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Description**Field of the Invention**

5 **[0001]** The field of the invention generally relates to glucocorticoid receptor agonist immunoconjugates, and methods of making and using the same, e.g., to treat autoimmune or inflammatory diseases.

Background of the Invention

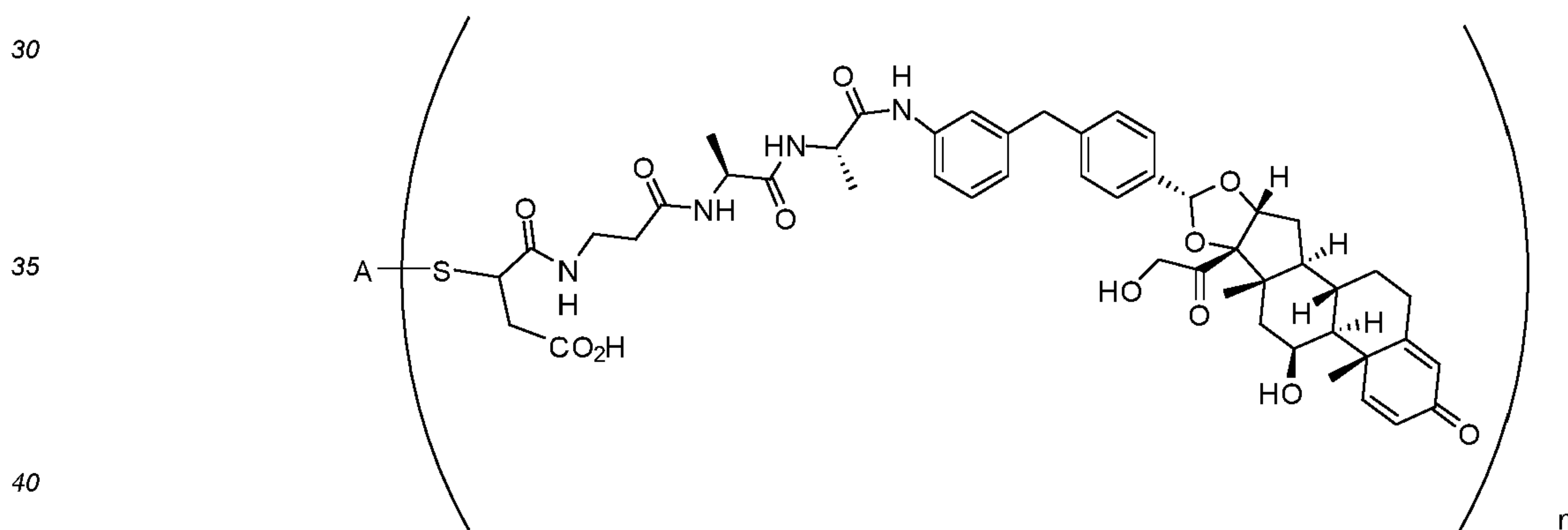
10 **[0002]** Tumor Necrosis Factor alpha (TNF α) plays a central role in the pathophysiology of several human disorders, and anti-TNF α agents (e.g., adalimumab, etanercept, and infliximab) have clinically validated therapeutic utility in the treatment of autoimmune and inflammatory disorders, such as rheumatoid arthritis, psoriasis and inflammatory bowel disease. Despite their success in the clinic, anti-TNF α biologics are still limited in the maximal efficacy they can achieve in patients, necessitating the identification and development of more potent and effective therapeutics. Patients treated

15 with anti-TNF α biologics may also develop an immunogenic response to the therapeutic thus limiting its effectiveness. Therefore anti-TNF α therapies with lower immunogenicity and high efficacy would be useful for further controlling disease.

20 **[0003]** Synthetic glucocorticoid receptor agonists (e.g., dexamethasone, prednisolone, and budesonide) are a potent class of small molecules used in the treatment of inflammatory disorders, but their utility in the chronic treatment of disease is limited due to severe side effects. Several approaches to retain the anti-inflammatory efficacy of synthetic glucocorticoids while sparing the unwanted toxicities have been described (Rosen, J and Miner, JN Endocrine Reviews 26: 452-64 (2005)). However these methodologies have met with little success. There is a need in the field of autoimmune and inflammatory disease therapeutics to develop therapeutics with enhanced efficacy and longer duration of action compared to anti-TNF antibodies and with minimal unwanted effects.

BRIEF SUMMARY OF THE INVENTION

25 **[0004]** The present invention provides a compound:



45 wherein n is 2 or 4, and A is an antibody comprising SEQ ID NO: 66 and SEQ ID NO: 73 or adalimumab. In further embodiments of the invention n is 4. In other embodiments of the invention n is 2. In other embodiments of the invention A is adalimumab.

BRIEF DESCRIPTION OF THE DRAWINGS/FIGURES**[0005]**

50 Figure 1 shows the proteolytic stability of an ADC containing a steroid and an ADC containing MMAE (monomethyl auristatin E). (See Example 76.)

Figure 2 shows the kinetics of drug linker loss of steroid ADC in mice. (See Example 77.)

55 Figure 3 shows the activity of a single therapeutic dose response of anti-mTNF α steroid ADC in a mouse model of arthritis. (See Example 85.)

Figure 4 shows the activity of anti-human TNF α steroid in huTNF α Tg CAIA mouse model of arthritis. (See Example 87.)

Figure 5 is a HIC chromatogram showing a heterogenous mixture containing antibodies having zero SM-L-Q- mol-

ecules attached ("E0" peak), two SM-L-Q- molecules attached ("E2" peak), four SM-L-Q- molecules attached ("E4" peak), SM-L-Q- moieties attached ("E6" peak), and eight SM-L-Q-molecules attached ("E8" peak), depending upon the number of interchain disulfide bonds that have been reduced. (SM is a radical of a glucocorticosteroid; L is a linker, and Q is a heterobifunctional group or heterotrifunctional group; or Q is absent.) (See Example 74.)

Figure 6 is a SEC chromatogram of adalimumab conjugated with a glucocorticosteroid. (See Example 74.)

Figure 7 is a line graph showing raw MS data of adalimumab conjugated with a glucocorticosteroid. (See Example 74.)

Figure 8 is a line graph showing deconvoluted MS data of adalimumab conjugated with a glucocorticosteroid. Black square and circle represent the ADC with succinimide hydrolyzed and unhydrolyzed, respectively. The relative abundance of hydrolyzed and unhydrolyzed ADC is used to determine hydrolysis conversion. (See Example 74.)

Figure 9 shows that an anti-TNF steroid ADC is significantly more effective in reducing ear inflammation in mice than the concurrent combination of the anti-TNF antibody and the steroid or than the anti-TNF antibody alone. (See Example 84.)

Figure 10 shows that a single dose of an anti-TNF steroid ADC is as effective in reducing paw swelling as 21 days of daily dosing of a steroid. (See Example 85.)

Figure 11 shows the change in weights of animals treated with steroid, an anti-TNF antibody, an anti-TNF ADC, or an isotype ADC. (See Example 85.)

Figure 12 shows that a single dose of an anti-TNF steroid ADC can reduce established paw swelling, whereas a single dose of an anti-TNF antibody had a minimal effect. (See Example 88.)

Figure 13 shows the effect of treatment with an anti-TNF steroid ADC on tarsal bone loss as measured by Micro-Computed Tomography (μ CT). (The individual data points (e.g., circles, squares, or triangles) represent individual animals.) (See Example 88.)

Figure 14 shows the effect of treatment with an anti-TNF steroid ADC on inflammation. (The individual data points (e.g., circles, squares, or triangles) represent individual animals.) (See Example 88.)

Figure 15 shows the effect of treatment with an anti-TNF steroid ADC on pannus formation. (The individual data points (e.g., circles, squares, or triangles) represent individual animals.) (See Example 88.)

Figure 16 shows the effect of treatment with an anti-TNF steroid ADC on bone erosion. (The individual data points (e.g., circles, squares, or triangles) represent individual animals.) (See Example 88.)

Figure 17 shows the effect of treatment with an anti-TNF steroid ADC on cartilage damage. (The individual data points (e.g., circles, squares, or triangles) represent individual animals.) (See Example 88.)

Figure 18 shows effect of treatment with an anti-TNF steroid ADC on white blood cells in peripheral blood. (The individual data points (e.g., circles, squares, or diamonds) represent individual animals.) (See Example 88.)

Figure 19 shows effect of treatment with an anti-TNF steroid ADC on neutrophils in peripheral blood. (The individual data points (e.g., circles, squares, or diamonds) represent individual animals.) (See Example 88.)

Figure 20 shows effect of treatment with an anti-TNF steroid ADC on lymphocytes in peripheral blood. (The individual data points (e.g., circles, squares, or diamonds) represent individual animals.) (See Example 88.)

Figure 21 shows effect of treatment with an anti-TNF steroid ADC on monocytes in peripheral blood. (The individual data points (e.g., circles, squares, or diamonds) represent individual animals.) (See Example 88.)

Figure 22 shows effect of treatment with an anti-TNF steroid ADC on eosinophils in peripheral blood. (See Example 88.)

Figure 23 shows effect of treatment with an anti-TNF steroid ADC on basophils in peripheral blood. (See Example 88.)

Figure 24 shows the activity of an anti-TNF steroid ADC and an anti-CD 163 steroid ADC in mouse collagen-induced arthritis. (See Example 89.)

DETAILED DESCRIPTION OF THE INVENTION

I. Definitions

[0006] To facilitate an understanding of the present disclosure, a number of terms and phrases are defined below.

[0007] The term "anti-TNF alpha protein" refers to proteins that are capable of (i) binding to TNF alpha and (ii) inhibiting binding of soluble TNF-alpha to cell surface TNF receptors (p55 and/or p75) and/or lysing surface TNF alpha or TNF alpha receptor expressing cells *in vitro* in the presence of complement. Anti-TNF alpha proteins include, for example, anti-TNF antibodies or antigen-binding fragments thereof (e.g., adalimumab or infliximab) as well as soluble TNF receptors (e.g., etanercept).

[0008] As used herein, the terms "antibody" and "antibodies" are terms of art and can be used interchangeably herein and refer to a molecule with an antigen-binding site that specifically binds an antigen.

[0009] The term "antibody" means an immunoglobulin molecule that recognizes and specifically binds to a target, such as a protein, polypeptide, peptide, carbohydrate, polynucleotide, lipid, or combinations of the foregoing through at least one antigen recognition site within the variable region of the immunoglobulin molecule. As used herein, the term "antibody"

encompasses intact polyclonal antibodies, intact monoclonal antibodies, chimeric antibodies, humanized antibodies, human antibodies, fusion proteins comprising an antibody, and any other modified immunoglobulin molecule so long as the antibodies exhibit the desired biological activity. An antibody can be of any the five major classes of immunoglobulins: IgA, IgD, IgE, IgG, and IgM, or subclasses (isotypes) thereof (e.g. IgG1, IgG2, IgG3, IgG4, IgA1 and IgA2), based on the identity of their heavy-chain constant domains referred to as alpha, delta, epsilon, gamma, and mu, respectively. The different classes of immunoglobulins have different and well known subunit structures and three-dimensional configurations. Antibodies can be naked or conjugated to other molecules such as toxins, radioisotopes, etc. As used herein, the term "antibody" encompasses bispecific and multispecific antibodies.

[0010] The term "antibody fragment" refers to a portion of an intact antibody. An "antigen-binding fragment" refers to a portion of an intact antibody that binds to an antigen. An antigen-binding fragment can contain the antigenic determining variable regions of an intact antibody. Examples of antibody fragments include, but are not limited to Fab, Fab', F(ab')₂, and Fv fragments, linear antibodies, and single chain antibodies. An "antigen-binding fragment" can be a bispecific or multispecific antigen-binding fragment.

[0011] The term "anti-TNF-alpha antibody" or "an antibody that binds to TNF-alpha" refers to an antibody that is capable of binding TNF-alpha with sufficient affinity such that the antibody is useful as a diagnostic and/or therapeutic agent in targeting TNF-alpha. The extent of binding of an anti-TNF-alpha antibody to an unrelated, non-TNF-alpha protein can be less than about 10% of the binding of the antibody to TNF-alpha as measured, e.g., by a radioimmunoassay (RIA). In certain embodiments, an antibody that binds to TNF-alpha has a dissociation constant (K_d) of $\leq 1 \mu\text{M}$, $\leq 100 \text{ nM}$, $\leq 10 \text{ nM}$, $\leq 1 \text{ nM}$, or $\leq 0.1 \text{ nM}$.

[0012] A "monoclonal" antibody or antigen-binding fragment thereof refers to a homogeneous antibody or antigen-binding fragment population involved in the highly specific recognition and binding of a single antigenic determinant, or epitope. This is in contrast to polyclonal antibodies that typically include different antibodies directed against different antigenic determinants. The term "monoclonal" antibody or antigen-binding fragment thereof encompasses both intact and full-length monoclonal antibodies as well as antibody fragments (such as Fab, Fab', F(ab')₂, Fv), single chain (scFv) mutants, fusion proteins comprising an antibody portion, and any other modified immunoglobulin molecule comprising an antigen recognition site. Furthermore, "monoclonal" antibody or antigen-binding fragment thereof refers to such antibodies and antigen-binding fragments thereof made in any number of manners including but not limited to by hybridoma, phage selection, recombinant expression, and transgenic animals.

[0013] The term "humanized" antibody or antigen-binding fragment thereof refers to forms of non-human (e.g. murine) antibodies or antigen-binding fragments that are specific immunoglobulin chains, chimeric immunoglobulins, or fragments thereof that contain minimal non-human (e.g., murine) sequences. Typically, humanized antibodies or antigen-binding fragments thereof are human immunoglobulins in which residues from the complementary determining region (CDR) are replaced by residues from the CDR of a non-human species (e.g. mouse, rat, rabbit, hamster) that have the desired specificity, affinity, and capability ("CDR grafted") (Jones et al., *Nature* 321:522-525 (1986); Riechmann et al., *Nature* 332:323-327 (1988); Verhoeyen et al., *Science* 239:1534-1536 (1988)). In some instances, the Fv framework region (FR) residues of a human immunoglobulin are replaced with the corresponding residues in an antibody or fragment from a non-human species that has the desired specificity, affinity, and capability. The humanized antibody or antigen-binding fragment thereof can be further modified by the substitution of additional residues either in the Fv framework region and/or within the replaced non-human residues to refine and optimize antibody or antigen-binding fragment thereof specificity, affinity, and/or capability. In general, the humanized antibody or antigen-binding fragment thereof will comprise substantially all of at least one, and typically two or three, variable domains containing all or substantially all of the CDR regions that correspond to the non-human immunoglobulin whereas all or substantially all of the FR regions are those of a human immunoglobulin consensus sequence. The humanized antibody or antigen-binding fragment thereof can also comprise at least a portion of an immunoglobulin constant region or domain (Fc), typically that of a human immunoglobulin. Examples of methods used to generate humanized antibodies are described in U.S. Pat. 5,225,539; Roguska et al., *Proc. Natl. Acad. Sci., USA*, 91(3):969-973 (1994), and Roguska et al., *Protein Eng.* 9(10):895-904 (1996). In some embodiments, a "humanized antibody" is a resurfaced antibody.

[0014] A "variable region" of an antibody refers to the variable region of the antibody light chain or the variable region of the antibody heavy chain, either alone or in combination. The variable regions of the heavy and light chain each consist of four framework regions (FR) connected by three complementarity determining regions (CDRs) also known as hypervariable regions. The CDRs in each chain are held together in close proximity by the FRs and, with the CDRs from the other chain, contribute to the formation of the antigen-binding site of antibodies. There are at least two techniques for determining CDRs: (1) an approach based on cross-species sequence variability (i.e., Kabat et al. *Sequences of Proteins of Immunological Interest*, (5th ed., 1991, National Institutes of Health, Bethesda Md.)); and (2) an approach based on crystallographic studies of antigen-antibody complexes (Al-lazikani et al (1997) *J. Molec. Biol.* 273:927-948)). In addition, combinations of these two approaches are sometimes used in the art to determine CDRs.

[0015] The Kabat numbering system is generally used when referring to a residue in the variable domain (approximately residues 1-107 of the light chain and residues 1-113 of the heavy chain) (e.g., Kabat et al., *Sequences of Immunological*

Interest. 5th Ed. Public Health Service, National Institutes of Health, Bethesda, Md. (1991)). Unless explicitly indicated otherwise, the numbering system used herein is the Kabat numbering system.

[0016] The amino acid position numbering as in Kabat, refers to the numbering system used for heavy chain variable domains or light chain variable domains of the compilation of antibodies in Kabat et al., Sequences of Proteins of Immunological Interest, 5th Ed. Public Health Service, National Institutes of Health, Bethesda, Md. (1991). Using this numbering system, the actual linear amino acid sequence can contain fewer or additional amino acids corresponding to a shortening of, or insertion into, a FR or CDR of the variable domain. For example, a heavy chain variable domain can include a single amino acid insert (residue 52a according to Kabat) after residue 52 of H2 and inserted residues (e.g. residues 82a, 82b, and 82c, etc. according to Kabat) after heavy chain FR residue 82. The Kabat numbering of residues can be determined for a given antibody by alignment at regions of homology of the sequence of the antibody with a "standard" Kabat numbered sequence. Chothia refers instead to the location of the structural loops (Chothia and Lesk J. Mol. Biol. 196:901-917 (1987)). The end of the Chothia CDR-H1 loop when numbered using the Kabat numbering convention varies between H32 and H34 depending on the length of the loop (this is because the Kabat numbering scheme places the insertions at H35A and H35B; if neither 35A nor 35B is present, the loop ends at 32; if only 35A is present, the loop ends at 33; if both 35A and 35B are present, the loop ends at 34). The AbM hypervariable regions represent a compromise between the Kabat CDRs and Chothia structural loops, and are used by Oxford Molecular's AbM antibody modeling software.

Loop	Kabat	AbM	Chothia
L1	L24-L34	L24-L34	L24-L34
L2	L50-L56	L50-L56	L50-L56
L3	L89-L97	L89-L97	L89-L97
H1	H31-H35B	H26-H35B	H26-H32..34
(Kabat Numbering)			
H1	H31-H35	H26-H35	H26-H32
(Chothia Numbering)			
H2	H50-H65	H50-H58	H52-H56
H3	H95-H102	H95-H102	H95-H102

[0017] In certain aspects, the CDRs of an antibody or antigen-binding fragment thereof can be determined according to the Chothia numbering scheme, which refers to the location of immunoglobulin structural loops (see, e.g., Chothia C & Lesk AM, (1987), J Mol Biol 196: 901-917; Al-Lazikani B et al., (1997) J Mol Biol 273: 927-948; Chothia C et al., (1992) J Mol Biol 227: 799-817; Tramontano A et al., (1990) J Mol Biol 215(1): 175-82; and U.S. Patent No. 7,709,226). Typically, when using the Kabat numbering convention, the Chothia CDR-H1 loop is present at heavy chain amino acids 26 to 32, 33, or 34, the Chothia CDR-H2 loop is present at heavy chain amino acids 52 to 56, and the Chothia CDR-H3 loop is present at heavy chain amino acids 95 to 102, while the Chothia CDR-L1 loop is present at light chain amino acids 24 to 34, the Chothia CDR-L2 loop is present at light chain amino acids 50 to 56, and the Chothia CDR-L3 loop is present at light chain amino acids 89 to 97. The end of the Chothia CDR-H1 loop when numbered using the Kabat numbering convention varies between H32 and H34 depending on the length of the loop (this is because the Kabat numbering scheme places the insertions at H35A and H35B; if neither 35A nor 35B is present, the loop ends at 32; if only 35A is present, the loop ends at 33; if both 35A and 35B are present, the loop ends at 34).

[0018] In certain aspects, the CDRs of an antibody or antigen-binding fragment thereof can be determined according to the IMGT numbering system as described in Lefranc M-P, (1999) The Immunologist 7: 132-136 and Lefranc M-P et al., (1999) Nucleic Acids Res 27: 209-212. According to the IMGT numbering scheme, VH-CDR1 is at positions 26 to 35, VH-CDR2 is at positions 51 to 57, VH-CDR3 is at positions 93 to 102, VL-CDR1 is at positions 27 to 32, VL-CDR2 is at positions 50 to 52, and VL-CDR3 is at positions 89 to 97.

[0019] In certain aspects, the CDRs of an antibody or antigen-binding fragment thereof can be determined according to MacCallum RM et al., (1996) J Mol Biol 262: 732-745. See also, e.g., Martin A. "Protein Sequence and Structure Analysis of Antibody Variable Domains," in Antibody Engineering, Kontermann and Dübel, eds., Chapter 31, pp. 422-439, Springer-Verlag, Berlin (2001).

[0020] In certain aspects, the CDRs of an antibody or antigen-binding fragment thereof can be determined according to the AbM numbering scheme, which refers AbM hypervariable regions which represent a compromise between the Kabat CDRs and Chothia structural loops, and are used by Oxford Molecular's AbM antibody modeling software (Oxford Molecular Group, Inc.).

[0021] The term "human" antibody means an antibody produced by a human or an antibody having an amino acid

sequence corresponding to an antibody produced by a human made using any technique known in the art. This definition of a human antibody includes intact or full-length antibodies, fragments thereof, and/or antibodies comprising at least one human heavy and/or light chain polypeptide such as, for example, an antibody comprising murine light chain and human heavy chain polypeptides.

[0022] The term "chimeric" antibodies refers to antibodies wherein the amino acid sequence of the immunoglobulin molecule is derived from two or more species. Typically, the variable region of both light and heavy chains corresponds to the variable region of antibodies derived from one species of mammals (e.g. mouse, rat, rabbit, etc.) with the desired specificity, affinity, and capability while the constant regions are homologous to the sequences in antibodies derived from another (usually human) to avoid eliciting an immune response in that species.

[0023] The term "epitope" or "antigenic determinant" are used interchangeably herein and refer to that portion of an antigen capable of being recognized and specifically bound by a particular antibody. When the antigen is a polypeptide, epitopes can be formed both from contiguous amino acids and noncontiguous amino acids juxtaposed by tertiary folding of a protein. Epitopes formed from contiguous amino acids are typically retained upon protein denaturing, whereas epitopes formed by tertiary folding are typically lost upon protein denaturing. An epitope typically includes at least 3, and more usually, at least 5 or 8-10 amino acids in a unique spatial conformation.

[0024] "Binding affinity" generally refers to the strength of the sum total of noncovalent interactions between a single binding site of a molecule (e.g., an antibody) and its binding partner (e.g., an antigen). Unless indicated otherwise, as used herein, "binding affinity" refers to intrinsic binding affinity which reflects a 1:1 interaction between members of a binding pair (e.g., antibody and antigen). The affinity of a molecule X for its partner Y can generally be represented by the dissociation constant (K_d). Affinity can be measured by common methods known in the art, including those described herein. Low-affinity antibodies generally bind antigen slowly and tend to dissociate readily, whereas high-affinity antibodies generally bind antigen faster and tend to remain bound longer. A variety of methods of measuring binding affinity are known in the art, any of which can be used for purposes of the present disclosure. Specific illustrative embodiments are described in the following.

[0025] "Or better" when used herein to refer to binding affinity refers to a stronger binding between a molecule and its binding partner. "Or better" when used herein refers to a stronger binding, represented by a smaller numerical K_d value. For example, an antibody which has an affinity for an antigen of "0.6 nM or better", the antibody's affinity for the antigen is <0.6 nM, i.e. 0.59 nM, 0.58 nM, 0.57 nM etc. or any value less than 0.6 nM.

[0026] By "specifically binds," it is generally meant that an antibody binds to an epitope via its antigen binding domain, and that the binding entails some complementarity between the antigen binding domain and the epitope. According to this definition, an antibody is said to "specifically bind" to an epitope when it binds to that epitope, via its antigen binding domain more readily than it would bind to a random, unrelated epitope. The term "specificity" is used herein to qualify the relative affinity by which a certain antibody binds to a certain epitope. For example, antibody "A" may be deemed to have a higher specificity for a given epitope than antibody "B," or antibody "A" may be said to bind to epitope "C" with a higher specificity than it has for related epitope "D."

[0027] By "preferentially binds," it is meant that the antibody specifically binds to an epitope more readily than it would bind to a related, similar, homologous, or analogous epitope. Thus, an antibody which "preferentially binds" to a given epitope would more likely bind to that epitope than to a related epitope, even though such an antibody may cross-react with the related epitope.

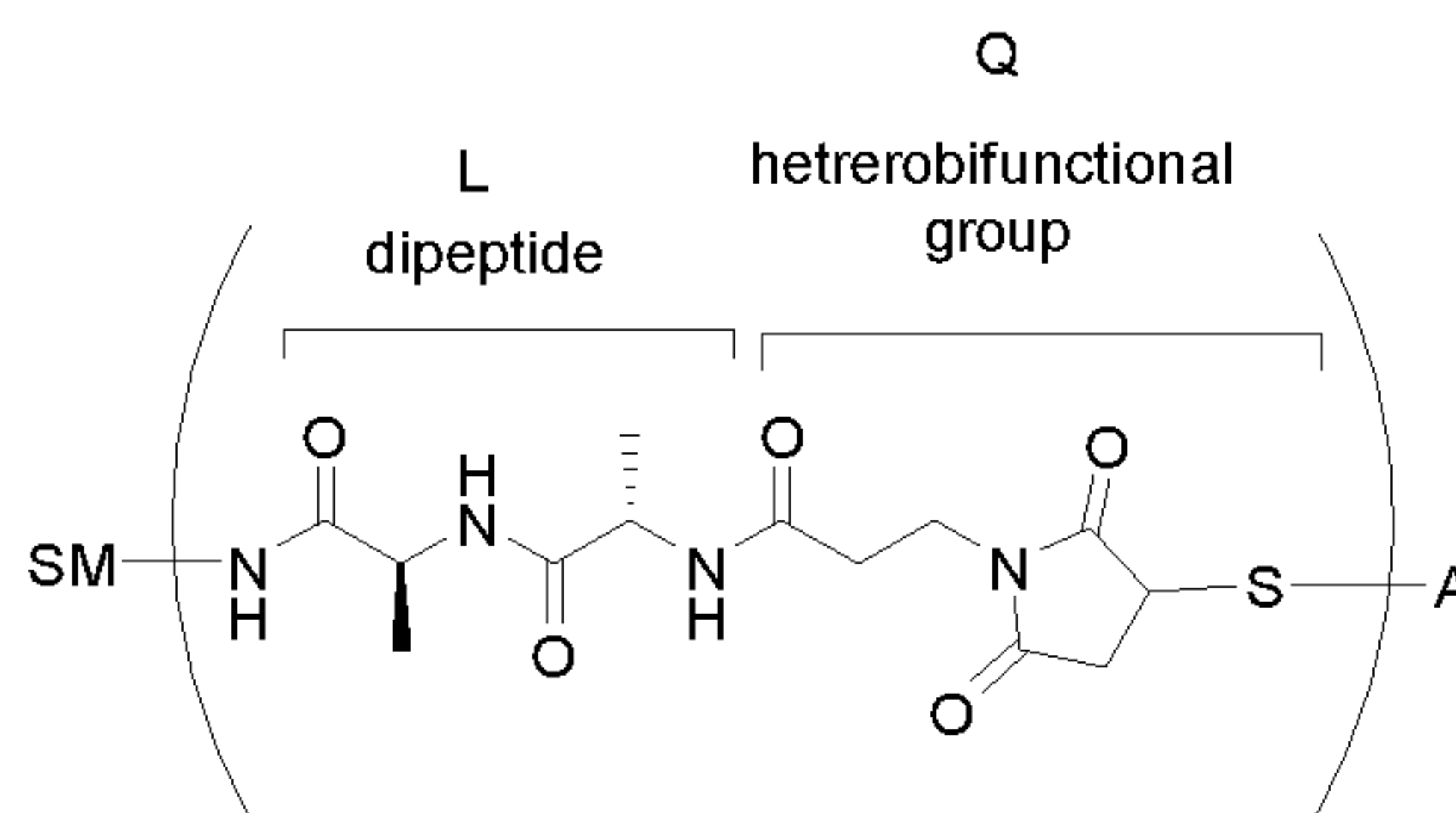
[0028] An antibody is said to "competitively inhibit" binding of a reference antibody to a given epitope if the antibody preferentially binds to that epitope or an overlapping epitope to the extent that it blocks, to some degree, binding of the reference antibody to the epitope. Competitive inhibition may be determined by any method known in the art, for example, competition ELISA assays. An antibody may be said to competitively inhibit binding of the reference antibody to a given epitope by at least 90%, at least 80%, at least 70%, at least 60%, or at least 50%.

[0029] A polypeptide, antibody, polynucleotide, vector, cell, or composition which is "isolated" is a polypeptide, antibody, polynucleotide, vector, cell, or composition which is in a form not found in nature. Isolated polypeptides, antibodies, polynucleotides, vectors, cell or compositions include those which have been purified to a degree that they are no longer in a form in which they are found in nature. In some embodiments, an antibody, polynucleotide, vector, cell, or composition which is isolated is substantially pure.

[0030] As used herein, "substantially pure" refers to material which is at least 50% pure (i.e., free from contaminants), at least 90% pure, at least 95% pure, at least 98% pure, or at least 99% pure.

[0031] The term "immunoconjugate," "conjugate," "antibody-drug conjugate," or "ADC" as used herein refers to a compound or a derivative thereof that is linked to protein such as a cell binding agent (e.g., an anti-TNF-alpha antibody or fragment thereof) and is defined by a generic formula: (SM-L-Q)_n-A, wherein SM = radical derived from a small-molecule glucocorticoid receptor agonist, e.g., a glucocorticosteroid, L = linker, Q = heterobifunctional group, a heterotrifunctional group, or is absent, and A = a protein (e.g., an antibody or antigen-binding fragment thereof, an anti-TNF protein, an anti-TNF-alpha antibody or fragment thereof, a soluble receptor, or a soluble TNF receptor), and n = 1-10. Immunoconjugates can also be defined by the generic formula in reverse order: A-(Q-L-SM)_n. By way of illustration, the

following generic formula shows a immunoconjugate having a dipeptide (Ala-Ala) linker and succinimide thioether-based heterobifunctional group:



[0032] In the present disclosure, the term "linker" refers to any chemical moiety capable of linking a protein, e.g., antibody, antibody fragment (e.g., antigen binding fragments) or functional equivalent to a glucocorticosteroid. Linkers may be susceptible to cleavage (a "cleavable linker") thereby facilitating release of the glucocorticosteroid. For example, such cleavable linkers may be susceptible to acid-induced cleavage, photo-induced cleavage, peptidase-induced cleavage, esterase-induced cleavage, and disulfide bond cleavage, at conditions under which the glucocorticosteroid and/or the antibody remains active. Alternatively, linkers may be substantially resistant to cleavage (a "noncleavable linker").

[0033] In the present disclosure, non-cleavable linkers are any chemical moiety capable of linking a glucocorticosteroid to an antibody in a stable, covalent manner and does not fall off under the categories listed above for cleavable linkers. Thus, non-cleavable linkers are substantially resistant to acid-induced cleavage, photo-induced cleavage, peptidase-induced cleavage, esterase-induced cleavage and disulfide bond cleavage. Furthermore, non-cleavable refers to the ability of the chemical bond in the linker or adjoining to the linker to withstand cleavage induced by an acid, photolabile-cleaving agent, a peptidase, an esterase, or a chemical or physiological compound that cleaves a disulfide bond, at conditions under which a glucocorticosteroid and/or the antibody does not lose its activity.

[0034] Some cleavable linkers are cleaved by peptidases ("peptidase cleavable linkers"). Only certain peptides are readily cleaved inside or outside cells, see e.g. Trout et al., 79 Proc. Natl. Acad. Sci. USA, 626-629 (1982) and Umemoto et al. 43 Int. J. Cancer, 677-684 (1989). Furthermore, peptides are composed of α -amino acid units and peptidic bonds, which chemically are amide bonds between the carboxylate of one amino acid and the amino group of a second amino acid. Other amide bonds, such as the bond between a carboxylate and the α -amino acid group of lysine, are understood not to be peptidic bonds and are considered non-cleavable.

[0035] Some linkers are cleaved by esterases ("esterase cleavable linkers"). Only certain esters can be cleaved by esterases present inside or outside of cells. Esters are formed by the condensation of a carboxylic acid and an alcohol. Simple esters are esters produced with simple alcohols, such as aliphatic alcohols, and small cyclic and small aromatic alcohols.

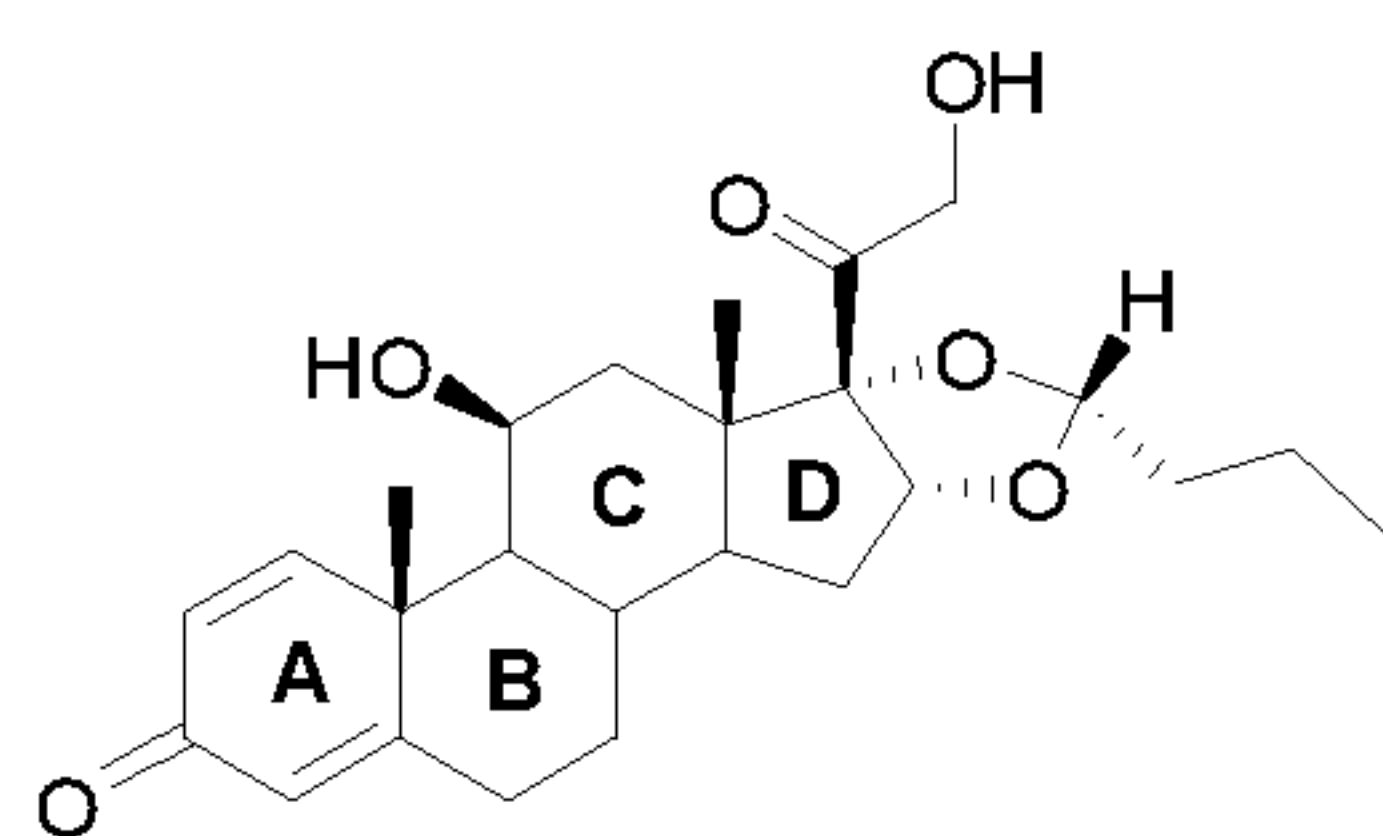
[0036] In some embodiments, the cleavable linker component may comprise a peptide comprising one to ten amino acid residues. In these embodiments, the peptide allows for cleavage of the linker by a protease, thereby facilitating release of the glucocorticosteroid upon exposure to intracellular proteases, such as lysosomal enzymes (Doronina et al. (2003) Nat. Biotechnol. 21:778-784). Exemplary peptides include, but are not limited to, dipeptides, tripeptides, tetrapeptides, and pentapeptides. Exemplary dipeptides include, but are not limited to, alanine-alanine (ala-ala), valine-citrulline (vc or val-cit), alanine-phenylalanine (af or ala-phe); phenylalanine-lysine (fk or phe-lys); phenylalanine-homolysine (phe-homolys); and N-methyl-valine-citrulline (Me-val-cit). Exemplary tripeptides include, but are not limited to, glycine-valine-citrulline (gly-val-cit) and glycine-glycine-glycine (gly-gly-gly).

[0037] A peptide may comprise naturally-occurring and/or non-natural amino acid residues. The term "naturally-occurring amino acid" refer to Ala, Asp, Cys, Glu, Phe, Gly, His, Ile, Lys, Leu, Met, Asn, Pro, Gln, Arg, Ser, Thr, Val, Trp, and Tyr. "Non-natural amino acids" (i.e., amino acids do not occur naturally) include, by way of non-limiting example, homoserine, homoarginine, citrulline, phenylglycine, taurine, iodotyrosine, seleno-cysteine, norleucine ("Nle"), norvaline ("Nva"), beta-alanine, L- or D-naphthalanine, ornithine ("Orn"), and the like. Peptides can be designed and optimized for enzymatic cleavage by a particular enzyme, for example, a tumor-associated protease, cathepsin B, C and D, or a plasmin protease.

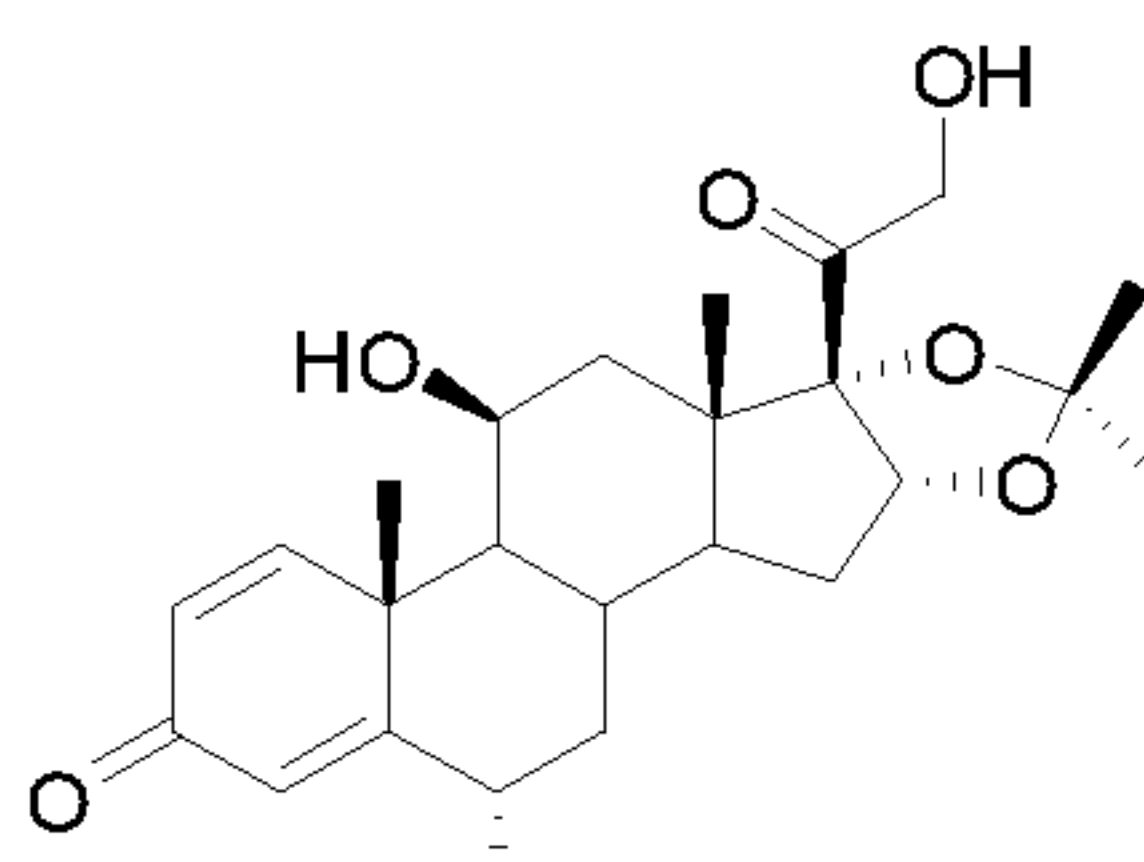
[0038] Amino acids also include the D-forms of natural and non-natural amino acids. "D-" designates an amino acid having the "D" (dextrorotary) configuration, as opposed to the configuration in the naturally occurring ("L-") amino acids. Natural and non-natural amino acids can be purchased commercially (Sigma Chemical Co., Advanced Chemtech) or synthesized using methods known in the art.

[0039] In the present disclosure, the term "glucocorticosteroid" refers to naturally-occurring or synthetic steroid hormones that interact with glucocorticoid receptors. Non-limiting exemplary glucocorticosteroids include:

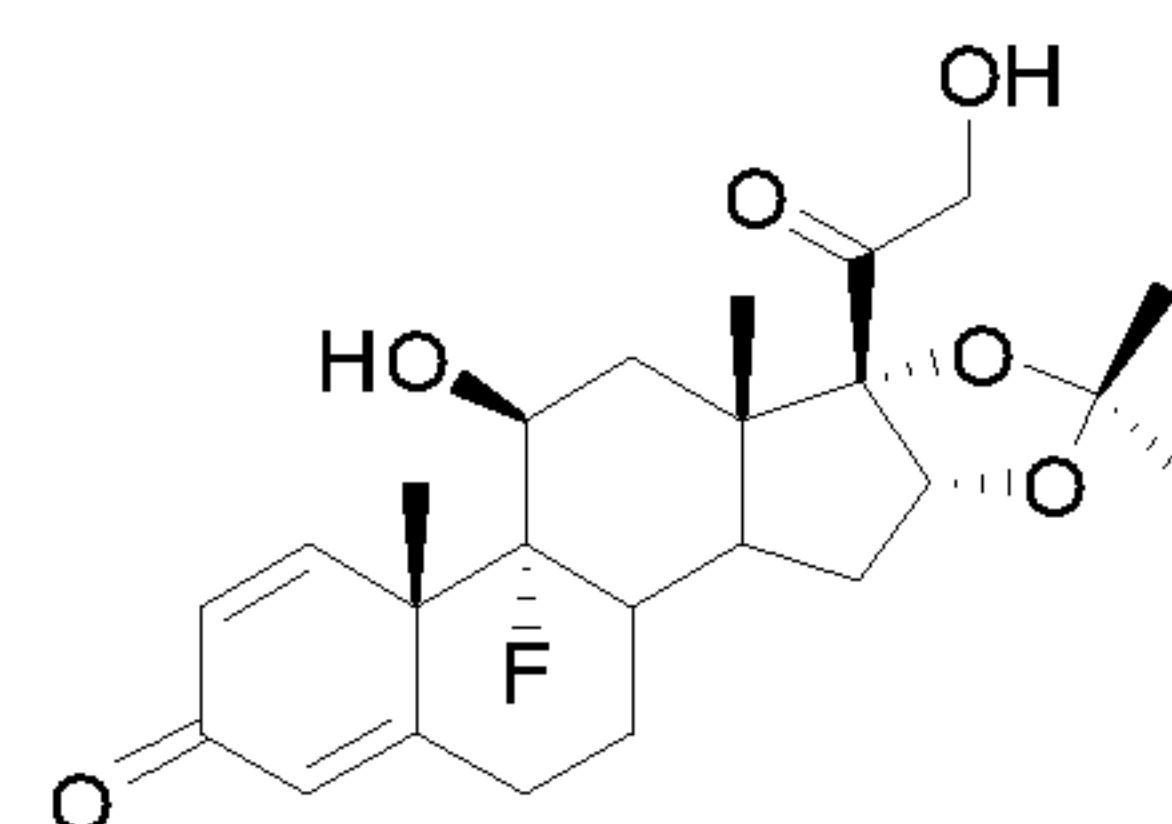
5



budesonide

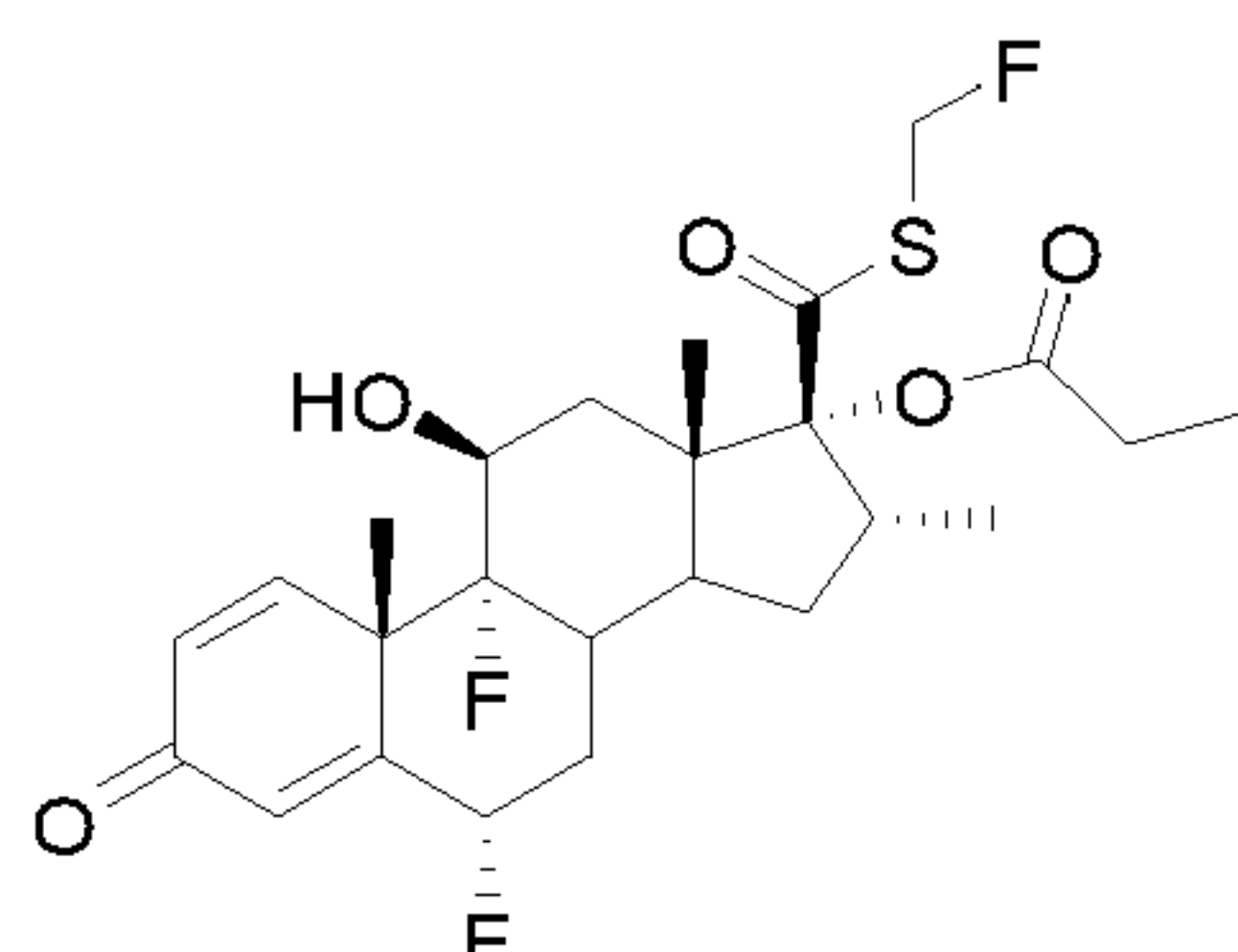


flunisolide

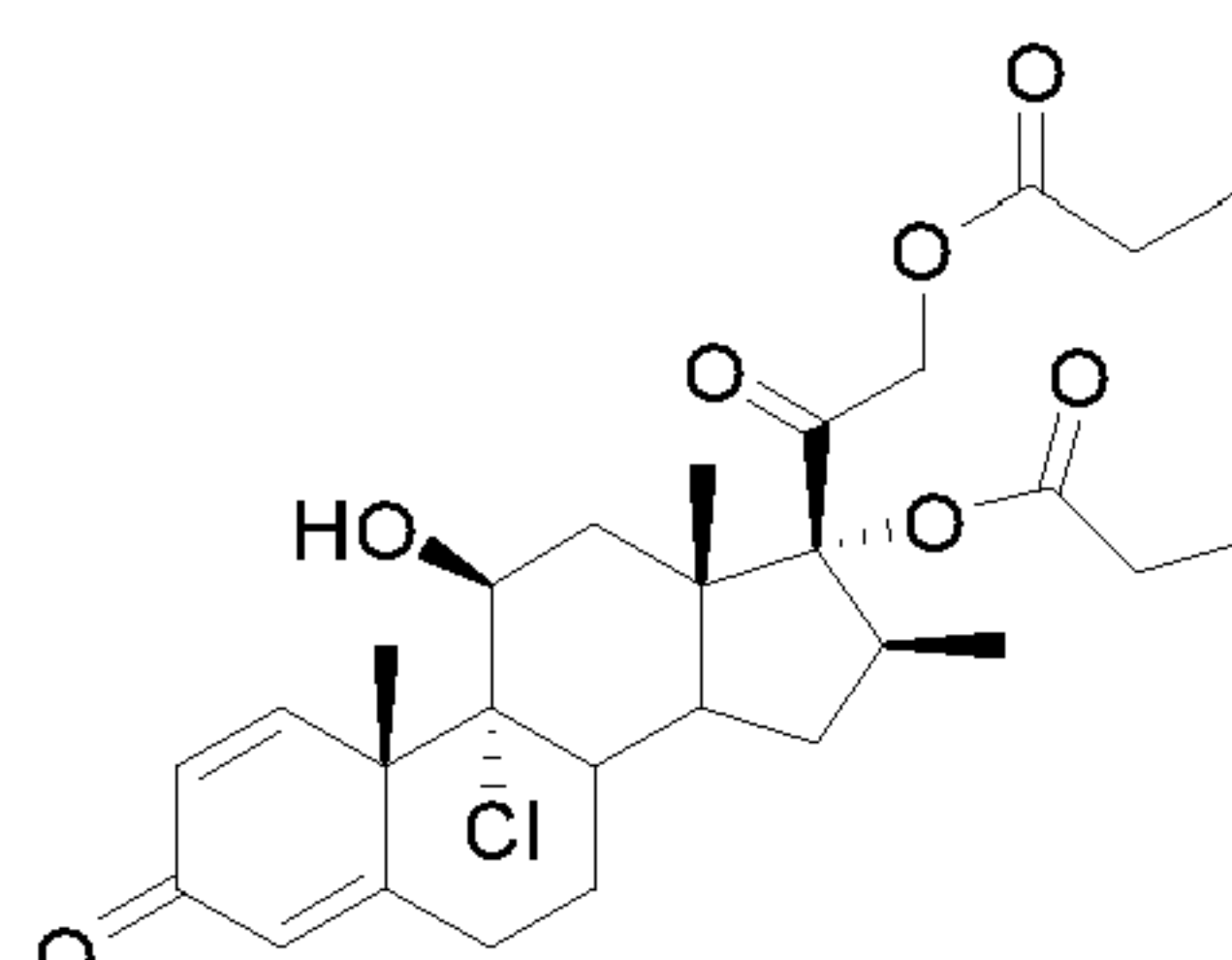


triamcinolone acetonide

10

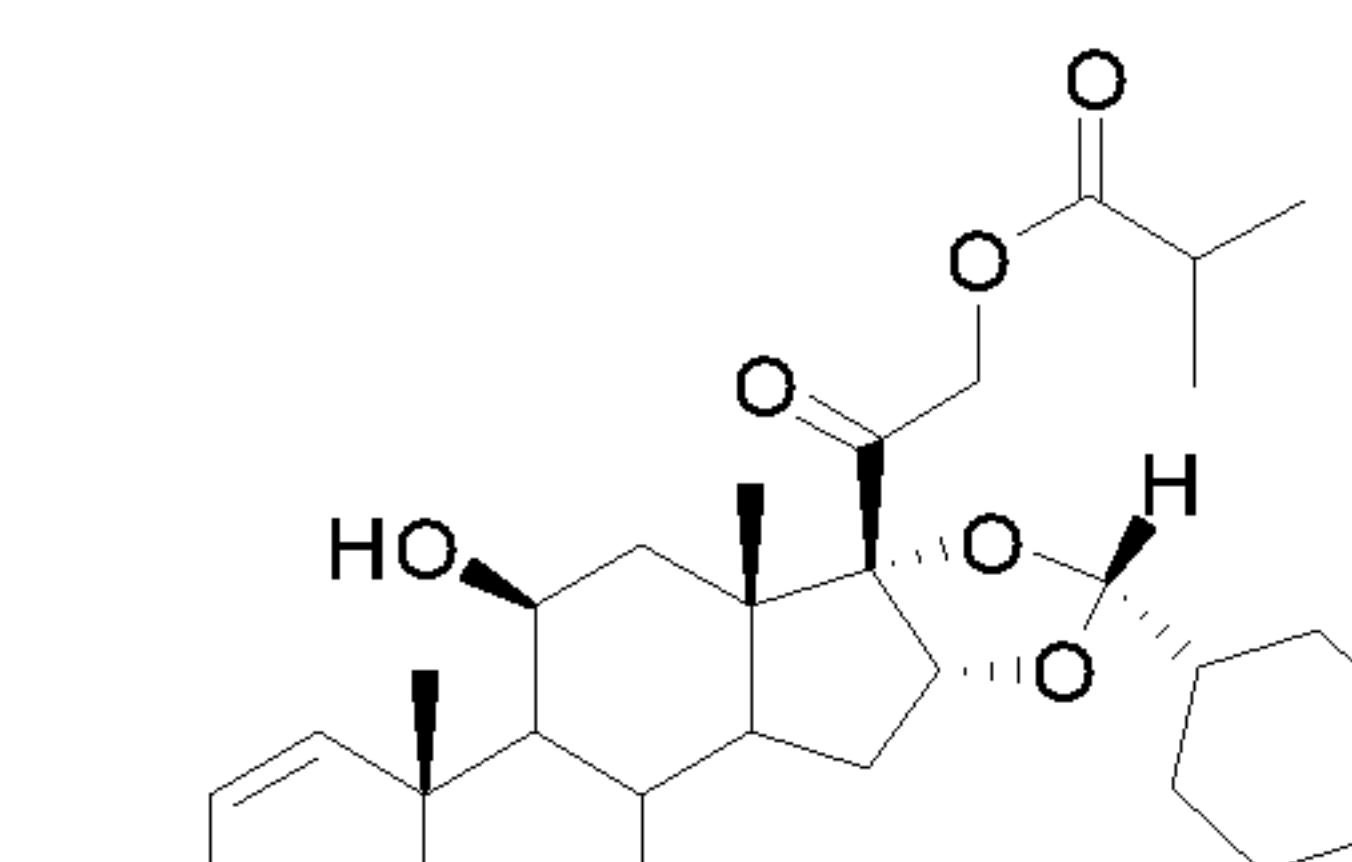


fluticasone propionate



beclomethasone dipropionate

20



ciclesonide

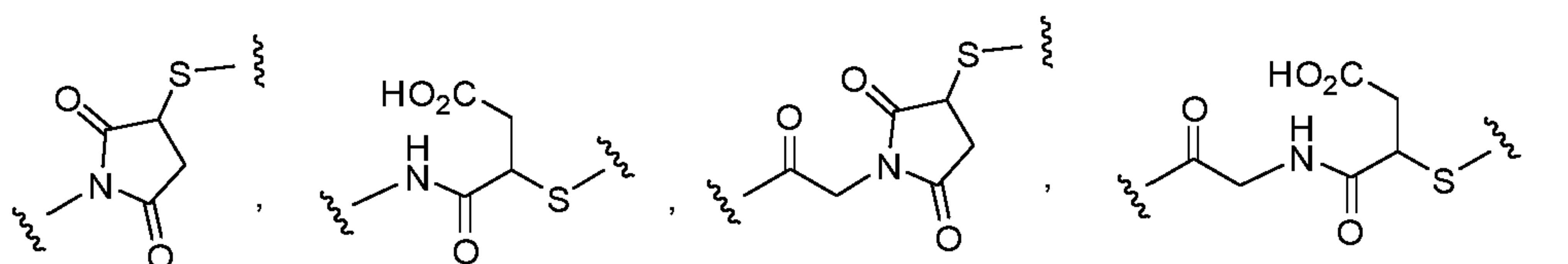
25

By way of example, the A-, B-, C-, and D-rings of the steroid skeleton are marked for budesonide. Glucocorticosteroids are described in WO 2009/069032.

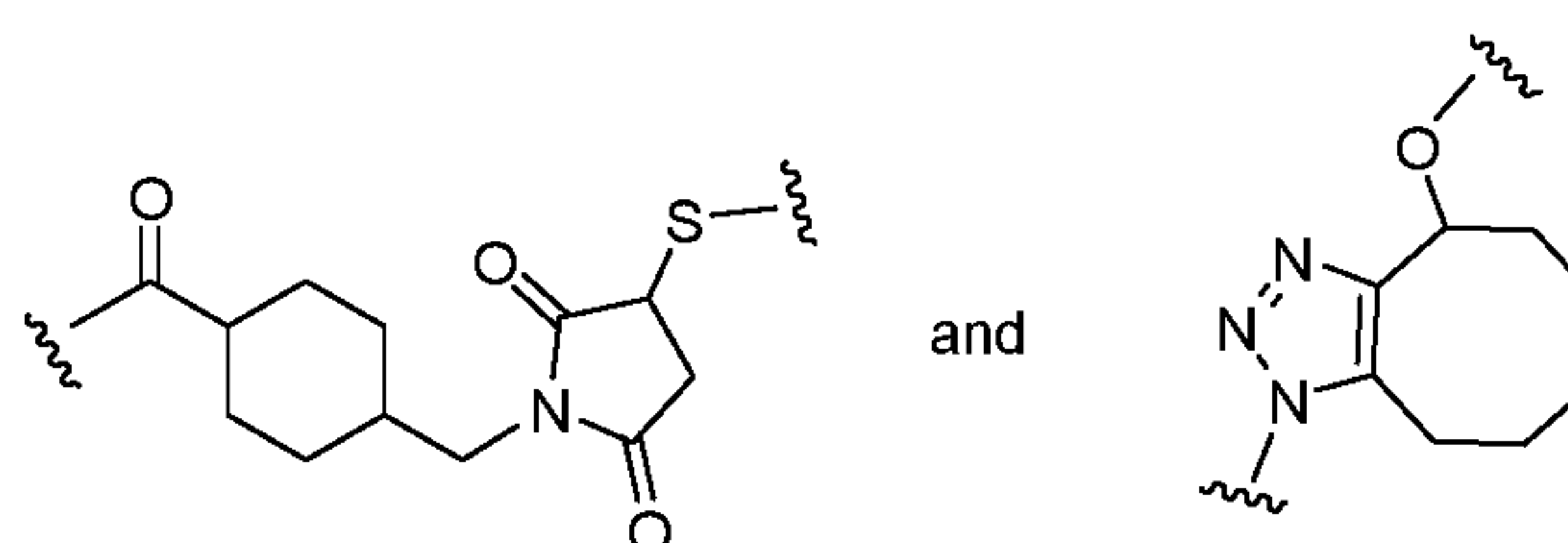
[0040] A "radical of a glucocorticosteroid" is derived from the removal of one or more hydrogen atoms from a parent glucocorticosteroid. The removal of hydrogen atom(s) facilitates the attachment of the parent glucocorticosteroid to a linker. In one embodiment, the hydrogen atom is removed from any suitable $-NH_2$ group of the parent glucocorticosteroid. In another embodiment, the hydrogen atom is removed from any suitable $-OH$ group of the parent glucocorticosteroid. In another embodiment, the hydrogen atom is removed from any suitable $-SH$ group of the parent glucocorticosteroid. In another embodiment, the hydrogen atom is removed from any suitable $-N(H)-$ group of the parent glucocorticosteroid. In another embodiment, the hydrogen atom is removed from any suitable $-CH_3$, $-CH_2-$ or $-CH=$ group of the parent glucocorticosteroid. In one embodiment, the "radical of a glucocorticosteroid" is a monovalent radical derived from the removal of one hydrogen atom from a parent glucocorticosteroid.

[0041] In the present disclosure, the term "heterobifunctional group" or the term "heterotrifunctional group" refers to a chemical moiety that connects a linker and protein, e.g., an antibody. Heterobi- and trifunctional groups are characterized as having different reactive groups at either end of the chemical moiety. Non-limiting exemplary heterobifunctional groups include:

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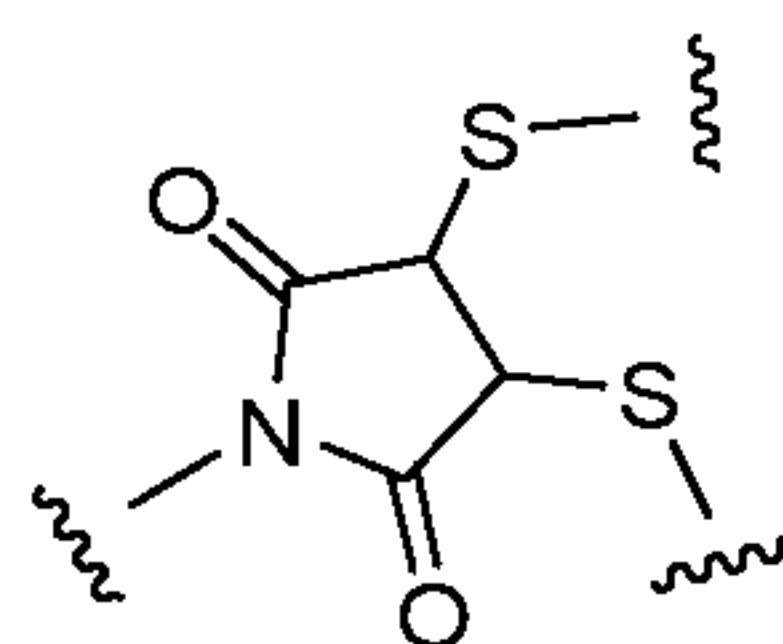
and

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A non-limiting exemplary heterotrifunctional group is:

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[0042] The term "drug antibody ratio" or "DAR" refers to the number of SMs (i.e., radical derived from a small-molecule glucocorticoid receptor agonist, e.g., a glucocorticosteroid) linked to A (i.e., a protein, e.g., an antibody or antigen-binding fragment thereof, an anti-TNF protein, an anti-TNF-alpha antibody or fragment thereof, a soluble receptor, or a soluble TNF receptor). Thus, in the immunoconjugate having the generic formula $(SM-L-Q)_n-A$, the DAR is defined by the variable "n."

[0043] When referring to a compound having formula $(SM-L-Q)_n-A$ representing an individual immunoconjugate, the DAR refers to the number of SMs linked to the individual A (e.g., n is an integer of 1 to 10).

[0044] When referring to a compound having formula $(SM-L-Q)_n-A$ representing a plurality of immunoconjugates, the DAR refers to the average number of SMs linked to the As (e.g., n is an integer or fraction of 1 to 10). Thus, by way of an example, a compound having formula $(SM-L-Q)_n-A$ comprising a first immunoconjugate with 3 SM per A and a second immunoconjugate with 4 SM per A would have a DAR (i.e., an "n") of 3.5.

[0045] The term "subject" refers to any animal (e.g., a mammal), including, but not limited to humans, non-human primates, rodents, and the like, which is to be the recipient of a particular treatment. Typically, the terms "subject" and "patient" are used interchangeably herein in reference to a human subject.

[0046] The term "pharmaceutical formulation" refers to a preparation which is in such form as to permit the biological activity of the active ingredient to be effective, and which contains no additional components which are unacceptably toxic to a subject to which the formulation would be administered. The formulation can be sterile.

[0047] Terms such as "treating" or "treatment" or "to treat" or "alleviating" or "to alleviate" refer to therapeutic measures that cure, slow down, lessen symptoms of, and/or halt progression of a diagnosed pathologic condition or disorder. Thus, those in need of treatment include those already diagnosed with or suspected of having the disorder. Prophylactic or preventative measures refer to measures that prevent and/or slow the development of a targeted pathological condition or disorder. Thus, those in need of prophylactic or preventative measures include those prone to have the disorder and those in whom the disorder is to be prevented.

[0048] "Polynucleotide," or "nucleic acid," as used interchangeably herein, refer to polymers of nucleotides of any length, and include DNA and RNA. The nucleotides can be deoxyribonucleotides, ribonucleotides, modified nucleotides or bases, and/or their analogs, or any substrate that can be incorporated into a polymer by DNA or RNA polymerase. A polynucleotide can comprise modified nucleotides, such as methylated nucleotides and their analogs. If present, modification to the nucleotide structure can be imparted before or after assembly of the polymer. The sequence of nucleotides can be interrupted by non-nucleotide components. A polynucleotide can be further modified after polymerization, such as by conjugation with a labeling component. Other types of modifications include, for example, "caps", substitution of one or more of the naturally occurring nucleotides with an analog, internucleotide modifications such as, for example, those with uncharged linkages (e.g., methyl phosphonates, phosphotriesters, phosphoramidates, cabamates, etc.) and with charged linkages (e.g., phosphorothioates, phosphorodithioates, etc.), those containing pendant moieties, such as, for example, proteins (e.g., nucleases, toxins, antibodies, signal peptides, ply-L-lysine, etc.), those with intercalators (e.g., acridine, psoralen, etc.), those containing chelators (e.g., metals, radioactive metals, boron, oxidative metals, etc.), those containing alkylators, those with modified linkages (e.g., alpha anomeric nucleic acids, etc.), as well as unmodified forms of the polynucleotide(s). Further, any of the hydroxyl groups ordinarily present in the sugars can be replaced, for example, by phosphonate groups, phosphate groups, protected by standard protecting groups, or activated to prepare additional linkages to additional nucleotides, or can be conjugated to solid supports. The 5' and 3' terminal OH can be phosphorylated or substituted with amines or organic capping group moieties of from 1 to 20 carbon atoms. Other hydroxyls can also be derivatized to standard protecting groups. Polynucleotides can also contain analogous forms of ribose or deoxyribose sugars that are generally known in the art, including, for example, 2'-O-methyl-, 2'-O-allyl, 2'-fluoro- or 2'-azido-ribose, carbocyclic sugar analogs, .alpha.-anomeric sugars, epimeric sugars such as arabinose, xyloses or lyxoses, pyranose sugars, furanose sugars, sedoheptuloses, acyclic analogs and abasic nucleoside analogs such as methyl riboside. One or more phosphodiester linkages can be replaced by alternative linking groups. These alternative linking groups include, but are not limited to, embodiments wherein phosphate is replaced by P(O)S ("thioate"), P(S)S ("dithioate"), "(O)NR₂" ("amidate"), P(O)R, P(O)OR', CO or CH₂ ("formacetal"), in which each R or R' is independently H or substituted or unsubstituted alkyl (1-20 C) optionally containing an ether (--O--) linkage, aryl, alkenyl, cycloalkyl, cycloalkenyl or araldyl. Not all linkages in a polynucleotide need be identical. The preceding description applies to all polynucleotides referred to herein, including RNA and DNA.

[0049] The term "vector" means a construct, which is capable of delivering, and optionally expressing, one or more

gene(s) or sequence(s) of interest in a host cell. Examples of vectors include, but are not limited to, viral vectors, naked DNA or RNA expression vectors, plasmid, cosmid or phage vectors, DNA or RNA expression vectors associated with cationic condensing agents, DNA or RNA expression vectors encapsulated in liposomes, and certain eukaryotic cells, such as producer cells..

[0050] The terms "polypeptide," "peptide," and "protein" are used interchangeably herein to refer to polymers of amino acids of any length. The polymer can be linear or branched, it can comprise modified amino acids, and it can be interrupted by non-amino acids. The terms also encompass an amino acid polymer that has been modified naturally or by intervention; for example, disulfide bond formation, glycosylation, lipidation, acetylation, phosphorylation, or any other manipulation or modification, such as conjugation with a labeling component. Also included within the definition are, for example, polypeptides containing one or more analogs of an amino acid (including, for example, unnatural amino acids, etc.), as well as other modifications known in the art. It is understood that, because the polypeptides of this disclosure are based upon antibodies, in certain embodiments, the polypeptides can occur as single chains or associated chains.

[0051] The terms "identical" or percent "identity" in the context of two or more nucleic acids or polypeptides, refer to two or more sequences or subsequences that are the same or have a specified percentage of nucleotides or amino acid residues that are the same, when compared and aligned (introducing gaps, if necessary) for maximum correspondence, not considering any conservative amino acid substitutions as part of the sequence identity. The percent identity can be measured using sequence comparison software or algorithms or by visual inspection. Various algorithms and software are known in the art that can be used to obtain alignments of amino acid or nucleotide sequences. One such non-limiting example of a sequence alignment algorithm is the algorithm described in Karlin et al, Proc. Natl. Acad. Sci., 87:2264-2268 (1990), as modified in Karlin et al., Proc. Natl. Acad. Sci., 90:5873-5877 (1993), and incorporated into the NBLAST and XBLAST programs (Altschul et al., Nucleic Acids Res., 25:3389-3402 (1991)). In certain embodiments, Gapped BLAST can be used as described in Altschul et al., Nucleic Acids Res. 25:3389-3402 (1997). BLAST-2, WU-BLAST-2 (Altschul et al., Methods in Enzymology, 266:460-480 (1996)), ALIGN, ALIGN-2 (Genentech, South San Francisco, California) or Megalign (DNASTAR) are additional publicly available software programs that can be used to align sequences. In certain embodiments, the percent identity between two nucleotide sequences is determined using the GAP program in GCG software (e.g., using a NWSgapdna.CMP matrix and a gap weight of 40, 50, 60, 70, or 90 and a length weight of 1, 2, 3, 4, 5, or 6). In certain alternative embodiments, the GAP program in the GCG software package, which incorporates the algorithm of Needleman and Wunsch (J. Mol. Biol. (48):444-453 (1970)) can be used to determine the percent identity between two amino acid sequences (e.g., 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). Alternatively, in certain embodiments, the percent identity between nucleotide or amino acid sequences is determined using the algorithm of Myers and Miller (CABIOS, 4:11-17 (1989)). For example, the percent identity can be determined using the ALIGN program (version 2.0) and using a PAM120 with residue table, a gap length penalty of 12 and a gap penalty of 4. Appropriate parameters for maximal alignment by particular alignment software can be determined by one skilled in the art. In certain embodiments, the default parameters of the alignment software are used. In certain embodiments, the percentage identity "X" of a first amino acid sequence to a second sequence amino acid is calculated as $100 \times (Y/Z)$, where Y is the number of amino acid residues scored as identical matches in the alignment of the first and second sequences (as aligned by visual inspection or a particular sequence alignment program) and Z is the total number of residues in the second sequence. If the length of a first sequence is longer than the second sequence, the percent identity of the first sequence to the second sequence will be longer than the percent identity of the second sequence to the first sequence.

[0052] As a non-limiting example, whether any particular polynucleotide has a certain percentage sequence identity (e.g., is at least 80% identical, at least 85% identical, at least 90% identical, and in some embodiments, at least 95%, 96%, 97%, 98%, or 99% identical) to a reference sequence can, in certain embodiments, be determined using the Bestfit program (Wisconsin Sequence Analysis Package, Version 8 for Unix, Genetics Computer Group, University Research Park, 575 Science Drive, Madison, WI 53711). Bestfit uses the local homology algorithm of Smith and Waterman (Advances in Applied Mathematics 2: 482 489 (1981)) to find the best segment of homology between two sequences. When using Bestfit or any other sequence alignment program to determine whether a particular sequence is, for instance, 95% identical to a reference sequence according to the present disclosure, the parameters are set such that the percentage of identity is calculated over the full length of the reference nucleotide sequence and that gaps in homology of up to 5% of the total number of nucleotides in the reference sequence are allowed.

[0053] In some embodiments, two nucleic acids or polypeptides of the disclosure are substantially identical, meaning they have at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, and in some embodiments at least 95%, 96%, 97%, 98%, 99% nucleotide or amino acid residue identity, when compared and aligned for maximum correspondence, as measured using a sequence comparison algorithm or by visual inspection. Identity can exist over a region of the sequences that is at least about 10, about 20, about 40-60 residues in length or any integral value there between, and can be over a longer region than 60-80 residues, for example, at least about 90-100 residues, and in some embodiments, the sequences are substantially identical over the full length of the sequences being compared, such as the coding region of a nucleotide sequence for example.

[0054] A "conservative amino acid substitution" is one in which one amino acid residue is replaced with another amino acid residue having a similar side chain. Families of amino acid residues having similar side chains have been defined in the art, including basic side chains (e.g., lysine, arginine, histidine), acidic side chains (e.g., aspartic acid, glutamic acid), uncharged polar side chains (e.g., glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine), nonpolar side chains (e.g., alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan), beta-branched side chains (e.g., threonine, valine, isoleucine) and aromatic side chains (e.g., tyrosine, phenylalanine, tryptophan, histidine). For example, substitution of a phenylalanine for a tyrosine is a conservative substitution. In some embodiments, conservative substitutions in the sequences of the polypeptides and antibodies of the disclosure do not abrogate the binding of the antibody containing the amino acid sequence, to the antigen(s), e.g., the TNF-alpha to which the antibody binds. Methods of identifying nucleotide and amino acid conservative substitutions which do not eliminate antigen binding are well-known in the art (see, e.g., Brummell et al., *Biochem. 32*: 1180-1 187 (1993); Kobayashi et al., *Protein Eng. 12*(10):879-884 (1999); and Burks et al., *Proc. Natl. Acad. Sci. USA 94*:412-417 (1997)).

[0055] In the present disclosure, the term "protecting group" or "PG" refers to group that blocks, i.e., protects, the amine functionality while reactions are carried out on other functional groups or parts of the molecule. Those skilled in the art will be familiar with the selection, attachment, and cleavage of amine protecting groups, and will appreciate that many different protective groups are known in the art, the suitability of one protective group or another being dependent on the particular the synthetic scheme planned. Treatises on the subject are available for consultation, such as Wuts, P. G. M.; Greene, T. W., "Greene's Protective Groups in Organic Synthesis", 4th Ed., J. Wiley & Sons, NY, 2007. Suitable protecting groups include the carbobenzyloxy (Cbz), *tert*-butyloxycarbonyl (BOC), 9-fluorenylmethyloxycarbonyl (Fmoc), and benzyl (Bn) group. In one embodiment, the protecting group is the BOC group.

[0056] The compounds disclosed herein contain asymmetric centers and thus give rise to enantiomers, diastereomers, and other stereoisomeric forms. The present disclosure is meant to encompass the use of all such possible forms, as well as their racemic and resolved forms and mixtures thereof. The individual enantiomers can be separated according to methods known in the art in view of the present disclosure. When the compounds described herein contain olefinic double bonds or other centers of geometric asymmetry, and unless specified otherwise, it is intended that they include both E and Z geometric isomers. All tautomers are also intended to be encompassed by the present disclosure.

[0057] The present disclosure encompasses the preparation and use of solvates of the compounds disclosed herein. Solvates typically do not significantly alter the physiological activity or toxicity of the compounds, and as such may function as pharmacological equivalents. The term "solvate" as used herein is a combination, physical association and/or solvation of a compound of the present disclosure with a solvent molecule such as, e.g. a disolvate, monosolvate or hemisolvate, where the ratio of solvent molecule to compound of the present disclosure is about 2:1, about 1:1 or about 1:2, respectively. This physical association involves varying degrees of ionic and covalent bonding, including hydrogen bonding. In certain instances, the solvate can be isolated, such as when one or more solvent molecules are incorporated into the crystal lattice of a crystalline solid. Thus, "solvate" encompasses both solution-phase and isolatable solvates. Compounds disclosed herein can be present as solvated forms with a pharmaceutically acceptable solvent, such as water, methanol, ethanol, and the like, and it is intended that the disclosure includes both solvated and unsolvated forms of compounds disclosed herein. One type of solvate is a hydrate. A "hydrate" relates to a particular subgroup of solvates where the solvent molecule is water. Solvates typically can function as pharmacological equivalents. Preparation of solvates is known in the art. See, for example, M. Caira et al, *J. Pharmaceut. Sci.*, 93(3):601-611 (2004), which describes the preparation of solvates of fluconazole with ethyl acetate and with water. Similar preparation of solvates, hemisolvates, hydrates, and the like are described by E.C. van Tonder et al., *AAPS Pharm. Sci. Tech.*, 5(1):Article 12 (2004), and A.L. Bingham et al., *Chem. Commun.* 603-604 (2001). A typical, non-limiting, process of preparing a solvate would involve dissolving a compound disclosed herein in a desired solvent (organic, water, or a mixture thereof) at temperatures above 20°C to about 25°C, then cooling the solution at a rate sufficient to form crystals, and isolating the crystals by known methods, e.g., filtration. Analytical techniques such as infrared spectroscopy can be used to confirm the presence of the solvent in a crystal of the solvate.

[0058] The present disclosure encompasses the preparation and use of salts of the compounds disclosed herein, including non-toxic pharmaceutically acceptable salts. Examples of pharmaceutically acceptable addition salts include inorganic and organic acid addition salts and basic salts. The pharmaceutically acceptable salts include, but are not limited to, metal salts such as sodium salt, potassium salt, cesium salt and the like; alkaline earth metals such as calcium salt, magnesium salt and the like; organic amine salts such as triethylamine salt, pyridine salt, picoline salt, ethanolamine salt, triethanolamine salt, dicyclohexylamine salt, N,N'-dibenzylethylenediamine salt and the like; inorganic acid salts such as hydrochloride, hydrobromide, phosphate, sulphate and the like; organic acid salts such as citrate, lactate, tartrate, maleate, fumarate, mandelate, acetate, dichloroacetate, trifluoroacetate, oxalate, formate and the like; sulfonates such as methanesulfonate, benzenesulfonate, p-toluenesulfonate and the like; and amino acid salts such as arginate, aspartate, glutamate and the like.

[0059] Acid addition salts can be formed by mixing a solution of the particular compound disclosed with a solution of a pharmaceutically acceptable non-toxic acid such as hydrochloric acid, fumaric acid, maleic acid, succinic acid, acetic

acid, citric acid, tartaric acid, carbonic acid, phosphoric acid, oxalic acid, dichloroacetic acid, or the like. Basic salts can be formed by mixing a solution of the compound of the present disclosure with a solution of a pharmaceutically acceptable non-toxic base such as sodium hydroxide, potassium hydroxide, choline hydroxide, sodium carbonate and the like.

[0060] As used in the present disclosure and claims, the singular forms "a," "an," and "the" include plural forms unless the context clearly dictates otherwise.

[0061] It is understood that wherever embodiments are described herein with the language "comprising," otherwise analogous embodiments described in terms of "consisting of" and/or "consisting essentially of" are also provided.

[0062] The term "and/or" as used in a phrase such as "A and/or B" herein is intended to include both "A and B," "A or B," "A," and "B." Likewise, the term "and/or" as used in a phrase such as "A, B, and/or C" is intended to encompass each of the following embodiments: A, B, and C; A, B, or C; A or C; A or B; B or C; A and C; A and B; B and C; A (alone); B (alone); and C (alone).

II. Proteins for linkage to glucocorticoid receptor agonists

[0063] The present disclosure provides agents immunoconjugates containing glucocorticoid receptor agonists linked to proteins, for example, antibodies or antigen-binding fragments thereof and soluble receptor proteins. In some embodiments, the antibody or antigen-binding fragment thereof is human, humanized, chimeric, or murine. In some embodiments, the protein, e.g., antibody, antigen-binding fragment thereof, or soluble receptor protein, can bind to a target on the surface of a cell and become internalized.

[0064] The present disclosure also provides immunoconjugates containing glucocorticoid receptor agonists linked to anti-TNF alpha proteins. In certain embodiments, the anti-TNF alpha proteins are antibodies or antigen-binding fragments thereof. In certain embodiments, the anti-TNF alpha proteins are antibodies or antigen-binding fragments thereof that bind to TNF alpha (e.g., soluble TNF alpha and/or membrane bound TNF alpha). In certain embodiments, the anti-TNF alpha proteins are soluble TNF receptor proteins, e.g., soluble TNF receptor proteins fused to a heavy chain constant domain or fragment thereof such as an Fc. In some embodiments, the anti-TNF alpha protein, e.g., anti-TNF antibody, antigen-binding fragment thereof, or soluble TNF receptor can bind to TNF alpha on the surface of a cell and become internalized. For example, US 2014/0294813 discloses anti-TNF proteins that exhibit cellular internalization upon binding to cell surface human TNF.

[0065] In certain embodiments, the antibodies or antigen-binding fragments thereof bind to human and/or mouse TNF-alpha. Antibodies and antigen-binding fragments that bind to TNF-alpha are known in the art.

[0066] The full-length amino acid sequence for membrane bound human TNF alpha is:

MSTESMIRDVELAEEALPKKTGGPQGSRRCLFLSLFSFLIVAGATTLCLLHFGVIGPQ
REEFPRDLISPLAQAVRSSSRTPSDKPVAVHVVANPQAEGLQWLNRRANALLANGVELRDNQ
LVVPSEGLYLIYSQVLFKGGQCPSTHVLLTHTISRIAVSYQTKVNLLSAIKSPCQRETPEGAEAKP

WYEPIYLGGVFQLEKGDRLSAEINRPDYLDFAESGQVYFGIIAL (SEQ ID NO:1). Soluble human TNF alpha contains amino acids 77-233 of SEQ ID NO:1. The full-length amino acid sequence for membrane bound murine TNF-alpha is:

MSTESMIRDVELAEEALPQKMGGFQNSRRCLCLSLFSFLLVAGATTLCLLNFGVIGPQRDEKFPN
GLPLISSMAQTLTLRSSSQNSSDKPVAVHVVANHQVEEQLEWLSQRANALLANGMDLKDNLV

PADGLYLVYSQVLFKGGQCPDYVLLTHTVSRFAISYQEKVNLLSAVKSPCKDTPEGAELKPWY EPIYLGGVFQLE-
KGDQLSAEVNLPKYLDFAESGQVYFGVIAL (SEQ ID NO:2). Soluble murine TNF alpha contains amino acids 80-235 of SEQ ID NO:2.

[0067] In some embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof binds to human TNF-alpha. In some embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof is human, humanized, or chimeric.

[0068] In some embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof binds to murine TNF-alpha. In some embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof is murine.

[0069] In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment has one or more of the following effects: neutralizes human TNF-alpha cytotoxicity in a *in vitro* L929 assay with an IC₅₀ of 1X10⁻⁷ M or less; blocks the interaction of TNF-alpha with p55 and p75 cell surface receptors; and/or lyses surface TNF expressing cells *in vitro* in the presence of complement.

[0070] In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment does not bind to TNF-beta.

[0071] Anti-TNF-alpha antibodies and antigen-binding fragments thereof include, for example, adalimumab, infliximab, certolizumab pegol, afelimomab, nerelimomab, ozoralizumab, placulumab, and golimumab. Additional anti-TNF-alpha antibodies and antigen-binding fragments are provided, for example, in WO 2013/087912, WO 2014/152247 and WO 2015/073884.

[0072] Adalimumab is described in U.S. Patent No. 6,258,562. Infliximab is described in U.S. Patent No. 5,656,272. Certolizumab is discussed in WO 01/94585. Afelimomab (also known as MAK195) is discussed in Vincent, Int. J. Clin. Pract. 54: 190-193 (2000). Ozoralizumab (also known as ATN-103) is a nanobody. It contains three heavy chain variable

regions fused by GlySer linkers. Variable regions 1 and 3 are identical, and ozoralizumab does not contain a heavy chain. Ozoralizumab is discussed in WO 2012/131053. Placulumab (also known as CEP-37247) is a domain antibody consisting of a dimer of VL-pCH1-CH2-CH3 or [V-kappa]2-Fc and is discussed in Gay et al., Mabs 2: 625-638 (2010). Golimumab (also known as CNTO 148) is discussed in WO2013/087912, and sequences are provided in GenBank: DI496971.1 and GenBank DI 496970.1.

[0073] Anti-TNF-alpha antibodies and antigen-binding fragments thereof also include antibodies and antigen-binding fragments thereof that competitively inhibit binding of adalimumab, infliximab, certolizumab pegol, afelimomab, nerelimomab, ozoralizumab, placulumab, or golimumab to TNF-alpha. Anti-TNF-alpha antibodies and antigen-binding fragments thereof also include antibodies and antigen-binding fragments that bind to the same TNF-alpha epitope as adalimumab, infliximab, certolizumab pegol, afelimomab, nerelimomab, ozoralizumab, placulumab, or golimumab.

[0074] In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof competitively inhibits binding of adalimumab to TNF-alpha. In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof binds to the same TNF-alpha epitope as adalimumab. In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof is adalimumab or an antigen-binding fragment thereof. In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof is adalimumab.

[0075] In certain embodiments, the anti-TNF-alpha antibody or antigen-binding fragment thereof comprises sequences of adalimumab. Sequences of adalimumab are provided in Tables 1-6.

Table 1 Variable heavy chain CDR amino acid sequences:

Antibody	VH-CDR1	VH-CDR2	VH-CDR3
adalimumab	DYAMH (SEQ ID NO:3) or GFTFDDYAMH (SEQ ID NO:6)	AITWNSGHIDYADSVEG (SEQ ID NO:4)	VSYLSTASS (SEQ ID NO:5) VSYLSTASSLDY (SEQ ID NO:94)

Table 2: Variable light chain CDR amino acid sequences

Antibody	VL-CDR1	VL-CDR2	VL-CDR3
adalimumab	RASQGIRNYLA (SEQ ID NO:32)	AASTLQS (SEQ ID NO:33)	QRYNRAPYT (SEQ ID NO:34)

Table 3: Variable heavy chain amino acid sequences

Antibody	VH Amino Acid Sequence (SEQ ID NO)
adalimumab	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSA ITWNSGHIDYADSVEGRFTISRDNAKNSLYLQMNSLRAEDTAVYYCAKVS Y LSTASSLDYWGQGTLVTVSS(SEQ ID NO:50)

Table 4: Variable light chain amino acid sequences

Antibody	VL Amino Acid Sequence (SEQ ID NO)
adalimumab	DIQMTQSPSSLSASVGDRVTITCRASQGIRNYLAWYQQKPGKAPKLLIYAAS TLQSGVPSRFSGSGSGTDFTLTISSLQPEDVATYYCQRYNRAPYTFGGQGTKV EIK (SEQ ID NO:59)

Table 5: Full-lenth heavy chain amino acid sequences

Antibody	Full-Length Heavy Chain Amino Acid Sequence (SEQ ID NO)
Adalimumab (D2E7)	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSA ITWNSGHIDYADSV EGRFTISRDN AKNSLYLQMNSLRAEDTAVYYCAKVS Y LSTASSLDYWGQGTLVTVSSASTKGPSVFPLAPSSKSTSGGTAALGCLVKDY FPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTQTYICNV N HKPSNTKVDKKVEPKSCDKTHTCPPCPAPELLGGPSVFLFPPKPKDTLMIS R TPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYNSTYRVVS V LTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSR D ELTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLY S KLTVDKSRWOOGNVFCSSVMHEALHNHYTOKSI SLSPGK (SEQ ID NO:66)

Table 6: Full-length light chain amino acid sequences

Antibody	Full-length Light Chain Amino Acid Sequence (SEQ ID NO)
Adalimumab (D2E7)	DIQMTQSPSSLSASVGDRVTITCRASQGIRNYLAWYQQKPGKAPKLLIYAAS TLQSGVPSRFSGSGSGTDFTLTISSLQPEDVATYYCQRYNRAPYTFGQGTKV EIKRTVAAPSVFIFPPSDEQLKSGTASVVCLLNFPYPREAKVQWKVDNALQS GNSQESVTEQDSKDYSLSSLTLSKADYEKHKVYACEVTHQGLSSPVTKS FNRGEC (SEQ ID NO:73)

[0076] Monoclonal antibodies can be prepared using hybridoma methods, such as those described by Kohler and Milstein (1975) Nature 256:495. Using the hybridoma method, a mouse, hamster, or other appropriate host animal, is immunized to elicit the production by lymphocytes of antibodies that will specifically bind to an immunizing antigen. Lymphocytes can also be immunized *in vitro*. Following immunization, the lymphocytes are isolated and fused with a suitable myeloma cell line using, for example, polyethylene glycol, to form hybridoma cells that can then be selected away from unfused lymphocytes and myeloma cells. Hybridomas that produce monoclonal antibodies directed specifically against a chosen antigen as determined by immunoprecipitation, immunoblotting, or by an *in vitro* binding assay (e.g., radioimmunoassay (RIA); enzyme-linked immunosorbent assay (ELISA)) can then be propagated either *in vitro* culture using standard methods (Goding, Monoclonal Antibodies: Principles and Practice, Academic Press, 1986) or *in vivo* as ascites tumors in an animal. The monoclonal antibodies can then be purified from the culture medium or ascites fluid as described for polyclonal antibodies.

[0077] Alternatively monoclonal antibodies can also be made using recombinant DNA methods as described in U.S. Patent 4,816,567. The polynucleotides encoding a monoclonal antibody are isolated from mature B-cells or hybridoma cells, such as by RT-PCR using oligonucleotide primers that specifically amplify the genes encoding the heavy and light chains of the antibody, and their sequence is determined using conventional procedures. The isolated polynucleotides encoding the heavy and light chains are then cloned into suitable expression vectors, which when transfected into host cells such as *E. coli* cells, simian COS cells, Chinese hamster ovary (CHO) cells, or myeloma cells that do not otherwise produce immunoglobulin protein, monoclonal antibodies are generated by the host cells. Also, recombinant monoclonal antibodies or fragments thereof of the desired species can be isolated from phage display libraries expressing CDRs of the desired species as described (McCafferty et al., 1990, Nature, 348:552-554; Clackson et al., 1991, Nature, 352:624-628; and Marks et al., 1991, J. Mol. Biol., 222:581-597).

[0078] The polynucleotide(s) encoding a monoclonal antibody can further be modified in a number of different manners using recombinant DNA technology to generate alternative antibodies. In some embodiments, the constant domains of the light and heavy chains of, for example, a mouse monoclonal antibody can be substituted 1) for those regions of, for example, a human antibody to generate a chimeric antibody or 2) for a non-immunoglobulin polypeptide to generate a fusion antibody. In some embodiments, the constant regions are truncated or removed to generate the desired antibody fragment of a monoclonal antibody. Site-directed or high-density mutagenesis of the variable region can be used to optimize specificity, affinity, etc. of a monoclonal antibody.

[0079] In some embodiments, the monoclonal antibody against the TNF-alpha is a humanized antibody. In certain embodiments, such antibodies are used therapeutically to reduce antigenicity and HAMA (human anti-mouse antibody) responses when administered to a human subject.

[0080] Methods for engineering, humanizing or resurfacing non-human or human antibodies can also be used and are well known in the art. A humanized, resurfaced or similarly engineered antibody can have one or more amino acid

residues from a source that is non-human, e.g., but not limited to, mouse, rat, rabbit, non-human primate or other mammal. These non-human amino acid residues are replaced by residues that are often referred to as "import" residues, which are typically taken from an "import" variable, constant or other domain of a known human sequence.

[0081] Such imported sequences can be used to reduce immunogenicity or reduce, enhance or modify binding, affinity, on-rate, off-rate, avidity, specificity, half-life, or any other suitable characteristic, as known in the art. In general, the CDR residues are directly and most substantially involved in influencing TNF-alpha binding. Accordingly, part or all of the non-human or human CDR sequences are maintained while the non-human sequences of the variable and constant regions can be replaced with human or other amino acids.

[0082] Antibodies can also optionally be humanized, resurfaced, engineered or human antibodies engineered with retention of high affinity for the antigen e.g., TNF-alpha, and other favorable biological properties. To achieve this goal, humanized (or human) or engineered antibodies and resurfaced antibodies can be optionally prepared by a process of analysis of the parental sequences and various conceptual humanized and engineered products using three-dimensional models of the parental, engineered, and humanized sequences. Three-dimensional immunoglobulin models are commonly available and are familiar to those skilled in the art. Computer programs are available which illustrate and display probable three-dimensional conformational structures of selected candidate immunoglobulin sequences. Inspection of these displays permits analysis of the likely role of the residues in the functioning of the candidate immunoglobulin sequence, i.e., the analysis of residues that influence the ability of the candidate immunoglobulin to bind its antigen, such as TNF-alpha. In this way, framework (FR) residues can be selected and combined from the consensus and import sequences so that the desired antibody characteristic, such as increased affinity for the target antigen(s), is achieved.

[0083] Humanization, resurfacing or engineering of antibodies of the present disclosure can be performed using any known method, such as but not limited to those described in, Winter (Jones et al., Nature 321:522 (1986); Riechmann et al., Nature 332:323 (1988); Verhoeyen et al., Science 239:1534 (1988)), Sims et al., J. Immunol. 151: 2296 (1993); Chothia and Lesk, J. Mol. Biol. 196:901 (1987), Carter et al., Proc. Natl. Acad. Sci. U.S.A. 89:4285 (1992); Presta et al., J. Immunol. 151:2623 (1993), U.S. Pat. Nos. 5,639,641, 5,723,323; 5,976,862; 5,824,514; 5,817,483; 5,814,476; 5,763,192; 5,723,323; 5,766,886; 5,714,352; 6,204,023; 6,180,370; 5,693,762; 5,530,101; 5,585,089; 5,225,539; 4,816,567; PCT/: US98/16280; US96/18978; US91/09630; US91/05939; US94/01234; GB89/01334; GB91/01134; GB92/01755; WO90/14443; WO90/14424; WO90/14430; EP 229246; 7,557,189; 7,538,195; and 7,342,110.

[0084] In certain alternative embodiments, the antibody (e.g., an anti-TNFalpha antibody) is a human antibody. Human antibodies can be directly prepared using various techniques known in the art. Immortalized human B lymphocytes immunized *in vitro* or isolated from an immunized individual that produce an antibody directed against a target antigen can be generated (See, e.g., Cole et al., Monoclonal Antibodies and Cancer Therapy, Alan R. Liss, p. 77 (1985); Boemer et al., 1991, J. Immunol., 147 (1):86-95; and U.S. Patent 5,750,373). Also, the human antibody can be selected from a phage library, where that phage library expresses human antibodies, as described, for example, in Vaughan et al., 1996, Nat. Biotech., 14:309-314, Sheets et al., 1998, Proc. Nat'l. Acad. Sci., 95:6157-6162, Hoogenboom and Winter, 1991, J. Mol. Biol., 227:381, and Marks et al., 1991, J. Mol. Biol., 222:581). Techniques for the generation and use of antibody phage libraries are also described in U.S. Patent Nos. 5,969,108, 6,172,197, 5,885,793, 6,521,404; 6,544,731; 6,555,313; 6,582,915; 6,593,081; 6,300,064; 6,653,068; 6,706,484; and 7,264,963; and Rothe et al., 2007, J. Mol. Bio., doi:10.1016/j.jmb.2007.12.018. Affinity maturation strategies and chain shuffling strategies (Marks et al., 1992, Bio/Technology 10:779-783) are known in the art and can be employed to generate high affinity human antibodies.

[0085] Humanized antibodies can also be made in transgenic mice containing human immunoglobulin loci that are capable upon immunization of producing the full repertoire of human antibodies in the absence of endogenous immunoglobulin production. This approach is described in U.S. Patents 5,545,807; 5,545,806; 5,569,825; 5,625,126; 5,633,425; and 5,661,016.

[0086] In certain embodiments are provided an antibody fragment to, for example, increase tumor penetration. Various techniques are known for the production of antibody fragments. Traditionally, these fragments are derived via proteolytic digestion of intact antibodies (for example Morimoto et al., 1993, Journal of Biochemical and Biophysical Methods 24:107-117; Brennan et al., 1985, Science, 229:81). In certain embodiments, antibody fragments are produced recombinantly. Fab, Fv, and scFv antibody fragments can all be expressed in and secreted from *E. coli* or other host cells, thus allowing the production of large amounts of these fragments. Such antibody fragments can also be isolated from antibody phage libraries. The antibody fragment can also be linear antibodies as described in U.S. Patent 5,641,870. Other techniques for the production of antibody fragments will be apparent to the skilled practitioner.

[0087] For the purposes of the present disclosure, it should be appreciated that modified antibodies can comprise any type of variable region that provides for the association of the antibody with the antigen (e.g., TNF alpha). In this regard, the variable region can comprise or be derived from any type of mammal that can be induced to mount a humoral response and generate immunoglobulins against the desired tumor associated antigen. As such, the variable region of the modified antibodies can be, for example, of human, murine, non-human primate (e.g., cynomolgus monkeys, macaques, etc.) or lupine origin. In some embodiments both the variable and constant regions of the modified immunoglobulins are human. In other embodiments the variable regions of compatible antibodies (usually derived from a non-

human source) can be engineered or specifically tailored to improve the binding properties or reduce the immunogenicity of the molecule. In this respect, variable regions useful in the present disclosure can be humanized or otherwise altered through the inclusion of imported amino acid sequences.

[0088] Anti-TNF alpha proteins include soluble TNF receptor proteins. The anti-TNF alpha protein can be a soluble p75 TNF receptor. The anti-TNF alpha protein can be a soluble p55 TNF receptor.

[0089] The soluble TNF receptor can bind to both TNF alpha and TNF beta. The soluble TNF receptor can bind to TNF alpha, but not to TNF beta.

[0090] The soluble TNF receptor can inhibit binding of TNF alpha (and optionally TNF beta) to cell surface TNF receptors.

[0091] The soluble TNF receptor can be etanercept.

[0092] An anti-TNF alpha protein, e.g., a soluble TNF receptor, can be fused to a heavy chain constant domain or fragment thereof or an Fc region or fragment thereof. The heavy chain constant domain fragment or Fc fragment can be a portion of the constant domain or Fc that is capable of binding to Fc receptor. The heavy chain constant domain fragment or Fc fragment can be a portion of the constant domain or Fc that is capable of inducing cell lysis *in vitro* in the presence of complement. The heavy chain constant domain fragment or Fc fragment can be a portion of the constant domain or Fc that is capable of inducing ADCC.

[0093] The heavy chain constant domain or fragment thereof or Fc region or fragment thereof can be a human heavy chain constant domain or fragment thereof or human Fc region or fragment thereof. The heavy chain constant domain or fragment thereof or Fc region or fragment thereof can be an IgG1 heavy chain constant domain or fragment thereof or an IgG1 Fc region or fragment thereof. The heavy chain constant domain or fragment thereof or Fc region or fragment thereof can be a human IgG1 heavy chain constant domain or fragment thereof or human IgG1 Fc region or fragment thereof.

[0094] Those skilled in the art will appreciate that the antibodies and antigen-binding fragments thereof of this disclosure and the anti-TNF proteins of this disclosure include antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) comprising one or more of constant region domains, including domains that have been altered so as to provide desired biochemical characteristics such as reduced serum half-life when compared with an antibody, antigen-binding fragment thereof, or anti-TNF protein of approximately the same immunogenicity comprising a native or unaltered constant region. In some embodiments, the constant region of the antibody, antigen-binding fragment thereof, or anti-TNF protein (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) will comprise a human constant region. Modifications to the constant region compatible with this disclosure comprise additions, deletions, or substitutions of one or more amino acids in one or more domains. That is, the antibody, antigen-binding fragment thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) disclosed herein can comprise alterations or modifications to one or more of the three heavy chain constant domains (CH1, CH2 or CH3) and/or to the light chain constant domain (CL). In some embodiments, modified constant regions wherein one or more domains are partially or entirely deleted are contemplated. In some embodiments, the antibodies, antigen-binding fragments thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) will comprise domain deleted constructs or variants wherein the entire CH2 domain has been removed (Δ CH2 constructs). In some embodiments, the omitted constant region domain will be replaced by a short amino acid spacer (e.g., 10 residues) that provides some of the molecular flexibility typically imparted by the absent constant region.

[0095] It will be noted that in certain embodiments, the antibodies, antigen-binding fragments thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) can be engineered to fuse the CH3 domain directly to the hinge region of the respective antibodies, antigen-binding fragments thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins). In other constructs it can be desirable to provide a peptide spacer between the hinge region and the modified CH2 and/or CH3 domains. For example, compatible constructs could be expressed wherein the CH2 domain has been deleted and the remaining CH3 domain (modified or unmodified) is joined to the hinge region with a 5-20 amino acid spacer. Such a spacer can be added, for instance, to ensure that the regulatory elements of the constant domain remain free and accessible or that the hinge region remains flexible. However, it should be noted that amino acid spacers can, in some cases, prove to be immunogenic and elicit an unwanted immune response against the construct. Accordingly, in certain embodiments, any spacer added to the construct will be relatively non-immunogenic, or even omitted altogether, so as to maintain the desired biochemical qualities of the antibodies, antigen-binding fragments thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins).

[0096] It will be appreciated that the antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) of the present disclosure can be provided by the partial deletion or substitution of a few or even a single amino acid. For example, the mutation of a single amino acid in selected areas of the CH2 domain can be enough to substantially reduce Fc binding and thereby

increase tumor localization. Similarly, it may be desirable to simply delete that part of one or more constant region domains that control the effector function (e.g., complement C1Q binding) to be modulated. Such partial deletions of the constant regions can improve selected characteristics of the antibody (serum half-life) while leaving other desirable functions associated with the subject constant region domain intact. Moreover, as alluded to above, the constant regions of the disclosed antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) can be modified through the mutation or substitution of one or more amino acids that enhances the profile of the resulting construct. In this respect it can be possible to disrupt the activity provided by a conserved binding site (e.g., Fc binding) while substantially maintaining the configuration and immunogenic profile of the antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins). Certain embodiments can comprise the addition of one or more amino acids to the constant region to enhance desirable characteristics such as decreasing or increasing effector function or provide for more glucocorticoid receptor agonist attachment. In such embodiments it can be desirable to insert or replicate specific sequences derived from selected constant region domains.

[0097] It will be appreciated that the antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) of the present disclosure can be modified to reduce immunogenicity, i.e., to reduce the anti-drug immune response (ADA). Methods of doing so are disclosed, for example, in WO 2015/073884.

[0098] The present disclosure further embraces variants and equivalents which are substantially homologous to antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) set forth herein. These can contain, for example, conservative substitution mutations, i.e., the substitution of one or more amino acids by similar amino acids. For example, conservative substitution refers to the substitution of an amino acid with another within the same general class such as, for example, one acidic amino acid with another acidic amino acid, one basic amino acid with another basic amino acid or one neutral amino acid by another neutral amino acid. What is intended by a conservative amino acid substitution is well known in the art.

[0099] The polypeptides of the present disclosure can be recombinant polypeptides, natural polypeptides, or synthetic polypeptides of an antibody, antigen-binding fragment thereof, or anti-TNF protein. It will be recognized in the art that some amino acid sequences of the disclosure can be varied without significant effect of the structure or function of the protein. Thus, the disclosure further includes variations of the polypeptides which show substantial activity or which include regions of an antibody, antigen-binding fragment thereof, or anti-TNF alpha protein. Such mutants include deletions, insertions, inversions, repeats, and type substitutions.

[0100] The polypeptides and analogs can be further modified to contain additional chemical moieties not normally part of the protein. Those derivatized moieties can improve the solubility, the biological half life or absorption of the protein. The moieties can also reduce or eliminate any desirable side effects of the proteins and the like. An overview for those moieties can be found in REMINGTON'S PHARMACEUTICAL SCIENCES, 20th ed., Mack Publishing Co., Easton, PA (2000).

[0101] The isolated polypeptides described herein can be produced by any suitable method known in the art. Such methods range from direct protein synthetic methods to constructing a DNA sequence encoding isolated polypeptide sequences and expressing those sequences in a suitable transformed host. In some embodiments, a DNA sequence is constructed using recombinant technology by isolating or synthesizing a DNA sequence encoding a wild-type protein of interest. Optionally, the sequence can be mutagenized by site-specific mutagenesis to provide functional analogs thereof. See, e.g., Zoeller et al., Proc. Nat'l. Acad. Sci. USA 81:5662-5066 (1984) and U.S. Pat. No. 4,588,585.

[0102] In some embodiments a DNA sequence encoding a polypeptide of interest would be constructed by chemical synthesis using an oligonucleotide synthesizer. Such oligonucleotides can be designed based on the amino acid sequence of the desired polypeptide and selecting those codons that are favored in the host cell in which the recombinant polypeptide of interest will be produced. Standard methods can be applied to synthesize an isolated polynucleotide sequence encoding an isolated polypeptide of interest. For example, a complete amino acid sequence can be used to construct a back-translated gene. Further, a DNA oligomer containing a nucleotide sequence coding for the particular isolated polypeptide can be synthesized. For example, several small oligonucleotides coding for portions of the desired polypeptide can be synthesized and then ligated. The individual oligonucleotides typically contain 5' or 3' overhangs for complementary assembly.

[0103] Once assembled (by synthesis, site-directed mutagenesis or another method), the polynucleotide sequences encoding a particular isolated polypeptide of interest will be inserted into an expression vector and operatively linked to an expression control sequence appropriate for expression of the protein in a desired host. Proper assembly can be confirmed by nucleotide sequencing, restriction mapping, and expression of a biologically active polypeptide in a suitable host. As is well known in the art, in order to obtain high expression levels of a transfected gene in a host, the gene must be operatively linked to transcriptional and translational expression control sequences that are functional in the chosen expression host.

[0104] In certain embodiments, recombinant expression vectors are used to amplify and express DNA encoding

antibodies, antigen-binding fragments thereof, or anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins). Recombinant expression vectors are replicable DNA constructs which have synthetic or cDNA-derived DNA fragments encoding a polypeptide chain of an antibody, antigen-binding fragment thereof, or anti-TNF protein (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins), operatively linked to suitable transcriptional or translational regulatory elements derived from mammalian, microbial, viral or insect genes. A transcriptional unit generally comprises an assembly of (1) a genetic element or elements having a regulatory role in gene expression, for example, transcriptional promoters or enhancers, (2) a structural or coding sequence which is transcribed into mRNA and translated into protein, and (3) appropriate transcription and translation initiation and termination sequences. Such regulatory elements can include an operator sequence to control transcription. The ability to replicate in a host, usually conferred by an origin of replication, and a selection gene to facilitate recognition of transformants can additionally be incorporated. DNA regions are operatively linked when they are functionally related to each other. For example, DNA for a signal peptide (secretory leader) is operatively linked to DNA for a polypeptide if it is expressed as a precursor which participates in the secretion of the polypeptide; a promoter is operatively linked to a coding sequence if it controls the transcription of the sequence; or a ribosome binding site is operatively linked to a coding sequence if it is positioned so as to permit translation. Structural elements intended for use in yeast expression systems include a leader sequence enabling extracellular secretion of translated protein by a host cell. Alternatively, where recombinant protein is expressed without a leader or transport sequence, it can include an N-terminal methionine residue. This residue can optionally be subsequently cleaved from the expressed recombinant protein to provide a final product.

[0105] The choice of expression control sequence and expression vector will depend upon the choice of host. A wide variety of expression host/vector combinations can be employed. Useful expression vectors for eukaryotic hosts, include, for example, vectors comprising expression control sequences from SV40, bovine papilloma virus, adenovirus and cytomegalovirus. Useful expression vectors for bacterial hosts include known bacterial plasmids, such as plasmids from *Escherichia coli*, including pCR 1, pBR322, pMB9 and their derivatives, wider host range plasmids, such as M13 and filamentous single-stranded DNA phages.

[0106] Suitable host cells for expression of antibodies, antigen-binding fragments thereof, and anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins) include prokaryotes, yeast, insect or higher eukaryotic cells under the control of appropriate promoters. Prokaryotes include gram negative or gram positive organisms, for example *E. coli* or bacilli. Higher eukaryotic cells include established cell lines of mammalian origin. Cell-free translation systems could also be employed. Appropriate cloning and expression vectors for use with bacterial, fungal, yeast, and mammalian cellular hosts are described by Pouwels et al. (Cloning Vectors: A Laboratory Manual, Elsevier, N.Y., 1985). Additional information regarding methods of protein production, including antibody production, can be found, e.g., in U.S. Patent Publication No. 2008/0187954, U.S. Patent Nos. 6,413,746 and 6,660,501, and International Patent Publication No. WO 04009823.

[0107] Various mammalian or insect cell culture systems are also advantageously employed to express recombinant protein. Expression of recombinant proteins in mammalian cells can be performed because such proteins are generally correctly folded, appropriately modified and completely functional. Examples of suitable mammalian host cell lines include HEK-293 and HEK-293T, the COS-7 lines of monkey kidney cells, described by Gluzman (Cell 23:175, 1981), and other cell lines including, for example, L cells, C127, 3T3, Chinese hamster ovary (CHO), HeLa and BHK cell lines. Mammalian expression vectors can comprise nontranscribed elements such as an origin of replication, a suitable promoter and enhancer linked to the gene to be expressed, and other 5' or 3' flanking nontranscribed sequences, and 5' or 3' non-translated sequences, such as necessary ribosome binding sites, a polyadenylation site, splice donor and acceptor sites, and transcriptional termination sequences. Baculovirus systems for production of heterologous proteins in insect cells are reviewed by Luckow and Summers, Bio/Technology 6:47 (1988).

[0108] The proteins produced by a transformed host can be purified according to any suitable method. Such standard methods include chromatography (e.g., ion exchange, affinity and sizing column chromatography), centrifugation, differential solubility, or by any other standard technique for protein purification. Affinity tags such as hexahistidine, maltose binding domain, influenza coat sequence and glutathione-S-transferase can be attached to the protein to allow easy purification by passage over an appropriate affinity column. Isolated proteins can also be physically characterized using such techniques as proteolysis, nuclear magnetic resonance and x-ray crystallography.

[0109] For example, supernatants from systems which secrete recombinant protein into culture media can be first concentrated using a commercially available protein concentration filter, for example, an Amicon or Millipore Pellicon ultrafiltration unit. Following the concentration step, the concentrate can be applied to a suitable purification matrix. Alternatively, an anion exchange resin can be employed, for example, a matrix or substrate having pendant diethylaminoethyl (DEAE) groups. The matrices can be acrylamide, agarose, dextran, cellulose or other types commonly employed in protein purification. Alternatively, a cation exchange step can be employed. Suitable cation exchangers include various insoluble matrices comprising sulfopropyl or carboxymethyl groups. Finally, one or more reversed-phase high performance liquid chromatography (RP-HPLC) steps employing hydrophobic RP-HPLC media, e.g., silica gel having pendant

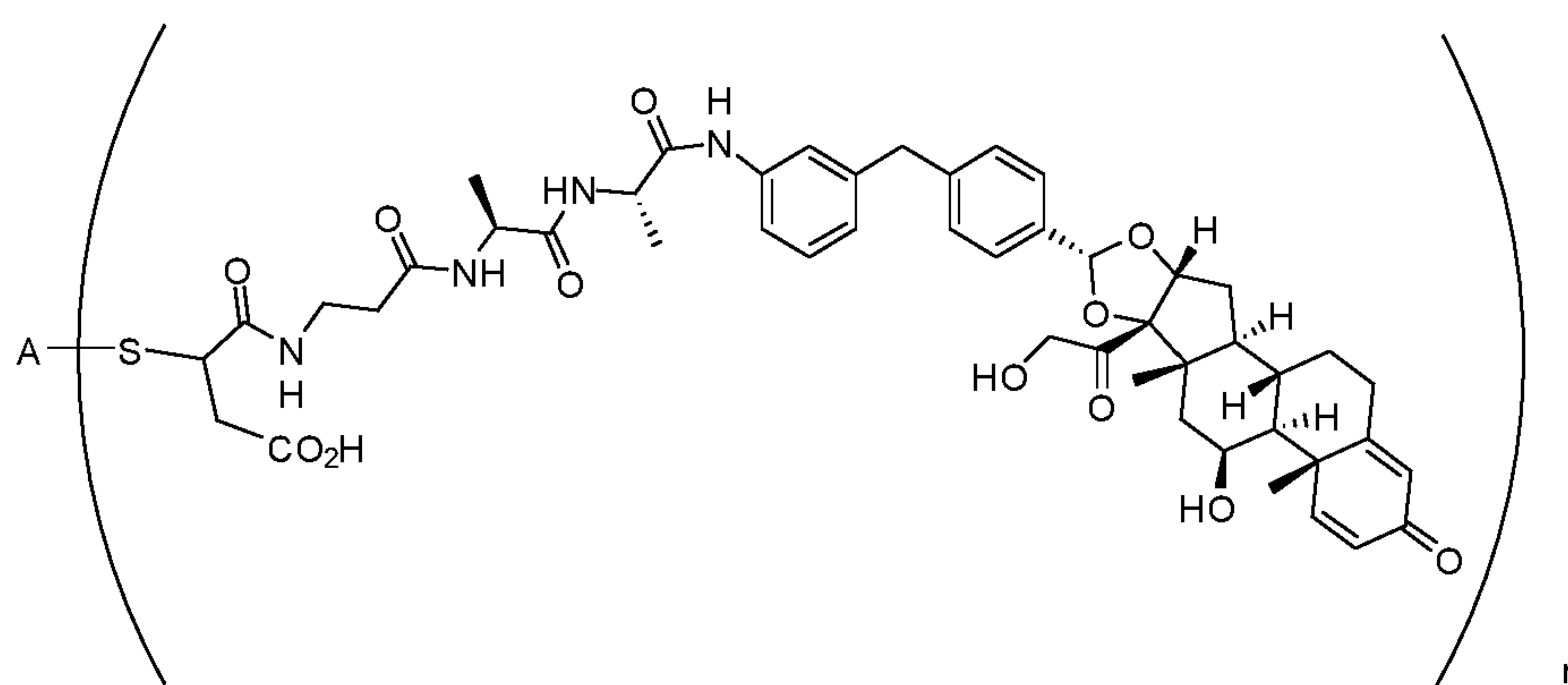
methyl or other aliphatic groups, can be employed to further purify anti-TNF proteins (e.g., full-length antibodies, antigen-binding fragments of antibodies, or soluble TNF receptor proteins). Some or all of the foregoing purification steps, in various combinations, can also be employed to provide a homogeneous recombinant protein.

[0110] Recombinant protein produced in bacterial culture can be isolated, for example, by initial extraction from cell pellets, followed by one or more concentration, salting-out, aqueous ion exchange or size exclusion chromatography steps. High performance liquid chromatography (HPLC) can be employed for final purification steps. Microbial cells employed in expression of a recombinant protein can be disrupted by any convenient method, including freeze-thaw cycling, sonication, mechanical disruption, or use of cell lysing agents.

[0111] Methods known in the art for purifying antibodies, antigen-binding fragments thereof, and anti-TNF alpha proteins also include, for example, those described in U.S. Patent Publication Nos. 2008/0312425, 2008/0177048, and 2009/0187005.

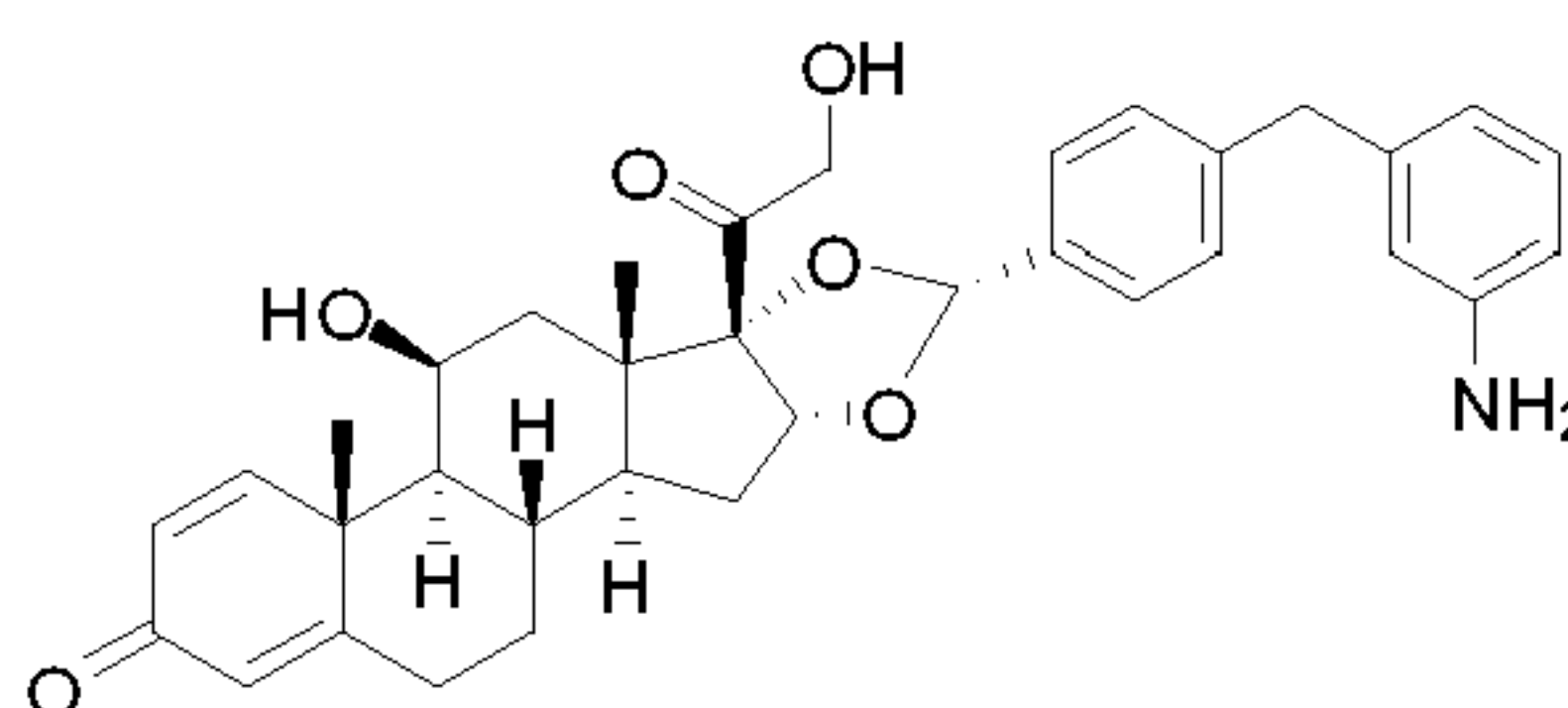
III. Immunoconjugates containing glucocorticoid receptor agonists

[0112] Immunoconjugates containing glucocorticoid receptor agonists are provided herein. The invention provides immunoconjugates with the formula:



wherein n is 2 or 4, and A is an antibody comprising SEQ ID NO: 66 and SEQ ID NO: 73 or adalimumab. In further embodiments of the invention n is 4. In other embodiments of the invention n is 2. In other embodiments of the invention A is adalimumab.

[0113] In another embodiment, disclosed herein is a compound having Formulae VIII, or a pharmaceutically acceptable salt thereof, selected from the group consisting of:



IV. Methods of making immunoconjugates and synthetic intermediates

[0114] According to the present disclosure, glucocorticoid receptor agonists can be linked to the antibody, antigen-binding fragment thereof, or anti-TNF alpha proteins via any method and at any location that does not prevent the antibody, antigen-binding fragment thereof, or anti-TNF alpha protein from binding antigen (e.g., TNF alpha) or prevent activity of the glucocorticoid receptor agonist. Methods for achieving such a linkage have been discussed, for example, in Panowski et al., mAbs 6: 34-45 (2014), Jain et al., Pharm. Res. 32: 3526-3540 (2015), Mack et al., Seminars in Oncology 41: 637-652 (2014), U.S. Published Application No. 2008/0305044, and U.S. Published Application No. 2011/0097322.

[0115] The glucocorticoid receptor agonist can also be linked to a cysteine residue. Methods for conjugation via cysteine are known. IgG1 antibodies contain four inter-chain disulfide bonds, and conjugation via cysteine can occur after reduction of these bonds creates sulfhydryls available for conjugation.

[0116] The glucocorticoid receptor agonists can be linked to the antibody, antigen-binding fragment thereof, or anti-TNF alpha proteins via site-specific conjugation.

[0117] One method of site-specific conjugation is cysteine-based site-specific conjugation. An example of this method

has been reported by Junutula et al., Nat. Biotechnol 26: 925-935 (2008); see also Junutula et al., J. Immunol. Methods 332: 41-52 (2008). Using this method, antibodies, antigen-binding fragments thereof or anti-TNF alpha proteins can be engineered with additional cysteines that provide reactive thiol groups to conjugate glucocorticoid receptor agonist. These publications also provide guidance regarding the selection of reactive cysteines that do not interfere with antigen binding.

[0118] Another method of site-specific conjugation makes use of selenocysteine. Selenocysteine is similar to cysteine but contains a more reactive selenium atom in place of the sulfur atom in cysteine. Conditions can be used in which selenocysteines are selectively activated. Hofer et al., Biochemistry 48: 12047-12057 (2009) has exemplified this technique.

[0119] Another method of site-specific conjugation makes use of unnatural amino acids, e.g., acetylphenylalanine (pAcPhe) or para-azido phenylalanine (pAF). Wang et al. Proc. Natl. Acad. Sci. 100: 56-61 (2003), Axup et al., Proc. Natl. Acad. Sci. 109:16101-16106 (2012), and Kern et al., JACS 138: 1430-1445 (2016) have exemplified this technique.

[0120] Another method of site-specific conjugation makes use of enzymatic approaches, e.g., via glycotransferases or transglutaminases. Mutant glycotransferases can be used to attach a chemically active sugar moiety to a glycosylation site on an antibody, antigen-binding fragment thereof, or anti-TNF alpha protein. Human IgG antibodies contain an N-glycosylation site at residue Asn-297 of the Fc fragment. The glycans attached at this residue can be degalactosylated so that a mutant glycotransferase is capable of transferring thereto. Boeggeman et al., Bioconjug. Chem. 20: 1228-1236 (2009) has exemplified this technique. Transglutaminases, e.g., from *Streptovorticillium mobaranse*, recognize a glutamine tag, e.g., LLQG, that can be engineered into an anti-TNF alpha protein. Jeger et al., Angew Chem. Int. Ed. Engl. 49: 9995-9997 (2010) has exemplified this technique.

[0121] C-terminal attachment via expressed protein ligation can also be used. For example, intein mediated C-terminal thioester formation can be used for chemoselective ligation with an anti-TNF alpha protein containing an N-terminal cysteine peptide. Chiang et al., J. Am. Chem. Soc. 136: 3370-3373 (2014) has exemplified this technique.

V. Methods of use and pharmaceutical compositions

[0122] Provided herein is a glucocorticoid receptor agonist immunoconjugate that can be used *in vitro* or *in vivo*. Accordingly, also provided herein are compositions, e.g., pharmaceutical compositions for certain *in vivo* uses, comprising a conjugate or a glucocorticoid receptor agonist described herein having the desired degree of purity in a physiologically acceptable carrier, excipient or stabilizer (Remington's Pharmaceutical Sciences (1990) Mack Publishing Co., Easton, PA). Acceptable carriers, excipients, or stabilizers are nontoxic to recipients at the dosages and concentrations employed.

[0123] The compositions (e.g., pharmaceutical compositions) to be used for *in vivo* administration can be sterile. This is readily accomplished by filtration through, e.g., sterile filtration membranes. The compositions (e.g., pharmaceutical compositions) to be used for *in vivo* administration can comprise a preservative.

[0124] A pharmaceutical composition comprising a glucocorticoid receptor agonist provided herein can be formulated, for example, as a nasal spray, an inhalation aerosol (e.g., for oral inhalation), or a capsule, tablet, or pill (e.g., for oral administration).

[0125] The glucocorticoid receptor agonists provided herein (e.g., an anti-TNF ADC) are compounds, wherein the average number of glucocorticosteroids per antibody (DAR) in the composition is 2 or 4.

[0126] Glucocorticoid receptor agonists and pharmaceutical compositions comprising a glucocorticoid receptor agonist described herein can be useful in inhibiting cytokine release (*in vitro* or *in vivo*) and/or for the treatment of autoimmune or inflammatory diseases. Glucocorticoid receptor agonists and pharmaceutical compositions comprising a glucocorticoid receptor agonist described herein can be used for the treatment of asthma (e.g., bronchial asthma), Crohn's disease (e.g., mild to moderate active Crohn's disease involving the ileum and/or the ascending colon and/or the maintenance of clinical remission of mild to moderate Crohn's disease involving the ileum and/or the ascending colon for up to 3 months), ulcerative colitis (e.g., for the induction of remission in patients with active, mild to moderate ulcerative colitis), allergic rhinitis (e.g. nasal symptoms associated with seasonal allergic rhinitis and/or perennial allergic rhinitis).

[0127] For administration to human patients, the total daily dose of glucocorticoid receptor agonists provided herein is typically in the range of 0.001 mg to 5000 mg, or in the range of 0.01 mg to 1000 mg, depending on the mode of administration. For example, oral administration or intravenous, intramuscular, intra-articular, or peri-articular administration can require a total daily dose of from 0.01 mg to 1000 mg, or from 0.1 mg to 100 mg. The total daily dose can be administered in single or divided doses.

[0128] A pharmaceutical composition comprising a conjugate provided herein can be formulated, for example, for intravenous administration or infusion.

[0129] Conjugates and pharmaceutical compositions comprising conjugates described herein can be useful in lysing a cell expressing surface TNF-alpha (*in vitro* or *in vivo*), for the treatment of diseases or disorders characterized by increased TNF-alpha (e.g., increased TNF-alpha in synovial fluid), and/or for the treatment of an autoimmune or inflammatory disease.

[0130] A pharmaceutical composition comprising a glucocortic receptor agonist or a conjugate described herein is used for the treatment of rheumatoid arthritis (RA), juvenile idiopathic arthritis (JIA), psoriatic arthritis (PsA), a spondyloarthropathy such as ankylosing spondylitis (AS) or axial spondyloarthritis (axSpA), adult Crohns' disease (CD), pediatric Crohn's disease, ulcerative colitis (UC), plaque psoriasis (Ps), hidradenitis suppurativa (HS), uveitis, Behcets disease, or psoriasis, including plaque psoriasis.

[0131] For administration to human patients, the total daily dose of conjugate provided herein is typically in the range of from 0.01 μg to 100 mg per kg of body weight, and can be given once or more daily, weekly, monthly or yearly.

[0132] Embodiments of the present disclosure can be further defined by reference to the following non-limiting examples, which describe in detail preparation of certain antibodies of the present disclosure and methods for using antibodies of the present disclosure.

Examples

[0133] It is understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to persons skilled in the art and are to be included within the spirit and purview of this disclosure.

Analytical Methods for Compound Synthesis and Characterization

[0134] Analytical data is included within the procedures below, in the illustrations of the general procedures, or in the tables of examples. Unless otherwise stated, all ¹H and ¹³C NMR data were collected on a Varian Mercury Plus 400 MHz or a Bruker AVIII 300 MHz instrument; chemical shifts are quoted in parts per million (ppm). HPLC analytical data are either detailed within the experimental or referenced to the table of LC/MS and HPLC conditions, using the method provided in Table 7.

Table 7: List of LC/MS and GC/MS Methods

Method	Conditions
a	The gradient was 10-100% B in 3.4 min with a hold at 100% B for 0.45 min, 100-10% B in 0.01min, and then held at 10% B for 0.65 min (0.8 mL/min flow rate). Mobile phase A was 0.0375% trifluoroactic acid in water, mobile phase B was 0.018% TFA in MeCN. The column used for the chromatography was a 2.0 x 50 mm phenomenex Luna-C18 column (5 μm particles). Detection methods are diode array (DAD) and evaporative light scattering (ELSD) detection as well as positive electrospray ionization(MS).
d	The gradient was 5% B for 0.2 min, and to 95% B within 1.7 min then with a hold at 95% B for 1.3 min, back to 5% B within 0.01 min (2.3 mL/min flow rate). Mobile phase A was 0.01% TFA in water, and mobile phase B was 0.01% TFA in HPLC grade MeCN. The column used for the chromatography was an XBridge C18 column (4.6 x 50 mm, 3.5μm particles). Detection methods are diode array (DAD) and evaporative light scattering (ELSD) detection as well as positive/negative electrospray ionization
s	Analytical UPLC-MS was performed on a Waters SQD mass spectrometer and Acquity UPLC system running MassLynx 4.1 and Openlynx 4.1 software. The SQD mass spectrometer was operated under positive APCI ionization conditions. The column used was a Waters BEH C8, 1.7μm (2.1mm × 30mm) at a temperature of 55°C. A gradient of 10-100% acetonitrile (A) and 10 mM ammonium acetate in water (B) was used, at a flow rate of 1.0mL/min (0-0.1 min 10% A, 0.1-1.1 min 10-100% A, 1.1-1.3 min 100% A, 1.3-1.4 min 100-10% A).

[0135] Abbreviations used in the examples that follow are:

APCI	Atmospheric pressure chemical ionization	HIC	Hydrophobic Interaction Chromatography
BOC	<i>tert</i> -butyloxycarbonyl	HPLC	High performance liquid chromatography
DCM	Dichloromethane	MeCN	Acetontrile
DMF	Dimethyl formamide	MeOH	Methanol

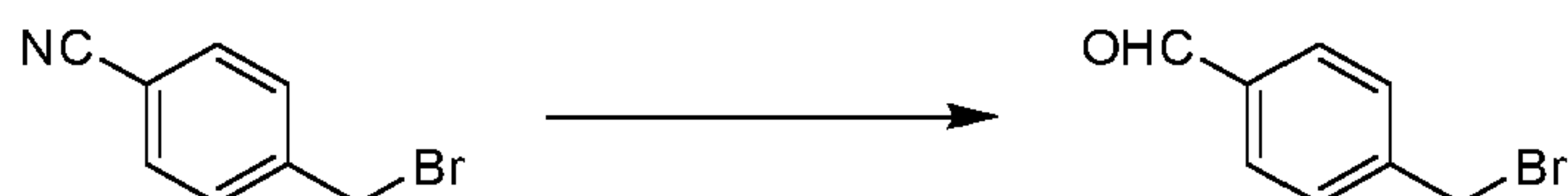
(continued)

	APCI	Atmospheric pressure chemical ionization	HIC	Hydrophobic Interaction Chromatography
5	DMSO	Dimethyl sulfoxide	Min	Minute(s)
	Eq	Equivalent	NaHCO ₃	Sodium hydrogen carbonate
	EtOAc	Ethyl acetate	Na ₂ SO ₄	Sodium sulfate
10	HATU	1-[Bis(dimethylamino)methylene]-1H-1,2,3-triazolo[4,5-b]pyridinium 3-oxid hexafluorophosphate	NMR	Nuclear magnetic resonance
	HCl	Hydrochloric acid	PBST	Phosphate Buffered Saline with Tween 20
15	HEPES	4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid	PE	Petroleum ether
	TFA	Trifluoroacetic acid	R _t	Retention time

Example 2A: Synthesis of (6aR,6bS,7S,8aS,8bS,10R,11aR,12aS,12bS)-10-(4-(3-aminobenzyl)phenyl)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-1,2,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-4H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-4-one (Cpd. No. 41).

Step 1: Synthesis of 4-(bromomethyl)benzaldehyde

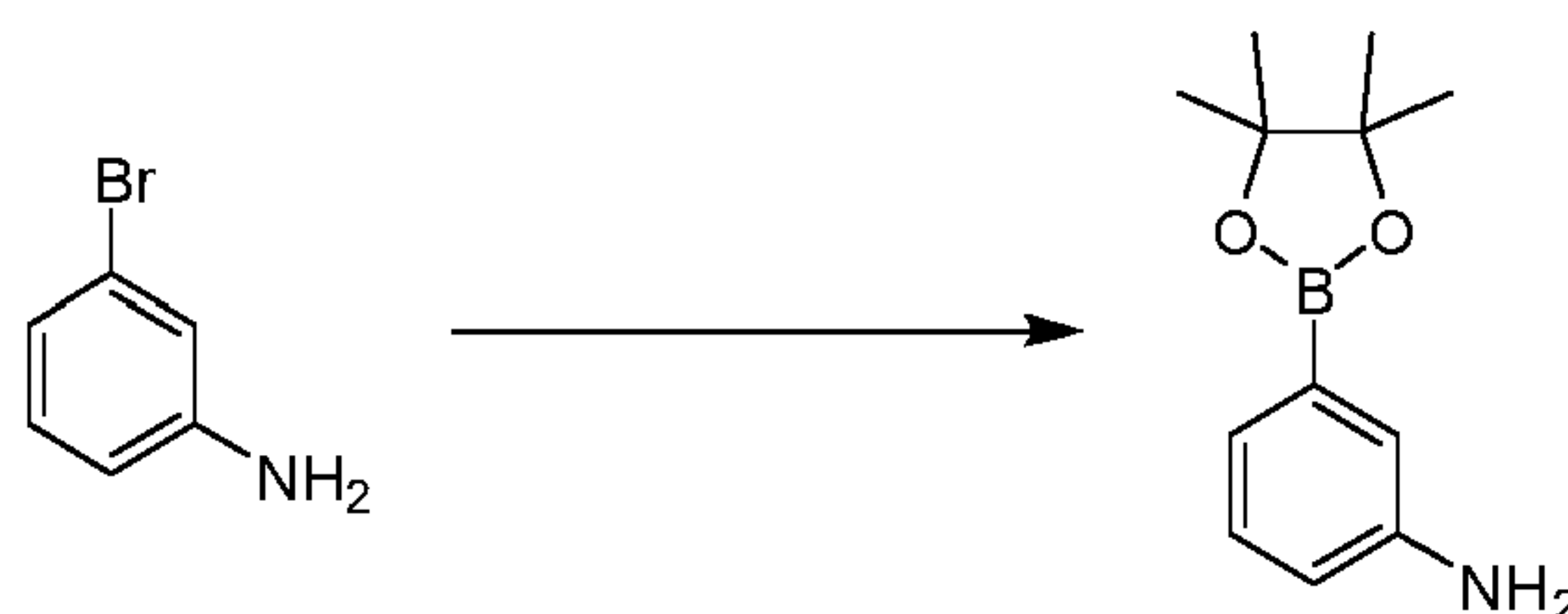
[0136]



[0137] To a solution of 4-(bromomethyl)benzonitrile (50 g, 255 mmol) in toluene (1 L) was added diisobutylaluminum hydride (383 mL, 383 mmol, 1 M in toluene) dropwise at 0°C. The mixture was stirred for 1 hour. Two additional vials were set up as described above. All three reaction mixtures were combined. 10% aqueous HCl (1.5 L) was added and then extracted with DCM (3 X 1.5 L). The organic layer was dried over Na₂SO₄, filtered and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (eluted with petroleum ether/ethyl acetate = 10/1) to afford the title compound (120 g, 82%) as a white solid. ¹H NMR (400MHz, CDCl₃) δ 10.01 (s, 1H), 7.86 (d, J=8.4 Hz, 2H), 7.55 (d, J=7.9 Hz, 2H), 4.51 (s, 2H).

Step 2: Synthesis of 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)aniline

[0138]

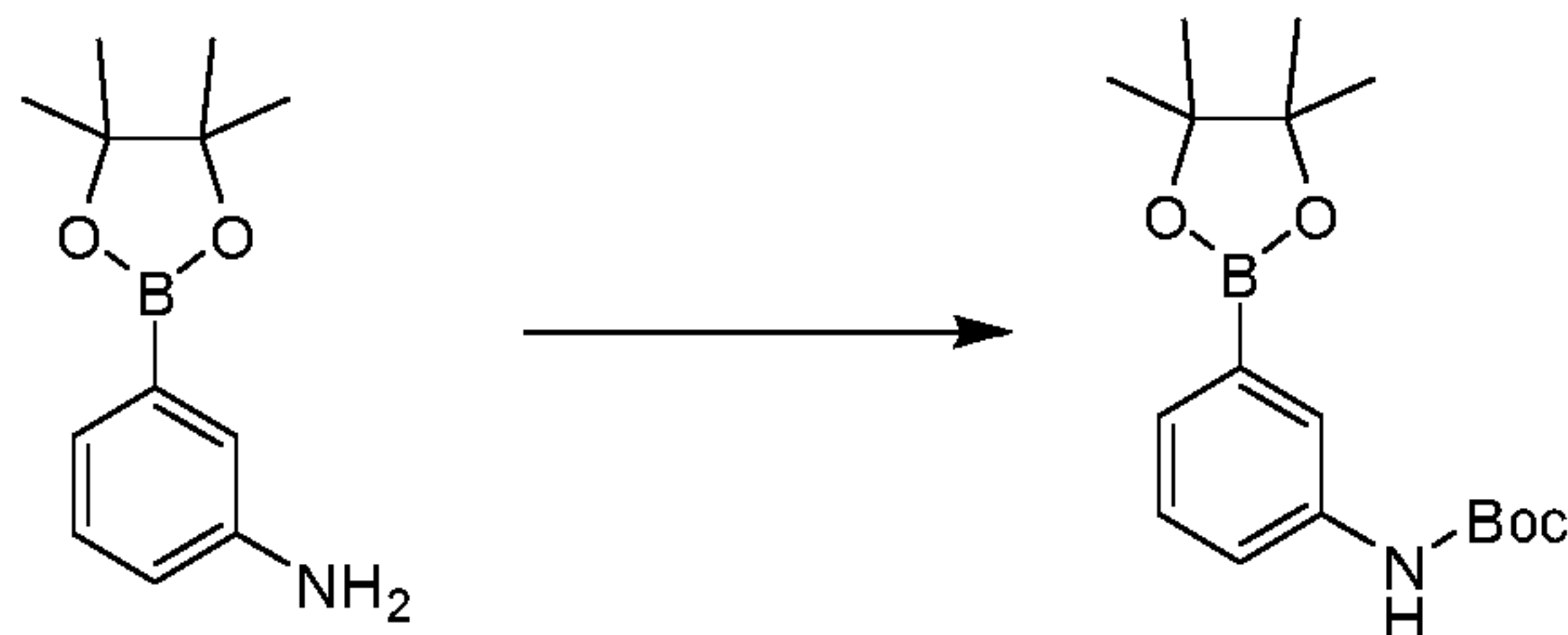


[0139] To a solution of 3-bromoaniline (80 g, 465 mmol) in 1,4-dioxane (960 mL) was added 4,4,4',4',5,5,5',5'-octamethyl-2,2'-bi(1,3,2-dioxaborolane) (177 g, 698 mmol), potassium acetate (91 g, 930 mmol), 2-dicyclohexylphosphino-2',4',6'-tri-*i*-propyl-1,1'-biphenyl (13.45 g, 23.25 mmol) and tris(dibenzylideneacetone)dipalladium(0) (17.03 g, 18.60 mmol). The mixture was heated at 80°C for 4 hours under nitrogen. Two additional vials were set up as described above. Three reaction mixtures were combined, concentrated and the residue purified by column chromatography on silica gel (eluted with petroleum ether/ethyl acetate = 10/1) to afford the title compound (150 g, 46.6 %) as a light yellow solid. ¹H NMR (400MHz, CDCl₃) δ 7.23 - 7.13 (m, 3H), 6.80 (d, J=7.5 Hz, 1H), 3.82 - 3.38 (m, 2H), 1.34 (s, 12H).

Step 3: Synthesis of tert-butyl (3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)carbamate**[0140]**

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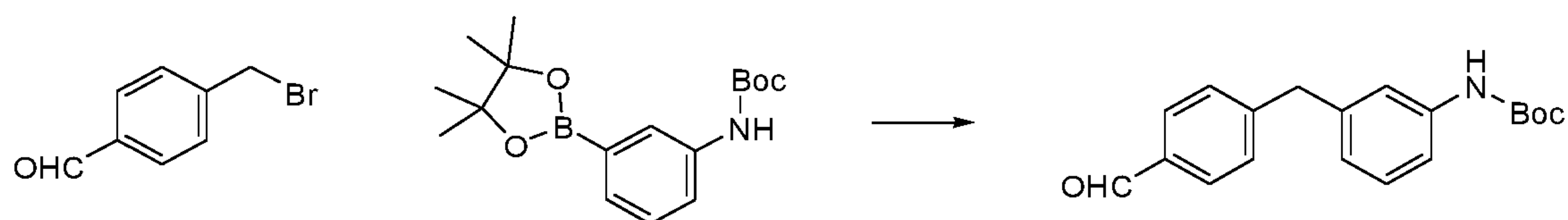


[0141] 3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline (50 g, 228 mmol) and di-tert-butyl dicarbonate (64.8 g, 297 mmol) were mixed in toluene (500 mL) and the mixture stirred at 100°C for 24 hours. Two additional vials were set up as described above. The three reaction mixtures were combined. The brown mixture was concentrated and the residue was washed with PE to afford the title compound (120 g, 49.5 %) as a white solid. ¹H NMR (400MHz, CDCl₃) δ 7.62 (s, 2H), 7.48 (d, *J*=7.5 Hz, 1H), 7.35 - 7.29 (m, 1H), 6.46 (br. s., 1H), 1.52 (s, 9H), 1.34 (s, 12H).

Step 4: Synthesis of tert-butyl (3-(4-formylbenzyl)phenyl)carbamate**[0142]**

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[0143] A mixture of 4-(bromomethyl)benzaldehyde (29.9 g, 150 mmol), 1,1'-bis(diphenylphosphino) ferrocenedichloro palladium(II) (20.63 g, 28.2 mmol), tert-butyl (3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)carbamate (30 g, 94 mmol) and potassium carbonate (64.9 g, 470 mmol) in THF (600 mL) was heated to 80°C for 12 hours. Three additional vials were set up as described above. All four reaction mixtures were combined. The reaction mixture was diluted with water (1 L). The aqueous layer was extracted with EtOAc (3 X 800 mL). The organic layer was dried over Na₂SO₄, filtered and concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (eluted with PE/EtOAc = 10/1) to afford the title compound (35.5 g, 27.3 %) as a white solid. ¹H NMR (400MHz, CDCl₃) δ 9.97 (s, 1H), 7.80 (d, *J*=7.9 Hz, 2H), 7.35 (d, *J*=7.9 Hz, 2H), 7.26 (s, 2H), 7.24 - 7.13 (m, 2H), 6.84 (d, *J*=7.1 Hz, 1H), 6.43 (br. s., 1H), 4.02 (s, 2H), 1.50 (s, 9H).

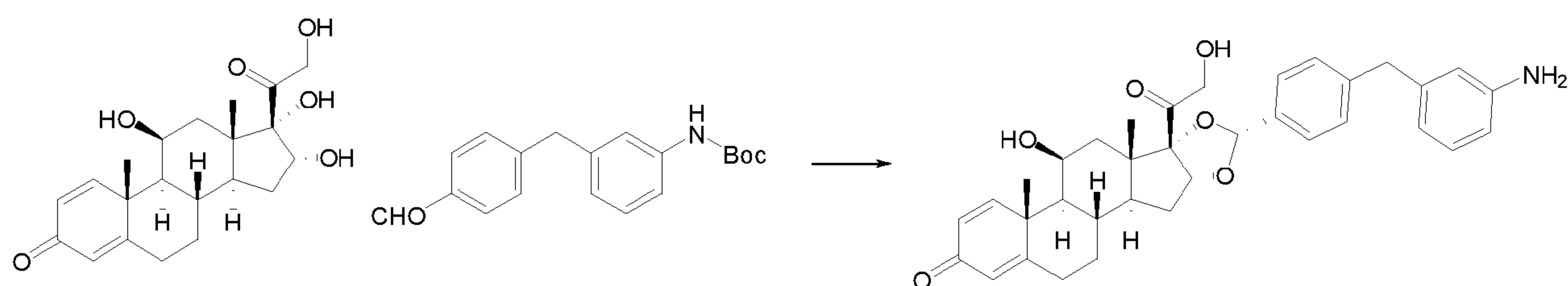
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Step 5: Synthesis of (6aR,6bS,7S,8aS,8bS,10R,11aR,12aS,12bS)-10-(4-(3-aminobenzyl)phenyl)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-1,2,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-4H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-4-one**[0144]**

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[0145] To a solution of (8S,9S,10R,11S,13S,14S,16R,17S)-11,16,17-trihydroxy-17-(2-hydroxyacetyl)-10,13-dimethyl-6,7,8,9,10,11,12,13,14,15,16,17-dodecahydro-3H-cyclopenta[a]phenanthren-3-one (6 g, 15.94 mmol) and tert-butyl (3-(4-formylbenzyl)phenyl)carbamate (4.96 g, 15.94 mmol) in MeCN (50 mL) was added perchloric acid (4.79 mL, 80

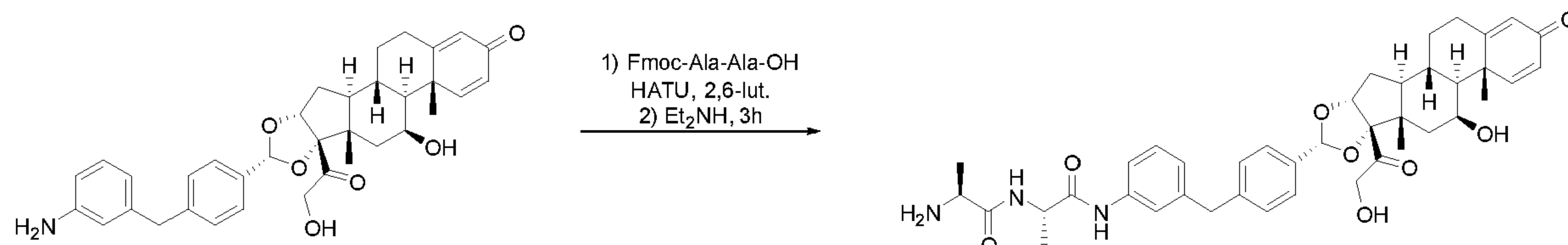
mmol) dropwise while maintaining an internal temperature below 25°C using an ice bath. After the addition, the mixture was stirred at 20°C for 2 hours. Three additional vials were set up as described above. All four reaction mixtures were combined. The reaction mixture was quenched with saturated NaHCO₃ aqueous (500 mL) and extracted with dichloromethane (3 X 800 mL). The organic phase was concentrated and the residue was purified by Prep-HPLC to afford the title compound (10 g, 27.0 %) as a yellow solid. ¹H NMR (400MHz, DMSO-d₆) δ 7.36 (d, *J*=7.9 Hz, 2H), 7.31 (d, *J*=10.1 Hz, 1H), 7.20 (d, *J*=7.9 Hz, 2H), 6.89 (t, *J*=7.9 Hz, 1H), 6.39 - 6.28 (m, 3H), 6.16 (dd, *J*=1.5, 9.9 Hz, 1H), 5.93 (s, 1H), 5.39 (s, 1H), 5.08 (t, *J*=5.7 Hz, 1H), 4.98 - 4.87 (m, 3H), 4.78 (d, *J*=3.1 Hz, 1H), 4.49 (dd, *J*=6.2, 19.4 Hz, 1H), 4.29 (br. s., 1H), 4.17 (dd, *J*=5.5, 19.6 Hz, 1H), 3.74 (s, 2H), 2.61 - 2.53 (m, 1H), 2.36 - 2.26 (m, 1H), 2.11 (d, *J*=11.0 Hz, 1H), 2.07 (s, 1H), 2.02 (d, *J*=12.8 Hz, 1H), 1.83 - 1.54 (m, 5H), 1.39 (s, 3H), 1.16 - 0.96 (m, 2H), 0.85 (s, 3H). LCMS: *t_R* = 2.365 min, 98% purity, *m/z* = 570.2 (M+H)⁺ LC/MS (Table 7, method a)

[0146] Method of Prep-HPLC: Instrument: Gilson 281 semi-preparative HPLC system, Mobile phase: A: CF₃COOH/H₂O=0.075% v/v; B: CH₃CN, Column: Phenomenex Luna(2) C18 250*50 10u, Flow rate: 80 mL/min, Monitor wavelength: 220&254 nm, Time B%, 0.0 28, 20.0 45, 20.1 45, 20.2 100, 30.2 100, 0.3 28, 31.5 28.

Example 34A: Synthesis of 3-(2,5-dioxo-2,5-dihydro-1H-pyrrol-1-yl)-*N*-((*S*)-1-(((*S*)-1-((3-(4-((6a*R*,6b*S*,7*S*,8a*S*,8b*S*,10*R*,11a*R*,12a*S*,12b*S*)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-4-oxo-2,4,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-1H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-10-yl)benzyl)phenyl)amino)-1-oxopropan-2-yl)amino)-1-oxopropan-2-yl)propanamide (Cpd. No. 88)

Step 1: Synthesis of (*S*)-2-amino-*N*-((*S*)-1-((3-(4-((6a*R*,6b*S*,7*S*,8a*S*,8b*S*,10*R*,11a*R*,12a*S*,12b*S*)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-4-oxo-2,4,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-1H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-10-yl)benzyl)phenyl)amino)-1-oxopropan-2-yl)propanamide

[0147]

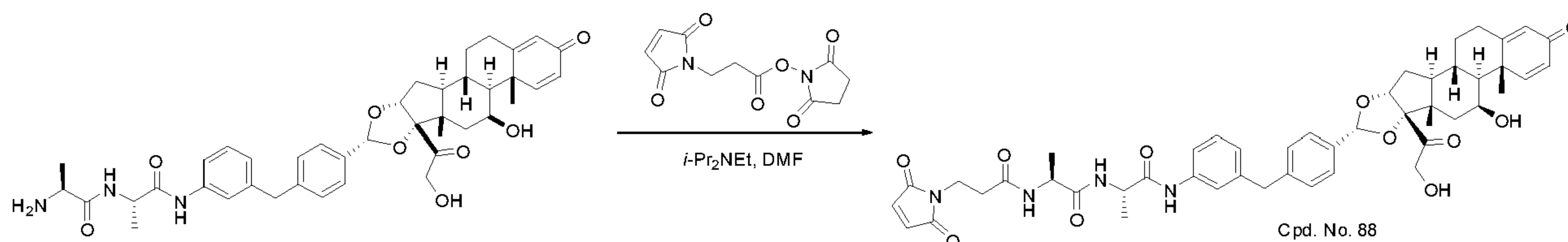


[0148] HATU (601 mg, 1.580 mmol) and 2,6-lutidine (0.37 mL, 3.16 mmol) were added to a 0 °C solution of (*S*)-2-(((9H-fluoren-9-yl)methoxy)carbonyl)amino)propanamido)propanoic acid (765 mg, 2.00 mmol), (6a*R*,6b*S*,7*S*,8a*S*,8b*S*,10*R*,11a*R*,12a*S*,12b*S*)-10-(4-(3-aminobenzyl)phenyl)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-6a,6b,7,8,8a,8b,11a,12,12a,12b-decahydro-1H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-4(2H)-one (600 mg, 1.053 mmol) in DCM (6 mL) and DMF (12 mL). After 30 min, the mixture was warmed to room temperature and stirred overnight. Diethylamine (2.18 mL, 21.06 mmol) was added to the reaction mixture, and stirring continued at room temp for 3 h, whereupon volatile solvents were removed under reduced pressure. The residue was dissolved in 1:1 DMSO:MeOH (12 mL) and purified by reverse phase HPLC on a Phenomenex C18(2) 10 micron column (250 x 50 mm column). A gradient of MeCN (A) and 0.1% TFA in water (B) was used, at a flow rate of 90 mL/min (0-5.0 min 15% A, 5.0-20 min linear gradient 15-85% A, hold 5 min). Combined product fractions were lyophilized to give the title compound as an off-white solid (447 mg, 0.628 mmol, 60% yield). LC-MS (Method r, Table 7) *R_t* = 0.78 min, *m/z* = 711.9 [M+H]. ¹H NMR (501 MHz, DMSO-d₆) δ 10.03 (s, 1H), 8.63 (d, *J*= 7.2 Hz, 1H), 8.07 (d, *J*= 5.4 Hz, 3H), 7.44 - 7.38 (m, 2H), 7.38 - 7.34 (m, 2H), 7.29 (d, *J* = 10.1 Hz, 1H), 7.23 - 7.16 (m, 3H), 6.90 (dt, *J* = 7.7, 1.3 Hz, 1H), 6.14 (dd, *J* = 10.1, 1.9 Hz, 1H), 5.90 (t, *J* = 1.6 Hz, 1H), 5.38 (s, 1H), 4.90 (d, *J* = 5.3 Hz, 1H), 4.52 - 4.37 (m, 2H), 4.27 (q, *J* = 3.3 Hz, 1H), 4.16 (d, *J* = 19.4 Hz, 1H), 3.87 (s, 2H), 2.58 - 2.49 (m, 1H), 2.28 (ddd, *J* = 13.4, 4.5, 2.1 Hz, 1H), 2.09 (dtd, *J* = 17.0, 10.6, 5.0 Hz, 1H), 2.00 (dd, *J* = 12.2, 5.7 Hz, 1H), 1.78 - 1.54 (m, 5H), 1.37 (s, 3H), 1.35 (s, 3H), 1.30 (d, *J*= 7.1 Hz, 3H), 1.01 (ddd, *J* = 22.1, 11.9, 4.2 Hz, 2H), 0.84 (s, 3H).

Step 2: Synthesis of 3-(2,5-dioxo-2,5-dihydro-1H-pyrrol-1-yl)-*N*-((*S*)-1-(((*S*)-1-((3-(4-((6a*R*,6b*S*,7*S*,8a*S*,8b*S*,10*R*,11a*R*,12a*S*,12b*S*)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-4-oxo-2,4,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-1H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-10-yl)benzyl)phenyl)amino)-1-oxopropan-2-yl)amino)-1-oxopropan-2-yl)propanamide

[0149]

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[0150] *N,N*-Diisopropylethylamine (0.33 mL, 1.875 mmol) was added to a room temperature solution of *N*-succinimidyl 3-maleimidopropionate (250 mg, 0.938 mmol) and (S)-2-amino-*N*-((S)-1-((3-(4-((6aR,6bS,7S,8aS,8bS,10R,11aR,12aS,12bS)-7-hydroxy-8b-(2-hydroxyacetyl)-6a,8a-dimethyl-4-oxo-2,4,6a,6b,7,8,8a,8b,11a,12,12a,12b-dodecahydro-1H-naphtho[2',1':4,5]indeno[1,2-d][1,3]dioxol-10-yl)benzyl)phenyl)amino)-1-oxopropan-2-yl)propanamide (445 mg, 0.625 mmol) in DMF (12 mL). After 30 min at room temperature, the volatile solvents were removed under reduced pressure. The residue was diluted with 1:1 DMSO:MeOH (12 mL) and purified by reverse phase HPLC on a Phenomenex C18(2) 10 micron column (250 x 50 mm column). A gradient of MeCN (A) and 0.1% TFA in water (B) was used, at a flow rate of 90 mL/min (0-5.0 min 25% A, 5.0-20 min linear gradient 25-90% A, hold 5 min). Combined product fractions were lyophilized to give the title compound as an off-white solid (295.1 mg, 0.342 mmol, 55% yield). LC-MS (Method r, Table 7) $R_t = 0.85$ min, $m/z = 863.4$ [M+H]. ^1H NMR (501 MHz, DMSO- d_6) δ 9.71 (s, 1H), 8.17 (d, $J = 7.0$ Hz, 1H), 8.03 (d, $J = 7.3$ Hz, 1H), 7.43 (dd, $J = 7.8, 1.1$ Hz, 2H), 7.38 - 7.32 (m, 2H), 7.29 (d, $J = 10.1$ Hz, 1H), 7.22 - 7.15 (m, 3H), 6.96 (s, 2H), 6.88 (dt, $J = 7.8, 1.3$ Hz, 1H), 6.13 (dd, $J = 10.1, 1.9$ Hz, 1H), 5.90 (t, $J = 1.6$ Hz, 1H), 5.37 (s, 1H), 4.90 (d, $J = 5.4$ Hz, 1H), 4.48 (d, $J = 19.4$ Hz, 1H), 4.32 (p, $J = 7.1$ Hz, 1H), 4.27 (q, $J = 3.3$ Hz, 1H), 4.21 (p, $J = 7.1$ Hz, 1H), 4.16 (d, $J = 19.4$ Hz, 1H), 3.87 (s, 2H), 3.59 (t, $J = 7.3$ Hz, 2H), 2.57 - 2.49 (m, 1H), 2.38 (dd, $J = 8.0, 6.6$ Hz, 2H), 2.32 - 2.24 (m, 1H), 2.15 - 2.04 (m, 1H), 2.04 - 1.95 (m, 1H), 1.80 - 1.54 (m, 5H), 1.37 (s, 3H), 1.26 (d, $J = 7.1$ Hz, 3H), 1.15 (d, $J = 7.1$ Hz, 3H), 1.02 (ddd, $J = 21.2, 12.1, 4.2$ Hz, 2H), 0.84 (s, 3H).

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Example 35:

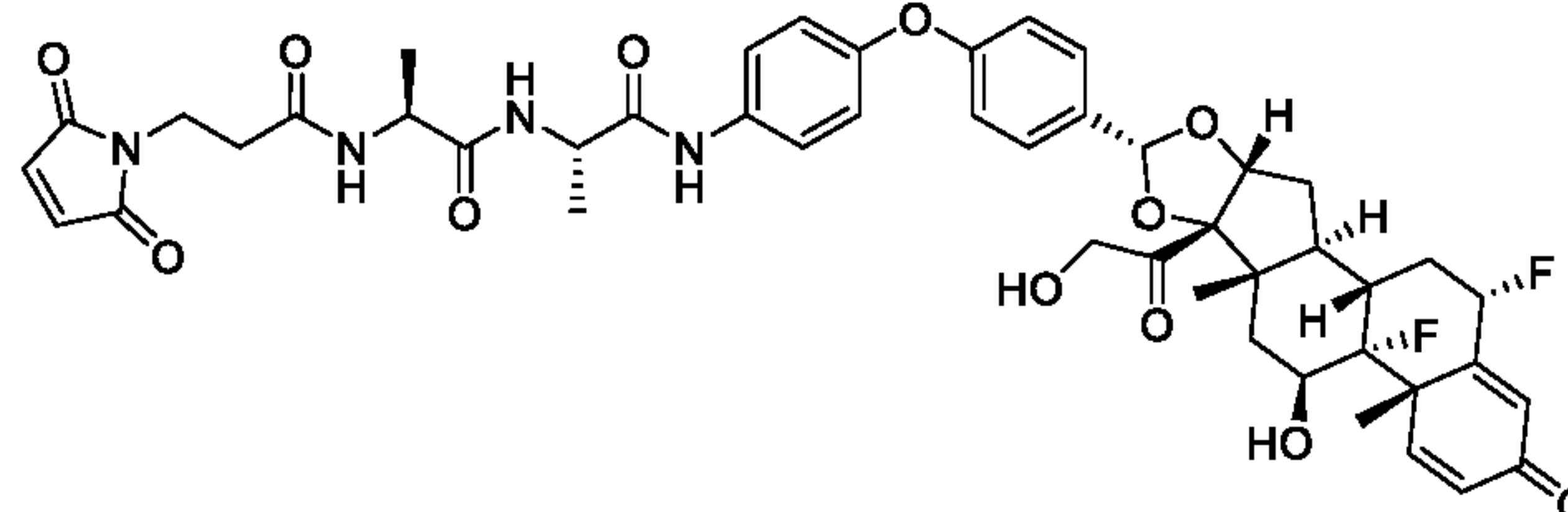
[0151] The following compounds were prepared using the methods described above.

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Cpd. No.

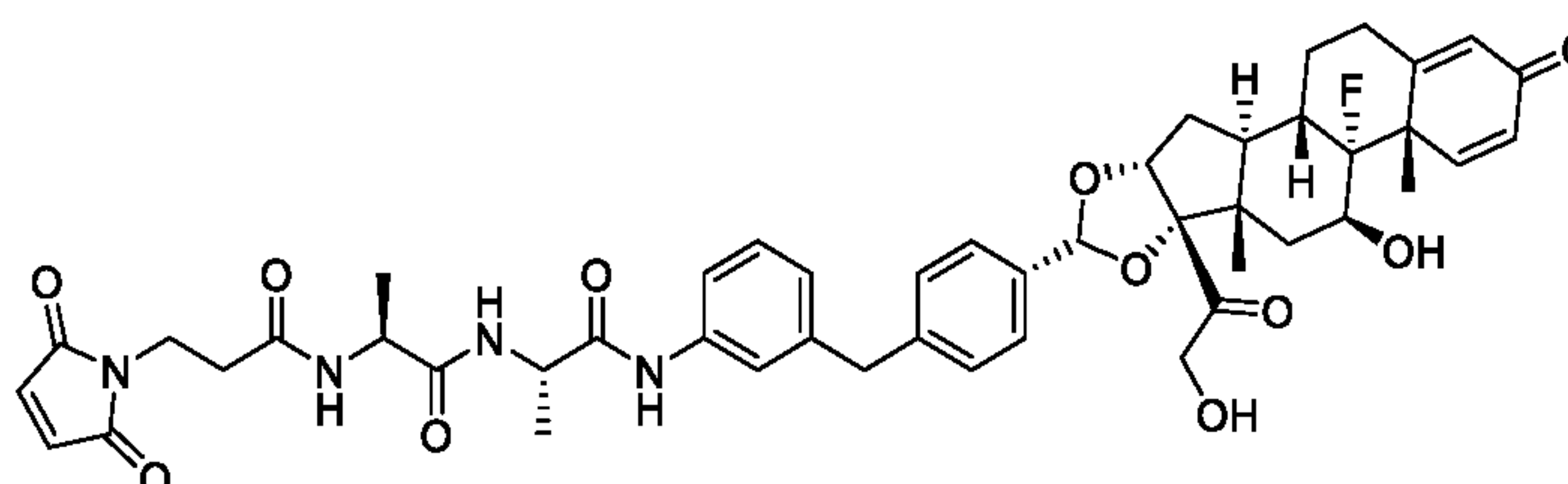
Structure

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Cpd. No.	LC-MS Data	¹ H NMR Data
88	Method r, Table 7 R _t = 0.87 min; m/z = 863.32 [M+H ⁺]	¹ H NMR (DMSO- <i>d</i> ₆) δ: 0.84 (s, 3H), 1.02 (ddd, <i>J</i> = 21.3, 12.1, 4.2 Hz, 2H), 1.15 (d, <i>J</i> = 7.1 Hz, 3H), 1.26 (d, <i>J</i> = 7.1 Hz, 3H), 1.37 (s, 3H), 1.53 - 1.81 (m, 4H), 2.00 (dd, <i>J</i> = 12.2, 5.5 Hz, 1H), 2.04 - 2.15 (m, 1H), 2.23 - 2.33 (m, 1H), 2.38 (dd, <i>J</i> = 8.0, 6.6 Hz, 2H), 2.51 (d, <i>J</i> = 18.2 Hz, 1H), 3.59 (t, <i>J</i> = 7.3 Hz, 2H), 3.87 (s, 2H), 4.16 (d, <i>J</i> = 19.4 Hz, 1H), 4.21 (p, <i>J</i> = 7.1 Hz, 1H), 4.27 (q, <i>J</i> = 3.3 Hz, 1H), 4.32 (p, <i>J</i> = 7.1 Hz, 1H), 4.48 (d, <i>J</i> = 19.4 Hz, 1H), 4.72 (s, 2H), 4.90 (d, <i>J</i> = 5.4 Hz, 1H), 5.37 (s, 1H), 5.90 (t, <i>J</i> = 1.6 Hz, 1H), 6.13 (dd, <i>J</i> = 10.1, 1.8 Hz, 1H), 6.88 (dt, <i>J</i> = 7.9, 1.3 Hz, 1H), 6.96 (s, 2H), 7.14 - 7.22 (m, 3H), 7.29 (d, <i>J</i> = 10.1 Hz, 1H), 7.33 - 7.38 (m, 2H), 7.43 (dd, <i>J</i> = 7.8, 1.1 Hz, 2H), 8.03 (d, <i>J</i> = 7.2 Hz, 1H), 8.17 (d, <i>J</i> = 7.0 Hz, 1H), 9.71 (s, 1H)

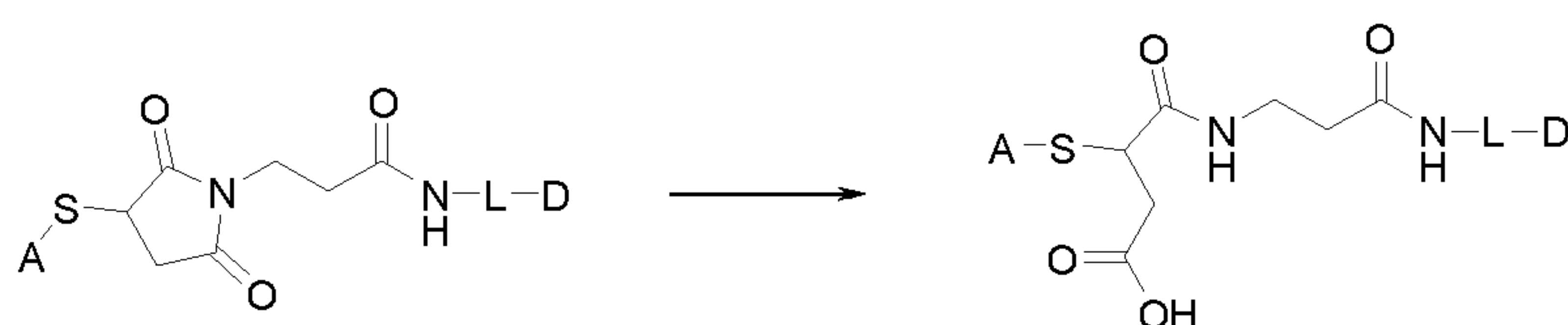
Example 73: Conjugation Protocols

General Cysteine Conjugation Protocol

[0152] An approximate 10 mg/mL solution of the desired antibody was prepared in PBS buffer, pH 7.4 as well as a 10 mM TCEP solution in PBS (Pierce Bond-Breaker, cat. 77720). Antibodies (anti-hTNF hlgG1 (D2E7) or anti-mTNF mlgG2a (8C11; McRae BL et al. J Crohns Colitis 10 (1): 69-76 (2016))) were then partially reduced by adding approximately two molar eq of 10 mM TCEP, briefly mixing, and incubating for 60 min at 37 °C. DMSO was then added to the partially reduced antibodies in sufficient quantity to 15% total DMSO. For the conjugations, 8 molar eq of a 10 mM D-L-maleimide solution (wherein SM is a radical of a glucocorticosteroid and L is a linker) were then added and incubated for 30 min at room temperature. Excess combo and DMSO were then removed using NAP-5 desalting columns (GE Healthcare, cat. 17-0853-02) previously equilibrated with PBS buffer, pH 7.4. Desalted samples were then analyzed by size exclusion chromatography (SEC), hydrophobic interaction chromatography (HIC), and reduced mass spectrometry.

Thiosuccinimide Hydrolysis

[0153]



[0154] Hydrolysis of the thiosuccinimide ring of ADCs of the disclosure was accomplished by incubating the ADCs at an elevated pH. Briefly, a 0.7 M arginine, pH 9.0 solution was prepared and added to each ADC in PBS buffer to bring the total arginine concentration to 50 mM (pH ~ 8.9). The material was then incubated at 25°C for 72 hours. Hydrolysis of the succinimide ring was then confirmed by reduced mass spectrometry, after which, hydrolysis was quenched with the addition of a 0.1 M acetic acid solution to 12.5 mM total acetic acid (pH ~ 7.1).

ADC Analytical Procedures

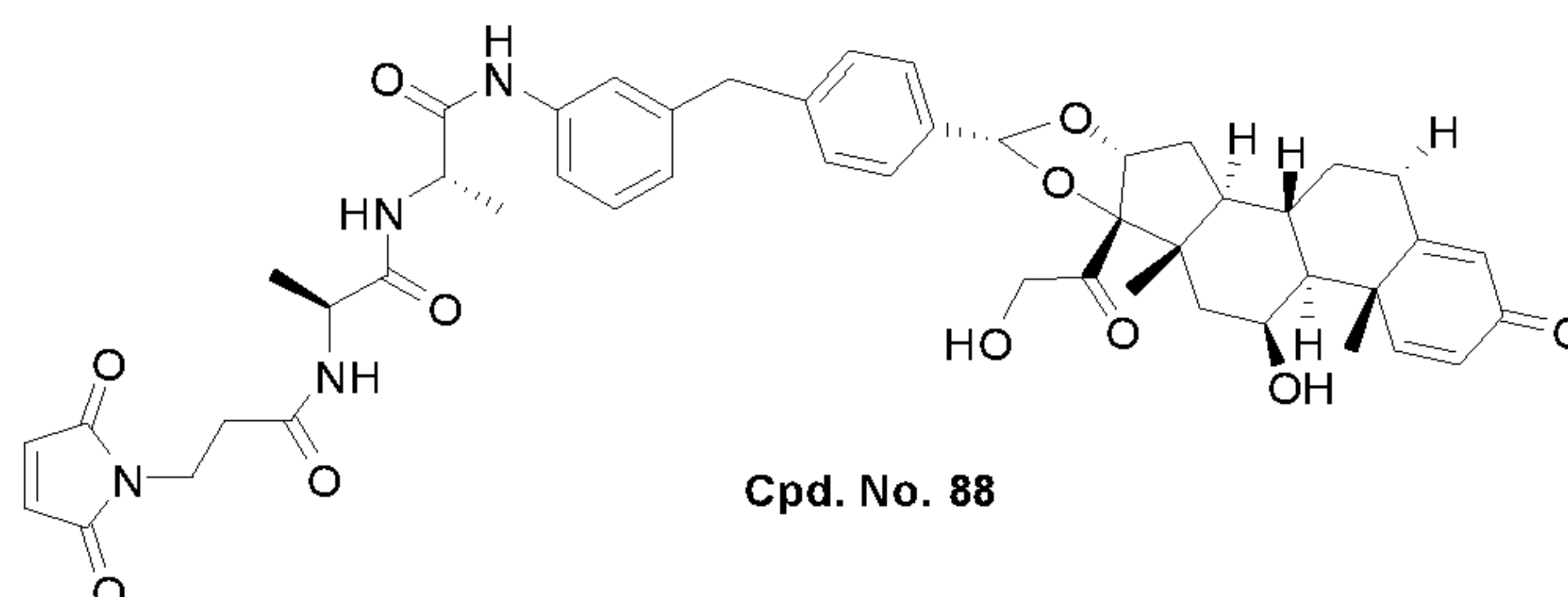
[0155] Hydrophobic Interaction Chromatography. ADCs were profiled by hydrophobic interaction chromatography (HIC) to determine degree of conjugation and to calculate approximate drug to antibody drug ratios (DARs). Briefly, 100 µg of the ADCs were loaded onto an Ultimate 3000 Dual LC system (Thermo Scientific) equipped with a 4.6 X 35 mm butyl-NPR column (Tosoh Bioscience, cat. 14947). ADCs were loaded onto the column equilibrated in 100% buffer A and eluted using a linear gradient from 100% buffer A to 100% buffer B over 12 min at 0.8 mL/min, where buffer A is 25 mM sodium phosphate, 1.5 M ammonium sulfate, pH 7.25 and buffer B is 25 mM sodium phosphate, 20% isopropanol, pH 7.25. The DAR was determined by taking the sum of each peak percent area multiplied by their corresponding drug load and dividing the weighted sum by 100.

[0156] Size Exclusion Chromatography. Size distributions of the ADCs were profiled by size exclusion chromatography (SEC) using an Ultimate 3000 Dual LC system (Thermo Scientific) equipped with a 7.8 X 300 mm TSK-gel 3000SW_{XL} column (Tosoh Bioscience, cat. 08541). 20 µg of each of the ADCs were loaded onto the column and eluted over 17

min using an isocratic gradient at 1 mL/min of 100 mM sodium sulfate, 100 mM sodium phosphate, pH 6.8 at 0.8 mL/min.

Example 74: Preparation of adalimumab conjugated with a glucocorticosteroid to give an ADC

[0157] Adalimumab MP-ala-ala steroid ADC having an average DAR 3.5 was prepared by a two-step chemical process: disulfide reduction of adalimumab followed by alkylation (conjugation) with maleimidopropyl alanine-alanine steroid Cpd. No. 88.



[0158] In the first step, a limited number of interchain disulfide bonds of adalimumab are reduced with tris(2-carboxyethyl) phosphine ("TCEP") (≥ 1.8 equiv). Partially-reduced adalimumab is then conjugated to Cpd. No. 88 (≥ 5 equiv) in DMSO.

[0159] Referring to Figure 5 which shows a chromatographic resolution of the resultant ADC preparation, the ADC is a heterogenous mixture containing antibodies having zero drug linker molecules attached ("E0" peak), two drug linker molecules attached ("E2" peak), four drug linker molecules attached ("E4" peak), six drug linker molecules attached ("E6" peak) and eight drug linker molecules attached ("E8" peak), depending upon the number of interchain disulfide bonds reduced. Methods of chromatographically separating and isolating the homogenous E2 and E4 peaks are described by Hamblett et al., Clin Cancer Res 2004;10:7063-7070. The HIC conditions used in Figure 5 were as follows:

[0160] The column was TOSOH Tskgel Butyl-NPR, 4.6 mm x 3.5 cm, 2.5 μ and the column temperature was 30°C. Wavelength was 280 nm, run time was 22 minutes, injection, volume was 40 μ L, flow rate was 0.5 mL/minute. Mobile Phase A: 25mM Na₂HPO₄, pH 7.0 and 1.5M (NH₄)₂SO₄, Mobile Phase B: 25mM Na₂HPO₄, pH 7.0/IPA =75/25. Gradient Profile:

Time (minutes)	Mobile Phase A	Mobile Phase B
0	90	10
2	85	15
18	5	95
18.1	90	10
22	90	10

[0161] Methods of chromatographically separating and isolating the homogenous E2 and E4 peaks are described by Hamblett et al., Clin Cancer Res 2004;10:7063-7070. Briefly, after hydrolysis and adjustment to pH <7.4, the broad distribution mixture was treated with 3 M ammonium sulfate/50 mM phosphate buffer to bring the overall solution concentration of ammonium sulfate to approximately 0.8 M. A pre-packed Hydrophobic Interaction Chromatography (HIC) column (resin butyl sepharose HP) was prepared by sanitizing with 0.5 N NaOH solution (4 CV), rinsing with water for injection (WFI, 0.5 CV) and equilibration with 0.8 M ammonium sulfate/25 mM phosphate buffer (4 CV). The broad distribution/ammonium sulfate buffered solution was loaded on the HIC column (approximate loading, 30 mg protein per mL of resin) followed by a wash with 0.8 M ammonium sulfate/25 mM phosphate buffer (2.5 CV). Elution of the product was as follows: 0.72 M ammonium sulfate/25 mM phosphate buffer (3 CV), unconjugated mAb; 0.56 M ammonium sulfate/25 mM phosphate buffer (4.5 CV), DAR2 ADC; 0.32 M ammonium sulfate/25 mM phosphate buffer (6.5 CV), DAR4 ADC. The DAR 2 and DAR4 product fractions were then separately concentrated to approximately 30 mg/mL via ultrafiltration (Millipore Ultracel, 30 kD cutoff) followed by diafiltration into WFI (8 CV).

[0162] The succinimide of the purified E4 conjugate was hydrolyzed to provide the stabilized attachment by adjusting the pH of the product solution to ≥ 9 using an arginine buffer. The solution was held at ambient temperature for ≥ 2 days at which time LC-MS analysis determined the hydrolysis was $>90\%$ complete. See Figure 6 for a portion of the LC-MS chromatogram. The SEC conditions used in Figure 6 were as follows:

The column was TOSOH TSK-gel G3000SW_{xl}, 5 μ , 250Å, 7.8 x 300 mm, the column was ambient temperature, Wave-

length was 214 nm, Run Time was 55 minutes, Injection Volume was 10 μ L, Flow Rate was 0.25 mL/minute, Autosampler Temp. was 4°C. Mobile Phase: 100 mM Na₂HPO₄ & 100mM Na₂SO₄, pH 6.8 / IPA = 90/10.

[0163] Raw (Figure 7) and deconvoluted (Figure 8) MS data of adalimumab conjugated with MP-ala-ala- steroid Cpd. No. 88. Black square and circle represent the ADC with succinimide hydrolyzed and unhydrolyzed, respectively. The relative abundance of hydrolyzed and unhydrolyzed ADC is used to determine hydrolysis conversion.

Example 75: *In vitro* activity of small molecule steroids

Glucocorticoid Receptor Binding Assay

[0164] Small molecules were tested for glucocorticoid receptor (GR) binding using the Polarscreen™ Glucocorticoid Receptor Assay Kit, Red (ThermoFisher A 15898) according to the manufacturer's protocol. Briefly, compounds were serially diluted in DMSO then transferred into assay kit buffer at a 1:10 dilution. Compounds were further diluted 1:5 in assay kit buffer, and 10 μ L was transferred to a 384 well low volume black walled plate (Corning 4514). 5 μ L of 4X Fluormone GS Red stock solution and 5 μ L of 4x GR full length stock solution were added to each well containing test compound, and plates were incubated protected from light at room temperature for 4 hours. Fluorescence Polarization (mP) was measured for each plate using an EnVision Multilabel Plate Reader (Perkinelmer # 2104-0010), and data were analyzed using a four parameter curve fit to generate EC50 values. The results are shown in Table 10 below.

Mineralcorticoid Receptor Cell Assay

[0165] Small molecules were tested for mineralcorticoid receptor (MR) agonist activity using the PathHunter® NHRPRO CHO-K1 MR cell line (DiscoverX cat# 93-0451C2) according to the manufacturer's protocol. Briefly, 20,000 cells/well in culture medium were plated in a 96 half-well plate (Costar cat# 3885) overnight at 37°C. Media was removed and replaced with serially diluted small molecules in assay medium (30 μ L; 0.3% DMSO final). Plates were incubated overnight at 37°C. Media was removed, replaced with detection reagent (DiscoverX cat# 93-0001; 12 μ L/well), and incubated at room temperature (RT) for 60 minutes. Luminescence was measured for each plate using an EnVision Multilabel Plate Reader (Perkinelmer # 2104-0010), and data were analyzed using a four parameter curve fit to generate EC50 values. The results are shown in Table 10 below.

Progesterone Receptor Binding Assay

[0166] Small molecules were tested for progesterone receptor (PR) binding using a modification of the LanthaScreen® TR-FRET Progesterone Receptor Coactivator Assay (ThermoFisher cat# A15903) where the fluorescein-labeled coactivator peptide was replaced with Fluormone AL-Red (ThermoFisher cat# PV4294) to improve assay signal. Briefly, compounds were serially diluted in DMSO, then transferred into assay buffer (ThermoFisher cat# PV4301 + 5mM DTT) at a 1:10 dilution. 10 μ L of compound was transferred to a 96 half-area black well plate (Corning cat#3694) in duplicate. 5 μ L of PR-LBD protein (4nM stock in assay buffer; ThermoFisher cat# P2899) was added to each well. In addition 5 μ L of a prepared mixture of Fluormone AL-Red (12nM) and terbium-labeled anti-GST monoclonal antibody (mAb) (20nM; ThermoFisher cat#PV3550) in assay buffer was also added to each well. Plates were incubated at room temperature (RT) for 2 hours, and then TR-FRET emission ratio was measured using an EnVision Multilabel Plate Reader (Perkinelmer # 2104-0010). Data were analyzed using a four parameter curve fit to generate EC50 values. The results are shown in Table 10 below.

Androgen Receptor Binding Assay

[0167] Small molecules were tested for androgen receptor (AR) binding using a modification of the LanthaScreen® TR-FRET Androgen Receptor Coactivator Assay (ThermoFisher cat# A15878) where the fluorescein-labeled coactivator peptide was replaced with Fluormone AL-Red (ThermoFisher cat# PV4294) to improve assay signal. Briefly, compounds were serially diluted in DMSO then transferred into assay buffer (ThermoFisher cat# PV4295 + 5mM DTT) at a 1:10 dilution. 10 μ L of compound was transferred to a 96 half-area black well plate (Corning cat#3694) in duplicate. 5 μ L of AR-LBD protein (5nM stock in assay buffer; ThermoFisher cat#3009) was added to each well. In addition 5 μ L of a prepared stock of Fluormone AL-Red (20nM) and terbium-labeled anti-GST monoclonal antibody (mAb) (30nM; ThermoFisher cat#PV3550) in assay buffer was also added to each well. Plates were incubated at room temperature (RT) for 6 hours then TR-FRET emission ratio was measured using an EnVision Multilabel Plate Reader (Perkinelmer # 2104-0010). Data were analyzed using a four parameter curve fit to generate EC50 values. The results are shown in Table 10 below.

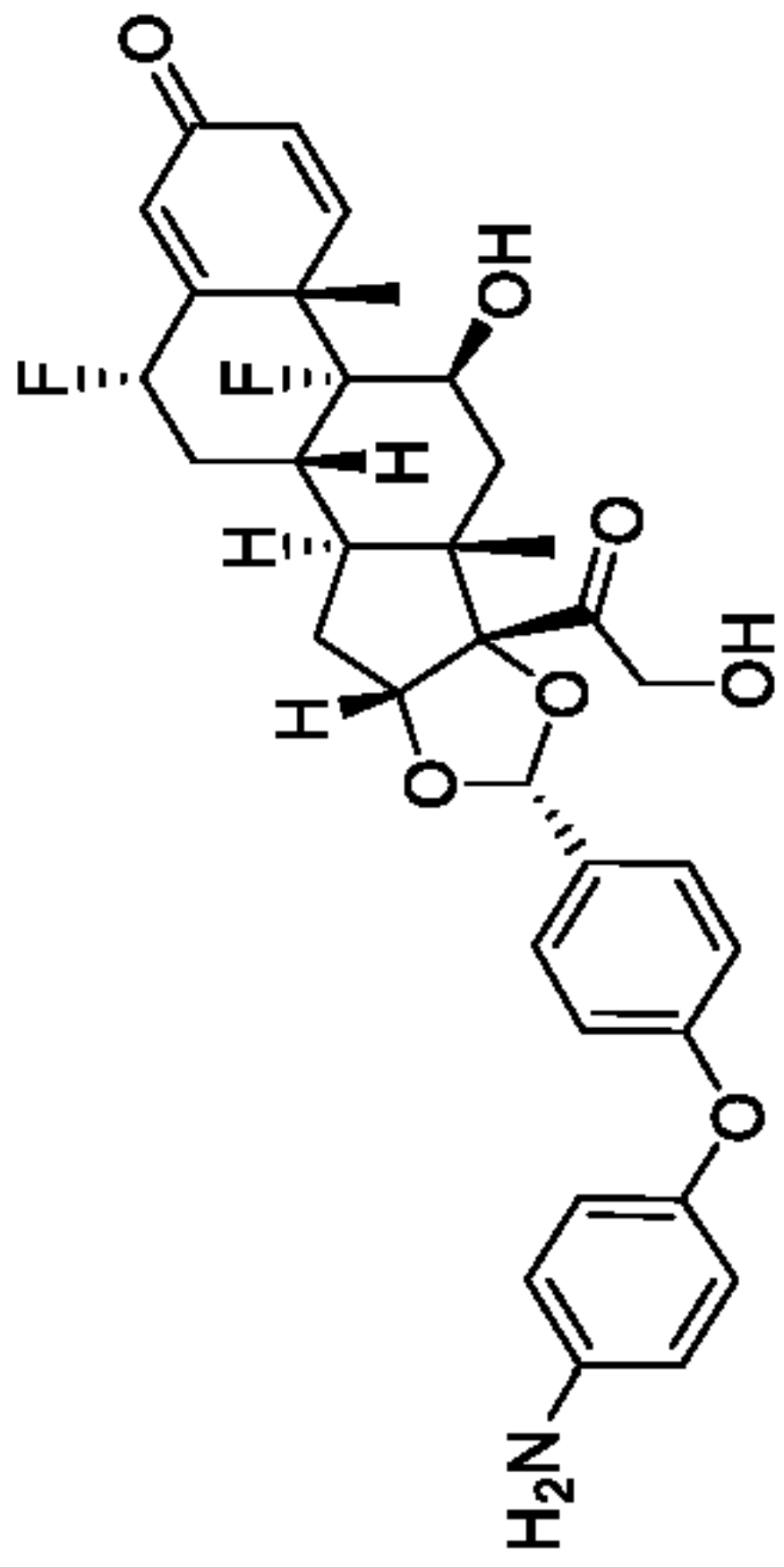
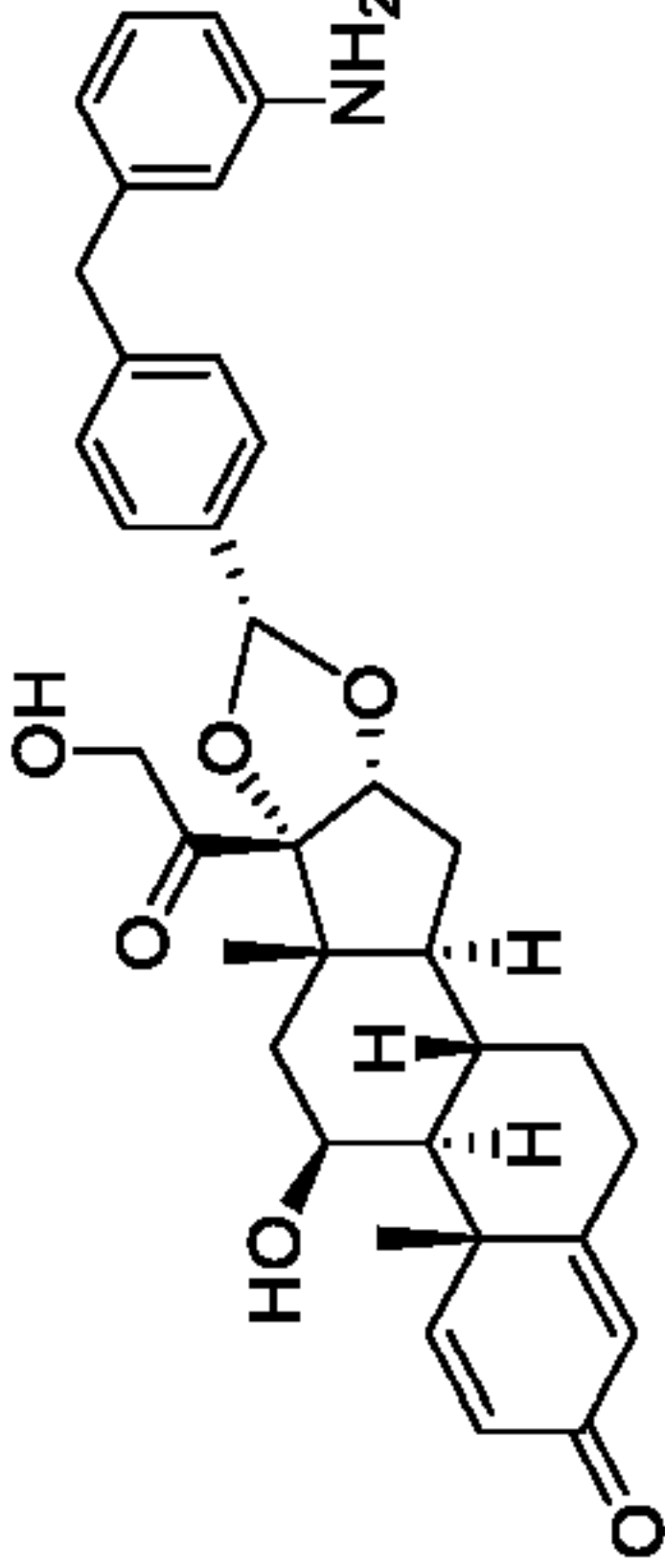
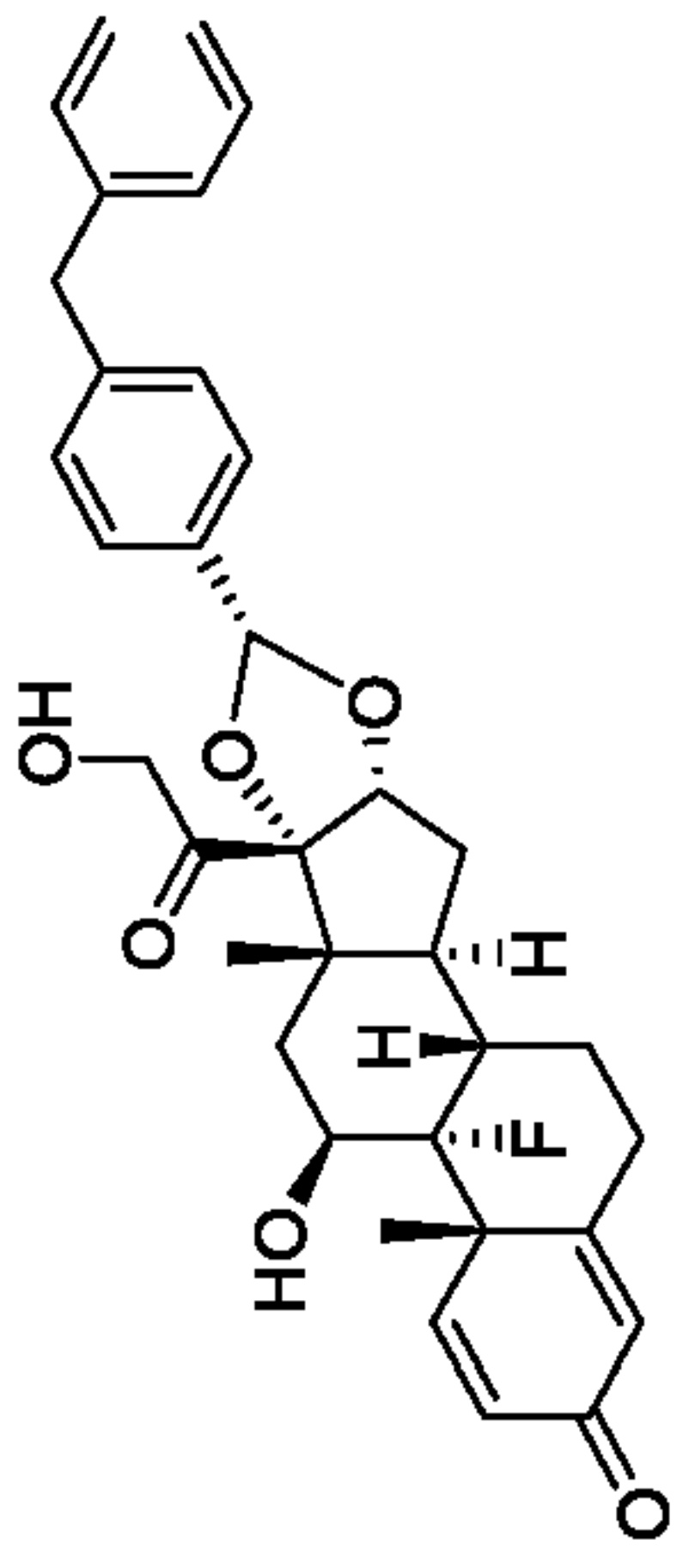
GRE Reporter Assay

[0168] K562 parental GRE (pGL4.36[luc2P/MMTV/Hygro]) cells described in Example 78 were plated onto 96 well tissue culture treated white plates (Costar: 3917) at 50,000 cells per well in 50 µL of assay medium (RPMI, 1% CSFBS, 1% L-glutamine, 1% Na Pyruvate and 1% MEAA). Small molecule GR agonist compounds were serial diluted at a starting concentration of 100 µM and serial diluted 4 fold in 100% DMSO. The small molecule compounds were diluted further in assay medium by transferring 2 µl of serial diluted compounds into 248 µl assay medium into a secondary dilution plate (1:125 dilution). The cells were then treated with 25 µL of 1:125 diluted GR agonist compound for a final starting concentration of 266.7 nM (1:3) or media alone and incubated for 24 hours at 37°, 5% CO₂. After 24 hours incubation, cells were treated with 75 µL of Dual-Glo Luciferase Assay System (Promega-E2920) for 10 minutes and analyzed for luminescence using the TopCount or MicroBeta2 (PerkinElmer).

Estrogen Receptor Binding Assay

[0169] Small molecules were tested for estrogen receptor (ER) alpha binding using a modification of the LanthaScreen® TR-FRET Estrogen Receptor Alpha Coactivator Assay (Thermofisher cat# A15885) where the fluorescein-labeled coactivator peptide was replaced with Fluormone ES2 Green (Thermofisher cat# PV6045) to improve assay signal. Briefly, compounds were serially diluted in DMSO then transferred into assay buffer (Thermofisher cat# PV4295 + 5mM DTT) at a 1:10 dilution. 10 µl of compound was transferred to a 96 half-area black well plate (Corning cat#3694) in duplicate. 5 µl of ER-LBD protein (5nM stock in assay buffer; Thermofisher cat#4542) was added to each well. In addition 5 µl of a prepared stock of Fluormone ES2 Green (12nM) and terbium-labeled anti-GST monoclonal antibody (mAb) (8nM; Thermofisher cat#PV3550) in assay buffer was also added to each well. Plates were incubated at room temperature (RT) for 4 hours, and then TR-FRET emission ratio was measured using an EnVision Multilabel Plate Reader (Perkinelmer # 2104-0010). Data were analyzed using a four parameter curve fit to generate EC50 values. The results are shown in Table 10 below.

Table 10: *in vitro* activity

Cpd. No.	Chemical Structure	GR binding IC ₅₀ (μM)	GRE Reporter EC ₅₀ (μM)	MR (Agonist) EC ₅₀ (μM)	PR Binding IC ₅₀ (μM)	ER Binding IC ₅₀ (μM)	AR Binding IC ₅₀ (μM)
3		0.0036	0.0002	0.0846	0.0026	30++	>30
41		0.0028	0.0014	30++	0.076	30++	>30
42		0.0124	0.0004	10.1	0.0873	9.75	>30
++ indicates that the reported data is an average of multiple data points and the reported data can be read as "greater than" the reported data NT indicates Not Tested							

Example 76: Stability of anti-TNF-alpha immunoconjugates

Matrix Stability

[0170] Anti-TNF α steroid ADCs were tested for their susceptibility to prematurely release small molecule payload under physiological conditions. In these experiments, ADCs were diluted in plasma (human, monkey, mouse, or rat) or buffer in duplicate and incubated for 6 days at 37°C, 5% CO₂. Each sample was quenched at time 0 minutes and at various time points over the 6-day period. Samples were then analyzed using LC/MS/MS and compared with standard curves for the corresponding small molecule. The % maximum release of small molecule payload over time was calculated. The results are summarized in Table 11 below.

Table 11: Stability of anti-TNF α steroid ADCs

Matrix stability (% max SM release)				
Cpd. No.	PBS buffer	Human plasma	Cynomolgous Monkey Plasma	Mouse plasma
145	0.00451	0	0	0

[0171] These results demonstrate that anti-TNF α steroid ADCs are stable in buffer and plasma of multiple species and that minimal small molecule release is observed.

Proteolytic Stability

[0172] The susceptibility of steroid ADCs to release their payload through protease treatment was compared with an ADC generated using the vcmcMMAE drug linker conjugated to a murine CD-19 antibody. ADCs (average DAR of 4) were incubated with either cathepsin B or proteinase K, and payload release was analyzed by LC-MS at various timepoints (0, 1, 4, 7 and 24 hours).

[0173] The results are shown in Figure 1 and demonstrate that the steroid ADCs are resistant to exogenous cathepsin-mediated release of payload from the ADC. This is in contrast to a known payload linker (mcvcMMAE) ADC, where MMAE is released in significant amounts upon cathepsin treatment. This data indicates that steroid ADCs are much less susceptible to premature payload release that results from cathepsin activity in circulation than known ADCs. Indeed, steroid release is only observed with proteinase K, a serine protease that displays broad cleavage specificity. This indicates that the antibody portion of the steroid ADC needs to be significantly catabolized prior to steroid linker cleavage and that payload release can be restricted to an environment where digestion of the antibody scaffold of the ADC can occur, such as the lysosome.

Cathepsin B Digestion

[0174] A 0.2mg/mL stock solution of cathepsin B (Sigma) was prepared in buffer (25mM Tris, 50mM NaCl and 5% glycerol). To generate a 10 μ g/mL working solution of cathepsin B, 5 μ l of 0.2 mg/mL cathepsin B stock was mixed with 95 μ l of activation buffer (50mM sodium acetate pH5, 1mM EDTA, and 5mM DTT) and incubated at 37°C for 15 minutes. For ADC digestion, 20 μ l of 100 ug/mL ADC and 20 μ l of cathepsin B working solution were mixed with 160 μ l dilution buffer (50mM sodium acetate, 1mM EDTA). The sample was incubated at 37°C with shaking, and 40 μ l aliquots were removed after 0, 1, 4, 7, and 24 hours. To each aliquot was added 160 μ l of quench solution (0.1% formic acid; 1:1 MeOH:MeCN; 100 nM carbutamide), and released small molecule was detected by LC-MS/MS as previously described.

Proteinase K Digestion

[0175] A 5 mg/mL stock of proteinase K (Sigma) was prepared in deionized (DI) water. A 0.25 mg/mL working solution of proteinase K was prepared by mixing 50 μ L of 5 mg/mL proteinase K with 950 μ l dilution buffer (1x HBSS and 1mM EDTA). For ADC digestion, 20 μ L of 100 ug/mL ADC and 40 μ l of proteinase K working solution were mixed with 140 μ l dilution buffer. The sample was incubated at 37°C with shaking, and 40 μ L aliquots were removed after 0, 1, 4, 7, and 24 hours. To each aliquot was added 160 μ l of quench solution (0.1% formic acid; 1:1 MeOH:MeCN; 100 nM carbutamide), and released small molecule was detected by LC-MS/MS as previously described.

Example 77: In vivo stability of anti-TNF-alpha immunoconjugates

[0176] The susceptibility of the steroid ADC to undergo drug linker loss was assessed in mice. MP-Ala-Ala-steroid

was conjugated to human IgG1 mAb (av. DAR 4) and incubated at pH 9 to catalyze ring-opening hydrolysis of the thiosuccinimide ring. After neutralization, the steroid ADC was injected in mice, and the kinetics of drug linker loss were monitored over 7 days by LC-MS.

[0177] In these experiments, ADC formulated in phosphate buffer saline was dosed intravenously to 15 male DBA/1 mice at 5 mg/kg. Three mice were sacrificed at 1 hr, 24 hr, 72 hr, 168 hr and 240 hr post-dose. EDTA whole blood was collected and serum was prepared for *in vivo* DAR analysis by mass spectrometry.

Serum sample pre-dilution

[0178] Serum samples were diluted in horse serum (Life technologies, 16050-122) based on total antibody concentrations of ADC measured by total antibody ligand binding assay. Dilutions were based on estimations of final concentration to a range of 10-30 µg/mL, which is suitable for the magnetic beads upper limit of binding capacity.

Immunoaffinity affinity purification

[0179] In a protein LoBind tube (Eppendorf North America), 350 µL horse serum was added to 100 µL of each pre-diluted ADC serum sample to a total volume of 450 µL, followed by addition of 4 µg of biotin-anti-human Fc antibody (2 µL of biotin-anti human at 2 mg/mL solution). Samples were incubated for 2 hours (hr) at room temperature by shaking at 900 rpm on an orbital shaker. For each serum sample, 50 µL slurry of streptavidin coated magnetic beads (Pierce, Cat# 88817) was equilibrated with 0.1% Tween in PBS buffer (PBST) in a LoBind tube. Phosphate Buffered Saline with Tween 20 (PBST) buffer was removed by a pipette after pulling the magnetic beads to the side of the LoBind tube by placing the LoBind tube on a magnetic rack. Serum samples after 2 hr incubation with anti-human capturing reagent were transferred to the LoBind tubes containing equilibrated magnetic beads, and incubated at room temperature for 1 hr at 900 rpm on an orbital shaker. Serum was removed after magnetic bead incubation, and the magnetic bead was washed thoroughly with 500 µL PBST (3 times) followed by 500 µL 5% MeOH in MilliQ water (3 times). Magnetic bead bound ADC was released by incubating the magnetic beads with 100 µL 0.5% formic acid in 50% MeOH/MilliQ water for 15 minutes.

Reduction of purified ADC

[0180] Released ADC was reduced by adding 10 µL reducing reagent (10mM TCEP freshly prepared from powder purchased from Thermo Scientific, with 10mM EDTA in 2M pH7.5 Tris buffer) to 100 µL of sample and incubated at 37°C for 30 minutes.

LC/MS analysis

[0181] Reduced samples (10 µL) were injected into an Agilent 6550 QToF LC/MS system through a temperature controlled (5°C) CTC autosampler. Sample elution was achieved on a Waters C-4, 3.5 µm, 300 Å, 2.1 x 50 mm i.d. HPLC column. The mobile phases were: A: 0.1% formic acid in water, and B: 0.1% formic acid in MeCN; the flow rate was 0.45 mL/min; and the column compartment was maintained at 40°C.

[0182] The HPLC gradient was as follows:

Time (min)	%A	%B
0	95	5
0.6	95	5
1.1	10	90
2.2	10	90
2.4	95	5
3.5	95	5

[0183] High resolution MS analysis of reduced ADC was performed on an Agilent 6550 quadruple time-of-flight (Agilent Technology, San Clara, CA) equipped with a Dual Agilent Jet Stream electrospray ionization (ESI) source operated in the positive ion mode. Mass spectrometer was operated in the extended dynamic range (2G Hz) mode with a MS range up to 3,200 m/z. The primary ESI source was used for LC/MS analysis, and the secondary ESI probe was used for infusing calibration solution at 922.009798 m/z to achieve real time MS calibration. The mass spectrometer was calibrated on a daily basis. Typical mass errors of analytes relative to theoretical masses were less than ± 5 parts per million in

daily operations. MS data were processed using MassHunter Qual Browser Build 5.0.

MS spectrum deconvolution

5 **[0184]** Maximum entropy method in the MassHunter Bioconfirm software package was used to deconvolute the multiple charged ion mass spectra to derive neutral molecular weight spectra. The intensity of the deconvoluted peak was used to calculate DAR.

DAR value calculation from de-convoluted MS spectrum

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[0185] DAR values were calculated using de-convoluted MS peak intensity based on the following equations:

DAR value from light chain (LC): $LC\ DAR = (2 \times \text{peak intensity of } LC^0) / (\text{peak intensity of } LC^0 + \text{peak intensity of } LC^1)$

15

LC and LC^1 are light chains with zero and one drug linker, respectively.

[0186] DAR value from heavy chain (HC):

20 $HC\ DAR = 2 \times (\text{peak intensity of } HC^0 + 2 \times \text{peak intensity of } HC^1 + 3 \times \text{peak intensity of } HC^2) / (\text{peak intensity of } HC^0 + \text{peak intensity of } HC^1 + \text{peak intensity of } HC^2)$

HC, HC^1 , HC^2 and HC^3 are heavy chains with zero, one, two and three drug linkers, respectively.

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$$\text{Total DAR} = \text{LC DAR} + \text{HC DAR}$$

Results

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[0187] The results are shown in Figure 2. This example demonstrates that minimal loss of drug linker is observed from steroid ADC over 7 days.

Example 78: Generation of human and mouse transmembrane TNF-alpha GRE reporter cell lines

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[0188] In order to create a parental cell line, K562 cells were seeded onto a 6 well dish (Costar: 3516) with 2 mL of complete growth medium (RPMI, 10% FBS, 1% L-glutamine, 1% Na Pyruvate and 1% MEM NEAA) at 500,000 cells per well for 24 hours at 37°, 5% CO₂. The next day, 1.5 µg of pGL4.36[Luc2P/MMTV/Hygro] (Promega: E316), 1.5 µg pGL4.75[hRLuc/CMV] (Promega: E639A), and 3 µl of PLUS reagent (Invitrogen: 10964-021) were diluted into 244 µL Opti-MEM (Gibco: 31985-070) and incubated at room temperature for 15 minutes. The pGL4.36[Luc2P/MMTV/Hygro] vector contains MMTV LTR (Murine Mammary Tumor Virus Long Terminal Repeat) that drives the transcription of the luciferase reporter gene *Luc2P* in response to activation of several nuclear receptors such as glucocorticoid receptor and androgen receptor. The pGL4.75[hRLuc/CMV] Vector encodes the luciferase reporter gene *hRLuc* (*Renilla reniformis*) and is designed for high expression and reduced anomalous transcription. After incubation, diluted DNA solution was pre-incubated with 1:1 Lipofectamine LTX solution (Invitrogen: 94756) (13.2 µl + 256.8 µl Opti-MEM) and incubated at room temperature for 25 minutes to form DNA-Lipofectamine LTX complexes. After incubation, 500 µl of DNA-Lipofectamine complexes were added directly to the well containing cells. K562 cells were transfected for 24 hours at 37°, 5% CO₂. After incubation, cells were washed with 3 mL of PBS and selected with complete growth medium containing 125 µg/mL of hygromycin B (Invitrogen: 10687-010) for two weeks. "K562 pGL4.36[Luc2P/MMTV/Hygro]_pGL4.75[hRLuc/CMV]" cells were produced.

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[0189] In order to create a murine transmembrane TNF-alpha GRE reporter cell line, the parental cells, K562 pGL4.36[Luc2P/MMTV/Hygro]_pGL4.75[hRLuc/CMV], were seeded onto 6 well dish (Costar: 3516) with 2 mL of complete growth medium (RPMI, 10% FBS, 1% L-glutamine, 1% Na Pyruvate and 1% MEM NEAA) at 500,000 cells per well for 24 hours at 37°, 5% CO₂. The next day, 3 µg of mFL_TNFα DNA (Origene: MC208048), which encodes untagged mouse TNF, and 3 µl of PLUS reagent (Invitrogen: 10964-021) were diluted into 244 µL Opti-MEM (Gibco: 31985-070) and incubated at room temperature for 15 minutes. After incubation, diluted DNA solution was pre-incubated with 1:1 Lipofectamine LTX solution (Invitrogen: 94756) (13.2 µL + 256.8 µL Opti-MEM) and incubated at room temperature for 25 minutes to form DNA-Lipofectamine LTX complexes. After incubation, 500 µl of DNA-Lipofectamine complexes were

55

added directly to the well containing cells. The parental K562 pGL4.36[Luc2P/MMTV/Hygro]_pGL4.75[hRLuc/CMV] cells were transfected for 24 hours at 37°, 5% CO₂. After incubation, cells were washed with 3 mL of PBS and selected with complete growth medium containing 125 µg/mL of hygromycin B (Invitrogen: 10687-010) and 250 µg/mL G418 (Gibco: 10131-027) for two weeks. "K562 mouse FL-TNFα GRE (pGL4.36[luc2P/MMTV/Hygro])" cells were produced.

5 **[0190]** In order to create a human transmembrane TNF-alpha GRE reporter cell line, the parental cells, K562 pGL4.36[Luc2P/MMTV/Hygro]_pGL4.75[hRLuc/CMV], were transfected with the plasmid hTNF delta 1-12 C-Myc pcDNA3.1(-) plasmid construct. This plasmid is pcDNA 3.1 (Thermofisher cat# V79020) encoding tace resistant trans-

10 membrane TNF (i.e., SEQ ID NO:1 lacking amino acids 77-88). (See Perez C et al. Cell 63 (2): 251-8 (1990) discussing tace resistant transmembrane TNF.) These cell lines were then used in the TNF-alpha reporter assays described in the subsequent examples.

Example 79: Activity of anti-TNF-alpha immunoconjugates in GRE transmembrane TNF-alpha reporter assays

[0191] K562 parental GRE (pGL4.36[luc2P/MMTV/Hygro]) cells and K562 mFL-TNF-a or hTNF delta 1-12 GRE

15 (pGL4.36[luc2P/MMTV/Hygro]) cells were plated onto 96 well tissue culture treated white plates (Costar: 3917) at 50,000 cells per well in 50 µL of assay medium (RPMI, 1% CSFBS, 1% L-glutamine, 1% Na Pyruvate and 1% MEAA). The cells were treated with 25 µL of 3x serial diluted murine or human anti-TNF-a antibody drug conjugates in assay medium, steroid compound, or media alone and incubated for 48 hours at 37°, 5% CO₂. After 48 hours of incubation, cells were

20 treated with 75 µL of Dual-Glo Luciferase Assay System (Promega-E2920) for 10 minutes and analyzed for luminescence using the TopCount (PerkinElmer). Data were analyzed using a four parameter curve fit to generate EC50 values. % maximum activation was normalized to 100nM dexamethasone, which was considered maximum activation. The results using the murine TNF-alpha cell line are shown in Table 12 below, and the results using the human TNF-alpha cell line are shown in Table 13 below. In Table 12 below, A refers to 8C11. In Table 13 below, A refers to adalimumab (SEQ ID

25 NOs: 66 and 73). Percent (%) monomer was determined by SEC as previously described (see ADC analytical procedures).

Table 12: *In vitro* activity of anti-murine TNFa antibody drug conjugates in mouse transmembrane TNFa GRE reporter assay (A refers to the anti-murine TNFa antibody 8C11)

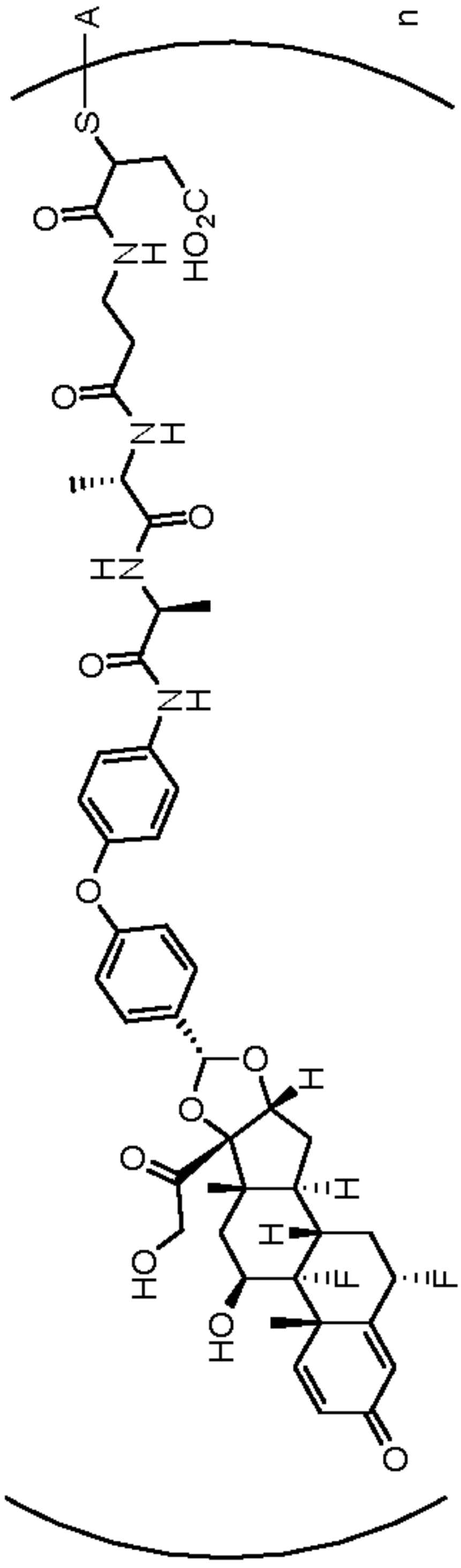
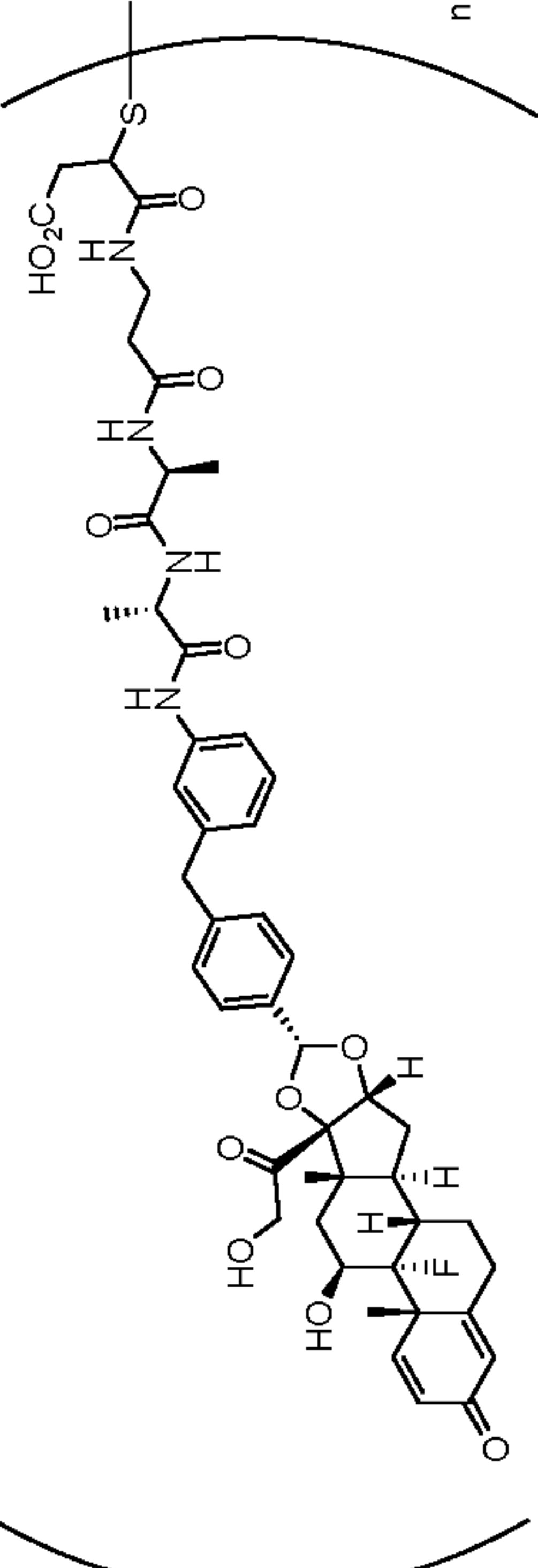
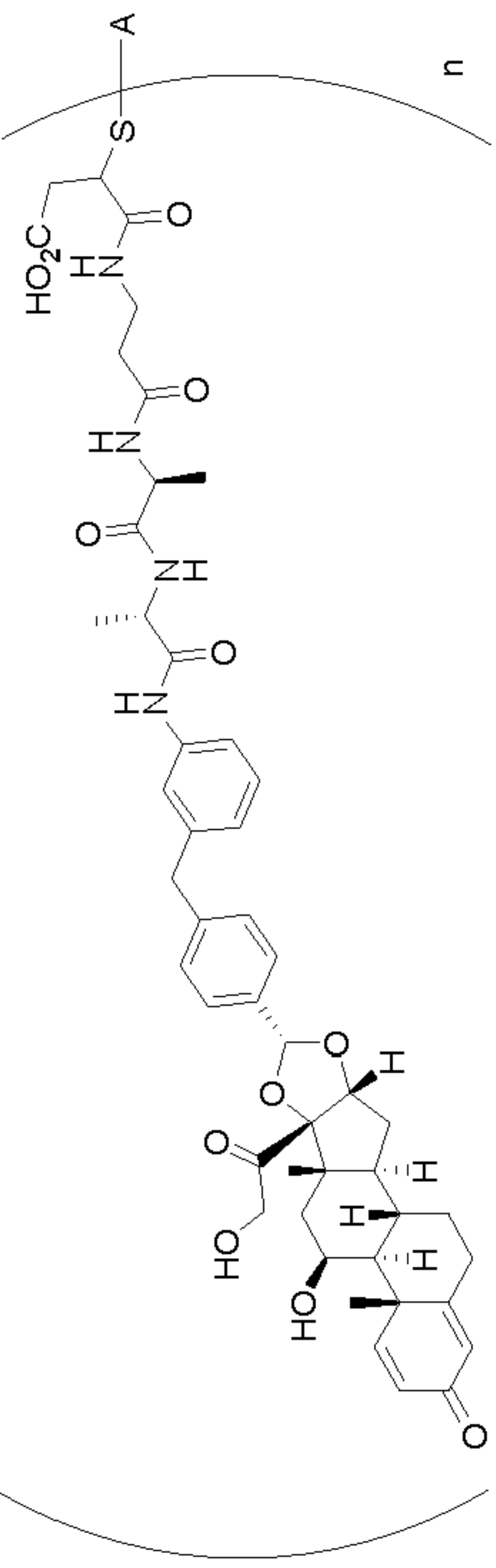
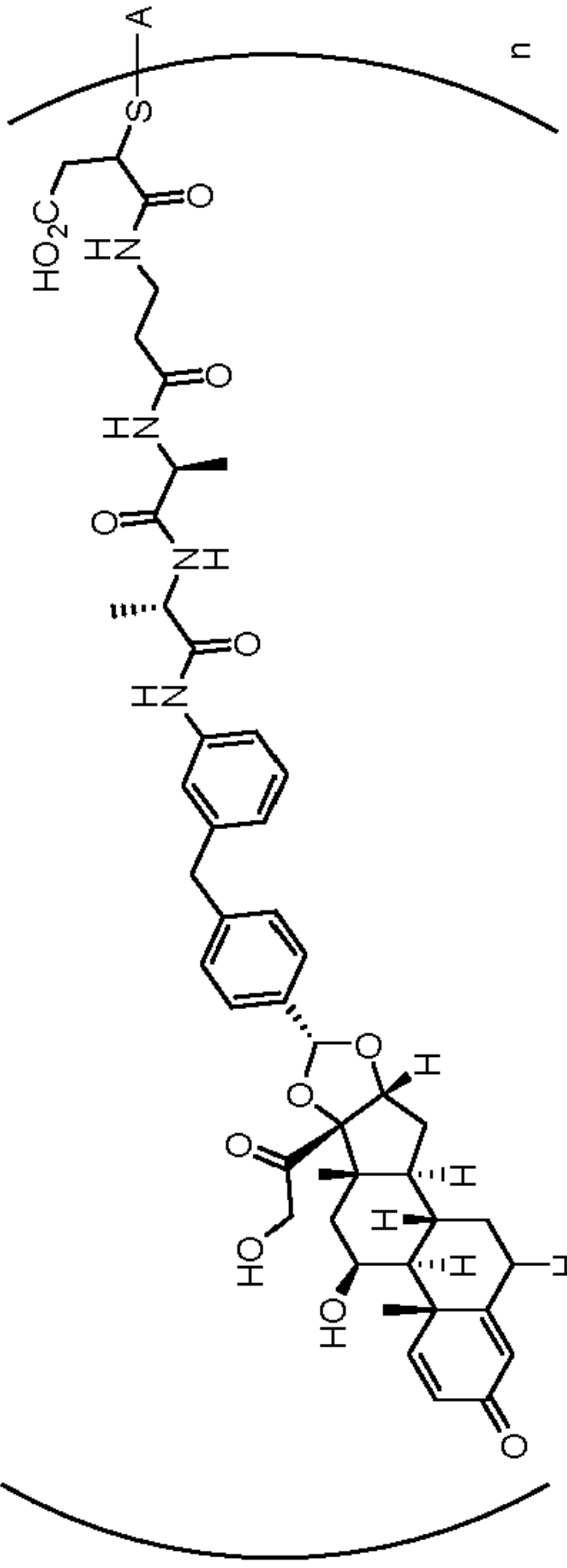
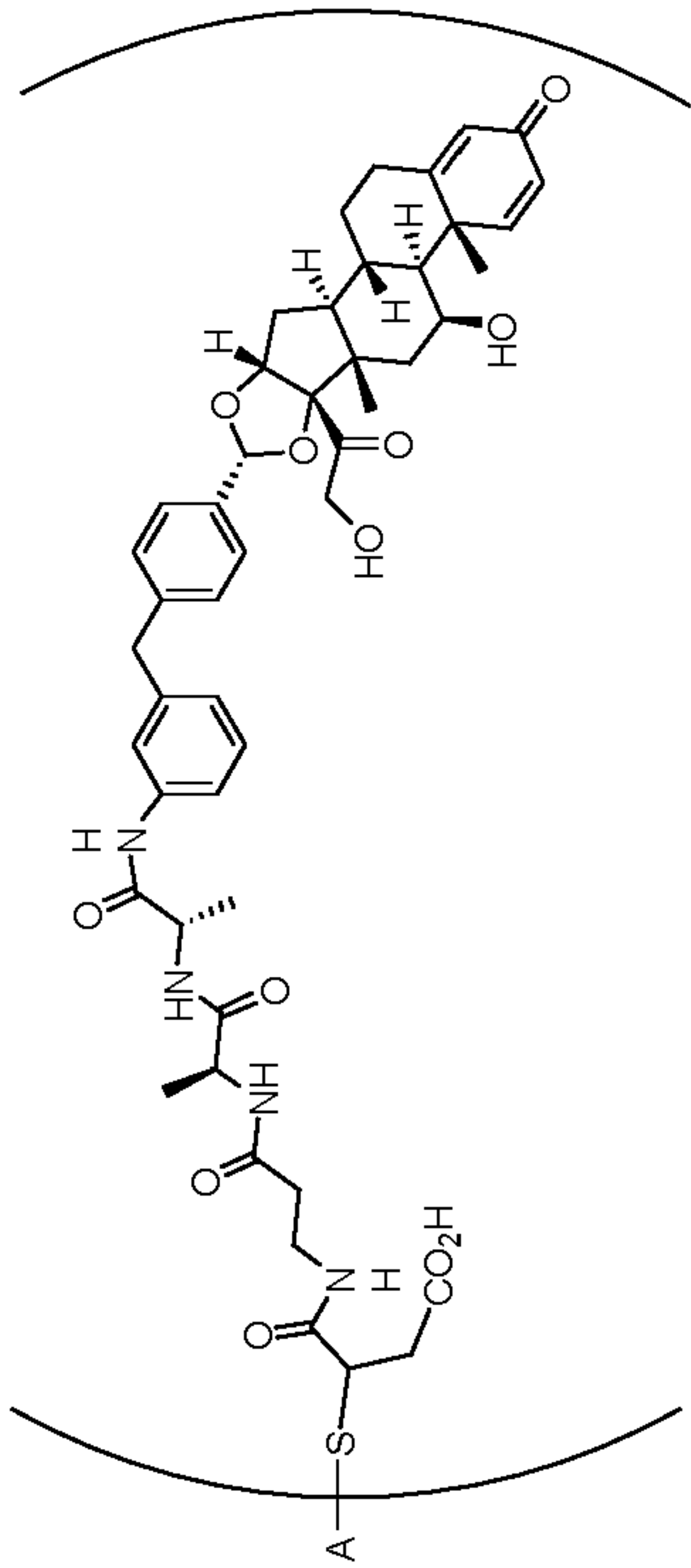
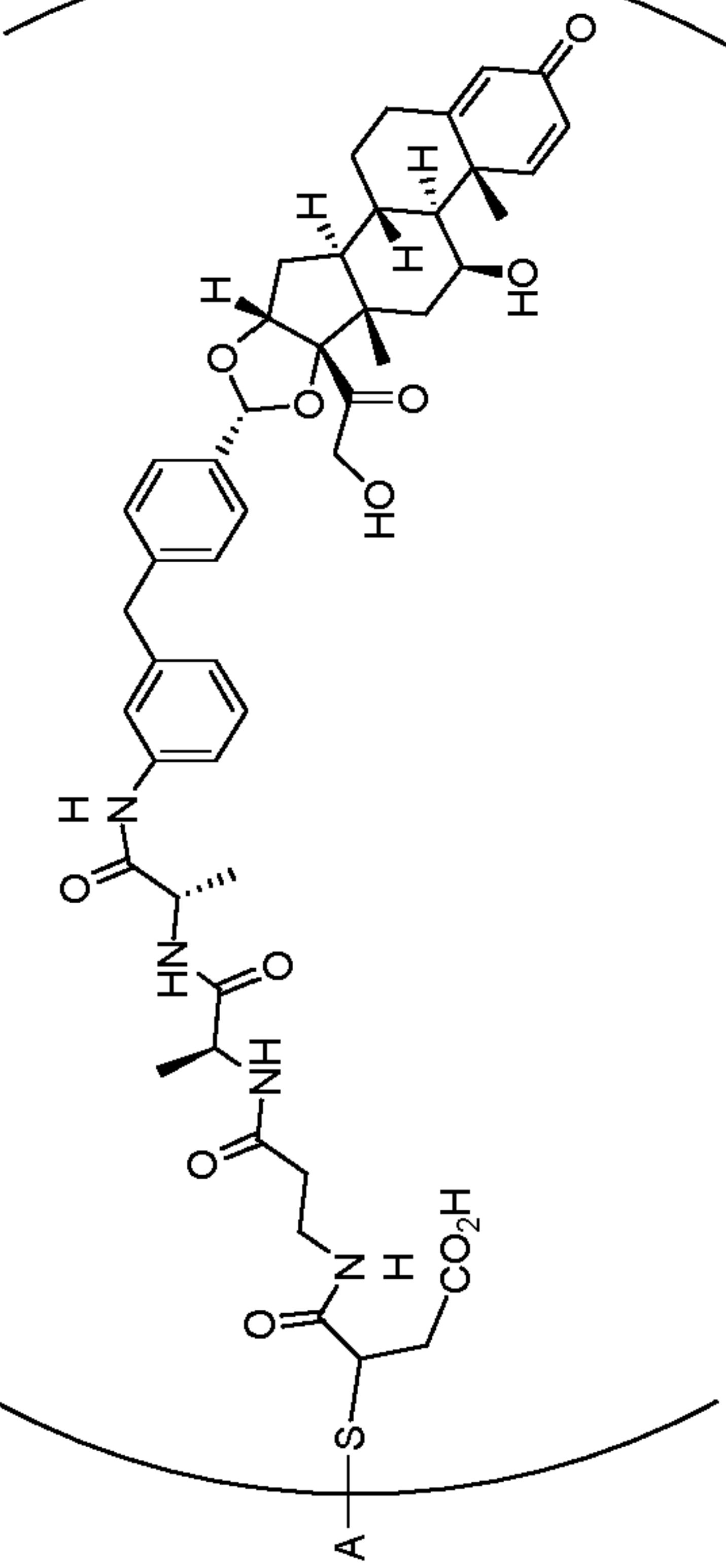
Cpd. No.	Structure	n	% monomer	mTNFa GRE EC50 (ug/mL)	mTNFa GRE (% max)	K562 GRE EC ₅₀ (ug/mL)	K562 GRE (% max)
137		4	99.9	0.0105	114	5.27	93
139		4	96.6	0.0239	92	15.2	61
143		2	97.7	0.0795	82	>50	24
145		4	98	0.0393	95	24.7	36

Table 13: *In vitro* activity of anti-human TNFa antibody drug conjugates in human transmembrane TNFa GRE reporter assay (A refers to the anti-human TNFa antibody adalimumab (SEQ ID NOs: 66 and 73))

Cpd. No.	Structure	n	% monomer	hTNFa GRE EC ₅₀ (ug/mL)	hTNFa GRE (% max)	K562 GRE EC ₅₀ (ug/mL)	K562 GRE (% max)
203		4	98.2	0.0482	118	>50	35
204		2	99.4	0.0767	103	>50	21

Example 81: Activity of anti-hTNF alpha steroid ADCs in Lipopolysacharride Stimulated Human PBMC Cytokine Release Assay

[0192] Primary human peripheral blood mononuclear cells (PBMCs) were purchased from Biological Specialty Corporation (cat# 214-00-10), washed in 50 mL PBS, re-suspended in FBS with 5% DMSO, aliquoted and cryopreserved in liquid nitrogen until use. The PBMCs were thawed, re-suspended in RPMI supplemented with 2% FBS, and 1% Penicillin-Streptomycin, and plated into a cell assay plate (Costar #3799). The cells were incubated with varying concentration of anti-hTNF alpha steroid ADCs at 37 °C and 5% CO₂ for 4 hours. Cells were then stimulated with 100ng/ml LPS for overnight. On the following day, plate was spun for five minutes at 1000 rpm, and 100 µL of supernatant media was directly transferred to an additional 96-well plate and analyzed for IL-6 (MSD, #K151AKB) and IL-1 beta(MSD, #K151AGB) concentrations. The dose response data were fitted to a sigmoidal curve using nonlinear regression, and the IC₅₀ values calculated with the aid of GraphPad 5.0 (GraphPad Software, Inc.). The results shown in Table 17 demonstrate that the anti-hTNF alpha steroid ADCs have potent activity in inhibiting the release of pro-inflammatory cytokines IL-6 and IL-1beta from activated primary immune cells.

Table 17: *In vitro* activity of anti-human TNF alpha ADCs in LPS-stimulated human PBMC cytokine release assay (n=2)

Cpd No.	Cytokine Release IC ₅₀ (ng/ml)	
	IL-6	IL-1beta
203	14.3 ± 3.5	3.6 ± 1.2

Example 82: Activity of anti-TNF-alpha immunoconjugate in TNFa-induced cytotoxicity assay in L929 cells

[0193] L929 is a murine aneuploid fibrosarcoma cell line that is sensitized by pretreatment with actinomycin D. Treatment with TNFa initiates apoptosis and subsequent cell death. L929 cells in log phase were harvested using trypsin 0.05%, washed twice with D-PBS and counted by CEDEX. The cells were resuspended at 1E6 cell/mL in assay media containing 4 µg/mL actinomycin D and 50 µL was added to all wells. Anti-murine TNF alpha steroid ADC (anti-murine TNF alpha 8C11 conjugated to Cpd 71; also referred to as anti-mTNF alpha steroid ADC) and anti-murine TNF mAb (8C11) were diluted to a 4× concentration in assay media and serial 1:3 dilutions were performed. Mouse TNF α was diluted to a 4x concentration of 600 pg/mL. The anti-mTNF steroid ADC and anti-mTNF mAb (125 µL) were added to the mTNF α (125 µL) in a 1:2 dilution scheme and allowed to incubate for 1 hour at room temperature, gently shaking. The antibody/mTNF α (or ADC/ mTNF α) mixture was added to wells at 50 µL/well in triplicate. The plates were incubated for 20 hours at 37 °C, 5 % CO₂. To quantify viability, 10 µL of WST-1 reagent (Roche cat# 11644807001) was added to wells. Plates were incubated under assay conditions for 3.5 hours, centrifuged at 500 ×g and 75 µL supernatant transferred to an ELISA plate (Costar cat#3369). The plates were read at OD 420-600 nm using a Spectromax 190 ELISA plate reader. Data was analyzed and IC₅₀ values calculated using a sigmoidal dose response (variable slope) fit in GraphPad Prism 5.

[0194] Anti-mTNF alpha steroid ADC had comparable neutralizing potency (IC₅₀ 1.9nM) to unconjugated anti-mTNF alpha mAb (IC₅₀ 1.5nM).

Example 83: Binding of anti-mTNF-alpha steroid ADC to mouse Fcgamma receptors

[0195] SPR (surface plasmon resonance) based Biacore T200 instrument (GE Healthcare) was used to evaluate binding of anti-mTNF-alpha steroid ADC (anti-mTNF 8C11 conjugated to Cpd 71) and anti-mTNF-alpha mAb to recombinant mouse FcgRs (all R&D Systems). The FcgRs were directly immobilized on the surface of the flow cells two, three and/or four of the CM5 type S Biacore chip(s) to achieve densities of ~1000-2000 RU (resonance units). Blank modified surface of the flow cell one of each Biacore chip was used as a reference surface. Each experiment consisted of association and dissociation phases. Association phase consisted of titrating parental mAb and ADC over all flow cells at a flow rate of 50 ul/min and concentrations of 4000, 2000, 1000, 500, 250, 125, 62.5, 31.25 and 0 nM for FcgRIIB and FcgRIII and 100, 50, 25, 12.5, 6.25, 3.13, 1.56 and 0 nM for receptors I and IV. Dissociation phase consisted of the continuous flow of the running buffer (HBS-EP+, pH 7.4, GE Healthcare)at the flow rate of 50 ul/min. Association and dissociation phases were monitored for 5 min each (receptors I and IV) or 1 min (receptors II and III). Chip surfaces were regenerated with a 5s pulse of 100 mM HCl at a flow rate of 100 ul/min after each binding cycle. Biacore Evaluation software was used to fit the raw data to 1:1 (FcgRI and IV) or Steady State (receptors IIB and III) binding models. Results are shown in Table 19. k_a is the association rate constant (1/Ms); k_d is the dissociation rate constant (1/s); K_D is the equilibrium dissociation constant (M).

Table 19: Binding affinities of anti-TNF-alpha immunoconjugate to mouse Fcgamma receptors

	muFcγRI			muFcγRIIb	muFcγRIII	muFcγRIV		
	k _a (1/Ms)	k _d (1/s)	K _D (M)	K _D (M)	K _D (M)	k _a (1/Ms)	k _d (1/s)	K _D (M)
Anti-mTNF mAb	7.4E+05	1.6E-02	2.1E-08	3.7E-06	3.1E-06	1.2E+05	5.3E-03	4.6E-08
Anti-mTNF ADC	3.2E+05	8.7E-03	2.8E-08	5.9E-06	3.3E-06	8.4E+04	4.6E-03	5.5E-08

Example 84: Activity of anti mTNF-alpha steroid ADCs in contact hypersensitivity model

[0196] Anti-mTNF alpha steroid ADCs were evaluated in an acute contact hypersensitivity model, an elicitation of acute skin inflammation using delayed-type hypersensitivity (DTH) response (T-cell driven) via application of a sensitizing agent (fluorescein isothiocyanate (FITC)). The efficacy of anti-mTNF alpha steroid ADCs was measured by the ability to reduce ear swelling. The steroid biomarkers corticosterone and procollagen type 1 N-terminal propeptide (P1NP) were included as readouts to assess the putative impact of anti-mTNF alpha steroid ADC treatment on the Hypothalamus-Pituitary-Adrenal (HPA) axis and bone turnover respectively.

Ear Swelling

[0197] On day 0 mice were placed under general anesthesia and the abdomens were shaved. Using a micropipettor, mice were sensitized by epicutaneous application of 400uL of FITC solution (1.5% solution in 1:1 acetone:DBP) on the abdomen. 6 days later mice were dosed with vehicle or therapeutic agent 1 hour prior to ear challenge with FITC. For ear challenge, mice were placed under general anesthesia and were challenged with 20μl FITC applied onto right ear. 24 hours after challenge mice were placed under general anesthesia and their ear thickness is measured by caliper. Difference between challenged and unchallenged ears was calculated. 72 hours after ear challenge, mice were injected with ACTH at 1mpk IP, and terminally bled at 30min post-ACTH. Plasma is collected and analyzed P1NP, corticosterone, free steroid, and large molecule levels.

Quantification of released free steroid and endogenous corticosterone

[0198] Calibration curve of steroid was prepared in mouse plasma with final concentrations from 0.03 nM to 0.1 μM at 8 different concentration levels. Corticosterone calibration curve ranging from 0.3 nM to 1 μM final corticosterone concentrations was prepared in 70 mg/mL bovine serum albumin solution in PBS buffer. A solution of 160 μL MeCN with 0.1% formic acid was added to 40 μL study plasma samples or calibration standards. Supernatants were diluted with distilled water and 30 μL final sample solution was injected for LC/MS analysis.

[0199] Quantification of released free steroid and corticosterone was conducted on an AB Sciex 5500 triple quadrupole mass spectrometer connected to a Shimadzu AC20 HPLC system interfaced with an electrospray ionization source operating in positive mode. A Waters XBridge BEH C18, 2.1x30mm, 3.5 μm column was used for chromatography separation. The mobile phase A was 0.1% formic acid in Milli Q HPLC water, and mobile phase B was 0.1% formic acid in MeCN. A linear gradient from 2% of mobile phase B to 98% mobile phase B was applied from 0.6 to 1.2 minutes. The total run time was 2.6min at a flow rate of 0.8 mL/min. The mass spectrometer was operated in positive MRM mode at source temperature of 700°C.

Quantification of plasma P1NP

[0200] Quantification of plasma P1NP was conducted on a LC/MS platform based on protein trypsin digestion. Plasma samples were partially precipitated and fully reduced by adding MeCN/0.1M ammonium bicarbonate/DTT mixture. Supernatant was collected and alkylated by adding iodoacetic acid. The alkylated proteins were digested by trypsin and resulting tryptic peptides were analyzed by LC/MS. Calibration curve were generated by using synthetic tryptic peptide spiked into horse serum (non-interfering surrogate matrix). Stable isotope labeled flanking peptide (3-6 amino acids extension on both termini of the tryptic peptide) was used as internal standard added in the MeCN/DTT protein precipitation mixture to normalize both digestion efficiency and LC/MS injection.

[0201] A Columnex Chromenta BB-C18, 2.1x150mm, 5 μm column was used for chromatography separation. The mobile phase A was 0.1% formic acid in Milli Q HPLC water and mobile phase B was 0.1% formic acid in MeCN. A linear gradient from 2% of mobile phase B to 65% mobile phase B was applied from 0.6 to 3 min. The total run time was 8min at a flow rate of 0.45 mL/min. An AB Sciex 4000Qtrap mass spectrometer was used in positive MRM mode to quantify

P1NP peptides, at source temperature of 700°C.

Quantification of total ADC in plasma

[0202] Concentrations of total antibody (ADC and backbone mAb) were measured by ligand binding assay using Mesoscale Discovery (MSD) platform. Biotin labeled mouse TNF was used as the capture reagent for anti-mTNF alpha steroid ADCs and Sulfo-TAG conjugated goat anti-mouse detection antibody was used for detection. A calibration curve was generated by serial dilution of the ADC molecule in matching matrix and QC samples were used to qualify the assay

Results

[0203] The results are shown in Table 20 below:

Table 20: Comparison of anti-mTNF alpha steroid ADC activity on ear swelling and steroid biomarkers in CHS model of inflammation

ADC	Ear swelling (% inhib @ 10mpk)	SEM	P1NP (% inhib. @ 10mpk)	SEM	Corticosterone(% inhib @ 10mpk)	SEM
Cpd. No. 145	87.8	3.4	19.2	6.3	15.1	9.9

[0204] These results demonstrate that anti-mTNF alpha steroid ADCs can obtain an efficacious response equivalent to small molecule steroid treatment while sparing the undesired effects on corticosterone and P1NP.

[0205] An additional contact hypersensitivity (CHS) study was conducted to address whether conjugation of the steroid payload to anti-TNF mAb was required for enhanced efficacy. Mice were dosed i.p. once according to the protocol described above with either vehicle, anti-mTNF alpha mAb (10mpk), anti-mTNF alpha steroid ADC (10mpk) (cpd no 139) or a mixture of anti-mTNF alpha mAb co-dosed (concurrently delivered in a single i.p. injection) with an equivalent amount of small molecule steroid to match the ADC stoichiometry. For a 10mpk dose of anti-mTNF alpha steroid ADC with a DAR of 4, this was calculated to be 4 µg of small molecule steroid (Cpd. No. 42). The results shown in Figure 9 demonstrate that anti-mTNF alpha steroid ADC treatment had significantly increased efficacy in reducing ear inflammation when compared to the combination of anti-mTNF alpha mAb and small molecule steroid or anti-mTNF alpha mAb alone.

Example 85: Activity of anti-mTNF-alpha steroid ADCs in collagen-induced arthritis

[0206] The ability of anti-mTNF alpha steroid ADC (Cpd. No. 137) to impact disease was assessed in the collagen-induced arthritis (CIA) model of arthritis.

[0207] In these experiments, male DBA/1J mice were obtained from Jackson Labs (Bar Harbor, ME). Mice were used at 6 to 12 weeks of age. All animals were maintained at constant temperature and humidity under a 12-hour light/dark cycle and fed with rodent chow (Lab Diet 5010 PharmaServ, Framingham, MA) and water ad libitum. AbbVie is AAALAC (Association for Assessment and Accreditation of Laboratory Animal Care) accredited, and all procedures were approved by the Institutional Animal Care and Use Committee (IACUC) and monitored by an attending veterinarian. Body weight and condition were monitored, and animals were euthanized if exhibiting >20% weight loss.

[0208] The male DBA/J mice were immunized intradermally (i.d.) at the base of the tail with 100 µL of emulsion containing 100 µg of type II bovine collagen (MD Biosciences) dissolved in 0.1 N acetic acid and 200 µg of heat-inactivated Mycobacterium tuberculosis H37Ra (Complete Freund's Adjuvant, Difco, Laurence, KS). Twenty-one days after immunization with collagen, mice were boosted IP with 1 mg of Zymosan A (Sigma, St. Louis, MO) in PBS. Following the boost, mice were monitored 3 to 5 times per week for arthritis. Rear paws were evaluated for paw swelling using Dyer spring calipers (Dyer 310-115)

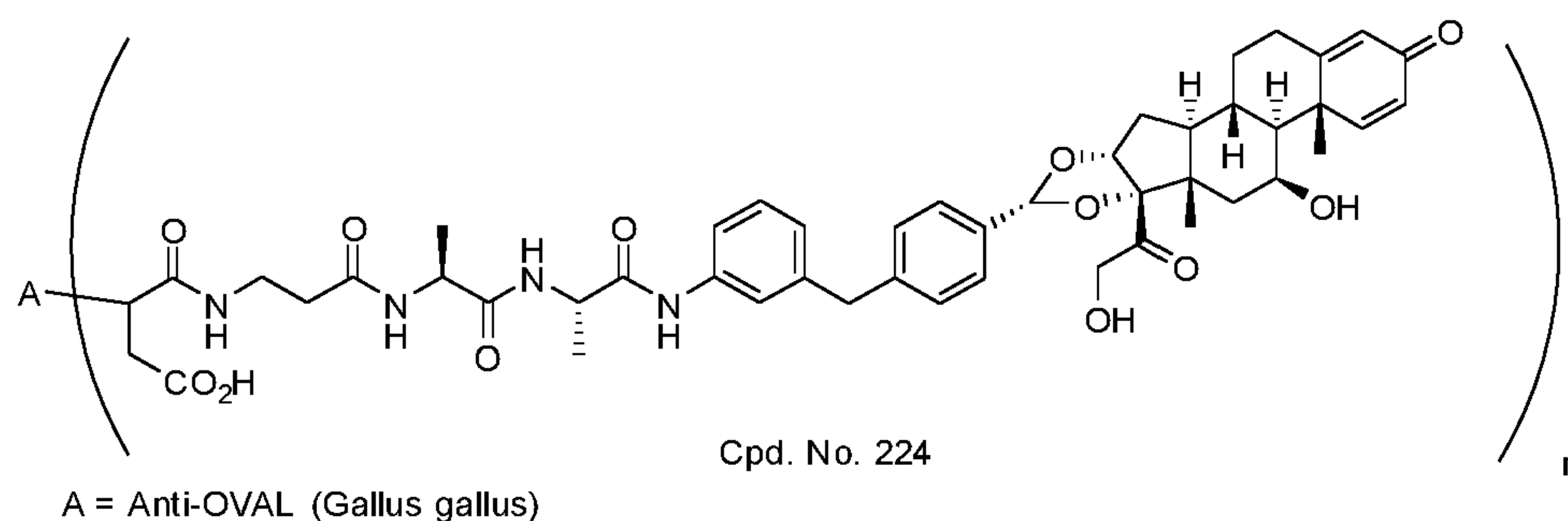
[0209] Mice were enrolled between days 24 and 28 at the first clinical signs of disease and distributed into groups of equivalent arthritic severity. Early therapeutic treatment began at the time of enrollment.

[0210] Animals were dosed once orally (p.o.) with steroid (Cpd. No. 3) (10mpk) in a 0.5%HPMC/0.02%Tween80 vehicle [v/] or intraperitoneal (i.p.) with anti-mTNF alpha mAb (10mpk) (8C11) or anti-mTNF alpha steroid ADC (10mpk) (Cpd. No. 137) in 0.9% saline. Blood was collected for antibody exposure by tail nick at 24 and 72 hours after dose. Paws were collected at the terminal timepoint for histopathology. Blood was collected at the terminal timepoint by cardiac puncture for complete blood counts (Sysmex XT-2000iV). Statistical significance was determined by ANOVA.

[0211] The results are shown in Figure 3 and demonstrate that a single dose of anti-mTNF alpha steroid ADC can

exhibit an extended duration of action through amelioration of paw swelling for ~6 weeks compared to anti-mTNF alpha mAb or small molecule steroid alone.

[0212] In a separate study designed to address the TNF-targeting functionality of the anti-mTNF alpha steroid ADC, animals were dosed once i.p. with anti-mTNF alpha mAb (10mpk) or anti-mTNF alpha steroid ADC (10mpk) (Cpd. No. 145) or with isotype steroid ADC (10mpk) (Cpd. No. 224):



which recognizes the hen egg protein ovalbumin, an antigen not expressed in mice. Both ADCs had equivalent drug load. Small molecule steroid (3mpk) was dosed orally once daily (q.d). The results are shown in Figure 10 and demonstrate that a single dose of anti-mTNF alpha steroid ADC has equivalent efficacy to small molecule steroid dosed daily over a 21 day period. A single dose of the non-targeted isotype steroid ADC had only partial efficacy, similar to anti-mTNF mAb alone over the same time-frame. Percentages denote % inhibition compared to vehicle. An evaluation of the animals' body weights throughout the course of this study (Figure 11) revealed all the treatment groups with the exception of the anti-mTNF alpha steroid ADC group lost weight. In contrast, the anti-mTNF alpha steroid ADC treated mice exhibited normal weight gain throughout the 21 day study.

Example 86: Activity of various anti-mTNF alpha steroid ADCs in collagen-induced arthritis

[0213] Several anti-mTNF alpha steroid ADCs with different steroid payloads or drug:antibody ratios (DARs) were tested for efficacy in a mouse model of arthritis. The studies were conducted according to the procedure outlined in Example 85. The results are shown in Table 21 below.

Table 21: Efficay of anti-mTNF alpha steroid ADCs in model of arthritis

Cpd No.	DAR (n)	% inhibition of paw swelling vs vehicle (AUC _{0-21d}) (at 10mpk)	SEM
143	2	96	3.3
145	4	95	4

Example 87: Activity of anti-hTNF-alpha immunoconjugates in human TNF transgenic Tg1278TNF knock-out mouse model of Collagen Antibody Induced Arthritis

[0214] The efficacy of anti-human TNF alpha ADCs was assessed in a human TNFa transgenic mouse model of arthritis.

[0215] The Collagen Antibody-Induced Arthritis (CAIA) model (Moore, AR J Transl Med 12:285 (2014)) was performed using the human TNF transgenic Tg1278TNF knock-out mice as previously described (Moore A et al. J Transl Med 12 (1): 285 (2014)). Eight mgs of a cocktail of monoclonal antibodies that target different epitopes of collagen type II (ArthritoMab™) were administered intraperitoneally (i.p.) to the mice on day 0. On day 3, the mice were injected i.p. with 10 µg LPS to boost the disease pathology. Animals were evaluated for arthritic score daily starting from day 3 until day 14 of the study. Eight male mice were used per group and test articles or PBS vehicle were administered i.p. twice a week for two weeks.

[0216] The results are shown in Figure 4 and demonstrate that anti-human TNF alpha ADCs can significantly reduce disease score compared to an anti-human TNF alpha mAb (adalimumab).

Example 88: Activity of anti-mTNF alpha steroid ADCs on peak inflammation

[0217] A mouse CIA experiment was conducted to establish the efficacy of anti-mTNF alpha steroid ADC on animals with peak inflammation. For late therapeutic dosing, mice were enrolled in the study at first clinical signs of disease and dosed 6 days after enrollment. A group of animals was sacrificed at day 7 of disease to provide a baseline for arthritic

changes by micro-computed tomography (μ CT) and histologic analysis at the time all other groups were dosed. All animals were dosed once on day 6 with either vehicle (0.9% saline), anti-mTNF alpha mAb (10mpk) (8C11) or anti-mTNF alpha steroid ADC (10mpk) (Cpd. No. 145) and sacrificed on day 21. Arthritic hind paws were collected and μ CT analysis was performed. The same paws were then used for histologic evaluation. At the termination of the experiment, whole blood was collected by cardiac puncture to evaluate complete blood counts (CBCs).

Micro-Computed Tomography (μ CT)

[0218] Rear paws were removed intact at the tibia/fibula and fixed in 10% Formalin. Paws were scanned by μ CT (Scanco Medical AG, Micro-CT40) at 55 kVp at 145 μ A at High Resolution setting (1000 Projections/180° at 2048x2048 Pixel Reconstruction) using Isotropic Voxels and 300 millisecond integration time. A cylindrical contour was manually drawn around region of interest from the tibiotalar junction and extending into the ankle for 100 slices (1.8 mm). Evaluation was performed by Scanco software utilizing 0.8 sigma gauss, with an upper threshold of 1000 and a lower threshold of 320.

Histologic evaluation

[0219] Rear paws from treated mice were immersion fixed in 10% neutral buffered formalin and partially decalcified in Calrite solution for 48 hours to allow trimming of the lateral and medial edges of the tarsus. Paws were then placed back into Calrite for ~48 hours to complete decalcification. Samples were routinely processed, embedded in paraffin in the sagittal plane, sectioned at 5 microns and stained with hematoxylin and eosin. Slides were evaluated microscopically for the presence of inflammation/ pannus formation, neutrophil infiltration, bone erosion and cartilage damage using a 0-4 scale: 0= none present, 1 = mild, 2 = moderate, 3 = marked, 4 = severe.

[0220] The results shown in Figure 12 demonstrate that a single dose of anti-mTNF alpha steroid ADC can reverse established disease and reduce paw swelling to near baseline. In contrast, a single dose of anti-mTNF alpha mAb had a minimal effect on inflammation.

[0221] The effect of treatment on tarsal bone loss as measured by μ CT is shown in Figure 13. The results demonstrate that a single dose of anti-mTNF alpha steroid ADC administered at peak of inflammation is able to significantly inhibit disease-mediated joint bone erosion compared to anti-mTNF alpha mAb alone.

[0222] The results of histological evaluation of the joints of treated CIA mice are shown in Figures 14-17. They demonstrate that a single dose of anti-mTNF alpha steroid ADC administered at peak disease resulted in a significant decrease in inflammation, pannus formation, bone erosion and cartilage damage by day 21 relative to age-matched vehicle controls ($p < 0.001$), and levels of disease were equivalent to the levels observed in controls at baseline (vehicle d6). In two of six paws evaluated, no disease was detectable in the tarsus/ phalangeal joints of anti-mTNF alpha steroid ADC treated animals at day 21, as compared to 100% incidence in mice at day 6 baseline (prior to treatment) and day 21 vehicle treated mice.

[0223] In contrast, a single dose of anti-mTNF alpha mAb at peak disease did not inhibit inflammation, bone erosion, pannus formation, or cartilage destruction, relative to age-matched vehicle controls at d21. Levels of disease were more severe than baseline controls, and a mild trend for improved inflammation was observed.

[0224] Whole blood was analyzed to evaluate changes in peripheral blood cell subsets with treatment. The results shown in Figure 18-23 demonstrate that the increase in some peripheral blood cell populations observed in diseased animals can be resolved with a single dose of anti-mTNF alpha steroid ADC. Statistically significant reductions in overall white blood cells, neutrophils and monocytes were observed with anti-mTNF alpha steroid ADC treatment.

Example 89: Comparison of anti-mTNF-alpha steroid ADCs and anti-CD 163 ADCs

[0225] To demonstrate the enhanced therapeutic efficacy of an anti-TNF immunoconjugate in the treatment of inflammatory disease, we compared its activity to an ADC targeting the hemoglobin scavenger receptor CD163, a glucocorticoid immunoconjugate approach described in the literature to have targeted anti-inflammatory functionality (PCT Int. Appl. WO2011039510A2 by Graversen NJH, et al.; Graversen JH et al., Mol. Ther. 20 (8): 1550-8 (2012)).

Generation of a mouse CD163 GRE report cell line

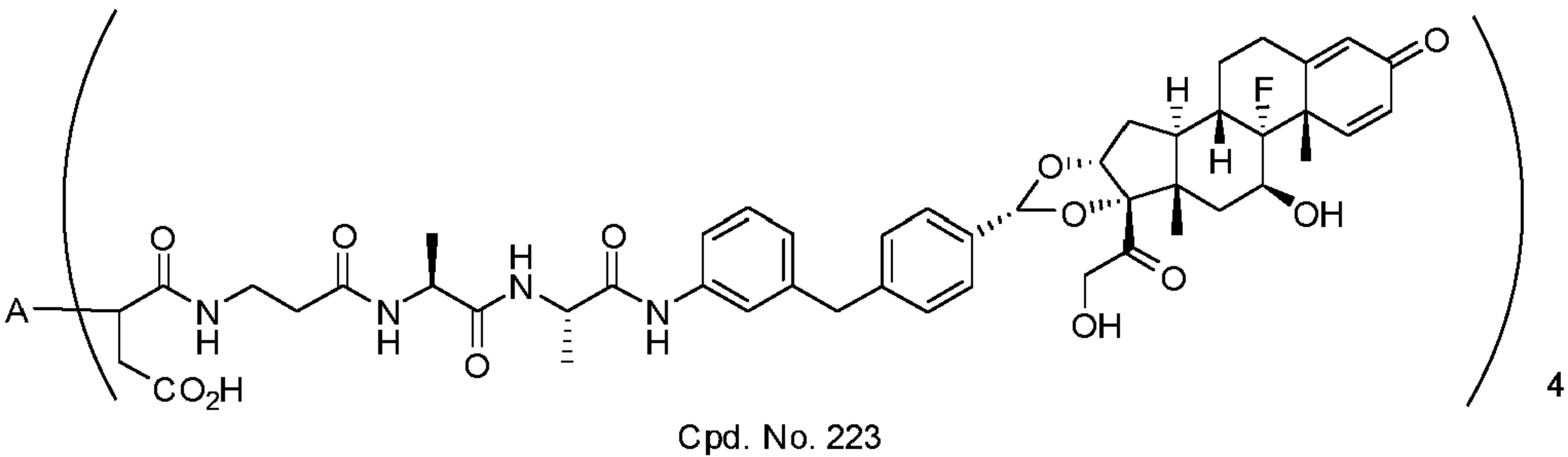
[0226] A parental cell line was created similar to that described in Example 78 but with CHO-K1 cells instead of K562 cells. The resulting parental cell line CHO pGL4.36[Luc2P/MMTV/Hygro]_PGL4.75[hRLuc/CMV] was then transfected with a plasmid which encodes mouse CD163 (Origene cat.no. MR216798) under conditions described in Example 78. The resulting cell line CHO mCD163 GRE (pGL4.36[luc2P/MMTV/Hygro]) was used to test the in vitro activity of both anti-mTNF-alpha and anti-mouse CD163 immunoconjugates (also referred to as anti-mCD163 immunoconjugates or anti-mCD163 steroid ADC).

Preparation of an anti-mouse CD163 immunoconjugate

[0227] A chimeric rat anti-mouse CD163 mIgG2a/k antibody was generated from the VH and VL sequence for clone 3E10B10 as described (SEQ ID NO: 87/88 from PCT Int. Appl. WO 2011/039510A2). This antibody was conjugated to Cpd. No. 99 using conditions highlighted under the general cysteine conjugation protocol in Example 36 to give a drug:antibody ratio (DAR) of 4.

Activity of an anti-mouse CD163 immunoconjugate in mouse CD163 GRE reporter assay

[0228] The anti-mouse CD163 immunoconjugate was tested for activity on the CHO mCD163 GRE (pGL4.36[luc2P/MMTV/Hygro]) cell line under conditions described in Example 79. An anti-mTNF alpha steroid ADC (Cpd. No. 145) was included as a negative control. The results in Table 22 demonstrate the anti-mouse CD163 immunoconjugate (Cpd. No. 223):



shows antigen-dependent activity dissociated from the anti-mTNF alpha steroid ADC on the mouse CD163 GRE cell line.

Table 22

Cpd No.	DAR	% monomer	mCD163 GRE EC50 (ug/ml)	mCD163 GRE (% max)	CHO GRE EC50 (ug/ml)	CHO GRE (% max)
223	4	93	0.2	92	>50	55
145	4	97	>20	70	>50	39

Activity of anti-mouse CD163 immunoconjugate in mouse collagen-induced arthritis

[0229] The ability of anti-mouse CD163 steroid immunoconjugate to impact paw swelling was assessed in the collagen-induced arthritis (CIA) model of RA A control anti-mTNF alpha steroid ADC (cpd 139) with the same drug-linker and DAR as the anti-mCD163 steroid ADC was also evaluated in the same study and the parental mAbs for both ADCs were also included as treatment groups. The experiment was conducted according to the procedure outlined in Example 85. The results are shown in Figure 24 and demonstrate that while the anti-mCD163 steroid ADC initially reduces paw swelling in the first few days after single dose treatment, this effect is transient. In comparison, a single dose of anti-mTNF alpha steroid ADC is sufficient to completely suppress inflammation through the duration of the study.

SEQUENCE LISTING

[0230]

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Oh, Jason Z.

Hernandez Jr, Axel
Randolph, John T.

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<150> 62/344,948

<151> 2016-06-02

<150> 62/371,134

<151> 2016-08-04

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25	Met	Glu	Leu	Ser	Ser	Leu	Thr	Ser	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
					85					90					95	
30	Ala	Arg	Ser	Ala	Phe	Tyr	Asn	Asn	Tyr	Glu	Tyr	Phe	Asp	Val	Trp	Gly
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<400> 55

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5	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Phe	Thr	Phe	Ser	Asp	Tyr
				20					25					30		
10	Trp	Met	Tyr	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
			35					40					45			
15	Ser	Glu	Ile	Asn	Thr	Asn	Gly	Leu	Ile	Thr	Lys	Tyr	Pro	Asp	Ser	Val
		50					55					60				
20	Lys	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asn	Ala	Lys	Asn	Thr	Leu	Tyr
	65					70					75					80
25	Leu	Gln	Met	Asn	Ser	Leu	Arg	Pro	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
					85					90					95	
30	Ala	Arg	Ser	Pro	Ser	Gly	Phe	Asn	Arg	Gly	Gln	Gly	Thr	Leu	Val	Thr
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50	Gly	Met	Ser	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
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	Ser	Ser	Ile	Ser	Gly	Ser	Gly	Ser	Asp	Thr	Leu	Tyr	Ala	Asp	Ser	Val
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	65					70					75					80
	Leu	Gln	Met	Asn	Ser	Leu	Arg	Pro	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
10					85					90					95	
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	Trp	Met	Tyr	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
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	Ser	Glu	Ile	Asn	Thr	Asn	Gly	Leu	Ile	Thr	Lys	Tyr	Pro	Asp	Ser	Val
	50						55					60				
45	Lys	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asn	Ala	Lys	Asn	Thr	Leu	Tyr
	65					70					75					80
	Leu	Gln	Met	Asn	Ser	Leu	Arg	Pro	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
50					85					90					95	
	Ala	Arg	Ser	Pro	Ser	Gly	Phe	Asn	Arg	Gly	Gln	Gly	Thr	Leu	Val	Thr
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Ala Met His Trp Val Arg Gln Ala Pro Gly Asn Gly Leu Glu Trp Val
35 40 45

Ala Phe Met Ser Tyr Asp Gly Ser Asn Lys Lys Tyr Ala Asp Ser Val
50 55 60

Lys Gly Arg Phe Thr Ile Ser Arg Asp Asn Ser Lys Asn Thr Leu Tyr
65 70 75 80

Leu Gln Met Asn Ser Leu Arg Ala Glu Asp Thr Ala Val Tyr Tyr Cys
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Met Asp Val Trp Gly Gln Gly Thr Thr Val Thr Val Ser Ser
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				20					25					30		
10	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Leu	Leu	Ile
			35					40					45			
	Tyr	Ala	Ala	Ser	Thr	Leu	Gln	Ser	Gly	Val	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
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	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Gln	Pro
	65					70					75					80
20																
	Glu	Asp	Val	Ala	Thr	Tyr	Tyr	Cys	Gln	Arg	Tyr	Asn	Arg	Ala	Pro	Tyr
					85					90					95	
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				20					25					30		
10	Ile	His	Trp	Tyr	Gln	Gln	Arg	Thr	Asn	Gly	Ser	Pro	Arg	Leu	Leu	Ile
			35					40					45			
15	Lys	Tyr	Ala	Ser	Glu	Ser	Met	Ser	Gly	Ile	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Ser	Ile	Asn	Thr	Val	Glu	Ser
	65					70					75					80
25	Glu	Asp	Ile	Ala	Asp	Tyr	Tyr	Cys	Gln	Gln	Ser	His	Ser	Trp	Pro	Phe
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30	Thr	Phe	Gly	Ser	Gly	Thr	Asn	Leu	Glu	Val	Lys					
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				20					25					30		
10	Val	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Ala	Leu	Ile
			35					40					45			
15	Tyr	Ser	Ala	Ser	Phe	Leu	Tyr	Ser	Gly	Val	Pro	Tyr	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Gln	Pro
	65					70					75					80
25	Glu	Asp	Phe	Ala	Thr	Tyr	Tyr	Cys	Gln	Gln	Tyr	Asn	Ile	Tyr	Pro	Leu
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30	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys					
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	1				5					10					15	
45	Asp	Arg	Val	Ser	Ile	Thr	Cys	Lys	Ala	Ser	Gln	Ala	Val	Ser	Ser	Ala
				20					25					30		
50	Val	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Gln	Ser	Pro	Lys	Leu	Leu	Ile
			35					40					45			
55	Tyr	Trp	Ala	Ser	Thr	Arg	His	Thr	Gly	Val	Pro	Asp	Arg	Phe	Thr	Gly
		50					55					60				
	Ser	Gly	Ser	Val	Thr	Asp	Phe	Thr	Leu	Thr	Ile	His	Asn	Leu	Gln	Ala
	65					70					75					80
	Glu	Asp	Leu	Ala	Leu	Tyr	Tyr	Cys	Gln	Gln	His	Tyr	Ser	Thr	Pro	Phe
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20		Asp	Arg	Val	Thr	Ile	Thr	Cys	Lys	Ser	Ser	Gln	Ser	Leu	Leu	Tyr	Ser
					20					25					30		
25		Asn	Asn	Gln	Lys	Asn	Tyr	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Gln
				35					40					45			
30		Ala	Pro	Lys	Leu	Leu	Ile	Ser	Trp	Ala	Ser	Thr	Arg	Glu	Ser	Gly	Val
			50					55					60				
35		Pro	Ser	Arg	Phe	Ile	Gly	Ser	Gly	Ser	Gly	Thr	Glu	Phe	Thr	Leu	Thr
		65					70					75					80
40		Ile	Ser	Ser	Leu	Gln	Pro	Asp	Asp	Val	Ala	Thr	Tyr	Tyr	Cys	Gln	Gln
						85					90					95	
45		Tyr	Tyr	Asp	Tyr	Pro	Trp	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile
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					20					25					30		

	Leu	His	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Leu	Leu	Ile
			35					40					45			
5	Tyr	Ser	Ala	Ser	Asn	Leu	Glu	Thr	Gly	Val	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
10	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Leu	Pro
	65					70					75					80
15	Glu	Asp	Phe	Ala	Thr	Tyr	Tyr	Cys	Gln	Gln	Val	Val	Trp	Arg	Pro	Phe
					85					90					95	
20	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys					
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35	Glu	Arg	Ala	Thr	Leu	Ser	Cys	Arg	Ala	Ser	Gln	Ser	Val	Tyr	Ser	Tyr
				20					25					30		
40	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Gln	Ala	Pro	Arg	Leu	Leu	Ile
			35					40					45			
45	Tyr	Asp	Ala	Ser	Asn	Arg	Ala	Thr	Gly	Ile	Pro	Ala	Arg	Phe	Ser	Gly
		50					55					60				
50	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Glu	Pro
	65					70					75					80
55	Glu	Asp	Phe	Ala	Val	Tyr	Tyr	Cys	Gln	Gln	Arg	Ser	Asn	Trp	Pro	Pro
					85					90					95	
	Phe	Thr	Phe	Gly	Pro	Gly	Thr	Lys	Val	Asp	Ile	Lys				
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<220>

<223> Adalimumab (D2E7) Full-Length Heavy Chain

<400> 66

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5	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Phe	Thr	Phe	Asp	Asp	Tyr
				20					25					30		
10	Ala	Met	His	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
			35					40					45			
15	Ser	Ala	Ile	Thr	Trp	Asn	Ser	Gly	His	Ile	Asp	Tyr	Ala	Asp	Ser	Val
	50					55					60					
20	Glu	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asn	Ala	Lys	Asn	Ser	Leu	Tyr
	65					70				75						80
25	Leu	Gln	Met	Asn	Ser	Leu	Arg	Ala	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
				85						90					95	
30	Ala	Lys	Val	Ser	Tyr	Leu	Ser	Thr	Ala	Ser	Ser	Leu	Asp	Tyr	Trp	Gly
				100					105					110		
35	Gln	Gly	Thr	Leu	Val	Thr	Val	Ser	Ser	Ala	Ser	Thr	Lys	Gly	Pro	Ser
			115					120					125			
40	Val	Phe	Pro	Leu	Ala	Pro	Ser	Ser	Lys	Ser	Thr	Ser	Gly	Gly	Thr	Ala
		130					135					140				
45	Ala	Leu	Gly	Cys	Leu	Val	Lys	Asp	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Val
	145					150					155					160
50	Ser	Trp	Asn	Ser	Gly	Ala	Leu	Thr	Ser	Gly	Val	His	Thr	Phe	Pro	Ala
					165					170					175	
55	Val	Leu	Gln	Ser	Ser	Gly	Leu	Tyr	Ser	Leu	Ser	Ser	Val	Val	Thr	Val
				180					185					190		
60	Pro	Ser	Ser	Ser	Leu	Gly	Thr	Gln	Thr	Tyr	Ile	Cys	Asn	Val	Asn	His
			195					200					205			
65	Lys	Pro	Ser	Asn	Thr	Lys	Val	Asp	Lys	Lys	Val	Glu	Pro	Lys	Ser	Cys
	210						215					220				
70	Asp	Lys	Thr	His	Thr	Cys	Pro	Pro	Cys	Pro	Ala	Pro	Glu	Leu	Leu	Gly

	225				230					235					240	
5	Gly	Pro	Ser	Val	Phe	Leu	Phe	Pro	Pro	Lys	Pro	Lys	Asp	Thr	Leu	Met
					245					250					255	
	Ile	Ser	Arg	Thr	Pro	Glu	Val	Thr	Cys	Val	Val	Val	Asp	Val	Ser	His
10				260					265					270		
	Glu	Asp	Pro	Glu	Val	Lys	Phe	Asn	Trp	Tyr	Val	Asp	Gly	Val	Glu	Val
			275					280					285			
15	His	Asn	Ala	Lys	Thr	Lys	Pro	Arg	Glu	Glu	Gln	Tyr	Asn	Ser	Thr	Tyr
		290					295					300				
	Arg	Val	Val	Ser	Val	Leu	Thr	Val	Leu	His	Gln	Asp	Trp	Leu	Asn	Gly
20	305					310					315					320
	Lys	Glu	Tyr	Lys	Cys	Lys	Val	Ser	Asn	Lys	Ala	Leu	Pro	Ala	Pro	Ile
25					325					330					335	
	Glu	Lys	Thr	Ile	Ser	Lys	Ala	Lys	Gly	Gln	Pro	Arg	Glu	Pro	Gln	Val
				340					345					350		
30	Tyr	Thr	Leu	Pro	Pro	Ser	Arg	Asp	Glu	Leu	Thr	Lys	Asn	Gln	Val	Ser
			355					360					365			
	Leu	Thr	Cys	Leu	Val	Lys	Gly	Phe	Tyr	Pro	Ser	Asp	Ile	Ala	Val	Glu
35		370					375					380				
	Trp	Glu	Ser	Asn	Gly	Gln	Pro	Glu	Asn	Asn	Tyr	Lys	Thr	Thr	Pro	Pro
40	385					390					395					400
	Val	Leu	Asp	Ser	Asp	Gly	Ser	Phe	Phe	Leu	Tyr	Ser	Lys	Leu	Thr	Val
					405					410					415	
45	Asp	Lys	Ser	Arg	Trp	Gln	Gln	Gly	Asn	Val	Phe	Ser	Cys	Ser	Val	Met
				420					425					430		
	His	Glu	Ala	Leu	His	Asn	His	Tyr	Thr	Gln	Lys	Ser	Leu	Ser	Leu	Ser
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<223> infliximab Full-Length Heavy Chain

<400> 67

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5	Ser	Met	Lys	Leu	Ser	Cys	Val	Ala	Ser	Gly	Phe	Ile	Phe	Ser	Asn	His	
				20					25					30			
10	Trp	Met	Asn	Trp	Val	Arg	Gln	Ser	Pro	Glu	Lys	Gly	Leu	Glu	Trp	Val	
			35					40					45				
15	Ala	Glu	Ile	Arg	Ser	Lys	Ser	Ile	Asn	Ser	Ala	Thr	His	Tyr	Ala	Glu	
		50					55					60					
20	Ser	Val	Lys	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asp	Ser	Lys	Ser	Ala	
	65					70					75					80	
25	Val	Tyr	Leu	Gln	Met	Thr	Asp	Leu	Arg	Thr	Glu	Asp	Thr	Gly	Val	Tyr	
					85					90					95		
30	Tyr	Cys	Ser	Arg	Asn	Tyr	Tyr	Gly	Ser	Thr	Tyr	Asp	Tyr	Trp	Gly	Gln	
				100					105					110			
35	Gly	Thr	Thr	Leu	Thr	Val	Ser	Ser	Ala	Ser	Thr	Lys	Gly	Pro	Ser	Val	
			115					120					125				
40	Phe	Pro	Leu	Ala	Pro	Ser	Ser	Lys	Ser	Thr	Ser	Gly	Gly	Thr	Ala	Ala	
		130					135					140					
45	Leu	Gly	Cys	Leu	Val	Lys	Asp	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Val	Ser	
	145					150					155					160	
50	Trp	Asn	Ser	Gly	Ala	Leu	Thr	Ser	Gly	Val	His	Thr	Phe	Pro	Ala	Val	
					165					170					175		
55	Leu	Gln	Ser	Ser	Gly	Leu	Tyr	Ser	Leu	Ser	Ser	Val	Val	Thr	Val	Pro	
				180					185					190			
60	Ser	Ser	Ser	Leu	Gly	Thr	Gln	Thr	Tyr	Ile	Cys	Asn	Val	Asn	His	Lys	
			195					200					205				
65	Pro	Ser	Asn	Thr	Lys	Val	Asp	Lys	Lys	Val	Glu	Pro	Lys	Ser	Cys	Asp	
		210					215					220					
70	Lys	Thr	His	Thr	Cys	Pro	Pro	Cys	Pro	Ala	Pro	Glu	Leu	Leu	Gly	Gly	

	225				230					235				240		
5	Pro	Ser	Val	Phe	Leu	Phe	Pro	Pro	Lys	Pro	Lys	Asp	Thr	Leu	Met	Ile
				245						250				255		
	Ser	Arg	Thr	Pro	Glu	Val	Thr	Cys	Val	Val	Val	Asp	Val	Ser	His	Glu
10				260					265					270		
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			275					280					285			
15	Asn	Ala	Lys	Thr	Lys	Pro	Arg	Glu	Glu	Gln	Tyr	Asn	Ser	Thr	Tyr	Arg
		290					295					300				
	Val	Val	Ser	Val	Leu	Thr	Val	Leu	His	Gln	Asp	Trp	Leu	Asn	Gly	Lys
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	Glu	Tyr	Lys	Cys	Lys	Val	Ser	Asn	Lys	Ala	Leu	Pro	Ala	Pro	Ile	Glu
25					325					330					335	
	Lys	Thr	Ile	Ser	Lys	Ala	Lys	Gly	Gln	Pro	Arg	Glu	Pro	Gln	Val	Tyr
				340					345					350		
30	Thr	Leu	Pro	Pro	Ser	Arg	Asp	Glu	Leu	Thr	Lys	Asn	Gln	Val	Ser	Leu
			355					360					365			
	Thr	Cys	Leu	Val	Lys	Gly	Phe	Tyr	Pro	Ser	Asp	Ile	Ala	Val	Glu	Trp
35		370					375					380				
	Glu	Ser	Asn	Gly	Gln	Pro	Glu	Asn	Asn	Tyr	Lys	Thr	Thr	Pro	Pro	Val
40		385				390					395					400
	Leu	Asp	Ser	Asp	Gly	Ser	Phe	Phe	Leu	Tyr	Ser	Lys	Leu	Thr	Val	Asp
					405					410					415	
45	Lys	Ser	Arg	Trp	Gln	Gln	Gly	Asn	Val	Phe	Ser	Cys	Ser	Val	Met	His
				420					425					430		
	Glu	Ala	Leu	His	Asn	His	Tyr	Thr	Gln	Lys	Ser	Leu	Ser	Leu	Ser	Pro
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<220>

<223> certolizumab Full-Length Heavy Chain

<400> 68

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5	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Tyr	Val	Phe	Thr	Asp	Tyr
				20					25					30		
10	Gly	Met	Asn	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Met
			35					40					45			
15	Gly	Trp	Ile	Asn	Thr	Tyr	Ile	Gly	Glu	Pro	Ile	Tyr	Ala	Asp	Ser	Val
		50					55					60				
20	Lys	Gly	Arg	Phe	Thr	Phe	Ser	Leu	Asp	Thr	Ser	Lys	Ser	Thr	Ala	Tyr
	65					70					75					80
25	Leu	Gln	Met	Asn	Ser	Leu	Arg	Ala	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
					85					90					95	
30	Ala	Arg	Gly	Tyr	Arg	Ser	Tyr	Ala	Met	Asp	Tyr	Trp	Gly	Gln	Gly	Thr
				100					105					110		
35	Leu	Val	Thr	Val	Ser	Ser	Ala	Ser	Thr	Lys	Gly	Pro	Ser	Val	Phe	Pro
			115					120					125			
40	Leu	Ala	Pro	Ser	Ser	Lys	Ser	Thr	Ser	Gly	Gly	Thr	Ala	Ala	Leu	Gly
		130					135					140				
45	Cys	Leu	Val	Lys	Asp	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Val	Ser	Trp	Asn
	145					150					155					160
50	Ser	Gly	Ala	Leu	Thr	Ser	Gly	Val	His	Thr	Phe	Pro	Ala	Val	Leu	Gln
					165					170					175	
55	Ser	Ser	Gly	Leu	Tyr	Ser	Leu	Ser	Ser	Val	Val	Thr	Val	Pro	Ser	Ser
				180					185					190		
60	Ser	Leu	Gly	Thr	Gln	Thr	Tyr	Ile	Cys	Asn	Val	Asn	His	Lys	Pro	Ser
			195					200					205			
65	Asn	Thr	Lys	Val	Asp	Lys	Lys	Val	Glu	Pro	Lys	Ser	Cys	Asp	Lys	Thr
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	Ser	Leu	Ser	Ile	Thr	Cys	Thr	Val	Ser	Gly	Phe	Ser	Leu	Thr	Asp	Tyr
				20					25					30		
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	Gly	Val	Asn	Trp	Val	Arg	Gln	Pro	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Leu
			35					40					45			
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	Gly	Met	Ile	Trp	Gly	Asp	Gly	Ser	Thr	Asp	Tyr	Asp	Ser	Thr	Leu	Lys
		50					55					60				
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	Ser	Arg	Leu	Ser	Ile	Ser	Lys	Asp	Asn	Ser	Lys	Ser	Gln	Ile	Phe	Leu
	65					70					75					80
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					85					90					95	
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	Arg	Glu	Trp	His	His	Gly	Pro	Val	Ala	Tyr	Trp	Gly	Gln	Gly	Thr	Leu
				100					105					110		
45																
	Val	Thr	Val	Ser	Ala	Ala	Thr	Thr	Thr	Ala	Pro	Ser	Val	Tyr	Pro	Leu
			115					120					125			
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	Val	Pro	Gly	Cys	Ser	Asp	Thr	Ser	Gly	Ser	Ser	Val	Thr	Leu	Gly	Cys
		130					135					140				
55																
	Leu	Val	Lys	Gly	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Val	Lys	Trp	Asn	Tyr
	145					150					155					160
60																
	Gly	Ala	Leu	Ser	Ser	Gly	Val	Arg	Thr	Val	Ser	Ser	Val	Leu	Gln	Ser
					165					170					175	
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	Gly	Phe	Tyr	Ser	Leu	Ser	Ser	Leu	Val	Thr	Val	Pro	Ser	Ser	Thr	Trp
				180					185					190		
70																
	Pro	Ser	Gln	Thr	Val	Ile	Cys	Asn	Val	Ala	His	Pro	Ala	Ser	Lys	Thr
			195					200					205			

	Glu	Leu	Ile	Lys	Arg	Ile	Glu	Pro	Arg	Ile	Pro	Lys	Pro	Ser	Thr	Pro
	210						215					220				
5	Pro	Gly	Ser	Ser	Cys	Pro	Pro	Gly	Asn	Ile	Leu	Gly	Gly	Pro	Ser	Val
	225					230					235					240
10	Phe	Ile	Phe	Pro	Pro	Lys	Pro	Lys	Asp	Ala	Leu	Met	Ile	Ser	Leu	Thr
				245					250						255	
15	Pro	Lys	Val	Thr	Cys	Val	Val	Val	Asp	Val	Ser	Glu	Asp	Asp	Pro	Asp
				260					265					270		
20	Val	His	Val	Ser	Trp	Phe	Val	Asp	Asn	Lys	Glu	Val	His	Thr	Ala	Trp
			275					280					285			
25	Thr	Gln	Pro	Arg	Glu	Ala	Gln	Tyr	Asn	Ser	Thr	Phe	Arg	Val	Val	Ser
		290					295					300				
30	Ala	Leu	Pro	Ile	Gln	His	Gln	Asp	Trp	Met	Arg	Gly	Lys	Glu	Phe	Lys
	305					310					315					320
35	Cys	Lys	Val	Asn	Asn	Lys	Ala	Leu	Pro	Ala	Pro	Ile	Glu	Arg	Thr	Ile
				325						330					335	
40	Ser	Lys	Pro	Lys	Gly	Arg	Ala	Gln	Thr	Pro	Gln	Val	Tyr	Thr	Ile	Pro
				340					345					350		
45	Pro	Pro	Arg	Glu	Gln	Met	Ser	Lys	Lys	Lys	Val	Ser	Leu	Thr	Cys	Leu
			355					360					365			
50	Val	Thr	Asn	Phe	Phe	Ser	Glu	Ala	Ile	Ser	Val	Glu	Trp	Glu	Arg	Asn
		370					375					380				
55	Gly	Glu	Leu	Glu	Gln	Asp	Tyr	Lys	Asn	Thr	Pro	Pro	Ile	Leu	Asp	Ser
	385					390					395					400
60	Asp	Gly	Thr	Tyr	Phe	Leu	Tyr	Ser	Lys	Leu	Thr	Val	Asp	Thr	Asp	Ser
				405						410					415	
65	Trp	Leu	Gln	Gly	Glu	Ile	Phe	Thr	Cys	Ser	Val	Val	His	Glu	Ala	Leu
			420						425					430		
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<212> PRT
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<220>
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<400> 70

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				20					25					30		
10	Trp	Met	Tyr	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
			35					40					45			
15	Ser	Glu	Ile	Asn	Thr	Asn	Gly	Leu	Ile	Thr	Lys	Tyr	Pro	Asp	Ser	Val
		50					55					60				
20	Lys	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asn	Ala	Lys	Asn	Thr	Leu	Tyr
	65					70					75					80
25	Leu	Gln	Met	Asn	Ser	Leu	Arg	Pro	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
					85					90					95	
30	Ala	Arg	Ser	Pro	Ser	Gly	Phe	Asn	Arg	Gly	Gln	Gly	Thr	Leu	Val	Thr
				100					105					110		
35	Val	Ser	Ser	Gly	Gly	Gly	Gly	Ser	Gly	Gly	Gly	Ser	Glu	Val	Gln	Leu
			115					120					125			
40	Val	Glu	Ser	Gly	Gly	Gly	Leu	Val	Gln	Pro	Gly	Asn	Ser	Leu	Arg	Leu
		130					135					140				
45	Ser	Cys	Ala	Ala	Ser	Gly	Phe	Thr	Phe	Ser	Ser	Phe	Gly	Met	Ser	Trp
	145					150					155					160
50	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val	Ser	Ser	Ile	Ser
					165					170					175	
55	Gly	Ser	Gly	Ser	Asp	Thr	Leu	Tyr	Ala	Asp	Ser	Val	Lys	Gly	Arg	Phe
				180					185					190		
60	Thr	Ile	Ser	Arg	Asp	Asn	Ala	Lys	Thr	Thr	Leu	Tyr	Leu	Gln	Met	Asn
			195					200					205			
65	Ser	Leu	Arg	Pro	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys	Thr	Ile	Gly	Gly
		210					215					220				

	Ser 225	Leu	Ser	Arg	Ser	Ser 230	Gln	Gly	Thr	Leu	Val 235	Thr	Val	Ser	Ser	Gly 240
5	Gly	Gly	Gly	Ser	Gly 245	Gly	Gly	Ser	Glu	Val 250	Gln	Leu	Val	Glu	Ser	Gly 255
10	Gly	Gly	Leu	Val 260	Gln	Pro	Gly	Gly	Ser 265	Leu	Arg	Leu	Ser	Cys 270	Ala	Ala
	Ser	Gly	Phe 275	Thr	Phe	Ser	Asp	Tyr 280	Trp	Met	Tyr	Trp	Val 285	Arg	Gln	Ala
15	Pro	Gly 290	Lys	Gly	Leu	Glu	Trp 295	Val	Ser	Glu	Ile	Asn 300	Thr	Asn	Gly	Leu
20	Ile 305	Thr	Lys	Tyr	Pro	Asp 310	Ser	Val	Lys	Gly	Arg 315	Phe	Thr	Ile	Ser	Arg 320
25	Asp	Asn	Ala	Lys	Asn 325	Thr	Leu	Tyr	Leu	Gln 330	Met	Asn	Ser	Leu	Arg 335	Pro
	Glu	Asp	Thr	Ala 340	Val	Tyr	Tyr	Cys	Ala 345	Arg	Ser	Pro	Ser	Gly 350	Phe	Asn
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50	Pro	Ala	Pro	Glu 20	Leu	Leu	Gly	Gly	Pro 25	Ser	Val	Phe	Leu	Phe 30	Pro	Pro
	Lys	Pro	Lys 35	Asp	Thr	Leu	Met	Ile 40	Ser	Arg	Thr	Pro	Glu 45	Val	Thr	Cys
55	Val 50	Val	Val	Asp	Val	Ser	His 55	Glu	Asp	Pro	Glu	Val 60	Lys	Phe	Asn	Trp

	Tyr	Val	Asp	Gly	Val	Glu	Val	His	Asn	Ala	Lys	Thr	Lys	Pro	Arg	Glu
	65					70					75					80
5	Glu	Gln	Tyr	Asn	Ser	Thr	Tyr	Arg	Val	Val	Ser	Val	Leu	Thr	Val	Leu
					85					90					95	
10	His	Gln	Asp	Trp	Leu	Asn	Gly	Lys	Glu	Tyr	Lys	Cys	Lys	Val	Ser	Asn
				100					105					110		
15	Lys	Ala	Leu	Pro	Ala	Pro	Ile	Glu	Lys	Thr	Ile	Ser	Lys	Ala	Lys	Gly
			115					120					125			
	Gln	Pro	Arg	Glu	Pro	Gln	Val	Tyr	Thr	Leu	Pro	Pro	Ser	Arg	Asp	Glu
		130					135					140				
20	Leu	Thr	Lys	Asn	Gln	Val	Ser	Leu	Thr	Cys	Leu	Val	Lys	Gly	Phe	Tyr
	145					150					155					160
25	Pro	Ser	Asp	Ile	Ala	Val	Glu	Trp	Glu	Ser	Asn	Gly	Gln	Pro	Glu	Asn
					165					170					175	
30	Asn	Tyr	Lys	Thr	Thr	Pro	Pro	Val	Leu	Asp	Ser	Asp	Gly	Ser	Phe	Phe
				180					185					190		
	Leu	Tyr	Ser	Lys	Leu	Thr	Val	Asp	Lys	Ser	Arg	Trp	Gln	Gln	Gly	Asn
			195					200					205			
35	Val	Phe	Ser	Cys	Ser	Val	Met	His	Glu	Ala	Leu	His	Asn	His	Tyr	Thr
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	225					230										
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55	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Phe	Ile	Phe	Ser	Ser	Tyr
				20					25					30		

	Ala	Met	His	Trp	Val	Arg	Gln	Ala	Pro	Gly	Asn	Gly	Leu	Glu	Trp	Val	
			35					40					45				
5	Ala	Phe	Met	Ser	Tyr	Asp	Gly	Ser	Asn	Lys	Lys	Tyr	Ala	Asp	Ser	Val	
		50					55					60					
	Lys	Gly	Arg	Phe	Thr	Ile	Ser	Arg	Asp	Asn	Ser	Lys	Asn	Thr	Leu	Tyr	
10	65					70					75					80	
	Leu	Gln	Met	Asn	Ser	Leu	Arg	Ala	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys	
					85					90					95		
15	Ala	Arg	Asp	Arg	Gly	Ile	Ala	Ala	Gly	Gly	Asn	Tyr	Tyr	Tyr	Tyr	Gly	
				100					105					110			
	Met	Asp	Val	Trp	Gly	Gln	Gly	Thr	Thr	Val	Thr	Val	Ser	Ser	Ala	Ser	
20			115					120					125				
	Thr	Lys	Gly	Pro	Ser	Val	Phe	Pro	Leu	Ala	Pro	Ser	Ser	Lys	Ser	Thr	
		130					135					140					
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	Ser	Gly	Gly	Thr	Ala	Ala	Leu	Gly	Cys	Leu	Val	Lys	Asp	Tyr	Phe	Pro	
	145					150					155					160	
30	Glu	Pro	Val	Thr	Val	Ser	Trp	Asn	Ser	Gly	Ala	Leu	Thr	Ser	Gly	Val	
					165					170					175		
	His	Thr	Phe	Pro	Ala	Val	Leu	Gln	Ser	Ser	Gly	Leu	Tyr	Ser	Leu	Ser	
35				180					185					190			
	Ser	Val	Val	Thr	Val	Pro	Ser	Ser	Ser	Leu	Gly	Thr	Gln	Thr	Tyr	Ile	
			195				200						205				
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	Cys	Asn	Val	Asn	His	Lys	Pro	Ser	Asn	Thr	Lys	Val	Asp	Lys	Lys	Val	
	210						215					220					
45	Glu	Pro	Lys	Ser	Cys	Asp	Lys	Thr	His	Thr	Cys	Pro	Pro	Cys	Pro	Ala	
	225					230					235					240	
	Pro	Glu	Leu	Leu	Gly	Gly	Pro	Ser	Val	Phe	Leu	Phe	Pro	Pro	Lys	Pro	
					245					250					255		
50																	
	Lys	Asp	Thr	Leu	Met	Ile	Ser	Arg	Thr	Pro	Glu	Val	Thr	Cys	Val	Val	
				260					265					270			
55	Val	Asp	Val	Ser	His	Glu	Asp	Pro	Glu	Val	Lys	Phe	Asn	Trp	Tyr	Val	
			275					280					285				

	Asp	Gly	Val	Glu	Val	His	Asn	Ala	Lys	Thr	Lys	Pro	Arg	Glu	Glu	Gln
	290						295					300				
5	Tyr	Asn	Ser	Thr	Tyr	Arg	Val	Val	Ser	Val	Leu	Thr	Val	Leu	His	Gln
	305					310					315					320
10	Asp	Trp	Leu	Asn	Gly	Lys	Glu	Tyr	Lys	Cys	Lys	Val	Ser	Asn	Lys	Ala
					325					330					335	
15	Leu	Pro	Ala	Pro	Ile	Glu	Lys	Thr	Ile	Ser	Lys	Ala	Lys	Gly	Gln	Pro
				340					345					350		
	Arg	Glu	Pro	Gln	Val	Tyr	Thr	Leu	Pro	Pro	Ser	Arg	Asp	Glu	Leu	Thr
			355					360					365			
20	Lys	Asn	Gln	Val	Ser	Leu	Thr	Cys	Leu	Val	Lys	Gly	Phe	Tyr	Pro	Ser
	370						375					380				
25	Asp	Ile	Ala	Val	Glu	Trp	Glu	Ser	Asn	Gly	Gln	Pro	Glu	Asn	Asn	Tyr
	385					390					395					400
30	Lys	Thr	Thr	Pro	Pro	Val	Leu	Asp	Ser	Asp	Gly	Ser	Phe	Phe	Leu	Tyr
					405					410					415	
	Ser	Lys	Leu	Thr	Val	Asp	Lys	Ser	Arg	Trp	Gln	Gln	Gly	Asn	Val	Phe
				420					425					430		
35	Ser	Cys	Ser	Val	Met	His	Glu	Ala	Leu	His	Asn	His	Tyr	Thr	Gln	Lys
			435					440					445			
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	450						455									
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55	Asp	Arg	Val	Thr	Ile	Thr	Cys	Arg	Ala	Ser	Gln	Gly	Ile	Arg	Asn	Tyr
				20					25					30		

	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Leu	Leu	Ile
			35					40					45			
5	Tyr	Ala	Ala	Ser	Thr	Leu	Gln	Ser	Gly	Val	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
10	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Gln	Pro
	65					70					75					80
15	Glu	Asp	Val	Ala	Thr	Tyr	Tyr	Cys	Gln	Arg	Tyr	Asn	Arg	Ala	Pro	Tyr
					85					90					95	
	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys	Arg	Thr	Val	Ala	Ala
				100					105					110		
20	Pro	Ser	Val	Phe	Ile	Phe	Pro	Pro	Ser	Asp	Glu	Gln	Leu	Lys	Ser	Gly
			115					120					125			
25	Thr	Ala	Ser	Val	Val	Cys	Leu	Leu	Asn	Asn	Phe	Tyr	Pro	Arg	Glu	Ala
		130					135					140				
30	Lys	Val	Gln	Trp	Lys	Val	Asp	Asn	Ala	Leu	Gln	Ser	Gly	Asn	Ser	Gln
	145					150					155					160
	Glu	Ser	Val	Thr	Glu	Gln	Asp	Ser	Lys	Asp	Ser	Thr	Tyr	Ser	Leu	Ser
					165					170					175	
35	Ser	Thr	Leu	Thr	Leu	Ser	Lys	Ala	Asp	Tyr	Glu	Lys	His	Lys	Val	Tyr
				180					185					190		
40	Ala	Cys	Glu	Val	Thr	His	Gln	Gly	Leu	Ser	Ser	Pro	Val	Thr	Lys	Ser
			195					200					205			
	Phe	Asn	Arg	Gly	Glu	Cys										
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5	Glu	Arg	Val	Ser	Phe	Ser	Cys	Arg	Ala	Ser	Gln	Phe	Val	Gly	Ser	Ser
				20					25					30		
10	Ile	His	Trp	Tyr	Gln	Gln	Arg	Thr	Asn	Gly	Ser	Pro	Arg	Leu	Leu	Ile
			35					40					45			
15	Lys	Tyr	Ala	Ser	Glu	Ser	Met	Ser	Gly	Ile	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Ser	Ile	Asn	Thr	Val	Glu	Ser
	65					70					75					80
	Glu	Asp	Ile	Ala	Asp	Tyr	Tyr	Cys	Gln	Gln	Ser	His	Ser	Trp	Pro	Phe
					85					90					95	
25	Thr	Phe	Gly	Ser	Gly	Thr	Asn	Leu	Glu	Val	Lys	Arg	Thr	Val	Ala	Ala
				100					105					110		
30	Pro	Ser	Val	Phe	Ile	Phe	Pro	Pro	Ser	Asp	Glu	Gln	Leu	Lys	Ser	Gly
			115					120					125			
35	Thr	Ala	Ser	Val	Val	Cys	Leu	Leu	Asn	Asn	Phe	Tyr	Pro	Arg	Glu	Ala
		130					135					140				
	Lys	Val	Gln	Trp	Lys	Val	Asp	Asn	Ala	Leu	Gln	Ser	Gly	Asn	Ser	Gln
	145					150					155					160
40	Glu	Ser	Val	Thr	Glu	Gln	Asp	Ser	Lys	Asp	Ser	Thr	Tyr	Ser	Leu	Ser
					165					170					175	
45	Ser	Thr	Leu	Thr	Leu	Ser	Lys	Ala	Asp	Tyr	Glu	Lys	His	Lys	Val	Tyr
				180					185					190		
	Ala	Cys	Glu	Val	Thr	His	Gln	Gly	Leu	Ser	Ser	Pro	Val	Thr	Lys	Ser
			195					200					205			
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5		Asp	Ile	Gln	Met	Thr	Gln	Ser	Pro	Ser	Ser	Leu	Ser	Ala	Ser	Val	Gly
		1				5					10					15	
10		Asp	Arg	Val	Thr	Ile	Thr	Cys	Lys	Ala	Ser	Gln	Asn	Val	Gly	Thr	Asn
					20					25					30		
15		Val	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Ala	Leu	Ile
				35					40					45			
20		Tyr	Ser	Ala	Ser	Phe	Leu	Tyr	Ser	Gly	Val	Pro	Tyr	Arg	Phe	Ser	Gly
			50					55					60				
25		Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Gln	Pro
		65					70					75					80
30		Glu	Asp	Phe	Ala	Thr	Tyr	Tyr	Cys	Gln	Gln	Tyr	Asn	Ile	Tyr	Pro	Leu
						85					90					95	
35		Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys	Arg	Thr	Val	Ala	Ala
					100					105					110		
40		Pro	Ser	Val	Phe	Ile	Phe	Pro	Pro	Ser	Asp	Glu	Gln	Leu	Lys	Ser	Gly
				115				120						125			
45		Thr	Ala	Ser	Val	Val	Cys	Leu	Leu	Asn	Asn	Phe	Tyr	Pro	Arg	Glu	Ala
			130					135					140				
50		Lys	Val	Gln	Trp	Lys	Val	Asp	Asn	Ala	Leu	Gln	Ser	Gly	Asn	Ser	Gln
		145					150					155					160
55		Glu	Ser	Val	Thr	Glu	Gln	Asp	Ser	Lys	Asp	Ser	Thr	Tyr	Ser	Leu	Ser
						165					170					175	
60		Ser	Thr	Leu	Thr	Leu	Ser	Lys	Ala	Asp	Tyr	Glu	Lys	His	Lys	Val	Tyr
					180					185					190		
65		Ala	Cys	Glu	Val	Thr	His	Gln	Gly	Leu	Ser	Ser	Pro	Val	Thr	Lys	Ser
				195					200					205			
70		Phe	Asn	Arg	Gly	Glu	Cys										
			210														

<210> 76
<211> 214

<212> PRT

<213> artificial sequence

<220>

5 <223> afelimomab Full-Length Light Chain

<400> 76

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	Asp	Ile	Val	Met	Thr	Gln	Ser	His	Lys	Phe	Met	Ser	Thr	Thr	Val	Gly
	1				5					10					15	
5	Asp	Arg	Val	Ser	Ile	Thr	Cys	Lys	Ala	Ser	Gln	Ala	Val	Ser	Ser	Ala
				20					25					30		
10	Val	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Gln	Ser	Pro	Lys	Leu	Leu	Ile
			35					40					45			
15	Tyr	Trp	Ala	Ser	Thr	Arg	His	Thr	Gly	Val	Pro	Asp	Arg	Phe	Thr	Gly
		50					55					60				
20	Ser	Gly	Ser	Val	Thr	Asp	Phe	Thr	Leu	Thr	Ile	His	Asn	Leu	Gln	Ala
	65					70					75					80
25	Glu	Asp	Leu	Ala	Leu	Tyr	Tyr	Cys	Gln	Gln	His	Tyr	Ser	Thr	Pro	Phe
					85					90					95	
30	Thr	Phe	Gly	Ser	Gly	Thr	Lys	Leu	Glu	Ile	Lys	Arg	Ala	Asp	Ala	Ala
				100					105					110		
35	Pro	Thr	Val	Ser	Ile	Phe	Pro	Pro	Ser	Ser	Glu	Gln	Leu	Thr	Ser	Gly
			115					120					125			
40	Gly	Ala	Ser	Val	Val	Cys	Phe	Leu	Asn	Asn	Phe	Tyr	Pro	Lys	Asp	Ile
		130					135					140				
45	Asn	Val	Lys	Trp	Lys	Ile	Asp	Gly	Ser	Glu	Arg	Gln	Asn	Gly	Val	Leu
	145					150					155					160
50	Asn	Ser	Trp	Thr	Asp	Gln	Asp	Ser	Lys	Asp	Ser	Thr	Tyr	Ser	Met	Ser
					165					170					175	
55	Ser	Thr	Leu	Thr	Leu	Thr	Lys	Asp	Glu	Tyr	Glu	Arg	His	Asn	Ser	Tyr
				180					185					190		
60	Thr	Cys	Glu	Ala	Thr	His	Lys	Thr	Ser	Thr	Ser	Pro	Ile	Val	Lys	Ser
			195					200					205			
65	Phe	Asn	Arg	Asn	Glu	Cys										
		210														

<210> 77
<211> 108
<212> PRT
<213> artificial sequence

<220>

<223> placulumab Full-Length Light Chain

<400> 77

5	Asp	Ile	Gln	Met	Thr	Gln	Ser	Pro	Ser	Ser	Leu	Ser	Ala	Ser	Val	Gly
	1				5					10					15	
10	Asp	Arg	Val	Thr	Ile	Thr	Cys	Arg	Ala	Ser	Gln	Ala	Ile	Asp	Ser	Tyr
				20					25					30		
15	Leu	His	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Leu	Leu	Ile
			35				40						45			
	Tyr	Ser	Ala	Ser	Asn	Leu	Glu	Thr	Gly	Val	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Leu	Pro
	65					70					75					80
25	Glu	Asp	Phe	Ala	Thr	Tyr	Tyr	Cys	Gln	Gln	Val	Val	Trp	Arg	Pro	Phe
					85					90					95	
30	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys	Arg				
				100					105							

<210> 78
<211> 215
<212> PRT
<213> artificial sequence

<220>
<223> golimumab Full-Length Light Chain

<400> 78

	Glu	Ile	Val	Leu	Thr	Gln	Ser	Pro	Ala	Thr	Leu	Ser	Leu	Ser	Pro	Gly
	1				5					10					15	
5	Glu	Arg	Ala	Thr	Leu	Ser	Cys	Arg	Ala	Ser	Gln	Ser	Val	Tyr	Ser	Tyr
				20					25					30		
10	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Gln	Ala	Pro	Arg	Leu	Leu	Ile
			35					40					45			
15	Tyr	Asp	Ala	Ser	Asn	Arg	Ala	Thr	Gly	Ile	Pro	Ala	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Glu	Pro
	65					70					75				80	
25	Glu	Asp	Phe	Ala	Val	Tyr	Tyr	Cys	Gln	Gln	Arg	Ser	Asn	Trp	Pro	Pro
					85					90					95	
30	Phe	Thr	Phe	Gly	Pro	Gly	Thr	Lys	Val	Asp	Ile	Lys	Arg	Thr	Val	Ala
				100					105					110		
35	Ala	Pro	Ser	Val	Phe	Ile	Phe	Pro	Pro	Ser	Asp	Glu	Gln	Leu	Lys	Ser
			115					120					125			
40	Gly	Thr	Ala	Ser	Val	Val	Cys	Leu	Leu	Asn	Asn	Phe	Tyr	Pro	Arg	Glu
		130					135					140				
45	Ala	Lys	Val	Gln	Trp	Lys	Val	Asp	Asn	Ala	Leu	Gln	Ser	Gly	Asn	Ser
	145					150					155					160
50	Gln	Glu	Ser	Val	Thr	Glu	Gln	Asp	Ser	Lys	Asp	Ser	Thr	Tyr	Ser	Leu
					165					170					175	
55	Ser	Ser	Thr	Leu	Thr	Leu	Ser	Lys	Ala	Asp	Tyr	Glu	Lys	His	Lys	Val
				180					185					190		
60	Tyr	Ala	Cys	Glu	Val	Thr	His	Gln	Gly	Leu	Ser	Ser	Pro	Val	Thr	Lys
			195					200					205			
65	Ser	Phe	Asn	Arg	Gly	Glu	Cys									
		210					215									

<210> 79
<211> 467
<212> PRT
<213> Artificial Sequence

<220>
<223> etanercept

<400> 79

5	Leu	Pro	Ala	Gln	Val	Ala	Phe	Thr	Pro	Tyr	Ala	Pro	Glu	Pro	Gly	Ser
	1				5					10					15	
10	Thr	Cys	Arg	Leu	Arg	Glu	Tyr	Tyr	Asp	Gln	Thr	Ala	Gln	Met	Cys	Cys
				20					25					30		
15	Ser	Lys	Cys	Ser	Pro	Gly	Gln	His	Ala	Lys	Val	Phe	Cys	Thr	Lys	Thr
			35					40					45			
20	Ser	Asp	Thr	Val	Cys	Asp	Ser	Cys	Glu	Asp	Ser	Thr	Tyr	Thr	Gln	Leu
		50					55					60				
25	Trp	Asn	Trp	Val	Pro	Glu	Cys	Leu	Ser	Cys	Gly	Ser	Arg	Cys	Ser	Ser
	65					70					75					80

	Asp	Gln	Val	Glu	Thr	Gln	Ala	Cys	Thr	Arg	Glu	Gln	Asn	Arg	Ile	Cys	
					85					90					95		
5	Thr	Cys	Arg	Pro	Gly	Trp	Tyr	Cys	Ala	Leu	Ser	Lys	Gln	Glu	Gly	Cys	
				100					105					110			
10	Arg	Leu	Cys	Ala	Pro	Leu	Arg	Lys	Cys	Arg	Pro	Gly	Phe	Gly	Val	Ala	
			115					120					125				
15	Arg	Pro	Gly	Thr	Glu	Thr	Ser	Asp	Val	Val	Cys	Lys	Pro	Cys	Ala	Pro	
		130					135					140					
20	Gly	Thr	Phe	Ser	Asn	Thr	Thr	Ser	Ser	Thr	Asp	Ile	Cys	Arg	Pro	His	
	145					150					155					160	
25	Gln	Ile	Cys	Asn	Val	Val	Ala	Ile	Pro	Gly	Asn	Ala	Ser	Met	Asp	Ala	
					165					170					175		
30	Val	Cys	Thr	Ser	Thr	Ser	Pro	Thr	Arg	Ser	Met	Ala	Pro	Gly	Ala	Val	
				180					185					190			
35	His	Leu	Pro	Gln	Pro	Val	Ser	Thr	Arg	Ser	Gln	His	Thr	Gln	Pro	Thr	
			195					200					205				
40	Pro	Glu	Pro	Ser	Thr	Ala	Pro	Ser	Thr	Ser	Phe	Leu	Leu	Pro	Met	Gly	
		210					215					220					
45	Pro	Ser	Pro	Pro	Ala	Glu	Gly	Ser	Thr	Gly	Asp	Glu	Pro	Lys	Ser	Cys	
	225					230					235					240	
50	Asp	Lys	Thr	His	Thr	Cys	Pro	Pro	Cys	Pro	Ala	Pro	Glu	Leu	Leu	Gly	
					245					250					255		
55	Gly	Pro	Ser	Val	Phe	Leu	Phe	Pro	Pro	Lys	Pro	Lys	Asp	Thr	Leu	Met	
				260					265					270			
60	Ile	Ser	Arg	Thr	Pro	Glu	Val	Thr	Cys	Val	Val	Val	Asp	Val	Ser	His	
			275					280					285				
65	Glu	Asp	Pro	Glu	Val	Lys	Phe	Asn	Trp	Tyr	Val	Asp	Gly	Val	Glu	Val	
		290					295					300					
70	His	Asn	Ala	Lys	Thr	Lys	Pro	Arg	Glu	Glu	Gln	Tyr	Asn	Ser	Thr	Tyr	
	305					310					315					320	
75	Arg	Val	Val	Ser	Val	Leu	Thr	Val	Leu	His	Gln	Asp	Trp	Leu	Asn	Gly	

				325					330					335			
5	Lys	Glu	Tyr	Lys	Cys	Lys	Val	Ser	Asn	Lys	Ala	Leu	Pro	Ala	Pro	Ile	
				340					345					350			
	Glu	Lys	Thr	Ile	Ser	Lys	Ala	Lys	Gly	Gln	Pro	Arg	Glu	Pro	Gln	Val	
10			355					360					365				
	Tyr	Thr	Leu	Pro	Pro	Ser	Arg	Glu	Glu	Met	Thr	Lys	Asn	Gln	Val	Ser	
		370					375					380					
15	Leu	Thr	Cys	Leu	Val	Lys	Gly	Phe	Tyr	Pro	Ser	Asp	Ile	Ala	Val	Glu	
	385					390					395					400	
	Trp	Glu	Ser	Asn	Gly	Gln	Pro	Glu	Asn	Asn	Tyr	Lys	Thr	Thr	Pro	Pro	
20				405					410						415		
	Val	Leu	Asp	Ser	Asp	Gly	Ser	Phe	Phe	Leu	Tyr	Ser	Lys	Leu	Thr	Val	
25			420						425					430			
	Asp	Lys	Ser	Arg	Trp	Gln	Gln	Gly	Asn	Val	Phe	Ser	Cys	Ser	Val	Met	
			435					440					445				
30	His	Glu	Ala	Leu	His	Asn	His	Tyr	Thr	Gln	Lys	Ser	Leu	Ser	Leu	Ser	
		450				455						460					
35	Pro	Gly	Lys														
	465																

<210> 80
<211> 587
<212> PRT
40 <213> Artificial Sequence

<220>
<223> ABT-122 Heavy Chain

45 <400> 80

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	Glu	Val	Gln	Leu	Val	Glu	Ser	Gly	Gly	Gly	Leu	Val	Gln	Pro	Gly	Arg
	1				5					10					15	
5	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Phe	Thr	Phe	Asp	Asp	Tyr
				20					25					30		
10	Ala	Met	His	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Val
			35					40					45			
	Ser	Ala	Ile	Thr	Trp	Asn	Ser	Gly	His	Ile	Asp	Tyr	Ala	Asp	Ser	Val
		50					55					60				
15																
20																
25																
30																
35																
40																
45																
50																
55																

		Glu 65	Gly	Arg	Phe	Thr 70	Ile	Ser	Arg	Asp	Asn 75	Ala	Lys	Asn	Ser	Leu	Tyr 80
5		Leu	Gln	Met	Asn 85	Ser	Leu	Arg	Ala	Glu	Asp 90	Thr	Ala	Val	Tyr	Tyr 95	Cys
10		Ala	Lys	Val	Ser 100	Tyr	Leu	Ser	Thr	Ala 105	Ser	Ser	Leu	Asp	Tyr 110	Trp	Gly
15		Gln	Gly	Thr 115	Leu	Val	Thr	Val	Ser 120	Ser	Gly	Gly	Gly	Gly 125	Ser	Gly	Gly
20		Gly 130	Gly	Ser	Glu	Val	Gln	Leu 135	Val	Gln	Ser	Gly	Ala 140	Glu	Val	Lys	Lys
25		Pro 145	Gly	Ser	Ser	Val	Lys 150	Val	Ser	Cys	Lys	Ala 155	Ser	Gly	Gly	Ser	Phe 160
30		Gly	Gly	Tyr	Gly	Ile 165	Gly	Trp	Val	Arg	Gln 170	Ala	Pro	Gly	Gln	Gly 175	Leu
35		Glu	Trp	Met	Gly 180	Gly	Ile	Thr	Pro	Phe 185	Phe	Gly	Phe	Ala	Asp 190	Tyr	Ala
40		Gln	Lys	Phe 195	Gln	Gly	Arg	Val	Thr 200	Ile	Thr	Ala	Asp	Glu 205	Ser	Thr	Thr
45		Thr	Ala 210	Tyr	Met	Glu	Leu	Ser 215	Gly	Leu	Thr	Ser	Asp 220	Asp	Thr	Ala	Val
50		Tyr 225	Tyr	Cys	Ala	Arg	Asp 230	Pro	Asn	Glu	Phe	Trp 235	Asn	Gly	Tyr	Tyr	Ser 240
55		Thr	His	Asp	Phe	Asp 245	Ser	Trp	Gly	Gln	Gly 250	Thr	Thr	Val	Thr	Val 255	Ser
60		Ser	Ala	Ser	Thr 260	Lys	Gly	Pro	Ser	Val 265	Phe	Pro	Leu	Ala	Pro 270	Ser	Ser
65		Lys	Ser	Thr 275	Ser	Gly	Gly	Thr	Ala 280	Ala	Leu	Gly	Cys	Leu 285	Val	Lys	Asp
70		Tyr 290	Phe	Pro	Glu	Pro	Val	Thr 295	Val	Ser	Trp	Asn 300	Ser	Gly	Ala	Leu	Thr
75		Ser	Gly	Val	His	Thr	Phe	Pro	Ala	Val	Leu	Gln	Ser	Ser	Gly	Leu	Tyr

	305				310					315					320	
5	Ser	Leu	Ser	Ser	Val 325	Val	Thr	Val	Pro	Ser 330	Ser	Ser	Leu	Gly	Thr 335	Gln
10	Thr	Tyr	Ile	Cys 340	Asn	Val	Asn	His	Lys 345	Pro	Ser	Asn	Thr	Lys 350	Val	Asp
15	Lys	Lys	Val 355	Glu	Pro	Lys	Ser	Cys 360	Asp	Lys	Thr	His	Thr 365	Cys	Pro	Pro
20	Cys 370	Pro	Ala	Pro	Glu	Leu	Leu 375	Gly	Gly	Pro	Ser	Val 380	Phe	Leu	Phe	Pro
25	Pro 385	Lys	Pro	Lys	Asp	Thr 390	Leu	Met	Ile	Ser	Arg 395	Thr	Pro	Glu	Val	Thr 400
30	Cys	Val	Val	Val	Asp 405	Val	Ser	His	Glu	Asp 410	Pro	Glu	Val	Lys	Phe 415	Asn
35	Trp	Tyr	Val	Asp 420	Gly	Val	Glu	Val	His 425	Asn	Ala	Lys	Thr	Lys 430	Pro	Arg
40	Glu	Glu	Gln 435	Tyr	Asn	Ser	Thr	Tyr 440	Arg	Val	Val	Ser	Val 445	Leu	Thr	Val
45	Leu	His 450	Gln	Asp	Trp	Leu	Asn 455	Gly	Lys	Glu	Tyr	Lys 460	Cys	Lys	Val	Ser
50	Asn 465	Lys	Ala	Leu	Pro	Ala 470	Pro	Ile	Glu	Lys	Thr 475	Ile	Ser	Lys	Ala	Lys 480
55	Gly	Gln	Pro	Arg	Glu 485	Pro	Gln	Val	Tyr	Thr 490	Leu	Pro	Pro	Ser	Arg 495	Asp
60	Glu	Leu	Thr	Lys 500	Asn	Gln	Val	Ser	Leu 505	Thr	Cys	Leu	Val	Lys 510	Gly	Phe
65	Tyr	Pro	Ser 515	Asp	Ile	Ala	Val	Glu 520	Trp	Glu	Ser	Asn	Gly 525	Gln	Pro	Glu
70	Asn 530	Asn	Tyr	Lys	Thr	Thr	Pro 535	Pro	Val	Leu	Asp 540	Ser	Asp	Gly	Ser	Phe
75	Phe 545	Leu	Tyr	Ser	Lys	Leu 550	Thr	Val	Asp	Lys	Ser 555	Arg	Trp	Gln	Gln	Gly 560

	Asn	Val	Phe	Ser	Cys	Ser	Val	Met	His	Glu	Ala	Leu	His	Asn	His	Tyr
					565					570					575	
5	Thr	Gln	Lys	Ser	Leu	Ser	Leu	Ser	Pro	Gly	Lys					
				580					585							
	<210> 81															
	<211> 331															
10	<212> PRT															
	<213> Artificial Sequence															
	<220>															
	<223> ABT-122 Light Chain															
15	<400> 81															
20																
25																
30																
35																
40																
45																
50																
55																

	Asp	Ile	Gln	Met	Thr	Gln	Ser	Pro	Ser	Ser	Leu	Ser	Ala	Ser	Val	Gly
	1				5					10					15	
5	Asp	Arg	Val	Thr	Ile	Thr	Cys	Arg	Ala	Ser	Gln	Gly	Ile	Arg	Asn	Tyr
				20					25					30		
10	Leu	Ala	Trp	Tyr	Gln	Gln	Lys	Pro	Gly	Lys	Ala	Pro	Lys	Leu	Leu	Ile
			35					40					45			
15	Tyr	Ala	Ala	Ser	Thr	Leu	Gln	Ser	Gly	Val	Pro	Ser	Arg	Phe	Ser	Gly
		50					55					60				
20	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile	Ser	Ser	Leu	Gln	Pro
	65					70					75					80
25	Glu	Asp	Val	Ala	Thr	Tyr	Tyr	Cys	Gln	Arg	Tyr	Asn	Arg	Ala	Pro	Tyr
					85					90					95	
30	Thr	Phe	Gly	Gln	Gly	Thr	Lys	Val	Glu	Ile	Lys	Arg	Gly	Gly	Ser	Gly
				100					105					110		
35	Gly	Gly	Gly	Ser	Gly	Glu	Ile	Val	Leu	Thr	Gln	Ser	Pro	Asp	Phe	Gln
			115					120					125			
40	Ser	Val	Thr	Pro	Lys	Glu	Lys	Val	Thr	Ile	Thr	Cys	Arg	Ala	Ser	Gln
		130					135					140				
45	Asp	Ile	Gly	Ser	Glu	Leu	His	Trp	Tyr	Gln	Gln	Lys	Pro	Asp	Gln	Pro
	145					150					155					160
50	Pro	Lys	Leu	Leu	Ile	Lys	Tyr	Ala	Ser	His	Ser	Thr	Ser	Gly	Val	Pro
					165					170					175	
55	Ser	Arg	Phe	Ser	Gly	Ser	Gly	Ser	Gly	Thr	Asp	Phe	Thr	Leu	Thr	Ile

190

Asn Gly Leu Glu Ala Glu Asp Ala Gly Thr Tyr Tyr Cys His Gln Thr
195 200 205

Asp Ser Leu Pro Tyr Thr Phe Gly Pro Gly Thr Lys Val Asp Ile Lys
210 215 220

Arg Thr Val Ala Ala Pro Ser Val Phe Ile Phe Pro Pro Ser Asp Glu
225 230 235 240

Gln Leu Lys Ser Gly Thr Ala Ser Val Val Cys Leu Leu Asn Asn Phe
245 250 255

Tyr Pro Arg Glu Ala Lys Val Gln Trp Lys Val Asp Asn Ala Leu Gln
260 265 270

Ser Gly Asn Ser Gln Glu Ser Val Thr Glu Gln Asp Ser Lys Asp Ser
275 280 285

Thr Tyr Ser Leu Ser Ser Thr Leu Thr Leu Ser Lys Ala Asp Tyr Glu
290 295 300

Lys His Lys Val Tyr Ala Cys Glu Val Thr His Gln Gly Leu Ser Ser
305 310 315 320

Pro Val Thr Lys Ser Phe Asn Arg Gly Glu Cys
325 330

<211> 235

<213> Artificial

<223> Certolizumab Heavy Chain

<400> 82

	Glu	Val	Gln	Leu	Val	Glu	Ser	Gly	Gly	Gly	Leu	Val	Gln	Pro	Gly	Gly
	1				5					10					15	
5	Ser	Leu	Arg	Leu	Ser	Cys	Ala	Ala	Ser	Gly	Tyr	Val	Phe	Thr	Asp	Tyr
				20					25					30		
10	Gly	Met	Asn	Trp	Val	Arg	Gln	Ala	Pro	Gly	Lys	Gly	Leu	Glu	Trp	Met
			35					40					45			
15	Gly	Trp	Ile	Asn	Thr	Tyr	Ile	Gly	Glu	Pro	Ile	Tyr	Ala	Asp	Ser	Val
		50					55					60				
20	Lys	Gly	Arg	Phe	Thr	Phe	Ser	Leu	Asp	Thr	Ser	Lys	Ser	Thr	Ala	Tyr
	65					70					75					80
25	Leu	Gln	Met	Asn	Ser	Leu	Arg	Ala	Glu	Asp	Thr	Ala	Val	Tyr	Tyr	Cys
					85					90					95	
30	Ala	Arg	Gly	Tyr	Arg	Ser	Tyr	Ala	Met	Asp	Tyr	Trp	Gly	Gln	Gly	Thr
				100					105					110		
35	Leu	Val	Thr	Val	Ser	Ser	Ala	Ser	Thr	Lys	Gly	Pro	Ser	Val	Phe	Pro
			115					120					125			
40	Leu	Ala	Pro	Ser	Ser	Lys	Ser	Thr	Ser	Gly	Gly	Thr	Ala	Ala	Leu	Gly
		130					135					140				
45	Cys	Leu	Val	Lys	Asp	Tyr	Phe	Pro	Glu	Pro	Val	Thr	Val	Ser	Trp	Asn
	145					150					155					160
50	Ser	Gly	Ala	Leu	Thr	Ser	Gly	Val	His	Thr	Phe	Pro	Ala	Val	Leu	Gln
					165					170					175	
55	Ser	Ser	Gly	Leu	Tyr	Ser	Leu	Ser	Ser	Val	Val	Thr	Val	Pro	Ser	Ser
				180					185					190		
60	Ser	Leu	Gly	Thr	Gln	Thr	Tyr	Ile	Cys	Asn	Val	Asn	His	Lys	Pro	Ser
			195					200					205			
65	Asn	Thr	Lys	Val	Asp	Lys	Lys	Val	Glu	Pro	Lys	Ser	Cys	Asp	Lys	Thr
		210					215					220				
70	His	Thr	Cys	Ala	Ala	His	His	His	His	His	His					
	225					230						235				

<210> 83
<211> 214

<212> PRT
<213> Artificial Sequence

<220>
<223> Certolizumab Light Chain

<400> 83

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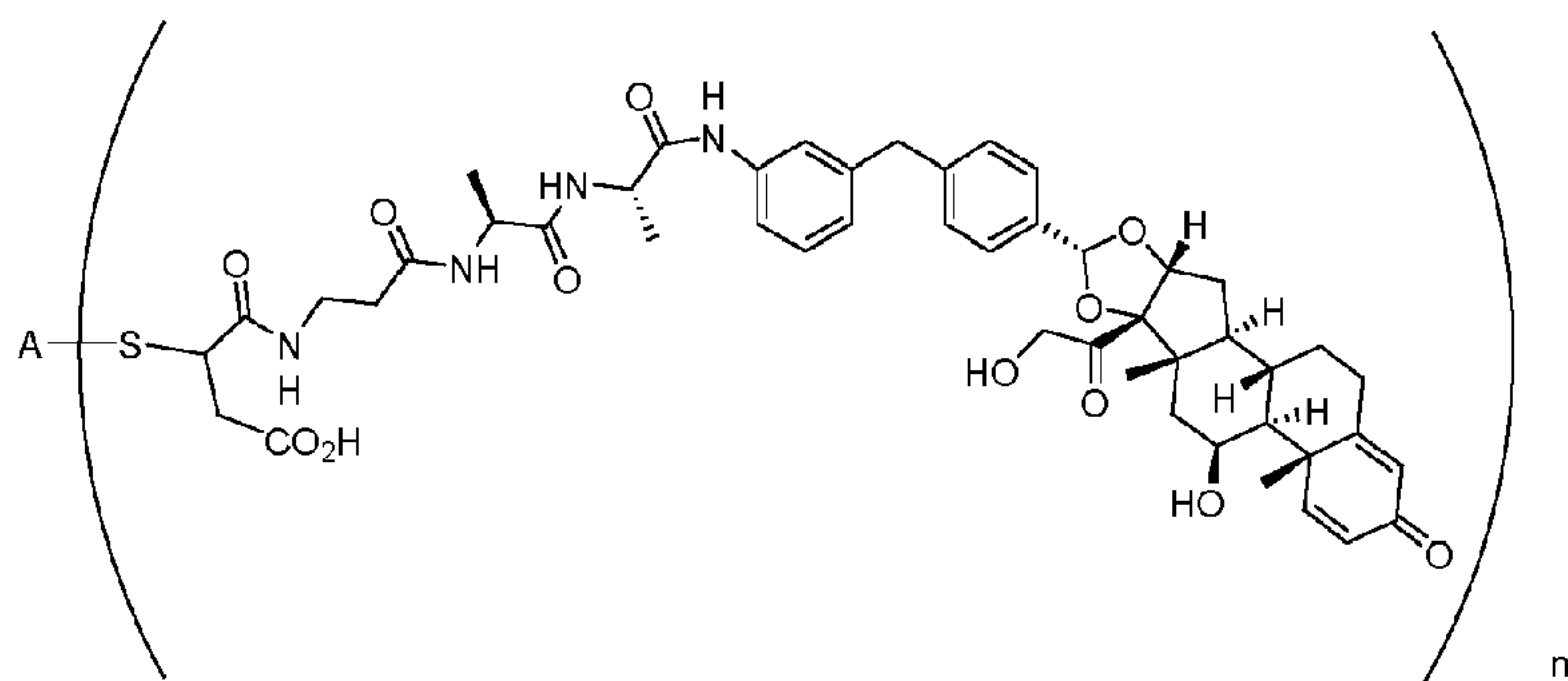
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Patentkrav**1. Forbindelse:**

hvor n er 2 eller 4, og A er et antistof, der omfatter SEQ ID NO: 66 og SEQ ID NO: 73 eller adalimumab.

2. Forbindelse ifølge krav 1, hvor n er 4.

3. Forbindelse ifølge krav 1, hvor n er 2.

4. Forbindelse ifølge krav 2 eller krav 3, hvor A er adalimumab.

DRAWINGS

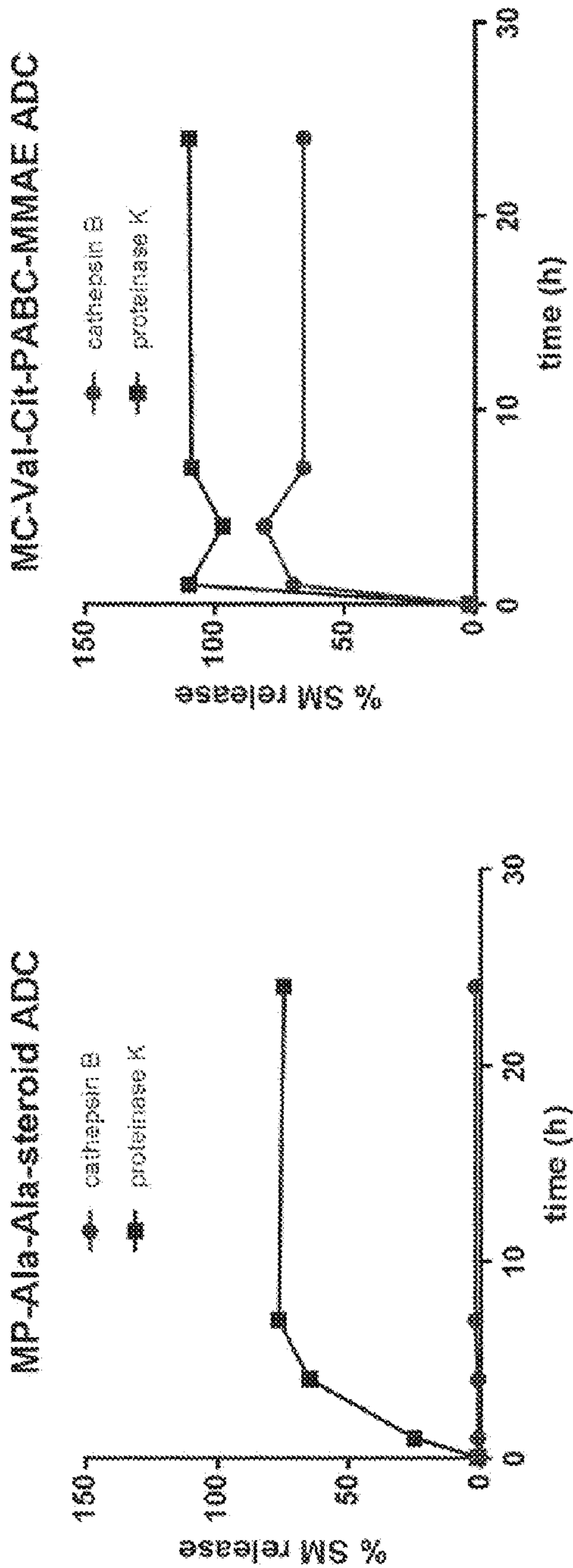


Fig. 1

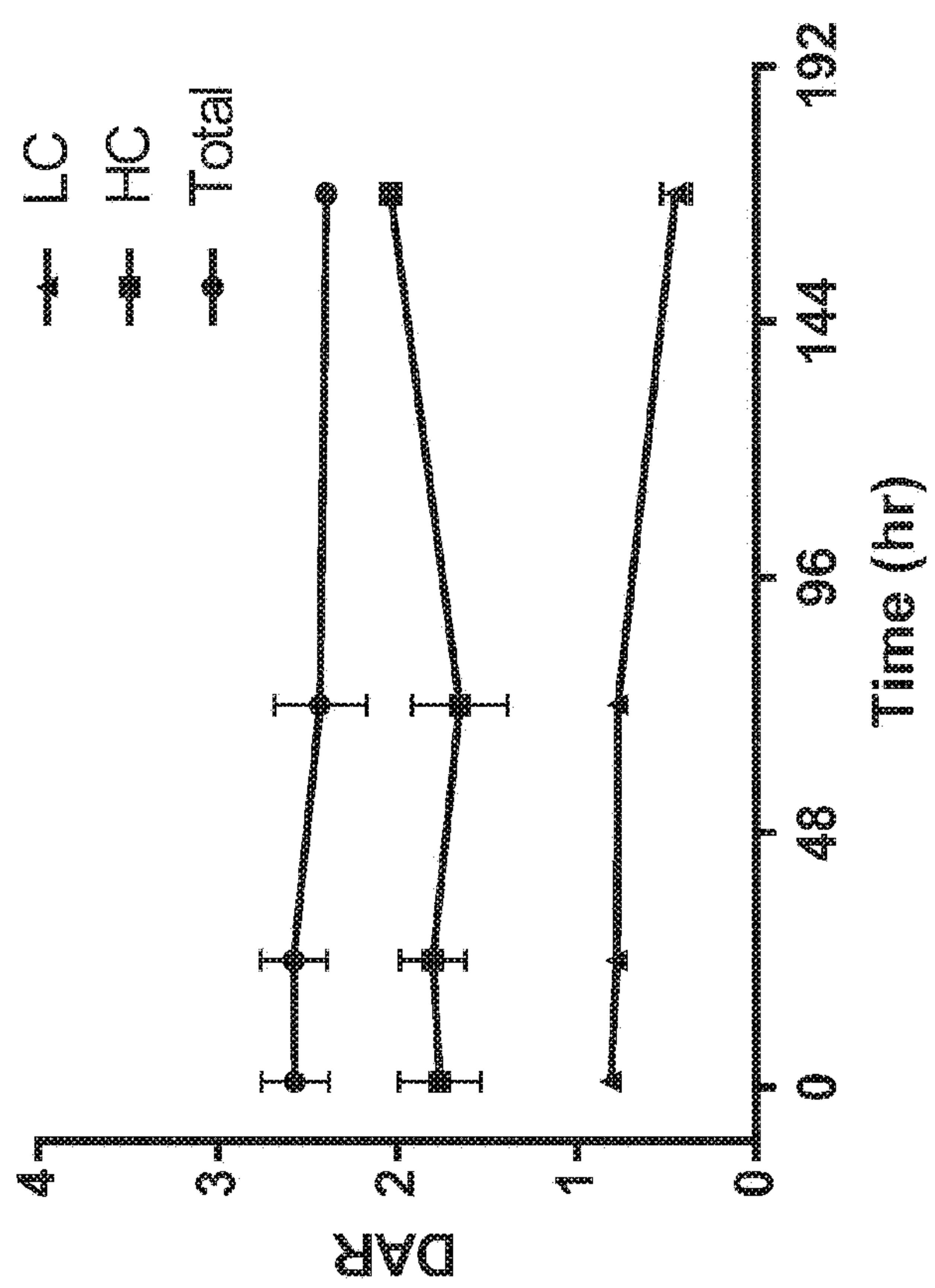


Fig. 2

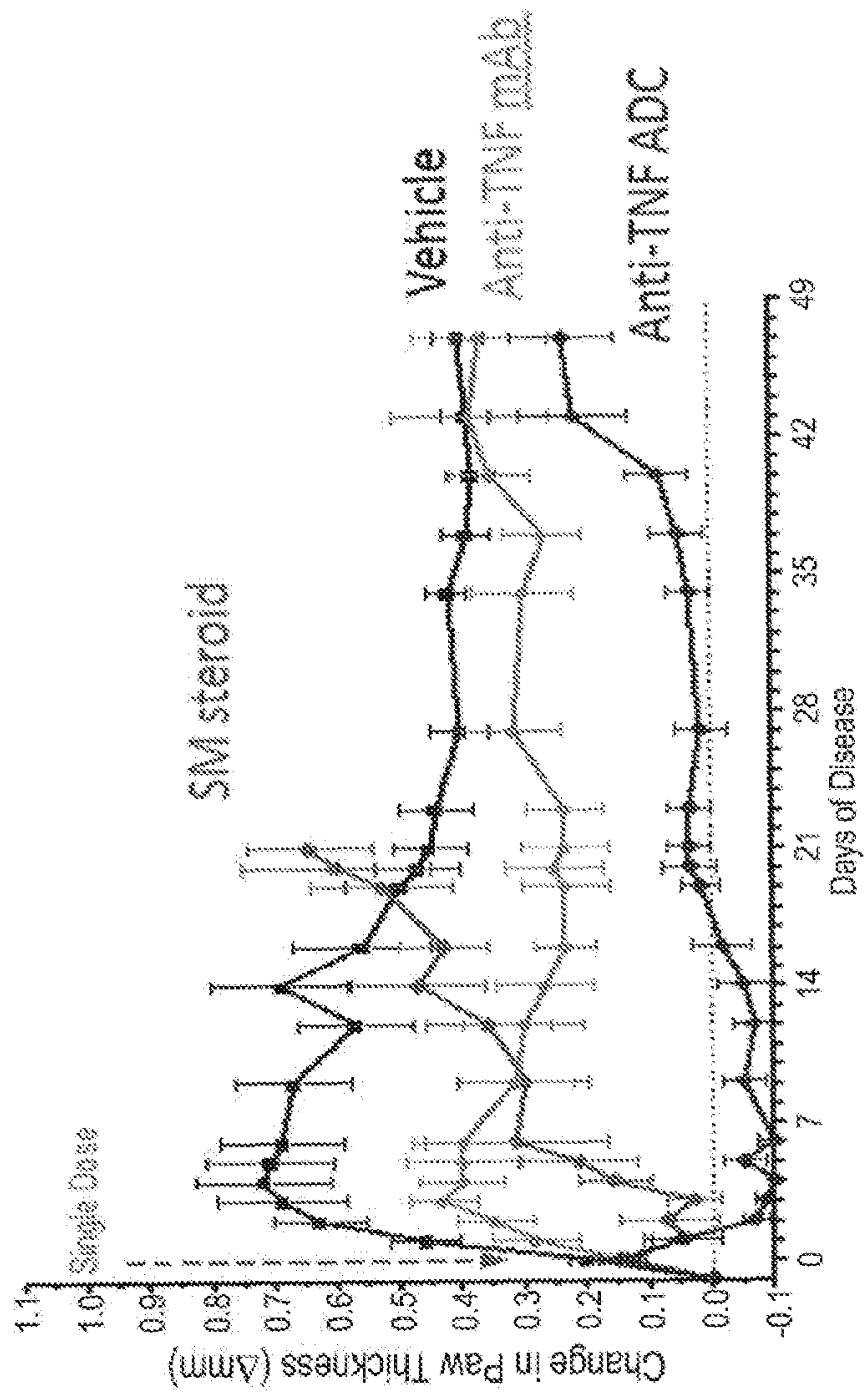


Fig. 3

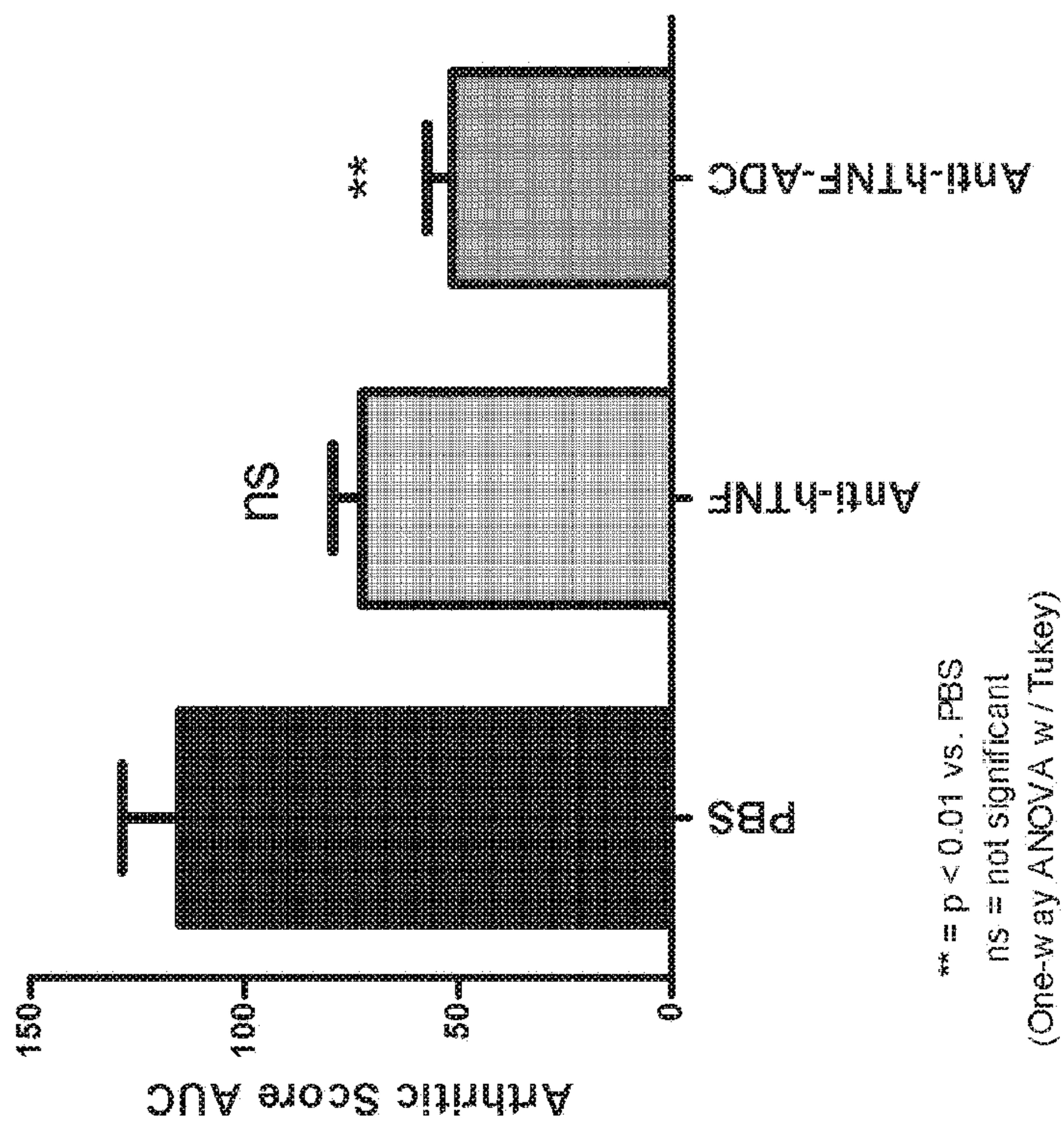


Fig. 4

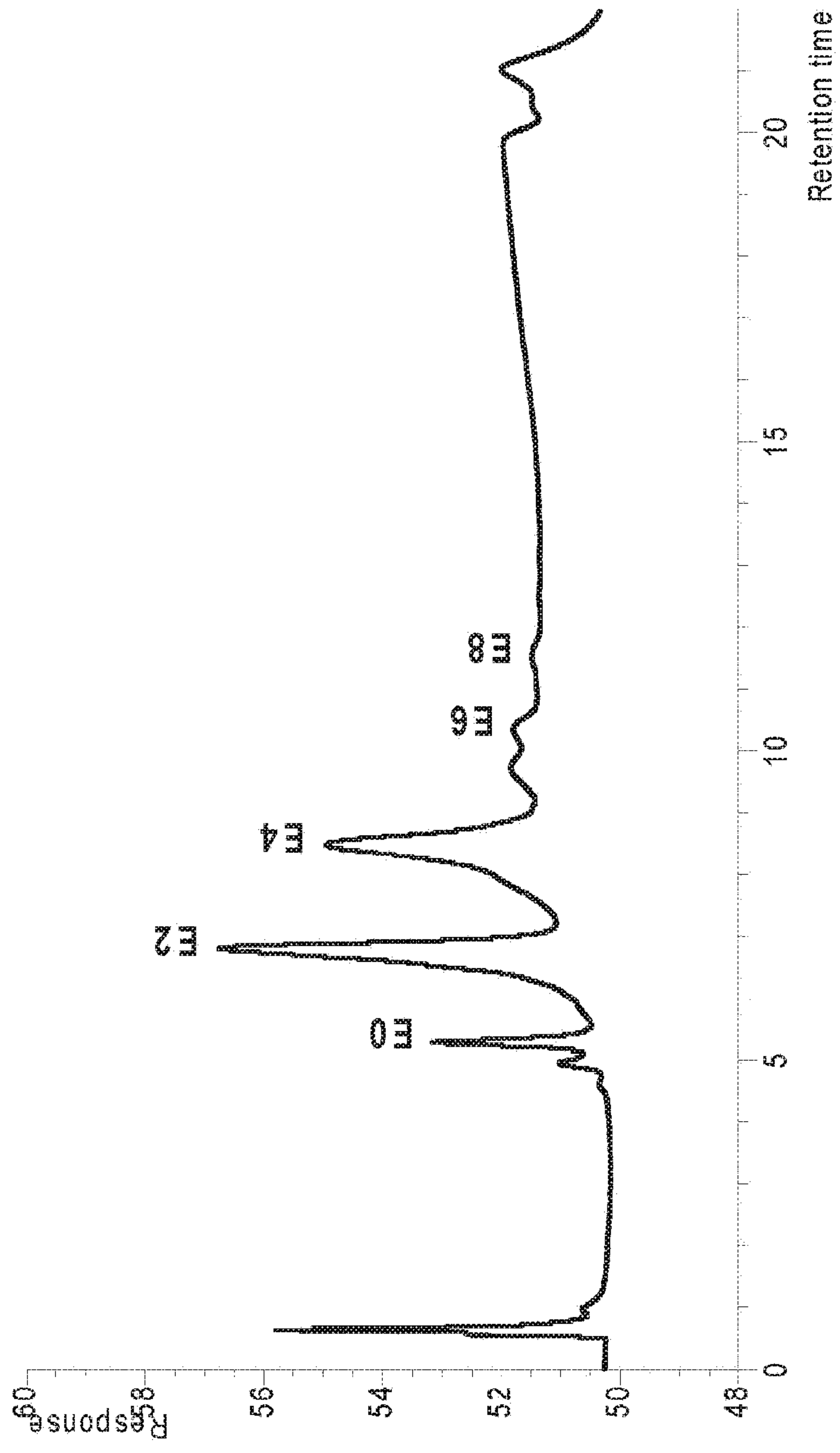


Fig. 5

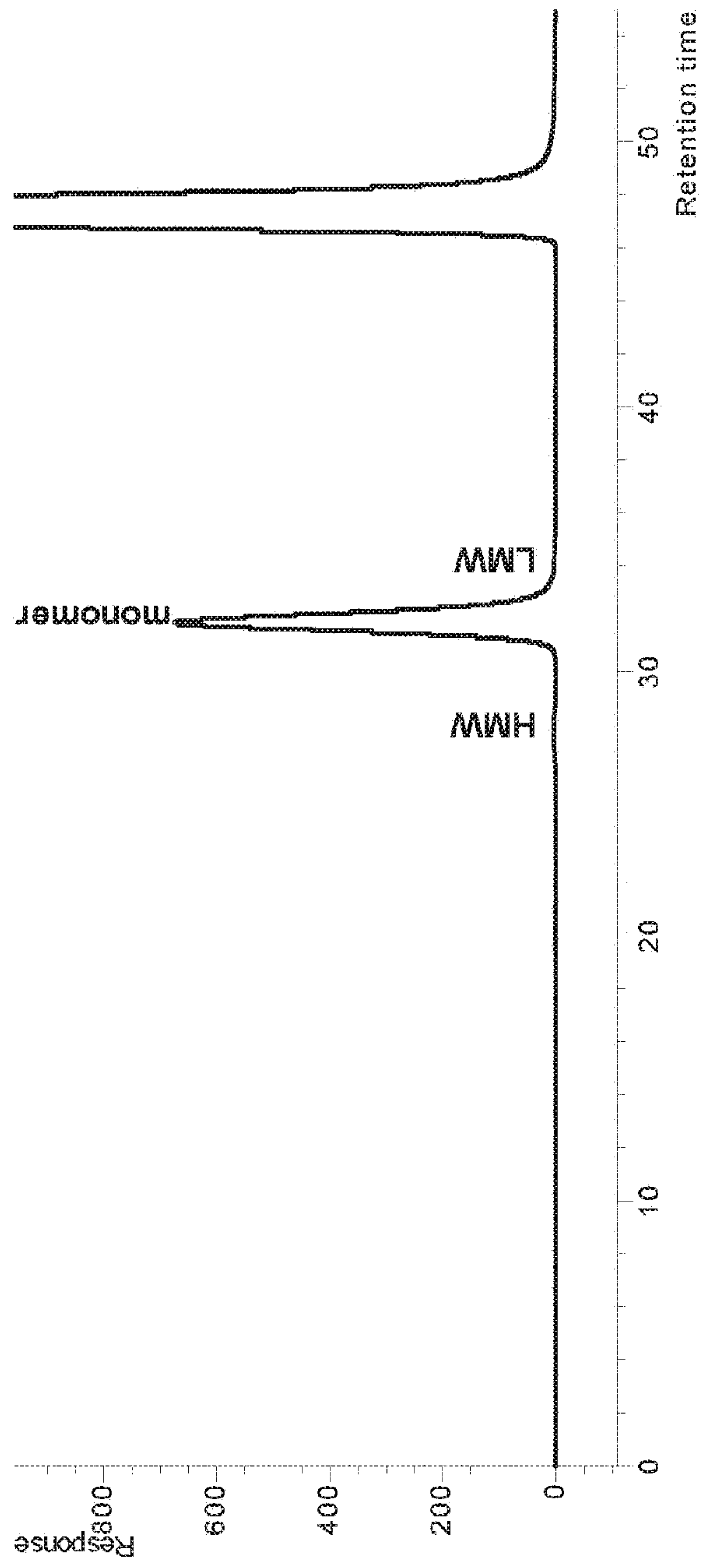


Fig. 6

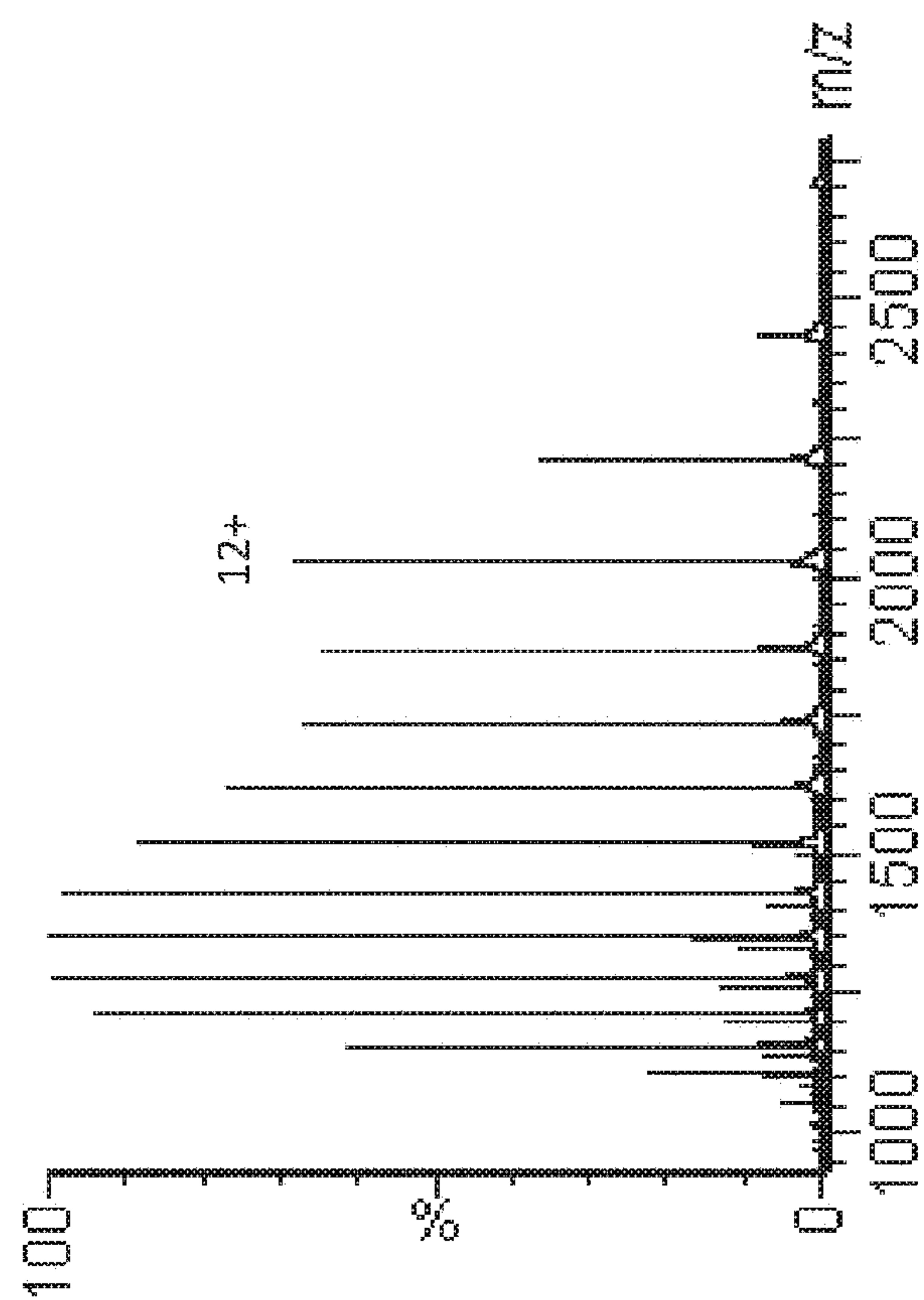


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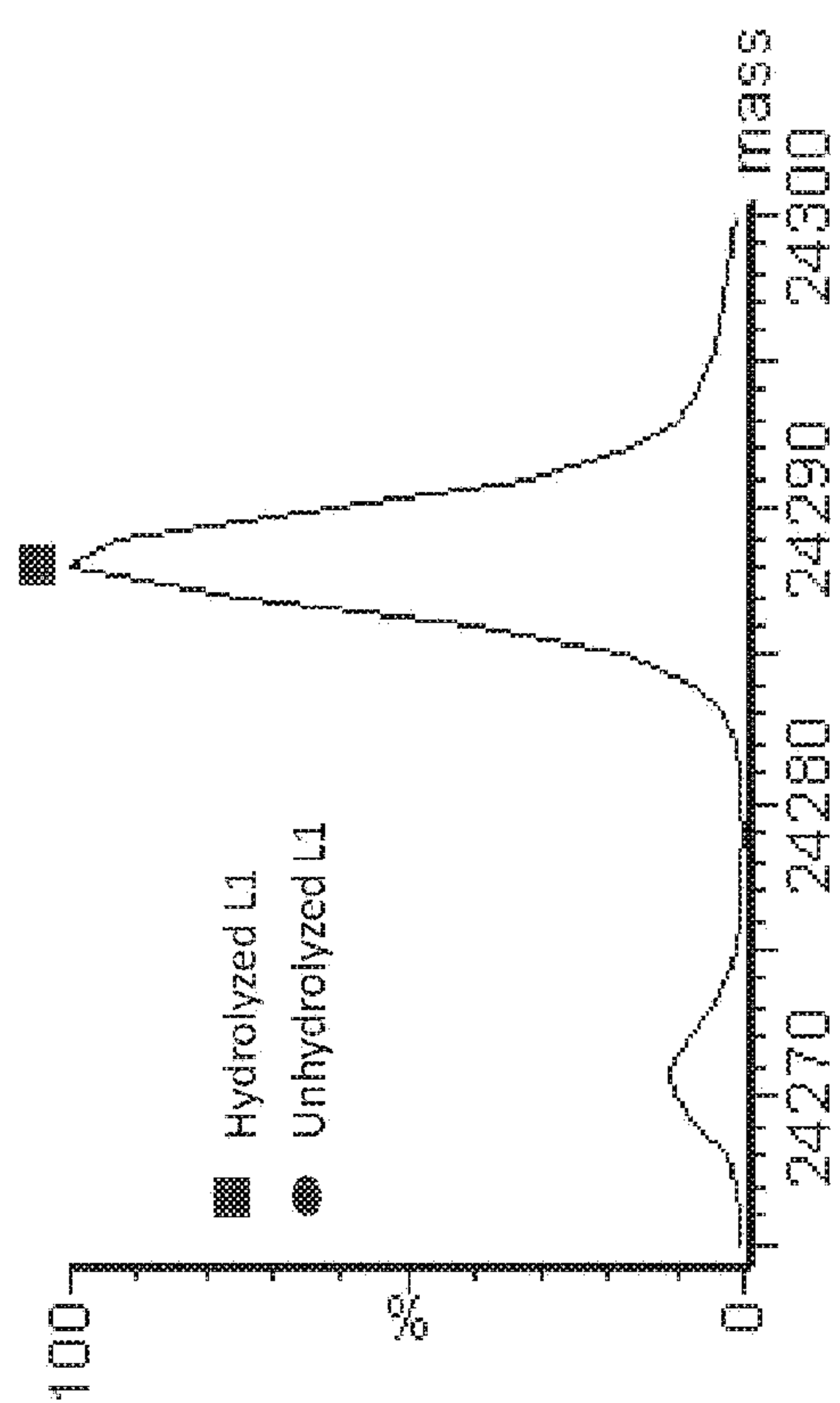


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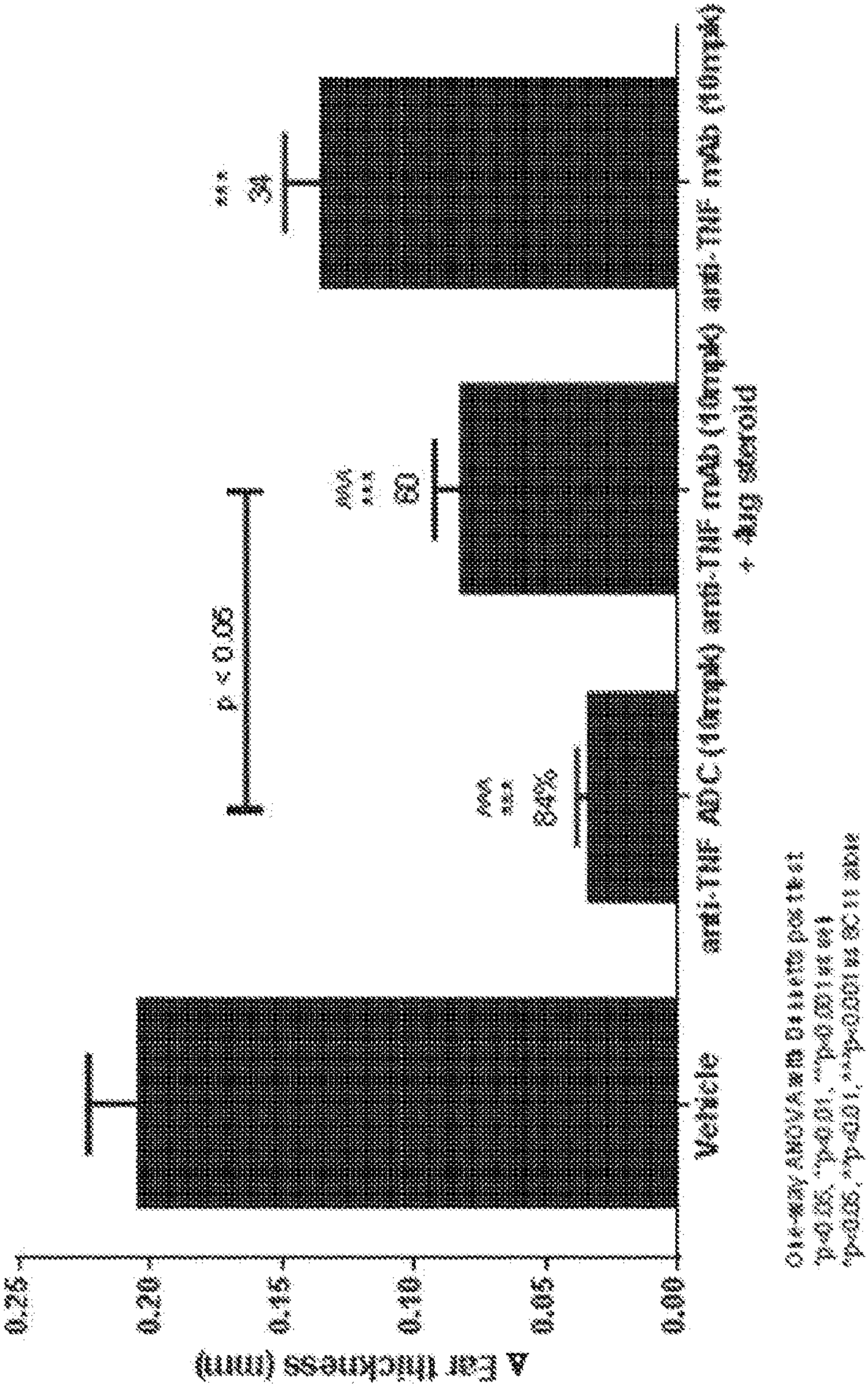


Fig. 9

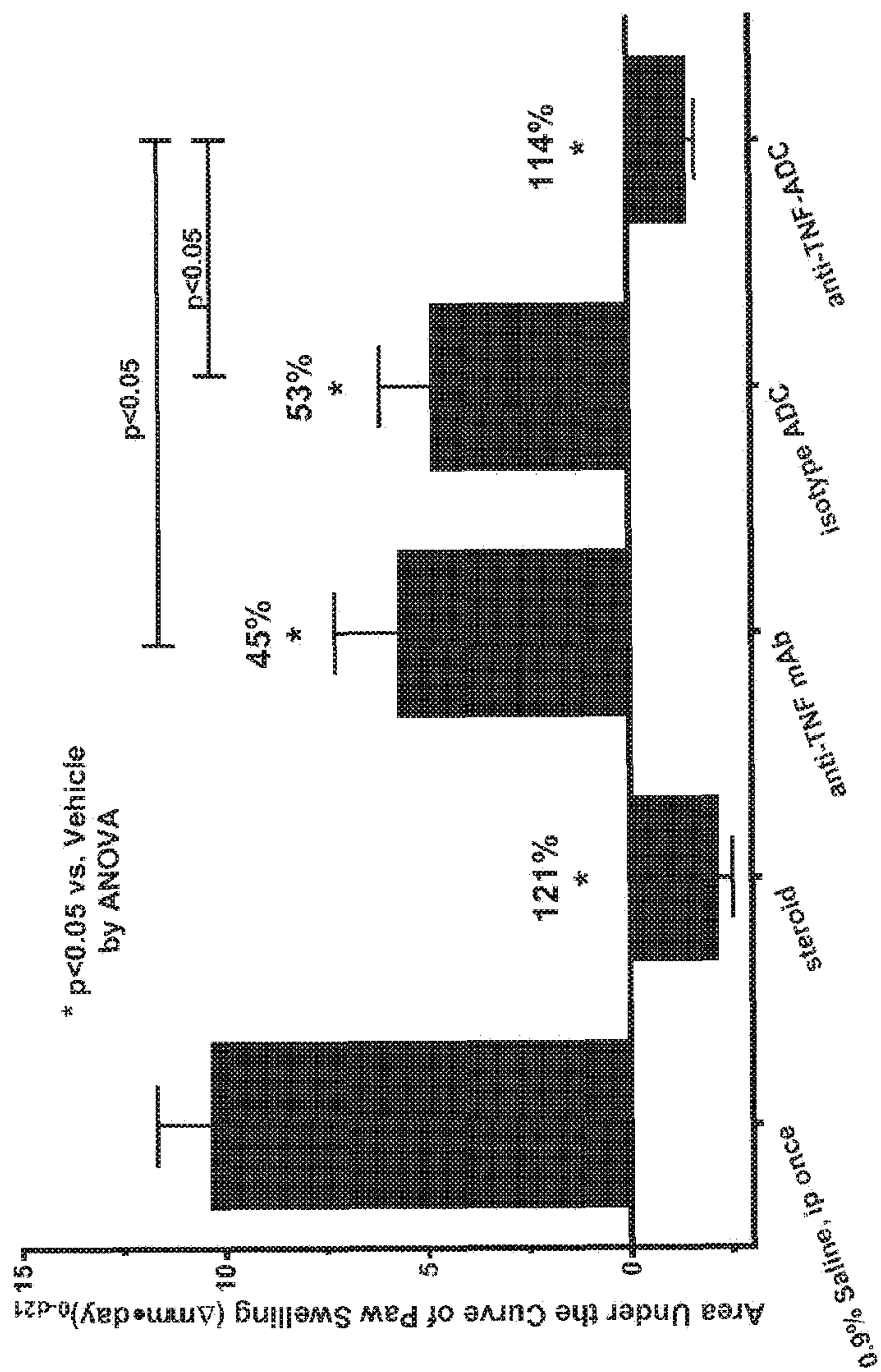


Fig. 10

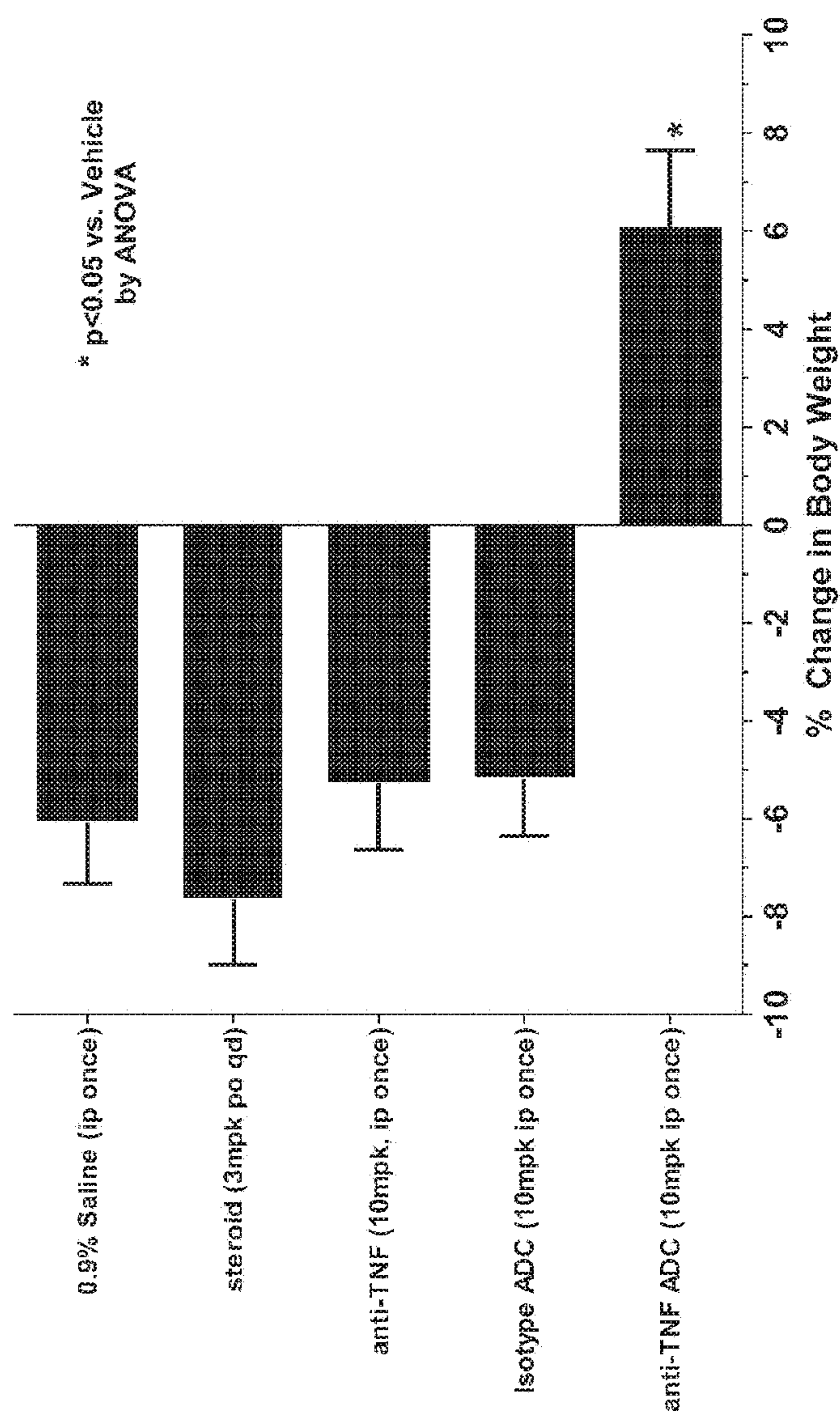


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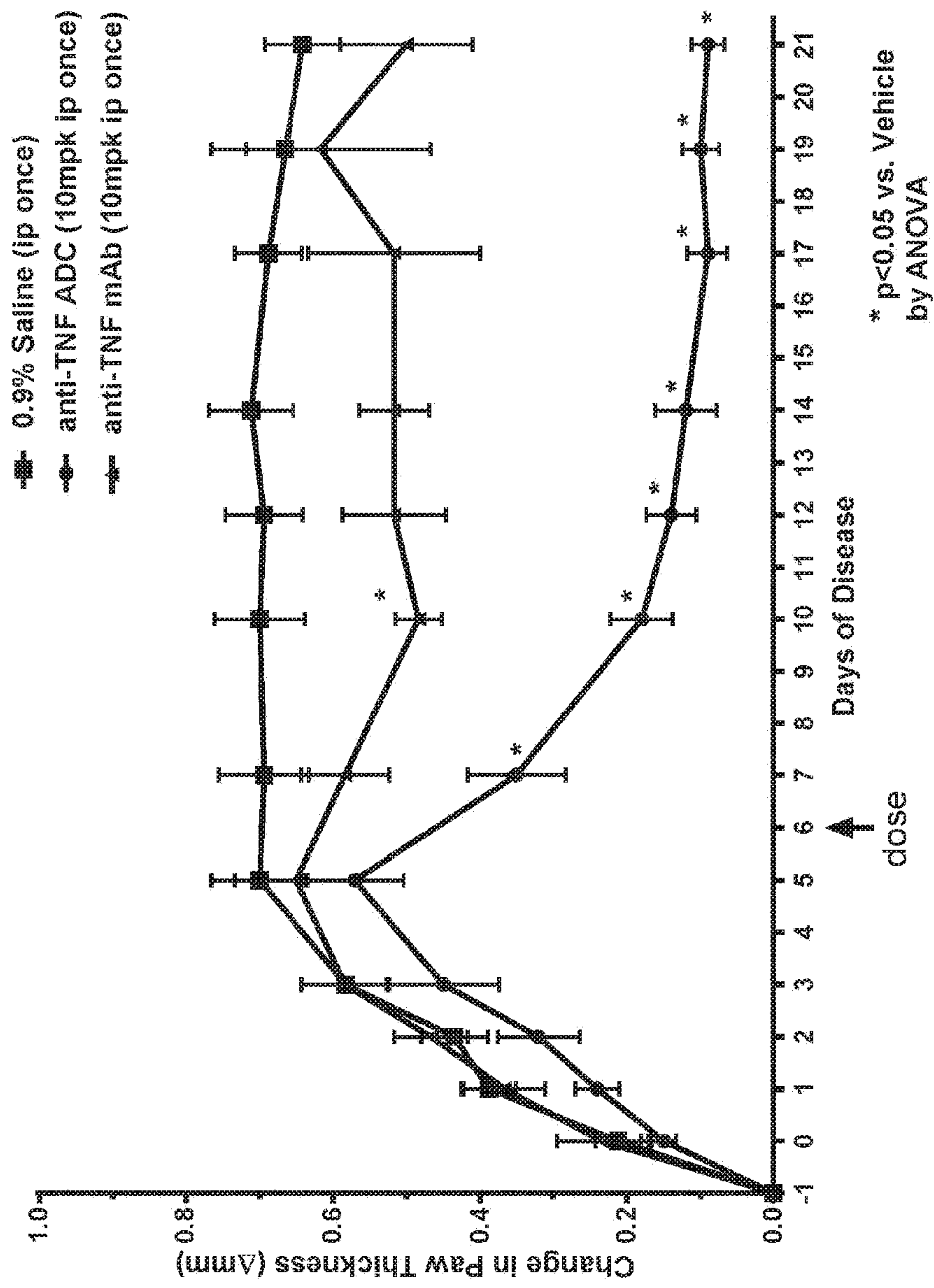


Fig. 12

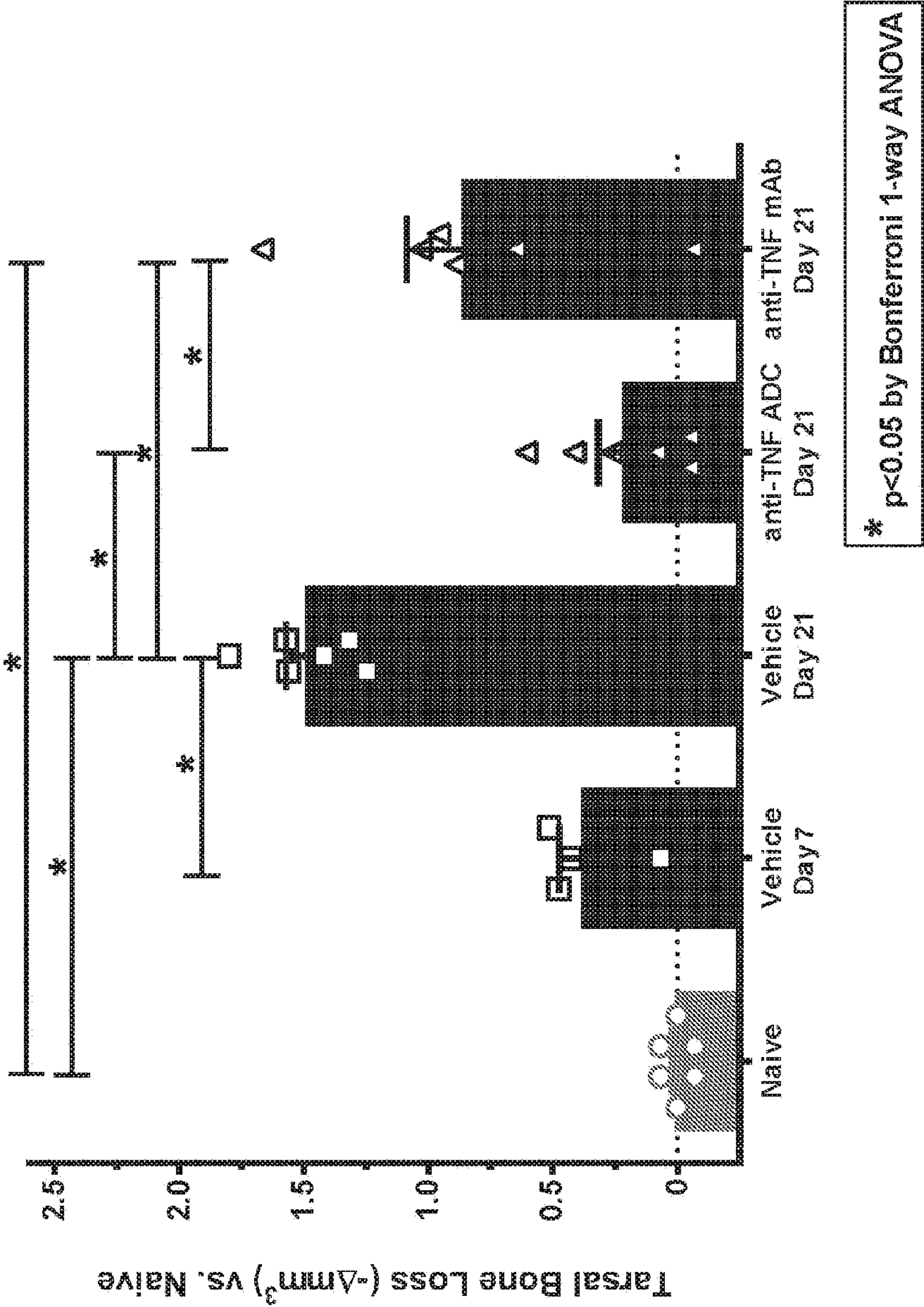
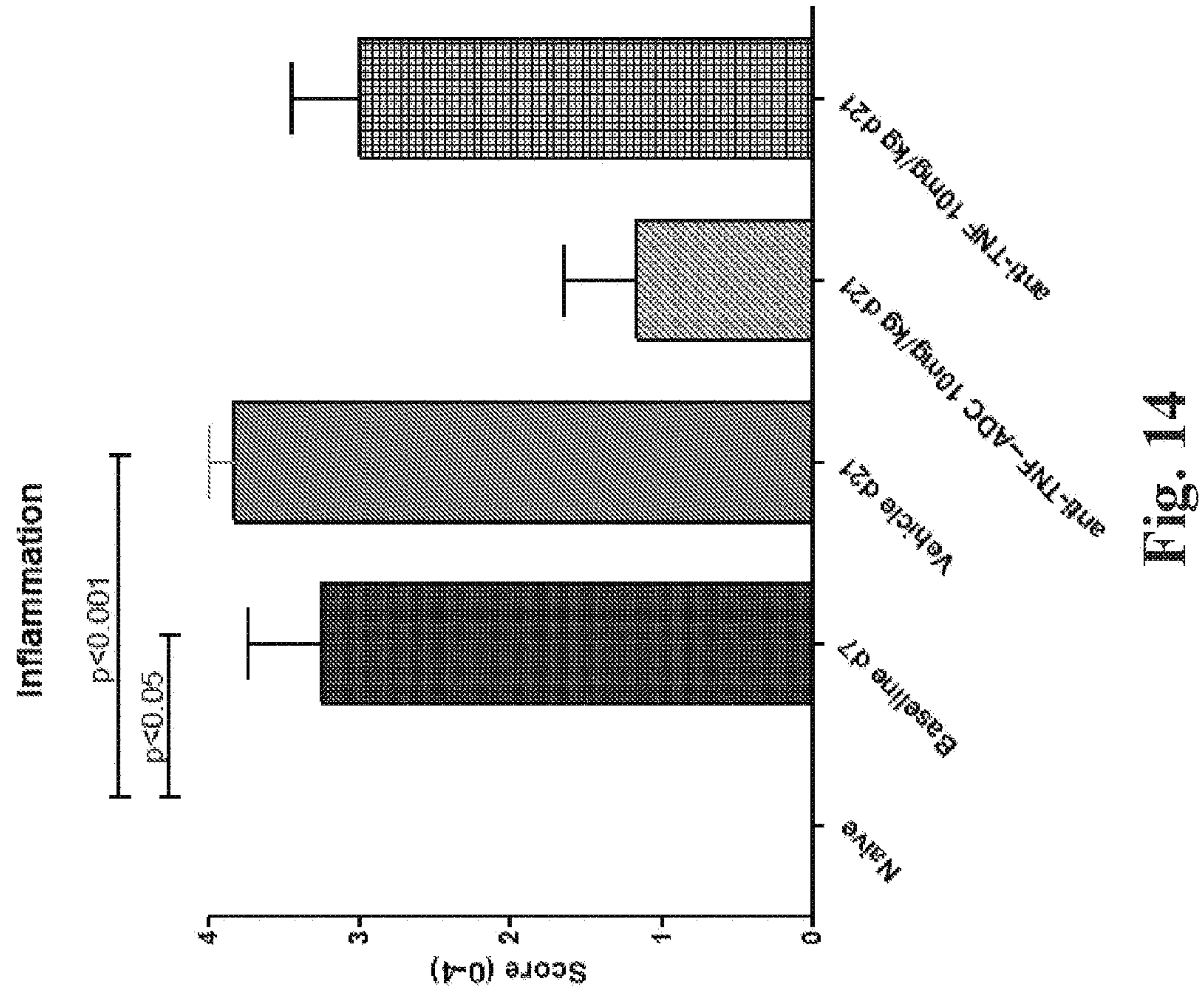


Fig. 13



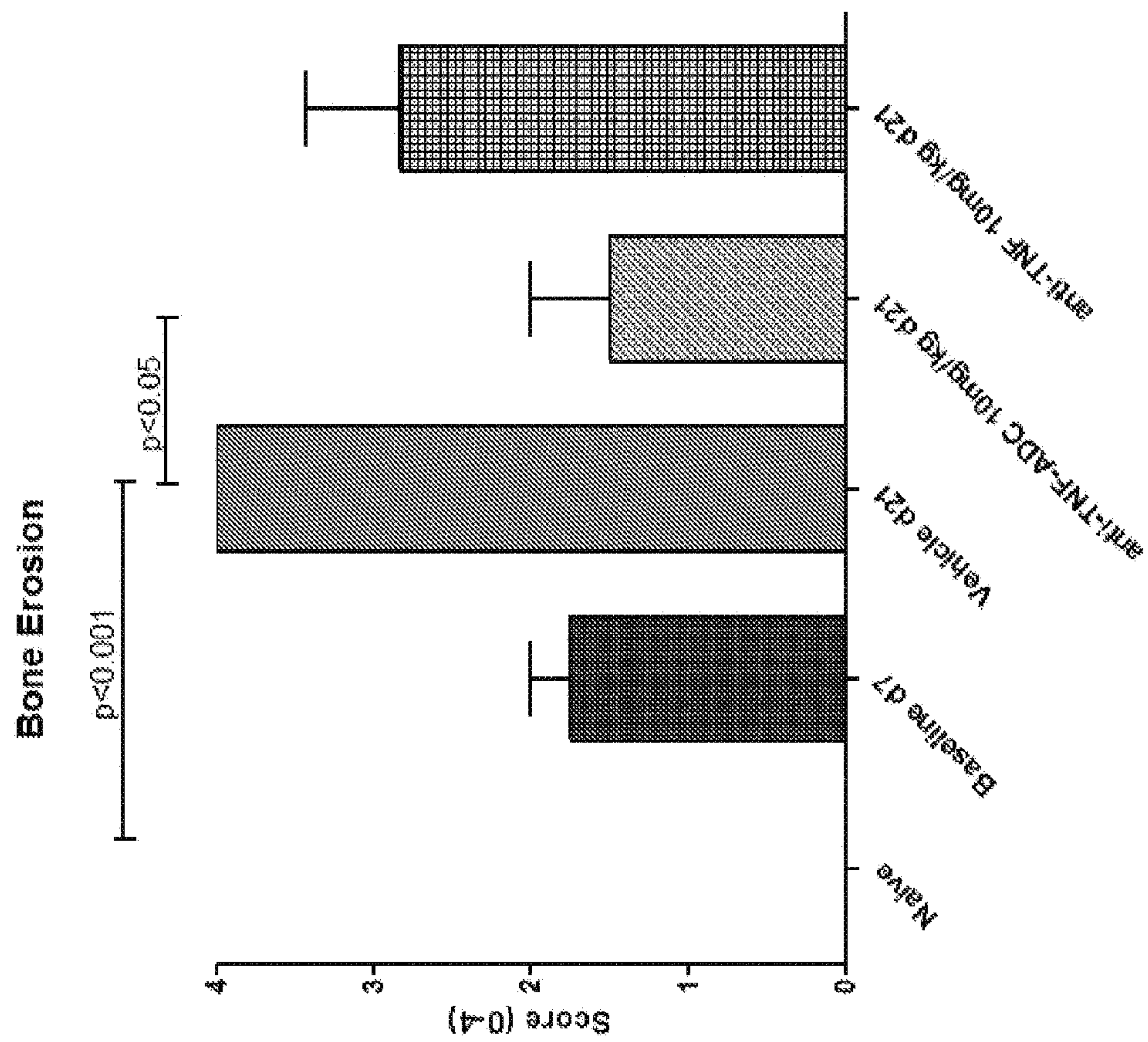
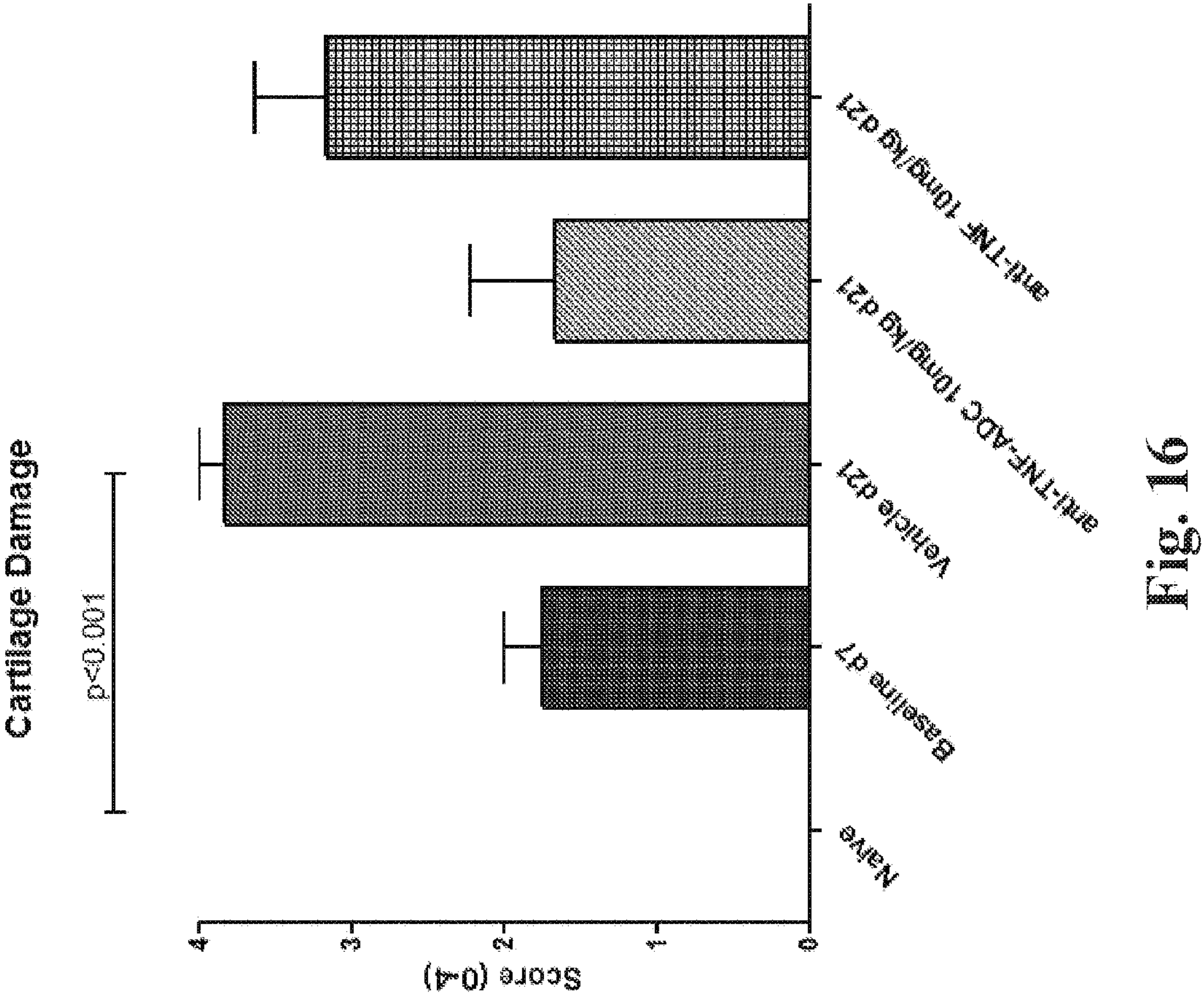


Fig. 15



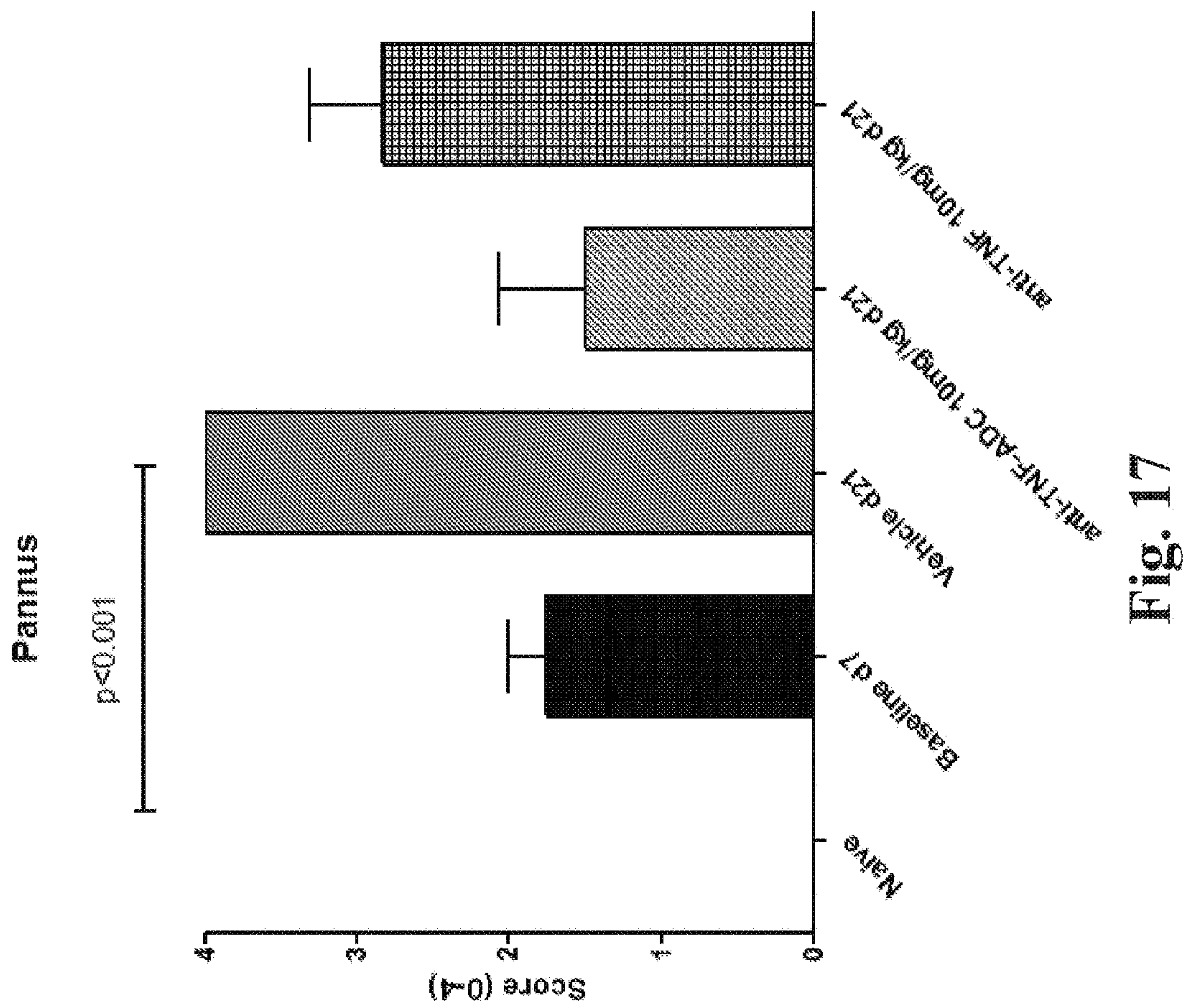


Fig. 17

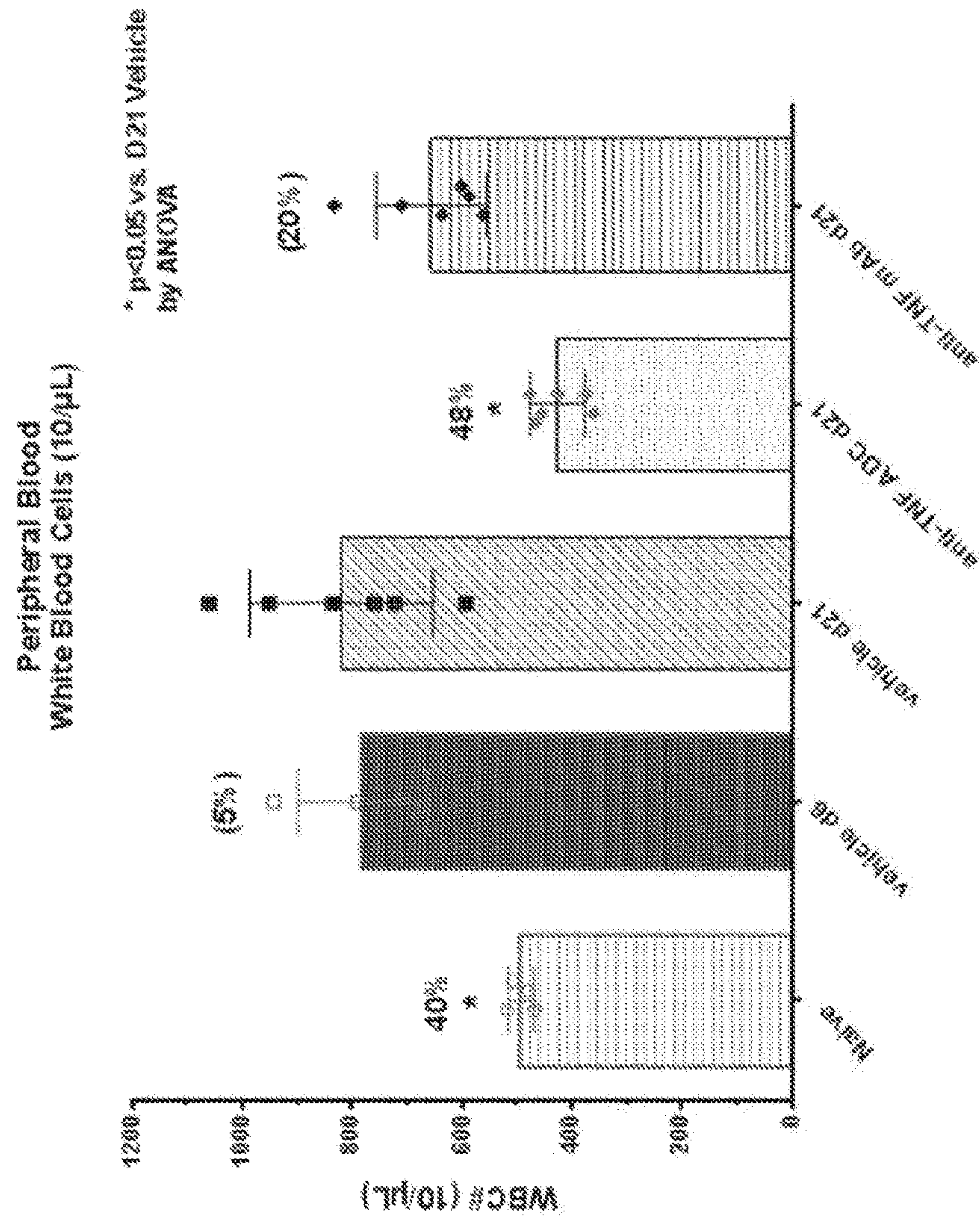


Fig. 18

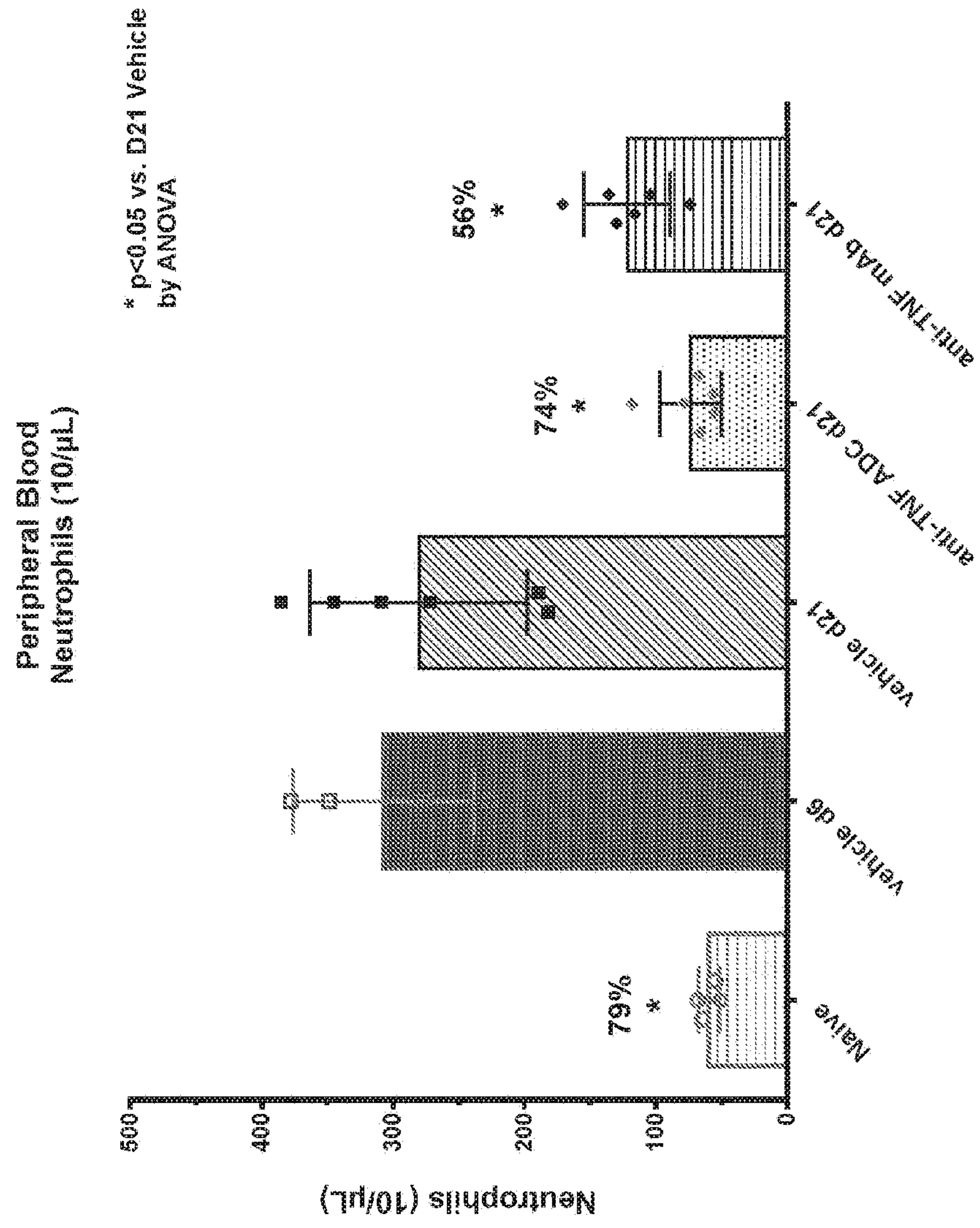
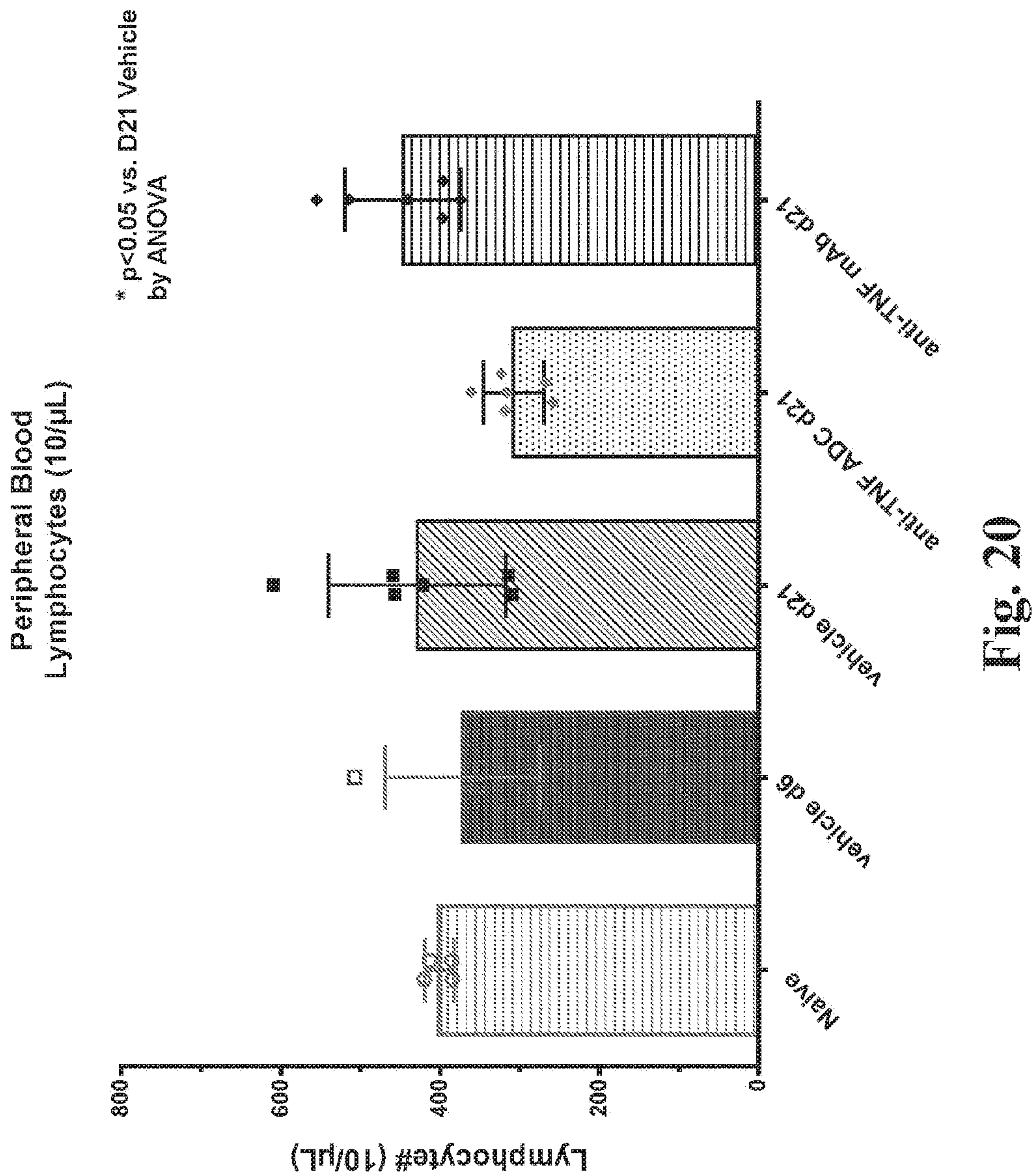


Fig. 19



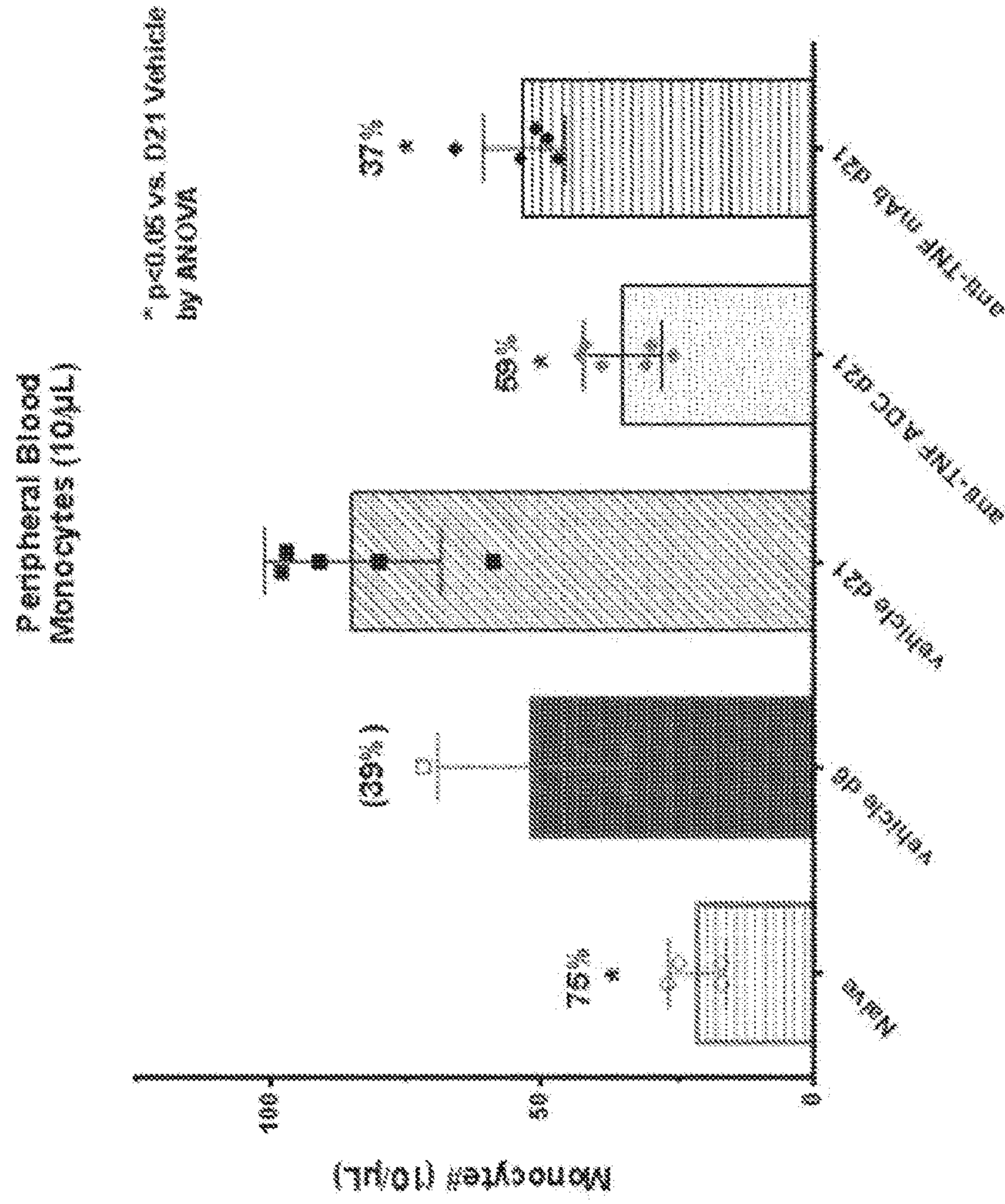
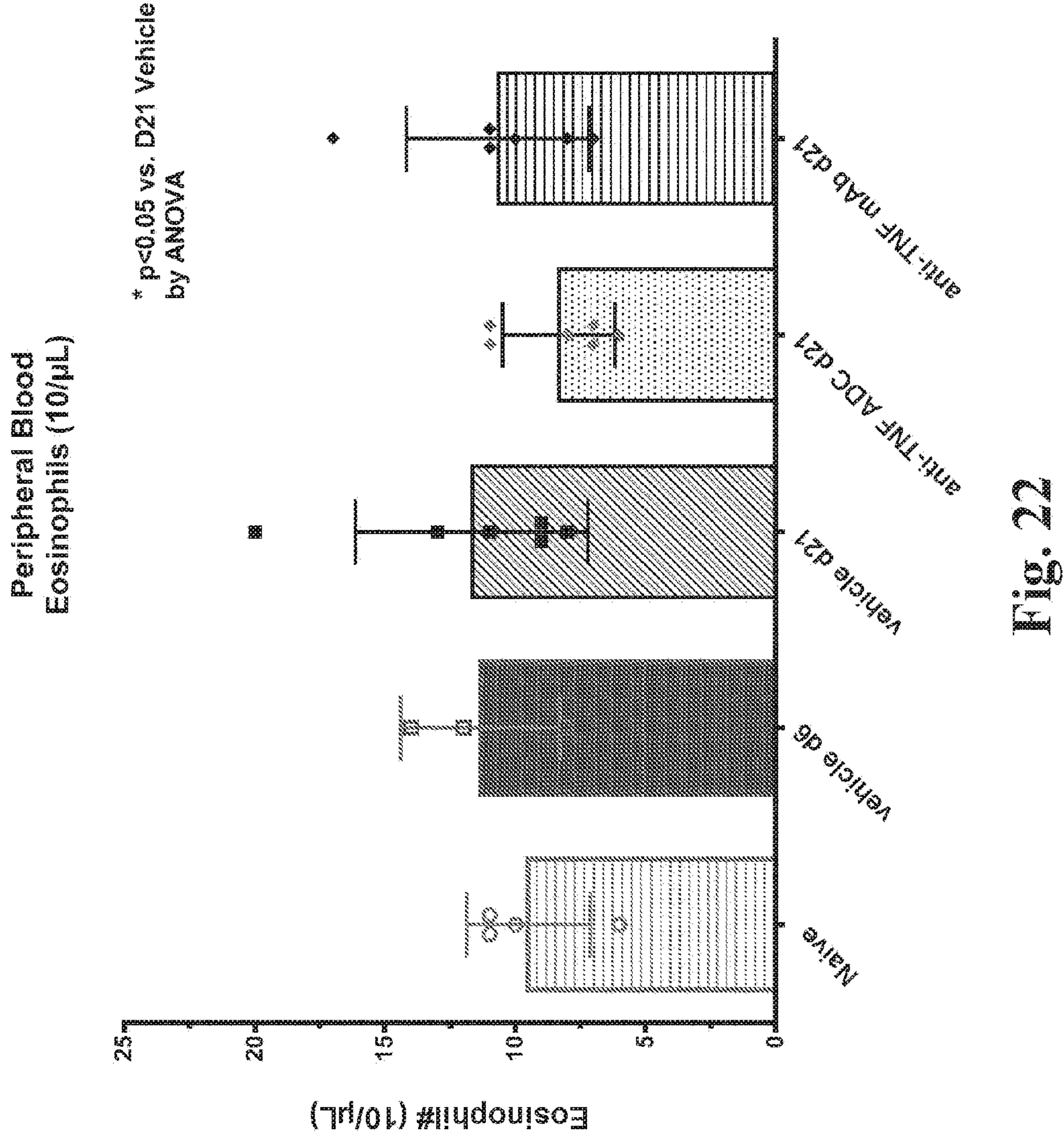


Fig. 21



Peripheral Blood
Basophils (10/ μ L)

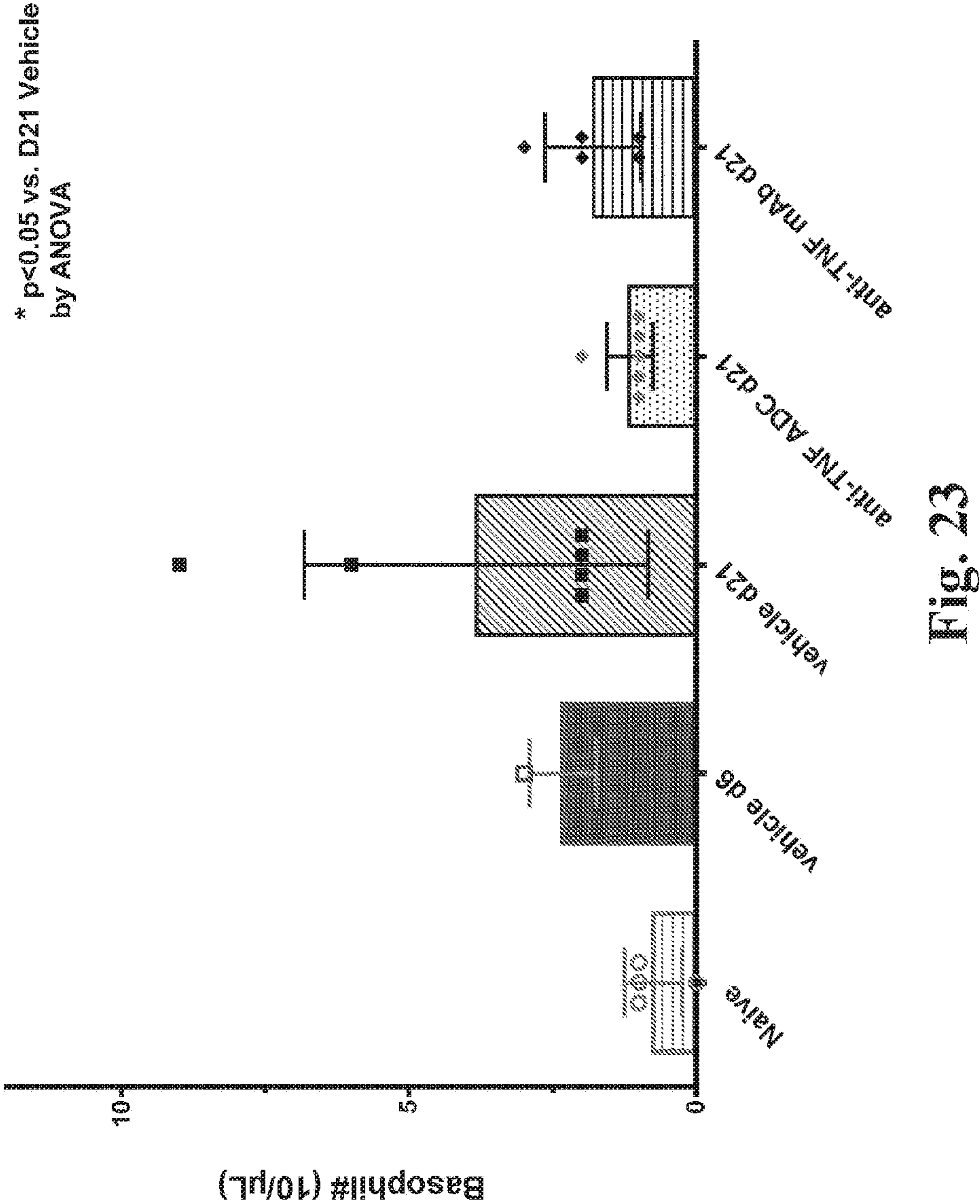


Fig. 23

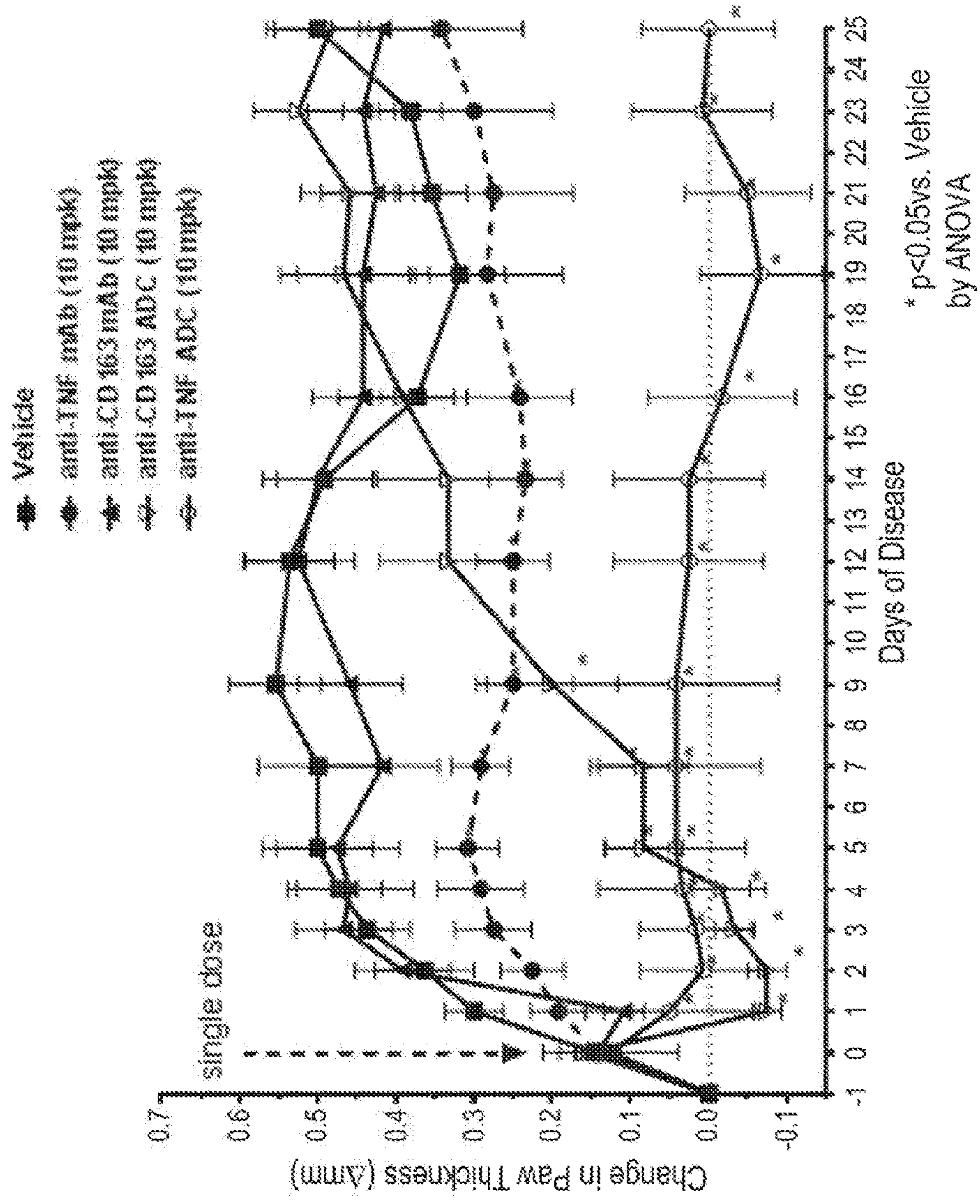


Fig. 24