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- 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))

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25 March 2010



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(54) Title: THREE-DIMENSIONAL MICROFLUIDIC PLATFORMS AND METHODS OF USE THEREOF

(57) Abstract: Provided are methods and devices for formation and study of three-dimensional biological systems, including prokaryotic and eukaryotic cell migration, proliferation, and differentiation.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/039434**A. CLASSIFICATION OF SUBJECT MATTER***C12Q 1/02(2006.01)i, G01N 33/48(2006.01)i, C12M 1/34(2006.01)i*

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: C12Q 1/02, C12Q 1/24, C12Q 1/68, G01N 33/48, G01N 33/53, C12M 1/00, C12M 1/34, C12M 3/00, C12M 3/06, C12N 5/00, C12N 5/06, C12N 5/08

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 since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KOMPASS(KIPO Internal): microfluidic, scaffold, substrate, fluid-flow, three dimension, transparent, space and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006-0154361 A1 (WIKSWO, J. P. et al.) 13 JULY 2006 See abstract; figures 1A, 1B, 10C, 10D.	1-4, 29, 31-42, 48-56
A	WO 2008-040015 A2 (UNIVERSITY OF WASHINGTON) 03 APRIL 2008 See abstract; claims 1, 5, 8, 16	1-4, 29, 31-42, 48-56
A	US 2007-0099294 A1 (YANG, S. -T. et al.) 03 MAY 2007 See abstract; figure 3; claims 1, 6-8, 14, 15, 18, 26.	1-4, 29, 31-42, 48-56
A	US 2005-0260745 A1 (DOMANSKY, K. et al.) 24 NOVEMBER 2005 See abstract; figures 3, 4, 7; claims 1-8.	1-4, 29, 31-42, 48-56
A	US 2004-0142411 A1 (KIRK, G. L. et al.) 22 JULY 2004 See abstract; figures 3B, 10, 14; claims 1, 3-6, 11.	1-4, 29, 31-42, 48-56
A	US 2003-0175824 A1 (PISHKO, M. V. et al.) 18 SEPTEMBER 2003 See abstract; claims 1-3, 11, 12, 30, 51.	1-4, 29, 31-42, 48-56
A	US 2003-0049839 A1 (ROMERO-ORTEGA, M. I. et al.) 13 MARCH 2003 See abstract; figure 1, 8, 9; claims 1-4, 12-14, 31, 37-39, 42.	1-4, 29, 31-42, 48-56

 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

22 JANUARY 2010 (22.01.2010)

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02 FEBRUARY 2010 (02.02.2010)

Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/039434**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.: 6, 13, 14, 24, 25, 28
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:

The subject matter of claims 6, 13, 14, 24, 25, 28 is not considered to be clear, since the claims 6, 13, 14, 24, 25, 28 are respectively referring to one of the claims 5, 12, 23, 27, which are not drafted in accordance with the second and the third sentence of Rule 6.4(a).
3. Claims Nos.: 5, 7-12, 15-23, 26, 27, 30, 47
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:

<See Extra Sheet>

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 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.: 1-4, 29, 31-42, 48-56

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/US2009/039434

Patent document cited in search report	Publication date	Patent family member(s)	Publication date		
US 2006-0154361 A1	13.07.2006	EP 1546299 A2	29.06.2005		
		EP 1545750 A2	29.06.2005		
		EP 1543101 A2	22.06.2005		
		EP 1539919 A1	15.06.2005		
		US 2006-0166354 A1	27.07.2006		
		US 2006-0141607 A1	29.06.2006		
		US 2006-0099705 A1	11.05.2006		
		WO 2004-020341 A2	11.03.2004		
		WO 2004-020342 A2	11.03.2004		
		WO 2004-020573 A1	11.03.2004		
		WO 2004-020590 A2	11.03.2004		
		WO 2008-040015 A2	03.04.2008	EP 2069068 A2	17.06.2009
				US 2008-0102478 A1	01.05.2008
US 2007-0099294 A1	03.05.2007	None			
US 2005-0260745 A1	24.11.2005	EP 1773978 A2	18.04.2007		
		WO 2005-123950 A2	29.12.2005		
US 2004-0142411 A1	22.07.2004	CA 2503186 A1	06.05.2004		
		CA 2484058 A1	06.11.2003		
		CA 2429056 A1	20.06.2002		
		CA 2503203 A1	06.05.2004		
		EP 1578194 A2	28.09.2005		
		EP 1558076 A2	03.08.2005		
		EP 1502108 A1	02.02.2005		
		EP 1339838 A2	03.09.2003		
		JP 2006-503581 A	02.02.2006		
		JP 2005-523710 A	11.08.2005		
		JP 2004-515776 A	27.05.2004		
		JP 2006-507815 A	09.03.2006		
		US 2003-068637 A1	10.04.2003		
		US 2003-073228 A1	17.04.2003		
		US 06699665 B1	02.03.2004		
		US 06803205 B2	12.10.2004		
		US 06811968 B2	02.11.2004		
		US 06818403 B2	16.11.2004		
		US 06844184 B2	18.01.2005		
		US 06864065 B2	08.03.2005		
		US 06893851 B2	17.05.2005		
		US 06921660 B2	26.07.2005		
		US 06967074 B2	22.11.2005		
US 06982171 B2	03.01.2006				
US 07001740 B2	21.02.2006				

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/039434

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 07033819 B2	25.04.2006
		US 07033821 B2	25.04.2006
		US 07123764 B2	17.10.2006
		US 07166459 B2	23.01.2007
		US 07211209 B2	01.05.2007
		US 07326563 B2	05.02.2008
		US 07351575 B2	01.04.2008
		US 07364899 B2	29.04.2008
		US 07371563 B2	13.05.2008
		US 07374906 B2	20.05.2008
		US 07419823 B2	02.09.2008
		WO 02-48676 A2	20.06.2002
		WO 03-012392 A2	13.02.2003
		WO 03-012726 A1	13.02.2003
		WO 03-062920 A2	31.07.2003
		WO 03-078565 A1	25.09.2003
		WO 03-091730 A1	06.11.2003
		WO 2004-038367 A2	06.05.2004
		WO 2004-038368 A2	06.05.2004
US 2003-0175824 A1	18.09.2003	WO 03-061585 A2	31.07.2003
US 2003-0049839 A1	13.03.2003	US 2007-0100358 A2	03.05.2007
		US 2007-0010831 A1	11.01.2007
		US 2008-0300691 A1	04.12.2008
		WO 2005-046457 A2	26.05.2005

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/039434

<Continuation of Box No. III>

D1: US 2006-154361 A1 (WIKSWO, P. J. et al.) 13 July 2006

This ISA found multiple inventions as follows:

Group 1: Microfluidic device comprising a scaffold having dimension of at least 1 μ m in three-dimensional space, and the method using the microfluidic device(Claims 1-4, 29, 31-42, 48-56)

Group 2: Method of fabricating a device comprising the step of contacting a liquid scaffold material with a substrate(Claims 43-46)

The only common technical feature among groups 1 and 2 is a microfluidic device having a scaffold; and a substrate comprising a first fluid-flow path, a second fluid-flow path, and post; and optically transparent material, which is already known from the prior art D1(see Abstract, Figure 1A, Claims 1, 2, 4-6, 30-32), and is not considered to contribute over the prior art as a whole.

Therefore, the requisite unity of invention (PCT Rule 13.1) no longer exists in as much as a technical relationship involving one or more of the same or corresponding special technical features in the sense of PCT Rule 13.2 does not exist between the subject matter of the above groups of invention.