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C12Q 1/68 (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, 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, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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:** CELL SURFACE MARKER AND METHODS OF USE THEREOF

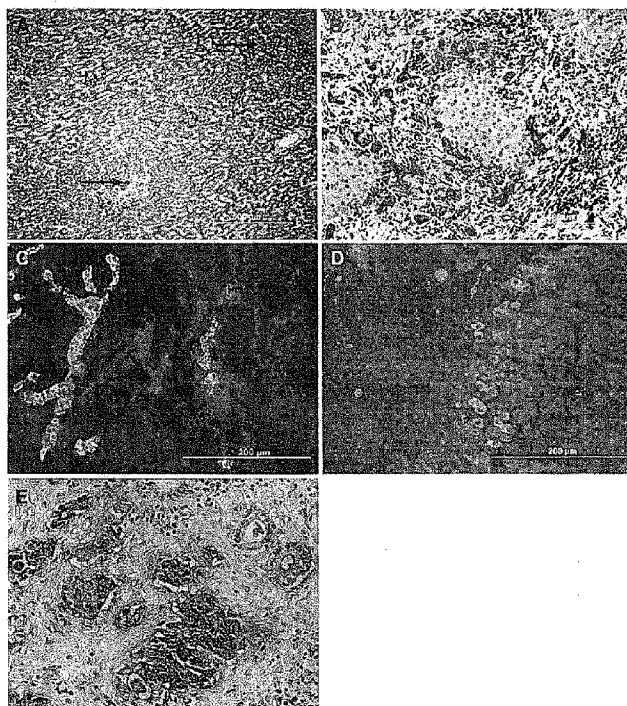


Figure 1

(57) **Abstract:** The present invention provides biomarkers comprising GCTM-5 antigen for detection and screening of cancer, as well as a distinct population of cells identified by the expression pattern of GCTM-5, diagnostic methods for utilizing the biomarkers and reagents for detecting the biomarkers.



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).

— *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))*

Published:

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

(88) Date of publication of the international search report:

20 March 2014

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/46436

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.:

Group I: Claims 1-32

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

International application No.

PCT/US13/46436

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01N 33/53; C12Q 1/68; C12N 5/074 (2014.01)

USPC - 435/7.1, 325; 424/93.7

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(8): G01N 33/53, 33/574; C12Q 1/68; C12N 5/074 (2014.01)

USPC: 435/7.1, 4, 332, 326, 325, 370; 424/93.7, 93.1, 141.2,

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)

MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); ScienceDirect; ProQuest; Google; Google Scholar; 'pancreatic cancer,' sample, 'GCTM-5,' computer, algorithm, cancer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2004/099432 A1 (CHAN, DW et al.) November 18, 2004; abstract; page 2, lines 2-8; page 31, lines 26-27; page 44, lines 15-16; page 45, lines 15-16; page 50, lines 10-17; page 55, lines 22-33; page 56, lines 4-5; Claim 1	1-32
Y	US2007/0218059 A1 (PERA, M et al.) September 20, 2007; paragraphs [0004], [0038], [0076], [0089], [0094], [0105]	1-32
Y	US 2008/0286284 A1 (MADDON, PJ et al.) November 20, 2008; paragraphs [0211], [0213]	12, 31
Y	US 2004/0009492 A1 (KIM, MK et al.) January 15, 2004; paragraphs [0057], [0058], [0095]	13, 32

☐ Further documents are listed in the continuation of Box C.


* 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

09 January 2014 (09.01.2014)

Date of mailing of the international search report

17 JAN 2014

Name and mailing address of the ISA/US

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PCT OSP: 571-272-7774

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, the appropriate additional examination fees must be paid.

Group I: Claims 1-32 are directed toward a method for detecting cancer in a sample obtained from a subject, comprising: a) obtaining the sample from the subject; b) detecting expression or presence of a biomarker in the sample, wherein the biomarker is a GCTM-5 epitope; and c) analyzing the results of (b) via a computer generated algorithm to characterize the one or more cells of the sample which are positive for the biomarker as cancer, thereby detecting cancer; and a method for detecting and characterizing a subpopulation of cells in a sample, comprising: a) detecting expression or presence of a biomarker of one or more cells in the sample, wherein the biomarker is a GCTM-5 epitope; and b) analyzing the results of (a) via a computer generated algorithm to characterize the one or more cells of the sample which are positive for the biomarker as a subpopulation of progenitor cells, thereby detecting and characterizing the subpopulation of cells in the sample.

Group II, Claims 33-46 are directed toward an isolated antibody which specifically binds native GCTM-5 epitope of mucin-line glycoprotein FCGBP; and a method of isolating a progenitor subpopulation of cells from a sample, comprising: a) contacting the sample with an agent that specifically binds a biomarker present on a subpopulation of progenitor cells present in the sample to form a plurality of cellular complexes, wherein the biomarker is native GCTM-5 epitope of FCGBP; and b) isolating the cellular complexes from the sample, thereby isolating the progenitor subpopulation of cells.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical features of Group I include detecting cancer in a sample obtained from a subject, comprising: a) obtaining the sample from the subject and analyzing the results via a computer generated algorithm to characterize the one or more cells of the sample which are positive for the biomarker as cancer, thereby detecting cancer; and detecting and characterizing a subpopulation of cells, which is not present Group II; the special technical features of Group II including an isolated antibody which specifically binds native GCTM-5 epitope of mucin-line glycoprotein FCGBP; and a method of isolating a progenitor subpopulation of cells from a sample, wherein the biomarker is native GCTM-5 epitope of FCGBP; and isolating the cellular complexes, thereby isolating the progenitor subpopulation of cells.

Groups I-II share the technical features including a method for a subpopulation of progenitor cells from a sample, comprising: detecting expression or presence of a biomarker in the sample, wherein the biomarker is a GCTM-5 epitope.

However, these shared technical elements are previously disclosed by US 2007/0218059 A1 to Pera, et al. (hereinafter 'Pera'). Pera discloses a method for a subpopulation (a method for a subpopulation; paragraph [0047]) of progenitor cells (stem cells (progenitor cells); paragraph [0047]) from a sample (sample; paragraph [0047]), comprising: detecting expression or presence of a biomarker in the sample (detecting expression or presence of a biomarker in the sample; paragraph [0048]), wherein the biomarker is a GCTM-5 epitope (a cell marker that binds to a GCTM-5; abstract, paragraph [0048]).

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US13/46436

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing filed or furnished:

a. (means)

☐

on paper

☒

in electronic form

b. (time)

☐

in the international application as filed

☐

together with the international application in electronic form

☒

subsequently to this Authority for the purposes of search

2. ☒ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

3. Additional comments: