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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, BN, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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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(54) Title: METHODS OF TREATING BACTERIAL INFECTIONS

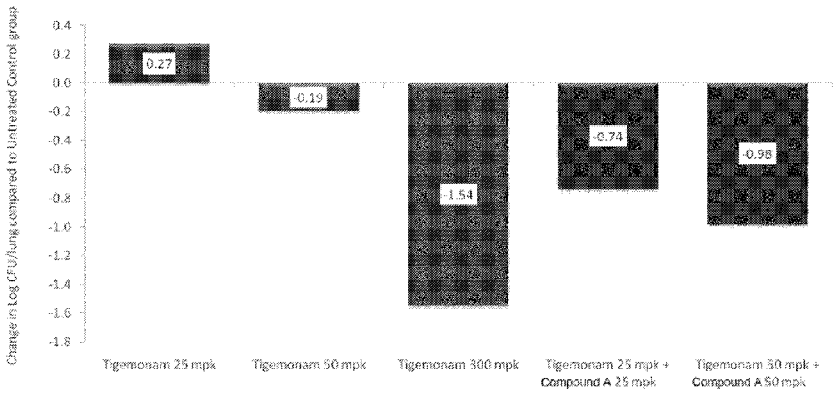

Figure 1

(57) Abstract: The present invention relates to compounds, compositions and methods for treating bacterial infections. Embodiments of the present invention include antibiotics and β-lactamase inhibitors to treat resistant infections.

WO 2013/122888 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/025621

A. CLASSIFICATION OF SUBJECT MATTER

A61K 31/397 (2006.01) A61K 31/69 (2006.01) A61P 31/04 (2006.01)

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)

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)

EPOQUE (Epodoc, medline, WPI); Google Scholar & keywords: Bacterial infection, serine β-lactamase, carbapenemases, NMC-A, SME, KPC, KPC-2, OXA-48, KPC-3, GES, IMI, not metalloenzyme carbapenemase, imipenem hydrolyzing β-lactamase, *Klebsiella pneumoniae* carbapenemase, Guiana extended spectrum, class A, metallo β-lactamase, carbapenemases, NDM-1, IMP, VIM, SPM, GIM, verona imipenemase, new delhi metallo-B-lactamase, active on imipenem, Sao Paulo metallo-β-lactamases, German imipenemase, Seoul imipenemase, class B, β-lactamase inhibitor, NXL104, MK-7655, BAL-29880, SYN-2190, BLI-489, AM-112, β-lactam, antibiotic, antimicrobial, penicillins, cephamycins, carbapenems, imipenem, doripenem, meropenem, ertapenem, monobactam, aztreonam, tigemonam, biapenem, carumonam, syn-2416, bal30072, nocardicin A, BAL19764, PTX2416 & like terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C

[X] 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	Date of mailing of the international search report
9 May 2013	09 May 2013

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INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/US2013/025621**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/0178357 A1 (BUYNAK, J.D. AND CHEN, H.) 10 August 2006 abstract; paragraphs 0064-0067; table 1; claim 2	1-9,15,24,26,27
X	WO 2011/103686 A1 (VISWANATHA, T. ET AL) 01 September 2011 abstract; paragraphs 0017, 00101, 00102, 00123, 00127, 00149; table 1; claims 45, 60	1-9,14,20-27
X	LIVERMORE, D.M., ET AL, "Activities of NXL104 combinations with Ceftazidime and Aztreonam against Carbapenemase-producing Enterobacteriaceae" Antimicrobial Agents and Chemotherapy, January 2011, vol. 55, no. 1, pages 390-394 whole document	1-9,16,20,23-27
X Y	WO 2001/030149 A1 (MERCK & CO., INC.) 03 May 2001 abstract; pages 18-20 abstract; pages 18-20	1-9,14-16,24,25 10-12
Y	RODRIGUEZ-MARTINEZ, J-M., ET AL, "VIM-19, a Metallo-β-lactamase with increased Carbapenemase Activity from Escherichia coli and Klebsiella pneumoniae". Antimicrobial Agents and Chemotherapy, 2010, vol. 54, no. 1, pages 471-476 Tables 1,2	10-12
P,X	WO 2012/021455 A1 (REMPEX PHARMACEUTICALS, INC.) 16 February 2012 abstract; table 1 – compound 1; paragraphs 0155-0157; page 94	1-9,14-16,20-22,25-30

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/025621

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.: **31-67**
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:
See Supplemental Box

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 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.

Supplemental Box

Continuation of **Box II**

Search and examination of the claims is restricted to those claims that are adequately supported by the description (see box VIII of the ISO for full reasoning).

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/US2013/025621**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
US 2006/0178357 A1	10 Aug 2006	US 2006178357 A1	10 Aug 2006
WO 2011/103686 A1	01 Sep 2011	EP 2539348 A1	02 Jan 2013
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		CA 2807546 A1	16 Feb 2012
		SG 187757 A1	28 Mar 2013
		US 2012040932 A1	16 Feb 2012
		WO 2012021455 A1	16 Feb 2012

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.