Claims

1. An antibody, fusion protein or a binding fragment thereof for use in the therapeutic treatment of a canine, wherein said antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:8, SEQ ID NO:11 or SEQ ID NO:13, wherein the amino acid sequence of the heavy chain minimises the activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen.

2. The antibody, fusion protein or binding fragment as claimed in claim 1 wherein the therapeutic treatment of the canine relates to the treatment of pain or inflammation or a condition associated therewith.

3. The antibody, fusion protein or binding fragment as claimed in claim 2 wherein the therapeutic treatment of the canine relates to the treatment of arthritis or an arthritic condition.

4. The antibody, fusion protein or binding fragment as claimed in claim 2 wherein the pain is selected from the group consisting of neuropathic pain, oncologic pain, pain associated with, or resulting from, rheumatoid arthritis, pain associated with, or resulting from, osteoarthritis, pain associated with, or resulting from, inflammation and pain associated with, or resulting from, pruritis.

5. The antibody, fusion protein or binding fragment as claimed in any one of claims 1 to 4 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

6. The antibody, fusion protein or binding fragment as claimed in any one of claims 1 to 5 wherein the target antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

7. Use of an antibody or a fusion protein or a binding fragment thereof comprising a heavy chain constant domain having the amino acid sequence of SEQ ID NO:8, SEQ ID NO:11 or SEQ ID NO:13, wherein the amino acid sequence of the heavy chain minimises the activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen, in the preparation of a medicament for use in the treatment of pain or inflammation in a canine subject.

8. Use as claimed in claim 7 wherein the pain is selected from the group consisting of neuropathic pain, oncologic pain, pain associated with, or resulting from, rheumatoid arthritis, pain associated with, or resulting from, osteoarthritis, pain associated with, or resulting from, inflammation and pain associated with, or resulting from, pruritis.

9. Use as claimed in claim 7 or 8 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

10. Use as claimed in any one of claims 7 to 9 wherein the target antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

11. A method for treating, inhibiting or ameliorating pain or inflammation in a canine subject in need thereof, the method comprising the steps of:

- providing an antibody or a fusion protein or a binding fragment thereof which binds specifically to a target antigen which has a specific function in the treatment or prevention of pain or inflammation, wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:8, SEQ ID NO:11 or SEQ ID NO:13 and wherein the antibody, fusion protein or binding fragment does not activate downstream immune system effector functions, and

- administering a therapeutically effective amount of the antibody, fusion protein or binding fragment to the canine subject.

12. The method as claimed in claim 11 wherein the pain is selected from the group consisting of neuropathic pain, oncologic pain, pain associated with, or resulting from, rheumatoid arthritis, pain associated with, or resulting from, osteoarthritis, pain associated with, or resulting from, inflammation and pain associated with, or resulting from, pruritis.

13. The method as claimed in claim 11 or 12 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

14. The method as claimed in any one of claims 11 to 13 wherein the target antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

15. The method as claimed in any one of claims 11 to 14 wherein the method further comprises the step of co-administering at least one further agent selected from the group consisting of an analgesic, NSAID, opioid, corticosteroid and steroid.

16. An antibody or a fusion protein or a binding fragment thereof for use in the therapeutic treatment of a canine, wherein said antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:9, SEQ ID NO:10, or SEQ ID NO:14 wherein the amino acid sequence of the heavy chain mediates the activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen.

17. The antibody, fusion protein or binding fragment as claimed in claim 16 wherein the therapeutic treatment relates to the treatment of a cancerous or malignant condition.

18. The antibody, fusion protein or binding fragment as claimed in claim 16 or 17 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

19. The antibody, fusion protein or binding fragment as claimed in any one of claims 16 to 18 wherein the target antigen is a cancer specific antigen.

20. The antibody, fusion protein or binding fragment as claimed in claim 19 wherein the cancer specific antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

21. The antibody, fusion protein or binding fragment as claimed in claim 19 wherein the cancer specific antigen is selected from the group consisting of proteins CD2, CD4, CD8, CD20, EGFR, VEGFR and HER2.

22. Use of an antibody or a fusion protein or a binding fragment thereof comprising a heavy chain constant domain having the amino acid sequence of SEQ ID NO:9, SEQ ID NO:10 or SEQ ID NO:14, wherein the amino acid sequence of the heavy chain mediates the activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen, in the preparation of a medicament for use in the treatment of a cancerous or malignant condition in a canine subject.

23. Use as claimed in claim 22 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

24. Use as claimed in claim 22 or 23 wherein the target antigen is a cancer specific antigen.

25. Use as claimed in claim 24 wherein the cancer specific antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

26. Use as claimed in claim 24 wherein the cancer specific antigen is selected from the group consisting of proteins CD2, CD4, CD8, CD20, EGFR, VEGFR and HER2.

27. A method for the treatment or prevention of a cancerous or malignant condition in a canine subject, the method comprising the steps of:

- providing an antibody or a fusion protein or a binding fragment thereof which binds specifically to a target antigen which has a specific function in the treatment of a cancerous or malignant condition, wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:9, SEQ ID

NO:10 or SEQ ID NO:14 and wherein the antibody, fusion protein or binding fragment activates downstream immune system effector functions, and

- administering a therapeutically effective amount of the antibody, fusion protein or binding fragment to the canine subject in need of such treatment.

28. The method as claimed in claim 27 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

29. The method as claimed in claim 27 or 28 wherein the target antigen is a cancer specific antigen.

30. The method as claimed in claim 29 cancer specific antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

31. The method as claimed in claim 29 wherein the cancer specific antigen is selected from the group consisting of proteins CD2, CD4, CD8, CD20, EGFR, VEGFR and HER2.

32. An antibody or a fusion protein or a binding fragment thereof for use in the treatment of a condition in a canine, wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain which does not bind to C1q when the antibody, fusion protein or binding fragment is bound to its target antigen and wherein the antibody, fusion protein or binding fragment can be purified using Protein A chromatography.

33. The antibody, fusion protein or binding fragment as claimed in claim 32 wherein the antibody has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:6.

34. The antibody, fusion protein or binding fragment as claimed in claim 32 wherein the antibody has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:13.

35. Use of an antibody or a fusion protein or a binding fragment thereof which comprises a heavy chain constant domain which does not bind to C1q when the antibody, fusion protein or binding fragment is bound to its target antigen and wherein the antibody, fusion protein or binding fragment can be purified using Protein A chromatography in the preparation of a medicament for the treatment of a condition associated with pain and/or inflammation in a canine.

36. Use as claimed in claim 35 wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:6.

37. Use as claimed in claim 35 wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence selected from the group consisting of SEQ ID NO:12, SEQ ID NO:13 and SEQ ID NO:15.

38. A method for treating, inhibiting or ameliorating pain or inflammation in a canine subject in need thereof, the method comprising the steps of:

- providing an antibody or a fusion protein or a binding fragment thereof which comprises a heavy chain constant domain which does not bind to C1q when the antibody, fusion protein or binding fragment is bound to its

target antigen and wherein the antibody, fusion protein or binding fragment can be purified using Protein A chromatography, and

- administering a therapeutically effective amount of the antibody, fusion protein or binding fragment to the canine subject.

39. The method as claimed in claim 38 wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:6.

40. The method as claimed in claim 38 wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:13.

41. A recombinant antibody or a fusion protein or a binding fragment thereof which can be therapeutically administered to a canine in order to specifically bind to a target antigen, wherein the constant domain of the antibody, fusion protein or binding fragment does not bind to C1q complement, and wherein the heavy chain of the constant domain comprises a canine immunoglobulin heavy chain constant domain isotype A having an amino acid sequence of SEQ ID NO: 8, a canine immunoglobulin heavy chain constant domain isotype D having an amino acid sequence of SEQ ID NO:11 or an aglycosyl canine immunoglobulin heavy chain constant domain isotype B having an amino acid sequence of SEQ ID NO:13.

42. The recombinant antibody, fusion protein or binding fragment as claimed in claim 41 wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence selected from the group consisting of SEQ ID NO:6, SEQ ID NO:12, SEQ ID NO:13 and SEQ ID NO:15.

43. A recombinant antibody or a fusion protein or a binding fragment thereof which can be therapeutically administered to a canine in order to specifically

bind to a target antigen and which further mediates an immune response which is characterised by C1q complement binding to said antibody, fusion protein or binding fragment and associated complement dependent cytotoxicity, wherein the heavy chain of the antibody, fusion protein or binding fragment comprises canine immunoglobulin heavy chain constant domain isotype B having an amino acid sequence of SEQ ID NO: 9, canine immunoglobulin heavy chain constant domain isotype C having an amino acid sequence of SEQ ID NO:10 or aglycosyl canine immunoglobulin heavy chain isotype C having an amino acid sequence of SEQ ID NO:14.

44. A pharmaceutical composition comprising an antibody, fusion protein or binding fragment as claimed in any one of claims 41 to 43 and at least one pharmaceutically acceptable carrier, excipient or diluent.

45. An isolated nucleic acid that encodes an antibody, fusion protein or binding fragment according to any one of claims 41 to 43, an expression vector comprising said nucleic acid or a host cell comprising said expression vector.

46. A method for the purification of a canine derived immunoglobulin or an immunoglobulin or fusion protein comprising a canine heavy chain constant domain of isotype A having an amino acid sequence of SEQ ID NO:8 or a canine immunoglobulin heavy chain constant domain of isotype D having an amino acid sequence of SEQ ID NO:11 from a source mixture, the method comprising the steps of:

(i) providing a source mixture comprising target immunoglobulins or fusion proteins,

(ii) subjecting the source mixture to anion exchange chromatography;

(iii) subjecting the source mixture to hydrophobic interaction chromatography; and

(iv) subjecting the source mixture to size exclusion chromatography.

47. A method for the purification of a canine derived immunoglobulin or an immunoglobulin or fusion protein comprising a canine heavy chain constant domain of isotype A having an amino acid sequence of SEQ ID NO:8 or a canine immunoglobulin heavy chain constant domain of isotype D having an amino acid sequence of SEQ ID NO:11 from a source mixture, the method comprising the steps of:

(i) providing a source mixture comprising target immunoglobulins or fusion proteins,

(ii) subjecting the source mixture to captoadhere affinity chromatography; and

(iii) subjecting the source mixture to anion exchange chromatography.

48. An antibody or fusion protein produced from the purification method of claim 46 or 47 for use in the treatment of a canine.

Claims

1. An antibody or a fusion protein or a binding fragment thereof for use in the therapeutic treatment of a canine where target neutralisation is desired in the absence of undesirable effector function, wherein said antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:8, SEQ ID NO:11 or SEQ ID NO:13, wherein the amino acid sequence of the heavy chain minimises the activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen.

2. The antibody, fusion protein or binding fragment as claimed in claim 1 wherein the therapeutic treatment of the canine relates to the treatment, inhibition or amelioration of pain or inflammation in the canine.

3. The antibody, fusion protein or binding fragment as claimed in claim 2 wherein the pain is selected from the group consisting of neuropathic pain, oncologic pain, pain associated with, or resulting from, rheumatoid arthritis, pain associated with, or resulting from, osteoarthritis, pain associated with, or resulting from, inflammation and pain associated with, or resulting from, pruritus.

4. The antibody, fusion protein or binding fragment as claimed in any one of claims 1 to 3 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

5. The antibody, fusion protein or binding fragment as claimed in claim 4, wherein the antibody, fusion protein or binding fragment has a heavy chain constant domain which does not bind to C1q when the antibody, fusion protein or binding fragment is bound to its target antigen.

6. The antibody, fusion protein or binding fragment as claimed in claim 5 wherein the antibody has a heavy chain comprising the amino acid sequence of SEQ ID NO:6.

7. The antibody, fusion protein or binding fragment as claimed in any one of claims 1 to 6 wherein the target antigen is selected from the group consisting of a cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

8. An antibody or a fusion protein or a binding fragment thereof for use in the therapeutic treatment of a canine where target destruction is desired, wherein said antibody, fusion protein or binding fragment has a heavy chain constant domain comprising the amino acid sequence of SEQ ID NO:9, SEQ ID NO:10, or SEQ ID NO:14 wherein the amino acid sequence of the heavy chain mediates activation of downstream immune system effector functions when the antibody, fusion protein or binding fragment is bound to its target antigen.

9. The antibody, fusion protein or binding fragment as claimed in claim 8 wherein the therapeutic treatment of the canine relates to the treatment of cancer or infectious disease in the canine.

10. The antibody, fusion protein or binding fragment as claimed in claim 9 wherein the downstream immune system effector functions are selected from the group consisting of complement dependent cytotoxicity, antibody dependent cell mediated cytotoxicity and antibody dependent cellular pathogenesis.

11. The antibody, fusion protein or binding fragment as claimed in claim 9 or claim 10 wherein the target antigen is a cancer specific antigen.

12. The antibody, fusion protein or binding fragment as claimed in claim 11 wherein the cancer specific antigen is selected from the group consisting of a

cytokine, a chemokine, a growth factor, a cell surface receptor, a virus and a component of the complement cascade.

13. The antibody, fusion protein or binding fragment as claimed in claim 11 wherein the cancer specific antigen is selected from the group consisting of proteins CD2, CD4, CD8, CD20, EGFR, VEGFR and HER2.

14. A method for the purification of an immunoglobulin or a fusion protein from a source mixture, wherein the immunoglobulin or fusion protein comprises a canine heavy chain constant domain of isotype A having an amino acid sequence of SEQ ID NO:8 or a canine immunoglobulin heavy chain constant domain of isotype D having an amino acid sequence of SEQ ID NO:11, the method comprising the steps of:

(i) subjecting the source mixture comprising target immunoglobulins or fusion proteins to anion exchange chromatography;

(ii) subjecting the source mixture to hydrophobic interaction chromatography; and

(iii) subjecting the source mixture to size exclusion chromatography.

15. A method for the purification of an immunoglobulin or a fusion protein from a source mixture, wherein the immunoglobulin or fusion protein comprises a canine heavy chain constant domain of isotype A having an amino acid sequence of SEQ ID NO:8 or a canine immunoglobulin heavy chain constant domain of isotype D having an amino acid sequence of SEQ ID NO:11, the method comprising the steps of:

(i) subjecting the source mixture comprising target immunoglobulins or fusion proteins to captoadhere affinity chromatography; and

(ii) subjecting the source mixture to anion exchange chromatography.