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

[Continued on next page]

(54) Title: FUSION PROTEINS COMPRISING MODIFIED ALPHA VIRUS SURFACE GLYCOPROTEINS AND TUMOR ASSOCIATED ANTIGEN AND METHODS THEREOF

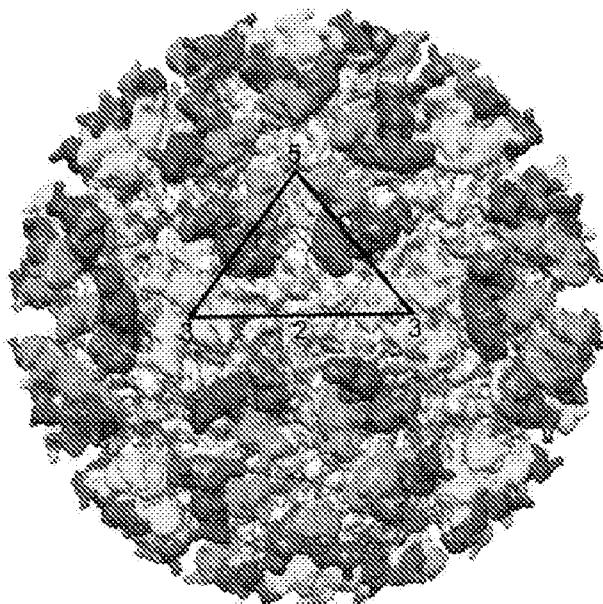


FIG 1A

(57) Abstract: The present disclosure relates to fusion proteins that comprise one or more modified alpha virus surface glycoproteins and one or more tumor specific antigens. Also disclosed are fusion proteins that comprise one or more modified alpha virus surface glycoproteins and one or more viral specific antigens. Also disclosed are fusion proteins that comprise one or more modified alpha virus surface glycoproteins. It also relates to methods to activate the immune system in cancer patients to infiltrate and kill tumor cells or cells infected with a latent virus. The present disclosure provides a platform technology that elicits a faster, broader and stronger immune response using the fusion proteins.



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- *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))* (88) **Date of publication of the international search report:**
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/023203

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A61K 39/00; A61K 39/12; A61P 35/00; A61P 37/04; C12N 15/63 (2016.01) CPC - A61K 39/0011; A61K 39/12; C07K 14/005; C12N 15/63; C12N 2770/36111 (2016.08) 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) IPC - A61K 39/00; A61K 39/12; A61P 35/00; A61P 37/04; C12N 15/63 CPC - A61K 39/0011; A61K 39/12; C07K 14/005; C12N 15/63; C12N 2770/36111 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC - 424/192.1; 424/204.1; 424/277.1; 435/455; 435/320.1; 536/23.72 (keyword delimited) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patents, Google Scholar, PubMed Search terms used: alphavirus TR339 Sindbis E1 E2 viral antigen tumor antigen		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2008/0260775 A1 (JOHNSTON et al) 23 October 2008 (23.10.2008) entire document	1, 9-11, 14, 15, 17-22, 26 --- 6-8, 12, 13, 16, 23-25, 27-30
Y	US 2012/0328655 A1 (DUBENSKY JR. et al) 27 December 2012 (27.12.2012) entire document	6, 7, 23, 24
Y	US 2004/0180354 A1 (SIMARD et al) 16 September 2004 (16.09.2004) entire document	8, 27
Y	US 2005/0130259 A1 (IDENO et al) 16 June 2005 (16.06.2005) entire document	12, 13, 25, 27-30
Y	US 2009/0075338 A1 (MOORE et al) 19 March 2009 (19.03.2009) entire document	16
Y	US 6,168,932 B1 (UCKUN et al) 02 January 2001 (02.01.2001) entire document	30
A	CHEEVER et al. "The prioritization of cancer antigens: a national cancer institute pilot project for the acceleration of translational research," Clin Cancer Res, 01 September 2009 (01.09.2009), Vol. 15, Pgs. 5323-37. entire document	1-30
☐ 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 12 October 2016		Date of mailing of the international search report 31 OCT 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300		Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/023203

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☒ furnished subsequent to the international filing date for the purposes of international search only:
 - ☒ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).
2. ☒ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
3. Additional comments:
SEQ ID NOs:1-15 were searched.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2016/023203

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.: 31
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.