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(54) Title: USE OF BACTERIOPHAGE IN MEDICAMENTS

(57) Abstract: The present invention relates to medicaments suitable for use in the prevention and/or treatment of bacterial infection and/or colonisation. More particularly, the invention relates to medicaments comprising bacteriophages capable of binding to bacterial efflux pump components suitable for use in the prevention or treatment of diseases associated with Gram-negative bacteria. The invention also provides methods of treatment and methods of food preparation utilising such bacteriophages, as well as an assay by which such bacteriophages may be identified.



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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001992

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61K35/76

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 practical, search terms used)

EPO-Internal, WPI Data, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EL-SHIBINY A ET AL: "Enumeration and diversity of campylobacters and bacteriophages isolated during the rearing cycles of free-range and organic chickens." APPLIED AND ENVIRONMENTAL MICROBIOLOGY. MAR 2005, vol. 71, no. 3, March 2005 (2005-03), pages 1259-1266, XP002404410 ISSN: 0099-2240 cited in the application page 1265, last paragraph ----- -/--	1-5, 11-14,16

☒ 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 document but published on or after the international filing date

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"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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INTERNATIONAL SEARCH REPORT

International application No

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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	CONNERTON P L ET AL: "Longitudinal study of Campylobacter jejuni bacteriophages and their hosts from broiler chickens" APPLIED AND ENVIRONMENTAL MICROBIOLOGY, WASHINGTON, DC, US, vol. 70, no. 7, July 2004 (2004-07), pages 3877-3883, XP002313914 ISSN: 0099-2240 cited in the application page 3882, last paragraph -----	1-5, 11-14, 16
X	WO 03/103578 A2 (UNIV IOWA RES FOUND [US]; HARRIS DELBERT L [US]; LEE NAKHYUNG [US]) 18 December 2003 (2003-12-18) paragraph [0011] -----	1-17
X	WO 02/38104 A2 (UNIV IOWA RES FOUND [US]) 16 May 2002 (2002-05-16) paragraphs [0025] - [0032] claims 13, 32 -----	18-22
X	WO 2005/023010 A2 (UNIV NOTTINGHAM [GB]; CONNERTON IAN FRANK [GB]) 17 March 2005 (2005-03-17) examples 1, 2 claims 11, 12, 15 -----	18-22
X	WO 95/23848 A (AMERSHAM INT PLC [GB]; STEWART GORDON SYDNEY ANDERSON [GB]; DENYER STE) 8 September 1995 (1995-09-08) example 1 page 2, lines 4-11 page 6, lines 13-15 -----	23
A	GERMAN G J ET AL: "The TolC protein of Escherichia coli serves as a cell-surface receptor for the newly characterized TLS bacteriophage" JOURNAL OF MOLECULAR BIOLOGY, LONDON, GB, vol. 308, no. 4, 11 May 2001 (2001-05-11), pages 579-585, XP004480454 ISSN: 0022-2836 -----	1-23
A	HUSAIN FASAHATH ET AL: "Interaction between the TolC and AcrA proteins of a multidrug efflux system of Escherichia coli." JOURNAL OF BACTERIOLOGY, DEC 2004, vol. 186, no. 24, December 2004 (2004-12), pages 8533-8536, XP002404027 ISSN: 0021-9193 ----- -/-	6

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/001992

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SCHMIEGER H: "Molecular survey of the Salmonella phage typing system of Anderson." JOURNAL OF BACTERIOLOGY. MAR 1999, vol. 181, no. 5, March 1999 (1999-03), pages 1630-1635, XP002404411 ISSN: 0021-9193 the whole document -----	10,22
A	CARLTON R M: "PHAGE THERAPY: PAST HISTORY AND FUTURE PROSPECTS" ARCHIVUM IMMUNOLOGIAE ET THERAPIAE EXPERIMENTALIS, POLISH ACADEMY OF SCIENCES, WROCLAW, PL, vol. 47, no. 5, 1999, pages 267-274, XP001199870 ISSN: 0004-069X the whole document -----	
A	THIEL KARL: "Old dogma, new tricks--21st Century phage therapy." NATURE BIOTECHNOLOGY. JAN 2004, vol. 22, no. 1, January 2004 (2004-01), pages 31-36, XP002404412 ISSN: 1087-0156 -----	
A	ANDERSON E S ET AL: "Bacteriophage typing of enteric pathogens and staphylococci and its use in epidemiology." JOURNAL OF CLINICAL PATHOLOGY. MAY 1956, vol. 9, no. 2, May 1956 (1956-05), pages 94-127, XP002404413 ISSN: 0021-9746 -----	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2006/001992

Box 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 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 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.
- ☐ 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:

Invention 1: claims 1-17 (complete)

Relating to a bacteriophage binding to a bacterial efflux pump for medical use.

Invention 2: claims 18-22 (complete)

Relating to use of a bacteriophage binding to a bacterial efflux pump in a method for preparing food for human consumption.

Invention 3: claim 23 (complete)

Relating to a method of indentifying a bacteriophage of medical interest, by selecting a bacteriophage capable of binding to a bacterial efflux pump.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/001992

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 03103578	A2	18-12-2003	AU 2003240505 A1	22-12-2003
WO 0238104	A2	16-05-2002	AU 3042202 A	21-05-2002
			CA 2428370 A1	16-05-2002
			DE 01990656 T1	15-04-2004
			EP 1341496 A2	10-09-2003
			MX PA03004182 A	26-03-2004
WO 2005023010	A2	17-03-2005	AU 2004269961 A1	17-03-2005
			CA 2545018 A1	17-03-2005
			EP 1662888 A2	07-06-2006
			US 2006222632 A1	05-10-2006
WO 9523848	A	08-09-1995	AU 1716295 A	18-09-1995
			BR 9506962 A	16-09-1997
			JP 9509831 T	07-10-1997