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61/641,448 2 May 2012 (02.05.2012) US(71) Applicant (for all designated States except US): **UNIVERSITY OF TENNESSEE RESEARCH FOUNDATION**
[US/US]; 1534 White Avenue, Suite 403, Knoxville, Tennessee 37996-1527 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **DALE, James, B.**
[US/US]; 3884 St. Andrews Green, Memphis, Tennessee 38111 (US).(74) Agents: **ROSOK, Mae, Joanne** et al.; Seed Intellectual Property Law Group PLLC, Suite 5400, 701 Fifth Avenue, Seattle, Washington 98104-7064 (US).

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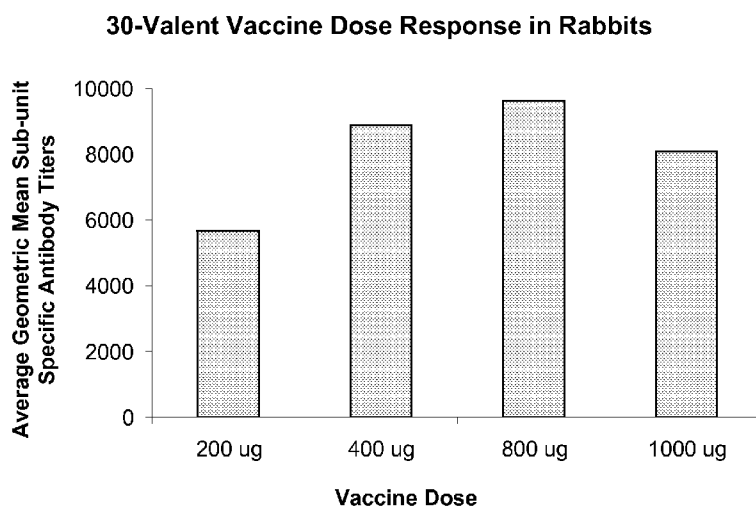
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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

[Continued on next page]

(54) Title: GROUP A STREPTOCOCCUS MULTIVALENT VACCINE

**Fig. 3**

(57) Abstract: Immunogenic compositions are provided herein that are useful for inducing an immune response specific against group A streptococcus (GAS). Immunogenic compositions provided herein are multivalent and comprise a plurality of immunogenic peptides or fusion polypeptides comprising the immunogenic peptides that induce an immune response against GAS. The immunogenic compositions provided herein induce an immune response against the GAS serotypes represented by an immunogenic peptide (derived from an M protein or Spa protein) comprised within the immunogenic composition and also induce an immune response against serotypes that are unrepresented by any immunogenic peptide included in the immunogenic composition. Methods for using the compositions for inducing an immune response against GAS and for treating or reducing the likelihood of occurrence of a GAS infection are also provided.



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:

14 March 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/042782**A. CLASSIFICATION OF SUBJECT MATTER****A61K 38/16(2006.01)i, A61K 38/17(2006.01)i, A61K 39/395(2006.01)i, A61K 39/40(2006.01)i, A61P 37/00(2006.01)i, A61P 31/00(2006.01)i**

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 38/16; C12P 21/04; C07K 14/315; A61K 39/02; A61K 39/00; A61K 39/09

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: group A streptococcus (GAS), multivalent vaccine, M protein, Spa protein, fusion protein

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	MCNEIL et al., 'Safety and immunogenicity of 26-valent group A streptococcus vaccine in Healthy adult volunteers' Clinical Infectious Diseases, Vol.41, Issue 8, pp.1114-1122 (15 October 2005) See the whole document, especially figure 1.	1-24,28-40
A	US 2005-0220808 A1 (BEALL et al.) 06 October 2005 See claim 158.	1-24,28-40
A	US 7402316 B2 (DALE) 22 July 2008 See claim 1.	1-24,28-40
A	US 7838010 B2 (BENSI et al.) 23 November 2010 See the abstract and claim 1.	1-24,28-40
PX	DALE et al., 'New 30-valent M protein-based vaccine evokes cross-opsonic antibodies against non-vaccine serotypes of group A streptococci' Vaccine, Vol.29, pp.8175-8178 (13 September 2011) See the whole document, especially figure 1.	1-24,28-40

☐ 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 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

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Date of mailing of the international search report

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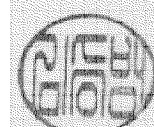
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189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan
City, 302-701, Republic of Korea

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Authorized officer

Kim Seung Beom

Telephone No. 82-42-481-3488



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/042782

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005-0220808 A1	06.10.2005	CA 2447599 A1	28.11.2002
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		WO 2006-042027 A2	20.04.2006
		WO 2006-042027 A3	24.08.2006

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/042782**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.: 25-27
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 25-27 pertain to methods for treatment of the human body by therapy, and thus relate to a subject matter which this International Searching Authority is not required, under Article 17(2)(a)(i) of the PCT and Rule 39.1(iv) of the Regulations under the PCT, to search.
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:

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 fee, this Authority did not invite payment of any additional fee.
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.