

SUMMARY ~~OF THE INVENTION~~

[0008] This ~~invention~~disclosure relates to the development of antigen binding proteins, particularly fully human antibodies that specifically bind TL1A. Preferred antigen binding proteins have strong binding affinity to both human and cynomolgus TL1A, and block TL1A mediated NF-kB activation and T cell activation. These antigen binding proteins have potential to be used as therapeutics for treatment of inflammatory bowel disease (IBD) and other autoimmune and inflammatory conditions.

[0008a] In one aspect, the present disclosure refers to an antigen binding protein specific for TL1A wherein:

- a. the antigen binding protein has one or two light chain variable domains and one or two heavy chain variable domains;
- b. the light chain variable domain comprises a LCDR1, LCDR2, and LCDR3;
- c. the heavy chain variable domain comprises a HCDR1, HCDR2, and HCDR3;
and
- d. the HCDR1 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 777, 783, 792, 798, 804, 809, 815, 819, 265, 836, 847, 857, 639, 654, 655, 632, 664, 955, 979, 994, 1010, 1017, 1022, 1027, 1028, 1029, 1037, 1045, 1087, 253, 256, 259, 262, 268, 271, 265, and 950);
- e. the HCDR2 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 779, 785, 794, 800, 811, 817, 821, 827, 832, 838, 843, 849, 853, 859, 864, 640, 204, 678, 679, 644, 648, 649, 633, 656, 659, 660, 665, 666, 677, 114, 227, 230, 691, 715, 669, 711, 971, 972, 973, 974, 975, 980, 981, 982, 983, 984, 995, 996, 997, 998, 0999, 1011, 1023, 1030, 1038, 1039, 1040, 1041, 1042, 1046, 1047, 1048, 1058, 1059, 1060, 1061, 1062, 1066, 1067, 1068, 1069, 1070, 1074, 1088, 1089, 1090, 1095, 1096, 1097, 1102, 1103, 1104, 1108, 1109, 1110, 1111, 1112, 254, 260, 184, 269, 272, 266, 951, 953, 956, and 963); and
- f. the HCDR3 sequence is selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675).

[0008b] In another aspect, the present disclosure refers to one or more isolated nucleic acids encoding the antigen binding protein of the disclosure. In yet another aspect, the present disclosure refers to one or more expression vectors comprising the nucleic acid or acids of the

disclosure. In a still further aspect, the present disclosure refers to a host cell comprising the one or more expression vectors of the disclosure. In a further aspect, the present disclosure refers to a method for the preparation of an antigen binding protein, comprising a) culturing the host cell of the disclosure under conditions that allow expression of the antigen binding protein; and b) recovering the antigen binding protein from the culture. In a further aspect, the present disclosure refers to a pharmaceutical composition comprising the antigen binding protein of the disclosure and a pharmaceutically acceptable diluent, excipient or carrier. In yet another aspect, the present disclosure refers to the use of the antigen binding protein of the disclosure in the preparation of a medicament for treating a condition associated with TL1A in a patient in need thereof, wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis. In still another aspect, the present disclosure refers to the antigen binding protein of the disclosure for use in therapy.

[0008] ———

[0009] The ~~invention~~disclosure further relates to bispecific antigen binding proteins, particularly bispecific antibodies. Bispecific antigen binding proteins of the ~~invention~~disclosure comprise a TL1A binding entity and a TNF- α binding entity. TL1A blocking proteins and TNF- α blocking proteins have different effects in studies measuring inhibition of induction of cytokines IFN γ , IL-5, IL-6, IL-8, and IL-10. TL1A but not TNF- α induces T cell activation in vivo. TL1A and TNF- α induce NF- κ B in different cell types in human peripheral blood monocytes (PBMCs). TL1A and TNF- α further induce different cytokines in human PBMCs. TL1A and TNF- α induce some of the same genes but in different cell types (16 overlapping genes induced by TL1A in whole blood and TNF- α in NCM460 cells; 13 overlapping genes induced by TL1A in whole blood and TNF- α in PBMCs). There is a strong genetic association of TL1A with inflammatory bowel disease (IBD) and anti-TNF agents are clinically validated for treatment of IBD. Such bispecific antigen binding proteins thus are useful for treatment of IBD and other autoimmune and inflammatory conditions. For these and other reasons, there is a benefit to bispecific antigen binding proteins that specifically bind TL1A and TNF- α .

[0010] One format for such bispecific antigen binding proteins is heterodimeric immunoglobulins (hetero Ig). Such hetero Ig antigen binding proteins have one heavy chain-light chain pair directed to TL1A and another directed to TNF- α .

[0011] Another format for such bispecific antigen binding proteins is IgG-scFv molecules. In an IgG-scFv, each heavy chain of an antibody that specifically binds one target is linked to a single chain antibody (scFv) that specifically binds the other target. The scFv portion can be linked to the heavy chain of the IgG portion directly or through a peptide linker. In the IgG-scFv format, the IgG is directed to TL1A and the scFv portion to TNF- α or vice-versa. Bispecific antigen binding proteins in the IgG-scFv format have the advantage of being bivalent for both of their target antigens.

[0012] A further format for such bispecific antigen binding proteins is IgG-Fab molecules. In this format, the antigen binding protein has a structure such that a Fab molecule that binds to one target is fused to each heavy chain of an IgG molecule that binds to another target. One chain of a Fab portion can be linked directly or through a peptide linker to the C-terminus of a heavy chain of the IgG portion. The resulting molecule has the advantage of being tetravalent and bispecific. All variations of the IgG-Fab format preferably comprise the CDR sequences of Tables 21.2A and 21.2B hereinafter. Preferred heavy and light chain sequences of IgG-Fab molecules appear in Table 21.1 hereinafter.

[0013] Other formats for bispecific antigen binding proteins are within the scope of this ~~invention~~disclosure. One such format is IgG-Fab molecules. In this format, each heavy chain of an antibody that specifically binds to one target is linked to a Fab fragment that specifically binds to the other target. In the IgG-Fab format, the IgG is directed to TL1A and the Fab portion to TNF- α or vice-versa. Bispecific antigen binding proteins in the IgG-Fab format have the advantage of being bivalent for both of their target antigens. Other formats for bispecific antigen binding proteins within the scope of this ~~invention~~disclosure are described infra.

[0014] The ~~invention~~disclosure also relates to isolated nucleic acids encoding the TL1A-specific antigen binding proteins of the ~~invention~~disclosure, as well as vectors comprising the nucleic acids, host cells comprising the vectors, and methods of making and using the TL1A-specific antigen binding proteins.

[0015] The ~~invention~~disclosure also relates to isolated nucleic acids encoding the bispecific antigen binding proteins of the ~~invention~~disclosure, as well as vectors comprising the nucleic acids, host cells comprising the vectors, and methods of making and using the bispecific antigen binding proteins.

[0016] In other ~~embodiment~~examples, the present ~~invention~~disclosure provides compositions comprising the TL1A-specific antigen binding proteins, the bispecific antigen binding proteins and kits comprising the anti-TL1A or bispecific antigen binding proteins, as well as articles of manufacture comprising the anti-TL1A or bispecific antigen binding proteins.

[0017] The TL1A-specific antigen binding proteins and the bispecific antigen binding proteins described herein can be used in the manufacture of pharmaceutical compositions or medicaments for the treatment of conditions associated with TL1A and/or, in the case of bispecific antigen binding proteins, conditions associated with TNF- α . Thus, the present ~~invention~~disclosure also provides pharmaceutical compositions comprising a TL1A-specific antigen binding protein or a bispecific antigen binding protein and a pharmaceutically acceptable diluent, excipient or carrier.

[0018] The inventiondisclosure further relates to methods of treatment using the TL1A-specific antigen binding proteins. The TL1A-specific antigen binding proteins of the present inventiondisclosure are useful for the inhibition of the proinflammatory cytokine TL1A. The antibodies can be used to reduce, limit, neutralize, or block the proinflammatory effects of TL1A. Thus, in some embodimentsexamples, the inventiondisclosure relates to the treatment of IBD and other autoimmune or inflammatory conditions using the TL1A-specific antigen binding proteins.

[0019] The inventiondisclosure further relates to methods of treatment using bispecific antigen binding proteins. The bispecific antigen binding proteins of the present inventiondisclosure are useful for the inhibition of the proinflammatory cytokines, TL1A and TNF- α . The bispecific binding proteins can be used to reduce, limit, neutralize, or block the proinflammatory effects of TL1A. Likewise, the bispecific antigen binding proteins hereof can be used to reduce, limit, neutralize, or block the proinflammatory effects of TNF- α . Thus, in some embodimentsexamples, the inventiondisclosure relates to the treatment of IBD and other autoimmune or inflammatory conditions using TL1A-specific/TNF-specific antigen binding proteins.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Figure 1 shows a schematic representation of four bispecific hetero Ig formats used to generate anti-TL1A/anti-TNF- α bispecific antigen binding proteins. As shown, a heavy chain directed to one antigen is disulfide-bonded to a heavy chain directed to a different antigen. A light chain for each antigen is disulfide-bonded to the heavy chain for the corresponding antigen. Figure 1 shows a preferred embodiment, in which the heavy and light chains comprise charge mutations to aid in correct association of the heavy and light chains. The Kabat-Eu numbering scheme is used to denote the positions of charge pair mutations within each of the chains and for all sequences throughout this specification. This IgG-like bispecific antigen binding protein format is a heterotetramer comprising two different light chains and two different heavy chains. HC1 and LC1 refer to the heavy chain and light chain, respectively, of one Fab binding arm and HC2 and LC2 refers to the heavy chain and light chain, respectively, of the second Fab binding arm. For example, in the schematic, HC1 and LC1 correspond to the anti-TL1A receptor binding arm and HC2 and LC2 correspond to the anti-TNF- α binding arm. However, the two binding arms can be switched such that HC1 and LC1 correspond to the anti-TNF- α binding arm and HC2 and LC2 correspond to the anti-TL1A receptor binding arm.

[0021] Figure 2 shows a schematic representation of the IgG-scFv format used to generate anti-TL1A/anti-TNF- α bispecific antigen binding proteins. As shown, the structure

CLAIMS

What is claimed is:

1. ~~An antigen binding protein comprising a TL1A binding entity and a second binding entity that is not a TL1A binding entity, wherein:~~
 - a. ~~the TL1A binding entity has one or two light chain variable domains and one or two heavy chain variable domains;~~
 - b. ~~the TL1A binding entity light chain variable domain comprises a LCDR1, LCDR2, and LCDR3;~~
 - c. ~~the TL1A binding entity heavy chain variable domain comprises a HCDR1, HCDR2, and HCDR3; and~~
 - d. ~~the HCDR1 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 777, 783, 792, 798, 804, 809, 815, 819, 265, 836, 847, 857, 639, 654, 655, 632, 664, 955, 979, 994, 1010, 1017, 1022, 1027, 1028, 1029, 1037, 1045, 1087, 253, 256, 259, 262, 268, 271, 265, and 950);~~
 - e. ~~the HCDR2 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 779, 785, 794, 800, 811, 817, 821, 827, 832, 838, 843, 849, 853, 859, 864, 640, 204, 678, 679, 644, 648, 649, 633, 656, 659, 660, 665, 666, 677, 114, 227, 230, 691, 715, 669, 711, 971, 972, 973, 974, 975, 980, 981, 982, 983, 984, 995, 996, 997, 998, 0999, 1011, 1023, 1030, 1038, 1039, 1040, 1041, 1042, 1046, 1047, 1048, 1058, 1059, 1060, 1061, 1062, 1066, 1067, 1068, 1069, 1070, 1074, 1088, 1089, 1090, 1095, 1096, 1097, 1102, 1103, 1104, 1108, 1109, 1110, 1111, 1112, 254, 260, 184, 269, 272, 266, 951, 953, 956, and 963); and~~
 - f. ~~the HCDR3 sequence is selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675).~~
2. ~~The antigen binding protein of claim 1, wherein the HCDR3 comprises a sequence selected from Table A (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 781, 787, 796, 802, 807, 813, 823, 829, 834, 840, 845, 851, 855, and 861).~~
3. ~~The antigen binding protein of claim 2, wherein the HCDR3 has a sequence selected from antibodies and 9C8 and 3B3 (SEQ ID NO: 180 and 192).~~

4. ~~The antigen binding protein of claim 2, wherein:~~
 - a. ~~the HCDR1 has a sequence selected from Table A (SEQ ID NOS: 164, 170, 182, 188, 777, 783, 792, 798, 804, 809, 815, 819, 265, 836, 847, and 857) and~~
 - b. ~~the HCDR2 has a sequence selected from Table A (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 779, 785, 794, 800, 811, 817, 821, 827, 832, 838, 843, 849, 853, 859, and 864).~~
5. ~~The antigen binding protein of claim 3 wherein;~~
 - a. ~~the HCDR1 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NO: 170 and 188) and~~
 - b. ~~the HCDR2 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NO: 178 and 190).~~
6. ~~The antigen binding protein of claim 1 wherein:~~
 - a. ~~the LCDR1 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 683, 689, 235, 697, 146, 709, 713, 719, 723, 229, 226, 741, 747, 753, 773, 635, 642, 646, 651, 658, 661, 668, 759, 743, 765, 977, 986, 987, 1001, 1016, 1021, 1025, 1031, 1032, 1033, 1044, 1053, 1064, 1072, 1078, 1079, 1080, 1106, 226, 229, 232, 235, 241, 238, , 1113, , 146, and 947);~~
 - b. ~~the LCDR2 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 100, 106, 112, 118, 124, 235, 699, 705, 721, 725, 731, 737, 749, 755, 761, 769, 636, 643, 647, 652, 662, 789, 988, 1001, 1002, 1004, 1026, 1054, 1073, 1081, 1082, 1083, 1084, 1085, 1092, 1098, 242, 935, 148, 948, and 943); and~~
 - c. ~~the LCDR3 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 102, 108, 263, 120, 126, 687, 693, 701, 707, 717, 727, 733, 739, 745, 751, 757, 763, 767, 771, 775, 637, 638, 631, 653, 663, 637, 233, 940, 978, 989, 990, 991, 992, 993, 1005, 1006, 1007, 1008, 1009, 1034, 1035, 1036, 1055, 1056, 1057, 1065, 1086, 1093, 1094, 1099, 1100, 1101, 1107, 228, 231, 234, 237, 243, 240, 674, 936, 938, 701, 707, , 949, , 942, and 944).~~
7. ~~The antigen binding protein of claim 2 wherein the LCDR3 has a sequence selected from Table A (SEQ ID NOS: 102, 108, 263, 120, 126, 687, 693, 701, 707, 717, 727, 733, 739, 745, 751, 757, 763, 767, 771, and 775).~~

8. ~~The antigen binding protein of claim 3 wherein the LCDR3 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 263 and 126).~~
9. ~~The antigen binding protein of claim 7, wherein:~~
 - a. ~~the LCDR1 has a sequence selected from Table A (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 683, 689, 235, 697, 146, 709, 713, 719, 723, 229, 226, 741, 747, 753, and 773) and~~
 - b. ~~the LCDR2 has a sequence selected from Table A (SEQ ID NOS: 100, 106, 112, 118, 124, 685, 699, 705, 721, 725, 731, 737, 749, 755, 761, and 769).~~
10. ~~The antigen binding protein of claim 8 wherein:~~
 - a. ~~the LCDR1 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 110 and 122) and~~
 - b. ~~the LCDR2 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 112 and 124).~~
11. ~~The antigen binding protein of claim 1 wherein the heavy chain variable domain comprises a sequence at least about 90% identical to a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, 32, 495, 497, 868, 872, 876, 880, 884, 888, 892, 896, 900, 904, 908, 912, 916, 920, 926, 930, and 934).~~
12. ~~The antigen binding protein of claim 1 wherein the heavy chain variable domain comprises a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, 32, 495, 497, 868, 872, 876, 880, 884, 888, 892, 896, 900, 904, 908, 912, 916, 920, 926, 930, and 934).~~
13. ~~The antigen binding protein of claim 1 wherein the heavy chain variable domain comprises a heavy chain variable domain sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 16 and 24).~~
14. ~~The antigen binding protein of claim 1, wherein the light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).~~
15. ~~The antigen binding protein of claim 1, wherein the light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS:~~

- 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).
16. ~~The antigen binding protein of claim 11 wherein the light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).~~
17. ~~The antigen binding protein of claim 12 wherein the light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).~~
18. ~~The antigen binding protein of claim 13 wherein the light chain variable domain sequence comprises a light chain variable domain sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 14 and 22).~~
19. ~~The antigen binding protein of claim 1 wherein the protein comprises a heavy chain having a heavy chain sequence selected from Table E (SEQ ID NOS: 52, 56, 60, 64, 68, 72, 76, 457, 461, 1118, 1122, 1126, 1130, 1134, 1138, 1142, 1146, 1150, 1154, 1158, 1162, 1166, 1170, 1174, 1178, 1182, 1186 and 1190).~~
20. ~~The antigen binding protein of claim 1 wherein the protein comprises a light chain having a light chain sequence selected from Table E (SEQ ID NOS: 66, 54, 58, 62, 66, 70, 74, 455, 459, 1116, 1120, 1124, 1128, 1132, 1136, 1140, 1144, 1148, 1152, 1156, 1160, 1164, 1168, 1172, 1176, 1180, 1184 and 1188).~~
21. ~~The antigen binding protein of claim 1 comprising the light and heavy chain sequences of an antibody selected from Table E, SEQ ID NOS:~~
- ~~a. 50 and 52,~~
 - ~~b. 54 and 56,~~
 - ~~c. 58 and 60,~~
 - ~~d. 62 and 64,~~
 - ~~e. 66 and 68,~~
 - ~~f. 70 and 72,~~
 - ~~g. 74 and 76,~~

~~h. 455 and 457,~~
~~i. 459 and 461~~
~~j. 1116 and 1118,~~
~~k. 1120 and 1122,~~
~~l. 1124 and 1126,~~
~~m. 1128 and 1130,~~
~~n. 1132 and 1134,~~
~~o. 1136 and 1138,~~
~~p. 1140 and 1142,~~
~~q. 1144 and 1146,~~
~~r. 1148 and 1150,~~
~~s. 1152 and 1154,~~
~~t. 1156 and 1158,~~
~~u. 1160 and 1162,~~
~~v. 1164 and 1166,~~
~~w. 1168 and 1170,~~
~~x. 1172 and 1174,~~
~~y. 1176 and 1178,~~
~~z. 1180 and 1182,~~
~~aa. 1184 and 1186, and~~
~~bb. 1188 and 1190.~~

~~22. The antigen binding protein of claims 1 to 21, wherein the second binding entity is a TNF- α binding entity.~~

~~23. The antigen binding protein of claim 22, wherein:~~

- ~~a. the TNF- α binding entity has one or two light chain variable domains and one or two heavy chain variable domains;~~
- ~~b. the TNF- α binding entity light chain variable domain comprises an LCDR1, LCDR2, and LCDR3; and~~
- ~~c. the TNF- α binding entity heavy chain variable domain comprises an HCDR1, HCDR2, and HCDR3.~~

- ~~24. The antigen binding protein of claim 23, wherein the TNF- α binding entity HCDR3 comprises a sequence selected from Table G (SEQ ID NOS: 162, 222, 210, and 216).~~
- ~~25. The antigen binding protein of claim 23, wherein the TNF- α binding entity HCDR3 comprises a sequence selected from certolizumab (SEQ ID NO: 222).~~
- ~~26. The antigen binding protein of claim 24, wherein:~~
- ~~a. the TNF- α binding entity HCDR1 comprises a sequence selected from Table G (SEQ ID NOS: 158, 218, 206, and 212); and~~
- ~~b. the TNF- α binding entity HCDR2 comprises a sequence selected from Table G (SEQ ID NOS: 160, 220, 208, and 214).~~
- ~~27. The antigen binding protein of claim 26 wherein the TNF binding entity light chain sequence comprises:~~
- ~~a. an LCDR1 sequence selected from Table G (SEQ ID NOS: 92, 152, 140, and 146);~~
- ~~b. an LCDR2 sequence selected from Table G (SEQ ID NOS: 94, 154, 112, and 148);~~
- ~~and~~
- ~~c. an LCDR3 sequence selected from Table G (SEQ ID NOS: 96, 156, 144, and 150).~~
- ~~28. The antigen binding protein of claim 23, wherein the TNF binding entity heavy chain variable domain comprises a sequence at least about 90% identical to a heavy chain variable domain sequence selected from Table H (SEQ ID NOS: 4, 44, 318, 40, and 36).~~
- ~~29. The antigen binding protein of claim 23, wherein the TNF binding entity heavy chain variable domain sequence is a heavy chain variable domain sequence selected from Table H (SEQ ID NOS: 4, 44, 318, 40, and 36).~~
- ~~30. The antigen binding protein of claim 23, wherein the TNF- α binding entity light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table H (SEQ ID NOS: 2, 42, 38, and 34).~~
- ~~31. The antigen binding protein of claim 23, wherein the TNF binding entity comprises light chain variable domain sequence is a light chain variable domain sequence selected from Table H (SEQ ID NOS: 2, 42, 38, and 34).~~
- ~~32. The antigen binding protein of claim 28, wherein the TNF- α binding entity light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table H (SEQ ID NOS: 2, 42, 38, and 34).~~

- ~~33. The antigen binding protein of claim 29, wherein the TNF binding entity light chain variable domain sequence is a light chain variable domain sequence selected from Table H (SEQ ID NOS: 2, 42, 38, and 34).~~
- ~~34. The antigen binding protein of claim 23, wherein the antigen binding protein comprises variable region sequences selected from an antigen binding protein in Table I, SEQ ID NOS:~~
- ~~a. 42, 286, 288, and 290;~~
 - ~~b. 42, 44, 292, and 294;~~
 - ~~c. 42, 44, 296, and 298;~~
 - ~~d. 42, 44, 300 and 302;~~
 - ~~e. 42, 44, 304, and 306;~~
 - ~~f. 42, 44, 308, and 310;~~
 - ~~g. 312, 314, 288, and 290;~~
 - ~~h. 312, 314, 292, and 294;~~
 - ~~i. 312, 314, 300 and 302;~~
 - ~~j. 312, 314, 304, and 306;~~
 - ~~k. 312, 314, 308, and 310;~~
 - ~~l. 42, 318, 288, and 290;~~
 - ~~m. 42, 318, 292, and 294;~~
 - ~~n. 42, 318, 296, and 298;~~
 - ~~o. 42, 318, 304, and 306;~~
 - ~~p. 42, 318, 308, and 310;~~
 - ~~q. 320, 322, 288, and 290;~~
 - ~~r. 320, 322, 292, and 294;~~
 - ~~s. 320, 322, 31, and 298;~~
 - ~~t. 320, 322, 300, and 302;~~
 - ~~u. 320, 322, 304, and 306; or~~
 - ~~v. 320, 322, 308, and 310.~~
- ~~35. The antigen binding protein of claim 23, wherein:~~
- ~~a. the heavy and light chains are IgG1, IgG2, or IgG4;~~

- b. ~~the antigen binding protein comprises one TL1A binding entity heavy chain variable domain, one TL1A binding entity light chain variable domain, one TNF- α binding entity heavy chain variable domain, and one TNF- α binding entity light chain variable domain;~~
 - c. ~~the TL1A binding entity light chain variable domain is comprised in a light chain separate from the TL1A binding entity heavy chain variable domain, the TNF- α binding entity heavy chain variable domain, and the TNF- α binding entity light chain variable domain;~~
 - d. ~~the TL1A binding entity heavy chain variable domain is comprised in a heavy chain separate from the TL1A binding entity light chain variable domain, the TNF- α binding entity heavy chain variable domain, and the TNF- α binding entity light chain variable domain;~~
 - e. ~~the TNF- α binding entity heavy chain variable domain is comprised in a heavy chain separate from the TNF- α binding entity light chain domain, the TL1A binding entity heavy chain variable domain, and the TL1A binding entity light chain variable domain;~~
 - f. ~~the heavy chain comprising the TL1A binding entity heavy chain variable domain is covalently bound to the light chain comprising the TL1A binding entity light chain variable domain;~~
 - g. ~~the heavy chain comprising the TNF- α binding entity heavy chain variable domain is covalently bound to the light chain comprising the TNF- α binding entity light chain variable domain; and~~
 - h. ~~the heavy chain comprising the TL1A binding entity heavy chain variable domain is covalently bound to the heavy chain comprising the TNF- α binding entity heavy chain variable domain.~~
36. ~~The antigen binding protein of claim 35, wherein:~~
- a. ~~the TL1A binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 635, 642, 646, 651, 658, 661, 668, 226, 229, 232, 235, 241, 238 and) and~~

- ii. ~~an LCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 100, 106, 112, 118, 124, 636, 643, 647, 652, 662, 227, 230, 233, 242, and 473);~~
 - iii. ~~an LCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 102, 108, 263, 120, 126, 637, 638, 631, 653, 663, 228, 231, 234, 237, 243, 240, and 674);~~
 - b. ~~the TL1A binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 639, 654, 655, 632, 664, 253, 256, 259, 262, 268, 271, and 265);~~
 - ii. ~~an HCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 640, 204, 644, 648, 633, 656, 659, 660, 665, 666, 114, 669, 254, 172, 260, 184, 269, 272, 266, and 254); and~~
 - iii. ~~an HCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675);~~
 - e. ~~the TNF- α binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Table G (SEQ ID NOS: 92, 152, 140, and 146);~~
 - ii. ~~an LCDR2 sequence selected from Table G (SEQ ID NOS: 94, 154, 112, and 148); and~~
 - iii. ~~an LCDR3 sequence selected from Table G (SEQ ID NOS: 96, 156, 144, and 150); and~~
 - d. ~~the TNF- α binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Table G (SEQ ID NOS: 158, 218, 206, and 212);~~
 - ii. ~~an HCDR2 sequence selected from Table G (SEQ ID NOS: 160, 220, 208, and 214); and~~
 - iii. ~~an HCDR3 sequence selected from Table G (SEQ ID NOS: 162, 222, 210, and 216);~~
37. ~~The antigen binding protein of claim 36, wherein:~~
- a. ~~the TL1A binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Table A (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, and 469);~~

- ~~ii. an LCDR2 sequence selected from Table A (SEQ ID NOS: 100, 106, 112, 118, and 124);~~
- ~~iii. an LCDR3 sequence selected from Table A (SEQ ID NOS: 102, 108, 263, 120, and 126);~~
 - ~~b. the TL1A binding entity heavy chain sequence comprises:~~
 - ~~i. an HCDR1 sequence selected from Table A (SEQ ID NOS: 164, 170, 182, and 188);~~
 - ~~ii. an HCDR2 sequence selected from Table A (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, and 485), and~~
 - ~~iii. an HCDR3 sequence selected from Table A (SEQ ID NOS: 168, 174, 180, 186, 192, and 489).~~
- ~~38. The antigen binding protein of claim 35, wherein the antigen binding protein comprises variable region sequences selected from an antigen binding protein in Table I, SEQ ID NOS:~~
 - ~~a. 42, 286, 288, and 290;~~
 - ~~b. 42, 44, 292, and 294;~~
 - ~~c. 42, 44, 296, and 298;~~
 - ~~d. 42, 44, 300 and 302;~~
 - ~~e. 42, 44, 304, and 306;~~
 - ~~f. 42, 44, 308, and 310;~~
 - ~~g. 312, 314, 288, and 290;~~
 - ~~h. 312, 314, 292, and 294;~~
 - ~~i. 312, 314, 300 and 302;~~
 - ~~j. 312, 314, 304, and 306;~~
 - ~~k. 312, 314, 308, and 310;~~
 - ~~l. 42, 318, 288, and 290;~~
 - ~~m. 42, 318, 292, and 294;~~
 - ~~n. 42, 318, 296, and 298;~~
 - ~~o. 42, 318, 304, and 306;~~
 - ~~p. 42, 318, 308, and 310;~~
 - ~~q. 320, 322, 288, and 290;~~

~~r. 320, 322, 292, and 294;~~

~~s. 320, 322, 31, and 298;~~

~~t. 320, 322, 300, and 302;~~

~~u. 320, 322, 304, and 306; or~~

~~v. 320, 322, 308, and 310.~~

~~39. — The antigen binding protein of claim 38, wherein the antigen binding protein comprises sequences selected from an antigen binding protein in Table J, SEQ ID NOS:~~

~~i. 132, 136, 134, and 130;~~

~~j. 132, 136, 239, and 138;~~

~~k. 132, 136, 253, and 323;~~

~~l. 132, 136, 327, and 325;~~

~~m. 132, 136, 331, and 329;~~

~~n. 132, 136, 335, and 329;~~

~~o. 337, 339, 134, and 130;~~

~~p. 337, 339, 323, and 253;~~

~~q. 337, 339, 327, and 325;~~

~~r. 337, 339, 331, and 329;~~

~~s. 337, 339, 335, and 329;~~

~~t. 132, 316, 239, and 138;~~

~~u. 132, 316, 323, and 253;~~

~~v. 132, 316, 335, and 329;~~

~~w. 132, 316, 331, and 329;~~

~~x. 333, 316, 134, and 130;~~

~~y. 333, 316, 239, and 138;~~

~~z. 333, 463, 323, and 253;~~

~~aa. — 333, 463, 331, and 329;~~

~~bb. — 333, 463, 335, and 329;~~

~~cc. — 341, 343, 134, and 130;~~

~~dd. — 341, 343, 239, and 138;~~

~~ee. — 341, 343, 323, and 253;~~

~~ff. 341, 343, 327, and 325;~~
~~gg. — 341, 343, 331, and 329;~~
~~hh. — 341, 343, 335, and 329;~~
~~ii. 510, 514, 512, and 555;~~
~~jj. 510, 514, 541, and 558;~~
~~kk. — 510, 514, 539, and 562;~~
~~ll. 510, 514, 543, and 565;~~
~~mm. — 510, 514, 543, and 568;~~
~~nn. — 510, 514, 544, and 568;~~
~~oo. — 542, 571, 512, and 555;~~
~~pp. — 542, 571, 541, and 558;~~
~~qq. — 542, 571, 539, and 562;~~
~~rr. 542, 571, 543, and 565;~~
~~ss. 542, 571, 543, and 568;~~
~~tt. 542, 571, 544, and 568;~~
~~uu. — 510, 573, 512, and 555;~~
~~vv. — 510, 573, 541, and 558;~~
~~ww. — 510, 573, 539, and 562;~~
~~xx. — 510, 573, 543, and 568;~~
~~yy. — 510, 573, 544, and 568;~~
~~zz. — 540, 573, 512, and 555;~~
~~aaa. — 540, 573, 541, and 558;~~
~~bbb. — 540, 573, 539, and 562;~~
~~ccc. — 540, 573, 543, and 568;~~
~~ddd. — 540, 573, 544, and 568;~~
~~eee. — 540, 487, 512, and 555;~~
~~fff. — 540, 487, 541, and 558;~~
~~ggg. — 540, 487, 539, and 562;~~
~~hhh. — 540, 487, 543, and 568;~~
~~iii. 540, 487, 544, and 568;~~
~~jjj. 518, 522, 512, and 555;~~

kkk. — 518, 522, 541, and 558;
 lll. 518, 522, 539, and 562;
 mmm. — 518, 522, 543, and 565;
 nnn. — 518, 522, 543, and 568;
 ooo. — 518, 522, 544, and 568;
 ppp. — 545, 578, 546, and 579;
 qqq. — 545, 578, 548, and 562;
 rrr. — 545, 578, 549, and 585;
 sss. — 545, 578, 550, and 588;
 ttt. 545, 578, 551, and 591;
 uuu. — 545, 578, 552, and 591;
 vvv. — 547, 595, 546, and 579;
 www. — 547, 595, 548, and 582;
 xxx. — 547, 595, 549, and 585;
 yyy. — 547, 595, 550, and 588;
 zzz. — 547, 595, 551, and 591;
 aaaa. — 547, 595, 552, and 591;
 bbbb. — 132, 599, 134, and 598;
 cccc. — 132, 599, 239, and 601;
 dddd. — 132, 599, 323, and 603;
 eeee. — 132, 599, 327, and 605;
 ffff. — 132, 599, 331, and 607;
 gggg. — 132, 599, 335, and 607;
 hhhh. — 337, 609, 134, and 598;
 iiii. — 337, 609, 239, and 601;
 jjjj. — 337, 609, 323, and 603;
 kkkk. — 337, 609, 327, and 605;
 llll. — 337, 609, 335, and 607;
 mmmm. 132, 611, 134, and 598;
 nnnn. — 132, 611, 239, and 601;
 oooo. — 132, 611, 323, and 603;

pppp. — 132, 611, 331, and 607;
qqqq. — 132, 611, 335, and 607;
rrrr. — 333, 611, 134, and 598;
ssss. — 333, 611, 239, and 601;
tttt. — 333, 611, 323, and 603;
uuuu. — 333, 611, 331, and 607;
vvvv. — 333, 611, 335, and 607;
www. — 333, 613, 134, and 598;
xxxx. — 333, 613, 239, and 601;
yyyy. — 333, 613, 323, and 603;
zzzz. — 333, 613, 335, and 607;
aaaaa. — 341, 615, 134, and 598;
bbbbb. — 341, 615, 239, and 601;
ceeee. — 341, 615, 323, and 603;
ddddd. — 341, 615, 327, and 605;
eeeee. — 341, 615, 331, and 607;
fffff. — 341, 615, 335, and 607;
ggggg. — 333, 613, 331, and 607;
hhhhh. — 132, 463, 239, and 138;
iiii. — 132, 463, 331, and 329;
jjjj. — 132, 463, 335, and 320;
kkkkk. — 510, 487, 512, and 555;
llll. — 510, 487, 541, and 558;
mmmmm. — 510, 487, 543, and 568;
nnnnn. — 510, 487, 544, and 568;
ooooo. — 132, 613, 134, and 598;
ppppp. — 132, 613, 323, and 603;
qqqqq. — 132, 613, 331, and 607;
rrrrr. — 132, 613, 335, and 607;
sssss. — 132, 463, 134, and 130;
ttttt. — 540, 616, 512, and 508;

~~uuuuu. — 540, 620, 512, and 508;~~

~~vvvvv. — 540, 616, 541, and 558;~~

~~wwwww. 540, 616, 539, and 562;~~

~~xxxxx. — 540, 620, 539, and 562;~~

~~yyyyy. — 538, 623, 512, and 502;~~

~~zzzzz. — 537, 626, 512, and 508;~~

~~aaaaa. — 546, 514, 194, and 535;~~

~~bbbbbb. — 536, 616, 194, and 535;~~

~~cecece. — 536, 620, 194, and 535;~~

~~ddddd. — 546, 487, 194, and 535;~~

~~eeeee. — 471, 136, 473, and 198;~~

~~fffff. — 176, 136, 520, and 198;~~

~~gggggg. — 475, 477, 520, and 198;~~

~~hhhhh. — 471, 463, 473, and 198;~~

~~iiiiii. — 176, 463, 473, and 198;~~

~~jjjjj. — 471, 465, 473, and 198;~~

~~kkkkkk. — 176, 463, 570, and 198;~~

~~lllll. — 471, 465, 473, and 198;~~

~~mmmmm. — 176, 465, 520, and 198;~~

~~nnnnnn. — 510, 514, 512, and 508;~~

~~oooooo. — 518, 522, 512, and 508;~~

~~pppppp. — 540, 616, 512, and 508;~~

~~qqqqqq. — 540, 620, 512, and 508; and~~

~~rrrrr. — 537, 626, 512, and 508.~~

~~40. — The antigen binding protein of claim 39, wherein the antigen binding protein comprises the sequences of iPS No. 376543 (SEQ ID NOS: 510, 516, 512, and 508).~~

~~41. — The antigen binding protein of claim 35, wherein:~~

~~a. one heavy chain comprises substitutions K392D and K409D and the other heavy chain comprises substitutions E356K and D399K using EU numbering; or~~

~~b. one heavy chain comprises substitutions K392D, K409D and K370D and the other heavy chain comprises substitutions E356K, D399K and E357K using EU numbering.~~

~~42. — The antigen binding protein of claim 35, wherein:~~

~~a. one heavy chain comprises substitution S183K, the other heavy chain comprises substitution S183E, one light chain comprises substitution S176E, and the other light chain comprises substitution S176K using EU numbering; or~~

~~b. one heavy chain comprises substitutions Q39K and S183K, the other heavy chain comprises substitutions Q39E and S183E, one light chain comprises substitutions Q38E and S176E, and the other light chain comprises substitutions Q38K and S176K using EU numbering; or~~

~~c. one heavy chain comprises substitutions G44K and S183K, the other heavy chain comprises substitutions G44E and S183E, one light chain comprises substitutions G100E and S176E, and the other light chain comprises substitutions G100K and S176K using EU numbering; or~~

~~d. one heavy chain comprises substitution S183K, the other heavy chain comprises substitution S183E, one light chain comprises substitution S176E, and the other light chain comprises substitution S176K using EU numbering.~~

~~43. — The antigen binding protein of claim 41, wherein:~~

~~a. one heavy chain comprises substitution S183K, the other heavy chain comprises substitution S183E, one light chain comprises substitution S176E, and the other light chain comprises substitution S176K using EU numbering; or~~

~~b. one heavy chain comprises substitutions Q39K and S183K, the other heavy chain comprises substitutions Q39E and S183E, one light chain comprises substitutions Q38E and S176E, and the other light chain comprises substitutions Q38K and S176K using EU numbering; or~~

~~c. one heavy chain comprises substitutions G44K and S183K, the other heavy chain comprises substitutions G44E and S183E, one light chain comprises substitutions G100E and S176E, and the other light chain comprises substitutions G100K and S176K using EU numbering; or~~

~~d. one heavy chain comprises substitution S183K, the other heavy chain comprises substitution S183E, one light chain comprises substitution S176E, and the other light chain comprises substitution S176K using EU numbering.~~

44. ~~The antigen binding protein of claim 35, wherein the bispecific antigen binding protein comprises two IgG1 heavy chains comprising substitutions R292C, V302C and N297G using EU numbering.~~
45. ~~The antigen binding protein of claim 41, wherein the bispecific antigen binding protein comprises two IgG1 heavy chains comprising substitutions R292C, V302C and N297G using EU numbering.~~
46. ~~The antigen binding protein of claim 40, wherein the bispecific antigen binding protein comprises two IgG1 heavy chains comprising substitutions R292C, V302C and N297G using EU numbering.~~
47. ~~The antigen binding protein of claim 43, wherein the bispecific antigen binding protein comprises two IgG1 heavy chains comprising substitutions R292C, V302C and N297G using EU numbering.~~
48. ~~The antigen binding protein of claim 23, wherein:~~
- ~~a. the antigen binding protein comprises two light chains and two heavy chains;~~
 - ~~b. the heavy and light chains comprise IgG1, IgG2, or IgG4 constant domains;~~
 - ~~c. the antigen binding protein comprises two TL1A binding entity heavy chain variable domains, two TL1A binding entity light chain variable domains, two TNF- α binding entity heavy chain variable domains, and two TNF- α binding entity light chain variable domains;~~
 - ~~d. each light chain comprises a TL1A binding entity light chain variable domain sequence; and~~
 - ~~e. each heavy chain comprises a TL1A binding entity heavy chain variable domain sequence, a TNF- α binding entity heavy chain variable domain sequence and a TNF- α binding entity light chain variable domain sequence.~~
49. ~~The antigen binding protein of claim 48, wherein:~~
- ~~a. the TL1A binding entity light chain sequence comprises:~~
 - ~~i. an LCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 635, 642, 646, 651, 658, 661, 668, 226, 229, 232, 235, 241, 238 and) and~~
 - ~~ii. an LCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 100, 106, 112, 118, 124, 636, 643, 647, 652, 662, 227, 230, 233, 242, and 473);~~

- iii. ~~an LCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 102, 108, 263, 120, 126, 637, 638, 631, 653, 663, 228, 231, 234, 237, 243, 240, and 674);~~
 - b. ~~the TL1A binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 639, 654, 655, 632, 664, 253, 256, 259, 262, 268, 271, and 265);~~
 - ii. ~~an HCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 640, 204, 644, 648, 633, 656, 659, 660, 665, 666, 114, 669, 254, 172, 260, 184, 269, 272, 266, and 254); and~~
 - iii. ~~an HCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675);~~
 - e. ~~the TNF- α binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Table G (SEQ ID NOS: 92, 152, 140, and 146);~~
 - ii. ~~an LCDR2 sequence selected from Table G (SEQ ID NOS: 94, 154, 112, and 148); and~~
 - iii. ~~an LCDR3 sequence selected from Table G (SEQ ID NOS: 96, 156, 144, and 150); and~~
 - d. ~~the TNF- α binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Table G (SEQ ID NOS: 158, 218, 206, and 212);~~
 - ii. ~~an HCDR2 sequence selected from Table G (SEQ ID NOS: 160, 220, 208, and 214); and~~
 - iii. ~~an HCDR3 sequence selected from Table G (SEQ ID NOS: 162, 222, 210, and 216).~~

50. ~~The antigen binding protein of claim 49, wherein:~~
 - a. ~~the TL1A binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Table A (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, and 469);~~
 - ii. ~~an LCDR2 sequence selected from Table A (SEQ ID NOS: 100, 106, 112, 118, and 124);~~

~~iii. an LCDR3 sequence selected from Table A (SEQ ID NOS: 102, 108, 263, 120, and 126);~~

~~b. the TL1A binding entity heavy chain sequence comprises:~~

~~i. an HCDR1 sequence selected from Table A (SEQ ID NOS: 164, 170, 182, and 188);~~

~~ii. an HCDR2 sequence selected from Table A (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, and 485); and~~

~~iii. an HCDR3 sequence selected from Table A (SEQ ID NOS: 168, 174, 180, 186, 192, and 489).~~

~~51. The antigen binding protein of claim 48, wherein:~~

~~a. the TL1A binding entity heavy chain variable domain comprises a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, and 32);~~

~~b. the TL1A binding entity light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, and 30);~~

~~c. the TNF- α binding entity light chain variable domain sequence is selected from Table H (SEQ ID NOS: 2, 42, 38, and 34) and~~

~~d. the TNF- α binding entity heavy chain variable domain sequence is selected from Table H (SEQ ID NOS: 4, 44, 318, 40, and 36).~~

~~52. The antigen binding protein of claim 48, wherein the anti-TNF- α binding entity heavy chain variable domain comprises a cysteine residue at position 44 and the anti-TNF- α light chain binding domain comprises a cysteine residue at position 100, numbering as in Kabat.~~

~~53. The antigen binding protein of claim 48 wherein the protein comprises the heavy and light chain sequences of an antigen binding protein selected from Table L, SEQ ID NOS:~~

~~a. 355 and 447,~~

~~b. 357 and 447,~~

~~c. 359 and 447,~~

~~d. 361 and 447,~~

~~e. 363 and 447,~~

~~f. 365 and 58,~~

~~g. 367 and 70,~~
~~h. 369 and 70,~~
~~i. 371 and 70,~~
~~j. 373 and 70,~~
~~k. 375 and 70,~~
~~l. 377 and 70,~~
~~m. 391 and 467,~~
~~n. 391 and 66,~~
~~o. 395 and 66,~~
~~p. 397 and 66,~~
~~q. 399 and 66,~~
~~r. 401 and 66,~~
~~s. 403 and 66,~~
~~t. 405 and 66~~
~~u. 407 and 447,~~
~~v. 409 and 447,~~
~~w. 411 and 66,~~
~~x. 413 and 66,~~
~~y. 415 and 66,~~
~~z. 417 and 66,~~
~~aa. ——— 419 and 70,~~
~~bb. ——— 421 and 70,~~
~~cc. ——— 423 and 70, and~~
~~dd. ——— 425 and 70.~~

~~54. ——— The antigen binding protein of claim 48 wherein:~~

- ~~a. the light chain sequence comprises SEQ ID NO: 453 and the heavy chain sequence comprises SEQ ID NO: 441;~~
- ~~b. the light chain sequence comprises SEQ ID NO: 451 and the heavy chain sequence comprises SEQ ID NO: 433; or~~
- ~~c. the light chain sequence comprises SEQ ID NO: 453 and the heavy chain sequence comprises SEQ ID NO: 445.~~

~~55. The antigen binding protein of claim 23, wherein:~~

- ~~a. the antigen binding protein comprises two light chains and two heavy chains;~~
- ~~b. the heavy and light chains comprise IgG1, IgG2, or IgG4 constant domains;~~
- ~~c. the antigen binding protein comprises two TL1A binding entity heavy chain variable domains, two TL1A binding entity light chain variable domains, two TNF- α binding entity heavy chain variable domains, and two TNF- α binding entity light chain variable domains;~~
- ~~d. each light chain comprises a TNF- α binding entity light chain sequence; and~~
- ~~e. each heavy chain comprises a TNF- α binding entity heavy chain sequence, a TL1A binding entity heavy chain binding domain sequence and a TL1A binding entity light chain binding domain sequence.~~

~~56. The antigen binding protein of claim 55, wherein:~~

- ~~a. the TL1A binding entity light chain sequence comprises:~~
 - ~~i. an LCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 635, 642, 646, 651, 658, 661, 668, 226, 229, 232, 235, 241, 238 and) and~~
 - ~~ii. an LCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 100, 106, 112, 118, 124, 636, 643, 647, 652, 662, 227, 230, 233, 242, and 473);~~
 - ~~iii. an LCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 102, 108, 263, 120, 126, 637, 638, 631, 653, 663, 228, 231, 234, 237, 243, 240, and 674);~~
- ~~b. the TL1A binding entity heavy chain sequence comprises:~~
 - ~~i. an HCDR1 sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 639, 654, 655, 632, 664, 253, 256, 259, 262, 268, 271, and 265);~~
 - ~~ii. an HCDR2 sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 640, 204, 644, 648, 633, 656, 659, 660, 665, 666, 114, 669, 254, 172, 260, 184, 269, 272, 266, and 254); and~~
 - ~~iii. an HCDR3 sequence selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675);~~
- ~~c. the TNF- α binding entity light chain sequence comprises:~~

- i. ~~an LCDR1 sequence selected from Table G (SEQ ID NOS: 92, 152, 140, and 146),~~
- ii. ~~an LCDR2 sequence selected from Table G (SEQ ID NOS: 94, 154, 112, and 148), and~~
- iii. ~~an LCDR3 sequence selected from Table G (SEQ ID NOS: 96, 156, 144, and 150); and~~
- d. ~~the TNF- α binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Table G (SEQ ID NOS: 158, 218, 206, and 212),~~
 - ii. ~~an HCDR2 sequence selected from Table G (SEQ ID NOS: 160, 220, 208, and 214), and~~
 - iii. ~~an HCDR3 sequence selected from Table G (SEQ ID NOS: 162, 222, 210, and 216).~~

~~57. The antigen binding protein of claim 56, wherein:~~

- a. ~~the TL1A binding entity light chain sequence comprises:~~
 - i. ~~an LCDR1 sequence selected from Table A (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, and 469),~~
 - ii. ~~an LCDR2 sequence selected from Table A (SEQ ID NOS: 100, 106, 112, 118, and 124);~~
 - iii. ~~an LCDR3 sequence selected from Table A (SEQ ID NOS: 102, 108, 263, 120, and 126),~~
- b. ~~the TL1A binding entity heavy chain sequence comprises:~~
 - i. ~~an HCDR1 sequence selected from Table A (SEQ ID NOS: 164, 170, 182, and 188),~~
 - ii. ~~an HCDR2 sequence selected from Table A (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, and 485), and~~
 - iii. ~~an HCDR3 sequence selected from Table A (SEQ ID NOS: 168, 174, 180, 186, 192, and 489).~~

~~58. The antigen binding protein of claim 55, wherein:~~

- a. ~~the TL1A binding entity heavy chain variable domain comprises a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, and 32);~~

- ~~b. the TL1A binding entity light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, and 30);~~
- ~~c. the TNF- α binding entity light chain variable domain sequence is selected from Table H (SEQ ID NOS: 2, 42, 38, and 34) and~~
- ~~d. the TNF- α binding entity heavy chain variable domain sequence is selected from Table H (SEQ ID NOS: 4, 44, 318, 40, and 36).~~
- ~~59. — The antigen binding protein of claim 55, wherein the TL1A binding entity heavy chain variable domain comprises a cysteine residue at position 44 and the TL1A binding entity light chain binding domain comprises a cysteine residue at position 100, numbering as in Kabat.~~
- ~~60. — The antigen binding protein of claim 55, wherein the protein comprises the heavy and light chain sequences of an antigen binding protein selected from Table M, SEQ ID NOS:~~
 - ~~a. 82 and 46,~~
 - ~~b. 284 and 46,~~
 - ~~c. 286 and 46,~~
 - ~~d. 441 and 453~~
 - ~~e. 312 and 46,~~
 - ~~f. 445 and 453,~~
 - ~~g. 314 and 84,~~
 - ~~h. 320 and 84,~~
 - ~~i. 322 and 84,~~
 - ~~j. 345 and 84,~~
 - ~~k. 347 and 78,~~
 - ~~l. 349 and 78,~~
 - ~~m. 351 and 78,~~
 - ~~n. 353 and 78,~~
 - ~~o. 379 and 46,~~
 - ~~p. 381 and 46,~~
 - ~~q. 383 and 84,~~
 - ~~r. 385 and 84,~~

~~s. 387 and 78,~~

~~t. 389 and 78,~~

~~u. 433 and 451,~~

~~v. 427 and 449,~~

~~w. 429 and 449,~~

~~x. 431 and 451,~~

~~y. 433 and 451,~~

~~z. 435 and 451,~~

~~aa. ——— 437 and 451,~~

~~bb. ——— 439 and 453,~~

~~cc. ——— 441 and 453,~~

~~dd. ——— 443 and 453, and~~

~~ee. ——— 445 and 453.~~

~~61. ——— The antigen binding protein of claim 55 comprising SEQ ID NOS:~~

~~a. 441 and 453;~~

~~b. 433 and 451; or~~

~~c. 445 and 453.~~

~~62. ——— One or more isolated nucleic acids encoding the antigen binding protein of any one of claims 1 to 61 and 105 to 135.~~

~~63. ——— One or more expression vectors comprising the nucleic acid or acids of claim 62.~~

~~64. ——— A host cell comprising the one or more expression vectors of claim 63.~~

~~65. ——— A method for the preparation of an antigen binding protein, comprising:~~

~~a. culturing the host cell of claim 64 under conditions that allow expression of the antigen binding protein; and~~

~~b. recovering the antigen binding protein from the culture.~~

~~66. ——— A pharmaceutical composition comprising the antigen binding protein of any one of claims 1 to 61 and a pharmaceutically acceptable diluent, excipient or carrier.~~

~~67. ——— A method for treating a condition associated with TL1A and/or TNF- α in a patient in need thereof, comprising administering to the patient an effective~~

~~amount of the antigen binding protein of any one of claims 1 to 61 and 105 to 135.~~

~~68. The method of claim 67, wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.~~

~~69. Use of the antigen binding protein of any one of claims 1 to 61 and 105 to 135 in the preparation of a medicament for treating a condition associated with TL1A in a patient in need thereof.~~

~~70. The use of claim 68 wherein the condition is inflammatory bowel disease, Crohn's disease or ulcerative colitis.~~

~~71. The antigen binding protein of any one of claims 1 to 61 and 105 to 135 for use in a method for treating a condition associated with TL1A and/or TNF- α in a patient in need thereof.~~

~~72. The antigen binding protein of claim 71 wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.~~

~~73.1.~~ An antigen binding protein specific for TL1A wherein:

- a. the antigen binding protein has one or two light chain variable domains and one or two heavy chain variable domains;
- b. the light chain variable domain comprises a LCDR1, LCDR2, and LCDR3;
- c. the heavy chain variable domain comprises a HCDR1, HCDR2, and HCDR3; and
- d. the HCDR1 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 164, 170, 182, 188, 777, 783, 792, 798, 804, 809, 815, 819, 265, 836, 847, 857, 639, 654, 655, 632, 664, 955, 979, 994, 1010, 1017, 1022, 1027, 1028, 1029, 1037, 1045, 1087, 253, 256, 259, 262, 268, 271, 265, and 950);
- e. the HCDR2 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 779, 785, 794, 800, 811, 817, 821, 827, 832, 838, 843, 849, 853, 859, 864, 640, 204, 678, 679, 644, 648, 649, 633, 656, 659, 660, 665, 666, 677, 114, 227, 230, 691, 715, 669, 711, 971, 972, 973, 974, 975, 980, 981, 982, 983, 984, 995, 996, 997, 998, 0999, 1011, 1023, 1030, 1038, 1039, 1040, 1041, 1042, 1046, 1047, 1048, 1058, 1059, 1060, 1061, 1062, 1066, 1067, 1068, 1069, 1070, 1074, 1088, 1089, 1090, 1095, 1096, 1097, 1102, 1103, 1104, 1108, 1109, 1110, 1111, 1112, 254, 260, 184, 269, 272, 266, 951, 953, 956, and 963); and

- f. the HCDR3 sequence is selected from Tables A, B, and C (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 641, 645, 650, 657, 676, 657, 667, 671, 255, 258, 261, 264, 267, 270, 273, 672, and 675).
- ~~74.2.~~ The antigen binding protein of claim ~~73~~1, wherein the HCDR3 comprises a sequence selected from Table A (SEQ ID NOS: 168, 174, 180, 186, 192, 489, 781, 787, 796, 802, 807, 813, 823, 829, 834, 840, 845, 851, 855, and 861).
- ~~75.3.~~ The antigen binding protein of claim ~~73~~1, wherein the HCDR3 has a sequence selected from antibodies and 9C8 and 3B3 (SEQ ID NO: 180 and 192).
- ~~76.4.~~ The antigen binding protein of claim ~~74~~2, wherein:
- a. the HCDR1 has a sequence selected from Table A (SEQ ID NOS: 164, 170, 182, 188, 777, 783, 792, 798, 804, 809, 815, 819, 265, 836, 847, and 857) and
 - b. the HCDR2 has a sequence selected from Table A (SEQ ID NOS: 166, 172, 178, 184, 190, 196, 202, 483, 485, 779, 785, 794, 800, 811, 817, 821, 827, 832, 838, 843, 849, 853, 859, and 864).
- ~~77.5.~~ The antigen binding protein of claim ~~75~~3 wherein:
- a. the HCDR1 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NO: 170 and 188) and
 - b. the HCDR2 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NO: 178 and 190).
- ~~78.6.~~ The antigen binding protein of claim ~~73~~1 wherein the LCDR3 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 102, 108, 263, 120, 126, 687, 693, 701, 707, 717, 727, 733, 739, 745, 751, 757, 763, 767, 771, 775, 637, 638, 631, 653, 663, 637, 233, 940, 978, 989, 990, 991, 992, 993, 1005, 1006, 1007, 1008, 1009, 1034, 1035, 1036, 1055, 1056, 1057, 1065, 1086, 1093, 1094, 1099, 1100, 1101, 1107, 228, 231, 234, 237, 243, 240, 674, 936, 938, 701, 707, , 949, , 942, and 944).
- ~~79.7.~~ The antigen binding protein of claim ~~76~~4 wherein the LCDR3 has a sequence selected from Table A (SEQ ID NOS: 102, 108, 263, 120, 126, 687, 693, 701, 707, 717, 727, 733, 739, 745, 751, 757, 763, 767, 771, and 775).
- ~~80.8.~~ The antigen binding protein of claim ~~77~~5 wherein the LCDR3 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 263 and 126).
- ~~81.9.~~ The antigen binding protein of claim ~~78~~6 wherein:

- a. the LCDR1 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 683, 689, 235, 697, 146, 709, 713, 719, 723, 229, 226, 741, 747, 753, 773, 635, 642, 646, 651, 658, 661, 668, 759, 743, 765, 977, 986, 987, 1001, 1016, 1021, 1025, 1031, 1032, 1033, 1044, 1053, 1064, 1072, 1078, 1079, 1080, 1106, 226, 229, 232, 235, 241, 238, , 1113, , 146, and 947) and
- b. the LCDR2 has a sequence selected from Tables A, B, and C (SEQ ID NOS: 100, 106, 112, 118, 124, 235, 699, 705, 721, 725, 731, 737, 749, 755, 761, 769, 636, 643, 647, 652, 662, 789, 988, 1001, 1002, 1004, 1026, 1054, 1073, 1081, 1082, 1083, 1084, 1085, 1092, 1098, 242, 935, 148, 948, and 943).

~~82.10.~~ The antigen binding protein of claim ~~79-7~~ wherein:

- a. the LCDR1 has a sequence selected from Table A (SEQ ID NOS: 98, 104, 110, 116, 122, 128, 467, 469, 683, 689, 235, 697, 146, 709, 713, 719, 723, 229, 226, 741, 747, 753, and 773) and
- b. the LCDR2 has a sequence selected from Table A (SEQ ID NOS: 100, 106, 112, 118, 124, 685, 699, 705, 721, 725, 731, 737, 749, 755, 761, and 769).

~~83.11.~~ The antigen binding protein of claim ~~80-8~~ wherein:

- a. the LCDR1 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 110 and 122) and
- b. the LCDR2 has a sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 112 and 124).

~~84.12.~~ The antigen binding protein of claim ~~73-1~~ wherein the heavy chain variable domain comprises a sequence at least about 90% identical to a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, 32, 495, 497, 868, 872, 876, 880, 884, 888, 892, 896, 900, 904, 908, 912, 916, 920, 926, 930, and 934).

~~85.13.~~ The antigen binding protein of claim ~~173~~ wherein the heavy chain variable domain comprises a heavy chain variable domain sequence selected from Table D (SEQ ID NOS: 8, 12, 16, 20, 24, 28, 32, 495, 497, 868, 872, 876, 880, 884, 888, 892, 896, 900, 904, 908, 912, 916, 920, 926, 930, and 934).

~~86.14.~~ The antigen binding protein of claim ~~731~~, wherein the light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866,

870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932,).

~~87.15.~~ The antigen binding protein of claim ~~73~~1, wherein the light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).

~~88.16.~~ The antigen binding protein of claim ~~84~~12, wherein the light chain variable domain comprises a sequence at least about 90% identical to a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932,).

~~89.17.~~ The antigen binding protein of claim ~~85~~13, wherein the light chain variable domain comprises a light chain variable domain sequence selected from Table D (SEQ ID NOS: 6, 10, 14, 18, 22, 26, 30, 491, 493, 866, 870, 874, 878, 882, 886, 890, 894, 898, 902, 906, 910, 914, 918, 922, 924, 928, and 932).

~~90.18.~~ The antigen binding protein of claim ~~73~~1 wherein:

- a. the light chain variable domain sequence comprises a light chain variable domain sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 14 and 22) and
- b. the heavy chain variable domain comprises a heavy chain variable domain sequence selected from antibodies 9C8 and 3B3 (SEQ ID NOS: 16 and 24).

~~91.19.~~ The antigen binding protein of claim ~~73~~1 wherein the protein comprises a heavy chain having a heavy chain sequence selected from Table E (SEQ ID NOS: 52, 56, 60, 64, 68, 72, 76, 457, 461, 1118, 1122, 1126, 1130, 1134, 1138, 1142, 1146, 1150, 1154, 1158, 1162, 1166, 1170, 1174, 1178, 1182, 1186 and 1190).

~~92.20.~~ The antigen binding protein of claim ~~73~~1 wherein the protein comprises a light chain having a light chain sequence selected from Table E (SEQ ID NOS: 66, 54, 58, 62, 66, 70, 74, 455, 459, 1116, 1120, 1124, 1128, 1132, 1136, 1140, 1144, 1148, 1152, 1156, 1160, 1164, 1168, 1172, 1176, 1180, 1184 and 1188).

~~93.21.~~ The antigen binding protein of claim ~~73~~1 comprising the light and heavy chain sequences of an antibody selected from Table E, SEQ ID NOS:

- a. 50 and 52,

- b. 54 and 56,
- c. 58 and 60,
- d. 62 and 64,
- e. 66 and 68,
- f. 70 and 72,
- g. 74 and 76,
- h. 455 and 457,
- i. 459 and 461,
- j. 1116 and 1118,
- k. 1120 and 1122,
- l. 1124 and 1126,
- m. 1128 and 1130,
- n. 1132 and 1134,
- o. 1136 and 1138,
- p. 1140 and 1142,
- q. 1144 and 1146,
- r. 1148 and 1150,
- s. 1152 and 1154,
- t. 1156 and 1158,
- u. 1160 and 1162,
- v. 1164 and 1166,
- w. 1168 and 1170,
- x. 1172 and 1174,
- y. 1176 and 1178,
- z. 1180 and 1182,
- aa. 1184 and 1186, and
- bb. 1188 and 1190.

~~94.22.~~ One or more isolated nucleic acids encoding the antigen binding protein of any one of claims ~~73-1~~ to ~~93~~21.

~~95.23.~~ One or more expression vectors comprising the nucleic acid or acids of claim ~~94~~22.

~~96.24.~~ A host cell comprising the one or more expression vectors of claim ~~95~~23.

~~97.25.~~ A method for the preparation of an antigen binding protein, comprising:

- a. culturing the host cell of claim ~~96.24~~ under conditions that allow expression of the antigen binding protein; and
- b. recovering the antigen binding protein from the culture.

~~98.26.~~ A pharmaceutical composition comprising the antigen binding protein of any one of claims ~~73.1~~ to ~~93.21~~ and a pharmaceutically acceptable diluent, excipient or carrier.

~~99.~~ A method for treating a condition associated with TL1A in a patient in need thereof, comprising administering to the patient an effective amount of the antigen binding protein of any one of claims ~~73~~ to ~~93~~.

~~100.~~ The method of claim ~~99~~, wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.

~~101.27.~~ Use of the antigen binding protein of any one of claims ~~73.1~~ to ~~93.21~~ in the preparation of a medicament for treating a condition associated with TL1A in a patient in need thereof, wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.

~~102.~~ The use of claim ~~101~~ wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.

~~103.28.~~ The antigen binding protein of any one of claims ~~73.1~~ to ~~93.21~~ for use in a method for treating a condition associated with TL1A in a patient in need thereof therapy.

~~104.~~ The antigen binding protein of claim ~~103~~ wherein the condition is inflammatory bowel disease, Crohn's disease, or ulcerative colitis.

~~105.~~ The antigen binding protein of claim ~~23~~, comprising:

- a. a first polypeptide comprising a first heavy chain of a first antibody comprising a first heavy chain variable region (VH1) and a first CH1 domain, wherein the first heavy chain is fused through its C-terminus to the N-terminus of a polypeptide comprising a second heavy chain variable region of a second antibody (VH2), wherein the VH2 is fused through its C-terminus to the N-terminus of a second CH1 domain, and wherein the first antibody comprises one of the TL1A binding entity or the TNF- α binding entity and the second antibody comprises the other; wherein:

- i. ~~the VH1 or first CH1 domain comprises at least one amino acid substitution to introduce a positively charged amino acid at a residue selected from the group consisting of positions 39, 44, and 183 using EU numbering; and~~
 - ii. ~~the VH2 or second CH1 domain comprises at least one amino acid substitution to introduce a negatively charged amino acid at a residue selected from the group consisting of a residue that corresponds to positions 39, 44, and 183 using EU numbering; and~~
 - b. ~~a second polypeptide comprising a first light chain of the first antibody of a., wherein the first light chain comprises a first light chain variable region (VL1) and a first CL region; and wherein the VL1 or first CL domain comprises at least one amino acid substitution to introduce a negatively charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering; and~~
 - c. ~~a third polypeptide comprising a second light chain of the second antibody of a., wherein the second light chain comprises a second light chain variable region (VL2) and a second CL region; and wherein the VL1 or first CL domain comprises at least one amino acid substitution to introduce a positively charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering.~~
106. ~~The antigen binding protein of claim 105, wherein the first heavy chain is fused to the VH2 via a peptide linker.~~
107. ~~The antigen binding protein according to claim 106, wherein the peptide linker comprises a sequence selected from the group consisting of (Gly₃Ser)₂, (Gly₄Ser)₂, (Gly₃Ser)₃, (Gly₄Ser)₃, (Gly₃Ser)₄, (Gly₄Ser)₄, (Gly₃Ser)₅, (Gly₄Ser)₅, (Gly₃Ser)₆, and (Gly₄Ser)₆.~~
108. ~~The antigen binding protein according to claim 105, wherein:~~
- a. ~~the VH1 or first CH1 domain comprises a mutation selected from the group consisting of Q39K, G44K, and S183K using EU numbering;~~
 - b. ~~the VH2 or second CH1 domain comprises a mutation selected from the group consisting of Q39E, G44E, and S183E using EU numbering;~~
 - c. ~~the VL1 or first CL domain comprises a mutation selected from the group consisting of Q38E, G100E, and S176E using EU numbering; and~~
 - d. ~~the VL2 or second CL domain comprises a mutation selected from the group consisting of Q38K, G100K, and S176K using EU numbering.~~

- ~~109.—The antigen binding protein according to claim 108, wherein:~~
- ~~a.—the first CH1 domain comprises a S183K mutation using EU numbering;~~
 - ~~b.—the second CH1 domain comprises a S183E mutation using EU numbering;~~
 - ~~c.—the first CL domain comprises a S176E mutation using EU numbering; and~~
 - ~~d.—the second CL domain comprises a S176K mutation using EU numbering.~~
- ~~110.—The antigen binding protein according to claim 108, wherein:~~
- ~~a.—the VH1 comprises a Q39K mutation and the first CH1 domain comprises a S183K mutation using EU numbering;~~
 - ~~b.—the VH2 comprises a Q39E mutation and the second CH1 domain comprises a S183E mutation using EU numbering;~~
 - ~~c.—the VL1 comprises a Q38E mutation and the first CL domain comprises a S176E mutation using EU numbering; and~~
 - ~~d.—the VL2 comprises a Q38K mutation and the second CL domain comprises a S176K mutation using EU numbering.~~
- ~~111.—The antigen binding protein according to claim 108, wherein:~~
- ~~a.—the first CH1 domain comprises G44K and S183K mutations using EU numbering;~~
 - ~~b.—the second CH1 domain comprises G44E and S183E mutations using EU numbering;~~
 - ~~c.—the first CL domain comprises G100E and S176E mutations using EU numbering;~~
~~and~~
 - ~~d.—the second CL domain comprises G100K and S176K mutations using EU numbering.~~
- ~~112.—The antigen binding protein of claim 23, comprising:~~
- ~~a.—a first polypeptide comprising a first heavy chain of a first antibody comprising a first heavy chain variable region (VH1) and a first CH1 domain, wherein the first heavy chain is fused through its C terminus to the N terminus of a polypeptide comprising a second heavy chain variable region of a second antibody (VH2), wherein the VH2 is fused through its C terminus to the N terminus of a second CH1 domain, and wherein the first antibody comprises one of the TL1A binding entity and the TNF- α binding entity and the second antibody comprises the other; wherein:~~
 - ~~i.—the VH1 or first CH1 domain comprises at least one amino acid substitution to introduce a negatively charged amino acid at a residue selected from the group consisting of positions 39, 44, and 183 using EU numbering; and~~

- ii. ~~the VH2 or second CH1 domain comprises at least one amino acid substitution to introduce a positively charged amino acid at a residue selected from the group consisting of a residue that corresponds to positions 39, 44, and 183 using EU numbering; and~~
- a. ~~a second polypeptide comprising a first light chain of the first antibody of a., wherein the first light chain comprises a first light chain variable region (VL1) and a first CL region; and wherein the VL1 or first CL domain comprises at least one amino acid substitution to introduce a positively charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering; and~~
- b. ~~a third polypeptide comprising a second light chain of the second antibody of a., wherein the second light chain comprises a second light chain variable region (VL2) and a second CL region; and wherein the VL1 or first CL domain comprises at least one amino acid substitution to introduce a negatively charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering.~~
- 113. ~~The antigen binding protein according to claim 112, wherein the first heavy chain is fused to the VH2 via a peptide linker.~~
- 114. ~~The antigen binding protein according to claim 113, wherein the peptide linker comprises a sequence selected from the group consisting of (Gly₃Ser)₂, (Gly₄Ser)₂, (Gly₃Ser)₃, (Gly₄Ser)₃, (Gly₃Ser)₄, (Gly₄Ser)₄, (Gly₃Ser)₅, (Gly₄Ser)₅, (Gly₃Ser)₆, and (Gly₄Ser)₆.~~
- 115. ~~The antigen binding protein according to claim 112, wherein:~~
 - a. ~~the VH1 or first CH1 domain comprises a mutation selected from the group consisting of Q39E, G44E, and S183E using EU numbering;~~
 - b. ~~the VH2 or second CH1 domain comprises a mutation selected from the group consisting of Q39K, G44K, and S183K using EU numbering;~~
 - c. ~~the VL1 or first CL domain comprises a mutation selected from the group consisting of Q38K, G100K, and S176K using EU numbering; and~~
 - d. ~~the VL2 or second CL domain comprises a mutation selected from the group consisting of Q38E, G100E, and S176E using EU numbering.~~
- 116. ~~The antigen binding protein according to claim 115, wherein:~~
 - a. ~~the first CH1 domain comprises a S183E mutation using EU numbering;~~
 - b. ~~the second CH1 domain comprises a S183K mutation using EU numbering;~~

- ~~c. the first CL domain comprises a S176K mutation using EU numbering; and~~
 - ~~d. the second CL domain comprises a S176E mutation using EU numbering.~~
- ~~117. The antigen binding protein according to claim 115, wherein:~~
 - ~~a. the VH1 comprises a Q39E mutation and the first CH1 domain comprises a S183E mutation using EU numbering;~~
 - ~~b. the VH2 comprises a Q39K mutation and the second CH1 domain comprises a S183K mutation using EU numbering;~~
 - ~~c. the VL1 comprises a Q38K mutation and the first CL domain comprises a S176K mutation using EU numbering; and~~
 - ~~d. the VL2 comprises a Q38E mutation and the second CL domain comprises a S176E mutation using EU numbering.~~
- ~~118. The antigen binding protein according to claim 115, wherein:~~
 - ~~a. the first CH1 domain comprises G44E and S183E mutations using EU numbering;~~
 - ~~b. the second CH1 domain comprises G44K and S183K mutations using EU numbering;~~
 - ~~c. the first CL domain comprises G100K and S176K mutations using EU numbering;~~
~~and~~
 - ~~d. the second CL domain comprises G100E and S176E mutations using EU numbering.~~
- ~~119. The antigen binding protein of claim 23, comprising:~~
 - ~~a. a first polypeptide comprising a first heavy chain of a first antibody comprising a first heavy chain variable region (VH1) and a first CH1 domain, wherein the first heavy chain is fused through its C terminus to the N terminus of a polypeptide comprising a second heavy chain variable region of a second antibody (VH2), wherein the VH2 is fused through its C terminus to the N terminus of a second CH1 domain, and wherein the first antibody comprises one of the TL1A binding entity and the TNF- α binding entity and the second antibody comprises the other; wherein:~~
 - ~~i. the VH1 or first CH1 domain comprises at least one amino acid substitution to introduce a charged amino acid at a residue selected from the group consisting of positions 39, 44, and 183 using EU numbering; and~~
 - ~~ii. the VH2 or second CH1 domain comprises at least one amino acid substitution to introduce a charged amino acid at a residue selected from the group consisting of a residue that corresponds to positions 39, 44, and 183 using EU numbering.~~

- wherein the charge is the opposite of the substituted residue of the ~~VH1~~ or first ~~CH1~~ of the first heavy chain; and
- b. ~~a second polypeptide comprising a first light chain of the first antibody of a., wherein the first light chain comprises a first light chain variable region (VL1) and a first CL region; and wherein the VL1 or first CL domain comprises at least one amino acid substitution to introduce a charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering, wherein:~~
- i. ~~the charge at position 38 is the opposite of the substituted residue of the VH1 or first CH1 of the first heavy chain at position 39 using EU numbering; the charge at position 100 using EU numbering is the opposite of the substituted residue of the VH1 or first CH1 of the first heavy chain at position 44 using EU numbering; the charge at position 176 is the opposite of the substituted residue of the VH1 or first CH1 of the first heavy chain at position 183 using EU numbering; and~~
- c. ~~a third polypeptide comprising a second light chain of the second antibody of a., wherein the second light chain comprises a second light chain variable region (VL2) and a second CL region; and wherein the VL2 or second CL domain comprises at least one amino acid substitution to introduce a charged amino acid at a residue selected from the group consisting of positions 38, 100, and 176 using EU numbering, wherein:~~
- i. ~~the charge at position 38 is the opposite of the substituted residue of the VH2 or second CH1 of the second heavy chain at position 39; the charge at position 100 is the opposite of the substituted residue of the VH2 or second CH1 of the second heavy chain at position 44; the charge at position 176 is the opposite of the substituted residue of the VH2 or second CH1 of the second heavy chain at position 183.~~
120. ~~The antigen binding protein according to claim 119, wherein the first heavy chain is fused to the VH2 via a peptide linker.~~
121. ~~The antigen binding protein according to claim 120, wherein the peptide linker comprises a sequence selected from the group consisting of (Gly₃Ser)₂, (Gly₄Ser)₂, (Gly₃Ser)₃, (Gly₄Ser)₃, (Gly₃Ser)₄, (Gly₄Ser)₄, (Gly₃Ser)₅, (Gly₄Ser)₅, (Gly₃Ser)₆, and (Gly₄Ser)₆.~~
122. ~~The antigen binding protein according to claim 119, wherein:~~

- a. ~~the VH1 comprises a Q39E mutation and the first CH1 domain comprises a S183K mutation using EU numbering;~~
 - b. ~~the VH2 comprises a Q39K mutation and the second CH1 domain comprises a S183E mutation using EU numbering;~~
 - c. ~~the VL1 comprises a Q38K mutation and the first CL domain comprises a S176E mutation using EU numbering; and~~
 - d. ~~the VL2 comprises a Q38E mutation and the second CL domain comprises a S176K mutation using EU numbering.~~
123. ~~The antigen binding protein according to claim 122, wherein:~~
- a. ~~the first CH1 domain comprises G44E and S183K mutations using EU numbering;~~
 - b. ~~the second CH1 domain comprises G44K and S183E mutations using EU numbering;~~
 - c. ~~the first CL domain comprises G100K and S176E mutations using EU numbering;~~
~~and~~
 - d. ~~the second CL domain comprises G100E and S176K mutations using EU numbering.~~
124. ~~The antigen binding protein according to claim 122, wherein:~~
- a. ~~the VH1 comprises a Q39K mutation and the first CH1 domain comprises a S183E mutation using EU numbering;~~
 - b. ~~the VH2 comprises a Q39E mutation and the second CH1 domain comprises a S183K mutation using EU numbering;~~
 - c. ~~the VL1 comprises a Q38E mutation and the first CL domain comprises a S176K mutation using EU numbering; and~~
 - d. ~~the VL2 comprises a Q38K mutation and the second CL domain comprises a S176E mutation using EU numbering.~~
125. ~~The antigen binding protein according to claim 122, wherein:~~
- a. ~~the first CH1 domain comprises G44K and S183E mutations using EU numbering;~~
 - b. ~~the second CH1 domain comprises G44E and S183K mutations using EU numbering;~~
 - c. ~~the first CL domain comprises G100E and S176K mutations using EU numbering;~~
~~and~~
 - d. ~~the second CL domain comprises G100K and S176E mutations using EU numbering.~~
126. ~~The antigen binding protein of claim 23, comprising:~~

a. ~~a first polypeptide comprising a first heavy chain (VH2-CH1-CH2-CH3) from a first antibody, wherein the first heavy chain is fused at its carboxyl terminus (optionally through a peptide linker) to a polypeptide comprising VH2-CH1 domains of a second antibody,~~

b. ~~a second polypeptide comprising a light chain from the first antibody (VL1-CL) and~~

c. ~~a third polypeptide comprising VL2-CL domains of the second antibody;~~

~~wherein the first antibody comprises one of a TL1A binding entity and a TNF- α binding entity and the second antibody comprises the other.~~

~~127.—The antigen binding protein of claim 126, wherein:~~

- a. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, CL from the second antibody comprises K at position 230, and CH1 from the second antibody comprises E at position 230;~~
- b. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, VL from the first antibody comprises E at position 46, VH from the first antibody comprises K at position 46, CL from the second antibody comprises K at position 230, CH1 from the second antibody comprises E at position 230, VL from the second antibody comprises E at position 46, and VH from the second antibody comprises K at position 46; or~~
- c. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, VL from the first antibody comprises E at position 141, VH from the first antibody comprises K at position 51, CL from the second antibody comprises K at position 230, CH1 from the second antibody comprises E at position 230, VL from the second antibody comprises E at position 51, and VH from the second antibody comprises K at position 141;~~

~~wherein all positions are according to EU numbering.~~

~~128.—The antigen binding protein of claim 23, comprising:~~

- a. ~~a first polypeptide comprising VH1-CL-CH2-CH3 domains of a first antibody fused at their carboxyl terminus (optionally through a peptide linker) to a polypeptide comprising VH2-CH1 domains of a second antibody,~~
- b. ~~a second polypeptide comprising a light chain from the first antibody (VL1-CH1) and~~
- c. ~~a third polypeptide comprising VL2-CL domains of the second antibody;~~

~~wherein the first antibody comprises one of a TL1A binding entity or a TNF- α binding entity and the second antibody comprises the other.~~

~~129.—The antigen binding protein of claim 128, wherein:~~

- ~~a.—CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, CL from the second antibody comprises K at position 230, and CH1 from the second antibody comprises E at position 230;~~
- ~~b.—CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, VL from the first antibody comprises E at position 46, VH from the first antibody comprises K at position 46, CL from the second antibody comprises K at position 230, CH1 from the second antibody comprises E at position 230, VL from the second antibody comprises E at position 46, and VH from the second antibody comprises K at position 46; or~~
- ~~c.—CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, VL from the first antibody comprises E at position 141, VH from the first antibody comprises K at position 51, CL from the second antibody comprises K at position 230, CH1 from the second antibody comprises E at position 230, VL from the second antibody comprises E at position 51, and VH from the second antibody comprises K at position 141;~~

~~wherein all positions are according to EU numbering.~~

~~130.—The antigen binding protein of claim 23, comprising:~~

- ~~a.—a first polypeptide comprising a first heavy chain (VH1-CH1-CH2-CH3) of a first antibody, wherein the first heavy chain is fused at its carboxyl terminus (optionally through a peptide linker) to a polypeptide comprising VH2-CL domains of a second antibody;~~
- ~~b.—a second polypeptide comprising a light chain from a first antibody (VL1-CL) and~~
- ~~c.—a third polypeptide comprising VL2-CH1 domains of the second antibody;~~

~~wherein the first antibody comprises one of a TL1A binding entity or a TNF- α binding entity and the second antibody comprises the other.~~

~~131.—The antigen binding protein of claim 130, wherein:~~

- a. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, CL from the second antibody comprises E at position 230, and CH1 from the second antibody comprises K at position 230;~~
- b. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, VL from the first antibody comprises E at position 46, VH from the first antibody comprises K at position 46, CL from the second antibody comprises E at position 230, CH1 from the second antibody comprises K at position 230, VL from the second antibody comprises E at position 46, and VH from the second antibody comprises K at position 46; or~~
- c. ~~CL from the first antibody comprises E at position 230, CH1 from the first antibody comprises K at position 230, VL from the first antibody comprises E at position 141, VH from the first antibody comprises K at position 51, CL from the second antibody comprises E at position 230, CH1 from the second antibody comprises K at position 230, VL from the second antibody comprises E at position 51, and VH from the second antibody comprises K at position 141;~~

~~wherein all positions are according to EU numbering.~~

~~132. The antigen binding protein of claim 23, comprising:~~

- a. ~~a first polypeptide comprising VH1-CL-CH2-CH3 domains of a first antibody fused at their carboxyl terminus (optionally through a peptide linker) to a polypeptide comprising VH2-CL domains of a second antibody,~~
- b. ~~a second polypeptide comprising VL1-CH1 domains from the first antibody and~~
- c. ~~a third polypeptide comprising VL2-CH1 domains of the second antibody;~~

~~wherein the first antibody comprises one of a TL1A binding entity or a TNF- α binding entity and the second antibody comprises the other.~~

~~133. The antigen binding protein of claim 132, wherein:~~

- a. ~~CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, CL from the second antibody comprises E at position 230, and CH1 from the second antibody comprises K at position 230;~~
- b. ~~CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, VL from the first antibody comprises E at position 46, VH from the first antibody comprises K at position 46, CL from the second antibody~~

- comprises E at position 230, CH1 from the second antibody comprises K at position 230, VL from the second antibody comprises E at position 46, and VH from the second antibody comprises K at position 46; or
- c. ~~CL from the first antibody comprises K at position 230, CH1 from the first antibody comprises E at position 230, VL from the first antibody comprises E at position 141, VH from the first antibody comprises K at position 51, CL from the second antibody comprises E at position 230, CH1 from the second antibody comprises K at position 230, VL from the second antibody comprises E at position 51, and VH from the second antibody comprises K at position 141;~~
- wherein all positions are according to EU numbering.
134. ~~The antigen binding protein according to claims 105, 112, 119, 126, 128, 130, and 132 wherein the antigen binding protein comprises:~~
- a. ~~CDRL1, CDRL2, and CDRL3 amino acid sequences selected from Table 21.2A, SEQ ID NOS:~~
- i. ~~92, 110, 122, 128, and 146;~~
- ii. ~~112, 118, 124, 148, and 242;~~
- iii. ~~96, 108, 120, 126 and 150; and~~
- b. ~~CDRH1, CDRH2, and CDRH3 amino acid sequences selected from Table 21.2B, SEQ ID NOS:~~
- i. ~~158, 170, 182, 188, and 212;~~
- ii. ~~160, 190, 196, 214, and 633;~~
- iii. ~~162, 180, 186, 192 and 216.~~
135. ~~The antigen binding protein according to claims 105, 112, 119, 126, 128, 130, and 132 wherein the antigen binding protein comprises sequences of an antigen binding protein selected from Table 21.1, SEQ ID NOS:~~
- a. ~~_____1254, 1256, and 1258;~~
- b. ~~_____1260, 1262, and 1264;~~
- c. ~~_____1266, 1268, and 1270;~~
- d. ~~_____1272, 1274, and 1276;~~
- e. ~~_____1278, 1280, and 1282;~~
- f. ~~_____1284, 1286, and 1288;~~

g.	1290, 1292, and 1294;
h.	1296, 1298, and 1300;
i.	1302, 1304, and 1306;
j.	1308, 1310, and 1312;
k.	1314, 1316, and 1318;
l.	1320, 1322, and 1324;
m.	1326, 1328, and 1330;
n.	1332, 1334, and 1336;
o.	1338, 1340, and 1342;
p.	1344, 1346, and 1348;
q.	1350, 1352, and 1354;
r.	1356, 1358, and 1360;
s.	1362, 1364, and 1366;
t.	1368, 1370, and 1372;
u.	1374, 1376, and 1378;
v.	1380, 1382, and 1384;
w.	1386, 1388, and 1390;
x.	1392, 1394, and 1396;
y.	1398, 1400, and 1402;
z.	1404, 1406, and 1408;
aa.	1410, 1412, and 1414;
bb.	1416, 1418, and 1420;
cc.	1422, 1424, and 1426;
dd.	1428, 1430, and 1432;
ee.	1434, 1436, and 1438;
ff.	1440, 1442, and 1444;
gg.	1446, 1448, and 1450;
hh.	1452, 1454, and 1456;
ii.	1458, 1460, and 1462;
jj.	1464, 1466, and 1468;
kk.	1470, 1472, and 1474;

ll.	1476, 1478, and 1480;
mm.	1482, 1484, and 1486;
nn.	1488, 1490, and 1492;
oo.	1494, 1496, and 1498;
pp.	1500, 1502, and 1504;
qq.	1506, 1508, and 1510;
rr.	1512, 1514, and 1516;
ss.	1518, 1520, and 1522;
tt.	1524, 1526, and 1528;
uu.	1530, 1532, and 1534;
vv.	1536, 1538, and 1540;
ww.	1542, 1544, and 1546;
xx.	1548, 1550, and 1552;
yy.	1554, 1556, and 1558;
zz.	1560, 1562, and 1564;
aaa.	1566, 1568, and 1570;
bbb.	1572, 1574, and 1576;
ccc.	1578, 1580, and 1582;
ddd.	1584, 1586, and 1588;
eee.	1590, 1592, and 1594;
fff.	1596, 1598, and 1600;
ggg.	1602, 1604, and 1606;
hhh.	1608, 1610, and 1612;
iii.	1614, 1616, and 1618;
jjj.	1620, 1622, and 1624;
kkk.	1626, 1628, and 1630;
lll.	1632, 1634, and 1636;
mmm.	1638, 1640, and 1642;
nnn.	1644, 1646, and 1648;
ooo.	1650, 1652, and 1654;
ppp.	1656, 1658, and 1660;

qqq. ————— 1662, 1664, and 1666;
 rrr. ————— 1668, 1670, and 1672;
 sss. ————— 1674, 1676, and 1678;
 ttt. ————— 1680, 1682, and 1684;
 uuu. ————— 1686, 1688, and 1690;
 vvv. ————— 1692, 1694, and 1696;
 www. ————— 1698, 1700, 1702;
 xxx. ————— 1704, 1706, and 1708;
 yyy. ————— 1710, 1712, and 1714;
 zzz. ————— 1716, 1718, and 1720;
 aaaa. ————— 1722, 1724, and 1726;
 bbbb. ————— 1728, 1730, and 1732;
 eeee. ————— 1734, 1736, and 1738;
 dddd. ————— 1740, 1742, and 1744;
 eeee. ————— 1746, 1748, and 1750;
 ffff. ————— 1752, 1754, and 1756;
 gggg. ————— 1758, 1760, and 1762;
 hhhh. ————— 1764, 1766, and 1768;
 iiii. ————— 1770, 1772, and 1774;
 jjjj. ————— 1776, 1778, and 1780;
 kkkk. ————— 1782, 1784, and 1786;
 llll. ————— 1788, 1790, and 1792;
 mmmm. ————— 1794, 1796, and 1798;
 nnnn. ————— 1800, 1802, and 1804;
 oooo. ————— 1806, 1808, and 1810;
 pppp. ————— 1812, 1814, and 1816;
 qqqq. ————— 1818, 1820, and 1822;
 rrrr. ————— 1824, 1826, and 1828;
 ssss. ————— 1830, 1832, and 1834;
 tttt. ————— 1836, 1838, and 1840;
 uuuu. ————— 1842, 1844, and 1846;

vvvv. ————— 1848, 1950, and 1852;
 wwww. ————— 1854, 1856, and 1858;
 xxxx. ————— 1860, 1862, and 1864;
 yyyy. ————— 1866, 1868, and 1870;
 zzzz. ————— 1872, 1874, and 1876;
 aaaaa. ————— 1878, 1880, and 1882;
 bbbbb. ————— 1884, 1886, and 1888;
 ccccc. ————— 1890, 1892, and 1894;
 ddddd. ————— 1896, 1898, and 1900;
 eeeee. ————— 1902, 1904, and 1906;
 fffff. ————— 1908, 1910, and 1912;
 ggggg. ————— 1914, 1916, and 1918;
 hhhhh. ————— 1920, 1922, and 1924;
 iiiii. ————— 1926, 1928, and 1930;
 jjjjj. ————— 1932, 1934, and 1936;
 kkkkk. ————— 1938, 1940, and 1942;
 llll. ————— 1944, 1946, and 1948;
 mmmmm. ————— 1950, 1952, and 1954;
 nnnnn. ————— 1956, 1958, and 1960;
 ooooo. ————— 1962, 1964, and 1966;
 ppppp. ————— 1968, 1970, and 1972;
 qqqqq. ————— 1974, 1976, and 1978;
 rrrrr. ————— 1980, 1982, and 1984;
 sssss. ————— 1986, 1988, and 1990;
 ttttt. ————— 1992, 1994, and 1996;
 uuuuu. ————— 1998, 2000, and 2002;
 vvvvv. ————— 2004, 2006, and 2008;
 wwwww. ————— 2010, 2012, and 2014;
 xxxxx. ————— 2016, 2018, and 2020;
 yyyyy. ————— 2022, 2024, and 2026;
 zzzzz. ————— 2028, 2030, and 2032;

aaaaaa. 2034, 2036, and 2038;
bbbbbb. 2040, 2042, and 2044;
cecece. 2046, 2048, and 2050;
ddddd. 2052, 2054, and 2056;
eeceee. 2058, 2060, and 2062;
fffff. 2064, 2066, and 2068;
gggggg. 2070, 2072, and 2074;
hhhhhh. 2076, 2078, and 2080;
iiiii. 2082, 2084, and 2086;
jjjjj. 2088, 2090, and 2092;
kkkkkk. 2094, 2096, and 2098;
lllll. 2100, 2102, and 2104;
mmmmm. 2106, 2108, and 2110; and
nnnnn. 2112, 2114, and 2116.