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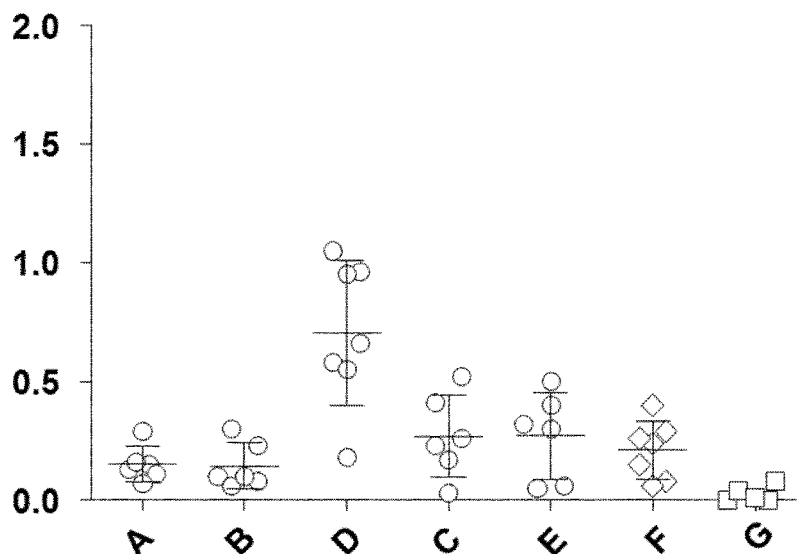
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[Continued on next page]

(54) Title: ADJUVANTED FORMULATIONS OF BOOSTER VACCINES

FIGURE 1

(57) Abstract: The invention improves Tdap vaccines by including a TLR agonist in them. This agonist can provide stronger protection, longer-lasting protection, and/or can reduce the amount of antigen which is required to achieve a particular immune response.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

— *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))*

Published:

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

(88) Date of publication of the international search report:

10 April 2014

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/054672

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.:

1-6, 9-13, 17-23(all partially)

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/EP2013/054672

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K39/08 A61K39/05 A61K39/116
ADD.

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 practicable, search terms used)

EP0-Internal, WPI Data, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	J. GEURTSSEN ET AL: "Lipopolysaccharide Analogs Improve Efficacy of Acellular Pertussis Vaccine and Reduce Type I Hypersensitivity in Mice", CLINICAL AND VACCINE IMMUNOLOGY, vol. 14, no. 7, 1 July 2007 (2007-07-01), pages 821-829, XP055060805, ISSN: 1556-6811, DOI: 10.1128/CVI.00074-07 abstract page 822, left-hand column, paragraph 3 - paragraph 7 page 827, left-hand column, paragraph 4 - paragraph 6 ----- -/--	1-6, 9-13, 17-23

☒ 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

"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

30 January 2014

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/054672

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 98/19702 A1 (SMITHKLINE BEECHAM BIOLOG [BE]; FLORENT PATRICK [BE]; STEPHENNE JEAN []) 14 May 1998 (1998-05-14) page 2, line 7 - page 3, line 19 page 5, line 1 - page 6, line 2; claims; examples -----	1-6, 9-13, 17-23
Y	WO 2010/067201 A2 (NOVARTIS AG [CA]; CONTORNI MARIO [IT]) 17 June 2010 (2010-06-17) page 2, paragraph 1 - paragraph 5 page 4, paragraph 2 - paragraph 3 page 9 - page 12 page 18, last paragraph - page 22, paragraph 6 -----	1-6, 9-13, 17-23
Y	WO 2008/020328 A2 (NOVARTIS AG [CH]; FRINGS ERIC [DE]) 21 February 2008 (2008-02-21) page 1, line 8 - line 17 page 6, line 30 - line 36; examples -----	1-6, 9-13, 17-23
A	SUGAI ET AL: "A CpG-containing oligodeoxynucleotide as an efficient adjuvant counterbalancing the Th1/Th2 immune response in diphtheria-tetanus-pertussis vaccine", VACCINE, ELSEVIER LTD, GB, vol. 23, no. 46-47, 16 November 2005 (2005-11-16), pages 5450-5456, XP27651991, ISSN: 0264-410X, DOI: 10.1016/J.VACCINE.2004.09.041 abstract page 5451, right-hand column, paragraph 3 page 5455, left-hand column, paragraph 2 -----	1-6, 9-13, 17-23
A	VAN DUIN D ET AL: "Triggering TLR signaling in vaccination", TRENDS IN IMMUNOLOGY, ELSEVIER LTD. * TRENDS JOURNALS, GB, vol. 27, no. 1, 1 January 2006 (2006-01-01), pages 49-55, XP028058539, ISSN: 1471-4906, DOI: 10.1016/J.IT.2005.11.005 [retrieved on 2006-01-01] page 5455, left-hand column, paragraph 2; table 2 ----- -/--	1-6, 9-13, 17-23

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/054672

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	BANUS SANDER ET AL: "The role of Toll-like receptor-4 in pertussis vaccine-induced immunity", BMC IMMUNOLOGY, BIOMED CENTRAL, LONDON, GB, vol. 9, no. 1, 22 May 2008 (2008-05-22), page 21, XP021033213, ISSN: 1471-2172 page 1218, left-hand column, paragraph 2 -----	1-6, 9-13, 17-23
A	M. MANSOUR ET AL: "Improved Efficacy of a Licensed Acellular Pertussis Vaccine, Reformulated in an Adjuvant Emulsion of Liposomes in Oil, in a Murine Model", CLINICAL AND VACCINE IMMUNOLOGY, vol. 14, no. 10, 22 August 2007 (2007-08-22), pages 1381-1383, XP055025140, ISSN: 1556-6811, DOI: 10.1128/CVI.00143-07 abstract -----	1-6, 9-13, 17-23
A	FOLKERT STEINHAGEN ET AL: "TLR-based immune adjuvants", VACCINE, ELSEVIER LTD, GB, vol. 29, no. 17, 1 August 2010 (2010-08-01), pages 3341-3355, XP028380413, ISSN: 0264-410X, DOI: 10.1016/J.VACCINE.2010.08.002 [retrieved on 2010-08-07] page 3344, right-hand column, paragraph 1 - page 3346, paragraph 4 -----	1-6, 9-13, 17-23
A	RACKE M K ET AL: "PTX cruiser: driving autoimmunity via TLR4", TRENDS IN IMMUNOLOGY, ELSEVIER LTD. * TRENDS JOURNALS, GB, vol. 26, no. 6, 1 June 2005 (2005-06-01), pages 289-291, XP027724307, ISSN: 1471-4906 [retrieved on 2005-06-01] page 289, right-hand column, last paragraph - page 291, left-hand column, last paragraph ----- -/--	1-6, 9-13, 17-23

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/054672

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GRÖNDAHL-YLI-HANNUKSELA KIRSI ET AL: "Gene polymorphism in toll-like receptor 4: effect on antibody production and persistence after acellular pertussis vaccination during adolescence.", THE JOURNAL OF INFECTIOUS DISEASES 15 APR 2012, vol. 205, no. 8, 1 March 2012 (2012-03-01) , pages 1214-1219, XP002696252, ISSN: 1537-6613 page 1218, left-hand column, paragraph 2 -----	1-6, 9-13, 17-23
A	GARCON-N ET AL: "Development and evaluation of AS04, a novel and improved adjuvant system containing MPL and aluminum salt", 1 January 2006 (2006-01-01), IMMUNOPOTENTIATORS IN MODERN VACCINES,, PAGE(S) 161 - 177, XP009140248, the whole document -----	1-6, 9-13, 17-23
A,P	WO 2012/117377 A1 (NOVARTIS AG [CH]; BAUDNER BARBARA [IT]; SKIBINSKI DAVID A G [SG]; SING) 7 September 2012 (2012-09-07) page 20, line 19 - page 21, line 21; claims; examples -----	1-6, 9-13, 17-23

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/054672

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INTERNATIONAL SEARCH REPORT

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International application No

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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-6, 9-13, 17-23(all partially)

Subject-matter of claims 1 to 6, 9 to 13 and 17 to 23
wherein the composition comprises a TLR4 agonist

2. claims: 7, 8(completely); 1-6, 9-13, 17-23(partially)

Subject-matter of claims 1 to 13 and 17 to 23 wherein the
composition comprises a TLR7 agonist

3. claims: 1-6, 9-13, 17-23(all partially)

Subject-matter of claims 1 to 6, 9 to 13 and 17 to 23
wherein the composition comprises a TLR2 agonist

4. claims: 1-6, 9-13, 17-23(all partially)

Subject-matter of claims 1 to 6, 9 to 13 and 17 to 23
wherein the composition comprises a TLR8 agonist

5. claims: 14-16(completely); 17-23(partially)

Subject-matter of claims 14 to 23 wherein the composition
comprises an oil-in-water emulsion adjuvant.

6. claims: 24-29

Subject-matter of claims 24 to 29
