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C07K 19/00 (2006.01) *A61K 9/127 (2006.01)*
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(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, 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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, 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.

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[Continued on next page]

(54) Title: ERYTHROCYTE-BINDING THERAPEUTICS

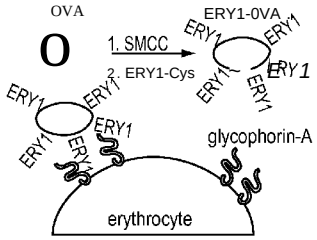

FIG. 8A

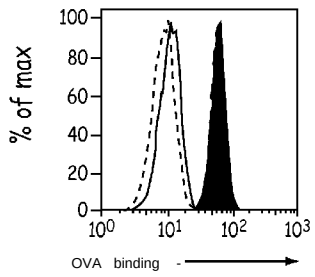

FIG. 8B

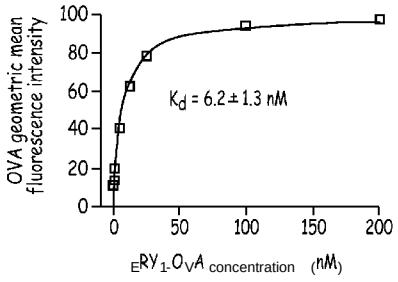

FIG. 8C

(57) Abstract: Peptides that specifically bind erythrocytes are described. These are provided as peptidic ligands having sequences that specifically bind, or as antibodies or fragments thereof that provide specific binding, to erythrocytes. The peptides may be prepared as molecular fusions with therapeutic agents, tolerizing antigens, or targeting peptides. Immunotolerance may be created by use of the fusions and choice of an antigen on a substance for which tolerance is desired. Fusions with targeting peptides direct the fusions to the target, for instance a tumor, where the erythrocyte-binding ligands reduce or entirely eliminate blood flow to the tumor by recruiting erythrocytes to the target.

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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, ML, MR, NE, SN, TD, TG).

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))*

(88) Date of publication of the international search report:
21 June 2012

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/047078

A. CLASSIFICATION OF SUBJECT MATTER

C07K 14/47(2006.01)i, C07K 16/18(2006.01)1, C07K 19/00(2006.01)1, C07K 14/755(2006.01)1, A61K 38/1 7(2006.01)1, A61K 39/395(2006.01)i, A61K 9/127(2006.01)i, A61P 35/00(2006.01)1

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)
C07K 14/47; A61K 39/015; A61K 39/002; A61K 39/00; C07K 14/445, A61K 39/35

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal), Google & PubMed

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7585508 B1 (PRENDERGAST, K. F.) 08 September 2009 See column 10.	31-43,45
Y	WD 2009-078796 A1 (MIYAC DEVELOPMENT AKTIEBOLAG) 25 June 2009 See claims 1-28; pages 16-18.	31-43,45
Y	CHASIS, J. A. et al., 'Signal transduction by glycophorin A: role of extracellular and cytoplasmic domains in a modulatable process', J. Cell Biol., Oct. 1988, Vol. 107, No. 4, pp. 1351-1357 See abstract; reagents.	43
A	US 2006-0153881 A1 (NARUM, D. L. et al.) 13 July 2006 See abstract.	31-43,45
A	US 06120770 A (ADAMS, J. H. et al.) 19 September 2000 See abstract.	31-43,45

☐ 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 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
26 APRIL 2012 (26.04.2012)	**01 MAY 2012 (01.05.2012)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
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Seo-gu, Daejeon 302-701, Republic of Korea
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Authorized officer
Park, Jung Min
Telephone No. 82-42-481-8291

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/047078

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.: 12-30, 53-59
because they relate to subject matter not required to be searched by this Authority, namely:

Claims 12-30, 53-59 pertain to methods of treatment of the human body by therapy, and thus relate to a subject matter which this International Searching Authority is not required to search under Article 17(2)(a)(i) of the PCT and Rule 39.1(iv) of the Regulations under the PCT.

2. ☒ Claims Nos.: **1-11,** 30, 44, 49, 55, 62
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:

A sequence listing in electronic form was not furnished to this Authority. Therefore, a meaningful search on claims 1-11, 30, 44, 49, 55, 62 could not be carried out.

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. Ill 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:

See Extra Sheet.

1. ☐ As all required addtional 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 an additional fee, this Authority did not invite payment of any additional fee.

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.:

31-43, 45

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/US2011/047078

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7585508 B1	08.09.2009	EP 0630407 A1	28. 12 . 1994
		EP 0630407 B1	02. 08 ,2000
		GB 2268494 A	12. 0 1 , 1994
		GB 9219562 DO	28. 10 , 1992
		US 201 1-0082075 A1	07. 04,,201 1
		WO 93-18160 A1	16. 09 . 1993
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		CA 2708942 A1	25. 06 ,2009
		CN 101945666 A	12. 0 1 ,201 1
		EP 2219669 A1	25. 08.2010
		EP 2219669 A4	09. 03.201 1
		JP 201 1-5075 11 A	10. 03 ,201 1
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US 2006-0153881 A 1	13 .07 .2006	US 2002-0127241 A1	12. 09 .2002
		US 7303751 B2	04. 12 ,2007
US 06120770 A	19 .09 .2000	None	

INTERNATIONAL SEARCH REPORT

International application No.
PCTYUS2011/047078

Group I. Claims 31-43, 45 relate to a composition comprising: a molecular fusion that comprises a tolerogenic antigen and an erythrocyte-binding moiety that specifically binds an erythrocyte in the patient and thereby links the antigen to the erythrocyte.

Group II. Claims 46-48, 50-52 relate to a composition comprising: an erythrocyte-binding moiety that specifically binds an erythrocyte joined to an entity chosen from the group consisting of a synthetic polymer, a branched synthetic polymer, and a particle.

Group III. Claims 60, 61, 63-65 relate to a medicament for embolizing a tumor in a patient comprising: a composition that comprises a molecular fusion of an erythrocyte-binding moiety and a tumor-homing ligand, wherein the tumor-homing ligand is an antibody, antibody fragment, a single chain antigen binding domain (ScFv), or peptide ligand that is directed to specifically bind a target chosen from the group consisting of a tumor and tumor microvasculature, and wherein the erythrocyte-binding moiety comprises a peptide ligand, an antibody, an antibody fragment, an ScFv, or an aptamer that specifically binds erythrocytes .

Group IV. Claims 66-68 relate to a single chain antigen binding domain (scFv) comprising a peptide ligand that specifically binds an erythrocyte.

The only common technical feature between Groups I—IV is the erythrocyte-binding moiety. However, the feature lacks novelty with respect to the following documents : (A) US 7585508 Bl, (B) US 2006/0153881 Al, (C) US 6120770 A , (D) US 4894347 A . Thus, there is no technical relationship left over the prior art among the groups, leaving the groups without a single general inventive concept. Hence, there is a lack of unity "a posteriori"(PCT Rules 13.1 and 13.2).