(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 May 2009 (28.05.2009)

PCT

(10) International Publication Number
WO 2009/067177 A3

(51) International Patent Classification:
A61K 38/10 (2006.01)

(21) International Application Number:
PCT/US2008/012833

(22) International Filing Date:
14 November 2008 (14.11.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/985,745 16 November 2007 (16.11.2007) US

(71) Applicant *(for all designated States except US)*: **THE REGENTS OF THE UNIVERSITY OF CALIFORNIA** [US/US]; 1111 Franklin Street, 4th Floor, Oakland, CA 94607-5200 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **MURRAY, Samuel, S.** [US/US]; 21407 Angela Yvonne Avenue, Saugus, CA 91350 (US). **MURRAY, Elsa, J.** [US/US]; 21407 Angela Yvonne Avenue, Saugus, CA 91350 (US). **WANG, Jeffrey, C.** [US/US]; 14946 Greenleaf Street, Sherman Oaks, CA 91403 (US). **BEHNAM, Keyvan** [IR/US]; 66 Riverside Avenue, #3, Red Bank, NJ 07701 (US).

(74) Agent: **MORNEAULT, Monique, A.**; Mcdermott Will & Emery LLP, 227 West Monroe Street, Chicago, IL 60606 (US).

(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, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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:
30 December 2009

(54) Title: BONE MORPHOGENIC PROTEIN BINDING PEPTIDE

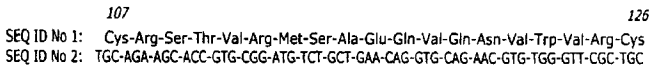

FIG. 1A

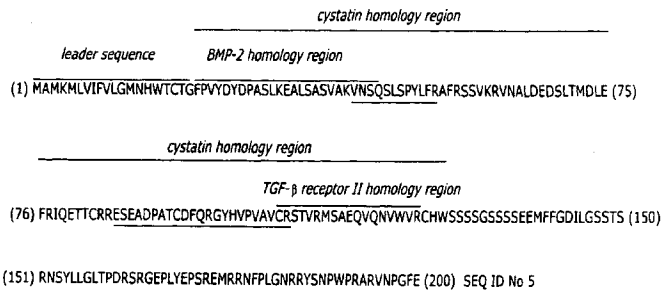

FIG. 1B

(57) Abstract: A cyclized peptide designated BMP Binding Peptide (BBP) is a synthetic peptide that avidly binds rhBMP-2, as do endogenous forms of BBP, and sequence conservation between species results in a variety of useful BBP compositions. BBP increases the over-all osteogenic activity of rhBMP- 2, increases the rate at which rhBMP-2 induces bone formation, and BBP induces calcification alone. Compositions and substrates including BBP, and methods of using BBP are useful in therapeutic, diagnostic and clinical applications requiring calcification and osteogenesis.

WO 2009/067177 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/12833

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A61K 38/10 (2009.01)
USPC - 514/13, 424/93.7, 530/326
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 - 514/13, 424/93.7, 530/326

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 514/2, 13; 424/93.1, 93.7; 530/300, 326

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST (PBGB, USPT,EPAB, JPAB); Google; Google Scholar
Search Terms Used: bone morphogenetic protein, BMP binding peptide, sequence, amino acid, peptide, TGF-beta receptor, nucleic acid, osteogenesis, calcification, cystatin, composition, conservative, semi-conservative, synthesized peptide, demineralized bone matrix

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Behnam et al., "BMP binding peptide: A BMP-2 enhancing factor deduced from the sequence of native bovine bone morphogenetic protein/non-collagenous protein", Journal of Orthopaedic Research, Volume 23(1): 175-180 (2005) - p. 177, col. 2, para 1, Fig. 2; p.179, col. 2; p.178, col. 1, para 1; p.178, col. 1, para 1	1-17, 19, 21
A	US 2007/0056050 A1 (Clokie et al.) 08 March 2007 (08.03.2007) - para [0024]	1-17, 19, 21
A	Hu et al., "Isolation and Molecular Cloning of a Novel Bone Phosphoprotein Related in Sequence to the Cystatin Family of Thiol Protease Inhibitors", Journal of Biological Chemistry, 271(22): 431-436 (1995)	1-17, 19, 21
A	Demetriou et al., "Fetuin/a2-HS Glycoprotein Is a Transforming Growth Factor-b Type II Receptor Mimic and Cytokine Antagonist", Journal of Biological Chemistry, 270(1):12755-12761 (1996)	1-17, 19, 21
A	US 5,981,483 A (Dennis et al.) 09 November 1999 (09.11.1999)	1-17, 19, 21
A	US 2007/0065415 A1 (Kleinsek et al.) 22 March 2007 (22.03.2007)	1-17, 19, 21

☐ 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 April 2009 (20.04.2009)

Date of mailing of the international search report
04 MAY 2009

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:
Lee W. Young
PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 08/12833

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.:
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. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

---see extra 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 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.:
1-22 restricted to SEQ ID NO:11 (namely claims 1-17, 19 and 21).

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/US 08/12833

Continuation of Box No. III, Observations where unity of invention is lacking:

Group I and II Claims 1-22 are directed to a peptide. The first named invention herein corresponds to Group I and is restricted to those claims specific for SEQ ID NO:11. An additional search fee is required for claims designating SEQ ID NO:13.

Group III Claims 23 is directed to a peptide comprising the amino acid sequence of SEQ ID No: 23.

Group IV Claim 24 is directed to a peptide comprising the amino acid sequence of SEQ ID No: 25.

Group V Claim 25 is directed to a peptide comprising the amino acid sequence of SEQ ID No: 27.

There is no special technical feature shared by the Groups based on the amino acid sequences of the claimed inventions. The amino acid sequences represented by the unique sequences designated SEQ ID NOs: 11, 13, 23, 25 and 27 do not relate to a single general inventive concept because, under PCT Rule 13.2, the different polypeptides represented by the sequences are not common to one another but are different because they are composed of unique amino acid sequences.