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60/981,719 22 October 2007 (22.10.2007) US
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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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- Published:**
— with international search report (Art. 21(3))
- (88) **Date of publication of the international search report:**
30 December 2009

(54) **Title:** RESPIRATORY SYNCYTIAL VIRUS VACCINE BASED ON CHIMERIC PAPILLOMAVIRUS VIRUS-LIKE PARTICLES OR CAPSOMERES

(57) **Abstract:** The present invention is directed to a chimeric papillomavirus virus-like particle (VLP) or capsomere including an L1 polypeptide and, optionally, an L2 polypeptide, and a respiratory syncytial virus (RSV) protein or polypeptide fragment thereof comprising a first epitope, where the RSV protein or polypeptide fragment thereof is attached to one or both of the L1 and L2 polypeptides. Chimeric proteins, genetic constructions, and recombinant vectors and host cells suitable for expression of the constructs and making of the chimeric VLPs or capsomeres are also disclosed. Use of the VLPs or capsomeres, or a pharmaceutical composition containing the same, is contemplated for inducing a protective immune response against RSV.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/80822

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - C12N 7/00, 7/01(2009.01) USPC - 435/235.1 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) USPC: 435/235.1 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC: 424/93.2, 184.1, 199.1, 204.1, 208.1; 435/5, 235.1, 320.1, 456; 536/23.1 (see search terms below) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWEST(USPT,PGPB,EPAB,JPAB); GoogleScholar Search Chimeric papillomavirus, VLP, respiratory syncytial virus, capsomere, epitopes, in-frame gene fusion, helix 4 deletion, helices, helical, antigenic, C-terminus, N-terminus																						
C. DOCUMENTS CONSIDERED TO BE RELEVANT																						
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>US 2005/0123563 A1 (DORANZ et al.) 9 June 2005 (09.06.2005) para [0035-[0036], [0141], [0145], [0192]-[0193], [0237], [0432], [0483], [0484], [0634], [0662], [0706], [0755], [0994]-[0995]</td> <td>1-21, 23, 25-29, 32-33, 35-39, 54-55, 60-65, 69-70, 73 and 76-79</td> </tr> <tr> <td>Y</td> <td>DOORBAR et al. Identification of Proteins Encoded by the L1 and L2 Open Reading Frames of Human Papillomavirus 1a. JOURNAL OF VIROLOGY, Sept. 1987, pg 2793-2799, Abstract; pg 2796, first col</td> <td>1-21, 23, 25-29, 32-33, 35-39, 54-55, 60-65, 69-70, 73 and 76-79</td> </tr> <tr> <td>Y</td> <td>US 2003/0133942 A1 (SEGAL) 17 July 2003 (17.07.2003) para [0007]</td> <td>2, 6-7, 9, 25-29, 64-65, 69-70 and 73</td> </tr> <tr> <td>Y</td> <td>Pinard et al. Modifications and deletions of helices within the hairpin ribozyme-substrate complex: An active ribozyme lacking helix 1. RNA (2004), Vol 10:395-402, Fig 1, pg 391, col 2</td> <td>5-7</td> </tr> <tr> <td>Y</td> <td>US 5,618,536 A (LOWY et al.) 8 April 1997 (08.04.1997) col 6, ln 22-35</td> <td>8-9</td> </tr> <tr> <td>Y</td> <td>US 2007/0212374 A1 (SCHLEGEL et al.) 13 September 2007 (13.09.2007) para [0008]</td> <td>11</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	US 2005/0123563 A1 (DORANZ et al.) 9 June 2005 (09.06.2005) para [0035-[0036], [0141], [0145], [0192]-[0193], [0237], [0432], [0483], [0484], [0634], [0662], [0706], [0755], [0994]-[0995]	1-21, 23, 25-29, 32-33, 35-39, 54-55, 60-65, 69-70, 73 and 76-79	Y	DOORBAR et al. Identification of Proteins Encoded by the L1 and L2 Open Reading Frames of Human Papillomavirus 1a. JOURNAL OF VIROLOGY, Sept. 1987, pg 2793-2799, Abstract; pg 2796, first col	1-21, 23, 25-29, 32-33, 35-39, 54-55, 60-65, 69-70, 73 and 76-79	Y	US 2003/0133942 A1 (SEGAL) 17 July 2003 (17.07.2003) para [0007]	2, 6-7, 9, 25-29, 64-65, 69-70 and 73	Y	Pinard et al. Modifications and deletions of helices within the hairpin ribozyme-substrate complex: An active ribozyme lacking helix 1. RNA (2004), Vol 10:395-402, Fig 1, pg 391, col 2	5-7	Y	US 5,618,536 A (LOWY et al.) 8 April 1997 (08.04.1997) col 6, ln 22-35	8-9	Y	US 2007/0212374 A1 (SCHLEGEL et al.) 13 September 2007 (13.09.2007) para [0008]	11	<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>
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* 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 another 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 8 April 2009 (08.04.2009)	Date of mailing of the international search report 22 APR 2009																					
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774																					

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	US 2006/0057158 A1 (BUCHHOLZ et al.) 16 March 2006 (16.03.2006) para[0050]	17
Y	US 2004/0091479 A1 (NIELAND et al.) 13 May 2004 (13.05.2004) para[0067]	32-33
Y	Chen et al. Spatial and Dynamic Interactions between Phospholamban and the Canine Cardiac Ca ₂ Pump Revealed with Use of Heterobifunctional Cross-linking Agents. THE JOURNAL OF BIOLOGICAL CHEMISTRY, 2003, Vol 278, No 48, pp. 48348-48356	77-79
Y	US 2003/0198645 A1 (PAGE et al.) 23 October 2003 (23.10.2003) para [0360], [0361]	79

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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.: 22, 24, 30-31, 34, 56-59, 71-72, and 74-75
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 applicant failed to comply with the ISA/225 mailed on 05 November 2008. A CRF was submitted on 19 March 2009. However, this CRF contained errors and was not timely. Accordingly, the USPTO cannot supply a search for the sequences listed in this application. No valid CRF was filed in response to the ISA/225 of 05 November 2008. The CRF filed on 19 March 2009 was untimely and defective and was not entered.

3. Claims Nos.: 40-53 and 66-68
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:

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 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.:

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.