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KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,  
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- with sequence listing part of description (Rule 5.2(a))

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

16 August 2018 (16.08.2018)

(54) Title: MERS CORONAVIRUS VACCINE

(57) Abstract: The present invention relates to mRNAs suitable for use as mRNA-based vaccines against infections with MERS coronaviruses. Additionally, the present invention relates to a composition comprising the mRNAs and the use of the mRNAs or the composition for the preparation of a pharmaceutical composition, especially a vaccine, e.g. for use in the prophylaxis or treatment of MERS coronavirus infections. The present invention further describes a method of treatment or prophylaxis of infections with MERS coronavirus using the mRNA sequences.



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# INTERNATIONAL SEARCH REPORT

International application No PCT/EP2017/084564
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 INV. A61K39/215 C07K14/165 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 C07K C12N G01N

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, EMBASE, 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	WO 2015/164674 A1 (MODERNA THERAPEUTICS INC [US]) 29 October 2015 (2015-10-29)  page 889 - page 890; example 20 ----- -/--	1-6, 18-20, 31-35, 37-44, 46-51, 53-83



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

3 July 2018

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17/07/2018

Name and mailing address of the ISA/

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**INTERNATIONAL SEARCH REPORT**

International application No PCT/EP2017/084564
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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	<p>K. MUTHUMANI ET AL: "A synthetic consensus anti-spike protein DNA vaccine induces protective immunity against Middle East respiratory syndrome coronavirus in nonhuman primates", SCIENCE TRANSLATIONAL MEDICINE, vol. 7, no. 301, 19 August 2015 (2015-08-19), pages 301ra132-301ra132, XP055271204, US ISSN: 1946-6234, DOI: 10.1126/scitranslmed.aac7462 the whole document</p> <p align="center">-----</p>	<p>1-6, 18-20, 31-35, 37-44, 46-51, 53-83</p>
A	<p>LANYING DU ET AL: "The spike protein of SARS-CoV - a target for vaccine and therapeutic development", NATURE REVIEWS. MICROBIOLOGY, vol. 7, no. 3, 1 March 2009 (2009-03-01), pages 226-236, XP055302112, GB ISSN: 1740-1526, DOI: 10.1038/nrmicro2090 the whole document</p> <p align="center">-----</p>	<p>1-6, 18-20, 31-35, 37-44, 46-51, 53-83</p>

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/EP2017/084564

## 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.:  
  
1-6, 18-20, 31-35, 37-44, 46-51, 53-83(all 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: 1-6, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "S" (SEQ ID Nos 16 and 2377; RNA ID: R1) and related subject-matter.

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2. claims: 1-6, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "S(V1060P, K1061P)" (SEQ ID Nos 2357 and 2373; RNA ID: R2) and related subject-matter.

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3. claims: 1-8, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "S1" (SEQ ID Nos 1463 and 2378; RNA ID: R3) and related subject-matter.

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4. claims: 1-6, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "HsIgE(1-18)\_S(18-1353)" (SEQ ID Nos 2358 and 2374; RNA ID: R4) and related subject-matter.

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5. claims: 1-8, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "HsIgE(1-18)\_S(18-1353,V1060P, K1061P)" (SEQ ID Nos 2359 and 2375; RNA ID: R5) and related subject-matter.

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6. claims: 1-6, 18-20, 31-35, 37-44, 46-51, 53-83(all partially)

mRNA construct "HsIgE(1-18)\_S(18-747)" (SEQ ID Nos 2360 and 2376; RNA ID: R6) and related subject-matter.

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- 7-251. claims: 1-83(partially)

mRNA constructs containing SEQ ID Nos. 1-15, 17-152, 1448-1462 and 1464-1548 and related subject-matter.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No  
PCT/EP2017/084564

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015164674	A1	29-10-2015	
		AU 2015249553 A1	10-11-2016
		BR 112016024644 A2	10-10-2017
		CA 2946751 A1	29-10-2015
		CN 106659803 A	10-05-2017
		EP 3134131 A1	01-03-2017
		JP 2017513956 A	01-06-2017
		SG 11201608798Y A	29-11-2016
		US 2016317647 A1	03-11-2016
		US 2016331828 A1	17-11-2016
		WO 2015164674 A1	29-10-2015
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