shared p40 subunit) should have a potentially superior safety profile compared to dual inhibition of IL-12 and IL-23.

Therefore, use of IL-23 specific antagonists that inhibit human IL-23 (such as antibodies that bind at least the unique p19 subunit or bind both the p19 and p40 subunits of IL-23) that spare IL-12 should provide efficacy equal to or greater than IL-12 antagonists or p40 antagonists without the potential risks associated with inhibition of IL-12. Murine, humanized and phage display antibodies selected for inhibition of recombinant IL-23 have been described; see for example US Patent 7,491,391, WIPO Publications WO1999/05280, WO2007/0244846, WO2007/027714, WO 2007/076524, WO2007/147019, WO2008/103473, WO 2008/103432, WO2009/043933 and WO2009/082624. However, there is a need for fully human therapeutic agents that are able to inhibit native human IL-23. Such therapeutics are highly specific for the target, particularly in vivo. Complete inhibition of the in vivo target can result in lower dose formulations, less frequent and/or more effective dosing which in turn results in reduced cost and increased efficiency. The present invention provides such IL-23 antagonists.

SUMMARY

Antigen binding proteins that bind IL-23, particularly native human IL-23, are provided. The human IL-23 antigen binding proteins can reduce, inhibit, interfere with, and/or modulate at least one of the biological responses related to IL-23, and as such, are useful for ameliorating the effects of IL-23 related diseases or disorders. IL-23 antigen binding proteins can be used, for example, to reduce, inhibit, interfere with and/or modulate IL-23 signaling, IL-23 activation of Th17 cells, IL-23 activation of NK cells, or inducing production of proinflammatory cytokines.

In one aspect, the present invention refers to an antigen binding protein that binds to human IL-23, wherein said antigen binding protein comprises: (i) (a) a heavy chain variable region comprising a CDRH1 having SEQ ID NO:91, a CDRH2 having SEQ ID NO: 92 and a CDRH3 having SEQ ID NO:93, and a light chain variable region comprising a CDRL1 having SEQ ID NO:62, a CDRL2 having SEQ ID NO:63 and a CDRL3 having SEQ ID NO:64; or (b) a heavy chain variable region comprising a CDRH1 having SEQ ID NO:109, a CDRH2 having SEQ ID NO: 116 and a CDRH3 having SEQ ID NO:111, and a light chain variable region comprising a CDRL1 having SEQ ID NO:80, a CDRL2 having SEQ ID NO:81 and a CDRL3 having SEQ ID NO:76; and wherein said antigen binding protein according to (a) or (b) binds to human IL-23 with a K_D of $\leq 5x10^{-12}$ M; or (ii) a heavy chain variable region of SEQ ID NO:31 and a light chain variable region of SEQ ID NO:1; or a heavy chain variable region of SEQ ID NO:46 or 153 and a light chain variable region of SEQ ID NO:15; wherein said antigen binding protein is a monoclonal antibody, a recombinant antibody, a human antibody, a chimeric antibody, a multispecific antibody, or an antibody fragment thereof.

In another aspect, the present invention refers to use of at least one antigen binding protein of of the present invention in the manufacture of a medicament for the treatment of a condition associated with IL-23 in a patient; wherein the condition is selected from the group consisting of (i) an inflammatory disorder, a rheumatic disorder, an autoimmune disorder, an oncological disorder and a gastrointestinal disorder; or (ii) multiple sclerosis, rheumatoid arthritis, cancer, psoriasis, inflammatory

bowel disease, Crohn's disease, ulcerative colitis, systemic lupus erythematosus, psoriatic arthritis, autoimmune myocarditis; type 1 diabetes and ankylosing spondylitis.

In yet another aspect, the present invention refers to at least one antigen binding protein of the present invention for use in therapy, wherein said antigen binding protein reduces IL-23 activity in a patient and wherein said IL-23 activity is inducing production of a proinflammatroy cytokine.

Also provided are expression systems, including cell lines, for the production of IL-23 antigen binding proteins and methods of diagnosing and treating diseases related to human IL-23.

Some of the antigen binding proteins that bind IL-23 that are provided comprise at least one heavy chain variable region comprising a CDRH1, a CDRH2 and a CDRH3 selected from the group consisting of: a CDRH1 that differs by no more than one amino acid substitution, insertion or deletion from a CDRH1 as shown in TABLE 3; a CDRH2 that differs by no more than three, two or one amino acid substitutions, insertions and/or deletions from a CDRH2 as shown in TABLE 3; a CDRH3 that differs by no more than three, two or one amino acid substitutions, insertions and/or deletions from a CDRH3 as shown in TABLE 3; and comprising at least one light chain variable region comprising a CDRL1, a CDRL2 and a CDRL3 selected from the group consisting of: a CDRL1 that differs by no more than three, two or one amino acid substitutions, insertions and/or deletions from a CDRL1 as shown in TABLE 3; a CDRL2 that differs by no more than one amino acid substitution, insertion or deletion from a CDRL2 as shown in TABLE 3; a CDRL3 that differs by no more than one amino acid substitution, insertion or deletion from a CDRL3 as shown in TABLE 3. In one example is provided isolated antigen binding proteins comprising: a CDRH1 selected from the group consisting of SEQ ID NO: 91, 94, 97, 100, and 103; a CDRH2 selected from the group consisting of SEQ ID NO:92, 95, 98, 101, 104, 107, and 110; a CDRH3 selected from the group consisting of SEQ ID NO: 93, 96, 99, 102, and 105; a CDRL1 selected from the group consisting of SEQ ID NO: 62, 65, 68, 71, and 74;

a CDRL2 selected from the group consisting of SEQ ID NO:63, 66, 69, 72, 75, and 78; and a CDRL3 selected from the group consisting of SEQ ID NO:64, 67, 70 and 73. In another example is provided isolated antigen bindings protein of comprising: a CDRH1 selected from the group consisting of SEQ ID NO: 91, 106, 109, 112, and 115; a CDRH2 selected from the group consisting of SEQ ID NO: 113, 116, 118, 120, 121, and 122; a CDRH3 selected from the group consisting of SEQ ID NO: 108, 111, 114, 117, and 119; a CDRL1 selected from the group consisting of SEQ ID NO: 77, 80, 83, 85, 86, 87, 88, 89 and 90; a CDRL2 is SEQ ID NO: 81; and a CDRL3 selected from the group consisting of SEQ ID NO: 76, 79, 82 and 84. In another example is provided an isolated antigen-binding protein of that comprises at least one heavy chain variable region and at least one light chain variable region. In yet another example is provided an isolated antigen-binding protein as described above that comprise at least two heavy chain variable regions and at least two light chain variable regions. In yet another example is provided an isolated antigen binding protein wherein the antigen binding protein is coupled to a labeling group.

Also provided are isolated antigen binding proteins that bind IL-23 selected from the group consisting of a) an antigen binding protein having CDRH1 of SEQ ID NO:129, CDRH2 of SEQ ID NO:132, CDRH3 of SEQ ID NO:136, and CDRL1 of SEQ ID NO:123, CDRL2 of SEQ ID NO:81, and CDRL3 of SEQ ID NO: 76; b) an antigen binding protein having CDRH1 of SEQ ID NO:131, CDRH2 of SEQ ID NO: 134, CDRH3 of SEQ ID NO:137 and CDRL1 of SEQ ID NO:124, CDRL2 of SEQ ID NO126 and CDRL3 of SEQ ID NO:128; c) a) an antigen binding protein having CDRH1 of SEQ ID NO:130, CDRH2 of SEQ ID NO:133, CDRH3 of SEQ ID NO:99 and CDRL1 of SEQ ID NO:68, CDRL2 of SEQ ID NO:69, and CDRL3 of SEQ ID NO:67; and d) an antigen binding protein having CDRH1 SEQ ID NO:91, CDRH2 SEQ ID NO: 135, CDRH3 SEQ ID NO:138 and CDRL1 SEQ ID NO:125, CDRL2 SEQ ID NO:127, and CDRL3 SEQ ID NO:64.

Also provided are isolated antigen binding proteins that bind IL-23 comprising at least one heavy chain variable region and at least one light chain variable region, selected from the group consisting of: a heavy chain variable region comprising amino acid residues 31-35, 50-65 and 99-113 of SEQ ID NO:31; and a light chain variable region comprising amino acid residues 23-36, 52-58 and 91-101 of SEQ ID NO:1;a heavy chain variable region comprising amino acid residues 31-35, 50-65 and 99-110 of SEQ ID NO:34 and heavy chain variable region comprising amino acid residues 31-35, 50-66 and 99-110 of SEQ ID NO:36; and a light chain variable region comprising amino acid residues 23-36, 52-62 and 97-105 of SEQ ID NO:4 ; a heavy chain variable region comprising amino acid residues 31-35, 50-66 and 99-114 of SEQ ID NO:38; and a light chain variable region comprising amino acid residues 23-34, 50-61 and 94-106 of SEQ ID NO:7; a heavy chain variable region comprising amino acid residues 31-35, 50-66 and 99-114 of SEQ ID NO:40; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 94-106 of SEQ ID NO:9; a heavy chain variable region comprising amino acid residues 31-35, 50-66 and 99-114 of SEQ ID NO:42; and a light chain variable region comprising amino acid residues 23-34, 50-61 and 94-106 of SEQ ID NO:11; a heavy chain variable region comprising amino acid residues 31-35, 50-65 and 98-107 of SEQ ID NO:44; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO:13; a heavy chain variable region comprising amino acid residues 31-37, 52-67 and 100-

109 of SEQ ID NO:46 or SEQ ID NO:153; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO15; a heavy chain variable region comprising amino acid residues 31-37, 52-67 and 100-109 of SEQ ID NO:48; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO:17; a heavy chain variable region comprising amino acid residues 31-37, 52-67 and 101-109 of SEQ ID NO:50; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO:19; a heavy chain variable region comprising amino acid residues 31-35, 50-65 and 98-107 of SEQ ID NO: 52; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 98-107 of SEQ ID NO:21; a heavy chain variable region comprising amino acid residues 31-37, 52-67 and 100-109 of SEQ ID NO:54; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO:23; a heavy chain variable region comprising amino acid residues 31-37, 52-67 and 100-109 of SEQ ID NO:56; and a light chain variable region comprising amino acid residues 24-34, 50-56 and 89-97 of SEQ ID NO:25; and a heavy chain variable region comprising amino acid residues 31-37, 52-57 and 100-109 of SEQ ID NO:58; and a light chain variable region comprising amino acid residues 24-34, 500-56 and 89-97 of SEQ ID NO:27.

Provided herein is an isolated antigen binding protein that binds IL-23 comprising a heavy chain variable region and a light chain variable region, wherein the heavy chain variable region sequence differs by no more than 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 or 1 amino acid substitutions, additions and/or deletions from a heavy chain variable region sequence as shown in TABLE 2; and wherein the light chain variable region sequence differs by no more than 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 or 1 amino acid substitutions, additions and/or deletions from a light chain variable region sequence as shown in TABLE 1.

Also provided is an isolated antigen binding protein that binds IL-23 selected from the group consisting of a) a heavy chain variable region of SEQ ID NO:140 and a light chain variable region of SEQ ID NO: 30; b) a heavy chain variable region of SEQ ID NO:141 and a light chain variable region of SEQ ID NO:61; c) a heavy chain variable region of SEQ ID NO:142 and a light chain variable region of SEQ ID NO:4; and d) a heavy chain variable region of SEQ ID NO:143 and a light chain variable region of SEQ ID NO:139.

Also provided is an isolated antigen binding protein comprising a heavy chain variable region comprising of an amino acid sequence having at least 90%, 95%, 96%, 97%, 98% or 99% sequence identity to SEQ ID NO:31, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56 and 58; and a light chain variable region comprising an amino acid sequence having at least 90% sequence identity to SEQ ID NO: 1, 4, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25 and 27. In another example is an isolated antigen binding protein comprising a heavy chain variable region selected from the group consisting of SEQ ID NO: 44, 46, 48, 50, 52, 54, 56, 58 and 153, and a light chain variable region selected from the group consisting of SEQ ID NO:13, 15, 17, 19, 21, 23, 25, and 27. In yet another example is an isolated antigen binding protein comprising a heavy chain variable region selected from the group consisting of SEQ ID NO: 31, 34, 36, 38, 40 and 42, and a light chain variable region selected from the group consisting of SEQ ID NO: 1, 4, 7, 9 and 11.

Also provided is an isolated antigen binding protein that binds IL-23 comprising a heavy chain variable region and a light chain variable region selected from the group consisting of: a) a heavy chain variable region of SEQ ID NO:31 and a light chain variable region of SEQ ID NO:1; b) a heavy chain variable region of SEQ ID NO:34 or 36 and a light chain variable region of SEQ ID NO:4; c) a heavy chain variable region of SEQ ID NO:38 and a light chain variable region of SEQ ID NO: 7; d) a heavy chain variable region of SEQ ID NO:40 and a light chain variable region of SEQ ID NO:9; e) a heavy chain variable region of SEQ ID NO:42 and a light chain variable region of SEQ ID NO: 11; f) a heavy chain variable region of SEQ ID NO:44 and a light chain variable region of SEQ ID NO:13; g) a heavy chain variable region of SEQ ID NO:46 or SEQ ID NO:153 and a light chain variable region of SEQ ID NO:15; h) a heavy chain variable region of SEQ ID NO:48 and a light chain variable region of SEQ ID NO:17; i) a heavy chain variable region of SEQ ID NO:50 and a light chain variable region of SEQ ID NO: 19; j) a heavy chain variable region of SEQ ID NO:52 and a light chain variable region of SEQ ID NO:21; k) a heavy chain variable region of SEQ ID NO:54 and a light chain variable region of SEQ ID NO:23; l) a heavy chain variable region of SEQ ID NO:56 and a light chain variable region of SEQ ID NO:25; and m) a heavy chain variable region of SEQ ID NO:58 and a light chain variable region of SEQ ID NO:27.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contacts 30, 31, 32, 49, 50, 52, 53, 56, 92 and 94 of SEQ ID NO:15, wherein the residue contacts have a difference value of greater than or equal to 10 $Å^2$ as determined by solvent exposed surface area. Within one example the residue contacts comprise residues 31-35, 54, 58-60, 66, and 101-105 of SEQ ID NO:46..

Also provided is an isolated antigen binding protein that binds human IL-23, wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contacts 31-34, 51, 52, 55, 68, 93 and 98 of SEQ ID NO:1, wherein the residue contacts have a difference value of greater than or equal to 10 $Å^2$ as determined by solvent exposed surface area. Within one example the residue contacts comprise residues 1, 26, 28, 31, 32, 52, 53, 59, 76, 101, 102 and 104-108 of SEQ ID NO:31.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5 Å or less from residues 32-35, 54, 58-60, 66 and 101-105 of SEQ ID NO:46, as determined by X-ray crystallography. In one example the antigen binding protein is 5 Å or less from residues 31-35, 54, 56, 58-60, 66 and 101-105 of SEQ ID NO:46.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5 Å or less from residues 30-32, 49, 52, 53, 91-94 and 96 of SEQ ID NO:15, as determined by X-ray crystallography. In one example the antigen binding protein is 5 Å or less from residues 30-32, 49, 50, 52, 53, 56, 91-94 and 96 of SEQ ID NO:15.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5 Å or less from

residues 26-28, 31, 53, 59, 102 and 104-108 of SEQ ID NO:31, as determined by X-ray crystallography. In one example the antigen binding protein is 5 Å or less from residues 1, 26-28, 30-32, 52, 53, 59, 100, and 102-108 of SEQ ID NO:31.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein when said antigen binding protein is bound to human IL-23, said antigen binding protein is 5 Å or less from residues 31-34, 51, 52, 55, 68 and 93 of SEQ ID NO:1 as determined by X-ray crystallography. In one example the antigen binding protein is 5 Å or less from residues 29, 31-34, 51, 52, 55, 68, 93 and 100 of SEQ ID NO:1.

Also provided is an isolated antigen binding protein as described above, wherein the antigen binding protein is an antibody. In one example is provided an isolated antigen binding protein wherein the antibody is a monoclonal antibody, a recombinant antibody, a human antibody, a humanized antibody, a chimeric antibody, a multispecific antibody, or an antibody fragment thereof. In another example is provided an isolated antigen binding protein wherein the antibody fragment is a Fab fragment, a Fab' fragment, a F(ab')2 fragment, a Fv fragment, a diabody, or a single chain antibody molecule. In yet another example is provided an isolated antigen binding protein wherein the antigen binding protein is a human antibody. In still another example is provided an isolated antigen binding protein wherein the antigen binding protein is a monoclonal antibody. In another example is provided an isolated antigen binding protein wherein the antigen binding protein is of the IgG1-, IgG2- IgG3- or IgG4-type. In yet another example is provided an isolated antigen binding protein wherein the antigen binding protein is of the IgG1- or IgG2-type.

An isolated nucleic acid molecule encoding an antigen binding protein as described above, is also provided. In one example is provided an isolated nucleic acid molecule wherein at least one heavy chain variable region is encoded by an isolated nucleic acid molecule selected from the group consisting of SEQ ID NOs:32, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55, 57, 59 and 152 and at least one light chain variable region is encoded by an isolated nucleic acid molecule selected from the group consisting of SEQ ID NOs:2, 5, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, and 28. In another example is provided a nucleic acid molecule wherein the nucleic acid molecule is operably linked to a control sequence. In another example is provided a vector comprising a nucleic acid molecule as described above. In yet another example is provided a host cell comprising the nucleic acid molecule as described above. In another example is provided a host cell comprising the vector described above. In yet another example is provided an isolated polynucleotide sufficient for use as a hybridization probe, PCR primer or sequencing primer that is a fragment of the nucleic acid molecule as described above or its complement.

Also provided is a method of making the antigen binding protein as described above, comprising the step of preparing said antigen binding protein from a host cell that secretes said antigen binding protein.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises a residue contact within residues 46-58, a residue contact within residues 112-120, and a residue contact within residues 155-163 of the human IL-23p19 subunit as described in SEQ ID NO:145, wherein the

residue contact has a difference value greater than or equal to 10Å^2 as determined by solvent exposed surface area. In one example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve or thirteen residue contacts within residues 46-58, one, two, three, four, five, six, seven, eight, nine or ten residue contacts within residues 112-120, and one, two, three, four, five, six, seven, eight or nine residue contacts within residues 155-163 of the human IL-23p19 subunit as described in SEQ ID NO:145. In another example is provided wherein the covered patch formed when the antigen binding protein binds to human IL-23 comprises a residue contact within residues 121-125 of the human IL-23p40 subunit as described in SEQ ID NO:147. In a related example is wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises one, two, three, four or five residue contacts within residues 121-125 of the human IL-23p40 subunit as described in SEQ ID NO:147. Within another example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contacts 46, 47, 49, 50, 53, 112-116, 118, 120, 155, 156, 159, 160, and 163 of SEQ ID NO:145. In another example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contacts 46, 47, 49, 50, 53, 112-118, 120, 155, 156, 159, 160, and 163 of SEQ ID NO:145. Within another example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residues 46, 47, 49, 50, 53-55, 57, 58, 112-116, 118-120, 155, 156, 159, 160, 162 and 163 of SEQ ID NO:145. In a related example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contact 122 of the human IL-23p40 subunit as described in SEQ ID NO:147. In another related example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contacts 122 and 124 of the human IL-23p40 subunit as described in SEQ ID NO:147. In yet another related example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contact 121-123 and 125 of the human IL-23p40 subunit as described in SEQ ID NO:147. In a further related example is provided wherein the covered patch formed when the antigen binding protein is bound to human IL-23 comprises residue contact 121-123, 125 and 283 of the human IL-23p40 subunit as described in SEQ ID NO:147.

Also provided is an isolated antigen binding protein that binds human IL-23, wherein when said antigen binding protein is bound to human IL-23 said antigen binding protein is 5Å or less from a residue within residues 46-58, from a residue within residues 112-123, and from a residue within residues 155-163 of the human IL-23p19 subunit as described in SEQ ID NO:145, as determined by X-ray crystallography. In one example, when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5Å or less from one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve or thirteen residues within residues 46-58, from one, two, three, four, five, six, seven, eight, nine or ten, residues within residues 112-123, and from one, two, three, four, five, six, seven, eight or nine residues within residues 155-163 of the human IL-23p19 subunit as described in SEQ ID NO:145. Within another example when the antigen binding protein is bound to human IL-23 the antigen binding protein is 5Å or less from residues 46-50, 113-116, 120, 156, 159, 160 and 163 of SEQ ID NO:145. Within another example when the antigen binding protein is bound to human IL-23,

the antigen binding protein is 5Å or less from residues 46-50, 112-120, 156, 159, 160 and 163 of SEQ ID NO:145. Within a related example when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5Å or less from residues 46-50, 53, 112-120, 156, 159, 160 and 163 of SEQ ID NO:145. Within another example when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5Å or less from residues 46-50, 53-55, 58, 113-116, 120, 121, 156, 159, 160, 162 and 163 of SEQ ID NO:145. Within a related example when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5Å or less from residues 46-51, 53-55, 57, 58, 112-116, 118-121, 123, 155, 156, 159, 160, 162 and 163 of SEQ ID NO:145. Within a further example when the antigen binding protein is bound to human IL-23 the antigen binding protein is 5Å or less from a residue within residues 121-125, of the human IL-23p40 subunit as described in SEQ ID NO:147, as determined by X-ray crystallography. With a related example when the antigen binding protein is bound to human IL-23, said antigen binding protein is 5 Å or less from residues 122 and 124 of SEQ ID NO:147. Within another example when the antigen binding protein is bound to human IL-23, the antigen binding protein is 5 Å or less from residues 121-123 and 125 of SEQ ID NO:147.

Also provided is an isolated antigen binding protein as described above, wherein the antigen binding protein has at least one property selected from the group consisting of: a) reducing human IL-23 activity; b) reducing production of a proinflammatory cytokine; c) binding to human IL-23 with a KD of ≤ 5x10-8 M; d) having a Koff rate of ≤ 5x10-6 1/s; and d) having an IC50 of ≤ 400 pM.

A pharmaceutical composition comprising at least one antigen binding protein as described above and pharmaceutically acceptable excipient is provided. In one example is provided a pharmaceutical composition further comprises a labeling group or an effector group. In yet another example is provided a pharmaceutical composition wherein the labeling group is selected from the group consisting of isotopic labels, magnetic labels, redox active moieties, optical dyes, biotinylated groups and predetermined polypeptide epitopes recognized by a secondary reporter. In yet another example is provided a pharmaceutical composition wherein the effector group is selected from the group consisting of a radioisotope, radionuclide, a toxin, a therapeutic group and a chemotherapeutic group.

Also provided is a method for treating or preventing a condition associated with IL-23 in a patient, comprising administering to a patient in need thereof an effective amount of at least one isolated antigen binding protein as described above. In one example is provided a method of wherein the condition is selected from the group consisting of an inflammatory disorder, a rheumatic disorder, an autoimmune disorder, an oncological disorder and a gastrointestinal disorder. In yet another example is provided a method wherein the condition is selected from the group consisting of multiple sclerosis, rheumatoid arthritis, cancer, psoriasis, inflammatory bowel disease, Crohn's disease, ulcerative colitis, systemic lupus erythematosus, psoriatic arthritis, autoimmune myocarditis; type 1 diabetes and ankylosing spondylitis. In still another example is provided a method wherein the isolated antigen-binding protein is administered alone or as a combination therapy.

Also provided is a method of reducing IL-23 activity in a patient comprising administering an effective amount of at least one antigen binding protein as described above. In one example is

Claims

1. An antigen binding protein that binds to human IL-23, wherein said antigen binding protein comprises:

(i) (a) a heavy chain variable region comprising

a CDRH1 having SEQ ID NO:91,
a CDRH2 having SEQ ID NO: 92 and
a CDRH3 having SEQ ID NO:93,

and a light chain variable region comprising

a CDRL1 having SEQ ID NO:62,
a CDRL2 having SEQ ID NO:63 and
a CDRL3 having SEQ ID NO:64;

or (b) a heavy chain variable region comprising

a CDRH1 having SEQ ID NO:109,
a CDRH2 having SEQ ID NO: 116 and
a CDRH3 having SEQ ID NO:111,

and a light chain variable region comprising

a CDRL1 having SEQ ID NO:80,
a CDRL2 having SEQ ID NO:81 and
a CDRL3 having SEQ ID NO:76;

and wherein said antigen binding protein according to (a) or (b) binds to human IL-23 with a K_D of $\leq 5x10^{-12}$ M; or

(ii) a heavy chain variable region of SEQ ID NO:31 and a light chain variable region of SEQ ID NO:1; or a heavy chain variable region of SEQ ID NO:46 or 153 and a light chain variable region of SEQ ID NO:15;
wherein said antigen binding protein is a monoclonal antibody, a recombinant antibody, a human antibody, a chimeric antibody, a multispecific antibody, or an antibody fragment thereof.

2. An antigen binding protein according to claim 1 part (i)(a), wherein said antigen binding protein binds to human IL-23 with a K_D of $\leq 5x10^{-13}$ M.

3. An antigen binding protein according to claim 1 part (i)(b), wherein said antigen binding protein has a K_{off} rate of $\leq 5x10^{-6}$ 1/s.

4. An antigen binding protein of any of the preceding claims, wherein said antigen binding protein is an antibody, optionally an antibody of the IgG1-, IgG2- IgG3- or IgG4-type.

5. An antigen binding protein of any one of claims 1-3, wherein

(i) said antibody fragment is a Fab fragment, a Fab' fragment, a $F(ab')_2$ fragment, a F_v fragment, a diabody, or a single chain antibody molecule;
(ii) said antigen binding protein is a human antibody; or
(iii) said antigen binding protein is a monoclonal antibody.

6. A nucleic acid molecule, wherein said nucleic acid molecule encodes an antigen binding protein of any one of the preceding claims, said nucleic acid molecule optionally being operably linked to a control sequence.

7. A nucleic acid molecule according to claim 6, wherein the nucleic acid molecule comprises the heavy chain variable region nucleic acid SEQ ID NO: 32 and the light chain variable region nucleic acid SEQ ID NO: 2.

8. A nucleic acid molecule according to claim 6, wherein the nucleic acid molecule comprises the heavy chain variable region nucleic acid SEQ ID NO: 47 and the light chain variable region nucleic acid SEQ ID NO: 16.

9. A vector comprising a nucleic acid molecule according to any one of claims 6-8.

10. A host cell comprising the nucleic acid molecule according to any one of claims 6-8 or the vector of claim 9.

11. A method of making the antigen binding protein of any one of claims 1-5 comprising the step of preparing said antigen binding protein from a host cell that secretes said antigen binding protein.

12. An antigen binding protein of any one of claims 1-5, wherein said antigen binding protein has at least one property selected from the group consisting of:

a) reducing human IL-23 activity in a STAT-luciferase assay;
b) reducing production of a proinflammatory cytokine;
c) having a K_{off} rate of $\leq 5x10^{-6}$ 1/s; and
d) having an IC_{50} of $\leq$ 400 pM.

13. A pharmaceutical composition comprising at least one antigen binding protein of any one of claims 1-5 and pharmaceutically acceptable excipient.

14. A pharmaceutical composition of claim 13, wherein said pharmaceutical composition

(i) further comprises a labeling group or an effector group;
(ii) further comprises a labeling group, wherein said labeling group is selected from the group consisting of isotopic labels, magnetic labels, redox active moieties, optical dyes, biotinylated groups and predetermined polypeptide epitopes recognized by a secondary reporter;
(iii) further comprises an effector group, wherein said effector group is selected from the group consisting of a radioisotope, radionuclide, a toxin, a therapeutic group and a chemotherapeutic group; or
(iv) further comprises a labeling group, wherein said antigen binding protein is coupled to a labeling group.

15. Use of at least one antigen binding protein of any one of claims 1-5 in the manufacture of a medicament for the treatment of a condition associated with IL-23 in a patient; wherein the condition is selected from the group consisting of

(i) an inflammatory disorder, a rheumatic disorder, an autoimmune disorder, an oncological disorder and a gastrointestinal disorder; or
(ii) multiple sclerosis, rheumatoid arthritis, cancer, psoriasis, inflammatory bowel disease, Crohn's disease, ulcerative colitis, systemic lupus erythematosus, psoriatic arthritis, autoimmune myocarditis; type 1 diabetes and ankylosing spondylitis.

16. The use according to claim 15, wherein the antigen-binding protein is to be administered alone or as a combination therapy.

17. At least one antigen binding protein of any one of claims 1-5 for use in therapy, wherein said antigen binding protein reduces IL-23 activity in a patient and wherein said IL-23 activity is inducing production of a proinflammatroy cytokine.