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(54) **METHODS OF TREATING SPORADIC INCLUSION BODY MYOSITIS**

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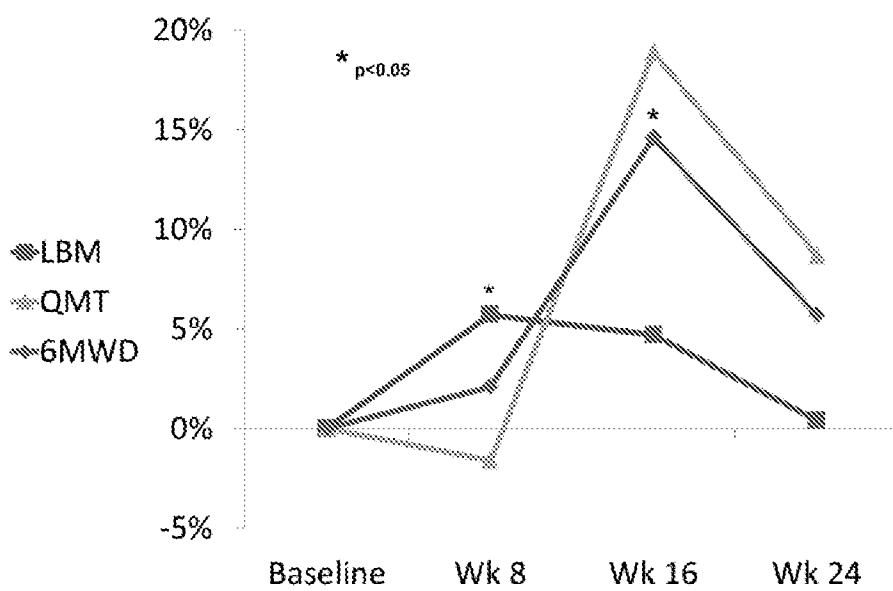
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(57) **ABSTRACT**

The disclosure relates to the treatment of sporadic inclusion body myositis and other muscle wasting disorders with novel regimens, which employ a therapeutically effective amount of a myostatin antagonist, e.g., a myostatin binding molecule, e.g., a myostatin antibody or an ActRII receptor binding molecule, an ActRII receptor antibody, such as the bimagramab antibody.

Figure 1.



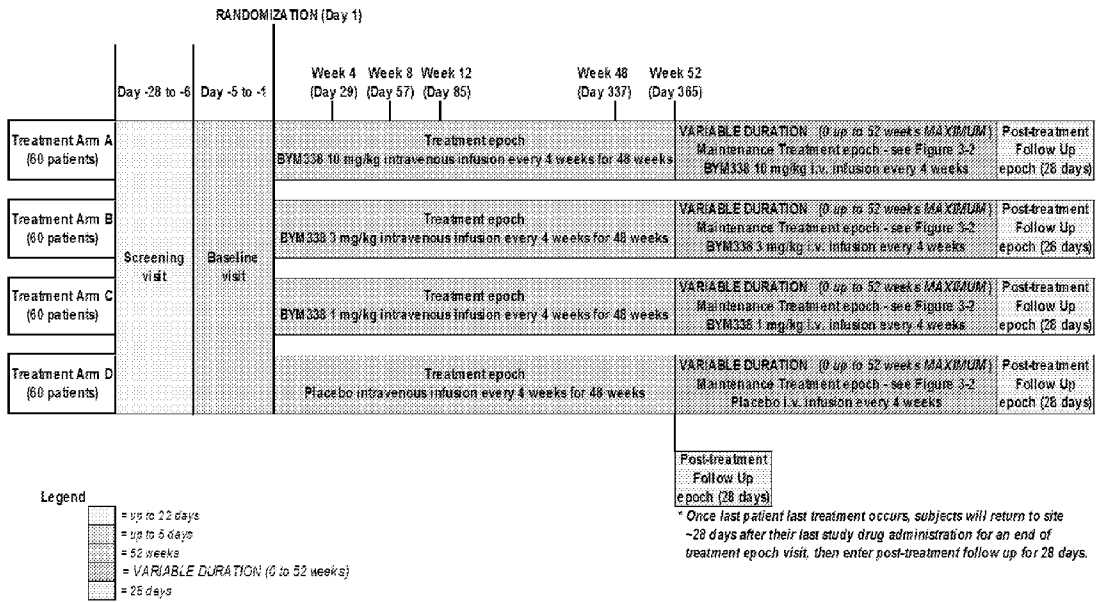


Figure 2.

## METHODS OF TREATING SPORADIC INCLUSION BODY MYOSITIS

**[0001]** This disclosure claims priority to U.S. Provisional Patent Application No. 61/865861, filed Aug. 14, 2013 and U.S. Provisional Patent Application No. 61/983567 filed Apr. 24, 2014, the disclosure of which are incorporated by reference herein in their entirety.

### TECHNICAL FIELD

**[0002]** This disclosure is in the field of myostatin antagonists, e.g., myostatin binding molecules or Activin receptor II (ActRII) binding molecules, e.g., an antagonist antibody to myostatin or to ActRII, e.g., BYM338. In particular, it relates to the treatment of sporadic inclusion body myositis (sIBM), and novel dosing regimens for treating it which employ a therapeutically effective amount of an ActRII antagonist, e.g., an Activin receptor II (ActRII) binding molecule, e.g., an anti-Activin receptor II (ActRII) antibody, such as the BYM338 antibody (which is also known as "bimagrumab").

### BACKGROUND OF THE DISCLOSURE

**[0003]** Sporadic inclusion-body myositis (sIBM) is a very rare disease. While there are limited epidemiological literature regarding the prevalence of the disease based on modern diagnostic criteria, it is sporadic with a prevalence estimate of 15-71 per million for all ages, and 51 per million over age 50. Men are more often affected than women approximately 2:1. There are notable regional differences in prevalence rates, which may involve both genetic and environmental factors. The primary underlying etiology of sIBM is unknown and is unfortunately refractory to any known treatments despite evidence of possibly secondary degenerative and inflammatory features (Hohlfeld 2011).

**[0004]** Although rare, sIBM represents the most common form for idiopathic inflammatory myopathies affecting those >50 years of age (Dimachkie and Barohn 2013, Griggs 2006, Peng et al 2000) and accounts for a total of 30% of all inflammatory myopathies. The disease is characterized clinically by the insidious and asymmetric onset of proximal and distal weakness which generally develops after the age of 50 years and progresses with time (Needham et al 2008). Diagnosis is often not made until 5-8 years after the onset of symptoms, mainly due to the slow evolution of the disease and the difficulty in recognizing the subtle early symptoms and the complex diagnostic criteria, including need for biopsy muscle pathology expertise. Lower extremity complaints come typically in the form of difficulty arising from chairs, and walking upstairs or downstairs. As the disease progresses, lower extremity weakness leads to frequent falls with potential injuries. Falls in sIBM patients may occur as a result of proximal muscle weakness, but distal lower extremity weakness (foot drop) occurs as well and may play a contributing role to such falls. In addition there is early onset of hand and finger weakness which eventually impairs the ability to retain independence in activities of daily living (e.g. writing, feeding, bathing, dressing, brushing teeth). Of other important symptoms, dysphagia occurs in at least 40% of patients due to esophageal and pharyngeal muscle involvement. This can lead to weight loss or aspiration with consequent pneumonia (Amato & Barohn 2009, Oh et al 2008). Disease progression is relatively slow but relentless and virtually all patients with sIBM require an assistive device, such as a cane or walker within a few years and a wheelchair, by about ten years of onset

(Griggs et al 1995, Dalakas 2006). The irreversible morbidity of sIBM is well-recognized by the clinical and patient community (Hohlfeld 2011).

**[0005]** Long-term follow up studies on a relatively larger number of sIBM patients have confirmed the seriously debilitating nature of sIBM (Benveniste et al 2011, Cox et al 2011). The highly debilitating nature of sIBM was confirmed by a national epidemiological study of 64 patients conducted in the Netherlands conducted over a period of 10-13 years focusing on the progressive decline in muscle strength, functional status and life expectancy with sIBM (Cox et al 2011). Although not a formal prospective registry, the authors reported that life expectancy was normal at 81 years, but activities of daily life were clearly restricted. At follow-up, all the 15 surviving patients who consented to further follow-up were found to be using a wheelchair, seven of them (47%) being completely wheelchair-bound. After a mean disease duration of 20 years, three patients were living in a nursing home and 12 at home with adaptations (stair lift, no thresholds, standup chairs). Nearly all patients required considerable help with daily activities from their partners or other caregivers; 40% of patients were completely or severely dependent (Barthel index <10), and 20% of patients were moderately dependent (Barthel index 10-15). In three patients (6.5%), euthanasia was requested because of "unbearable suffering and severe loss of quality of life due to extensive weakness" and in another three (6.5%), requests for continuous deep sedation due to severe disabling dysphagia, cachexia, and dehydration was granted. The fact that end-of-life care interventions were reported in six of these Dutch patients (13%) reflects the severe disability and loss of quality of life at the end stage of this disease.

**[0006]** There is no drug approved for the treatment of sIBM as no treatments have been found to slow or reverse the progression of muscle weakness in sIBM (Greenberg 2009, Aggarwal and Oddis 2012). Moreover, patients with sIBM have not demonstrated a clinically meaningful response to agents used traditionally to treat inflammatory myopathies, including corticosteroids, methotrexate, azathioprine, or cyclophosphamide (Griggs 2006, Mann and Vencovsky 2011, Needham and Mastaglia 2007, Solorzano and Phillips 2011). Intravenous immunoglobulin is used off-label in some centers, but there is no evidence to support its long-term effectiveness in this condition. Similar overall conclusions can be drawn on the efficacy of different immunotherapies such as the anti-T lymphocyte inhibitor, the anti-TNF medication (etanercept) and beta-interferon 1A. Oxandrolone is still in an explorative phase and further data are required before reaching conclusions on its potential benefits. Therefore, there is currently a clear, unmet medical need in the treatment of patients with sIBM.

**[0007]** The mean rate of decline in muscle strength is 3.5-5.4% per year based on different methods and scores, with the potential rate of progression considerably faster for individual patients (Hohlfeld 2011, Cox et al 2011). Since sIBM causes dramatic skeletal muscle atrophy, treatments that target atrophy pathways in muscle, like bimagrumab, may be effective in this disease.

**[0008]** Preliminary data from Dr. Steven Greenberg's laboratory at Brigham & Women's Hospital suggest that the signaling pathway downstream of ActRIIB and other receptors may be inappropriately activated in sIBM, further supporting the hypothesis that ActRIIB inhibition could help patients with sIBM. Based on the data from 17 patients with sIBM

compared to 12 patients with polymyositis or dermatomyositis and 5 normal controls, patients with sIBM had prominent phosphorylated SMAD (pSMAD) signaling (which is downstream of the ActRIIB receptor and acts as a second messenger for TGF $\beta$  signaling), with a mean 27-fold increase compared to normal controls (Greenberg et al 2013).

**[0009]** On this basis, the hypothesis is that inappropriate signaling through the TGF $\beta$  pathway is contributing to the pathogenesis of sIBM. While it is not known if this TGF $\beta$  up-regulation occurs via the ActRIIB receptor or another TGF $\beta$  receptor, it seemed reasonable to test whether ActRIIB inhibition by bimagrumab can intervene on muscle atrophy signaling pathways and target weakness symptoms experienced by patients with sIBM.

**[0010]** Moreover, the study by Wojcik et al included analyses of biopsies from 12 sIBM patients and suggests that the myostatin/myostatin precursor, either alone, or bound to amyloid- $\beta$ , may play a role in the pathogenesis of sIBM (Wojcik et al 2005).

**[0011]** Bimagrumab (BYM338) is a monoclonal antibody developed to bind competitively to activin receptor type II (ActRII) with greater affinity than myostatin or activin, its natural ligands. Bimagrumab is a fully human antibody (modified IgG1, 234-235-Ala-Ala,  $\lambda_2$ ) which binds to the ligand binding domain of ActRII, thereby preventing binding and subsequent signaling of its ligands, one of which is myostatin and activin. Myostatin, a member of the transforming growth factor beta (TGF- $\beta$ ) superfamily, is a secreted protein that negatively regulates skeletal muscle mass in animals and humans. Myostatin signaling occurs at ActRII and its proposed mechanism of action is through the Smad 2/3 pathway to inhibit protein synthesis and myocyte differentiation and proliferation. Myostatin inhibition or genetic ablation increases muscle mass and strength (Lee et al 2005; Lee and McPherron 2001; Whittimore et al 2003).

**[0012]** BYM338 is cross-reactive with human and mouse ActRIIB and effective on human, cynomolgus, mouse and rat skeletal muscle cells. BYM338 is formulated for both intravenous (i.v.) and subcutaneous (s.c.) administration.

**[0013]** Data from study CBYM338X2205 on 14 patients with sIBM (11 active, 3 placebo) showed statistically significant increases in BYM338 relative to placebo for both muscle volume and lean body mass after a single dose of BYM338 30 mg/kg i.v. was administered. Eight weeks after dosing, the mean change from baseline in dominant thigh muscle volume (TMV) favored BYM338 (+6.5%; P=0.024). Non-dominant TMV and whole body lean mass (measured by DXA) also favored BYM338 (+7.6% and +5.7% respectively; P=0.009 and P=0.014). Patients were followed for 24 weeks after the single dose and demonstrated a numerical increase in muscle strength in several muscle groups as measured by both Quantitative Muscle Testing (QMT) and Manual Muscle Testing. Data also suggested benefits 16 weeks after the single BYM338 administration in physical function and mobility as shown by a 14.6% statistically significant increase (p=0.008) in the 6-minute walking distance test (6 MWD) as compared to placebo.

**[0014]** As illustrated by data from patients with sporadic inclusion body myositis, a progressive muscle degenerative disease, the rapid increases in lean body mass (>5% from baseline) induced by a single injection of bimagrumab (30 mg/kg) are able to trigger significant increases in physical performance (FIG. 1). Importantly, improvement of functional following muscle mass increase require a period of lag

time possibly reflecting the structural/functional remodeling of skeletal muscle before becoming fully matured and ready to serve increased contractile activities.

**[0015]** The present disclosure is further studying these favorable preliminary single dose findings and investigate how long-term treatment with different doses of bimagrumab influence the changes of muscle mass, muscle strength, physical function, and mobility in ambulatory sIBM patients.

**[0016]** Myostatin, ActRIIB Receptor and ActRIIB Receptor Antibodies

**[0017]** Bimagrumab, also known as BYM338, is a human monoclonal antibody developed to bind competitively to activin receptor type II B (ActRIIB) with greater affinity than myostatin, its principal natural ligand. Bimagrumab is disclosed in WO2010/125003, which is incorporated by reference herein in its entirety. Myostatin, a member of the transforming growth factor beta (TGF- $\beta$ ) superfamily, is a secreted protein that negatively regulates skeletal muscle mass in animals and humans, throughout the lifecycle. Myostatin signaling occurs at ActRIIB and its proposed mechanism of action is through the Smad 2/3 pathway to inhibit protein synthesis and myocyte differentiation and proliferation. The absence of myostatin in developing animals and humans results in a hypermuscular phenotype with an increased number and size of muscle fibers. Reducing the level of myostatin postpartum results in the hypertrophy of skeletal muscle due to an increase in the size of existing myofibers. In the adult, myostatin is produced in skeletal muscle and circulated in the blood in part as a latent inactive complex.

**[0018]** Consistent with the role of myostatin as an endogenous inhibitor of skeletal muscle mass, BYM338 dramatically increased skeletal muscle mass in preclinical murine models of disuse and steroid-induced atrophy and in toxicology studies with healthy cynomolgus monkeys. In addition, the increased mass in mouse and rat resulted in a corresponding increase in muscle strength (force production). Following i.v. and s.c. administration to mice and cynomolgus monkey, bimagrumab showed a consistent IgG1 pharmacokinetic (PK) profile with target mediated drug disposition (TMDD) and was well tolerated.

**[0019]** An analysis of the six dose levels of the first in human, single ascending dose study, suggests that single i.v. doses of 0.1, 0.3, 1, 3, 10 and 30 mg/kg of bimagrumab are safe, well tolerated, and produce a PK profile that is predictable from modeled preclinical data. At four weeks doses of 3-30 mg/kg result in a measurable increase in thigh muscle volume of 2.7-5.2% from baseline over placebo.

**[0020]** The potential clinical application of bimagrumab is in conditions with muscle wasting. Of particular note are clinical scenarios that require the recovery of muscle mass from atrophy resulting from disuse, cachexia, corticosteroid use, and sarcopenia. Sporadic inclusion-body myositis (sIBM) is a clinical situation in which elements of all of these are likely to play a part.

#### SUMMARY OF THE DISCLOSURE

**[0021]** Intervening in a patient population with sporadic inclusion body myositis (sIBM) would be highly innovative and would meet a high unmet medical need. Indeed, there is currently no therapeutic option to treat sIBM. This objective is achieved by the use, methods and dosing regimen provided within this disclosure.

**[0022]** A first subject matter of the disclosure therefore relates to methods or uses for treating sIBM of compositions

comprising a myostatin antagonist, which can be a myostatin binding molecule or an ActRII binding molecule. The myostatin binding molecule can be, e.g., an antagonist antibody to myostatin. The ActRII binding molecule can be, e.g., an antagonist antibody to ActRII, e.g., bimagrumab also known as BYM338.

**[0023]** “Myostatin antagonist” as used herein refers to a molecule capable of antagonizing (e.g., reducing, inhibiting, decreasing, delaying) myostatin function, expression and/or signalling (e.g., by blocking the binding of myostatin to the myostatin receptor, i.e., ActRIIB). Non-limiting examples of antagonists include myostatin binding molecules and ActRIIB receptor binding molecules. In some embodiments of the disclosed methods, regimens, kits, processes, uses and compositions, a myostatin antagonist is employed.

**[0024]** By “myostatin binding molecule” is meant any molecule capable of binding to the human myostatin antigen either alone or associated with other molecules. The binding reaction may be shown by standard methods (qualitative assays) including, for example, a binding assay, competition assay or a bioassay for determining the inhibition of myostatin binding to its receptor or any kind of binding assays, with reference to a negative control test in which an antibody of unrelated specificity, but ideally of the same isotype, e.g., an anti-CD25 antibody, is used. Non-limiting examples of myostatin binding molecules include small molecules, myostatin receptor decoys, and antibodies that bind to myostatin as produced by B-cells or hybridomas and chimeric, CDR-grafted or human antibodies or any fragment thereof, e.g., F(ab')<sub>2</sub> and Fab fragments, as well as single chain or single domain antibodies. Preferably the myostatin binding molecule antagonizes (e.g., reduces, inhibits, decreases, delays) myostatin function, expression and/or signalling. In some embodiments of the disclosed methods, regimens, kits, processes, uses and compositions, a myostatin binding molecule is employed.

**[0025]** By “ActRII binding molecule” is meant any molecule capable of binding to the human ActRII receptor (ActRII A and/or ActRIIB) either alone or associated with other molecules. The binding reaction may be shown by standard methods (qualitative assays) including, for example, a binding assay, competition assay or a bioassay for determining the inhibition of ActRII receptor binding to myostatin or any kind of binding assays, with reference to a negative control test in which an antibody of unrelated specificity, but ideally of the same isotype, e.g., an anti-CD25 antibody, is used. Non-limiting examples of ActRII receptor binding molecules include small molecules, myostatin decoys, and antibodies to the ActRII receptor as produced by B-cells or hybridomas and chimeric, CDR-grafted or human antibodies or any fragment thereof, e.g., F(ab')<sub>2</sub> and Fab fragments, as well as single chain or single domain antibodies. Preferably the ActRII receptor binding molecule antagonizes (e.g., reduces, inhibits, decreases, delays) myostatin function, expression and/or signalling. In some embodiments of the disclosed methods, regimens, kits, processes, uses and compositions, an ActRIIB receptor binding molecule is employed.

**[0026]** In another embodiment the composition comprises an anti-ActRII antibody which binds to a binding domain consisting of amino acids 19-134 of SEQ ID NO: 181 (SEQ ID NO:182), or to an epitope comprising or consisting of (a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN—SEQ ID NO:188); (b) amino acids 76-84 of SEQ ID NO:181 (GCWLDDFNC—SEQ ID NO:186); (c) amino acids 75-85

of SEQ ID NO:181 (KGCWLDDFNCY—SEQ ID NO:190); (d) amino acids 52-56 of SEQ ID NO:181 (EQDKR—SEQ ID NO:189); (e) amino acids 49-63 of SEQ ID NO:181 (CEGEQDKRLHCYASW—SEQ ID NO:187); (f) amino acids 29-41 of SEQ ID NO:181 (CIYYNANWELERT—SEQ ID NO:191); (g) amino acids 100-110 of SEQ ID NO:181 (YFCCCEGNFCN—SEQ ID NO:192); or (h) amino acids 78-83 of SEQ ID NO:181 (WLDDFN) and amino acids 52-56 of SEQ ID NO:181 (EQDKR).

**[0027]** In a yet further alternative embodiment, the above mentioned compositions comprise an anti-ActRII antibody which binds ActRIIB with a 10-fold or greater affinity than it binds to ActRIIA.

**[0028]** Additionally, the disclosure relates to composition wherein the anti-ActRIIB antibody comprises a heavy chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 1-14; a heavy chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28; a heavy chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42; a light chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56; a light chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 57-70; and a light chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84.

**[0029]** In certain embodiments, the disclosure provides compositions wherein the anti-ActRII antibody comprises: (a) a heavy chain variable region CDR1 of SEQ ID NO: 1; a heavy chain variable region CDR2 of SEQ ID NO: 15; a heavy chain variable region CDR3 of SEQ ID NO: 29; a light chain variable region CDR1 of SEQ ID NO: 43; a light chain variable region CDR2 of SEQ ID NO: 57; and a light chain variable region CDR3 of SEQ ID NO: 71; (b) a heavy chain variable region CDR1 of SEQ ID NO: 2; a heavy chain variable region CDR2 of SEQ ID NO: 16; a heavy chain variable region CDR3 of SEQ ID NO: 30; a light chain variable region CDR1 of SEQ ID NO: 44; a light chain variable region CDR2 of SEQ ID NO: 58; and a light chain variable region CDR3 of SEQ ID NO: 72; (c) a heavy chain variable region CDR1 of SEQ ID NO: 3; a heavy chain variable region CDR2 of SEQ ID NO: 17; a heavy chain variable region CDR3 of SEQ ID NO: 31; a light chain variable region CDR1 of SEQ ID NO: 45; a light chain variable region CDR2 of SEQ ID NO: 59; and a light chain variable region CDR3 of SEQ ID NO: 73; (d) a heavy chain variable region CDR1 of SEQ ID NO: 4; a heavy chain variable region CDR2 of SEQ ID NO: 18; a heavy chain variable region CDR3 of SEQ ID NO: 32; a light chain variable region CDR1 of SEQ ID NO: 46; a light chain variable region CDR2 of SEQ ID NO: 60; and a light chain variable region CDR3 of SEQ ID NO: 74; (e) a heavy chain variable region CDR1 of SEQ ID NO: 5; a heavy chain variable region CDR2 of SEQ ID NO: 19; a heavy chain variable region CDR3 of SEQ ID NO: 33; a light chain variable region CDR1 of SEQ ID NO: 47; a light chain variable region CDR2 of SEQ ID NO: 61; and a light chain variable region CDR3 of SEQ ID NO: 75; (f) a heavy chain variable region CDR1 of SEQ ID NO: 6; a heavy chain variable region CDR2 of SEQ ID NO: 20; a heavy chain variable region CDR3 of SEQ ID NO: 34; a light chain

variable region CDR1 of SEQ ID NO: 48; a light chain variable region CDR2 of SEQ ID NO: 62; and a light chain variable region CDR3 of SEQ ID NO: 76, (g) a heavy chain variable region CDR2 of SEQ ID NO: 21; a heavy chain variable region CDR3 of SEQ ID NO: 35; a light chain variable region CDR1 of SEQ ID NO: 49; a light chain variable region CDR2 of SEQ ID NO: 63; and a light chain variable region CDR3 of SEQ ID NO: 77, (h) a heavy chain variable region CDR1 of SEQ ID NO: 8; a heavy chain variable region CDR2 of SEQ ID NO: 22; a heavy chain variable region CDR3 of SEQ ID NO: 36; a light chain variable region CDR1 of SEQ ID NO: 50 a light chain variable region CDR2 of SEQ ID NO: 64; and a light chain variable region CDR3 of SEQ ID NO: 78, (i) a heavy chain variable region CDR1 of SEQ ID NO: 9; a heavy chain variable region CDR2 of SEQ ID NO: 23; a heavy chain variable region CDR3 of SEQ ID NO: 37; a light chain variable region CDR1 of SEQ ID NO: 51; a light chain variable region CDR2 of SEQ ID NO: 65; and a light chain variable region CDR3 of SEQ ID NO: 79, (j) a heavy chain variable region CDR1 of SEQ ID NO: 10; a heavy chain variable region CDR2 of SEQ ID NO: 24; a heavy chain variable region CDR3 of SEQ ID NO: 38; a light chain variable region CDR1 of SEQ ID NO: 52; a light chain variable region CDR2 of SEQ ID NO: 66; and a light chain variable region CDR3 of SEQ ID NO: 80, (k) a heavy chain variable region CDR1 of SEQ ID NO: 11; a heavy chain variable region CDR2 of SEQ ID NO: 25; a heavy chain variable region CDR3 of SEQ ID NO: 39; a light chain variable region CDR1 of SEQ ID NO: 53; a light chain variable region CDR2 of SEQ ID NO: 67; and a light chain variable region CDR3 of SEQ ID NO: 81, (l) a heavy chain variable region CDR1 of SEQ ID NO: 12; a heavy chain variable region CDR2 of SEQ ID NO: 26; a heavy chain variable region CDR3 of SEQ ID NO: 40; a light chain variable region CDR1 of SEQ ID NO: 54; a light chain variable region CDR2 of SEQ ID NO: 68; and a light chain variable region CDR3 of SEQ ID NO: 82, (m) a heavy chain variable region CDR1 of SEQ ID NO: 13; a heavy chain variable region CDR2 of SEQ ID NO: 27; a heavy chain variable region CDR3 of SEQ ID NO: 41; a light chain variable region CDR1 of SEQ ID NO: 55; a light chain variable region CDR2 of SEQ ID NO: 69; and a light chain variable region CDR3 of SEQ ID NO: 83, or (n) a heavy chain variable region CDR1 of SEQ ID NO: 14; a heavy chain variable region CDR2 of SEQ ID NO: 28; a heavy chain variable region CDR3 of SEQ ID NO: 42; a light chain variable region CDR1 of SEQ ID NO: 56; a light chain variable region CDR2 of SEQ ID NO: 70; and a light chain variable region CDR3 of SEQ ID NO: 84.

**[0030]** In yet another embodiment, the above mentioned anti-ActR11 antibody comprises (i) a full length heavy chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs:146-150 and 156-160, (ii) a full length light chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs:141-145 and 151-155 or (iii) (a) the variable heavy chain sequence of SEQ ID NO: 99 and variable light chain sequence of SEQ ID NO: 85; (b) the variable heavy chain sequence of SEQ ID NO: 100 and variable light chain sequence of SEQ ID NO: 86; (c) the variable heavy chain sequence of SEQ ID NO: 101 and variable light

chain sequence of SEQ ID NO: 87; (d) the variable heavy chain sequence of SEQ ID NO: 102 and variable light chain sequence of SEQ ID NO: 88; (e) the variable heavy chain sequence of SEQ ID NO: 103 and variable light chain sequence of SEQ ID NO: 89; (f) the variable heavy chain sequence of SEQ ID NO: 104 and variable light chain sequence of SEQ ID NO: 90; (g) the variable heavy chain sequence of SEQ ID NO: 105 and variable light chain sequence of SEQ ID NO: 91; (h) the variable heavy chain sequence of SEQ ID NO: 106 and variable light chain sequence of SEQ ID NO: 92; (i) the variable heavy chain sequence of SEQ ID NO: 107 and variable light chain sequence of SEQ ID NO: 93; (j) the variable heavy chain sequence of SEQ ID NO: 108 and variable light chain sequence of SEQ ID NO: 94; (k) the variable heavy chain sequence of SEQ ID NO: 109 and variable light chain sequence of SEQ ID NO: 95; (l) the variable heavy chain sequence of SEQ ID NO: 110 and variable light chain sequence of SEQ ID NO: 96; (m) the variable heavy chain sequence of SEQ ID NO: 111 and variable light chain sequence of SEQ ID NO: 97; or (n) the variable heavy chain sequence of SEQ ID NO: 112 and variable light chain sequence of SEQ ID NO: 98.

**[0031]** In certain aspects the disclosure relates to the above described compositions, wherein the comprised anti-ActR11 antibody comprises (a) the heavy chain sequence of SEQ ID NO: 146 and light chain sequence of SEQ ID NO: 141; (b) the heavy chain sequence of SEQ ID NO: 147 and light chain sequence of SEQ ID NO: 142; (c) the heavy chain sequence of SEQ ID NO: 148 and light chain sequence of SEQ ID NO: 143; (d) the heavy chain sequence of SEQ ID NO: 149 and light chain sequence of SEQ ID NO: 144; (e) the heavy chain sequence of SEQ ID NO: 150 and light chain sequence of SEQ ID NO: 145; (f) the heavy chain sequence of SEQ ID NO: 156 and light chain sequence of SEQ ID NO: 151; (g) the heavy chain sequence of SEQ ID NO: 157 and light chain sequence of SEQ ID NO: 152; (h) the heavy chain sequence of SEQ ID NO: 158 and light chain sequence of SEQ ID NO: 153; (i) the heavy chain sequence of SEQ ID NO: 159 and light chain sequence of SEQ ID NO: 154; or (j) the heavy chain sequence of SEQ ID NO: 160 and light chain sequence of SEQ ID NO: 155.

**[0032]** An additional subject matter of the disclosure relates to composition, wherein (i) the anti-ActR11 antibody cross-blocks or is cross blocked by one of the above described antibodies, (ii) has altered effector function through mutation of the Fc region and/or (iii) binds to an epitope recognized by one of the above described antibodies.

**[0033]** In yet another embodiment, the disclosed composition comprises an anti-ActR11 antibody encoded by pBW522 (DSM22873) or pBW524 (DSM22874).

#### BRIEF DESCRIPTION OF THE FIGURES

**[0034]** FIG. 1: Bimagrumab-induced changes of lean body mass (LBM), quadriceps strength (QMT) and 6-minute walking distance (6 MWD) from baseline in sporadic inclusion body myositis patients. Note the time-lag between increase in LBM (at Week 8 to Week 16) and significant increases in muscle strength and physical performance starting at Week 16.

**[0035]** FIG. 2: Study design

#### DEFINITIONS

**[0036]** In order that the present disclosure may be more readily understood, certain terms are first defined. Additional definitions are set forth throughout the detailed description.

**[0037]** The term “comprising” means “including” e.g. a composition “comprising” X may consist exclusively of X or may include something additional e.g. X+Y.

**[0038]** The term “about” in relation to a numerical value x means, for example,  $x \pm 10\%$ .

**[0039]** The following exemplifies a possible pre-clinical treatment regimes to evaluate possible effects of a treatment with a myostatin antagonist, e.g., myostatin binding molecule or ActRII binding molecule, preferably ActRII binding molecule, more preferably an antagonist antibody to ActRII, e.g. bimagrumab.

**[0040]** The treatment is exemplified by using cynomolgus monkeys, but the described experiments are not limited to monkeys and the skilled person knows how to set up suitable experiments or dosing regimens for other species, in particular for humans: the anti-ActRII antibody, e.g., bimagrumab, can be administered once a week for 3 months to male and female cynomolgus monkeys by intravenous injection. 32 cynomolgus monkeys (16/sex) can be assigned to one of four treatment groups (3 to 5 animals/sex/group) and can be administered intravenous injections of either vehicle or the ActRIIB antibody, e.g., BYM338, at 10, 30, or 100 mg/kg once weekly for 13 weeks (total of 14 doses; doses shall be selected on the basis of muscle hypertrophy activity in monkey).

**[0041]** The terms “ActRII”, “ActRIIA” and “ActRIIB” refer to Activin receptors. Activins signal through a heterodimeric complex of receptor serine kinases which include at least two type I (I and IB) and two type II “ActRII” (IIA and IIB, aka ACVR2A and ACVR2B) receptors. These receptors are all transmembrane proteins, composed of a ligand-binding extracellular domain with a cysteine-rich region, a transmembrane domain, and a cytoplasmic domain with predicted serine/threonine specificity. Type I receptors are essential for signaling while type II receptors are required for binding ligands and for expression/recruitment of type I receptors. Type I and II receptors form a stable complex after ligand binding resulting in the phosphorylation of type I receptors by type II receptors. The activin receptor II (ActRII) is a receptor for myostatin. The activin receptor type II B (ActRIIB) is a receptor for myostatin. The activin receptor type II A (ActRIIA) is also a receptor for myostatin. The term ActRIIB or Act IIB receptor refers to human ActRIIB as defined in SEQ ID NO: 181 (AAC64515.1, GI:3769443). Research grade polyclonal and monoclonal anti-ActRIIB antibodies are known in the art, such as those made by R&D Systems®, MN, USA. Of course, antibodies could be raised against ActRIIB from other species and used to treat pathological conditions in those species.

**[0042]** The term “immune response” refers to the action of, for example, lymphocytes, antigen presenting cells, phagocytic cells, granulocytes, and soluble macromolecules produced by the above cells or the liver (e.g. antibodies, cytokines, and complement) that results in selective damage to, destruction of, or elimination from the human body of invading pathogens, cells or tissues infected with pathogens, cancerous cells, or, in cases of autoimmunity or pathological inflammation, normal human cells or tissues.

**[0043]** A “signaling activity” refers to a biochemical causal relationship generally initiated by a protein-protein interaction such as binding of a growth factor to a receptor, resulting in transmission of a signal from one portion of a cell to another portion of a cell. In general, the transmission involves specific phosphorylation of one or more tyrosine, serine, or

threonine residues on one or more proteins in the series of reactions causing signal transduction. Penultimate processes typically include nuclear events, resulting in a change in gene expression.

**[0044]** The term “antibody” as referred to herein includes whole antibodies and any antigen binding fragment (i.e. “antigen-binding portion”) or single chains thereof. A naturally occurring “antibody” is a glycoprotein comprising at least two heavy (H) chains and two light (L) chains interconnected by disulfide bonds. Each heavy chain is comprised of a heavy chain variable region (abbreviated herein as  $V_H$ ) and a heavy chain constant region. The heavy chain constant region is comprised of three domains, CH1, CH2 and CH3. Each light chain is comprised of a light chain variable region (abbreviated herein as  $V_L$ ) and a light chain constant region. The light chain constant region is comprised of one domain,  $C_L$ . The  $V_H$  and  $V_L$  regions can be further subdivided into regions of hypervariability, termed complementarity determining regions (CDR), interspersed with regions that are more conserved, termed framework regions (FR). Each  $V_H$  and  $V_L$  is composed of three CDRs and four FRs arranged from amino-terminus to carboxy-terminus in the following order: FR1, CDR1, FR2, CDR2, FR3, CDR3, FR4. The variable regions of the heavy and light chains contain a binding domain that interacts with an antigen. The constant regions of the antibodies may mediate the binding of the immunoglobulin to host tissues or factors, including various cells of the immune system (e.g. effector cells) and the first component (C1q) of the classical complement system.

**[0045]** The term “antigen-binding portion” of an antibody (or simply “antigen portion”), as used herein, refers to full length or one or more fragments of an antibody that retain the ability to specifically bind to an antigen (e.g. a portion of ActRIIB). It has been shown that the antigen-binding function of an antibody can be performed by fragments of a full-length antibody. Examples of binding fragments encompassed within the term “antigen-binding portion” of an antibody include a Fab fragment, a monovalent fragment consisting of the  $V_L$ ,  $V_H$ ,  $C_L$  and CH1 domains; a  $F(ab)_2$  fragment, a bivalent fragment comprising two Fab fragments, each of which binds to the same antigen, linked by a disulfide bridge at the hinge region; a Fd fragment consisting of the  $V_H$  and CH1 domains; a Fv fragment consisting of the  $V_L$  and  $V_H$  domains of a single arm of an antibody; a dAb fragment (Ward et al., 1989 Nature 341:544-546), which consists of a  $V_H$  domain; and an isolated complementarity determining region (CDR).

**[0046]** Furthermore, although the two domains of the Fv fragment,  $V_L$  and  $V_H$ , are coded for by separate genes, they can be joined, using recombinant methods, by a synthetic linker that enables them to be made as a single protein chain in which the  $V_L$  and  $V_H$  regions pair to form monovalent molecules (known as single chain Fv (scFv); see e.g. Bird et al., 1988 Science 242:423-426; and Huston et al., 1988 Proc. Natl. Acad. Sci. 85:5879-5883). Such single chain antibodies are also intended to be encompassed within the term “antigen-binding region” of an antibody. These antibody fragments are obtained using conventional techniques known to those of skill in the art, and the fragments are screened for utility in the same manner as are intact antibodies.

**[0047]** An “isolated antibody”, as used herein, refers to an antibody that is substantially free of other antibodies having different antigenic specificities (e.g., an isolated antibody that specifically binds ActRIIB is substantially free of antibodies



that specifically bind antigens other than ActRIIB). An isolated antibody that specifically binds ActRIIB may, however, have cross-reactivity to other antigens, such as ActRIIB molecules from other species. Moreover, an isolated antibody may be substantially free of other cellular material and/or chemicals.

**[0048]** The terms “cross-block”, “cross-blocked” and “cross-blocking” are used interchangeably herein to mean the ability of an antibody or other binding agent to interfere with the binding of other antibodies or binding agents to ActRIIB, particularly the ligand binding domain, in a standard competitive binding assay.

**[0049]** 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.

**[0050]** The term “human antibody”, as used herein, is intended to include antibodies having variable regions in which both the framework and CDR regions are derived from sequences of human origin. Furthermore, if the antibody contains a constant region, the constant region also is derived from such human sequences, e.g. human germline sequences, or mutated versions of human germline sequences or antibody containing consensus framework sequences derived from human framework sequences analysis, for example, as described in Knappik, et al. (2000. *J Mol Biol* 296, 57-86). The human antibodies of the disclosure may include amino acid residues not encoded by human sequences (e.g. mutations introduced by random or site-specific mutagenesis in vitro or by somatic mutation in vivo). However, the term “human antibody”, as used herein, is not intended to include antibodies in which CDR sequences derived from the germline of another mammalian species, such as a mouse, have been grafted onto human framework sequences.

**[0051]** The term “human monoclonal antibody” refers to antibodies displaying a single binding specificity which have variable regions in which both the framework and CDR regions are derived from human sequences. In one embodiment, the human monoclonal antibodies are produced by a hybridoma which includes a B cell obtained from a transgenic nonhuman animal, e.g. a transgenic mouse, having a genome comprising a human heavy chain transgene and a light chain transgene fused to an immortalized cell.

**[0052]** The term “recombinant human antibody”, as used herein, includes all human antibodies that are prepared, expressed, created or isolated by recombinant means, such as antibodies isolated from an animal (e.g. a mouse) that is transgenic or transchromosomal for human immunoglobulin genes or a hybridoma prepared therefrom, antibodies isolated from a host cell transformed to express the human antibody, e.g. from a transfectoma, antibodies isolated from a recombinant, combinatorial human antibody library, and antibodies prepared, expressed, created or isolated by any other means that involve splicing of all or a portion of a human immunoglobulin gene, sequences to other DNA sequences. Such recombinant human antibodies have variable regions in which the framework and CDR regions are derived from human germline immunoglobulin sequences. In certain embodiments, however, such recombinant human antibodies can be subjected to in vitro mutagenesis (or, when an animal transgenic for human Ig sequences is used, in vivo somatic mutagenesis) and thus the amino acid sequences of the  $V_H$  and  $V_L$  regions of the recombinant antibodies are sequences

that, while derived from and related to human germline  $V_H$  and  $V_L$  sequences, may not naturally exist within the human antibody germline repertoire in vivo.

**[0053]** As used herein, “isotype” refers to the antibody class (e.g. IgM, IgE, IgG such as IgG1 or IgG2) that is provided by the heavy chain constant region genes.

**[0054]** The phrases “an antibody recognizing an antigen” and “an antibody specific for an antigen” are used interchangeably herein with the term “an antibody which binds specifically to an antigen”.

**[0055]** As used herein, an antibody that “specifically binds to ActRIIB polypeptide” is intended to refer to an antibody that binds to human ActRIIB polypeptide with a  $K_D$  of about 100 nM or less, about 10 nM or less, about 1 nM or less. An antibody that “cross-reacts with an antigen other than ActRIIB” is intended to refer to an antibody that binds that antigen with a  $K_D$  of about  $10 \times 10^{-9}$  M or less, about  $5 \times 10^{-9}$  M or less, or about  $2 \times 10^{-9}$  M or less. An antibody that “does not cross-react with a particular antigen” is intended to refer to an antibody that binds to that antigen, with a  $K_D$  of about  $1.5 \times 10^{-8}$  M or greater, or a  $K_D$  of about  $5 \cdot 10 \times 10^{-8}$  M, or about  $1 \times 10^{-7}$  M or greater. In certain embodiments, such antibodies that do not cross-react with the antigen exhibit essentially undetectable binding against these proteins in standard binding assays.  $K_D$  may be determined using a biosensor system, such as a Biacore® system, or Solution Equilibrium Titration.

**[0056]** As used herein, the term “antagonist antibody” is intended to refer to an antibody that inhibits ActRIIB induced signaling activity in the presence of myostatin or of other ActRIIB ligands such as activins or GDF-11 and/or to an antibody that inhibits ActRIA induced signaling activity in the presence of myostatin or of other ActRIA ligands such as activins or GDF-11. Examples of an assay to detect this include inhibition of myostatin induced signalling (for instance by a Smad dependent reporter gene assay), inhibition of myostatin induced Smad phosphorylation (P-Smad ELISA) and inhibition of myostatin induced inhibition of skeletal muscle cell differentiation (for instance by a creatine kinase assay).

**[0057]** In some embodiments, the antibodies inhibit myostatin induced signalling as measured in a Smad dependent reporter gene assay at an  $IC_{50}$  of about 10 nM or less, about 1 nM or less, or about 100 pM or less.

**[0058]** As used herein, an antibody with “no agonistic activity” is intended to refer to an antibody that does not significantly increase ActRIIB mediated signaling activity in the absence of myostatin in a cell-based assay, such as inhibition of myostatin induced signalling (for instance by a Smad dependent reporter gene assay), inhibition of myostatin induced Smad phosphorylation (P-Smad ELISA) and inhibition of myostatin induced inhibition of skeletal muscle cell differentiation (for instance by a creatine kinase assay). Such assays are described in more details in the examples below.

**[0059]** The term “ $K_{assoc}$ ” or “ $K_a$ ”, as used herein, is intended to refer to the association rate of a particular antibody-antigen interaction, whereas the term “ $K_{dis}$ ” or “ $K_d$ ”, as used herein, is intended to refer to the dissociation rate of a particular antibody-antigen interaction. The term “ $K_D$ ”, as used herein, is intended to refer to the dissociation constant, which is obtained from the ratio of  $K_{dis}$  to  $K_a$  (i.e.  $K_d/K_a$ ) and is expressed as a molar concentration (M).  $K_D$  values for antibodies can be determined using methods well established in the art. A method for determining the  $K_D$  of an antibody is

by using surface plasmon resonance, such as the biosensor system of Biacore®, or Solution Equilibrium Titration (SET) (see Friguet B et al. (1985) *J. Immunol Methods*; 77(2): 305-319, and Hanel C et al. (2005) *Anal Biochem*; 339(1): 182-184).

**[0060]** As used herein, the term “Affinity” refers to the strength of interaction between antibody and antigen at single antigenic sites. Within each antigenic site, the variable region of the antibody “arm” interacts through weak non-covalent forces with antigen at numerous sites; the more interactions, the stronger the affinity.

**[0061]** As used herein, the term “Avidity” refers to an informative measure of the overall stability or strength of the antibody-antigen complex. It is controlled by three major factors: antibody epitope affinity; the valency of both the antigen and antibody; and the structural arrangement of the interacting parts. Ultimately these factors define the specificity of the antibody, that is, the likelihood that the particular antibody is binding to a precise antigen epitope.

**[0062]** As used herein, the term “ADCC” or “antibody dependent cellular cytotoxicity” activity refers to human B cell depleting activity. ADCC activity can be measured by the human B cell depleting assays known in the art.

**[0063]** In order to get a higher avidity probe, a dimeric conjugate (two molecules of an antibody protein coupled to a FACS marker) can be constructed, thus making low affinity interactions (such as with the germline antibody) more readily detected by FACS. In addition, another means to increase the avidity of antigen binding involves generating dimers, trimers or multimers of any of the constructs described herein of the anti-ActRIIB antibodies. Such multimers may be generated through covalent binding between individual modules, for example, by imitating the natural C-to-N-terminus binding or by imitating antibody dimers that are held together through their constant regions. The bonds engineered into the Fc/Fc interface may be covalent or non-covalent. In addition, dimerizing or multimerizing partners other than Fc can be used in ActRIIB hybrids to create such higher order structures. For example, it is possible to use multimerizing domains such as the trimerizing domain described in WO2004/039841 or pentamerizing domain described in WO98/18943.

**[0064]** As used herein, the term “selectivity” for an antibody refers to an antibody that binds to a certain target polypeptide but not to closely related polypeptides.

**[0065]** As used herein, the term “high affinity” for an antibody refers to an antibody having a  $K_D$  of 1 nM or less for a target antigen. As used herein, the term “subject” includes any human or nonhuman animal.

**[0066]** The term “nonhuman animal” includes all vertebrates, e.g. mammals and non-mammals, such as nonhuman primates, sheep, dogs, cats, horses, cows, chickens, amphibians, reptiles, etc.

**[0067]** As used herein, the term, “optimized” means that a nucleotide sequence has been altered to encode an amino acid sequence using codons that are preferred in the production cell or organism, generally a eukaryotic cell, for example, a cell of *Pichia*, a cell of *Trichoderma*, a Chinese Hamster Ovary cell (CHO) or a human cell. The optimized nucleotide sequence is engineered to retain completely or as much as possible the amino acid sequence originally encoded by the starting nucleotide sequence, which is also known as the “parental” sequence. The optimized sequences herein have been engineered to have codons that are preferred in CHO

mammalian cells, however optimized expression of these sequences in other eukaryotic cells is also envisioned herein. The amino acid sequences encoded by optimized nucleotide sequences are also referred to as optimized.

#### DETAILED DESCRIPTION OF THE DISCLOSURE

**[0068]** It has been discovered that antibodies directed to the ActRII receptors, e.g. bimagrumab, can prevent myostatin from binding to the receptor, thus treating sIBM patients.

**[0069]** Therefore, in one aspect, the disclosure provides a composition comprising a myostatin antagonist, e.g., myostatin binding molecule or ActRII binding molecule, preferably ActRII binding molecule, more preferably an anti-ActRII antibody, e.g. bimagrumab or a functional protein comprising an antigen-binding portion of said antibody for use. In one embodiment, the ActRIIB is human ActRIIB. The polypeptide sequence of human ActRIIB is recited in SEQ ID NO: 181 (AAC64515.1, GI:3769443). In one embodiment, the antibody or functional protein is from a mammal, having an origin such as human or camelid. Thus the antibody comprised in the disclosed composition may be a chimeric, human or a humanized antibody. In a particular embodiment, the anti-ActRIIB antibody comprised in the disclosed composition is characterized as having an antigen-binding region that is specific for the target protein ActRIIB and binds to ActRIIB or a fragment of ActRIIB.

**[0070]** The disclosed composition and regimen are also suitable for use in treating age related mobility disability, cancer cachexia, chronic obstructive pulmonary disease (COPD) and joint replacement, e.g. knee arthroplasty or hip arthroplasty, or hip fracture.

**[0071]** In one embodiment, the antibodies comprised in the disclosed composition are ActRII antagonists with no or low agonistic activity. In another embodiment, the antibody or functional fragment comprised in the disclosed composition binds the target protein ActRII and decreases the binding of myostatin to ActRII to a basal level. In a further aspect of this embodiment, the antibody or functional fragment comprised in the disclosed composition completely prevents myostatin from binding to ActRII. In a further embodiment, the antibody or functional fragment comprised in the disclosed composition inhibits Smad activation. In a further embodiment, the antibody or functional fragment comprised in the disclosed composition inhibits activin receptor type IIB mediated myostatin-induced inhibition of skeletal differentiation via the Smad-dependent pathway.

**[0072]** The binding may be determined by one or more assays that can be used to measure an activity which is either antagonism or agonism by the antibody. Preferably, the assays measure at least one of the effects of the antibody on ActRIIB that include: inhibition of myostatin binding to ActRIIB by ELISA, inhibition of myostatin induced signaling (for instance by a Smad dependent reporter gene assay), inhibition of myostatin induced Smad phosphorylation (P-Smad ELISA) and inhibition of myostatin induced inhibition of skeletal muscle cell differentiation (for instance by a creatine kinase assay).

**[0073]** In one embodiment, the disclosure provides compositions comprising antibodies that specifically bind to the myostatin binding region (i.e. ligand binding domain) of ActRIIB. This ligand binding domain consists of amino acids

19-134 of SEQ ID NO: 181 and has been assigned SEQ ID NO: 182 herein. The ligand binding domain comprises several below described epitopes.

**[0074]** In one embodiment, the antibodies comprised in the disclosed composition bind to ActRIIB with a  $K_D$  of about 100 nM or less, about 10 nM or less, about 1 nM or less. Preferably, the antibodies comprised in the disclosed composition bind to ActRIIB with an affinity of 100 pM or less (i.e. about 100 pM, about 50 pM, about 10 pM, about 2 pM, about 1 pM or less). In one embodiment, the antibodies comprised in the disclosed composition bind to ActRIIB with an affinity of between about 1 and about 10 pM.

**[0075]** In one embodiment, the antibodies comprised in the disclosed composition do not cross-react with an ActRIIB related protein, particularly do not cross-react with human ActRIIA (NP\_001607.1, GI:4501897). In another embodiment, the antibodies comprised in the disclosed composition cross-react with ActRIIA and bind to ActRIIB with equivalent affinity, or about 1, 2, 3, 4 or 5-fold greater affinity than they bind to ActRIIA, more preferably about 10-fold, still more preferably about 20-, 30-, 40- or 50-fold, still more preferably about 100-fold.

**[0076]** In one embodiment, the antibodies comprised in the disclosed composition bind to ActRIIA with an affinity of 100 pM or more (i.e. about 250 pM, about 500 pM, about 1 nM, about 5 nM or more).

**[0077]** In one embodiment the antibodies comprised in the disclosed composition are of the IgG<sub>2</sub> isotype.

**[0078]** In another embodiment, the antibodies comprised in the disclosed composition are of the IgG<sub>1</sub> isotype. In a further embodiment, the antibodies comprised in the disclosed composition are of the IgG1 isotype and have an altered effector function through mutation of the Fc region. Said altered effector function may be a reduced ADCC and CDC activity. In one embodiment, said altered effector function is silenced ADCC and CDC activity.

**[0079]** In another related embodiment, the antibodies comprised in the disclosed composition are fully human or humanized IgG1 antibodies with no antibody dependent cellular cytotoxicity (ADCC) activity or CDC activity and bind to a region of ActRIIB consisting of amino acids 19-134 of SEQ ID NO:181.

**[0080]** In another related embodiment, the antibodies comprised in the disclosed composition are fully human or humanized IgG1 antibodies with reduced antibody dependent cellular cytotoxicity (ADCC) activity or CDC activity and bind to a region of ActRIIB consisting of amino acids 19-134 of SEQ ID NO:181.

**[0081]** The present disclosure relates to compositions comprising human or humanized anti-ActRIIB antibodies for use reducing time to mechanical ventilation liberation in an intensive care patient with failure to wean from the mechanical ventilation.

**[0082]** In certain embodiments, the antibodies comprised in the disclosed composition are derived from particular heavy and light chain sequences and/or comprise particular structural features such as CDR regions comprising particular amino acid sequences. The disclosure provides isolated ActRIIB antibodies, methods of making such antibodies, immunoconjugates and multivalent or multispecific molecules comprising such antibodies and pharmaceutical compositions containing the antibodies, immunoconjugates or bispecific molecules.

**[0083]** In alternative embodiments the disclosure relates to compositions comprising a myostatin antagonist for use according to the following aspects:

**[0084]** 1. A myostatin antagonist for use in treating sporadic inclusion body myositis.

**[0085]** 2. A myostatin antagonist for use according to aspect 1, wherein said myostatin antagonist is to be administered to a patient in need thereof at a dose of about 1-10 mg/kg.

**[0086]** 3. A myostatin antagonist for use according to aspects 1-2, wherein said myostatin antagonist is to be administered at a dose of about 1, about 3 or about 10 mg/kg body weight.

**[0087]** 4. A myostatin antagonist for use according to aspects 1-3, wherein said myostatin antagonist is to be administered intravenously.

**[0088]** 5. A myostatin antagonist for use according to any one of aspects 1-4, wherein said myostatin antagonist is to be administered every four weeks.

**[0089]** 6. A myostatin antagonist for use according to any one of aspects 1-5, wherein said patient is ambulatory.

**[0090]** 7. A myostatin antagonist for use according to any one of aspects 1-6, wherein treating sporadic inclusion body myositis comprises slowing down the progression of the disease or improving physical function and mobility.

**[0091]** 8. A myostatin antagonist for use according to any one of aspects 1-6, wherein treating sporadic inclusion body myositis comprises improving dysphagia or swallowing difficulties.

**[0092]** 9. A myostatin antagonist for use according to any one of aspects 1-6, wherein treating sporadic inclusion body myositis comprises improving upper extremity strength.

**[0093]** 10. A myostatin antagonist for use according to anyone of aspects 1-6, wherein treating sporadic inclusion body myositis comprises reducing incidence of falls or preventing falls.

**[0094]** 11. A myostatin antagonist for use according to anyone of aspects 1-10, wherein the myostatin antagonist is a myostatin receptor binding molecule.

**[0095]** 12. A myostatin antagonist for use according to anyone of aspects 1-11, wherein the myostatin antagonist is an ActRII receptor antagonist.

**[0096]** 13. A myostatin antagonist for use according to anyone of aspects 1-12, wherein the myostatin antagonist is an anti-ActRII receptor antibody.

**[0097]** 14. A myostatin antagonist for use according to anyone of aspects 1-13, wherein the anti-ActRII receptor antibody is bimagrumab.

**[0098]** 15. A myostatin antagonist for use according to any one of aspects 13-14, wherein the myostatin antagonist is an anti-ActRII antibody that binds to an epitope of ActRIIB consisting of amino acids 19-134 of SEQ ID NO: 181 (SEQ ID NO: 182).

**[0099]** 16. A myostatin antagonist for use according to anyone of aspects 13-15, wherein the anti-ActRII antibody binds to an epitope of ActRIIB comprising or consisting of:

(a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFNC - SEQ ID NO: 186);

-continued

(c) amino acids 75-85 of SEQ ID NO: 181  
(KGCWLDDFNFCY - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181  
(EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181  
(CEGEQDKRHLHCYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181  
(CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181  
(YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN)  
and amino acids 52-56 of SEQ ID NO: 181 (EQDKR).

**[0100]** 17. A myostatin antagonist for use according to any of aspects 13-16, wherein the anti-ActRIIB antibody is selected from the group consisting of:

**[0101]** a) an anti-ActRIIB antibody that binds to an epitope of ActRIIB comprising:

(a) amino acids 78-83 of SEQ ID NO: 181  
(WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181  
(GCWLDDFNFC - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181  
(KGCWLDDFNFCY - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181  
(EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181  
(CEGEQDKRHLHCYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181  
(CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181  
(YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN)  
and amino acids 52-56 of SEQ ID NO: 181 (EQDKR);

**[0102]** and b) an antagonist antibody to ActRIIB that binds to an epitope of ActRIIB comprising amino acids 78-83 of SEQ ID NO: 181 (WLDDFN-SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181  
(GCWLDDFNFC - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181  
(KGCWLDDFNFCY - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181  
(EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181  
(CEGEQDKRHLHCYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181  
(CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181  
(YFCCCEGNFCN - SEQ ID NO: 192);

-continued

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN)  
and amino acids 52-56 of SEQ ID NO: 181 (EQDKR),

wherein the antibody has a  $K_D$  of about 2 pM.

**[0103]** 18. A myostatin antagonist for use according to any of aspects 13-17, wherein the antibody binds to ActRIIB with a 10-fold or greater affinity than it binds to ActRIIA.

**[0104]** 19. A myostatin antagonist for use according to anyone of aspects 13-18, wherein the antibody comprises a heavy chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 1-14; a heavy chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28; a heavy chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42; a light chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56; a light chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 57-70; and a light chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84.

**[0105]** 20. A myostatin antagonist for use according to any of aspects 13-19 wherein the antibody comprises:

**[0106]** (a) a heavy chain variable region CDR1 of SEQ ID NO: 1; a heavy chain variable region CDR2 of SEQ ID NO: 15; a heavy chain variable region CDR3 of SEQ ID NO: 29; a light chain variable region CDR1 of SEQ ID NO: 43; a light chain variable region CDR2 of SEQ ID NO: 57; and a light chain variable region CDR3 of SEQ ID NO: 71,

**[0107]** (b) a heavy chain variable region CDR1 of SEQ ID NO: 2; a heavy chain variable region CDR2 of SEQ ID NO: 16; a heavy chain variable region CDR3 of SEQ ID NO: 30; a light chain variable region CDR1 of SEQ ID NO: 44; a light chain variable region CDR2 of SEQ ID NO: 58; and a light chain variable region CDR3 of SEQ ID NO: 72,

**[0108]** (c) a heavy chain variable region CDR1 of SEQ ID NO: 3; a heavy chain variable region CDR2 of SEQ ID NO: 17; a heavy chain variable region CDR3 of SEQ ID NO: 31; a light chain variable region CDR1 of SEQ ID NO: 45; a light chain variable region CDR2 of SEQ ID NO: 59; and a light chain variable region CDR3 of SEQ ID NO: 73,

**[0109]** (d) a heavy chain variable region CDR1 of SEQ ID NO: 4; a heavy chain variable region CDR2 of SEQ ID NO: 18; a heavy chain variable region CDR3 of SEQ ID NO: 32; a light chain variable region CDR1 of SEQ ID NO: 46; a light chain variable region CDR2 of SEQ ID NO: 60; and a light chain variable region CDR3 of SEQ ID NO: 74,

**[0110]** (e) a heavy chain variable region CDR1 of SEQ ID NO: 5; a heavy chain variable region CDR2 of SEQ ID NO: 19; a heavy chain variable region CDR3 of SEQ ID NO: 33; a light chain variable region CDR1 of SEQ ID NO: 47; a light chain variable region CDR2 of SEQ ID NO: 61; and a light chain variable region CDR3 of SEQ ID NO: 75,

**[0111]** (f) a heavy chain variable region CDR1 of SEQ ID NO: 6; a heavy chain variable region CDR2 of SEQ

- ID NO: 20; a heavy chain variable region CDR3 of SEQ ID NO: 34; a light chain variable region CDR1 of SEQ ID NO: 48; a light chain variable region CDR2 of SEQ ID NO: 62; and a light chain variable region CDR3 of SEQ ID NO: 76,
- [0112]** (g) a heavy chain variable region CDR1 of SEQ ID NO: 7; a heavy chain variable region CDR2 of SEQ ID NO: 21; a heavy chain variable region CDR3 of SEQ ID NO: 35; a light chain variable region CDR1 of SEQ ID NO: 49; a light chain variable region CDR2 of SEQ ID NO: 63; and a light chain variable region CDR3 of SEQ ID NO: 77,
- [0113]** (h) a heavy chain variable region CDR1 of SEQ ID NO: 8; a heavy chain variable region CDR2 of SEQ ID NO: 22; a heavy chain variable region CDR3 of SEQ ID NO: 36; a light chain variable region CDR1 of SEQ ID NO: 50; a light chain variable region CDR2 of SEQ ID NO: 64; and a light chain variable region CDR3 of SEQ ID NO: 78,
- [0114]** (i) a heavy chain variable region CDR1 of SEQ ID NO: 9; a heavy chain variable region CDR2 of SEQ ID NO: 23; a heavy chain variable region CDR3 of SEQ ID NO: 37; a light chain variable region CDR1 of SEQ ID NO: 51; a light chain variable region CDR2 of SEQ ID NO: 65; and a light chain variable region CDR3 of SEQ ID NO: 79,
- [0115]** (j) a heavy chain variable region CDR1 of SEQ ID NO: 10; a heavy chain variable region CDR2 of SEQ ID NO: 24; a heavy chain variable region CDR3 of SEQ ID NO: 38; a light chain variable region CDR1 of SEQ ID NO: 52; a light chain variable region CDR2 of SEQ ID NO: 66; and a light chain variable region CDR3 of SEQ ID NO: 80,
- [0116]** (k) a heavy chain variable region CDR1 of SEQ ID NO: 11; a heavy chain variable region CDR2 of SEQ ID NO: 25; a heavy chain variable region CDR3 of SEQ ID NO: 39; a light chain variable region CDR1 of SEQ ID NO: 53; a light chain variable region CDR2 of SEQ ID NO: 67; and a light chain variable region CDR3 of SEQ ID NO: 81,
- [0117]** (l) a heavy chain variable region CDR1 of SEQ ID NO: 12; a heavy chain variable region CDR2 of SEQ ID NO: 26; a heavy chain variable region CDR3 of SEQ ID NO: 40; a light chain variable region CDR1 of SEQ ID NO: 54; a light chain variable region CDR2 of SEQ ID NO: 68; and a light chain variable region CDR3 of SEQ ID NO: 82,
- [0118]** (m) a heavy chain variable region CDR1 of SEQ ID NO: 13; a heavy chain variable region CDR2 of SEQ ID NO: 27; a heavy chain variable region CDR3 of SEQ ID NO: 41; a light chain variable region CDR1 of SEQ ID NO: 55; a light chain variable region CDR2 of SEQ ID NO: 69; and a light chain variable region CDR3 of SEQ ID NO: 83, or
- [0119]** (n) a heavy chain variable region CDR1 of SEQ ID NO: 14; a heavy chain variable region CDR2 of SEQ ID NO: 28; a heavy chain variable region CDR3 of SEQ ID NO: 42; a light chain variable region CDR1 of SEQ ID NO: 56; a light chain variable region CDR2 of SEQ ID NO: 70; and a light chain variable region CDR3 of SEQ ID NO: 84.
- [0120]** 21. A myostatin antagonist for use according to according to any of aspects 13-20, wherein the antibody comprises a full length heavy chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs: 146-150 and 156-160.
- [0121]** 22. A myostatin antagonist for use according to according to any of aspects 13-21, wherein the antibody comprises a full length light chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs: 141-145 and 151-155.
- [0122]** 23. A myostatin antagonist for use according to according to any of aspects 13-22, wherein the antibody comprises:
- [0123]** (a) the variable heavy chain sequence of SEQ ID NO: 99 and variable light chain sequence of SEQ ID NO: 85;
- [0124]** (b) the variable heavy chain sequence of SEQ ID NO: 100 and variable light chain sequence of SEQ ID NO: 86;
- [0125]** (c) the variable heavy chain sequence of SEQ ID NO: 101 and variable light chain sequence of SEQ ID NO: 87;
- [0126]** (d) the variable heavy chain sequence of SEQ ID NO: 102 and variable light chain sequence of SEQ ID NO: 88;
- [0127]** (e) the variable heavy chain sequence of SEQ ID NO: 103 and variable light chain sequence of SEQ ID NO: 89;
- [0128]** (f) the variable heavy chain sequence of SEQ ID NO: 104 and variable light chain sequence of SEQ ID NO: 90;
- [0129]** (g) the variable heavy chain sequence of SEQ ID NO: 105 and variable light chain sequence of SEQ ID NO: 91;
- [0130]** (h) the variable heavy chain sequence of SEQ ID NO: 106 and variable light chain sequence of SEQ ID NO: 92;
- [0131]** (i) the variable heavy chain sequence of SEQ ID NO: 107 and variable light chain sequence of SEQ ID NO: 93;
- [0132]** (j) the variable heavy chain sequence of SEQ ID NO: 108 and variable light chain sequence of SEQ ID NO: 94;
- [0133]** (k) the variable heavy chain sequence of SEQ ID NO: 109 and variable light chain sequence of SEQ ID NO: 95;
- [0134]** (l) the variable heavy chain sequence of SEQ ID NO: 110 and variable light chain sequence of SEQ ID NO: 96;
- [0135]** (m) the variable heavy chain sequence of SEQ ID NO: 111 and variable light chain sequence of SEQ ID NO: 97; or
- [0136]** (n) the variable heavy chain sequence of SEQ ID NO: 112 and variable light chain sequence of SEQ ID NO: 98.
- [0137]** 24. A myostatin antagonist for use according to according to any of aspects 13-23, wherein the antibody comprises:
- [0138]** (a) the heavy chain sequence of SEQ ID NO: 146 and light chain sequence of SEQ ID NO: 141;
- [0139]** (b) the heavy chain sequence of SEQ ID NO: 147 and light chain sequence of SEQ ID NO: 142;
- [0140]** (c) the heavy chain sequence of SEQ ID NO: 148 and light chain sequence of SEQ ID NO: 143;

- [0141] (d) the heavy chain sequence of SEQ ID NO: 149 and light chain sequence of SEQ ID NO: 144;
- [0142] (e) the heavy chain sequence of SEQ ID NO: 150 and light chain sequence of SEQ ID NO: 145;
- [0143] (f) the heavy chain sequence of SEQ ID NO: 156 and light chain sequence of SEQ ID NO: 151;
- [0144] (g) the heavy chain sequence of SEQ ID NO: 157 and light chain sequence of SEQ ID NO: 152;
- [0145] (h) the heavy chain sequence of SEQ ID NO: 158 and light chain sequence of SEQ ID NO: 153;
- [0146] (i) the heavy chain sequence of SEQ ID NO: 159 and light chain sequence of SEQ ID NO: 154; or
- [0147] (j) the heavy chain sequence of SEQ ID NO: 160 and light chain sequence of SEQ ID NO: 155.
- [0148] 25. A myostatin antagonist for use according to according to any of aspects 13-24, wherein the antibody comprised in said composition cross-blocks or is cross blocked by at least one antibody of claim 10 from binding to ActRIIB.
- [0149] 26. A myostatin antagonist for use according to according to any of aspects 13-25, wherein the antibody comprised in said composition has altered effector function through mutation of the Fc region.
- [0150] 27. A myostatin antagonist for use according to according to any of aspects 13-26, wherein the antibody comprised in said composition binds to an epitope recognised by an antibody listed in aspects 15-17.
- [0151] 28. A myostatin antagonist for use according to any of aspects 13-27, wherein the antibody is encoded by pBW522 (DSM22873) or pBW524 (DSM22874).
- [0152] 29. Bimaghumab for use in treating sporadic inclusion body myositis, wherein bimagrumb is to be administered intravenously at a dose of about 1-10 mg/kg body weight every four weeks.
- [0153] 30. Bimagrumb for use in treating sporadic inclusion body myositis, wherein bimagrumb is to be administered intravenously at a dose of about 1 mg/kg body weight every four weeks.
- [0154] 31. Bimagrumb for use in treating sporadic inclusion body myositis, wherein bimagrumb is to be administered intravenously at a dose of about 3 mg/kg body weight every four weeks.
- [0155] 32. Bimagrumb for use in treating sporadic inclusion body myositis, wherein bimagrumb is to be administered intravenously at a dose of about 10 mg/kg body weight every four weeks.
- [0156] 33. A method of treating sporadic inclusion body myositis comprising administering a therapeutically effective amount of a myostatin antagonist to a patient in need thereof.
- [0157] 34. A method of treating sporadic inclusion body myositis according to claim 33, comprising administering said myostatin antagonist at a dose of about 1-10 mg/kg.
- [0158] 35. A method of treating sporadic inclusion body myositis according to any of aspects 33-34, comprising administering at a dose of about 1, about 3 or about 10 mg/kg body weight.
- [0159] 36. A method of treating sporadic inclusion body myositis according to any of aspects 33-35, comprising administering said myostatin antagonist intravenously.
- [0160] 37. A method of treating sporadic inclusion body myositis according to any of aspects 33-36, comprising administering said myostatin antagonist every four weeks.
- [0161] 38. A method of treating sporadic inclusion body myositis according to any of aspects 33-37, wherein said patient is ambulatory.
- [0162] 39. A method of treating sporadic inclusion body myositis according to any of aspects 33-38, wherein treating sporadic inclusion body myositis comprises slowing down the progression of the disease or improving physical function and mobility.
- [0163] 40. A method of treating sporadic inclusion body myositis according to any of aspects 33-38, wherein treating sporadic inclusion body myositis comprises improving dysphagia or swallowing difficulties.
- [0164] 41. A method of treating sporadic inclusion body myositis according to any of aspects 33-38, wherein treating sporadic inclusion body myositis comprises improving upper extremity strength.
- [0165] 42. A method of treating sporadic inclusion body myositis according to any of aspects 33-38, wherein treating sporadic inclusion body myositis comprises reducing incidence of falls or preventing falls.
- [0166] 43. A method of treating sporadic inclusion body myositis according to any of aspects 33-42, wherein the myostatin antagonist is a myostatin receptor binding molecule.
- [0167] 44. A method of treating sporadic inclusion body myositis according to any of aspects 33-43, wherein the myostatin antagonist is an ActRII receptor antagonist.
- [0168] 45. A method of treating sporadic inclusion body myositis according to any of aspects 33-44, wherein the myostatin antagonist is an anti-ActRII receptor antibody.
- [0169] 46. A method of treating sporadic inclusion body myositis according to any of aspects 33-45, wherein the anti-ActRII receptor antibody is bimagrumb.
- [0170] 47. A method of treating sporadic inclusion body myositis according to any of aspects 45 or 46, wherein the myostatin antagonist is an anti-ActRII antibody that binds to an epitope of ActRIIB consisting of amino acids 19-134 of SEQ ID NO: 181 (SEQ ID NO: 182).
- [0171] 48. A method of treating sporadic inclusion body myositis according to any of aspects 45-47, wherein the anti-ActRII antibody binds to an epitope of ActRIIB comprising or consisting of:
- (a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN - SEQ ID NO: 188);
- (b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN - SEQ ID NO: 186);
- (c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN - SEQ ID NO: 190);
- (d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);
- (e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHLCYASW - SEQ ID NO: 187);
- (f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);
- (g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);
- or
- (h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR).

**[0172]** 49. A method of treating sporadic inclusion body myositis according to any of aspects 45-48, wherein the anti-ActRIIB antibody is selected from the group consisting of:

**[0173]** a) an anti-ActRIIB antibody that binds to an epitope of ActRIIB comprising:

(a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCHYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR);

**[0174]** and b) an antagonist antibody to ActRIIB that binds to an epitope of ActRIIB comprising amino acids 78-83 of SEQ ID NO: 181 (WLDDFN—SEQ ID NO:188);

(b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCHYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR);

wherein the antibody has a  $K_D$  of about 2 pM.

**[0175]** 50. A method of treating sporadic inclusion body myositis according to any of aspects 45-49, wherein the antibody binds to ActRIIB with a 10-fold or greater affinity than it binds to ActRIIA.

**[0176]** 51. A method of treating sporadic inclusion body myositis to any of aspects 45-50, wherein the antibody comprises a heavy chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 1-14; a heavy chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28; a heavy chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42; a light

chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56; a light chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 57-70; and a light chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84.

**[0177]** 52. A method of treating sporadic inclusion body myositis according to any of aspects 45-51, wherein the antibody comprises:

**[0178]** (a) a heavy chain variable region CDR1 of SEQ ID NO: 1; a heavy chain variable region CDR2 of SEQ ID NO: 15; a heavy chain variable region CDR3 of SEQ ID NO: 29; a light chain variable region CDR1 of SEQ ID NO: 43; a light chain variable region CDR2 of SEQ ID NO: 57; and a light chain variable region CDR3 of SEQ ID NO: 71,

**[0179]** (b) a heavy chain variable region CDR1 of SEQ ID NO: 2; a heavy chain variable region CDR2 of SEQ ID NO: 16; a heavy chain variable region CDR3 of SEQ ID NO: 30; a light chain variable region CDR1 of SEQ ID NO: 44; a light chain variable region CDR2 of SEQ ID NO: 58; and a light chain variable region CDR3 of SEQ ID NO: 72,

**[0180]** (c) a heavy chain variable region CDR1 of SEQ ID NO: 3; a heavy chain variable region CDR2 of SEQ ID NO: 17; a heavy chain variable region CDR3 of SEQ ID NO: 31; a light chain variable region CDR1 of SEQ ID NO: 45; a light chain variable region CDR2 of SEQ ID NO: 59; and a light chain variable region CDR3 of SEQ ID NO: 73,

**[0181]** (d) a heavy chain variable region CDR1 of SEQ ID NO: 4; a heavy chain variable region CDR2 of SEQ ID NO: 18; a heavy chain variable region CDR3 of SEQ ID NO: 32; a light chain variable region CDR1 of SEQ ID NO: 46; a light chain variable region CDR2 of SEQ ID NO: 60; and a light chain variable region CDR3 of SEQ ID NO: 74,

**[0182]** (e) a heavy chain variable region CDR1 of SEQ ID NO: 5; a heavy chain variable region CDR2 of SEQ ID NO: 19; a heavy chain variable region CDR3 of SEQ ID NO: 33; a light chain variable region CDR1 of SEQ ID NO: 47; a light chain variable region CDR2 of SEQ ID NO: 61; and a light chain variable region CDR3 of SEQ ID NO: 75,

**[0183]** (f) a heavy chain variable region CDR1 of SEQ ID NO: 6; a heavy chain variable region CDR2 of SEQ ID NO: 20; a heavy chain variable region CDR3 of SEQ ID NO: 34; a light chain variable region CDR1 of SEQ ID NO: 48; a light chain variable region CDR2 of SEQ ID NO: 62; and a light chain variable region CDR3 of SEQ ID NO: 76,

**[0184]** (g) a heavy chain variable region CDR1 of SEQ ID NO: 7; a heavy chain variable region CDR2 of SEQ ID NO: 21; a heavy chain variable region CDR3 of SEQ ID NO: 35; a light chain variable region CDR1 of SEQ ID NO: 49; a light chain variable region CDR2 of SEQ ID NO: 63; and a light chain variable region CDR3 of SEQ ID NO: 77,

**[0185]** (h) a heavy chain variable region CDR1 of SEQ ID NO: 8; a heavy chain variable region CDR2 of SEQ ID NO: 22; a heavy chain variable region CDR3 of SEQ ID NO: 36; a light chain variable region CDR1 of SEQ

- ID NO: 50 a light chain variable region CDR2 of SEQ ID NO: 64; and a light chain variable region CDR3 of SEQ ID NO: 78,
- [0186]** (i) a heavy chain variable region CDR1 of SEQ ID NO: 9; a heavy chain variable region CDR2 of SEQ ID NO: 23; a heavy chain variable region CDR3 of SEQ ID NO: 37; a light chain variable region CDR1 of SEQ ID NO: 51; a light chain variable region CDR2 of SEQ ID NO: 65; and a light chain variable region CDR3 of SEQ ID NO: 79,
- [0187]** (j) a heavy chain variable region CDR1 of SEQ ID NO: 10; a heavy chain variable region CDR2 of SEQ ID NO: 24; a heavy chain variable region CDR3 of SEQ ID NO: 38; a light chain variable region CDR1 of SEQ ID NO: 52; a light chain variable region CDR2 of SEQ ID NO: 66; and a light chain variable region CDR3 of SEQ ID NO: 80,
- [0188]** (k) a heavy chain variable region CDR1 of SEQ ID NO: 11; a heavy chain variable region CDR2 of SEQ ID NO: 25; a heavy chain variable region CDR3 of SEQ ID NO: 39; a light chain variable region CDR1 of SEQ ID NO: 53; a light chain variable region CDR2 of SEQ ID NO: 67; and a light chain variable region CDR3 of SEQ ID NO: 81,
- [0189]** (l) a heavy chain variable region CDR1 of SEQ ID NO: 12; a heavy chain variable region CDR2 of SEQ ID NO: 26; a heavy chain variable region CDR3 of SEQ ID NO: 40; a light chain variable region CDR1 of SEQ ID NO: 54; a light chain variable region CDR2 of SEQ ID NO: 68; and a light chain variable region CDR3 of SEQ ID NO: 82,
- [0190]** (m) a heavy chain variable region CDR1 of SEQ ID NO: 13; a heavy chain variable region CDR2 of SEQ ID NO: 27; a heavy chain variable region CDR3 of SEQ ID NO: 41; a light chain variable region CDR1 of SEQ ID NO: 55; a light chain variable region CDR2 of SEQ ID NO: 69; and a light chain variable region CDR3 of SEQ ID NO: 83, or
- [0191]** (n) a heavy chain variable region CDR1 of SEQ ID NO: 14; a heavy chain variable region CDR2 of SEQ ID NO: 28; a heavy chain variable region CDR3 of SEQ ID NO: 42; a light chain variable region CDR1 of SEQ ID NO: 56; a light chain variable region CDR2 of SEQ ID NO: 70; and a light chain variable region CDR3 of SEQ ID NO: 84.
- [0192]** 53. A method of treating sporadic inclusion body myositis according to any of aspects 45-52, wherein the antibody comprises a full length heavy chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs: 146-150 and 156-160.
- [0193]** 54. A method of treating sporadic inclusion body myositis according to any of aspects 45-53, wherein the antibody comprises a full length light chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOs: 141-145 and 151-155.
- [0194]** 55. A method of treating sporadic inclusion body myositis according to any of aspects 45-54, wherein the antibody comprises:
- [0195]** (a) the variable heavy chain sequence of SEQ ID NO: 99 and variable light chain sequence of SEQ ID NO: 85;
- [0196]** (b) the variable heavy chain sequence of SEQ ID NO: 100 and variable light chain sequence of SEQ ID NO: 86;
- [0197]** (c) the variable heavy chain sequence of SEQ ID NO: 101 and variable light chain sequence of SEQ ID NO: 87;
- [0198]** (d) the variable heavy chain sequence of SEQ ID NO: 102 and variable light chain sequence of SEQ ID NO: 88;
- [0199]** (e) the variable heavy chain sequence of SEQ ID NO: 103 and variable light chain sequence of SEQ ID NO: 89;
- [0200]** (f) the variable heavy chain sequence of SEQ ID NO: 104 and variable light chain sequence of SEQ ID NO: 90;
- [0201]** (g) the variable heavy chain sequence of SEQ ID NO: 105 and variable light chain sequence of SEQ ID NO: 91;
- [0202]** (h) the variable heavy chain sequence of SEQ ID NO: 106 and variable light chain sequence of SEQ ID NO: 92;
- [0203]** (i) the variable heavy chain sequence of SEQ ID NO: 107 and variable light chain sequence of SEQ ID NO: 93;
- [0204]** (j) the variable heavy chain sequence of SEQ ID NO: 108 and variable light chain sequence of SEQ ID NO: 94;
- [0205]** (k) the variable heavy chain sequence of SEQ ID NO: 109 and variable light chain sequence of SEQ ID NO: 95;
- [0206]** (l) the variable heavy chain sequence of SEQ ID NO: 110 and variable light chain sequence of SEQ ID NO: 96;
- [0207]** (m) the variable heavy chain sequence of SEQ ID NO: 111 and variable light chain sequence of SEQ ID NO: 97; or
- [0208]** (n) the variable heavy chain sequence of SEQ ID NO: 112 and variable light chain sequence of SEQ ID NO: 98.
- [0209]** 56. A method of treating sporadic inclusion body myositis according to any of aspects 45-55, wherein the antibody comprises:
- [0210]** (a) the heavy chain sequence of SEQ ID NO: 146 and light chain sequence of SEQ ID NO: 141;
- [0211]** (b) the heavy chain sequence of SEQ ID NO: 147 and light chain sequence of SEQ ID NO: 142;
- [0212]** (c) the heavy chain sequence of SEQ ID NO: 148 and light chain sequence of SEQ ID NO: 143;
- [0213]** (d) the heavy chain sequence of SEQ ID NO: 149 and light chain sequence of SEQ ID NO: 144;
- [0214]** (e) the heavy chain sequence of SEQ ID NO: 150 and light chain sequence of SEQ ID NO: 145;
- [0215]** (f) the heavy chain sequence of SEQ ID NO: 156 and light chain sequence of SEQ ID NO: 151;
- [0216]** (g) the heavy chain sequence of SEQ ID NO: 157 and light chain sequence of SEQ ID NO: 152;
- [0217]** (h) the heavy chain sequence of SEQ ID NO: 158 and light chain sequence of SEQ ID NO: 153;
- [0218]** (i) the heavy chain sequence of SEQ ID NO: 159 and light chain sequence of SEQ ID NO: 154; or
- [0219]** (j) the heavy chain sequence of SEQ ID NO: 160 and light chain sequence of SEQ ID NO: 155.
- [0220]** 57. A method of treating sporadic inclusion body myositis according to any of aspects 45-56, wherein the anti-



body comprised in said composition cross-blocks or is cross blocked by at least one antibody of aspect 10 from binding to ActRIIB.

**[0221]** 58. A method of treating sporadic inclusion body myositis according to any of aspects 45-57, wherein the antibody comprised in said composition has altered effector function through mutation of the Fc region.

**[0222]** 59. A method of treating sporadic inclusion body myositis according to any of aspects 45-58, wherein the antibody comprised in said composition binds to an epitope recognised by an antibody listed in aspects 46-48.

**[0223]** 60. A method of treating sporadic inclusion body myositis according to any of aspects 45-59, wherein the antibody is encoded by pBW522 (DSM22873) or pBW524 (DSM22874).

**[0224]** 61. A method of treating sporadic inclusion body myositis comprising administering bimagrumab,

**[0225]** 62. A method of treating sporadic inclusion body myositis comprising administering bimagrumab, wherein bimagrumab is to be administered intravenously at a dose of about 1-10 mg/kg body weight every four weeks.

**[0226]** 63. A method of treating sporadic inclusion body myositis comprising administering bimagrumab, wherein bimagrumab is to be administered intravenously at a dose of about 1 mg/kg body weight every four weeks.

**[0227]** 64. A method of treating sporadic inclusion body myositis comprising administering bimagrumab, wherein bimagrumab is to be administered intravenously at a dose of about 3 mg/kg body weight every four weeks.

**[0228]** 65. A method of treating sporadic inclusion body myositis comprising administering bimagrumab, wherein bimagrumab is to be administered intravenously at a dose of about 10 mg/kg body weight every four weeks.

**[0229]** 66. Bimagrumab for use in treating sporadic inclusion body myositis.

**[0230]** 67. A composition comprising 150 mg/ml of bimagrumab for use in a method of treating sporadic inclusion body myositis.

**[0231]** 68. A unitary dosage form comprising 150 mg/ml of bimagrumab.

**[0232]** In further aspects the unitary dosage form, i.e., a vial, comprises 100-200 mg/ml of bimagrumab, preferably 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155, 160, 165, 170, 175, 180, 185, 190, 195, 200 mg/ml of bimagrumab.

**[0233]** 69. An infusion bag comprising an appropriate amount of bimagrumab from one or more vials diluted with a solution.

**[0234]** The solution is preferably a dextrose solution.

**[0235]** In some further embodiments, the myostatin antagonist, preferably the ActRII antagonist or anti-ActRII antibody such as bimagrumab is to be administered at a dose of about 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10 mg/kg body weight.

**[0236]** Various aspects of the disclosure are described in further detail in the following subsections. Standard assays to evaluate the binding ability of the antibodies toward ActRII of various species are known in the art, including for example, ELISAs, western blots and RIAs. Suitable assays are described in detail in the Examples. The binding affinity of the antibodies also can be assessed by standard assays known in the art, such as by Biacore analysis or Solution Equilibrium Titration. Surface plasmon resonance based techniques such as Biacore can determine the binding kinetics which allows the calculation of the binding affinity. Assays to evaluate the

effects of the antibodies on functional properties of ActRIIB (e.g. receptor binding, preventing or inducing human B cell proliferation or IgG production) are described in further detail in the Examples.

**[0237]** Accordingly, an antibody that "inhibits" one or more of these ActRII functional properties (e.g. biochemical, immunochemical, cellular, physiological or other biological activities, or the like) as determined according to methodologies known to the art and described herein, will be understood to relate to a statistically significant decrease in the particular activity relative to that seen in the absence of the antibody (e.g. or when a control antibody of irrelevant specificity is present). An antibody that inhibits ActRII activity effects such a statistically significant decrease by at least 10% of the measured parameter, by at least 50%, 80% or 90%, and in certain embodiments an antibody of the disclosure may inhibit greater than 95%, 98% or 99% of ActRIIB functional activity.

**[0238]** The ability or extent to which an antibody or other binding agent is able to interfere with the binding of another antibody or binding molecule to ActRII, and therefore whether it can be said to cross-block according to the disclosure, can be determined using standard competition binding assays. One suitable assay involves the use of the Biacore technology (e.g. by using a BIAcore instrument (Biacore, Uppsala, Sweden)), which can measure the extent of interactions using surface plasmon resonance technology. Another assay for measuring cross-blocking uses an ELISA-based approach. A further assay uses FACS analysis, wherein competition of various antibodies for binding to ActRIIB expressing cells is tested (such as described in the Examples).

**[0239]** According to the disclosure, a cross-blocking antibody or other binding agent according to the disclosure binds to ActRII in the described BIAcore cross-blocking assay such that the recorded binding of the combination (mixture) of the antibodies or binding agents is between 80% and 0.1% (e.g. 80% to 4%) of the maximum theoretical binding, specifically between 75% and 0.1% (e.g. 75% to 4%) of the maximum theoretical binding, and more specifically between 70% and 0.1% (e.g. 70% to 4%), and more specifically between 65% and 0.1% (e.g. 65% to 4%) of maximum theoretical binding (as defined above) of the two antibodies or binding agents in combination.

**[0240]** An antibody is defined as cross-blocking an anti-ActRIIB antibody of the disclosure in an ELISA assay, if the test antibody is able to cause a reduction of anti-ActRII antibody binding to ActRIIB of between 60% and 100%, specifically between 70% and 100%, and more specifically between 80% and 100%, when compared to the positive control wells (i.e. the same anti-ActRIIB antibody and ActRIIB, but no "test" cross-blocking antibody). Examples of cross blocking antibodies as cited herein are MOR08159 and MOR08213 (disclosed in WO2010/125003). Thus, the disclosure provides compositions comprising antibodies that cross block MOR08159 or MOR08213 for binding to ActRIIB.

**[0241]** Recombinant Antibodies

**[0242]** Antibodies, e.g., antagonist antibodies to ActRII, such as bimagrumab, comprised in the compositions used within this disclosure include the human recombinant antibodies, isolated and structurally characterized, as described in the Examples. The  $V_H$  amino acid sequences of antibodies comprised in the inventive compositions are shown in SEQ ID NOs: 99-112. The  $V_L$  amino acid sequences of antibodies comprised in the inventive compositions are shown in SEQ ID

NOs: 85-98 respectively. Examples of preferred full length heavy chain amino acid sequences of antibodies comprised in the inventive compositions are shown in SEQ ID NOs: 146-150 and 156-160. Examples of preferred full length light chain amino acid sequences of antibodies comprised in the inventive compositions are shown in SEQ ID NOs: 141-145 and 151-155 respectively. Other antibodies comprised in the inventive compositions include amino acids that have been mutated by amino acid deletion, insertion or substitution, yet have at least 60, 70, 80, 90, 95, 97 or 99 percent identity in the CDR regions with the CDR regions depicted in the sequences described above. In some embodiments, it includes mutant amino acid sequences wherein no more than 1, 2, 3, 4 or 5 amino acids have been mutated by amino acid deletion, insertion or substitution in the CDR regions when compared with the CDR regions depicted in the sequence described above.

**[0243]** Further, variable heavy chain parental nucleotide sequences are shown in SEQ ID NOs: 127-140. Variable light chain parental nucleotide sequences are shown in SEQ ID NOs: 113-126. Full length light chain nucleotide sequences optimized for expression in a mammalian cell are shown in SEQ ID NOs: 161-165 and 171-175. Full length heavy chain nucleotide sequences optimized for expression in a mammalian cell are shown in SEQ ID NOs: 166-170 and 176-180. Other antibodies comprised in the inventive compositions include amino acids or are encoded by nucleic acids that have been mutated, yet have at least 60 or more (i.e. 80, 90, 95, 97, 99 or more) percent identity to the sequences described above. In some embodiments, it includes mutant amino acid sequences wherein no more than 1, 2, 3, 4 or 5 amino acids have been mutated by amino acid deletion, insertion or substitution in the variable regions when compared with the variable regions depicted in the sequence described above.

**[0244]** Since each of these antibodies binds the same epitope and are progenies from the same parental antibody, the  $V_H$ ,  $V_L$ , full length light chain, and full length heavy chain sequences (nucleotide sequences and amino acid sequences) can be "mixed and matched" to create other anti-ActRIIB binding molecules of the disclosure. ActRIIB binding of such "mixed and matched" antibodies can be tested using the binding assays described above and in the Examples (e.g. ELISAs). When these chains are mixed and matched, a  $V_H$  sequence from a particular  $V_H/V_L$  pairing should be replaced with a structurally similar  $V_H$  sequence. Likewise a full length heavy chain sequence from a particular full length heavy chain/full length light chain pairing should be replaced with a structurally similar full length heavy chain sequence. Likewise, a  $V_L$  sequence from a particular  $V_H/V_L$  pairing should be replaced with a structurally similar  $V_L$  sequence. Likewise a full length light chain sequence from a particular full length heavy chain/full length light chain pairing should be replaced with a structurally similar full length light chain sequence. Accordingly, in one aspect, the disclosure provides compositions comprising a recombinant anti-ActRII antibody or antigen binding region thereof having: a heavy chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 99-112; and a light chain variable region comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 85-98.

**[0245]** In another aspect, the disclosure provides compositions comprising:

**[0246]** (i) an isolated recombinant anti-ActRII antibody having: a full length heavy chain comprising an amino acid sequence selected from the group consisting of SEQ ID NOs:

99-112; and a full length light chain comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 85-98, or

**[0247]** (ii) a functional protein comprising an antigen binding portion thereof.

**[0248]** In another aspect, the disclosure provides compositions comprising:

**[0249]** (i) an isolated recombinant anti-ActRII antibody having a full length heavy chain encoded by a nucleotide sequence that has been optimized for expression in the cell of a mammalian selected from the group consisting of SEQ ID NOs:127-140, and a full length light chain encoded by a nucleotide sequence that has been optimized for expression in the cell of a mammalian selected from the group consisting of SEQ ID NOs:113-126, or

**[0250]** (ii) a functional protein comprising an antigen binding portion thereof.

**[0251]** Examples of amino acid sequences of the  $V_H$  CDR1s of the antibodies comprised in the inventive compositions are shown in SEQ ID NOs: 1-14. The amino acid sequences of the  $V_H$  CDR2s of the antibodies are shown in SEQ ID NOs: 15-28. The amino acid sequences of the  $V_H$  CDR3s of the antibodies are shown in SEQ ID NOs: 29-42. The amino acid sequences of the  $V_L$  CDR1s of the antibodies are shown in SEQ ID NOs: 43-56. The amino acid sequences of the  $V_L$  CDR2s of the antibodies are shown in SEQ ID NOs: 57-70. The amino acid sequences of the  $V_L$  CDR3s of the antibodies are shown in SEQ ID NOs: 71-84. The CDR regions are delineated using the Kabat system (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). An alternative method of determining CDR regions uses the method devised by Chothia (Chothia et al. 1989, Nature, 342:877-883). The Chothia definition is based on the location of the structural loop regions. However, due to changes in the numbering system used by Chothia (see e.g. <http://www.biochem.ucl.ac.uk/~martin/abs/GeneralInfo.html> and <http://www.bioinf.org.uk/abs/>), this system is now less commonly used. Other systems for defining CDRs exist and are also mentioned in these two websites.

**[0252]** Given that each of these antibodies can bind to ActRII and that antigen-binding specificity is provided primarily by the CDR1, 2 and 3 regions, the  $V_H$  CDR1, 2 and 3 sequences and  $V_L$  CDR1, 2 and 3 sequences can be "mixed and matched" (i.e. CDRs from different antibodies can be mixed and matched, each antibody containing a  $V_H$  CDR1, 2 and 3 and a  $V_L$  CDR1, 2 and 3 create other anti-ActRII binding molecules of the disclosure. ActRIIB binding of such "mixed and matched" antibodies can be tested using the binding assays described above and in the Examples (e.g. ELISAs). When  $V_H$  CDR sequences are mixed and matched, the CDR1, CDR2 and/or CDR3 sequence from a particular  $V_H$  sequence should be replaced with a structurally similar CDR sequence(s). Likewise, when  $V_L$  CDR sequences are mixed and matched, the CDR1, CDR2 and/or CDR3 sequence from a particular  $V_L$  sequence should be replaced with a structurally similar CDR sequence(s). It will be readily apparent to the ordinarily skilled artisan that novel  $V_H$  and  $V_L$  sequences can be created by substituting one or more  $V_H$  and/or  $V_L$  CDR region sequences with structurally similar sequences from the CDR sequences shown herein for monoclonal antibodies.

**[0253]** Anti-ActRII antibody comprised in the disclosed compositions, or antigen binding region thereof has: a heavy



heavy chain sequence of SEQ ID NO: 85 and variable light chain sequence of SEQ ID NO: 99; (b) the variable heavy chain sequence of SEQ ID NO: 86 and variable light chain sequence of SEQ ID NO: 100; (c) the variable heavy chain sequence of SEQ ID NO: 87 and variable light chain sequence of SEQ ID NO: 101; (d) the variable heavy chain sequence of SEQ ID NO: 88 and variable light chain sequence of SEQ ID NO: 102; (e) the variable heavy chain sequence of SEQ ID NO: 89 and variable light chain sequence of SEQ ID NO: 103; (f) the variable heavy chain sequence of SEQ ID NO: 90 and variable light chain sequence of SEQ ID NO: 104; (g) the variable heavy chain sequence of SEQ ID NO: 91 and variable light chain sequence of SEQ ID NO: 105; (h) the variable heavy chain sequence of SEQ ID NO: 92 and variable light chain sequence of SEQ ID NO: 106; (i) the variable heavy chain sequence of SEQ ID NO: 93 and variable light chain sequence of SEQ ID NO: 107; (j) the variable heavy chain sequence of SEQ ID NO: 94 and variable light chain sequence of SEQ ID NO: 108; (k) the variable heavy chain sequence of SEQ ID NO: 95 and variable light chain sequence of SEQ ID NO: 109; (l) the variable heavy chain sequence of SEQ ID NO: 96 and variable light chain sequence of SEQ ID NO: 110; (m) the variable heavy chain sequence of SEQ ID NO: 97 and variable light chain sequence of SEQ ID NO: 111; or (n) the variable heavy chain sequence of SEQ ID NO: 98 and variable light chain sequence of SEQ ID NO: 112.

**[0269]** In one embodiment, the disclosure provides a composition comprising an antibody comprising: (a) the heavy chain sequence of SEQ ID NO: 146 and light chain sequence of SEQ ID NO: 141; (b) the heavy chain sequence of SEQ ID NO: 147 and light chain sequence of SEQ ID NO: 142; (c) the heavy chain sequence of SEQ ID NO: 148 and light chain sequence of SEQ ID NO: 143; (d) the heavy chain sequence of SEQ ID NO: 149 and light chain sequence of SEQ ID NO: 144; (e) the heavy chain sequence of SEQ ID NO: 150 and light chain sequence of SEQ ID NO: 145; (f) the heavy chain sequence of SEQ ID NO: 156 and light chain sequence of SEQ ID NO: 151; (g) the heavy chain sequence of SEQ ID NO: 157 and light chain sequence of SEQ ID NO: 152; (h) the heavy chain sequence of SEQ ID NO: 158 and light chain sequence of SEQ ID NO: 153; (i) the heavy chain sequence of SEQ ID NO: 159 and light chain sequence of SEQ ID NO: 154; or (j) the heavy chain sequence of SEQ ID NO: 160 and light chain sequence of SEQ ID NO: 155.

**[0270]** As used herein, a human antibody comprises heavy or light chain variable regions or full length heavy or light chains that are “the product of” or “derived from” a particular germline sequence if the variable regions or full length chains of the antibody are obtained from a system that uses human germline immunoglobulin genes. Such systems include immunizing a transgenic mouse carrying human immunoglobulin genes with the antigen of interest or screening a human immunoglobulin gene library displayed on phage with the antigen of interest. A human antibody that is “the product of” or “derived from” a human germline immunoglobulin sequence can be identified as such by comparing the amino acid sequence of the human antibody to the amino acid sequences of human germline immunoglobulins and selecting the human germline immunoglobulin sequence that is closest in sequence (i.e. greatest % identity) to the sequence of the human antibody. A human antibody that is “the product of” or “derived from” a particular human germline immunoglobulin sequence may contain amino acid differences as compared to the germline sequence, due to, for example,

naturally occurring somatic mutations or intentional introduction of site-directed mutation. However, a selected human antibody typically is at least 90% identical in amino acid sequence to an amino acid sequence encoded by a human germline immunoglobulin gene and contains amino acid residues that identify the human antibody as being human when compared to the germline immunoglobulin amino acid sequences of other species (e.g. murine germline sequences). In certain cases, a human antibody may be at least 80%, 90%, or at least 95%, or even at least 96%, 97%, 98%, or 99% identical in amino acid sequence to the amino acid sequence encoded by the germline immunoglobulin gene. Typically, a human antibody derived from a particular human germline sequence will display no more than 10 amino acid differences from the amino acid sequence encoded by the human germline immunoglobulin gene. In certain cases, the human antibody may display no more than 5, or even no more than 4, 3, 2, or 1 amino acid difference from the amino acid sequence encoded by the germline immunoglobulin gene.

**[0271]** In one embodiment the antibody comprised in the compositions of the disclosure is that encoded by pBW522 or pBW524 (deposited at DSMZ, Inhoffenstr. 7B, D-38124 Braunschweig, Germany on 18 Aug. 2009 under deposit numbers DSM22873 and DSM22874, respectively).

**[0272]** Homologous Antibodies

**[0273]** In yet another embodiment, an antibody comprised in the inventive composition has full length heavy and light chain amino acid sequences; full length heavy and light chain nucleotide sequences, variable region heavy and light chain nucleotide sequences, or variable region heavy and light chain amino acid sequences that are homologous to the amino acid and nucleotide sequences of the antibodies described herein, and wherein the antibodies retain the desired functional properties of the anti-ActRIIB antibodies of the disclosure.

**[0274]** For example, the disclosure provides a composition comprising an isolated recombinant anti-ActRIIB antibody (or a functional protein comprising an antigen binding portion thereof) comprising a heavy chain variable region and a light chain variable region, wherein: the heavy chain variable region comprises an amino acid sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to an amino acid sequence selected from the group consisting of SEQ ID NOs: 99-112; the light chain variable region comprises an amino acid sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to an amino acid sequence selected from the group consisting of SEQ ID NOs: 85-98; alternatively the compositions comprises a recombinant anti-ActRIIB antibody (or a functional protein comprising an antigen binding portion thereof) comprising a heavy chain variable region and a light chain variable region, wherein: the heavy chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID NOs: 99-112; the light chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID NOs: 85-98 and the antibody exhibits at least one of the following functional properties: (i) it inhibits myostatin binding in vitro or in vivo, (ii) decreases inhibition of muscle differentiation through the Smad-dependent path-

way and/or (iii) does not induce hematological changes, in particular no changes in RBC. In this context, the term “change” refers to insertions, deletions and/or substitutions.

**[0275]** In a further example, the disclosure provides a composition comprising an isolated recombinant anti-ActRII antibody, (or a functional protein comprising an antigen binding portion thereof) comprising a full length heavy chain and a full length light chain, wherein: the full length heavy chain comprises an amino acid sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to an amino acid sequence selected from the group consisting of SEQ ID NOs: 146-150 and 156-160; the full length light chain comprises an amino acid sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to an amino acid sequence selected from the group consisting of SEQ ID NOs: 141-145 and 151-155; alternatively the composition comprises a recombinant anti-ActRII antibody (or a functional protein comprising an antigen binding portion thereof) comprising a heavy chain variable region and a light chain variable region, wherein: the heavy chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID NOs: 146-150 and 156-160; the light chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID NOs: 141-145 and 151-155 and the antibody exhibits at least one of the following functional properties: (i) it inhibits myostatin binding in vitro or in vivo, (ii) decreases inhibition of muscle differentiation through the Smad-dependent pathway and/or (iii) does not induce hematological changes, in particular no changes in RBC. Preferably such an antibody binds to the ligand binding domain of ActRIIB and/or ActRIIA. In this context, the term “change” refers to insertions, deletions and/or substitutions.

**[0276]** In another example, the disclosure provides a composition comprising an isolated recombinant anti-ActRII antibody (or a functional protein comprising an antigen binding portion thereof), comprising a full length heavy chain and a full length light chain, wherein: the full length heavy chain is encoded by a nucleotide sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to a nucleotide sequence selected from the group consisting of SEQ ID NOs: 166-170 and 176-180; the full length light chain is encoded by a nucleotide sequence that is at least 80%, or at least 90% (preferably at least 95, 97 or 99%) identical to a nucleotide sequence selected from the group consisting of SEQ ID NOs: 161-165 and 171-175; alternatively the composition comprises a recombinant anti-ActRIIB antibody (or a functional protein comprising an antigen binding portion thereof) comprising a heavy chain variable region and a light chain variable region, wherein: the heavy chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID NOs: 166-170 and 176-180; the light chain variable region comprises no more than 5 amino acid, or no more than 4 amino acid, or no more than 3 amino acid, or no more than 2 or no more than 1 amino acid change compared to the amino acid sequence selected from the group consisting of SEQ ID

NOs: 161-165 and 171-175 and the antibody exhibits at least one of the following functional properties: (i) it inhibits myostatin binding in vitro or in vivo, (ii) decreases inhibition of muscle differentiation through the Smad-dependent pathway and/or (iii) does not induce hematological changes, in particular no changes in RBC. Preferably such an antibody binds to the ligand binding domain of ActRIIB. In this context, the term “change” refers to insertions, deletions and/or substitutions.

**[0277]** In various embodiments, the antibody comprised in the inventive composition may exhibit one or more, two or more, or three of the functional properties discussed above. The antibody can be, for example, a human antibody, a humanized antibody or a chimeric antibody. Preferably the antibody is a fully human IgG1 antibody.

**[0278]** In other embodiments, the  $V_H$  and/or  $V_L$  amino acid sequences may be at least 80%, 90%, 95%, 96%, 97%, 98% or 99% identical to the sequences set forth above. In other embodiments, the  $V_H$  and/or  $V_L$  amino acid sequences may be identical except an amino acid substitution in no more than 1, 2, 3, 4 or 5 amino acid position. An antibody having  $V_H$  and  $V_L$  regions having high (i.e. 80% or greater) identity to the  $V_H$  and  $V_L$  regions of SEQ ID NOs 99-112 and SEQ ID NOs: 85-98 respectively, can be obtained by mutagenesis (e.g. site-directed or PCR-mediated mutagenesis) of nucleic acid molecules SEQ ID NOs: 127-140 and 113-126 respectively, followed by testing of the encoded altered antibody for retained function (i.e. the functions set forth above) using the functional assays described herein.

**[0279]** In other embodiments, the full length heavy chain and/or full length light chain amino acid sequences may be at least 80%, 90%, 95%, 96%, 97%, 98% or 99% identical to the sequences set forth above or may be identical except an amino acid change in no more than 1, 2, 3, 4 or 5 amino acid position. An antibody having a full length heavy chain and full length light chain having high (i.e. at least 80% or greater) identity to the full length heavy chains of any of SEQ ID NOs: 146-150 and 156-160 and full length light chains of any of SEQ ID NOs: 141-145 and 151-155 respectively, can be obtained by mutagenesis (e.g. site-directed or PCR-mediated mutagenesis) of nucleic acid molecules SEQ ID NOs: 166-170 and 176-180 and SEQ ID NOs: 161-165 and 171-175 respectively, followed by testing of the encoded altered antibody for retained function (i.e. the functions set forth above) using the functional assays described herein.

**[0280]** In other embodiments, the full length heavy chain and/or full length light chain nucleotide sequences may be at least 80%, 90%, 95%, 96%, 97%, 98% or 99% identical to the sequences set forth above.

**[0281]** In other embodiments, the variable regions of heavy chain and/or light chain nucleotide sequences may be at least 80%, 90%, 95%, 96%, 97%, 98% or 99% identical to the sequences set forth above or may be identical except an amino acid change in no more than 1, 2, 3, 4 or 5 amino acid position.

**[0282]** As used herein, the percent identity between the two sequences is a function of the number of identical positions shared by the sequences (i.e. % identity = # of identical positions/total # of positions × 100), 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, as described below.

**[0283]** The percent identity between two amino acid sequences can be determined using the algorithm of E. Meyers and W. Miller (Comput. Appl. Biosci., 4:11-17, 1988) 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. In addition, the percent identity between two amino acid sequences can be determined using the Needleman and Wunsch (J. Mol. Biol. 48:444-453, 1970) algorithm which has been incorporated into the GAP program in the GCG software package (available at <http://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.

**[0284]** Antibodies with Conservative Modifications

**[0285]** In certain embodiments, an antibody comprised in the inventive composition has a heavy chain variable region comprising CDR1, CDR2, and CDR3 sequences and a light chain variable region comprising CDR1, CDR2, and CDR3 sequences, wherein one or more of these CDR sequences have specified amino acid sequences based on the antibodies described herein or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes or conservative modifications thereof, and wherein the antibodies retain the desired functional properties of the anti-ActRIIB antibodies of the disclosure. Accordingly, the disclosure provides compositions comprising an isolated recombinant anti-ActRIIB antibody, or a functional protein comprising an antigen binding portion thereof, consisting of a heavy chain variable region comprising CDR1, CDR2, and CDR3 sequences and a light chain variable region comprising CDR1, CDR2, and CDR3 sequences, wherein: the heavy chain variable region CDR1 amino acid sequences are selected from the group consisting of SEQ ID NOs: 1-14 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; the heavy chain variable region CDR2 amino acid sequences are selected from the group consisting of SEQ ID NOs: 15-28 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; the heavy chain variable region CDR3 amino acid sequences are selected from the group consisting of SEQ ID NOs: 29-42 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; the light chain variable regions CDR1 amino acid sequences are selected from the group consisting of SEQ ID NOs: 43-56 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; the light chain variable regions CDR2 amino acid sequences are selected from the group consisting of SEQ ID NOs: 57-70 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; the light chain variable regions of CDR3 amino acid sequences are selected from the group consisting of SEQ ID NOs: 71-84 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof. Preferably the antibody exhibits at least one of the following functional properties: (i) it inhibits myostatin binding in vitro or in vivo, (ii) decreases inhibition of muscle differentiation through the Smad-dependent pathway and/or (iii) does not induce hematological changes, in particular no changes in RBC.

**[0286]** In various embodiments, the antibody may exhibit one or both of the functional properties listed above. Such antibodies can be, for example, human antibodies, humanized antibodies or chimeric antibodies.

**[0287]** In other embodiments, an antibody comprised in the inventive composition optimized for expression in a mammalian cell has a full length heavy chain sequence and a full length light chain sequence, wherein one or more of these sequences have specified amino acid sequences based on the antibodies described herein or conservative modifications thereof, and wherein the antibodies retain the desired functional properties of the anti-ActRIIB antibodies of the disclosure. Accordingly, the disclosure provides compositions comprising an isolated monoclonal anti-ActRII antibody optimized for expression in a mammalian cell consisting of a full length heavy chain and a full length light chain wherein: the full length heavy chain has amino acid sequences selected from the group of SEQ ID NOs: 146-150 and 156-160 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; and the full length light chain has amino acid sequences selected from the group of SEQ ID NOs: 141-145 and 151-155 or variant sequences thereof comprising 1, 2, 3, 4 or 5 amino acid changes, and conservative modifications thereof; and the antibody exhibits at least one of the following functional properties: (i) it inhibits myostatin binding in vitro or in vivo, (ii) decreases inhibition of muscle differentiation through the Smad-dependent pathway and/or (iii) does not induce hematological changes, in particular no changes in RBC.

**[0288]** In various embodiments, the antibody may exhibit one or both of the functional properties listed above. Such antibodies can be, for example, human antibodies, humanized antibodies or chimeric antibodies.

**[0289]** As used herein, the term "conservative sequence modifications" is intended to refer to amino acid modifications that do not significantly affect or alter the binding characteristics of the antibody containing the amino acid sequence. Such conservative modifications include amino acid substitutions, additions and deletions. Modifications can be introduced into an antibody of the disclosure by standard techniques known in the art, such as site-directed mutagenesis and PCR-mediated mutagenesis.

**[0290]** Conservative amino acid substitutions are ones 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, tryptophan), nonpolar side chains (e.g. alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine), beta-branched side chains (e.g. threonine, valine, isoleucine) and aromatic side chains (e.g. tyrosine, phenylalanine, tryptophan, histidine). Thus, one or more amino acid residues within the CDR regions of an antibody of the disclosure can be replaced with other amino acid residues from the same side chain family, and the altered antibody can be tested for retained function using the functional assays described herein.

**[0291]** Antibodies that Bind to the Same Epitope as Anti-ActRII Antibodies Comprised in the Disclosed Composition

**[0292]** In another embodiment, the disclosure provides compositions comprising antibodies that bind to the same epitope as the various specific anti-ActRII antibodies described herein. All the antibodies described in the examples that are capable of blocking myostatin binding to ActRIIA and ActRIIB bind to one of the epitopes in ActRIIA and

ActRIIB with high affinity, said epitope being comprised between amino acids 19-134 of SEQ ID NO:181.

**[0293]** Additional antibodies can therefore be identified based on their ability to cross-compete (e.g. to competitively inhibit the binding of, in a statistically significant manner) with other antibodies of the disclosure in standard ActRIIB binding assays. The ability of a test antibody to inhibit the binding of antibodies comprised in the inventive compositions to human ActRIIB demonstrates that the test antibody can compete with said antibody for binding to human ActRIIB; such an antibody may, according to non-limiting theory, bind to the same or a related (e.g. a structurally similar or spatially proximal) epitope on human ActRIIB as the antibody with which it competes. In a certain embodiment, the antibody that binds to the same epitope on human ActRIIA and ActRIIA as the antibodies comprised in the inventive compositions is a human recombinant antibody. Such human recombinant antibodies can be prepared and isolated as described in the examples.

**[0294]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by and/or that competes for binding with an antibody having the variable heavy chain sequence recited in SEQ ID NO: 85, and the variable light chain sequence recited in SEQ ID NO: 99.

**[0295]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 86, and the variable light chain sequence recited in SEQ ID NO: 100.

**[0296]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 87, and the variable light chain sequence recited in SEQ ID NO: 101.

**[0297]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 88, and the variable light chain sequence recited in SEQ ID NO: 102.

**[0298]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 89, and the variable light chain sequence recited in SEQ ID NO: 103.

**[0299]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 90, and the variable light chain sequence recited in SEQ ID NO: 104.

**[0300]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 91, and the variable light chain sequence recited in SEQ ID NO: 105.

**[0301]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 92, and the variable light chain sequence recited in SEQ ID NO: 106.

**[0302]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 93, and the variable light chain sequence recited in SEQ ID NO: 107.

**[0303]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 94, and the variable light chain sequence recited in SEQ ID NO: 108.

**[0304]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 95, and the variable light chain sequence recited in SEQ ID NO: 109.

**[0305]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 96, and the variable light chain sequence recited in SEQ ID NO: 110.

**[0306]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 97, and the variable light chain sequence recited in SEQ ID NO: 111.

**[0307]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope recognised by an antibody having the variable heavy chain sequence recited in SEQ ID NO: 98, and the variable light chain sequence recited in SEQ ID NO: 112.

**[0308]** Following more detailed epitope mapping experiments, the binding regions of preferred antibodies of the inventive compositions have been more clearly defined.

**[0309]** Thus, the disclosure provides a composition comprising an antibody that binds to an epitope comprising amino acids 78-83 of SEQ ID NO: 181 (WLDDFN—SEQ ID NO:188). The disclosure also provides a composition comprising an antibody that binds to an epitope comprising amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN—SEQ ID NO:186).

**[0310]** The disclosure also provides a composition comprising an antibody that binds to an epitope comprising amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN—SEQ ID NO:190).

**[0311]** The disclosure also provides a composition comprising an antibody that binds to an epitope comprising amino acids 52-56 of SEQ ID NO: 181 (EQDKR—SEQ ID NO:189). The disclosure also provides a composition comprising an antibody that binds to an epitope comprising amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHC-YASW—SEQ ID NO:187).

**[0312]** The disclosure also provides a composition comprising an antibody that binds to an epitope comprising or consisting of amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT—SEQ ID NO:191).

**[0313]** The disclosure also provides a composition comprising an antibody that binds to an epitope comprising or consisting of amino acids 100-110 of SEQ ID NO: 181 (YFC-CEGNFCN—SEQ ID NO:192);

**[0314]** The disclosure also provides a composition comprising an antibody that binds to an epitope comprising or consisting of amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR).

**[0315]** The disclosure also provides a composition comprising antibodies that bind to epitopes consisting of these sequences or epitopes comprising combinations of these epitope regions.

**[0316]** Thus, the disclosure also provides a composition comprising an antibody that binds to an epitope comprising or

consisting of amino acids 78-83 of SEQ ID NO: 181 (WLD-DFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR).

**[0317] Engineered and Modified Antibodies**

**[0318]** An antibody comprised in the inventive compositions further can be prepared using an antibody having one or more of the  $V_H$  and/or  $V_L$  sequences shown herein as starting material to engineer a modified antibody, which modified antibody may have altered properties from the starting antibody. An antibody can be engineered by modifying one or more residues within one or both variable regions (i.e.  $V_H$  and/or  $V_L$ ), for example within one or more CDR regions and/or within one or more framework regions. Additionally or alternatively, an antibody can be engineered by modifying residues within the constant region(s), for example to alter the effector function(s) of the antibody.

**[0319]** One type of variable region engineering that can be performed is CDR grafting. Antibodies interact with target antigens predominantly through amino acid residues that are located in the six heavy and light chain complementarity determining regions (CDRs). For this reason, the amino acid sequences within CDRs are more diverse between individual antibodies than sequences outside of CDRs. Because CDR sequences are responsible for most antibody-antigen interactions, it is possible to express recombinant antibodies that mimic the properties of specific naturally occurring antibodies by constructing expression vectors that include CDR sequences from the specific naturally occurring antibody grafted onto framework sequences from a different antibody with different properties (see, e.g. Riechmann, L. et al., 1998 Nature 332:323-327; Jones, P. et al., 1986 Nature 321:522-525; Queen, C. et al., 1989 Proc. Natl. Acad. Sci. U.S.A. 86:10029-10033; U.S. Pat. No. 5,225,539 to Winter, and U.S. Pat. Nos. 5,530,101; 5,585,089; 5,693,762 and 6,180,370 to Queen et al.).

**[0320]** Accordingly, another embodiment of the disclosure pertains to compositions comprising a monoclonal anti-ActRII antibody, or a functional protein comprising an antigen binding portion thereof, comprising a heavy chain variable region comprising CDR1 sequences having an amino acid sequence selected from the group consisting of SEQ ID NOs: 1-14; CDR2 sequences having an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28; CDR3 sequences having an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42, respectively; and a light chain variable region having CDR1 sequences having an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56; CDR2 sequences having an amino acid sequence selected from the group consisting of SEQ ID NOs: 57-70; and CDR3 sequences consisting of an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84, respectively. Thus, such antibodies contain the  $V_H$  and  $V_L$  CDR sequences of monoclonal antibodies, yet may contain different framework sequences from these antibodies.

**[0321]** Such framework sequences can be obtained from public DNA databases or published references that include germline antibody gene sequences. For example, germline DNA sequences for human heavy and light chain variable region genes can be found in the "VBase" human germline sequence database (available on the Internet at [www.mrc-cpe.cam.ac.uk/vbase](http://www.mrc-cpe.cam.ac.uk/vbase)), as well as in Kabat, E. A., et al., [supra]; Tomlinson, I. M., et al., 1992 J. Mol. Biol. 227:776-798; and Cox, J. P. L. et al., 1994 Eur. J Immunol. 24:827-836. An example of framework sequences for use in the antibodies of

the disclosure are those that are structurally similar to the framework sequences used by selected antibodies of the disclosure, e.g. consensus sequences and/or framework sequences used by monoclonal antibodies of the disclosure. The  $V_H$  CDR1, 2 and 3 sequences, and the  $V_L$  CDR1, 2 and 3 sequences, can be grafted onto framework regions that have the identical sequence as that found in the germline immunoglobulin gene from which the framework sequence derive, or the CDR sequences can be grafted onto framework regions that contain one or more mutations as compared to the germline sequences. For example, it has been found that in certain instances it is beneficial to mutate residues within the framework regions to maintain or enhance the antigen binding ability of the antibody (see e.g. U.S. Pat. Nos. 5,530,101; 5,585,089; 5,693,762 and 6,180,370 to Queen et al.).

**[0322]** Another type of variable region modification is to mutate amino acid residues within the  $V_H$  and/or  $V_L$  CDR1, CDR2 and/or CDR3 regions to thereby improve one or more binding properties (e.g. affinity) of the antibody of interest, known as "affinity maturation." Site-directed mutagenesis or PCR-mediated mutagenesis can be performed to introduce the mutation(s) and the effect on antibody binding, or other functional property of interest, can be evaluated in vitro or in vivo assays as described herein and provided in the Examples. Conservative modifications (as discussed above) can be introduced. The mutations may be amino acid substitutions, additions or deletions. Moreover, typically no more than one, two, three, four or five residues within a CDR region are altered.

**[0323]** Accordingly, in another embodiment, the disclosure provides isolated anti-ActRII monoclonal antibodies, or a functional protein comprising an antigen binding portion thereof, consisting of a heavy chain variable region having: a  $V_H$  CDR1 region consisting of an amino acid sequence selected from the group having SEQ ID NOs: 1-14 or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 1-14; a  $V_H$  CDR2 region having an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28, or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 15-28; a  $V_H$  CDR3 region having an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42, or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 29-42; a  $V_L$  CDR1 region having an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56, or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 43-56; a  $V_L$  CDR2 region having an amino acid sequence selected from the group consisting of SEQ ID NOs: 52-70, or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 52-70; and a  $V_L$  CDR3 region having an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84, or an amino acid sequence having one, two, three, four or five amino acid substitutions, deletions or additions as compared to SEQ ID NOs: 71-84.

**[0324] Camelid Antibodies**

**[0325]** Antibody proteins obtained from members of the camel and dromedary family (*Camelus bactrianus* and *Camelus dromaderius*) including new world members such as llama species (*Lama paccos*, *Lama glama* and *Lama vicugna*)



have been characterized with respect to size, structural complexity and antigenicity for human subjects. Certain IgG antibodies from this family of mammals as found in nature lack light chains, and are thus structurally distinct from the typical four chain quaternary structure having two heavy and two light chains, for antibodies from other animals (see WO94/04678).

**[0326]** A region of the camelid antibody which is the small single variable domain identified as  $V_{HH}$  can be obtained by genetic engineering to yield a small protein having high affinity for a target, resulting in a low molecular weight antibody-derived protein known as a “camelid nanobody” (see U.S. Pat. No. 5,759,808; Stijlemans, B. et al., 2004 J Biol Chem 279: 1256-1261; Dumoulin, M. et al., 2003 Nature 424: 783-788; Pleschberger, M. et al. 2003 Bioconjugate Chem 14: 440-448; Cortez-Retamozo, V. et al. 2002 Int J Cancer 89: 456-62; and Lauwereys, M. et al. 1998 EMBO J 17: 3512-3520). Engineered libraries of camelid antibodies and antibody fragments are commercially available, for example, from Ablynx, Ghent, Belgium. As with other antibodies of non-human origin, an amino acid sequence of a camelid antibody can be altered recombinantly to obtain a sequence that more closely resembles a human sequence, i.e. the nanobody can be “humanized”. Thus the natural low antigenicity of camelid antibodies to humans can be further reduced.

**[0327]** The camelid nanobody has a molecular weight approximately one-tenth that of a human IgG molecule, and the protein has a physical diameter of only a few nanometers. One consequence of the small size is the ability of camelid nanobodies to bind to antigenic sites that are functionally invisible to larger antibody proteins, i.e. camelid nanobodies are useful as reagents detect antigens that are otherwise cryptic using classical immunological techniques, and as possible therapeutic agents. Thus yet another consequence of small size is that a camelid nanobody can inhibit as a result of binding to a specific site in a groove or narrow cleft of a target protein, and hence can serve in a capacity that more closely resembles the function of a classical low molecular weight drug than that of a classical antibody.

**[0328]** The low molecular weight and compact size further result in camelid nanobodies being extremely thermostable, stable to extreme pH and to proteolytic digestion, and poorly antigenic. Another consequence is that camelid nanobodies readily move from the circulatory system into tissues, and even cross the blood-brain barrier and can treat disorders that affect nervous tissue. Nanobodies can further facilitate drug transport across the blood brain barrier (see US2004/0161738). These features combined with the low antigenicity to humans indicate great therapeutic potential. Further, these molecules can be fully expressed in prokaryotic cells such as *E. coli* and are expressed as fusion proteins with bacteriophage and are functional.

**[0329]** Accordingly, in one embodiment, the present disclosure related to composition comprising a camelid antibody or nanobody having high affinity for ActRIIB. In certain embodiments herein, the camelid antibody or nanobody is naturally produced in the camelid animal, i.e. is produced by the camelid following immunization with ActRIIB or a peptide fragment thereof, using techniques described herein for other antibodies.

**[0330]** Alternatively, the anti-ActRIIB camelid nanobody is engineered, i.e. produced by selection for example from a library of phage displaying appropriately mutagenized camelid nanobody proteins using panning procedures with

ActRIIB as a target as described in the examples herein. Engineered nanobodies can further be customized by genetic engineering to have a half life in a recipient subject of from 45 minutes to two weeks. In a specific embodiment, the camelid antibody or nanobody is obtained by grafting the CDRs sequences of the heavy or light chain of the human antibodies of the disclosure into nanobody or single domain antibody framework sequences, as described for example in WO94/04678.

**[0331]** Non-Antibody Scaffold

**[0332]** Known non-immunoglobulin frameworks or scaffolds include, but are not limited to, Adnectins (fibronectin) (Compound Therapeutics, Inc., Waltham, Mass.), ankyrin (Molecular Partners AG, Zurich, Switzerland), domain antibodies (Domantis, Ltd (Cambridge, Mass.) and Ablynx nv (Zwijnaarde, Belgium)), lipocalin (Anticalin) (Pieris Proteolab AG, Freising, Germany), small modular immunopharmaceuticals (Trubion Pharmaceuticals Inc., Seattle, Wash.), maxybodies (Avidia, Inc. (Mountain View, Calif.)), Protein A (Affibody AG, Sweden) and affilin (gamma-crystallin or ubiquitin) (Scil Proteins GmbH, Halle, Germany), protein epitope mimetics (Polyphor Ltd, Allschwil, Switzerland).

**[0333]** (i) Fibronectin Scaffold

**[0334]** The fibronectin scaffolds are based preferably on fibronectin type III domain (e.g. the tenth module of the fibronectin type III (10 Fn3 domain)). The fibronectin type III domain has 7 or 8 beta strands which are distributed between two beta sheets, which themselves pack against each other to form the core of the protein, and further containing loops (analogous to CDRs) which connect the beta strands to each other and are solvent exposed. There are at least three such loops at each edge of the beta sheet sandwich, where the edge is the boundary of the protein perpendicular to the direction of the beta strands (U.S. Pat. No. 6,818,418).

**[0335]** These fibronectin-based scaffolds are not an immunoglobulin, although the overall fold is closely related to that of the smallest functional antibody fragment, the variable region of the heavy chain, which comprises the entire antigen recognition unit in camel and llama IgG. Because of this structure, the non-immunoglobulin antibody mimics antigen binding properties that are similar in nature and affinity to those of antibodies. These scaffolds can be used in a loop randomization and shuffling strategy in vitro that is similar to the process of affinity maturation of antibodies in vivo. These fibronectin-based molecules can be used as scaffolds where the loop regions of the molecule can be replaced with CDRs of the disclosure using standard cloning techniques.

**[0336]** (ii) Ankyrin—Molecular Partners

**[0337]** The technology is based on using proteins with ankyrin derived repeat modules as scaffolds for bearing variable regions which can be used for binding to different targets. The ankyrin repeat module is a 33 amino acid polypeptide consisting of two anti-parallel  $\alpha$ -helices and a  $\beta$ -turn. Binding of the variable regions is mostly optimized by using ribosome display.

**[0338]** (iii) Maxybodies/Avimers—Avidia

**[0339]** Avimers are derived from natural A-domain containing protein such as LRP-1. These domains are used by nature for protein-protein interactions and in human over 250 proteins are structurally based on A-domains. Avimers consist of a number of different “A-domain” monomers (2-10) linked via amino acid linkers. Avimers can be created that can bind to the target antigen using the methodology described in,

for example, US2004/0175756; US2005/0053973; US2005/0048512; and US2006/0008844.

**[0340]** (vi) Protein A—Affibody

**[0341]** Affibody® affinity ligands are small, simple proteins composed of a three-helix bundle based on the scaffold of one of the IgG-binding domains of Protein A. Protein A is a surface protein from the bacterium *Staphylococcus aureus*. This scaffold domain consists of 58 amino acids, 13 of which are randomized to generate Affibody® libraries with a large number of ligand variants (See e.g. U.S. Pat. No. 5,831,012). Affibody® molecules mimic antibodies, they have a molecular weight of 6 kDa, compared to the molecular weight of antibodies, which is 150 kDa. In spite of its small size, the binding site of Affibody® molecules is similar to that of an antibody.

**[0342]** (v) Anticalins—Pieris

**[0343]** Anticalins® are products developed by the company Pieris ProteoLab AG. They are derived from lipocalins, a widespread group of small and robust proteins that are usually involved in the physiological transport or storage of chemically sensitive or insoluble compounds. Several natural lipocalins occur in human tissues or body liquids.

**[0344]** The protein architecture is reminiscent of immunoglobulins, with hypervariable loops on top of a rigid framework. However, in contrast with antibodies or their recombinant fragments, lipocalins are composed of a single polypeptide chain with 160 to 180 amino acid residues, being just marginally bigger than a single immunoglobulin domain.

**[0345]** The set of four loops, which makes up the binding pocket, shows pronounced structural plasticity and tolerates a variety of side chains. The binding site can thus be reshaped in a proprietary process in order to recognize prescribed target molecules of different shape with high affinity and specificity.

**[0346]** One protein of lipocalin family, the bilin-binding protein (BBP) of *Pieris brassicae* has been used to develop anticalins by mutagenizing the set of four loops. One example of a patent application describing “anticalins” is WO1999/16873.

**[0347]** (vi) Affilin—Scil Proteins

**[0348]** AFFILIN™ molecules are small non-immunoglobulin proteins which are designed for specific affinities towards proteins and small molecules. New AFFILIN™ molecules can be very quickly selected from two libraries, each of which is based on a different human derived scaffold protein.

**[0349]** AFFILIN™ molecules do not show any structural homology to immunoglobulin proteins. Scil Proteins employs two AFFILIN™ scaffolds, one of which is gamma crystalline, a human structural eye lens protein and the other is “ubiquitin” superfamily proteins. Both human scaffolds are very small, show high temperature stability and are almost resistant to pH changes and denaturing agents. This high stability is mainly due to the expanded beta sheet structure of the proteins. Examples of gamma crystalline derived proteins are described in WO2001/004144 and examples of “ubiquitin-like” proteins are described in WO2004/106368.

**[0350]** (vii) Protein Epitope Mimetics (PEM)

**[0351]** PEM are medium-sized, cyclic, peptide-like molecules (MW 1-2 kDa) mimicking beta-hairpin secondary structures of proteins, the major secondary structure involved in protein-protein interactions.

**[0352]** Grafting Antigen-Binding Domains into Alternative Frameworks or Scaffolds

**[0353]** A wide variety of antibody/immunoglobulin frameworks or scaffolds can be employed so long as the resulting

polypeptide includes at least one binding region which specifically binds to ActRIIB. Such frameworks or scaffolds include the 5 main idiotypes of human immunoglobulins, or fragments thereof (such as those disclosed elsewhere herein), and include immunoglobulins of other animal species, preferably having humanized aspects. Single heavy-chain antibodies such as those identified in camelids are of particular interest in this regard. Novel frameworks, scaffolds and fragments continue to be discovered and developed by those skilled in the art.

**[0354]** In one aspect, the compositions of the disclosure may comprise non-immunoglobulin based antibodies using non-immunoglobulin scaffolds onto which CDRs of the disclosed antibodies can be grafted. Known or future non-immunoglobulin frameworks and scaffolds may be employed, as long as they comprise a binding region specific for the target protein of SEQ ID NO: 181 (preferably, the ligand binding domain thereof as shown in SEQ ID NO: 182). Such compounds are known herein as “polypeptides comprising a target-specific binding region”. Examples of non-immunoglobulin framework are further described in the sections below (camelid antibodies and non-antibody scaffold).

**[0355]** Framework or Fc Engineering

**[0356]** Engineered antibodies comprised in the compositions of the disclosure include those in which modifications have been made to framework residues within  $V_H$  and/or  $V_L$ , e.g. to improve the properties of the antibody. Typically such framework modifications are made to decrease the immunogenicity of the antibody. For example, one approach is to “backmutate” one or more framework residues to the corresponding germline sequence. More specifically, an antibody that has undergone somatic mutation may contain framework residues that differ from the germline sequence from which the antibody is derived. Such residues can be identified by comparing the antibody framework sequences to the germline sequences from which the antibody is derived. To return the framework region sequences to their germline configuration, the somatic mutations can be “backmutated” to the germline sequence by, for example, site-directed mutagenesis or PCR-mediated mutagenesis. Such “backmutated” antibodies can also be comprised in the compositions of the disclosure.

**[0357]** Another type of framework modification involves mutating one or more residues within the framework region, or even within one or more CDR regions, to remove T-cell epitopes to thereby reduce the potential immunogenicity of the antibody. This approach is also referred to as “deimmunization” and is described in further detail in US2003/0153043.

**[0358]** In addition or alternative to modifications made within the framework or CDR regions, antibodies of the disclosure may be engineered to include modifications within the Fc region, typically to alter one or more functional properties of the antibody, such as serum half-life, complement fixation, Fc receptor binding, and/or antigen-dependent cellular cytotoxicity. Furthermore, an antibody comprised in the compositions of the disclosure may be chemically modified (e.g. one or more chemical moieties can be attached to the antibody) or be modified to alter its glycosylation, again to alter one or more functional properties of the antibody. Each of these embodiments is described in further detail below. The numbering of residues in the Fc region is that of the EU index of Kabat.

**[0359]** In one embodiment, the hinge region of CH1 is modified such that the number of cysteine residues in the hinge region is altered, e.g. increased or decreased. This approach is described further in U.S. Pat. No. 5,677,425. The number of cysteine residues in the hinge region of CH1 is altered to, for example, facilitate assembly of the light and heavy chains or to increase or decrease the stability of the antibody.

**[0360]** In another embodiment, the Fc hinge region of an antibody is mutated to decrease the biological half-life of the antibody. More specifically, one or more amino acid mutations are introduced into the CH2-CH3 domain interface region of the Fc-hinge fragment such that the antibody has impaired *Staphylococcal* protein A (SpA) binding relative to native Fc-hinge domain SpA binding. This approach is described in further detail in U.S. Pat. No. 6,165,745.

**[0361]** In another embodiment, the antibody is modified to increase its biological half-life. Various approaches are possible. For example, one or more of the following mutations can be introduced: T252L, T254S, T256F, as described in U.S. Pat. No. 6,277,375. Alternatively, to increase the biological half life, the antibody can be altered within the CH1 or CL region to contain a salvage receptor binding epitope taken from two loops of a CH2 domain of an Fc region of an IgG, as described in U.S. Pat. No. 5,869,046 and U.S. Pat. No. 6,121,022.

**[0362]** In yet other embodiments, the Fc region is altered by replacing at least one amino acid residue with a different amino acid residue to alter the effector functions of the antibody. For example, one or more amino acids can be replaced with a different amino acid residue such that the antibody has an altered affinity for an effector ligand but retains the antigen-binding ability of the parent antibody. The effector ligand to which affinity is altered can be, for example, an Fc receptor or the C1 component of complement. This approach is described in further detail in U.S. Pat. No. 5,624,821 and U.S. Pat. No. 5,648,260, both by Winter et al. In particular, residues 234 and 235 may be mutated. In particular, these mutations may be to alanine. Thus in one embodiment the antibody comprised in the compositions of the disclosure has a mutation in the Fc region at one or both of amino acids 234 and 235. In another embodiment, one or both of amino acids 234 and 235 may be substituted to alanine. Substitution of both amino acids 234 and 235 to alanine results in a reduced ADCC activity.

**[0363]** In another embodiment, one or more amino acids selected from amino acid residues of the described antibodies can be replaced with a different amino acid residue such that the antibody has altered C1q binding and/or reduced or abolished complement dependent cytotoxicity (CDC). This approach is described in further detail in U.S. Pat. No. 6,194,551.

**[0364]** In another embodiment, one or more amino acid residues of the described antibodies are altered to thereby alter the ability of the antibody to fix complement. This approach is described further in WO94/29351.

**[0365]** In yet another embodiment, the Fc region of the described antibodies is modified to increase the ability of the antibody to mediate antibody dependent cellular cytotoxicity (ADCC) and/or to increase the affinity of the antibody for an Fc $\gamma$  receptor by modifying one or more amino acids. This approach is described further in WO00/42072. Moreover, the binding sites on human IgG1 for Fc $\gamma$ RI, Fc $\gamma$ RII, Fc $\gamma$ RIII and

FcRn have been mapped and variants with improved binding have been described (see Shields, R. L. et al., 2001 J. Biol. Chem. 276:6591-6604).

**[0366]** In still another embodiment, the glycosylation of an antibody comprised in the compositions of the disclosure is modified. For example, an aglycosylated antibody can be made (i.e. the antibody lacks glycosylation). Glycosylation can be altered to, for example, increase the affinity of the antibody for the antigen. Such carbohydrate modifications can be accomplished by; for example, altering one or more sites of glycosylation within the antibody sequence. For example, one or more amino acid substitutions can be made that result in elimination of one or more variable region framework glycosylation sites to thereby eliminate glycosylation at that site. Such aglycosylation may increase the affinity of the antibody for antigen. Such an approach is described in further detail in U.S. Pat. Nos. 5,714,350 and 6,350,861 by Co et al.

**[0367]** Additionally or alternatively, an antibody can be used that has an altered type of glycosylation, such as a hypofucosylated antibody having reduced amounts of fucosyl residues or an antibody having increased bisecting GlcNac structures. Such altered glycosylation patterns have been demonstrated to increase the ADCC ability of antibodies. Such carbohydrate modifications can be accomplished by, for example, expressing the antibody in a host cell with altered glycosylation machinery. Cells with altered glycosylation machinery have been described in the art and can be used as host cells in which to express the disclosed recombinant antibodies to thereby produce an antibody with altered glycosylation. For example, EP 1,176,195 by Hang et al. describes a cell line with a functionally disrupted FUT8 gene, which encodes a fucosyl transferase, such that antibodies expressed in such a cell line exhibit hypofucosylation. Therefore, in one embodiment, the antibodies comprised in the compositions of the disclosure are produced by recombinant expression in a cell line which exhibit hypofucosylation pattern, for example, a mammalian cell line with deficient expression of the FUT8 gene encoding fucosyltransferase. WO03/035835 describes a variant CHO cell line, Lec13 cells, with reduced ability to attach fucose to Asn(297)-linked carbohydrates, also resulting in hypofucosylation of antibodies expressed in that host cell (see also Shields, R. L. et al., 2002 J. Biol. Chem. 277:26733-26740). WO99/54342 describes cell lines engineered to express glycoprotein-modifying glycosyl transferases (e.g. beta(1,4)-N acetylglucosaminyltransferase III (GnTIII)) such that antibodies expressed in the engineered cell lines exhibit increased bisecting GlcNac structures which results in increased ADCC activity of the antibodies (see also Umama et al., 1999 Nat. Biotech. 17:176-180). Alternatively, the antibodies comprised in the compositions of the disclosure can be produced in a yeast or a filamentous fungi engineered for mammalian-like glycosylation pattern, and capable of producing antibodies lacking fucose as glycosylation pattern (see for example EP1297172B1).

**[0368]** Another modification of the antibodies herein that is contemplated by the disclosure is pegylation. An antibody can be pegylated to, for example, increase the biological (e.g. serum) half-life of the antibody. To pegylate an antibody, the antibody, or fragment thereof, typically is reacted with polyethylene glycol (PEG), such as a reactive ester or aldehyde derivative of PEG, under conditions in which one or more PEG groups become attached to the antibody or antibody fragment. The pegylation can be carried out by an acylation

reaction or an alkylation reaction with a reactive PEG molecule (or an analogous reactive water-soluble polymer). As used herein, the term "polyethylene glycol" is intended to encompass any of the forms of PEG that have been used to derivatize other proteins, such as mono (C1-C10) alkoxy- or aryloxy-polyethylene glycol or polyethylene glycol-maleimide. In certain embodiments, the used antibody to be pegylated is an aglycosylated antibody. Methods for pegylating proteins are known in the art and can be applied to the disclosed antibodies (see for example, EP0154316 and EP0401384).

**[0369]** Another modification of the antibodies that is contemplated by the disclosure is a conjugate or a protein fusion of at least the antigen-binding region of the antibody comprised in the composition of the disclosure to serum protein, such as human serum albumin or a fragment thereof to increase half-life of the resulting molecule (see, for example, EP0322094).

**[0370]** Another possibility is a fusion of at least the antigen-binding region of the antibody comprised in the composition of the disclosure to proteins capable of binding to serum proteins, such as human serum albumin to increase half life of the resulting molecule (see, for example, EP0486525).

**[0371]** Methods of Engineering Altered Antibodies

**[0372]** As discussed above, the anti-ActRIIB antibodies having CDR sequences,  $V_H$  and  $V_L$  sequences or full length heavy and light chain sequences shown herein can be used to create new anti-ActRIIB antibodies by modifying the CDR sequences full length heavy chain and/or light chain sequences,  $V_H$  and/or  $V_L$  sequences, or the constant region(s) attached thereto. Thus, in another aspect of the disclosure, the structural features of an anti-ActRIIB antibody comprised in the compositions of the disclosure are used to create structurally related anti-ActRIIB antibodies that retain at least one functional property of the antibodies comprised in the compositions of the disclosure, such as binding to human ActRIIB but also inhibit one or more functional properties of ActRIIB (for example, the inhibition of Smad activation).

**[0373]** For example, one or more CDR regions of the antibodies comprised in the compositions of the present disclosure, or mutations thereof, can be combined recombinantly with known framework regions and/or other CDRs to create additional, recombinantly-engineered, anti-ActRIIB antibodies comprised in the compositions of the disclosure, as discussed above. Other types of modifications include those described in the previous section. The starting material for the engineering method is one or more of the  $V_H$  and/or  $V_L$  sequences provided herein, or one or more CDR regions thereof. To create the engineered antibody, it is not necessary to actually prepare (i.e. express as a protein) an antibody having one or more of the  $V_H$  and/or  $V_L$  sequences provided herein, or one or more CDR regions thereof. Rather, the information contained in the sequence(s) is used as the starting material to create a "second generation" sequence(s) derived from the original sequence(s) and then the "second generation" sequence(s) is prepared and expressed as a protein.

**[0374]** The altered antibody sequence can also be prepared by screening antibody libraries having fixed CDR3 sequences selected among the group consisting of SEQ ID NO: 29-42 and SEQ ID NO: 71-84 or minimal essential binding determinants as described in US2005/0255552 and diversity on CDR1 and CDR2 sequences. The screening can be performed

according to any screening technology appropriate for screening antibodies from antibody libraries, such as phage display technology.

**[0375]** Standard molecular biology techniques can be used to prepare and express the altered antibody sequence. The antibody encoded by the altered antibody sequence(s) is one that retains one, some or all of the functional properties of the anti-ActRIIB antibodies described herein, which functional properties include, but are not limited to, specifically binding to human ActRIIB and inhibition of Smad activation.

**[0376]** The altered antibody may exhibit one or more, two or more, or three or more of the functional properties discussed above.

**[0377]** The functional properties of the altered antibodies can be assessed using standard assays available in the art and/or described herein, such as those set forth in the Examples (e.g. ELISAs).

**[0378]** Mutations can be introduced randomly or selectively along all or part of an anti-ActRIIB antibody coding sequence and the resulting modified anti-ActRIIB antibodies can be screened for binding activity and/or other functional properties as described herein. Mutational methods have been described in the art. For example, WO02/092780 describes methods for creating and screening antibody mutations using saturation mutagenesis, synthetic ligation assembly, or a combination thereof. Alternatively, WO03/074679 describes methods of using computational screening methods to optimize physicochemical properties of antibodies.

**[0379]** Nucleic Acid Molecules Encoding Antibodies Comprised in the Compositions of the Disclosure

**[0380]** Examples of full length light chain nucleotide sequences optimized for expression in a mammalian cell are shown in SEQ ID NOs: 161-165 and 171-175. Examples of full length heavy chain nucleotide sequences optimized for expression in a mammalian cell are shown in SEQ ID NOs: 166-170 and 176-180.

**[0381]** The nucleic acids may be present in whole cells, in a cell lysate, or may be nucleic acids in a partially purified or substantially pure form. A nucleic acid is "isolated" or "rendered substantially pure" when purified away from other cellular components or other contaminants, e.g. other cellular nucleic acids or proteins, by standard techniques, including alkaline/SDS treatment, CsCl banding, column chromatography, agarose gel electrophoresis and others well known in the art. See, F. Ausubel, et al., ed. 1987 Current Protocols in Molecular Biology, Greene Publishing and Wiley Interscience, New York. Nucleic acids can be obtained using standard molecular biology techniques. For antibodies expressed by hybridomas (e.g. hybridomas prepared from transgenic mice carrying human immunoglobulin genes as described further below), cDNAs encoding the light and heavy chains of the antibody made by the hybridoma can be obtained by standard PCR amplification or cDNA cloning techniques. For antibodies obtained from an immunoglobulin gene library (e.g. using phage display techniques), nucleic acid encoding the antibody can be recovered from various phage clones that are members of the library.

**[0382]** Once DNA fragments encoding  $V_H$  and  $V_L$  segments are obtained, these DNA fragments can be further manipulated by standard recombinant DNA techniques, for example to convert the variable region genes to full-length antibody chain genes, to Fab fragment genes or to an scFv gene. In these manipulations, a  $V_L$ - or  $V_H$ -encoding DNA fragment is operatively linked to another DNA molecule, or

to a fragment encoding another protein, such as an antibody constant region or a flexible linker. The term “operatively linked”, as used in this context, is intended to mean that the two DNA fragments are joined in a functional manner, for example, such that the amino acid sequences encoded by the two DNA fragments remain in-frame, or such that the protein is expressed under control of a desired promoter.

**[0383]** The isolated DNA encoding the  $V_H$  region can be converted to a full-length heavy chain gene by operatively linking the  $V_H$ -encoding DNA to another DNA molecule encoding heavy chain constant regions (CH1, CH2 and CH3). The sequences of human heavy chain constant region genes are known in the art (see e.g. Kabat, E. A., et al. [supra]) and DNA fragments encompassing these regions can be obtained by standard PCR amplification. The heavy chain constant region can be an IgG1, IgG2, IgG3, IgG4, IgA, IgE, IgM or IgD constant region. The heavy chain constant region can be selected among IgG1 isotypes. For a Fab fragment heavy chain gene, the  $V_H$ -encoding DNA can be operatively linked to another DNA molecule encoding only the heavy chain CH1 constant region.

**[0384]** The isolated DNA encoding the  $V_L$  region can be converted to a full-length light chain gene (as well as to a Fab light chain gene) by operatively linking the  $V_L$ -encoding DNA to another DNA molecule encoding the light chain constant region, CL. The sequences of human light chain constant region genes are known in the art (see e.g. Kabat, E. A., et al. [supra]) and DNA fragments encompassing these regions can be obtained by standard PCR amplification. The light chain constant region can be a kappa or a lambda constant region.

**[0385]** To create an scFv gene, the  $V_H$ - and  $V_L$ -encoding DNA fragments are operatively linked to another fragment encoding a flexible linker, e.g. encoding the amino acid sequence (Gly4-Ser)<sub>3</sub>, such that the  $V_H$  and  $V_L$  sequences can be expressed as a contiguous single-chain protein, with the  $V_L$  and  $V_H$  regions joined by the flexible linker (see e.g. Bird et al., 1988 Science 242:423-426; Huston et al., 1988 Proc. Natl. Acad. Sci. USA 85:5879-5883; McCafferty et al., 1990 Nature 348:552-554).

**[0386]** Generation of Monoclonal Antibodies

**[0387]** Monoclonal antibodies (mAbs) can be produced by a variety of techniques, including conventional monoclonal antibody methodology e.g. the standard somatic cell hybridization technique of Kohler and Milstein (1975 Nature 256: 495). Many techniques for producing monoclonal antibody can be employed e.g. viral or oncogenic transformation of B lymphocytes.

**[0388]** An animal system for preparing hybridomas is the murine system. Hybridoma production in the mouse is a well established procedure. Immunization protocols and techniques for isolation of immunized splenocytes for fusion are known in the art. Fusion partners (e.g. murine myeloma cells) and fusion procedures are also known.

**[0389]** Chimeric or humanized antibodies comprised in the compositions of the present disclosure can be prepared based on the sequence of a murine monoclonal antibody prepared as described above. DNA encoding the heavy and light chain immunoglobulins can be obtained from the murine hybridoma of interest and engineered to contain non-murine (e.g. human) immunoglobulin sequences using standard molecular biology techniques. For example, to create a chimeric antibody, the murine variable regions can be linked to human constant regions using methods known in the art (see e.g. U.S.

Pat. No. 4,816,567). To create a humanized antibody, the murine CDR regions can be inserted into a human framework using methods known in the art (see e.g. U.S. Pat. No. 5,225, 539; 5,530,101; 5,585,089; 5,693,762 and 6,180,370).

**[0390]** In a certain embodiment, the antibodies comprised in the compositions of the disclosure are human monoclonal antibodies. Such human monoclonal antibodies directed against ActRIIB can be generated using transgenic or transchromosomal mice carrying parts of the human immune system rather than the mouse system. These transgenic and transchromosomal mice include mice referred to herein as HuMAb mice and KM mice, respectively, and are collectively referred to herein as “human Ig mice.”

**[0391]** The HuMAb mouse® (Medarex, Inc.) contains human immunoglobulin gene miniloci that encode un-rearranged human heavy ( $\mu$  and  $\gamma$ ) and  $\kappa$  light chain immunoglobulin sequences, together with targeted mutations that inactivate the endogenous  $\mu$  and  $\kappa$  chain loci (see e.g. Lonberg, et al., 1994 Nature 368(6474): 856-859). Accordingly, the mice exhibit reduced expression of mouse IgM or  $\kappa$ , and in response to immunization, the introduced human heavy and light chain transgenes undergo class switching and somatic mutation to generate high affinity human IgGk monoclonal (Lonberg, N. et al., 1994 [supra]; reviewed in Lonberg, N., 1994 Handbook of Experimental Pharmacology 113:49-101; Lonberg, N. and Huszar, D., 1995 Intern. Rev. Immunol. 13: 65-93, and Harding, F. and Lonberg, N., 1995 Ann. N. Y. Acad. Sci. 764:536-546). The preparation and use of HuMAb mice, and the genomic modifications carried by such mice, is further described in Taylor, L. et al., 1992 Nucleic Acids Research 20:6287-6295; Chen, J. et al., 1993 International Immunology 5: 647-656; Tuailon et al., 1993 Proc. Natl. Acad. Sci. USA 94:3720-3724; Choi et al., 1993 Nature Genetics 4:117-123; Chen, J. et al., 1993 EMBO J. 12: 821-830; Tuailon et al., 1994 J. Immunol. 152:2912-2920; Taylor, L. et al., 1994 International Immunology 579-591; and Fishwild, D. et al., 1996 Nature Biotechnology 14: 845-851, the contents of all of which are hereby specifically incorporated by reference in their entirety. See further, U.S. Pat. Nos. 5,545,806; 5,569,825; 5,625,126; 5,633,425; 5,789,650; 5,877,397; 5,661,016; 5,814,318; 5,874,299; 5,770,429; and 5,545,807; as well as WO92/103918, WO93/12227, WO94/25585, WO97/113852, WO98/24884; WO99/45962; and WO01/14424.

**[0392]** In another embodiment, human antibodies comprised in the compositions of the disclosure can be raised using a mouse that carries human immunoglobulin sequences on transgenes and transchromosomes such as a mouse that carries a human heavy chain transgene and a human light chain transchromosomes. Such mice, referred to herein as “KM mice”, are described in detail in WO02/43478.

**[0393]** Still further, alternative transgenic animal systems expressing human immunoglobulin genes are available in the art and can be used to raise anti-ActRIIB antibodies of the disclosure. For example, an alternative transgenic system referred to as the Xenomouse (Abgenix, Inc.) can be used. Such mice are described in, e.g. U.S. Pat. Nos. 5,939,598; 6,075,181; 6,114,598; 6,150,584 and 6,162,963.

**[0394]** Moreover, alternative transchromosomal animal systems expressing human immunoglobulin genes are available in the art and can be used to raise anti-ActRIIB antibodies of the disclosure. For example, mice carrying both a human heavy chain transchromosomes and a human light chain transchromosome, referred to as “TC mice” can be used;

such mice are described in Tomizuka et al., 2000 Proc. Natl. Acad. Sci. USA 97:722-727. Furthermore, cows carrying human heavy and light chain transchromosomes have been described in the art (Kuroiwa et al., 2002 Nature Biotechnology 20:889-894) and can be used to raise anti-ActRIIB antibodies.

**[0395]** Human recombinant antibodies comprised in the compositions of the disclosure can also be prepared using phage display methods for screening libraries of human immunoglobulin genes. Such phage display methods for isolating human antibodies are established in the art or described in the examples below. See for example: U.S. Pat. Nos. 5,223,409; 5,403,484; 5,571,698; 5,427,908; 5,580,717; 5,969,108; 6,172,197; 5,885,793; 6,521,404; 6,544,731; 6,555,313; 6,582,915 and 6,593,081.

**[0396]** Human monoclonal antibodies comprised in the compositions of the disclosure can also be prepared using SCID mice into which human immune cells have been reconstituted such that a human antibody response can be generated upon immunization. Such mice are described in, for example, U.S. Pat. Nos. 5,476,996 and 5,698,767.

**[0397]** Generation of Hybridomas Producing Human Monoclonal Antibodies

**[0398]** To generate hybridomas producing human monoclonal antibodies comprised in the compositions of the disclosure, splenocytes and/or lymph node cells from immunized mice can be isolated and fused to an appropriate immortalized cell line, such as a mouse myeloma cell line. The resulting hybridomas can be screened for the production of antigen-specific antibodies. For example, single cell suspensions of splenic lymphocytes from immunized mice can be fused to one-sixth the number of P3X63-Ag8.653 nonsecreting mouse myeloma cells (ATCC, CRL 1580) with 50% PEG. Cells are plated at approximately  $2 \times 10^4$  in flat bottom microtiter plates, followed by a two week incubation in selective medium containing 20% fetal Clone Serum, 18% "653" conditioned media, 5% origen (IGEN), 4 mM L-glutamine, 1 mM sodium pyruvate, 5 mM HEPES, 0.055 mM 2-mercaptoethanol, 50 units/ml penicillin, 50 mg/ml streptomycin, 50 mg/ml gentamycin and  $1 \times$  HAT (Sigma; the HAT is added 24 hours after the fusion). After approximately two weeks, cells can be cultured in medium in which the HAT is replaced with HT. Individual wells can then be screened by ELISA for human monoclonal IgM and IgG antibodies. Once extensive hybridoma growth occurs, medium can be observed usually after 10-14 days. The antibody secreting hybridomas can be replated, screened again, and if still positive for human IgG, the monoclonal antibodies can be subcloned at least twice by limiting dilution. The stable subclones can then be cultured in vitro to generate small amounts of antibody in tissue culture medium for characterization. To purify human monoclonal antibodies, selected hybridomas can be grown in two-liter spinner-flasks for monoclonal antibody purification. Supernatants can be filtered and concentrated before affinity chromatography with protein A-sepharose (Pharmacia).

**[0399]** Eluted IgG can be checked by gel electrophoresis and high performance liquid chromatography to ensure purity. The buffer solution can be exchanged into PBS, and the concentration can be determined by  $OD_{280}$  using 1.43 extinction coefficient. The monoclonal antibodies can be aliquoted and stored at  $-80^\circ$  C.

**[0400]** Generation of Transfectomas Producing Monoclonal Antibodies

**[0401]** Antibodies comprised in the compositions of the disclosure also can be produced in a host cell transfectoma using, for example, a combination of recombinant DNA techniques and gene transfection methods as is well known in the art (e.g. Morrison, S. (1985) Science 229:1202).

**[0402]** For example, to express the antibodies, or antibody fragments thereof, DNAs encoding partial or full-length light and heavy chains, can be obtained by standard molecular biology techniques (e.g. PCR amplification or cDNA cloning using a hybridoma that expresses the antibody of interest) and the DNAs can be inserted into expression vectors such that the genes are operatively linked to transcriptional and translational control sequences. In this context, the term "operatively linked" is intended to mean that an antibody gene is ligated into a vector such that transcriptional and translational control sequences within the vector serve their intended function of regulating the transcription and translation of the antibody gene. The expression vector and expression control sequences are chosen to be compatible with the expression host cell used. The antibody light chain gene and the antibody heavy chain gene can be inserted into separate vector or, more typically, both genes are inserted into the same expression vector. The antibody genes are inserted into the expression vector by standard methods (e.g. ligation of complementary restriction sites on the antibody gene fragment and vector, or blunt end ligation if no restriction sites are present). The light and heavy chain variable regions of the antibodies described herein can be used to create full-length antibody genes of any antibody isotype by inserting them into expression vectors already encoding heavy chain constant and light chain constant regions of the desired isotype such that the  $V_H$  segment is operatively linked to the CH segment(s) within the vector and the  $V_L$  segment is operatively linked to the CL segment within the vector. Additionally or alternatively, the recombinant expression vector can encode a signal peptide that facilitates secretion of the antibody chain from a host cell. The antibody chain gene can be cloned into the vector such that the signal peptide is linked in frame to the amino terminus of the antibody chain gene. The signal peptide can be an immunoglobulin signal peptide or a heterologous signal peptide (i.e. a signal peptide from a non-immunoglobulin protein).

**[0403]** In addition to the antibody chain genes, the recombinant expression vectors of the disclosure carry regulatory sequences that control the expression of the antibody chain genes in a host cell. The term "regulatory sequence" is intended to include promoters, enhancers and other expression control elements (e.g. polyadenylation signals) that control the transcription or translation of the antibody chain genes. Such regulatory sequences are described, for example, in Goeddel (Gene Expression Technology. Methods in Enzymology 185, Academic Press, San Diego, Calif. 1990). It will be appreciated by those skilled in the art that the design of the expression vector, including the selection of regulatory sequences, may depend on such factors as the choice of the host cell to be transformed, the level of expression of protein desired, etc. Regulatory sequences for mammalian host cell expression include viral elements that direct high levels of protein expression in mammalian cells, such as promoters and/or enhancers derived from cytomegalovirus (CMV), Simian Virus 40 (SV40), adenovirus (e.g. the adenovirus major late promoter (AdMLP)), and polyoma. Alternatively, nonviral regulatory sequences may be used, such as the ubiq-

uitin promoter or P-globin promoter. Still further, regulatory elements composed of sequences from different sources, such as the SRa promoter system, which contains sequences from the SV40 early promoter and the long terminal repeat of human T cell leukemia virus type 1 (Takebe, Y. et al., 1988 *Mol. Cell. Biol.* 8:466-472).

**[0404]** In addition to the antibody chain genes and regulatory sequences, the recombinant expression vectors may carry additional sequences, such as sequences that regulate replication of the vector in host cells (e.g. origins of replication) and selectable marker genes. The selectable marker gene facilitates selection of host cells into which the vector has been introduced (see, e.g. U.S. Pat. Nos. 4,399,216, 4,634,665 and 5,179,017). For example, typically the selectable marker gene confers resistance to drugs, such as G418, hygromycin or methotrexate, on a host cell into which the vector has been introduced. Selectable marker genes include the dihydrofolate reductase (DHFR) gene (for use in dhfr-host cells with methotrexate selection/amplification) and the neo gene (for G418 selection).

**[0405]** For expression of the light and heavy chains, the expression vector(s) encoding the heavy and light chains is transfected into a host cell by standard techniques. The various forms of the term "transfection" are intended to encompass a wide variety of techniques commonly used for the introduction of exogenous DNA into a prokaryotic or eukaryotic host cell, e.g. electroporation, calcium-phosphate precipitation, DEAE-dextran transfection and the like. It is theoretically possible to express the antibodies of the disclosure in either prokaryotic or eukaryotic host cells. Expression of antibodies in eukaryotic cells, in particular mammalian host cells, is discussed because such eukaryotic cells, and in particular mammalian cells, are more likely than prokaryotic cells to assemble and secrete a properly folded and immunologically active antibody. Prokaryotic expression of antibody genes has been reported to be ineffective for production of high yields of active antibody (Boss, M. A. and Wood, C. R., 1985 *Immunology Today* 6:12-13).

**[0406]** Mammalian host cells for expressing the recombinant antibodies comprised in the compositions of the disclosure include Chinese Hamster Ovary (CHO cells) (including dhfr-CHO cells, described Urlaub and Chasin, 1980 *Proc. Natl. Acad. Sci. USA* 77:4216-4220 used with a DH FR selectable marker, e.g. as described in R. J. Kaufman and P. A. Sharp, 1982 *Mol. Biol.* 159:601-621), NSO myeloma cells, COS cells and SP2 cells. In one embodiment the host cells are CHO K1PD cells. In particular, for use with NSO myeloma cells, another expression system is the GS gene expression system shown in WO87/04462, WO89/01036 and EP 338,841. Mammalian host cells for expressing the recombinant antibodies comprised in the compositions of the disclosure include mammalian cell lines deficient for FUT8 gene expression, for example as described in U.S. Pat. No. 6,946,292B2. When recombinant expression vectors encoding antibody genes are introduced into mammalian host cells, the antibodies are produced by culturing the host cells for a period of time sufficient to allow for expression of the antibody in the host cells or secretion of the antibody into the culture medium in which the host cells are grown. Antibodies can be recovered from the culture medium using standard protein purification methods.

**[0407]** Immunoconjugates

**[0408]** In another aspect, the present disclosure features compositions comprising an anti-ActRIIB antibody, or a

fragment thereof, conjugated to a therapeutic moiety, such as a cytotoxin, a drug (e.g., an immunosuppressant) or a radiotoxin. Such conjugates are referred to herein as "immunoconjugates". Immunoconjugates that include one or more cytotoxins are referred to as "immunotoxins." A cytotoxin or cytotoxic agent includes any agent that is detrimental to (e.g., kills) cells.

**[0409]** Cytotoxins can be conjugated to antibodies of the disclosure using linker technology available in the art. Examples of linker types that have been used to conjugate a cytotoxin to an antibody include, but are not limited to, hydrazones, thioethers, esters, disulfides and peptide-containing linkers. A linker can be chosen that is, for example, susceptible to cleavage by low pH within the lysosomal compartment or susceptible to cleavage by proteases, such as proteases preferentially expressed in tumor tissue such as cathepsins (e.g. cathepsins B, C, D).

**[0410]** For further discussion of types of cytotoxins, linkers and methods for conjugating therapeutic agents to antibodies, see also Saito, G. et al., 2003 *Adv. Drug Deliv. Rev.* 55:199-215; Trail, P. A. et al., 2003 *Cancer Immunol. Immunother.* 52:328-337; Payne, G. 2003 *Cancer Cell* 3:207-212; Allen, T. M., 2002 *Nat. Rev. Cancer* 2:750-763; Pastan, I. and Kreitman, R. J., 2002 *Curr. Opin. Investig. Drugs* 3:1089-1091; Senter, P. D. and Springer, C. J., 2001 *Adv. Drug Deliv. Rev.* 53:247-264.

**[0411]** Antibodies comprised in the compositions of the present disclosure also can be conjugated to a radioactive isotope to generate cytotoxic radiopharmaceuticals, also referred to as radioimmunoconjugates. Examples of radioactive isotopes that can be conjugated to antibodies for use diagnostically or therapeutically include, but are not limited to, iodine<sup>131</sup>, indium<sup>111</sup>, yttrium<sup>90</sup>, and lutetium<sup>177</sup>. Methods for preparing radioimmunoconjugates are established in the art. Examples of radioimmunoconjugates are commercially available, including Zevalin™ (DEC Pharmaceuticals) and Bexxar™ (Corixa Pharmaceuticals), and similar methods can be used to prepare radioimmunoconjugates using the antibodies of the disclosure.

**[0412]** The antibody conjugates comprised in the compositions of the disclosure can be used to modify a given biological response, and the drug moiety is not to be construed as limited to classical chemical therapeutic agents. For example, the drug moiety may be a protein or polypeptide possessing a desired biological activity. Such proteins may include, for example, an enzymatically active toxin, or active fragment thereof, such as abrin, ricin A, pseudomonas exotoxin, or diphtheria toxin; a protein such as tumor necrosis factor or interferon- $\gamma$ ; or, biological response modifiers such as, for example, lymphokines, interleukin-1 ("IL-1"), interleukin-2 ("IL-2"), interleukin-6 ("IL-6"), granulocyte macrophage colony stimulating factor ("GM-CSF"), granulocyte colony stimulating factor ("G-CSF"), or other growth factors.

**[0413]** Techniques for conjugating such therapeutic moiety to antibodies are well known, see, e.g. Amon et al., "Monoclonal Antibodies For Immunotargeting Of Drugs In Cancer Therapy", in *Monoclonal Antibodies And Cancer Therapy*, Reisfeld et al. (eds.), pp. 243-56 (Alan R. Liss, Inc. 1985); Hellstrom et al., "Antibodies For Drug Delivery", in *Controlled Drug Delivery* (2nd Ed.), Robinson et al. (eds.), pp. 623-53 (Marcel Dekker, Inc. 1987); Thorpe, "Antibody Carriers Of Cytotoxic Agents In Cancer Therapy: A Review", in *Monoclonal Antibodies '84: Biological And Clinical Applications*, Pinchera et al. (eds.), pp. 475-506 (1985); "Analysis,

Results, And Future Prospective Of The Therapeutic Use Of Radiolabeled Antibody In Cancer Therapy”, in *Monoclonal Antibodies For Cancer Detection And Therapy*, Baldwin et al. (eds.), pp. 303-16 (Academic Press 1985), and Thorpe et al., “The Preparation And Cytotoxic Properties Of Antibody-Toxin Conjugates”, *Inmunol. Rev.*, 62:119-58 (1982).

**[0414] Bispecific Molecules**

**[0415]** In another aspect, the present disclosure features compositions comprising bispecific or multispecific molecules comprising an anti-ActRIIB antibody, or a fragment thereof, of the disclosure. An antibody comprised in the compositions of the disclosure, or antigen-binding regions thereof, can be derivatized or linked to another functional molecule, e.g. another peptide or protein (e.g. another antibody or ligand for a receptor) to generate a bispecific molecule that binds to at least two different binding sites or target molecules. The antibody of the disclosure may in fact be derivatized or linked to more than one other functional molecule to generate multi-specific molecules that bind to more than two different binding sites and/or target molecules; such multi-specific molecules are also intended to be encompassed by the term “bispecific molecule” as used herein. To create a bispecific molecule of the disclosure, an antibody of the disclosure can be functionally linked (e.g. by chemical coupling, genetic fusion, noncovalent association or otherwise) to one or more other binding molecules, such as another antibody, antibody fragment, peptide or binding mimetic, such that a bispecific molecule results.

**[0416]** Accordingly, the present disclosure includes compositions comprising bispecific molecules comprising at least one first binding specificity for ActRIIB and a second binding specificity for a second target epitope. For example, the second target epitope may be another epitope of ActRIIB different from the first target epitope.

**[0417]** Additionally, for the compositions in which the bispecific molecule is multi-specific, the molecule can further include a third binding specificity, in addition to the first and second target epitope.

**[0418]** In one embodiment, the bispecific molecules of the disclosed compositions comprise as a binding specificity at least one antibody, or an antibody fragment thereof, including, e.g. an Fab, Fab', F(ab')<sub>2</sub>, Fv, or a single chain Fv. The antibody may also be a light chain or heavy chain dimer, or any minimal fragment thereof such as a Fv or a single chain construct as described in Ladner et al. U.S. Pat. No. 4,946,778, the contents of which is expressly incorporated by reference.

**[0419]** Other antibodies which can be employed in the bispecific molecules are murine, chimeric and humanized monoclonal antibodies.

**[0420]** The bispecific molecules comprised in the compositions of the present disclosure can be prepared by conjugating the constituent binding specificities, using methods known in the art. For example, each binding specificity of the bispecific molecule can be generated separately and then conjugated to one another. When the binding specificities are proteins or peptides, a variety of coupling or cross-linking agents can be used for covalent conjugation. Examples of cross-linking agents include protein A, carbodiimide, N-succinimidyl-S-acetyl-thioacetate (SATA), 5,5'-dithiobis(2-nitrobenzoic acid) (DTNB), o-phenylenedimaleimide (oPDM), N-succinimidyl-3-(2-pyridyldithio)propionate (SPDP), and sulfo-succinimidyl 4-(N-maleimidomethyl)cyclohexane-1-carboxylate (sulfo-SMCC) (see e.g. Karpovsky et al., 1984 J.

Exp. Med. 160:1686; Liu, MA et al., 1985 Proc. Natl. Acad. Sci. USA 82:8648). Other methods include those described in Paulus, 1985 Behring Ins. Mitt. No. 78,118-132; Brennan et al., 1985 Science 229:81-83), and Glennie et al., 1987 J. Immunol. 139: 2367-2375). Conjugating agents are SATA and sulfo-SMCC, both available from Pierce Chemical Co. (Rockford, Ill.).

**[0421]** When the binding specificities are antibodies, they can be conjugated by sulfhydryl bonding of the C-terminus hinge regions of the two heavy chains. In a particularly embodiment, the hinge region is modified to contain an odd number of sulfhydryl residues, for example one, prior to conjugation.

**[0422]** Alternatively, both binding specificities can be encoded in the same vector and expressed and assembled in the same host cell. This method is particularly useful where the bispecific molecule is a mAbxmAb, mAbxFab, FabxF(ab')<sub>2</sub> or ligandxFab fusion protein. A bispecific molecule comprised in the compositions of the disclosure can be a single chain molecule comprising one single chain antibody and a binding determinant, or a single chain bispecific molecule comprising two binding determinants. Bispecific molecules may comprise at least two single chain molecules. Methods for preparing bispecific molecules are described for example in U.S. Pat. Nos. 5,260,203; 5,455,030; 4,881,175; 5,132,405; 5,091,513; 5,476,786; 5,013,653; 5,258,498; and 5,482,858.

**[0423]** Binding of the bispecific molecules to their specific targets can be confirmed by, for example, enzyme-linked immunosorbent assay (ELISA), radioimmunoassay (RIA), FACS analysis, bioassay (e.g. growth inhibition), or Western Blot assay. Each of these assays generally detects the presence of protein-antibody complexes of particular interest by employing a labeled reagent (e.g. an antibody) specific for the complex of interest.

**[0424] Multivalent Antibodies**

**[0425]** In another aspect, the present disclosure relates to compositions comprising multivalent antibodies comprising at least two identical or different antigen-binding portions of the disclosed antibodies binding to ActRIIB. In one embodiment, the multivalent antibodies provide at least two, three or four antigen-binding portions of the antibodies. The antigen-binding portions can be linked together via protein fusion or covalent or non covalent linkage. Alternatively, methods of linkage have been described for the bispecific molecules. In various embodiments, the composition can be mono-, bi- or multi-valent (e.g., capable of binding to one, two or several antigens), and/or mono-, bi- or multi-specific (e.g., having binding region(s) capable of binding to one, two or several different antigens). a composition can be any combination of these, e.g., monovalent and mono-specific (having one binding region that binds to one antigen or epitope); or bi-valent and bi-specific (having two binding regions, each of which bind to a different epitope or antigen); or bi-valent and mono-specific (having two binding regions, each of which bind to the same epitope or antigen); or multi-valent and mono-specific (having several binding regions that all bind to the same antigen or epitope); or multi-valent and multi-specific (having several binding regions that bind to several different antigens or epitopes).

**[0426] Pharmaceutical Compositions**

**[0427]** In another aspect, the present disclosure provides a composition, e.g. a pharmaceutical composition, containing one or a combination of the above described antibodies/



monoclonal antibodies, or antigen-binding portion(s) thereof, formulated together with a pharmaceutically acceptable carrier. Such compositions may include one or a combination of (e.g. two or more different) the described antibodies, or immunoconjugates or bispecific molecules. For example, a pharmaceutical composition of the disclosure can comprise a combination of antibodies that bind to different epitopes on the target antigen or that have complementary activities.

**[0428]** Pharmaceutical compositions of the disclosure also can be administered in combination therapy, i.e. combined with other agents. For example, the combination therapy can include an anti-ActRII antibody of the present disclosure combined with at least one other muscle mass/strength increasing agent, for example, IGF-1, IGF-2 or variants of IGF-1 or IGF-2, an anti-myostatin antibody, a myostatin propeptide, a myostatin decoy protein that binds ActRIIB but does not activate it, a beta 2 agonist, a Ghrelin agonist, a SARM, GH agonists/mimetics or follistatin. Examples of therapeutic agents that can be used in combination therapy are described in greater detail below in the section on uses of the antibodies of the disclosure.

**[0429]** As used herein, "pharmaceutically acceptable carrier" includes any and all solvents, dispersion media, coatings, antibacterial and antifungal agents, isotonic and absorption delaying agents, and the like that are physiologically compatible. The carrier should be suitable for intravenous, intramuscular, subcutaneous, parenteral, spinal or epidermal administration (e.g. by injection or infusion), preferably for intravenous injection or infusion. Depending on the route of administration, the active compound, i.e. antibody, immunoconjugate, or bispecific molecule, may be coated in a material to protect the compound from the action of acids and other natural conditions that may inactivate the compound.

**[0430]** The pharmaceutical compositions of the disclosure may include one or more pharmaceutically acceptable salts. A "pharmaceutically acceptable salt" refers to a salt that retains the desired biological activity of the parent compound and does not impart any undesired toxicological effects (see e.g. Berge, S. M., et al., 1977 J. Pharm. Sci. 66:1-19). Examples of such salts include acid addition salts and base addition salts. Acid addition salts include those derived from nontoxic inorganic acids, such as hydrochloric, nitric, phosphoric, sulfuric, hydrobromic, hydroiodic, phosphorous and the like, as well as from nontoxic organic acids such as aliphatic mono- and di-carboxylic acids, phenyl-substituted alkanolic acids, hydroxy alkanolic acids, aromatic acids, aliphatic and aromatic sulfonic acids and the like. Base addition salts include those derived from alkaline earth metals, such as sodium, potassium, magnesium, calcium and the like, as well as from nontoxic organic amines, such as N,N'-dibenzylethylenediamine, N-methylglucamine, chlorprocaine, choline, diethanolamine, ethylenediamine, procaine and the like.

**[0431]** A pharmaceutical composition of the disclosure also may include a pharmaceutically acceptable anti-oxidant. Examples of pharmaceutically acceptable antioxidants include: water soluble antioxidants, such as ascorbic acid, cysteine hydrochloride, sodium bisulfate, sodium metabisulfite, sodium sulfite and the like; oil-soluble antioxidants, such as ascorbyl palmitate, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), lecithin, propyl gallate, alpha-tocopherol, and the like; and metal chelating agents, such as citric acid, ethylenediamine tetraacetic acid (EDTA), sorbitol, tartaric acid, phosphoric acid, and the like.

**[0432]** Examples of suitable aqueous and nonaqueous carriers that may be employed in the pharmaceutical compositions of the disclosure include water, ethanol, polyols (such as glycerol, propylene glycol, polyethylene glycol, and the like), and suitable mixtures thereof, vegetable oils, such as olive oil, and injectable organic esters, such as ethyl oleate. Proper fluidity can be maintained, for example, by the use of coating materials, such as lecithin, by the maintenance of the required particle size in the case of dispersions, and by the use of surfactants.

**[0433]** These compositions may also contain adjuvants such as preservatives, wetting agents, emulsifying agents and dispersing agents. Prevention of presence of microorganisms may be ensured both by sterilization procedures, supra, and by the inclusion of various antibacterial and antifungal agents, for example, parabens, chlorobutanol, phenol sorbic acid, and the like. It may also be desirable to include isotonic agents, such as sugars, sodium chloride, and the like into the compositions. In addition, prolonged absorption of the injectable pharmaceutical form may be brought about by the inclusion of agents which delay absorption such as, aluminum monostearate and gelatin.

**[0434]** Pharmaceutically acceptable carriers include sterile aqueous solutions or dispersions and sterile powders for the extemporaneous preparation of sterile injectable solutions or dispersion. The use of such media and agents for pharmaceutically active substances is known in the art. Except insofar as any conventional media or agent is incompatible with the active compound, use thereof in the pharmaceutical compositions of the disclosure is contemplated. Supplementary active compounds can also be incorporated into the compositions.

**[0435]** Therapeutic compositions typically must be sterile and stable under the conditions of manufacture and storage. The composition can be formulated as a solution, microemulsion, liposome, or other ordered structure suitable to high drug concentration. The carrier can be a solvent or dispersion medium containing, for example, water, ethanol, polyol (for example, glycerol, propylene glycol, and liquid polyethylene glycol, and the like), and suitable mixtures thereof. The proper fluidity can be maintained, for example, by the use of a coating such as lecithin, by the maintenance of the required particle size in the case of dispersion and by the use of surfactants. In many cases, one can include isotonic agents, for example, sugars, polyalcohols such as mannitol, sorbitol, or sodium chloride in the composition. Prolonged absorption of the injectable compositions can be brought about by including in the composition an agent that delays absorption for example, monostearate salts and gelatin.

**[0436]** Sterile injectable solutions can be prepared by incorporating the active compound in the required amount in an appropriate solvent with one or a combination of agents enumerated above, as required, followed by sterilization microfiltration. Generally, dispersions are prepared by incorporating the active compound into a sterile vehicle that contains a basic dispersion medium and the required other agents from those enumerated above. In the case of sterile powders for the preparation of sterile injectable solutions, the methods of preparation are vacuum drying and freeze-drying (lyophilization) that yield a powder of the active agent plus any additional desired agent from a previously sterile-filtered solution thereof.

**[0437]** The amount of active agent which can be combined with a carrier material to produce a single dosage form will

vary depending upon the subject being treated, and the particular mode of administration. The amount of active agent which can be combined with a carrier material to produce a single dosage form will generally be that amount of the composition which produces a therapeutic effect. Generally, out of one hundred percent, this amount will range from about 0.01 percent to about ninety-nine percent of active agent, from about 0.1 percent to about 70 percent, or from about 1 percent to about 30 percent of active agent in combination with a pharmaceutically acceptable carrier.

**[0438]** 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 disclosure are dictated by and directly dependent on the unique characteristics of the active compound and the particular therapeutic effect to be achieved, and the limitations inherent in the art of compounding such an active compound for the treatment of sensitivity in individuals.

**[0439]** For administration of the antibody comprising composition for use according to the present disclosure, the antibody dosage ranges from about 0.0001 to about 100 mg/kg, and more usually about 0.01 to about 30 mg/kg, of the host body weight. For example dosages are about 1 mg/kg body weight, about 3 mg/kg body weight, about 5 mg/kg body weight or about 10 mg/kg body weight within the ranges of about 1-10 mg/kg e.g., about 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 mg/kg body weight, preferably once every 4 weeks. Such administration is preferably carried out intravenously. Alternatively, administration is carried out subcutaneously.

**[0440]** Dosage regimens for an anti-ActR11 antibody of the disclosure, e.g., bimagrumab, include about 1 mg/kg body weight or about 3 mg/kg body weight or about 10 mg/kg body weight once every four weeks weight by intravenous administration.

**[0441]** Preferably the compositions of the disclosure are for use in the treatment of sporadic inclusion body myositis.

**[0442]** In one specific embodiment the physical function and mobility of the patient suffering from sporadic inclusion body myositis are improved.

**[0443]** In one specific embodiment the swallowing difficulties or dysphagia of the patient suffering from sporadic inclusion body myositis are improved.

**[0444]** In one specific embodiment upper extremity strength of the patient suffering from sporadic inclusion body myositis is improved.

**[0445]** In one specific embodiment incidence of falls or risk of falling of the patient suffering from sporadic inclusion body myositis are reduced.

**[0446]** In some methods, two or more monoclonal antibodies with different binding specificities are comprised in the compositions of the disclosure and, thus, administered simultaneously, in which case the dosage of each antibody administered falls within the ranges indicated. An antibody is usually administered on multiple occasions. Intervals between

single dosages can be, for example, weekly, monthly, every three months, every six months or yearly. Intervals can also be irregular as indicated by measuring blood levels of antibody to the target antigen in the patient. In some methods, dosage is adjusted to achieve a plasma antibody concentration of about 1-about 1000  $\mu\text{g/ml}$  and in some methods about 25-about 300  $\mu\text{g/ml}$ . For example, an ActR11 antibody of the disclosure could be co-administered with an anti-myostatin antibody.

**[0447]** Dosage and frequency vary depending on the half-life of the antibody in the patient. In general, human antibodies show the longest half-life, followed by humanized antibodies, chimeric antibodies, and nonhuman antibodies. The dosage and frequency of administration can vary depending on whether the treatment is prophylactic or therapeutic. In prophylactic applications, a relatively low dosage is administered at relatively infrequent intervals over a long period of time. Some patients continue to receive treatment for the rest of their lives. In therapeutic applications, a relatively high dosage at relatively short intervals is sometimes required until progression of the disease is reduced or terminated or until the patient shows partial or complete amelioration of symptoms of disease. Thereafter, the patient can be administered a prophylactic regime.

**[0448]** Administration of a "therapeutically effective dosage" of an anti-ActR11 antibody comprised in the compositions of the disclosure can result in a decrease in severity of disease symptoms, an increase in frequency and duration of disease symptom-free periods, or a prevention of impairment or disability due to the disease affliction i.e. an increase in muscle mass and/or strength.

**[0449]** The active compounds can be prepared with carriers 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.

**[0450]** Therapeutic compositions can be administered with medical devices known in the art.

**[0451]** Uses and Methods of the Disclosure

**[0452]** The compositions of the present disclosure and the disclosed antibodies have therapeutic utilities, because they have an impact on the treatment of sporadic inclusion body myositis or on the amelioration of the condition of patients affected by sporadic inclusion body myositis or on the reduction of symptoms associated with sporadic inclusion body myositis.

**[0453]** The term "subject" or "individual" as used herein is intended to include human and non-human animals. Non-human animals include all vertebrates, e.g. mammals and non-mammals, such as non-human primates, sheep, dogs, cats, cows, horses, chickens, amphibians, and reptiles.

**[0454]** Hence, the disclosure also relates to methods of treatment in which compositions of the disclosure or the disclosed myostatin antagonists, e.g., myostatin binding molecules or ActR11 binding molecules, preferably ActR11 binding molecules, more preferably antibodies to ActR11, e.g. bimagrumab or BYM338, inhibit, i.e. antagonize, the function of ActR11 and thereby resulting in the alleviation of

sporadic inclusion body myositis. The disclosure provides a method of treating a patient suffering from sporadic inclusion body myositis comprising administering a therapeutically effective amount of a myostatin antagonist, e.g., myostatin binding molecule or ActRIIB binding molecule, preferably ActRIIB binding molecule, more preferably an antagonist antibody to ActRIIB, e.g., BYM338 or the disclosed compositions to the patient.

**[0455]** Examples of myostatin antagonists, e.g., myostatin binding molecules or ActRII binding molecules, preferably ActRIIB binding molecules, more preferably antagonist antibodies to ActRIIB, e.g., bimagrumab or BYM338, that can be used in the disclosed methods of treatment are those disclosed or described in detail above. In certain embodiments, the ActRII antibodies (e.g., bimagrumab or BYM338) are comprised in the herein disclosed inventive compositions.

**[0456]** The disclosure also relates to the use of a myostatin antagonist, e.g., myostatin binding molecule or ActRIIB binding molecule, preferably ActRIIB binding molecule, more preferably an antagonist antibody to ActRII, e.g., BYM338, in the manufacture of a medicament for treating sporadic inclusion body myositis.

**[0457]** In a further embodiment, the patient may be one who has not responded to previous treatments. For example, the patient may not have responded to treatment with IGF-1, IGF-2 or variants of IGF-1 or IGF-2, an anti-myostatin antibody, a myostatin propeptide, a myostatin decoy protein that binds ActRIIB but does not activate it, a beta 2 agonist, a Ghrelin agonist, a SARM, GH agonists/mimetics or follistatin. A simple way of measuring a patient's response to treatment may be timing how long it takes for a patient to climb a known height of stairs and comparing the results both before and after treatment.

**[0458]** The myostatin antagonist, e.g., myostatin binding molecule or ActRII binding molecule, preferably ActRII binding molecule, more preferably an antagonist antibody to ActRII, e.g., bimagrumab or BYM338, may be administered as the sole active agent or in conjunction with, e.g. as an adjuvant to or in combination to, other drugs e.g. IGF-1, IGF-2 or variants of IGF-1 or IGF-2, an anti-myostatin antibody, a myostatin propeptide, a myostatin decoy protein that binds ActRIIB but does not activate it, a beta 2 agonist, a Ghrelin agonist, a SARM, GH agonists/mimetics or follista-

tin. For example, the antagonists of the disclosure may be used in combination with an IGF-1 mimetic as disclosed in WO2007/146689.

**[0459]** In accordance with the foregoing the present disclosure provides in a yet further aspect: A method or use as defined above comprising co-administration, e.g. concomitantly or in sequence, of a therapeutically effective amount of a myostatin antagonist, e.g., myostatin binding molecule or ActRII binding molecule, preferably an ActRII or binding molecule, more preferably an antagonist antibody to ActRII, e.g., bimagrumab or BYM338, and at least one second drug substance, said second drug substance being IGF-1, IGF-2 or variants of IGF-1 or IGF-2, an anti-myostatin antibody, a myostatin propeptide, a myostatin decoy protein that binds ActRII but does not activate it, a beta 2 agonist, a Ghrelin agonist, a SARM, GH agonists/mimetics or follistatin.

**[0460]** Kits

**[0461]** The invention also encompasses kits which may comprise a myostatin antagonist, e.g., a myostatin binding molecule (e.g., a myostatin antibody or antigen binding fragment thereof, e.g., bimagrumab or BYM338) or myostatin receptor (i.e., ActRIIB receptor) binding molecule (e.g., anti-ActRIIB antibody or antigen binding fragment thereof) (e.g., in liquid or lyophilized form) or a pharmaceutical composition comprising the myostatin antagonist (described supra). Additionally, such kits may comprise means for administering the myostatin antagonist (e.g., a syringe and vial, a pre-filled syringe, a pre-filled pen) and instructions for use. These kits may contain additional therapeutic agents (described supra), e.g., for delivery in combination with the enclosed myostatin antagonist, e.g., BYM338.

**[0462]** The phrase "means for administering" is used to indicate any available implement for systemically administering a drug to a patient, including, but not limited to, a pre-filled syringe, a vial and syringe, an injection pen, an autoinjector, an i.v. drip and bag, a pump, etc. With such items, a patient may self-administer the drug (i.e., administer the drug on their own behalf) or a physician may administer the drug.

**[0463]** Each component of the kit is usually enclosed within an individual container, and all of the various containers are within a single package along with instructions for use.

**[0464]** Sequences

TABLE 1

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO1	HCDR1	GYTFTSSYIN
SEQ ID NO2	HCDR1	GYTFTSSYIN
SEQ ID NO3	HCDR1	GYTFTSSYIN
SEQ ID NO4	HCDR1	GYTFTSSYIN
SEQ ID NO5	HCDR1	GYTFTSSYIN
SEQ ID NO6	HCDR1	GYTFTSSYIN
SEQ ID NO7	HCDR1	GYTFTSSYIN
SEQ ID NO8	HCDR1	GYTFTSSYIN
SEQ ID NO9	HCDR1	GYTFTSSYIN

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO10	HCDR1	GYTFTSSYIN
SEQ ID NO11	HCDR1	GYTFTSSYIN
SEQ ID NO12	HCDR1	GYTFTSSYIN
SEQ ID NO13	HCDR1	GYTFTSSYIN
SEQ ID NO14	HCDR1	GYTFTSSYIN
SEQ ID NO15	HCDR2	TINPVSGNTSYAQKFQG
SEQ ID NO16	HCDR2	TINPVSGNTSYAQKFQG
SEQ ID NO17	HCDR2	TINPVSGNTSYAQKFQG
SEQ ID NO18	HCDR2	TINPVSGNTSYAQKFQG
SEQ ID NO19	HCDR2	MINAPIGTTRYAQKFQG
SEQ ID NO20	HCDR2	QINAASGMTRYAQKFQG
SEQ ID NO21	HCDR2	MINAPIGTTRYAQKFQG
SEQ ID NO22	HCDR2	TINPVSGNTRYAQKFQG
SEQ ID NO23	HCDR2	TINPVSGSTSYAQKFQG
SEQ ID NO24	HCDR2	QINAASGMTRYAQKFQG
SEQ ID NO25	HCDR2	NINAAAAGITLYAQKFQG
SEQ ID NO26	HCDR2	TINPPTGGTYAQKFQG
SEQ ID NO27	HCDR2	GINPPAGTTSYAQKFQG
SEQ ID NO28	HCDR2	NINPATGHADYAQKFQG
SEQ ID NO29	HCDR3	GGWFDY
SEQ ID NO30	HCDR3	GGWFDY
SEQ ID NO31	HCDR3	GGWFDY
SEQ ID NO32	HCDR3	GGWFDY
SEQ ID NO33	HCDR3	GGWFDY
SEQ ID NO34	HCDR3	GGWFDY
SEQ ID NO35	HCDR3	GGWFDY
SEQ ID NO36	HCDR3	GGWFDY
SEQ ID NO37	HCDR3	GGWFDY
SEQ ID NO38	HCDR3	GGWFDY
SEQ ID NO39	HCDR3	GGWFDY
SEQ ID NO40	HCDR3	GGWFDY
SEQ ID NO41	HCDR3	GGWFDY
SEQ ID NO42	HCDR3	GGWFDY
SEQ ID NO43	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO44	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO45	LCDR1	TGTSSDVGSYNYVN

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO46	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO47	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO48	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO49	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO50	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO51	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO52	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO53	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO54	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO55	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO56	LCDR1	TGTSSDVGSYNYVN
SEQ ID NO57	LDCR2	LMIYGVSKRPS
SEQ ID NO58	LDCR2	LMIYGVSKRPS
SEQ ID NO59	LDCR2	LMIYGVSKRPS
SEQ ID NO60	LDCR2	LMIYGVSKRPS
SEQ ID NO61	LDCR2	LMIYGVSKRPS
SEQ ID NO62	LDCR2	LMIYGVSKRPS
SEQ ID NO63	LDCR2	LMIYGVSKRPS
SEQ ID NO64	LDCR2	LMIYGVSKRPS
SEQ ID NO65	LDCR2	LMIYGVSKRPS
SEQ ID NO66	LDCR2	LMIYGVSKRPS
SEQ ID NO67	LDCR2	LMIYGVSKRPS
SEQ ID NO68	LDCR2	LMIYGVSKRPS
SEQ ID NO69	LDCR2	LMIYGVSKRPS
SEQ ID NO70	LDCR2	LMIYGVSKRPS
SEQ ID NO71	LCDR3	QAWTSKMAG
SEQ ID NO72	LCDR3	SSYTRMGHP
SEQ ID NO73	LCDR3	ATYKGVTTPP
SEQ ID NO74	LCDR3	GTFAGGSYYG
SEQ ID NO75	LCDR3	QAWTSKMAG
SEQ ID NO76	LCDR3	QAWTSKMAG
SEQ ID NO77	LCDR3	GTFAGGSYYG
SEQ ID NO78	LCDR3	GTFAGGSYYG
SEQ ID NO79	LCDR3	GTFAGGSYYG
SEQ ID NO80	LCDR3	GTFAGGSYYG
SEQ ID NO81	LCDR3	GTFAGGSYYG

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO82	LCDR3	GTFAGGSYYG
SEQ ID NO83	LCDR3	GTFAGGSYYG
SEQ ID NO84	LCDR3	GTFAGGSYYG
SEQ ID NO85	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CQAWTS KMAGVFGGGTKLTVLGQ
SEQ ID NO86	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CSSYTRMGHPVFGGGTKLTVLGQ
SEQ ID NO87	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CATYKGVTPVFGGGTKLTVLGQ
SEQ ID NO88	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO89	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CQAWTS KMAGVFGGGTKLTVLGQ
SEQ ID NO90	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CQAWTS KMAGVFGGGTKLTVLGQ
SEQ ID NO91	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO92	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO93	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO94	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO95	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO96	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO97	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO98	VL	DIALTPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQOHPGKAPKLM IYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADY CGTFAGGSYGVFGGGTKLTVLGQ
SEQ ID NO99	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGTINPVSGNT SYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO100	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGTINPVSGNT SYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO101	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGTINPVSGNT SYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO102	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGTINPVSGNT SYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO103	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGMINAPIGTTR YAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO104	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGQINAASGMT RYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO105	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGMINAPIGTTR YAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS
SEQ ID NO106	VH	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGTINPVSGNT RYAQKFPQGRVTMTRDTSISTAYMELSLRSED TAVYYCARGGWFYWGQGLTVTVSS

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO107	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGTINPVSGST SYAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO108	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGQINAASGMT RYAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO109	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGNINAAAGITL YAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO110	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGTINPPTGGT YYAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO111	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGINPPAGTT SYAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO112	VH	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSSYINWVRQAPGGQLEWMGNINPATGHA DYAQKFPQGRVTMTRDTSISTAYMELSSLRSEDVAVYVCARGGWFYWGQGLTLVTVSS
SEQ ID NO113	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGAGGCTTGACTTCT AAGATGGCTGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO114	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGTCTTCTTATACTCGTA TGGGTATCCTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO115	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGTACTTATGGTAAG GGTGTACTCCTCCTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO116	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGGTACTTTTGCTGGT GGTTCCTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO117	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGAGGCTTGACTTCT AAGATGGCTGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO118	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGAGGCTTGACTTCT AAGATGGCTGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO119	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGGTACTTTTGCTGGT GGTTCCTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG
SEQ ID NO120	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAAATTATGTGAATTGGTACC AGCAGCATCCCGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACACCCGAGCCTGACC ATTAGCGGCTGCAAGCGGAAGACGAAGCGGATATTATATGCGGTACTTTTGCTGGT GGTTCCTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTTCCTGGCCAG

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO121	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC AGCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO122	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC AGCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO123	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACGGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC AGCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO124	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACTGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC GCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT AGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO125	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACTGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC AGCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO126	DNA VL	GATATCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTCAGAGCATTACC ATCTCGGTACTGGTACTAGCAGCGATGTTGGTTCCTATAATTATGTGAATTGGTACC AGCAGCATCCCGGGAAGGCGCCGAACTTATGATTTATGGTGTTCCTAAGCGTCCCT CAGGCGTGAGCAACCGTTTTAGCGGATCCAAAAGCGGCAACCCGCGAGCCTGACC ATTAGCGCCTGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGGT GGTCTTATTATGGTGTGTTTGGCGGCGCACGAAGTTAACCGTTCTTGCCAG
SEQ ID NO127	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTCTTATATTAATTGGGTCCGCC AAGCCCCGGGAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCAATA CGTCTTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATT GCACCGGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATATTATT GCGCGGTGGTGGTTGGTTTGTATTATGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO128	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTCTTATATTAATTGGGTCCGCC AAGCCCCGGGAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCAATA CGTCTTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATT GCACCGGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATATTATT GCGCGGTGGTGGTTGGTTTGTATTATGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO129	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTCTTATATTAATTGGGTCCGCC AAGCCCCGGGAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCAATA CGTCTTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATT GCACCGGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATATTATT GCGCGGTGGTGGTTGGTTTGTATTATGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO130	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTCTTATATTAATTGGGTCCGCC AAGCCCCGGGAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCAATA



TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		CGTCTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATTAGCACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO131	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCATGATTAATGCTCCTATTGGTACTA CTCGTTATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO132	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCAGATTAATGCTCCTATTGGTACTA CTCGTTATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO133	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCATGATTAATGCTCCTATTGGTACTA CTCGTTATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO134	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCAATA CGCGTTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO135	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCACTATCAATCCGGTTCTGGCTCTA CGTCTTACGCGCAGAAGTTTCAGGGCCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO136	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCCAGATTAATGCTGCTTCTGGTATGA CTCGTTATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCT CA
SEQ ID NO137	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCAATTAATGCTGCTGCTGGTATTA CTTTTATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATTG CAGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCTCA
SEQ ID NO138	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCC TGGGCAGGGTCTCGAGTGGATGGGCACTATTAATCCTCCTACTGGAGGTA CTTATATGCTCAGAAGTTTCAGGGTTCGGGTGACCATGACCCGTGATACCAGCATTAGC ACC CGTATATGGAAC TGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATTG CAGCGTGGTGGTTGGTTTGATTATTGGGGCCAAGGCACCC TGGTGACGGTTAGCTCA

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO139	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTATATTAATTGGGTCCGCC AAGCCCCCTGGGCAGGGTCTCGAGTGGATGGGCGGTATTAATCCTCTGTGCTACTA CTTCTTATGCTCAGAAGTTTCAGGGTCGGGTACCATGACCCGTGATACCAGCATTAG CACCGCGTATATGGAAGTACGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATTG CGCGCGTGGTGGTGGTTGATTATTGGGGCCAAGGCACCTGGTGACGGTTAGCTCA
SEQ ID NO140	DNA VH	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTAAAAACCGGGCGCGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTATATTAATTGGGTCCGCC AAGCCCCCTGGGCAGGGTCTCGAGTGGATGGGCAATATTAATCCTGCTACTGGTCATG CTGATTATGCTCAGAAGTTTCAGGGTCGGGTACCATGACCCGTGATACCAGCATTG GCACCGCGTATATGGAAGTACGAGCAGCCTGCGTAGCGAAGATACGGCCGTGATTATT GCGCGCGTGGTGGTGGTTGATTATTGGGGCCAAGGCACCTGGTGACGGTTAGCTCA
SEQ ID NO141	Light Chain	QSALTQPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQHPGKAPKLM IYGVSKRPSG VSNRFSGSKSGNTASLTI SGLQAEDEADY YCGTFAGGSY YGVFPGGKTLTVLGQPKAAP SVTLFPPSS EELQANKATLVCLISDFYPGAVTVAWKADSPVKAGVETTPSKQSNKYA ASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
SEQ ID NO142	Light Chain	QSALTQPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQHPGKAPKLM IYGVSKRPSG VSNRFSGSKSGNTASLTI SGLQAEDEADY YCGTFAGGSY YGVFPGGKTLTVLGQPKAAP SVTLFPPSS EELQANKATLVCLISDFYPGAVTVAWKADSPVKAGVETTPSKQSNKYA ASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
SEQ ID NO143	Light Chain	QSALTQPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQHPGKAPKLM IYGVSKRPSG VSNRFSGSKSGNTASLTI SGLQAEDEADY YCGTFAGGSY YGVFPGGKTLTVLGQPKAAP SVTLFPPSS EELQANKATLVCLISDFYPGAVTVAWKADSPVKAGVETTPSKQSNKYA ASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
SEQ ID NO144	Light Chain	QSALTQPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQHPGKAPKLM IYGVSKRPSG VSNRFSGSKSGNTASLTI SGLQAEDEADY YCGTFAGGSY YGVFPGGKTLTVLGQPKAAP SVTLFPPSS EELQANKATLVCLISDFYPGAVTVAWKADSPVKAGVETTPSKQSNKYA ASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
SEQ ID NO145	Light Chain	QSALTQPASVSGSPGQSI TISCTGTS SDVGSYNYVNWYQHPGKAPKLM IYGVSKRPSG VSNRFSGSKSGNTASLTI SGLQAEDEADY YCGTFAGGSY YGVFPGGKTLTVLGQPKAAP SVTLFPPSS EELQANKATLVCLISDFYPGAVTVAWKADSPVKAGVETTPSKQSNKYA ASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
SEQ ID NO146	Heavy Chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGQLEWMGTINPVSGST SYAQKFGQGRVTMRDTSISTAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGPSVFPPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSKVHTFPVAVLQSS GLYSLSVVTVPSSSLGTQTYICNVNHKPSNTKVDKRVKPKSCDKTHTCPPCPAPEAAGG PSVFLFPPKPKDTLMI SRTP EVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQY NSTYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRE EMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTTPVLDSDGSFFLYSKLTVDKSR WQQGNVFCSCVMHEALHNYTQKSLSLSPGK
SEQ ID NO147	Heavy Chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGQLEWMGQINAAAGMT RYAQKFGQGRVTMRDTSISTAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGPSVFPPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSKVHTFPVAVLQSS GLYSLSVVTVPSSSLGTQTYICNVNHKPSNTKVDKRVKPKSCDKTHTCPPCPAPEAAGG PSVFLFPPKPKDTLMI SRTP EVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQY NSTYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRE EMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTTPVLDSDGSFFLYSKLTVDKSR WQQGNVFCSCVMHEALHNYTQKSLSLSPGK
SEQ ID NO148	Heavy Chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGQLEWMGNINAAGITL YAQKFGQGRVTMRDTSISTAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSAS TKGPSVFPPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSKVHTFPVAVLQSSGL YLSLSVVTVPSSSLGTQTYICNVNHKPSNTKVDKRVKPKSCDKTHTCPPCPAPEAAGG PSVFLFPPKPKDTLMI SRTP EVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQY NSTYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRE EMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTTPVLDSDGSFFLYSKLTVDKSRWQ QGNVFCSCVMHEALHNYTQKSLSLSPGK
SEQ ID NO149	Heavy Chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGQLEWMGGINPPAGTT SYAQKFGQGRVTMRDTSISTAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGPSVFPPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSKVHTFPVAVLQSS GLYSLSVVTVPSSSLGTQTYICNVNHKPSNTKVDKRVKPKSCDKTHTCPPCPAPEAAGG

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		PSVFLFPPKPKDTLMI SRTP E V T C V V D V S H E D P E V K F N W Y V D G V E V H N A K T K P R E E Q Y N S T Y R V V S V L T V L H Q D W L N G K E Y K C K V S N K A L P A P I E K T I S K A K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P V L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
SEQ ID NO150	Heavy Chain	QVQLVQSGAEVKKPGASVKVSCASGYTFTSSYINWVRQAPGGLEWGMGINPATGHA DYAQKFQGRVTMTRDTSIS TAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGP SVFPLAPS S K S T S G G T A A L G C L V K D Y F P E P V T V S W N S G A L T S G V H T F P A V L Q S S G L Y S L S S V V T V P S S L G T Q T Y I C N V N H K P S N T K V D K R V E P K S C D K T H T C P P C P A P E A A G G P S V F L F P P K P K D T L M I S R T P E V T C V V D V S H E D P E V K F N W Y V D G V E V H N A K T K P R E E Q Y N S T Y R V V S V L T V L H Q D W L N G K E Y K C K V S N K A L P A P I E K T I S K A K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P V L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
SEQ ID NO151	Light Chain	QSALTQPASVSGSPGQSI T I S C T G T S S D V G S Y N Y V N W Y Q Q H P G K A P K L M I Y G V S K R P S G V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y C G T F A G G S Y Y G V F G G G T K L T V L G Q P K A A P S V T L F P P S S E E L Q A N K A T L V C L I S D F Y P G A V T V A W K A D S S P V K A G V E T T P S K Q S N N K Y A A S S Y L S L T P E Q W K S H R S Y S C Q V T H E G S T V E K T V A P T E C S
SEQ ID NO152	Light Chain	QSALTQPASVSGSPGQSI T I S C T G T S S D V G S Y N Y V N W Y Q Q H P G K A P K L M I Y G V S K R P S G V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y C G T F A G G S Y Y G V F G G G T K L T V L G Q P K A A P S V T L F P P S S E E L Q A N K A T L V C L I S D F Y P G A V T V A W K A D S S P V K A G V E T T P S K Q S N N K Y A A S S Y L S L T P E Q W K S H R S Y S C Q V T H E G S T V E K T V A P T E C S
SEQ ID NO153	Light Chain	QSALTQPASVSGSPGQSI T I S C T G T S S D V G S Y N Y V N W Y Q Q H P G K A P K L M I Y G V S K R P S G V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y C G T F A G G S Y Y G V F G G G T K L T V L G Q P K A A P S V T L F P P S S E E L Q A N K A T L V C L I S D F Y P G A V T V A W K A D S S P V K A G V E T T P S K Q S N N K Y A A S S Y L S L T P E Q W K S H R S Y S C Q V T H E G S T V E K T V A P T E C S
SEQ ID NO154	Light Chain	QSALTQPASVSGSPGQSI T I S C T G T S S D V G S Y N Y V N W Y Q Q H P G K A P K L M I Y G V S K R P S G V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y C G T F A G G S Y Y G V F G G G T K L T V L G Q P K A A P S V T L F P P S S E E L Q A N K A T L V C L I S D F Y P G A V T V A W K A D S S P V K A G V E T T P S K Q S N N K Y A A S S Y L S L T P E Q W K S H R S Y S C Q V T H E G S T V E K T V A P T E C S
SEQ ID NO155	Light Chain	QSALTQPASVSGSPGQSI T I S C T G T S S D V G S Y N Y V N W Y Q Q H P G K A P K L M I Y G V S K R P S G V S N R F S G S K S G N T A S L T I S G L Q A E D E A D Y Y C G T F A G G S Y Y G V F G G G T K L T V L G Q P K A A P S V T L F P P S S E E L Q A N K A T L V C L I S D F Y P G A V T V A W K A D S S P V K A G V E T T P S K Q S N N K Y A A S S Y L S L T P E Q W K S H R S Y S C Q V T H E G S T V E K T V A P T E C S
SEQ ID NO156	Heavy Chain	QVQLVQSGAEVKKPGASVKVSCASGYTFTSSYINWVRQAPGGLEWGMGINPVSGST SYAQKFQGRVTMTRDTSIS TAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGP SVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSG LYSLSSVTVPSNFGTQTYTCNV D H K P S N T K V D K T V E R K C C V E C P P C P A P P V A G P S V F L F P P K P K D T L M I S R T P E V T C V V D V S H E D P E V Q F N W Y V D G V E V H N A K T K P R E E Q F N S T F R V V S V L T V V H Q D W L N G K E Y K C K V S N K G L P A P I E K T I S K T K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P M L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
SEQ ID NO157	Heavy Chain	QVQLVQSGAEVKKPGASVKVSCASGYTFTSSYINWVRQAPGGLEWGMGINAASGMT RYAQKFQGRVTMTRDTSIS TAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGP SVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSG LYSLSSVTVPSNFGTQTYTCNV D H K P S N T K V D K T V E R K C C V E C P P C P A P P V A G P S V F L F P P K P K D T L M I S R T P E V T C V V D V S H E D P E V Q F N W Y V D G V E V H N A K T K P R E E Q F N S T F R V V S V L T V V H Q D W L N G K E Y K C K V S N K G L P A P I E K T I S K T K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P M L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
SEQ ID NO158	Heavy Chain	QVQLVQSGAEVKKPGASVKVSCASGYTFTSSYINWVRQAPGGLEWGMGINAAAAGITL Y AQ K F Q G R V T M T R D T S I S T A Y M E L S R L R S D D T A V Y Y C A R G G W F D Y W G Q G L T V T V S S A T K G P S V F P L A P C S R S T S E S T A A L G C L V K D Y F P E P V T V S W N S G A L T S G V H T F P A V L Q S S G L Y S L S S V V T V P S N F G T Q T Y T C N V D H K P S N T K V D K T V E R K C C V E C P P C P A P P V A G P S V F L F P P K P K D T L M I S R T P E V T C V V D V S H E D P E V Q F N W Y V D G V E V H N A K T K P R E E Q F N S T F R V S V L T V V H Q D W L N G K E Y K C K V S N K G L P A P I E K T I S K T K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P M L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
SEQ ID NO159	Heavy Chain	QVQLVQSGAEVKKPGASVKVSCASGYTFTSSYINWVRQAPGGLEWGMGINPPAGTT SYAQKFQGRVTMTRDTSIS TAYMELSRRLSDDTAVYYCARGGWFYWGQGLTVTVSSA STKGP SVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSG LYSLSSVTVPSNFGTQTYTCNV D H K P S N T K V D K T V E R K C C V E C P P C P A P P V A G P S V F L F P P K P K D T L M I S R T P E V T C V V D V S H E D P E V Q F N W Y V D G V E V H N A K T K P R E E Q F N S T F R V V S V L T V V H Q D W L N G K E Y K C K V S N K G L P A P I E K T I S K T K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P M L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		QVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTTPMLDSDGSAFFLYSKLTVDKSRWQQG NVFSCVMHEALHNHYTQKSLSLSPGK
SEQ ID NO160	Heavy Chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWMGNINPATGHA DYAQKFPQGRVTMTRDTSISITAYMELSRRLRSDDTAVYYCARGGWFYWGQGLVTVSSA STKGPSVFLPAPCSRSTSESTAAALGLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSG LYSLSSVTVPPSSNFGTQTYTCNVLDHKPSNTKVDKTVVERKCCVECPAPPVAGPSVFL FPPKPKDTLMI SRTPEVTVVVDVSHEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTFR VVSVLTVVHQDLNGLKEYKCKVSNKGLPAPIEKTI SKTKGQPREPQVYTLPPSREEMTKN QVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTTPMLDSDGSAFFLYSKLTVDKSRWQQG NVFSCVMHEALHNHYTQKSLSLSPGK
SEQ ID NO161	DNA Light Chain	CAGAGCGCCCTGACCCAGCCCGCCAGCGTGTCCGGCAGCCAGGCCAGTCTATCAC AATCAGCTGCACCCGGCACCTCCAGCGACGTGGGCAGCTACAACACTACGTGAACGGTA TCAGCAGCACCCCGGCAAGGCCCCCAAGCTGATGATCTACGGCGTGAGCAAGAGGC CCAGCGCGTGTCCAACAGGTT CAGCGGCAGCAAGAGCGGCAACACCGCCAGCCTG ACAATCAGTGGGCTGCAGGCTGAGGACGAGGCCGACTACTACTGCGGCACCTTTGC CGGCGGATCATACTACGGCGTGTTCGGCGGAGGGACCAAGCTGACCGTGTGGGCC AGCCTAAGGCTGCCCCAGCGTGACCTGTTCCCCCAGCAGCGAGGAGCTGCAG GCCAACAGGCCACCCCTGGTGTGCTGATCAGCGACTTCTACCCAGGCCCGGTGAC CGTGGCCTGGAAGGCCGACAGCAGCCCGTGAAGGCCGGCGTGGAGACCACCACC CCCAGCAAGCAGAGCAACAACAAGTACGCCCGCAGCAGCTACTGAGCCTGACCCC CGAGCAGTGAAGAGCCACAGGTCCTACAGCTGCCAGGTGACCCACGAGGGCAGCA CCGTGGAAAAGACCGTGGCCCCAACCGAGTGCAGC
SEQ ID NO162	DNA Light Chain	CAGAGCGCCCTGACCCAGCCCGCCAGCGTGTCCGGCAGCCAGGCCAGTCTATCAC AATCAGCTGCACCCGGCACCTCCAGCGACGTGGGCAGCTACAACACTACGTGAACGGTA TCAGCAGCACCCCGGCAAGGCCCCCAAGCTGATGATCTACGGCGTGAGCAAGAGGC CCAGCGCGTGTCCAACAGGTT CAGCGGCAGCAAGAGCGGCAACACCGCCAGCCTG ACAATCAGTGGGCTGCAGGCTGAGGACGAGGCCGACTACTACTGCGGCACCTTTGC CGGCGGATCATACTACGGCGTGTTCGGCGGAGGGACCAAGCTGACCGTGTGGGCC AGCCTAAGGCTGCCCCAGCGTGACCTGTTCCCCCAGCAGCGAGGAGCTGCAG GCCAACAGGCCACCCCTGGTGTGCTGATCAGCGACTTCTACCCAGGCCCGGTGAC CGTGGCCTGGAAGGCCGACAGCAGCCCGTGAAGGCCGGCGTGGAGACCACCACC CCCAGCAAGCAGAGCAACAACAAGTACGCCCGCAGCAGCTACTGAGCCTGACCCC CGAGCAGTGAAGAGCCACAGGTCCTACAGCTGCCAGGTGACCCACGAGGGCAGCA CCGTGGAAAAGACCGTGGCCCCAACCGAGTGCAGC
SEQ ID NO163	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAAGCGGCTCACCAGGTCAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGCGCCGAAACTTATGATTTATGGTGTTCCTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGTGG TGGTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTCCCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCGTCAAGCGGGAGTGGAGACCACCACACCCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGAGCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCGTGGAG AAGACAGTGGCCCTACAGAATGTTCA
SEQ ID NO164	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAAGCGGCTCACCAGGTCAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGCGCCGAAACTTATGATTTATGGTGTTCCTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGTGG TGGTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTCCCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCGTCAAGCGGGAGTGGAGACCACCACACCCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGAGCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCGTGGAG AAGACAGTGGCCCTACAGAATGTTCA
SEQ ID NO165	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAAGCGGCTCACCAGGTCAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGCGCCGAAACTTATGATTTATGGTGTTCCTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGTGG TGGTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTCCCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCGTCAAGCGGGAGTGGAGACCACCACACCCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGAGCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCGTGGAG AAGACAGTGGCCCTACAGAATGTTCA

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		CTGGAAGGCAGATAGCAGCCCCGTCAAGGCGGGAGTGGAGACCACCACACCCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGCCTGAGCAGT GGAAGTCCACAGAAGCTACAGTGCAGGTACGCATGAAGGGAGCACCGTGGAG AAGACAGTGGCCCCACAGAATGTCA
SEQ ID NO166	DNA Heavy Chain	CAGGTGCAGCTGGTGCAGAGCGGAGCTGAGGTGAAGAAGCCAGGCGCCAGCGTCAA GGTGTCTGCAAGGCCAGCGGCTACACCTTACCAGCAGCTACATCAACTGGGTCCG CCAGGCTCTGGGCAGGGACTGGAGTGGATGGGCACCATCAACCCCGTGTCCGGCA GCACCAGCTACGCCAGAAGTTCCAGGGCAGAGTCCACATGACCAGGGACACCAGC ATCAGCACCCGCTACATGGAGCTGTCCAGGCTGAGAAGCGACGACACCCGCGTGA CTACTGCGCCAGGGCGGCTGGTTGCACTACTGGGGCCAGGGCACCCTGGTGACCG TGTCTCAGCTAGCACCAAGGGCCCCAGCGTGTTCCTCCCTGGGCCCCAGCAGCAAG AGCACCTCCGGCGGCACAGCCGCCCCGGGCTGCCTGGTGAAGGACTACTTCCCCGA GCCCGTGACCGTGTCTTGGAAACAGCGGAGCCCCGACCAGCGCGGTGCACACCTTCC CCGCGTGTGCAGAGCAGCGCCGTGTACAGCCTGTCCAGCGTGGTGACAGTCCCC AGCAGCAGCCTGGGCACCAGACCTACATCTGCAACGTGAACCAAGCCAGCAAC ACCAAGGTGGACAAGAGAGTGGAGCCCAAGAGCTGCGACAAGACCCACACCTGCC CCCCGTGCCAGCCCCGAAGCTGCAGGGCGGCCCTTCCGTGTTCTCTCCCCCA AGCCCAAGGACACCTGATGATCAGCAGGACCCCCGAGGTGACCTGCGTGGTGGTG GACGTGAGCCACGAGGACCAGAGGTGAAGTTCAACTGGTACGTGGACGGCGTGGGA GGTGACAAACGCAAGACCAAGCCCAAGAGGAGCAGTACAACAGCACCTACAGGG TGGTGTCCGTGTGACCGTGTGCACAGGACTGGCTGAACGGCAAGAATAACAAGT GCAAGGTCTCCAACAAGGCCCTGCCTGCCCCCATCGAAAAGACCATCAGCAAGGCCA AGGGCCAGCCACGGGAGCCCCAGGTGTACACCTGCCCTTCTCGGGAGGAGATG ACCAAGAACCAGGTGTCTGACCTGTCTGGTGAAGGGCTTACCCCCAGCGACATC GCCCGTGGAGTGGGAGAGCAACGGCCAGCCCGAGAAACAATACAAGACCCCCCC AGTGTGGACAGCGACGGCAGCTTCTTCTGTACAGCAAGCTGACCGTGGACAGAG CAGGTGGCAGCAGGGCAACGTGTTGAGCTGCAGCGTGTGCACGAGGCCCTGCACA ACCACTACACCAGAAGGCCTGAGCCTGTACCCGGCAAG
SEQ ID NO167	DNA Heavy Chain	CAGGTGCAGCTGGTGCAGAGCGGAGCTGAGGTGAAGAAGCCAGGCGCCAGCGTCAA GGTGTCTGCAAGGCCAGCGGCTACACCTTACCAGCAGCTACATCAACTGGGTGCG CCAGGCTCCAGGGCAGGGACTGGAGTGGATGGGCAGATCAACGCGCCAGCGGC ATGACCAGATACGCCAGAAGTTCCAGGGCAGAGTCAARTGACCAGGGACACCTCT ATCAGCACCCGCTACATGGAGCTGTCCAGGCTGAGAAGCGACGACACCCGCGTGA CTACTGCGCCAGGGCGGCTGGTTGCACTACTGGGGCCAGGGCACCCTGGTGACCG TGTCTCAGCTAGCACCAAGGGCCCCAGCGTGTTCCTCCCTGGGCCCCAGCAGCAAG AGCACCTCCGGCGGCACAGCCGCCCCGGGCTGCCTGGTGAAGGACTACTTCCCCGA GCCCGTGCAGCGTGTCTTGGAAACAGCGGAGCCCCGACCAGCGCGGTGCACACCTTCC CCGCGTGTGCAGAGCAGCGGCCGTGTACAGCCTGTCCAGCGTGGTGACAGTCCCC AGCAGCAGCCTGGGCACCAGACCTACATCTGCAACGTGAACCAAGCCAGCAAC ACCAAGGTGGACAAGAGAGTGGAGCCCAAGAGCTGCGACAAGACCCACACCTGCC CCCCGTGCCAGCCCCGAAGCTGCAGGGCGGCCCTTCCGTGTTCTCTCCCCCA AGCCCAAGGACACCTGATGATCAGCAGGACCCCCGAGGTGACCTGCGTGGTGGTG GACGTGAGCCACGAGGACCAGAGGTGAAGTTCAACTGGTACGTGGACGGCGTGGGA GGTGACAAACGCAAGACCAAGCCCAAGAGGAGCAGTACAACAGCACCTACAGGG TGGTGTCCGTGTGACCGTGTGCACAGGACTGGCTGAACGGCAAGAATAACAAGT GCAAGGTCTCCAACAAGGCCCTGCCTGCCCCCATCGAAAAGACCATCAGCAAGGCCA AGGGCCAGCCACGGGAGCCCCAGGTGTACACCTGCCCTTCTCGGGAGGAGATG ACCAAGAACCAGGTGTCTGACCTGTCTGGTGAAGGGCTTACCCCCAGCGACATC GCCGTGGAGTGGGAGAGCAACGGCCAGCCCGAGAAACAATACAAGACCCCCCC AGTGTGGACAGCGACGGCAGCTTCTTCTGTACAGCAAGCTGACCGTGGACAGAG CAGGTGGCAGCAGGGCAACGTGTTGAGCTGCAGCGTGTGCACGAGGCCCTGCACA ACCACTACACCAGAAGGCCTGAGCCTGTACCCGGCAAG
SEQ ID NO168	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAGAAAAACGGGCGCGAGCGTGAA AGTGAGCTGCAAGCCCTCCGGATATACCTTACTTCTTCTTATATTAATTGGGTCCGCG AAGCCCCGGGCAGGGTCTCAGTGGATGGCAATATTAATGTGTGTGTTGTTATTA CTCTTTATGCTCAGAAGTTTCAGGGTCCGGTCAACATGACCCGTGATACCAGCATTAG CACCGGTATATGGAACTGAGCCGCTGCGTAGCGATGATACGGCCGTGTATTATTG CGCGCGTGGTGGTTGGTTGATTATTGGGGCCAGGCACCCCTGGTGACGGTTAGCTC AGCCTCCACCAAGGTCCATCGGTCTTCCCCCTGGCACCCCTCCTCAAGAGCACCTC TGGGGGCACAGCGGCCCTGGGCTGCCTGGTCAAGGACTACTTCCCCGAACCGGTGA CGGTGTCGTGGAACCTCAGCGCCCTGACCAGCGCGGTGCACACCTTCCCGGTGTCT CTACAGTCTCAGGACTCTACTCCCTCAGCAGCGTGGTACCGTGCCTTCCAGCAGC TTGGGCACCCAGACCTACATCTGCAACGTGAATCAAGCCAGCAACCAAGGTG GACAAGAGAGTGTAGCCCAATCTTGTGACAAACCTCACACATGCCACCCGTGCCCA GCACCTGAAGCAGCGGGGGACCGTCACTTCTCTTCCCCCAAAACCAAGGA CACCTCATGATCTCCCGACCCCTGAGGTACATGCGTGGTGGTGGACGTGAGCC ACGAAGACCCCTGAGGTCAAGTTCACTGGTACGTGGACGGCGTGGAGGTGCATAATG CCAAGCAAAGCCGCGGGAGGAGCAGTACAACAGCACGTACCGGGTGGTCAAGCTC CTCACCGTCTGCACCAGGACTGGCTGAATGGCAAGGAGTACAGTGAAGGTCTCC

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		AACAAAGCCCTCCAGCCCCATCGAGAAAAACCATCTCCAAGGCCAAAGGGCAGCCC CGAGAACCACAGGTGTACACCCCTGCCCCATCCCGGGAGGAGATGACCAAGAACCA GGTCAGCCTGACCTGCCTGGTCAAAGGCTTCTATCCAGCGACATCGCCGTGGAGTG GGAGAGCAATGGGCAGCCGGAGAACAACTACAAGACCACGCCCTCCCGTGTGGACT CCGACGGCTCCTTCTTCTACAGCAAGCTCACCGTGGACAAGAGCAGGTGGCAGC AGGGGAACGCTTCTCATGCTCCGTGATGCATGAGGCTCTGCACAACCACTACACGC AGAAGAGCCTCTCCCTGTCTCCGGGTAAA
SEQ ID NO169	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCCTCCGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCTGGGCAGGGTCTCGAGTGGATGGGCGGTATTAATCCTCCTGCTGGTACTA CTTCTTATGCTCAGAAGTTTCAGGGTCGGGTCAACATGACCCGTGATACAGCATTAG CACCGCGTATATGGAACCTGAGCCGCTGCGTAGCGATGATACGGCCGTGATTATTG CGCGCGTGGTGGTGGTTTGATTATTTGGGGCCAAGGCACCCCTGGTGACGGTTAGCT AGCCTCCACCAAGGGTCCATCGGTCTTCCCTTGGCACCTCTCCCAAGAGCACCTC TGGGGGCACAGCGGCCCTGGGCTGCCTGGTCAAGGACTACTTCCCGAACCGGTGA CGGTGTCGTGGAACCTCAGGCGCCCTGACCAGCGGCGTGACACCTTCCCGGCTGT CTACAGTCTCAGGACTCTACTCCCTCAGCAGCGTGGTGACCGTGCCTCCAGCAGC TTGGGCACCCAGACTACATCTGCAACGTGAATCAAGCCAGCAACCAAGGTG GACAAGAGAGTTGAGCCCAAATCTGTGACAAAACACACATGCCACCGTGCCCA GCACCTGAAGCAGCGGGGGACCGTCAGTCTTCTCTTCCCCCAAACCAAGGA CACCTCATGATCTCCCGACCCCTGAGGTACATGCGTGGTGGTGGACGTGAGCC ACGAAGACCCCTGAGGTCAAGTTCAACTGGTACGTGGACGGCGTGGAGGTGCATAATG CCAAGACAAGCCGCGGGAGGAGCAGTACAACAGCACGTACCGGGTGGTGGAGCGTC CTCACCGTCTGCACAGGACTGGCTGAAATGGCAAGGAGTACAAGTCAAGGTCTCC AACAAAGCCCTCCAGCCCCATCGAGAAAAACCATCTCCAAGGCCAAAGGGCAGCCC CGAGAACCACAGGTGTACACCCCTGCCCCATCCCGGGAGGAGATGACCAAGAACCA GGTCAGCCTGACCTGCCTGGTCAAAGGCTTCTATCCAGCGACATCGCCGTGGAGTG GGAGAGCAATGGGCAGCCGGAGAACAACTACAAGACCACGCCCTCCCGTGTGGACT CCGACGGCTCCTTCTTCTACAGCAAGCTCACCGTGGACAAGAGCAGGTGGCAGC AGGGGAACGCTTCTCATGCTCCGTGATGCATGAGGCTCTGCACAACCACTACACGC AGAAGAGCCTCTCCCTGTCTCCGGGTAAA
SEQ ID NO170	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCCTCCGATATACCTTTACTTCTTCTTATATTAATTGGGTCCGCC AAGCCCTGGGCAGGGTCTCGAGTGGATGGGCAATATTAATCCTGCTACTGGTCATG CTGATTATGCTCAGAAGTTTCAGGGTCGGGTGACCATGACCCGTGATACAGCATTAG GCACCGGTATATGGAACCTGAGCCGCTGCGTAGCGATGATACGGCCGTGTATATT GCGCGCGTGGTGGTGGTTTGATTATTTGGGGCCAAGGCACCCCTGGTGACGGTTAGCT CAGCCTCCACCAAGGGTCCATCGGTCTTCCCTTGGCACCTCTCCCAAGAGCACCT CTGGGGGCACAGCGGCCCTGGGCTGCCTGGTCAAGGACTACTTCCCGAACCGGTG ACGGTGTGCTGGAACCTCAGGCGCCCTGACCAGCGGCGTGACACCTTCCCGGCTGT CCTACAGTCTCAGGACTCTACTCCCTCAGCAGCGTGGTGACCGTGCCTCCAGCAG CTTGGGCACCCAGACTACATCTGCAACGTGAATCAAGCCAGCAACCAAGGTG GGACAAGAGAGTTGAGCCCAAATCTGTGACAAAACACACATGCCACCGTGCC AGCACCTGAAGCAGCGGGGGACCGTCAGTCTTCTCTTCCCCCAAACCAAGGA CACCTCATGATCTCCCGACCCCTGAGGTACATGCGTGGTGGTGGACGTGAGCC ACGAAGACCCCTGAGGTCAAGTTCAACTGGTACGTGGACGGCGTGGAGGTGCATAATG CCAAGACAAGCCGCGGGAGGAGCAGTACAACAGCACGTACCGGGTGGTGGAGCGTC CTCACCGTCTGCACAGGACTGGCTGAATGGCAAGGAGTACAAGTCAAGGTCTCC AACAAAGCCCTCCAGCCCCATCGAGAAAAACCATCTCCAAGGCCAAAGGGCAGCCC CGAGAACCACAGGTGTACACCCCTGCCCCATCCCGGGAGGAGATGACCAAGAACCA GGTCAGCCTGACCTGCCTGGTCAAAGGCTTCTATCCAGCGACATCGCCGTGGAGTG GGAGAGCAATGGGCAGCCGGAGAACAACTACAAGACCACGCCCTCCCGTGTGGACT CCGACGGCTCCTTCTTCTACAGCAAGCTCACCGTGGACAAGAGCAGGTGGCAGC AGGGGAACGCTTCTCATGCTCCGTGATGCATGAGGCTCTGCACAACCACTACACGC AGAAGAGCCTCTCCCTGTCTCCGGGTAAA
SEQ ID NO171	DNA Light Chain	CAGAGCGCCCTGACCCAGCCCGCCAGCGTGTCCGGCAGCCAGGCCAGTCTATCAC AATCAGCTGCACCCGGCACCTCCAGCGACGTGGGCAGCTACAACCTACGTGAACCTGGTA TCAGCAGCACCCCGCAAGGCCCAAGCTGATGATCTACGGCGTGAGCAAGAGGC CCAGCGGCGTGTCCAACAGGTTTCAAGCGGAGCAAGAGCGGCAACACCGCCAGCCTG ACAATCAGTGGGCTGCAGGCTGAGGACGAGGCCGACTACTTACGCGGCACCTTTGTC CGGCGGATCATACTACCGCGTGTTCGGCGGAGGGGCAAGCTGACCGTGTGGGCT AGCCTAAGGCTGCCCCAGCGTGACCTGTCTCCCCCAAGCAGCGAGGAGCTGCAG GCCAACAAAGGCCACCTGGTGTGCTGATCAGCGACTTCTACCCAGGCGCCGTGAC CGTGGCTTGGAAAGGCCGACAGCAGCCCGTGAAGGCCGGCGTGGAGACCAACCC CCCAGCAAGCAGAGCAACAACAGTACCGCCGAGCAGCTACTGAGCCTGACCC CGAGCAGTGGAAAGAGCCAAGGCTCTACAGCTGCCAGGTGACCCACGAGGGCAGCA CCGTGGAAAGACCGTGGCCCAACCGAGTGCAGC

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO172	DNA Light Chain	CAGAGCGCCTGACCCAGCCGCGCAGCGTGTCCGGCAGCCAGGCCAGTCTATCAC AATCAGCTGCACCGGCACCTCCAGCGACGTGGGCAGCTACAACCTACGTGAACGGTA TCAGCAGCACCCCGGCAAGGCCCCCAAGCTGATGATCTACGGCGTGAGCAAGAGGC CCAGCGCGGTGTCCAACAGGTT CAGCGGCAGCAAGAGCGGCAACACCGCCAGCCTG ACAATCAGTGGGCTGCAGGCTGAGGACGAGGCCGACTACTAC TGC CGGCACCTTTGC CGGCGGATCATACTACGGCGTGTTCGGCGGAGGGACCAAGCTGACCCGTGCTGGGCC AGCCTAAGGCTGCCCCAGCGTGACCTGTTCCCCCAGCAGCGAGGAGCTGCAG GCCAACAGGCCACCCCTGGTGTGCTGATCAGCGACTTCTACCCAGGCGCGGTGAC CGTGGCC TGAAGGCCGACAGCAGCCCGTGAAGGCCGGCGTGGAGACCACCACC CCCAGCAAGCAGAGCAACAACAAGTACGCGCGCCAGCAGCTACCTGAGCTGACCCC CGAGCAGTGAAGAGCCAAGGTCCTACAGCTGCCAGGTGACCCACGAGGGCAGCA CCGTGGAAGACCCGTGGCCCCAACCCAGTGCAGC
SEQ ID NO173	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTGAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGGCGCCGAAACTTATGATTTATGGTGTCTTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGG TGGTTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTC CCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCCGTCAAGGCGGGAGTGGAGACCACCACACCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGAGCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCCGTGGAG AAGACAGTGGCCCCTACAGAATGTTCA
SEQ ID NO174	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTGAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGGCGCCGAAACTTATGATTTATGGTGTCTTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGG TGGTTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTC CCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCCGTCAAGGCGGGAGTGGAGACCACCACACCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGCCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCCGTGGAG AAGACAGTGGCCCCTACAGAATGTTCA
SEQ ID NO175	DNA Light Chain	CAGAGCGCACTGACCCAGCCAGCTTCAGTGAGCGGCTCACCAGGTGAGAGCATTAC CATCTCGTGTACGGGTACTAGCAGCGATGTTGGTTCTTATAATTATGTGAATTGGTAC CAGCAGCATCCCGGAAGGCGCCGAAACTTATGATTTATGGTGTCTTAAGCGTCCC TCAGGCGTGAGCAACCGTTT TAGCGGATCCAAAGCGGCAACACCGCGAGCCTGAC CATTAGCGGCC TGCAAGCGGAAGACGAAGCGGATTATTATTGCGGTACTTTTGCTGG TGGTTCTTATTATGGTGTGTTTGGCGGCGGCACGAAGTTAACCGTCTAGGTGAGCC CAAGGCTGCCCCCTCGGTCACTCTGTTC CCGCCCTCCTCTGAGGAGCTTCAAGCCAA CAAGGCCACACTGGTGTGTCATAAGTGACTTCTACCCGGGAGCCGTGACAGTGGC CTGGAAGGCAGATAGCAGCCCCGTCAAGGCGGGAGTGGAGACCACCACACCCTCCA AACAAAGCAACAACAAGTACGCGGCCAGCAGCTATCTGAGCCTGACGCCCTGAGCAGT GGAAGTCCACAGAAGCTACAGCTGCCAGGTACGCATGAAGGGAGCACCCGTGGAG AAGACAGTGGCCCCTACAGAATGTTCA
SEQ ID NO176	DNA Heavy Chain	CAGGTGCAGCTGGTGCAGAGCGGAGCTGAGGTGAAGAAGCCAGGCGCCAGCGTCAA GGTGTCTTGCAAGGCCAGCGGCTACACCTTACCAGCAGCTACATCAACTGGGTCCG CCAGGCTCCTGGGCAGGGACTGGAGTGGATGGGCACCATCAACCCCGTGTCCGGCA GCACCAGCTACGCCAGAAGTTCCAGGGCAGAGTCAACATGACCAGGGACACCAGC ATCAGCACCCGCTACATGGAGCTGTCCAGGCTGAGAAGCGACGACACCCGCGTGA CTACTGCGCCAGGGCGGCTGGTTCGACTACTGGGGCCAGGGCACCTGGTGAACCG TGTCTCAGCTAGCACCAGGGCCCCAGCGTGTTC CCGCTGGCCCCCTGCAGCAGA AGCACCAGCGAGAGCACAGCCGCCCCGGGCTGCCTGGTGAAGGACTACTTCCCCGA GCCAGTGACCGTGTCTTGAAACAGCGGAGCCCCTGACCAGCGGCTGCACACCTTCC CGCCCTGCTGCAGAGCAGCGGCCGTGACAGCTGTCCAGCGTGGTGAACCGTCCCC AGCAGCAACTTCGGCACCCAGACCTACACCTGCAACGTGGACCACAAGCCAGCAAC ACCAAGGTGGAACAAGACCCGTGGAGAGGAAGTGTGCGTGGAGTGCCCCCTGCC AGCCCCCAGTGGCCGGACCCCTCCGTGTCTGTTC CCGCCCCAAGCCCAAGGACA CCCTGATGATCAGCAGGACCCCGAGGTGACCTGCGTGGTGGTGGACGTGAGCCAC GAGGCCACAGAGGTGCAGTTCAACTGGTACGTGGAAGCGGCTGGAGTGCACAACGC CAAGACCAAGCCAGAGAGGAACAGTTTAAACAGCACCTTCAGGGTGGTGTCCGTGCT GACCGTGGTGCACCAGGACTGGCTGAACGGCAAGAGTACAAGTGCAGGTCTCCA ACAAGGGCTGCCAGCCCCATCGAGAAAACCATCAGCAAGCAACAAGGGCCAGCCA CGGAGCCCCAGGTGACACCTGCCCCCCAGCCGGGAGGAAATGACCAAGAACCA

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		GGTGTCCCTGACCTGTCTGGTGAAGGGCTTCTACCCAGCGACATCGCCGTGGAGT GGGAGAGCAACGGCCAGCCGAGCAACAACACAAGACACCCCCCATGCTGGAC AGCGACGGCAGCTTCTTCTGTACAGCAAGCTGACAGTGGACAGAGCAGGTGGCA GCAGGGCAACGTGTTTCAGCTGCAGCGTGTATGCACGAGGCCCTGCACAACCACTACA CCCAGAAGACCTGAGCCTGTCCCCGGCAAG
SEQ ID NO177	DNA Heavy Chain	CAGGTGCAGCTGGTGCAGAGCGGAGCTGAGGTGAAGAAGCCAGGCGCCAGCGTCAA GGTGTCCCTGCAAGGCCAGCGGCTACACCTTACCCAGCAGCTACATCAACTGGGTGCC CCAGGCTCCAGGGCAGGGACTGGAGTGGATGGGCCAGATCAACGCCGCCAGCGGC ATGACCAGATACGCCCCAGAAGTTCAGGGCAGAGTCAATGACCAGGGACACCTCT ATCAGCACCGCCTACATGGAGCTGTCCAGGCTGAGAAGCGACGACACCGCCGTGA CTACTGCGCCAGGGCGGCTGGTTGACTACTGGGCGCAGGGCACCCTGGTGACCG TGTCCTCAGCTAGCACCAAGGGCCCCAGCGTGTTCCTCCCTGGCCCCCTGCAGCAGA AGCACCGCAGAGCACAGCCGCCCCGGGCTGCCTGGTGAAGGACTACTTCCCCGA GCCAGTGACCGTGTCTTGAAACAGCGGAGCCCTGACCAGCGCGGTGCACACTTCC CCGCGTGTCTGCAGAGCAGCGGCCCTGTACAGCCTGTCCAGCGTGGTGACCGTGCC AGCAGCAACTTCGGCACCCAGACCTACACCTGCAACGTTGGACACAAGCCAGCAAC ACCAGGTGGACAAGACCTGGAGAGGAAGTGTGCGTGGAGTGCCCCCTGCC AGCCCCCAGTGGCCGGACCTCCGTGTCTGTTCCTCCCAAGCCCAAGGACA CCCTGATGATCAGCAGGACCCCGAGGTGACCTGCGTGGTGGTGGACGTGAGCCAC GAGGACCCAGAGGTGCAGTTCAACTGGTACGTGGACGGCGTGGAGGTGCACAAGC CAAGACCAAGCCAGAGAGGAACAGTTTAAACAGCACCTTCCAGGGTGGTGTCCGTGCT GACCGTGGTGCACCAAGGACTGGCTGAACGGCAAGAGTACAAGTCAAGGTCTCCA ACAAGGGCTGCGCAGCCCCATCGAGAAAACATCAGCAAGCAAGGGCCAGCCA CGGGAGCCCCAGGTGTACACCTGCCCCCAGCCGGGAGGAAATGACCAAGAACCA GGTGTCCCTGACCTGTCTGGTGAAGGGCTTCTACCCAGCAGCATCGCCGTGGAGT GGGAGAGCAACGGCCAGCCGAGAACACTACAAGACACCCCCCATGCTGGAC AGCGACGGCAGCTTCTTCTGTACAGCAAGCTGACAGTGGACAGAGCAGGTGGCA GCAGGGCAACGTGTTTCAGCTGCAGCGTGTATGCACGAGGCCCTGCACAACCACTACA CCCAGAAGACCTGAGCCTGTCCCCGGCAAG
SEQ ID NO178	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAATAAACCAGGCGCGAGCGTGAA AGTGAGCTGCAAGCCTCCGGATATACCTTTACTTCTTCTATATTAATTGGGTCCGCG AAGCCCCGGGCGAGGCTCCGAGTGGATGGGCAATATTAATGCTGCTGCTGGTATTA CTCTTATGCTCAGAAGTTTCAGGGTCCGGTCAACATGACCCGTGATACAGCATTAG CACCGCTATATGGAACTGAGCCGCTGCGTAGCGATGATACGGCCGTGTATTATTG CGCGCGTGGTGGTTGGTTTGATTTATGGGGCCAAGGCACCCCTGGTGACGGTTAGCTC AGCTTCCACCAAGGGCCCCAGCGTGTTCCTCCCTGGCCCCCTGCAGCAGAAGACCA GCGAGAGCACAGCCGCCCTGGGCTGCCTGGTGAAGGACTACTTCCCGAGCCCGTG ACCGTGAGCTGGAACAGCGGAGCCCTGACCAGCGCGTGCACACTTCCCGCCGT GCTGCAGAGCAGCGCCCTGTACAGCCTGAGCAGCGTGGTGACCGTCCCGCAGCAGCA ACTTCGGCACCCAGACCTACACCTGCAACGTGGACACAAGCCAGCAACCAAGG TGGACAAGACCTGGAGCGGAAGTGTGCGTGGAGTGCCCCCTGCCCTGCCCT CTGTGGCCGGACCTCCGTGTCTGTTCCCCCAAGCCCAAGGACACCTGATG ATCAGCCGGACCCCGAGGTGACCTGCGTGGTGGTGGACGTGAGCCACGAGGACCC CGAGGTGCACTCAACTGGTACGTGGACGGCGTGGAGGTGCACAACGCCAAGACCA AGCCCCGGGAGGAACAGTTCAACAGCACCTTCCGGTGGTGTCCGTGCTGACCGTG GTGCACAGGACTGGCTGAACGGCAAGAAATACAAGTGAAGGTGTCCAACAAGGG CCTGCTGCCCCATCGAGAAAACATCAGCAAGCAAGGGCCAGCCAGGGAAC CCCAGGTGTACACCTGCCCCAGCCGGGAGGAAATGACCAAGAACCAGGTGTCC CTGACCTGTCTGGTGAAGGGCTTCTACCCAGCGACATCGCCGTGGAGTGGGAGAG CAACGGCCAGCCGAGAACAACTACAAGACACCCCCCATGCTGGACAGCGAGC GCAGCTTCTTCTGTACAGCAAGCTGACAGTGGACAAAGACCCGTTGGCAGCAGGGC AACGTGTTTCAGCTGCAGCGTGTATGCACGAGGCCCTGCACAACCACTACACCCAGAAG AGCCTGAGCCTGTCCCCGGCAAG
SEQ ID NO179	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAATAAACCAGGCGCGAGCGTGAA AGTGAGCTGCAAGCCTCCGGATATACCTTTACTTCTTCTATATTAATTGGGTCCGCG AAGCCCCGGGCGAGGCTCCGAGTGGATGGGCGGTATTAATCCTCCTGCTGGTACTA CTTCTTATGCTCAGAAGTTTCAGGGTCCGGTCAACATGACCCGTGATACAGCATTAG CACCGCTATATGGAACTGAGCCGCTGCGTAGCGATGATACGGCCGTGTATTATTG CGCGCGTGGTGGTTGGTTTGATTTATGGGGCCAAGGCACCCCTGGTGACGGTTAGCTC AGCTTCCACCAAGGGCCCCAGCGTGTTCCTCCCTGGCCCCCTGCAGCAGAAGACCA GCGAGAGCACAGCCGCCCTGGGCTGCCTGGTGAAGGACTACTTCCCGAGCCCGTG ACCGTGAGCTGGAACAGCGGAGCCCTGACCAGCGCGTGCACACTTCCCGCCGT GCTGCAGAGCAGCGCCCTGTACAGCCTGAGCAGCGTGGTGACCGTCCCGCAGCAGCA ACTTCGGCACCCAGACCTACACCTGCAACGTGGACACAAGCCAGCAACCAAGG TGGACAAGACCTGGAGCGGAAGTGTGCGTGGAGTGCCCCCTGCCCTGCCCT CTGTGGCCGGACCTCCGTGTCTGTTCCCCCAAGCCCAAGGACACCTGATG ATCAGCCGGACCCCGAGGTGACCTGCGTGGTGGTGGACGTGAGCCACGAGGACCC CGAGGTGCACTCAACTGGTACGTGGACGGCGTGGAGGTGCACAACGCCAAGACCA AGCCCCGGGAGGAACAGTTCAACAGCACCTTCCGGTGGTGTCCGTGCTGACCGTG GTGCACAGGACTGGCTGAACGGCAAGAAATACAAGTGAAGGTGTCCAACAAGGG CCTGCTGCCCCATCGAGAAAACATCAGCAAGCAAGGGCCAGCCAGGGAAC CCCAGGTGTACACCTGCCCCAGCCGGGAGGAAATGACCAAGAACCAGGTGTCC CTGACCTGTCTGGTGAAGGGCTTCTACCCAGCGACATCGCCGTGGAGTGGGAGAG CAACGGCCAGCCGAGAACAACTACAAGACACCCCCCATGCTGGACAGCGAGC GCAGCTTCTTCTGTACAGCAAGCTGACAGTGGACAAAGACCCGTTGGCAGCAGGGC AACGTGTTTCAGCTGCAGCGTGTATGCACGAGGCCCTGCACAACCACTACACCCAGAAG AGCCTGAGCCTGTCCCCGGCAAG



TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
		GTGCACCAGGACTGGCTGAACGGCAAAGAATACAAGTGAAGGTGTCCAACAAGGG CCTGCCTGCCCCATCGAGAAAACCATCAGCAAGACAAAGGGCCAGCCCAGGGAAC CCCAGGTGTACACCTGCCCCAGCCGGGAGGAAATGACCAAGAACAGGTGTCC CTGACCTGTCTGGTGAAGGGCTTCTACCCAGCGACATCGCCGTGGAGTGGGAGAG CAACGGCCAGCCGAGAACAACTACAAGACCACCCCCCATGCTGGACAGCGACG GCAGCTTCTTCGTACAGCAAGCTGACAGTGGACAAAGGCCGTGGCAGCAGGGC AACGTGTTACAGCTGCAGCGTATGCACGAGGCCCTGCACAACCACTACACCCAGAAG AGCCTGAGCCTGTCCCCGGCAA
SEQ ID NO180	DNA Heavy Chain	CAGGTGCAATTGGTTCAGAGCGGCGCGGAAGTGAACAAAAACCGGGCGGAGCGTGAA AGTGAGCTGCAAAGCCTCCGGATATACCTTTACTTCTTCTTATATTAATTGGGTCGCGC AAGCCCCGGGAGGGTCTCGAGTGGATGGGCAATATTAATCTGCTACTGGTCATG CTGATTATGCTCAGAAGTTTCAGGGTCGGGTGACCATGACCCGTGATACCAGCATT GCACCGCGTATATGGAAC TGAGCCGCTGCGTAGCGATGATACGGCCGTGTATTATT GCGCGCGTGGTGGTGGTTGATTATTGGGGCCAAAGGCCCTGGTGACGGTTAGCT CAGCTTCCACCAAGGGCCCCAGCGTGTCCCCCTGGCCCCCTGCAGCAGAAGCACC AGCGAGAGCACAGCCGCTGGGCTGCCTGGTGAAGGACTACTTCCCCGAGCCCGT GACCGTGAGCTGGAACAGCGGAGCCCTGACAGCGCGTGCACACCTTCCCCCGCG TGCTGCAGAGCAGCGGCCGTGACAGCCTGAGCAGCGTGGTGACCGTGCCAGCAGC AACTTCGGCACCCAGACTTACACCTGCAACGTGGACCACAAGCCAGCAACACCAAG GTGGACAAGACCGTGGAGCGGAAGTGTGCGTGGAGTGCCCCCTGCCCTGCCCT TCCTGTGGCCGACCCCTCCGTGTTCTGTTCCTGTTCCCCCAAGCCCAAGGACACCCCTGAT GATCAGCCGGACCCCCGAGGTGACTGCGTGGTGGAGCGTGAGCCACGAGGAC CCCCGAGGTGACGTTCAACTGGTACGTGGACGGCGTGGAGTGACAAACGCAAGAC CAAGCCCCGGGAGGAACAGTTCAACAGCACCTTCCGGGTGGTGTCCGTGCTGACCG TGGTGCACCAGGACTGGCTGAACGGCAAAGAATACAAGTGAAGGTGTCCAACAAGG GCCTGCCTGCCCCATCGAGAAAACCATCAGCAAGACAAAGGGCCAGCCCAGGGAA CCCCAGGTGTACACCTGCCCCAGCCGGGAGGAAATGACC AAGAACAGGTGTC CCTGACCTGTCTGGTGAAGGGCTTCTACCCAGCGACATCGCCGTGGAGTGGGAGA GCAACGGCCAGCCGAGAACAACTACAAGACCACCCCCCATGCTGGACAGCGAC GGCAGCTTCTTCTGTACAGCAAGCTGACAGTGGACAAGAGCCGGTGGCAGCAGGG CAACGTGTTACAGCTGCAGCGTATGCACGAGGCCCTGCACAACCACTACACCCAGAA GAGCCTGAGCCTGTCCCCGGCAA
SEQ ID NO181	ActRIIB	MTAPWVALALLWGS L CAGSGRGEAETRECIYYNANWELERTNQSLERCEGEQDKRLH CYASWRNNSSGTIELVKKGCWLDLDFNFCYDRQECVATEENPQVYFCCCEGNFCNERFTHL PEAGGPEVTYEPPTAPTLTTLVLA YSLPIGLSLIVLLAFWYMRHRKPPYGHVDIHEDPG PPPPSPLVGLKPLQLLEIKARGRFVCVWKAQLMND FVAVKIFPLQDKQSWQSEREIFSTP GMKHENLLQFI AAEKRGSNLEVE L W L I T A F H D K G S L T D Y L K G N I I T W N E L C H V A E T M S R G L SYLHEDVPWCRGEGHKPSIAHRDFKSKNVLKSDLTAVLADFLAVRFEPGKPPGDTHG QVGTTRRYMAPEVLEGAINFQRDAFLRIDMYAMGLVLWELVSRCKAADGVPVDEYMLPFEE EIQHPSLEELQEVVHKKMRPTIKDHWLKHPLGLQLCVTIEACWDHDAEARLSAGCVEE RVSLIRRSVNGTTS DCLVSLVTSVTNVDLPPKESI
SEQ ID NO182	ActRIIB ligand binding domain (aa19-134)	SGRGEAETRECIYYNANWELERTNQSLERCEGEQDKRLH CYASWRNNSSGTIELVKKGC WLDLDFNFCYDRQECVATEENPQVYFCCCEGNFCNERFTHLPEAGGPEVTYEPPTAPT
SEQ ID NO183	Antibody binding region	IELVKKGSWLDLDFNS
SEQ ID NO184	Antibody binding region	VKKGSWLDLDFNSYDR
SEQ ID NO185	Antibody binding region	GSWLDLDFNSYDRQES
SEQ ID NO186	Antibody binding region	GCWLDLDFNC
SEQ ID NO187	Antibody binding region	CEGEQDKRLHCYASW

TABLE 1-continued

sequence listing		
SEQ ID NO	Ab region	Sequence
SEQ ID NO188	Antibody binding region	WLDDFN
SEQ ID NO189	Antibody binding region	EQDKR
SEQ ID NO190	Antibody binding region	KGCWLDDFNCY
SEQ ID NO191	Antibody binding region	CIYYNANWELERT
SEQ ID NO192	Antibody binding region	YFCCCEGNFCN
SEQ ID NO193	Light-h/mIgG2 aLALA chain	DIALTQPASVSGSPGQSIITISCTGTSDDVGSYNYVNWYQQHPGKAPKLMIIYGVSKRPSGV SNRFSGSKSGNTASLTISGLQAEDEADYYCGTFAGGSYYGVFGGGKLTVLGQPKSTPTL TVFPPSSSELKENKATLVCLISNFSPSGVTVAWKANGTPIITQGVDTSNPTKEGNKFMAS FLHLTSDQWRSHNSFTCQVTHEGDVTEKLSLPAECL
SEQ ID NO194	Heavy-h/mIgG2 chain	QVQLVQSGAEVKKPGASVKVSKASGYTFTSSYINWVRQAPGGLEWM GTINPVSSTSYAQKFGQGRVTMTRDTSISTAYMELSSLRSED TAVYYCARGGWFDYWGQ GTLVTVSSAKTAPSVYPLAPVCGDTTGS SVTLGCLVKGYFPEPVTLTWNSGSLSSGVHT FPAVLQSDLYTLSSVTVTSSTWPSQSITCNVAHPASSTKVDKKIEPRGPTIKPCPPCKCP APNAAGGPSVFI FPPKIKDVLMI SLSPIVTCVVVDVSEDDPDVQISWVFNNEVHTAQTQT HREDYNSLRVVSALPIQHQQDWMGKPEKCKVNNKDLPAPIERTISKPKGSVRAPQVYVL PPPEEEMTKQVTLTCMVTD FMPEDIYVEWTNNGKTELNYKNTEPVLDS DGSYFMYSKL RVEKKNWVERNSYSCSVVHEGLNHHHTKFSRTPGK

[0465] Some embodiments of the disclosed methods, treatments, regimens, uses and kits employ a myostatin antagonist, e.g., a myostatin binding molecule or an ActRIIB binding molecule. In further embodiments, the ActRIIB binding molecule is an antagonist antibody to ActRIIB.

[0466] In some embodiments of the disclosed methods, treatments, regimens, uses and kits, the anti-ActRIIB antibody is selected from the group consisting of: a) an anti-ActRIIB antibody that binds to an epitope of ActRIIB comprising SEQ ID NO: amino acids 78-83 of SEQ ID NO: 181 (WLDDFN-SEQ ID NO: 188);

- (b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFNC - SEQ ID NO: 186);
- (c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFNCY - SEQ ID NO: 190);
- (d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);
- (e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCYASW - SEQ ID NO: 187);
- (f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);
- (g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

-continued

or

- (h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR);

[0467] and b) an antagonist antibody to ActRIIB that binds to an epitope of ActRIIB comprising amino acids 78-83 of SEQ ID NO: 181 (WLDDFN—SEQ ID NO:188);

- (b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFNC - SEQ ID NO: 186);
- (c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFNCY - SEQ ID NO: 190);
- (d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);
- (e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCYASW - SEQ ID NO: 187);
- (f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);
- (g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

or -continued

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR),

wherein the antibody has a  $K_D$  of about 2 pM.

**[0468]** In some embodiments of the disclosed methods, treatments, regimens, uses and kits, the antagonist antibody to ActRIIB is a human antibody.

**[0469]** In some embodiments of the disclosed methods, treatments, regimens, uses and kits, the antibody is bimagrumab or BYM338.

**[0470]** The details of one or more embodiments of the disclosure are set forth in the accompanying description above. Although any methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present disclosure, the preferred methods and materials are now described. Other features, objects, and advantages of the disclosure will be apparent from the description and from the claims. In the specification and the appended claims, the singular forms include plural referents unless the context clearly dictates otherwise. Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure belongs. All patents and publications cited in this specification are incorporated by reference. The following Examples are presented in order to more fully illustrate the preferred embodiments of the disclosure. These examples should in no way be construed as limiting the scope of the disclosed patient matter, as defined by the appended claims.

#### EXAMPLES

**[0471]** General Methodology

**[0472]** ActRIIB antibodies, their characterisation and methods related thereto like (i) Functional Assays, (ii) REPORTER GENE ASSAYS (RGA), (iii) Cultivation of HEK293T/17 Cell Lines, (iv) Myostatin-Induced Luciferase Reporter Gene Assays, (v) SPECIFICITY ELISAs, (vi) ActRIIB/Fc-Myostatin Binding Interaction ELISA, (vii) FACS titration on hActRIIB- and hActRIIA-Expressing Cells, (viii) Binding to primary human skeletal muscle cells, (ix) affinity Determination of Selected Anti-Human ActRIIB Fabs Using Surface Plasmon Resonance (Biacore), (x) CK ASSAY, (xi) Animal Models, (xii) TREATMENT PROTOCOLS, (xiii) Statistical Analysis, (xiiii) Pannings, (xv) antibody identification and characterization, (xvi) Optimization of antibodies derived from first affinity maturation, (xvii) IgG2 Conversion of Affinity Matured Fabs (1st Maturation), (xviii) Second Affinity Maturation, (xx) IgG2 Conversion and Characterization of IgG2 (2nd Maturation), (xxi) Characterization of anti-ActRIIB antibodies in in vivo murine studies, (xxii) Confirmation of affinity by SET, (xxiii) Cross Blocking Studies and (xxiv) Epitope mapping details and technologies have been disclosed in the WO 2010/125003.

**[0473]** Study Design

**[0474]** This is a multi-center, randomized, double-blind, placebo-controlled, pivotal, 4 arm dose-finding phase IIB/III trial. A total of approximately 240 subjects with sporadic Inclusion Body Myositis (sIBM) are randomized into one of the 4 trial arms (A, B, C, or D) in a 1:1:1:1 ratio (FIG. 2).

**[0475]** A maximum of 20% of patients with baseline 6 minute walk distance  $\geq 400$  meters will be randomized.

**[0476]** For each subject, the study consists of a maximum 28 day screening period which includes a baseline visit up to 5 days, a 52 week treatment period, a variable 0-52 week maintenance treatment period, and a 28 day treatment-free follow up period.

**[0477]** The study includes 4 study epochs:

**[0478]** 1. Screening epoch: With duration up to 28 days (Day -28 to Day -1), during which study eligibility will be confirmed and if applicable, to taper subjects off disallowed medications. The screening epoch consists of a screening visit and a baseline visit. Subjects do not receive any study medication during this epoch.

**[0479]** Screening visit: Visit may occur 28 to 6 days prior to randomization (Day -28 to Day -6). Informed consent must be obtained prior to implementing any study specific procedure. Subjects that meet the inclusion/exclusion criteria will undergo safety assessments that will include physical examinations, ECG, vital signs, standard clinical laboratory evaluations (hematology, blood chemistry, urinalysis).

**[0480]** Baseline visit: All required assessments prior to beginning study drug administration will be performed during this 5 day timeframe (Day -5 to Day -1). Subjects that meet the safety requirements and inclusion/exclusion criteria at the screening visit will be asked to return to the site for baseline assessments. Once baseline evaluations (including the 6 MWD) have been checked and the patient again confirmed as eligible for the study, the patient will be asked to return to the site at Day 1 to be randomized.

**[0481]** 2. Treatment epoch: The treatment period is defined as Day 1 to Week 52 (pre-dose administration). At the Day 1 visit, subjects will be randomized into one of four parallel treatment arms:

Arm A:	BYM338 10 mg/kg i.v. infusion every 4 weeks
Arm B:	BYM338 3 mg/kg i.v. infusion every 4 weeks
Arm C:	BYM338 1 mg/kg i.v. infusion every 4 weeks
Arm D:	Placebo, administered as i.v. infusion every 4 weeks

**[0482]** Depending on the study arm the subject will receive either 13 doses of BYM338 or matching placebo administered as intravenous infusion every 4 weeks. The first study drug administration will occur at Day 1 and all baseline safety evaluation results must be available prior to dosing. For all subsequent visits including Week 52, all evaluations must be performed prior to drug administration. Final dose administration for this treatment epoch will occur at the Week 48 visit. Subjects will return to the site every four weeks for safety, pharmacodynamics, pharmacokinetic, biomarker and efficacy evaluations.

**[0483]** All subjects will perform their End of Treatment assessments at Week 52 and then move into the Maintenance Treatment epoch until the last subject continuing in this Treatment epoch has completed their Week 48 dose.

**[0484]** Once the last subject continuing in this Treatment epoch has completed their Week 48 dose, no other subjects will receive study drug, and:

**[0485]** Subjects that have not yet completed this Treatment epoch should complete an End of Treatment (EOT) visit approximately 28 days following their last study drug administration.

- [0486] After the EOT visit is completed, these subjects will enter directly into the treatment-free follow up period (they will not be eligible to enter into the Maintenance Treatment epoch).
- [0487] For subjects that have already entered the Maintenance epoch, see below.
- [0488] 3. Maintenance Treatment epoch: This epoch will be defined by the duration of patient enrollment, but will be limited to a maximum duration of 52 weeks (in case the enrollment period exceeds 52 weeks). Thus, with variable duration of 0 up to 52 weeks, the maintenance treatment period is defined as Week 52 post-dose administration up to a maximum of Week 104.
- [0489] During this Maintenance Treatment epoch, subjects will continue in the treatment arm assigned at randomization. The dose given at Week 52 is the first dose of the maintenance treatment period and is followed by doses of BYM338 or placebo every four weeks up to Week 100. Subjects will return to the site every four weeks for safety and efficacy evaluations.
- [0490] The Week 104 visit is the end of maintenance treatment (EOMT) visit. The EOMT visit is considered complete when all visit assessments are completed and the visit has been registered into Interactive Response Technology (IRT).
- [0491] Treatment duration for all subjects beyond Week 52 will be determined by the date the last subject continuing in the Treatment epoch receives their Week 48 dose, but will be limited to 52 weeks (i.e. a maximum total treatment duration in the study of 2 years).
- [0492] Once the last subject has received their Week 48 dose, no other subjects will receive study drug, and:
- [0493] All subjects in the Maintenance Treatment epoch should complete an End of Maintenance Treatment (EOMT) visit approximately 28 days following their last study drug administration.
- [0494] After EOMT visit is completed, all subjects will enter the treatment-free follow up period.
- [0495] 4. Post-Treatment Follow Up epoch: With duration of 28 days, subjects do not receive any study medication during this epoch. The End of Follow Up (EOF) visit will occur 4 weeks after completion of the respective subject's treatment epoch (Treatment epoch or Maintenance epoch) and 8 weeks after the last study drug administration. The EOF visit should be completed for all subjects, regardless of whether they complete the entire study as planned or discontinue prematurely). Subjects that complete this study may be eligible for entry into an open-label study to collect additional long-term efficacy and safety data of BYM338 in sIBM patients.
- [0496] An outline of the study design is presented in FIG. 3-1, while the Maintenance Treatment epoch variable treatment duration is represented in FIG. 3-2. A detailed visit and assessment schedule can be found in Table 6-1 and Table 6-2.
- [0497] Rationale of Study Design
- [0498] Preliminary clinical data are available for a single dose administration of BYM338 30 mg/kg in patients with sIBM. No multiple dose data and no data on other doses of BYM338 are available yet in patients with sIBM. A dose-ranging study is proposed to study different BYM338 doses on the basis of efficacy, pharmacodynamics, pharmacokinetics, and key safety data in the targeted patient population. The design of this study addresses these needs, focusing in particular on subject safety and the effect of BYM338 on lean body mass, muscle strength, muscle function, and mobility. The primary endpoint of this trial measures a change in physical function and mobility via the 6-minute walk distance test at Week 52.
- [0499] This double-blind, placebo-controlled study is designed to allow dose ranging assessment between doses of 1 mg/kg, 3 mg/kg, and 10 mg/kg BYM338 administered every 4 weeks. Currently, there is no approved treatment for sIBM. In addition, there is no pharmacological therapy available that would help sIBM patients to reverse the steady course of the disease progression Greenberg 2009, Aggarwal and Oddis 2012). The finding of elevated expression of TGF $\beta$  signaling activation through pSMAD suggests that myostatin over-expression could be an important part of the pathophysiology of sIBM, and therefore that BYM338 could be beneficial in this disease.
- [0500] Given that there is no drug approved for the treatment of sIBM and no current standard of care, a placebo-control is proposed. Placebo-controlled trials provide the maximum ability to distinguish adverse effects caused by a drug from those resulting from underlying disease or "background noise." Placebo-controlled trials also provide an optimal setting to demonstrate the efficacy of an investigational therapy, and to demonstrate a dose-response relationship, and may increase the ability of the study to detect true drug effects by decreasing the amount of improvement resulting from subject or investigator expectations. It is particularly important to be able to distinguish the adverse effect profile of BYM338 in sIBM patients, as sIBM is the first indication for BYM338 and only limited human data with BYM338 are available to date.
- [0501] Subjects randomized to any of the three non-placebo arms will receive at least 13 doses of BYM338 every 4 weeks. Study drug treatment duration beyond 52 weeks will vary per subject with a minimum total treatment duration in this study of 52 weeks and a maximum of 104 weeks, followed in all cases by a 4 week treatment-free follow up period, to allow for evaluation of long-term efficacy and safety in this population. This study is designed to gather data regarding onset of therapeutic effect as measured by the 6 minute walk test. The trial also includes measurements of the effects of sIBM on quality of life, including swallowing difficulties that may result from this disease.
- [0502] The blinding is maintained until database lock to ensure reliable efficacy and safety measures. Ideally, a standard exercise program would be performed by all subjects, to avoid variability in assessing the efficacy of various BYM338 doses. Due to the wide variation of physical function within the sIBM population (i.e. asymmetrical neuromuscular pathology), subjects will be provided with a customized, subject-specific exercise recommendation by a qualified physical therapist that will assess the subject's abilities and severity of weakness at each visit. Subjects will be encouraged to engage in the physical activity that is determined to be safe for them by the site physical therapist. A video describing a suggested home-based exercise program will be provided to the physical therapist to assist in the development of an exercise recommendation to the subject. The physical therapist can choose to provide a copy of the video to the subject, if he/she judges it to be appropriate to be used by the subject. The effect of an exercise program alone remains to be defined in a placebo group and may synergize with a group receiving active drug.

**[0503]** The study population will consist of ambulatory sIBM patients fulfilling the sIBM diagnostic criteria (adapted from the proposed Medical Research Council criteria—refer to Appendix 1) at the time of screening. Eligible subjects are required to have pathologically defined or clinically defined sIBM diagnosis as per the sIBM diagnostic criteria (Hohlfeld 2011 adapted from Hilton-Jones et al 2010).

**[0504]** Patients with 6 MWD $\geq$ 400 m at baseline will represent no more than 20% of the study sample size as many publications argue for a threshold of 400 m as a marker of subnormal physical function and mobility in healthy volunteers and patients under various disease conditions (Chetta et al 2006, Troosters et al 1999, Simonsick et al 2008, Chang et al 2004, Enright et al 2003, Enright et al 1998, Kruis et al 2010, Morley et al 2011, Kommuri et al 2010, Villalba et al 2007).

**[0505]** 3.3 Rationale of Dose/Regimen, Route of Administration and Duration of Treatment

**[0506]** The proposed doses have been chosen based on inferences made from available clinical data, including consideration of the recently available on-treatment results from the ongoing study CBYM338X2205.

**[0507]** Data from study CBYM338X2205 on 14 patients (11 active, 3 placebo) demonstrated that administration of a single dose of BYM338 30 mg/kg i.v. showed a significant increase from baseline in thigh muscle volume (TMV) via MRI as well as total and appendicular LBM via DXA as compared to placebo. In addition, this dose also induced sustained strength and functional performance and mobility improvements as per the Quantitative Muscle Testing and the 6-minute walking distance tests 16 weeks after drug administration. As the single 30 mg/kg dose showed an effect of at least 8 weeks duration, repeated treatment with 10 mg/kg may achieve similar efficacy. Therefore, 10 mg/kg has been selected as the highest dose in this study. However, the minimum efficacious dose remains to be identified.

**[0508]** In this study, the efficacy of long-term repeated dosing will be investigated with the objective to understand the dose-response relationship of BYM338. All doses of BYM338 chosen for this study (10, 3, and 1 mg/kg i.v.) have been tested and found to be well-tolerated in normal healthy volunteers.

**[0509]** The objective for the doses is to evaluate whether repeated doses of 10, 3, or 1 mg/kg i.v. can offer additional muscle structure and functional benefit to patients, and whether lower doses can do so with fewer side-effects such as acne or involuntary muscle contractions.

**[0510]** In healthy volunteers (CBYM338X2101 and CBYM338X2102), thigh muscle MRI volume increased comparably for single doses of 10 mg/kg and 30 mg/kg, but the effect of 30 mg/kg lasted longer. With 3 repeat monthly doses of BYM338, there was a comparable increase in TMV in healthy adults at 3 mg/kg and 10 mg/kg, even though it is thought that 3 mg/kg causes complete receptor occupancy for approximately half the duration of 10 mg/kg. It is not yet clear if 10 mg/kg would have fewer adverse effects than 30 mg/kg, presumably due to a lower C<sub>max</sub>, even if it were given more frequently than the 30 mg/kg dose.

**[0511]** In summary 3 mg/kg and 10 mg/kg q4 were effective in increasing TMV in healthy volunteers, thus are expected to be effective as well in sIBM patients.

**[0512]** The lower dose of 1 mg/kg did not demonstrate a persistent increase in TMV beyond 2 weeks after a single dose was administered to healthy volunteers. However, it is

being tested on the premise that patients with sIBM could have an increased sensitivity to BYM338 and that this dose could prove effective when administered multiple times.

**[0513]** A consensus paper arising from a conference of international experts in neuromuscular diseases in 2010 recommends that treatment trials in sIBM must exceed 6 months in length in order to adequately assess the effect of a treatment on the disease (Hilton-Jones et al 2010). Both EMA and FDA agreed that a 12-month duration for sIBM trials was adequate, thus all subjects will receive at least 52 weeks of treatment. Additional data up to a maximum of 3 years from randomization is being generated to evaluate the long-term safety and efficacy in this population.

**[0514]** Although it is preferable to maintain subjects on placebo for the shortest possible duration, there is currently no approved treatment for sIBM, and no standard of care. Furthermore, given that sIBM is the first indication planned for registration with BYM338, and because sIBM is expected to require chronic treatment, it is important to develop a robust database with sufficient long-term safety data. Therefore, it is reasonable to conduct a 1 year placebo-controlled study with an additional maintenance period (for a total treatment duration of up to 2 years). Regular assessments of disease activity ensure that subjects who are experiencing worsening of disease in any of the treatment groups can exit the study upon their own wish or based on the advice of the investigator at any time. It should be noted that as soon as efficacy and safety are determined based on the results of the study, all subjects will be invited to participate in a separate open label extension study with active drug. Thus, no subject will be on placebo after the 52 week safety and efficacy has been determined. Though currently available data are insufficient to demonstrate convincing efficacy of BYM338 in the sIBM population, this study is designed to collect this data and inform on both efficacy and safety of BYM338 in the sIBM population at the study conclusion.

**[0515]** Rationale for Choice of Comparator

**[0516]** Given that there is no drug approved for the treatment of sIBM, a placebo-control is proposed. Placebo-controlled trials also provide the maximum ability to distinguish adverse effects caused by a drug from those resulting from underlying disease or “background noise.” Placebo-controlled trials also provide an optimal setting to demonstrate the efficacy of an investigational therapy, and to demonstrate a dose-response relationship, and may increase the ability of the study to detect true drug effects by decreasing the amount of improvement resulting from subject or investigator expectations.

**[0517]** Risks and Benefits

**[0518]** The safety data from the completed Phase I studies do not highlight any specific safety risk or concern or any particular pattern of major event clustering. From the standpoint of the overall risk benefit assessment the current study design and its trial-related risks (infusion, blood draws, exposure to radiation during imaging) with BYM338 is justified.

**[0519]** To date 213 patients and healthy volunteers have been enrolled in studies with bimagrumab with 150 having received active drug at doses ranging from single and multiple doses of 0.1 to 30 mg/kg i.v. Early phase clinical data support a favorable benefit-risk profile for BYM338 in healthy volunteers and patients.

**[0520]** Preliminary data from the first studies in healthy volunteers and older patients indicate observations of diffuse acne on the face and less frequently on the back and chest may

be present in some adults receiving a single dose of 30 mg/kg. A possible mechanistic link between BYM338 and skin reactivity remains unclear.

**[0521]** In approximately 20%-48% of normal healthy volunteers and patients with sIBM treated with a single 30 mg/kg i.v. dose of BYM338, involuntary muscle contractions, referred to as 'muscle twitching' were reported. The reported muscle twitches were mild in intensity, transient, of short duration, self-limiting and did not require medical treatment. While twitching could theoretically be more pronounced in aging and atrophying muscle, this has not been observed in sIBM patients with age up to 78 years. The biological explanation of twitching is being pursued by the BYM338 Project Team using both internal and external resources.

**[0522]** Preclinical studies in rats demonstrated a marked cardiac hypertrophy deemed compensatory to the substantial increase in skeletal muscle mass. Although inconsistently seen in monkey studies, the observed increase in ventricular muscle mass without any effect on left ventricular chamber size and, importantly, on global left ventricular systolic function in female monkeys is also supportive of a compensatory effect rather than a direct effect of BYM338. It is not clear if cardiac hypertrophy may occur with BYM338 treatment in patients with small increases in skeletal muscle mass. Echocardiography and EKG Holter monitor data showed no evidence of significant change in posterior wall thickness, interventricular septum thickness, left ventricular diastolic diameter, left ventricular mass or cardiac conduction when compared with placebo after single and multiple doses up to and including 30 mg/kg. ECGs and electrocardiography will be conducted in study CBYM338B2203 to monitor this potential risk.

**[0523]** Weekly doses of 1, 10 and 100 mg/kg of BYM338 in the 4- and 13-week toxicity studies resulted in reversible changes in the uterus, vagina and ovaries of the rat and to a much lesser extent to the ovaries of the cynomolgus monkey. At 100 mg/kg given weekly, BYM338 was shown to be developmentally toxic in the rat, with evidence of teratogenicity. These findings are not unexpected based on the pharmacology of BYM338 and the role of activins in organogenesis (Xia and Schneyer 2009). Suppression of FSH levels in postmenopausal and premenopausal women of non-childbearing potential, increasing with the dose of BYM338, has been identified and plans are in place to monitor data closely in ongoing and future studies. The clinical meaning of reduced FSH in postmenopausal women is unknown; in premenopausal women it is expected that such a reduction could interfere with menstrual cycling, fecundity and potentially cause symptoms of low estrogen in the body (e.g. hot flushes, vaginal dryness, accelerated bone loss), which could require additional treatment. Only, women of non-child bearing potential have been recruited in all healthy volunteer studies. For subjects who are premenopausal, this study plans to enroll women of childbearing potential (WOCBP) who consent to use two forms of highly effective contraception from the day written consent is given through 6 months after the last study drug administration. Pregnancy testing will be administered at screening, throughout the study period and 30 days after the last visit.

**[0524]** Body weight may increase with BYM338 treatment, but it is expected that the increase will be primarily in LBM, with stable or reduced body fat mass.

**[0525]** It is possible that anti-drug antibodies could develop against BYM338, which could neutralize the drug and attenu-

ate its efficacy. However, as of the publication date of the IB version 4.0, no neutralizing antibodies have been observed in the samples evaluated from single dose studies. Analysis is planned for the multiple dose study and other single dose studies.

**[0526]** Infusion related reactions can occur with monoclonal antibodies. Hypersensitivity reactions can manifest as fever, chills, urticaria, dyspnea, headaches, myalgia and/or hypotension. A serious infusion reaction that results in anaphylaxis is a rare event in monoclonal antibody therapy. If a severe hypersensitivity reaction occurs, administration of BYM338 should be discontinued and appropriate therapy initiated.

**[0527]** As with any other investigational drug, there are unknown risks to BYM338 which may be serious and unforeseen.

**[0528]** Population

**[0529]** The study population will consist of ambulatory (i.e. not wheel-chair bound or bed-ridden at screening and baseline) male and female patients with a pathologically defined or clinically defined diagnosis of sIBM as per the 2010 definition of the European Neuromuscular Center. It is aimed to randomize a total of 240 patients in approximately 30 centers worldwide.

**[0530]** Inclusion Criteria

**[0531]** Patients eligible for inclusion in this study have to fulfill all of the following criteria at screening and baseline visits:

**[0532]** Male and female patients age 35 to 85 years of age (inclusive)

**[0533]** Diagnosed with pathologically-defined or clinically-defined sporadic inclusion body myositis as per the sIBM diagnostic criteria (adapted from the proposed 2010 MRC criteria), including evaluation of a pathology report.

**[0534]** Must not be wheel-chair bound (intermittent use of wheelchair is allowed) at both screening and baseline visits, as defined by a 6 MWD score >1 meter.

**[0535]** Able to communicate well with the investigator.

**[0536]** Willing to participate for the entire duration of the study with commitment to follow study requirements and procedures.

**[0537]** Exclusion Criteria

**[0538]** Patients fulfilling any of the following criteria at screening and baseline visits are not eligible for inclusion in this study.

**[0539]** 1. Use of other investigational drugs at the time of enrollment or within 30 days or 5 half-lives of enrollment, whichever is longer, or longer if required by any other limitation of participation in an investigational trial based on local regulations. Current or planned participation to another clinical trial during this study. Participation in observational or registry studies not involving drug therapy is allowed;

**[0540]** 2. History of an allergic reaction or anaphylactic reaction to the study medication or history of hypersensitivity to any component of the study medication. History of hypersensitivity to biologics;

**[0541]** 3. Reasons that preclude adequate intake of protein, defined as at least 0.8 g protein/kg/day and/or diseases known to cause malabsorption of protein or energy from the gastrointestinal tract, such as inflammatory bowel disease, celiac disease, short bowel syndrome, pancreatic insufficiency;

- [0542]** 4. Any non-sIBM conditions or other neurologic (congenital or acquired) or neuromuscular diseases that cause significant lower leg muscular or joint pain or muscle weakness that significantly limit mobility, including polymyositis or dermatomyositis, polymyalgia rheumatica, fibromyalgia, significant dementia/Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis, stroke, cerebral palsy, epilepsy, multiple sclerosis, spinal cord injury, muscular dystrophy, myasthenia gravis, and weakness related to degenerative joint disease of the spine. Note: Previous misdiagnosis of these is not exclusionary. Patients with conditions such as osteoarthritis can participate unless their pain limits them from performing study procedures;
- [0543]** 5. Any active chronic non-sIBM condition associated with cachexia or muscle atrophy or that limits mobility as a result of respiratory function, including: severe chronic obstructive pulmonary disease (FEV1<50% predicted or functional dyspnea Grade 3 on the Medical Research Council Dyspnea Scale), advanced organ failure, chronic kidney disease (estimated GFR<30 mL/min using the MDRD equation), hyperthyroidism, rheumatoid arthritis;
- [0544]** 6. Uncontrolled hypothyroidism. Hypothyroid patients who have changed their dose of hormone replacement therapy in the past 6 weeks prior to screening are not eligible for the study;
- [0545]** 7. Uncontrolled diabetes mellitus (i.e. HbA1C≥9.0 mmol/l) and/or any other uncontrolled endocrine disease;
- [0546]** 8. Potential subjects who have recently donated blood in the past 60 days, or plasma donation in the past 2 weeks;
- [0547]** 9. History of a hip fracture in the last 6 months or has undergone surgery for a hip or knee prosthesis in the last 6 months;
- [0548]** 10. Experienced an acute illness within the 30 days prior to screening (Screening Visit) that, in the opinion of the investigator, affects lower extremity function or the patient's ability to participate in the study;
- [0549]** 11. Score "yes" on item 4 or item 5 of the Suicidal Ideation section of the Columbia Suicide Severity Rating Scale (CSSRS), if this ideation occurred in the past 6 months, or "yes" on any item of the Suicidal Behavior section, except for the "Non-Suicidal Self-Injurious Behavior" (item also included in the Suicidal Behavior section), if this behavior occurred in the past 2 years;
- [0550]** 12. Pregnant or nursing (lactating) women, where pregnancy is defined as the state of a female after conception and until the termination of gestation, confirmed by a positive hCG laboratory test;
- [0551]** 13. Women of child-bearing potential, defined as all women physiologically capable of becoming pregnant, UNLESS they are using highly effective methods of contraception during dosing and for 6 months after the last BYM338 dose.
- [0552]** Highly Effective Contraception Methods Include:
- [0553]** 1. Total abstinence (when this is in line with the preferred and usual lifestyle of the subject). Periodic abstinence (e.g., calendar, ovulation, symptothermal, post-ovulation methods) and withdrawal are not acceptable methods of contraception.
- [0554]** 2. Female Sterilization (have had surgical bilateral oophorectomy with or without hysterectomy) or tubal ligation at least six weeks before taking study treatment. In case of oophorectomy alone, only when the reproductive status of the woman has been confirmed by follow up hormone level assessment.
- [0555]** Male sterilization (at least 6 months prior to screening). For female subjects in the study, the vasectomised male partner should be the sole partner for that subject.
- [0556]** 4. Combination of Any Two of the Following Methods (a+b or a+c or b+c):
- [0557]** a. Use of oral, injected or implanted hormonal methods of contraception or other forms of hormonal contraception that have comparable efficacy (failure rate <1%), for example hormone vaginal ring or transdermal hormone contraception.
- [0558]** b. Placement of an intrauterine device (IUD) or intrauterine system (IUS).
- [0559]** c. Barrier methods of contraception: Condom or Occlusive cap (diaphragm or cervical/vault caps) with spermicidal foam/gel/film/cream/vaginal suppository.
- [0560]** In case of use of oral contraception women should have been stable on the same pill for a minimum of 3 months before taking study treatment.
- [0561]** Women are considered post-menopausal and not of child bearing potential if they have had 12 months of natural (spontaneous) amenorrhea with an appropriate clinical profile (e.g. age appropriate, history of vasomotor symptoms) or have had surgical bilateral oophorectomy (with or without hysterectomy) or tubal ligation at least six weeks ago. In the case of oophorectomy alone, only when the reproductive status of the woman has been confirmed by follow up hormone level assessment is she considered not of child bearing potential;
- [0562]** 14. Any anticipated scheduled in-patient surgery within 12 months following randomization;
- [0563]** 15. Severe Vitamin D deficiency defined as 25-OH-vitamin D levels <9.2 ng/mL or <23 nmol/mL at screening;
- [0564]** 16. Significant psychiatric disorder, clinically manifest peripheral vascular disease or disorder, or systemic disorder which could affect any of the efficacy assessments (e.g. diabetic neuropathy, chronic fatigue syndrome, schizophrenia, bipolar disorder, severe depression, intermittent claudication);
- [0565]** 17. Lack of peripheral venous access;
- [0566]** 18. Known heart failure classified as New York Heart Association Class III and IV or a history of chronic hypotension (systolic blood pressure <100 mmHg);
- [0567]** 19. Systolic blood pressure >180 or <90 mm Hg or diastolic blood pressure >100 or <50 mmHg at screening, or malignant hypertension;
- [0568]** 20. History of unstable angina, myocardial infarction, coronary artery bypass graft surgery, or percutaneous coronary intervention (such as angioplasty or stent placement) within 180 days of screening;
- [0569]** 21. Prolonged QT syndrome or QTcF>450 msec (Fridericia Correction) for males and >470 msec for females at screening or baseline at repeated assessment;
- [0570]** 22. ECG showing clinically significant abnormalities including any current supra-ventricular arrhythmia with an uncontrolled ventricular response (mean heart rate >100 beats per minute [bpm]) at rest despite medical or device therapy, or any history of spontaneous or induced sustained ventricular tachycardia (heart rate >100 bpm for 30 sec)

despite medical or device therapy, or any history of resuscitated cardiac arrest or presence of an automated internal cardioverter-defibrillator;

**[0571]** 23. Significant coagulopathy, platelet count less than 75,000/mm<sup>3</sup>, hemoglobin less than 11.0 g/dL;

**[0572]** 24. Liver disease or liver injury as indicated by abnormal liver function tests such as SGOT (AST), SGPT (ALT), alkaline phosphatase, or serum bilirubin (except Gilbert's Disease).

**[0573]** The Investigator should be guided by the following criteria:

**[0574]** Any single transaminase may not exceed 3× times upper limit of normal (ULN). A single parameter elevated up to and including 3× ULN should be rechecked as soon as possible, and in all cases, at least prior to randomization, to rule out any lab error.

**[0575]** If the total bilirubin concentration is increased above 1.5× ULN, total bilirubin should be differentiated into the direct and indirect reacting bilirubin. In any case, serum bilirubin should not exceed the value of 1.6 mg/dL (27 μmol/L);

**[0576]** 14. Known history or presence of severe acute or chronic liver disease (compensated or decompensated), known gallbladder or bile duct disease, acute or chronic pancreatitis, renal failure or chronic treatment with medication which has a hepatotoxic potential;

**[0577]** 15. History of malignancy of any organ system (other than localized basal cell carcinoma or squamous cell carcinoma of the skin that has been definitively treated), treated or untreated, within the past 5 years, regardless of whether there is evidence of local recurrence or metastases. Participants with carcinoma in situ of the uterine cervix treated definitively more than 1 year prior to screening may enter the study;

**[0578]** 16. Use of prohibited systemic treatments, including VEGF inhibitors (bevacizumab), within past 6 months prior to randomization or any therapies known to affect muscle mass, including androgen supplements (including OTC DHEA), GnRH analogues, anti-androgens, anti-estrogens (tamoxifen), progestins with known androgenic component (e.g. NETA), recombinant human growth hormone, oral beta agonists, insulin, megestrol acetate, or dronabinol within the past 3 months prior to randomization;

**[0579]** 17. Ongoing chronic corticosteroid use or history of systemic corticosteroid use for at least 90 days prior to randomization at a daily dose greater than or equal to 10 mg prednisone equivalent;

**[0580]** 18. Ongoing immunosuppressive therapy OR antibody immunosuppressive therapy (rituximab or i.v. immunoglobulin, TNF-alpha inhibitors) within the past 6 months prior to randomization OR non-antibody therapy for autoimmune diseases (e.g. cyclosporine, methotrexate, tacrolimus, cyclophosphamide, azathioprine) within the past 3 months (90 days) prior to randomization);

**[0581]** 19. Currently active alcohol or drug abuse or history of alcohol or drug abuse within the last 24 weeks prior to randomization;

**[0582]** 20. Known active infection of any kind (excluding fungal infection of nail beds) or any major episode of infection requiring hospitalization or treatment with i.v. anti-infectives within 8 weeks prior to randomization;

**[0583]** 21. Any chronic active infection (e.g., HIV, hepatitis B or C, tuberculosis, etc). Patients receiving chemoprophylaxis for latent tuberculosis infection are eligible for the study;

**[0584]** 22. Patient has any medical condition or laboratory finding during screening, which, in the investigator's opinion may interfere with participation, confound the results, or pose any additional risk to the patient when administering BYM338;

**[0585]** 23. A maximum of 20% of patients with baseline 6 minute walk distance ≥400 meters will be randomized.

**[0586]** No additional exclusions may be applied by the investigator, in order to ensure that the study population will be representative of all eligible patients.

**[0587]** Treatment

**[0588]** Protocol Requested Treatment

**[0589]** 1. Investigational Treatment

**[0590]** Novartis will supply the following investigational drug:

**[0591]** BYM338: 150 mg liquid in vial, provided in colorless glass vials with rubber stopper and aluminum flip-off caps.

**[0592]** Placebo: Provided in colorless glass vials with rubber stopper and aluminum flip-off caps.

**[0593]** Note: To maintain a blind, open-label investigational treatment will be prepared by an unblinded pharmacist/designee and administered only by blinded study personnel.

**[0594]** 2. Additional Study Treatment

**[0595]** No additional treatment beyond investigational treatment is required for this trial.

**[0596]** However, subjects may receive sufficient elemental calcium and vitamin D treatment as per local guidelines and under the guidance of the treating physician.

**[0597]** Treatment Arms

**[0598]** This is a four arm study. 240 subjects with sIBM will be randomized at Day 1 to one of the following 4 arms in a ratio of 1:1:1:1:

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Arm A: BYM338 at 10 mg/kg i.v. infusion every 4 weeks (n = 60)

Arm B: BYM338 at 3 mg/kg i.v. infusion every 4 weeks (n = 60)

Arm C: BYM338 at 1 mg/kg i.v. infusion every 4 weeks (n = 60)

Arm D: Placebo, administered as i.v. infusion every 4 weeks for (n = 60)

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**[0599]** Arm D: Placebo, administered as i.v. infusion every 4 weeks for (n=60)

**[0600]** Depending on the study arm the subject receives at minimum 13 doses of BYM338 or matching placebo administered as intravenous infusion every 4 weeks. The first administration will occur at Day 1 and the final dose administration during the Treatment Epoch will occur at the Week 48 visit, defining the minimum treatment duration of 52 weeks. Subjects that enter the Maintenance Treatment epoch will continue to receive BYM338 or matching placebo i.v. infusions every 4 weeks according to their Day 1 treatment arm randomization assignment. Since all subjects will continue to receive study medication until the last subject reaches the Week 48 treatment dose, the final study drug administration is variable. However, the maximum total treatment duration for an individual subject in this study will be limited to 2 years (104 weeks); in this maximal treatment duration case, the final study drug administration would occur at the Week 100 visit.



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<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 10

Gly Tyr Thr Phe Thr Ser Ser Tyr Ile Asn  
1 5 10

<210> SEQ ID NO 11  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 11

Gly Tyr Thr Phe Thr Ser Ser Tyr Ile Asn  
1 5 10

<210> SEQ ID NO 12  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

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<400> SEQUENCE: 12

Gly Tyr Thr Phe Thr Ser Ser Tyr Ile Asn  
1 5 10

<210> SEQ ID NO 13

<211> LENGTH: 10

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 13

Gly Tyr Thr Phe Thr Ser Ser Tyr Ile Asn  
1 5 10

<210> SEQ ID NO 14

<211> LENGTH: 10

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 14

Gly Tyr Thr Phe Thr Ser Ser Tyr Ile Asn  
1 5 10

<210> SEQ ID NO 15

<211> LENGTH: 17

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 15

Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 16

<211> LENGTH: 17

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 16

Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 17

<211> LENGTH: 17

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 17

Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

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<210> SEQ ID NO 18  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 18

Thr	Ile	Asn	Pro	Val	Ser	Gly	Asn	Thr	Ser	Tyr	Ala	Gln	Lys	Phe	Gln
1				5					10					15	

Gly

<210> SEQ ID NO 19  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 19

Met	Ile	Asn	Ala	Pro	Ile	Gly	Thr	Thr	Arg	Tyr	Ala	Gln	Lys	Phe	Gln
1				5					10					15	

Gly

<210> SEQ ID NO 20  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 20

Gln	Ile	Asn	Ala	Ala	Ser	Gly	Met	Thr	Arg	Tyr	Ala	Gln	Lys	Phe	Gln
1				5					10					15	

Gly

<210> SEQ ID NO 21  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 21

Met	Ile	Asn	Ala	Pro	Ile	Gly	Thr	Thr	Arg	Tyr	Ala	Gln	Lys	Phe	Gln
1				5					10					15	

Gly

<210> SEQ ID NO 22  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 22

Thr	Ile	Asn	Pro	Val	Ser	Gly	Asn	Thr	Arg	Tyr	Ala	Gln	Lys	Phe	Gln
1				5					10					15	

Gly

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<210> SEQ ID NO 23  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 23

Thr Ile Asn Pro Val Ser Gly Ser Thr Ser Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 24  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 24

Gln Ile Asn Ala Ala Ser Gly Met Thr Arg Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 25  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 25

Asn Ile Asn Ala Ala Ala Gly Ile Thr Leu Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 26  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 26

Thr Ile Asn Pro Pro Thr Gly Gly Thr Tyr Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

<210> SEQ ID NO 27  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 27

Gly Ile Asn Pro Pro Ala Gly Thr Thr Ser Tyr Ala Gln Lys Phe Gln  
1 5 10 15

Gly

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<210> SEQ ID NO 28  
<211> LENGTH: 17  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 28

Asn Ile Asn Pro Ala Thr Gly His Ala Asp Tyr Ala Gln Lys Phe Gln  
1                   5                                   10                                   15

Gly

<210> SEQ ID NO 29  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 29

Gly Gly Trp Phe Asp Tyr  
1                   5

<210> SEQ ID NO 30  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 30

Gly Gly Trp Phe Asp Tyr  
1                   5

<210> SEQ ID NO 31  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 31

Gly Gly Trp Phe Asp Tyr  
1                   5

<210> SEQ ID NO 32  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 32

Gly Gly Trp Phe Asp Tyr  
1                   5

<210> SEQ ID NO 33  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 33

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Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 34  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 34

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 35  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 35

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 36  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 36

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 37  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 37

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 38  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 38

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 39  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

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<400> SEQUENCE: 39

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 40  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 40

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 41  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 41

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 42  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 42

Gly Gly Trp Phe Asp Tyr  
1 5

<210> SEQ ID NO 43  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 43

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 44  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 44

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 45  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:



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<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 45

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 46

<211> LENGTH: 14

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 46

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 47

<211> LENGTH: 14

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 47

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 48

<211> LENGTH: 14

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 48

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 49

<211> LENGTH: 14

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 49

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 50

<211> LENGTH: 14

<212> TYPE: PRT

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 50

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 51

<211> LENGTH: 14

<212> TYPE: PRT

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<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 51

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 52  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 52

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 53  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 53

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 54  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 54

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 55  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 55

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 56  
<211> LENGTH: 14  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 56

Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr Asn Tyr Val Asn  
1 5 10

<210> SEQ ID NO 57

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<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 57

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 58  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 58

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 59  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 59

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 60  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 60

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 61  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 61

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 62  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 62

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

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<210> SEQ ID NO 63  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 63

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 64  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 64

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 65  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 65

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 66  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 66

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 67  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 67

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                   5                   10

<210> SEQ ID NO 68  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 68

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser

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1                    5                    10

<210> SEQ ID NO 69  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 69

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                    5                    10

<210> SEQ ID NO 70  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 70

Leu Met Ile Tyr Gly Val Ser Lys Arg Pro Ser  
1                    5                    10

<210> SEQ ID NO 71  
<211> LENGTH: 9  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 71

Gln Ala Trp Thr Ser Lys Met Ala Gly  
1                    5

<210> SEQ ID NO 72  
<211> LENGTH: 9  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 72

Ser Ser Tyr Thr Arg Met Gly His Pro  
1                    5

<210> SEQ ID NO 73  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 73

Ala Thr Tyr Gly Lys Gly Val Thr Pro Pro  
1                    5                    10

<210> SEQ ID NO 74  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 74

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Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
1 5 10

<210> SEQ ID NO 75  
<211> LENGTH: 9  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 75

Gln Ala Trp Thr Ser Lys Met Ala Gly  
1 5

<210> SEQ ID NO 76  
<211> LENGTH: 9  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 76

Gln Ala Trp Thr Ser Lys Met Ala Gly  
1 5

<210> SEQ ID NO 77  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 77

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
1 5 10

<210> SEQ ID NO 78  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 78

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
1 5 10

<210> SEQ ID NO 79  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

<400> SEQUENCE: 79

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
1 5 10

<210> SEQ ID NO 80  
<211> LENGTH: 10  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: CDR

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&lt;400&gt; SEQUENCE: 80

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
 1                   5                   10

&lt;210&gt; SEQ ID NO 81

&lt;211&gt; LENGTH: 10

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: CDR

&lt;400&gt; SEQUENCE: 81

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
 1                   5                   10

&lt;210&gt; SEQ ID NO 82

&lt;211&gt; LENGTH: 10

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: CDR

&lt;400&gt; SEQUENCE: 82

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
 1                   5                   10

&lt;210&gt; SEQ ID NO 83

&lt;211&gt; LENGTH: 10

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: CDR

&lt;400&gt; SEQUENCE: 83

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
 1                   5                   10

&lt;210&gt; SEQ ID NO 84

&lt;211&gt; LENGTH: 10

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: CDR

&lt;400&gt; SEQUENCE: 84

Gly Thr Phe Ala Gly Gly Ser Tyr Tyr Gly  
 1                   5                   10

&lt;210&gt; SEQ ID NO 85

&lt;211&gt; LENGTH: 112

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: VL

&lt;400&gt; SEQUENCE: 85

Asp Ile 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 Ser Tyr  
                  20                   25                   30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
           35                   40                   45

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Met Ile Tyr Gly Val Ser Lys 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 Gln Ala Trp Thr Ser Lys
  85                               90                               95

Met Ala Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly Gln
  100                               105                               110

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<210> SEQ ID NO 86
<211> LENGTH: 112
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

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<400> SEQUENCE: 86

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Asp Ile 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 Ser Tyr
  20           25           30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
  35           40           45

Met Ile Tyr Gly Val Ser Lys 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 Arg Met
  85                               90                               95

Gly His Pro Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly Gln
  100                               105                               110

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<210> SEQ ID NO 87
<211> LENGTH: 113
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

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<400> SEQUENCE: 87

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Asp Ile 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 Ser Tyr
  20           25           30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
  35           40           45

Met Ile Tyr Gly Val Ser Lys 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 Ala Thr Tyr Gly Lys Gly
  85                               90                               95

Val Thr Pro Pro Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
  100                               105                               110

```

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Gln

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<210> SEQ ID NO 88  
 <211> LENGTH: 113  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 88

```

Asp Ile 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 Ser Tyr
20          25          30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
35          40          45
Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
85          90          95
Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
100         105         110

```

Gln

<210> SEQ ID NO 89  
 <211> LENGTH: 112  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 89

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Asp Ile 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 Ser Tyr
20          25          30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
35          40          45
Met Ile Tyr Gly Val Ser Lys 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 Gln Ala Trp Thr Ser Lys
85          90          95
Met Ala Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly Gln
100         105         110

```

<210> SEQ ID NO 90  
 <211> LENGTH: 112  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 90

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Asp Ile Ala Leu Thr Gln Pro Ala Ser Val Ser Gly Ser Pro Gly Gln

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1           5           10           15
Ser Ile Thr Ile Ser Cys Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr
      20           25           30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
      35           40           45
Met Ile Tyr Gly Val Ser Lys 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 Gln Ala Trp Thr Ser Lys
      85           90           95
Met Ala Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly Gln
      100           105           110

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<210> SEQ ID NO 91
<211> LENGTH: 113
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

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<400> SEQUENCE: 91

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Asp Ile 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 Ser Tyr
      20           25           30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
      35           40           45
Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
      85           90           95
Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
      100           105           110

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Gln

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<210> SEQ ID NO 92
<211> LENGTH: 113
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

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<400> SEQUENCE: 92

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Asp Ile 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 Ser Tyr
      20           25           30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
      35           40           45
Met Ile Tyr Gly Val Ser Lys 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

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<210> SEQ ID NO 95  
 <211> LENGTH: 113  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 95

Asp Ile 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 Ser Tyr  
 20 25 30  
 Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45  
 Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
 85 90 95  
 Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
 100 105 110

Gln

<210> SEQ ID NO 96  
 <211> LENGTH: 113  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 96

Asp Ile 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 Ser Tyr  
 20 25 30  
 Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45  
 Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
 85 90 95  
 Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
 100 105 110

Gln

<210> SEQ ID NO 97  
 <211> LENGTH: 113  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

<400> SEQUENCE: 97

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Asp Ile 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 Ser Tyr  
 20 25 30  
 Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45  
 Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
 85 90 95  
 Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
 100 105 110

Gln

<210> SEQ ID NO 98  
 <211> LENGTH: 113  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VL

&lt;400&gt; SEQUENCE: 98

Asp Ile 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 Ser Tyr  
 20 25 30  
 Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45  
 Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
 85 90 95  
 Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
 100 105 110

Gln

<210> SEQ ID NO 99  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

&lt;400&gt; SEQUENCE: 99

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe

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      50              55              60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
      100              105              110
Val Ser Ser
      115

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<210> SEQ ID NO 100
<211> LENGTH: 115
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

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<400> SEQUENCE: 100

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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 Tyr Thr Phe Thr Ser Ser
      20              25              30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
      35              40              45
Gly Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe
      50              55              60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
      100              105              110
Val Ser Ser
      115

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<210> SEQ ID NO 101
<211> LENGTH: 115
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

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<400> SEQUENCE: 101

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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 Tyr Thr Phe Thr Ser Ser
      20              25              30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
      35              40              45
Gly Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe
      50              55              60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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

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Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

Val Ser Ser  
 115

<210> SEQ ID NO 102  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 102

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Thr Ile Asn Pro Val Ser Gly Asn Thr Ser Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

Val Ser Ser  
 115

<210> SEQ ID NO 103  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 103

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Met Ile Asn Ala Pro Ile Gly Thr Thr Arg Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

Val Ser Ser  
 115

<210> SEQ ID NO 104

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<211> LENGTH: 115
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 104

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 Ser
20          25          30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35          40          45
Gly Gln Ile Asn Ala Ala Ser Gly Met Thr Arg Tyr Ala Gln Lys Phe
50          55          60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
100         105         110

Val Ser Ser
115

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<210> SEQ ID NO 105
<211> LENGTH: 115
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 105

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 Ser
20          25          30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35          40          45
Gly Met Ile Asn Ala Pro Ile Gly Thr Thr Arg Tyr Ala Gln Lys Phe
50          55          60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
100         105         110

Val Ser Ser
115

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<210> SEQ ID NO 106
<211> LENGTH: 115
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 106

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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 Tyr Thr Phe Thr Ser Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Thr Ile Asn Pro Val Ser Gly Asn Thr Arg Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110  
 Val Ser Ser  
 115

<210> SEQ ID NO 107  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 107

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Thr Ile Asn Pro Val Ser Gly Ser Thr Ser Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110  
 Val Ser Ser  
 115

<210> SEQ ID NO 108  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 108

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45

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Gly Gln Ile Asn Ala Ala Ser Gly Met Thr Arg Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

Val Ser Ser  
 115

<210> SEQ ID NO 109  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 109

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 Ser  
 20 25 30

Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45

Gly Asn Ile Asn Ala Ala Ala Gly Ile Thr Leu Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile 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 Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

Val Ser Ser  
 115

<210> SEQ ID NO 110  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 110

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 Ser  
 20 25 30

Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45

Gly Thr Ile Asn Pro Pro Thr Gly Gly Thr Tyr Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80

Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys

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	85	90	95
Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr	100	105	110
Val Ser Ser			
	115		

<210> SEQ ID NO 111  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 111

Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala	5	10	15
Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Ser	20	25	30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met	35	40	45
Gly Gly Ile Asn Pro Pro Ala Gly Thr Thr Ser Tyr Ala Gln Lys Phe	50	55	60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr	65	70	75
Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys	85	90	95
Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr	100	105	110
Val Ser Ser			
	115		

<210> SEQ ID NO 112  
 <211> LENGTH: 115  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: VH

<400> SEQUENCE: 112

Gln Val Gln Leu Val Gln Ser Gly Ala Glu Val Lys Lys Pro Gly Ala	5	10	15
Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Ser	20	25	30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met	35	40	45
Gly Asn Ile Asn Pro Ala Thr Gly His Ala Asp Tyr Ala Gln Lys Phe	50	55	60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr	65	70	75
Met Glu Leu Ser Ser Leu Arg Ser Glu Asp Thr Ala Val Tyr Tyr Cys	85	90	95
Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr	100	105	110
Val Ser Ser			
	115		

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<210> SEQ ID NO 113  
<211> LENGTH: 336  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL  
  
<400> SEQUENCE: 113  
  
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggg tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacct tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc caggcttggg cttctaagat ggctggtgtg 300  
ttggcgggcg gcacgaagtt aaccgttctt ggccag 336

<210> SEQ ID NO 114  
<211> LENGTH: 336  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL  
  
<400> SEQUENCE: 114  
  
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggg tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacct tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc tcttcttata ctcgatggg tcatcctgtg 300  
ttggcgggcg gcacgaagtt aaccgttctt ggccag 336

<210> SEQ ID NO 115  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL  
  
<400> SEQUENCE: 115  
  
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggg tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacct tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc gctacttatg gtaaggtgtg tactcctcct 300  
gtgtttggcg gcggcacgaa gttaaccggt cttggccag 339

<210> SEQ ID NO 116  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL  
  
<400> SEQUENCE: 116

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gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg 240
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtggttc ttattatggt 300
gtgtttggcg gcggcacgaa gttaaccggt cttggccag 339

```

```

<210> SEQ ID NO 117
<211> LENGTH: 336
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

```

```

<400> SEQUENCE: 117

```

```

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg 240
caagcggaag acgaagcgga ttattattgc caggcttggc cttctaagat ggctggtgtg 300
tttggcggcg gcacgaagt aaccgttctt ggccag 336

```

```

<210> SEQ ID NO 118
<211> LENGTH: 336
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

```

```

<400> SEQUENCE: 118

```

```

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg 240
caagcggaag acgaagcgga ttattattgc caggcttggc cttctaagat ggctggtgtg 300
tttggcggcg gcacgaagt aaccgttctt ggccag 336

```

```

<210> SEQ ID NO 119
<211> LENGTH: 339
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VL

```

```

<400> SEQUENCE: 119

```

```

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg 240
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtggttc ttattatggt 300

```

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-continued

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gtgtttggcg gcggcacgaa gttaaccgtt cttggccag 339

<210> SEQ ID NO 120  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL

<400> SEQUENCE: 120

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtggttc ttattatggt 300  
gtgtttggcg gcggcacgaa gttaaccgtt cttggccag 339

<210> SEQ ID NO 121  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL

<400> SEQUENCE: 121

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtggttc ttattatggt 300  
gtgtttggcg gcggcacgaa gttaaccgtt cttggccag 339

<210> SEQ ID NO 122  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL

<400> SEQUENCE: 122

gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240  
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtggttc ttattatggt 300  
gtgtttggcg gcggcacgaa gttaaccgtt cttggccag 339

<210> SEQ ID NO 123  
<211> LENGTH: 339  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VL

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-continued

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<400> SEQUENCE: 123

```
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggg tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgaccat tagcggcctg    240
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtgggtc ttattatggt    300
gtgtttggcg gcggcacgaa gttaaccggt cttggccag                               339
```

<210> SEQ ID NO 124

<211> LENGTH: 339

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VL

<400> SEQUENCE: 124

```
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtactg gtactagcag cgatgttggg tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgaccat tagcggcctg    240
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtgggtc ttattatggt    300
gtgtttggcg gcggcacgaa gttaaccggt cttggccag                               339
```

<210> SEQ ID NO 125

<211> LENGTH: 339

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VL

<400> SEQUENCE: 125

```
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggg tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgaccat tagcggcctg    240
caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtgggtc ttattatggt    300
gtgtttggcg gcggcacgaa gttaaccggt cttggccag                               339
```

<210> SEQ ID NO 126

<211> LENGTH: 339

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VL

<400> SEQUENCE: 126

```
gatatcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggg tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgaccat tagcggcctg    240
```

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---

```

caagcggaag acgaagcgga ttattattgc ggtacttttg ctggtgggtc ttattatggt 300
gtgtttggcg gcggcacgaa gttaaccgtt cttggccag 339

```

```

<210> SEQ ID NO 127
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 127

```

```

caggtgcaat tggttcagag cggcgcgga gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgaaaag cctccgata tacctttact tcttcttata ttaattgggt ccgccaagcc 120
cctgggcagg gtctcgagt gatgggcact atcaatccgg tttctggcaa tacgtcttac 180
gcgcagaagt ttcagggccg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 128
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 128

```

```

caggtgcaat tggttcagag cggcgcgga gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgaaaag cctccgata tacctttact tcttcttata ttaattgggt ccgccaagcc 120
cctgggcagg gtctcgagt gatgggcact atcaatccgg tttctggcaa tacgtcttac 180
gcgcagaagt ttcagggccg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 129
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 129

```

```

caggtgcaat tggttcagag cggcgcgga gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgaaaag cctccgata tacctttact tcttcttata ttaattgggt ccgccaagcc 120
cctgggcagg gtctcgagt gatgggcact atcaatccgg tttctggcaa tacgtcttac 180
gcgcagaagt ttcagggccg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 130
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:

```



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---

<223> OTHER INFORMATION: VH

<400> SEQUENCE: 130

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggact atcaatccgg tttctggca tacgtcttac 180
gcgagaagt ttcaggggc ggtgacctg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgc tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca 345
```

<210> SEQ ID NO 131

<211> LENGTH: 345

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VH

<400> SEQUENCE: 131

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcatg attaattgctc ctattggtac tactcgttat 180
gctcagaagt ttcagggtgc ggtgacctg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgc tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca 345
```

<210> SEQ ID NO 132

<211> LENGTH: 345

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VH

<400> SEQUENCE: 132

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcccag attaattgctc cttctggtat gactcgttat 180
gctcagaagt ttcagggtgc ggtgacctg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgc tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca 345
```

<210> SEQ ID NO 133

<211> LENGTH: 345

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: VH

<400> SEQUENCE: 133

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagt 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcatg attaattgctc ctattggtac tactcgttat 180
```

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```

gctcagaagt ttcagggtcg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 134
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 134

```

```

cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcact atcaatccgg tttctggca tacgcgttac 180
gcgcagaagt ttcagggtcg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 135
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 135

```

```

cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcact atcaatccgg tttctggctc tacgtcttac 180
gcgcagaagt ttcagggtcg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 136
<211> LENGTH: 345
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: VH

```

```

<400> SEQUENCE: 136

```

```

cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg 60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc 120
cctgggcagg gtctcgagt gatgggcagg attaatgctg cttctggtat gactcgttat 180
gctcagaagt ttcagggtcg ggtcaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 137
<211> LENGTH: 345
<212> TYPE: DNA

```

---

-continued

---

<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 137

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc    120
cctgggcagg gtctcgagt gatgggcaat attaagtctg ctgctggtat tactctttat    180
gctcagaagt ttcagggtcg ggtcaccatg acccgtgata ccagcattag caccgctgat    240
atggaactga gcagcctgag tagcgaagat acggccgtgt attattgcgc gcgtggtggt    300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca                    345
```

<210> SEQ ID NO 138  
<211> LENGTH: 345  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 138

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc    120
cctgggcagg gtctcgagt gatgggcact attaatcctc ctactggagg tacttattat    180
gctcagaagt ttcagggtcg ggtgaccatg acccgtgata ccagcattag caccgctgat    240
atggaactga gcagcctgag tagcgaagat acggccgtgt attattgcgc gcgtggtggt    300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca                    345
```

<210> SEQ ID NO 139  
<211> LENGTH: 345  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 139

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc    120
cctgggcagg gtctcgagt gatggggcgt attaatcctc ctgctggtac tacttcttat    180
gctcagaagt ttcagggtcg ggtcaccatg acccgtgata ccagcattag caccgctgat    240
atggaactga gcagcctgag tagcgaagat acggccgtgt attattgcgc gcgtggtggt    300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctca                    345
```

<210> SEQ ID NO 140  
<211> LENGTH: 345  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: VH

<400> SEQUENCE: 140

```
cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaag cctccgata tacctttact tttcttata ttaattgggt cgcgaagcc    120
```

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```

cctgggcagg gtctcgagt gatgggcaat attaactctg ctactggcca tgctgattat 180
gctcagaagt ttcagggtcg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gcagcctgcg tagcgaagat acggccgtgt attattgcgc gctggttggt 300
tggtttgatt attggggcca aggcaccctg gtgacggtta gctca 345

```

```

<210> SEQ ID NO 141
<211> LENGTH: 217
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: light chain

```

```

<400> SEQUENCE: 141

```

```

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 Ser Tyr
20          25          30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
35          40          45
Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
85          90          95
Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
100         105         110
Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
115         120         125
Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
130         135         140
Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
145         150         155         160
Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys
165         170         175
Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser
180         185         190
His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu
195         200         205
Lys Thr Val Ala Pro Thr Glu Cys Ser
210         215

```

```

<210> SEQ ID NO 142
<211> LENGTH: 217
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: light chain

```

```

<400> SEQUENCE: 142

```

```

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 Ser Tyr
20          25          30

```

-continued

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```

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
   35                               40                               45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
   85                               90                               95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
  100                               105                               110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
  115                               120                               125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
  130                               135                               140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
  145                               150                               155                               160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys
  165                               170                               175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser
  180                               185                               190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu
  195                               200                               205

Lys Thr Val Ala Pro Thr Glu Cys Ser
  210                               215

```

```

<210> SEQ ID NO 143
<211> LENGTH: 217
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: light chain

```

```

<400> SEQUENCE: 143

```

```

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 Ser Tyr
  20           25           30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
   35                               40                               45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
   85                               90                               95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
  100                               105                               110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
  115                               120                               125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
  130                               135                               140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
  145                               150                               155                               160

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Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys  
 165 170 175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
 180 185 190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
 195 200 205

Lys Thr Val Ala Pro Thr Glu Cys Ser  
 210 215

<210> SEQ ID NO 144  
 <211> LENGTH: 217  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 144

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 Ser Tyr  
 20 25 30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
 85 90 95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
 100 105 110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu  
 115 120 125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe  
 130 135 140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val  
 145 150 155 160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys  
 165 170 175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
 180 185 190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
 195 200 205

Lys Thr Val Ala Pro Thr Glu Cys Ser  
 210 215

<210> SEQ ID NO 145  
 <211> LENGTH: 217  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 145

Gln Ser Ala Leu Thr Gln Pro Ala Ser Val Ser Gly Ser Pro Gly Gln  
 1 5 10 15

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Ser Ile Thr Ile Ser Cys Thr Gly Thr Ser Ser Asp Val Gly Ser Tyr
      20                25                30
Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
      35                40                45
Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
      85                90                95
Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
      100               105               110
Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
      115                120               125
Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
      130                135               140
Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
      145                150               155                160
Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys
      165                170                175
Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser
      180                185                190
His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu
      195                200               205
Lys Thr Val Ala Pro Thr Glu Cys Ser
      210                215

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<210> SEQ ID NO 146
<211> LENGTH: 445
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: heavy chain

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<400> SEQUENCE: 146

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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 Tyr Thr Phe Thr Ser Ser
20     25     30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35     40     45
Gly Thr Ile Asn Pro Val Ser Gly Ser Thr Ser Tyr Ala Gln Lys Phe
50     55     60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr
65     70     75     80
Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys
85     90     95
Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
100    105    110
Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro
115    120    125
Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu Val
130    135    140

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Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160  
 Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175  
 Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly  
 180 185 190  
 Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr Lys  
 195 200 205  
 Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys  
 210 215 220  
 Pro Pro Cys Pro Ala Pro Glu Ala Ala 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 His Glu Asp Pro Glu Val Lys  
 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 Tyr 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 Ala Leu Pro Ala Pro 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  
 Arg 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 Lys Leu Thr Val Asp Lys Ser Arg Trp Gln  
 405 410 415  
 Gln 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 Pro Gly Lys  
 435 440 445

&lt;210&gt; SEQ ID NO 147

&lt;211&gt; LENGTH: 445

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 147

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45



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Gly Gln Ile Asn Ala Ala Ser Gly Met Thr Arg Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80

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

Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

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

Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140

Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160

Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175

Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly  
 180 185 190

Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr Lys  
 195 200 205

Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys  
 210 215 220

Pro Pro Cys Pro Ala Pro Glu Ala Ala 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 His Glu Asp Pro Glu Val Lys  
 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 Tyr 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 Ala Leu Pro Ala Pro 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

Arg 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 Lys Leu Thr Val Asp Lys Ser Arg Trp Gln  
 405 410 415

Gln 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 Pro Gly Lys  
 435 440 445

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<210> SEQ ID NO 148
<211> LENGTH: 445
<212> TYPE: PRT
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 148

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 Ser
20          25          30
Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met
35          40          45
Gly Asn Ile Asn Ala Ala Ala Gly Ile Thr Leu Tyr Ala Gln Lys Phe
50          55          60
Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr
65          70          75          80
Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys
85          90          95
Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr
100         105         110
Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro
115         120         125
Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu Val
130         135         140
Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala
145         150         155         160
Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly
165         170         175
Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly
180         185         190
Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr Lys
195         200         205
Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys
210         215         220
Pro Pro Cys Pro Ala Pro Glu Ala Ala 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 His Glu Asp Pro Glu Val Lys
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 Tyr 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 Ala Leu Pro Ala Pro 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

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Arg 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 Lys Leu Thr Val Asp Lys Ser Arg Trp Gln  
 405 410 415

Gln 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 Pro Gly Lys  
 435 440 445

<210> SEQ ID NO 149  
 <211> LENGTH: 445  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 149

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 Ser  
 20 25 30

Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45

Gly Gly Ile Asn Pro Pro Ala Gly Thr Thr Ser Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80

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

Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

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

Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140

Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160

Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175

Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly  
 180 185 190

Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr Lys  
 195 200 205

Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys  
 210 215 220

Pro Pro Cys Pro Ala Pro Glu Ala Ala 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

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Val Thr Cys Val Val Val Asp Val Ser His Glu Asp Pro Glu Val Lys  
 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 Tyr 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 Ala Leu Pro Ala Pro 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  
 Arg 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 Lys Leu Thr Val Asp Lys Ser Arg Trp Gln  
 405 410 415  
 Gln 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 Pro Gly Lys  
 435 440 445

<210> SEQ ID NO 150  
 <211> LENGTH: 445  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 150

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Asn Ile Asn Pro Ala Thr Gly His Ala Asp Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80  
 Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys  
 85 90 95  
 Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110  
 Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro  
 115 120 125  
 Ser Ser Lys Ser Thr Ser Gly Gly Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140  
 Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160

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Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175  
 Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Ser Leu Gly  
 180 185 190  
 Thr Gln Thr Tyr Ile Cys Asn Val Asn His Lys Pro Ser Asn Thr Lys  
 195 200 205  
 Val Asp Lys Arg Val Glu Pro Lys Ser Cys Asp Lys Thr His Thr Cys  
 210 215 220  
 Pro Pro Cys Pro Ala Pro Glu Ala Ala 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 His Glu Asp Pro Glu Val Lys  
 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 Tyr 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 Ala Leu Pro Ala Pro 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  
 Arg 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 Lys Leu Thr Val Asp Lys Ser Arg Trp Gln  
 405 410 415  
 Gln 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 Pro Gly Lys  
 435 440 445

<210> SEQ ID NO 151  
 <211> LENGTH: 217  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 151

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 Ser Tyr  
 20 25 30  
 Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
 35 40 45  
 Met Ile Tyr Gly Val Ser Lys Arg Pro Ser Gly Val Ser Asn Arg Phe  
 50 55 60

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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 Gly Thr Phe Ala Gly Gly  
85 90 95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
100 105 110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu  
115 120 125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe  
130 135 140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val  
145 150 155 160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys  
165 170 175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
180 185 190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
195 200 205

Lys Thr Val Ala Pro Thr Glu Cys Ser  
210 215

<210> SEQ ID NO 152  
 <211> LENGTH: 217  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 152

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 Ser Tyr  
20 25 30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
35 40 45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
85 90 95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
100 105 110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu  
115 120 125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe  
130 135 140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val  
145 150 155 160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys  
165 170 175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
180 185 190

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His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
195 200 205

Lys Thr Val Ala Pro Thr Glu Cys Ser  
210 215

<210> SEQ ID NO 153  
<211> LENGTH: 217  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 153

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 Ser Tyr  
20 25 30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
35 40 45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
85 90 95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
100 105 110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu  
115 120 125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe  
130 135 140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val  
145 150 155 160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys  
165 170 175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
180 185 190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
195 200 205

Lys Thr Val Ala Pro Thr Glu Cys Ser  
210 215

<210> SEQ ID NO 154  
<211> LENGTH: 217  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 154

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 Ser Tyr  
20 25 30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
35 40 45

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Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
  85                               90                               95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
  100                              105                              110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
  115                               120                               125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
  130                               135                               140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
  145                               150                               155                               160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys
  165                               170                               175

Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser
  180                               185                               190

His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu
  195                               200                               205

Lys Thr Val Ala Pro Thr Glu Cys Ser
  210                               215

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&lt;210&gt; SEQ ID NO 155

&lt;211&gt; LENGTH: 217

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: light chain

&lt;400&gt; SEQUENCE: 155

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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 Ser Tyr
  20           25           30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu
  35           40           45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly
  85                               90                               95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly
  100                              105                              110

Gln Pro Lys Ala Ala Pro Ser Val Thr Leu Phe Pro Pro Ser Ser Glu
  115                               120                               125

Glu Leu Gln Ala Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asp Phe
  130                               135                               140

Tyr Pro Gly Ala Val Thr Val Ala Trp Lys Ala Asp Ser Ser Pro Val
  145                               150                               155                               160

Lys Ala Gly Val Glu Thr Thr Thr Pro Ser Lys Gln Ser Asn Asn Lys
  165                               170                               175

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Tyr Ala Ala Ser Ser Tyr Leu Ser Leu Thr Pro Glu Gln Trp Lys Ser  
 180 185 190  
 His Arg Ser Tyr Ser Cys Gln Val Thr His Glu Gly Ser Thr Val Glu  
 195 200 205  
 Lys Thr Val Ala Pro Thr Glu Cys Ser  
 210 215

<210> SEQ ID NO 156  
 <211> LENGTH: 441  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 156

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Thr Ile Asn Pro Val Ser Gly Ser Thr Ser Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80  
 Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys  
 85 90 95  
 Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110  
 Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro  
 115 120 125  
 Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140  
 Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160  
 Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175  
 Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Asn Phe Gly  
 180 185 190  
 Thr Gln Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys  
 195 200 205  
 Val Asp Lys Thr Val Glu Arg Lys Cys Cys Val Glu Cys Pro Pro Cys  
 210 215 220  
 Pro Ala Pro Pro Val Ala Gly Pro Ser Val Phe Leu Phe Pro Pro Lys  
 225 230 235 240  
 Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val  
 245 250 255  
 Val Val Asp Val Ser His Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr  
 260 265 270  
 Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu  
 275 280 285  
 Gln Phe Asn Ser Thr Phe Arg Val Val Ser Val Leu Thr Val Val His  
 290 295 300

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Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys  
 305 310 315 320

Gly Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Thr Lys Gly Gln  
 325 330 335

Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met  
 340 345 350

Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro  
 355 360 365

Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn  
 370 375 380

Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe Phe Leu  
 385 390 395 400

Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val  
 405 410 415

Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln  
 420 425 430

Lys Ser Leu Ser Leu Ser Pro Gly Lys  
 435 440

<210> SEQ ID NO 157  
 <211> LENGTH: 441  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 157

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 Ser  
 20 25 30

Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45

Gly Gln Ile Asn Ala Ala Ser Gly Met Thr Arg Tyr Ala Gln Lys Phe  
 50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80

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

Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

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

Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140

Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160

Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175

Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Asn Phe Gly  
 180 185 190

Thr Gln Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys  
 195 200 205

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Val Asp Lys Thr Val Glu Arg Lys Cys Cys Val Glu Cys Pro Pro Cys  
 210 215 220  
 Pro Ala Pro Pro Val Ala Gly Pro Ser Val Phe Leu Phe Pro Pro Lys  
 225 230 235 240  
 Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val  
 245 250 255  
 Val Val Asp Val Ser His Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr  
 260 265 270  
 Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu  
 275 280 285  
 Gln Phe Asn Ser Thr Phe Arg Val Val Ser Val Leu Thr Val Val His  
 290 295 300  
 Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys  
 305 310 315 320  
 Gly Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Thr Lys Gly Gln  
 325 330 335  
 Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met  
 340 345 350  
 Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro  
 355 360 365  
 Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn  
 370 375 380  
 Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe Phe Leu  
 385 390 395 400  
 Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val  
 405 410 415  
 Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln  
 420 425 430  
 Lys Ser Leu Ser Leu Ser Pro Gly Lys  
 435 440

&lt;210&gt; SEQ ID NO 158

&lt;211&gt; LENGTH: 441

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 158

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 Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Asn Ile Asn Ala Ala Ala Gly Ile Thr Leu Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80  
 Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys  
 85 90 95  
 Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110

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Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro  
 115 120 125  
 Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140  
 Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160  
 Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175  
 Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Asn Phe Gly  
 180 185 190  
 Thr Gln Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys  
 195 200 205  
 Val Asp Lys Thr Val Glu Arg Lys Cys Cys Val Glu Cys Pro Pro Cys  
 210 215 220  
 Pro Ala Pro Pro Val Ala Gly Pro Ser Val Phe Leu Phe Pro Pro Lys  
 225 230 235 240  
 Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val  
 245 250 255  
 Val Val Asp Val Ser His Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr  
 260 265 270  
 Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu  
 275 280 285  
 Gln Phe Asn Ser Thr Phe Arg Val Val Ser Val Leu Thr Val Val His  
 290 295 300  
 Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys  
 305 310 315 320  
 Gly Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Thr Lys Gly Gln  
 325 330 335  
 Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met  
 340 345 350  
 Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro  
 355 360 365  
 Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn  
 370 375 380  
 Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe Phe Leu  
 385 390 395 400  
 Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val  
 405 410 415  
 Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln  
 420 425 430  
 Lys Ser Leu Ser Leu Ser Pro Gly Lys  
 435 440

&lt;210&gt; SEQ ID NO 159

&lt;211&gt; LENGTH: 441

&lt;212&gt; TYPE: PRT

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 159

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

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Ser Val Lys Val Ser Cys Lys Ala Ser Gly Tyr Thr Phe Thr Ser Ser  
 20 25 30  
 Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
 35 40 45  
 Gly Gly Ile Asn Pro Pro Ala Gly Thr Thr Ser Tyr Ala Gln Lys Phe  
 50 55 60  
 Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
 65 70 75 80  
 Met Glu Leu Ser Arg Leu Arg Ser Asp Asp Thr Ala Val Tyr Tyr Cys  
 85 90 95  
 Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
 100 105 110  
 Val Ser Ser Ala Ser Thr Lys Gly Pro Ser Val Phe Pro Leu Ala Pro  
 115 120 125  
 Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val  
 130 135 140  
 Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
 145 150 155 160  
 Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
 165 170 175  
 Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Asn Phe Gly  
 180 185 190  
 Thr Gln Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys  
 195 200 205  
 Val Asp Lys Thr Val Glu Arg Lys Cys Cys Val Glu Cys Pro Pro Cys  
 210 215 220  
 Pro Ala Pro Pro Val Ala Gly Pro Ser Val Phe Leu Phe Pro Pro Lys  
 225 230 235 240  
 Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val  
 245 250 255  
 Val Val Asp Val Ser His Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr  
 260 265 270  
 Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu  
 275 280 285  
 Gln Phe Asn Ser Thr Phe Arg Val Val Ser Val Leu Thr Val Val His  
 290 295 300  
 Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys  
 305 310 315 320  
 Gly Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Thr Lys Gly Gln  
 325 330 335  
 Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met  
 340 345 350  
 Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro  
 355 360 365  
 Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn  
 370 375 380  
 Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe Phe Leu  
 385 390 395 400  
 Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val  
 405 410 415

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Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln  
420 425 430

Lys Ser Leu Ser Leu Ser Pro Gly Lys  
435 440

<210> SEQ ID NO 160  
<211> LENGTH: 441  
<212> TYPE: PRT  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 160

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 Ser  
20 25 30

Tyr Ile Asn Trp Val Arg Gln Ala Pro Gly Gln Gly Leu Glu Trp Met  
35 40 45

Gly Asn Ile Asn Pro Ala Thr Gly His Ala Asp Tyr Ala Gln Lys Phe  
50 55 60

Gln Gly Arg Val Thr Met Thr Arg Asp Thr Ser Ile Ser Thr Ala Tyr  
65 70 75 80

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

Ala Arg Gly Gly Trp Phe Asp Tyr Trp Gly Gln Gly Thr Leu Val Thr  
100 105 110

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

Cys Ser Arg Ser Thr Ser Glu Ser Thr Ala Ala Leu Gly Cys Leu Val  
130 135 140

Lys Asp Tyr Phe Pro Glu Pro Val Thr Val Ser Trp Asn Ser Gly Ala  
145 150 155 160

Leu Thr Ser Gly Val His Thr Phe Pro Ala Val Leu Gln Ser Ser Gly  
165 170 175

Leu Tyr Ser Leu Ser Ser Val Val Thr Val Pro Ser Ser Asn Phe Gly  
180 185 190

Thr Gln Thr Tyr Thr Cys Asn Val Asp His Lys Pro Ser Asn Thr Lys  
195 200 205

Val Asp Lys Thr Val Glu Arg Lys Cys Cys Val Glu Cys Pro Pro Cys  
210 215 220

Pro Ala Pro Pro Val Ala Gly Pro Ser Val Phe Leu Phe Pro Pro Lys  
225 230 235 240

Pro Lys Asp Thr Leu Met Ile Ser Arg Thr Pro Glu Val Thr Cys Val  
245 250 255

Val Val Asp Val Ser His Glu Asp Pro Glu Val Gln Phe Asn Trp Tyr  
260 265 270

Val Asp Gly Val Glu Val His Asn Ala Lys Thr Lys Pro Arg Glu Glu  
275 280 285

Gln Phe Asn Ser Thr Phe Arg Val Val Ser Val Leu Thr Val Val His  
290 295 300

Gln Asp Trp Leu Asn Gly Lys Glu Tyr Lys Cys Lys Val Ser Asn Lys  
305 310 315 320

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Gly Leu Pro Ala Pro Ile Glu Lys Thr Ile Ser Lys Thr Lys Gly Gln  
 325 330 335

Pro Arg Glu Pro Gln Val Tyr Thr Leu Pro Pro Ser Arg Glu Glu Met  
 340 345 350

Thr Lys Asn Gln Val Ser Leu Thr Cys Leu Val Lys Gly Phe Tyr Pro  
 355 360 365

Ser Asp Ile Ala Val Glu Trp Glu Ser Asn Gly Gln Pro Glu Asn Asn  
 370 375 380

Tyr Lys Thr Thr Pro Pro Met Leu Asp Ser Asp Gly Ser Phe Phe Leu  
 385 390 395 400

Tyr Ser Lys Leu Thr Val Asp Lys Ser Arg Trp Gln Gln Gly Asn Val  
 405 410 415

Phe Ser Cys Ser Val Met His Glu Ala Leu His Asn His Tyr Thr Gln  
 420 425 430

Lys Ser Leu Ser Leu Ser Pro Gly Lys  
 435 440

<210> SEQ ID NO 161  
 <211> LENGTH: 651  
 <212> TYPE: DNA  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 161

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cagagcgccc tgaccagccc cgccagcgtg tccggcagcc caggccagtc tatcacaatc      60
agctgcaccg gcacctccag cgacgtgggc agctacaact acgtgaactg gtatcagcag      120
caccocggca agggccccc aa gctgatgac tacggcgtga gcaagaggcc cagcggcgtg      180
tccaacaggt tcagcggcag caagagcggc aacaccgcca gcctgacaat cagtgggctg      240
caggctgagg acgaggccga ctactactgc ggcacctttg cggcgggatc atactacggc      300
gtgttcggcg gagggaccaa gctgaccgtg ctgggccagc ctaaggctgc cccagcgtg      360
accctgttcc cccccagcag cgaggagctg caggccaaca agggccacct ggtgtgcctg      420
atcagcgact tctaccagc gcacctgacc gtggcctgga aggccgacag cagccccgtg      480
aaggccggcg tggagaccac cccccagc aagcagagca acaacaagta cgccgccagc      540
agctacctga gcctgacccc cgagcagtg aagagccaca ggtcctacag ctgccaggtg      600
accacagagg gcagcaccgt ggaaaagacc gtggccccc cagagtgcag c                651
    
```

<210> SEQ ID NO 162  
 <211> LENGTH: 651  
 <212> TYPE: DNA  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: light chain

<400> SEQUENCE: 162

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cagagcgccc tgaccagccc cgccagcgtg tccggcagcc caggccagtc tatcacaatc      60
agctgcaccg gcacctccag cgacgtgggc agctacaact acgtgaactg gtatcagcag      120
caccocggca agggccccc aa gctgatgac tacggcgtga gcaagaggcc cagcggcgtg      180
tccaacaggt tcagcggcag caagagcggc aacaccgcca gcctgacaat cagtgggctg      240
caggctgagg acgaggccga ctactactgc ggcacctttg cggcgggatc atactacggc      300
    
```

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gtgttcggcg gagggaccaa gctgaccgtg ctgggccagc ctaaggctgc ccccagcgtg 360  
accctgttcc cccccagcag cgaggagctg caggccaaca aggccaccct ggtgtgcctg 420  
atcagcgact tctaccagg cgccgtgacc gtggcctgga aggccgacag cagccccgtg 480  
aaggccggcg tggagaccac cccccagc aagcagagca acaacaagta cgccgccagc 540  
agctacctga gcctgacccc cgagcagtgg aagagccaca ggtcctacag ctgccaggtg 600  
accacgagg gcagcacctg ggaaaagacc gtggcccaa ccgagtgcag c 651

<210> SEQ ID NO 163  
<211> LENGTH: 651  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 163

cagagcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggg tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240  
caagcggag acgaagcggg ttattattgc ggtacttttg ctggtggttc ttattatggt 300  
gtgtttggcg gcggcacgaa gttaaccgtc ctaggtcagc ccaaggctgc cccctcggtc 360  
actctgttcc cgccctcctc tgaggagctt caagccaaca aggccacact ggtgtgtctc 420  
ataagtgact tctaccggg agccgtgaca gtggcctgga aggcagatag cagccccgtc 480  
aaggcgggag tggagaccac cacaccctcc aaacaaagca acaacaagta cgccgccagc 540  
agctatctga gcctgacgcc tgagcagtgg aagtcccaca gaagctacag ctgccaggtc 600  
acgcatgaag ggagcacctg ggagaagaca gtggccccta cagaatgttc a 651

<210> SEQ ID NO 164  
<211> LENGTH: 651  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 164

cagagcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc 60  
tcgtgtacgg gtactagcag cgatgttggg tcttataatt atgtgaattg gtaccagcag 120  
catccccgga aggcgccgaa acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg 180  
agcaaccggt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240  
caagcggag acgaagcggg ttattattgc ggtacttttg ctggtggttc ttattatggt 300  
gtgtttggcg gcggcacgaa gttaaccgtc ctaggtcagc ccaaggctgc cccctcggtc 360  
actctgttcc cgccctcctc tgaggagctt caagccaaca aggccacact ggtgtgtctc 420  
ataagtgact tctaccggg agccgtgaca gtggcctgga aggcagatag cagccccgtc 480  
aaggcgggag tggagaccac cacaccctcc aaacaaagca acaacaagta cgccgccagc 540  
agctatctga gcctgacgcc tgagcagtgg aagtcccaca gaagctacag ctgccaggtc 600  
acgcatgaag ggagcacctg ggagaagaca gtggccccta cagaatgttc a 651



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<210> SEQ ID NO 165  
<211> LENGTH: 651  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 165

```
cagagcgcac tgaccagccc agcttcagtg agcggctcac caggtcagag cattaccatc      60
tcgtgtacgg gtactagcag cgatgttggt tcttataatt atgtgaattg gtaccagcag     120
catccccgga aggcgcccga acttatgatt tatggtgttt ctaagcgtcc ctcaggcgtg     180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgaccat tagcggcctg     240
caagcgggaag acgaagcggg ttattattgc ggtacttttg ctggtggttc ttattatggt     300
gtgtttggcg ggcgcacgaa gttaacctgc ctaggtcagc ccaaggctgc cccctcggtc     360
actctgttcc cgccctctc tgaggagctt caagccaaca aggccacact ggtgtgtctc     420
ataagtgact tctaccggg agccgtgaca gtggcctgga aggcagatag cagccccgtc     480
aaggcgggag tggagaccac cacaccctcc aaacaaagca acaacaagta cgcggccagc     540
agctatctga gcctgacgcc tgagcagtgg aagtcccaca gaagctacag ctgccaggtc     600
acgcatgaag ggagcaccgt ggagaagaca gtggccccta cagaatgttc a              651
```

<210> SEQ ID NO 166  
<211> LENGTH: 1335  
<212> TYPE: DNA  
<213> ORGANISM: Artificial  
<220> FEATURE:  
<223> OTHER INFORMATION: heavy chain

<400> SEQUENCE: 166

```
caggtgcagc tgggtgcagag cggagctgag gtgaagaagc caggcggccag cgtcaagggtg      60
tcttgaagg ccagcggcta caccttcacc agcagctaca tcaactgggt ccgccaggct     120
cctgggcagg gactggagtg gatgggcacc atcaaccccg tgtccggcag caccagctac     180
gcccagaagt tccagggcag agtcaccatg accagggaca ccagcatcag caccgcctac     240
atggagctgt ccaggctgag aagcagcagc accgcccgtg actactgcgc caggggcggc     300
tggttcgact actggggcca gggcacccctg gtgaccgtgt cctcagctag caccaagggc     360
cccagcgtgt tccccctgge ccccagcagc aagagcacct ccggcggcac agccgcctc     420
ggctgcctgg tgaaggacta cttccccgag cccgtgaccg tgcctggaa cagcggagcc     480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg     540
tccagcgtgg tgacagtgcc cagcagcagc ctgggcaccc agacctacat ctgcaactgt     600
aaccacaagc ccagcaaacac caaggtggac aagagagtgg agcccaagag ctgcgacaag     660
accacacact gccccccctg cccagcccc gaagctgcag gcggcccttc cgtgttctctg     720
ttcccccca agcccaagga caccctgatg atcagcagga cccccgaggt gacctgcgtg     780
gtggtggacg tgagccacga ggaccagag gtgaagttca actggtacgt ggacggcgtg     840
gaggtgcaca acgccaagac caagcccaga gaggagcagt acaacagcac ctacagggtg     900
gtgtccgtgc tgaccgtgct gcaccaggac tggctgaacg gcaagaata caagtgcgaag     960
gtctccaaca aggcctgcc tgcccccatc gaaaagacca tcagcaaggc caagggccag    1020
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ccacgggagc cccaggtgta caccctgccc ccttctcggg aggagatgac caagaaccag 1080
gtgtccctga cctgtctggt gaagggttc taccacagcg acatcgccgt ggagtgggag 1140
agcaacggcc agcccagaaa caactacaag accaccccc cagtgtctgga cagcgacggc 1200
agcttcttcc tgtacagcaa gctgaccgtg gacaagagca ggtggcagca gggcaactgt 1260
ttcagctgca gcgtgatgca cgaggccctg cacaaccact acaccagaa gagcctgagc 1320
ctgtcaccgg gcaag 1335

```

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<210> SEQ ID NO 167
<211> LENGTH: 1335
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: heavy chain

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<400> SEQUENCE: 167

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```

caggtgcagc tgggtgcagag cggagctgag gtgaagaagc caggcggccag cgtcaaggtg 60
tcctgcaagg ccagcggcta cacctcacc agcagctaca tcaactgggt gcgccaggct 120
ccagggcagc gactggagtg gatgggccag atcaacgccg ccagcggcat gaccagatac 180
gcccagaagt tccagggcag agtcacaatg accagggaca cctctatcag caccgcctac 240
atggagctgt ccaggctgag aagcgacgac accgccctgt actactgcgc caggggcggc 300
tggttcgact actggggcca gggcaccctg gtgaccctgt cctcagctag caccaagggc 360
cccagcgtgt tccccctggc ccccagcagc aagagcacct ccggcggcac agccgcctctg 420
ggctgcctgg tgaaggacta cttccccgag cccgtgaccg tgcctggaa cagcggagcc 480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg 540
tccagcgtgg tgacagtgcc cagcagcagc ctgggcaccc agacctacat ctgcaactgt 600
aaccacaagc ccagcaacac caaggtggac aagagagtgg agcccaagag ctgcgacaag 660
accacacact gccccctctg cccagcccc gaagctgcag gcggcccttc cgtgttctctg 720
ttcccccca agcccaagga caccctgatg atcagcagga cccccgaggt gacctgcgtg 780
gtggtggacg tgagccacga ggaccacagag gtgaagtcca actggtactg ggacggcgtg 840
gaggtgcaca acgccaagac caagcccaga gaggagcagt acaacagcac ctacagggtg 900
gtgtccgtgc tgaccgtgct gcaccaggac tggctgaacg gcaaagaata caagtgcgaag 960
gtctccaaca aggccctgcc tgccccatc gaaaagacca tcagcaaggc caagggccag 1020
ccacgggagc cccaggtgta caccctgccc ccttctcggg aggagatgac caagaaccag 1080
gtgtccctga cctgtctggt gaagggttc taccacagcg acatcgccgt ggagtgggag 1140
agcaacggcc agcccagaaa caactacaag accaccccc cagtgtctgga cagcgacggc 1200
agcttcttcc tgtacagcaa gctgaccgtg gacaagagca ggtggcagca gggcaactgt 1260
ttcagctgca gcgtgatgca cgaggccctg cacaaccact acaccagaa gagcctgagc 1320
ctgtcaccgg gcaag 1335

```

```

<210> SEQ ID NO 168
<211> LENGTH: 1335
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: heavy chain

```

-continued

&lt;400&gt; SEQUENCE: 168

```

caggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaaag cctccggata tacctttact tcttcttata ttaattgggt cgcgaagcc    120
cctgggcagg gtctcgagt gatgggcaat attaattgctg ctgctggtat tactctttat    180
gctcagaagt ttcagggtcg ggtcaccatg acccgtgata ccagcattag caccgcgtat    240
atggaactga gccgcctcg tagcgatgat acggccgtgt attattgcgc gcgtggtggt    300
tggtttgatt attggggcca aggcaccctg gtgacggta gctcagcctc caccaagggt    360
ccatcggtct tccccctgge accctcctcc aagagcacct ctgggggcac agcggcctg    420
ggctgcctgg tcaaggacta cttccccgaa cgggtgacgg tgcgtggaa ctcaggcgcc    480
ctgaccagcg gcgtgcacac cttcccgct gtcctacagt cctcaggact ctactcctc    540
agcagcgtgg tgaccgtgcc ctccagcagc ttgggcaccc agacctacat ctgcaacgtg    600
aatcacaagc ccagcaacac caaggtggac aagagagttg agcccaaatc ttgtgacaaa    660
actcacacat gccaccgtg cccagcacct gaagcagcgg ggggaccgtc agtcttctc    720
ttcccccaa aaccacaagga caccctcatg atctcccga cccctgaggt cacatgcgtg    780
gtggtggacg tgagccacga agaccctgag gtcaagttca actggtacgt ggacggcggtg    840
gaggtgcata atgccaagac aaagcccgcg gaggagcagt acaacagcac gtaccgggtg    900
gtcagcgtcc tcaccgtcct gcaccaggac tggctgaatg gcaaggagta caagtgcgaag    960
gtctccaaca aagccctccc agccccatc gagaaaacca tctccaaagc caaagggcag    1020
ccccgagaac cacaggtgta caccctgccc ccatcccggg aggagatgac caagaaccag    1080
gtcagcctga cctgcctggt caaaggcttc tatcccagcg acatcgccgt ggagtgggag    1140
agcaatgggc agccggagaa caactacaag accacgcctc ccgtgctgga ctccgacggc    1200
tccttcttcc tctacagcaa gctcaccgtg gacaagagca ggtggcagca ggggaacgtc    1260
ttctcatgct ccgtgatgca tgaggctctg cacaaccact acacgcagaa gagcctctcc    1320
ctgtctccgg gtaaa    1335

```

&lt;210&gt; SEQ ID NO 169

&lt;211&gt; LENGTH: 1335

&lt;212&gt; TYPE: DNA

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 169

```

caggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cgggcgcgag cgtgaaagtg    60
agctgcaaaag cctccggata tacctttact tcttcttata ttaattgggt cgcgaagcc    120
cctgggcagg gtctcgagt gatggggcgt attaattcctc ctgctggtac tacttcttat    180
gctcagaagt ttcagggtcg ggtcaccatg acccgtgata ccagcattag caccgcgtat    240
atggaactga gccgcctcg tagcgatgat acggccgtgt attattgcgc gcgtggtggt    300
tggtttgatt attggggcca aggcaccctg gtgacggta gctcagcctc caccaagggt    360
ccatcggtct tccccctgge accctcctcc aagagcacct ctgggggcac agcggcctg    420
ggctgcctgg tcaaggacta cttccccgaa cgggtgacgg tgcgtggaa ctcaggcgcc    480
ctgaccagcg gcgtgcacac cttcccgct gtcctacagt cctcaggact ctactcctc    540

```

-continued

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```

agcagcgtgg tgaccgtgcc ctccagcagc ttgggcaccc agacctacat ctgcaacgtg 600
aatcacaagc ccagcaacac caaggtggac aagagagttg agcccaaatc ttgtgacaaa 660
actcacacat gccaccctgt cccagcacct gaagcagcgg ggggaccgtc agtcttctc 720
ttcccccaa aaccaagga caccctcatg atctcccgga cccctgaggt cacatgcgtg 780
gtggtggacg tgagccacga agaccctgag gtcaagttca actggtacgt ggacggcgtg 840
gaggtgcata atgccaaagc aaagcgcggg gaggagcagt acaacagcac gtaccgggtg 900
gtcagcgtcc tcaccgtcct gcaccaggac tggctgaatg gcaaggagta caagtgcaag 960
gtctccaaca aagccctccc agccccatc gagaaaacca tctccaaagc caaagggcag 1020
ccccgagaac cacaggtgta caccctgccc ccattcccggg aggagatgac caagaaccag 1080
gtcagcctga cctgcctggt caaaggcttc tatcccagcg acatcgccgt ggagtgggag 1140
agcaatgggc agccggagaa caactacaag accacgcctc ccgtgctgga ctccgacggc 1200
tccttcttc tctacagcaa gctcaccgtg gacaagagca ggtggcagca ggggaacgtc 1260
ttctcatgct ccgtgatgca tgaggctctg cacaaccact acacgcagaa gagcctctcc 1320
ctgtctccgg gtaaa 1335

```

&lt;210&gt; SEQ ID NO 170

&lt;211&gt; LENGTH: 1335

&lt;212&gt; TYPE: DNA

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 170

```

caggtgcaat tggttcagag cggcgcggaa gtgaaaaaac cggcgcgag cgtgaaagtg 60
agctgcaaaag cctccgata tacctttact tcttttata ttaattgggt ccgccaagcc 120
cctgggcagg gtctcagatg gatgggcaat attaatcctg ctactggtca tgctgattat 180
gtcagaagt ttcagggctg ggtgaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gccgcctcgc tagcgatgat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaacctg gtgacggtta gctcagcctc caccaagggt 360
ccatcggctc tccccctgac accctcctcc aagagcacct ctgggggac agcggccctg 420
ggctgcctgg tcaaggacta cttccccgaa ccgggtgacgg tgtcgtggaa ctcaggcgcc 480
ctgaccagcg gcgtgcacac cttcccggct gtcctacagt cctcaggact ctactcctc 540
agcagcgtgg tgaccgtgcc ctccagcagc ttgggcaccc agacctacat ctgcaacgtg 600
aatcacaagc ccagcaacac caaggtggac aagagagttg agcccaaatc ttgtgacaaa 660
actcacacat gccaccctgt cccagcacct gaagcagcgg ggggaccgtc agtcttctc 720
ttcccccaa aaccaagga caccctcatg atctcccgga cccctgaggt cacatgcgtg 780
gtggtggacg tgagccacga agaccctgag gtcaagttca actggtacgt ggacggcgtg 840
gaggtgcata atgccaaagc aaagcgcggg gaggagcagt acaacagcac gtaccgggtg 900
gtcagcgtcc tcaccgtcct gcaccaggac tggctgaatg gcaaggagta caagtgcaag 960
gtctccaaca aagccctccc agccccatc gagaaaacca tctccaaagc caaagggcag 1020
ccccgagaac cacaggtgta caccctgccc ccattcccggg aggagatgac caagaaccag 1080
gtcagcctga cctgcctggt caaaggcttc tatcccagcg acatcgccgt ggagtgggag 1140

```

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```

agcaatgggc agccggagaa caactacaag accacgcctc ccgtgctgga ctccgacggc 1200
tccttcttcc tctacagcaa gctcacctg gacaagagca ggtggcagca ggggaacgtc 1260
ttctcatgct ccgtgatgca tgaggctctg cacaaccact acacgcagaa gagcctctcc 1320
ctgtctccgg gtaaa 1335

```

```

<210> SEQ ID NO 171
<211> LENGTH: 651
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: light chain

```

```

<400> SEQUENCE: 171

```

```

cagagcgccc tgaccagcc cgccagcgtg tccggcagcc caggccagtc tatcacaatc 60
agctgcaccg gcacctccag cgacgtgggc agctacaact acgtgaactg gtatcagcag 120
caccgccgca agggccccc aa gctgatgac tacggcgtga gcaagaggcc cagcggcgtg 180
tccaacaggt tcagcggcag caagagcggc aacaccgcca gcctgacaat cagtgggctg 240
caggctgagg acgaggccga ctactactgc ggcaccttg ccggcggatc atactacggc 300
gtgttcggcg gagggaccaa gctgaccgtg ctgggccagc ctaaggctgc cccagcgtg 360
accctgttcc cccccagcag cgaggagctg caggccaaca aggccacct ggtgtgcctg 420
atcagcgact tctaccagc gcctgtgacc gtggcctgga aggccgacag cagccccgtg 480
aaggccggcg tggagaccac cccccagc aagcagagca acaacaagta cgccgccagc 540
agctacctga gcctgacccc cgagcagtg aagagccaca ggtcctacag ctgccaggtg 600
accacgagg gcagcaccgt ggaaaagacc gtggccccc cagagtgacg c 651

```

```

<210> SEQ ID NO 172
<211> LENGTH: 651
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: light chain

```

```

<400> SEQUENCE: 172

```

```

cagagcgccc tgaccagcc cgccagcgtg tccggcagcc caggccagtc tatcacaatc 60
agctgcaccg gcacctccag cgacgtgggc agctacaact acgtgaactg gtatcagcag 120
caccgccgca agggccccc aa gctgatgac tacggcgtga gcaagaggcc cagcggcgtg 180
tccaacaggt tcagcggcag caagagcggc aacaccgcca gcctgacaat cagtgggctg 240
caggctgagg acgaggccga ctactactgc ggcaccttg ccggcggatc atactacggc 300
gtgttcggcg gagggaccaa gctgaccgtg ctgggccagc ctaaggctgc cccagcgtg 360
accctgttcc cccccagcag cgaggagctg caggccaaca aggccacct ggtgtgcctg 420
atcagcgact tctaccagc gcctgtgacc gtggcctgga aggccgacag cagccccgtg 480
aaggccggcg tggagaccac cccccagc aagcagagca acaacaagta cgccgccagc 540
agctacctga gcctgacccc cgagcagtg aagagccaca ggtcctacag ctgccaggtg 600
accacgagg gcagcaccgt ggaaaagacc gtggccccc cagagtgacg c 651

```

```

<210> SEQ ID NO 173
<211> LENGTH: 651
<212> TYPE: DNA

```

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<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 173

```
cagagcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggt tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg    240
caagcgggaag acgaagcggg ttattattgc ggtacttttg ctggtgggtc ttattatggt    300
gtgtttggcg gcggcacgaa gtttaaccgtc ctaggtcagc ccaaggctgc cccctcggtc    360
actctgttcc cgcctcctc tgaggagctt caagccaaca aggccacact ggtgtgtctc    420
ataagtgact tctaccggg agccgtgaca gtggcctgga aggcagatag cagccccgtc    480
aaggcgggag tggagaccac cacaccctcc aaacaaagca acaacaagta cgcggccagc    540
agctatctga gcctgacgcc tgagcagtg aagtcccaca gaagctacag ctgccaggtc    600
acgcatgaag ggagcaccgt ggagaagaca gtggccccta cagaatgttc a          651
```

<210> SEQ ID NO 174

<211> LENGTH: 651

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 174

```
cagagcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggt tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg    180
agcaaccggt ttagcggatc caaaagcggc aacaccgcca gcctgacccat tagcggcctg    240
caagcgggaag acgaagcggg ttattattgc ggtacttttg ctggtgggtc ttattatggt    300
gtgtttggcg gcggcacgaa gtttaaccgtc ctaggtcagc ccaaggctgc cccctcggtc    360
actctgttcc cgcctcctc tgaggagctt caagccaaca aggccacact ggtgtgtctc    420
ataagtgact tctaccggg agccgtgaca gtggcctgga aggcagatag cagccccgtc    480
aaggcgggag tggagaccac cacaccctcc aaacaaagca acaacaagta cgcggccagc    540
agctatctga gcctgacgcc tgagcagtg aagtcccaca gaagctacag ctgccaggtc    600
acgcatgaag ggagcaccgt ggagaagaca gtggccccta cagaatgttc a          651
```

<210> SEQ ID NO 175

<211> LENGTH: 651

<212> TYPE: DNA

<213> ORGANISM: Artificial

<220> FEATURE:

<223> OTHER INFORMATION: light chain

<400> SEQUENCE: 175

```
cagagcgcac tgaccagcc agcttcagtg agcggctcac caggtcagag cattaccatc    60
tcgtgtacgg gtactagcag cgatgttggt tttataatt atgtgaattg gtaccagcag    120
catccccgga aggcgccgaa acttatgatt tatgggtgtt ctaagcgtcc ctcaggcgtg    180
```

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```

agcaaccgtt ttagcggatc caaaagcggc aacaccgca gcctgaccat tagcggcctg 240
caagcggaag acgaagcggg ttattattgc ggtacttttg ctggtgggtc ttattatggt 300
gtgtttggcg gcggcagcaa gttaaccgtc ctaggtcagc ccaaggctgc cccctcggtc 360
actctgttcc cgcctcctc tgaggagctt caagccaaca aggccacact ggtgtgtctc 420
ataagtgact tctaccggg agccgtgaca gtggcctgga aggagatag cagccccgtc 480
aaggcgggag tggagaccac cacaccctcc aaacaagca acaacaagta cgcggccagc 540
agctatctga gcctgacgcc tgagcagtg aagtcccaca gaagctacag ctgccaggtc 600
acgcatgaag ggagcaccgt ggagaagaca gtggccccta cagaatgttc a 651

```

&lt;210&gt; SEQ ID NO 176

&lt;211&gt; LENGTH: 1323

&lt;212&gt; TYPE: DNA

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 176

```

cagggtcagc tgggtcagag cggagctgag gtgaagaagc caggcgcag cgtcaagggtg 60
tctgcaagg ccagcggcta cacctcacc agcagctaca tcaactgggt ccgccaggt 120
cctgggcagg gactggagt gatgggcacc atcaaccocg tgtccggcag caccagctac 180
gcccagaagt tccagggcag agtcaccatg accagggaca ccagcatcag caccgcctac 240
atggagctgt ccaggctgag aagcagcagc accgccgtgt actactgcgc caggggcggc 300
tggttcgact actggggcca gggcacccctg gtgaccgtgt cctcagctag caccaagggc 360
cccagcgtgt tccccctggc cccctgcagc agaagcaca gcgagagcac agccgcctc 420
ggctgcctgg tgaaggacta cttccccgag ccagtgaccg tgtcctggaa cagcggagcc 480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg 540
tccagcgtgg tgaccgtgcc cagcagcaac ttcggcacc agacctacac ctgcaacgtg 600
gaccacaagc ccagcaaac caaggtggac aagaccgtgg agaggaagtg ctgctggag 660
tgccccccct gccagcccc cccagtgccc ggaccctcog tgttcctgtt ccccccaag 720
cccaaggaca ccctgatgat cagcaggacc cccaggtga cctgcgtggt ggtggacgtg 780
agccacgagg acccagaggt gcagttcaac tggtagctgg acggcgtgga ggtgcacaac 840
gccaagacca agcccagaga ggaacagttt aacagcacct tcagggtggt gtcctgctg 900
accgtggtgc accaggactg gctgaacggc aaagagtaca agtgcaaggt ctccaacaag 960
ggcctgccag cccccatcga gaaaaccatc agcaagacca agggccagcc acgggagccc 1020
cagggtgtaca ccctgcccc cagccgggag gaaatgacca agaaccaggt gtcctgacc 1080
tgtctggtga agggcttcta cccagcagc atcgccgtgg agtgggagag caacggccag 1140
cccgagaaca actacaagac ccccccccc atgctggaca gcgacggcag cttcttctg 1200
tacagcaagc tgacagtgga caagagcagg tggcagcagg gcaacgtgtt cagctgcagc 1260
gtgatgcagc aggcctgca caaccactac acccagaaga gcctgagcct gtcccccggc 1320
aag 1323

```

&lt;210&gt; SEQ ID NO 177

&lt;211&gt; LENGTH: 1323

&lt;212&gt; TYPE: DNA

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---

  
<213> ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 177

```

cagggtgcagc tgggtgcagag cggagctgag gtgaagaagc caggcgccag cgtcaaggtg    60
tcctgcaagg ccagcggcta caccttcacc agcagctaca tcaactgggt gcgccaggct    120
ccagggcagg gactggagtg gatgggccag atcaacgccg ccagcggcat gaccagatac    180
gcccagaagt tccagggcag agtcacaatg accagggaca cctctatcag caccgcctac    240
atggagctgt ccaggctgag aagcgacgac accgccgtgt actactgcgc caggggcggc    300
tggttcgact actggggcca gggcacccctg gtgaccgtgt cctcagctag caccaagggc    360
cccagcgtgt tccccctggc cccctgcagc agaagcacca gcgagagcac agccgccttg    420
gggtgcctgg tgaaggacta cttccccgag ccagtgaccg tgcctggaa cagcggagcc    480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg    540
tccagcgtgg tgaccgtgcc cagcagcaac ttcggcacc agacctacac ctgcaacgtg    600
gaccacaagc ccagcaacac caaggtggac aagaccgtgg agaggaagtg ctgctggag    660
tgccccctt gccccagccc cccagtggcc ggaccctcgg tgttctgtt ccccccaag    720
cccaaggaca ccctgatgat cagcaggacc cccgaggtga cctgcgtggt ggtggacgtg    780
agccacgagg acccagaggt gcagttaac tggtagctgg acggcgtgga ggtgcacaac    840
gccaaagaca agcccagaga ggaacagttt aacagcacct tcagggtggt gtcctgtctg    900
accgtggtgc accaggactg gctgaacggc aaagagtaca agtgcaaggt ctccaacaag    960
ggcctgccag cccccatcga gaaaaccatc agcaagacca agggccagcc acgggagccc   1020
cagggtgtaca ccctgcccc cagccgggag gaaatgacca agaaccaggt gtcctgacc   1080
tgtctggtga agggcttcta ccccagcgac atcgccctgg agtgggagag caacggccag   1140
cccgagaaca actacaagac ccccccccc atgctggaca gcgacggcag cttcttctg   1200
tacagcaagc tgacagtgga caagagcagg tggcagcagg gcaacgtgtt cagctgcagc   1260
gtgatgcacg aggccctgca caaccactac acccagaaga gcctgagcct gtcccccgcc   1320
aag                                                                                   1323

```

&lt;210&gt; SEQ ID NO 178

&lt;211&gt; LENGTH: 1323

&lt;212&gt; TYPE: DNA

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 178

```

cagggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagtg    60
agctgcaaaag cctccggata tacctttact tcttcttata ttaattgggt ccgccaaagc   120
cctgggcagg gtctcgagtg gatgggcaat attaagtctg ctgctggtat tactctttat   180
gctcagaagt ttcagggctg ggtcaccatg acccgtgata ccagcattag caccgcgtat   240
atggaactga gccgcctgcg tagcgatgat acggccgtgt attattgcgc gcgtggtggt   300
tggtttgatt attggggcca aggcacccctg gtgacgggta gctcagcttc caccaagggc   360
cccagcgtgt tccccctggc cccctgcagc agaagcacca gcgagagcac agccgccttg   420

```



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```

ggctgcctgg tgaaggacta cttccccgag cccgtgaccg tgagctggaa cagcggagcc 480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg 540
agcagcgtgg tgaccgtgcc cagcagcaac ttcggcacc agacctacac ctgcaactg 600
gaccacaagc ccagcaacac caaggtggac aagaccgtgg agcgggaagt ctgcgtggag 660
tgccccccct gccctgcccc tcctgtggcc ggaccctcgg tgttctgtt ccccccaag 720
cccaaggaca ccctgatgat cagccggacc cccgaggtga cctgcgtggt ggtggacgtg 780
agccacgagg accccgaggt gcagttaac tggtagctgg acggcgtgga ggtgcacaac 840
gccaagacca agccccggga ggaacagttc aacagcacct tccgggtggt gtcctgctg 900
accgtggtgc accaggactg gctgaacggc aaagaataca agtcaaggt gtccaacaag 960
ggcctgcctg cccccatcga gaaaaccatc agcaagaca agggccagcc cagggaaacc 1020
caggtgtaca ccctgcccc cagccgggag gaaatgacca agaaccaggt gtcctgacc 1080
tgtctggtga agggctteta ccccagcagc atcgccgtgg agtgggagag caacggccag 1140
cccgagaaca actacaagac ccccccccc atgctggaca gcgacggcag cttcttctg 1200
tacagcaagc tgacagtgga caagagccgg tggcagcagg gcaacgtgt cagctgcagc 1260
gtgatgcagc aggcctgca caacctac acccagaaga gcctgagcct gtcccccgcc 1320
aaa 1323

```

&lt;210&gt; SEQ ID NO 179

&lt;211&gt; LENGTH: 1323

&lt;212&gt; TYPE: DNA

&lt;213&gt; ORGANISM: Artificial

&lt;220&gt; FEATURE:

&lt;223&gt; OTHER INFORMATION: heavy chain

&lt;400&gt; SEQUENCE: 179

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caggtgcaat tggttcagag cggcgcggaa gtgaaaaaac cgggcgcgag cgtgaaagt 60
agctgcaaa cctccggata tacctttact tcttcttata ttaattgggt ccgccaaagc 120
cctgggcagg gtctcgagt gatggggggt attaatectc ctgctggtac tacttcttat 180
gctcagaagt ttcaggtcgg ggtcaccatg acccgtgata ccagcattag caccgcgtat 240
atggaactga gccgcctcgg tagcgatgat acggccctgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctcagcttc caccaagggc 360
cccagcgtgt tccccctggt cccctgcagc agaagcacca gcgagagcac agccgcctg 420
ggctgcctgg tgaaggacta cttccccgag cccgtgaccg tgagctggaa cagcggagcc 480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg 540
agcagcgtgg tgaccgtgcc cagcagcaac ttcggcacc agacctacac ctgcaactg 600
gaccacaagc ccagcaacac caaggtggac aagaccgtgg agcgggaagt ctgcgtggag 660
tgccccccct gccctgcccc tcctgtggcc ggaccctcgg tgttctgtt ccccccaag 720
cccaaggaca ccctgatgat cagccggacc cccgaggtga cctgcgtggt ggtggacgtg 780
agccacgagg accccgaggt gcagttaac tggtagctgg acggcgtgga ggtgcacaac 840
gccaagacca agccccggga ggaacagttc aacagcacct tccgggtggt gtcctgctg 900
accgtggtgc accaggactg gctgaacggc aaagaataca agtcaaggt gtccaacaag 960
ggcctgcctg cccccatcga gaaaaccatc agcaagaca agggccagcc cagggaaacc 1020

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caggtgtaca ccctgcccc cagccgggag gaaatgacca agaaccaggt gtcctgacc 1080
tgtctgtgta agggcttcta ccccagcgac atcgccgtgg agtgggagag caacggccag 1140
cccgagaaca actacaagac ccccccccc atgctggaca gcgacggcag cttcttctg 1200
tacagcaagc tgacagtgga caagagccgg tggcagcagg gcaacgtgtt cagctgcagc 1260
gtgatgcacg aggccctgca caaccactac acccagaaga gcctgagcct gtcccccggc 1320
aaa 1323

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<210> SEQ ID NO 180
<211> LENGTH: 1323
<212> TYPE: DNA
<213> ORGANISM: Artificial
<220> FEATURE:
<223> OTHER INFORMATION: heavy chain

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```

<400> SEQUENCE: 180

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caggtgcaat tggttcagag cggcgcgaa gtgaaaaaac cggcgcgag cgtgaaagtg 60
agctgcaaag cctccgata taccttact tcttctata ttaattgggt ccgccaagcc 120
cctgggcagg gtctcgatg gatgggcaat attaactctg ctactggtea tgctgattat 180
gctcagaagt ttcagggtcg ggtgacctg acccgtgata ccagcattag caccgcgtat 240
atggaactga gccgcctgag tagcgatgat acggccgtgt attattgcgc gcgtggtggt 300
tggtttgatt attggggcca aggcaccctg gtgacgggta gctcagcttc caccaagggc 360
cccagcgtgt tccccctggc cccctgcagc agaagcacca gcgagagcac agccgcccctg 420
ggctgcctgg tgaaggacta cttccccgag cccgtgaccg tgagctggaa cagcggagcc 480
ctgaccagcg gcgtgcacac cttccccgcc gtgctgcaga gcagcggcct gtacagcctg 540
agcagcgtgg tgaccgtgcc cagcagcaac ttgggcaacc agacctacac ctgcaacgtg 600
gaccacaagc ccagcaacac caagtggtgac aagaccgtgg agcgggaagtg ctgcgtggag 660
tgccccccct gccctgcccc tctgtgggcc ggaccctcag tgttctggt ccccccaag 720
cccaaggaca ccctgatgat cagccggacc cccaggtga cctgcgtggt ggtggacgtg 780
agccacgagg accccgaggt gcagttaac tggtagctgg acggcgtgga ggtgcacaac 840
gccaagacca agccccggga ggaacagttc aacagcacct tccgggtggt gtccgtgctg 900
accgtggtgc accaggactg gctgaacggc aaagaataca agtgcaaggt gtccaacaag 960
ggcctgcctg cccccatcga gaaaaccatc agcaagacaa agggccagcc cagggaaacc 1020
caggtgtaca ccctgcccc cagccgggag gaaatgacca agaaccaggt gtcctgacc 1080
tgtctgtgta agggcttcta ccccagcgac atcgccgtgg agtgggagag caacggccag 1140
cccgagaaca actacaagac ccccccccc atgctggaca gcgacggcag cttcttctg 1200
tacagcaagc tgacagtgga caagagccgg tggcagcagg gcaacgtgtt cagctgcagc 1260
gtgatgcacg aggccctgca caaccactac acccagaaga gcctgagcct gtcccccggc 1320
aaa 1323

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<210> SEQ ID NO 181
<211> LENGTH: 512
<212> TYPE: PRT
<213> ORGANISM: Homo sapiens

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<400> SEQUENCE: 181

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Met	Thr	Ala	Pro	Trp	Val	Ala	Leu	Ala	Leu	Leu	Trp	Gly	Ser	Leu	Cys	1	5	10	15
Ala	Gly	Ser	Gly	Arg	Gly	Glu	Ala	Glu	Thr	Arg	Glu	Cys	Ile	Tyr	Tyr	20	25	30	
Asn	Ala	Asn	Trp	Glu	Leu	Glu	Arg	Thr	Asn	Gln	Ser	Gly	Leu	Glu	Arg	35	40	45	
Cys	Glu	Gly	Glu	Gln	Asp	Lys	Arg	Leu	His	Cys	Tyr	Ala	Ser	Trp	Arg	50	55	60	
Asn	Ser	Ser	Gly	Thr	Ile	Glu	Leu	Val	Lys	Lys	Gly	Cys	Trp	Leu	Asp	65	70	75	80
Asp	Phe	Asn	Cys	Tyr	Asp	Arg	Gln	Glu	Cys	Val	Ala	Thr	Glu	Glu	Asn	85	90	95	
Pro	Gln	Val	Tyr	Phe	Cys	Cys	Cys	Glu	Gly	Asn	Phe	Cys	Asn	Glu	Arg	100	105	110	
Phe	Thr	His	Leu	Pro	Glu	Ala	Gly	Gly	Pro	Glu	Val	Thr	Tyr	Glu	Pro	115	120	125	
Pro	Pro	Thr	Ala	Pro	Thr	Leu	Leu	Thr	Val	Leu	Ala	Tyr	Ser	Leu	Leu	130	135	140	
Pro	Ile	Gly	Gly	Leu	Ser	Leu	Ile	Val	Leu	Leu	Ala	Phe	Trp	Met	Tyr	145	150	155	160
Arg	His	Arg	Lys	Pro	Pro	Tyr	Gly	His	Val	Asp	Ile	His	Glu	Asp	Pro	165	170	175	
Gly	Pro	Pro	Pro	Pro	Ser	Pro	Leu	Val	Gly	Leu	Lys	Pro	Leu	Gln	Leu	180	185	190	
Leu	Glu	Ile	Lys	Ala	Arg	Gly	Arg	Phe	Gly	Cys	Val	Trp	Lys	Ala	Gln	195	200	205	
Leu	Met	Asn	Asp	Phe	Val	Ala	Val	Lys	Ile	Phe	Pro	Leu	Gln	Asp	Lys	210	215	220	
Gln	Ser	Trp	Gln	Ser	Glu	Arg	Glu	Ile	Phe	Ser	Thr	Pro	Gly	Met	Lys	225	230	235	240
His	Glu	Asn	Leu	Leu	Gln	Phe	Ile	Ala	Ala	Glu	Lys	Arg	Gly	Ser	Asn	245	250	255	
Leu	Glu	Val	Glu	Leu	Trp	Leu	Ile	Thr	Ala	Phe	His	Asp	Lys	Gly	Ser	260	265	270	
Leu	Thr	Asp	Tyr	Leu	Lys	Gly	Asn	Ile	Ile	Thr	Trp	Asn	Glu	Leu	Cys	275	280	285	
His	Val	Ala	Glu	Thr	Met	Ser	Arg	Gly	Leu	Ser	Tyr	Leu	His	Glu	Asp	290	295	300	
Val	Pro	Trp	Cys	Arg	Gly	Glu	Gly	His	Lys	Pro	Ser	Ile	Ala	His	Arg	305	310	315	320
Asp	Phe	Lys	Ser	Lys	Asn	Val	Leu	Leu	Lys	Ser	Asp	Leu	Thr	Ala	Val	325	330	335	
Leu	Ala	Asp	Phe	Gly	Leu	Ala	Val	Arg	Phe	Glu	Pro	Gly	Lys	Pro	Pro	340	345	350	
Gly	Asp	Thr	His	Gly	Gln	Val	Gly	Thr	Arg	Arg	Tyr	Met	Ala	Pro	Glu	355	360	365	
Val	Leu	Glu	Gly	Ala	Ile	Asn	Phe	Gln	Arg	Asp	Ala	Phe	Leu	Arg	Ile	370	375	380	
Asp	Met	Tyr	Ala	Met	Gly	Leu	Val	Leu	Trp	Glu	Leu	Val	Ser	Arg	Cys	385	390	395	400
Lys	Ala	Ala	Asp	Gly	Pro	Val	Asp	Glu	Tyr	Met	Leu	Pro	Phe	Glu	Glu				

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405	410	415
Glu Ile Gly Gln His Pro Ser Leu Glu Glu Leu Gln Glu Val Val Val		
420	425	430
His Lys Lys Met Arg Pro Thr Ile Lys Asp His Trp Leu Lys His Pro		
435	440	445
Gly Leu Ala Gln Leu Cys Val Thr Ile Glu Ala Cys Trp Asp His Asp		
450	455	460
Ala Glu Ala Arg Leu Ser Ala Gly Cys Val Glu Glu Arg Val Ser Leu		
465	470	475
Ile Arg Arg Ser Val Asn Gly Thr Thr Ser Asp Cys Leu Val Ser Leu		
485	490	495
Val Thr Ser Val Thr Asn Val Asp Leu Pro Pro Lys Glu Ser Ser Ile		
500	505	510

<210> SEQ ID NO 182  
 <211> LENGTH: 116  
 <212> TYPE: PRT  
 <213> ORGANISM: Homo sapiens

<400> SEQUENCE: 182

Ser Gly Arg Gly Glu Ala Glu Thr Arg Glu Cys Ile Tyr Tyr Asn Ala		
1	5	10
Asn Trp Glu Leu Glu Arg Thr Asn Gln Ser Gly Leu Glu Arg Cys Glu		
20	25	30
Gly Glu Gln Asp Lys Arg Leu His Cys Tyr Ala Ser Trp Arg Asn Ser		
35	40	45
Ser Gly Thr Ile Glu Leu Val Lys Lys Gly Cys Trp Leu Asp Asp Phe		
50	55	60
Asn Cys Tyr Asp Arg Gln Glu Cys Val Ala Thr Glu Glu Asn Pro Gln		
65	70	75
Val Tyr Phe Cys Cys Cys Glu Gly Asn Phe Cys Asn Glu Arg Phe Thr		
85	90	95
His Leu Pro Glu Ala Gly Gly Pro Glu Val Thr Tyr Glu Pro Pro Pro		
100	105	110
Thr Ala Pro Thr		
115		

<210> SEQ ID NO 183  
 <211> LENGTH: 15  
 <212> TYPE: PRT  
 <213> ORGANISM: Homo sapiens

<400> SEQUENCE: 183

Ile Glu Leu Val Lys Lys Gly Ser Trp Leu Asp Asp Phe Asn Ser		
1	5	10
15		

<210> SEQ ID NO 184  
 <211> LENGTH: 15  
 <212> TYPE: PRT  
 <213> ORGANISM: Homo sapiens

<400> SEQUENCE: 184

Val Lys Lys Gly Ser Trp Leu Asp Asp Phe Asn Ser Tyr Asp Arg		
1	5	10
15		

<210> SEQ ID NO 185

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-continued

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<211> LENGTH: 15  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 185

Gly Ser Trp Leu Asp Asp Phe Asn Ser Tyr Asp Arg Gln Glu Ser  
1 5 10 15

<210> SEQ ID NO 186  
<211> LENGTH: 9  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 186

Gly Cys Trp Leu Asp Asp Phe Asn Cys  
1 5

<210> SEQ ID NO 187  
<211> LENGTH: 15  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 187

Cys Glu Gly Glu Gln Asp Lys Arg Leu His Cys Tyr Ala Ser Trp  
1 5 10 15

<210> SEQ ID NO 188  
<211> LENGTH: 6  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 188

Trp Leu Asp Asp Phe Asn  
1 5

<210> SEQ ID NO 189  
<211> LENGTH: 5  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 189

Glu Gln Asp Lys Arg  
1 5

<210> SEQ ID NO 190  
<211> LENGTH: 11  
<212> TYPE: PRT  
<213> ORGANISM: Homo sapiens

<400> SEQUENCE: 190

Lys Gly Cys Trp Leu Asp Asp Phe Asn Cys Tyr  
1 5 10

<210> SEQ ID NO 191  
<211> LENGTH: 13  
<212> TYPE: PRT  
<213> ORGANISM: Human

<400> SEQUENCE: 191

Cys Ile Tyr Tyr Asn Ala Asn Trp Glu Leu Glu Arg Thr  
1 5 10

-continued

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<210> SEQ ID NO 192  
 <211> LENGTH: 11  
 <212> TYPE: PRT  
 <213> ORGANISM: Human

<400> SEQUENCE: 192

Tyr Phe Cys Cys Cys Glu Gly Asn Phe Cys Asn  
 1                   5                   10

<210> SEQ ID NO 193  
 <211> LENGTH: 216  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial Sequence  
 <220> FEATURE:  
 <223> OTHER INFORMATION: Light Chain

<400> SEQUENCE: 193

Asp Ile 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 Ser Tyr  
                  20                   25                   30

Asn Tyr Val Asn Trp Tyr Gln Gln His Pro Gly Lys Ala Pro Lys Leu  
                  35                   40                   45

Met Ile Tyr Gly Val Ser Lys 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 Gly Thr Phe Ala Gly Gly  
                  85                   90                   95

Ser Tyr Tyr Gly Val Phe Gly Gly Gly Thr Lys Leu Thr Val Leu Gly  
                  100                   105                   110

Gln Pro Lys Ser Thr Pro Thr Leu Thr Val Phe Pro Pro Ser Ser Glu  
 115                   120                   125

Glu Leu Lys Glu Asn Lys Ala Thr Leu Val Cys Leu Ile Ser Asn Phe  
 130                   135                   140

Ser Pro Ser Gly Val Thr Val Ala Trp Lys Ala Asn Gly Thr Pro Ile  
 145                   150                   155                   160

Thr Gln Gly Val Asp Thr Ser Asn Pro Thr Lys Glu Gly Asn Lys Phe  
                  165                   170                   175

Met Ala Ser Ser Phe Leu His Leu Thr Ser Asp Gln Trp Arg Ser His  
                  180                   185                   190

Asn Ser Phe Thr Cys Gln Val Thr His Glu Gly Asp Thr Val Glu Lys  
 195                   200                   205

Ser Leu Ser Pro Ala Glu Cys Leu  
 210                   215

<210> SEQ ID NO 194  
 <211> LENGTH: 445  
 <212> TYPE: PRT  
 <213> ORGANISM: Artificial  
 <220> FEATURE:  
 <223> OTHER INFORMATION: Heavy Chain

<400> SEQUENCE: 194

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 Ser

-continued

20					25					30					
Tyr	Ile	Asn	Trp	Val	Arg	Gln	Ala	Pro	Gly	Gln	Gly	Leu	Glu	Trp	Met
		35					40					45			
Gly	Thr	Ile	Asn	Pro	Val	Ser	Gly	Ser	Thr	Ser	Tyr	Ala	Gln	Lys	Phe
	50					55					60				
Gln	Gly	Arg	Val	Thr	Met	Thr	Arg	Asp	Thr	Ser	Ile	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	Gly	Gly	Trp	Phe	Asp	Tyr	Trp	Gly	Gln	Gly	Thr	Leu	Val	Thr
		100						105					110		
Val	Ser	Ser	Ala	Lys	Thr	Thr	Ala	Pro	Ser	Val	Tyr	Pro	Leu	Ala	Pro
		115					120					125			
Val	Cys	Gly	Asp	Thr	Thr	Gly	Ser	Ser	Val	Thr	Leu	Gly	Cys	Leu	Val
	130					135					140				
Lys	Gly	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Leu	Thr	Trp	Asn	Ser	Gly	Ser
145					150					155					160
Leu	Ser	Ser	Gly	Val	His	Thr	Phe	Pro	Ala	Val	Leu	Gln	Ser	Asp	Leu
			165						170					175	
Tyr	Thr	Leu	Ser	Ser	Ser	Val	Thr	Val	Thr	Ser	Ser	Thr	Trp	Pro	Ser
		180						185					190		
Gln	Ser	Ile	Thr	Cys	Asn	Val	Ala	His	Pro	Ala	Ser	Ser	Thr	Lys	Val
		195					200						205		
Asp	Lys	Lys	Ile	Glu	Pro	Arg	Gly	Pro	Thr	Ile	Lys	Pro	Cys	Pro	Pro
	210					215					220				
Cys	Lys	Cys	Pro	Ala	Pro	Asn	Ala	Ala	Gly	Gly	Pro	Ser	Val	Phe	Ile
225					230					235					240
Phe	Pro	Pro	Lys	Ile	Lys	Asp	Val	Leu	Met	Ile	Ser	Leu	Ser	Pro	Ile
			245						250					255	
Val	Thr	Cys	Val	Val	Val	Asp	Val	Ser	Glu	Asp	Asp	Pro	Asp	Val	Gln
		260						265					270		
Ile	Ser	Trp	Phe	Val	Asn	Asn	Val	Glu	Val	His	Thr	Ala	Gln	Thr	Gln
		275					280						285		
Thr	His	Arg	Glu	Asp	Tyr	Asn	Ser	Thr	Leu	Arg	Val	Val	Ser	Ala	Leu
	290					295					300				
Pro	Ile	Gln	His	Gln	Asp	Trp	Met	Ser	Gly	Lys	Glu	Phe	Lys	Cys	Lys
305					310					315					320
Val	Asn	Asn	Lys	Asp	Leu	Pro	Ala	Pro	Ile	Glu	Arg	Thr	Ile	Ser	Lys
			325						330					335	
Pro	Lys	Gly	Ser	Val	Arg	Ala	Pro	Gln	Val	Tyr	Val	Leu	Pro	Pro	Pro
		340					345						350		
Glu	Glu	Glu	Met	Thr	Lys	Lys	Gln	Val	Thr	Leu	Thr	Cys	Met	Val	Thr
		355					360					365			
Asp	Phe	Met	Pro	Glu	Asp	Ile	Tyr	Val	Glu	Trp	Thr	Asn	Asn	Gly	Lys
	370					375						380			
Thr	Glu	Leu	Asn	Tyr	Lys	Asn	Thr	Glu	Pro	Val	Leu	Asp	Ser	Asp	Gly
385					390					395					400
Ser	Tyr	Phe	Met	Tyr	Ser	Lys	Leu	Arg	Val	Glu	Lys	Lys	Asn	Trp	Val
			405						410					415	
Glu	Arg	Asn	Ser	Tyr	Ser	Cys	Ser	Val	Val	His	Glu	Gly	Leu	His	Asn
		420						425					430		

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His His Thr Thr Lys Ser Phe Ser Arg Thr Pro Gly Lys  
435 440 445

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**1.-32.** (canceled)

**33.** A method of treating sporadic inclusion body myositis comprising, administering a therapeutically effective amount of myostatin antagonist to a patient in need thereof.

**34.** The method of treating sporadic inclusion body myositis according to claim **33**, comprising administering said myostatin antagonist to said patient at a dose of about 1-10 mg/kg.

**35.** The method of treating sporadic inclusion body myositis according to claim **33**, comprising administering said myostatin antagonist to said patient at a dose of about 1, about 3 or about 10 mg/kg body weight.

**36.** The method of treating sporadic inclusion body myositis according to claim **33**, comprising administering said myostatin antagonist to said patient intravenously.

**37.** The method of treating sporadic inclusion body myositis according to claim **33**, comprising administering said myostatin antagonist every four weeks.

**38.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein said patient is ambulatory.

**39.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein treating sporadic inclusion body myositis comprises slowing down the progression of the disease or improving physical function and mobility.

**40.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein treating sporadic inclusion body myositis comprises improving dysphagia/swallowing difficulties.

**41.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein treating sporadic inclusion body myositis comprises improving upper extremity strength.

**42.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein treating sporadic inclusion body myositis comprises reducing incidence of falls or preventing falls.

**43.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein the myostatin antagonist is a myostatin receptor binding molecule.

**44.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein the myostatin antagonist is an ActRII receptor antagonist.

**45.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein the myostatin antagonist is an anti-ActRII receptor antibody.

**46.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody is bimagrumab.

**47.** The method of treating sporadic inclusion body myositis according to claim **33**, wherein the myostatin antagonist is an anti-ActRII antibody that binds to an epitope of ActRIIB consisting of amino acids 19-134 of SEQ ID NO: 181 (SEQ ID NO: 182).

**48.** The method of treating sporadic inclusion body myositis according to claim **47**, wherein the anti-ActRII antibody binds to an epitope of ActRIIB comprising or consisting of:

(a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCVASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR).

**49.** The method of treating sporadic inclusion body myositis according to claim **47**, wherein the anti-ActRIIB antibody is selected from the group consisting of:

i) an anti-ActRIIB antibody that binds to an epitope of ActRIIB comprising:

(a) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181 (GCWLDDFN - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181 (KGCWLDDFN - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181 (EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181 (CEGEQDKRLHCVASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181 (CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181 (YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181 (WLDDFN) and amino acids 52-56 of SEQ ID NO: 181 (EQDKR);



and

- ii) an antagonist antibody to ActRIIB that binds to an epitope of ActRIIB comprising

(a) amino acids 78-83 of SEQ ID NO: 181  
(WLDDFN - SEQ ID NO: 188);

(b) amino acids 76-84 of SEQ ID NO: 181  
(GCWLDDFN - SEQ ID NO: 186);

(c) amino acids 75-85 of SEQ ID NO: 181  
(KGCWLDDFN - SEQ ID NO: 190);

(d) amino acids 52-56 of SEQ ID NO: 181  
(EQDKR - SEQ ID NO: 189);

(e) amino acids 49-63 of SEQ ID NO: 181  
(CEGEQDKRLHCYASW - SEQ ID NO: 187);

(f) amino acids 29-41 of SEQ ID NO: 181  
(CIYYNANWELERT - SEQ ID NO: 191);

(g) amino acids 100-110 of SEQ ID NO: 181  
(YFCCCEGNFCN - SEQ ID NO: 192);

or

(h) amino acids 78-83 of SEQ ID NO: 181  
(WLDDFN) and amino acids 52-56 of SEQ ID  
NO: 181 (EQDKR),

wherein the antibody has a  $K_D$  of about 2 pM.

**50.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody binds to ActRIIB with a 10-fold or greater affinity than it binds to ActRIIA.

**51.** The method of treating sporadic inclusion body myositis to any of claim **45**, wherein the anti-ActRII receptor antibody comprises a heavy chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 1-14; a heavy chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 15-28; a heavy chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 29-42; a light chain variable region CDR1 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 43-56; a light chain variable region CDR2 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 57-70; and a light chain variable region CDR3 comprising an amino acid sequence selected from the group consisting of SEQ ID NOs: 71-84.

**52.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody comprises:

(a) a heavy chain variable region CDR1 of SEQ ID NO: 1; a heavy chain variable region CDR2 of SEQ ID NO: 15; a heavy chain variable region CDR3 of SEQ ID NO: 29; a light chain variable region CDR1 of SEQ ID NO: 43; a light chain variable region CDR2 of SEQ ID NO: 57; and a light chain variable region CDR3 of SEQ ID NO: 71,

(b) a heavy chain variable region CDR1 of SEQ ID NO: 2; a heavy chain variable region CDR2 of SEQ ID NO: 16; a heavy chain variable region CDR3 of SEQ ID NO: 30; a light chain variable region CDR1 of SEQ ID NO: 44; a light chain variable region CDR2 of SEQ ID NO: 58; and a light chain variable region CDR3 of SEQ ID NO: 72,

(c) a heavy chain variable region CDR1 of SEQ ID NO: 3; a heavy chain variable region CDR2 of SEQ ID NO: 17; a heavy chain variable region CDR3 of SEQ ID NO: 31; a light chain variable region CDR1 of SEQ ID NO: 45; a light chain variable region CDR2 of SEQ ID NO: 59; and a light chain variable region CDR3 of SEQ ID NO: 73,

(d) a heavy chain variable region CDR1 of SEQ ID NO: 4; a heavy chain variable region CDR2 of SEQ ID NO: 18; a heavy chain variable region CDR3 of SEQ ID NO: 32; a light chain variable region CDR1 of SEQ ID NO: 46; a light chain variable region CDR2 of SEQ ID NO: 60; and a light chain variable region CDR3 of SEQ ID NO: 74,

(e) a heavy chain variable region CDR1 of SEQ ID NO: 5; a heavy chain variable region CDR2 of SEQ ID NO: 19; a heavy chain variable region CDR3 of SEQ ID NO: 33; a light chain variable region CDR1 of SEQ ID NO: 47; a light chain variable region CDR2 of SEQ ID NO: 61; and a light chain variable region CDR3 of SEQ ID NO: 75,

(f) a heavy chain variable region CDR1 of SEQ ID NO: 6; a heavy chain variable region CDR2 of SEQ ID NO: 20; a heavy chain variable region CDR3 of SEQ ID NO: 34; a light chain variable region CDR1 of SEQ ID NO: 48; a light chain variable region CDR2 of SEQ ID NO: 62; and a light chain variable region CDR3 of SEQ ID NO: 76,

(g) a heavy chain variable region CDR1 of SEQ ID NO: 7; a heavy chain variable region CDR2 of SEQ ID NO: 21; a heavy chain variable region CDR3 of SEQ ID NO: 35; a light chain variable region CDR1 of SEQ ID NO: 49; a light chain variable region CDR2 of SEQ ID NO: 63; and a light chain variable region CDR3 of SEQ ID NO: 77,

(h) a heavy chain variable region CDR1 of SEQ ID NO: 8; a heavy chain variable region CDR2 of SEQ ID NO: 22; a heavy chain variable region CDR3 of SEQ ID NO: 36; a light chain variable region CDR1 of SEQ ID NO: 50; a light chain variable region CDR2 of SEQ ID NO: 64; and a light chain variable region CDR3 of SEQ ID NO: 78,

(i) a heavy chain variable region CDR1 of SEQ ID NO: 9; a heavy chain variable region CDR2 of SEQ ID NO: 23; a heavy chain variable region CDR3 of SEQ ID NO: 37; a light chain variable region CDR1 of SEQ ID NO: 51; a light chain variable region CDR2 of SEQ ID NO: 65; and a light chain variable region CDR3 of SEQ ID NO: 79,

(j) a heavy chain variable region CDR1 of SEQ ID NO: 10; a heavy chain variable region CDR2 of SEQ ID NO: 24; a heavy chain variable region CDR3 of SEQ ID NO: 38; a light chain variable region CDR1 of SEQ ID NO: 52; a light chain variable region CDR2 of SEQ ID NO: 66; and a light chain variable region CDR3 of SEQ ID NO: 80,

(k) a heavy chain variable region CDR1 of SEQ ID NO: 11; a heavy chain variable region CDR2 of SEQ ID NO: 25; a heavy chain variable region CDR3 of SEQ ID NO: 39; a light chain variable region CDR1 of SEQ ID NO: 53; a light chain variable region CDR2 of SEQ ID NO: 67; and a light chain variable region CDR3 of SEQ ID NO: 81,

- (l) a heavy chain variable region CDR1 of SEQ ID NO: 12; a heavy chain variable region CDR2 of SEQ ID NO: 26; a heavy chain variable region CDR3 of SEQ ID NO: 40; a light chain variable region CDR1 of SEQ ID NO: 54; a light chain variable region CDR2 of SEQ ID NO: 68; and a light chain variable region CDR3 of SEQ ID NO: 82.
- (m) a heavy chain variable region CDR1 of SEQ ID NO: 13; a heavy chain variable region CDR2 of SEQ ID NO: 27; a heavy chain variable region CDR3 of SEQ ID NO: 41; a light chain variable region CDR1 of SEQ ID NO: 55; a light chain variable region CDR2 of SEQ ID NO: 69; and a light chain variable region CDR3 of SEQ ID NO: 83, or
- (n) a heavy chain variable region CDR1 of SEQ ID NO: 14; a heavy chain variable region CDR2 of SEQ ID NO: 28; a heavy chain variable region CDR3 of SEQ ID NO: 42; a light chain variable region CDR1 of SEQ ID NO: 56; a light chain variable region CDR2 of SEQ ID NO: 70; and a light chain variable region CDR3 of SEQ ID NO: 84.

**53.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody comprises a full length heavy chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOS: 146-150 and 156-160.

**54.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody comprises a full length light chain amino acid sequence having at least 95% sequence identity to at least one sequence selected from the group consisting of SEQ ID NOS: 141-145 and 151-155.

**55.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody comprises:

- (a) the variable heavy chain sequence of SEQ ID NO: 99 and variable light chain sequence of SEQ ID NO: 85;
- (b) the variable heavy chain sequence of SEQ ID NO: 100 and variable light chain sequence of SEQ ID NO: 86;
- (c) the variable heavy chain sequence of SEQ ID NO: 101 and variable light chain sequence of SEQ ID NO: 87;
- (d) the variable heavy chain sequence of SEQ ID NO: 102 and variable light chain sequence of SEQ ID NO: 88;
- (e) the variable heavy chain sequence of SEQ ID NO: 103 and variable light chain sequence of SEQ ID NO: 89;
- (f) the variable heavy chain sequence of SEQ ID NO: 104 and variable light chain sequence of SEQ ID NO: 90;
- (g) the variable heavy chain sequence of SEQ ID NO: 105 and variable light chain sequence of SEQ ID NO: 91;
- (h) the variable heavy chain sequence of SEQ ID NO: 106 and variable light chain sequence of SEQ ID NO: 92;
- (i) the variable heavy chain sequence of SEQ ID NO: 107 and variable light chain sequence of SEQ ID NO: 93;
- (j) the variable heavy chain sequence of SEQ ID NO: 108 and variable light chain sequence of SEQ ID NO: 94;

- (k) the variable heavy chain sequence of SEQ ID NO: 109 and variable light chain sequence of SEQ ID NO: 95;
- (l) the variable heavy chain sequence of SEQ ID NO: 110 and variable light chain sequence of SEQ ID NO: 96;
- (m) the variable heavy chain sequence of SEQ ID NO: 111 and variable light chain sequence of SEQ ID NO: 97; or
- (n) the variable heavy chain sequence of SEQ ID NO: 112 and variable light chain sequence of SEQ ID NO: 98.

**56.** The A method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody comprises:

- (a) the heavy chain sequence of SEQ ID NO: 146 and light chain sequence of SEQ ID NO: 141;
- (b) the heavy chain sequence of SEQ ID NO: 147 and light chain sequence of SEQ ID NO: 142;
- (c) the heavy chain sequence of SEQ ID NO: 148 and light chain sequence of SEQ ID NO: 143;
- (d) the heavy chain sequence of SEQ ID NO: 149 and light chain sequence of SEQ ID NO: 144;
- (e) the heavy chain sequence of SEQ ID NO: 150 and light chain sequence of SEQ ID NO: 145;
- (f) the heavy chain sequence of SEQ ID NO: 156 and light chain sequence of SEQ ID NO: 151;
- (g) the heavy chain sequence of SEQ ID NO: 157 and light chain sequence of SEQ ID NO: 152;
- (h) the heavy chain sequence of SEQ ID NO: 158 and light chain sequence of SEQ ID NO: 153;
- (i) the heavy chain sequence of SEQ ID NO: 159 and light chain sequence of SEQ ID NO: 154; or
- (j) the heavy chain sequence of SEQ ID NO: 160 and light chain sequence of SEQ ID NO: 155.

**57.** (canceled)

**58.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the anti-ActRII receptor antibody has altered effector function through mutation of the Fc region.

**59.** (canceled)

**60.** The method of treating sporadic inclusion body myositis according to claim **45**, wherein the antibody is encoded by pBW522 (DSM22873) or pBW524 (DSM22874).

**61.** A method of treating sporadic inclusion body myositis comprising administering bimagrumab to a patient in need thereof.

**62.** The method of treating sporadic inclusion body myositis according to claim **61**, comprising administering bimagrumab to the patient, intravenously at a dose of about 1-10 mg/kg body weight every four weeks.

**63.** The method of treating sporadic inclusion body myositis according to claim **62**, comprising administering bimagrumab to the patient, intravenously at a dose of about 1 mg/kg body weight every four weeks, intravenously at a dose of about 3 mg/kg body weight every four weeks, or intravenously at a dose of about 10 mg/kg body weight every four weeks.

**64.-69.** (canceled)

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