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- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
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- Published:**
- with international search report (Art. 21(3))
 - with sequence listing part of description (Rule 5.2(a))
- (88) **Date of publication of the international search report:**
3 April 2014

(54) **Title:** BACTERIOPHAGES EXPRESSING ANTIMICROBIAL PEPTIDES AND USES THEREOF

(57) **Abstract:** The present invention is generally related to engineered bacteriophages expressing antimicrobial peptides or lytic enzymes or fragments thereof for targeting a broad spectrum of bacterial hosts, and for the long-term suppression of bacterial phage resistance for reducing bacterial infections. In some embodiments, bacteriophages express antimicrobial peptides or antimicrobial polypeptides (e.g. phage lytic enzymes) which are secreted from the host bacteria, or alternatively released upon lysis of the bacterial host cell. Aspects of the present invention also relate to the use of the engineered bacteriophages for the reduction of bacterial infections, both in a subject or for bioremediation purposes, in clinical settings and wound healing.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/26357

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C12P 21/06; C07H 21/04 (2010.01)

USPC - 435/69.1; 536/23.1

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)
USPC- 435/69.1; 536/23.1Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC- 435/252.33 435/320.1 (text search)Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Electronic data bases : PubWEST (PGPB, USPT, EPAB, JPAB); Google Scholar: phage, bacteriophage, antimicrobial peptide (AMP), lytic enzyme, endolysin, LysK, bacteriocin, phage therapy, biofilm

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 6,759,229 B2 (SCHAAK) 6 July 2004 (2004.07.06) abstract, col 3 In 20-50, col 20 SEQ ID NO:2	1-2, 11, 46 ----- 3, 8
Y	STEIN et al. Two Different Lantibiotic-Like Peptides Originate from the Ericin Gene Cluster of <i>Bacillus subtilis</i> A1/3. <i>J Bacteriol</i> 2002,184(6):1703-1711; pg 1703 left col para 1 and right col para 2, pg 1706 fig 6	3
Y	OBESO et al. Lytic activity of the recombinant staphylococcal Bacteriophage PhiH5 endolysin active against <i>Staphylococcus aureus</i> in milk. <i>Int J Food Microbiol.</i> 2008, 128(2):212-218; abstract	8

☐ Further documents are listed in the continuation of Box C.

* 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

20 October 2010 (20.10.2010)

Date of mailing of the international search report

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Name and mailing address of the ISA/US

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/26357

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.: 4-7, 9-10, 12-45, 47-49
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.