more preferably by at least about 60%, and still more preferably by at least about 80%

relative to untreated subjects. The ability of a compound to inhibit a measurable parameter, *e.g.*, cancer, can be evaluated in an animal model system predictive of efficacy in human tumors. Alternatively, this property of a composition can be evaluated by examining the ability of the compound to inhibit, such inhibition in vitro by assays known to the skilled practitioner.

A "prophylactically effective amount" refers to an amount effective, at dosages and for periods of time necessary, to achieve the desired prophylactic result. Typically, since a prophylactic dose is used in subjects prior to or at an earlier stage of disease, the prophylactically effective amount will be less than the therapeutically effective amount.

Also within the scope of the disclosure is a kit comprising an anti-LAG-3 antibody molecule, composition, or formulation described herein. The kit can include one or more other elements including: instructions for use (*e.g.*, in accordance a dosage regimen described herein); other reagents, *e.g.*, a label, a therapeutic agent, or an agent useful for chelating, or otherwise coupling, an antibody to a label or therapeutic agent, or a radioprotective composition; devices or other materials for preparing the antibody for administration; pharmaceutically acceptable carriers; and devices or other materials for administration to a subject.

Use of Anti-LAG-3 Antibody Molecules

The anti-LAG-3 antibody molecules described herein can be used to modify an immune response in a subject. In some embodiments, the immune response is enhanced, stimulated or up-regulated. In certain embodiments, the immune response is inhibited, reduced, or down-regulated. For example, these antibody molecules can be administered to cells in culture, *e.g. in vitro* or *ex vivo*, or in a subject, *e.g.*, *in vivo*, to treat, prevent, and/or diagnose a variety of disorders, such as cancers, immune disorders, and infectious diseases.

As used herein, the term "subject" is intended to include human and non-human animals. In some embodiments, the subject is a human subject, *e.g.*, a human patient having a disorder or condition characterized by abnormal LAG-3 functioning. Generally, the subject has at least some LAG-3 protein, including the LAG-3 epitope that is bound by the antibody molecule, *e.g.*, a high enough level of the protein and epitope to support antibody binding to LAG-3. The term "non-human animals" includes mammals and non-mammals, such as non-human primates. In some embodiments, the subject is a human. In some embodiments, the subject is a human patient in need of enhancement of an immune response. The methods and compositions described herein are suitable for treating human patients having a disorder that can be treated by modulating (*e.g.*, augmenting or inhibiting) an immune response. In certain embodiments, the patient has or is at risk of having a disorder described herein, *e.g.*, a breast cancer, *e.g.*, a triple negative breast cancer (TNBC). In certain embodiments, a patient with TNBC is more immunogenic than other breast cancer subtypes, has higher expression of PD-L1, and/or has increased infiltration by tumor-infiltrating lymphocytes (TILs) (Loi *et al.* (2014)

Ann Oncol; 25: 1544-50; Mittendorf *et al.* (2014) Cancer Immunol Res; 2:361-70). In one embodiment, the patient does not exhibit liver metastasis.

Combination immunotherapy approaches suggest that synergistic blockade of co-inhibitory receptors demonstrates greater antitumor activity than the single agent (Wolchok *et al.* (2013) New Engl J Med; 369: 122-33). LAG-3 is a co-inhibitory receptor that may cooperate with PD-1 to inhibit immune responses (Anderson *et al.* (2016) Immunity; 44: 989–1004). The combined inhibition of PD-1 and LAG-3 checkpoints synergistically enhances antitumor responses over inhibition of either checkpoint alone (Woo *et al.* (2012) Cancer Res; 72: 917-27).

Also, there is increasing evidence that cytotoxic agents influence the tumor-host environment to be more favorable to the immune response, and consequently, the combination of immunotherapy with cytotoxic agents may synergize to increase therapeutic efficacy (Zitvogel *et al.* (2013) Immunity; 39: 74-88). Importantly, chemotherapy can induce immunogenic cell death, which facilitates efficient antigen presentation, and has been shown to trigger potent T cell responses in preclinical models (Kroemer *et al.* (2013) Immunol; 31:51–72; Pfirschke *et al.* (2016) Immunity; 44:343–54; Lu *et al.* (2017) Biomedical Res; 28:828-34). Without wishing to be bound by theory, it is believed that in some embodiments, chemotherapy (*e.g.*, a platinum agent), will create an environment early during T cell activation (*e,g.*, increased antigen concentration and/or antigen availability) that will favor the arising of LAG-3+CD8+ T cells, which will require only LAG3 inhibition to differentiate into tumor antigen specific effector cells. While the main mechanism of action of platinum agents is believed to be the induction of cancer cell apoptosis as a response of their covalent binding to DNA, recent studies have indicated that cellular molecules other than DNA may potentially act as targets, and that part of the antitumor effects of platinum drugs occurs through modulation of the immune system (Hato *et al.* (2014) Clin Cancer Res; 20: 2831–7). These immunogenic effects include modulation of STAT signaling (Lesterhuis *et al.* (2011) J Clin Invest; 121:3100–08); induction of an immunogenic type of cancer cell death through exposure of calreticulin and release of ATP and high-mobility group protein box-1 (HMGB-1) (Kroemer *et al.* (2013) Immunol; 31:51–72; Tesniere *et al.* (2010) Oncogenel; 29: 482–91); and enhancement of the effector immune response through modulation of programmed death receptor 1-ligand and mannose-6-phosphate receptor expression (Liu *et al.* (2010) Br J Cancer; 102:115–23). Without wishing to be bound by theory, it is believed that in some embodiments, combining platinum with immune checkpoint blockade will enhance the immunotherapy, in that platinum can provide immunogenic cell death, tumor cell sensitization to CTL lysis, and downregulation of PD-Ls.

In some embodiments, the subject has not been treated with a therapeutic agent, procedure, or modality prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with a therapeutic agent, procedure, or modality prior to receiving the anti-LAG-3 antibody molecule.

In certain embodiments, the subject has not been treated with an anti-LAG-3 therapy prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with an anti-LAG-3 therapy prior to receiving the anti-LAG-3 antibody molecule.

In certain embodiments, the subject has not been treated with a PD-1/PD-L1 therapy prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with a PD-1/PD-L1 therapy prior to receiving the anti-LAG-3 antibody molecule.

In certain embodiments, the subject has not been treated with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)) prior to receiving the anti-LAG-3 antibody molecule. In other embodiments, the subject has been treated with a chemotherapeutic agent (*e.g.*, a platinum agent (*e.g.*, carboplatin, cisplatin, oxaliplatin, or tetraplatin) or a nucleotide analog or precursor analog (*e.g.*, capecitabine)) prior to receiving the anti-LAG-3 antibody molecule.

In certain embodiments, the subject has been identified as having LAG-3 expression in tumor infiltrating lymphocytes. In other embodiments, the subject does not have detectable level of LAG-3 expression in tumor infiltrating lymphocytes.

Methods of Treating Cancer

In one aspect, the disclosure relates to treatment of a subject *in vivo* using an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein), or a composition or formulation comprising an anti-LAG-3 antibody molecule (*e.g.*, a composition or formulation described herein) such that growth of cancerous tumors is inhibited or reduced.

In certain embodiments, the anti-LAG-3 antibody molecule is administered in an amount effective to treat a cancer or a metastatic lesion thereof. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose from about 100 mg to about 2000 mg once every two week, once every three weeks, or once every four weeks. For example, the anti-LAG-3 antibody molecule can be administered at a dose from about 200 mg to about 1000 mg, about 300 mg to about 900 mg, about 200 mg to about 600 mg, about 300 mg to about 500 mg, about 600 to about 1000 mg, about 700 mg to about 900 mg, or about 400 mg to about 800 mg, once every three weeks or once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 700 mg to about 900 mg (*e.g.*, about 800 mg) once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 500 mg to about 700 mg (*e.g.*, about 533 mg or about 600 mg) once every four weeks.

An anti-LAG-3 antibody, or a composition or formulation comprising an anti-LAG-3 antibody molecule, may be used alone to inhibit the growth of cancerous tumors. Alternatively, an

anti-LAG-3 antibody, or a composition or formulation comprising an anti-LAG-3 antibody molecule, may be used in combination with one or more of: a standard of care treatment (*e.g.*, for cancers or infectious disorders), another antibody or antigen-binding fragment thereof, an immunomodulator (*e.g.*, an activator of a costimulatory molecule or an inhibitor of an inhibitory molecule); a vaccine, *e.g.*, a therapeutic cancer vaccine; or other forms of cellular immunotherapy, as described herein.

Accordingly, in one embodiment, the disclosure provides a method of inhibiting growth of tumor cells in a subject, comprising administering to the subject a therapeutically effective amount of an anti-LAG-3 antibody molecule described herein, *e.g.*, in accordance with a dosage regimen described herein. In an embodiment, the anti-LAG-3 antibody molecule is administered in the form of a composition or formulation described herein.

In one embodiment, the method is suitable for the treatment of cancer *in vivo*. To achieve antigen-specific enhancement of immunity, the anti-LAG-3 antibody molecule can be administered together with an antigen of interest. When an anti-LAG-3 antibody is administered in combination with one or more agents, the combination can be administered in either order or simultaneously.

In another aspect, a method of treating a subject, *e.g.*, reducing or ameliorating, a hyperproliferative condition or disorder (*e.g.*, a cancer), *e.g.*, solid tumor, a hematological cancer, soft tissue tumor, or a metastatic lesion, in a subject is provided. The method includes administering to the subject an anti-LAG-3 antibody molecule, or a composition or formulation comprising an anti-LAG-3 antibody molecule, as disclosed herein, in accordance with a dosage regimen disclosed herein.

As used herein, the term "cancer" is meant to include all types of cancerous growths or oncogenic processes, metastatic tissues or malignantly transformed cells, tissues, or organs, irrespective of histopathological type or stage of invasiveness. Examples of cancerous disorders include, but are not limited to, solid tumors, hematological cancers, soft tissue tumors, and metastatic lesions. Examples of solid tumors include malignancies, *e.g.*, sarcomas, and carcinomas (including adenocarcinomas and squamous cell carcinomas), of the various organ systems, such as those affecting liver, lung, breast, lymphoid, gastrointestinal (*e.g.*, colon), genitourinary tract (*e.g.*, renal, urothelial, bladder cells), prostate, CNS (*e.g.*, brain, neural or glial cells), skin, pancreas, and pharynx. Adenocarcinomas include malignancies such as most colon cancers, rectal cancer, renal-cell carcinoma, liver cancer, non-small cell carcinoma of the lung, cancer of the small intestine and cancer of the esophagus. Squamous cell carcinomas include malignancies, *e.g.*, in the lung, esophagus, skin, head and neck region, oral cavity, anus, and cervix. In one embodiment, the cancer is a melanoma, *e.g.*, an advanced stage melanoma. Metastatic lesions of the aforementioned cancers can also be treated or prevented using the methods and compositions of the invention.

Exemplary cancers whose growth can be inhibited using the antibodies molecules, compositions, or formulations, as disclosed herein, include cancers typically responsive to immunotherapy. Non-limiting examples of typical cancers for treatment include melanoma (*e.g.*, metastatic malignant melanoma), renal cancer (*e.g.*, clear cell carcinoma), prostate cancer (*e.g.*,

hormone refractory prostate adenocarcinoma), breast cancer, colon cancer and lung cancer (*e.g.*, non-small cell lung cancer). Additionally, refractory or recurrent malignancies can be treated using the antibody molecules described herein.

Examples of other cancers that can be treated include, but are not limited to, basal cell carcinoma, biliary tract cancer; bladder cancer; bone cancer; brain and CNS cancer; primary CNS lymphoma; neoplasm of the central nervous system (CNS); breast cancer; cervical cancer; choriocarcinoma; colon and rectum cancer; connective tissue cancer; cancer of the digestive system; endometrial cancer; esophageal cancer; eye cancer; cancer of the head and neck; gastric cancer; intra-epithelial neoplasm; kidney cancer; larynx cancer; leukemia (including acute myeloid leukemia, chronic myeloid leukemia, acute lymphoblastic leukemia, chronic lymphocytic leukemia, chronic or acute leukemia); liver cancer; lung cancer (*e.g.*, small cell and non-small cell); lymphoma including Hodgkin's and non-Hodgkin's lymphoma; lymphocytic lymphoma; melanoma, *e.g.*, cutaneous or intraocular malignant melanoma; myeloma; neuroblastoma; oral cavity cancer (*e.g.*, lip, tongue, mouth, and pharynx); ovarian cancer; pancreatic cancer; prostate cancer; retinoblastoma; rhabdomyosarcoma; rectal cancer; cancer of the respiratory system; sarcoma; skin cancer; stomach cancer; testicular cancer; thyroid cancer; uterine cancer; cancer of the urinary system, hepatocarcinoma, cancer of the anal region, carcinoma of the fallopian tubes, carcinoma of the vagina, carcinoma of the vulva, cancer of the small intestine, cancer of the endocrine system, cancer of the parathyroid gland, cancer of the adrenal gland, sarcoma of soft tissue, cancer of the urethra, cancer of the penis, solid tumors of childhood, spinal axis tumor, brain stem glioma, pituitary adenoma, Kaposi's sarcoma, epidermoid cancer, squamous cell cancer, T-cell lymphoma, environmentally induced cancers including those induced by asbestos, as well as other carcinomas and sarcomas, and combinations of said cancers.

In some embodiments, the disorder is a cancer, *e.g.*, a cancer described herein. In certain embodiments, the cancer is a solid tumor. In some embodiments, the cancer is brain tumor, *e.g.*, a glioblastoma, a gliosarcoma, or a recurrent brain tumor. In some embodiments, the cancer is a pancreatic cancer, *e.g.*, an advanced pancreatic cancer. In some embodiments, the cancer is a skin cancer, *e.g.*, a melanoma (*e.g.*, a stage II-IV melanoma, an HLA-A2 positive melanoma, an unresectable melanoma, or a metastatic melanoma), or a Merkel cell carcinoma. In some embodiments, the cancer is a renal cancer, *e.g.*, a renal cell carcinoma (RCC) (*e.g.*, a metastatic renal cell carcinoma) or a treatment-naïve metastatic kidney cancer. In some embodiments, the cancer is a breast cancer, *e.g.*, a metastatic breast carcinoma or a stage IV breast carcinoma, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the cancer is a virus-associated cancer. In some embodiments, the cancer is an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal). In some embodiments, the cancer is a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix). In some embodiments, the cancer is a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma). In some embodiments, the

cancer is a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)). In some embodiments, the cancer is a nasopharyngeal cancer (NPC). In some embodiments, the cancer is a penile cancer (*e.g.*, a squamous cell carcinoma of the penile). In some embodiments, the cancer is a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the cancer is a colorectal cancer, *e.g.*, a relapsed colorectal cancer or a metastatic colorectal cancer, *e.g.*, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the cancer is a lung cancer, *e.g.*, a non-small cell lung cancer (NSCLC). In certain embodiments, the cancer is a hematological cancer. In some embodiments, the cancer is a leukemia. In some embodiments, the cancer is a lymphoma, *e.g.,* a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL) (*e.g.*, a relapsed or refractory HL or DLBCL). In some embodiments, the cancer is a myeloma. In some embodiments, the cancer is an MSI-high cancer. In some embodiments, the cancer is a metastatic cancer. In other embodiments, the cancer is an advanced cancer. In other embodiments, the cancer is a relapsed or refractory cancer.

In one embodiment, the cancer is a Merkel cell carcinoma. In other embodiments, the cancer is a melanoma. In other embodiments, the cancer is a breast cancer, *e.g.,* a triple negative breast cancer (TNBC) or a HER2-negative breast cancer. In other embodiments, the cancer is a renal cell carcinoma (*e.g.,* a clear cell renal cell carcinoma (CCRCC) or a non-clear cell renal cell carcinoma (nccRCC)). In other embodiments, the cancer is a thyroid cancer, *e.g.,* an anaplastic thyroid carcinoma (ATC). In other embodiments, the cancer is a neuroendocrine tumor (NET), *e.g.,* an atypical pulmonary carcinoid tumor or an NET in pancreas, gastrointestinal (GI) tract, or lung. In certain embodiments, the cancer is a non-small cell lung cancer (NSCLC) (*e.g.,* a squamous NSCLC or a non-squamous NSCLC). In certain embodiments, the cancer is a fallopian tube cancer. In certain embodiments, the cancer is a microsatellite instability-high colorectal cancer (MSI-high CRC) or a microsatellite stable colorectal cancer (MSS CRC).

In other embodiments, the cancer is a hematological malignancy or cancer including but is not limited to a leukemia or a lymphoma. For example, an anti-LAG-3 antibody molecule can be used to treat cancers and malignancies including, but not limited to, *e.g.*, an acute leukemia, *e.g.,* B-cell acute lymphoid leukemia ("BALL"), T-cell acute lymphoid leukemia ("TALL"), acute lymphoid leukemia (ALL); a chronic leukemia, *e.g.*, chronic myelogenous leukemia (CML), chronic lymphocytic leukemia (CLL); an additional hematologic cancer or hematologic condition, *e.g.*, B cell prolymphocytic leukemia, blastic plasmacytoid dendritic cell neoplasm, Burkitt's lymphoma, diffuse large B cell lymphoma, Follicular lymphoma, Hairy cell leukemia, small cell- or a large cell-follicular lymphoma, malignant lymphoproliferative conditions, MALT lymphoma, mantle cell lymphoma, Marginal zone lymphoma, multiple myeloma, myelodysplasia and myelodysplastic syndrome, non-Hodgkin's lymphoma, plasmablastic lymphoma, plasmacytoid dendritic cell neoplasm, Waldenström

macroglobulinemia, and "preleukemia" which are a diverse collection of hematological conditions united by ineffective production (or dysplasia) of myeloid blood cells, and the like.

As used herein, the term "subject" is intended to include human and non-human animals. In some embodiments, the subject is a human subject, *e.g.*, a human patient having a disorder or condition characterized by abnormal LAG-3 functioning. Generally, the subject has at least some LAG-3 protein, including the LAG-3 epitope that is bound by the antibody molecule, *e.g.*, a high enough level of the protein and epitope to support antibody binding to LAG-3. The term "non-human animals" includes mammals and non-mammals, such as non-human primates. In some embodiments, the subject is a human. In some embodiments, the subject is a human patient in need of enhancement of an immune response. The methods and compositions described herein are suitable for treating human patients having a disorder that can be treated by modulating (*e.g.*, augmenting or inhibiting) an immune response.

In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor, a PD-L1 inhibitor, or a chemotherapeutic agent. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein. In some embodiments, the chemotherapeutic agent is a platinum agent. In certain embodiments, the platinum agent is carboplatin. In certain embodiments, the platinum agent is cisplatin. In certain embodiments, the platinum agent is oxaliplatin. In certain embodiments, the platinum agent is tetraplatin.

In some embodiments, the chemotherapeutic agent is a nucleotide analog or precursor analog. In certain embodiments, the nucleotide analog or precursor analog is capecitabine.

In certain embodiments, the cancer is a solid tumor. In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the solid tumor. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the solid tumor. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-PD-1 antibody molecule is REGN2810. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a breast cancer, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the breast cancer (*e.g.*, the TNBC). In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent, *e.g.*, a PD-1 inhibitor, to treat the breast cancer (*e.g.*, the TNBC). In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In certain embodiments, the anti-PD-1 antibody molecule is REGN2810. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks and the PD-1 inhibitor is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks to treat the breast cancer (*e.g.*, TNBC). In certain embodiments, the anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein) is administered at a dose of about 600 mg to about 1000 mg (*e.g.*, about 800 mg) once every four weeks and the PD-1 inhibitor (*e.g.*, an anti-PD-1 antibody molecule described herein) is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every four weeks to treat the breast cancer (*e.g.*, TNBC).

In certain embodiments, the cancer is a breast cancer, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent, *e.g.*, a chemotherapeutic agent, to treat the breast cancer (*e.g.*, the TNBC). In some embodiments, the chemotherapeutic agent is a platinum agent. In certain embodiments, the platinum agent is carboplatin. In certain embodiments, the platinum agent is cisplatin. In certain embodiments, the platinum agent is oxaliplatin. In certain embodiments, the platinum agent is tetraplatin. In some embodiments, the chemotherapeutic agent is a nucleotide analog or precursor analog. In certain embodiments, the nucleotide analog or precursor analog is capecitabine. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks and the chemotherapeutic agent is administered at a dose to achieve an area under the curve (AUC) of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks to treat the breast cancer (*e.g.*, TNBC).

In certain embodiments, the cancer is a breast cancer, *e.g.*, a triple negative breast cancer (TNBC). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule is administered in combination with a PD-1 inhibitor and a chemotherapeutic agent to treat the breast cancer (*e.g.*, the TNBC). In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001

(spartalizumab). In certain embodiments, the anti-PD-1 antibody molecule is REGN2810. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the chemotherapeutic agent is a platinum agent. In certain embodiments, the platinum agent is carboplatin. In certain embodiments, the platinum agent is cisplatin. In certain embodiments, the platinum agent is oxaliplatin. In certain embodiments, the platinum agent is tetraplatin. In some embodiments, the chemotherapeutic agent is a nucleotide analog or precursor analog. In certain embodiments, the nucleotide analog or precursor analog is capecitabine. In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 300 mg to about 500 mg (*e.g.*, about 400 mg) once every three weeks, the PD-1 inhibitor is administered at a dose of about 200 mg to about 400 mg (*e.g.*, about 300 mg) once every three weeks, and the chemotherapeutic agent is administered at a dose to achieve an AUC of about 4 to about 8 or about 5 to about 7 (*e.g.*, an AUC of about 6) once every three weeks to treat the breast cancer (*e.g.*, TNBC).

In certain embodiments, the cancer is a brain tumor. In some embodiments, the brain tumor is a glioblastoma (*e.g.*, a recurrent glioblastoma). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the brain tumor. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the brain tumor. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001 (spartalizumab). In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a pancreatic cancer. In some embodiments, the pancreatic cancer is an advanced pancreatic cancer. In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the pancreatic cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, to treat the pancreatic cancer. In some embodiments, the second therapeutic agent or modality comprises a chemotherapeutic agent (*e.g.*, gemcitabine).

In certain embodiments, the cancer is a melanoma. In some embodiments, the melanoma is an HLA-A2 positive, a stage II, III, or IV melanoma, an unresectable melanoma, or a metastatic melanoma. In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the melanoma. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a

second therapeutic agent or modality, to treat the melanoma. In some embodiments, the second therapeutic agent or modality is an HLA-A2 peptide. In certain embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, and optionally, the HLA-A2 peptide, is administered to a disease-free melanoma patient. In some embodiments, the second therapeutic agent or modality comprises a PD-1 inhibitor or a PD-L1 inhibitor. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a renal cancer. In some embodiments, the renal cancer is a renal cell carcinoma (RCC), *e.g.*, a metastatic renal cell carcinoma. In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the renal cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the renal cancer. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a breast cancer. In some embodiments, the breast cancer is a metastatic breast carcinoma. In some embodiments, the breast cancer is a triple negative breast cancer (TNBC). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the breast cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, to treat the breast cancer. In certain embodiments, the second therapeutic agent or modality is a chemotherapeutic agent (*e.g.*, paclitaxel). In certain embodiments, the anti-LAG-3 antibody molecule is administered at a dose of about 700 mg to about 900 mg once every four weeks to treat the breast cancer (*e.g.*, TNBC).

In certain embodiments, the cancer is a virus-associated tumor. In some embodiments, the virus-associated tumor is chosen from an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal), a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix), a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma), a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)), a nasopharyngeal cancer (NPC), a penile cancer (*e.g.*, a squamous cell carcinoma of the penile), a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation

comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the virus-associated tumor. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the virus-associated tumor. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is chosen from an anal canal cancer (*e.g.*, a squamous cell carcinoma of the anal canal), a cervical cancer (*e.g.*, a squamous cell carcinoma of the cervix), a gastric cancer (*e.g.*, an Epstein Barr Virus (EBV) positive gastric cancer, or a gastric or gastro-esophageal junction carcinoma), a head and neck cancer (*e.g.*, an HPV positive and negative squamous cell cancer of the head and neck (SCCHN)), a nasopharyngeal cancer (NPC), a penile cancer (*e.g.*, a squamous cell carcinoma of the penile), or a vaginal or vulvar cancer (*e.g.*, a squamous cell carcinoma of the vagina or vulva). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the cancer. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a colorectal cancer. In some embodiments, the colorectal cancer is a relapsed colorectal cancer, a metastatic colorectal cancer, a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer. In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the colorectal cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the colorectal cancer. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In other embodiments, the anti-PD-1

antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a lung cancer. In some embodiments, the lung cancer is a non-small cell lung cancer (NSCLC). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the lung cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, *e.g.*, a PD-1 inhibitor or a PD-L1 inhibitor, to treat the lung cancer. In some embodiments, the PD-1 inhibitor is an anti-PD-1 antibody molecule, *e.g.*, an anti-PD-1 antibody described herein. In certain embodiments, the anti-PD-1 antibody molecule is PDR001. In other embodiments, the anti-PD-1 antibody molecule is nivolumab. In some embodiments, the PD-L1 inhibitor is an anti-PD-L1 antibody molecule, *e.g.*, an anti-PD-L1 antibody molecule described herein.

In certain embodiments, the cancer is a hematological cancer. In some embodiments, the hematological cancer is a lymphoma, *e.g.*, a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DCBCL) (*e.g.*, a relapsed or refractory HL or DCBCL). In some embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered as a single agent to treat the hematological cancer. In other embodiments, the anti-LAG-3 antibody molecule, or the composition or formulation comprising the anti-LAG-3 antibody molecule, is administered in combination with a second therapeutic agent or modality, to treat the hematological cancer.

Methods and compositions disclosed herein are useful for treating metastatic lesions associated with the aforementioned cancers.

In some embodiments, the method further comprises determining whether a tumor sample is positive for one or more of PD-L1, CD8, and IFN-γ, and if the tumor sample is positive for one or more, *e.g.*, two, or all three, of the markers, then administering to the patient a therapeutically effective amount of an anti-LAG-3 antibody molecule, optionally in combination with one or more other immunomodulators or anti-cancer agents, as described herein.

In some embodiments, the anti-LAG-3 antibody molecule is used to treat a cancer that expresses LAG-3. LAG-3-expressing cancers include, *e.g.*, colorectal cancer (Xiao and Freeman *Cancer Discov.* 2015; 5(1):16-8), breast cancer (Bottai *et al. Breast Cancer Res.* 2016; 18(1): 121), prostate cancer (Sfanos *et al. Clin Cancer Res.* 2008; 14(11):3254-61), lung cancer (He *et al. J Thorac Oncol.* 2017; 12(5): 814-823), and liver cancer (Pedroza-Gonzalez et al. Oncoimmunology. 2015; 4(6):e1008355). The LAG-3-expressing cancer may be a metastatic cancer.

In other embodiments, the anti-LAG-3 antibody molecule is used to treat a cancer that is characterized by microsatellite instability-high (MSI-H) or mismatch repair deficient (dMMR). The identification of MSI-H or dMMR tumor status for patients can be determined using, *e.g.*, polymerase

chain reaction (PCR) tests for MSI-H status or immunohistochemistry (IHC) tests for dMMR. Methods for identification of MSI-H or dMMR tumor status are described, *e.g.*, in Ryan *et al. Crit Rev Oncol Hematol.* 2017; 116:38-57; Dietmaier and Hofstadter. *Lab Invest 2001*, 81:1453-1456; Kawakami *et al. Curr Treat Options Oncol.* 2015; 16(7): 30).

The combination therapies described herein can include a composition of the present invention co-formulated with, and/or co-administered with, one or more additional therapeutic agents, *e.g.*, one or more anti-cancer agents, cytotoxic or cytostatic agents, hormone treatment, vaccines, and/or other immunotherapies. In other embodiments, the antibody molecules are administered in combination with other therapeutic treatment modalities, including surgery, radiation, cryosurgery, and/or thermotherapy. Such combination therapies may advantageously utilize lower dosages of the administered therapeutic agents, thus avoiding possible toxicities or complications associated with the various monotherapies.

The methods, compositions and combinations described herein (*e.g.*, anti-LAG-3 antibodies and methods of using them) can be used in combination with other agents or therapeutic modalities, *e.g.*, a second therapeutic agent chosen from one or more of the agents listed in Table 6 of WO 2017/019897, the content of which is incorporated by reference in its entirety. In one embodiment, the methods described herein include administering to the subject an anti-LAG-3 antibody molecule as described in WO2017/019894 (optionally in combination with one or more inhibitors of PD-1, PD-L1, TIM-3, CEACAM (*e.g.*, CEACAM-1 and/or CEACAM-5), or CTLA-4)), further include administration of a second therapeutic agent chosen from one or more of the agents listed in Table 6 of WO 2017/019897, in an amount effective to treat or prevent a disorder, *e.g.*, a disorder as described herein, *e.g.*, a cancer. When administered in combination, the anti-LAG-3 antibody molecule, the additional agent (*e.g.*, second or third agent), or all, can be administered in an amount or dose that is higher, lower or the same than the amount or dosage of each agent used individually, *e.g.*, as a monotherapy. In certain embodiments, the administered amount or dosage of the anti-LAG-3 antibody molecule, the additional agent (*e.g.*, second or third agent), or all, is lower (*e.g.*, at least 20%, at least 30%, at least 40%, or at least 50%) than the amount or dosage of each agent used individually, *e.g.*, as a monotherapy. In other embodiments, the amount or dosage of the anti-LAG-3 antibody molecule, the additional agent (*e.g.*, second or third agent), or all, that results in a desired effect (*e.g.*, treatment of cancer) is lower (*e.g.*, at least 20%, at least 30%, at least 40%, or at least 50% lower).

In other embodiments, the additional therapeutic agent is chosen from one or more of the agents listed in Table 6 of WO 2017/019894. In some embodiments, the additional therapeutic agent is chosen from one or more of: 1) a protein kinase C (PKC) inhibitor; 2) a heat shock protein 90 (HSP90) inhibitor; 3) an inhibitor of a phosphoinositide 3-kinase (PI3K) and/or target of rapamycin (mTOR); 4) an inhibitor of cytochrome P450 (*e.g.*, a CYP17 inhibitor or a 17alpha-Hydroxylase/C17-20 Lyase inhibitor); 5) an iron chelating agent; 6) an aromatase inhibitor; 7) an inhibitor of p53, *e.g.*, an inhibitor of a p53/Mdm2 interaction; 8) an apoptosis inducer; 9) an angiogenesis inhibitor; 10) an

aldosterone synthase inhibitor; 11) a smoothened (SMO) receptor inhibitor; 12) a prolactin receptor (PRLR) inhibitor; 13) a Wnt signaling inhibitor; 14) a CDK4/6 inhibitor; 15) a fibroblast growth factor receptor 2 (FGFR2)/fibroblast growth factor receptor 4 (FGFR4) inhibitor; 16) an inhibitor of macrophage colony-stimulating factor (M-CSF); 17) an inhibitor of one or more of c-KIT, histamine release, Flt3 (*e.g.*, FLK2/STK1) or PKC; 18) an inhibitor of one or more of VEGFR-2 (*e.g.*, FLK-1/KDR), PDGFRbeta, c-KIT or Raf kinase C; 19) a somatostatin agonist and/or a growth hormone release inhibitor; 20) an anaplastic lymphoma kinase (ALK) inhibitor; 21) an insulin-like growth factor 1 receptor (IGF-1R) inhibitor; 22) a P-Glycoprotein 1 inhibitor; 23) a vascular endothelial growth factor receptor (VEGFR) inhibitor; 24) a BCR-ABL kinase inhibitor; 25) an FGFR inhibitor; 26) an inhibitor of CYP11B2; 27) a HDM2 inhibitor, *e.g.*, an inhibitor of the HDM2-p53 interaction; 28) an inhibitor of a tyrosine kinase; 29) an inhibitor of c-MET; 30) an inhibitor of JAK; 31) an inhibitor of DAC; 32) an inhibitor of 11β-hydroxylase; 33) an inhibitor of IAP; 34) an inhibitor of PIM kinase; 35) an inhibitor of Porcupine; 36) an inhibitor of BRAF, *e.g.*, BRAF V600E or wild-type BRAF; 37) an inhibitor of HER3; 38) an inhibitor of MEK; or 39) an inhibitor of a lipid kinase, *e.g.*, as described in Table 6 of WO 2017/019894.

Additional embodiments of combination therapies comprising an anti-LAG-3 antibody molecule described herein are described in WO 2017/019894, which is incorporated by reference in its entirety.

Methods of Treating Infectious Diseases

Disclosed herein are methods of treating infectious diseases using an anti-LAG-3 antibody molecule (*e.g.*, an anti-LAG-3 antibody molecule described herein), or a composition or formulation comprising an anti-LAG-3 antibody molecule (*e.g.*, a composition or formulation described herein). In certain embodiments, the antibody molecule, composition, or formulation is administered to a subject in accordance with a dosage regimen described herein.

In certain embodiments, the anti-LAG-3 antibody molecule is administered in an amount effective to treat an infectious disease or a symptom thereof. In some embodiments, the anti-LAG-3 antibody molecule is administered at a dose from about 100 mg to about 2000 mg once every two weeks, once every three weeks, or once every four weeks. For example, the anti-LAG-3 antibody molecule can be administered at a dose from about 200 mg to about 1000 mg, about 300 mg to about 900 mg, about 200 mg to about 600 mg, about 300 mg to about 500 mg, about 600 to about 1000 mg, about 700 mg to about 900 mg, or about 400 mg to about 800 mg, once every three weeks or once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 300 mg to 500 mg (*e.g.*, about 400 mg) once every three weeks. In one embodiment, the anti-LAG-3 antibody molecule is administered at a dose from about 700 mg to about 900 mg (*e.g.*, about 800 mg) once every four weeks. In one embodiment, the anti-LAG-3 antibody molecule is

administered at a dose from about 500 mg to about 700 mg (*e.g.*, about 533 mg or about 600 mg) once every four weeks.

Certain methods described herein are used to treat subjects that have been exposed to particular toxins or pathogens. Without wishing to be bound by theory, it is believed that in some embodiments, anti-LAG-3 antibodies can stimulate NK cell mediated killing of target cells and can enhances IFN-gamma secretion and proliferation of CD4+ T cells. Accordingly, in certain embodiments, the anti-LAG-3 antibody molecules, compositions, and formulations described herein are suitable for use in stimulating an immune response against an infectious agent. Accordingly, another aspect of the invention provides a method of treating an infectious disease in a subject comprising administering to the subject an anti-LAG-3 antibody molecule, or a composition or formulation comprising an anti-LAG-3 antibody molecule, *e.g.*, in accordance with a dosage regimen described herein, such that the subject is treated for the infectious disease. In the treatment of infection (*e.g.*, acute and/or chronic), administration of the anti-LAG-3 antibody molecules can be combined with conventional treatments in addition to or in lieu of stimulating natural host immune defenses to infection. Natural host immune defenses to infection include, but are not limited to inflammation, fever, antibody-mediated host defense, T-lymphocyte-mediated host defenses, including lymphokine secretion and cytotoxic T-cells (especially during viral infection), complement mediated lysis and opsonization (facilitated phagocytosis), and phagocytosis. The ability of the anti-LAG-3 antibody molecules to reactivate dysfunctional T-cells would be useful to treat chronic infections, in particular those in which cell-mediated immunity is important for complete recovery.

Similar to its application to tumors as discussed in the previous section, the anti-LAG-3 antibody molecules, compositions, and formulations described herein can be used alone, or in combination with a second therapeutic agent or modality, or as an adjuvant, in combination with a vaccine, to stimulate an immune response to a pathogen or toxin. Examples of pathogens for which this therapeutic approach may be particularly useful, include pathogens for which there is currently no effective vaccine, or pathogens for which conventional vaccines are less than completely effective. These include, but are not limited to HIV, Hepatitis (A, B, & C), Influenza, Herpes, Giardia, Malaria, Leishmania, *Staphylococcus aureus, Pseudomonas aeruginosa*. Anti-LAG-3 antibody molecule therapy is also useful against established infections by agents such as HIV that present altered antigens over the course of the infections.

Accordingly, in some embodiments, an anti-LAG-3 antibody molecule, composition, or formulation described herein is used to treat a subject that has an infection or is at risk of having an infection. An infection refers to, *e.g.*, a disease or condition attributable to the presence in a host of a foreign organism or agent that reproduces within the host. Infections typically involve breach of a normal mucosal or other tissue barrier by an infectious organism or agent. A subject that has an infection is a subject having objectively measurable infectious organisms or agents present in the subject's body. A subject at risk of having an infection is a subject that is predisposed to develop an

infection. Such a subject can include, for example, a subject with a known or suspected exposure to an infectious organism or agent. A subject at risk of having an infection also can include a subject with a condition associated with impaired ability to mount an immune response to an infectious organism or agent, *e.g.*, a subject with a congenital or acquired immunodeficiency, a subject undergoing radiation therapy or chemotherapy, a subject with a burn injury, a subject with a traumatic injury, a subject undergoing surgery or other invasive medical or dental procedure.

Infections are broadly classified as bacterial, viral, fungal, or parasitic based on the category of infectious organism or agent involved. Other less common types of infection include, *e.g.*, infections involving rickettsiae, mycoplasmas, and agents causing scrapie, bovine spongiform encephalopthy (BSE), and prion diseases (*e.g.*, kuru and Creutzfeldt-Jacob disease). Examples of bacteria, viruses, fungi, and parasites which cause infection are well known in the art. An infection can be acute, sub-acute, chronic, or latent, and it can be localized or systemic. Furthermore, an infection can be predominantly intracellular or extracellular during at least one phase of the infectious organism's or agent's life cycle in the host.

Viruses

In certain embodiments, the anti-LAG-3 antibody molecule, composition, or formulation described herein is used to treat a viral infection or a disease associated with a virus.

Examples of viruses that have been found to cause infections in humans include but are not limited to: Retroviridae (*e.g.*, human immunodeficiency viruses, such as HIV-1 (also referred to as HTLV-III), HIV-2, LAV or HTLV-III/LAV, or HIV-III, and other isolates, such as HIV-LP; Picornaviridae (*e.g.*, polio viruses, hepatitis A virus; enteroviruses, human Coxsackie viruses, rhinoviruses, echoviruses); Calciviridae (*e.g.*, strains that cause gastroenteritis); Togaviridae (*e.g.*, equine encephalitis viruses, rubella viruses); Flaviviridae (*e.g.*, dengue viruses, encephalitis viruses, yellow fever viruses); Coronaviridae (*e.g.*, coronaviruses); Rhabdoviridae (*e.g.*, vesicular stomatitis viruses, rabies viruses); Filoviridae (*e.g.*, ebola viruses); Paramyxoviridae (*e.g.*, parainfluenza viruses, mumps virus, measles virus, respiratory syncytial virus); Orthomyxoviridae (*e.g.*, influenza viruses); Bungaviridae (*e.g.*, Hantaan viruses, bunga viruses, phleboviruses and Nairo viruses); Arena viridae (hemorrhagic fever viruses); Reoviridae (*e.g.*, reoviruses, orbiviurses and rotaviruses); Birnaviridae; Hepadnaviridae (Hepatitis B virus); Parvoviridae (parvoviruses); Papovaviridae (papilloma viruses, polyoma viruses); Adenoviridae (most adenoviruses); Herpesviridae (herpes simplex virus (HSV) 1 and 2, varicella zoster virus, cytomegalovirus (CMV), herpes virus; Poxyiridae (variola viruses, vaccinia viruses, pox viruses); and Iridoviridae (*e.g.*, African swine fever virus); and unclassified viruses (*e.g.*, the etiological agents of Spongiform encephalopathies, the agent of delta hepatitis (thought to be a defective satellite of hepatitis B virus), the agents of non-A, non-B hepatitis (class 1=enterally transmitted; class 2=parenterally transmitted (i.e., Hepatitis C); Norwalk and related viruses, and astroviruses). Some examples of pathogenic viruses causing infections treatable by

methods herein include HIV, hepatitis (A, B, or C), herpes virus (*e.g.*, VZV, HSV-1, HAV-6, HSV-II, and CMV, Epstein Barr virus), adenovirus, influenza virus, flaviviruses, echovirus, rhinovirus, coxsackie virus, cornovirus, respiratory syncytial virus, mumps virus, rotavirus, measles virus, rubella virus, parvovirus, vaccinia virus, HTLV virus, dengue virus, papillomavirus, molluscum virus, poliovirus, rabies virus, JC virus and arboviral encephalitis virus.

For infections resulting from viral causes, the anti-LAG-3 antibody molecules can be combined by application simultaneous with, prior to or subsequent to application of standard therapies for treating viral infections. Such standard therapies vary depending upon type of virus, although in almost all cases, administration of human serum containing antibodies (*e.g.*, IgA, IgG) specific to the virus can be effective.

Some examples of pathogenic viruses causing infections treatable by methods include HIV, hepatitis (A, B, or C), herpes virus (*e.g.*, VZV, HSV-1, HAV-6, HSV-II, and CMV, Epstein Barr virus), adenovirus, influenza virus, flaviviruses, echovirus, rhinovirus, coxsackie virus, cornovirus, respiratory syncytial virus, mumps virus, rotavirus, measles virus, rubella virus, parvovirus, vaccinia virus, HTLV virus, dengue virus, papillomavirus, molluscum virus, poliovirus, rabies virus, JC virus, arboviral encephalitis virus, and ebolaviruses (*e.g.*, BDBV, EBOV, RESTV, SUDV and TAFV).

In one embodiment, the infection is an influenza infection. Influenza infection can result in fever, cough, myalgia, headache and malaise, which often occur in seasonal epidemics. Influenza is also associated with a number of postinfectious disorders, such as encephalitis, myopericarditis, Goodpasture's syndrome, and Reye's syndrome. Influenza infection also suppresses normal pulmonary antibacterial defenses, such that patients recovering from influenza have an increased risk of developing bacterial pneumonia. Influenza viral surface proteins show marked antigenic variation, resulting from mutation and recombination. Thus, cytolytic T lymphocytes are the host's primary vehicle for the elimination of virus after infection. Influenza is classified into three primary types: A, B and C. Influenza A is unique in that it infects both humans and many other animals (*e.g.*, pigs, horses, birds and seals) and is the principal cause of pandemic influenza. Also, when a cell is infected by two different influenza A strains, the segmented RNA genomes of two parental virus types mix during replication to create a hybrid replicant, resulting in new epidemic strains. Influenza B does not replicate in animals and thus has less genetic variation and influenza C has only a single serotype.

Most conventional therapies are palliatives of the symptoms resulting from infection, while the host's immune response actually clears the disease. However, certain strains (*e.g.*, influenza A) can cause more serious illness and death. Influenza A may be treated both clinically and prophylactically by the administration of the cyclic amines inhibitors amantadine and rimantadine, which inhibit viral replication. However, the clinical utility of these drugs is limited due to the relatively high incidence of adverse reactions, their narrow anti-viral spectrum (influenza A only), and the propensity of the virus to become resistant. The administration of serum IgG antibody to the major influenza surface proteins, hemagglutinin and neuraminidase can prevent pulmonary infection,

whereas mucosal IgA is required to prevent infection of the upper respiratory tract and trachea. The most effective current treatment for influenza is vaccination with the administration of virus inactivated with formalin or β-propiolactone.

In another embodiment, the infection is a hepatitis infection, *e.g.*, a Hepatitis B or C infection.

Hepatitis B virus (HB-V) is the most infectious known bloodborne pathogen. It is a major cause of acute and chronic heptatis and hepatic carcinoma, as well as life-long, chronic infection. Following infection, the virus replicates in hepatocytes, which also then shed the surface antigen HBsAg. The detection of excessive levels of HBsAg in serum is used a standard method for diagnosing a hepatitis B infection. An acute infection may resolve or it can develop into a chronic persistent infection. Current treatments for chronic HBV include α-interferon, which increases the expression of class I human leukocyte antigen (HLA) on the surface of hepatocytes, thereby facilitating their recognition by cytotoxic T lymphocytes. Additionally, the nucleoside analogs ganciclovir, famciclovir and lamivudine have also shown some efficacy in the treatment of HBV infection in clinical trials. Additional treatments for HBV include pegylated a-interferon, adenfovir, entecavir and telbivudine. While passive immunity can be conferred through parental administration of anti-HBsAg serum antibodies, vaccination with inactivated or recombinant HBsAg also confers resistance to infection. The anti-LAG-3 antibody molecules may be combined with conventional treatments for hepatitis B infections for therapeutic advantage.

Hepatitis C virus (HC-V) infection may lead to a chronic form of hepatitis, resulting in cirrosis. While symptoms are similar to infections resulting from Hepatitis B, in distinct contrast to HB-V, infected hosts can be asymptomatic for 10-20 years. The anti-LAG-3 antibody molecule can be administered as a monotherapy, or combined with the standard of care for hepatitis C infection. For example, the anti-LAG-3 antibody molecule can be administered with one or more of Sovaldi (sofosbuvir) Olysio (simeprevir), plus ribavirin or pegylated interferon. Although regimens that include Incivek (telaprevir) or Victrelis (boceprevir) plus ribavirin and pegylated interferon are also approved, they are associated with increased side effects and longer duration of treatment and are therefore not considered preferred regimens.

Conventional treatment for HC-V infection includes the administration of a combination of α-interferon and ribavirin. A promising potential therapy for HC-V infection is the protease inhibitor telaprevir (VX-960). Additional treatments include: anti-PD-1 antibody (MDX-1106, Medarex), bavituximab (an antibody that binds anionic phospholipid phosphatidylserine in a B2-glycoprotein I dependent manner, Peregrine Pharmaceuticals), anti-HPV viral coat protein E2 antibod(y)(ies) (*e.g.*, ATL 6865–Ab68+Ab65, XTL Pharmaceuticals) and Civacir® (polyclonal anti-HCV human immune globulin). The anti-LAG-3 antibodies of the invention may be combined with one or more of these treatments for hepatitis C infections for therapeutic advantage. Protease, polymerase and NS5A inhibitors which may be used in combination with the anti-LAG-3 antibody molecules to specifically

treat Hepatitis C infection include those described in US 2013/0045202, incorporated herein by reference.

In another embodiment, the infection is a measles virus. After an incubation of 9-11 days, hosts infected with the measles virus develop fever, cough, coryza and conjunctivitis. Within 1-2 days, an erythematous, maculopapular rash develop, which quickly spreads over the entire body. Because infection also suppresses cellular immunity, the host is at greater risk for developing bacterial superinfections, including otitis media, pneumonia and postinfectious encephalomyelitis. Acute infection is associated with significant morbidity and mortality, especially in malnourished adolescents.

Treatment for measles includes the passive administration of pooled human IgG, which can prevent infection in non-immune subjects, even if given up to one week after exposure. However, prior immunization with live, attenuated virus is the most effective treatment and prevents disease in more than 95% of those immunized. As there is one serotype of this virus, a single immunization or infection typically results in protection for life from subsequent infection.

In a small proportion of infected hosts, measles can develop into SSPE, which is a chronic progressive neurologic disorder resulting from a persistent infection of the central nervous system. SSPE is caused by clonal variants of measles virus with defects that interfere with virion assembly and budding. For these patients, reactivation of T-cells with the anti-LAG-3 antibody molecules so as to facilitate viral clearance would be desirable.

In another embodiment, the infection is HIV. HIV attacks $CD4^+$ cells, including T-lymphocytes, monocyte-macrophages, follicular dendritic cells and Langerhan's cells, and $CD4^+$ helper/inducer cells are depleted. As a result, the host acquires a severe defect in cell-mediated immunity. Infection with HIV results in AIDS in at least 50% of individuals, and is transmitted via sexual contact, administration of infected blood or blood products, artificial insemination with infected semen, exposure to blood-containing needles or syringes and transmission from an infected mother to infant during childbirth.

A host infected with HIV may be asymptomatic, or may develop an acute illness that resembling mononucleosis – fever, headache, sore throat, malaise and rash. Symptoms can progress to progressive immune dysfunction, including persistent fever, night sweats, weight loss, unexplained diarrhea, eczema, psoriasis, seborrheic dermatitis, herpes zoster, oral candidiasis and oral hairy leukoplakia. Opportunistic infections by a host of parasites are common in patients whose infections develop into AIDS.

Treatments for HIV include antiviral therapies including nucleoside analogs, zidovudine (AST) either alone or in combination with didanosine or zalcitabine, dideoxyinosine, dideoxycytidine, lamidvudine, stavudine; reverse transcriptive inhibitors such as delavirdine, nevirapine, loviride, and proteinase inhibitors such as saquinavir, ritonavir, indinavir and nelfinavir. The anti-LAG-3 antibody

molecules may be combined with conventional treatments for HIV infections for therapeutic advantage.

In another embodiment, the infection is a Cytomegalovirus (CMV). CMV infection is often associated with persistent, latent and recurrent infection. CMV infects and remains latent in monocytes and granulocyte-monocyte progenitor cells. The clinical symptoms of CMV include mononucleosis-like symptoms (*i.e.*, fever, swollen glands, malaise), and a tendancy to develop allergic skin rashes to antibiotics. The virus is spread by direct contact. The virus is shed in the urine, saliva, semen and to a lesser extent in other body fluids. Transmission can also occur from an infected mother to her fetus or newborn and by blood transfusion and organ transplants. CMV infection results in general impairment of cellular immunity, characterized by impaired blastogenic responses to nonspecific mitogens and specific CMV antigens, diminished cytotoxic ability and elevation of CD8 lymphocyte number of $CD4^+$ lymphocytes.

Treatments of CMV infection include the anti-virals ganciclovir, foscarnet and cidovir, but these druges are typically only prescribed in immunocompromised patients. The anti-LAG-3 antibody molecules may be combined with conventional treatments for cytomegalovirus infections for therapeutic advantage.

In another embodiment, the infection is Epstein-Barr virus (EBV). EBV can establish persistent and latent infections and primarily attacks B cells. Infection with EBV results in the clinical condition of infectious mononucleosis, which includes fever, sore throat, often with exudate, generalized lymphadenopathy and splenomegaly. Hepatitis is also present, which can develop into jaundice.

While typical treatments for EBV infections are palliative of symptoms, EBV is associated with the development of certain cancers such as Burkitt's lymphoma and nasopharyngeal cancer. Thus, clearance of viral infection before these complications result would be of great benefit. The anti-LAG-3 antibody molecules may be combined with conventional treatments for Epstein-Barr virus infections for therapeutic advantage.

In another embodiment, the infection is Herpes simplex virus (HSV). HSV is transmitted by direct contact with an infected host. A direct infection may be asymptomatic, but typically result in blisters containing infectious particles. The disease manifests as cycles of active periods of disease, in which lesions appear and disappear as the viral latently infect the nerve ganglion for subsequent outbreaks. Lesions may be on the face, genitals, eyes and/or hands. In some case, an infection can also cause encephalitis.

Treatments for herpes infections are directed primarily to resolving the symptomatic outbreaks, and include systemic antiviral medicines such as: acyclovir (*e.g.*, Zovirax®), valaciclovir, famciclovir, penciclovir, and topical medications such as docosanol (Abreva®), tromantadine and zilactin. The clearance of latent infections of herpes would be of great clinical benefit. The anti-LAG-

3 antibody molecules may be combined with conventional treatments for herpes virus infections for therapeutic advantage.

In another embodiment, the infection is Human T-lymphotrophic virus (HTLV-1, HTLV-2). HTLV is transmitted via sexual contact, breast feeding or exposure to contaminated blood. The virus activates a subset of T_H cells called Th1 cells, resulting in their overproliferation and overproduction of Th1 related cytokines (*e.g.*, IFN-γ and TNF-α). This in turn results in a suppression of Th2 lymphocytes and reduction of Th2 cytokine production (*e.g.*, IL-4, IL-5, IL-10 and IL-13), causing a reduction in the ability of an infected host to mount an adequate immune response to invading organisms requiring a Th2-dependent response for clearance (*e.g.*, parasitic infections, production of mucosal and humoral antibodies).

HTLV infections cause lead to opportunistic infections resulting in bronchiectasis, dermatitis and superinfections with *Staphylococcus* spp. and *Strongyloides* spp. resulting in death from polymicrobial sepsis. HTLV infection can also lead directly to adult T-cell leukemia/lymphoma and progressive demyelinating upper motor neuron disease known as HAM/TSP. The clearance of HTLV latent infections would be of great clinical benefit. The anti-LAG-3 antibody molecules may be combined with conventional treatments for HTLV infections for therapeutic advantage.

In another embodiment, the infection is Human papilloma virus (HPV). HPV primarily affects keratinocytes and occurs in two forms: cutaneous and genital. Transmission is believed to occur through direct contact and/or sexual activity. Both cutaneous and genital HPV infection, can result in warts and latent infections and sometimes recurring infections, which are controlled by host immunity which controls the symptoms and blocks the appearance of warts, but leaves the host capable of transmitting the infection to others.

Infection with HPV can also lead to certain cancers, such as cervical, anal, vulvar, penile and oropharynial cancer. There are no known cures for HPV infection, but current treatment is topical application of Imiquimod, which stimulates the immune system to attack the affected area. The clearance of HPV latent infections would be of great clinical benefit. The anti-LAG-3 antibodies of the invention may be combined with conventional treatments for HPV infections for therapeutic advantage.

In another embodiment, the infection is Ebola virus (EBOV). EBOV is one of five known viruses within the Ebolavirus genus. EBOV causes severe and often fatal hemorrhagic fever in humans and mammals, known as Ebola virus disease (EVD). Transmission occurs through contact with blood, secretions, organs, or other boldily fluids of infected patients. Currently, there is no proven treatment or vaccine.

Bacteria

In certain embodiments, the anti-LAG-3 antibody molecule, composition, or formulation described herein is used to treat a bacterial infection or a disease associated with a bacterium.

Bacteria include both Gram negative and Gram positive bacteria. Examples of Gram positive bacteria include, but are not limited to Pasteurella species, Staphylococci species, and Streptococcus species. Examples of Gram negative bacteria include, but are not limited to, Escherichia coli, Pseudomonas species, and Salmonella species. Specific examples of infectious bacteria include but are not limited to: Helicobacter pyloris, Borrelia burgdorferi, Legionella pneumophilia, Mycobacteria spp. (*e.g.*, M. tuberculosis, M. avium, M. intracellulare, M. kansasii, M. gordonae), Staphylococcus aureus, Neisseria gonorrhoeae, Neisseria meningitidis, Listeria monocytogenes, Streptococcus pyogenes (Group A Streptococcus), Streptococcus agalactiae (Group B Streptococcus), Streptococcus (viridans group), Streptococcus faecalis, Streptococcus bovis, Streptococcus (anaerobic spp.), Streptococcus pneumoniae, pathogenic Campylobacter spp., Enterococcus spp., Haemophilus influenzae, Bacillus anthracis, Corynebacterium diphtheriae, Corynebacterium spp., Erysipelothrix rhusiopathiae, Clostridium perfringens, Clostridium tetani, Enterobacter aerogenes, Klebsiella pneumoniae, Pasturella multocida, Bacteroides spp., Fusobacterium nucleatum, Streptobacillus moniliformis, Treponema pallidum, Treponema pertenue, Leptospira, Mycobacterium leprae, Rickettsia, and Actinomyces israelii. Some examples of pathogenic bacteria causing infections treatable by methods herein include chlamydia, rickettsial bacteria, mycobacteria, staphylococci, streptococci, pneumonococci, meningococci and conococci, klebsiella, proteus, serratia, pseudomonas, legionella, diphtheria, salmonella, bacilli, cholera, tetanus, botulism, anthrax, plague, leptospirosis, and Lymes disease bacteria.

Some examples of pathogenic bacteria causing infections treatable by methods of the invention include syphilis, *chlamydia*, *rickettsial bacteria*, *mycobacteria*, *staphylococci*, *streptococci*, *pneumonococci*, *meningococci and conococci*, *klebsiella*, *proteus*, *serratia*, *pseudomonas*, *legionella, diphtheria, salmonella, bacilli*, *cholera, tetanus*, *botulism*, *anthrax*, *plague, leptospirosis*, *and Lymes disease bacteria*. The anti-LAG-3 antibody molecules can be used in combination with existing treatment modalities for the aforesaid infections. For example, Treatments for syphilis include penicillin (*e.g.*, penicillin G.), tetracycline, doxycycline, ceftriaxone and azithromycin.

Lyme disease, caused by *Borrelia burgdorferi* is transmitted into humans through tick bites. The disease manifests initially as a localized rash, followed by flu-like symptoms including malaise, fever, headache, stiff neck and arthralgias. Later manifestations can include migratory and polyarticular arthritis, neurologic and cardiac involvement with cranial nerve palsies and radiculopathy, myocarditis and arrhythmias. Some cases of Lyme disease become persistent, resulting in irreversible damage analogous to tertiary syphilis. Current therapy for Lyme disease includes primarily the administration of antibiotics. Antibiotic-resistant strains may be treated with hydroxychloroquine or methotrexate. Antibiotic refractory patients with neuropathic pain can be treated with gabapentin. Minocycline may be helpful in late/chronic Lyme disease with neurological or other inflammatory manifestations.

Other forms of borreliois, such as those resulting from *B. recurentis, B. hermsii, B. turicatae, B. parikeri., B. hispanica, B. duttonii* and *B. persica*, as well leptospirosis (*E.g., L. interrogans*), typically resolve spontaneously unless blood titers reach concentrations to cause intrahepatic obstruction.

Fungi and Parasites

In certain embodiments, the anti-LAG-3 antibody molecule, composition, or formulation described herein is used to treat a fungal or parasitic infection or a disease associated with a fungus or a parasite.

Examples of fungi include: *Aspergillus spp., Blastomyces dermatitidis, Candida albicans, other Candida spp., Coccidioides immitis, Cryptococcus neoformans, Histoplasma capsulatum, Chlamydia trachomatis, Nocardia spp., Pneumocystis carinii*. Some examples of pathogenic fungi causing infections treatable by methods herein include Candida (albicans, krusei, glabrata, tropicalis, etc.), Cryptococcus neoformans, Aspergillus (fumigatus, niger, etc.), Genus Mucorales (mucor, absidia, rhizophus), *Sporothrix schenkii, Blastomyces dermatitidis, Paracoccidioides brasiliensis, Coccidioides immitis* and *Histoplasma capsulatum.*

Parasites include but are not limited to blood-borne and/or tissues parasites such as Babesia microti, *Babesia divergens, Entamoeba histolytica, Giardia lamblia, Leishmania tropica, Leishmania spp., Leishmania braziliensis, Leishmania donovani, Plasmodium falciparum, Plasmodium malariae, Plasmodium ovale, Plasmodium vivax, and Toxoplasma gondii, Trypanosoma gambiense* and *Trypanosoma rhodesiense* (African sleeping sickness), *Trypanosoma cruzi* (Chagas' disease), and *Toxoplasma gondii*, flat worms, round worms. Some examples of pathogenic parasites causing infections treatable by methods herein include *Entamoeba histolytica, Balantidium coli, Naegleriafowleri, Acanthamoeba sp., Giardia lambia, Cryptosporidium sp., Pneumocystis carinii, Plasmodium vivax, Babesia microti, Trypanosoma brucei, Trypanosoma cruzi, Leishmania donovani, Toxoplasma gondi*, and *Nippostrongylus brasiliensis*.

Some examples of pathogenic fungi causing infections treatable by methods of the invention include *Candida* (*albicans, krusei, glabrata, tropicalis, etc.*), *Cryptococcus neoformans, Aspergillus* (*fumigatus, niger, etc.*), *Genus Mucorales* (*mucor, absidia, rhizophus*), *Sporothrix schenkii, Blastomyces dermatitidis, Paracoccidioides brasiliensis, Coccidioides immitis* and *Histoplasma capsulatum.*

Some examples of pathogenic parasites causing infections treatable by methods described herein include *Entamoeba histolytica, Balantidium coli, Naegleriafowleri, Acanthamoeba sp., Giardia lambia, Cryptosporidium sp., Pneumocystis carinii, Plasmodium vivax, Babesia microti, Trypanosoma brucei, Trypanosoma cruzi, Leishmania donovani, Toxoplasma gondi, and Nippostrongylus brasiliensis.*

Nucleic Acids

The anti-LAG-3 antibody molecules described herein can be encoded by nucleic acids described herein. The nucleic acids can be used to produce the anti-LAG-3 antibody molecules described herein.

In certain embodiments, the nucleic acid comprises nucleotide sequences that encode heavy and light chain variable regions and CDRs of the anti-LAG-3 antibody molecules, as described herein. For example, the present disclosure features a first and second nucleic acid encoding heavy and light chain variable regions, respectively, of an anti-LAG-3 antibody molecule chosen from one or more of the antibody molecules disclosed herein, *e.g.*, an antibody of Table 1 of US 2015/0259420. The nucleic acid can comprise a nucleotide sequence encoding any one of the amino acid sequences in the tables herein, or a sequence substantially identical thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, or which differs by no more than 3, 6, 15, 30, or 45 nucleotides from the sequences provided in Table 1. For example, disclosed herein is a first and second nucleic acid encoding heavy and light chain variable regions, respectively, of an anti-LAG-3 antibody molecule chosen from one or more of, *e.g.*, any of BAP050-hum01, BAP050-hum02, BAP050-hum03, BAP050-hum04, BAP050-hum05, BAP050-hum06, BAP050-hum07, BAP050-hum08, BAP050-hum09, BAP050-hum10, BAP050-hum11, BAP050-hum12, BAP050-hum13, BAP050-hum14, BAP050-hum15, BAP050-hum16, BAP050-hum17, BAP050-hum18, BAP050-hum19, BAP050-hum20, huBAP050(Ser) (*e.g.*, BAP050-hum01-Ser, BAP050-hum02-Ser, BAP050-hum03-Ser, BAP050-hum04-Ser, BAP050-hum05-Ser, BAP050-hum06-Ser, BAP050-hum07-Ser, BAP050-hum08-Ser, BAP050-hum09-Ser, BAP050-hum10-Ser, BAP050-hum11-Ser, BAP050-hum12-Ser, BAP050-hum13-Ser, BAP050-hum14-Ser, BAP050-hum15-Ser, BAP050-hum18-Ser, BAP050-hum19-Ser, or BAP050-hum20-Ser), BAP050-Clone-F, BAP050-Clone-G, BAP050-Clone-H, BAP050-Clone-I, or BAP050-Clone-J, as summarized in Table 1, or a sequence substantially identical thereto.

In certain embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs from a heavy chain variable region having an amino acid sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one or more substitutions, *e.g.*, conserved substitutions). In some embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs from a light chain variable region having an amino acid sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one or more substitutions, *e.g.*, conserved substitutions). In some embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, three, four, five, or six CDRs from heavy and light chain variable regions having an amino acid sequence as set forth in Table 1, or a sequence substantially

homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one or more substitutions, *e.g.*, conserved substitutions).

In certain embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs from a heavy chain variable region having the nucleotide sequence as set forth in Table 1, a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or capable of hybridizing under the stringency conditions described herein). In some embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs from a light chain variable region having the nucleotide sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or capable of hybridizing under the stringency conditions described herein). In certain embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, three, four, five, or six CDRs from heavy and light chain variable regions having the nucleotide sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or capable of hybridizing under the stringency conditions described herein).The nucleic acids disclosed herein include deoxyribonucleotides or ribonucleotides, or analogs thereof. The polynucleotide may be either single-stranded or double-stranded, and if single-stranded may be the coding strand or non-coding (antisense) strand. A polynucleotide may comprise modified nucleotides, such as methylated nucleotides and nucleotide analogs. The sequence of nucleotides may be interrupted by non-nucleotide components. A polynucleotide may be further modified after polymerization, such as by conjugation with a labeling component. The nucleic acid may be a recombinant polynucleotide, or a polynucleotide of genomic, cDNA, semisynthetic, or synthetic origin which either does not occur in nature or is linked to another polynucleotide in a nonnatural arrangement.

In certain embodiments, the nucleotide sequence that encodes the anti-LAG-3 antibody molecule is codon optimized.

In some embodiments, nucleic acids comprising nucleotide sequences that encode heavy and light chain variable regions and CDRs of the anti-LAG-3 antibody molecules, as described herein, are disclosed. For example, the disclosure provides a first and second nucleic acid encoding heavy and light chain variable regions, respectively, of an anti-LAG-3 antibody molecule according to Table 1 or a sequence substantially identical thereto. For example, the nucleic acid can comprise a nucleotide sequence encoding an anti-LAG-3 antibody molecule according to Table 1, or a sequence substantially identical to that nucleotide sequence (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, or which differs by no more than 3, 6, 15, 30, or 45 nucleotides from the aforementioned nucleotide sequence. .

In certain embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs, or hypervariable loops, from a heavy chain variable region having an

amino acid sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one, two, three or more substitutions, insertions or deletions, *e.g.*, conserved substitutions).

In certain embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, or three CDRs, or hypervariable loops, from a light chain variable region having an amino acid sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one, two, three or more substitutions, insertions or deletions, *e.g.*, conserved substitutions).

In some embodiments, the nucleic acid can comprise a nucleotide sequence encoding at least one, two, three, four, five, or six CDRs, or hypervariable loops, from heavy and light chain variable regions having an amino acid sequence as set forth in Table 1, or a sequence substantially homologous thereto (*e.g.*, a sequence at least about 85%, 90%, 95%, 99% or more identical thereto, and/or having one, two, three or more substitutions, insertions or deletions, *e.g.*, conserved substitutions).

In some embodiments, the nucleic acid is isolated or recombinant.

The nucleic acids described herein may be present in a single vector or separate vectors present in the same host cell or separate host cell, as described in more detail herein.

Vectors and Host Cells

The anti-LAG-3 antibody molecules described herein can be produced using host cells and vectors containing the nucleic acids described herein. The nucleic acids may be present in a single vector or separate vectors present in the same host cell or separate host cell.

In one embodiment, the vectors comprise nucleotides encoding an antibody molecule described herein. In one embodiment, the vectors comprise the nucleotide sequences described herein. The vectors include, but are not limited to, a virus, plasmid, cosmid, lambda phage or a yeast artificial chromosome (YAC).

Numerous vector systems can be employed. For example, one class of vectors utilizes DNA elements which are derived from animal viruses such as, for example, bovine papilloma virus, polyoma virus, adenovirus, vaccinia virus, baculovirus, retroviruses (Rous Sarcoma Virus, MMTV or MOMLV) or SV40 virus. Another class of vectors utilizes RNA elements derived from RNA viruses such as Semliki Forest virus, Eastern Equine Encephalitis virus and Flaviviruses.

Additionally, cells which have stably integrated the DNA into their chromosomes may be selected by introducing one or more markers which allow for the selection of transfected host cells. The marker may provide, for example, prototropy to an auxotrophic host, biocide resistance (*e.g.*, antibiotics), or resistance to heavy metals such as copper, or the like. The selectable marker gene can be either directly linked to the DNA sequences to be expressed, or introduced into the same cell by cotransformation. Additional elements may also be needed for optimal synthesis of mRNA. These

elements may include splice signals, as well as transcriptional promoters, enhancers, and termination signals.

Once the expression vector or DNA sequence containing the constructs has been prepared for expression, the expression vectors may be transfected or introduced into an appropriate host cell. Various techniques may be employed to achieve this, such as, for example, protoplast fusion, calcium phosphate precipitation, electroporation, retroviral transduction, viral transfection, gene gun, lipid based transfection or other conventional techniques. In the case of protoplast fusion, the cells are grown in media and screened for the appropriate activity. Methods and conditions for culturing the resulting transfected cells and for recovering the antibody molecule produced are known to those skilled in the art, and may be varied or optimized depending upon the specific expression vector and mammalian host cell employed, based upon the present description.

In certain embodiments, the host cell comprises a nucleic acid encoding an anti-LAG-3 antibody molecule described herein. In other embodiments, the host cell is genetically engineered to comprise a nucleic acid encoding the anti-LAG-3 antibody molecule.

In one embodiment, the host cell is genetically engineered by using an expression cassette. The phrase "expression cassette," refers to nucleotide sequences, which are capable of affecting expression of a gene in hosts compatible with such sequences. Such cassettes may include a promoter, an open reading frame with or without introns, and a termination signal. Additional factors necessary or helpful in effecting expression may also be used, such as, for example, an inducible promoter. In certain embodiments, the host cell comprises a vector described herein.

The cell can be, but is not limited to, a eukaryotic cell, a bacterial cell, an insect cell, or a human cell. Suitable eukaryotic cells include, but are not limited to, Vero cells, HeLa cells, COS cells, CHO cells, HEK293 cells, BHK cells and MDCKII cells. Suitable insect cells include, but are not limited to, Sf9 cells.

In some embodiments, the host cell is a eukaryotic cell, *e.g.*, a mammalian cell, an insect cell, a yeast cell, or a prokaryotic cell, *e.g.*, *E. coli*. For example, the mammalian cell can be a cultured cell or a cell line. Exemplary mammalian cells include lymphocytic cell lines (*e.g.*, NSO), Chinese hamster ovary cells (CHO), COS cells, oocyte cells, and cells from a transgenic animal, *e.g.*, mammary epithelial cell.

EXAMPLES

The Examples below are set forth to aid in the understanding of the inventions but are not intended, and should not be construed, to limit its scope in any way.

Example 1: Population Pharmacokinetics and Pharmacodynamics of an Exemplary Anti-LAG-3 Antibody and Soluble LAG-3

Summary

The objectives of this study are to predict the relationship between serum anti-LAG-3 antibody concentration and LAG-3 occupancy in serum (soluble LAG-3) and in tumor (membrane-bound LAG-3); to assess the relationship between anti-LAG-3 antibody dose and pharmacokinetics (PK), and whether PK variability depends upon the dose; to assess expected variability in anti-LAG-3 steady state trough levels from fixed and weight-based dosing; and to assess whether co-administration of anti-PD-1 antibody affects anti-LAG-3 antibody exposure.

The following methods were used in this study. A two compartment, linear population PK model was used to describe the anti-LAG-3 antibody concentration. A standard binding model to describe target mediated drug disposition was used to describe the soluble LAG-3 data; the quasi-equilibrium approximation was used. A covariate analysis was used to estimate the impact of weight on clearance and both central and peripheral volume. A graphical analysis was used to assess the impact on co-administration of anti-PD-1 antibody on anti-LAG-3 antibody clearance. Model simulation was then performed to identify the relationship between anti-LAG-3 antibody dose and free LAG-3 for both the soluble LAG-3 in serum and the membrane-bound LAG-3 in the tumor.

The following results were obtained from this study. The relationship between dose and free LAG-3 in serum and in the tumor was characterized. Anti-LAG-3 antibody PK appears nonlinear at doses below 80 mg every 2-4 weeks and linear at doses above 240 mg every 3-4 weeks. Fixed and weight-based dosing regimens were predicted to give comparable variability of trough concentrations at steady state. No obvious impact of co-administration with anti-PD-1 antibody on anti-LAG-3 antibody PK was observed.

The relationship between anti-LAG-3 antibody dose and receptor occupancy of both serum soluble LAG-3 and intratumoral membrane-bound LAG-3 receptor occupancy at doses of 240 mg and above was well characterized by the model. At lower doses (*e.g.* 80 mg every 2-4 weeks), a nonlinearity in the anti-LAG-3 antibody PK was observed in some patients. Above 240 mg every 3-4 weeks, anti-LAG-3 antibody PK appeared linear. The nonlinearity is thought to be due to target mediated drug disposition, as observed for many other monoclonal antibodies. Fixed and body-weight based dosing were predicted to give comparable variability in the steady state trough levels of anti-LAG-3 antibody. Co-administration of anti-PD-1 antibody did not show any obvious impact on the anti-LAG-3 antibody PK.

The observations illustrated in this Example can be used to guide dose selection for anti-LAG-3 antibody molecules described herein.

Data

This study used data from the dose escalation study in patients with advanced solid tumors, where an exemplary anti-LAG-3 antibody, LAG525, was given both as monotherapy and in combination with an exemplary anti-PD-1 antibody, PDR001. The anti-LAG-3 antibody concentration and the soluble LAG-3 concentration were measured at various times (pre-infusion, hour 1, day 1, 7, 10, 14).

The anti-LAG-3 antibody was quantified by liquid chromatography mass spectroscopy (LC/MS) with lower limit of quantification of 250 ng/ml (1.7 nM). Total soluble LAG-3 was quantified by an enzyme linked immunosorbent assay (ELISA) in human serum with lower limit of quantification of 0.146 ng/ml (1 pM).

A single dataset was generated and validated at the most critical level. All anti-LAG-3 antibody and soluble LAG-3 measurements were included in this analysis. No data was excluded or classified as outliners.

Methods

This study was performed using a nonlinear mixed effects modeling approach, where the model has two components: a structural model which accounts for the systematic trends in the data and the random effects model, which accounts for both inter-subject variability and residual variability about those trends. The covariate model describes how covariates are incorporated. A PopPKPD model was simultaneously fit to both the PK and soluble LAG-3 data. Model simulations with additional assumptions were then performed to make predictions about the membrane-bound LAG-3 inhibition in the tumor.

The analysis was performed using the Monolix software system, version 2016R1 utilizing the MODESIM high performance computing environment. The technical computing package R was used to explore the data, assist in model building, and report the final results.

While many models were explored when first analyzing this data, only a single structural model was used because it was found that this model was adequate for meeting the objectives.

Structural model. The structural PKPD model for anti-LAG-3, soluble LAG-3, and complex concentration is a standard binding model used for describing target mediated drug disposition (TMDD) with the quasi-equilibrium approximation (Mager & Krzyzanski. *Pharmaceutical Research* 22, 1589–1596 (2005)), such that the differential equations describe the total drug, total target, and peripheral drug concentration and the algebraic expressions further below are used to calculate the free drug, free target, and complex concentrations.

A Michaelis-Menten version of this model was also fit. In the exploratory analysis, this model did not improve the fits, and so it was not explored further.

Random effects model. The PK model is parameterized by the following four parameters: clearance, central volume, peripheral volume, and inter-compartmental clearance and the PD (soluble LAG-3) model adds the following four parameters: initial sLAG-3, steady state sLAG-3 for a large dose of anti-LAG-3 antibody, antibody-sLAG-3 complex elimination rate, and dissociation constant. Lognormal random effects are added to all eight parameters.

Covariate model. A covariate analysis was used to assess the impact of weight on clearance and central volume. Graphical analysis was used to assess the impact of anti-PD-1 antibody on anti-LAG-3 antibody PK, by comparing the anti-LAG-3 antibody concentrations in patients who received identical anti-LAG-3 antibody dosing regimens and either did or did not receive anti-PD-1 antibody. A formal covariate analysis was not performed because patients at the lowest anti-LAG-3 antibody dose (0.3 mg/kg q2w) had the fastest rate of elimination and also always received anti-PD-1 antibody. It is thought that faster elimination at the lowest dose is due to target mediated drug disposition, but this effect was observed to confound a formal assessment of anti-PD-1 antibody as a covariate on clearance.

Comparing fixed and body-weight scaled dosing regimens. The anti-LAG-3 antibody trough levels at week 24 (approximately 6 months) were simulated for 1000 patients using the model for 10 mg/kg or 700 mg given every 2, 3, or 4 weeks. Preliminary model fits showed the terminal half-life of anti-LAG-3 antibody was around 2 weeks, so all patients were expected to be at steady state by week 24; also, week 24 was a trough for all dosing regimens tested (q2w, q3w, q4w). The median and 95% prediction interval values were plotted. It was assumed that the typical patient weighed 80 kg so that the equivalent fixed dose regimen could be calculated (*e.g.* 1 mg/kg corresponds to 80 mg). However, the median weight in the population in this study was closer to 70 kg. For that reason, for this particular simulation, 10 mg/kg was compared to 700 mg.

Predicting LAG-3 inhibition in serum and in tumor. Simulation from the above PKPD model was used to estimate LAG-3 occupancy at the 6 month trough levels, when the PK is at steady state. Two different LAG-3 occupancy estimates are provided: (1) the ratio of free soluble LAG-3 in serum compared to baseline soluble LAG-3, which is computed directly from the PKPD model; and (2) the occupancy of membrane-bound LAG-3 in tumor (RO).

The prediction for the intra-tumoral LAG-3 inhibition is thought to be more relevant for guiding dose selection because this is the site at which the tumor infiltrating lymphocytes interact with the tumor.

Using this approach to predict target occupancy in the tumor involves a number of assumptions: (1) the estimated dissociation constant for the anti-LAG-3 antibody to sLAG-3 in the serum is the same as the dissociation for anti-LAG-3 antibody to membrane-bound LAG-3 in the

tumor; (2) that ABC_{ISF} = 30% in human tumors, based on mouse data (Deng *et al. MAbs,* vol. 8, 593–603 (2016)); (3) the tumor can be treated like a homogenous tissues; (4) membrane-bound LAG-3 in the tumor does not accumulate in the presence of drug; (5) the anti-LAG-3 antibody is in vast excess to the membrane-bound LAG-3 concentration in the tumor; and (6) the binding between LAG-3 and its endogenous binding partners (*e.g.* MHCII) is not modeled and it is assumed that this does not significantly impact the prediction for suppression.

In addition to these assumptions, a desired level of inhibition for a desired fraction of the patient population must be selected. Typically, 60-90% suppression is required for antagonists and so an occupancy of 90-95% is targeted for this analysis (Grimwood & Hartig. *Pharmacology & Therapeutics* 122, 281–301 (2009); Tiwari *et al. The AAPS Journal* 1-10 (2016); Agoram. *British Journal of Clinical Pharmacology* 67, 153-160 (2009)).

For these trial simulations, the following doses were tested at q2w, q3w, and q4w regimens for 1000 patients: 10, 20, 30, 50, 70, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000 mg. Then, the 5, 25, 50, 75, 95 percentile is computed for the PK, and for soluble LAG-3 occupancy in the serum and membrane-bound LAG-3 occupancy in the tumor.

Results

A total of 196 patients were included in this analysis with median follow up times of 30 and 29.5 days for the anti-LAG-3 antibody and soluble-LAG-3 assessments respectively. A summary of the number of patients on each dosing regimen, sorted by total monthly dose (average total dose over four weeks) is shown in **Table 13**.

Table 13. Summary of dosing regimens and number of patients

Average total anti-LAG-3 dose every 4 weeks (mg)	Category	Anti-LAG-3 regimen	Anti-PD-1 regimen	Number of pts.	Number of pts. with PK	Number of pts. with sLAG-3
2400	high	15 mg/kg q2w	none	6	6	6
1600	high	10 mg/kg q2w	none	6	6	6
1000	high	1000 mg q4w	400 mg q4w	6	6	1
800	high	10 mg/kg q4w	none	11	11	11
800	high	600 mg q3w	300 mg q3w	12	7	6
800	high	800 mg q4w	400 mg q4w	12	7	6
800	high	400 mg q2w	none	23	16	16
800	high	5 mg/kg q2w	none	6	6	6
600	medium	300 mg q2w	400 mg q4w	6	5	5
533	medium	400 mg q3w	300 mg q3w	6	5	4
480	medium	240 mg q2w	400 mg q4w	6	4	3
480	medium	240 mg q2w	none	23	15	15
480	medium	240 mg q2w	240 mg q2w	6	6	6
480	medium	3 mg/kg q2w	none	12	11	11
400	medium	5 mg/kg q4w	none	6	6	6
400	medium	400 mg q4w	400 mg q4w	6	3	3

400	medium	400 mg q4w	none	5	5	5
320	medium	240 mg q3w	300 mg q3w	20	12	9
240	medium	3 mg/kg q4w	none	5	5	5
160	low	1 mg/kg q2w	1 mg/kg q2w	6	6	6
160	low	80 mg q2w	80 mg q2w	6	6	6
160	low	80 mg q2w	240 mg q2w	5	5	5
160	low	80 mg q2w	400 mg q4w	11	11	8
160	low	1 mg/kg q2w	none	13	13	13
80	low	80 mg q4w	240 mg q4w	7	7	7
48	very low	0.3 mg/kg q2w	1 mg/kg q2w	6	6	6

The anti-LAG-3 antibody and soluble LAG-3 data were obtained. The anti-LAG-3 antibody concentration data during the first 4 weeks were normalized by the first dose by mg. The anti-LAG-3 antibody dose was stratified into four groups (very low, low, medium, and high) based on the estimated total monthly dosing (over 28 days, in mg). For body-weight scaled doses, the total mg dose is calculated for the 80 kg patient. A larger decline in anti-LAG-3 antibody concentration was observed in some patients for the very low and low dose data than for the medium and high dose data, indicating nonlinear PK at the lower doses. The stratification groups were chosen to illustrate this nonlinearity.

The normalized anti-LAG-3 antibody concentrations two weeks (all regimens) after the first dose were obtained. At the lower doses (80 mg and below), there was a decline in the normalized drug concentration in some patients, indicating a nonlinearity in the PK. A model-based analysis of the data can also help to better characterize this nonlinearity using all available data.

PKPD Model fits

The PK parameters used were typical for a monoclonal antibody. Simulating the parameters, the terminal half-life and its 5-95% prediction interval was estimated to be 17.0 (7.0, 59.9) days. The estimated dissociation constant of 1.5 nM (Kd) was higher than measured in the Biacore assay (0.1 nM), but comparable to what was measured in the *in vitro* cell-based assays (1.9 - 2.3 nM). Visual predictive check of anti-LAG-3 antibody concentration normalized by total monthly dose showed good description of the PK data except in the low and very low dose groups where the PK nonlinearity was observed. A simulation of the largest anti-LAG-3 antibody dose within each panel was performed. The simulation describes the sLAG-3 curves well for all doses above 3 mg/kg (or 240 mg) q4w. For the low dose data, the PK was overestimated and thus the sLAG-3 was also overestimated.

Given the more rapid elimination at lower doses, a Michaelis-Menten PK model with nonlinear elimination was previously explored. However, the fits were not considerably better. Moreover, the additive error was generally estimated to be around 20 nM, much larger than the trough concentrations observed at 0.3 mg/kg q2w or 80 mg q4w, even for the models with nonlinear

elimination. Thus in this Example, only a linear model was used, with the caveat that the model over-estimates the trough concentrations at lower doses (*e.g.* 80 mg q2w).

To establish a threshold for when the nonlinearity in the PK becomes relevant, the anti-LAG-3 antibody population prediction vs measurement was examined. Note that below a critical concentration C_{crit} = 60 nM, the population prediction over predicts the measurement; it is below C_{crit} that the nonlinear PK begins to be observed. Using the trial simulation, the fraction of patients expected to stay above C_{crit} at trough was estimated in **Table 14**.

Fixed vs weight-based dosing predictions

Simulations of the anti-LAG-3 antibody trough level at 6 months for 700 mg and 10 mg/kg dosing were performed for both fixed and body-scaled dosing. Because the exponent relating weight to clearance was close to 0.5, the predicted variability in the anti-LAG-3 antibody trough is comparable for patients receiving fixed or body-weight based dosing, as also observed for other drugs (Bai et al. Clinical pharmacokinetics 51, 119–135 (2012); Wang et al., The Journal of Clinical Pharmacology 49, 1012–1024 (2009)). As the anti-LAG-3 antibody PK model is linear above 240 mg, similar results would be observed for any dose above 240 mg.

LAG-3 occupancy predictions

The simulated free LAG-3 concentration was compared to baseline from the PKPD model. Recall that this model did not capture the nonlinearity in the PK observed in lower doses and so below doses of 240 mg, there is likely less LAG-3 inhibition than predicted. Reducing the free soluble LAG-3 to 10% requires doses that are over 10x higher than for reducing the intra-tumoral membrane-bound LAG-3 to 10%. This is because the soluble LAG-3 accumulates about 75x in the serum, whereas it is not expected that membrane-bound LAG-3 would accumulate.

The results from the simulation above are summarized in **Table 14**, where the dose needed for 75, 90, and 95% of patients to meet the following three criteria at steady state are summarized:

1. LAG525 trough above C_{crit}
2. Tumor, membrane-bound LAG-3 free receptor below 10% of baseline
3. Serum soluble LAG-3 free receptor below 10% of baseline

Table 14. Predicted dose (mg) needed for 75%, 90%, and 95% of patients at steady state to meet the PK or PD criteria specified under q2w, q3w, and q4w regimens.

Dose for 75% patients to meet criteria:			
Criteria	q2w	q3w	q4w
LAG525 trough above Ccrit	100	210	350

Free tumor mLAG-3 < 10% Baseline Free serum sLAG-3 < 10% Baseline	100 >2000	200 >2000	400 >2000
Dose for 90% patients to meet criteria:			
Criteria	q2w	q3w	q4w
LAG525 trough above Ccrit	170	410	740
Free tumor mLAG-3 < 10% Baseline Free serum sLAG-3 < 10% Baseline	200 >2000	400 >2000	800 >2000
Dose for 95% patients to meet criteria:			
Criteria	q2w	q3w	q4w
LAG525 trough above Ccrit	270	670	1190
Free tumor mLAG-3 < 10% Baseline Free serum sLAG-3 < 10% Baseline	400 >2000	700 >2000	1400 >2000

Note that the doses needed for linear PK (anti-LAG-3 antibody trough > C_{crit}) and the dose needed to reduce the free tumor mLAG-3 concentration to < 10% from baseline are similar. This result is consistent with the hypothesis that target mediated drug disposition by the tumor infiltrating lymphocytes is what drives the rapid elimination at lower doses.

For antagonists, it is typical to target 90-95% receptor occupancy (or 5-10% free target compared to baseline) throughout the dosing interval, but this rule of thumb has not been validated for LAG-3 or for immune checkpoint inhibitors in general. If it is desired to achieve such receptor occupancy in most patients, it would be important to give a large enough dose such that rapid elimination at lower concentrations is not observed. Visual predictive check of anti-LAG-3 antibody concentration normalized by total monthly dose suggests that doses above 240 mg q4w may be sufficient to avoid this nonlinearity. **Table 14** predicts that 400 mg q3w or 800 mg q4w would give 90% receptor occupancy (10% free LAG-3 vs baseline) in 90% of patients.

Thus, this study shows that the relationship between the dose of an exemplary anti-LAG-3 antibody, LAG525, and receptor occupancy of both serum soluble LAG-3 and intratumoral membrane-bound LAG-3 receptor occupancy at doses of 240 mg and above was well characterized by the model. At lower doses (*e.g.* 80 mg every 2-4 weeks), a nonlinearity in the anti-LAG-3 antibody PK was observed in some patients. Above 240 mg every 3-4 weeks, anti-LAG-3 antibody PK appeared linear. The nonlinearity is thought to be due to target mediated drug disposition, as observed for many other monoclonal antibodies. Fixed and body-weight based dosing were predicted to give comparable variability in the steady state trough levels of anti-LAG-3 antibody. Co-administration of an anti-PD-1 antibody, PDR001, did not show any obvious impact on the anti-LAG-3 antibody PK.

INCORPORATION BY REFERENCE

All publications, patents, and Accession numbers mentioned herein are hereby incorporated by reference in their entirety as if each individual publication or patent was specifically and individually indicated to be incorporated by reference.

EQUIVALENTS

While specific embodiments of the subject invention have been discussed, the above specification is illustrative and not restrictive. Many variations of the invention will become apparent to those skilled in the art upon review of this specification and the claims below. The full scope of the invention should be determined by reference to the claims, along with their full scope of equivalents, and the specification, along with such variations.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word “comprise”, and variations such as “comprises” and “comprising”, will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Use of an anti-LAG-3 antibody molecule in the manufacture of a medicament for treating a cancer in a subject, wherein the anti-LAG-3 antibody molecule is formulated for use at a flat dose of about 300 mg to about 500 mg once every three weeks, or about 700 mg to about 900 mg once every four weeks;

wherein the anti-LAG-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 701, a VHCDR2 amino acid sequence of SEQ ID NO: 702, and a VHCDR3 amino acid sequence of SEQ ID NO: 703; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 710, a VLCDR2 amino acid sequence of SEQ ID NO: 711, and a VLCDR3 amino acid sequence of SEQ ID NO: 712.

2. A method of treating a cancer in a subject, the method comprising administering to the subject an anti-LAG-3 antibody molecule at a dose of about 300 mg to about 500 mg once every three weeks, or about 700 mg to about 900 mg once every four weeks,

wherein the anti-LAG-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 701, a VHCDR2 amino acid sequence of SEQ ID NO: 702, and a VHCDR3 amino acid sequence of SEQ ID NO: 703; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 710, a VLCDR2 amino acid sequence of SEQ ID NO: 711, and a VLCDR3 amino acid sequence of SEQ ID NO: 712.

3. The use of claim 1, or the method of claim 2, wherein the anti-LAG-3 antibody molecule is used at a dose of about:

(a) 300 mg to about 500 mg once every three weeks;

(b) about 400 mg once every three weeks;

(c) about 700 mg to about 900 mg once every four weeks; or

(d) about 800 mg once every four weeks.

4. The use of claim 1 or claim 3, or the method of claim 2 or claim 3, wherein the antibody molecule comprises:

(a) a VH comprising the amino acid sequence of SEQ ID NO: 706 and a VL comprising the amino acid sequence of SEQ ID NO: 718; or

(b) a VH comprising the amino acid sequence of SEQ ID NO: 724 and a VL comprising the amino acid sequence of SEQ ID NO: 730.

5. The use of any one of claims 1, 3, or 4, or the method of any one of claims 2-4, wherein the antibody molecule comprises:

(a) a heavy chain comprising the amino acid sequence of SEQ ID NO: 709 and a light chain comprising the amino acid sequence of SEQ ID NO: 721; or

(b) a heavy chain comprising the amino acid sequence of SEQ ID NO: 727 and a light chain comprising the amino acid sequence of SEQ ID NO: 733.

6. The use of any one of claims 1 or 3-5, or the method of any one of claims 2-5, wherein the cancer is a solid tumor or a hematological cancer.

7. The use of any one of claims 1 or 3-6, or the method of any one of claims 2-6, wherein the cancer is chosen from a brain cancer, a pancreatic cancer, a skin cancer, a renal cancer, a breast cancer, a virus-associated cancer, an anal canal cancer, a cervical cancer, a gastric cancer, a head and neck cancer, a nasopharyngeal cancer (NPC), a penile cancer, a vaginal or vulvar cancer, a colorectal cancer, a lung cancer, a leukemia, a lymphoma, a myeloma, or a metastatic lesion of the cancer.

8. The use of claim 7, or the method of claim 7, wherein:

(a) the brain cancer is a glioblastoma or a gliosarcoma;

(b) the skin cancer is a melanoma or a Merkel cell carcinoma;

(c) the renal cancer is a renal cell carcinoma (RCC);

(d) the breast cancer is a breast carcinoma or a triple negative breast cancer (TNBC);

(e) the virus-associated cancer is chosen from an anal canal cancer, a cervical cancer, a gastric cancer, a head and neck cancer, a nasopharyngeal cancer (NPC), a penile cancer, or a vaginal or vulvar cancer;

(f) the colorectal cancer is chosen from a microsatellite unstable colorectal cancer, a microsatellite stable colorectal cancer, a mismatch repair proficient colorectal cancer, or a mismatch repair deficient colorectal cancer;

(g) the lung cancer is a non-small cell lung cancer (NSCLC); or

(h) the lymphoma is a Hodgkin lymphoma (HL) or a diffuse large B cell lymphoma (DLBCL).

9. The use of any one of claims 1 or 3-8, or the method of any one of claims 2-8, wherein the cancer is an advanced cancer, a metastatic cancer, a recurrent cancer, a relapsed cancer, or an unresectable cancer.

10. The use of any one of claims 1 or 3-9, or the method of any one of claims 2-9, wherein the anti-LAG-3 antibody molecule is used in combination with a second therapeutic agent or modality.

11. The use of any one of claims 1 or 3-10, or the method of any one of claims 2-10, wherein the anti-LAG-3 antibody molecule is used in combination with:

(a) a PD-1 inhibitor;

(b) a PD-L1 inhibitor; or

(c) a chemotherapeutic agent.

12. The use of claim 11, or the method of claim 11, wherein:

(a) the PD-1 inhibitor is chosen from PDR001, nivolumab, pembrolizumab, pidilizumab, MEDI0680, REGN2810, PF-06801591, BGB-A317, INCHR1210, TSR-042, or AMP-224;

(b) the PD-L1 inhibitor is chosen from FAZ053, atezolizumab, avelumab, durvalumab, or BMS-936559; or

(c) the chemotherapeutic agent is chosen from a platinum agent and a nucleotide analog or precursor analog.

13. The use of claim 11 or claim 12, or the method of claim 11 or claim 12, wherein the PD-1 inhibitor is used at a dose of about 300 mg once every three weeks or about 400 mg once every four weeks.

14. The use of claim 12, or the method of claim 12, wherein:

(a) the chemotherapeutic agent is a platinum agent, and wherein the platinum agent is chosen from carboplatin, cisplatin, oxaliplatin, or tetraplatin;

(b) the chemotherapeutic agent is a nucleotide analog or precursor analog, and wherein the nucleotide analog or precursor analog comprises capecitabine.

15. The use of any one of claims 1 or 3-14, or the method of any one of claims 2-14, wherein the subject has, or is identified as having:

(a) LAG-3 expression in tumor-infiltrating lymphocytes (TILs); and/or

(b) a cancer that expresses PD-L1.

16. Use of a pharmaceutical composition or dose formulation comprising an anti-LAG-3 antibody molecule in the manufacture of a medicament for treating a cancer in a subject, wherein the anti-LAG-3 antibody molecule is formulated for use at a flat dose of about 300 mg to about 500 mg once every three weeks, or about 700 mg to about 900 mg once every four weeks;

wherein the anti-LAG-3 antibody molecule comprises a heavy chain variable region (VH) comprising a VHCDR1 amino acid sequence of SEQ ID NO: 701, a VHCDR2 amino acid sequence of SEQ ID NO: 702, and a VHCDR3 amino acid sequence of SEQ ID NO: 703; and a light chain variable region (VL) comprising a VLCDR1 amino acid sequence of SEQ ID NO: 710, a VLCDR2 amino acid sequence of SEQ ID NO: 711, and a VLCDR3 amino acid sequence of SEQ ID NO: 712.

17. The use of claim 16, wherein the antibody molecule comprises:

(a) a VH comprising the amino acid sequence of SEQ ID NO: 706 and a VL comprising the amino acid sequence of SEQ ID NO: 718; or

(b) a VH comprising the amino acid sequence of SEQ ID NO: 724 and a VL comprising the amino acid sequence of SEQ ID NO: 730.

18. The use of claim 16 or claim 17, wherein the antibody molecule comprises:

(a) a heavy chain comprising the amino acid sequence of SEQ ID NO: 709 and a light chain comprising the amino acid sequence of SEQ ID NO: 721; or

(b) a heavy chain comprising the amino acid sequence of SEQ ID NO: 727 and a light chain comprising the amino acid sequence of SEQ ID NO: 733.

19. The use of any one of claims 16-18, wherein the cancer is a solid tumor or a hematological cancer.

20. The use of any one of claims 16-19, wherein the cancer is chosen from a brain cancer, a pancreatic cancer, a skin cancer, a renal cancer, a breast cancer, a virus-associated cancer, an anal canal cancer, a cervical cancer, a gastric cancer, a head and neck cancer, a nasopharyngeal cancer (NPC), a penile cancer, a vaginal or vulvar cancer, a colorectal cancer, a lung cancer, a leukemia, a lymphoma, a myeloma, or a metastatic lesion of the cancer.

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<210> 501
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 501
Thr Tyr Trp Met His
1 5

<210> 502
<211> 17
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 502
Asn Ile Tyr Pro Gly Thr Gly Gly Ser Asn Phe Asp Glu Lys Phe Lys
1 5 10 15

Asn

<210> 503
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 503
Trp Thr Thr Gly Thr Gly Ala Tyr
1 5

<210> 504
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 504
Gly Tyr Thr Phe Thr Thr Tyr
1 5

<210> 505
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 505
Tyr Pro Gly Thr Gly Gly
1 5

<210> 506
<211> 117
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 506
Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Glu
1 5 10 15

Ser Leu Arg Ile Ser Cys Lys Gly Ser Gly Tyr Thr Phe Thr Thr Tyr
20 25 30

Trp Met His Trp Val Arg Gln Ala Thr Gly Gln Gly Leu Glu Trp Met

35 40 45

Gly Asn Ile Tyr Pro Gly Thr Gly Gly Ser Asn Phe Asp Glu Lys Phe
50 55 60

Lys Asn Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Ala Tyr
65 70 75 80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Thr Arg Trp Thr Thr Gly Thr Gly Ala Tyr Trp Gly Gln Gly Thr Thr
100 105 110

Val Thr Val Ser Ser
115

<210> 507
<211> 351
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 507
gaggtgcagc tggtgcagtc aggcgccgaa gtgaagaagc ccggcgagtc actgagaatt 60

agctgtaaag gttcaggcta caccttcact acctactgga tgcactgggt ccgccaggct 120

accggtcaag gcctcgagtg gatgggtaat atctaccccg gcaccggcgg ctctaacttc 180

gacgagaagt ttaagaatag agtgactatc accgccgata agtctactag caccgcctat 240

atggaactgt ctagcctgag atcagaggac accgccgtct actactgcac taggtggact 300

accggcacag gcgcctactg gggtcaaggc actaccgtga ccgtgtctag c 351

<210> 508
<211> 443
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 508

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Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Glu
1               5                  10                  15

Ser Leu Arg Ile Ser Cys Lys Gly Ser Gly Tyr Thr Phe Thr Thr Tyr
            20                  25                  30

Trp Met His Trp Val Arg Gln Ala Thr Gly Gln Gly Leu Glu Trp Met
        35                  40                  45

Gly Asn Ile Tyr Pro Gly Thr Gly Gly Ser Asn Phe Asp Glu Lys Phe
    50                  55                  60

Lys Asn Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Ala Tyr
65                  70                  75                  80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Thr Arg Trp Thr Thr Gly Thr Gly Ala Tyr Trp Gly Gln Gly Thr Thr
            100                 105                 110

Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu
        115                 120                 125

Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys
    130                 135                 140

Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser
145                 150                 155                 160

Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser
                165                 170                 175

Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser
            180                 185                 190
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Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn
        195                 200                 205

Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro Pro Cys Pro
    210                 215                 220

Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val Phe Leu Phe
225                 230                 235                 240

Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val
                245                 250                 255

Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu Val Gln Phe
            260                 265                 270

Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro
        275                 280                 285

Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser Val Leu Thr
    290                 295                 300

Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val
305                 310                 315                 320

Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile Ser Lys Ala
                325                 330                 335

Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln
            340                 345                 350

Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly
        355                 360                 365

Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro
    370                 375                 380

Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser
385                 390                 395                 400
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Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu
405 410 415

Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His
420 425 430

Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly
435 440

<210> 509
<211> 1329
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 509
gaggtgcagc tggtgcagtc aggcgccgaa gtgaagaagc ccggcgagtc actgagaatt 60

agctgtaaag gttcaggcta caccttcact acctactgga tgcactgggt ccgccaggct 120

accggtcaag gcctcgagtg gatgggtaat atctaccccg gcaccggcgg ctctaacttc 180

gacgagaagt ttaagaatag agtgactatc accgccgata agtctactag caccgcctat 240

atggaactgt ctagcctgag atcagaggac accgccgtct actactgcac taggtggact 300

accggcacag gcgcctactg gggtcaaggc actaccgtga ccgtgtctag cgctagcact 360

aagggcccgt ccgtgttccc cctggcacct tgtagccgga gcactagcga atccaccgct 420

gccctcggct gcctggtcaa ggattacttc ccggagcccg tgaccgtgtc ctggaacagc 480

ggagccctga cctccggagt gcacaccttc cccgctgtgc tgcagagctc cgggctgtac 540

tcgctgtcgt cggtggtcac ggtgccttca tctagcctgg gtaccaagac ctacacttgc 600

aacgtggacc acaagccttc caacactaag gtggacaagc gcgtcgaatc gaagtacggc 660

ccaccgtgcc cgccttgtcc cgcgccggag ttcctcggcg gtccctcggt ctttctgttc 720

ccaccgaagc ccaaggacac tttgatgatt tcccgcaccc ctgaagtgac atgcgtggtc 780

gtggacgtgt cacaggaaga tccggaggtg cagttcaatt ggtacgtgga tggcgtcgag 840

gtgcacaacg ccaaaaccaa gccgagggag gagcagttca actccactta ccgcgtcgtg 900

tccgtgctga cggtgctgca tcaggactgg ctgaacggga aggagtacaa gtgcaaagtg 960

tccaacaagg gacttcctag ctcaatcgaa aagaccatct cgaaagccaa gggacagccc 1020

cgggaacccc aagtgtatac cctgccaccg agccaggaag aaatgactaa gaaccaagtc 1080

tcattgactt gccttgtgaa gggcttctac ccatcggata tcgccgtgga atgggagtcc 1140

aacggccagc cggaaaacaa ctacaagacc acccctccgg tgctggactc agacggatcc 1200

ttcttcctct actcgcggct gaccgtggat aagagcagat ggcaggaggg aaatgtgttc 1260

agctgttctg tgatgcatga agccctgcac aaccactaca ctcagaagtc cctgtccctc 1320

tccctggga 1329

<210> 510
<211> 17
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 510
Lys Ser Ser Gln Ser Leu Leu Asp Ser Gly Asn Gln Lys Asn Phe Leu
1 5 10 15

Thr

<210> 511
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 511
Trp Ala Ser Thr Arg Glu Ser
1 5

<210> 512
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 512
Gln Asn Asp Tyr Ser Tyr Pro Tyr Thr
1 5

<210> 513
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 513
Ser Gln Ser Leu Leu Asp Ser Gly Asn Gln Lys Asn Phe
1 5 10

<210> 514
<211> 3
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 514
Trp Ala Ser
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<210> 515
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 515
Asp Tyr Ser Tyr Pro Tyr
1 5

<210> 516
<211> 113
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 516
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Lys Ser Ser Gln Ser Leu Leu Asp Ser
20 25 30

Gly Asn Gln Lys Asn Phe Leu Thr Trp Tyr Gln Gln Lys Pro Gly Lys
35 40 45

Ala Pro Lys Leu Leu Ile Tyr Trp Ala Ser Thr Arg Glu Ser Gly Val
50 55 60

Pro Ser Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr
65 70 75 80

Ile Ser Ser Leu Gln Pro Glu Asp Ile Ala Thr Tyr Tyr Cys Gln Asn
85 90 95

Asp Tyr Ser Tyr Pro Tyr Thr Phe Gly Gln Gly Thr Lys Val Glu Ile
100 105 110

Lys

<210> 517
<211> 339
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 517
gagatcgtcc tgactcagtc acccgctacc ctgagcctga gccctggcga gcgggctaca 60

ctgagctgta aatctagtca gtcactgctg gatagcggta atcagaagaa cttcctgacc 120

tggtatcagc agaagcccgg taaagcccct aagctgctga tctactgggc ctctactaga 180

gaatcaggcg tgccctctag gtttagcggt agcggtagtg gcaccgactt caccttcact 240

atctctagcc tgcagcccga ggatatcgct acctactact gtcagaacga ctatagctac 300

ccctacacct tcggtcaagg cactaaggtc gagattaag 339

<210> 518
<211> 220
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 518
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Lys Ser Ser Gln Ser Leu Leu Asp Ser
20 25 30

Gly Asn Gln Lys Asn Phe Leu Thr Trp Tyr Gln Gln Lys Pro Gly Lys
35 40 45

Ala Pro Lys Leu Leu Ile Tyr Trp Ala Ser Thr Arg Glu Ser Gly Val
50 55 60

Pro Ser Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr
65 70 75 80

Ile Ser Ser Leu Gln Pro Glu Asp Ile Ala Thr Tyr Tyr Cys Gln Asn
85 90 95

Asp Tyr Ser Tyr Pro Tyr Thr Phe Gly Gln Gly Thr Lys Val Glu Ile
100 105 110

Lys Arg Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp
115 120 125

Glu Gln Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn
130 135 140

Phe Tyr Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu
145 150 155 160

Gln Ser Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp
165 170 175

Ser Thr Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr
180 185 190

Glu Lys His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser
195 200 205

Ser Pro Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
210 215 220

<210> 519
<211> 660
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 519
gagatcgtcc tgactcagtc acccgctacc ctgagcctga gccctggcga gcgggctaca 60

ctgagctgta aatctagtca gtcactgctg gatagcggta atcagaagaa cttcctgacc 120

tggtatcagc agaagcccgg taaagcccct aagctgctga tctactgggc ctctactaga 180

gaatcaggcg tgccctctag gtttagcggt agcggtagtg gcaccgactt caccttcact 240

atctctagcc tgcagcccga ggatatcgct acctactact gtcagaacga ctatagctac 300

ccctacacct tcggtcaagg cactaaggtc gagattaagc gtacggtggc cgctcccagc 360

gtgttcatct tccccccag cgacgagcag ctgaagagcg gcaccgccag cgtggtgtgc 420

ctgctgaaca acttctaccc ccgggaggcc aaggtgcagt ggaaggtgga caacgccctg 480

cagagcggca acagccagga gagcgtcacc gagcaggaca gcaaggactc cacctacagc 540

ctgagcagca ccctgaccct gagcaaggcc gactacgaga agcataaggt gtacgcctgc 600

gaggtgaccc accagggcct gtccagcccc gtgaccaaga gcttcaacag gggcgagtgc 660

<210> 520
<211> 113
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 520
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Lys Ser Ser Gln Ser Leu Leu Asp Ser
20 25 30

Gly Asn Gln Lys Asn Phe Leu Thr Trp Tyr Gln Gln Lys Pro Gly Gln
35 40 45

Ala Pro Arg Leu Leu Ile Tyr Trp Ala Ser Thr Arg Glu Ser Gly Val
50 55 60

Pro Ser Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr
65 70 75 80

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Ile Ser Ser Leu Glu Ala Glu Asp Ala Ala Thr Tyr Tyr Cys Gln Asn
                85                  90                  95


Asp Tyr Ser Tyr Pro Tyr Thr Phe Gly Gln Gly Thr Lys Val Glu Ile
            100                 105                 110


Lys



<210> 521
<211> 339
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 521
gagatcgtcc tgactcagtc acccgctacc ctgagcctga gccctggcga gcgggctaca       60

ctgagctgta aatctagtca gtcactgctg gatagcggta atcagaagaa cttcctgacc      120

tggtatcagc agaagcccgg tcaagccccc agactgctga tctactgggc ctctactaga      180

gaatcaggcg tgccctctag gtttagcggt agcggtagtg gcaccgactt caccttcact      240

atctctagcc tggaagccga ggacgccgct acctactact gtcagaacga ctatagctac      300

ccctacacct tcggtcaagg cactaaggtc gagattaag                             339


<210> 522
<211> 220
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 522
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1               5                   10                  15
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Glu Arg Ala Thr Leu Ser Cys Lys Ser Ser Gln Ser Leu Leu Asp Ser
            20                  25                  30

Gly Asn Gln Lys Asn Phe Leu Thr Trp Tyr Gln Gln Lys Pro Gly Gln
        35                  40                  45

Ala Pro Arg Leu Leu Ile Tyr Trp Ala Ser Thr Arg Glu Ser Gly Val
    50                  55                  60

Pro Ser Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr
65                  70                  75                  80

Ile Ser Ser Leu Glu Ala Glu Asp Ala Ala Thr Tyr Tyr Cys Gln Asn
                85                  90                  95

Asp Tyr Ser Tyr Pro Tyr Thr Phe Gly Gln Gly Thr Lys Val Glu Ile
            100                 105                 110

Lys Arg Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp
        115                 120                 125

Glu Gln Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn
    130                 135                 140

Phe Tyr Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu
145                 150                 155                 160

Gln Ser Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp
                165                 170                 175

Ser Thr Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr
            180                 185                 190

Glu Lys His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser
        195                 200                 205

Ser Pro Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
    210                 215                 220
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<210> 523
<211> 660
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 523
gagatcgtcc tgactcagtc acccgctacc ctgagcctga gccctggcga gcgggctaca 60

ctgagctgta aatctagtca gtcactgctg gatagcggta atcagaagaa cttcctgacc 120

tggtatcagc agaagcccgg tcaagcccct agactgctga tctactgggc ctctactaga 180

gaatcaggcg tgccctctag gtttagcggt agcggtagtg gcaccgactt caccttcact 240

atctctagcc tggaagccga ggacgccgct acctactact gtcagaacga ctatagctac 300

ccctacacct tcggtcaagg cactaaggtc gagattaagc gtacggtggc cgctcccagc 360

gtgttcatct tccccccag cgacgagcag ctgaagagcg gcaccgccag cgtggtgtgc 420

ctgctgaaca acttctaccc ccgggaggcc aaggtgcagt ggaaggtgga caacgccctg 480

cagagcggca acagccagga gagcgtcacc gagcaggaca gcaaggactc cacctacagc 540

ctgagcagca ccctgaccct gagcaaggcc gactacgaga agcataaggt gtacgcctgc 600

gaggtgaccc accagggcct gtccagcccc gtgaccaaga gcttcaacag gggcgagtgc 660

<210> 524
<211> 15
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 524
acctactgga tgcac 15

<210> 525
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 525
aatatctacc ccggcaccgg cggctctaac ttcgacgaga agtttaagaa t 51

<210> 526
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 526
tggactaccg gcacaggcgc ctac 24

<210> 527
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 527
ggctacacct tcactaccta c 21

<210> 528
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 528
taccccggca ccggcggc 18

<210> 529
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 529
aaatctagtc agtcactgct ggatagcggt aatcagaaga acttcctgac c 51

<210> 530
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 530
tgggcctcta ctagagaatc a 21

<210> 531
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 531
cagaacgact atagctaccc ctacacc 27

<210> 532
<211> 39
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 532
agtcagtcac tgctggatag cggtaatcag aagaacttc 39

<210> 533
<211> 9
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 533
tgggcctct 9

<210> 534
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 534
gactatagct acccctac 18

<210> 535
<211> 440
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 535
Gln Val Gln Leu Val Glu Ser Gly Gly Gly Val Val Gln Pro Gly Arg
1 5 10 15

Ser Leu Arg Leu Asp Cys Lys Ala Ser Gly Ile Thr Phe Ser Asn Ser
20 25 30

Gly Met His Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val

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        35                  40                  45

Ala Val Ile Trp Tyr Asp Gly Ser Lys Arg Tyr Tyr Ala Asp Ser Val
    50                  55                  60

Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Phe
65                  70                  75                  80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Thr Asn Asp Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr Val Ser
            100                 105                 110

Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro Cys Ser
        115                 120                 125

Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val Lys Asp
    130                 135                 140

Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala Leu Thr
145                 150                 155                 160

Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly Leu Tyr
                165                 170                 175

Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly Thr Lys
            180                 185                 190

Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys Val Asp
        195                 200                 205

Lys Arg Val Glu Ser Lys Tyr Gly Pro Pro Cys Pro Pro Cys Pro Ala
    210                 215                 220

Pro Glu Phe Leu Gly Gly Pro Ser Val Phe Leu Phe Pro Pro Lys Pro
225                 230                 235                 240

Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val Val
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245 250 255

Val Asp Val Ser Gln Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr Val
260 265 270

Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln
275 280 285

Phe Asn Ser Thr Tyr Arg Val Val Ser Val Leu Thr Val Leu His Gln
290 295 300

Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys Gly
305 310 315 320

Leu Pro Ser Ser Ile Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro
325 330 335

Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Gln Glu Glu Met Thr
340 345 350

Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser
355 360 365

Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr
370 375 380

Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr
385 390 395 400

Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln Glu Gly Asn Val Phe
405 410 415

Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln Lys
420 425 430

Ser Leu Ser Leu Ser Leu Gly Lys
435 440

<210> 536

<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 536

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Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1               5                  10                  15


Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Gln Ser Val Ser Ser Tyr
            20                  25                  30


Leu Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu Ile
        35                  40                  45


Tyr Asp Ala Ser Asn Arg Ala Thr Gly Ile Pro Ala Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Glu Pro
65                  70                  75                  80


Glu Asp Phe Ala Val Tyr Tyr Cys Gln Gln Ser Ser Asn Trp Pro Arg
                85                  90                  95


Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
            100                 105                 110


Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
        115                 120                 125


Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
    130                 135                 140


Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145                 150                 155                 160


Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
                165                 170                 175
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Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
            180                 185                 190


Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
        195                 200                 205


Phe Asn Arg Gly Glu Cys
    210


<210> 537
<211> 447
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 537
Gln Val Gln Leu Val Gln Ser Gly Val Glu Val Lys Lys Pro Gly Ala
1               5                   10                  15


Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Asn Tyr
            20                  25                  30


Tyr Met Tyr Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
        35                  40                  45


Gly Gly Ile Asn Pro Ser Asn Gly Gly Thr Asn Phe Asn Glu Lys Phe
    50                  55                  60


Lys Asn Arg Val Thr Leu Thr Thr Asp Ser Ser Thr Thr Thr Ala Tyr
65                  70                  75                  80


Met Glu Leu Lys Ser Leu Gln Phe Asp Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95


Ala Arg Arg Asp Tyr Arg Phe Asp Met Gly Phe Asp Tyr Trp Gly Gln
            100                 105                 110
```

```
Gly Thr Thr Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val
        115                 120                 125

Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala
    130                 135                 140

Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser
145                 150                 155                 160

Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val
                165                 170                 175

Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro
            180                 185                 190

Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys
        195                 200                 205

Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro
    210                 215                 220

Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val
225                 230                 235                 240

Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr
                245                 250                 255

Pro Glu Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu
            260                 265                 270

Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys
        275                 280                 285

Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser
    290                 295                 300

Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys
305                 310                 315                 320
```

```
Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile
                325                 330                 335


Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro
            340                 345                 350


Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu
        355                 360                 365


Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn
    370                 375                 380


Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser
385                 390                 395                 400


Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg
                405                 410                 415


Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu
            420                 425                 430


His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
        435                 440                 445


<210> 538
<211> 218
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 538
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1               5                   10                  15


Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Lys Gly Val Ser Thr Ser
            20                  25                  30
```

```
Gly Tyr Ser Tyr Leu His Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro
        35                  40                  45

Arg Leu Leu Ile Tyr Leu Ala Ser Tyr Leu Glu Ser Gly Val Pro Ala
    50                  55                  60

Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser
65                  70                  75                  80

Ser Leu Glu Pro Glu Asp Phe Ala Val Tyr Tyr Cys Gln His Ser Arg
                85                  90                  95

Asp Leu Pro Leu Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys Arg
            100                 105                 110

Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln
        115                 120                 125

Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr
    130                 135                 140

Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser
145                 150                 155                 160

Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr
                165                 170                 175

Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys
            180                 185                 190

His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro
        195                 200                 205

Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
    210                 215
```

<210> 539
<211> 447
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 539
Gln Val Gln Leu Val Gln Ser Gly Ser Glu Leu Lys Lys Pro Gly Ala
1 5 10 15

Ser Val Lys Ile Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Asn Tyr
20 25 30

Gly Met Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Gln Trp Met
35 40 45

Gly Trp Ile Asn Thr Asp Ser Gly Glu Ser Thr Tyr Ala Glu Glu Phe
50 55 60

Lys Gly Arg Phe Val Phe Ser Leu Asp Thr Ser Val Asn Thr Ala Tyr
65 70 75 80

Leu Gln Ile Thr Ser Leu Thr Ala Glu Asp Thr Gly Met Tyr Phe Cys
85 90 95

Val Arg Val Gly Tyr Asp Ala Leu Asp Tyr Trp Gly Gln Gly Thr Leu
100 105 110

Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu
115 120 125

Ala Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys
130 135 140

Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser
145 150 155 160

Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser
165 170 175

Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser

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            180                 185                 190

Leu Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn
        195                 200                 205

Thr Lys Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His
    210                 215                 220

Thr Cys Pro Pro Cys Pro Ala Pro Glu Leu Leu Gly Gly Pro Ser Val
225                 230                 235                 240

Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr
                245                 250                 255

Pro Glu Val Thr Cys Val Val Val Asp Val Ser His Glu Asp Pro Glu
            260                 265                 270

Val Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys
        275                 280                 285

Thr Lys Pro Arg Glu Glu Gln Tyr Asn Ser Thr Tyr Arg Val Val Ser
    290                 295                 300

Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys
305                 310                 315                 320

Cys Lys Val Ser Asn Lys Ala Leu Pro Ala Pro Ile Glu Lys Thr Ile
                325                 330                 335

Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro
            340                 345                 350

Pro Ser Arg Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu
        355                 360                 365

Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn
    370                 375                 380

Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser
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385 390 395 400

Asp Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg
405 410 415

Trp Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu
420 425 430

His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
435 440 445

<210> 540
<211> 213
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 540
Glu Ile Val Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Ser Ala Arg Ser Ser Val Ser Tyr Met
20 25 30

His Trp Phe Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Trp Ile Tyr
35 40 45

Arg Thr Ser Asn Leu Ala Ser Gly Val Pro Ser Arg Phe Ser Gly Ser
50 55 60

Gly Ser Gly Thr Ser Tyr Cys Leu Thr Ile Asn Ser Leu Gln Pro Glu
65 70 75 80

Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Arg Ser Ser Phe Pro Leu Thr
85 90 95

Phe Gly Gly Gly Thr Lys Leu Glu Ile Lys Arg Thr Val Ala Ala Pro
100 105 110

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Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly Thr
        115                 120                 125


Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala Lys
    130                 135                 140


Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln Glu
145                 150                 155                 160


Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser Ser
                165                 170                 175


Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr Ala
            180                 185                 190


Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser Phe
        195                 200                 205


Asn Arg Gly Glu Cys
    210


<210> 541
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      peptide"

<400> 541
Gly Tyr Thr Phe Thr Thr Tyr Trp Met His
1               5                   10


<210> 542

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<210> 601
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
peptide"

<400> 601
Ser Tyr Trp Met Tyr
1 5

<210> 602
<211> 17

<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 602
Arg Ile Asp Pro Asn Ser Gly Ser Thr Lys Tyr Asn Glu Lys Phe Lys
1 5 10 15

Asn

<210> 603
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 603
Asp Tyr Arg Lys Gly Leu Tyr Ala Met Asp Tyr
1 5 10

<210> 604
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 604
Gly Tyr Thr Phe Thr Ser Tyr
1 5

<210> 605
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 605
Asp Pro Asn Ser Gly Ser
1 5

<210> 606
<211> 120
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 606
Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Thr Val Lys Ile Ser Cys Lys Val Ser Gly Tyr Thr Phe Thr Ser Tyr
20 25 30

Trp Met Tyr Trp Val Arg Gln Ala Arg Gly Gln Arg Leu Glu Trp Ile
35 40 45

Gly Arg Ile Asp Pro Asn Ser Gly Ser Thr Lys Tyr Asn Glu Lys Phe
50 55 60

Lys Asn Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr
65 70 75 80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Ala Arg Asp Tyr Arg Lys Gly Leu Tyr Ala Met Asp Tyr Trp Gly Gln
100 105 110

Gly Thr Thr Val Thr Val Ser Ser
115 120

<210> 607
<211> 360
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 607
gaagtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctac cgtgaagatt 60

agctgtaaag tctcaggcta caccttcact agctactgga tgtactgggt ccgacaggct 120

agagggcaaa gactggagtg gatcggtaga atcgacccta atagcggctc tactaagtat 180

aacgagaagt ttaagaatag gttcactatt agtagggata actctaagaa caccctgtac 240

ctgcagatga atagcctgag agccgaggac accgccgtct actactgcgc tagagactat 300

agaaagggcc tgtacgctat ggactactgg ggtcaaggca ctaccgtgac cgtgtcttca 360

<210> 608
<211> 446
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 608
Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Thr Val Lys Ile Ser Cys Lys Val Ser Gly Tyr Thr Phe Thr Ser Tyr
20 25 30

Trp Met Tyr Trp Val Arg Gln Ala Arg Gly Gln Arg Leu Glu Trp Ile
35 40 45

Gly Arg Ile Asp Pro Asn Ser Gly Ser Thr Lys Tyr Asn Glu Lys Phe
50 55 60

```
Lys Asn Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr
65                  70                  75                  80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Asp Tyr Arg Lys Gly Leu Tyr Ala Met Asp Tyr Trp Gly Gln
            100                 105                 110

Gly Thr Thr Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val
        115                 120                 125

Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala
    130                 135                 140

Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser
145                 150                 155                 160

Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val
                165                 170                 175

Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro
            180                 185                 190

Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys
        195                 200                 205

Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro
    210                 215                 220

Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val
225                 230                 235                 240

Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr
                245                 250                 255

Pro Glu Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu
            260                 265                 270
```

```
Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys
        275                 280                 285

Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser
    290                 295                 300

Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys
305                 310                 315                 320

Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile
                325                 330                 335

Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro
            340                 345                 350

Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu
        355                 360                 365

Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn
    370                 375                 380

Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser
385                 390                 395                 400

Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg
                405                 410                 415

Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu
            420                 425                 430

His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly
        435                 440                 445


<210> 609
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
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peptide"

<400> 609
Lys Ala Ser Gln Asp Val Gly Thr Ala Val Ala
1 5 10

<210> 610
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 610
Trp Ala Ser Thr Arg His Thr
1 5

<210> 611
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 611
Gln Gln Tyr Asn Ser Tyr Pro Leu Thr
1 5

<210> 612
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 612
Ser Gln Asp Val Gly Thr Ala
1 5

<210> 613
<211> 3
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 613
Trp Ala Ser
1

<210> 614
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 614
Tyr Asn Ser Tyr Pro Leu
1 5

<210> 615
<211> 1338
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 615
gaagtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctac cgtgaagatt 60

agctgtaaag tctcaggcta caccttcact agctactgga tgtactgggt ccgacaggct 120

agagggcaaa gactggagtg gatcggtaga atcgacccta atagcggctc tactaagtat 180

aacgagaagt ttaagaatag gttcactatt agtagggata actctaagaa caccctgtac 240

ctgcagatga atagcctgag agccgaggac accgccgtct actactgcgc tagagactat 300

agaaagggcc tgtacgctat ggactactgg ggtcaaggca ctaccgtgac cgtgtcttca 360

gctagcacta agggcccgtc cgtgttcccc ctggcacctt gtagccggag cactagcgaa 420

tccaccgctg ccctcggctg cctggtcaag gattacttcc cggagcccgt gaccgtgtcc 480

tggaacagcg gagccctgac ctccggagtg cacaccttcc ccgctgtgct gcagagctcc 540

gggctgtact cgctgtcgtc ggtggtcacg gtgccttcat ctagcctggg taccaagacc 600

tacacttgca acgtggacca caagccttcc aacactaagg tggacaagcg cgtcgaatcg 660

aagtacggcc caccgtgccc gccttgtccc gcgccggagt tcctcggcgg tccctcggtc 720

tttctgttcc caccgaagcc caaggacact ttgatgattt cccgcacccc tgaagtgaca 780

tgcgtggtcg tggacgtgtc acaggaagat ccggaggtgc agttcaattg gtacgtggat 840

ggcgtcgagg tgcacaacgc caaaaccaag ccgagggagg agcagttcaa ctccacttac 900

cgcgtcgtgt ccgtgctgac ggtgctgcat caggactggc tgaacgggaa ggagtacaag 960

tgcaaagtgt ccaacaaggg acttcctagc tcaatcgaaa agaccatctc gaaagccaag 1020

ggacagcccc gggaacccca agtgtatacc ctgccaccga gccaggaaga aatgactaag 1080

aaccaagtct cattgacttg ccttgtgaag ggcttctacc catcggatat cgccgtggaa 1140

tgggagtcca acggccagcc ggaaaacaac tacaagacca cccctccggt gctggactca 1200

gacggatcct tcttcctcta ctcgcggctg accgtggata agagcagatg gcaggaggga 1260

aatgtgttca gctgttctgt gatgcatgaa gccctgcaca accactacac tcagaagtcc 1320

ctgtccctct ccctggga 1338

<210> 616
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 616
Ala Ile Gln Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Lys Ala Ser Gln Asp Val Gly Thr Ala

20 25 30

Val Ala Trp Tyr Leu Gln Lys Pro Gly Gln Ser Pro Gln Leu Leu Ile
35 40 45

Tyr Trp Ala Ser Thr Arg His Thr Gly Val Pro Ser Arg Phe Ser Gly
50 55 60

Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr Ile Ser Ser Leu Glu Ala
65 70 75 80

Glu Asp Ala Ala Thr Tyr Tyr Cys Gln Gln Tyr Asn Ser Tyr Pro Leu
85 90 95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys
100 105

<210> 617
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 617
gctattcagc tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta aagcctctca ggacgtgggc accgccgtgg cctggtatct gcagaagcct 120

ggtcaatcac ctcagctgct gatctactgg gcctctacta gacacaccgg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgac ttcaccttca ctatctcttc actggaagcc 240

gaggacgccg ctacctacta ctgtcagcag tataatagct acccccctgac cttcggtcaa 300

ggcactaagg tcgagattaa g 321

<210> 618
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 618

```
Ala Ile Gln Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1               5                  10                  15


Asp Arg Val Thr Ile Thr Cys Lys Ala Ser Gln Asp Val Gly Thr Ala
            20                  25                  30


Val Ala Trp Tyr Leu Gln Lys Pro Gly Gln Ser Pro Gln Leu Leu Ile
        35                  40                  45


Tyr Trp Ala Ser Thr Arg His Thr Gly Val Pro Ser Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Phe Thr Ile Ser Ser Leu Glu Ala
65                  70                  75                  80


Glu Asp Ala Ala Thr Tyr Tyr Cys Gln Gln Tyr Asn Ser Tyr Pro Leu
                85                  90                  95


Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
            100                 105                 110


Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
        115                 120                 125


Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
    130                 135                 140


Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145                 150                 155                 160


Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
                165                 170                 175


Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
            180                 185                 190
```

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
195 200 205

Phe Asn Arg Gly Glu Cys
210

<210> 619
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 619
gctattcagc tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta aagcctctca ggacgtgggc accgccgtgg cctggtatct gcagaagcct 120

ggtcaatcac ctcagctgct gatctactgg gcctctacta gacacaccgg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgac ttcaccttca ctatctcttc actggaagcc 240

gaggacgccg ctacctacta ctgtcagcag tataatagct acccccctgac cttcggtcaa 300

ggcactaagg tcgagattaa gcgtacggtg gccgctccca gcgtgttcat cttccccccc 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gcctgctgaa caacttctac 420

ccccgggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcataag gtgtacgcct gcgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 620
<211> 120
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic

polypeptide"

<400> 620

```
Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1               5                   10                  15

Thr Val Lys Ile Ser Cys Lys Val Ser Gly Tyr Thr Phe Thr Ser Tyr
            20                  25                  30

Trp Met Tyr Trp Val Arg Gln Ala Thr Gly Gln Gly Leu Glu Trp Met
        35                  40                  45

Gly Arg Ile Asp Pro Asn Ser Gly Ser Thr Lys Tyr Asn Glu Lys Phe
    50                  55                  60

Lys Asn Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Ala Tyr
65                  70                  75                  80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Asp Tyr Arg Lys Gly Leu Tyr Ala Met Asp Tyr Trp Gly Gln
            100                 105                 110

Gly Thr Thr Val Thr Val Ser Ser
        115                 120
```

<210> 621
<211> 360
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 621

```
gaagtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctac cgtgaagatt       60

agctgtaaag tctcaggcta caccttcact agctactgga tgtactgggt ccgacaggct      120

accggtcaag gcctggagtg gatgggtaga atcgacccta atagcggctc tactaagtat      180
```

aacgagaagt ttaagaatag agtgactatc accgccgata agtctactag caccgcctat 240

atggaactgt ctagcctgag atcagaggac accgccgtct actactgcgc tagagactat 300

agaaagggcc tgtacgctat ggactactgg ggtcaaggca ctaccgtgac cgtgtcttca 360

<210> 622
<211> 446
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 622

```
Glu Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1               5                   10                  15

Thr Val Lys Ile Ser Cys Lys Val Ser Gly Tyr Thr Phe Thr Ser Tyr
            20                  25                  30

Trp Met Tyr Trp Val Arg Gln Ala Thr Gly Gln Gly Leu Glu Trp Met
        35                  40                  45

Gly Arg Ile Asp Pro Asn Ser Gly Ser Thr Lys Tyr Asn Glu Lys Phe
    50                  55                  60

Lys Asn Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Ala Tyr
65                  70                  75                  80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Asp Tyr Arg Lys Gly Leu Tyr Ala Met Asp Tyr Trp Gly Gln
            100                 105                 110

Gly Thr Thr Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val
        115                 120                 125

Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala
    130                 135                 140
```

```
Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser
145                 150                 155                 160


Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val
                165                 170                 175


Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro
            180                 185                 190


Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys
        195                 200                 205


Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro
    210                 215                 220


Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val
225                 230                 235                 240


Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr
                245                 250                 255


Pro Glu Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu
            260                 265                 270


Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys
        275                 280                 285


Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser
    290                 295                 300


Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys
305                 310                 315                 320


Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile
                325                 330                 335


Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro
            340                 345                 350
```

```
Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu
        355                 360                 365


Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn
    370                 375                 380


Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser
385                 390                 395                 400


Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg
                405                 410                 415


Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu
            420                 425                 430


His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly
        435                 440                 445


<210> 623
<211> 1338
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 623
gaagtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctac cgtgaagatt       60

agctgtaaag tctcaggcta caccttcact agctactgga tgtactgggt ccgacaggct      120

accggtcaag gcctggagtg gatgggtaga atcgacccta atagcggctc tactaagtat      180

aacgagaagt ttaagaatag agtgactatc accgccgata agtctactag caccgcctat      240

atggaactgt ctagcctgag atcagaggac accgccgtct actactgcgc tagagactat      300

agaaagggcc tgtacgctat ggactactgg ggtcaaggca ctaccgtgac cgtgtcttca      360

gctagcacta agggcccgtc cgtgttcccc ctggcacctt gtagccggag cactagcgaa      420

tccaccgctg ccctcggctg cctggtcaag gattacttcc cggagcccgt gaccgtgtcc      480
```

tggaacagcg gagccctgac ctccggagtg cacaccttcc ccgctgtgct gcagagctcc 540

gggctgtact cgctgtcgtc ggtggtcacg gtgccttcat ctagcctggg taccaagacc 600

tacacttgca acgtggacca caagccttcc aacactaagg tggacaagcg cgtcgaatcg 660

aagtacggcc caccgtgccc gccttgtccc gcgccggagt tcctcggcgg tccctcggtc 720

tttctgttcc caccgaagcc caaggacact ttgatgattt cccgcacccc tgaagtgaca 780

tgcgtggtcg tggacgtgtc acaggaagat ccggaggtgc agttcaattg gtacgtggat 840

ggcgtcgagg tgcacaacgc caaaaccaag ccgagggagg agcagttcaa ctccacttac 900

cgcgtcgtgt ccgtgctgac ggtgctgcat caggactggc tgaacgggaa ggagtacaag 960

tgcaaagtgt ccaacaaggg acttcctagc tcaatcgaaa agaccatctc gaaagccaag 1020

ggacagcccc gggaacccca agtgtatacc ctgccaccga gccaggaaga aatgactaag 1080

aaccaagtct cattgacttg ccttgtgaag ggcttctacc catcggatat cgccgtggaa 1140

tgggagtcca acggccagcc ggaaaacaac tacaagacca cccctccggt gctggactca 1200

gacggatcct tcttcctcta ctcgcggctg accgtggata agagcagatg gcaggaggga 1260

aatgtgttca gctgttctgt gatgcatgaa gccctgcaca accactacac tcagaagtcc 1320

ctgtccctct ccctggga 1338

<210> 624
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 624
Asp Val Val Met Thr Gln Ser Pro Leu Ser Leu Pro Val Thr Leu Gly
1 5 10 15

Gln Pro Ala Ser Ile Ser Cys Lys Ala Ser Gln Asp Val Gly Thr Ala
20 25 30

Val Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu Ile

35 40 45

Tyr Trp Ala Ser Thr Arg His Thr Gly Val Pro Ser Arg Phe Ser Gly
50 55 60

Ser Gly Ser Gly Thr Glu Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65 70 75 80

Asp Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Tyr Asn Ser Tyr Pro Leu
85 90 95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys
100 105

<210> 625
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 625
gacgtcgtga tgactcagtc acccctgagc ctgcccgtga ccctggggca gcccgcctct 60

attagctgta aagcctctca ggacgtgggc accgccgtgg cctggtatca gcagaagcca 120

gggcaagccc ctagactgct gatctactgg gcctctacta gacacaccgg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgag ttcaccctga ctatctcttc actgcagccc 240

gacgacttcg ctacctacta ctgtcagcag tataatagct acccccctgac cttcggtcaa 300

ggcactaagg tcgagattaa g 321

<210> 626
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 626
Asp Val Val Met Thr Gln Ser Pro Leu Ser Leu Pro Val Thr Leu Gly
1   5   10   15

Gln Pro Ala Ser Ile Ser Cys Lys Ala Ser Gln Asp Val Gly Thr Ala
            20   25   30

Val Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu Ile
        35   40   45

Tyr Trp Ala Ser Thr Arg His Thr Gly Val Pro Ser Arg Phe Ser Gly
    50   55   60

Ser Gly Ser Gly Thr Glu Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65   70   75   80

Asp Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Tyr Asn Ser Tyr Pro Leu
                85   90   95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
            100   105   110

Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
        115   120   125

Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
    130   135   140

Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145   150   155   160

Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
                165   170   175

Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
            180   185   190

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
        195   200   205

Phe Asn Arg Gly Glu Cys
210

<210> 627
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 627
gacgtcgtga tgactcagtc acccctgagc ctgcccgtga ccctggggca gcccgcctct 60

attagctgta aagcctctca ggacgtgggc accgccgtgg cctggtatca gcagaagcca 120

gggcaagccc ctagactgct gatctactgg gcctctacta gacacaccgg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgag ttcaccctga ctatctcttc actgcagccc 240

gacgacttcg ctacctacta ctgtcagcag tataatagct acccccctgac cttcggtcaa 300

ggcactaagg tcgagattaa gcgtacggtg gccgctccca gcgtgttcat cttccccccc 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gcctgctgaa caacttctac 420

ccccgggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcataag gtgtacgcct gcgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 628
<211> 15
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 628
agctactgga tgtac 15

<210> 629
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 629
agaatcgacc ctaatagcgg ctctactaag tataacgaga agtttaagaa t 51

<210> 630
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 630
gactatagaa agggcctgta cgctatggac tac 33

<210> 631
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 631
ggctacacct tcactagcta c 21

<210> 632
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic

oligonucleotide"

<400> 632
gaccctaata gcggctct 18

<210> 633
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 633
aaagcctctc aggacgtggg caccgccgtg gcc 33

<210> 634
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 634
tgggcctcta ctagacacac c 21

<210> 635
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 635
cagcagtata atagctaccc cctgacc 27

<210> 636
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 636
tctcaggacg tgggcaccgc c 21

<210> 637
<211> 9
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 637
tgggcctct 9

<210> 638
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 638
tataatagct acccctg 18

<210> 639
<211> 448
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 639
Glu Val Gln Leu Val Glu Ser Gly Gly Gly Leu Val Gln Pro Gly Gly
1 5 10 15

```
Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Thr Phe Ser Asp Ser
            20                  25                  30

Trp Ile His Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
        35                  40                  45

Ala Trp Ile Ser Pro Tyr Gly Gly Ser Thr Tyr Tyr Ala Asp Ser Val
    50                  55                  60

Lys Gly Arg Phe Thr Ile Ser Ala Asp Thr Ser Lys Asn Thr Ala Tyr
65                  70                  75                  80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Arg His Trp Pro Gly Gly Phe Asp Tyr Trp Gly Gln Gly Thr
            100                 105                 110

Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro
        115                 120                 125

Leu Ala Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly
    130                 135                 140

Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn
145                 150                 155                 160

Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln
                165                 170                 175

Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser
            180                 185                 190

Ser Leu Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser
        195                 200                 205

Asn Thr Lys Val Asp Lys Lys Val Glu Pro Lys Ser Cys Asp Lys Thr
    210                 215                 220
```

```
His Thr Cys Pro Pro Cys Pro Ala Pro Glu Leu Leu Gly Gly Pro Ser
225                 230                 235                 240


Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg
                245                 250                 255


Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser His Glu Asp Pro
            260                 265                 270


Glu Val Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala
        275                 280                 285


Lys Thr Lys Pro Arg Glu Glu Gln Tyr Ala Ser Thr Tyr Arg Val Val
    290                 295                 300


Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr
305                 310                 315                 320


Lys Cys Lys Val Ser Asn Lys Ala Leu Pro Ala Pro Ile Glu Lys Thr
                325                 330                 335


Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu
            340                 345                 350


Pro Pro Ser Arg Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys
        355                 360                 365


Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser
    370                 375                 380


Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp
385                 390                 395                 400


Ser Asp Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser
                405                 410                 415


Arg Trp Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala
            420                 425                 430
```

```
Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
        435                 440                 445


<210> 640
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 640
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1               5                   10                  15


Asp Arg Val Thr Ile Thr Cys Arg Ala Ser Gln Asp Val Ser Thr Ala
            20                  25                  30


Val Ala Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile
        35                  40                  45


Tyr Ser Ala Ser Phe Leu Tyr Ser Gly Val Pro Ser Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65                  70                  75                  80


Glu Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Tyr Leu Tyr His Pro Ala
                85                  90                  95


Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
            100                 105                 110


Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
        115                 120                 125


Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
    130                 135                 140
```

Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145 150 155 160

Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
165 170 175

Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
180 185 190

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
195 200 205

Phe Asn Arg Gly Glu Cys
210

<210> 641
<211> 450
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 641
Glu Val Gln Leu Leu Glu Ser Gly Gly Gly Leu Val Gln Pro Gly Gly
1 5 10 15

Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Thr Phe Ser Ser Tyr
20 25 30

Ile Met Met Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
35 40 45

Ser Ser Ile Tyr Pro Ser Gly Gly Ile Thr Phe Tyr Ala Asp Thr Val
50 55 60

Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr
65 70 75 80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys

```
                85                  90                  95

Ala Arg Ile Lys Leu Gly Thr Val Thr Thr Val Asp Tyr Trp Gly Gln
            100                 105                 110

Gly Thr Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val
        115                 120                 125

Phe Pro Leu Ala Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala
    130                 135                 140

Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser
145                 150                 155                 160

Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val
                165                 170                 175

Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro
            180                 185                 190

Ser Ser Ser Leu Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys
        195                 200                 205

Pro Ser Asn Thr Lys Val Asp Lys Lys Val Glu Pro Lys Ser Cys Asp
    210                 215                 220

Lys Thr His Thr Cys Pro Pro Cys Pro Ala Pro Glu Leu Leu Gly Gly
225                 230                 235                 240

Pro Ser Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile
                245                 250                 255

Ser Arg Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser His Glu
            260                 265                 270

Asp Pro Glu Val Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val His
        275                 280                 285

Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln Tyr Asn Ser Thr Tyr Arg
```

290 295 300

Val Val Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys
305 310 315 320

Glu Tyr Lys Cys Lys Val Ser Asn Lys Ala Leu Pro Ala Pro Ile Glu
325 330 335

Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr
340 345 350

Thr Leu Pro Pro Ser Arg Asp Glu Leu Thr Lys Asn Gln Val Ser Leu
355 360 365

Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp
370 375 380

Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val
385 390 395 400

Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val Asp
405 410 415

Lys Ser Arg Trp Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met His
420 425 430

Glu Ala Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Pro
435 440 445

Gly Lys
450

<210> 642
<211> 216
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 642
Gln Ser Ala Leu Thr Gln Pro Ala Ser Val Ser Gly Ser Pro Gly Gln
1   5   10   15

Ser Ile Thr Ile Ser Cys Thr Gly Thr Ser Ser Asp Val Gly Gly Tyr
            20   25   30

Asn Tyr Val Ser Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
        35   40   45

Met Ile Tyr Asp Val Ser Asn Arg Pro Ser Gly Val Ser Asn Arg Phe
    50   55   60

Ser Gly Ser Lys Ser Gly Asn Thr Ala Ser Leu Thr Ile Ser Gly Leu
65   70   75   80

Gln Ala Glu Asp Glu Ala Asp Tyr Tyr Cys Ser Ser Tyr Thr Ser Ser
                85   90   95

Ser Thr Arg Val Phe Gly Thr Gly Thr Lys Val Thr Val Leu Gly Gln
            100   105   110

Pro Lys Ala Asn Pro Thr Val Thr Leu Phe Pro Pro Ser Ser Glu Glu
        115   120   125

Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe Tyr
    130   135   140

Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Gly Ser Pro Val Lys
145   150   155   160

Ala Gly Val Glu Thr Thr Lys Pro Ser Lys Gln Ser Asn Asn Lys Tyr
                165   170   175

Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser His
            180   185   190

Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu Lys
        195   200   205

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Thr Val Ala Pro Thr Glu Cys Ser
    210                 215


<210> 643
<211> 451
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 643
Glu Val Gln Leu Val Glu Ser Gly Gly Gly Leu Val Gln Pro Gly Gly
1               5                   10                  15


Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Thr Phe Ser Arg Tyr
            20                  25                  30


Trp Met Ser Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
        35                  40                  45


Ala Asn Ile Lys Gln Asp Gly Ser Glu Lys Tyr Tyr Val Asp Ser Val
    50                  55                  60


Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ala Lys Asn Ser Leu Tyr
65                  70                  75                  80


Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95


Ala Arg Glu Gly Gly Trp Phe Gly Glu Leu Ala Phe Asp Tyr Trp Gly
            100                 105                 110


Gln Gly Thr Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser
        115                 120                 125


Val Phe Pro Leu Ala Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala
    130                 135                 140
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Ala Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val
145                 150                 155                 160

Ser Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala
                165                 170                 175

Val Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val
            180                 185                 190

Pro Ser Ser Ser Leu Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His
        195                 200                 205

Lys Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Pro Lys Ser Cys
    210                 215                 220

Asp Lys Thr His Thr Cys Pro Pro Cys Pro Ala Pro Glu Phe Glu Gly
225                 230                 235                 240

Gly Pro Ser Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met
                245                 250                 255

Ile Ser Arg Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser His
            260                 265                 270

Glu Asp Pro Glu Val Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val
        275                 280                 285

His Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln Tyr Asn Ser Thr Tyr
    290                 295                 300

Arg Val Val Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly
305                 310                 315                 320

Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys Ala Leu Pro Ala Ser Ile
                325                 330                 335

Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val
            340                 345                 350
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Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met Thr Lys Asn Gln Val Ser
355 360 365

Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu
370 375 380

Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro
385 390 395 400

Val Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val
405 410 415

Asp Lys Ser Arg Trp Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met
420 425 430

His Glu Ala Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser
435 440 445

Pro Gly Lys
450

<210> 644
<211> 215
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 644
Glu Ile Val Leu Thr Gln Ser Pro Gly Thr Leu Ser Leu Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Gln Arg Val Ser Ser Ser
20 25 30

Tyr Leu Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu
35 40 45

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Ile Tyr Asp Ala Ser Ser Arg Ala Thr Gly Ile Pro Asp Arg Phe Ser
    50                  55                  60

Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Arg Leu Glu
65                  70                  75                  80

Pro Glu Asp Phe Ala Val Tyr Tyr Cys Gln Gln Tyr Gly Ser Leu Pro
                85                  90                  95

Trp Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala
            100                 105                 110

Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser
        115                 120                 125

Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu
    130                 135                 140

Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser
145                 150                 155                 160

Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu
                165                 170                 175

Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val
            180                 185                 190

Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys
        195                 200                 205

Ser Phe Asn Arg Gly Glu Cys
    210                 215


<210> 645
<211> 123
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
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polypeptide"

<400> 645
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ser
1 5 10 15

Ser Val Lys Val Ser Cys Lys Thr Ser Gly Asp Thr Phe Ser Thr Tyr
20 25 30

Ala Ile Ser Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35 40 45

Gly Gly Ile Ile Pro Ile Phe Gly Lys Ala His Tyr Ala Gln Lys Phe
50 55 60

Gln Gly Arg Val Thr Ile Thr Ala Asp Glu Ser Thr Ser Thr Ala Tyr
65 70 75 80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Phe Cys
85 90 95

Ala Arg Lys Phe His Phe Val Ser Gly Ser Pro Phe Gly Met Asp Val
100 105 110

Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser
115 120

<210> 646
<211> 106
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 646
Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Gln Ser Val Ser Ser Tyr
20 25 30

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Leu Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu Ile
        35                  40                  45


Tyr Asp Ala Ser Asn Arg Ala Thr Gly Ile Pro Ala Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Glu Pro
65                  70                  75                  80


Glu Asp Phe Ala Val Tyr Tyr Cys Gln Gln Arg Ser Asn Trp Pro Thr
                85                  90                  95


Phe Gly Gln Gly Thr Lys Val Glu Ile Lys
            100                 105


<210> 647
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      peptide"

<400> 647
Gly Tyr Thr Phe Thr Ser Tyr Trp Met Tyr
1               5                   10


<210> 648

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<210> 649

<400> 649
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<210> 650

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<210> 701
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 701
Asn Tyr Gly Met Asn
1 5

<210> 702
<211> 17
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 702
Trp Ile Asn Thr Asp Thr Gly Glu Pro Thr Tyr Ala Asp Asp Phe Lys
1 5 10 15

Gly

<210> 703
<211> 16
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 703
Asn Pro Pro Tyr Tyr Tyr Gly Thr Asn Asn Ala Glu Ala Met Asp Tyr
1 5 10 15

<210> 704
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 704
Gly Phe Thr Leu Thr Asn Tyr

1 5

<210> 705
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 705
Asn Thr Asp Thr Gly Glu
1 5

<210> 706
<211> 125
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 706
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Phe Thr Leu Thr Asn Tyr
20 25 30

Gly Met Asn Trp Val Arg Gln Ala Arg Gly Gln Arg Leu Glu Trp Ile
35 40 45

Gly Trp Ile Asn Thr Asp Thr Gly Glu Pro Thr Tyr Ala Asp Asp Phe
50 55 60

Lys Gly Arg Phe Val Phe Ser Leu Asp Thr Ser Val Ser Thr Ala Tyr
65 70 75 80

Leu Gln Ile Ser Ser Leu Lys Ala Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Ala Arg Asn Pro Pro Tyr Tyr Tyr Gly Thr Asn Asn Ala Glu Ala Met
100 105 110

Asp Tyr Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser
115 120 125

<210> 707
<211> 375
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 707
caagtgcagc tggtgcagtc gggagccgaa gtgaagaagc ctggagcctc ggtgaaggtg 60

tcgtgcaagg catccggatt caccctcacc aattacggga tgaactgggt cagacaggcc 120

cggggtcaac ggctggagtg gatcggatgg attaacaccg acaccgggga gcctacctac 180

gcggacgatt tcaagggacg gttcgtgttc tccctcgaca cctccgtgtc caccgcctac 240

ctccaaatct cctcactgaa agcggaggac accgccgtgt actattgcgc gaggaacccg 300

ccctactact acggaaccaa caacgccgaa gccatggact actggggcca gggcaccact 360

gtgactgtgt ccagc 375

<210> 708
<211> 375
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 708
caggtgcagc tggtgcagtc tggcgccgaa gtgaagaaac ctggcgcctc cgtgaaggtg 60

tcctgcaagg cctctggctt caccctgacc aactacggca tgaactgggt gcgacaggcc 120

aggggccagc ggctggaatg gatcggctgg atcaacaccg acaccggcga gcctacctac 180

gccgacgact tcaagggcag attcgtgttc tccctggaca cctccgtgtc caccgcctac 240

ctgcagatct ccagcctgaa ggccgaggat accgccgtgt actactgcgc ccggaacccc 300

ccttactact acggcaccaa caacgccgag gccatggact attggggcca gggcaccacc 360

gtgaccgtgt cctct 375

<210> 709
<211> 451
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 709

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Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1               5                   10                  15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Phe Thr Leu Thr Asn Tyr
            20                  25                  30

Gly Met Asn Trp Val Arg Gln Ala Arg Gly Gln Arg Leu Glu Trp Ile
        35                  40                  45

Gly Trp Ile Asn Thr Asp Thr Gly Glu Pro Thr Tyr Ala Asp Asp Phe
    50                  55                  60

Lys Gly Arg Phe Val Phe Ser Leu Asp Thr Ser Val Ser Thr Ala Tyr
65                  70                  75                  80

Leu Gln Ile Ser Ser Leu Lys Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Asn Pro Pro Tyr Tyr Tyr Gly Thr Asn Asn Ala Glu Ala Met
            100                 105                 110

Asp Tyr Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser Ala Ser Thr
        115                 120                 125
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Lys Gly Pro Ser Val Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser
    130                 135                 140

Glu Ser Thr Ala Ala Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu
145                 150                 155                 160

Pro Val Thr Val Ser Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His
                165                 170                 175

Thr Phe Pro Ala Val Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser
            180                 185                 190

Val Val Thr Val Pro Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys
        195                 200                 205

Asn Val Asp His Lys Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu
    210                 215                 220

Ser Lys Tyr Gly Pro Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu
225                 230                 235                 240

Gly Gly Pro Ser Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu
                245                 250                 255

Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser
            260                 265                 270

Gln Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu
        275                 280                 285

Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr
    290                 295                 300

Tyr Arg Val Val Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn
305                 310                 315                 320

Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser
                325                 330                 335
```

Ile Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln
340 345 350

Val Tyr Thr Leu Pro Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val
355 360 365

Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val
370 375 380

Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro
385 390 395 400

Pro Val Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr
405 410 415

Val Asp Lys Ser Arg Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val
420 425 430

Met His Glu Ala Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu
435 440 445

Ser Leu Gly
450

<210> 710
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 710
Ser Ser Ser Gln Asp Ile Ser Asn Tyr Leu Asn
1 5 10

<210> 711
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 711
Tyr Thr Ser Thr Leu His Leu
1 5

<210> 712
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 712
Gln Gln Tyr Tyr Asn Leu Pro Trp Thr
1 5

<210> 713
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 713
Ser Gln Asp Ile Ser Asn Tyr
1 5

<210> 714
<211> 3
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 714
Tyr Thr Ser

1

<210> 715
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 715
Tyr Tyr Asn Leu Pro Trp
1 5

<210> 716
<211> 1353
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 716
caagtgcagc tggtgcagtc gggagccgaa gtgaagaagc ctggagcctc ggtgaaggtg 60

tcgtgcaagg catccggatt caccctcacc aattacggga tgaactgggt cagacaggcc 120

cggggtcaac ggctggagtg gatcggatgg attaacaccg acaccgggga gcctacctac 180

gcggacgatt tcaagggacg gttcgtgttc tccctcgaca cctccgtgtc caccgcctac 240

ctccaaatct cctcactgaa agcggaggac accgccgtgt actattgcgc gaggaacccg 300

ccctactact acggaaccaa caacgccgaa gccatggact actggggcca gggcaccact 360

gtgactgtgt ccagcgcgtc cactaagggc ccgtccgtgt tccccctggc accttgtagc 420

cggagcacta gcgaatccac cgctgccctc ggctgcctgg tcaaggatta cttcccggag 480

cccgtgaccg tgtcctggaa cagcggagcc ctgacctccg gagtgcacac cttccccgct 540

gtgctgcaga gctccgggct gtactcgctg tcgtcggtgg tcacggtgcc ttcatctagc 600

ctgggtacca agacctacac ttgcaacgtg gaccacaagc cttccaacac taaggtggac 660

aagcgcgtcg aatcgaagta cggcccaccg tgcccgcctt gtcccgcgcc ggagttcctc 720

ggcggtccct cggtctttct gttcccaccg aagcccaagg acactttgat gatttcccgc 780

acccctgaag tgacatgcgt ggtcgtggac gtgtcacagg aagatccgga ggtgcagttc 840

aattggtacg tggatggcgt cgaggtgcac aacgccaaaa ccaagccgag ggaggagcag 900

ttcaactcca cttaccgcgt cgtgtccgtg ctgacggtgc tgcatcagga ctggctgaac 960

gggaaggagt acaagtgcaa agtgtccaac aagggacttc ctagctcaat cgaaaagacc 1020

atctcgaaag ccaagggaca gccccgggaa ccccaagtgt ataccctgcc accgagccag 1080

gaagaaatga ctaagaacca agtctcattg acttgccttg tgaagggctt ctacccatcg 1140

gatatcgccg tggaatggga gtccaacggc cagccggaaa acaactacaa gaccacccct 1200

ccggtgctgg actcagacgg atccttcttc ctctactcgc ggctgaccgt ggataagagc 1260

agatggcagg agggaaatgt gttcagctgt tctgtgatgc atgaagccct gcacaaccac 1320

tacactcaga agtccctgtc cctctccctg gga 1353

<210> 717
<211> 1353
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 717
caggtgcagc tggtgcagtc tggcgccgaa gtgaagaaac ctggcgcctc cgtgaaggtg 60

tcctgcaagg cctctggctt caccctgacc aactacggca tgaactgggt gcgacaggcc 120

aggggccagc ggctggaatg gatcggctgg atcaacaccg acaccggcga gcctacctac 180

gccgacgact tcaagggcag attcgtgttc tccctggaca cctccgtgtc caccgcctac 240

ctgcagatct ccagcctgaa ggccgaggat accgccgtgt actactgcgc ccggaacccc 300

ccttactact acggcaccaa caacgccgag gccatggact attggggcca gggcaccacc 360

gtgaccgtgt cctctgcttc taccaagggg cccagcgtgt tccccctggc cccctgctcc 420

agaagcacca gcgagagcac agccgccctg ggctgcctgg tgaaggacta cttccccgag 480

cccgtgaccg tgtcctggaa cagcggagcc ctgaccagcg gcgtgcacac cttccccgcc 540

gtgctgcaga gcagcggcct gtacagcctg agcagcgtgg tgaccgtgcc cagcagcagc 600

ctgggcacca agacctacac ctgtaacgtg gaccacaagc ccagcaacac caaggtggac 660

aagagggtgg agagcaagta cggcccaccc tgcccccccct gcccagcccc cgagttcctg 720

ggcggaccca gcgtgttcct gttccccccc aagcccaagg acaccctgat gatcagcaga 780

acccccgagg tgacctgtgt ggtggtggac gtgtcccagg aggaccccga ggtccagttc 840

aactggtacg tggacggcgt ggaggtgcac aacgccaaga ccaagcccag agaggagcag 900

tttaacagca cctaccgggt ggtgtccgtg ctgaccgtgc tgcaccagga ctggctgaac 960

ggcaaagagt acaagtgtaa ggtctccaac aagggcctgc caagcagcat cgaaaagacc 1020

atcagcaagg ccaagggcca gcctagagag ccccaggtct acaccctgcc acccagccaa 1080

gaggagatga ccaagaacca ggtgtccctg acctgtctgg tgaagggctt ctacccaagc 1140

gacatcgccg tggagtggga gagcaacggc cagcccgaga acaactacaa gaccaccccc 1200

ccagtgctgg acagcgacgg cagcttcttc ctgtacagca ggctgaccgt ggacaagtcc 1260

agatggcagg agggcaacgt ctttagctgc tccgtgatgc acgaggccct gcacaaccac 1320

tacacccaga agagcctgag cctgtccctg ggc 1353

<210> 718
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 718
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Ser Ser Ser Gln Asp Ile Ser Asn Tyr
20 25 30

Leu Asn Trp Tyr Leu Gln Lys Pro Gly Gln Ser Pro Gln Leu Leu Ile
35 40 45

Tyr Tyr Thr Ser Thr Leu His Leu Gly Val Pro Ser Arg Phe Ser Gly
    50   55   60

Ser Gly Ser Gly Thr Glu Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65   70   75   80

Asp Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Tyr Tyr Asn Leu Pro Trp
                85   90   95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys
            100   105

<210> 719
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 719
gatattcaga tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gctctagtca ggatatctct aactacctga actggtatct gcagaagccc 120

ggtcaatcac ctcagctgct gatctactac actagcaccc tgcacctggg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgag ttcaccctga ctatctctag cctgcagccc 240

gacgacttcg ctacctacta ctgtcagcag tactataacc tgccctggac cttcggtcaa 300

ggcactaagg tcgagattaa g   321

<210> 720
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 720

gacatccaga tgacccagtc cccctccagc ctgtctgctt ccgtgggcga cagagtgacc 60

atcacctgtt cctccagcca ggacatctcc aactacctga actggtatct gcagaagccc 120

ggccagtccc ctcagctgct gatctactac acctccaccc tgcacctggg cgtgccctcc 180

agattttccg gctctggctc tggcaccgag tttaccctga ccatcagctc cctgcagccc 240

gacgacttcg ccacctacta ctgccagcag tactacaacc tgccctggac cttcggccag 300

ggcaccaagg tggaaatcaa g 321

<210> 721
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 721
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Ser Ser Ser Gln Asp Ile Ser Asn Tyr
20 25 30

Leu Asn Trp Tyr Leu Gln Lys Pro Gly Gln Ser Pro Gln Leu Leu Ile
35 40 45

Tyr Tyr Thr Ser Thr Leu His Leu Gly Val Pro Ser Arg Phe Ser Gly
50 55 60

Ser Gly Ser Gly Thr Glu Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65 70 75 80

Asp Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Tyr Tyr Asn Leu Pro Trp
85 90 95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
100 105 110

Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
115 120 125

Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
130 135 140

Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145 150 155 160

Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
165 170 175

Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
180 185 190

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
195 200 205

Phe Asn Arg Gly Glu Cys
210

<210> 722
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 722
gatattcaga tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gctctagtca ggatatctct aactacctga actggtatct gcagaagccc 120

ggtcaatcac ctcagctgct gatctactac actagcaccc tgcacctggg cgtgccctct 180

aggtttagcg gtagcggtag tggcaccgag ttcaccctga ctatctctag cctgcagccc 240

gacgacttcg ctacctacta ctgtcagcag tactataacc tgccctggac cttcggtcaa 300

ggcactaagg tcgagattaa gcgtacggtg gccgctccca gcgtgttcat cttccccccc 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gcctgctgaa caacttctac 420

ccccgggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcataag gtgtacgcct gcgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 723
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 723
gacatccaga tgacccagtc cccctccagc ctgtctgctt ccgtgggcga cagagtgacc 60

atcacctgtt cctccagcca ggacatctcc aactacctga actggtatct gcagaagccc 120

ggccagtccc ctcagctgct gatctactac acctccaccc tgcacctggg cgtgccctcc 180

agattttccg gctctggctc tggcaccgag tttaccctga ccatcagctc cctgcagccc 240

gacgacttcg ccacctacta ctgccagcag tactacaacc tgccctggac cttcggccag 300

ggcaccaagg tggaaatcaa gcgtacggtg gccgctccca gcgtgttcat cttcccccca 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gtctgctgaa caacttctac 420

cccagggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcacaag gtgtacgcct gtgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 724
<211> 125
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic

polypeptide"

<400> 724
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Phe Thr Leu Thr Asn Tyr
20 25 30

Gly Met Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35 40 45

Gly Trp Ile Asn Thr Asp Thr Gly Glu Pro Thr Tyr Ala Asp Asp Phe
50 55 60

Lys Gly Arg Phe Val Phe Ser Leu Asp Thr Ser Val Ser Thr Ala Tyr
65 70 75 80

Leu Gln Ile Ser Ser Leu Lys Ala Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Ala Arg Asn Pro Pro Tyr Tyr Tyr Gly Thr Asn Asn Ala Glu Ala Met
100 105 110

Asp Tyr Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser
115 120 125

<210> 725
<211> 375
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 725
caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctag tgtgaaagtc 60

agctgtaaag ctagtggctt caccctgact aactacggga tgaactgggt ccgccaggcc 120

ccaggtcaag gcctcgagtg gatgggctgg attaacaccg acaccggcga gcctacctac 180

gccgacgact ttaagggcag attcgtgttt agcctggaca ctagtgtgtc taccgcctac 240

ctgcagatct ctagcctgaa ggccgaggac accgccgtct actactgcgc tagaaacccc 300

ccctactact acggcactaa caacgccgag gctatggact actggggtca aggcactacc 360

gtgaccgtgt ctagc 375

<210> 726
<211> 375
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 726
caggtgcagc tggtgcagtc tggcgccgaa gtgaagaaac ctggcgcctc cgtgaaggtg 60

tcctgcaagg cctctggctt caccctgacc aactacggca tgaactgggt gcgacaggcc 120

cctggacagg gcctggaatg gatgggctgg atcaacaccg acaccggcga gcctacctac 180

gccgacgact tcaagggcag attcgtgttc tccctggaca cctccgtgtc caccgcctac 240

ctgcagatct ccagcctgaa ggccgaggat accgccgtgt actactgcgc ccggaacccc 300

ccttactact acggcaccaa caacgccgag gccatggact attggggcca gggcaccacc 360

gtgaccgtgt cctct 375

<210> 727
<211> 451
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 727
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Phe Thr Leu Thr Asn Tyr
20 25 30

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Gly Met Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
        35                  40                  45

Gly Trp Ile Asn Thr Asp Thr Gly Glu Pro Thr Tyr Ala Asp Asp Phe
    50                  55                  60

Lys Gly Arg Phe Val Phe Ser Leu Asp Thr Ser Val Ser Thr Ala Tyr
65                  70                  75                  80

Leu Gln Ile Ser Ser Leu Lys Ala Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95

Ala Arg Asn Pro Pro Tyr Tyr Tyr Gly Thr Asn Asn Ala Glu Ala Met
            100                 105                 110

Asp Tyr Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser Ala Ser Thr
        115                 120                 125

Lys Gly Pro Ser Val Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser
    130                 135                 140

Glu Ser Thr Ala Ala Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu
145                 150                 155                 160

Pro Val Thr Val Ser Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His
                165                 170                 175

Thr Phe Pro Ala Val Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser
            180                 185                 190

Val Val Thr Val Pro Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys
        195                 200                 205

Asn Val Asp His Lys Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu
    210                 215                 220

Ser Lys Tyr Gly Pro Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu
225                 230                 235                 240
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Gly Gly Pro Ser Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu
                245                 250                 255

Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser
            260                 265                 270

Gln Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu
        275                 280                 285

Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr
    290                 295                 300

Tyr Arg Val Val Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn
305                 310                 315                 320

Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser
                325                 330                 335

Ile Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln
            340                 345                 350

Val Tyr Thr Leu Pro Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val
        355                 360                 365

Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val
    370                 375                 380

Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro
385                 390                 395                 400

Pro Val Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr
                405                 410                 415

Val Asp Lys Ser Arg Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val
            420                 425                 430

Met His Glu Ala Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu
        435                 440                 445
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Ser Leu Gly
450

<210> 728
<211> 1353
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 728
caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctag tgtgaaagtc 60

agctgtaaag ctagtggctt caccctgact aactacggga tgaactgggt ccgccaggcc 120

ccaggtcaag gcctcgagtg gatgggctgg attaacaccg acaccggcga gcctacctac 180

gccgacgact ttaagggcag attcgtgttt agcctggaca ctagtgtgtc taccgcctac 240

ctgcagatct ctagcctgaa ggccgaggac accgccgtct actactgcgc tagaaacccc 300

ccctactact acggcactaa caacgccgag gctatggact actggggtca aggcactacc 360

gtgaccgtgt ctagcgctag cactaagggc ccgtccgtgt tccccctggc accttgtagc 420

cggagcacta gcgaatccac cgctgccctc ggctgcctgg tcaaggatta cttcccggag 480

cccgtgaccg tgtcctggaa cagcggagcc ctgacctccg gagtgcacac cttccccgct 540

gtgctgcaga gctccgggct gtactcgctg tcgtcggtgg tcacggtgcc ttcatctagc 600

ctgggtacca agacctacac ttgcaacgtg gaccacaagc cttccaacac taaggtggac 660

aagcgcgtcg aatcgaagta cggcccaccg tgcccgcctt gtcccgcgcc ggagttcctc 720

ggcggtccct cggtctttct gttcccaccg aagcccaagg acactttgat gatttcccgc 780

acccctgaag tgacatgcgt ggtcgtggac gtgtcacagg aagatccgga ggtgcagttc 840

aattggtacg tggatggcgt cgaggtgcac aacgccaaaa ccaagccgag ggaggagcag 900

ttcaactcca cttaccgcgt cgtgtccgtg ctgacggtgc tgcatcagga ctggctgaac 960

gggaaggagt acaagtgcaa agtgtccaac aagggacttc ctagctcaat cgaaaagacc 1020

atctcgaaag ccaagggaca gccccgggaa ccccaagtgt ataccctgcc accgagccag 1080

gaagaaatga ctaagaacca agtctcattg acttgccttg tgaagggctt ctacccatcg 1140

gatatcgccg tggaatggga gtccaacggc cagccggaaa acaactacaa gaccaccct 1200

ccggtgctgg actcagacgg atccttcttc ctctactcgc ggctgaccgt ggataagagc 1260

agatggcagg agggaaatgt gttcagctgt tctgtgatgc atgaagccct gcacaaccac 1320

tacactcaga agtccctgtc cctctccctg gga 1353

<210> 729
<211> 1353
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 729
caggtgcagc tggtgcagtc tggcgccgaa gtgaagaaac ctggcgcctc cgtgaaggtg 60

tcctgcaagg cctctggctt caccctgacc aactacggca tgaactgggt gcgacaggcc 120

cctggacagg gcctggaatg gatgggctgg atcaacaccg acaccggcga gcctacctac 180

gccgacgact tcaagggcag attcgtgttc tccctggaca cctccgtgtc caccgcctac 240

ctgcagatct ccagcctgaa ggccgaggat accgccgtgt actactgcgc ccggaacccc 300

ccttactact acggcaccaa caacgccgag gccatggact attggggcca gggcaccacc 360

gtgaccgtgt cctctgcttc taccaagggg cccagcgtgt tccccctggc cccctgctcc 420

agaagcacca gcgagagcac agccgccctg ggctgcctgg tgaaggacta cttccccgag 480

cccgtgaccg tgtcctggaa cagcggagcc ctgaccagcg gcgtgcacac cttccccgcc 540

gtgctgcaga gcagcggcct gtacagcctg agcagcgtgg tgaccgtgcc cagcagcagc 600

ctgggcacca agacctacac ctgtaacgtg gaccacaagc ccagcaacac caaggtggac 660

aagagggtgg agagcaagta cggcccaccc tgccccccct gcccagcccc cgagttcctg 720

ggcggaccca gcgtgttcct gttcccccccc aagcccaagg acaccctgat gatcagcaga 780

acccccgagg tgacctgtgt ggtggtggac gtgtcccagg aggaccccga ggtccagttc 840

aactggtacg tggacggcgt ggaggtgcac aacgccaaga ccaagcccag agaggagcag 900

tttaacagca cctaccgggt ggtgtccgtg ctgaccgtgc tgcaccagga ctggctgaac 960

ggcaaagagt acaagtgtaa ggtctccaac aagggcctgc caagcagcat cgaaaagacc 1020

atcagcaagg ccaagggcca gcctagagag ccccaggtct acaccctgcc acccagccaa 1080

gaggagatga ccaagaacca ggtgtccctg acctgtctgg tgaagggctt ctacccaagc 1140

gacatcgccg tggagtggga gagcaacggc cagcccgaga acaactacaa gaccaccccc 1200

ccagtgctgg acagcgacgg cagcttcttc ctgtacagca ggctgaccgt ggacaagtcc 1260

agatggcagg agggcaacgt ctttagctgc tccgtgatgc acgaggccct gcacaaccac 1320

tacacccaga agagcctgag cctgtccctg ggc 1353

<210> 730
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 730
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Ser Ser Ser Gln Asp Ile Ser Asn Tyr
20 25 30

Leu Asn Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile
35 40 45

Tyr Tyr Thr Ser Thr Leu His Leu Gly Ile Pro Pro Arg Phe Ser Gly
50 55 60

Ser Gly Tyr Gly Thr Asp Phe Thr Leu Thr Ile Asn Asn Ile Glu Ser
65 70 75 80

Glu Asp Ala Ala Tyr Tyr Phe Cys Gln Gln Tyr Tyr Asn Leu Pro Trp
85 90 95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys
100 105

<210> 731
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 731
gatattcaga tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gctctagtca ggatatctct aactacctga actggtatca gcagaagccc 120

ggtaaagccc ctaagctgct gatctactac actagcaccc tgcacctggg aatcccccct 180

aggtttagcg gtagcggcta cggcaccgac ttcaccctga ctattaacaa tatcgagtca 240

gaggacgccg cctactactt ctgtcagcag tactataacc tgccctggac cttcggtcaa 300

ggcactaagg tcgagattaa g 321

<210> 732
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 732
gacatccaga tgacccagtc cccctccagc ctgtctgctt ccgtgggcga cagagtgacc 60

atcacctgtt cctccagcca ggacatctcc aactacctga actggtatca gcagaagccc 120

ggcaaggccc ccaagctgct gatctactac acctccaccc tgcacctggg catccccct 180

agattctccg gctctggcta cggcaccgac ttcaccctga ccatcaacaa catcgagtcc 240

gaggacgccg cctactactt ctgccagcag tactacaacc tgccctggac cttcggccag 300

ggcaccaagg tggaaatcaa g 321

<210> 733
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 733
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Ser Ser Ser Gln Asp Ile Ser Asn Tyr
20 25 30

Leu Asn Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile
35 40 45

Tyr Tyr Thr Ser Thr Leu His Leu Gly Ile Pro Pro Arg Phe Ser Gly
50 55 60

Ser Gly Tyr Gly Thr Asp Phe Thr Leu Thr Ile Asn Asn Ile Glu Ser
65 70 75 80

Glu Asp Ala Ala Tyr Tyr Phe Cys Gln Gln Tyr Tyr Asn Leu Pro Trp
85 90 95

Thr Phe Gly Gln Gly Thr Lys Val Glu Ile Lys Arg Thr Val Ala Ala
100 105 110

Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
115 120 125

Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
130 135 140

Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145 150 155 160

Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
165 170 175

Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
180 185 190

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
195 200 205

Phe Asn Arg Gly Glu Cys
210

<210> 734
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 734
gatattcaga tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gctctagtca ggatatctct aactacctga actggtatca gcagaagccc 120

ggtaaagccc ctaagctgct gatctactac actagcaccc tgcacctggg aatcccccct 180

aggtttagcg gtagcggcta cggcaccgac ttcaccctga ctattaacaa tatcgagtca 240

gaggacgccg cctactactt ctgtcagcag tactataacc tgccctggac cttcggtcaa 300

ggcactaagg tcgagattaa gcgtacggtg gccgctccca gcgtgttcat cttccccccc 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gcctgctgaa caacttctac 420

ccccgggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcataag gtgtacgcct gcgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 735
<211> 642

<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 735
gacatccaga tgacccagtc cccctccagc ctgtctgctt ccgtgggcga cagagtgacc 60

atcacctgtt cctccagcca ggacatctcc aactacctga actggtatca gcagaagccc 120

ggcaaggccc ccaagctgct gatctactac acctccaccc tgcacctggg catcccccct 180

agattctccg gctctggcta cggcaccgac ttcaccctga ccatcaacaa catcgagtcc 240

gaggacgccg cctactactt ctgccagcag tactacaacc tgccctggac cttcggccag 300

ggcaccaagg tggaaatcaa gcgtacggtg gccgctccca gcgtgttcat cttcccccca 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gtctgctgaa caacttctac 420

cccagggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcacaag gtgtacgcct gtgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 736
<211> 15
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 736
aattacggga tgaac 15

<210> 737
<211> 15
<212> DNA
<213> Artificial Sequence

<220>

<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 737
aactacggca tgaac 15

<210> 738
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 738
tggattaaca ccgacaccgg ggagcctacc tacgcggacg atttcaaggg a 51

<210> 739
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 739
tggatcaaca ccgacaccgg cgagcctacc tacgccgacg acttcaaggg c 51

<210> 740
<211> 48
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 740
aacccgccct actactacgg aaccaacaac gccgaagcca tggactac 48

<210> 741
<211> 48

<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 741
aacccccctt actactacgg caccaacaac gccgaggcca tggactat 48

<210> 742
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 742
ggattcaccc tcaccaatta c 21

<210> 743
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 743
ggcttcaccc tgaccaacta c 21

<210> 744
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 744
aacaccgaca ccggggag 18

<210> 745
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 745
aacaccgaca ccggcgag 18

<210> 746
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 746
agctctagtc aggatatctc taactacctg aac 33

<210> 747
<211> 33
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 747
tcctccagcc aggacatctc caactacctg aac 33

<210> 748
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic

oligonucleotide"

<400> 748
tacactagca ccctgcacct g 21

<210> 749
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 749
tacacctcca ccctgcacct g 21

<210> 750
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 750
cagcagtact ataacctgcc ctggacc 27

<210> 751
<211> 27
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 751
cagcagtact acaacctgcc ctggacc 27

<210> 752
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 752
agtcaggata tctctaacta c 21

<210> 753
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 753
agccaggaca tctccaacta c 21

<210> 754
<211> 9
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 754
tacactagc 9

<210> 755
<211> 9
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 755
tacacctcc 9

<210> 756
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 756
tactataacc tgccctgg 18

<210> 757
<211> 18
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 757
tactacaacc tgccctgg 18

<210> 758
<211> 15
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 758
aactacggga tgaac 15

<210> 759
<211> 51
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
oligonucleotide"

<400> 759
tggattaaca ccgacaccgg cgagcctacc tacgccgacg actttaaggg c 51

<210> 760
<211> 48
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 760
aacccccct actactacgg cactaacaac gccgaggcta tggactac 48

<210> 761
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic oligonucleotide"

<400> 761
ggcttcaccc tgactaacta c 21

<210> 762
<211> 447
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 762
Gln Val Gln Leu Gln Gln Trp Gly Ala Gly Leu Leu Lys Pro Ser Glu
1 5 10 15

Thr Leu Ser Leu Thr Cys Ala Val Tyr Gly Gly Ser Phe Ser Asp Tyr
20 25 30

Tyr Trp Asn Trp Ile Arg Gln Pro Pro Gly Lys Gly Leu Glu Trp Ile

```
        35                  40                  45

Gly Glu Ile Asn His Arg Gly Ser Thr Asn Ser Asn Pro Ser Leu Lys
    50                  55                  60

Ser Arg Val Thr Leu Ser Leu Asp Thr Ser Lys Asn Gln Phe Ser Leu
65                  70                  75                  80

Lys Leu Arg Ser Val Thr Ala Ala Asp Thr Ala Val Tyr Tyr Cys Ala
                85                  90                  95

Phe Gly Tyr Ser Asp Tyr Glu Tyr Asn Trp Phe Asp Pro Trp Gly Gln
            100                 105                 110

Gly Thr Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val
        115                 120                 125

Phe Pro Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala
    130                 135                 140

Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser
145                 150                 155                 160

Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val
                165                 170                 175

Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro
            180                 185                 190

Ser Ser Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys
        195                 200                 205

Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro
    210                 215                 220

Pro Cys Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val
225                 230                 235                 240

Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr
```

```
                245                 250                 255

Pro Glu Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu
            260                 265                 270

Val Gln Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys
        275                 280                 285

Thr Lys Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser
    290                 295                 300

Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys
305                 310                 315                 320

Cys Lys Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile
                325                 330                 335

Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro
            340                 345                 350

Pro Ser Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu
        355                 360                 365

Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn
    370                 375                 380

Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser
385                 390                 395                 400

Asp Gly Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg
                405                 410                 415

Trp Gln Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu
            420                 425                 430

His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly Lys
        435                 440                 445

<210> 763
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<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 763

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Glu Ile Val Leu Thr Gln Ser Pro Ala Thr Leu Ser Leu Ser Pro Gly
1               5                  10                  15


Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Gln Ser Ile Ser Ser Tyr
            20                  25                  30


Leu Ala Trp Tyr Gln Gln Lys Pro Gly Gln Ala Pro Arg Leu Leu Ile
        35                  40                  45


Tyr Asp Ala Ser Asn Arg Ala Thr Gly Ile Pro Ala Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Glu Pro
65                  70                  75                  80


Glu Asp Phe Ala Val Tyr Tyr Cys Gln Gln Arg Ser Asn Trp Pro Leu
                85                  90                  95


Thr Phe Gly Gln Gly Thr Asn Leu Glu Ile Lys Arg Thr Val Ala Ala
            100                 105                 110


Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
        115                 120                 125


Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
    130                 135                 140


Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145                 150                 155                 160


Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
                165                 170                 175
```

```
Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
            180                 185                 190


Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
        195                 200                 205


Phe Asn Arg Gly Glu Cys
    210


<210> 764
<211> 446
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 764
Gln Val Gln Leu Lys Glu Ser Gly Pro Gly Leu Val Ala Pro Ser Gln
1               5                   10                  15


Ser Leu Ser Ile Thr Cys Thr Val Ser Gly Phe Ser Leu Thr Ala Tyr
            20                  25                  30


Gly Val Asn Trp Val Arg Gln Pro Pro Gly Lys Gly Leu Glu Trp Leu
        35                  40                  45


Gly Met Ile Trp Asp Asp Gly Ser Thr Asp Tyr Asn Ser Ala Leu Lys
    50                  55                  60


Ser Arg Leu Ser Ile Ser Lys Asp Asn Ser Lys Ser Gln Val Phe Leu
65                  70                  75                  80


Lys Met Asn Ser Leu Gln Thr Asp Asp Thr Ala Arg Tyr Tyr Cys Ala
                85                  90                  95


Arg Glu Gly Asp Val Ala Phe Asp Tyr Trp Gly Gln Gly Thr Thr Leu
            100                 105                 110
```

```
Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala
        115                 120                 125

Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu
    130                 135                 140

Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly
145                 150                 155                 160

Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser
                165                 170                 175

Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu
            180                 185                 190

Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr
        195                 200                 205

Lys Val Asp Lys Lys Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr
    210                 215                 220

Cys Pro Pro Cys Pro Ala Pro Glu Leu Leu Gly Gly Pro Ser Val Phe
225                 230                 235                 240

Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro
                245                 250                 255

Glu Val Thr Cys Val Val Val Asp Val Ser His Glu Asp Pro Glu Val
            260                 265                 270

Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys Thr
        275                 280                 285

Lys Pro Arg Glu Glu Gln Tyr Asn Ser Thr Tyr Arg Val Val Ser Val
    290                 295                 300

Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys
305                 310                 315                 320
```

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Lys Val Ser Asn Lys Ala Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser
                325                 330                 335


Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro
            340                 345                 350


Ser Arg Asp Glu Leu Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val
        355                 360                 365


Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly
    370                 375                 380


Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp
385                 390                 395                 400


Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp
                405                 410                 415


Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His
            420                 425                 430


Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Pro Gly Lys
        435                 440                 445


<210> 765
<211> 220
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 765
Asp Ile Val Met Thr Gln Ser Pro Ser Ser Leu Ala Val Ser Val Gly
1               5                   10                  15


Gln Lys Val Thr Met Ser Cys Lys Ser Ser Gln Ser Leu Leu Asn Gly
            20                  25                  30
```

```
Ser Asn Gln Lys Asn Tyr Leu Ala Trp Tyr Gln Gln Lys Pro Gly Gln
        35                  40                  45

Ser Pro Lys Leu Leu Val Tyr Phe Ala Ser Thr Arg Asp Ser Gly Val
    50                  55                  60

Pro Asp Arg Phe Ile Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr
65                  70                  75                  80

Ile Ser Ser Val Gln Ala Glu Asp Leu Ala Asp Tyr Phe Cys Leu Gln
                85                  90                  95

His Phe Gly Thr Pro Pro Thr Phe Gly Gly Gly Thr Lys Leu Glu Ile
            100                 105                 110

Lys Arg Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp
        115                 120                 125

Glu Gln Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn
    130                 135                 140

Phe Tyr Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu
145                 150                 155                 160

Gln Ser Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp
                165                 170                 175

Ser Thr Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr
            180                 185                 190

Glu Lys His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser
        195                 200                 205

Ser Pro Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
    210                 215                 220
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<210> 766
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
peptide"

<400> 766
Gly Phe Thr Leu Thr Asn Tyr Gly Met Asn
1 5 10

<210> 767

<400> 767
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<210> 801
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 801
Ser Tyr Asn Met His
1 5

<210> 802
<211> 17
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 802
Asp Ile Tyr Pro Gly Asn Gly Asp Thr Ser Tyr Asn Gln Lys Phe Lys
1 5 10 15

Gly

<210> 803
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 803

Val Gly Gly Ala Phe Pro Met Asp Tyr
1   5

<210> 804
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      peptide"

<400> 804
Gly Tyr Thr Phe Thr Ser Tyr
1   5

<210> 805
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      peptide"

<400> 805
Tyr Pro Gly Asn Gly Asp
1   5

<210> 806
<211> 118
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 806
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ser
1   5   10   15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Tyr
            20   25   30

```
Asn Met His Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
        35                  40                  45


Gly Asp Ile Tyr Pro Gly Asn Gly Asp Thr Ser Tyr Asn Gln Lys Phe
    50                  55                  60


Lys Gly Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Val Tyr
65                  70                  75                  80


Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95


Ala Arg Val Gly Gly Ala Phe Pro Met Asp Tyr Trp Gly Gln Gly Thr
            100                 105                 110


Thr Val Thr Val Ser Ser
        115


<210> 807
<211> 354
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 807
caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggctctag cgtgaaagtt       60

tcttgtaaag ctagtggcta caccttcact agctataata tgcactgggt tcgccaggcc      120

ccagggcaag gcctcgagtg gatgggcgat atctaccccg ggaacggcga cactagttat      180

aatcagaagt ttaagggtag agtcactatc accgccgata agtctactag caccgtctat      240

atggaactga gttccctgag gtctgaggac accgccgtct actactgcgc tagagtgggc      300

ggagccttcc ctatggacta ctggggtcaa ggcactaccg tgaccgtgtc tagc            354


<210> 808
<211> 444
<212> PRT
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<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 808

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Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ser
1               5                   10                  15


Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Tyr
            20                  25                  30


Asn Met His Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
        35                  40                  45


Gly Asp Ile Tyr Pro Gly Asn Gly Asp Thr Ser Tyr Asn Gln Lys Phe
    50                  55                  60


Lys Gly Arg Val Thr Ile Thr Ala Asp Lys Ser Thr Ser Thr Val Tyr
65                  70                  75                  80


Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
                85                  90                  95


Ala Arg Val Gly Gly Ala Phe Pro Met Asp Tyr Trp Gly Gln Gly Thr
            100                 105                 110


Thr Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro
        115                 120                 125


Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly
    130                 135                 140


Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn
145                 150                 155                 160


Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln
                165                 170                 175
```

```
Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser
            180                 185                 190

Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser
        195                 200                 205

Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro Pro Cys
    210                 215                 220

Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val Phe Leu
225                 230                 235                 240

Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu
                245                 250                 255

Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu Val Gln
            260                 265                 270

Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys
        275                 280                 285

Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser Val Leu
    290                 295                 300

Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys
305                 310                 315                 320

Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile Ser Lys
                325                 330                 335

Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser
            340                 345                 350

Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys
        355                 360                 365

Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln
    370                 375                 380
```

Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly
385 390 395 400

Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln
405 410 415

Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn
420 425 430

His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly
435 440

<210> 809
<211> 1332
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 809
caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggctctag cgtgaaagtt 60

tcttgtaaag ctagtggcta caccttcact agctataata tgcactgggt tcgccaggcc 120

ccagggcaag gcctcgagtg gatgggcgat atctaccccg ggaacggcga cactagttat 180

aatcagaagt ttaagggtag agtcactatc accgccgata agtctactag caccgtctat 240

atggaactga gttccctgag gtctgaggac accgccgtct actactgcgc tagagtgggc 300

ggagccttcc ctatggacta ctggggtcaa ggcactaccg tgaccgtgtc tagcgctagc 360

actaagggcc cgtccgtgtt ccccctggca ccttgtagcc ggagcactag cgaatccacc 420

gctgccctcg gctgcctggt caaggattac ttcccggagc ccgtgaccgt gtcctggaac 480

agcggagccc tgacctccgg agtgcacacc ttccccgctg tgctgcagag ctccgggctg 540

tactcgctgt cgtcggtggt cacggtgcct tcatctagcc tgggtaccaa gacctacact 600

tgcaacgtgg accacaagcc ttccaacact aaggtggaca agcgcgtcga atcgaagtac 660

ggcccaccgt gcccgccttg tcccgcgccg gagttcctcg gcggtccctc ggtctttctg 720

ttcccaccga agcccaagga cactttgatg atttcccgca cccctgaagt gacatgcgtg 780

gtcgtggacg tgtcacagga agatccggag gtgcagttca attggtacgt ggatggcgtc 840

gaggtgcaca acgccaaaac caagccgagg gaggagcagt tcaactccac ttaccgcgtc 900

gtgtccgtgc tgacggtgct gcatcaggac tggctgaacg ggaaggagta caagtgcaaa 960

gtgtccaaca agggacttcc tagctcaatc gaaaagacca tctcgaaagc caagggacag 1020

ccccgggaac cccaagtgta taccctgcca ccgagccagg aagaaatgac taagaaccaa 1080

gtctcattga cttgccttgt gaagggcttc tacccatcgg atatcgccgt ggaatgggag 1140

tccaacggcc agccggaaaa caactacaag accacccctc cggtgctgga ctcagacgga 1200

tccttcttcc tctactcgcg gctgaccgtg gataagagca gatggcagga gggaaatgtg 1260

ttcagctgtt ctgtgatgca tgaagccctg cacaaccact acactcagaa gtccctgtcc 1320

ctctccctgg ga 1332

<210> 810
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 810
Arg Ala Ser Glu Ser Val Glu Tyr Tyr Gly Thr Ser Leu Met Gln
1 5 10 15

<210> 811
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 811
Ala Ala Ser Asn Val Glu Ser
1 5

<210> 812
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 812
Gln Gln Ser Arg Lys Asp Pro Ser Thr
1 5

<210> 813
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 813
Ser Glu Ser Val Glu Tyr Tyr Gly Thr Ser Leu
1 5 10

<210> 814
<211> 3
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 814
Ala Ala Ser
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<210> 815
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source

<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 815
Ser Arg Lys Asp Pro Ser
1 5

<210> 816
<211> 111
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 816
Ala Ile Gln Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Arg Ala Ser Glu Ser Val Glu Tyr Tyr
20 25 30

Gly Thr Ser Leu Met Gln Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro
35 40 45

Lys Leu Leu Ile Tyr Ala Ala Ser Asn Val Glu Ser Gly Val Pro Ser
50 55 60

Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser
65 70 75 80

Ser Leu Gln Pro Glu Asp Phe Ala Thr Tyr Phe Cys Gln Gln Ser Arg
85 90 95

Lys Asp Pro Ser Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys
100 105 110

<210> 817
<211> 333
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 817
gctattcagc tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gagctagtga atcagtcgag tactacggca ctagcctgat gcagtggtat 120

cagcagaagc ccgggaaagc ccctaagctg ctgatctacg ccgcctctaa cgtggaatca 180

ggcgtgccct ctaggtttag cggtagcggt agtggcaccg acttcaccct gactatctct 240

agcctgcagc ccgaggactt cgctacctac ttctgtcagc agtctaggaa ggaccctagc 300

accttcggcg gaggcactaa ggtcgagatt aag 333

<210> 818
<211> 218
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 818
Ala Ile Gln Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Arg Ala Ser Glu Ser Val Glu Tyr Tyr
20 25 30

Gly Thr Ser Leu Met Gln Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro
35 40 45

Lys Leu Leu Ile Tyr Ala Ala Ser Asn Val Glu Ser Gly Val Pro Ser
50 55 60

Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser
65 70 75 80

Ser Leu Gln Pro Glu Asp Phe Ala Thr Tyr Phe Cys Gln Gln Ser Arg
85 90 95

Lys Asp Pro Ser Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys Arg
100 105 110

Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln
115 120 125

Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr
130 135 140

Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser
145 150 155 160

Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr
165 170 175

Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys
180 185 190

His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro
195 200 205

Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
210 215

<210> 819
<211> 654
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 819
gctattcagc tgactcagtc acctagtagc ctgagcgcta gtgtgggcga tagagtgact 60

atcacctgta gagctagtga atcagtcgag tactacggca ctagcctgat gcagtggtat 120

cagcagaagc ccgggaaagc ccctaagctg ctgatctacg ccgcctctaa cgtggaatca 180

ggcgtgccct ctaggtttag cggtagcggt agtggcaccg acttcaccct gactatctct 240

agcctgcagc ccgaggactt cgctacctac ttctgtcagc agtctaggaa ggaccctagc 300

accttcggcg gaggcactaa ggtcgagatt aagcgtacgg tggccgctcc cagcgtgttc 360

atcttccccc ccagcgacga gcagctgaag agcggcaccg ccagcgtggt gtgcctgctg 420

aacaacttct acccccggga ggccaaggtg cagtggaagg tggacaacgc cctgcagagc 480

ggcaacagcc aggagagcgt caccgagcag gacagcaagg actccaccta cagcctgagc 540

agcaccctga ccctgagcaa ggccgactac gagaagcata aggtgtacgc ctgcgaggtg 600

acccaccagg gcctgtccag ccccgtgacc aagagcttca acaggggcga gtgc 654

<210> 820
<211> 17
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 820
Asp Ile Tyr Pro Gly Gln Gly Asp Thr Ser Tyr Asn Gln Lys Phe Lys
1 5 10 15

Gly

<210> 821
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 821
Tyr Pro Gly Gln Gly Asp
1 5

<210> 822
<211> 118

<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 822
Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala
1 5 10 15

Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Tyr
20 25 30

Asn Met His Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Ile
35 40 45

Gly Asp Ile Tyr Pro Gly Gln Gly Asp Thr Ser Tyr Asn Gln Lys Phe
50 55 60

Lys Gly Arg Ala Thr Met Thr Ala Asp Lys Ser Thr Ser Thr Val Tyr
65 70 75 80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Ala Arg Val Gly Gly Ala Phe Pro Met Asp Tyr Trp Gly Gln Gly Thr
100 105 110

Leu Val Thr Val Ser Ser
115

<210> 823
<211> 354
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polynucleotide"

<400> 823

caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctag tgtgaaagtt 60

agctgtaaag ctagtggcta tactttcact tcttataata tgcactgggt ccgccaggcc 120

ccaggtcaag gcctcgagtg gatcggcgat atctaccccg gtcaaggcga cacttcctat 180

aatcagaagt ttaagggtag agctactatg accgccgata agtctacttc taccgtctat 240

atggaactga gttccctgag gtctgaggac accgccgtct actactgcgc tagagtgggc 300

ggagccttcc caatggacta ctggggtcaa ggcaccctgg tcaccgtgtc tagc 354

<210> 824
<211> 444
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 824

Gln	Val	Gln	Leu	Val	Gln	Ser	Gly	Ala	Glu	Val	Lys	Lys	Pro	Gly	Ala
1				5					10					15	
Ser	Val	Lys	Val	Ser	Cys	Lys	Ala	Ser	Gly	Tyr	Thr	Phe	Thr	Ser	Tyr
			20					25					30		
Asn	Met	His	Trp	Val	Arg	Gln	Ala	Pro	Gly	Gln	Gly	Leu	Glu	Trp	Ile
		35					40					45			
Gly	Asp	Ile	Tyr	Pro	Gly	Gln	Gly	Asp	Thr	Ser	Tyr	Asn	Gln	Lys	Phe
	50					55					60				
Lys	Gly	Arg	Ala	Thr	Met	Thr	Ala	Asp	Lys	Ser	Thr	Ser	Thr	Val	Tyr
65					70					75					80
Met	Glu	Leu	Ser	Ser	Leu	Arg	Ser	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
				85					90					95	
Ala	Arg	Val	Gly	Gly	Ala	Phe	Pro	Met	Asp	Tyr	Trp	Gly	Gln	Gly	Thr
			100					105					110		

```
Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro
        115                 120                 125

Leu Ala Pro Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly
    130                 135                 140

Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn
145                 150                 155                 160

Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln
                165                 170                 175

Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser
            180                 185                 190

Ser Leu Gly Thr Lys Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser
        195                 200                 205

Asn Thr Lys Val Asp Lys Arg Val Glu Ser Lys Tyr Gly Pro Pro Cys
    210                 215                 220

Pro Pro Cys Pro Ala Pro Glu Phe Leu Gly Gly Pro Ser Val Phe Leu
225                 230                 235                 240

Phe Pro Pro Lys Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu
                245                 250                 255

Val Thr Cys Val Val Val Asp Val Ser Gln Glu Asp Pro Glu Val Gln
            260                 265                 270

Phe Asn Trp Tyr Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys
        275                 280                 285

Pro Arg Glu Glu Gln Phe Asn Ser Thr Tyr Arg Val Val Ser Val Leu
    290                 295                 300

Thr Val Leu His Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys
305                 310                 315                 320
```

Val Ser Asn Lys Gly Leu Pro Ser Ser Ile Glu Lys Thr Ile Ser Lys
325 330 335

Ala Lys Gly Gln Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser
340 345 350

Gln Glu Glu Met Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys
355 360 365

Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln
370 375 380

Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly
385 390 395 400

Ser Phe Phe Leu Tyr Ser Arg Leu Thr Val Asp Lys Ser Arg Trp Gln
405 410 415

Glu Gly Asn Val Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn
420 425 430

His Tyr Thr Gln Lys Ser Leu Ser Leu Ser Leu Gly
435 440

<210> 825
<211> 1332
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 825
caggtgcagc tggtgcagtc aggcgccgaa gtgaagaaac ccggcgctag tgtgaaagtt 60

agctgtaaag ctagtggcta tactttcact tcttataata tgcactgggt ccgccaggcc 120

ccaggtcaag gcctcgagtg gatcggcgat atctaccccg gtcaaggcga cacttcctat 180

aatcagaagt ttaagggtag agctactatg accgccgata agtctacttc taccgtctat 240

atggaactga gttccctgag gtctgaggac accgccgtct actactgcgc tagagtgggc 300

ggagccttcc caatggacta ctggggtcaa ggcaccctgg tcaccgtgtc tagcgctagc 360

actaagggcc cgtccgtgtt ccccctggca ccttgtagcc ggagcactag cgaatccacc 420

gctgccctcg gctgcctggt caaggattac ttcccggagc ccgtgaccgt gtcctggaac 480

agcggagccc tgacctccgg agtgcacacc ttccccgctg tgctgcagag ctccgggctg 540

tactcgctgt cgtcggtggt cacggtgcct tcatctagcc tgggtaccaa gacctacact 600

tgcaacgtgg accacaagcc ttccaacact aaggtggaca agcgcgtcga atcgaagtac 660

ggcccaccgt gcccgccttg tcccgcgccg gagttcctcg gcggtccctc ggtctttctg 720

ttcccaccga agcccaagga cactttgatg atttcccgca cccctgaagt gacatgcgtg 780

gtcgtggacg tgtcacagga agatccggag gtgcagttca attggtacgt ggatggcgtc 840

gaggtgcaca acgccaaaac caagccgagg gaggagcagt tcaactccac ttaccgcgtc 900

gtgtccgtgc tgacggtgct gcatcaggac tggctgaacg ggaaggagta caagtgcaaa 960

gtgtccaaca agggacttcc tagctcaatc gaaaagacca tctcgaaagc caagggacag 1020

ccccgggaac cccaagtgta taccctgcca ccgagccagg aagaaatgac taagaaccaa 1080

gtctcattga cttgccttgt gaagggcttc tacccatcgg atatcgccgt ggaatgggag 1140

tccaacggcc agccggaaaa caactacaag accacccctc cggtgctgga ctcagacgga 1200

tccttcttcc tctactcgcg gctgaccgtg gataagagca gatggcagga gggaaatgtg 1260

ttcagctgtt ctgtgatgca tgaagccctg cacaaccact acactcagaa gtccctgtcc 1320

ctctccctgg ga 1332

<210> 826
<211> 111
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 826
Asp Ile Val Leu Thr Gln Ser Pro Asp Ser Leu Ala Val Ser Leu Gly
1 5 10 15

```
Glu Arg Ala Thr Ile Asn Cys Arg Ala Ser Glu Ser Val Glu Tyr Tyr
            20                  25                  30


Gly Thr Ser Leu Met Gln Trp Tyr Gln Gln Lys Pro Gly Gln Pro Pro
        35                  40                  45


Lys Leu Leu Ile Tyr Ala Ala Ser Asn Val Glu Ser Gly Val Pro Asp
    50                  55                  60


Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser
65                  70                  75                  80


Ser Leu Gln Ala Glu Asp Val Ala Val Tyr Tyr Cys Gln Gln Ser Arg
                85                  90                  95


Lys Asp Pro Ser Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys
            100                 105                 110


<210> 827
<211> 333
<212> DNA
<213> Artificial Sequence

<220>
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<223> /note="Description of Artificial Sequence: Synthetic
      polynucleotide"

<400> 827
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attaactgta gagctagtga atcagtcgag tactacggca ctagcctgat gcagtggtat      120

cagcagaagc ccggtcaacc ccctaagctg ctgatctacg ccgcctctaa cgtggaatca      180

ggcgtgcccg ataggtttag cggtagcggt agtggcaccg acttcaccct gactattagt      240

agcctgcagg ccgaggacgt ggccgtctac tactgtcagc agtctaggaa ggaccctagc      300

accttcggcg gaggcactaa ggtcgagatt aag                                   333


<210> 828
<211> 218
<212> PRT
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<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 828

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Asp Ile Val Leu Thr Gln Ser Pro Asp Ser Leu Ala Val Ser Leu Gly
1               5                  10                  15


Glu Arg Ala Thr Ile Asn Cys Arg Ala Ser Glu Ser Val Glu Tyr Tyr
            20                  25                  30


Gly Thr Ser Leu Met Gln Trp Tyr Gln Gln Lys Pro Gly Gln Pro Pro
        35                  40                  45


Lys Leu Leu Ile Tyr Ala Ala Ser Asn Val Glu Ser Gly Val Pro Asp
    50                  55                  60


Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser
65                  70                  75                  80


Ser Leu Gln Ala Glu Asp Val Ala Val Tyr Tyr Cys Gln Gln Ser Arg
                85                  90                  95


Lys Asp Pro Ser Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys Arg
            100                 105                 110


Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln
        115                 120                 125


Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr
    130                 135                 140


Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser
145                 150                 155                 160


Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr
                165                 170                 175
```

Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys
180 185 190

His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro
195 200 205

Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
210 215

<210> 829
<211> 654
<212> DNA
<213> Artificial Sequence

<220>
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<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 829
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cagcagaagc ccggtcaacc ccctaagctg ctgatctacg ccgcctctaa cgtggaatca 180

ggcgtgcccg ataggtttag cggtagcggt agtggcaccg acttcaccct gactattagt 240

agcctgcagg ccgaggacgt ggccgtctac tactgtcagc agtctaggaa ggaccctagc 300

accttcggcg gaggcactaa ggtcgagatt aagcgtacgg tggccgctcc cagcgtgttc 360

atcttccccc ccagcgacga gcagctgaag agcggcaccg ccagcgtggt gtgcctgctg 420

aacaacttct acccccggga ggccaaggtg cagtggaagg tggacaacgc cctgcagagc 480

ggcaacagcc aggagagcgt caccgagcag gacagcaagg actccaccta cagcctgagc 540

agcaccctga ccctgagcaa ggccgactac gagaagcata aggtgtacgc ctgcgaggtg 600

acccaccagg gcctgtccag ccccgtgacc aagagcttca acaggggcga gtgc 654

<210> 830
<211> 114
<212> PRT
<213> Artificial Sequence

<220>

<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 830
Glu Val Gln Leu Leu Glu Ser Gly Gly Gly Leu Val Gln Pro Gly Gly
1 5 10 15

Ser Leu Arg Leu Ser Cys Ala Ala Ala Ser Gly Phe Thr Phe Ser Ser
20 25 30

Tyr Asp Met Ser Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Asp Trp
35 40 45

Val Ser Thr Ile Ser Gly Gly Gly Thr Tyr Thr Tyr Tyr Gln Asp Ser
50 55 60

Val Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu
65 70 75 80

Tyr Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr
85 90 95

Cys Ala Ser Met Asp Tyr Trp Gly Gln Gly Thr Thr Val Thr Val Ser
100 105 110

Ser Ala

<210> 831
<211> 108
<212> PRT
<213> Artificial Sequence

<220>
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<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 831
Asp Ile Gln Met Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

```
Asp Arg Val Thr Ile Thr Cys Arg Ala Ser Gln Ser Ile Arg Arg Tyr
            20                  25                  30


Leu Asn Trp Tyr His Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile
        35                  40                  45


Tyr Gly Ala Ser Thr Leu Gln Ser Gly Val Pro Ser Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65                  70                  75                  80


Glu Asp Phe Ala Val Tyr Tyr Cys Gln Gln Ser His Ser Ala Pro Leu
                85                  90                  95


Thr Phe Gly Gly Gly Thr Lys Val Glu Ile Lys Arg
            100                 105


<210> 832
<211> 120
<212> PRT
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<223> /note="Description of Artificial Sequence: Synthetic
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<400> 832
Glu Val Gln Val Leu Glu Ser Gly Gly Gly Leu Val Gln Pro Gly Gly
1               5                   10                  15


Ser Leu Arg Leu Tyr Cys Val Ala Ser Gly Phe Thr Phe Ser Gly Ser
            20                  25                  30


Tyr Ala Met Ser Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp
        35                  40                  45


Val Ser Ala Ile Ser Gly Ser Gly Gly Ser Thr Tyr Tyr Ala Asp Ser
    50                  55                  60


Val Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu
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65 70 75 80

Tyr Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr
85 90 95

Cys Ala Lys Lys Tyr Tyr Val Gly Pro Ala Asp Tyr Trp Gly Gln Gly
100 105 110

Thr Leu Val Thr Val Ser Ser Gly
115 120

<210> 833
<211> 113
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 833
Asp Ile Val Met Thr Gln Ser Pro Asp Ser Leu Ala Val Ser Leu Gly
1 5 10 15

Glu Arg Ala Thr Ile Asn Cys Lys Ser Ser Gln Ser Val Leu Tyr Ser
20 25 30

Ser Asn Asn Lys Asn Tyr Leu Ala Trp Tyr Gln His Lys Pro Gly Gln
35 40 45

Pro Pro Lys Leu Leu Ile Tyr Trp Ala Ser Thr Arg Glu Ser Gly Val
50 55 60

Pro Asp Arg Phe Ser Gly Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr
65 70 75 80

Ile Ser Ser Leu Gln Ala Glu Asp Val Ala Val Tyr Tyr Cys Gln Gln
85 90 95

Tyr Tyr Ser Ser Pro Leu Thr Phe Gly Gly Gly Thr Lys Ile Glu Val
100 105 110

Lys

<210> 834

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<210> 901
<211> 121
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic

polypeptide"

<400> 901
Glu Val Gln Leu Val Glu Ser Gly Gly Gly Leu Val Gln Ser Gly Gly
1 5 10 15

Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Ser Leu Ser Ser Tyr
20 25 30

Gly Val Asp Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
35 40 45

Gly Val Ile Trp Gly Gly Gly Gly Thr Tyr Tyr Ala Ser Ser Leu Met
50 55 60

Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr Leu
65 70 75 80

Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys Ala
85 90 95

Arg His Ala Tyr Gly His Asp Gly Gly Phe Ala Met Asp Tyr Trp Gly
100 105 110

Gln Gly Thr Leu Val Thr Val Ser Ser
115 120

<210> 902
<211> 107
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 902
Glu Ile Val Met Thr Gln Ser Pro Ala Thr Leu Ser Val Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Glu Ser Val Ser Ser Asn
20 25 30

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Val Ala Trp Tyr Gln Gln Arg Pro Gly Gln Ala Pro Arg Leu Leu Ile
        35                  40                  45


Tyr Gly Ala Ser Asn Arg Ala Thr Gly Ile Pro Ala Arg Phe Ser Gly
    50                  55                  60


Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Arg Leu Glu Pro
65                  70                  75                  80


Glu Asp Phe Ala Val Tyr Tyr Cys Gly Gln Ser Tyr Ser Tyr Pro Phe
                85                  90                  95


Thr Phe Gly Gln Gly Thr Lys Leu Glu Ile Lys
            100                 105


<210> 903
<211> 451
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
      polypeptide"

<400> 903
Glu Val Gln Leu Val Glu Ser Gly Gly Gly Leu Val Gln Ser Gly Gly
1               5                   10                  15


Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Ser Leu Ser Ser Tyr
            20                  25                  30


Gly Val Asp Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
        35                  40                  45


Gly Val Ile Trp Gly Gly Gly Gly Thr Tyr Tyr Ala Ser Ser Leu Met
    50                  55                  60


Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr Leu
65                  70                  75                  80
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Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys Ala
                85                  90                  95

Arg His Ala Tyr Gly His Asp Gly Gly Phe Ala Met Asp Tyr Trp Gly
            100                 105                 110

Gln Gly Thr Leu Val Thr Val Ser Ser Ala Ser Thr Lys Gly Pro Ser
        115                 120                 125

Val Phe Pro Leu Ala Pro Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala
    130                 135                 140

Ala Leu Gly Cys Leu Val Lys Asp Tyr Phe Pro Glu Pro Val Thr Val
145                 150                 155                 160

Ser Trp Asn Ser Gly Ala Leu Thr Ser Gly Val His Thr Phe Pro Ala
                165                 170                 175

Val Leu Gln Ser Ser Gly Leu Tyr Ser Leu Ser Ser Val Val Thr Val
            180                 185                 190

Pro Ser Ser Ser Leu Gly Thr Gln Thr Tyr Ile Cys Asn Val Asn His
        195                 200                 205

Lys Pro Ser Asn Thr Lys Val Asp Lys Arg Val Glu Pro Lys Ser Cys
    210                 215                 220

Asp Lys Thr His Thr Cys Pro Pro Cys Pro Ala Pro Glu Leu Leu Gly
225                 230                 235                 240

Gly Pro Ser Val Phe Leu Phe Pro Pro Lys Pro Lys Asp Thr Leu Met
                245                 250                 255

Ile Ser Arg Thr Pro Glu Val Thr Cys Val Val Val Asp Val Ser His
            260                 265                 270

Glu Asp Pro Glu Val Lys Phe Asn Trp Tyr Val Asp Gly Val Glu Val
        275                 280                 285
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His Asn Ala Lys Thr Lys Pro Arg Glu Glu Gln Tyr Asn Ser Thr Tyr
    290                 295                 300

Arg Val Val Ser Val Leu Thr Val Leu His Gln Asp Trp Leu Asn Gly
305                 310                 315                 320

Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys Ala Leu Pro Ala Pro Ile
                325                 330                 335

Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln Pro Arg Glu Pro Gln Val
            340                 345                 350

Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met Thr Lys Asn Gln Val Ser
        355                 360                 365

Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro Ser Asp Ile Ala Val Glu
    370                 375                 380

Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn Tyr Lys Thr Thr Pro Pro
385                 390                 395                 400

Val Leu Asp Ser Asp Gly Ser Phe Phe Leu Tyr Ser Lys Leu Thr Val
                405                 410                 415

Asp Lys Ser Arg Trp Gln Gln Gly Asn Val Phe Ser Cys Ser Val Met
            420                 425                 430

His Glu Ala Leu His Asn His Tyr Thr Gln Lys Ser Leu Ser Leu Ser
        435                 440                 445

Pro Gly Lys
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<210> 904
<211> 214
<212> PRT
<213> Artificial Sequence

<220>
<221> source

<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 904
Glu Ile Val Met Thr Gln Ser Pro Ala Thr Leu Ser Val Ser Pro Gly
1 5 10 15

Glu Arg Ala Thr Leu Ser Cys Arg Ala Ser Glu Ser Val Ser Ser Asn
20 25 30

Val Ala Trp Tyr Gln Gln Arg Pro Gly Gln Ala Pro Arg Leu Leu Ile
35 40 45

Tyr Gly Ala Ser Asn Arg Ala Thr Gly Ile Pro Ala Arg Phe Ser Gly
50 55 60

Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Arg Leu Glu Pro
65 70 75 80

Glu Asp Phe Ala Val Tyr Tyr Cys Gly Gln Ser Tyr Ser Tyr Pro Phe
85 90 95

Thr Phe Gly Gln Gly Thr Lys Leu Glu Ile Lys Arg Thr Val Ala Ala
100 105 110

Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu Gln Leu Lys Ser Gly
115 120 125

Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe Tyr Pro Arg Glu Ala
130 135 140

Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln Ser Gly Asn Ser Gln
145 150 155 160

Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser Thr Tyr Ser Leu Ser
165 170 175

Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu Lys His Lys Val Tyr
180 185 190

Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser Pro Val Thr Lys Ser
195 200 205

Phe Asn Arg Gly Glu Cys
210

<210> 905
<211> 363
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 905
gaggtgcagc tggtggaatc tggcggcgga ctggtgcagt ccggcggctc tctgagactg 60

tcttgcgctg cctccggctt ctccctgtcc tcttacggcg tggactgggt gcgacaggcc 120

cctggcaagg gcctggaatg ggtgggagtg atctggggcg gaggcggcac ctactacgcc 180

tcttccctga tgggccggtt caccatctcc cgggacaact ccaagaacac cctgtacctg 240

cagatgaact ccctgcgggc cgaggacacc gccgtgtact actgcgccag acacgcctac 300

ggccacgacg gcggcttcgc catggattat tggggccagg gcaccctggt gacagtgtcc 360

tcc 363

<210> 906
<211> 321
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 906
gagatcgtga tgacccagtc ccccgccacc ctgtctgtgt ctcccggcga gagagccacc 60

ctgagctgca gagcctccga gtccgtgtcc tccaacgtgg cctggtatca gcagagacct 120

ggtcaggccc ctcggctgct gatctacggc gcctctaacc gggccaccgg catccctgcc 180

agattctccg gctccggcag cggcaccgac ttcaccctga ccatctcccg gctggaaccc 240

gaggacttcg ccgtgtacta ctgcggccag tcctactcat acccttcac cttcggccag 300

ggcaccaagc tggaaatcaa g 321

<210> 907
<211> 1353
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 907
gaggtgcagc tggtggaatc tggcggcgga ctggtgcagt ccggcggctc tctgagactg 60

tcttgcgctg cctccggctt ctccctgtcc tcttacggcg tggactgggt gcgacaggcc 120

cctggcaagg gcctggaatg ggtgggagtg atctggggcg gaggcggcac ctactacgcc 180

tcttccctga tgggccggtt caccatctcc cgggacaact ccaagaacac cctgtacctg 240

cagatgaact ccctgcgggc cgaggacacc gccgtgtact actgcgccag acacgcctac 300

ggccacgacg gcggcttcgc catggattat tggggccagg gcaccctggt gacagtgtcc 360

tccgctagca ccaagggccc aagtgtgttt cccctggccc ccagcagcaa gtctacttcc 420

ggcggaactg ctgccctggg ttgcctggtg aaggactact tccccgagcc cgtgacagtg 480

tcctggaact ctggggctct gacttccggc gtgcacacct tccccgccgt gctgcagagc 540

agcggcctgt acagcctgag cagcgtggtg acagtgccct ccagctctct gggaacccag 600

acctatatct gcaacgtgaa ccacaagccc agcaacacca aggtggacaa gagagtggag 660

cccaagagct gcgacaagac ccacacctgc ccccccctgcc cagctccaga actgctggga 720

gggccttccg tgttcctgtt ccccccccaag cccaaggaca ccctgatgat cagcaggacc 780

cccgaggtga cctgcgtggt ggtggacgtg tcccacgagg acccagaggt gaagttcaac 840

tggtacgtgg acggcgtgga ggtgcacaac gccaagacca agcccagaga ggagcagtac 900

aacagcacct acagggtggt gtccgtgctg accgtgctgc accaggactg gctgaacggc 960

aaagaataca agtgcaaagt ctccaacaag gccctgccag ccccaatcga aaagacaatc 1020

agcaaggcca agggccagcc acgggagccc caggtgtaca ccctgccccc cagccgggag 1080

gagatgacca agaaccaggt gtccctgacc tgtctggtga agggcttcta ccccagcgat 1140

atcgccgtgg agtgggagag caacggccag cccgagaaca actacaagac cacccccca 1200

gtgctggaca gcgacggcag cttcttcctg tacagcaagc tgaccgtgga caagtccagg 1260

tggcagcagg gcaacgtgtt cagctgcagc gtgatgcacg aggccctgca caaccactac 1320

acccagaagt ccctgagcct gagccccggc aag 1353

<210> 908
<211> 642
<212> DNA
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polynucleotide"

<400> 908
gagatcgtga tgacccagtc ccccgccacc ctgtctgtgt ctcccggcga gagagccacc 60

ctgagctgca gagcctccga gtccgtgtcc tccaacgtgg cctggtatca gcagagacct 120

ggtcaggccc ctcggctgct gatctacggc gcctctaacc gggccaccgg catccctgcc 180

agattctccg gctccggcag cggcaccgac ttcaccctga ccatctcccg gctggaaccc 240

gaggacttcg ccgtgtacta ctgcggccag tcctactcat acccccttcac cttcggccag 300

ggcaccaagc tggaaatcaa gcgtacggtg gccgctccca gcgtgttcat cttcccccc 360

agcgacgagc agctgaagag cggcaccgcc agcgtggtgt gcctgctgaa caacttctac 420

ccccgggagg ccaaggtgca gtggaaggtg gacaacgccc tgcagagcgg caacagccag 480

gagagcgtca ccgagcagga cagcaaggac tccacctaca gcctgagcag caccctgacc 540

ctgagcaagg ccgactacga gaagcataag gtgtacgcct gcgaggtgac ccaccagggc 600

ctgtccagcc ccgtgaccaa gagcttcaac aggggcgagt gc 642

<210> 909
<211> 5
<212> PRT
<213> Artificial Sequence

<220>

<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 909
Ser Tyr Gly Val Asp
1 5

<210> 910
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 910
Gly Phe Ser Leu Ser Ser Tyr
1 5

<210> 911
<211> 16
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 911
Val Ile Trp Gly Gly Gly Gly Thr Tyr Tyr Ala Ser Ser Leu Met Gly
1 5 10 15

<210> 912
<211> 5
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 912
Trp Gly Gly Gly Gly
1 5

<210> 913
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
peptide"

<400> 913
His Ala Tyr Gly His Asp Gly Gly Phe Ala Met Asp Tyr
1 5 10

<210> 914
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
peptide"

<400> 914
Arg Ala Ser Glu Ser Val Ser Ser Asn Val Ala
1 5 10

<210> 915
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic
peptide"

<400> 915
Ser Glu Ser Val Ser Ser Asn
1 5

<210> 916
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
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<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 916
Gly Ala Ser Asn Arg Ala Thr
1 5

<210> 917
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<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 917
Gly Ala Ser
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<210> 918
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
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<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 918
Gly Gln Ser Tyr Ser Tyr Pro Phe Thr
1 5

<210> 919
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<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic peptide"

<400> 919
Ser Tyr Ser Tyr Pro Phe

1 5

<210> 920
<211> 124
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 920
Gln Val Gln Leu Val Glu Ser Gly Gly Gly Val Val Gln Pro Gly Arg
1 5 10 15

Ser Leu Arg Leu Ser Cys Ala Ala Ser Gly Phe Thr Phe Ser Ser Tyr
20 25 30

Gly Met His Trp Val Arg Gln Ala Pro Gly Lys Gly Leu Glu Trp Val
35 40 45

Ala Val Ile Trp Tyr Glu Gly Ser Asn Lys Tyr Tyr Ala Asp Ser Val
50 55 60

Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr
65 70 75 80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
85 90 95

Ala Arg Gly Gly Ser Met Val Arg Gly Asp Tyr Tyr Tyr Gly Met Asp
100 105 110

Val Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser
115 120

<210> 921
<211> 107
<212> PRT
<213> Artificial Sequence

<220>

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<223> /note="Description of Artificial Sequence: Synthetic
polypeptide"

<400> 921
Ala Ile Gln Leu Thr Gln Ser Pro Ser Ser Leu Ser Ala Ser Val Gly
1 5 10 15

Asp Arg Val Thr Ile Thr Cys Arg Ala Ser Gln Gly Ile Ser Ser Ala
20 25 30

Leu Ala Trp Tyr Gln Gln Lys Pro Gly Lys Ala Pro Lys Leu Leu Ile
35 40 45

Tyr Asp Ala Ser Ser Leu Glu Ser Gly Val Pro Ser Arg Phe Ser Gly
50 55 60

Ser Gly Ser Gly Thr Asp Phe Thr Leu Thr Ile Ser Ser Leu Gln Pro
65 70 75 80

Glu Asp Phe Ala Thr Tyr Tyr Cys Gln Gln Phe Asn Ser Tyr Pro Tyr
85 90 95

Thr Phe Gly Gln Gly Thr Lys Leu Glu Ile Lys
100 105

<210> 922

<400> 922
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<210> 1000

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<210> 1001
<211> 114
<212> PRT
<213> Homo sapiens

<400> 1001
Asn Trp Val Asn Val Ile Ser Asp Leu Lys Lys Ile Glu Asp Leu Ile
1 5 10 15

Gln Ser Met His Ile Asp Ala Thr Leu Tyr Thr Glu Ser Asp Val His
20 25 30

```
Pro Ser Cys Lys Val Thr Ala Met Lys Cys Phe Leu Leu Glu Leu Gln
        35                  40                  45

Val Ile Ser Leu Glu Ser Gly Asp Ala Ser Ile His Asp Thr Val Glu
    50                  55                  60

Asn Leu Ile Ile Leu Ala Asn Asn Ser Leu Ser Ser Asn Gly Asn Val
65                  70                  75                  80

Thr Glu Ser Gly Cys Lys Glu Cys Glu Glu Leu Glu Glu Lys Asn Ile
                85                  90                  95

Lys Glu Phe Leu Gln Ser Phe Val His Ile Val Gln Met Phe Ile Asn
            100                 105                 110

Thr Ser
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<210> 1002
<211> 170
<212> PRT
<213> Homo sapiens

<400> 1002

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Ile Thr Cys Pro Pro Pro Met Ser Val Glu His Ala Asp Ile Trp Val
1               5                   10                  15

Lys Ser Tyr Ser Leu Tyr Ser Arg Glu Arg Tyr Ile Cys Asn Ser Gly
            20                  25                  30

Phe Lys Arg Lys Ala Gly Thr Ser Ser Leu Thr Glu Cys Val Leu Asn
        35                  40                  45

Lys Ala Thr Asn Val Ala His Trp Thr Thr Pro Ser Leu Lys Cys Ile
    50                  55                  60

Arg Asp Pro Ala Leu Val His Gln Arg Pro Ala Pro Pro Ser Thr Val
65                  70                  75                  80

Thr Thr Ala Gly Val Thr Pro Gln Pro Glu Ser Leu Ser Pro Ser Gly
```

85 90 95

Lys Glu Pro Ala Ala Ser Ser Pro Ser Ser Asn Asn Thr Ala Ala Thr
100 105 110

Thr Ala Ala Ile Val Pro Gly Ser Gln Leu Met Pro Ser Lys Ser Pro
115 120 125

Ser Thr Gly Thr Thr Glu Ile Ser Ser His Glu Ser Ser His Gly Thr
130 135 140

Pro Ser Gln Thr Thr Ala Lys Asn Trp Glu Leu Thr Ala Ser Ala Ser
145 150 155 160

His Gln Pro Pro Gly Val Tyr Pro Gln Gly
165 170

<210> 1003
<211> 114
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 1003
Asn Trp Val Asn Val Ile Ser Asp Leu Lys Lys Ile Glu Asp Leu Ile
1 5 10 15

Gln Ser Met His Ile Asp Ala Thr Leu Tyr Thr Glu Ser Asp Val His
20 25 30

Pro Ser Cys Lys Val Thr Ala Met Lys Cys Phe Leu Leu Glu Leu Gln
35 40 45

Val Ile Ser Leu Glu Ser Gly Asp Ala Ser Ile His Asp Thr Val Glu
50 55 60

Asn Leu Ile Ile Leu Ala Asn Asp Ser Leu Ser Ser Asn Gly Asn Val
65 70 75 80

Thr Glu Ser Gly Cys Lys Glu Cys Glu Glu Leu Glu Glu Lys Asn Ile
85 90 95

Lys Glu Phe Leu Gln Ser Phe Val His Ile Val Gln Met Phe Ile Asn
100 105 110

Thr Ser

<210> 1004
<211> 297
<212> PRT
<213> Artificial Sequence

<220>
<221> source
<223> /note="Description of Artificial Sequence: Synthetic polypeptide"

<400> 1004
Ile Thr Cys Pro Pro Pro Met Ser Val Glu His Ala Asp Ile Trp Val
1 5 10 15

Lys Ser Tyr Ser Leu Tyr Ser Arg Glu Arg Tyr Ile Cys Asn Ser Gly
20 25 30

Phe Lys Arg Lys Ala Gly Thr Ser Ser Leu Thr Glu Cys Val Leu Asn
35 40 45

Lys Ala Thr Asn Val Ala His Trp Thr Thr Pro Ser Leu Lys Cys Ile
50 55 60

Arg Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys Pro Pro Cys Pro
65 70 75 80

Ala Pro Glu Leu Leu Gly Gly Pro Ser Val Phe Leu Phe Pro Pro Lys
85 90 95

Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val
100 105 110

```
Val Val Asp Val Ser His Glu Asp Pro Glu Val Lys Phe Asn Trp Tyr
        115                 120                 125


Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu
    130                 135                 140


Gln Tyr Asn Ser Thr Tyr Arg Val Val Ser Val Leu Thr Val Leu His
145                 150                 155                 160


Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys
                165                 170                 175


Ala Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Ala Lys Gly Gln
            180                 185                 190


Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Asp Glu Leu
        195                 200                 205


Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro
    210                 215                 220


Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn
225                 230                 235                 240


Tyr Lys Thr Thr Pro Pro Val Leu Asp Ser Asp Gly Ser Phe Phe Leu
                245                 250                 255


Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val
            260                 265                 270


Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln
        275                 280                 285


Lys Ser Leu Ser Leu Ser Pro Gly Lys
    290                 295


<210> 1005
<211> 114
<212> PRT
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<213> Homo sapiens

<220>
<221> MOD_RES
<222> (93)..(93)
<223> Glu or Lys

<400> 1005

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Asn Trp Val Asn Val Ile Ser Asp Leu Lys Lys Ile Glu Asp Leu Ile
1               5                  10                  15

Gln Ser Met His Ile Asp Ala Thr Leu Tyr Thr Glu Ser Asp Val His
            20                  25                  30

Pro Ser Cys Lys Val Thr Ala Met Lys Cys Phe Leu Leu Glu Leu Gln
        35                  40                  45

Val Ile Ser Leu Glu Ser Gly Asp Ala Ser Ile His Asp Thr Val Glu
    50                  55                  60

Asn Leu Ile Ile Leu Ala Asn Asn Ser Leu Ser Ser Asn Gly Asn Val
65                  70                  75                  80

Thr Glu Ser Gly Cys Lys Glu Cys Glu Glu Leu Glu Xaa Lys Asn Ile
                85                  90                  95

Lys Glu Phe Leu Gln Ser Phe Val His Ile Val Gln Met Phe Ile Asn
            100                 105                 110

Thr Ser
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<210> 1006
<211> 77
<212> PRT
<213> Homo sapiens

<400> 1006

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Ile Thr Cys Pro Pro Pro Met Ser Val Glu His Ala Asp Ile Trp Val
1               5                  10                  15

Lys Ser Tyr Ser Leu Tyr Ser Arg Glu Arg Tyr Ile Cys Asn Ser Gly
```

```
            20                  25                  30

Phe Lys Arg Lys Ala Gly Thr Ser Ser Leu Thr Glu Cys Val Leu Asn
        35                  40                  45

Lys Ala Thr Asn Val Ala His Trp Thr Thr Pro Ser Leu Lys Cys Ile
    50                  55                  60

Arg Asp Pro Ala Leu Val His Gln Arg Pro Ala Pro Pro
65                  70                  75
```