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(71) Applicants (for all designated States except US): **UNIVERSITÄTSKLINIKUM HAMBURG-EPPENDORF** [DE/DE]; Martinistr. 52, 20246 Hamburg (DE). **UNIVERSITÄT ZÜRICH** [CH/CH]; Prorektorat MNW, Rämistrasse 71, CH-8006 Zürich (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **JELCIC, Ilijas** [DE/CH]; Eidmattstr. 60, CH-8032 Zürich (CH). **MARTIN, Roland** [DE/CH]; Voltastrasse 80, CH-8044 Zürich (CH). **SCHIPPLING, Sven** [DE/CH]; Döltschihalde 15, CH-8055 Zürich (CH). **SOSPEDRA, Mireia** [DE/CH]; Voltastrasse 80, CH-8044 Zürich (CH). **YOUSEF, Sara** [DE/DE]; Borsteler Chaussee 9, 22453 Hamburg (DE).

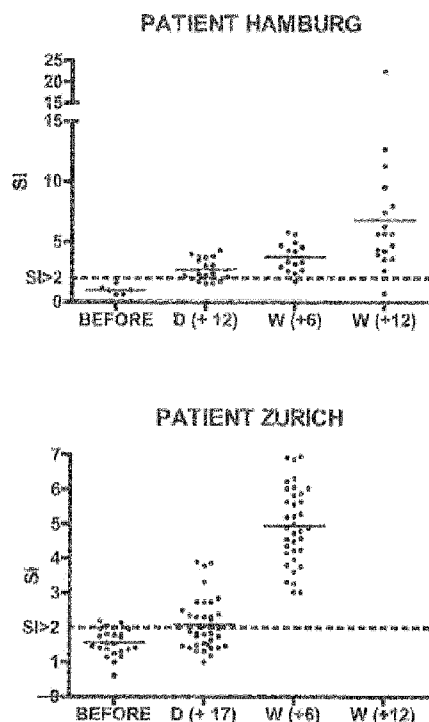
(74) Agent: **UEXKÜLL & STOLBERG**; Beselerstr. 4, 22607 Hamburg (DE).

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[Continued on next page]

(54) Title: POLYOMA VIRUS JC PEPTIDES AND PROTEINS IN VACCINATION AND DIAGNOSTIC APPLICATIONS

Fig. 11



(57) Abstract: The present invention relates to the field of vaccination or immunization, in particular therapeutic vaccination, and diagnosis. Pharmaceutical compositions and kits capable of eliciting a protective immune response against polyoma virus JC (JCV) are disclosed, which may be used e.g., for therapy or for prevention of progressive multifocal leukoencephalopathy (PML) and/or progressive multifocal leukoencephalopathy-immune reconstitution inflammatory syndrome (PML-IRIS). Individuals in danger of such PML or PML-IRIS may, e.g., be immuno-compromised or immunosuppressed patients or patients having an autoimmune disease eligible for immunosuppressive treatment. The invention also relates to compositions comprising at least one CD4⁺ epitope of a JCV protein and to therapeutic, prophylactic and diagnostic uses thereof.



(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, 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).

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K38/04 A61K38/16 C07K14/025
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 C07K

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2005 341864 A (JAPAN SCIENCE & TECH AGENCY) 15 December 2005 (2005-12-15) the whole document & "machine-based translation of the abstract of JP2005341864" In: "machine-based translation of the abstract of JP2005341864", 1 December 2005 (2005-12-01), XP055044936, & "machine-based full-text translation of JP2005341864" In: "machine-based full-text translation of JP2005341864", 1 December 2005 (2005-12-01), XP055044941, ----- -/--	1,2,7, 12-14 1-32



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

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"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

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Date of mailing of the international search report

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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

Merlos, Ana Maria

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/064445

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 03/106626 A2 (UNIV TEMPLE [US]; KHALILI KAMEL [US]) 24 December 2003 (2003-12-24) page 12, line 19 - page 13, line 25 page 5, line 12 - line 26; claims 26, 27 page 19, line 14 - line 23 -----	1,2,7, 12,13
X	SHISHIDO-HARA Y ET AL: "Analysis of capsid formation of human polyomavirus JC (Tokyo-1 strain) by a eukaryotic expression system: splicing of late RNAs, translation and nuclear transport of major capsid protein VP1, and assembly", JOURNAL OF VIROLOGY, THE AMERICAN SOCIETY FOR MICROBIOLOGY, US, vol. 74, no. 4, 1 February 2000 (2000-02-01), pages 1840-1853, XP002997063, ISSN: 0022-538X, DOI: 10.1128/JVI.74.4.1840-1853.2000 page 1841, left-hand column, paragraph 2; figures 1, 2 page 1843, left-hand column, paragraph 4 - page 1844, left-hand column, paragraph 1 -----	1-5
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/064445

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/064445

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	TAN C S ET AL: "Progressive multifocal leukoencephalopathy and other disorders caused by JC virus: clinical features and pathogenesis", LANCET NEUROLOGY, LANCET PUBLISHING GROUP, LONDON, GB, vol. 9, no. 4, 1 April 2010 (2010-04-01), pages 425-437, XP027155413, ISSN: 1474-4422 [retrieved on 2010-04-01] the whole document	1-32
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A	----- GHEUENS SARAH ET AL: "Role of CD4+ and CD8+ T-cell responses against JC virus in the outcome of patients with progressive multifocal leukoencephalopathy (PML) and PML with immune reconstitution inflammatory syndrome", JOURNAL OF VIROLOGY, vol. 85, no. 14, 1 July 2011 (2011-07-01), pages 7256-7263, XP009154706, AMERICAN SOCIETY FOR MICROBIOLOGY, US ISSN: 1098-5514 the whole document	1-32
A	----- GASNAULT JACQUES ET AL: "Critical role of JC virus-specific CD4 T-cell responses in preventing progressive multifocal leukoencephalopathy", AIDS, vol. 17, no. 10, 4 July 2003 (2003-07-04), pages 1443-1449, XP002520358, LONDON, GB ISSN: 0269-9370, DOI: 10.1097/00002030-200307040-00004 the whole document	1-32
4 2	A ----- US 2004/259767 A1 (NAGASHIMA KAZUO [JP] ET AL) 23 December 2004 (2004-12-23) the whole document -----	1-32

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2012/064445

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.:

1-32(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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-32(partially)

A protein or peptide or pharmaceutical kit comprising at least one CD4+ epitope derived from JCV which epitope comprises SEQ ID NO: 1 (agnoprotein) and its use for treating PML

2. claims: 1-32(partially)

A protein or peptide or pharmaceutical kit comprising at least one CD4+ epitope derived from JCV which epitope is selected from the group comprising SEQ ID NOS: 2-45 and 77-92 (VP1) and its use for treating PML

3. claims: 1-32(partially)

A protein or peptide or pharmaceutical kit comprising at least one CD4+ epitope derived from JCV which epitope is selected from the group comprising SEQ ID NOS: 46-55 (VP2) and its use for treating PML

4. claims: 1-32(partially)

A protein or peptide or pharmaceutical kit comprising at least one CD4+ epitope derived from JCV which epitope is selected from the group comprising SEQ ID NOS: 56-69 (LTA_g) and its use for treating PML

5. claims: 1-32(partially)

A protein or peptide or pharmaceutical kit comprising at least one CD4+ epitope derived from JCV which epitope is selected from the group comprising SEQ ID NOS: 70-76 (StAg)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/064445

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