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FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE,  
SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,  
GQ, GW, 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))
- of inventorship (Rule 4.17(iv))

**Published:**

- with international search report
- 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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14 December 2006

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: APPARATUS AND METHODS FOR DETECTING TARGET ANALYTE

(57) Abstract: This invention relates to apparatus and methods to detect a target analyte in a test sample by forming a fluorescent complex comprising the target analyte and a probe. The fluorescence decay and/or lifetime changes upon complex formation. The apparatus includes a pulsed light source and a digitizer to measure fluorescent decay and/or lifetime of the fluorophore in the complex



WO 2005/040759 A3

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US04/36401

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(8): C12M 3/00( 2006.01)

USPC: 435/287.2  
 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)  
 U.S. : 435/287.2

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)  
 Please See Continuation Sheet

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,962,045 (PICOZZA et al.) 09 OCTOBER 1990 (09.10.1990), see columns 3 and 4.	1-6
Y	US 6,632,655 B1 (MEHTA et al.) 14 October 2003 (14.10.2003), see column 33, second and fifth paragraphs.	1-6
Y	US 2003/0022207 A1 (BALASUBRAMANIAN et al.) 30 January 2003 (30/01.2003), see paragraphs 0050 and 0064.	1-6

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	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  
 13 September 2006 (13.09.2006)

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/36401

## 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 Continuation 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 additional fees, this Authority did not invite payment of any 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.: 1-8

- 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/US04/36401

### BOX 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, claim(s) 1-11, drawn to an apparatus.

Group II, claim(s) 12-22, 31, and 32, drawn to method of measuring fluorescence decay and/or lifetime of the fluorophore.

Group III, claim(s) 22-32, drawn to method for determining the presence of heterozygous polynucleotide alleles in a test sample.

In addition to the different inventions set forth above, this application contains claims directed to more than one species of the generic inventions. These species are deemed to lack unity of invention because they are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In order for more than one species to be examined, the appropriate additional examination fees must be paid. The species are as follows:

Substrate configuration is:

- Bead arrays
- Microarrays
- Membranes
- Microwell plates
- Encoded particles

The pulsed-light source is:

- Laser
- Microlaser
- Solid-state passively q-switched laser
- Light emitting diode (LED)
- Laser diode

The species of probe and target are:

- a) Polynucleotides
- b) Protein
- c) Antibody-antigen
- d) Antigen-antibody.

Fluorophore comprises:

- Derivatives of naphthalene
- Cyanine
- Pyridyloxazole
- Dapoxyl
- Pyrene

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US04/36401

Indole  
Bisbenzimidazole  
Phenanthridine  
Acridine.

The claims are deemed to correspond to the species listed above in the following manner:

Claim 7 teaches substrate configuration species.

Claim 8 lists microlaser.

Claim 9 lists solid-state passively q-switched laser.

Claim 10 lists LED.

Claim 11 lists LD.

Claim 19 lists probe and target as being polynucleotides.

Claim 20 lists probe and target as being proteins.

Claim 21 lists probe and target as being antigen and antibody; or antibody and antigen, respectively.

Claim 31 lists species of what fluorophore comprises.

The following claim(s) are generic:

In Group I: Claims 1-6.

In Group II: Claims 12-18.

In Group III: Claims 22-30

The inventions listed as Groups I-III 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 method of Group II and III does not require the use of the device of invention of claim 1 (Group I).

The species listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: The nucleic acids/polynucleotides, which are comprised of nucleotide bases, lack the same or corresponding technical feature of proteins, which are comprised of amino acids. Said polynucleotides and proteins are not comprised of the support nor are comprised of the fluorophore derivative.

Continuation of B. FIELDS SEARCHED Item 3:

EAST (Databases: USPAT, USPGP, EPO, JPO, Derwent), Search terms: fluorophore same nucleotide same array and @pd<"20031028", fluorophore same nucleotide same array and laser and @pd<"20031028", fluorophore same nucleotide same array same laser and @pd<"20031028"; nucleotide same fluorescen\$ adj decay and @pd<"20031028"