(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 March 2017 (23.03.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/049038 A3

(51) International Patent Classification:
A61K 39/395 (2006.01) *C07K 16/28* (2006.01)

(21) International Application Number:
PCT/US2016/052063

(22) International Filing Date:
16 September 2016 (16.09.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/219,578 16 September 2015 (16.09.2015) US
62/220,147 17 September 2015 (17.09.2015) US

(71) Applicant: **ABLEXIS, LLC** [US/US]; 533 Airport Boulevard, Suite 400, Burlingame, California 94010 (US).

(72) Inventors: **LIPPINCOTT, John**; c/o Ablexis, LLC, 533 Airport Boulevard, Suite 400, Burlingame, California 94010 (US). **DUEY, Dana**; c/o Ablexis, LLC, 533 Airport Boulevard, Suite 400, Burlingame, California 94010 (US).

(74) Agents: **MASHRUWALA, Mary Anne** et al.; Cooley LLP, 1299 Pennsylvania Avenue, NW, Suite 700, Washington, District of Columbia 20004 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

— *with sequence listing part of description (Rule 5.2(a))*

(88) Date of publication of the international search report:
27 April 2017

(54) Title: ANTI-CD115 ANTIBODIES

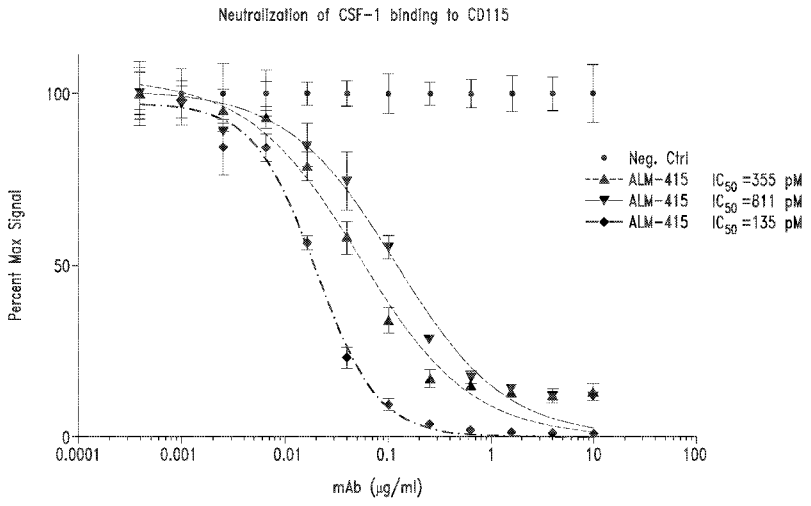

FIG. 10

(57) Abstract: The present invention provides anti-CD115 monoclonal antibodies and related compositions, which may be used in any of a variety of therapeutic and diagnostic methods for the treatment of cancer, autoimmune, and other diseases.

WO 2017/049038 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US16/52063

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - C07K 2/00, 16/10, 16/12,16/18, 16/22; A61K 39/395; A61P 35/00, 37/00; C12N 15/63 (2017.01)
CPC - C07K 16/00, 16/1018, 16/18, 16/10, 16/22; A61K 39/395
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC: C07K 2/00, 16/10, 16/12,16/18, 16/22; A61K 38/00, 39/395; A61P 35/00, 37/00; C12N 15/63; C12P 21/00 (2017.1)
CPC: C07K 16/00, 16/1018, 16/18, 16/10, 16/22; A61K 39/395

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Lens.org; Google Scholar; NCBI; EBSCO
Terms: CD115, FMS, CSFR, FIM2, HDLS, C-FMS, CD115, antibody,expression vector, bispecific, VHCDR1, VHCDR2, VHCDR3, VLCDR1, VLCDR2, VLCDR3, single-variable, single, scFv, multi-specific, Fab, whole

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2013/0216547 A1 (REGENERON PHARMACEUTICALS, INC.) 22 August 2013; paragraphs [0013]-[0014]; Table 1	1-5, and 8-14
A	US 2011/0027286 A1 (THURSTON, G et al.) 03 February 2011; paragraph [0012]	1-5, and 8-14
A	(KUROSAWA, Y et al.) Immunoglobulin Heavy Chain VHDJ Region, Partial [Homo sapiens]. National Center for Biotechnology Information. Genbank entry. 25 July 2001 [retrieved on 23 January 2017]. Retrieved from the Internet: <URL: https://www.ncbi.nlm.nih.gov/protein/21670603>; page 1	1-5, and 8-14
A	WO 2014/096333 A1 (MORPHOSYS AG) 26 June 2014; Table 3	1-5, and 8-14
A	US 2009/0155164 A1 (BRASEL, K.A. et al.) 18 June 2009; SEQ ID NO: 352 & 1516; Table 3b, 4b, 4c	1-5, and 8-14
A	US 2006/0246071 A1 (GREEN, L. et al.) 2 November 2006; SEQ ID NO: 109	4
A	US 2014/0322757 A1 (FIVE PRIME THERAPEUTICS, INC.) 30 October 2014; entire document	1-5, and 8-14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 February 2017 (21.02.2017)	08 MAR 2017
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US16/52063

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
-***-Please see supplemental page-***-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Groups I+, Claims 1-14; SEQ ID NO: 109 (VH), SEQ ID NO: 436 (VHCDR1), SEQ ID NO: 868 (VHCDR2), SEQ ID NO: 1300 (VHCDR3); SEQ ID NO: 325 (VL), SEQ ID NO: 652 (VLCDR1), SEQ ID NO: 1084 (VLCDR2) and SEQ ID NO: 1516 (VLCDR3)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US16/52063

-***-Continued from Box No. III: Observations where unity of invention is lacking-***-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, teh appropriate additional examination fees must be paid.

Groups I+, Claims 1-14 and SEQ ID NOs: 436, 868, 1300, 652, 1084, 1516, 109, and 325 are directed toward an isolated anti-CD115 antibody, comprising i) a heavy chain variable region comprising a VHCDR1, VHCDR2 and VHCDR3; and ii) a light chain variable region comprising a VLCDR1, VLCDR2 and VLCDR3; a polynucleotide encoding the antibody; an expression vector comprising the polynucleotide; a host cell comprising the expression vector; and a composition comprising the antibody.

The antibody, polynucleotides, host cell and composition will be searched to the extent they encompass an antibody comprising a VH encompassing SEQ ID NO: 109 (first exemplary VH), with a VHCDR1 encompassing SEQ ID NO: 436 (first exemplary VHCDR1), a VHCDR2 encompassing SEQ ID NO: 868 (first exemplary VHCDR2), and VHCDR3 encompassing SEQ ID NO: 1300 (first exemplary VHCDR3); and a LV encompassing SEQ ID NO: 325 (first exemplary VL), with a VLCDR1 encompassing SEQ ID NO: 652 (first exemplary VLCDR1), a VLCDR2 encompassing SEQ ID NO: 1084 (first exemplary VLCDR2) and a VLCDR3 encompassing SEQ ID NO: 1516 (first exemplary VLCDR3). Applicant is invited to elect additional VH and/or LV sequence(s), with specified SEQ ID NO: for each, and associated CDR(s) thereof, with specified set(s) of CDR SEQ ID NO(s), to be searched. Additional VH and/or VL sequence(s) and corresponding set(s) of CDR sequence(s) will be searched upon the payment of additional fees. It is believed that claims 1 (in-part), 2 (in-part), 3 (in-part), 4 (in-part), 5 (in-part), 8 (in-part), 9 (in-part), 10 (in-part), 11 (in-part), 12 (in-part), 13 (in-part) and 14 (in-part) encompass this first named invention and thus these claims will be searched without fee to the extent that they encompass SEQ ID NO: 109 (VH), SEQ ID NO: 436 (VHCDR1), SEQ ID NO: 868 (VHCDR2), SEQ ID NO: 1300 (VHCDR3); SEQ ID NO: 325 (VL), SEQ ID NO: 652 (VLCDR1), SEQ ID NO: 1084 (VLCDR2) and SEQ ID NO: 1516 (VLCDR3). Applicants must specify the claims that encompass any additionally elected sequences. Applicants must further indicate, if applicable, the claims which encompass the first named invention, if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched/examined. An exemplary election would be a VH encompassing SEQ ID NO: 110 (first exemplary elected VH), with a VHCDR1 encompassing SEQ ID NO: 437 (first exemplary elected VHCDR1), a VHCDR2 encompassing SEQ ID NO: 867 (first exemplary elected VHCDR2), and VHCDR3 encompassing SEQ ID NO: 1301 (first exemplary elected VHCDR3).

No technical features are shared between the sequences of Groups I+ and, accordingly, these groups lack unity a priori.

Groups I+ share the technical features including: an isolated anti-CD115 antibody, or an antigen-binding fragment thereof comprising i) a heavy chain variable region comprising a VHCDR1, a VHCDR2, and a VHCDR3 and ii) a light chain variable region comprising a VLCDR1, a VLCDR2, and a VLCDR3; a recombinant polynucleotide encoding the antibody; an expression vector comprising the recombinant polynucleotide; an isolated host cell comprising the expression vector; a composition comprising the antibody and a physiologically acceptable carrier.

However, these shared technical features are previously disclosed by US 2014/0322757 A1 to Five Prime Therapeutics Inc. (hereinafter 'Prime').

Prime discloses an isolated anti-CD115 antibody (a purified anti-CSF1R antibody (an isolated anti-CD115 antibody); paragraph [0008]) comprising i) a heavy chain variable region (comprising a heavy chain with variable region CDRs (comprising i) a heavy chain variable region); paragraphs [0014], [0016]) comprising a VHCDR1, a VHCDR2, and a VHCDR3 (comprising a VHCDR1, a VHCDR2, and a VHCDR3; paragraph [0016]) and ii) a light chain variable region (comprising a light chain with variable region CDRs (a light chain variable region); paragraphs [0014], [0016]) comprising a VLCDR1, a VLCDR2, and a VLCDR3 (comprising a VLCDR1, a VLCDR2, and a VLCDR3; paragraph [0016]); a recombinant polynucleotide encoding the antibody (a recombinant polynucleotide encoding the antibody; abstract, paragraphs [0024], [0168]); an expression vector comprising the recombinant polynucleotide (an expression vector comprising the recombinant polynucleotide; paragraphs [0024], [0064], [0168]); an isolated host cell comprising the expression vector (an isolated host cell comprising the expression vector; paragraphs [0024], [0065], [0168]); a composition comprising the antibody and a physiologically acceptable carrier (a composition comprising the antibody and a physiologically acceptable carrier; paragraph [0189]).

Since none of the special technical features of the Groups I+ inventions is found in more than one of the inventions, and since all of the shared technical features are previously disclosed by the Prime reference, unity of invention is lacking.