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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:

12 February 2015

(54) Title: HEPCIDIN ANALOGUES AND USES THEREOF

(57) Abstract: The present invention relates, inter alia, to certain hepcidin peptide analogues, including peptides and dimers thereof, and to the use of the peptides and peptide dimers in the treatment and/or prevention of a variety of diseases, conditions or disorders, including treatment and/or prevention of iron overload diseases, which include hereditary hemochromatosis and iron-loading anemias, and other conditions and disorders described herein.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/30352

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61K 38/00, A61K 38/08, A61K 38/04, C07K 5/00, C07K 7/00, C07K 16/00, C07K 17/00 (2014.01)

CPC - A61K 38/00, A61K 38/08, A61K 38/05, A61K 33/26, A61K 38/1709, C07K 7/06, C07K 7/23

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)

CPC- A61K 38/00, A61K 38/08, A61K 38/05, A61K 33/26, A61K 38/1709, C07K 7/06, C07K 7/23

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 CPC- C07K 7/08, C07K 14/52, C07K 14/70539, C07K 5/1013, C07K 5/0812, C07K 5/1008, C12N 5/00, C12N 5/02, C07K 14/755
 USPC- 14/5.4, 514/13.5, 514/21.6, 514/21.7, 514/21.8, 530/328, 530/329, 530/409, 435/375

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 PubWEST(PGPB,USPT,USOC,EPAB,JPAB); PatBase, Google/Scholar: Protagonist Therapeutics, INC.; hepcidin, LEAP-1, HAMP, HEPC, HFE2B, LEAP1, Liver-expressed antimicrobial peptide 1, PLTR, isovaleric acid-DTHFPCIKCK; isoaleroyl-DTHFPCIKFCK; Asp, iminodiacetic acid, pyroglutamic acid. GenCore 6.4.1: SEQ ID NO: 14, 15

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X - A	US 2009/0053819 A1 (Seymour, et al.) 26 February 2009 (26.02.2009) SEQ ID NO: 37; para [0054]	1, 2, 31 ----- 3-5, 32

☐ 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

17 October 2014 (17.10.2014)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/30352

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.: 6-30 and 34-56
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:
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.

Group I+: claims 1-5, 31-33, drawn to a peptide of Formula I' (SEQ ID NO:21) or Formula I'' (SEQ ID NO:27). Group I+ will be searched to the extent that it reads on Formula I' or I'', wherein R'/R'' is hydrogen, R2'/R2'' is OH, X' is SEQ ID NO:14, 15, X'' is SEQ ID NO:22, Y'/Y'' is absent, without fee. It is believed that claims 1-5, 31, 32 read on this first named invention. [Note that claim 33 is excluded since X7 is Ile in SEQ ID NO:14, 15]. Applicants must 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.
An exemplary election would read on Formula I' or I'', wherein R'/R'' is hydrogen, R2'/R2'' is OH, X'/X'' is SEQ ID NO:13, 15, respectively, wherein X7 is Cys, i.e. claims 1-4, 32-33.

***** See Supplemental Sheet to continue *****

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.: 1-5, 31, 32, restricted to Formula I' or I'', wherein R'/R'' is hydrogen, R2'/R2'' is OH, X' is SEQ ID NO:14, 15; X'' is SEQ ID NO:22, Y'/Y'' is absent

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.

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***** Supplemental Sheet *****

In Continuation of Box III. Observations where unity of invention is lacking:

The inventions listed as Group 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:

Special Technical Features

The special technical feature of each invention of Group I+ is a specific amino acid sequence recited therein.

Common Technical Features

Inventions of Group I+ share the technical feature of a peptide of Formula I' (SEQ ID NO:21) or Formula I'' (SEQ ID NO:27). However, this shared technical feature does not represent a contribution over prior art as being anticipated by US 2009/0053819 A1 to Seymour, et al. 26 February 2009 (hereinafter "Seymour").

Seymour discloses a peptide of Formula I' (SEQ ID NO:21) or Formula I'' (SEQ ID NO:27) (Seymour, SEQ ID NO: 37, Ala Ala Ala Ala Ile Ala Ala Ala, para [0054], "the two peptides AAAAIAAAA, and AAAALAAA possess very similar masses"), wherein

R'/R'' is hydrogen,

R2'/R2'' is OH,

X'/X'' is SEQ ID NO:13 and 22, respectively. Wherein

X1, X2 absent;

X3 is Ala

X4 is Ala

X5 is Ala

X6 is Ala

X7 Ile

X8 is Ala

X9 is Ala,

X10 absent;

Y'/Y'' is absent, satisfying the proviso if X7 Ile, then Y'/Y'' is absent. As said technical feature was known in the art at the time of the invention, this cannot be considered special technical feature that would otherwise unify the groups.

The inventions of Group I+ therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

Note re item 4:

Claims 6-30 and 34-56 are not drafted in accordance with the second and third sentences of Rule 6.4 (a). These claims are improper multiple dependent claims.