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[Continued on next page]

(54) Title: DNA VACCINE, METHOD OF INDUCING THE IMMUNE RESPONSE, METHOD OF IMMUNISATION, ANTIBODIES SPECIFICALLY RECOGNISING THE H5 HAEMAGGLUTININ OF AN INFLUENZA VIRUS AND USE OF THE DNA VACCINE

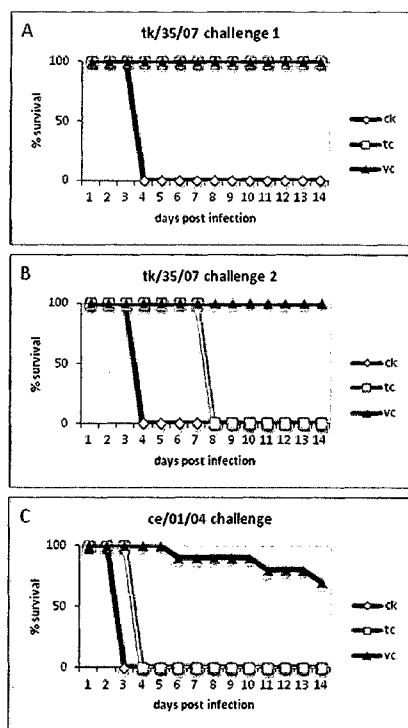


Fig. 7

(57) Abstract: The object of the invention is a DNA vaccine, method of inducing the immune response, antibodies specifically recognising the haemagglutinin H5 of an influenza virus and application of the DNA vaccine. According to the invention, one or two-fold immunisation of hens with DNA vaccine containing a cDNA encoding the modified H5 haemagglutinin HA protein, i.e. with the deletion of the cleavage site between HA subunits (this provides for greater safety of the vaccines). Moreover, the encoding region of the HA is modified in such a way that protein production in the bird cells should achieve maximal yield. The main modification is codon optimisation for the hens and deletion of the site of proteolytic cleavage between subunits HA1 and HA2.

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, 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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A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED
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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, Sequence Search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	RAO SRINIVAS ET AL: "Multivalent HA DNA Vaccination Protects against Highly Pathogenic H5N1 Avian Influenza Infection in Chickens and Mice", PLOS ONE, PUBLIC LIBRARY OF SCIENCE, US, vol. 3, no. 6, 1 June 2008 (2008-06-01), pages E2432-1, XP002527215, ISSN: 1932-6203, DOI: 10.1371/JOURNAL.PONE.0002432	1,3,4, 6-13
Y	abstract page 2, left-hand column, paragraph 2 page 7, left-hand column, paragraph 4; figure 1 page 7, right-hand column, paragraph 4 page 8, left-hand column, paragraph 2 ----- -/--	2,5

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 16 September 2013	Date of mailing of the international search report 27/09/2013
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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 Loubradou, Gabriel
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INTERNATIONAL SEARCH REPORT

International application No
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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.
X	WO 2009/092038 A1 (US GOV HEALTH & HUMAN SERV [US]; RAO SRINIVAS [US]; NABEL GARY J [US];) 23 July 2009 (2009-07-23) cited in the application	1,3,4, 6-13
Y	page 17, paragraph [0047] - page 8, paragraph [0048]; examples	2,5
Y	----- JIANG ET AL: "Enhanced protective efficacy of H5 subtype avian influenza DNA vaccine with codon optimized HA gene in a pCAGGS plasmid vector", ANTIVIRAL RESEARCH, ELSEVIER BV, NL, vol. 75, no. 3, 13 June 2007 (2007-06-13), pages 234-241, XP022114363, ISSN: 0166-3542, DOI: 10.1016/J.ANTIVIRAL.2007.03.009 abstract	1-13
Y	----- TORO H ET AL: "Protection of chickens against avian influenza with nonreplicating adenovirus-vectored vaccine", POULTRY SCIENCE, CHAMPAIGN, IL, US, vol. 88, no. 4, 1 April 2009 (2009-04-01), pages 867-871, XP008119748, ISSN: 0032-5791, DOI: 10.3382/PS.2008-00333 abstract	1-13
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Y	----- JEONG HO PARK ET AL: "Protection of chicken against very virulent IBDV provided by in ovo priming with DNA vaccine and boosting with killed vaccine and the adjuvant effects of plasmid-encoded chicken interleukin-2 and interferon-[gamma]", JOURNAL OF VETERINARY SCIENCE, vol. 10, no. 2, 1 January 2009 (2009-01-01), page 131, XP055079018, ISSN: 1229-845X, DOI: 10.4142/jvs.2009.10.2.131 cited in the application abstract	5
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INTERNATIONAL SEARCH REPORT

International application No

PCT/PL2012/000095

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>SONG J M ET AL: "Protective immunity against H5N1 influenza virus by a single dose vaccination with virus-like particles", VIROLOGY, ELSEVIER, AMSTERDAM, NL, vol. 405, no. 1, 15 September 2010 (2010-09-15), pages 165-175, XP027180037, ISSN: 0042-6822 [retrieved on 2010-07-28] abstract page 171, right-hand column, paragraph 1</p> <p style="text-align: center;">-----</p>	1-13
X	<p>YIXIN CHEN ET AL: "Broad Cross-Protection against H5N1 Avian Influenza Virus Infection by Means of Monoclonal Antibodies that Map to Conserved Viral Epitopes", THE JOURNAL OF INFECTIOUS DISEASES, vol. 199, no. 1, 1 January 2009 (2009-01-01), pages 49-58, XP055023361, ISSN: 0022-1899, DOI: 10.1086/594374 abstract</p> <p style="text-align: center;">-----</p>	10-12
X	<p>EP 2 284 260 A1 (UNIV HOKKAIDO NAT UNIV CORP [JP]; FUJIREBIO KK [JP]) 16 February 2011 (2011-02-16) examples</p> <p style="text-align: center;">-----</p>	10-12
A	<p>DATABASE EMBL [Online]</p> <p>1 July 2002 (2002-07-01), "Gallus gallus breed broiler interleukin-2 precursor (IL2) mRNA, complete cds.", XP002712861, retrieved from EBI accession no. EM STD:AF483599 Database accession no. AF483599 sequence</p> <p style="text-align: center;">-----</p>	5
A	<p>DATABASE EMBL [Online]</p> <p>31 March 2007 (2007-03-31), "Influenza A virus (A/whooper swan/Germany/R88/06(H5N1)) HA gene for hemagglutinin, genomic RNA", XP002712862, retrieved from EBI accession no. EM STD:AM403462 Database accession no. AM403462 sequence</p> <p style="text-align: center;">-----</p> <p style="text-align: center;">-/--</p>	2

INTERNATIONAL SEARCH REPORT

International application No
PCT/PL2012/000095

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/115133 A2 (MERIAL LTD [US]; BUBLLOT MICHEL [FR]; REYNARD FREDERIC [FR]; LE GROS FR) 7 October 2010 (2010-10-07) the whole document -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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