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

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Published:
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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: NANOPARTICLES AND THEIR USE FOR MULTIFUNCTIONAL BIOIMAGING

(57) Abstract: The present invention relates to fluorescent, radio-opaque and magnetic quantum nanoparticles, useful as multifunctional contrast agents or probes for *in vivo* bioimaging, and methods of their use. The invention provides for multifaceted bioimaging (*e.g.*, intra-arterial pre-operative brain mapping and broad based *in vivo* diagnostic imaging), including imaging of various cell types, such as stem cells.

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A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K49/00 A61K49/18 A61K49/14 A61K49/08 A61K49/04

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)
A61K

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 practical, search terms used)
EPO-Internal, INSPEC, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/89585 A (BIOCRYSTAL LTD [US]) 29 November 2001 (2001-11-29) example 1	1-50
Y	DUBERTRET B ET AL: "In vivo imaging of quantum dots encapsulated in phospholipid micelles" SCIENCE, vol. 298, no. 5599, 29 November 2002 (2002-11-29), pages 1759-1762, XP002255863 ISSN: 0036-8075 the whole document	1-50

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[X] Further documents are listed in the continuation of Box C.

[X] 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 document but published on or after the international filing date

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 June 2007	22/06/2007

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Dullaart, Anwyn

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	YANG H ET AL: "EFFICIENT AND PHOTOSTABLE ZNS-PASSIVATED CDS:MN LUMINESCENT NANOCRYSTALS" ADVANCED FUNCTIONAL MATERIALS, vol. 14, no. 2, February 2004 (2004-02), pages 152-156, XP001046237 ISSN: 1616-301X abstract page 155, left-hand column	1-50
Y	YANG HEESUN ET AL: "Enhanced photoluminescence from CdS:Mn/ZnS core/shell quantum dots" APPLIED PHYSICS LETTERS, vol. 82, no. 12, 24 March 2003 (2003-03-24), pages 1965-1967, XP012033608 ISSN: 0003-6951 abstract page 1965, left-hand column page 1967, right-hand column	1-50
Y	TANAKA M: "Photoluminescence properties of Mn<2+>-doped II-VI semiconductor nanocrystals" JOURNAL OF LUMINESCENCE, vol. 100, no. 1-4, December 2002 (2002-12), pages 163-173, XP004396347 ISSN: 0022-2313 abstract page 164 figures page 171, right-hand column, last paragraph - page 172, left-hand column	1-50
Y	BALLOU B ET AL: "NONINVASIVE IMAGING OF QUANTUM DOTS IN MICE" BIOCONJUGATE CHEMISTRY, vol. 15, no. 1, January 2004 (2004-01), pages 79-86, XP001047128 ISSN: 1043-1802 abstract page 79, right-hand column - page 80, left-hand column figures 1-7	1-50

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GAO X ET AL: "Molecular profiling of single cells and tissue specimens with quantum dots" TRENDS IN BIOTECHNOLOGY, vol. 21, no. 9, September 2003 (2003-09), pages 371-373, XP004450443 ISSN: 0167-7799 abstract page 371, right-hand column, last paragraph - page 372, left-hand column, line 3 page 372, left-hand column, last paragraph - right-hand column, paragraph 2	1-50
Y	LARSON D R ET AL: "WATER-SOLUBLE QUANTUM DOTS FOR MULTIPHOTON FLUORESCENCE IMAGING IN VIVO" SCIENCE, vol. 300, no. 5624, 2003, pages 1434-1436, XP008053308 ISSN: 0036-8075 abstract figure 2 page 1436, middle column, last paragraph	1-50
Y	WU X ET AL: "IMMUNOFLUORESCENT LABELING OF CANCER MARKER HER2 AND OTHER CELLULAR TARGETS WITH SEMICONDUCTOR QUANTUM DOTS" NATURE BIOTECHNOLOGY, vol. 21, January 2003 (2003-01), pages 41-46, XP008053284 ISSN: 1087-0156 abstract figures page 45	1-50
Y	CHAN W C W ET AL: "Luminescent quantum dots for multiplexed biological detection and imaging" CURRENT OPINION IN BIOTECHNOLOGY, vol. 13, no. 1, February 2002 (2002-02), pages 40-46, XP002256995 ISSN: 0958-1669 abstract page 41 page 42, right-hand column, last paragraph - page 44; figure 3	1-50

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KIM S ET AL: "NEAR-INFRARED FLUORESCENT TYPE II QUANTUM DOTS FOR SENTINEL LYMPH NODE MAPPING" NATURE BIOTECHNOLOGY, vol. 22, no. 1, January 2004 (2004-01), pages 93-97, XP008053357 ISSN: 1087-0156 abstract figures page 95, right-hand column	1-50
Y	JAISWAL J K ET AL: "LONG-TERM MULTIPLE COLOR IMAGING OF LIVE CELLS USING QUANTUM DOT BIOCONJUGATES" NATURE BIOTECHNOLOGY, vol. 21, no. 1, January 2003 (2003-01), pages 47-51, XP009065963 ISSN: 1087-0156 abstract figures page 51	1-50
Y	AKERMAN M E ET AL: "NANOCRYSTAL TARGETING IN VIVO" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE USA, vol. 99, no. 20, 16 September 2002 (2002-09-16), pages 12617-12621, XP001182896 ISSN: 0027-8424 abstract figures page 12620, right-hand column, paragraph DISCUSSION	1-50
T	SHARMA ET AL: "Nanoparticles for bioimaging" ADVANCES IN COLLOID AND INTERFACE SCIENCE, vol. 123-126, 17 November 2006 (2006-11-17), pages 471-485, XP005848174 ISSN: 0001-8686 the whole document	1-50
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 2004/066361 A (TRUSTEES OF THE UNIVERSITY OF [US]; PENG XIAOGANG [US]; LI JIANQUING [) 5 August 2004 (2004-08-05) claims	1-50
P,Y	GAO X ET AL: "In vivo cancer targeting and imaging with semiconductor quantum dots" NATURE BIOTECHNOLOGY, vol. 22, no. 8, 18 July 2004 (2004-07-18), pages 969-976, XP002387133 ISSN: 1087-0156 abstract figures page 975	1-50
E	WO 2005/041747 A (TRUSTEES OF THE UNIVERSITY OF [US]; LUZZI DAVID [US]; SMITH BRIAN W [U) 12 May 2005 (2005-05-12) claims	1-50
E	US 2005/220714 A1 (KAUZLARICH SUSAN [US] ET AL) 6 October 2005 (2005-10-06) examples claims	1-50

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Box 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. [X] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claims 18-40 comprise a diagnostic method practised on the human/animal body, a search has been carried out and based on the alleged effects of the compound/composition.

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 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:

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.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0189585 A	29-11-2001	AU 6486001 A	03-12-2001
WO 2004066361 A	05-08-2004	EP 1590171 A2	02-11-2005
WO 2005041747 A	12-05-2005	WO 2005018681 A1	03-03-2005
US 2005220714 A1	06-10-2005	NONE	