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English

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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

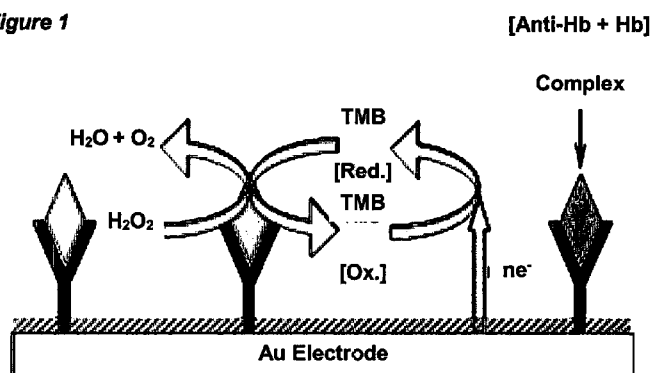
Published:

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

[Continued on next page]

(54) Title: METHODS FOR DETECTING PROTEINS OR BINDING PARTNERS FOR PROTEINS

Figure 1



(57) Abstract: Provided is a method for the detection of a protein, such as haemoglobin or a metalloprotein, in a test sample, such as faecal sample, the method comprising the steps of: (i) exposing the sample to a surface having a binding moiety and permitting the binding moiety to specifically immobilise the protein in the sample; (ii) permitting the immobilised protein to catalyse a reaction of a first reagent with a second reagent; and (iii) detecting, such as electrochemically detecting, the reaction of the first reagent with the second reagent. The binding moiety may be provided on the surface of an electrode. Also provided is a method for detecting an analyte in a sample, which analyte is a binding partner for a protein, the method comprising the steps of: (i) providing a protein that is immobilised, such as specifically immobilised, to a surface; (ii) exposing the immobilised protein to the analyte in the sample, thereby to bind the analyte to the immobilised protein; (iii) exposing the immobilised protein to a first reagent and a second reagent; and (iv) detecting, such as electrochemically detecting, the reaction of first reagent with the second reagent, wherein the immobilised protein is a catalyst for the reaction of the first reagent with the second reagent in the absence of the analyte, and the binding of the analyte to the immobilised protein alters the catalytic activity of the protein for the reaction of the first reagent with the second reagent. The binding moiety can be an antibody. The first reagent can be tetramethylbenzidine and the second reagent can be hydrogen peroxide.





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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 (Rule 48.2(h))*

**(88) Date of publication of the international search report:**  
23 April 2015

**INTERNATIONAL SEARCH REPORT**

International application No PCT/GB2014/052620
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
INV. C12Q1/00	B01L3/00	G01N33/543
G01N33/72	C12Q1/28	G01N27/00
ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) G01N C12Q		
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) EPO-Internal, BIOSIS, EMBASE, WPI Data		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 506 114 A (SANGHA JANGBIR S [US]) 9 April 1996 (1996-04-09) cited in the application	1, 4-7, 9, 15, 17
Y	abstract; claims	2, 3, 8, 10-14, 16, 18
Y	----- WO 2010/055306 A1 (MODE DIAGNOSTICS LTD [GB]; BENOIT VINCENT [GB]) 20 May 2010 (2010-05-20) abstract; claims	2, 3, 10, 11, 13, 14, 16
	----- -/-	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 but 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  10 November 2014	Date of mailing of the international search report  23/02/2015	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Stricker, J	

INTERNATIONAL SEARCH REPORT

International application No  
PCT/GB2014/052620

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>DONG-MIN KIM ET AL: "Disposable Amperometric Glycated Hemoglobin Sensor for the Finger Prick Blood Test", ANALYTICAL CHEMISTRY, vol. 85, no. 13, 2 July 2013 (2013-07-02), pages 6536-6543, XP055151954, ISSN: 0003-2700, DOI: 10.1021/ac401411y the whole document</p>	2,10-14
Y	<p>-----                      WO 2011/023949 A2 (UNIV GLASGOW [GB]; WILSON RAB [GB]; COOPER JONATHAN M [GB]; REBOUD JUL) 3 March 2011 (2011-03-03) cited in the application the whole document</p>	8,12,18
T	<p>-----                      GREGOIRE HERZOG ET AL: "Electrochemical strategies for the label-free detection of amino acids, peptides and proteins", THE ANALYST, vol. 132, no. 7, 1 July 2007 (2007-07-01), pages 615-32, XP055151993, ISSN: 0003-2654, DOI: 10.1039/b701472d abstract chapter 3.2 on p.625-627</p> <p>-----</p>	

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/GB2014/052620

## 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:

see additional 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 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.:

1-18

### 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.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18

A method for determining the presence of a protein in a sample, whereby said protein catalyses a reaction of a first reagent with a second reagent and said reaction is detected

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2. claims: 19-30

A method for detecting an analyte in a sample, whereby the binding of the analyte to an immobilised protein alters the catalytic activity of the protein for the reaction of a first reagent with a second reagent

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No <b>PCT/GB2014/052620</b>
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Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
US 5506114	A	09-04-1996	NONE	
WO 2010055306	A1	20-05-2010	CN 102282468 A	14-12-2011
			EP 2366107 A1	21-09-2011
			US 2011213229 A1	01-09-2011
			WO 2010055306 A1	20-05-2010
WO 2011023949	A2	03-03-2011	AU 2010288268 A1	19-04-2012
			CA 2771961 A1	03-03-2011
			CN 102612405 A	25-07-2012
			EP 2470297 A2	04-07-2012
			US 2012149126 A1	14-06-2012
			WO 2011023949 A2	03-03-2011