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Published:

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

— *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))*

— *with sequence listing part of description (Rule 5.2(a))*

(88) **Date of publication of the international search report**:
5 August 2010

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(54) **Title**: RECOMBINANT PROTEIN BODIES AS IMMUNOGEN-SPECIFIC ADJUVANTS

(57) **Abstract**: An immunogen-specif ic adjuvant for a vaccine or inoculum is disclosed. The adjuvant is comprised of particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein that contains two portions peptide-linked together. A first portion is a protein body-inducing sequence (PBIS) and a second portion is a T-cell stimulating immunogenic polypeptide whose sequence is that of a pathogenic polypeptide sequence present in or induced by a vaccine or inoculum. The adjuvant, when used as an inoculum in a host animal without a prior priming vaccination or inoculation, does not induce production of antibodies or T cell activation to the pathogenic sequence.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/063223

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07K14/025 C07K14/425 C12N15/62 C07K14/16 A61K39/00

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)
C07K 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 practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/096192 A (ERA BIOTECH S L [ES]; HEIFETZ PETER BERNARD [US]; LLOMPART ROYO BLANCA) 30 August 2007 (2007-08-30) claims 29-35	1-4,9

☐ 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 document 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	Date of mailing of the international search report
8 February 2010	11/06/2010

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2009/063223

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.:

see additional sheets

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: 1-4; 9 (partially)

A method for inducing an T-cell mediated immune response in a subject in need thereof against an immunogenic peptide which comprises the administration to a subject in need thereof of a vaccine selected from the group of
(i) a particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide and
(ii) a nucleic acid molecule that encodes a fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide.

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2. claim: 5; 9 (partially)

A method for inducing an T-cell mediated immune response in a subject in need thereof against an immunogenic peptide which comprises the administration to a subject in need thereof of a vaccine selected from the group of
(i) a particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide and
(ii) a nucleic acid molecule that encodes a fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide,
characterised in that the immunogenic polypeptide is selected from HPV E7, HIV-1 gag or HIV-1 pol.

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3. claim: 6; 9 (partially)

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

A method for inducing an T-cell mediated immune response in a subject in need thereof against an immunogenic peptide which comprises the administration to a subject in need thereof of a vaccine selected from the group of
(i) a particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide and
(ii) a nucleic acid molecule that encodes a fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide,
characterised in that the RPBLAs are assembled in vitro from the purified recombinant fusion protein.

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4. claims: 7, 8; 9 (partially)

A method for inducing an T-cell mediated immune response in a subject in need thereof against an immunogenic peptide which comprises the administration to a subject in need thereof of a vaccine selected from the group of
(i) a particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide and
(ii) a nucleic acid molecule that encodes a fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a immunogenic polypeptide,
characterised in that the administration step is preceded by a priming vaccination or inoculation step using a composition comprising the immunogenic polypeptide or a nucleic acid encoding the immunogenic polypeptide.

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5. claims: 10-23

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

An immunogen-specific adjuvant for a vaccine or inoculum that is comprised of particulate recombinant protein body-like assemblies (RPBLAs) that contain a recombinant fusion protein, said recombinant fusion protein containing two portions peptide-linked together in which a first portion is a protein body-inducing sequence (PBIS) and a second portion is a T-cell stimulating immunogenic polypeptide whose sequence is that of a pathogenic polypeptide sequence present in or induced by a vaccine or inoculum,
said adjuvant at the concentration used in an inoculum without a prior priming vaccination or inoculation not inducing production of antibodies or T cell activation to the pathogenic sequence.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/063223

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007096192 A	30-08-2007	AR 066387 A1	19-08-2009
		AU 2007217723 A1	30-08-2007
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		CN 101415820 A	22-04-2009
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