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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

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:

21 December 2017 (21.12.2017)

(54) Title: THERAPEUTIC SALL4 PEPTIDE

(57) Abstract: The present invention provides, in certain embodiments, isolated peptides and pharmaceutical compositions comprising isolated peptides that bind to retinoblastoma binding protein 4 RBBp4 such that, the binding blocks the SALL4-RBBp4 interaction. Methods of inhibiting binding of SALL4 with RBBp4 and methods for treating a subject having a disorder mediated by a dysregulation of SALL4 are also provided.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/030164

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61K 38/04; A61K 38/10; A61K 38/17; C07K 7/00; C07K 7/02; C07K 7/04; C07K 7/06 (2017.01)
 CPC - A61K 38/04; A61K 38/08; A61K 38/10; A61K 38/1709; C07K 7/00; C07K 7/02; C07K 7/04; C07K 7/06; C07K 7/08 (2017.08)

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)

See Search History document

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

USPC - 514/1.1; 530/300; 530/324; 530/326; 530/327; 530/328; 530/329; 530/330 (keyword delimited)

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

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/102536 A1 (AGENCY FOR SCIENCE, TECHNOLOGY AND RESEARCH) 09 July 2015 (09.07.2015) entire document	1, 3-11, 22, 25-34
A	US 7,790,407 B2 (MA) 07 September 2010 (07.09.2010) entire document	1, 3-11, 22, 25-34
A	US 9,309,496 B2 (MA) 12 April 2016 (12.04.2016) entire document	1, 3-11, 22, 25-34
A	US 2015/0080315 A1 (NATIONAL UNIVERSITY OF SINGAPORE et al) 19 March 2015 (19.03.2015) entire document	1, 3-11, 22, 25-34
A	US 2015/0211004 A1 (STEWART et al) 30 July 2015 (30.07.2015) entire document	1, 3-11, 22, 25-34

☐ 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

28 September 2017

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/030164

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.: 23
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 extra sheet(s).

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.:
1, 3-11, 22, and 25-34 to the extent that they read on a SAL4 polypeptide of SEQ ID NO:3, the isolated peptide further comprising a cell-penetrating peptide of SEQ ID NO:2 attached thereto at its N-terminus.

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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/030164

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I+: claims 1-22 and 24-34 are drawn to SAL4 polypeptides

The first invention of Group I+ is restricted to a SAL4 polypeptide, wherein the SAL4 polypeptide is selected to be isolated peptide selected to be SEQ ID NO:3, the isolated peptide further comprising a cell-penetrating peptide of SEQ ID NO:2 attached thereto at its N-terminus. It is believed that claims 1, 3-11, 22, and 25-34 read on this first named invention and thus these claims will be searched without fee to the extent that they read on a SAL4 polypeptide of SEQ ID NO:3 and SEQ ID NO:2.

Applicant is invited to elect additional SAL4 polypeptides, each with specified SEQ ID NO, to be searched in a specific combination by paying an additional fee for each set of election. An exemplary election would be a SAL4 polypeptide, wherein the SAL4 polypeptide is selected to be isolated peptide selected to be SEQ ID NO:4, the isolated peptide further comprising a cell-penetrating peptide of SEQ ID NO:2 attached thereto at its N-terminus. Additional SAL4 polypeptides will be searched upon the payment of additional fees. Applicants must specify the claims that read on any additional elected inventions. Applicants must further indicate, if applicable, the claims which read on the first named invention if different than what was indicated above for this group. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched/examined.

The inventions listed in Groups I+ do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The Groups I+ formulas do not share a significant structural element for binding to and inhibiting the activity of RBBp4, requiring the selection of alternatives for the SAL4 polypeptides, where "the peptide is RRKQAKPQHI, RRKAAKPQHI, RRKFAKPQHI, RRKFAKFQWI, RRKQKKPQHI, RRKQRKPQHI, RRKQAAPQHI, RRKQAVPQHI, RRKQALPQHI, RRKQAFPQHI, RRKQARPQHI, RRKQAKFQHI, RRKQAKPAHI, RRKQAKPEHI, RRKQAKPNHI, RRKQAKPVHI, RRKQAKPLHI, RRKQAKPQAI, RRKQAKPQFI, RRKQAKPQYI, RRKQAKPQWI, RRKQAKPQVI, RRKQAKPQHA, RRKQAKPQHV, RRKQAKPQHL, RRKQAKPQHTF, RRKFAKFQWI, RRKHAKPQHI, ORRKQAKPQHI, HRRKQAKPQHI, RRKQPKPQHI, HRRKQAKPQHI, URRKQAKPQHI or ZRRKQAKPQHI, ORRKIHIPKPQH".

The Groups I+ share the technical features of an isolated peptide, comprising: an amino acid sequence set forth in formula I RRKX1X2X3X4X5X6X7 (I), wherein X1, X2, X3, X4, X5, X6, or X7 is independently an amino acid with nonpolar side chain, polar side chain that is not charged at neutral pH or polar side chain that is positively charged at neutral pH; wherein the sequence of amino acids is written from the N-terminus (on the left) to the C-terminus (on the right). However, these shared technical features do not represent a contribution over the prior art.

Specifically, US 2015/0080315 A1 to National University of Singapore et al. discloses an isolated peptide (a therapeutic peptide, Para. [0103]), comprising: an amino acid sequence set forth in formula I RRKX1X2X3X4X5X6X7 (I), wherein X1, X2, X3, X4, X5, X6, or X7 is independently an amino acid with nonpolar side chain, polar side chain that is not charged at neutral pH or polar side chain that is positively charged at neutral pH; wherein the sequence of amino acids is written from the N-terminus (on the left) to the C-terminus (on the right) (the amino acid sequence MSRRKQAKPQHI (SEQ ID NO: 1), Para. [0103]).

The inventions listed in Groups I+ therefore lack unity under Rule 13 because they do not share a same or corresponding special technical features.