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(71) Applicant: **ENTEROME S.A.** [FR/FR]; 94/96 avenue Ledru-Rollin, 75011 Paris (FR).

(72) Inventors: **CHENE, Laurent**; 8 Rue du Cas Rouge Hainault, 45170 Neuville aux Bois (FR). **BONNY, Christophe**; 153 Boulevard Voltaire, 75011 Paris (FR). **STROZZI, Francesco**; 9 rue des Arquebusiers, Paris Paris (FR).

(74) Agent: **VON STOSCH, Andreas** et al.; Prinzregentenstr. 22, 80538 München (DE).

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Declarations under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

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:
28 November 2019 (28.11.2019)

(54) Title: ANTIGENIC PEPTIDES FOR PREVENTION AND TREATMENT OF CANCER

(57) Abstract: The present invention relates to antigen-based immunotherapy, in particular cancer immunotherapy. In particular, the present invention provides antigenic peptides, which are distinct from, but have amino acid similarity to, fragments of human tumor antigens. The present invention further provides immunogenic compounds, nanoparticles, cells and pharmaceutical compositions comprising such antigenic peptides and nucleic acids encoding such antigenic peptides.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/059329

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K39/00
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)
EPO-Internal, 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.
A	John Fikes: "2 The Rational Design of T-cell Epitopes with Enhanced Immunogenicity" In: Morse M.A., Clay T.M., Lyerly H.K. (eds): "HANDBOOK OF CANCER VACCINES", 1 January 2004 (2004-01-01), HUMANA PRESS, XP002768241, ISBN: 978-1-58829-209-4 pages 11-17, DOI: 10.1007/978-1-59259-680-5_2, page 12, paragraph 2 - page 14, paragraph 5	1,2, 4-10, 13-56

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[X] Further documents are listed in the continuation of Box C.

[X] 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	Date of mailing of the international search report
14 October 2019	28/10/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Noë, Veerle

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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.
A	PARKHURST ET AL: "Improved induction of melanoma-reactive CTL with peptides from the melanoma antigen gp100 modified at HLA-A*0201-binding residues", THE JOURNAL OF IMMUNOLOGY, vol. 157, no. 6, 15 September 1996 (1996-09-15), pages 2539-2548, XP002096010, THE AMERICAN ASSOCIATION OF IMMUNOLOGISTS, US ISSN: 0022-1767 the whole document	1,2, 4-10, 13-56
A	TOURDOT S ET AL: "A general strategy to enhance immunogenicity of low-affinity HLA-A2.1-associated peptides: Implication in the identification of cryptic tumor epitopes", EUROPEAN JOURNAL OF IMMUNOLOGY, vol. 30, 1 January 2000 (2000-01-01), pages 3411-3421, XP002237054, WILEY VCH, WEINHEIM ISSN: 0014-2980, DOI: 10.1002/1521-4141(2000012)30:12<3411::AID-IMMU3411>3.0.CO;2-R cited in the application the whole document	1,2, 4-10, 13-56
A	VERTUANI SIMONA ET AL: "Improved immunogenicity of an immunodominant epitope of the HER-2/neu protooncogene by alterations of MHC contact residues", THE JOURNAL OF IMMUNOLOGY, vol. 172, no. 6, 15 March 2004 (2004-03-15), pages 3501-3508, XP002768242, THE AMERICAN ASSOCIATION OF IMMUNOLOGISTS, US ISSN: 0022-1767, DOI: 10.4049/JIMMUNOL.172.6.3501 the whole document	1,2, 4-10, 13-56
A	EGUCHI JUNICHI ET AL: "Identification of interleukin-13 receptor alpha2 peptide analogues capable of inducing improved antiglioma CTL responses", CANCER RESEARCH, vol. 66, no. 11, 1 June 2006 (2006-06-01), pages 5883-5891, XP002768180, , AMERICAN ASSOCIATION FOR CANCER RESEARCH, US ISSN: 0008-5472, DOI: 10.1158/0008-5472.CAN-06-0363 the whole document	1,2, 4-10, 13-56

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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 2004/067023 A2 (SURVAC AS [DK]; STRATEN EIVIND PER THOR [DK]; ANDERSEN MADS HALD [DK]) 12 August 2004 (2004-08-12) sequences 4,5,10 page 1, paragraph 1 page 4 - page 5, paragraph 1 page 8, paragraph 4 page 9, paragraph 5 - page 10, paragraph 1 page 11, paragraph 2 - page 13, paragraph 3 page 15, last paragraph example 5	1,2, 4-10, 13-56
X	EP 2 189 471 A1 (ONCOTHERAPY SCIENCE INC [JP]) 26 May 2010 (2010-05-26) sequences 1,3,5,7,16,22,23 the whole document	1,2,4-7, 9,11, 13-56
X	DATABASE UniParc [Online] 12 April 2017 (2017-04-12), XP002794914, Database accession no. UPI00095AB054 the whole document	1,2,4-7, 9,11
E	WO 2019/072871 A2 (ENTEROME S A [FR]) 18 April 2019 (2019-04-18) claims 34,43,48,49,51,56,; sequence 75	1,2,4-7, 9,11, 13-56
A	KAZUNORI YOKOMINE ET AL: "The forkhead box M1 transcription factor as a candidate of target for anti-cancer immunotherapy", INTERNATIONAL JOURNAL OF CANCER, vol. 126, no. 9, 1 May 2010 (2010-05-01), pages 2153-2163, XP055083488, ISSN: 0020-7136, DOI: 10.1002/ijc.24836 the whole document	1,2,4-7, 9,11, 13-56

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2019/059329

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.:

10, 11(completely); 1, 2, 4-9, 13-56(partially)

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 10(completely); 1, 2, 4-9, 13-56(partially)

An antigenic peptide from BIRC5, consisting or comprising SEQ ID No:32; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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2. claims: 1, 2, 4-9, 13-56(all partially)

An antigenic peptide from BIRC5, consisting or comprising SEQ ID No:30; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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3. claims: 1, 2, 4-7, 13-56(all partially)

An antigenic peptide from BIRC5, consisting or comprising SEQ ID No:31; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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4. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from ACPP, consisting or comprising SEQ ID No:1-4; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

5-8. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens ANKRD30A, AREG, ASCL1 or ASCL2, consisting or comprising SEQ

ID No:5-29;immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

9-15. claims: 1, 2, 4, 13-56(all partially)

an antigenic peptide from one of the tumor antigens CA9, CCNA1, CCND1, CDH17, CDH6, CDKN2A, CEACAM5, consisting or comprising SEQ ID No:33-83; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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16. claims: 1, 2, 4-8, 13-56(all partially)

An antigenic peptide from CHI3L1, consisting or comprising SEQ ID No:84-114; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

17-22. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens CHI3L2, COL11A1,CD83, CTCFL, DCT, DMRTA2 consisting or comprising SEQ ID No: 114-134; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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23. claims: 1, 2, 4, 5, 13-56(all partially)

An antigenic peptide from EGFR consisting or comprising SEQ ID No:135-150; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and

peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

24-26. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens ERBB2, ERG, ESR1 consisting or comprising SEQ ID No: 151-192; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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27. claims: 1, 2, 4-9, 13-56(all partially)

An antigenic peptide from EZH2, consisting or comprising SEQ ID No:193-194; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

28-29. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens FAP, FLT1 consisting or comprising SEQ ID No: 195-216; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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30. claims: 11(completely); 1-7, 9, 13-56(partially)

An antigenic peptide from FOXM1 consisting or comprising SEQ ID No:217-227,861-877; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

31-34. claims: 1, 2, 4, 13-56(all partially)

n antigenic peptide from one of the tumor antigens FSIP1, GAL3ST1, GPR143, HES6 consisting or comprising SEQ ID No:228-248; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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35. claims: 12(completely); 1-7, 9, 13-56(partially)

An antigenic peptide from IL13RA2 consisting or comprising SEQ ID No:249-255, 878-887; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

36-71. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens KISS1R, KLHDC8A,... TRPM8 (see table page 23-39 of the application) consisting or comprising SEQ ID No:256-518; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

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72. claims: 1, 2, 4-7, 13-56(all partially)

An antigenic peptide from TYMS consisting or comprising SEQ ID No:519-524; immunogenic compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

73-80. claims: 1, 2, 4, 13-56(all partially)

An antigenic peptide from one of the tumor antigens TYR; UPK2,... ZNF280A (see table page 23-39 of the application) consisting or comprising SEQ ID No: 525-580; immunogenic

compound comprising the peptide;a nanoparticle or cell loaded with the antigenic peptide or immunogenic compound.; a nucleic acid coding for the antigenic peptide; a host cell comprising the nucleic acid; a pharmaceutical composition, kit, combination and peptide-MHC multimer comprising the antigenic peptide, the use of the products for prevention or treatment of cancer.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/059329

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