Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2868422 A1 2013/10/10

(21) 2 868 422

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) **Date de dépôt PCT/PCT Filing Date:** 2013/03/09
(87) **Date publication PCT/PCT Publication Date:** 2013/10/10
(85) **Entrée phase nationale/National Entry:** 2014/09/24
(86) **N° demande PCT/PCT Application No.:** US 2013/030059
(87) **N° publication PCT/PCT Publication No.:** 2013/151663
(30) **Priorités/Priorities:** 2012/04/02 (US61/618,862); 2012/04/02 (US61/618,873); 2012/04/02 (US61/618,870); 2012/04/02 (US61/618,868); 2012/04/02 (US61/618,866); 2012/04/02 (US61/618,953); 2012/04/02 (US61/618,945); 2012/04/02 (US61/618,935); 2012/04/02 (US61/618,922); 2012/04/02 (US61/618,911); 2012/04/02 (US61/618,896); 2012/04/02 (US61/618,885); 2012/04/02 (US61/618,878); 2012/04/02 (US61/618,957);

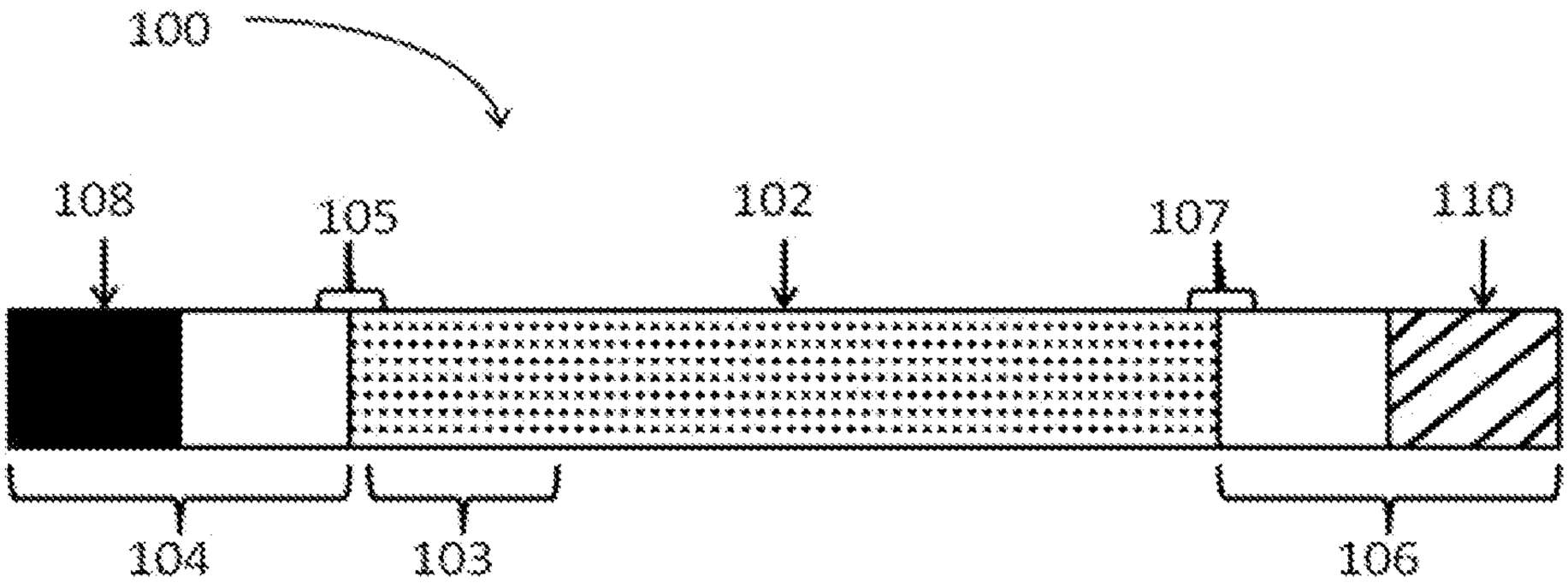
(51) **Cl.Int./Int.Cl.** ***C12N 15/63*** (2006.01), ***A61K 38/16*** (2006.01), ***A61K 47/48*** (2006.01), ***A61K 9/14*** (2006.01), ***C07H 21/00*** (2006.01), ***C07K 14/47*** (2006.01), ***C07K 14/705*** (2006.01), ***C12N 15/10*** (2006.01), ***C12N 15/113*** (2010.01), ***C12N 15/12*** (2006.01), ***C12N 15/52*** (2006.01), ***C12N 15/62*** (2006.01), ...

(71) **Demandeur/Applicant:**
MODERNA THERAPEUTICS, INC., US

(72) **Inventeurs/Inventors:**
BANCEL, STEPHANE, US;
CHAKRABORTY, TIRTHA, US;
...

(54) **Titre : POLYNUCLEOTIDES MODIFIES POUR LA PRODUCTION DE PROTEINES MEMBRANAIRES**
(54) **Title: MODIFIED POLYNUCLEOTIDES FOR THE PRODUCTION OF MEMBRANE PROTEINS**

FIGURE 1



(57) **Abrégé/Abstract:**
The disclosure relates to compositions and methods for the preparation, manufacture and therapeutic use of polynucleotides. More specifically, the disclosure provides compositions, methods, processes, kits and devices for the design, preparation, manufacture and/or formulation of modified mRNA (mmRNA) molecules from primary transcripts. Methods of using mmRNA for treating conditions or diseases are also disclosed.

CA 2868422 A1 2013/10/10

(21) 2 868 422

(13) A1

(30) **Priorités(suite)/Priorities(continued):** 2012/04/02 (US61/618,961); 2012/05/17 (US61/648,244); 2012/05/17 (US61/648,286); 2012/07/05 (US61/668,157); 2012/08/10 (US61/681,667); 2012/08/10 (US61/681,675); 2012/08/10 (US61/681,648); 2012/08/10 (US61/681,742); 2012/08/10 (US61/681,720); 2012/08/10 (US61/681,704); 2012/08/10 (US61/681,658); 2012/08/10 (US61/681,696); 2012/08/10 (US61/681,647); 2012/08/10 (US61/681,687); 2012/08/10 (US61/681,654); 2012/08/10 (US61/681,712); 2012/08/10 (US61/681,650); 2012/08/10 (US61/681,661); 2012/08/10 (US61/681,645); 2012/08/10 (US61/681,649); 2012/09/04 (US61/696,381); 2012/10/03 (US61/709,303); 2012/10/11 (US61/712,490); 2012/12/14 (US61/737,152); 2012/12/14 (US61/737,139); 2012/12/14 (US61/737,174); 2012/12/14 (US61/737,134); 2012/12/14 (US61/737,213); 2012/12/14 (US61/737,155); 2012/12/14 (US61/737,203); 2012/12/14 (US61/737,168); 2012/12/14 (US61/737,147); 2012/12/14 (US61/737,130); 2012/12/14 (US61/737,191); 2012/12/14 (US61/737,135); 2012/12/14 (US61/737,160); 2012/12/14 (US61/737,184)

(51) **Cl.Int./Int.Cl. (suite/continued)** ***C12N 15/85*** (2006.01), ***C12N 15/87*** (2006.01), ***C12N 9/00*** (2006.01), ***C12N 9/02*** (2006.01), ***C12N 9/10*** (2006.01), ***C12N 9/14*** (2006.01), ***C12N 9/88*** (2006.01)

(72) **Inventeurs(suite)/Inventors(continued):** DE FOUGEROLLES, ANTONIN, BE; ELBASHIR, SAYDA M., US; JOHN, MATTHIAS, US; ROY, ATANU, US; WHORISKEY, SUSAN, US; WOOD, KRISTY M., US; HATALA, PAUL, US; SCHRUM, JASON P., US; EJEBE, KENECHI, US; ELLSWORTH, JEFF LYNN, US; GUILD, JUSTIN, US

(74) **Agent:** SMART & BIGGAR

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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 October 2013 (10.10.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/151663 A1

(51) International Patent Classification:
C07H 21/04 (2006.01) *C12N 9/10* (2006.01)

(21) International Application Number:
PCT/US2013/030059

(22) International Filing Date:
9 March 2013 (09.03.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

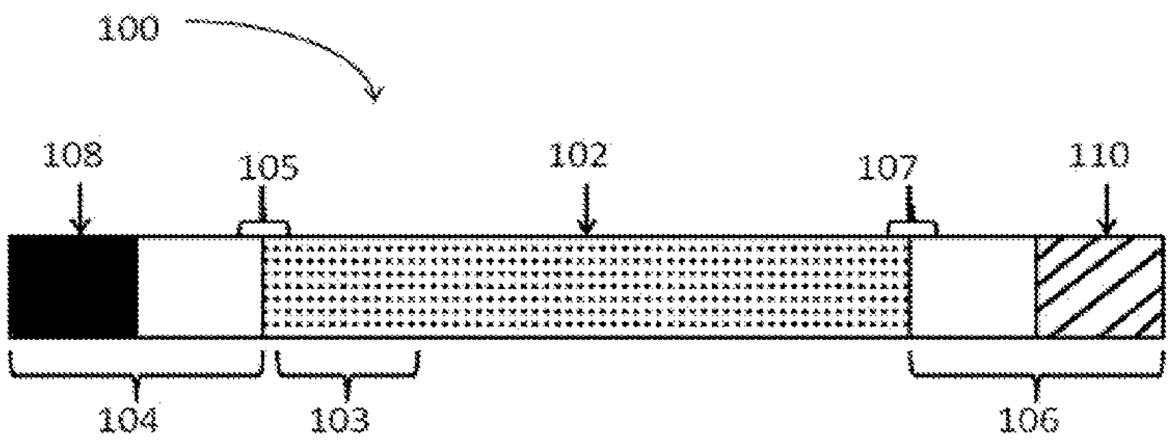
61/618,862	2 April 2012 (02.04.2012)	US
61/618,866	2 April 2012 (02.04.2012)	US
61/618,868	2 April 2012 (02.04.2012)	US
61/618,870	2 April 2012 (02.04.2012)	US
61/618,873	2 April 2012 (02.04.2012)	US
61/618,878	2 April 2012 (02.04.2012)	US
61/618,885	2 April 2012 (02.04.2012)	US
61/618,896	2 April 2012 (02.04.2012)	US
61/618,911	2 April 2012 (02.04.2012)	US
61/618,922	2 April 2012 (02.04.2012)	US
61/618,935	2 April 2012 (02.04.2012)	US
61/618,945	2 April 2012 (02.04.2012)	US
61/618,953	2 April 2012 (02.04.2012)	US
61/618,961	2 April 2012 (02.04.2012)	US
61/618,957	2 April 2012 (02.04.2012)	US
61/648,286	17 May 2012 (17.05.2012)	US
61/648,244	17 May 2012 (17.05.2012)	US
61/668,157	5 July 2012 (05.07.2012)	US
61/681,667	10 August 2012 (10.08.2012)	US
61/681,648	10 August 2012 (10.08.2012)	US
61/681,675	10 August 2012 (10.08.2012)	US
61/681,654	10 August 2012 (10.08.2012)	US
61/681,687	10 August 2012 (10.08.2012)	US
61/681,647	10 August 2012 (10.08.2012)	US
61/681,696	10 August 2012 (10.08.2012)	US
61/681,658	10 August 2012 (10.08.2012)	US
61/681,704	10 August 2012 (10.08.2012)	US
61/681,720	10 August 2012 (10.08.2012)	US
61/681,742	10 August 2012 (10.08.2012)	US
61/681,649	10 August 2012 (10.08.2012)	US
61/681,645	10 August 2012 (10.08.2012)	US
61/681,661	10 August 2012 (10.08.2012)	US
61/681,650	10 August 2012 (10.08.2012)	US
61/681,712	10 August 2012 (10.08.2012)	US
61/696,381	4 September 2012 (04.09.2012)	US
61/709,303	3 October 2012 (03.10.2012)	US
61/712,490	11 October 2012 (11.10.2012)	US
61/737,168	14 December 2012 (14.12.2012)	US
61/737,203	14 December 2012 (14.12.2012)	US
61/737,155	14 December 2012 (14.12.2012)	US
61/737,213	14 December 2012 (14.12.2012)	US
61/737,134	14 December 2012 (14.12.2012)	US
61/737,174	14 December 2012 (14.12.2012)	US
61/737,139	14 December 2012 (14.12.2012)	US
61/737,152	14 December 2012 (14.12.2012)	US
61/737,184	14 December 2012 (14.12.2012)	US
61/737,160	14 December 2012 (14.12.2012)	US
61/737,135	14 December 2012 (14.12.2012)	US
61/737,191	14 December 2012 (14.12.2012)	US
61/737,130	14 December 2012 (14.12.2012)	US
61/737,147	14 December 2012 (14.12.2012)	US

(71) Applicant: **MODERNA THERAPEUTICS** [US/US]; 161 First Street, First Floor, Cambridge, Massachusetts 02142 (US).

[Continued on next page]

(54) Title: MODIFIED POLYNUCLEOTIDES FOR THE PRODUCTION OF MEMBRANE PROTEINS

FIGURE 1



(57) Abstract: The disclosure relates to compositions and methods for the preparation, manufacture and therapeutic use of polynucleotides. More specifically, the disclosure provides compositions, methods, processes, kits and devices for the design, preparation, manufacture and/or formulation of modified mRNA (mmRNA) molecules from primary transcripts. Methods of using mmRNA for treating conditions or diseases are also disclosed.

WO 2013/151663 A1

WO 2013/151663 A1

(72) **Inventors**: **BANCEL, Stephane**; 68 Pinckney Road, Boston, Massachusetts 02114 (US). **CHAKRABORTY, Tirtha**; 153 Woburn Street, Medford, Massachusetts 02155 (US). **DE FOUGEROLLES, Antonin**; 66 Summit Avenue, Brookline, Massachusetts 02446 (US). **EL-BASHIR, Sayda M.**; 149 Grove Street, Cambridge, Massachusetts 02138 (US). **JOHN, Matthias**; 338 Harvard St. #5, Cambridge, Massachusetts 02138 (US). **ROY, Atanu**; 115 Hill Street #9, Stoneham, Massachusetts 02180 (US). **WHORISKEY, Susan**; 47 Louise Road, Belmont, Massachusetts 02478 (US). **WOOD, Kristy M.**; 501 Huron Ave, Unit 2, Cambridge, Massachusetts 02138 (US). **HATALA, Paul**; 26 Monument Street #1, Charlestown, Massachusetts 02124 (US). **SCHRUM, Jason P.**; 4601 Flat Rock Road, Apt. 417, Philadelphia, Pennsylvania 19127 (US). **EJEBE, Kenechi**; 208 Pearl Street, Apt. 1, Cambridge, Massachusetts 02139 (US). **ELLSWORTH, Jeff Lynn**; 23 Meriam Street, Lexington, Massachusetts 02420 (US). **GUILD, Justin**; 495 Edgell Rd, Framingham, Massachusetts 01701 (US).

(74) **Agent**: **WARD, Donna T.**; Dt Ward, P.C., 142A Main Street, Groton, Massachusetts 01450 (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, 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.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, 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))*

DEMANDE OU BREVET VOLUMINEUX

LA PRÉSENTE PARTIE DE CETTE DEMANDE OU CE BREVET COMPREND PLUS D'UN TOME.

CECI EST LE TOME	1	DE	4
CONTENANT LES PAGES	1	À	338

NOTE : Pour les tomes additionels, veuillez contacter le Bureau canadien des brevets

JUMBO APPLICATIONS/PATENTS

THIS SECTION OF THE APPLICATION/PATENT CONTAINS MORE THAN ONE VOLUME

THIS IS VOLUME	1	OF	4
CONTAINING PAGES	1	TO	338

NOTE: For additional volumes, please contact the Canadian Patent Office

NOM DU FICHIER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

MODIFIED POLYNUCLEOTIDES FOR THE PRODUCTION OF MEMBRANE PROTEINS

REFERENCE TO SEQUENCE LISTING

[0001] The instant application contains a "lengthy" Sequence Listing which has been submitted via CD-R in lieu of a printed paper copy, and is hereby incorporated by reference in its entirety. This contains a sequence listing text file as part of the originally filed subject matter as follows: File name: M305.20-2030.1305PCT_SL.txt; File size: 129,495,040 Bytes; Date created: March 4, 2013. These CD-Rs are labeled “CRF,” “Copy 1,” and “Copy 2,” respectively, and each contain only one identical file, as identified immediately above. The machine-readable format of each CD-R is IBM-PC and the operating system of each compact disc is MS-Windows.

CROSS REFERENCE TO RELATED APPLICATIONS

[0002] This application claims priority to U.S. Provisional Patent Application No 61/681,742, filed, August 10, 2012, entitled Modified Polynucleotides for the Production of Oncology-Related Proteins and Peptides, U.S. Provisional Patent Application No 61/737,224, filed December 14, 2012, entitled Terminally Optimized Modified RNAs, International Application No PCT/US2012/069610, filed December 14, 2012, entitled Modified Nucleoside, Nucleotide, and Nucleic Acid Compositions, U.S. Provisional Patent Application No 61/618,862, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Biologics, U.S. Provisional Patent Application No 61/681,645, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Biologics, U.S. Provisional Patent Application No 61/737,130, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Biologics, U.S. Provisional Patent Application No 61/618,866, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Antibodies, U.S. Provisional Patent Application No 61/681,647, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Antibodies, U.S. Provisional Patent Application No 61/737,134, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Antibodies, U.S. Provisional Patent Application No 61/618,868, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Vaccines, U.S. Provisional Patent Application No 61/681,648, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Vaccines, U.S.

Provisional Patent Application No 61/737,135, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Vaccines, U.S. Provisional Patent Application No 61/618,870, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Therapeutic Proteins and Peptides, U.S. Provisional Patent Application No 61/681,649, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Therapeutic Proteins and Peptides, U.S. Provisional Patent Application No 61/737,139, filed December 14, 2012, Modified Polynucleotides for the Production of Therapeutic Proteins and Peptides, U.S. Provisional Patent Application No 61/618,873, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Secreted Proteins, U.S. Provisional Patent Application No 61/681,650, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Secreted Proteins, U.S. Provisional Patent Application No 61/737,147, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Secreted Proteins, U.S. Provisional Patent Application No 61/618,878, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Plasma Membrane Proteins, U.S. Provisional Patent Application No 61/681,654, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Plasma Membrane Proteins, U.S. Provisional Patent Application No 61/737,152, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Plasma Membrane Proteins, U.S. Provisional Patent Application No 61/618,885, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Cytoplasmic and Cytoskeletal Proteins, U.S. Provisional Patent Application No 61/681,658, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Cytoplasmic and Cytoskeletal Proteins, U.S. Provisional Patent Application No 61/737,155, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Cytoplasmic and Cytoskeletal Proteins, U.S. Provisional Patent Application No 61/618,896, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Intracellular Membrane Bound Proteins, U.S. Provisional Patent Application No 61/668,157, filed July 5, 2012, entitled Modified Polynucleotides for the Production of Intracellular Membrane Bound Proteins, U.S. Provisional Patent Application No 61/681,661, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Intracellular Membrane Bound Proteins, U.S. Provisional Patent Application No 61/737,160, filed December 14, 2012,

entitled Modified Polynucleotides for the Production of Intracellular Membrane Bound Proteins, U.S. Provisional Patent Application No 61/618,911, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Nuclear Proteins, U.S. Provisional Patent Application No 61/681,667, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Nuclear Proteins, U.S. Provisional Patent Application No 61/737,168, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Nuclear Proteins, U.S. Provisional Patent Application No 61/618,922, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Proteins, U.S. Provisional Patent Application No 61/681,675, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Proteins, U.S. Provisional Patent Application No 61/737,174, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Proteins, U.S. Provisional Patent Application No 61/618,935, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/681,687, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/737,184, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/618,945, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/681,696, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/737,191, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/618,953, filed April 2, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/681,704, filed August 10, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/737,203, filed December 14, 2012, entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease, U.S. Provisional Patent Application No 61/618,961, filed April 2, 2012, entitled Dosing Methods for Modified mRNA, U.S. Provisional Patent Application No 61/648,286, filed

May 17, 2012, entitled Dosing Methods for Modified mRNA, the contents of each of which are herein incorporated by reference in its entirety.

[0003] This application is also related to International Publication No. PCT/US2012/58519, filed October 3, 2012, entitled Modified Nucleosides, Nucleotides, and Nucleic Acids, and Uses Thereof and International Publication No. PCT/US2012/69610, filed December 14, 2012, entitled Modified Nucleoside, Nucleotide, and Nucleic Acid Compositions.

[0004] The instant application is also related to co-pending applications, each filed concurrently herewith on March 9, 2013 and having Attorney Docket Number M300.20, (PCT/US13/XXXXX) entitled Modified Polynucleotides for the Production of Biologics and Proteins Associated with Human Disease; Attorney Docket Number M304.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Secreted Proteins; Attorney Docket Number M301.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Proteins; Attorney Docket Number M306.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Cytoplasmic and Cytoskeletal Proteins; Attorney Docket Number M308.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Nuclear Proteins; Attorney Docket Number M309.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Proteins; Attorney Docket Number M310.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Proteins Associated with Human Disease; Attorney Docket Number MNC1.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Cosmetic Proteins and Peptides and Attorney Docket Number MNC2.20 (PCT/US13/XXXXX), entitled Modified Polynucleotides for the Production of Oncology-Related Proteins and Peptides, the contents of each of which are herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0005] The invention relates to compositions, methods, processes, kits and devices for the design, preparation, manufacture and/or formulation of polynucleotides, primary constructs and modified mRNA molecules (mmRNA).

BACKGROUND OF THE INVENTION

[0006] There are multiple problems with prior methodologies of effecting protein expression. For example, introduced DNA can integrate into host cell genomic DNA at some frequency, resulting in alterations and/or damage to the host cell genomic DNA. Alternatively, the heterologous deoxyribonucleic acid (DNA) introduced into a cell can be inherited by daughter cells (whether or not the heterologous DNA has integrated into the chromosome) or by offspring.

[0007] In addition, assuming proper delivery and no damage or integration into the host genome, there are multiple steps which must occur before the encoded protein is made. Once inside the cell, DNA must be transported into the nucleus where it is transcribed into RNA. The RNA transcribed from DNA must then enter the cytoplasm where it is translated into protein. Not only do the multiple processing steps from administered DNA to protein create lag times before the generation of the functional protein, each step represents an opportunity for error and damage to the cell. Further, it is known to be difficult to obtain DNA expression in cells as DNA frequently enters a cell but is not expressed or not expressed at reasonable rates or concentrations. This can be a particular problem when DNA is introduced into primary cells or modified cell lines.

[0008] In the early 1990's Bloom and colleagues successfully rescued vasopressin-deficient rats by injecting in vitro-transcribed vasopressin mRNA into the hypothalamus (Science 255: 996–998; 1992). However, the low levels of translation and the immunogenicity of the molecules hampered the development of mRNA as a therapeutic and efforts have since focused on alternative applications that could instead exploit these pitfalls, i.e. immunization with mRNAs coding for cancer antigens.

[0009] Others have investigated the use of mRNA to deliver a polypeptide of interest and shown that certain chemical modifications of mRNA molecules, particularly pseudouridine and 5-methyl-cytosine, have reduced immunostimulatory effect.

[00010] These studies are disclosed in, for example, Ribostem Limited in United Kingdom patent application serial number 0316089.2 filed on July 9, 2003 now abandoned, PCT application number PCT/GB2004/002981 filed on July 9, 2004 published as WO2005005622, United States patent application national phase entry serial number 10/563,897 filed on June 8, 2006 published as US20060247195 now abandoned,

and European patent application national phase entry serial number EP2004743322 filed on July 9, 2004 published as EP1646714 now withdrawn; Novozymes, Inc. in PCT application number PCT/US2007/88060 filed on December 19, 2007 published as WO2008140615, United States patent application national phase entry serial number 12/520,072 filed on July 2, 2009 published as US20100028943 and European patent application national phase entry serial number EP2007874376 filed on July 7, 2009 published as EP2104739; University of Rochester in PCT application number PCT/US2006/46120 filed on December 4, 2006 published as WO2007064952 and United States patent application serial number 11/606,995 filed on December 1, 2006 published as US20070141030; BioNTech AG in European patent application serial number EP2007024312 filed December 14, 2007 now abandoned, PCT application number PCT/EP2008/01059 filed on December 12, 2008 published as WO2009077134, European patent application national phase entry serial number EP2008861423 filed on June 2, 2010 published as EP2240572, United States patent application national phase entry serial number 12/,735,060 filed November 24, 2010 published as US20110065103, German patent application serial number DE 10 2005 046 490 filed September 28, 2005, PCT application PCT/EP2006/0448 filed September 28, 2006 published as WO2007036366, national phase European patent EP1934345 published March, 21, 2012 and national phase US patent application serial number 11/992,638 filed August 14, 2009 published as 20100129877; Immune Disease Institute Inc. in United States patent application serial number 13/088,009 filed April 15, 2011 published as US20120046346 and PCT application PCT/US2011/32679 filed April 15, 2011 published as WO20110130624; Shire Human Genetic Therapeutics in United States patent application serial number 12/957,340 filed on November 20, 2010 published as US20110244026; Sequitur Inc. in PCT application PCT/US1998/019492 filed on September 18, 1998 published as WO1999014346; The Scripps Research Institute in PCT application number PCT/US2010/00567 filed on February 24, 2010 published as WO2010098861, and United States patent application national phase entry serial number 13/203,229 filed November 3, 2011 published as US20120053333; Ludwig-Maximillians University in PCT application number PCT/EP2010/004681 filed on July 30, 2010 published as WO2011012316; Cellscript Inc. in United States patent number 8,039,214 filed June 30,

2008 and granted October 18, 2011, United States patent application serial numbers 12/962,498 filed on December 7, 2010 published as US20110143436, 12/962,468 filed on December 7, 2010 published as US20110143397, 13/237,451 filed on September 20, 2011 published as US20120009649, and PCT applications PCT/US2010/59305 filed December 7, 2010 published as WO2011071931 and PCT/US2010/59317 filed on December 7, 2010 published as WO2011071936; The Trustees of the University of Pennsylvania in PCT application number PCT/US2006/32372 filed on August 21, 2006 published as WO2007024708, and United States patent application national phase entry serial number 11/990,646 filed on March 27, 2009 published as US20090286852; Curevac GMBH in German patent application serial numbers DE10 2001 027 283.9 filed June 5, 2001, DE10 2001 062 480.8 filed December 19, 2001, and DE 20 2006 051 516 filed October 31, 2006 all abandoned, European patent numbers EP1392341 granted March 30, 2005 and EP1458410 granted January 2, 2008, PCT application numbers PCT/EP2002/06180 filed June 5, 2002 published as WO2002098443, PCT/EP2002/14577 filed on December 19, 2002 published as WO2003051401, PCT/EP2007/09469 filed on December 31, 2007 published as WO2008052770, PCT/EP2008/03033 filed on April 16, 2008 published as WO2009127230, PCT/EP2006/004784 filed on May 19, 2005 published as WO2006122828, PCT/EP2008/00081 filed on January 9, 2007 published as WO2008083949, and United States patent application serial numbers 10/729,830 filed on December 5, 2003 published as US20050032730, 10/870,110 filed on June 18, 2004 published as US20050059624, 11/914,945 filed on July 7, 2008 published as US20080267873, 12/446,912 filed on October 27, 2009 published as US2010047261 now abandoned, 12/522,214 filed on January 4, 2010 published as US20100189729, 12/787,566 filed on May 26, 2010 published as US20110077287, 12/787,755 filed on May 26, 2010 published as US20100239608, 13/185,119 filed on July 18, 2011 published as US20110269950, and 13/106,548 filed on May 12, 2011 published as US20110311472 all of which are herein incorporated by reference in their entirety.

[00011] Notwithstanding these reports which are limited to a selection of chemical modifications including pseudouridine and 5-methyl-cytosine, there remains a need in the art for therapeutic modalities to address the myriad of barriers surrounding the efficacious

modulation of intracellular translation and processing of nucleic acids encoding polypeptides or fragments thereof.

[00012] To this end, the inventors have shown that certain modified mRNA sequences have the potential as therapeutics with benefits beyond just evading, avoiding or diminishing the immune response. Such studies are detailed in published co-pending applications International Application PCT/US2011/046861 filed August 5, 2011 and PCT/US2011/054636 filed October 3, 2011, International Application number PCT/US2011/054617 filed October 3, 2011, the contents of which are incorporated herein by reference in their entirety.

[00013] The present invention addresses this need by providing nucleic acid based compounds or polynucleotides which encode a polypeptide of interest (e.g., modified mRNA or mmRNA) and which have structural and/or chemical features that avoid one or more of the problems in the art, for example, features which are useful for optimizing formulation and delivery of nucleic acid-based therapeutics while retaining structural and functional integrity, overcoming the threshold of expression, improving expression rates, half life and/or protein concentrations, optimizing protein localization, and avoiding deleterious bio-responses such as the immune response and/or degradation pathways.

SUMMARY OF THE INVENTION

[00014] Described herein are compositions, methods, processes, kits and devices for the design, preparation, manufacture and/or formulation of modified mRNA (mmRNA) molecules.

[00015] The details of various embodiments of the invention are set forth in the description below. Other features, objects, and advantages of the invention will be apparent from the description and the drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[00016] The foregoing and other objects, features and advantages will be apparent from the following description of particular embodiments of the invention, as illustrated in the accompanying drawings in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of various embodiments of the invention.

[00017] FIG. 1 is a schematic of a primary construct of the present invention.

[00018] FIG. 2 illustrates lipid structures in the prior art useful in the present invention. Shown are the structures for 98N12-5 (TETA5-LAP), DLin-DMA, DLin-K-DMA (2,2-Dilinoleyl-4-dimethylaminomethyl-[1,3]-dioxolane), DLin-KC2-DMA, DLin-MC3-DMA and C12-200.

[00019] FIG. 3 is a representative plasmid useful in the IVT reactions taught herein. The plasmid contains Insert 64818, designed by the instant inventors.

[00020] FIG. 4 is a gel profile of modified mRNA encapsulated in PLGA microspheres.

[00021] FIG. 5 is a histogram of Factor IX protein production PLGA formulation Factor IX modified mRNA.

[00022] FIG. 6 is a histogram showing VEGF protein production in human keratinocyte cells after transfection of modified mRNA at a range of doses. Figure 6A shows protein production after transfection of modified mRNA comprising natural nucleoside triphosphate (NTP). Figure 6B shows protein production after transfection of modified mRNA fully modified with pseudouridine (Pseudo-U) and 5-methylcytosine (5mC). Figure 6C shows protein production after transfection of modified mRNA fully modified with N1-methyl-pseudouridine (N1-methyl-Pseudo-U) and 5-methylcytosine (5mC).

[00023] FIG. 7 is a histogram of VEGF protein production in HEK293 cells.

[00024] FIG. 8 is a histogram of VEGF expression and IFN-alpha induction after transfection of VEGF modified mRNA in peripheral blood mononuclear cells (PBMC). Figure 8A shows VEGF expression. Figure 8B shows IFN-alpha induction.

[00025] FIG. 9 is a histogram of VEGF protein production in HeLa cells from VEGF modified mRNA.

[00026] FIG. 10 is a histogram of VEGF protein production from lipoplexed VEGF modified mRNA in mice.

[00027] FIG. 11 is a histogram of G-CSF protein production in HeLa cells from G-CSF modified mRNA.

[00028] FIG. 12 is a histogram of Factor IX protein production in HeLa cell supernatant from Factor IX modified mRNA.

DETAILED DESCRIPTION

[00029] It is of great interest in the fields of therapeutics, diagnostics, reagents and for biological assays to be able to deliver a nucleic acid, e.g., a ribonucleic acid (RNA) inside a cell, whether *in vitro*, *in vivo, in situ* or *ex vivo*, such as to cause intracellular translation of the nucleic acid and production of an encoded polypeptide of interest. Of particular importance is the delivery and function of a non-integrative polynucleotide.

[00030] Described herein are compositions (including pharmaceutical compositions) and methods for the design, preparation, manufacture and/or formulation of polynucleotides encoding one or more polypeptides of interest. Also provided are systems, processes, devices and kits for the selection, design and/or utilization of the polynucleotides encoding the polypeptides of interest described herein.

[00031] According to the present invention, these polynucleotides are preferably modified as to avoid the deficiencies of other polypeptide-encoding molecules of the art. Hence these polynucleotides are referred to as modified mRNA or mmRNA.

[00032] The use of modified polynucleotides in the fields of antibodies, viruses, veterinary applications and a variety of *in vivo* settings has been explored by the inventors and these studies are disclosed in for example, co-pending and co-owned United States provisional patent application serial numbers 61/470,451 filed March 31, 2011 teaching in vivo applications of mmRNA; 61/517,784 filed on April 26, 2011 teaching engineered nucleic acids for the production of antibody polypeptides; 61/519,158 filed May 17, 2011 teaching veterinary applications of mmRNA technology; 61/533, 537 filed on September 12, 2011 teaching antimicrobial applications of mmRNA technology; 61/533,554 filed on September 12, 2011 teaching viral applications of mmRNA technology, 61/542,533 filed on October 3, 2011 teaching various chemical modifications for use in mmRNA technology; 61/570,690 filed on December 14, 2011 teaching mobile devices for use in making or using mmRNA technology; 61/570,708 filed on December 14, 2011 teaching the use of mmRNA in acute care situations; 61/576,651 filed on December 16, 2011 teaching terminal modification architecture for mmRNA; 61/576,705 filed on December 16, 2011 teaching delivery methods using lipidoids for mmRNA; 61/578,271 filed on December 21, 2011 teaching methods to increase the viability of organs or tissues using mmRNA; 61/581,322 filed on December

29, 2011 teaching mmRNA encoding cell penetrating peptides; 61/581,352 filed on December 29, 2011 teaching the incorporation of cytotoxic nucleosides in mmRNA and 61/631,729 filed on January 10, 2012 teaching methods of using mmRNA for crossing the blood brain barrier; all of which are herein incorporated by reference in their entirety.

[00033] Provided herein, in part, are polynucleotides, primary constructs and/or mmRNA encoding polypeptides of interest which have been designed to improve one or more of the stability and/or clearance in tissues, receptor uptake and/or kinetics, cellular access by the compositions, engagement with translational machinery, mRNA half-life, translation efficiency, immune evasion, protein production capacity, secretion efficiency (when applicable), accessibility to circulation, protein half-life and/or modulation of a cell's status, function and/or activity.

I. Compositions of the Invention (mmRNA)

[00034] The present invention provides nucleic acid molecules, specifically polynucleotides, primary constructs and/or mmRNA which encode one or more polypeptides of interest. The term "nucleic acid," in its broadest sense, includes any compound and/or substance that comprise a polymer of nucleotides. These polymers are often referred to as polynucleotides. Exemplary nucleic acids or polynucleotides of the invention include, but are not limited to, ribonucleic acids (RNAs), deoxyribonucleic acids (DNAs), threose nucleic acids (TNAs), glycol nucleic acids (GNAs), peptide nucleic acids (PNAs), locked nucleic acids (LNAs, including LNA having a β- D-ribo configuration, α-LNA having an α-L-ribo configuration (a diastereomer of LNA), 2′-amino-LNA having a 2′-amino functionalization, and 2′-amino- α-LNA having a 2′-amino functionalization) or hybrids thereof.

[00035] In preferred embodiments, the nucleic acid molecule is a messenger RNA (mRNA). As used herein, the term "messenger RNA" (mRNA) refers to any polynucleotide which encodes a polypeptide of interest and which is capable of being translated to produce the encoded polypeptide of interest *in vitro, in vivo, in situ* or *ex vivo*.

[00036] Traditionally, the basic components of an mRNA molecule include at least a coding region, a 5′UTR, a 3′UTR, a 5′ cap and a poly-A tail. Building on this wild type modular structure, the present invention expands the scope of functionality of traditional

mRNA molecules by providing polynucleotides or primary RNA constructs which maintain a modular organization, but which comprise one or more structural and/or chemical modifications or alterations which impart useful properties to the polynucleotide including, in some embodiments, the lack of a substantial induction of the innate immune response of a cell into which the polynucleotide is introduced. As such, modified mRNA molecules of the present invention are termed "mmRNA." As used herein, a "structural" feature or modification is one in which two or more linked nucleotides are inserted, deleted, duplicated, inverted or randomized in a polynucleotide, primary construct or mmRNA without significant chemical modification to the nucleotides themselves. Because chemical bonds will necessarily be broken and reformed to effect a structural modification, structural modifications are of a chemical nature and hence are chemical modifications. However, structural modifications will result in a different sequence of nucleotides. For example, the polynucleotide "ATCG" may be chemically modified to "AT-5meC-G". The same polynucleotide may be structurally modified from "ATCG" to "ATCCCG". Here, the dinucleotide "CC" has been inserted, resulting in a structural modification to the polynucleotide.

mmRNA Architecture

[00037] The mmRNA of the present invention are distinguished from wild type mRNA in their functional and/or structural design features which serve to, as evidenced herein, overcome existing problems of effective polypeptide production using nucleic acid-based therapeutics.

[00038] Figure 1 shows a representative polynucleotide primary construct **100** of the present invention. As used herein, the term "primary construct" or "primary mRNA construct" refers to a polynucleotide transcript which encodes one or more polypeptides of interest and which retains sufficient structural and/or chemical features to allow the polypeptide of interest encoded therein to be translated. Primary constructs may be polynucleotides of the invention. When structurally or chemically modified, the primary construct may be referred to as an mmRNA.

[00039] Returning to FIG. **1**, the primary construct **100** here contains a first region of linked nucleotides **102** that is flanked by a first flanking region **104** and a second flaking region **106**. As used herein, the "first region" may be referred to as a "coding region" or

"region encoding" or simply the "first region." This first region may include, but is not limited to, the encoded polypeptide of interest. The polypeptide of interest may comprise at its 5' terminus one or more signal sequences encoded by a signal sequence region **103**. The flanking region **104** may comprise a region of linked nucleotides comprising one or more complete or incomplete 5′ UTRs sequences. The flanking region **104** may also comprise a 5′ terminal cap **108**. The second flanking region **106** may comprise a region of linked nucleotides comprising one or more complete or incomplete 3′ UTRs. The flanking region **106** may also comprise a 3′ tailing sequence **110**.

[00040] Bridging the 5′ terminus of the first region **102** and the first flanking region **104** is a first operational region **105**. Traditionally this operational region comprises a Start codon. The operational region may alternatively comprise any translation initiation sequence or signal including a Start codon.

[00041] Bridging the 3′ terminus of the first region **102** and the second flanking region **106** is a second operational region **107**. Traditionally this operational region comprises a Stop codon. The operational region may alternatively comprise any translation initiation sequence or signal including a Stop codon. According to the present invention, multiple serial stop codons may also be used.

[00042] Generally, the shortest length of the first region of the primary construct of the present invention can be the length of a nucleic acid sequence that is sufficient to encode for a dipeptide, a tripeptide, a tetrapeptide, a pentapeptide, a hexapeptide, a heptapeptide, an octapeptide, a nonapeptide, or a decapeptide. In another embodiment, the length may be sufficient to encode a peptide of 2-30 amino acids, e.g. 5-30, 10-30, 2-25, 5-25, 10-25, or 10-20 amino acids. The length may be sufficient to encode for a peptide of at least 11, 12, 13, 14, 15, 17, 20, 25 or 30 amino acids, or a peptide that is no longer than 40 amino acids, e.g. no longer than 35, 30, 25, 20, 17, 15, 14, 13, 12, 11 or 10 amino acids. Examples of dipeptides that the polynucleotide sequences can encode or include, but are not limited to, carnosine and anserine.

[00043] Generally, the length of the first region encoding the polypeptide of interest of the present invention is greater than about 30 nucleotides in length (e.g., at least or greater than about 35, 40, 45, 50, 55, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1,000, 1,100, 1,200, 1,300, 1,400, 1,500,

1,600, 1,700, 1,800, 1,900, 2,000, 2,500, and 3,000, 4,000, 5,000, 6,000, 7,000, 8,000, 9,000, 10,000, 20,000, 30,000, 40,000, 50,000, 60,000, 70,000, 80,000, 90,000 or up to and including 100,000 nucleotides). As used herein, the "first region" may be referred to as a "coding region" or "region encoding" or simply the "first region."

[00044] In some embodiments, the polynucleotide, primary construct, or mmRNA includes from about 30 to about 100,000 nucleotides (e.g., from 30 to 50, from 30 to 100, from 30 to 250, from 30 to 500, from 30 to 1,000, from 30 to 1,500, from 30 to 3,000, from 30 to 5,000, from 30 to 7,000, from 30 to 10,000, from 30 to 25,000, from 30 to 50,000, from 30 to 70,000, from 100 to 250, from 100 to 500, from 100 to 1,000, from 100 to 1,500, from 100 to 3,000, from 100 to 5,000, from 100 to 7,000, from 100 to 10,000, from 100 to 25,000, from 100 to 50,000, from 100 to 70,000, from 100 to 100,000, from 500 to 1,000, from 500 to 1,500, from 500 to 2,000, from 500 to 3,000, from 500 to 5,000, from 500 to 7,000, from 500 to 10,000, from 500 to 25,000, from 500 to 50,000, from 500 to 70,000, from 500 to 100,000, from 1,000 to 1,500, from 1,000 to 2,000, from 1,000 to 3,000, from 1,000 to 5,000, from 1,000 to 7,000, from 1,000 to 10,000, from 1,000 to 25,000, from 1,000 to 50,000, from 1,000 to 70,000, from 1,000 to 100,000, from 1,500 to 3,000, from 1,500 to 5,000, from 1,500 to 7,000, from 1,500 to 10,000, from 1,500 to 25,000, from 1,500 to 50,000, from 1,500 to 70,000, from 1,500 to 100,000, from 2,000 to 3,000, from 2,000 to 5,000, from 2,000 to 7,000, from 2,000 to 10,000, from 2,000 to 25,000, from 2,000 to 50,000, from 2,000 to 70,000, and from 2,000 to 100,000).

[00045] According to the present invention, the first and second flanking regions may range independently from 15-1,000 nucleotides in length (e.g., greater than 30, 40, 45, 50, 55, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, and 900 nucleotides or at least 30, 40, 45, 50, 55, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, and 1,000 nucleotides).

[00046] According to the present invention, the tailing sequence may range from absent to 500 nucleotides in length (e.g., at least 60, 70, 80, 90, 120, 140, 160, 180, 200, 250, 300, 350, 400, 450, or 500 nucleotides). Where the tailing region is a polyA tail, the length may be determined in units of or as a function of polyA Binding Protein binding. In this embodiment, the polyA tail is long enough to bind at least 4 monomers of PolyA

Binding Protein. PolyA Binding Protein monomers bind to stretches of approximately 38 nucleotides. As such, it has been observed that polyA tails of about 80 nucleotides and 160 nucleotides are functional.

[00047] According to the present invention, the capping region may comprise a single cap or a series of nucleotides forming the cap. In this embodiment the capping region may be from 1 to 10, e.g. 2-9, 3-8, 4-7, 1-5, 5-10, or at least 2, or 10 or fewer nucleotides in length. In some embodiments, the cap is absent.

[00048] According to the present invention, the first and second operational regions may range from 3 to 40, e.g., 5-30, 10-20, 15, or at least 4, or 30 or fewer nucleotides in length and may comprise, in addition to a Start and/or Stop codon, one or more signal and/or restriction sequences.

Cyclic mmRNA

[00049] According to the present invention, a primary construct or mmRNA may be cyclized, or concatemerized, to generate a translation competent molecule to assist interactions between poly-A binding proteins and 5′-end binding proteins. The mechanism of cyclization or concatemerization may occur through at least 3 different routes: 1) chemical, 2) enzymatic, and 3) ribozyme catalyzed. The newly formed 5′-/3′-linkage may be intramolecular or intermolecular.

[00050] In the first route, the 5′-end and the 3′-end of the nucleic acid contain chemically reactive groups that, when close together, form a new covalent linkage between the 5′-end and the 3′-end of the molecule. The 5′-end may contain an NHS-ester reactive group and the 3′-end may contain a 3′-amino-terminated nucleotide such that in an organic solvent the 3′-amino-terminated nucleotide on the 3′-end of a synthetic mRNA molecule will undergo a nucleophilic attack on the 5′-NHS-ester moiety forming a new 5′-/3′-amide bond.

[00051] In the second route, T4 RNA ligase may be used to enzymatically link a 5′-phosphorylated nucleic acid molecule to the 3′-hydroxyl group of a nucleic acid forming a new phosphorodiester linkage. In an example reaction, 1μg of a nucleic acid molecule is incubated at 37°C for 1 hour with 1-10 units of T4 RNA ligase (New England Biolabs, Ipswich, MA) according to the manufacturer's protocol. The ligation reaction may occur

in the presence of a split oligonucleotide capable of base-pairing with both the 5′- and 3′-region in juxtaposition to assist the enzymatic ligation reaction.

[00052] In the third route, either the 5′-or 3′-end of the cDNA template encodes a ligase ribozyme sequence such that during *in vitro* transcription, the resultant nucleic acid molecule can contain an active ribozyme sequence capable of ligating the 5′-end of a nucleic acid molecule to the 3′-end of a nucleic acid molecule. The ligase ribozyme may be derived from the Group I Intron, Group I Intron, Hepatitis Delta Virus, Hairpin ribozyme or may be selected by SELEX (systematic evolution of ligands by exponential enrichment). The ribozyme ligase reaction may take 1 to 24 hours at temperatures between 0 and 37°C.

mmRNA Multimers

[00053] According to the present invention, multiple distinct polynucleotides, primary constructs or mmRNA may be linked together through the 3′-end using nucleotides which are modified at the 3′-terminus. Chemical conjugation may be used to control the stoichiometry of delivery into cells. For example, the glyoxylate cycle enzymes, isocitrate lyase and malate synthase, may be supplied into HepG2 cells at a 1:1 ratio to alter cellular fatty acid metabolism. This ratio may be controlled by chemically linking polynucleotides, primary constructs or mmRNA using a 3′-azido terminated nucleotide on one polynucleotide, primary construct or mmRNA species and a C5-ethynyl or alkynyl-containing nucleotide on the opposite polynucleotide, primary construct or mmRNA species. The modified nucleotide is added post-transcriptionally using terminal transferase (New England Biolabs, Ipswich, MA) according to the manufacturer's protocol. After the addition of the 3′-modified nucleotide, the two polynucleotide, primary construct or mmRNA species may be combined in an aqueous solution, in the presence or absence of copper, to form a new covalent linkage via a click chemistry mechanism as described in the literature.

[00054] In another example, more than two polynucleotides may be linked together using a functionalized linker molecule. For example, a functionalized saccharide molecule may be chemically modified to contain multiple chemical reactive groups (SH-, NH_2-, N_3, etc…) to react with the cognate moiety on a 3′-functionalized mRNA molecule (i.e., a 3′-maleimide ester, 3′-NHS-ester, alkynyl). The number of reactive groups on the

modified saccharide can be controlled in a stoichiometric fashion to directly control the stoichiometric ratio of conjugated polynucleotide, primary construct or mmRNA.

mmRNA Conjugates and Combinations

[00055] In order to further enhance protein production, primary constructs or mmRNA of the present invention can be designed to be conjugated to other polynucleotides, dyes, intercalating agents (*e.g.* acridines), cross-linkers (*e.g.* psoralene, mitomycin C), porphyrins (TPPC4, texaphyrin, Sapphyrin), polycyclic aromatic hydrocarbons (*e.g.*, phenazine, dihydrophenazine), artificial endonucleases (*e.g.* EDTA), alkylating agents, phosphate, amino, mercapto, PEG (*e.g.*, PEG-40K), MPEG, $[MPEG]_2$, polyamino, alkyl, substituted alkyl, radiolabeled markers, enzymes, haptens (*e.g.* biotin), transport/absorption facilitators (*e.g.*, aspirin, vitamin E, folic acid), synthetic ribonucleases, proteins, e.g., glycoproteins, or peptides, e.g., molecules having a specific affinity for a co-ligand, or antibodies *e.g.*, an antibody, that binds to a specified cell type such as a cancer cell, endothelial cell, or bone cell, hormones and hormone receptors, non-peptidic species, such as lipids, lectins, carbohydrates, vitamins, cofactors, or a drug.

[00056] Conjugation may result in increased stability and/or half life and may be particularly useful in targeting the polynucleotides, primary constructs or mmRNA to specific sites in the cell, tissue or organism.

[00057] According to the present invention, the mmRNA or primary constructs may be administered with, or further encode one or more of RNAi agents, siRNAs, shRNAs, miRNAs, miRNA binding sites, antisense RNAs, ribozymes, catalytic DNA, tRNA, RNAs that induce triple helix formation, aptamers or vectors, and the like.

Bifunctional mmRNA

[00058] In one embodiment of the invention are bifunctional polynucleotides (e.g., bifunctional primary constructs or bifunctional mmRNA). As the name implies, bifunctional polynucleotides are those having or capable of at least two functions. These molecules may also by convention be referred to as multi-functional.

[00059] The multiple functionalities of bifunctional polynucleotides may be encoded by the RNA (the function may not manifest until the encoded product is translated) or may be a property of the polynucleotide itself. It may be structural or chemical. Bifunctional modified polynucleotides may comprise a function that is covalently or

electrostatically associated with the polynucleotides. Further, the two functions may be provided in the context of a complex of a mmRNA and another molecule.

[00060] Bifunctional polynucleotides may encode peptides which are anti-proliferative. These peptides may be linear, cyclic, constrained or random coil. They may function as aptamers, signaling molecules, ligands or mimics or mimetics thereof. Anti-proliferative peptides may, as translated, be from 3 to 50 amino acids in length. They may be 5-40, 10-30, or approximately 15 amino acids long. They may be single chain, multichain or branched and may form complexes, aggregates or any multi-unit structure once translated.

Noncoding polynucleotides and primary constructs

[00061] As described herein, provided are polynucleotides and primary constructs having sequences that are partially or substantially not translatable, e.g., having a noncoding region. Such noncoding region may be the "first region" of the primary construct. Alternatively, the noncoding region may be a region other than the first region. Such molecules are generally not translated, but can exert an effect on protein production by one or more of binding to and sequestering one or more translational machinery components such as a ribosomal protein or a transfer RNA (tRNA), thereby effectively reducing protein expression in the cell or modulating one or more pathways or cascades in a cell which in turn alters protein levels. The polynucleotide or primary construct may contain or encode one or more long noncoding RNA (lncRNA, or lincRNA) or portion thereof, a small nucleolar RNA (sno-RNA), micro RNA (miRNA), small interfering RNA (siRNA) or Piwi-interacting RNA (piRNA).

Polypeptides of interest

[00062] According to the present invention, the primary construct is designed to encode one or more polypeptides of interest or fragments thereof. A polypeptide of interest may include, but is not limited to, whole polypeptides, a plurality of polypeptides or fragments of polypeptides, which independently may be encoded by one or more nucleic acids, a plurality of nucleic acids, fragments of nucleic acids or variants of any of the aforementioned. As used herein, the term "polypeptides of interest" refer to any polypeptide which is selected to be encoded in the primary construct of the present invention. As used herein, "polypeptide" means a polymer of amino acid residues

(natural or unnatural) linked together most often by peptide bonds. The term, as used herein, refers to proteins, polypeptides, and peptides of any size, structure, or function. In some instances the polypeptide encoded is smaller than about 50 amino acids and the polypeptide is then termed a peptide. If the polypeptide is a peptide, it will be at least about 2, 3, 4, or at least 5 amino acid residues long. Thus, polypeptides include gene products, naturally occurring polypeptides, synthetic polypeptides, homologs, orthologs, paralogs, fragments and other equivalents, variants, and analogs of the foregoing. A polypeptide may be a single molecule or may be a multi-molecular complex such as a dimer, trimer or tetramer. They may also comprise single chain or multichain polypeptides such as antibodies or insulin and may be associated or linked. Most commonly disulfide linkages are found in multichain polypeptides. The term polypeptide may also apply to amino acid polymers in which one or more amino acid residues are an artificial chemical analogue of a corresponding naturally occurring amino acid.

[00063] The term "polypeptide variant" refers to molecules which differ in their amino acid sequence from a native or reference sequence. The amino acid sequence variants may possess substitutions, deletions, and/or insertions at certain positions within the amino acid sequence, as compared to a native or reference sequence. Ordinarily, variants will possess at least about 50% identity (homology) to a native or reference sequence, and preferably, they will be at least about 80%, more preferably at least about 90% identical (homologous) to a native or reference sequence.

[00064] In some embodiments "variant mimics" are provided. As used herein, the term "variant mimic" is one which contains one or more amino acids which would mimic an activated sequence. For example, glutamate may serve as a mimic for phosphoro-threonine and/or phosphoro-serine. Alternatively, variant mimics may result in deactivation or in an inactivated product containing the mimic, e.g., phenylalanine may act as an inactivating substitution for tyrosine; or alanine may act as an inactivating substitution for serine.

[00065] "Homology" as it applies to amino acid sequences is defined as the percentage of residues in the candidate amino acid sequence that are identical with the residues in the amino acid sequence of a second sequence after aligning the sequences and introducing gaps, if necessary, to achieve the maximum percent homology. Methods and computer

programs for the alignment are well known in the art. It is understood that homology depends on a calculation of percent identity but may differ in value due to gaps and penalties introduced in the calculation.

[00066] By "homologs" as it applies to polypeptide sequences means the corresponding sequence of other species having substantial identity to a second sequence of a second species.

[00067] "Analogs" is meant to include polypeptide variants which differ by one or more amino acid alterations, e.g., substitutions, additions or deletions of amino acid residues that still maintain one or more of the properties of the parent or starting polypeptide.

[00068] The present invention contemplates several types of compositions which are polypeptide based including variants and derivatives. These include substitutional, insertional, deletion and covalent variants and derivatives. The term "derivative" is used synonymously with the term "variant" but generally refers to a molecule that has been modified and/or changed in any way relative to a reference molecule or starting molecule.

[00069] As such, mmRNA encoding polypeptides containing substitutions, insertions and/or additions, deletions and covalent modifications with respect to reference sequences, in particular the polypeptide sequences disclosed herein, are included within the scope of this invention. For example, sequence tags or amino acids, such as one or more lysines, can be added to the peptide sequences of the invention (e.g., at the N-terminal or C-terminal ends). Sequence tags can be used for peptide purification or localization. Lysines can be used to increase peptide solubility or to allow for biotinylation. Alternatively, amino acid residues located at the carboxy and amino terminal regions of the amino acid sequence of a peptide or protein may optionally be deleted providing for truncated sequences. Certain amino acids (e.g., C-terminal or N-terminal residues) may alternatively be deleted depending on the use of the sequence, as for example, expression of the sequence as part of a larger sequence which is soluble, or linked to a solid support.

[00070] "Substitutional variants" when referring to polypeptides are those that have at least one amino acid residue in a native or starting sequence removed and a different amino acid inserted in its place at the same position. The substitutions may be single,

where only one amino acid in the molecule has been substituted, or they may be multiple, where two or more amino acids have been substituted in the same molecule.

[00071] As used herein the term "conservative amino acid substitution" refers to the substitution of an amino acid that is normally present in the sequence with a different amino acid of similar size, charge, or polarity. Examples of conservative substitutions include the substitution of a non-polar (hydrophobic) residue such as isoleucine, valine and leucine for another non-polar residue. Likewise, examples of conservative substitutions include the substitution of one polar (hydrophilic) residue for another such as between arginine and lysine, between glutamine and asparagine, and between glycine and serine. Additionally, the substitution of a basic residue such as lysine, arginine or histidine for another, or the substitution of one acidic residue such as aspartic acid or glutamic acid for another acidic residue are additional examples of conservative substitutions. Examples of non-conservative substitutions include the substitution of a non-polar (hydrophobic) amino acid residue such as isoleucine, valine, leucine, alanine, methionine for a polar (hydrophilic) residue such as cysteine, glutamine, glutamic acid or lysine and/or a polar residue for a non-polar residue.

[00072] "Insertional variants" when referring to polypeptides are those with one or more amino acids inserted immediately adjacent to an amino acid at a particular position in a native or starting sequence. "Immediately adjacent" to an amino acid means connected to either the alpha-carboxy or alpha-amino functional group of the amino acid.

[00073] "Deletional variants" when referring to polypeptides are those with one or more amino acids in the native or starting amino acid sequence removed. Ordinarily, deletional variants will have one or more amino acids deleted in a particular region of the molecule.

[00074] "Covalent derivatives" when referring to polypeptides include modifications of a native or starting protein with an organic proteinaceous or non-proteinaceous derivatizing agent, and/or post-translational modifications. Covalent modifications are traditionally introduced by reacting targeted amino acid residues of the protein with an organic derivatizing agent that is capable of reacting with selected side-chains or terminal residues, or by harnessing mechanisms of post-translational modifications that function in selected recombinant host cells. The resultant covalent derivatives are useful in programs

directed at identifying residues important for biological activity, for immunoassays, or for the preparation of anti-protein antibodies for immunoaffinity purification of the recombinant glycoprotein. Such modifications are within the ordinary skill in the art and are performed without undue experimentation.

[00075] Certain post-translational modifications are the result of the action of recombinant host cells on the expressed polypeptide. Glutaminyl and asparaginyl residues are frequently post-translationally deamidated to the corresponding glutamyl and aspartyl residues. Alternatively, these residues are deamidated under mildly acidic conditions. Either form of these residues may be present in the polypeptides produced in accordance with the present invention.

[00076] Other post-translational modifications include hydroxylation of proline and lysine, phosphorylation of hydroxyl groups of seryl or threonyl residues, methylation of the alpha-amino groups of lysine, arginine, and histidine side chains (T. E. Creighton, Proteins: Structure and Molecular Properties, W.H. Freeman & Co., San Francisco, pp. 79-86 (1983)).

[00077] "Features" when referring to polypeptides are defined as distinct amino acid sequence-based components of a molecule. Features of the polypeptides encoded by the mmRNA of the present invention include surface manifestations, local conformational shape, folds, loops, half-loops, domains, half-domains, sites, termini or any combination thereof.

[00078] As used herein when referring to polypeptides the term "surface manifestation" refers to a polypeptide based component of a protein appearing on an outermost surface.

[00079] As used herein when referring to polypeptides the term "local conformational shape" means a polypeptide based structural manifestation of a protein which is located within a definable space of the protein.

[00080] As used herein when referring to polypeptides the term "fold" refers to the resultant conformation of an amino acid sequence upon energy minimization. A fold may occur at the secondary or tertiary level of the folding process. Examples of secondary level folds include beta sheets and alpha helices. Examples of tertiary folds include

domains and regions formed due to aggregation or separation of energetic forces. Regions formed in this way include hydrophobic and hydrophilic pockets, and the like.

[00081] As used herein the term "turn" as it relates to protein conformation means a bend which alters the direction of the backbone of a peptide or polypeptide and may involve one, two, three or more amino acid residues.

[00082] As used herein when referring to polypeptides the term "loop" refers to a structural feature of a polypeptide which may serve to reverse the direction of the backbone of a peptide or polypeptide. Where the loop is found in a polypeptide and only alters the direction of the backbone, it may comprise four or more amino acid residues. Oliva et al. have identified at least 5 classes of protein loops (J. Mol Biol 266 (4): 814-830; 1997). Loops may be open or closed. Closed loops or "cyclic" loops may comprise 2, 3, 4, 5, 6, 7, 8, 9, 10 or more amino acids between the bridging moieties. Such bridging moieties may comprise a cysteine-cysteine bridge (Cys-Cys) typical in polypeptides having disulfide bridges or alternatively bridging moieties may be non-protein based such as the dibromozylyl agents used herein.

[00083] As used herein when referring to polypeptides the term "half-loop" refers to a portion of an identified loop having at least half the number of amino acid resides as the loop from which it is derived. It is understood that loops may not always contain an even number of amino acid residues. Therefore, in those cases where a loop contains or is identified to comprise an odd number of amino acids, a half-loop of the odd-numbered loop will comprise the whole number portion or next whole number portion of the loop (number of amino acids of the loop/2+/-0.5 amino acids). For example, a loop identified as a 7 amino acid loop could produce half-loops of 3 amino acids or 4 amino acids (7/2=3.5+/-0.5 being 3 or 4).

[00084] As used herein when referring to polypeptides the term "domain" refers to a motif of a polypeptide having one or more identifiable structural or functional characteristics or properties (e.g., binding capacity, serving as a site for protein-protein interactions).

[00085] As used herein when referring to polypeptides the term "half-domain" means a portion of an identified domain having at least half the number of amino acid resides as the domain from which it is derived. It is understood that domains may not always

contain an even number of amino acid residues. Therefore, in those cases where a domain contains or is identified to comprise an odd number of amino acids, a half-domain of the odd-numbered domain will comprise the whole number portion or next whole number portion of the domain (number of amino acids of the domain/2+/-0.5 amino acids). For example, a domain identified as a 7 amino acid domain could produce half-domains of 3 amino acids or 4 amino acids (7/2=3.5+/-0.5 being 3 or 4). It is also understood that sub-domains may be identified within domains or half-domains, these subdomains possessing less than all of the structural or functional properties identified in the domains or half domains from which they were derived. It is also understood that the amino acids that comprise any of the domain types herein need not be contiguous along the backbone of the polypeptide (i.e., nonadjacent amino acids may fold structurally to produce a domain, half-domain or subdomain).

[00086] As used herein when referring to polypeptides the terms "site" as it pertains to amino acid based embodiments is used synonymously with "amino acid residue" and "amino acid side chain." A site represents a position within a peptide or polypeptide that may be modified, manipulated, altered, derivatized or varied within the polypeptide based molecules of the present invention.

[00087] As used herein the terms "termini" or "terminus" when referring to polypeptides refers to an extremity of a peptide or polypeptide. Such extremity is not limited only to the first or final site of the peptide or polypeptide but may include additional amino acids in the terminal regions. The polypeptide based molecules of the present invention may be characterized as having both an N-terminus (terminated by an amino acid with a free amino group (NH2)) and a C-terminus (terminated by an amino acid with a free carboxyl group (COOH)). Proteins of the invention are in some cases made up of multiple polypeptide chains brought together by disulfide bonds or by non-covalent forces (multimers, oligomers). These sorts of proteins will have multiple N- and C-termini. Alternatively, the termini of the polypeptides may be modified such that they begin or end, as the case may be, with a non-polypeptide based moiety such as an organic conjugate.

[00088] Once any of the features have been identified or defined as a desired component of a polypeptide to be encoded by the primary construct or mmRNA of the

invention, any of several manipulations and/or modifications of these features may be performed by moving, swapping, inverting, deleting, randomizing or duplicating. Furthermore, it is understood that manipulation of features may result in the same outcome as a modification to the molecules of the invention. For example, a manipulation which involved deleting a domain would result in the alteration of the length of a molecule just as modification of a nucleic acid to encode less than a full length molecule would.

[00089] Modifications and manipulations can be accomplished by methods known in the art such as, but not limited to, site directed mutagenesis. The resulting modified molecules may then be tested for activity using *in vitro* or *in vivo* assays such as those described herein or any other suitable screening assay known in the art.

[00090] According to the present invention, the polypeptides may comprise a consensus sequence which is discovered through rounds of experimentation. As used herein a "consensus" sequence is a single sequence which represents a collective population of sequences allowing for variability at one or more sites.

[00091] As recognized by those skilled in the art, protein fragments, functional protein domains, and homologous proteins are also considered to be within the scope of polypeptides of interest of this invention. For example, provided herein is any protein fragment (meaning a polypeptide sequence at least one amino acid residue shorter than a reference polypeptide sequence but otherwise identical) of a reference protein 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 or greater than 100 amino acids in length. In another example, any protein that includes a stretch of about 20, about 30, about 40, about 50, or about 100 amino acids which are about 40%, about 50%, about 60%, about 70%, about 80%, about 90%, about 95%, or about 100% identical to any of the sequences described herein can be utilized in accordance with the invention. In certain embodiments, a polypeptide to be utilized in accordance with the invention includes 2, 3, 4, 5, 6, 7, 8, 9, 10, or more mutations as shown in any of the sequences provided or referenced herein.

Encoded Polypeptides

[00092] The primary constructs or mmRNA of the present invention may be designed to encode polypeptides of interest selected from any of several target categories including, but not limited to, biologics, antibodies, vaccines, therapeutic proteins or

peptides, cell penetrating peptides, secreted proteins, plasma membrane proteins, cytoplasmic or cytoskeletal proteins, intracellular membrane bound proteins, nuclear proteins, proteins associated with human disease, targeting moieties or those proteins encoded by the human genome for which no therapeutic indication has been identified but which nonetheless have utility in areas of research and discovery.

[00093] In one embodiment primary constructs or mmRNA may encode variant polypeptides which have a certain identity with a reference polypeptide sequence. As used herein, a "reference polypeptide sequence" refers to a starting polypeptide sequence. Reference sequences may be wild type sequences or any sequence to which reference is made in the design of another sequence. A "reference polypeptide sequence" may, e.g., be any one of SEQ ID NOs: 8144-16131 as disclosed herein, e.g., any of SEQ ID NOs 8144, 8145, 8146, 8147, 8148, 8149, 8150, 8151, 8152, 8153, 8154, 8155, 8156, 8157, 8158, 8159, 8160, 8161, 8162, 8163, 8164, 8165, 8166, 8167, 8168, 8169, 8170, 8171, 8172, 8173, 8174, 8175, 8176, 8177, 8178, 8179, 8180, 8181, 8182, 8183, 8184, 8185, 8186, 8187, 8188, 8189, 8190, 8191, 8192, 8193, 8194, 8195, 8196, 8197, 8198, 8199, 8200, 8201, 8202, 8203, 8204, 8205, 8206, 8207, 8208, 8209, 8210, 8211, 8212, 8213, 8214, 8215, 8216, 8217, 8218, 8219, 8220, 8221, 8222, 8223, 8224, 8225, 8226, 8227, 8228, 8229, 8230, 8231, 8232, 8233, 8234, 8235, 8236, 8237, 8238, 8239, 8240, 8241, 8242, 8243, 8244, 8245, 8246, 8247, 8248, 8249, 8250, 8251, 8252, 8253, 8254, 8255, 8256, 8257, 8258, 8259, 8260, 8261, 8262, 8263, 8264, 8265, 8266, 8267, 8268, 8269, 8270, 8271, 8272, 8273, 8274, 8275, 8276, 8277, 8278, 8279, 8280, 8281, 8282, 8283, 8284, 8285, 8286, 8287, 8288, 8289, 8290, 8291, 8292, 8293, 8294, 8295, 8296, 8297, 8298, 8299, 8300, 8301, 8302, 8303, 8304, 8305, 8306, 8307, 8308, 8309, 8310, 8311, 8312, 8313, 8314, 8315, 8316, 8317, 8318, 8319, 8320, 8321, 8322, 8323, 8324, 8325, 8326, 8327, 8328, 8329, 8330, 8331, 8332, 8333, 8334, 8335, 8336, 8337, 8338, 8339, 8340, 8341, 8342, 8343, 8344, 8345, 8346, 8347, 8348, 8349, 8350, 8351, 8352, 8353, 8354, 8355, 8356, 8357, 8358, 8359, 8360, 8361, 8362, 8363, 8364, 8365, 8366, 8367, 8368, 8369, 8370, 8371, 8372, 8373, 8374, 8375, 8376, 8377, 8378, 8379, 8380, 8381, 8382, 8383, 8384, 8385, 8386, 8387, 8388, 8389, 8390, 8391, 8392, 8393, 8394, 8395, 8396, 8397, 8398, 8399, 8400, 8401, 8402, 8403, 8404, 8405, 8406, 8407, 8408, 8409, 8410, 8411, 8412, 8413, 8414, 8415, 8416, 8417, 8418, 8419, 8420, 8421, 8422, 8423,

8424, 8425, 8426, 8427, 8428, 8429, 8430, 8431, 8432, 8433, 8434, 8435, 8436, 8437, 8438, 8439, 8440, 8441, 8442, 8443, 8444, 8445, 8446, 8447, 8448, 8449, 8450, 8451, 8452, 8453, 8454, 8455, 8456, 8457, 8458, 8459, 8460, 8461, 8462, 8463, 8464, 8465, 8466, 8467, 8468, 8469, 8470, 8471, 8472, 8473, 8474, 8475, 8476, 8477, 8478, 8479, 8480, 8481, 8482, 8483, 8484, 8485, 8486, 8487, 8488, 8489, 8490, 8491, 8492, 8493, 8494, 8495, 8496, 8497, 8498, 8499, 8500, 8501, 8502, 8503, 8504, 8505, 8506, 8507, 8508, 8509, 8510, 8511, 8512, 8513, 8514, 8515, 8516, 8517, 8518, 8519, 8520, 8521, 8522, 8523, 8524, 8525, 8526, 8527, 8528, 8529, 8530, 8531, 8532, 8533, 8534, 8535, 8536, 8537, 8538, 8539, 8540, 8541, 8542, 8543, 8544, 8545, 8546, 8547, 8548, 8549, 8550, 8551, 8552, 8553, 8554, 8555, 8556, 8557, 8558, 8559, 8560, 8561, 8562, 8563, 8564, 8565, 8566, 8567, 8568, 8569, 8570, 8571, 8572, 8573, 8574, 8575, 8576, 8577, 8578, 8579, 8580, 8581, 8582, 8583, 8584, 8585, 8586, 8587, 8588, 8589, 8590, 8591, 8592, 8593, 8594, 8595, 8596, 8597, 8598, 8599, 8600, 8601, 8602, 8603, 8604, 8605, 8606, 8607, 8608, 8609, 8610, 8611, 8612, 8613, 8614, 8615, 8616, 8617, 8618, 8619, 8620, 8621, 8622, 8623, 8624, 8625, 8626, 8627, 8628, 8629, 8630, 8631, 8632, 8633, 8634, 8635, 8636, 8637, 8638, 8639, 8640, 8641, 8642, 8643, 8644, 8645, 8646, 8647, 8648, 8649, 8650, 8651, 8652, 8653, 8654, 8655, 8656, 8657, 8658, 8659, 8660, 8661, 8662, 8663, 8664, 8665, 8666, 8667, 8668, 8669, 8670, 8671, 8672, 8673, 8674, 8675, 8676, 8677, 8678, 8679, 8680, 8681, 8682, 8683, 8684, 8685, 8686, 8687, 8688, 8689, 8690, 8691, 8692, 8693, 8694, 8695, 8696, 8697, 8698, 8699, 8700, 8701, 8702, 8703, 8704, 8705, 8706, 8707, 8708, 8709, 8710, 8711, 8712, 8713, 8714, 8715, 8716, 8717, 8718, 8719, 8720, 8721, 8722, 8723, 8724, 8725, 8726, 8727, 8728, 8729, 8730, 8731, 8732, 8733, 8734, 8735, 8736, 8737, 8738, 8739, 8740, 8741, 8742, 8743, 8744, 8745, 8746, 8747, 8748, 8749, 8750, 8751, 8752, 8753, 8754, 8755, 8756, 8757, 8758, 8759, 8760, 8761, 8762, 8763, 8764, 8765, 8766, 8767, 8768, 8769, 8770, 8771, 8772, 8773, 8774, 8775, 8776, 8777, 8778, 8779, 8780, 8781, 8782, 8783, 8784, 8785, 8786, 8787, 8788, 8789, 8790, 8791, 8792, 8793, 8794, 8795, 8796, 8797, 8798, 8799, 8800, 8801, 8802, 8803, 8804, 8805, 8806, 8807, 8808, 8809, 8810, 8811, 8812, 8813, 8814, 8815, 8816, 8817, 8818, 8819, 8820, 8821, 8822, 8823, 8824, 8825, 8826, 8827, 8828, 8829, 8830, 8831, 8832, 8833, 8834, 8835, 8836, 8837, 8838, 8839, 8840, 8841, 8842, 8843, 8844, 8845, 8846, 8847, 8848, 8849, 8850, 8851, 8852, 8853, 8854, 8855, 8856, 8857,

8858, 8859, 8860, 8861, 8862, 8863, 8864, 8865, 8866, 8867, 8868, 8869, 8870, 8871, 8872, 8873, 8874, 8875, 8876, 8877, 8878, 8879, 8880, 8881, 8882, 8883, 8884, 8885, 8886, 8887, 8888, 8889, 8890, 8891, 8892, 8893, 8894, 8895, 8896, 8897, 8898, 8899, 8900, 8901, 8902, 8903, 8904, 8905, 8906, 8907, 8908, 8909, 8910, 8911, 8912, 8913, 8914, 8915, 8916, 8917, 8918, 8919, 8920, 8921, 8922, 8923, 8924, 8925, 8926, 8927, 8928, 8929, 8930, 8931, 8932, 8933, 8934, 8935, 8936, 8937, 8938, 8939, 8940, 8941, 8942, 8943, 8944, 8945, 8946, 8947, 8948, 8949, 8950, 8951, 8952, 8953, 8954, 8955, 8956, 8957, 8958, 8959, 8960, 8961, 8962, 8963, 8964, 8965, 8966, 8967, 8968, 8969, 8970, 8971, 8972, 8973, 8974, 8975, 8976, 8977, 8978, 8979, 8980, 8981, 8982, 8983, 8984, 8985, 8986, 8987, 8988, 8989, 8990, 8991, 8992, 8993, 8994, 8995, 8996, 8997, 8998, 8999, 9000, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9011, 9012, 9013, 9014, 9015, 9016, 9017, 9018, 9019, 9020, 9021, 9022, 9023, 9024, 9025, 9026, 9027, 9028, 9029, 9030, 9031, 9032, 9033, 9034, 9035, 9036, 9037, 9038, 9039, 9040, 9041, 9042, 9043, 9044, 9045, 9046, 9047, 9048, 9049, 9050, 9051, 9052, 9053, 9054, 9055, 9056, 9057, 9058, 9059, 9060, 9061, 9062, 9063, 9064, 9065, 9066, 9067, 9068, 9069, 9070, 9071, 9072, 9073, 9074, 9075, 9076, 9077, 9078, 9079, 9080, 9081, 9082, 9083, 9084, 9085, 9086, 9087, 9088, 9089, 9090, 9091, 9092, 9093, 9094, 9095, 9096, 9097, 9098, 9099, 9100, 9101, 9102, 9103, 9104, 9105, 9106, 9107, 9108, 9109, 9110, 9111, 9112, 9113, 9114, 9115, 9116, 9117, 9118, 9119, 9120, 9121, 9122, 9123, 9124, 9125, 9126, 9127, 9128, 9129, 9130, 9131, 9132, 9133, 9134, 9135, 9136, 9137, 9138, 9139, 9140, 9141, 9142, 9143, 9144, 9145, 9146, 9147, 9148, 9149, 9150, 9151, 9152, 9153, 9154, 9155, 9156, 9157, 9158, 9159, 9160, 9161, 9162, 9163, 9164, 9165, 9166, 9167, 9168, 9169, 9170, 9171, 9172, 9173, 9174, 9175, 9176, 9177, 9178, 9179, 9180, 9181, 9182, 9183, 9184, 9185, 9186, 9187, 9188, 9189, 9190, 9191, 9192, 9193, 9194, 9195, 9196, 9197, 9198, 9199, 9200, 9201, 9202, 9203, 9204, 9205, 9206, 9207, 9208, 9209, 9210, 9211, 9212, 9213, 9214, 9215, 9216, 9217, 9218, 9219, 9220, 9221, 9222, 9223, 9224, 9225, 9226, 9227, 9228, 9229, 9230, 9231, 9232, 9233, 9234, 9235, 9236, 9237, 9238, 9239, 9240, 9241, 9242, 9243, 9244, 9245, 9246, 9247, 9248, 9249, 9250, 9251, 9252, 9253, 9254, 9255, 9256, 9257, 9258, 9259, 9260, 9261, 9262, 9263, 9264, 9265, 9266, 9267, 9268, 9269, 9270, 9271, 9272, 9273, 9274, 9275, 9276, 9277, 9278, 9279, 9280, 9281, 9282, 9283, 9284, 9285, 9286, 9287, 9288, 9289, 9290, 9291,

9292, 9293, 9294, 9295, 9296, 9297, 9298, 9299, 9300, 9301, 9302, 9303, 9304, 9305, 9306, 9307, 9308, 9309, 9310, 9311, 9312, 9313, 9314, 9315, 9316, 9317, 9318, 9319, 9320, 9321, 9322, 9323, 9324, 9325, 9326, 9327, 9328, 9329, 9330, 9331, 9332, 9333, 9334, 9335, 9336, 9337, 9338, 9339, 9340, 9341, 9342, 9343, 9344, 9345, 9346, 9347, 9348, 9349, 9350, 9351, 9352, 9353, 9354, 9355, 9356, 9357, 9358, 9359, 9360, 9361, 9362, 9363, 9364, 9365, 9366, 9367, 9368, 9369, 9370, 9371, 9372, 9373, 9374, 9375, 9376, 9377, 9378, 9379, 9380, 9381, 9382, 9383, 9384, 9385, 9386, 9387, 9388, 9389, 9390, 9391, 9392, 9393, 9394, 9395, 9396, 9397, 9398, 9399, 9400, 9401, 9402, 9403, 9404, 9405, 9406, 9407, 9408, 9409, 9410, 9411, 9412, 9413, 9414, 9415, 9416, 9417, 9418, 9419, 9420, 9421, 9422, 9423, 9424, 9425, 9426, 9427, 9428, 9429, 9430, 9431, 9432, 9433, 9434, 9435, 9436, 9437, 9438, 9439, 9440, 9441, 9442, 9443, 9444, 9445, 9446, 9447, 9448, 9449, 9450, 9451, 9452, 9453, 9454, 9455, 9456, 9457, 9458, 9459, 9460, 9461, 9462, 9463, 9464, 9465, 9466, 9467, 9468, 9469, 9470, 9471, 9472, 9473, 9474, 9475, 9476, 9477, 9478, 9479, 9480, 9481, 9482, 9483, 9484, 9485, 9486, 9487, 9488, 9489, 9490, 9491, 9492, 9493, 9494, 9495, 9496, 9497, 9498, 9499, 9500, 9501, 9502, 9503, 9504, 9505, 9506, 9507, 9508, 9509, 9510, 9511, 9512, 9513, 9514, 9515, 9516, 9517, 9518, 9519, 9520, 9521, 9522, 9523, 9524, 9525, 9526, 9527, 9528, 9529, 9530, 9531, 9532, 9533, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9541, 9542, 9543, 9544, 9545, 9546, 9547, 9548, 9549, 9550, 9551, 9552, 9553, 9554, 9555, 9556, 9557, 9558, 9559, 9560, 9561, 9562, 9563, 9564, 9565, 9566, 9567, 9568, 9569, 9570, 9571, 9572, 9573, 9574, 9575, 9576, 9577, 9578, 9579, 9580, 9581, 9582, 9583, 9584, 9585, 9586, 9587, 9588, 9589, 9590, 9591, 9592, 9593, 9594, 9595, 9596, 9597, 9598, 9599, 9600, 9601, 9602, 9603, 9604, 9605, 9606, 9607, 9608, 9609, 9610, 9611, 9612, 9613, 9614, 9615, 9616, 9617, 9618, 9619, 9620, 9621, 9622, 9623, 9624, 9625, 9626, 9627, 9628, 9629, 9630, 9631, 9632, 9633, 9634, 9635, 9636, 9637, 9638, 9639, 9640, 9641, 9642, 9643, 9644, 9645, 9646, 9647, 9648, 9649, 9650, 9651, 9652, 9653, 9654, 9655, 9656, 9657, 9658, 9659, 9660, 9661, 9662, 9663, 9664, 9665, 9666, 9667, 9668, 9669, 9670, 9671, 9672, 9673, 9674, 9675, 9676, 9677, 9678, 9679, 9680, 9681, 9682, 9683, 9684, 9685, 9686, 9687, 9688, 9689, 9690, 9691, 9692, 9693, 9694, 9695, 9696, 9697, 9698, 9699, 9700, 9701, 9702, 9703, 9704, 9705, 9706, 9707, 9708, 9709, 9710, 9711, 9712, 9713, 9714, 9715, 9716, 9717, 9718, 9719, 9720, 9721, 9722, 9723, 9724, 9725,

9726, 9727, 9728, 9729, 9730, 9731, 9732, 9733, 9734, 9735, 9736, 9737, 9738, 9739, 9740, 9741, 9742, 9743, 9744, 9745, 9746, 9747, 9748, 9749, 9750, 9751, 9752, 9753, 9754, 9755, 9756, 9757, 9758, 9759, 9760, 9761, 9762, 9763, 9764, 9765, 9766, 9767, 9768, 9769, 9770, 9771, 9772, 9773, 9774, 9775, 9776, 9777, 9778, 9779, 9780, 9781, 9782, 9783, 9784, 9785, 9786, 9787, 9788, 9789, 9790, 9791, 9792, 9793, 9794, 9795, 9796, 9797, 9798, 9799, 9800, 9801, 9802, 9803, 9804, 9805, 9806, 9807, 9808, 9809, 9810, 9811, 9812, 9813, 9814, 9815, 9816, 9817, 9818, 9819, 9820, 9821, 9822, 9823, 9824, 9825, 9826, 9827, 9828, 9829, 9830, 9831, 9832, 9833, 9834, 9835, 9836, 9837, 9838, 9839, 9840, 9841, 9842, 9843, 9844, 9845, 9846, 9847, 9848, 9849, 9850, 9851, 9852, 9853, 9854, 9855, 9856, 9857, 9858, 9859, 9860, 9861, 9862, 9863, 9864, 9865, 9866, 9867, 9868, 9869, 9870, 9871, 9872, 9873, 9874, 9875, 9876, 9877, 9878, 9879, 9880, 9881, 9882, 9883, 9884, 9885, 9886, 9887, 9888, 9889, 9890, 9891, 9892, 9893, 9894, 9895, 9896, 9897, 9898, 9899, 9900, 9901, 9902, 9903, 9904, 9905, 9906, 9907, 9908, 9909, 9910, 9911, 9912, 9913, 9914, 9915, 9916, 9917, 9918, 9919, 9920, 9921, 9922, 9923, 9924, 9925, 9926, 9927, 9928, 9929, 9930, 9931, 9932, 9933, 9934, 9935, 9936, 9937, 9938, 9939, 9940, 9941, 9942, 9943, 9944, 9945, 9946, 9947, 9948, 9949, 9950, 9951, 9952, 9953, 9954, 9955, 9956, 9957, 9958, 9959, 9960, 9961, 9962, 9963, 9964, 9965, 9966, 9967, 9968, 9969, 9970, 9971, 9972, 9973, 9974, 9975, 9976, 9977, 9978, 9979, 9980, 9981, 9982, 9983, 9984, 9985, 9986, 9987, 9988, 9989, 9990, 9991, 9992, 9993, 9994, 9995, 9996, 9997, 9998, 9999, 10000, 10001, 10002, 10003, 10004, 10005, 10006, 10007, 10008, 10009, 10010, 10011, 10012, 10013, 10014, 10015, 10016, 10017, 10018, 10019, 10020, 10021, 10022, 10023, 10024, 10025, 10026, 10027, 10028, 10029, 10030, 10031, 10032, 10033, 10034, 10035, 10036, 10037, 10038, 10039, 10040, 10041, 10042, 10043, 10044, 10045, 10046, 10047, 10048, 10049, 10050, 10051, 10052, 10053, 10054, 10055, 10056, 10057, 10058, 10059, 10060, 10061, 10062, 10063, 10064, 10065, 10066, 10067, 10068, 10069, 10070, 10071, 10072, 10073, 10074, 10075, 10076, 10077, 10078, 10079, 10080, 10081, 10082, 10083, 10084, 10085, 10086, 10087, 10088, 10089, 10090, 10091, 10092, 10093, 10094, 10095, 10096, 10097, 10098, 10099, 10100, 10101, 10102, 10103, 10104, 10105, 10106, 10107, 10108, 10109, 10110, 10111, 10112, 10113, 10114, 10115, 10116, 10117, 10118, 10119, 10120, 10121, 10122, 10123, 10124, 10125, 10126, 10127, 10128, 10129, 10130, 10131, 10132, 10133, 10134, 10135, 10136,

10137, 10138, 10139, 10140, 10141, 10142, 10143, 10144, 10145, 10146, 10147, 10148, 10149, 10150, 10151, 10152, 10153, 10154, 10155, 10156, 10157, 10158, 10159, 10160, 10161, 10162, 10163, 10164, 10165, 10166, 10167, 10168, 10169, 10170, 10171, 10172, 10173, 10174, 10175, 10176, 10177, 10178, 10179, 10180, 10181, 10182, 10183, 10184, 10185, 10186, 10187, 10188, 10189, 10190, 10191, 10192, 10193, 10194, 10195, 10196, 10197, 10198, 10199, 10200, 10201, 10202, 10203, 10204, 10205, 10206, 10207, 10208, 10209, 10210, 10211, 10212, 10213, 10214, 10215, 10216, 10217, 10218, 10219, 10220, 10221, 10222, 10223, 10224, 10225, 10226, 10227, 10228, 10229, 10230, 10231, 10232, 10233, 10234, 10235, 10236, 10237, 10238, 10239, 10240, 10241, 10242, 10243, 10244, 10245, 10246, 10247, 10248, 10249, 10250, 10251, 10252, 10253, 10254, 10255, 10256, 10257, 10258, 10259, 10260, 10261, 10262, 10263, 10264, 10265, 10266, 10267, 10268, 10269, 10270, 10271, 10272, 10273, 10274, 10275, 10276, 10277, 10278, 10279, 10280, 10281, 10282, 10283, 10284, 10285, 10286, 10287, 10288, 10289, 10290, 10291, 10292, 10293, 10294, 10295, 10296, 10297, 10298, 10299, 10300, 10301, 10302, 10303, 10304, 10305, 10306, 10307, 10308, 10309, 10310, 10311, 10312, 10313, 10314, 10315, 10316, 10317, 10318, 10319, 10320, 10321, 10322, 10323, 10324, 10325, 10326, 10327, 10328, 10329, 10330, 10331, 10332, 10333, 10334, 10335, 10336, 10337, 10338, 10339, 10340, 10341, 10342, 10343, 10344, 10345, 10346, 10347, 10348, 10349, 10350, 10351, 10352, 10353, 10354, 10355, 10356, 10357, 10358, 10359, 10360, 10361, 10362, 10363, 10364, 10365, 10366, 10367, 10368, 10369, 10370, 10371, 10372, 10373, 10374, 10375, 10376, 10377, 10378, 10379, 10380, 10381, 10382, 10383, 10384, 10385, 10386, 10387, 10388, 10389, 10390, 10391, 10392, 10393, 10394, 10395, 10396, 10397, 10398, 10399, 10400, 10401, 10402, 10403, 10404, 10405, 10406, 10407, 10408, 10409, 10410, 10411, 10412, 10413, 10414, 10415, 10416, 10417, 10418, 10419, 10420, 10421, 10422, 10423, 10424, 10425, 10426, 10427, 10428, 10429, 10430, 10431, 10432, 10433, 10434, 10435, 10436, 10437, 10438, 10439, 10440, 10441, 10442, 10443, 10444, 10445, 10446, 10447, 10448, 10449, 10450, 10451, 10452, 10453, 10454, 10455, 10456, 10457, 10458, 10459, 10460, 10461, 10462, 10463, 10464, 10465, 10466, 10467, 10468, 10469, 10470, 10471, 10472, 10473, 10474, 10475, 10476, 10477, 10478, 10479, 10480, 10481, 10482, 10483, 10484, 10485, 10486, 10487, 10488, 10489, 10490, 10491, 10492, 10493, 10494, 10495, 10496, 10497, 10498, 10499, 10500, 10501, 10502, 10503, 10504, 10505, 10506, 10507, 10508,

10509, 10510, 10511, 10512, 10513, 10514, 10515, 10516, 10517, 10518, 10519, 10520, 10521, 10522, 10523, 10524, 10525, 10526, 10527, 10528, 10529, 10530, 10531, 10532, 10533, 10534, 10535, 10536, 10537, 10538, 10539, 10540, 10541, 10542, 10543, 10544, 10545, 10546, 10547, 10548, 10549, 10550, 10551, 10552, 10553, 10554, 10555, 10556, 10557, 10558, 10559, 10560, 10561, 10562, 10563, 10564, 10565, 10566, 10567, 10568, 10569, 10570, 10571, 10572, 10573, 10574, 10575, 10576, 10577, 10578, 10579, 10580, 10581, 10582, 10583, 10584, 10585, 10586, 10587, 10588, 10589, 10590, 10591, 10592, 10593, 10594, 10595, 10596, 10597, 10598, 10599, 10600, 10601, 10602, 10603, 10604, 10605, 10606, 10607, 10608, 10609, 10610, 10611, 10612, 10613, 10614, 10615, 10616, 10617, 10618, 10619, 10620, 10621, 10622, 10623, 10624, 10625, 10626, 10627, 10628, 10629, 10630, 10631, 10632, 10633, 10634, 10635, 10636, 10637, 10638, 10639, 10640, 10641, 10642, 10643, 10644, 10645, 10646, 10647, 10648, 10649, 10650, 10651, 10652, 10653, 10654, 10655, 10656, 10657, 10658, 10659, 10660, 10661, 10662, 10663, 10664, 10665, 10666, 10667, 10668, 10669, 10670, 10671, 10672, 10673, 10674, 10675, 10676, 10677, 10678, 10679, 10680, 10681, 10682, 10683, 10684, 10685, 10686, 10687, 10688, 10689, 10690, 10691, 10692, 10693, 10694, 10695, 10696, 10697, 10698, 10699, 10700, 10701, 10702, 10703, 10704, 10705, 10706, 10707, 10708, 10709, 10710, 10711, 10712, 10713, 10714, 10715, 10716, 10717, 10718, 10719, 10720, 10721, 10722, 10723, 10724, 10725, 10726, 10727, 10728, 10729, 10730, 10731, 10732, 10733, 10734, 10735, 10736, 10737, 10738, 10739, 10740, 10741, 10742, 10743, 10744, 10745, 10746, 10747, 10748, 10749, 10750, 10751, 10752, 10753, 10754, 10755, 10756, 10757, 10758, 10759, 10760, 10761, 10762, 10763, 10764, 10765, 10766, 10767, 10768, 10769, 10770, 10771, 10772, 10773, 10774, 10775, 10776, 10777, 10778, 10779, 10780, 10781, 10782, 10783, 10784, 10785, 10786, 10787, 10788, 10789, 10790, 10791, 10792, 10793, 10794, 10795, 10796, 10797, 10798, 10799, 10800, 10801, 10802, 10803, 10804, 10805, 10806, 10807, 10808, 10809, 10810, 10811, 10812, 10813, 10814, 10815, 10816, 10817, 10818, 10819, 10820, 10821, 10822, 10823, 10824, 10825, 10826, 10827, 10828, 10829, 10830, 10831, 10832, 10833, 10834, 10835, 10836, 10837, 10838, 10839, 10840, 10841, 10842, 10843, 10844, 10845, 10846, 10847, 10848, 10849, 10850, 10851, 10852, 10853, 10854, 10855, 10856, 10857, 10858, 10859, 10860, 10861, 10862, 10863, 10864, 10865, 10866, 10867, 10868, 10869, 10870, 10871, 10872, 10873, 10874, 10875, 10876, 10877, 10878, 10879, 10880,

10881, 10882, 10883, 10884, 10885, 10886, 10887, 10888, 10889, 10890, 10891, 10892, 10893, 10894, 10895, 10896, 10897, 10898, 10899, 10900, 10901, 10902, 10903, 10904, 10905, 10906, 10907, 10908, 10909, 10910, 10911, 10912, 10913, 10914, 10915, 10916, 10917, 10918, 10919, 10920, 10921, 10922, 10923, 10924, 10925, 10926, 10927, 10928, 10929, 10930, 10931, 10932, 10933, 10934, 10935, 10936, 10937, 10938, 10939, 10940, 10941, 10942, 10943, 10944, 10945, 10946, 10947, 10948, 10949, 10950, 10951, 10952, 10953, 10954, 10955, 10956, 10957, 10958, 10959, 10960, 10961, 10962, 10963, 10964, 10965, 10966, 10967, 10968, 10969, 10970, 10971, 10972, 10973, 10974, 10975, 10976, 10977, 10978, 10979, 10980, 10981, 10982, 10983, 10984, 10985, 10986, 10987, 10988, 10989, 10990, 10991, 10992, 10993, 10994, 10995, 10996, 10997, 10998, 10999, 11000, 11001, 11002, 11003, 11004, 11005, 11006, 11007, 11008, 11009, 11010, 11011, 11012, 11013, 11014, 11015, 11016, 11017, 11018, 11019, 11020, 11021, 11022, 11023, 11024, 11025, 11026, 11027, 11028, 11029, 11030, 11031, 11032, 11033, 11034, 11035, 11036, 11037, 11038, 11039, 11040, 11041, 11042, 11043, 11044, 11045, 11046, 11047, 11048, 11049, 11050, 11051, 11052, 11053, 11054, 11055, 11056, 11057, 11058, 11059, 11060, 11061, 11062, 11063, 11064, 11065, 11066, 11067, 11068, 11069, 11070, 11071, 11072, 11073, 11074, 11075, 11076, 11077, 11078, 11079, 11080, 11081, 11082, 11083, 11084, 11085, 11086, 11087, 11088, 11089, 11090, 11091, 11092, 11093, 11094, 11095, 11096, 11097, 11098, 11099, 11100, 11101, 11102, 11103, 11104, 11105, 11106, 11107, 11108, 11109, 11110, 11111, 11112, 11113, 11114, 11115, 11116, 11117, 11118, 11119, 11120, 11121, 11122, 11123, 11124, 11125, 11126, 11127, 11128, 11129, 11130, 11131, 11132, 11133, 11134, 11135, 11136, 11137, 11138, 11139, 11140, 11141, 11142, 11143, 11144, 11145, 11146, 11147, 11148, 11149, 11150, 11151, 11152, 11153, 11154, 11155, 11156, 11157, 11158, 11159, 11160, 11161, 11162, 11163, 11164, 11165, 11166, 11167, 11168, 11169, 11170, 11171, 11172, 11173, 11174, 11175, 11176, 11177, 11178, 11179, 11180, 11181, 11182, 11183, 11184, 11185, 11186, 11187, 11188, 11189, 11190, 11191, 11192, 11193, 11194, 11195, 11196, 11197, 11198, 11199, 11200, 11201, 11202, 11203, 11204, 11205, 11206, 11207, 11208, 11209, 11210, 11211, 11212, 11213, 11214, 11215, 11216, 11217, 11218, 11219, 11220, 11221, 11222, 11223, 11224, 11225, 11226, 11227, 11228, 11229, 11230, 11231, 11232, 11233, 11234, 11235, 11236, 11237, 11238, 11239, 11240, 11241, 11242, 11243, 11244, 11245, 11246, 11247, 11248, 11249, 11250, 11251, 11252,

11253, 11254, 11255, 11256, 11257, 11258, 11259, 11260, 11261, 11262, 11263, 11264, 11265, 11266, 11267, 11268, 11269, 11270, 11271, 11272, 11273, 11274, 11275, 11276, 11277, 11278, 11279, 11280, 11281, 11282, 11283, 11284, 11285, 11286, 11287, 11288, 11289, 11290, 11291, 11292, 11293, 11294, 11295, 11296, 11297, 11298, 11299, 11300, 11301, 11302, 11303, 11304, 11305, 11306, 11307, 11308, 11309, 11310, 11311, 11312, 11313, 11314, 11315, 11316, 11317, 11318, 11319, 11320, 11321, 11322, 11323, 11324, 11325, 11326, 11327, 11328, 11329, 11330, 11331, 11332, 11333, 11334, 11335, 11336, 11337, 11338, 11339, 11340, 11341, 11342, 11343, 11344, 11345, 11346, 11347, 11348, 11349, 11350, 11351, 11352, 11353, 11354, 11355, 11356, 11357, 11358, 11359, 11360, 11361, 11362, 11363, 11364, 11365, 11366, 11367, 11368, 11369, 11370, 11371, 11372, 11373, 11374, 11375, 11376, 11377, 11378, 11379, 11380, 11381, 11382, 11383, 11384, 11385, 11386, 11387, 11388, 11389, 11390, 11391, 11392, 11393, 11394, 11395, 11396, 11397, 11398, 11399, 11400, 11401, 11402, 11403, 11404, 11405, 11406, 11407, 11408, 11409, 11410, 11411, 11412, 11413, 11414, 11415, 11416, 11417, 11418, 11419, 11420, 11421, 11422, 11423, 11424, 11425, 11426, 11427, 11428, 11429, 11430, 11431, 11432, 11433, 11434, 11435, 11436, 11437, 11438, 11439, 11440, 11441, 11442, 11443, 11444, 11445, 11446, 11447, 11448, 11449, 11450, 11451, 11452, 11453, 11454, 11455, 11456, 11457, 11458, 11459, 11460, 11461, 11462, 11463, 11464, 11465, 11466, 11467, 11468, 11469, 11470, 11471, 11472, 11473, 11474, 11475, 11476, 11477, 11478, 11479, 11480, 11481, 11482, 11483, 11484, 11485, 11486, 11487, 11488, 11489, 11490, 11491, 11492, 11493, 11494, 11495, 11496, 11497, 11498, 11499, 11500, 11501, 11502, 11503, 11504, 11505, 11506, 11507, 11508, 11509, 11510, 11511, 11512, 11513, 11514, 11515, 11516, 11517, 11518, 11519, 11520, 11521, 11522, 11523, 11524, 11525, 11526, 11527, 11528, 11529, 11530, 11531, 11532, 11533, 11534, 11535, 11536, 11537, 11538, 11539, 11540, 11541, 11542, 11543, 11544, 11545, 11546, 11547, 11548, 11549, 11550, 11551, 11552, 11553, 11554, 11555, 11556, 11557, 11558, 11559, 11560, 11561, 11562, 11563, 11564, 11565, 11566, 11567, 11568, 11569, 11570, 11571, 11572, 11573, 11574, 11575, 11576, 11577, 11578, 11579, 11580, 11581, 11582, 11583, 11584, 11585, 11586, 11587, 11588, 11589, 11590, 11591, 11592, 11593, 11594, 11595, 11596, 11597, 11598, 11599, 11600, 11601, 11602, 11603, 11604, 11605, 11606, 11607, 11608, 11609, 11610, 11611, 11612, 11613, 11614, 11615, 11616, 11617, 11618, 11619, 11620, 11621, 11622, 11623, 11624,

11625, 11626, 11627, 11628, 11629, 11630, 11631, 11632, 11633, 11634, 11635, 11636, 11637, 11638, 11639, 11640, 11641, 11642, 11643, 11644, 11645, 11646, 11647, 11648, 11649, 11650, 11651, 11652, 11653, 11654, 11655, 11656, 11657, 11658, 11659, 11660, 11661, 11662, 11663, 11664, 11665, 11666, 11667, 11668, 11669, 11670, 11671, 11672, 11673, 11674, 11675, 11676, 11677, 11678, 11679, 11680, 11681, 11682, 11683, 11684, 11685, 11686, 11687, 11688, 11689, 11690, 11691, 11692, 11693, 11694, 11695, 11696, 11697, 11698, 11699, 11700, 11701, 11702, 11703, 11704, 11705, 11706, 11707, 11708, 11709, 11710, 11711, 11712, 11713, 11714, 11715, 11716, 11717, 11718, 11719, 11720, 11721, 11722, 11723, 11724, 11725, 11726, 11727, 11728, 11729, 11730, 11731, 11732, 11733, 11734, 11735, 11736, 11737, 11738, 11739, 11740, 11741, 11742, 11743, 11744, 11745, 11746, 11747, 11748, 11749, 11750, 11751, 11752, 11753, 11754, 11755, 11756, 11757, 11758, 11759, 11760, 11761, 11762, 11763, 11764, 11765, 11766, 11767, 11768, 11769, 11770, 11771, 11772, 11773, 11774, 11775, 11776, 11777, 11778, 11779, 11780, 11781, 11782, 11783, 11784, 11785, 11786, 11787, 11788, 11789, 11790, 11791, 11792, 11793, 11794, 11795, 11796, 11797, 11798, 11799, 11800, 11801, 11802, 11803, 11804, 11805, 11806, 11807, 11808, 11809, 11810, 11811, 11812, 11813, 11814, 11815, 11816, 11817, 11818, 11819, 11820, 11821, 11822, 11823, 11824, 11825, 11826, 11827, 11828, 11829, 11830, 11831, 11832, 11833, 11834, 11835, 11836, 11837, 11838, 11839, 11840, 11841, 11842, 11843, 11844, 11845, 11846, 11847, 11848, 11849, 11850, 11851, 11852, 11853, 11854, 11855, 11856, 11857, 11858, 11859, 11860, 11861, 11862, 11863, 11864, 11865, 11866, 11867, 11868, 11869, 11870, 11871, 11872, 11873, 11874, 11875, 11876, 11877, 11878, 11879, 11880, 11881, 11882, 11883, 11884, 11885, 11886, 11887, 11888, 11889, 11890, 11891, 11892, 11893, 11894, 11895, 11896, 11897, 11898, 11899, 11900, 11901, 11902, 11903, 11904, 11905, 11906, 11907, 11908, 11909, 11910, 11911, 11912, 11913, 11914, 11915, 11916, 11917, 11918, 11919, 11920, 11921, 11922, 11923, 11924, 11925, 11926, 11927, 11928, 11929, 11930, 11931, 11932, 11933, 11934, 11935, 11936, 11937, 11938, 11939, 11940, 11941, 11942, 11943, 11944, 11945, 11946, 11947, 11948, 11949, 11950, 11951, 11952, 11953, 11954, 11955, 11956, 11957, 11958, 11959, 11960, 11961, 11962, 11963, 11964, 11965, 11966, 11967, 11968, 11969, 11970, 11971, 11972, 11973, 11974, 11975, 11976, 11977, 11978, 11979, 11980, 11981, 11982, 11983, 11984, 11985, 11986, 11987, 11988, 11989, 11990, 11991, 11992, 11993, 11994, 11995, 11996,

11997, 11998, 11999, 12000, 12001, 12002, 12003, 12004, 12005, 12006, 12007, 12008, 12009, 12010, 12011, 12012, 12013, 12014, 12015, 12016, 12017, 12018, 12019, 12020, 12021, 12022, 12023, 12024, 12025, 12026, 12027, 12028, 12029, 12030, 12031, 12032, 12033, 12034, 12035, 12036, 12037, 12038, 12039, 12040, 12041, 12042, 12043, 12044, 12045, 12046, 12047, 12048, 12049, 12050, 12051, 12052, 12053, 12054, 12055, 12056, 12057, 12058, 12059, 12060, 12061, 12062, 12063, 12064, 12065, 12066, 12067, 12068, 12069, 12070, 12071, 12072, 12073, 12074, 12075, 12076, 12077, 12078, 12079, 12080, 12081, 12082, 12083, 12084, 12085, 12086, 12087, 12088, 12089, 12090, 12091, 12092, 12093, 12094, 12095, 12096, 12097, 12098, 12099, 12100, 12101, 12102, 12103, 12104, 12105, 12106, 12107, 12108, 12109, 12110, 12111, 12112, 12113, 12114, 12115, 12116, 12117, 12118, 12119, 12120, 12121, 12122, 12123, 12124, 12125, 12126, 12127, 12128, 12129, 12130, 12131, 12132, 12133, 12134, 12135, 12136, 12137, 12138, 12139, 12140, 12141, 12142, 12143, 12144, 12145, 12146, 12147, 12148, 12149, 12150, 12151, 12152, 12153, 12154, 12155, 12156, 12157, 12158, 12159, 12160, 12161, 12162, 12163, 12164, 12165, 12166, 12167, 12168, 12169, 12170, 12171, 12172, 12173, 12174, 12175, 12176, 12177, 12178, 12179, 12180, 12181, 12182, 12183, 12184, 12185, 12186, 12187, 12188, 12189, 12190, 12191, 12192, 12193, 12194, 12195, 12196, 12197, 12198, 12199, 12200, 12201, 12202, 12203, 12204, 12205, 12206, 12207, 12208, 12209, 12210, 12211, 12212, 12213, 12214, 12215, 12216, 12217, 12218, 12219, 12220, 12221, 12222, 12223, 12224, 12225, 12226, 12227, 12228, 12229, 12230, 12231, 12232, 12233, 12234, 12235, 12236, 12237, 12238, 12239, 12240, 12241, 12242, 12243, 12244, 12245, 12246, 12247, 12248, 12249, 12250, 12251, 12252, 12253, 12254, 12255, 12256, 12257, 12258, 12259, 12260, 12261, 12262, 12263, 12264, 12265, 12266, 12267, 12268, 12269, 12270, 12271, 12272, 12273, 12274, 12275, 12276, 12277, 12278, 12279, 12280, 12281, 12282, 12283, 12284, 12285, 12286, 12287, 12288, 12289, 12290, 12291, 12292, 12293, 12294, 12295, 12296, 12297, 12298, 12299, 12300, 12301, 12302, 12303, 12304, 12305, 12306, 12307, 12308, 12309, 12310, 12311, 12312, 12313, 12314, 12315, 12316, 12317, 12318, 12319, 12320, 12321, 12322, 12323, 12324, 12325, 12326, 12327, 12328, 12329, 12330, 12331, 12332, 12333, 12334, 12335, 12336, 12337, 12338, 12339, 12340, 12341, 12342, 12343, 12344, 12345, 12346, 12347, 12348, 12349, 12350, 12351, 12352, 12353, 12354, 12355, 12356, 12357, 12358, 12359, 12360, 12361, 12362, 12363, 12364, 12365, 12366, 12367, 12368,

12369, 12370, 12371, 12372, 12373, 12374, 12375, 12376, 12377, 12378, 12379, 12380, 12381, 12382, 12383, 12384, 12385, 12386, 12387, 12388, 12389, 12390, 12391, 12392, 12393, 12394, 12395, 12396, 12397, 12398, 12399, 12400, 12401, 12402, 12403, 12404, 12405, 12406, 12407, 12408, 12409, 12410, 12411, 12412, 12413, 12414, 12415, 12416, 12417, 12418, 12419, 12420, 12421, 12422, 12423, 12424, 12425, 12426, 12427, 12428, 12429, 12430, 12431, 12432, 12433, 12434, 12435, 12436, 12437, 12438, 12439, 12440, 12441, 12442, 12443, 12444, 12445, 12446, 12447, 12448, 12449, 12450, 12451, 12452, 12453, 12454, 12455, 12456, 12457, 12458, 12459, 12460, 12461, 12462, 12463, 12464, 12465, 12466, 12467, 12468, 12469, 12470, 12471, 12472, 12473, 12474, 12475, 12476, 12477, 12478, 12479, 12480, 12481, 12482, 12483, 12484, 12485, 12486, 12487, 12488, 12489, 12490, 12491, 12492, 12493, 12494, 12495, 12496, 12497, 12498, 12499, 12500, 12501, 12502, 12503, 12504, 12505, 12506, 12507, 12508, 12509, 12510, 12511, 12512, 12513, 12514, 12515, 12516, 12517, 12518, 12519, 12520, 12521, 12522, 12523, 12524, 12525, 12526, 12527, 12528, 12529, 12530, 12531, 12532, 12533, 12534, 12535, 12536, 12537, 12538, 12539, 12540, 12541, 12542, 12543, 12544, 12545, 12546, 12547, 12548, 12549, 12550, 12551, 12552, 12553, 12554, 12555, 12556, 12557, 12558, 12559, 12560, 12561, 12562, 12563, 12564, 12565, 12566, 12567, 12568, 12569, 12570, 12571, 12572, 12573, 12574, 12575, 12576, 12577, 12578, 12579, 12580, 12581, 12582, 12583, 12584, 12585, 12586, 12587, 12588, 12589, 12590, 12591, 12592, 12593, 12594, 12595, 12596, 12597, 12598, 12599, 12600, 12601, 12602, 12603, 12604, 12605, 12606, 12607, 12608, 12609, 12610, 12611, 12612, 12613, 12614, 12615, 12616, 12617, 12618, 12619, 12620, 12621, 12622, 12623, 12624, 12625, 12626, 12627, 12628, 12629, 12630, 12631, 12632, 12633, 12634, 12635, 12636, 12637, 12638, 12639, 12640, 12641, 12642, 12643, 12644, 12645, 12646, 12647, 12648, 12649, 12650, 12651, 12652, 12653, 12654, 12655, 12656, 12657, 12658, 12659, 12660, 12661, 12662, 12663, 12664, 12665, 12666, 12667, 12668, 12669, 12670, 12671, 12672, 12673, 12674, 12675, 12676, 12677, 12678, 12679, 12680, 12681, 12682, 12683, 12684, 12685, 12686, 12687, 12688, 12689, 12690, 12691, 12692, 12693, 12694, 12695, 12696, 12697, 12698, 12699, 12700, 12701, 12702, 12703, 12704, 12705, 12706, 12707, 12708, 12709, 12710, 12711, 12712, 12713, 12714, 12715, 12716, 12717, 12718, 12719, 12720, 12721, 12722, 12723, 12724, 12725, 12726, 12727, 12728, 12729, 12730, 12731, 12732, 12733, 12734, 12735, 12736, 12737, 12738, 12739, 12740,

12741, 12742, 12743, 12744, 12745, 12746, 12747, 12748, 12749, 12750, 12751, 12752, 12753, 12754, 12755, 12756, 12757, 12758, 12759, 12760, 12761, 12762, 12763, 12764, 12765, 12766, 12767, 12768, 12769, 12770, 12771, 12772, 12773, 12774, 12775, 12776, 12777, 12778, 12779, 12780, 12781, 12782, 12783, 12784, 12785, 12786, 12787, 12788, 12789, 12790, 12791, 12792, 12793, 12794, 12795, 12796, 12797, 12798, 12799, 12800, 12801, 12802, 12803, 12804, 12805, 12806, 12807, 12808, 12809, 12810, 12811, 12812, 12813, 12814, 12815, 12816, 12817, 12818, 12819, 12820, 12821, 12822, 12823, 12824, 12825, 12826, 12827, 12828, 12829, 12830, 12831, 12832, 12833, 12834, 12835, 12836, 12837, 12838, 12839, 12840, 12841, 12842, 12843, 12844, 12845, 12846, 12847, 12848, 12849, 12850, 12851, 12852, 12853, 12854, 12855, 12856, 12857, 12858, 12859, 12860, 12861, 12862, 12863, 12864, 12865, 12866, 12867, 12868, 12869, 12870, 12871, 12872, 12873, 12874, 12875, 12876, 12877, 12878, 12879, 12880, 12881, 12882, 12883, 12884, 12885, 12886, 12887, 12888, 12889, 12890, 12891, 12892, 12893, 12894, 12895, 12896, 12897, 12898, 12899, 12900, 12901, 12902, 12903, 12904, 12905, 12906, 12907, 12908, 12909, 12910, 12911, 12912, 12913, 12914, 12915, 12916, 12917, 12918, 12919, 12920, 12921, 12922, 12923, 12924, 12925, 12926, 12927, 12928, 12929, 12930, 12931, 12932, 12933, 12934, 12935, 12936, 12937, 12938, 12939, 12940, 12941, 12942, 12943, 12944, 12945, 12946, 12947, 12948, 12949, 12950, 12951, 12952, 12953, 12954, 12955, 12956, 12957, 12958, 12959, 12960, 12961, 12962, 12963, 12964, 12965, 12966, 12967, 12968, 12969, 12970, 12971, 12972, 12973, 12974, 12975, 12976, 12977, 12978, 12979, 12980, 12981, 12982, 12983, 12984, 12985, 12986, 12987, 12988, 12989, 12990, 12991, 12992, 12993, 12994, 12995, 12996, 12997, 12998, 12999, 13000, 13001, 13002, 13003, 13004, 13005, 13006, 13007, 13008, 13009, 13010, 13011, 13012, 13013, 13014, 13015, 13016, 13017, 13018, 13019, 13020, 13021, 13022, 13023, 13024, 13025, 13026, 13027, 13028, 13029, 13030, 13031, 13032, 13033, 13034, 13035, 13036, 13037, 13038, 13039, 13040, 13041, 13042, 13043, 13044, 13045, 13046, 13047, 13048, 13049, 13050, 13051, 13052, 13053, 13054, 13055, 13056, 13057, 13058, 13059, 13060, 13061, 13062, 13063, 13064, 13065, 13066, 13067, 13068, 13069, 13070, 13071, 13072, 13073, 13074, 13075, 13076, 13077, 13078, 13079, 13080, 13081, 13082, 13083, 13084, 13085, 13086, 13087, 13088, 13089, 13090, 13091, 13092, 13093, 13094, 13095, 13096, 13097, 13098, 13099, 13100, 13101, 13102, 13103, 13104, 13105, 13106, 13107, 13108, 13109, 13110, 13111, 13112,

13113, 13114, 13115, 13116, 13117, 13118, 13119, 13120, 13121, 13122, 13123, 13124, 13125, 13126, 13127, 13128, 13129, 13130, 13131, 13132, 13133, 13134, 13135, 13136, 13137, 13138, 13139, 13140, 13141, 13142, 13143, 13144, 13145, 13146, 13147, 13148, 13149, 13150, 13151, 13152, 13153, 13154, 13155, 13156, 13157, 13158, 13159, 13160, 13161, 13162, 13163, 13164, 13165, 13166, 13167, 13168, 13169, 13170, 13171, 13172, 13173, 13174, 13175, 13176, 13177, 13178, 13179, 13180, 13181, 13182, 13183, 13184, 13185, 13186, 13187, 13188, 13189, 13190, 13191, 13192, 13193, 13194, 13195, 13196, 13197, 13198, 13199, 13200, 13201, 13202, 13203, 13204, 13205, 13206, 13207, 13208, 13209, 13210, 13211, 13212, 13213, 13214, 13215, 13216, 13217, 13218, 13219, 13220, 13221, 13222, 13223, 13224, 13225, 13226, 13227, 13228, 13229, 13230, 13231, 13232, 13233, 13234, 13235, 13236, 13237, 13238, 13239, 13240, 13241, 13242, 13243, 13244, 13245, 13246, 13247, 13248, 13249, 13250, 13251, 13252, 13253, 13254, 13255, 13256, 13257, 13258, 13259, 13260, 13261, 13262, 13263, 13264, 13265, 13266, 13267, 13268, 13269, 13270, 13271, 13272, 13273, 13274, 13275, 13276, 13277, 13278, 13279, 13280, 13281, 13282, 13283, 13284, 13285, 13286, 13287, 13288, 13289, 13290, 13291, 13292, 13293, 13294, 13295, 13296, 13297, 13298, 13299, 13300, 13301, 13302, 13303, 13304, 13305, 13306, 13307, 13308, 13309, 13310, 13311, 13312, 13313, 13314, 13315, 13316, 13317, 13318, 13319, 13320, 13321, 13322, 13323, 13324, 13325, 13326, 13327, 13328, 13329, 13330, 13331, 13332, 13333, 13334, 13335, 13336, 13337, 13338, 13339, 13340, 13341, 13342, 13343, 13344, 13345, 13346, 13347, 13348, 13349, 13350, 13351, 13352, 13353, 13354, 13355, 13356, 13357, 13358, 13359, 13360, 13361, 13362, 13363, 13364, 13365, 13366, 13367, 13368, 13369, 13370, 13371, 13372, 13373, 13374, 13375, 13376, 13377, 13378, 13379, 13380, 13381, 13382, 13383, 13384, 13385, 13386, 13387, 13388, 13389, 13390, 13391, 13392, 13393, 13394, 13395, 13396, 13397, 13398, 13399, 13400, 13401, 13402, 13403, 13404, 13405, 13406, 13407, 13408, 13409, 13410, 13411, 13412, 13413, 13414, 13415, 13416, 13417, 13418, 13419, 13420, 13421, 13422, 13423, 13424, 13425, 13426, 13427, 13428, 13429, 13430, 13431, 13432, 13433, 13434, 13435, 13436, 13437, 13438, 13439, 13440, 13441, 13442, 13443, 13444, 13445, 13446, 13447, 13448, 13449, 13450, 13451, 13452, 13453, 13454, 13455, 13456, 13457, 13458, 13459, 13460, 13461, 13462, 13463, 13464, 13465, 13466, 13467, 13468, 13469, 13470, 13471, 13472, 13473, 13474, 13475, 13476, 13477, 13478, 13479, 13480, 13481, 13482, 13483, 13484,

13485, 13486, 13487, 13488, 13489, 13490, 13491, 13492, 13493, 13494, 13495, 13496, 13497, 13498, 13499, 13500, 13501, 13502, 13503, 13504, 13505, 13506, 13507, 13508, 13509, 13510, 13511, 13512, 13513, 13514, 13515, 13516, 13517, 13518, 13519, 13520, 13521, 13522, 13523, 13524, 13525, 13526, 13527, 13528, 13529, 13530, 13531, 13532, 13533, 13534, 13535, 13536, 13537, 13538, 13539, 13540, 13541, 13542, 13543, 13544, 13545, 13546, 13547, 13548, 13549, 13550, 13551, 13552, 13553, 13554, 13555, 13556, 13557, 13558, 13559, 13560, 13561, 13562, 13563, 13564, 13565, 13566, 13567, 13568, 13569, 13570, 13571, 13572, 13573, 13574, 13575, 13576, 13577, 13578, 13579, 13580, 13581, 13582, 13583, 13584, 13585, 13586, 13587, 13588, 13589, 13590, 13591, 13592, 13593, 13594, 13595, 13596, 13597, 13598, 13599, 13600, 13601, 13602, 13603, 13604, 13605, 13606, 13607, 13608, 13609, 13610, 13611, 13612, 13613, 13614, 13615, 13616, 13617, 13618, 13619, 13620, 13621, 13622, 13623, 13624, 13625, 13626, 13627, 13628, 13629, 13630, 13631, 13632, 13633, 13634, 13635, 13636, 13637, 13638, 13639, 13640, 13641, 13642, 13643, 13644, 13645, 13646, 13647, 13648, 13649, 13650, 13651, 13652, 13653, 13654, 13655, 13656, 13657, 13658, 13659, 13660, 13661, 13662, 13663, 13664, 13665, 13666, 13667, 13668, 13669, 13670, 13671, 13672, 13673, 13674, 13675, 13676, 13677, 13678, 13679, 13680, 13681, 13682, 13683, 13684, 13685, 13686, 13687, 13688, 13689, 13690, 13691, 13692, 13693, 13694, 13695, 13696, 13697, 13698, 13699, 13700, 13701, 13702, 13703, 13704, 13705, 13706, 13707, 13708, 13709, 13710, 13711, 13712, 13713, 13714, 13715, 13716, 13717, 13718, 13719, 13720, 13721, 13722, 13723, 13724, 13725, 13726, 13727, 13728, 13729, 13730, 13731, 13732, 13733, 13734, 13735, 13736, 13737, 13738, 13739, 13740, 13741, 13742, 13743, 13744, 13745, 13746, 13747, 13748, 13749, 13750, 13751, 13752, 13753, 13754, 13755, 13756, 13757, 13758, 13759, 13760, 13761, 13762, 13763, 13764, 13765, 13766, 13767, 13768, 13769, 13770, 13771, 13772, 13773, 13774, 13775, 13776, 13777, 13778, 13779, 13780, 13781, 13782, 13783, 13784, 13785, 13786, 13787, 13788, 13789, 13790, 13791, 13792, 13793, 13794, 13795, 13796, 13797, 13798, 13799, 13800, 13801, 13802, 13803, 13804, 13805, 13806, 13807, 13808, 13809, 13810, 13811, 13812, 13813, 13814, 13815, 13816, 13817, 13818, 13819, 13820, 13821, 13822, 13823, 13824, 13825, 13826, 13827, 13828, 13829, 13830, 13831, 13832, 13833, 13834, 13835, 13836, 13837, 13838, 13839, 13840, 13841, 13842, 13843, 13844, 13845, 13846, 13847, 13848, 13849, 13850, 13851, 13852, 13853, 13854, 13855, 13856,

13857, 13858, 13859, 13860, 13861, 13862, 13863, 13864, 13865, 13866, 13867, 13868, 13869, 13870, 13871, 13872, 13873, 13874, 13875, 13876, 13877, 13878, 13879, 13880, 13881, 13882, 13883, 13884, 13885, 13886, 13887, 13888, 13889, 13890, 13891, 13892, 13893, 13894, 13895, 13896, 13897, 13898, 13899, 13900, 13901, 13902, 13903, 13904, 13905, 13906, 13907, 13908, 13909, 13910, 13911, 13912, 13913, 13914, 13915, 13916, 13917, 13918, 13919, 13920, 13921, 13922, 13923, 13924, 13925, 13926, 13927, 13928, 13929, 13930, 13931, 13932, 13933, 13934, 13935, 13936, 13937, 13938, 13939, 13940, 13941, 13942, 13943, 13944, 13945, 13946, 13947, 13948, 13949, 13950, 13951, 13952, 13953, 13954, 13955, 13956, 13957, 13958, 13959, 13960, 13961, 13962, 13963, 13964, 13965, 13966, 13967, 13968, 13969, 13970, 13971, 13972, 13973, 13974, 13975, 13976, 13977, 13978, 13979, 13980, 13981, 13982, 13983, 13984, 13985, 13986, 13987, 13988, 13989, 13990, 13991, 13992, 13993, 13994, 13995, 13996, 13997, 13998, 13999, 14000, 14001, 14002, 14003, 14004, 14005, 14006, 14007, 14008, 14009, 14010, 14011, 14012, 14013, 14014, 14015, 14016, 14017, 14018, 14019, 14020, 14021, 14022, 14023, 14024, 14025, 14026, 14027, 14028, 14029, 14030, 14031, 14032, 14033, 14034, 14035, 14036, 14037, 14038, 14039, 14040, 14041, 14042, 14043, 14044, 14045, 14046, 14047, 14048, 14049, 14050, 14051, 14052, 14053, 14054, 14055, 14056, 14057, 14058, 14059, 14060, 14061, 14062, 14063, 14064, 14065, 14066, 14067, 14068, 14069, 14070, 14071, 14072, 14073, 14074, 14075, 14076, 14077, 14078, 14079, 14080, 14081, 14082, 14083, 14084, 14085, 14086, 14087, 14088, 14089, 14090, 14091, 14092, 14093, 14094, 14095, 14096, 14097, 14098, 14099, 14100, 14101, 14102, 14103, 14104, 14105, 14106, 14107, 14108, 14109, 14110, 14111, 14112, 14113, 14114, 14115, 14116, 14117, 14118, 14119, 14120, 14121, 14122, 14123, 14124, 14125, 14126, 14127, 14128, 14129, 14130, 14131, 14132, 14133, 14134, 14135, 14136, 14137, 14138, 14139, 14140, 14141, 14142, 14143, 14144, 14145, 14146, 14147, 14148, 14149, 14150, 14151, 14152, 14153, 14154, 14155, 14156, 14157, 14158, 14159, 14160, 14161, 14162, 14163, 14164, 14165, 14166, 14167, 14168, 14169, 14170, 14171, 14172, 14173, 14174, 14175, 14176, 14177, 14178, 14179, 14180, 14181, 14182, 14183, 14184, 14185, 14186, 14187, 14188, 14189, 14190, 14191, 14192, 14193, 14194, 14195, 14196, 14197, 14198, 14199, 14200, 14201, 14202, 14203, 14204, 14205, 14206, 14207, 14208, 14209, 14210, 14211, 14212, 14213, 14214, 14215, 14216, 14217, 14218, 14219, 14220, 14221, 14222, 14223, 14224, 14225, 14226, 14227, 14228,

14229, 14230, 14231, 14232, 14233, 14234, 14235, 14236, 14237, 14238, 14239, 14240, 14241, 14242, 14243, 14244, 14245, 14246, 14247, 14248, 14249, 14250, 14251, 14252, 14253, 14254, 14255, 14256, 14257, 14258, 14259, 14260, 14261, 14262, 14263, 14264, 14265, 14266, 14267, 14268, 14269, 14270, 14271, 14272, 14273, 14274, 14275, 14276, 14277, 14278, 14279, 14280, 14281, 14282, 14283, 14284, 14285, 14286, 14287, 14288, 14289, 14290, 14291, 14292, 14293, 14294, 14295, 14296, 14297, 14298, 14299, 14300, 14301, 14302, 14303, 14304, 14305, 14306, 14307, 14308, 14309, 14310, 14311, 14312, 14313, 14314, 14315, 14316, 14317, 14318, 14319, 14320, 14321, 14322, 14323, 14324, 14325, 14326, 14327, 14328, 14329, 14330, 14331, 14332, 14333, 14334, 14335, 14336, 14337, 14338, 14339, 14340, 14341, 14342, 14343, 14344, 14345, 14346, 14347, 14348, 14349, 14350, 14351, 14352, 14353, 14354, 14355, 14356, 14357, 14358, 14359, 14360, 14361, 14362, 14363, 14364, 14365, 14366, 14367, 14368, 14369, 14370, 14371, 14372, 14373, 14374, 14375, 14376, 14377, 14378, 14379, 14380, 14381, 14382, 14383, 14384, 14385, 14386, 14387, 14388, 14389, 14390, 14391, 14392, 14393, 14394, 14395, 14396, 14397, 14398, 14399, 14400, 14401, 14402, 14403, 14404, 14405, 14406, 14407, 14408, 14409, 14410, 14411, 14412, 14413, 14414, 14415, 14416, 14417, 14418, 14419, 14420, 14421, 14422, 14423, 14424, 14425, 14426, 14427, 14428, 14429, 14430, 14431, 14432, 14433, 14434, 14435, 14436, 14437, 14438, 14439, 14440, 14441, 14442, 14443, 14444, 14445, 14446, 14447, 14448, 14449, 14450, 14451, 14452, 14453, 14454, 14455, 14456, 14457, 14458, 14459, 14460, 14461, 14462, 14463, 14464, 14465, 14466, 14467, 14468, 14469, 14470, 14471, 14472, 14473, 14474, 14475, 14476, 14477, 14478, 14479, 14480, 14481, 14482, 14483, 14484, 14485, 14486, 14487, 14488, 14489, 14490, 14491, 14492, 14493, 14494, 14495, 14496, 14497, 14498, 14499, 14500, 14501, 14502, 14503, 14504, 14505, 14506, 14507, 14508, 14509, 14510, 14511, 14512, 14513, 14514, 14515, 14516, 14517, 14518, 14519, 14520, 14521, 14522, 14523, 14524, 14525, 14526, 14527, 14528, 14529, 14530, 14531, 14532, 14533, 14534, 14535, 14536, 14537, 14538, 14539, 14540, 14541, 14542, 14543, 14544, 14545, 14546, 14547, 14548, 14549, 14550, 14551, 14552, 14553, 14554, 14555, 14556, 14557, 14558, 14559, 14560, 14561, 14562, 14563, 14564, 14565, 14566, 14567, 14568, 14569, 14570, 14571, 14572, 14573, 14574, 14575, 14576, 14577, 14578, 14579, 14580, 14581, 14582, 14583, 14584, 14585, 14586, 14587, 14588, 14589, 14590, 14591, 14592, 14593, 14594, 14595, 14596, 14597, 14598, 14599, 14600,

14601, 14602, 14603, 14604, 14605, 14606, 14607, 14608, 14609, 14610, 14611, 14612, 14613, 14614, 14615, 14616, 14617, 14618, 14619, 14620, 14621, 14622, 14623, 14624, 14625, 14626, 14627, 14628, 14629, 14630, 14631, 14632, 14633, 14634, 14635, 14636, 14637, 14638, 14639, 14640, 14641, 14642, 14643, 14644, 14645, 14646, 14647, 14648, 14649, 14650, 14651, 14652, 14653, 14654, 14655, 14656, 14657, 14658, 14659, 14660, 14661, 14662, 14663, 14664, 14665, 14666, 14667, 14668, 14669, 14670, 14671, 14672, 14673, 14674, 14675, 14676, 14677, 14678, 14679, 14680, 14681, 14682, 14683, 14684, 14685, 14686, 14687, 14688, 14689, 14690, 14691, 14692, 14693, 14694, 14695, 14696, 14697, 14698, 14699, 14700, 14701, 14702, 14703, 14704, 14705, 14706, 14707, 14708, 14709, 14710, 14711, 14712, 14713, 14714, 14715, 14716, 14717, 14718, 14719, 14720, 14721, 14722, 14723, 14724, 14725, 14726, 14727, 14728, 14729, 14730, 14731, 14732, 14733, 14734, 14735, 14736, 14737, 14738, 14739, 14740, 14741, 14742, 14743, 14744, 14745, 14746, 14747, 14748, 14749, 14750, 14751, 14752, 14753, 14754, 14755, 14756, 14757, 14758, 14759, 14760, 14761, 14762, 14763, 14764, 14765, 14766, 14767, 14768, 14769, 14770, 14771, 14772, 14773, 14774, 14775, 14776, 14777, 14778, 14779, 14780, 14781, 14782, 14783, 14784, 14785, 14786, 14787, 14788, 14789, 14790, 14791, 14792, 14793, 14794, 14795, 14796, 14797, 14798, 14799, 14800, 14801, 14802, 14803, 14804, 14805, 14806, 14807, 14808, 14809, 14810, 14811, 14812, 14813, 14814, 14815, 14816, 14817, 14818, 14819, 14820, 14821, 14822, 14823, 14824, 14825, 14826, 14827, 14828, 14829, 14830, 14831, 14832, 14833, 14834, 14835, 14836, 14837, 14838, 14839, 14840, 14841, 14842, 14843, 14844, 14845, 14846, 14847, 14848, 14849, 14850, 14851, 14852, 14853, 14854, 14855, 14856, 14857, 14858, 14859, 14860, 14861, 14862, 14863, 14864, 14865, 14866, 14867, 14868, 14869, 14870, 14871, 14872, 14873, 14874, 14875, 14876, 14877, 14878, 14879, 14880, 14881, 14882, 14883, 14884, 14885, 14886, 14887, 14888, 14889, 14890, 14891, 14892, 14893, 14894, 14895, 14896, 14897, 14898, 14899, 14900, 14901, 14902, 14903, 14904, 14905, 14906, 14907, 14908, 14909, 14910, 14911, 14912, 14913, 14914, 14915, 14916, 14917, 14918, 14919, 14920, 14921, 14922, 14923, 14924, 14925, 14926, 14927, 14928, 14929, 14930, 14931, 14932, 14933, 14934, 14935, 14936, 14937, 14938, 14939, 14940, 14941, 14942, 14943, 14944, 14945, 14946, 14947, 14948, 14949, 14950, 14951, 14952, 14953, 14954, 14955, 14956, 14957, 14958, 14959, 14960, 14961, 14962, 14963, 14964, 14965, 14966, 14967, 14968, 14969, 14970, 14971, 14972,

14973, 14974, 14975, 14976, 14977, 14978, 14979, 14980, 14981, 14982, 14983, 14984, 14985, 14986, 14987, 14988, 14989, 14990, 14991, 14992, 14993, 14994, 14995, 14996, 14997, 14998, 14999, 15000, 15001, 15002, 15003, 15004, 15005, 15006, 15007, 15008, 15009, 15010, 15011, 15012, 15013, 15014, 15015, 15016, 15017, 15018, 15019, 15020, 15021, 15022, 15023, 15024, 15025, 15026, 15027, 15028, 15029, 15030, 15031, 15032, 15033, 15034, 15035, 15036, 15037, 15038, 15039, 15040, 15041, 15042, 15043, 15044, 15045, 15046, 15047, 15048, 15049, 15050, 15051, 15052, 15053, 15054, 15055, 15056, 15057, 15058, 15059, 15060, 15061, 15062, 15063, 15064, 15065, 15066, 15067, 15068, 15069, 15070, 15071, 15072, 15073, 15074, 15075, 15076, 15077, 15078, 15079, 15080, 15081, 15082, 15083, 15084, 15085, 15086, 15087, 15088, 15089, 15090, 15091, 15092, 15093, 15094, 15095, 15096, 15097, 15098, 15099, 15100, 15101, 15102, 15103, 15104, 15105, 15106, 15107, 15108, 15109, 15110, 15111, 15112, 15113, 15114, 15115, 15116, 15117, 15118, 15119, 15120, 15121, 15122, 15123, 15124, 15125, 15126, 15127, 15128, 15129, 15130, 15131, 15132, 15133, 15134, 15135, 15136, 15137, 15138, 15139, 15140, 15141, 15142, 15143, 15144, 15145, 15146, 15147, 15148, 15149, 15150, 15151, 15152, 15153, 15154, 15155, 15156, 15157, 15158, 15159, 15160, 15161, 15162, 15163, 15164, 15165, 15166, 15167, 15168, 15169, 15170, 15171, 15172, 15173, 15174, 15175, 15176, 15177, 15178, 15179, 15180, 15181, 15182, 15183, 15184, 15185, 15186, 15187, 15188, 15189, 15190, 15191, 15192, 15193, 15194, 15195, 15196, 15197, 15198, 15199, 15200, 15201, 15202, 15203, 15204, 15205, 15206, 15207, 15208, 15209, 15210, 15211, 15212, 15213, 15214, 15215, 15216, 15217, 15218, 15219, 15220, 15221, 15222, 15223, 15224, 15225, 15226, 15227, 15228, 15229, 15230, 15231, 15232, 15233, 15234, 15235, 15236, 15237, 15238, 15239, 15240, 15241, 15242, 15243, 15244, 15245, 15246, 15247, 15248, 15249, 15250, 15251, 15252, 15253, 15254, 15255, 15256, 15257, 15258, 15259, 15260, 15261, 15262, 15263, 15264, 15265, 15266, 15267, 15268, 15269, 15270, 15271, 15272, 15273, 15274, 15275, 15276, 15277, 15278, 15279, 15280, 15281, 15282, 15283, 15284, 15285, 15286, 15287, 15288, 15289, 15290, 15291, 15292, 15293, 15294, 15295, 15296, 15297, 15298, 15299, 15300, 15301, 15302, 15303, 15304, 15305, 15306, 15307, 15308, 15309, 15310, 15311, 15312, 15313, 15314, 15315, 15316, 15317, 15318, 15319, 15320, 15321, 15322, 15323, 15324, 15325, 15326, 15327, 15328, 15329, 15330, 15331, 15332, 15333, 15334, 15335, 15336, 15337, 15338, 15339, 15340, 15341, 15342, 15343, 15344,

15345, 15346, 15347, 15348, 15349, 15350, 15351, 15352, 15353, 15354, 15355, 15356, 15357, 15358, 15359, 15360, 15361, 15362, 15363, 15364, 15365, 15366, 15367, 15368, 15369, 15370, 15371, 15372, 15373, 15374, 15375, 15376, 15377, 15378, 15379, 15380, 15381, 15382, 15383, 15384, 15385, 15386, 15387, 15388, 15389, 15390, 15391, 15392, 15393, 15394, 15395, 15396, 15397, 15398, 15399, 15400, 15401, 15402, 15403, 15404, 15405, 15406, 15407, 15408, 15409, 15410, 15411, 15412, 15413, 15414, 15415, 15416, 15417, 15418, 15419, 15420, 15421, 15422, 15423, 15424, 15425, 15426, 15427, 15428, 15429, 15430, 15431, 15432, 15433, 15434, 15435, 15436, 15437, 15438, 15439, 15440, 15441, 15442, 15443, 15444, 15445, 15446, 15447, 15448, 15449, 15450, 15451, 15452, 15453, 15454, 15455, 15456, 15457, 15458, 15459, 15460, 15461, 15462, 15463, 15464, 15465, 15466, 15467, 15468, 15469, 15470, 15471, 15472, 15473, 15474, 15475, 15476, 15477, 15478, 15479, 15480, 15481, 15482, 15483, 15484, 15485, 15486, 15487, 15488, 15489, 15490, 15491, 15492, 15493, 15494, 15495, 15496, 15497, 15498, 15499, 15500, 15501, 15502, 15503, 15504, 15505, 15506, 15507, 15508, 15509, 15510, 15511, 15512, 15513, 15514, 15515, 15516, 15517, 15518, 15519, 15520, 15521, 15522, 15523, 15524, 15525, 15526, 15527, 15528, 15529, 15530, 15531, 15532, 15533, 15534, 15535, 15536, 15537, 15538, 15539, 15540, 15541, 15542, 15543, 15544, 15545, 15546, 15547, 15548, 15549, 15550, 15551, 15552, 15553, 15554, 15555, 15556, 15557, 15558, 15559, 15560, 15561, 15562, 15563, 15564, 15565, 15566, 15567, 15568, 15569, 15570, 15571, 15572, 15573, 15574, 15575, 15576, 15577, 15578, 15579, 15580, 15581, 15582, 15583, 15584, 15585, 15586, 15587, 15588, 15589, 15590, 15591, 15592, 15593, 15594, 15595, 15596, 15597, 15598, 15599, 15600, 15601, 15602, 15603, 15604, 15605, 15606, 15607, 15608, 15609, 15610, 15611, 15612, 15613, 15614, 15615, 15616, 15617, 15618, 15619, 15620, 15621, 15622, 15623, 15624, 15625, 15626, 15627, 15628, 15629, 15630, 15631, 15632, 15633, 15634, 15635, 15636, 15637, 15638, 15639, 15640, 15641, 15642, 15643, 15644, 15645, 15646, 15647, 15648, 15649, 15650, 15651, 15652, 15653, 15654, 15655, 15656, 15657, 15658, 15659, 15660, 15661, 15662, 15663, 15664, 15665, 15666, 15667, 15668, 15669, 15670, 15671, 15672, 15673, 15674, 15675, 15676, 15677, 15678, 15679, 15680, 15681, 15682, 15683, 15684, 15685, 15686, 15687, 15688, 15689, 15690, 15691, 15692, 15693, 15694, 15695, 15696, 15697, 15698, 15699, 15700, 15701, 15702, 15703, 15704, 15705, 15706, 15707, 15708, 15709, 15710, 15711, 15712, 15713, 15714, 15715, 15716,

15717, 15718, 15719, 15720, 15721, 15722, 15723, 15724, 15725, 15726, 15727, 15728, 15729, 15730, 15731, 15732, 15733, 15734, 15735, 15736, 15737, 15738, 15739, 15740, 15741, 15742, 15743, 15744, 15745, 15746, 15747, 15748, 15749, 15750, 15751, 15752, 15753, 15754, 15755, 15756, 15757, 15758, 15759, 15760, 15761, 15762, 15763, 15764, 15765, 15766, 15767, 15768, 15769, 15770, 15771, 15772, 15773, 15774, 15775, 15776, 15777, 15778, 15779, 15780, 15781, 15782, 15783, 15784, 15785, 15786, 15787, 15788, 15789, 15790, 15791, 15792, 15793, 15794, 15795, 15796, 15797, 15798, 15799, 15800, 15801, 15802, 15803, 15804, 15805, 15806, 15807, 15808, 15809, 15810, 15811, 15812, 15813, 15814, 15815, 15816, 15817, 15818, 15819, 15820, 15821, 15822, 15823, 15824, 15825, 15826, 15827, 15828, 15829, 15830, 15831, 15832, 15833, 15834, 15835, 15836, 15837, 15838, 15839, 15840, 15841, 15842, 15843, 15844, 15845, 15846, 15847, 15848, 15849, 15850, 15851, 15852, 15853, 15854, 15855, 15856, 15857, 15858, 15859, 15860, 15861, 15862, 15863, 15864, 15865, 15866, 15867, 15868, 15869, 15870, 15871, 15872, 15873, 15874, 15875, 15876, 15877, 15878, 15879, 15880, 15881, 15882, 15883, 15884, 15885, 15886, 15887, 15888, 15889, 15890, 15891, 15892, 15893, 15894, 15895, 15896, 15897, 15898, 15899, 15900, 15901, 15902, 15903, 15904, 15905, 15906, 15907, 15908, 15909, 15910, 15911, 15912, 15913, 15914, 15915, 15916, 15917, 15918, 15919, 15920, 15921, 15922, 15923, 15924, 15925, 15926, 15927, 15928, 15929, 15930, 15931, 15932, 15933, 15934, 15935, 15936, 15937, 15938, 15939, 15940, 15941, 15942, 15943, 15944, 15945, 15946, 15947, 15948, 15949, 15950, 15951, 15952, 15953, 15954, 15955, 15956, 15957, 15958, 15959, 15960, 15961, 15962, 15963, 15964, 15965, 15966, 15967, 15968, 15969, 15970, 15971, 15972, 15973, 15974, 15975, 15976, 15977, 15978, 15979, 15980, 15981, 15982, 15983, 15984, 15985, 15986, 15987, 15988, 15989, 15990, 15991, 15992, 15993, 15994, 15995, 15996, 15997, 15998, 15999, 16000, 16001, 16002, 16003, 16004, 16005, 16006, 16007, 16008, 16009, 16010, 16011, 16012, 16013, 16014, 16015, 16016, 16017, 16018, 16019, 16020, 16021, 16022, 16023, 16024, 16025, 16026, 16027, 16028, 16029, 16030, 16031, 16032, 16033, 16034, 16035, 16036, 16037, 16038, 16039, 16040, 16041, 16042, 16043, 16044, 16045, 16046, 16047, 16048, 16049, 16050, 16051, 16052, 16053, 16054, 16055, 16056, 16057, 16058, 16059, 16060, 16061, 16062, 16063, 16064, 16065, 16066, 16067, 16068, 16069, 16070, 16071, 16072, 16073, 16074, 16075, 16076, 16077, 16078, 16079, 16080, 16081, 16082, 16083, 16084, 16085, 16086, 16087, 16088,

16089, 16090, 16091, 16092, 16093, 16094, 16095, 16096, 16097, 16098, 16099, 16100, 16101, 16102, 16103, 16104, 16105, 16106, 16107, 16108, 16109, 16110, 16111, 16112, 16113, 16114, 16115, 16116, 16117, 16118, 16119, 16120, 16121, 16122, 16123, 16124, 16125, 16126, 16127, 16128, 16129, 16130, 16131.

[00094] The term "identity" as known in the art, refers to a relationship between the sequences of two or more peptides, as determined by comparing the sequences. In the art, identity also means the degree of sequence relatedness between peptides, as determined by the number of matches between strings of two or more amino acid residues. Identity measures the percent of identical matches between the smaller of two or more sequences with gap alignments (if any) addressed by a particular mathematical model or computer program (i.e., "algorithms"). Identity of related peptides can be readily calculated by known methods. Such methods include, but are not limited to, those described in Computational Molecular Biology, Lesk, A. M., ed., Oxford University Press, New York, 1988; Biocomputing: Informatics and Genome Projects, Smith, D. W., ed., Academic Press, New York, 1993; Computer Analysis of Sequence Data, Part 1, Griffin, A. M., and Griffin, H. G., eds., Humana Press, New Jersey, 1994; Sequence Analysis in Molecular Biology, von Heinje, G., Academic Press, 1987; Sequence Analysis Primer, Gribskov, M. and Devereux, J., eds., M. Stockton Press, New York, 1991; and Carillo et al., SIAM J. Applied Math. 48, 1073 (1988).

[00095] In some embodiments, the polypeptide variant may have the same or a similar activity as the reference polypeptide. Alternatively, the variant may have an altered activity (e.g., increased or decreased) relative to a reference polypeptide. Generally, variants of a particular polynucleotide or polypeptide of the invention will have at least about 40%, 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% but less than 100% sequence identity to that particular reference polynucleotide or polypeptide as determined by sequence alignment programs and parameters described herein and known to those skilled in the art. Such tools for alignment include those of the BLAST suite (Stephen F. Altschul, Thomas L. Madden, Alejandro A. Schäffer, Jinghui Zhang, Zheng Zhang, Webb Miller, and David J. Lipman (1997), "Gapped BLAST and PSI-BLAST: a new generation of protein database search

programs", Nucleic Acids Res. 25:3389-3402.) Other tools are described herein, specifically in the definition of "Identity."

[00096] Default parameters in the BLAST algorithm include, for example, an expect threshold of 10, Word size of 28, Match/Mismatch Scores 1, -2, Gap costs Linear. Any filter can be applied as well as a selection for species specific repeats, e.g., Homo sapiens.

Biologics

[00097] The polynucleotides, primary constructs or mmRNA disclosed herein, may encode one or more biologics. As used herein, a "biologic" is a polypeptide-based molecule produced by the methods provided herein and which may be used to treat, cure, mitigate, prevent, or diagnose a serious or life-threatening disease or medical condition. Biologics, according to the present invention include, but are not limited to, allergenic extracts (e.g. for allergy shots and tests), blood components, gene therapy products, human tissue or cellular products used in transplantation, vaccines, monoclonal antibodies, cytokines, growth factors, enzymes, thrombolytics, and immunomodulators, among others.

[00098] According to the present invention, one or more biologics currently being marketed or in development may be encoded by the polynucleotides, primary constructs or mmRNA of the present invention. While not wishing to be bound by theory, it is believed that incorporation of the encoding polynucleotides of a known biologic into the primary constructs or mmRNA of the invention will result in improved therapeutic efficacy due at least in part to the specificity, purity and/or selectivity of the construct designs.

Antibodies

[00099] The primary constructs or mmRNA disclosed herein, may encode one or more antibodies or fragments thereof. The term "antibody" includes monoclonal antibodies (including full length antibodies which have an immunoglobulin Fc region), antibody compositions with polyepitopic specificity, multispecific antibodies (e.g., bispecific antibodies, diabodies, and single-chain molecules), as well as antibody fragments. The term "immunoglobulin" (Ig) is used interchangeably with "antibody" herein. As used herein, the term "monoclonal antibody" refers to an antibody obtained from a population of substantially homogeneous antibodies, i.e., the individual antibodies comprising the

population are identical except for possible naturally occurring mutations and/or post-translation modifications (e.g., isomerizations, amidations) that may be present in minor amounts. Monoclonal antibodies are highly specific, being directed against a single antigenic site.

[000100] The monoclonal antibodies herein specifically include "chimeric" antibodies (immunoglobulins) in which a portion of the heavy and/or light chain is identical with or homologous to corresponding sequences in antibodies derived from a particular species or belonging to a particular antibody class or subclass, while the remainder of the chain(s) is(are) identical with or homologous to corresponding sequences in antibodies derived from another species or belonging to another antibody class or subclass, as well as fragments of such antibodies, so long as they exhibit the desired biological activity. Chimeric antibodies of interest herein include, but are not limited to, "primatized" antibodies comprising variable domain antigen-binding sequences derived from a non-human primate (e.g., Old World Monkey, Ape etc.) and human constant region sequences.

[000101] An "antibody fragment" comprises a portion of an intact antibody, preferably the antigen binding and/or the variable region of the intact antibody. Examples of antibody fragments include Fab, Fab', $F(ab')_2$ and Fv fragments; diabodies; linear antibodies; nanobodies; single-chain antibody molecules and multispecific antibodies formed from antibody fragments.

[000102] Any of the five classes of immunoglobulins, IgA, IgD, IgE, IgG and IgM, may be encoded by the mmRNA of the invention, including the heavy chains designated alpha, delta, epsilon, gamma and mu, respectively. Also included are polynucleotide sequences encoding the subclasses, gamma and mu. Hence any of the subclasses of antibodies may be encoded in part or in whole and include the following subclasses: IgG1, IgG2, IgG3, IgG4, IgA1 and IgA2.

[000103] According to the present invention, one or more antibodies or fragments currently being marketed or in development may be encoded by the polynucleotides, primary constructs or mmRNA of the present invention. While not wishing to be bound by theory, it is believed that incorporation into the primary constructs of the invention

will result in improved therapeutic efficacy due at least in part to the specificity, purity and selectivity of the mmRNA designs.

[000104] Antibodies encoded in the polynucleotides, primary constructs or mmRNA of the invention may be utilized to treat conditions or diseases in many therapeutic areas such as, but not limited to, blood, cardiovascular, CNS, poisoning (including antivenoms), dermatology, endocrinology, gastrointestinal, medical imaging, musculoskeletal, oncology, immunology, respiratory, sensory and anti-infective.

[000105] In one embodiment, primary constructs or mmRNA disclosed herein may encode monoclonal antibodies and/or variants thereof. Variants of antibodies may also include, but are not limited to, substitutional variants, conservative amino acid substitution, insertional variants, deletional variants and/or covalent derivatives. In one embodiment, the primary construct and/or mmRNA disclosed herein may encode an immunoglobulin Fc region. In another embodiment, the primary constructs and/or mmRNA may encode a variant immunoglobulin Fc region. As a non-limiting example, the primary constructs and/or mmRNA may encode an antibody having a variant immunoglobulin Fc region as described in U.S. Pat. No. 8,217,147 herein incorporated by reference in its entirety.

Vaccines

[000106] The primary constructs or mmRNA disclosed herein, may encode one or more vaccines. As used herein, a "vaccine" is a biological preparation that improves immunity to a particular disease or infectious agent. According to the present invention, one or more vaccines currently being marketed or in development may be encoded by the polynucleotides, primary constructs or mmRNA of the present invention. While not wishing to be bound by theory, it is believed that incorporation into the primary constructs or mmRNA of the invention will result in improved therapeutic efficacy due at least in part to the specificity, purity and selectivity of the construct designs.

[000107] Vaccines encoded in the polynucleotides, primary constructs or mmRNA of the invention may be utilized to treat conditions or diseases in many therapeutic areas such as, but not limited to, cardiovascular, CNS, dermatology, endocrinology, oncology, immunology, respiratory, and anti-infective.

Therapeutic proteins or peptides

[000108] The primary constructs or mmRNA disclosed herein, may encode one or more validated or "in testing" therapeutic proteins or peptides.

[000109] According to the present invention, one or more therapeutic proteins or peptides currently being marketed or in development may be encoded by the polynucleotides, primary constructs or mmRNA of the present invention. While not wishing to be bound by theory, it is believed that incorporation into the primary constructs or mmRNA of the invention will result in improved therapeutic efficacy due at least in part to the specificity, purity and selectivity of the construct designs.

[000110] Therapeutic proteins and peptides encoded in the polynucleotides, primary constructs or mmRNA of the invention may be utilized to treat conditions or diseases in many therapeutic areas such as, but not limited to, blood, cardiovascular, CNS, poisoning (including antivenoms), dermatology, endocrinology, genetic, genitourinary, gastrointestinal, musculoskeletal, oncology, and immunology, respiratory, sensory and anti-infective.

Cell-Penetrating Polypeptides

[000111] The primary constructs or mmRNA disclosed herein, may encode one or more cell-penetrating polypeptides. As used herein, "cell-penetrating polypeptide" or CPP refers to a polypeptide which may facilitate the cellular uptake of molecules. A cell-penetrating polypeptide of the present invention may contain one or more detectable labels. The polypeptides may be partially labeled or completely labeled throughout. The polynucleotide, primary construct or mmRNA may encode the detectable label completely, partially or not at all. The cell-penetrating peptide may also include a signal sequence. As used herein, a "signal sequence" refers to a sequence of amino acid residues bound at the amino terminus of a nascent protein during protein translation. The signal sequence may be used to signal the secretion of the cell-penetrating polypeptide.

[000112] In one embodiment, the polynucleotides, primary constructs or mmRNA may also encode a fusion protein. The fusion protein may be created by operably linking a charged protein to a therapeutic protein. As used herein, "operably linked" refers to the therapeutic protein and the charged protein being connected in such a way to permit the expression of the complex when introduced into the cell. As used herein, "charged protein" refers to a protein that carries a positive, negative or overall neutral electrical

charge. Preferably, the therapeutic protein may be covalently linked to the charged protein in the formation of the fusion protein. The ratio of surface charge to total or surface amino acids may be approximately 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8 or 0.9.

[000113] The cell-penetrating polypeptide encoded by the polynucleotides, primary constructs or mmRNA may form a complex after being translated. The complex may comprise a charged protein linked, e.g. covalently linked, to the cell-penetrating polypeptide. "Therapeutic protein" refers to a protein that, when administered to a cell has a therapeutic, diagnostic, and/or prophylactic effect and/or elicits a desired biological and/or pharmacological effect.

[000114] In one embodiment, the cell-penetrating polypeptide may comprise a first domain and a second domain. The first domain may comprise a supercharged polypeptide. The second domain may comprise a protein-binding partner. As used herein, "protein-binding partner" includes, but is not limited to, antibodies and functional fragments thereof, scaffold proteins, or peptides. The cell-penetrating polypeptide may further comprise an intracellular binding partner for the protein-binding partner. The cell-penetrating polypeptide may be capable of being secreted from a cell where the polynucleotide, primary construct or mmRNA may be introduced. The cell-penetrating polypeptide may also be capable of penetrating the first cell.

[000115] In a further embodiment, the cell-penetrating polypeptide is capable of penetrating a second cell. The second cell may be from the same area as the first cell, or it may be from a different area. The area may include, but is not limited to, tissues and organs. The second cell may also be proximal or distal to the first cell.

[000116] In one embodiment, the polynucleotides, primary constructs or mmRNA may encode a cell-penetrating polypeptide which may comprise a protein-binding partner. The protein binding partner may include, but is not limited to, an antibody, a supercharged antibody or a functional fragment. The polynucleotides, primary constructs or mmRNA may be introduced into the cell where a cell-penetrating polypeptide comprising the protein-binding partner is introduced.

S*ecreted proteins*

[000117] Human and other eukaryotic cells are subdivided by membranes into many functionally distinct compartments. Each membrane-bounded compartment, or organelle,

contains different proteins essential for the function of the organelle. The cell uses "sorting signals," which are amino acid motifs located within the protein, to target proteins to particular cellular organelles.

[000118] One type of sorting signal, called a signal sequence, a signal peptide, or a leader sequence, directs a class of proteins to an organelle called the endoplasmic reticulum (ER).

[000119] Proteins targeted to the ER by a signal sequence can be released into the extracellular space as a secreted protein. Similarly, proteins residing on the cell membrane can also be secreted into the extracellular space by proteolytic cleavage of a "linker" holding the protein to the membrane. While not wishing to be bound by theory, the molecules of the present invention may be used to exploit the cellular trafficking described above. As such, in some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a secreted protein. The secreted proteins may be selected from those described herein or those in US Patent Publication, 20100255574, the contents of which are incorporated herein by reference in their entirety.

[000120] In one embodiment, these may be used in the manufacture of large quantities of valuable human gene products.

Plasma membrane proteins

[000121] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a protein of the plasma membrane.

Cytoplasmic or cytoskeletal proteins

[000122] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a cytoplasmic or cytoskeletal protein.

Intracellular membrane bound proteins

[000123] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express an intracellular membrane bound protein.

Nuclear proteins

[000124] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a nuclear protein.

Proteins associated with human disease

[000125] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a protein associated with human disease.

Miscellaneous proteins

[000126] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a protein with a presently unknown therapeutic function.

Targeting Moieties

[000127] In some embodiments of the invention, polynucleotides, primary constructs or mmRNA are provided to express a targeting moiety. These include a protein-binding partner or a receptor on the surface of the cell, which functions to target the cell to a specific tissue space or to interact with a specific moiety, either *in vivo* or *in vitro*. Suitable protein-binding partners include, but are not limited to, antibodies and functional fragments thereof, scaffold proteins, or peptides. Additionally, polynucleotide, primary construct or mmRNA can be employed to direct the synthesis and extracellular localization of lipids, carbohydrates, or other biological moieties or biomolecules.

Polypeptide Libraries

[000128] In one embodiment, the polynucleotides, primary constructs or mmRNA may be used to produce polypeptide libraries. These libraries may arise from the production of a population of polynucleotides, primary constructs or mmRNA, each containing various structural or chemical modification designs. In this embodiment, a population of polynucleotides, primary constructs or mmRNA may comprise a plurality of encoded polypeptides, including but not limited to, an antibody or antibody fragment, protein binding partner, scaffold protein, and other polypeptides taught herein or known in the art. In a preferred embodiment, the polynucleotides are primary constructs of the present invention, including mmRNA which may be suitable for direct introduction into a target cell or culture which in turn may synthesize the encoded polypeptides.

[000129] In certain embodiments, multiple variants of a protein, each with different amino acid modification(s), may be produced and tested to determine the best variant in terms of pharmacokinetics, stability, biocompatibility, and/or biological activity, or a biophysical property such as expression level. Such a library may contain 10, 10^2, 10^3,

10^4, 10^5, 10^6, 10^7, 10^8, 10^9, or over 10^9 possible variants (including, but not limited to, substitutions, deletions of one or more residues, and insertion of one or more residues).

Anti-Microbial and Anti-viral Polypeptides

[000130] The polynucleotides, primary constructs and mmRNA of the present invention may be designed to encode on or more antimicrobial peptides (AMP) or antiviral peptides (AVP). AMPs and AVPs have been isolated and described from a wide range of animals such as, but not limited to, microorganisms, invertebrates, plants, amphibians, birds, fish, and mammals (Wang *et al.*, *Nucleic Acids Res.* 2009; 37 (Database issue):D933-7). For example, anti-microbial polypeptides are described in Antimicrobial Peptide Database (http://aps.unmc.edu/AP/main.php; Wang *et al., Nucleic Acids Res.* 2009; 37 (Database issue):D933-7), CAMP: Collection of Anti-Microbial Peptides (http://www.bicnirrh.res.in/antimicrobial/); Thomas *et al., Nucleic Acids Res.* 2010; 38 (Database issue):D774-80), US 5221732, US 5447914, US 5519115, US 5607914, US 5714577, US 5734015, US 5798336, US 5821224, US 5849490, US 5856127, US 5905187, US 5994308, US 5998374, US 6107460, US 6191254, US 6211148, US 6300489, US 6329504, US 6399370, US 6476189, US 6478825, US 6492328, US 6514701, US 6573361, US 6573361, US 6576755, US 6605698, US 6624140, US 6638531, US 6642203, US 6653280, US 6696238, US 6727066, US 6730659, US 6743598, US 6743769, US 6747007, US 6790833, US 6794490, US 6818407, US 6835536, US 6835713, US 6838435, US 6872705, US 6875907, US 6884776, US 6887847, US 6906035, US 6911524, US 6936432, US 7001924, US 7071293, US 7078380, US 7091185, US 7094759, US 7166769, US 7244710, US 7314858, and US 7582301, the contents of which are incorporated by reference in their entirety.

[000131] The anti-microbial polypeptides described herein may block cell fusion and/or viral entry by one or more enveloped viruses (*e.g.*, HIV, HCV). For example, the anti-microbial polypeptide can comprise or consist of a synthetic peptide corresponding to a region, *e.g.*, a consecutive sequence of at least about 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60 amino acids of the transmembrane subunit of a viral envelope protein, *e.g.*, HIV-1 gp120 or gp41. The amino acid and nucleotide sequences of HIV-1 gp120 or gp41 are described in, *e.g.*, Kuiken *et al.*, (2008). *"HIV Sequence Compendium,"* Los Alamos National Laboratory.

[000132] In some embodiments, the anti-microbial polypeptide may have at least about 75%, 80%, 85%, 90%, 95%, 100% sequence homology to the corresponding viral protein sequence. In some embodiments, the anti-microbial polypeptide may have at least about 75%, 80%, 85%, 90%, 95%, or 100% sequence homology to the corresponding viral protein sequence.

[000133] In other embodiments, the anti-microbial polypeptide may comprise or consist of a synthetic peptide corresponding to a region, *e.g.*, a consecutive sequence of at least about 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60 amino acids of the binding domain of a capsid binding protein. In some embodiments, the anti-microbial polypeptide may have at least about 75%, 80%, 85%, 90%, 95%, or 100% sequence homology to the corresponding sequence of the capsid binding protein.

[000134] The anti-microbial polypeptides described herein may block protease dimerization and inhibit cleavage of viral proproteins (*e.g.*, HIV Gag-pol processing) into functional proteins thereby preventing release of one or more enveloped viruses (*e.g.*, HIV, HCV). In some embodiments, the anti-microbial polypeptide may have at least about 75%, 80%, 85%, 90%, 95%, 100% sequence homology to the corresponding viral protein sequence.

[000135] In other embodiments, the anti-microbial polypeptide can comprise or consist of a synthetic peptide corresponding to a region, *e.g.*, a consecutive sequence of at least about 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, or 60 amino acids of the binding domain of a protease binding protein. In some embodiments, the anti-microbial polypeptide may have at least about 75%, 80%, 85%, 90%, 95%, 100% sequence homology to the corresponding sequence of the protease binding protein.

[000136] The anti-microbial polypeptides described herein can include an *in vitro*-evolved polypeptide directed against a viral pathogen.

Anti-Microbial Polypeptides

[000137] Anti-microbial polypeptides (AMPs) are small peptides of variable length, sequence and structure with broad spectrum activity against a wide range of microorganisms including, but not limited to, bacteria, viruses, fungi, protozoa, parasites, prions, and tumor/cancer cells. (See, *e.g.*, Zaiou, J Mol Med, 2007; 85:317; herein incorporated by reference in its entirety). It has been shown that AMPs have broad-

spectrum of rapid onset of killing activities, with potentially low levels of induced resistance and concomitant broad anti-inflammatory effects.

[000138] In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be under 10kDa, *e.g.*, under 8kDa, 6kDa, 4kDa, 2kDa, or 1kDa. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) consists of from about 6 to about 100 amino acids, *e.g.*, from about 6 to about 75 amino acids, about 6 to about 50 amino acids, about 6 to about 25 amino acids, about 25 to about 100 amino acids, about 50 to about 100 amino acids, or about 75 to about 100 amino acids. In certain embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may consist of from about 15 to about 45 amino acids. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) is substantially cationic.

[000139] In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be substantially amphipathic. In certain embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be substantially cationic and amphipathic. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytostatic to a Gram-positive bacterium. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytotoxic to a Gram-positive bacterium. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytostatic and cytotoxic to a Gram-positive bacterium. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytostatic to a Gram-negative bacterium. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytotoxic to a Gram-negative bacterium. In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be cytostatic and cytotoxic to a Gram-positive bacterium. In some embodiments, the anti-microbial polypeptide may be cytostatic to a virus, fungus, protozoan, parasite, prion, or a combination thereof. In some embodiments, the anti-microbial polypeptide may be cytotoxic to a virus, fungus, protozoan, parasite, prion, or a combination thereof. In certain embodiments, the anti-microbial polypeptide may be cytostatic and cytotoxic to a virus, fungus, protozoan, parasite, prion, or a combination thereof. In some embodiments, the anti-microbial

polypeptide may be cytotoxic to a tumor or cancer cell (*e.g.*, a human tumor and/or cancer cell). In some embodiments, the anti-microbial polypeptide may be cytostatic to a tumor or cancer cell (*e.g.*, a human tumor and/or cancer cell). In certain embodiments, the anti-microbial polypeptide may be cytotoxic and cytostatic to a tumor or cancer cell (*e.g.*, a human tumor or cancer cell). In some embodiments, the anti-microbial polypeptide (*e.g.*, an anti-bacterial polypeptide) may be a secreted polypeptide.

[000140] In some embodiments, the anti-microbial polypeptide comprises or consists of a defensin. Exemplary defensins include, but are not limited to, α-defensins (*e.g.*, neutrophil defensin 1, defensin alpha 1, neutrophil defensin 3, neutrophil defensin 4, defensin 5, defensin 6), β-defensins (*e.g.*, beta-defensin 1, beta-defensin 2, beta-defensin 103, beta-defensin 107, beta-defensin 110, beta-defensin 136), and θ-defensins. In other embodiments, the anti-microbial polypeptide comprises or consists of a cathelicidin (*e.g.*, hCAP18).

Anti-Viral Polypeptides

[000141] Anti-viral polypeptides (AVPs) are small peptides of variable length, sequence and structure with broad spectrum activity against a wide range of viruses. See, *e.g.*, Zaiou, J Mol Med, 2007; 85:317. It has been shown that AVPs have a broad-spectrum of rapid onset of killing activities, with potentially low levels of induced resistance and concomitant broad anti-inflammatory effects. In some embodiments, the anti-viral polypeptide is under 10kDa, *e.g.*, under 8kDa, 6kDa, 4kDa, 2kDa, or 1kDa. In some embodiments, the anti-viral polypeptide comprises or consists of from about 6 to about 100 amino acids, *e.g.*, from about 6 to about 75 amino acids, about 6 to about 50 amino acids, about 6 to about 25 amino acids, about 25 to about 100 amino acids, about 50 to about 100 amino acids, or about 75 to about 100 amino acids. In certain embodiments, the anti-viral polypeptide comprises or consists of from about 15 to about 45 amino acids. In some embodiments, the anti-viral polypeptide is substantially cationic. In some embodiments, the anti-viral polypeptide is substantially amphipathic. In certain embodiments, the anti-viral polypeptide is substantially cationic and amphipathic. In some embodiments, the anti-viral polypeptide is cytostatic to a virus. In some embodiments, the anti-viral polypeptide is cytotoxic to a virus. In some embodiments, the anti-viral polypeptide is cytostatic and cytotoxic to a virus. In some

embodiments, the anti-viral polypeptide is cytostatic to a bacterium, fungus, protozoan, parasite, prion, or a combination thereof. In some embodiments, the anti-viral polypeptide is cytotoxic to a bacterium, fungus, protozoan, parasite, prion or a combination thereof. In certain embodiments, the anti-viral polypeptide is cytostatic and cytotoxic to a bacterium, fungus, protozoan, parasite, prion, or a combination thereof. In some embodiments, the anti-viral polypeptide is cytotoxic to a tumor or cancer cell (*e.g.*, a human cancer cell). In some embodiments, the anti-viral polypeptide is cytostatic to a tumor or cancer cell (*e.g.*, a human cancer cell). In certain embodiments, the anti-viral polypeptide is cytotoxic and cytostatic to a tumor or cancer cell (*e.g.*, a human cancer cell). In some embodiments, the anti-viral polypeptide is a secreted polypeptide.

Cytotoxic Nucleosides

[000142] In one embodiment, the polynucleotides, primary constructs or mmRNA of the present invention may incorporate one or more cytotoxic nucleosides. For example, cytotoxic nucleosides may be incorporated into polynucleotides, primary constructs or mmRNA such as bifunctional modified RNAs or mRNAs. Cytotoxic nucleoside anti-cancer agents include, but are not limited to, adenosine arabinoside, cytarabine, cytosine arabinoside, 5-fluorouracil, fludarabine, floxuridine, FTORAFUR® (a combination of tegafur and uracil), tegafur ((RS)-5-fluoro-1-(tetrahydrofuran-2-yl)pyrimidine-2,4(1H,3H)-dione), and 6-mercaptopurine.

[000143] A number of cytotoxic nucleoside analogues are in clinical use, or have been the subject of clinical trials, as anticancer agents. Examples of such analogues include, but are not limited to, cytarabine, gemcitabine, troxacitabine, decitabine, tezacitabine, 2′-deoxy-2′-methylidenecytidine (DMDC), cladribine, clofarabine, 5-azacytidine, 4'-thio-aracytidine, cyclopentenylcytosine and 1-(2-C-cyano-2-deoxy-beta-D-arabino-pentofuranosyl)-cytosine. Another example of such a compound is fludarabine phosphate. These compounds may be administered systemically and may have side effects which are typical of cytotoxic agents such as, but not limited to, little or no specificity for tumor cells over proliferating normal cells.

[000144] A number of prodrugs of cytotoxic nucleoside analogues are also reported in the art. Examples include, but are not limited to, N4-behenoyl-1-beta-D-arabinofuranosylcytosine, N4-octadecyl-1-beta-D-arabinofuranosylcytosine, N4-

palmitoyl-1-(2-C-cyano-2-deoxy-beta-D-arabino-pentofuranosyl) cytosine, and P-4055 (cytarabine 5'-elaidic acid ester). In general, these prodrugs may be converted into the active drugs mainly in the liver and systemic circulation and display little or no selective release of active drug in the tumor tissue. For example, capecitabine, a prodrug of 5'-deoxy-5-fluorocytidine (and eventually of 5-fluorouracil), is metabolized both in the liver and in the tumor tissue. A series of capecitabine analogues containing "an easily hydrolysable radical under physiological conditions" has been claimed by Fujiu et al. (U.S. Pat. No. 4,966,891) and is herein incorporated by reference. The series described by Fujiu includes N4 alkyl and aralkyl carbamates of 5'-deoxy-5-fluorocytidine and the implication that these compounds will be activated by hydrolysis under normal physiological conditions to provide 5'-deoxy-5-fluorocytidine.

[000145] A series of cytarabine N4-carbamates has been by reported by Fadl et al (Pharmazie. 1995, 50, 382-7, herein incorporated by reference) in which compounds were designed to convert into cytarabine in the liver and plasma. WO 2004/041203, herein incorporated by reference, discloses prodrugs of gemcitabine, where some of the prodrugs are N4-carbamates. These compounds were designed to overcome the gastrointestinal toxicity of gemcitabine and were intended to provide gemcitabine by hydrolytic release in the liver and plasma after absorption of the intact prodrug from the gastrointestinal tract. Nomura et al (Bioorg Med. Chem. 2003, 11, 2453-61, herein incorporated by reference) have described acetal derivatives of 1-(3-C-ethynyl-β-D-ribo-pentofaranosyl) cytosine which, on bioreduction, produced an intermediate that required further hydrolysis under acidic conditions to produce a cytotoxic nucleoside compound.

[000146] Cytotoxic nucleotides which may be chemotherapeutic also include, but are not limited to, pyrazolo [3,4-D]-pyrimidines, allopurinol, azathioprine, capecitabine, cytosine arabinoside, fluorouracil, mercaptopurine, 6-thioguanine, acyclovir, ara-adenosine, ribavirin, 7-deaza-adenosine, 7-deaza-guanosine, 6-aza-uracil, 6-aza-cytidine, thymidine ribonucleotide, 5-bromodeoxyuridine, 2-chloro-purine, and inosine, or combinations thereof.

Flanking Regions: Untranslated Regions (UTRs)

[000147] Untranslated regions (UTRs) of a gene are transcribed but not translated. The 5′UTR starts at the transcription start site and continues to the start codon but does not

include the start codon; whereas, the 3′UTR starts immediately following the stop codon and continues until the transcriptional termination signal. There is growing body of evidence about the regulatory roles played by the UTRs in terms of stability of the nucleic acid molecule and translation. The regulatory features of a UTR can be incorporated into the polynucleotides, primary constructs and/or mmRNA of the present invention to enhance the stability of the molecule. The specific features can also be incorporated to ensure controlled down-regulation of the transcript in case they are misdirected to undesired organs sites.

5′ UTR and Translation Initiation

[000148] Natural 5′UTRs bear features which play roles in for translation initiation. They harbor signatures like Kozak sequences which are commonly known to be involved in the process by which the ribosome initiates translation of many genes. Kozak sequences have the consensus CCR(A/G)CCAUGG, where R is a purine (adenine or guanine) three bases upstream of the start codon (AUG), which is followed by another 'G'. 5′UTR also have been known to form secondary structures which are involved in elongation factor binding.

[000149] By engineering the features typically found in abundantly expressed genes of specific target organs, one can enhance the stability and protein production of the polynucleotides, primary constructs or mmRNA of the invention. For example, introduction of 5′ UTR of liver-expressed mRNA, such as albumin, serum amyloid A, Apolipoprotein A/B/E, transferrin, alpha fetoprotein, erythropoietin, or Factor VIII, could be used to enhance expression of a nucleic acid molecule, such as a mmRNA, in hepatic cell lines or liver. Likewise, use of 5′ UTR from other tissue-specific mRNA to improve expression in that tissue is possible for muscle (MyoD, Myosin, Myoglobin, Myogenin, Herculin), for endothelial cells (Tie-1, CD36), for myeloid cells (C/EBP, AML1, G-CSF, GM-CSF, CD11b, MSR, Fr-1, i-NOS), for leukocytes (CD45, CD18), for adipose tissue (CD36, GLUT4, ACRP30, adiponectin) and for lung epithelial cells (SP-A/B/C/D).

[000150] Other non-UTR sequences may be incorporated into the 5′ (or 3′ UTR) UTRs. For example, introns or portions of introns sequences may be incorporated into the flanking regions of the polynucleotides, primary constructs or mmRNA of the invention.

Incorporation of intronic sequences may increase protein production as well as mRNA levels.

3' UTR and the AU Rich Elements

[000151] 3′ UTRs are known to have stretches of Adenosines and Uridines embedded in them. These AU rich signatures are particularly prevalent in genes with high rates of turnover. Based on their sequence features and functional properties, the AU rich elements (AREs) can be separated into three classes (Chen et al, 1995): Class I AREs contain several dispersed copies of an AUUUA motif within U-rich regions. C-Myc and MyoD contain class I AREs. Class II AREs possess two or more overlapping UUAUUUA(U/A)(U/A) nonamers. Molecules containing this type of AREs include GM-CSF and TNF-a. Class III ARES are less well defined. These U rich regions do not contain an AUUUA motif. c-Jun and Myogenin are two well-studied examples of this class. Most proteins binding to the AREs are known to destabilize the messenger, whereas members of the ELAV family, most notably HuR, have been documented to increase the stability of mRNA. HuR binds to AREs of all the three classes. Engineering the HuR specific binding sites into the 3′ UTR of nucleic acid molecules will lead to HuR binding and thus, stabilization of the message *in vivo*.

[000152] Introduction, removal or modification of 3′ UTR AU rich elements (AREs) can be used to modulate the stability of polynucleotides, primary constructs or mmRNA of the invention. When engineering specific polynucleotides, primary constructs or mmRNA, one or more copies of an ARE can be introduced to make polynucleotides, primary constructs or mmRNA of the invention less stable and thereby curtail translation and decrease production of the resultant protein. Likewise, AREs can be identified and removed or mutated to increase the intracellular stability and thus increase translation and production of the resultant protein. Transfection experiments can be conducted in relevant cell lines, using polynucleotides, primary constructs or mmRNA of the invention and protein production can be assayed at various time points post-transfection. For example, cells can be transfected with different ARE-engineering molecules and by using an ELISA kit to the relevant protein and assaying protein produced at 6 hour, 12 hour, 24 hour, 48 hour, and 7 days post-transfection.

Incorporating microRNA Binding Sites

[000153] microRNAs (or miRNA) are 19-25 nucleotide long noncoding RNAs that bind to the 3′UTR of nucleic acid molecules and down-regulate gene expression either by reducing nucleic acid molecule stability or by inhibiting translation. The polynucleotides, primary constructs or mmRNA of the invention may comprise one or more microRNA target sequences, microRNA seqences, or microRNA seeds. Such sequences may correspond to any known microRNA such as those taught in US Publication US2005/0261218 and US Publication US2005/0059005, the contents of which are incorporated herein by reference in their entirety.

[000154] A microRNA sequence comprises a "seed" region, i.e., a sequence in the region of positions 2-8 of the mature microRNA, which sequence has perfect Watson-Crick complementarity to the miRNA target sequence. A microRNA seed may comprise positions 2-8 or 2-7 of the mature microRNA. In some embodiments, a microRNA seed may comprise 7 nucleotides (e.g., nucleotides 2-8 of the mature microRNA), wherein the seed-complementary site in the corresponding miRNA target is flanked by an adenine (A) opposed to microRNA position 1. In some embodiments, a microRNA seed may comprise 6 nucleotides (e.g., nucleotides 2-7 of the mature microRNA), wherein the seed-complementary site in the corresponding miRNA target is flanked byan adenine (A) opposed to microRNA position 1. See for example, Grimson A, Farh KK, Johnston WK, Garrett-Engele P, Lim LP, Bartel DP; Mol Cell. 2007 Jul 6;27(1):91-105; each of which is herein incorporated by reference in their entirety. The bases of the microRNA seed have complete complementarity with the target sequence. By engineering microRNA target sequences into the 3′UTR of polynucleotides, primary constructs or mmRNA of the invention one can target the molecule for degradation or reduced translation, provided the microRNA in question is available. This process will reduce the hazard of off target effects upon nucleic acid molecule delivery. Identification of microRNA, microRNA target regions, and their expression patterns and role in biology have been reported (Bonauer et al., Curr Drug Targets 2010 11:943-949; Anand and Cheresh Curr Opin Hematol 2011 18:171-176; Contreras and Rao Leukemia 2012 26:404-413 (2011 Dec 20. doi: 10.1038/leu.2011.356); Bartel Cell 2009 136:215-233; Landgraf et al, Cell, 2007 129:1401-1414; each of which is herein incorporated by reference in its entirety).

[000155] For example, if the nucleic acid molecule is an mRNA and is not intended to be delivered to the liver but ends up there, then miR-122, a microRNA abundant in liver, can inhibit the expression of the gene of interest if one or multiple target sites of miR-122 are engineered into the 3′ UTR of the polynucleotides, primary constructs or mmRNA. Introduction of one or multiple binding sites for different microRNA can be engineered to further decrease the longevity, stability, and protein translation of a polynucleotides, primary constructs or mmRNA.

[000156] As used herein, the term "microRNA site" refers to a microRNA target site or a microRNA recognition site, or any nucleotide sequence to which a microRNA binds or associates. It should be understood that "binding" may follow traditional Watson-Crick hybridization rules or may reflect any stable association of the microRNA with the target sequence at or adjacent to the microRNA site.

[000157] Conversely, for the purposes of the polynucleotides, primary constructs or mmRNA of the present invention, microRNA binding sites can be engineered out of (i.e. removed from) sequences in which they naturally occur in order to increase protein expression in specific tissues. For example, miR-122 binding sites may be removed to improve protein expression in the liver. Regulation of expression in multiple tissues can be accomplished through introduction or removal or one or several microRNA binding sites.

[000158] Examples of tissues where microRNA are known to regulate mRNA, and thereby protein expression, include, but are not limited to, liver (miR-122), muscle (miR-133, miR-206, miR-208), endothelial cells (miR-17-92, miR-126), myeloid cells (miR-142-3p, miR-142-5p, miR-16, miR-21, miR-223, miR-24, miR-27), adipose tissue (let-7, miR-30c), heart (miR-1d, miR-149), kidney (miR-192, miR-194, miR-204), and lung epithelial cells (let-7, miR-133, miR-126). MicroRNA can also regulate complex biological processes such as angiogenesis (miR-132) (Anand and Cheresh Curr Opin Hematol 2011 18:171-176; herein incorporated by reference in its entirety). In the polynucleotides, primary constructs or mmRNA of the present invention, binding sites for microRNAs that are involved in such processes may be removed or introduced, in order to tailor the expression of the polynucleotides, primary constructs or mmRNA expression to biologically relevant cell types or to the context of relevant biological

processes. A listing of MicroRNA, miR sequences and miR binding sites is listed in Table 9 of U.S. Provisional Application No. 61/753,661 filed January 17, 2013, in Table 9 of U.S. Provisional Application No. 61/754,159 filed January 18, 2013, and in Table 7 of U.S. Provisional Application No. 61/758,921 filed January 31, 2013, each of which are herein incorporated by reference in their entireties.

[000159] Examples of use of microRNA to drive tissue or disease-specific gene expression are listed (Getner and Naldini, Tissue Antigens. 2012, 80:393-403; herein incoroporated by reference in its entirety). In addition, microRNA seed sites can be incorporated into mRNA to decrease expression in certain cells which results in a biological improvement. An example of this is incorporation of miR-142 sites into a UGT1A1-expressing lentiviral vector. The presence of miR-142 seed sites reduced expression in hematopoietic cells, and as a consequence reduced expression in antigen-presentating cells, leading to the absence of an immune response against the virally expressed UGT1A1 (Schmitt et al., Gastroenterology 2010; 139:999-1007; Gonzalez-Asequinolaza et al. Gastroenterology 2010, 139:726-729; both herein incorporated by reference in its entirety) . Incorporation of miR-142 sites into modified mRNA could not only reduce expression of the encoded protein in hematopoietic cells, but could also reduce or abolish immune responses to the mRNA-encoded protein. Incorporation of miR-142 seed sites (one or multiple) into mRNA would be important in the case of treatment of patients with complete protein deficiencies (UGT1A1 type I, LDLR-deficient patients, CRIM-negative Pompe patients, etc.) .

[000160] Lastly, through an understanding of the expression patterns of microRNA in different cell types, polynucleotides, primary constructs or mmRNA can be engineered for more targeted expression in specific cell types or only under specific biological conditions. Through introduction of tissue-specific microRNA binding sites, polynucleotides, primary constructs or mmRNA could be designed that would be optimal for protein expression in a tissue or in the context of a biological condition.

[000161] Transfection experiments can be conducted in relevant cell lines, using engineered polynucleotides, primary constructs or mmRNA and protein production can be assayed at various time points post-transfection. For example, cells can be transfected with different microRNA binding site-engineering polynucleotides, primary constructs or

mmRNA and by using an ELISA kit to the relevant protein and assaying protein produced at 6 hour, 12 hour, 24 hour, 48 hour, 72 hour and 7 days post-transfection. *In vivo* experiments can also be conducted using microRNA-binding site-engineered molecules to examine changes in tissue-specific expression of formulated polynucleotides, primary constructs or mmRNA.

5′ Capping

[000162] The 5′ cap structure of an mRNA is involved in nuclear export, increasing mRNA stability and binds the mRNA Cap Binding Protein (CBP), which is responsibile for mRNA stability in the cell and translation competency through the association of CBP with poly(A) binding protein to form the mature cyclic mRNA species. The cap further assists the removal of 5′ proximal introns removal during mRNA splicing.

[000163] Endogenous mRNA molecules may be 5′-end capped generating a 5′-ppp-5′-triphosphate linkage between a terminal guanosine cap residue and the 5′-terminal transcribed sense nucleotide of the mRNA molecule. This 5′-guanylate cap may then be methylated to generate an N7-methyl-guanylate residue. The ribose sugars of the terminal and/or anteterminal transcribed nucleotides of the 5′ end of the mRNA may optionally also be 2′-O-methylated. 5′-decapping through hydrolysis and cleavage of the guanylate cap structure may target a nucleic acid molecule, such as an mRNA molecule, for degradation.

[000164] Modifications to the polynucleotides, primary constructs, and mmRNA of the present invention may generate a non-hydrolyzable cap structure preventing decapping and thus increasing mRNA half-life. Because cap structure hydrolysis requires cleavage of 5′-ppp-5′ phosphorodiester linkages, modified nucleotides may be used during the capping reaction. For example, a Vaccinia Capping Enzyme from New England Biolabs (Ipswich, MA) may be used with α-thio-guanosine nucleotides according to the manufacturer's instructions to create a phosphorothioate linkage in the 5′-ppp-5′ cap. Additional modified guanosine nucleotides may be used such as α-methyl-phosphonate and seleno-phosphate nucleotides.

[000165] Additional modifications include, but are not limited to, 2′-O-methylation of the ribose sugars of 5′-terminal and/or 5′-anteterminal nucleotides of the mRNA (as mentioned above) on the 2′-hydroxyl group of the sugar ring. Multiple distinct 5′-cap

structures can be used to generate the 5′-cap of a nucleic acid molecule, such as an mRNA molecule.

[000166] Cap analogs, which herein are also referred to as synthetic cap analogs, chemical caps, chemical cap analogs, or structural or functional cap analogs, differ from natural (i.e. endogenous, wild-type or physiological) 5′-caps in their chemical structure, while retaining cap function. Cap analogs may be chemically (i.e. non-enzymatically) or enzymatically synthesized and/or linked to a nucleic acid molecule.

[000167] For example, the Anti-Reverse Cap Analog (ARCA) cap contains two guanines linked by a 5′-5′-triphosphate group, wherein one guanine contains an N7 methyl group as well as a 3′-O-methyl group (i.e., N7,3′-O-dimethyl-guanosine-5′-triphosphate-5′-guanosine (m^7G-3′mppp-G; which may equivaliently be designated 3′ O-Me-m7G(5')ppp(5')G). The 3′-O atom of the other, unmodified, guanine becomes linked to the 5′-terminal nucleotide of the capped nucleic acid molecule (e.g. an mRNA or mmRNA). The N7- and 3′-O-methlyated guanine provides the terminal moiety of the capped nucleic acid molecule (e.g. mRNA or mmRNA).

[000168] Another exemplary cap is mCAP, which is similar to ARCA but has a 2′-O-methyl group on guanosine (i.e., N7,2′-O-dimethyl-guanosine-5′-triphosphate-5′-guanosine, m^7Gm-ppp-G).

[000169] While cap analogs allow for the concomitant capping of a nucleic acid molecule in an in vitro transcription reaction, up to 20% of transcripts can remain uncapped. This, as well as the structural differences of a cap analog from an endogenous 5′-cap structures of nucleic acids produced by the endogenous, cellular transcription machinery, may lead to reduced translational competency and reduced cellular stability.

[000170] Polynucleotides, primary constructs and mmRNA of the invention may also be capped post-transcriptionally, using enzymes, in order to generate more authentic 5′-cap structures. As used herein, the phrase "more authentic" refers to a feature that closely mirrors or mimics, either structurally or functionally, an endogenous or wild type feature. That is, a "more authentic" feature is better representative of an endogenous, wild-type, natural or physiological cellular function and/or structure as compared to synthetic features or analogs, etc., of the prior art, or which outperforms the corresponding endogenous, wild-type, natural or physiological feature in one or more

respects. Non-limiting examples of more authentic 5′cap structures of the present invention are those which, among other things, have enhanced binding of cap binding proteins, increased half life, reduced susceptibility to 5′ endonucleases and/or reduced 5′decapping, as compared to synthetic 5′cap structures known in the art (or to a wild-type, natural or physiological 5′cap structure). For example, recombinant Vaccinia Virus Capping Enzyme and recombinant 2′-O-methyltransferase enzyme can create a canonical 5′-5′-triphosphate linkage between the 5′-terminal nucleotide of an mRNA and a guanine cap nucleotide wherein the cap guanine contains an N7 methylation and the 5′-terminal nucleotide of the mRNA contains a 2′-O-methyl. Such a structure is termed the Cap1 structure. This cap results in a higher translational-competency and cellular stability and a reduced activation of cellular pro-inflammatory cytokines, as compared, e.g., to other 5′cap analog structures known in the art. Cap structures include, but are not limited to, 7mG(5')ppp(5')N,pN2p (cap 0), 7mG(5')ppp(5')NlmpNp (cap 1), and 7mG(5')-ppp(5')NlmpN2mp (cap 2).

[000171] Because the polynucleotides, primary constructs or mmRNA may be capped post-transcriptionally, and because this process is more efficient, nearly 100% of the polynucleotides, primary constructs or mmRNA may be capped. This is in contrast to ~80% when a cap analog is linked to an mRNA in the course of an in vitro transcription reaction.

[000172] According to the present invention, 5′ terminal caps may include endogenous caps or cap analogs. According to the present invention, a 5′ terminal cap may comprise a guanine analog. Useful guanine analogs include, but are not limited to, inosine, N1-methyl-guanosine, 2′fluoro-guanosine, 7-deaza-guanosine, 8-oxo-guanosine, 2-amino-guanosine, LNA-guanosine, and 2-azido-guanosine.

Viral Sequences

[000173] Additional viral sequences such as, but not limited to, the translation enhancer sequence of the barley yellow dwarf virus (BYDV-PAV), the Jaagsiekte sheep retrovirus (JSRV) and/or the Enzootic nasal tumor virus (See e.g., International Pub. No. WO2012129648; herein incorporated by reference in its entirety) can be engineered and inserted in the 3′ UTR of the polynucleotides, primary constructs or mmRNA of the invention and can stimulate the translation of the construct *in vitro* and *in vivo*.

Transfection experiments can be conducted in relevant cell lines at and protein production can be assayed by ELISA at 12hr, 24hr, 48hr, 72 hr and day 7 post-transfection.

IRES Sequences

[000174] Further, provided are polynucleotides, primary constructs or mmRNA which may contain an internal ribosome entry site (IRES). First identified as a feature Picorna virus RNA, IRES plays an important role in initiating protein synthesis in absence of the 5′ cap structure. An IRES may act as the sole ribosome binding site, or may serve as one of multiple ribosome binding sites of an mRNA. Polynucleotides, primary constructs or mmRNA containing more than one functional ribosome binding site may encode several peptides or polypeptides that are translated independently by the ribosomes ("multicistronic nucleic acid molecules"). When polynucleotides, primary constructs or mmRNA are provided with an IRES, further optionally provided is a second translatable region. Examples of IRES sequences that can be used according to the invention include without limitation, those from picornaviruses (e.g. FMDV), pest viruses (CFFV), polio viruses (PV), encephalomyocarditis viruses (ECMV), foot-and-mouth disease viruses (FMDV), hepatitis C viruses (HCV), classical swine fever viruses (CSFV), murine leukemia virus (MLV), simian immune deficiency viruses (SIV) or cricket paralysis viruses (CrPV).

Poly-A tails

[000175] During RNA processing, a long chain of adenine nucleotides (poly-A tail) may be added to a polynucleotide such as an mRNA molecules in order to increase stability. Immediately after transcription, the 3' end of the transcript may be cleaved to free a 3' hydroxyl. Then poly-A polymerase adds a chain of adenine nucleotides to the RNA. The process, called polyadenylation, adds a poly-A tail that can be between, for example, approximately 100 and 250 residues long.

[000176] It has been discovered that unique poly-A tail lengths provide certain advantages to the polynucleotides, primary constructs or mmRNA of the present invention.

[000177] Generally, the length of a poly-A tail of the present invention is greater than 30 nucleotides in length. In another embodiment, the poly-A tail is greater than 35

nucleotides in length (e.g., at least or greater than about 35, 40, 45, 50, 55, 60, 70, 80, 90, 100, 120, 140, 160, 180, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1,000, 1,100, 1,200, 1,300, 1,400, 1,500, 1,600, 1,700, 1,800, 1,900, 2,000, 2,500, and 3,000 nucleotides). In some embodiments, the polynucleotide, primary construct, or mmRNA includes from about 30 to about 3,000 nucleotides (e.g., from 30 to 50, from 30 to 100, from 30 to 250, from 30 to 500, from 30 to 750, from 30 to 1,000, from 30 to 1,500, from 30 to 2,000, from 30 to 2,500, from 50 to 100, from 50 to 250, from 50 to 500, from 50 to 750, from 50 to 1,000, from 50 to 1,500, from 50 to 2,000, from 50 to 2,500, from 50 to 3,000, from 100 to 500, from 100 to 750, from 100 to 1,000, from 100 to 1,500, from 100 to 2,000, from 100 to 2,500, from 100 to 3,000, from 500 to 750, from 500 to 1,000, from 500 to 1,500, from 500 to 2,000, from 500 to 2,500, from 500 to 3,000, from 1,000 to 1,500, from 1,000 to 2,000, from 1,000 to 2,500, from 1,000 to 3,000, from 1,500 to 2,000, from 1,500 to 2,500, from 1,500 to 3,000, from 2,000 to 3,000, from 2,000 to 2,500, and from 2,500 to 3,000).

[000178] In one embodiment, the poly-A tail is designed relative to the length of the overall polynucleotides, primary constructs or mmRNA. This design may be based on the length of the coding region, the length of a particular feature or region (such as the first or flanking regions), or based on the length of the ultimate product expressed from the polynucleotides, primary constructs or mmRNA.

[000179] In this context the poly-A tail may be 10, 20, 30, 40, 50, 60, 70, 80, 90, or 100% greater in length than the polynucleotides, primary constructs or mmRNA or feature thereof. The poly-A tail may also be designed as a fraction of polynucleotides, primary constructs or mmRNA to which it belongs. In this context, the poly-A tail may be 10, 20, 30, 40, 50, 60, 70, 80, or 90% or more of the total length of the construct or the total length of the construct minus the poly-A tail. Further, engineered binding sites and conjugation of polynucleotides, primary constructs or mmRNA for Poly-A binding protein may enhance expression.

[000180] Additionally, multiple distinct polynucleotides, primary constructs or mmRNA may be linked together to the PABP (Poly-A binding protein) through the 3′-end using modified nucleotides at the 3′-terminus of the poly-A tail. Transfection

experiments can be conducted in relevant cell lines at and protein production can be assayed by ELISA at 12hr, 24hr, 48hr, 72 hr and day 7 post-transfection.

[000181] In one embodiment, the polynucleotide primary constructs of the present invention are designed to include a polyA-G Quartet. The G-quartet is a cyclic hydrogen bonded array of four guanine nucleotides that can be formed by G-rich sequences in both DNA and RNA. In this embodiment, the G-quartet is incorporated at the end of the poly-A tail. The resultant mmRNA construct is assayed for stability, protein production and other parameters including half-life at various time points. It has been discovered that the polyA-G quartet results in protein production equivalent to at least 75% of that seen using a poly-A tail of 120 nucleotides alone.

Quantification

[000182] In one embodiment, the polynucleotides, primary constructs or mmRNA of the present invention may be quantified in exosomes derived from one or more bodily fluid. As used herein "bodily fluids" include peripheral blood, serum, plasma, ascites, urine, cerebrospinal fluid (CSF), sputum, saliva, bone marrow, synovial fluid, aqueous humor, amniotic fluid, cerumen, breast milk, broncheoalveolar lavage fluid, semen, prostatic fluid, cowper's fluid or pre-ejaculatory fluid, sweat, fecal matter, hair, tears, cyst fluid, pleural and peritoneal fluid, pericardial fluid, lymph, chyme, chyle, bile, interstitial fluid, menses, pus, sebum, vomit, vaginal secretions, mucosal secretion, stool water, pancreatic juice, lavage fluids from sinus cavities, bronchopulmonary aspirates, blastocyl cavity fluid, and umbilical cord blood. Alternatively, exosomes may be retrieved from an organ selected from the group consisting of lung, heart, pancreas, stomach, intestine, bladder, kidney, ovary, testis, skin, colon, breast, prostate, brain, esophagus, liver, and placenta.

[000183] In the quantification method, a sample of not more than 2mL is obtained from the subject and the exosomes isolated by size exclusion chromatography, density gradient centrifugation, differential centrifugation, nanomembrane ultrafiltration, immunoabsorbent capture, affinity purification, microfluidic separation, or combinations thereof. In the analysis, the level or concentration of a polynucleotide, primary construct or mmRNA may be an expression level, presence, absence, truncation or alteration of the administered construct. It is advantageous to correlate the level with one or more clinical

phenotypes or with an assay for a human disease biomarker. The assay may be performed using construct specific probes, cytometry, qRT-PCR, real-time PCR, PCR, flow cytometry, electrophoresis, mass spectrometry, or combinations thereof while the exosomes may be isolated using immunohistochemical methods such as enzyme linked immunosorbent assay (ELISA) methods. Exosomes may also be isolated by size exclusion chromatography, density gradient centrifugation, differential centrifugation, nanomembrane ultrafiltration, immunoabsorbent capture, affinity purification, microfluidic separation, or combinations thereof.

[000184] These methods afford the investigator the ability to monitor, in real time, the level of polynucleotides, primary constructs or mmRNA remaining or delivered. This is possible because the polynucleotides, primary constructs or mmRNA of the present invention differ from the endogenous forms due to the structural or chemical modifications.

II. Design and synthesis of mmRNA

[000185] Polynucleotides, primary constructs or mmRNA for use in accordance with the invention may be prepared according to any available technique including, but not limited to chemical synthesis, enzymatic synthesis, which is generally termed *in vitro* transcription (IVT) or enzymatic or chemical cleavage of a longer precursor, etc. Methods of synthesizing RNAs are known in the art (see, *e.g.*, Gait, M.J. (ed.) *Oligonucleotide synthesis: a practical approach*, Oxford [Oxfordshire], Washington, DC: IRL Press, 1984; and Herdewijn, P. (ed.) *Oligonucleotide synthesis: methods and applications*, Methods in Molecular Biology, v. 288 (Clifton, N.J.) Totowa, N.J.: Humana Press, 2005; both of which are incorporated herein by reference).

[000186] The process of design and synthesis of the primary constructs of the invention generally includes the steps of gene construction, mRNA production (either with or without modifications) and purification. In the enzymatic synthesis method, a target polynucleotide sequence encoding the polypeptide of interest is first selected for incorporation into a vector which will be amplified to produce a cDNA template. Optionally, the target polynucleotide sequence and/or any flanking sequences may be codon optimized. The cDNA template is then used to produce mRNA through *in vitro*

transcription (IVT). After production, the mRNA may undergo purification and clean-up processes. The steps of which are provided in more detail below.

Gene Construction

[000187] The step of gene construction may include, but is not limited to gene synthesis, vector amplification, plasmid purification, plasmid linearization and clean-up, and cDNA template synthesis and clean-up.

Gene Synthesis

[000188] Once a polypeptide of interest, or target, is selected for production, a primary construct is designed. Within the primary construct, a first region of linked nucleosides encoding the polypeptide of interest may be constructed using an open reading frame (ORF) of a selected nucleic acid (DNA or RNA) transcript. The ORF may comprise the wild type ORF, an isoform, variant or a fragment thereof. As used herein, an "open reading frame" or "ORF" is meant to refer to a nucleic acid sequence (DNA or RNA) which is capable of encoding a polypeptide of interest. ORFs often begin with the start codon, ATG and end with a nonsense or termination codon or signal.

[000189] Further, the nucleotide sequence of the first region may be codon optimized. Codon optimization methods are known in the art and may be useful in efforts to achieve one or more of several goals. These goals include to match codon frequencies in target and host organisms to ensure proper folding, bias GC content to increase mRNA stability or reduce secondary structures, minimize tandem repeat codons or base runs that may impair gene construction or expression, customize transcriptional and translational control regions, insert or remove protein trafficking sequences, remove/add post translation modification sites in encoded protein (e.g. glycosylation sites), add, remove or shuffle protein domains, insert or delete restriction sites, modify ribosome binding sites and mRNA degradation sites, to adjust translational rates to allow the various domains of the protein to fold properly, or to reduce or eliminate problem secondary structures within the mRNA. Codon optimization tools, algorithms and services are known in the art, non-limiting examples include services from GeneArt (Life Technologies), DNA2.0 (Menlo Park CA) and/or proprietary methods. In one embodiment, the ORF sequence is optimized using optimization algorithms. Codon options for each amino acid are given in Table 1.

Table 1. Codon Options

Amino Acid	Single Letter Code	Codon Options
Isoleucine	I	ATT, ATC, ATA
Leucine	L	CTT, CTC, CTA, CTG, TTA, TTG
Valine	V	GTT, GTC, GTA, GTG
Phenylalanine	F	TTT, TTC
Methionine	M	ATG
Cysteine	C	TGT, TGC
Alanine	A	GCT, GCC, GCA, GCG
Glycine	G	GGT, GGC, GGA, GGG
Proline	P	CCT, CCC, CCA, CCG
Threonine	T	ACT, ACC, ACA, ACG
Serine	S	TCT, TCC, TCA, TCG, AGT, AGC
Tyrosine	Y	TAT, TAC
Tryptophan	W	TGG
Glutamine	Q	CAA, CAG
Asparagine	N	AAT, AAC
Histidine	H	CAT, CAC
Glutamic acid	E	GAA, GAG
Aspartic acid	D	GAT, GAC
Lysine	K	AAA, AAG
Arginine	R	CGT, CGC, CGA, CGG, AGA, AGG
Selenocysteine	Sec	UGA in mRNA in presence of Selenocystein insertion element (SECIS)
Stop codons	Stop	TAA, TAG, TGA

[000190] Features, which may be considered beneficial in some embodiments of the present invention, may be encoded by the primary construct and may flank the ORF as a first or second flanking region. The flanking regions may be incorporated into the primary construct before and/or after optimization of the ORF. It is not required that a primary construct contain both a 5′ and 3′ flanking region. Examples of such features include, but are not limited to, untranslated regions (UTRs), Kozak sequences, an oligo(dT) sequence, and detectable tags and may include multiple cloning sites which may have XbaI recognition.

[000191] In some embodiments, a 5′ UTR and/or a 3′ UTR may be provided as flanking regions. Multiple 5′ or 3′ UTRs may be included in the flanking regions and may be the same or of different sequences. Any portion of the flanking regions, including none, may be codon optimized and any may independently contain one or more different structural or chemical modifications, before and/or after codon optimization. Combinations of features may be included in the first and second flanking regions and may be contained

within other features. For example, the ORF may be flanked by a 5' UTR which may contain a strong Kozak translational initiation signal and/or a 3' UTR which may include an oligo(dT) sequence for templated addition of a poly-A tail. 5'UTR may comprise a first polynucleotide fragment and a second polynucleotide fragment from the same and/or different genes such as the 5'UTRs described in US Patent Application Publication No. 20100293625, herein incorporated by reference in its entirety.

[000192] Tables 2 and 3 provide a listing of exemplary UTRs which may be utilized in the primary construct of the present invention as flanking regions. Shown in Table 2 is a listing of a 5′-untranslated region of the invention. Variants of 5' UTRs may be utilized wherein one or more nucleotides are added or removed to the termini, including A, T, C or G.

Table 2. 5′-Untranslated Regions

5′ UTR Identifier	Name/Description	Sequence	SEQ ID NO.
5UTR-001	Upstream UTR	GGGAAATAAGAGAGAAAAGAAGAGTAAGAAGAAATATAAGAGCCACC	1
5UTR-002	Upstream UTR	GGGAGATCAGAGAGAAAAGAAGAGTAAGAAGAAATATAAGAGCCACC	2
5UTR-003	Upstream UTR	GGAATAAAAGTCTCAACACAACATATACAAAACAAACGAATCTCAAGCAATCAAGCATTCTACTTCTATTGCAGCAATTTAAATCATTTCTTTTAAAGCAAAAGCAATTTTCTGAAAATTTTCACCATTTACGAACGATAGCAAC	3
5UTR-004	Upstream UTR	GGGAGACAAGCUUGGCAUUCCGGUACUGUUGGUAAAGCCACC	4

[000193] Shown in Table 3 is a representative listing of 3′-untranslated regions of the invention. Variants of 3' UTRs may be utilized wherein one or more nucleotides are added or removed to the termini, including A, T, C or G.

Table 3. 3′-Untranslated Regions

3′ UTR Identifier	Name/Description	Sequence	SEQ ID NO.
3UTR-001	Creatine Kinase	GCGCCTGCCCACCTGCCACCGACTGCTGGAACCCAGCCAGTGGGAGGGCCTGGCCCACCAGAGTCCTGCTCCCTCACTCCTCGCCCCGCCCCCTGTCCCAGAGTCCCACCTGGGGGCTCTCTCCACCCTTCTCAGAGTTCCAGTTTCAACCAGAGTTCCAACCAATGGGCTCCATCCTCTGGATTCTGGCCAATGAAATATCTCCC	5

		TGGCAGGGTCCTCTTCTTTTCCCAGAGCTC CACCCCAACCAGGAGCTCTAGTTAATGGA GAGCTCCCAGCACACTCGGAGCTTGTGCT TTGTCTCCACGCAAAGCGATAAATAAAAG CATTGGTGGCCTTTGGTCTTTGAATAAAGC CTGAGTAGGAAGTCTAGA	
3UTR-002	Myoglobin	GCCCCTGCCGCTCCCACCCCCACCCATCTG GGCCCCGGGTTCAAGAGAGAGCGGGGTCT GATCTCGTGTAGCCATATAGAGTTTGCTTC TGAGTGTCTGCTTTGTTTAGTAGAGGTGG GCAGGAGGAGCTGAGGGGCTGGGGCTGG GGTGTTGAAGTTGGCTTTGCATGCCCAGC GATGCGCCTCCCTGTGGGATGTCATCACC CTGGGAACCGGGAGTGGCCCTTGGCTCAC TGTGTTCTGCATGGTTTGGATCTGAATTAA TTGTCCTTTCTTCTAAATCCCAACCGAACT TCTTCCAACCTCCAAACTGGCTGTAACCCC AAATCCAAGCCATTAACTACACCTGACAG TAGCAATTGTCTGATTAATCACTGGCCCCT TGAAGACAGCAGAATGTCCCTTTGCAATG AGGAGGAGATCTGGGCTGGGCGGGCCAG CTGGGGAAGCATTTGACTATCTGGAACTT GTGTGTGCCTCCTCAGGTATGGCAGTGAC TCACCTGGTTTTAATAAAACAACCTGCAA CATCTCATGGTCTTTGAATAAAGCCTGAG TAGGAAGTCTAGA	6
3UTR-003	α-actin	ACACACTCCACCTCCAGCACGCGACTTCT CAGGACGACGAATCTTCTCAATGGGGGGG CGGCTGAGCTCCAGCCACCCCGCAGTCAC TTTCTTTGTAACAACTTCCGTTGCTGCCAT CGTAAACTGACACAGTGTTTATAACGTGT ACATACATTAACTTATTACCTCATTTTGTT ATTTTTCGAAACAAAGCCCTGTGGAAGAA AATGGAAAACTTGAAGAAGCATTAAAGTC ATTCTGTTAAGCTGCGTAAATGGTCTTTGA ATAAAGCCTGAGTAGGAAGTCTAGA	7
3UTR-004	Albumin	CATCACATTTAAAAGCATCTCAGCCTACC ATGAGAATAAGAGAAAGAAAATGAAGAT CAAAAGCTTATTCATCTGTTTTTCTTTTTC GTTGGTGTAAAGCCAACACCCTGTCTAAA AAACATAAATTTCTTTAATCATTTTGCCTC TTTTCTCTGTGCTTCAATTAATAAAAAATG GAAAGAATCTAATAGAGTGGTACAGCACT GTTATTTTTCAAAGATGTGTTGCTATCCTG AAAATTCTGTAGGTTCTGTGGAAGTTCCA GTGTTCTCTCTTATTCCACTTCGGTAGAGG ATTTCTAGTTTCTTGTGGGCTAATTAAATA AATCATTAATACTCTTCTAATGGTCTTTGA ATAAAGCCTGAGTAGGAAGTCTAGA	8
3UTR-005	α-globin	GCTGCCTTCTGCGGGGCTTGCCTTCTGGCC	9

		ATGCCCTTCTTCTCTCCCTTGCACCTGTAC CTCTTGGTCTTTGAATAAAGCCTGAGTAG GAAGGCGGCCGCTCGAGCATGCATCTAGA	
3UTR-006	G-CSF	GCCAAGCCCTCCCCATCCCATGTATTTATC TCTATTTAATATTTATGTCTATTTAAGCCT CATATTTAAAGACAGGGAAGAGCAGAAC GGAGCCCCAGGCCTCTGTGTCCTTCCCTGC ATTTCTGAGTTTCATTCTCCTGCCTGTAGC AGTGAGAAAAAGCTCCTGTCCTCCCATCC CCTGGACTGGGAGGTAGATAGGTAAATAC CAAGTATTTATTACTATGACTGCTCCCCAG CCCTGGCTCTGCAATGGGCACTGGGATGA GCCGCTGTGAGCCCCTGGTCCTGAGGGTC CCCACCTGGGACCCTTGAGAGTATCAGGT CTCCCACGTGGGAGACAAGAAATCCCTGT TTAATATTTAAACAGCAGTGTTCCCCATCT GGGTCCTTGCACCCCTCACTCTGGCCTCAG CCGACTGCACAGCGGCCCCTGCATCCCCT TGGCTGTGAGGCCCCTGGACAAGCAGAGG TGGCCAGAGCTGGGAGGCATGGCCCTGGG GTCCCACGAATTTGCTGGGGAATCTCGTTT TTCTTCTTAAGACTTTTGGGACATGGTTTG ACTCCCGAACATCACCGACGCGTCTCCTG TTTTTCTGGGTGGCCTCGGGACACCTGCCC TGCCCCCACGAGGGTCAGGACTGTGACTC TTTTTAGGGCCAGGCAGGTGCCTGGACAT TTGCCTTGCTGGACGGGGACTGGGGATGT GGGAGGGAGCAGACAGGAGGAATCATGT CAGGCCTGTGTGTGAAAGGAAGCTCCACT GTCACCCTCCACCTCTTCACCCCCCACTCA CCAGTGTCCCCTCCACTGTCACATTGTAAC TGAACTTCAGGATAATAAAGTGTTTGCCT CCATGGTCTTTGAATAAAGCCTGAGTAGG AAGGCGGCCGCTCGAGCATGCATCTAGA	10
3UTR-007	Col1a2; collagen, type I, alpha 2	ACTCAATCTAAATTAAAAAAGAAAGAAAT TTGAAAAAACTTTCTCTTTGCCATTTCTTC TTCTTCTTTTTTAACTGAAAGCTGAATCCT TCCATTTCTTCTGCACATCTACTTGCTTAA ATTGTGGGCAAAAGAGAAAAAGAAGGAT TGATCAGAGCATTGTGCAATACAGTTTCA TTAACTCCTTCCCCCGCTCCCCCAAAAATT TGAATTTTTTTTTCAACACTCTTACACCTG TTATGGAAAATGTCAACCTTTGTAAGAAA ACCAAAATAAAAATTGAAAAATAAAAAC CATAAACATTTGCACCACTTGTGGCTTTTG AATATCTTCCACAGAGGGAAGTTTAAAAC CCAAACTTCCAAAGGTTTAAACTACCTCA AAACACTTTCCCATGAGTGTGATCCACAT TGTTAGGTGCTGACCTAGACAGAGATGAA CTGAGGTCCTTGTTTTGTTTTGTTCATAAT ACAAAGGTGCTAATTAATAGTATTTCAGA	11

		TACTTGAAGAATGTTGATGGTGCTAGAAG AATTTGAGAAGAAATACTCCTGTATTGAG TTGTATCGTGTGGTGTATTTTTTAAAAAAT TTGATTTAGCATTCATATTTTCCATCTTAT TCCCAATTAAAAGTATGCAGATTATTTGC CCAAATCTTCTTCAGATTCAGCATTTGTTC TTTGCCAGTCTCATTTTCATCTTCTTCCAT GGTTCCACAGAAGCTTTGTTTCTTGGGCA AGCAGAAAAATTAAATTGTACCTATTTTG TATATGTGAGATGTTTAAATAAATTGTGA AAAAAATGAAATAAAGCATGTTTGGTTTT CCAAAAGAACATAT	
3UTR-008	Col6a2; collagen, type VI, alpha 2	CGCCGCCGCCCGGGCCCCGCAGTCGAGGG TCGTGAGCCCACCCCGTCCATGGTGCTAA GCGGGCCCGGGTCCCACACGGCCAGCACC GCTGCTCACTCGGACGACGCCCTGGGCCT GCACCTCTCCAGCTCCTCCCACGGGGTCC CCGTAGCCCCGGCCCCCGCCCAGCCCCAG GTCTCCCCAGGCCCTCCGCAGGCTGCCCG GCCTCCCTCCCCCTGCAGCCATCCCAAGG CTCCTGACCTACCTGGCCCCTGAGCTCTGG AGCAAGCCCTGACCCAATAAAGGCTTTGA ACCCAT	12
3UTR-009	RPN1; ribophorin I	GGGGCTAGAGCCCTCTCCGCACAGCGTGG AGACGGGGCAAGGAGGGGGGTTATTAGG ATTGGTGGTTTTGTTTTGCTTTGTTTAAAG CCGTGGGAAAATGGCACAACTTTACCTCT GTGGGAGATGCAACACTGAGAGCCAAGG GGTGGGAGTTGGGATAATTTTTATATAAA AGAAGTTTTTCCACTTTGAATTGCTAAAA GTGGCATTTTTCCTATGTGCAGTCACTCCT CTCATTTCTAAAATAGGGACGTGGCCAGG CACGGTGGCTCATGCCTGTAATCCCAGCA CTTTGGGAGGCCGAGGCAGGCGGCTCACG AGGTCAGGAGATCGAGACTATCCTGGCTA ACACGGTAAAACCCTGTCTCTACTAAAAG TACAAAAAATTAGCTGGGCGTGGTGGTGG GCACCTGTAGTCCCAGCTACTCGGGAGGC TGAGGCAGGAGAAAGGCATGAATCCAAG AGGCAGAGCTTGCAGTGAGCTGAGATCAC GCCATTGCACTCCAGCCTGGGCAACAGTG TTAAGACTCTGTCTCAAATATAAATAAAT AAATAAATAAATAAATAAATAAATAAAA ATAAAGCGAGATGTTGCCCTCAAA	13
3UTR-010	LRP1; low density lipoprotein receptor-related protein 1	GGCCCTGCCCCGTCGGACTGCCCCCAGAA AGCCTCCTGCCCCCTGCCAGTGAAGTCCTT CAGTGAGCCCCTCCCCAGCCAGCCCTTCC CTGGCCCCGCCGGATGTATAAATGTAAAA ATGAAGGAATTACATTTTATATGTGAGCG AGCAAGCCGGCAAGCGAGCACAGTATTAT	14

		TTCTCCATCCCCTCCCTGCCTGCTCCTTGG CACCCCCATGCTGCCTTCAGGGAGACAGG CAGGGAGGGCTTGGGGCTGCACCTCCTAC CCTCCCACCAGAACGCACCCCACTGGGAG AGCTGGTGGTGCAGCCTTCCCCTCCCTGTA TAAGACACTTTGCCAAGGCTCTCCCCTCTC GCCCCATCCCTGCTTGCCCGCTCCCACAGC TTCCTGAGGGCTAATTCTGGGAAGGGAGA GTTCTTTGCTGCCCCTGTCTGGAAGACGTG GCTCTGGGTGAGGTAGGCGGGAAAGGAT GGAGTGTTTTAGTTCTTGGGGGAGGCCAC CCCAAACCCCAGCCCCAACTCCAGGGGCA CCTATGAGATGGCCATGCTCAACCCCCCT CCCAGACAGGCCCTCCCTGTCTCCAGGGC CCCCACCGAGGTTCCCAGGGCTGGAGACT TCCTCTGGTAAACATTCCTCCAGCCTCCCC TCCCCTGGGGACGCCAAGGAGGTGGGCCA CACCCAGGAAGGGAAAGCGGGCAGCCCC GTTTTGGGGACGTGAACGTTTTAATAATTT TTGCTGAATTCCTTTACAACTAAATAACAC AGATATTGTTATAAATAAAATTGT	
3UTR-011	Nnt1; cardiotrophin-like cytokine factor 1	ATATTAAGGATCAAGCTGTTAGCTAATAA TGCCACCTCTGCAGTTTTGGGAACAGGCA AATAAAGTATCAGTATACATGGTGATGTA CATCTGTAGCAAAGCTCTTGGAGAAAATG AAGACTGAAGAAAGCAAAGCAAAAACTG TATAGAGAGATTTTTCAAAAGCAGTAATC CCTCAATTTTAAAAAAGGATTGAAAATTC TAAATGTCTTTCTGTGCATATTTTTTGTGT TAGGAATCAAAAGTATTTTATAAAAGGAG AAAGAACAGCCTCATTTTAGATGTAGTCC TGTTGGATTTTTTATGCCTCCTCAGTAACC AGAAATGTTTTAAAAAACTAAGTGTTTAG GATTTCAAGACAACATTATACATGGCTCT GAAATATCTGACACAATGTAAACATTGCA GGCACCTGCATTTTATGTTTTTTTTTTCAA CAAATGTGACTAATTTGAAACTTTTATGA ACTTCTGAGCTGTCCCCTTGCAATTCAACC GCAGTTTGAATTAATCATATCAAATCAGT TTTAATTTTTTAAATTGTACTTCAGAGTCT ATATTTCAAGGGCACATTTTCTCACTACTA TTTTAATACATTAAAGGACTAAATAATCTT TCAGAGATGCTGGAAACAAATCATTTGCT TTATATGTTTCATTAGAATACCAATGAAA CATACAACTTGAAAATTAGTAATAGTATT TTTGAAGATCCCATTTCTAATTGGAGATCT CTTTAATTTCGATCAACTTATAATGTGTAG TACTATATTAAGTGCACTTGAGTGGAATT CAACATTTGACTAATAAAATGAGTTCATC ATGTTGGCAAGTGATGTGGCAATTATCTC TGGTGACAAAAGAGTAAAATCAAATATTT	15

		CTGCCTGTTACAAATATCAAGGAAGACCT GCTACTATGAAATAGATGACATTAATCTG TCTTCACTGTTTATAATACGGATGGATTTT TTTTCAAATCAGTGTGTGTTTTGAGGTCTT ATGTAATTGATGACATTTGAGAGAAATGG TGGCTTTTTTTAGCTACCTCTTTGTTCATTT AAGCACCAGTAAAGATCATGTCTTTTTAT AGAAGTGTAGATTTTCTTTGTGACTTTGCT ATCGTGCCTAAAGCTCTAAATATAGGTGA ATGTGTGATGAATACTCAGATTATTTGTCT CTCTATATAATTAGTTTGGTACTAAGTTTC TCAAAAAATTATTAACACATGAAAGACAA TCTCTAAACCAGAAAAAGAAGTAGTACAA ATTTTGTTACTGTAATGCTCGCGTTTAGTG AGTTTAAAACACACAGTATCTTTTGGTTTT ATAATCAGTTTCTATTTTGCTGTGCCTGAG ATTAAGATCTGTGTATGTGTGTGTGTGTGT GTGTGCGTTTGTGTGTTAAAGCAGAAAAG ACTTTTTTAAAAGTTTTAAGTGATAAATGC AATTTGTTAATTGATCTTAGATCACTAGTA AACTCAGGGCTGAATTATACCATGTATAT TCTATTAGAAGAAAGTAAACACCATCTTT ATTCCTGCCCTTTTTCTTCTCTCAAAGTAG TTGTAGTTATATCTAGAAAGAAGCAATTT TGATTTCTTGAAAAGGTAGTTCCTGCACTC AGTTTAAACTAAAAATAATCATACTTGGA TTTTATTTATTTTTGTCATAGTAAAAATTT TAATTTATATATATTTTTATTTAGTATTAT CTTATTCTTTGCTATTTGCCAATCCTTTGTC ATCAATTGTGTTAAATGAATTGAAAATTC ATGCCCTGTTCATTTTATTTTACTTTATTG GTTAGGATATTTAAAGGATTTTTGTATATA TAATTTCTTAAATTAATATTCCAAAAGGTT AGTGGACTTAGATTATAAATTATGGCAAA AATCTAAAAACAACAAAAATGATTTTTAT ACATTCTATTTCATTATTCCTCTTTTTCCAA TAAGTCATACAATTGGTAGATATGACTTA TTTTATTTTTGTATTATTCACTATATCTTTA TGATATTTAAGTATAAATAATTAAAAAAA TTTATTGTACCTTATAGTCTGTCACCAAAA AAAAAAAATTATCTGTAGGTAGTGAAATG CTAATGTTGATTTGTCTTTAAGGGCTTGTT AACTATCCTTTATTTTCTCATTTGTCTTAA ATTAGGAGTTTGTGTTTAAATTACTCATCT AAGCAAAAAATGTATATAAATCCCATTAC TGGGTATATACCCAAAGGATTATAAATCA TGCTGCTATAAAGACACATGCACACGTAT GTTTATTGCAGCACTATTCACAATAGCAA AGACTTGGAACCAACCCAAATGTCCATCA ATGATAGACTTGATTAAGAAAATGTGCAC ATATACACCATGGAATACTATGCAGCCAT	

		AAAAAAGGATGAGTTCATGTCCTTTGTAG GGACATGGATAAAGCTGGAAACCATCATT CTGAGCAAACTATTGCAAGGACAGAAAAC CAAACACTGCATGTTCTCACTCATAGGTG GGAATTGAACAATGAGAACACTTGGACAC AAGGTGGGGAACACCACACACCAGGGCC TGTCATGGGGTGGGGGGAGTGGGGAGGG ATAGCATTAGGAGATATACCTAATGTAAA TGATGAGTTAATGGGTGCAGCACACCAAC ATGGCACATGTATACATATGTAGCAAACC TGCACGTTGTGCACATGTACCCTAGAACT TAAAGTATAATTAAAAAAAAAAAGAAAA CAGAAGCTATTTATAAAGAAGTTATTTGC TGAAATAAATGTGATCTTTCCCATTAAAA AAATAAAGAAATTTTGGGGTAAAAAAAC ACAATATATTGTATTCTTGAAAAATTCTAA GAGAGTGGATGTGAAGTGTTCTCACCACA AAAGTGATAACTAATTGAGGTAATGCACA TATTAATTAGAAAGATTTTGTCATTCCACA ATGTATATATACTTAAAAATATGTTATAC ACAATAAATACATACATTAAAAAATAAGT AAATGTA	
3UTR-012	Col6a1; collagen, type VI, alpha 1	CCCACCCTGCACGCCGGCACCAAACCCTG TCCTCCCACCCCTCCCCACTCATCACTAAA CAGAGTAAAATGTGATGCGAATTTTCCCG ACCAACCTGATTCGCTAGATTTTTTTTAAG GAAAAGCTTGGAAAGCCAGGACACAACG CTGCTGCCTGCTTTGTGCAGGGTCCTCCGG GGCTCAGCCCTGAGTTGGCATCACCTGCG CAGGGCCCTCTGGGGCTCAGCCCTGAGCT AGTGTCACCTGCACAGGGCCCTCTGAGGC TCAGCCCTGAGCTGGCGTCACCTGTGCAG GGCCCTCTGGGGCTCAGCCCTGAGCTGGC CTCACCTGGGTTCCCCACCCCGGGCTCTCC TGCCCTGCCCTCCTGCCCGCCCTCCCTCCT GCCTGCGCAGCTCCTTCCCTAGGCACCTCT GTGCTGCATCCCACCAGCCTGAGCAAGAC GCCCTCTCGGGGCCTGTGCCGCACTAGCC TCCCTCTCCTCTGTCCCCATAGCTGGTTTT TCCCACCAATCCTCACCTAACAGTTACTTT ACAATTAAACTCAAAGCAAGCTCTTCTCC TCAGCTTGGGGCAGCCATTGGCCTCTGTCT CGTTTTGGGAAACCAAGGTCAGGAGGCCG TTGCAGACATAAATCTCGGCGACTCGGCC CCGTCTCCTGAGGGTCCTGCTGGTGACCG GCCTGGACCTTGGCCCTACAGCCCTGGAG GCCGCTGCTGACCAGCACTGACCCCGACC TCAGAGAGTACTCGCAGGGGCGCTGGCTG CACTCAAGACCCTCGAGATTAACGGTGCT AACCCCGTCTGCTCCTCCCTCCCGCAGAG ACTGGGGCCTGGACTGGACATGAGAGCCC	16

		CTTGGTGCCACAGAGGGCTGTGTCTTACT AGAAACAACGCAAACCTCTCCTTCCTCAG AATAGTGATGTGTTCGACGTTTTATCAAA GGCCCCCTTTCTATGTTCATGTTAGTTTTG CTCCTTCTGTGTTTTTTTCTGAACCATATC CATGTTGCTGACTTTTCCAAATAAAGGTTT TCACTCCTCTC	
3UTR-013	Calr; calreticulin	AGAGGCCTGCCTCCAGGGCTGGACTGAGG CCTGAGCGCTCCTGCCGCAGAGCTGGCCG CGCCAAATAATGTCTCTGTGAGACTCGAG AACTTTCATTTTTTTCCAGGCTGGTTCGGA TTTGGGGTGGATTTTGGTTTTGTTCCCCTC CTCCACTCTCCCCCACCCCCTCCCCGCCCT TTTTTTTTTTTTTTTTTTAAACTGGTATTTTA TCTTTGATTCTCCTTCAGCCCTCACCCCTG GTTCTCATCTTTCTTGATCAACATCTTTTCT TGCCTCTGTCCCCTTCTCTCATCTCTTAGC TCCCCTCCAACCTGGGGGGCAGTGGTGTG GAGAAGCCACAGGCCTGAGATTTCATCTG CTCTCCTTCCTGGAGCCCAGAGGAGGGCA GCAGAAGGGGGTGGTGTCTCCAACCCCCC AGCACTGAGGAAGAACGGGGCTCTTCTCA TTTCACCCCTCCCTTTCTCCCCTGCCCCCA GGACTGGGCCACTTCTGGGTGGGGCAGTG GGTCCCAGATTGGCTCACACTGAGAATGT AAGAACTACAAACAAAATTTCTATTAAAT TAAATTTTGTGTCTCC	17
3UTR-014	Col1a1; collagen, type I, alpha 1	CTCCCTCCATCCCAACCTGGCTCCCTCCCA CCCAACCAACTTTCCCCCCAACCCGGAAA CAGACAAGCAACCCAAACTGAACCCCCTC AAAAGCCAAAAAATGGGAGACAATTTCA CATGGACTTTGGAAAATATTTTTTCCTTT GCATTCATCTCTCAAACTTAGTTTTTATCT TTGACCAACCGAACATGACCAAAAACCAA AAGTGCATTCAACCTTACCAAAAAAAAAA AAAAAAAAAGAATAAATAAATAACTTTTT AAAAAAGGAAGCTTGGTCCACTTGCTTGA AGACCCATGCGGGGGTAAGTCCCTTTCTG CCCGTTGGGCTTATGAAACCCCAATGCTG CCCTTTCTGCTCCTTTCTCCACACCCCCCT TGGGGCCTCCCCTCCACTCCTTCCCAAATC TGTCTCCCCAGAAGACACAGGAAACAATG TATTGTCTGCCCAGCAATCAAAGGCAATG CTCAAACACCCAAGTGGCCCCCACCCTCA GCCCCGCTCCTGCCCGCCCAGCACCCCCAG GCCCTGGGGGACCTGGGGTTCTCAGACTG CCAAAGAAGCCTTGCCATCTGGCGCTCCC ATGGCTCTTGCAACATCTCCCCTTCGTTTT TGAGGGGGTCATGCCGGGGGAGCCACCA GCCCCTCACTGGGTTCGGAGGAGAGTCAG GAAGGGCCACGACAAAGCAGAAACATCG	18

		GATTTGGGGAACGCGTGTCAATCCCTTGT GCCGCAGGGCTGGGCGGGAGAGACTGTTC TGTTCCTTGTGTAACTGTGTTGCTGAAAGA CTACCTCGTTCTTGTCTTGATGTGTCACCG GGGCAACTGCCTGGGGGCGGGGATGGGG GCAGGGTGGAAGCGGCTCCCCATTTTATA CCAAAGGTGCTACATCTATGTGATGGGTG GGGTGGGGAGGGAATCACTGGTGCTATAG AAATTGAGATGCCCCCCCAGGCCAGCAAA TGTTCCTTTTTGTTCAAAGTCTATTTTTATT CCTTGATATTTTTCTTTTTTTTTTTTTTTTT TGTGGATGGGGACTTGTGAATTTTTCTAA AGGTGCTATTTAACATGGGAGGAGAGCGT GTGCGGCTCCAGCCCAGCCCGCTGCTCAC TTTCCACCCTCTCTCCACCTGCCTCTGGCT TCTCAGGCCTCTGCTCTCCGACCTCTCTCC TCTGAAACCCTCCTCCACAGCTGCAGCCC ATCCTCCCGGCTCCCTCCTAGTCTGTCCTG CGTCCTCTGTCCCCGGGTTTCAGAGACAA CTTCCCAAAGCACAAAGCAGTTTTTCCCC CTAGGGGTGGGAGGAAGCAAAAGACTCT GTACCTATTTTGTATGTGTATAATAATTTG AGATGTTTTTAATTATTTTGATTGCTGGAA TAAAGCATGTGGAAATGACCCAAACATAA TCCGCAGTGGCCTCCTAATTTCCTTCTTTG GAGTTGGGGGAGGGGTAGACATGGGGAA GGGGCTTTGGGGTGATGGGCTTGCCTTCC ATTCCTGCCCTTTCCCTCCCCACTATTCTC TTCTAGATCCCTCCATAACCCCACTCCCCT TTCTCTCACCCTTCTTATACCGCAAACCTT TCTACTTCCTCTTTCATTTTCTATTCTTGCA ATTTCCTTGCACCTTTTCCAAATCCTCTTC TCCCCTGCAATACCATACAGGCAATCCAC GTGCACAACACACACACACACTCTTCACA TCTGGGGTTGTCCAAACCTCATACCCACTC CCCTTCAAGCCCATCCACTCTCCACCCCCT GGATGCCCTGCACTTGGTGGCGGTGGGAT GCTCATGGATACTGGGAGGGTGAGGGGA GTGGAACCCGTGAGGAGGACCTGGGGGC CTCTCCTTGAACTGACATGAAGGGTCATC TGGCCTCTGCTCCCTTCTCACCCACGCTGA CCTCCTGCCGAAGGAGCAACGCAACAGGA GAGGGGTCTGCTGAGCCTGGCGAGGGTCT GGGAGGGACCAGGAGGAAGGCGTGCTCC CTGCTCGCTGTCCTGGCCCTGGGGGAGTG AGGGAGACAGACACCTGGGAGAGCTGTG GGGAAGGCACTCGCACCGTGCTCTTGGGA AGGAAGGAGACCTGGCCCTGCTCACCACG GACTGGGTGCCTCGACCTCCTGAATCCCC AGAACACAACCCCCCTGGGCTGGGGTGGT CTGGGGAACCATCGTGCCCCCGCCTCCCG	

		CCTACTCCTTTTTAAGCTT	
3UTR-015	Plod1; procollagen-lysine, 2-oxoglutarate 5-dioxygenase 1	TTGGCCAGGCCTGACCCTCTTGGACCTTTC TTCTTTGCCGACAACCACTGCCCAGCAGC CTCTGGGACCTCGGGGTCCCAGGGAACCC AGTCCAGCCTCCTGGCTGTTGACTTCCCAT TGCTCTTGGAGCCACCAATCAAAGAGATT CAAAGAGATTCCTGCAGGCCAGAGGCGG AACACACCTTTATGGCTGGGGCTCTCCGT GGTGTTCTGGACCCAGCCCCTGGAGACAC CATTCACTTTTACTGCTTTGTAGTGACTCG TGCTCTCCAACCTGTCTTCCTGAAAAACCA AGGCCCCCTTCCCCCACCTCTTCCATGGGG TGAGACTTGAGCAGAACAGGGGCTTCCCC AAGTTGCCCAGAAAGACTGTCTGGGTGAG AAGCCATGGCCAGAGCTTCTCCCAGGCAC AGGTGTTGCACCAGGGACTTCTGCTTCAA GTTTTGGGGTAAAGACACCTGGATCAGAC TCCAAGGGCTGCCCTGAGTCTGGGACTTC TGCCTCCATGGCTGGTCATGAGAGCAAAC CGTAGTCCCCTGGAGACAGCGACTCCAGA GAACCTCTTGGGAGACAGAAGAGGCATCT GTGCACAGCTCGATCTTCTACTTGCCTGTG GGGAGGGGAGTGACAGGTCCACACACCA CACTGGGTCACCCTGTCCTGGATGCCTCTG AAGAGAGGGACAGACCGTCAGAAACTGG AGAGTTTCTATTAAAGGTCATTTAAACCA	19
3UTR-016	Nucb1; nucleobindin 1	TCCTCCGGGACCCCAGCCCTCAGGATTCC TGATGCTCCAAGGCGACTGATGGGCGCTG GATGAAGTGGCACAGTCAGCTTCCCTGGG GGCTGGTGTCATGTTGGGCTCCTGGGGCG GGGGCACGGCCTGGCATTTCACGCATTGC TGCCACCCCAGGTCCACCTGTCTCCACTTT CACAGCCTCCAAGTCTGTGGCTCTTCCCTT CTGTCCTCCGAGGGGCTTGCCTTCTCTCGT GTCCAGTGAGGTGCTCAGTGATCGGCTTA ACTTAGAGAAGCCCGCCCCCTCCCCTTCTC CGTCTGTCCCAAGAGGGTCTGCTCTGAGC CTGCGTTCCTAGGTGGCTCGGCCTCAGCT GCCTGGGTTGTGGCCGCCCTAGCATCCTG TATGCCCACAGCTACTGGAATCCCCGCTG CTGCTCCGGGCCAAGCTTCTGGTTGATTA ATGAGGGCATGGGGTGGTCCCTCAAGACC TTCCCCTACCTTTTGTGGAACCAGTGATGC CTCAAAGACAGTGTCCCCTCCACAGCTGG GTGCCAGGGGCAGGGGATCCTCAGTATAG CCGGTGAACCCTGATACCAGGAGCCTGGG CCTCCCTGAACCCCTGGCTTCCAGCCATCT CATCGCCAGCCTCCTCCTGGACCTCTTGGC CCCCAGCCCCTTCCCCACACAGCCCCAGA AGGGTCCCAGAGCTGACCCCACTCCAGGA CCTAGGCCCAGCCCCTCAGCCTCATCTGG	20

		AGCCCCTGAAGACCAGTCCCACCCACCTT TCTGGCCTCATCTGACACTGCTCCGCATCC TGCTGTGTGTCCTGTTCCATGTTCCGGTTC CATCCAAATACACTTTCTGGAACAAA	
3UTR-017	α-globin	GCTGGAGCCTCGGTGGCCATGCTTCTTGC CCCTTGGGCCTCCCCCCAGCCCCTCCTCCC CTTCCTGCACCCGTACCCCCGTGGTCTTTG AATAAAGTCTGAGTGGGCGGC	21

[000194] It should be understood that those listed in the previous tables are examples and that any UTR from any gene may be incorporated into the respective first or second flanking region of the primary construct. Furthermore, multiple wild-type UTRs of any known gene may be utilized. It is also within the scope of the present invention to provide artificial UTRs which are not variants of wild type genes. These UTRs or portions thereof may be placed in the same orientation as in the transcript from which they were selected or may be altered in orientation or location. Hence a 5′ or 3′ UTR may be inverted, shortened, lengthened, made chimeric with one or more other 5′ UTRs or 3′ UTRs. As used herein, the term "altered" as it relates to a UTR sequence, means that the UTR has been changed in some way in relation to a reference sequence. For example, a 3′ or 5′ UTR may be altered relative to a wild type or native UTR by the change in orientation or location as taught above or may be altered by the inclusion of additional nucleotides, deletion of nucleotides, swapping or transposition of nucleotides. Any of these changes producing an "altered" UTR (whether 3′ or 5′) comprise a variant UTR.

[000195] In one embodiment, a double, triple or quadruple UTR such as a 5′ or 3′ UTR may be used. As used herein, a "double" UTR is one in which two copies of the same UTR are encoded either in series or substantially in series. For example, a double beta-globin 3′ UTR may be used as described in US Patent publication 20100129877, the contents of which are incorporated herein by reference in its entirety.

[000196] It is also within the scope of the present invention to have patterned UTRs. As used herein "patterned UTRs" are those UTRs which reflect a repeating or alternating pattern, such as ABABAB or AABBAABBAABB or ABCABCABC or variants thereof repeated once, twice, or more than 3 times. In these patterns, each letter, A, B, or C represent a different UTR at the nucleotide level.

[000197] In one embodiment, flanking regions are selected from a family of transcripts whose proteins share a common function, structure, feature of property. For example, polypeptides of interest may belong to a family of proteins which are expressed in a particular cell, tissue or at some time during development. The UTRs from any of these genes may be swapped for any other UTR of the same or different family of proteins to create a new chimeric primary transcript. As used herein, a "family of proteins" is used in the broadest sense to refer to a group of two or more polypeptides of interest which share at least one function, structure, feature, localization, origin, or expression pattern.

[000198] After optimization (if desired), the primary construct components are reconstituted and transformed into a vector such as, but not limited to, plasmids, viruses, cosmids, and artificial chromosomes. For example, the optimized construct may be reconstituted and transformed into chemically competent *E. coli,* yeast, neurospora, maize, drosophila, etc. where high copy plasmid-like or chromosome structures occur by methods described herein.

[000199] The untranslated region may also include translation enhancer elements (TEE). As a non-limiting example, the TEE may include those described in US Application No. 20090226470, herein incorporated by reference in its entirety, and those known in the art.

Stop Codons

[000200] In one embodiment, the primary constructs of the present invention may include at least two stop codons before the 3' untranslated region (UTR). The stop codon may be selected from TGA, TAA and TAG. In one embodiment, the primary constructs of the present invention include the stop codon TGA and one additional stop codon. In a further embodiment the addition stop codon may be TAA. In another embodiment, the primary constructs of the present invention include three stop codons.

Vector Amplification

[000201] The vector containing the primary construct is then amplified and the plasmid isolated and purified using methods known in the art such as, but not limited to, a maxi prep using the Invitrogen PURELINK™ HiPure Maxiprep Kit (Carlsbad, CA).

Plasmid Linearization

[000202] The plasmid may then be linearized using methods known in the art such as, but not limited to, the use of restriction enzymes and buffers. The linearization reaction may be purified using methods including, for example Invitrogen's PURELINK™ PCR Micro Kit (Carlsbad, CA), and HPLC based purification methods such as, but not limited to, strong anion exchange HPLC, weak anion exchange HPLC, reverse phase HPLC (RP-HPLC), and hydrophobic interaction HPLC (HIC-HPLC) and Invitrogen's standard PURELINK™ PCR Kit (Carlsbad, CA). The purification method may be modified depending on the size of the linearization reaction which was conducted. The linearized plasmid is then used to generate cDNA for *in vitro* transcription (IVT) reactions.

cDNA Template Synthesis

[000203] A cDNA template may be synthesized by having a linearized plasmid undergo polymerase chain reaction (PCR). Table 4 is a listing of primers and probes that may be usefully in the PCR reactions of the present invention. It should be understood that the listing is not exhaustive and that primer-probe design for any amplification is within the skill of those in the art. Probes may also contain chemically modified bases to increase base-pairing fidelity to the target molecule and base-pairing strength. Such modifications may include 5-methyl-Cytidine, 2, 6-di-amino-purine, 2′-fluoro, phosphoro-thioate, or locked nucleic acids.

Table 4. Primers and Probes

Primer/ Probe Identifier	Sequence (5′-3′)	Hybridization target	SEQ ID NO.
UFP	TTGGACCCTCGTACAGAAGCTAA TACG	cDNA Template	22
URP	T_{x160}CTTCCTACTCAGGCTTTATTC AAAGACCA	cDNA Template	23
GBA1	CCTTGACCTTCTGGAACTTC	Acid glucocerebrosidase	24
GBA2	CCAAGCACTGAAACGGATAT	Acid glucocerebrosidase	25
LUC1	GATGAAAAGTGCTCCAAGGA	Luciferase	26
LUC2	AACCGTGATGAAAAGGTACC	Luciferase	27
LUC3	TCATGCAGATTGGAAAGGTC	Luciferase	28
GCSF1	CTTCTTGGACTGTCCAGAGG	G-CSF	29

GCSF2	GCAGTCCCTGATACAAGAAC	G-CSF	30
GCSF3	GATTGAAGGTGGCTCGCTAC	G-CSF	31

*UFP is universal forward primer; URP is universal reverse primer.

[000204] In one embodiment, the cDNA may be submitted for sequencing analysis before undergoing transcription.

mRNA Production

[000205] The process of mRNA or mmRNA production may include, but is not limited to, *in vitro* transcription, cDNA template removal and RNA clean-up, and mRNA capping and/or tailing reactions.

In Vitro Transcription

[000206] The cDNA produced in the previous step may be transcribed using an *in vitro* transcription (IVT) system. The system typically comprises a transcription buffer, nucleotide triphosphates (NTPs), an RNase inhibitor and a polymerase. The NTPs may be manufactured in house, may be selected from a supplier, or may be synthesized as described herein. The NTPs may be selected from, but are not limited to, those described herein including natural and unnatural (modified) NTPs. The polymerase may be selected from, but is not limited to, T7 RNA polymerase, T3 RNA polymerase and mutant polymerases such as, but not limited to, polymerases able to incorporate modified nucleic acids.

RNA Polymerases

[000207] Any number of RNA polymerases or variants may be used in the design of the primary constructs of the present invention.

[000208] RNA polymerases may be modified by inserting or deleting amino acids of the RNA polymerase sequence. As a non-limiting example, the RNA polymerase may be modified to exhibit an increased ability to incorporate a 2'-modified nucleotide triphosphate compared to an unmodified RNA polymerase (see International Publication WO2008078180 and U.S. Patent 8,101,385; herein incorporated by reference in their entireties).

[000209] Variants may be obtained by evolving an RNA polymerase, optimizing the RNA polymerase amino acid and/or nucleic acid sequence and/or by using other methods

known in the art. As a non-limiting example, T7 RNA polymerase variants may be evolved using the continuous directed evolution system set out by Esvelt *et al.* (Nature (2011) 472(7344):499-503; herein incorporated by reference in its entirety) where clones of T7 RNA polymerase may encode at least one mutation such as, but not limited to, lysine at position 93 substituted for threonine (K93T), I4M, A7T, E63V, V64D, A65E, D66Y, T76N, C125R, S128R, A136T, N165S, G175R, H176L, Y178H, F182L, L196F, G198V, D208Y, E222K, S228A, Q239R, T243N, G259D, M267I, G280C, H300R, D351A, A354S, E356D, L360P, A383V, Y385C, D388Y, S397R, M401T, N410S, K450R, P451T, G452V, E484A, H523L, H524N, G542V, E565K, K577E, K577M, N601S, S684Y, L699I, K713E, N748D, Q754R, E775K, A827V, D851N or L864F. As another non-limiting example, T7 RNA polymerase variants may encode at least mutation as described in U.S. Pub. Nos. 20100120024 and 20070117112; herein incorporated by reference in their entireties. Variants of RNA polymerase may also include, but are not limited to, substitutional variants, conservative amino acid substitution, insertional variants, deletional variants and/or covalent derivatives.

[000210] In one embodiment, the primary construct may be designed to be recognized by the wild type or variant RNA polymerases. In doing so, the primary construct may be modified to contain sites or regions of sequence changes from the wild type or parent primary construct.

[000211] In one embodiment, the primary construct may be designed to include at least one substitution and/or insertion upstream of an RNA polymerase binding or recognition site, downstream of the RNA polymerase binding or recognition site, upstream of the TATA box sequence, downstream of the TATA box sequence of the primary construct but upstream of the coding region of the primary construct, within the 5'UTR, before the 5'UTR and/or after the 5'UTR.

[000212] In one embodiment, the 5'UTR of the primary construct may be replaced by the insertion of at least one region and/or string of nucleotides of the same base. The region and/or string of nucleotides may include, but is not limited to, at least 3, at least 4, at least 5, at least 6, at least 7 or at least 8 nucleotides and the nucleotides may be natural and/or unnatural. As a non-limiting example, the group of nucleotides may include 5-8

adenine, cytosine, thymine, a string of any of the other nucleotides disclosed herein and/or combinations thereof.

[000213] In one embodiment, the 5'UTR of the primary construct may be replaced by the insertion of at least two regions and/or strings of nucleotides of two different bases such as, but not limited to, adenine, cytosine, thymine, any of the other nucleotides disclosed herein and/or combinations thereof. For example, the 5'UTR may be replaced by inserting 5-8 adenine bases followed by the insertion of 5-8 cytosine bases. In another example, the 5'UTR may be replaced by inserting 5-8 cytosine bases followed by the insertion of 5-8 adenine bases.

[000214] In one embodiment, the primary construct may include at least one substitution and/or insertion downstream of the transcription start site which may be recognized by an RNA polymerase. As a non-limiting example, at least one substitution and/or insertion may occur downstream the transcription start site by substituting at least one nucleic acid in the region just downstream of the transcription start site (such as, but not limited to, +1 to +6). Changes to region of nucleotides just downstream of the transcription start site may affect initiation rates, increase apparent nucleotide triphosphate (NTP) reaction constant values, and increase the dissociation of short transcripts from the transcription complex curing initial transcription (Brieba et al, Biochemistry (2002) 41: 5144-5149; herein incorporated by reference in its entirety). The modification, substitution and/or insertion of at least one nucleic acid may cause a silent mutation of the nucleic acid sequence or may cause a mutation in the amino acid sequence.

[000215] In one embodiment, the primary construct may include the substitution of at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7, at least 8, at least 9, at least 10, at least 11, at least 12 or at least 13 guanine bases downstream of the transcription start site.

[000216] In one embodiment, the primary construct may include the substitution of at least 1, at least 2, at least 3, at least 4, at least 5 or at least 6 guanine bases in the region just downstream of the transcription start site. As a non-limiting example, if the nucleotides in the region are GGGAGA the guanine bases may be substituted by at least 1, at least 2, at least 3 or at least 4 adenine nucleotides. In another non-limiting example,

if the nucleotides in the region are GGGAGA the guanine bases may be substituted by at least 1, at least 2, at least 3 or at least 4 cytosine bases. In another non-limiting example, if the nucleotides in the region are GGGAGA the guanine bases may be substituted by at least 1, at least 2, at least 3 or at least 4 thymine, and/or any of the nucleotides described herein.

[000217] In one embodiment, the primary construct may include at least one substitution and/or insertion upstream of the start codon. For the purpose of clarity, one of skill in the art would appreciate that the start codon is the first codon of the protein coding region whereas the transcription start site is the site where transcription begins. The primary construct may include, but is not limited to, at least 1, at least 2, at least 3, at least 4, at least 5, at least 6, at least 7 or at least 8 substitutions and/or insertions of nucleotide bases. The nucleotide bases may be inserted or substituted at 1, at least 1, at least 2, at least 3, at least 4 or at least 5 locations upstream of the start codon. The nucleotides inserted and/or substituted may be the same base (e.g., all A or all C or all T or all G), two different bases (e.g., A and C, A and T, or C and T), three different bases (e.g., A, C and T or A, C and T) or at least four different bases. As a non-limiting example, the guanine base upstream of the coding region in the primary construct may be substituted with adenine, cytosine, thymine, or any of the nucleotides described herein. In another non-limiting example the substitution of guanine bases in the primary construct may be designed so as to leave one guanine base in the region downstream of the transcription start site and before the start codon (see Esvelt *et al.* Nature (2011) 472(7344):499-503; herein incorporated by reference in its entirety). As a non-limiting example, at least 5 nucleotides may be inserted at 1 location downstream of the transcription start site but upstream of the start codon and the at least 5 nucleotides may be the same base type.

cDNA Template Removal and Clean-Up

[000218] The cDNA template may be removed using methods known in the art such as, but not limited to, treatment with Deoxyribonuclease I (DNase I). RNA clean-up may also include a purification method such as, but not limited to, AGENCOURT® CLEANSEQ® system from Beckman Coulter (Danvers, MA), HPLC based purification methods such as, but not limited to, strong anion exchange HPLC, weak anion exchange

HPLC, reverse phase HPLC (RP-HPLC), and hydrophobic interaction HPLC (HIC-HPLC) .

Capping and/or Tailing Reactions

[000219] The primary construct or mmRNA may also undergo capping and/or tailing reactions. A capping reaction may be performed by methods known in the art to add a 5′ cap to the 5′ end of the primary construct. Methods for capping include, but are not limited to, using a Vaccinia Capping enzyme (New England Biolabs, Ipswich, MA).

[000220] A poly-A tailing reaction may be performed by methods known in the art, such as, but not limited to, 2′ O-methyltransferase and by methods as described herein. If the primary construct generated from cDNA does not include a poly-T, it may be beneficial to perform the poly-A-tailing reaction before the primary construct is cleaned.

mRNA Purification

[000221] Primary construct or mmRNA purification may include, but is not limited to, mRNA or mmRNA clean-up, quality assurance and quality control. mRNA or mmRNA clean-up may be performed by methods known in the arts such as, but not limited to, AGENCOURT® beads (Beckman Coulter Genomics, Danvers, MA), poly-T beads, LNA™ oligo-T capture probes (EXIQON® Inc, Vedbaek, Denmark) or HPLC based purification methods such as, but not limited to, strong anion exchange HPLC, weak anion exchange HPLC, reverse phase HPLC (RP-HPLC), and hydrophobic interaction HPLC (HIC-HPLC). The term "purified" when used in relation to a polynucleotide such as a "purified mRNA or mmRNA" refers to one that is separated from at least one contaminant. As used herein, a "contaminant" is any substance which makes another unfit, impure or inferior. Thus, a purified polynucleotide (e.g., DNA and RNA) is present in a form or setting different from that in which it is found in nature, or a form or setting different from that which existed prior to subjecting it to a treatment or purification method.

[000222] A quality assurance and/or quality control check may be conducted using methods such as, but not limited to, gel electrophoresis, UV absorbance, or analytical HPLC.

[000223] In another embodiment, the mRNA or mmRNA may be sequenced by methods including, but not limited to reverse-transcriptase-PCR.

[000224] In one embodiment, the mRNA or mmRNA may be quantified using methods such as, but not limited to, ultraviolet visible spectroscopy (UV/Vis). A non-limiting example of a UV/Vis spectrometer is a NANODROP® spectrometer (ThermoFisher, Waltham, MA). The quantified mRNA or mmRNA may be analyzed in order to determine if the mRNA or mmRNA may be of proper size, check that no degradation of the mRNA or mmRNA has occurred. Degradation of the mRNA and/or mmRNA may be checked by methods such as, but not limited to, agarose gel electrophoresis, HPLC based purification methods such as, but not limited to, strong anion exchange HPLC, weak anion exchange HPLC, reverse phase HPLC (RP-HPLC), and hydrophobic interaction HPLC (HIC-HPLC), liquid chromatography-mass spectrometry (LCMS), capillary electrophoresis (CE) and capillary gel electrophoresis (CGE).

Signal Sequences

[000225] The primary constructs or mmRNA may also encode additional features which facilitate trafficking of the polypeptides to therapeutically relevant sites. One such feature which aids in protein trafficking is the signal sequence. As used herein, a "signal sequence" or "signal peptide" is a polynucleotide or polypeptide, respectively, which is from about 9 to 200 nucleotides (3-60 amino acids) in length which is incorporated at the 5′ (or N-terminus) of the coding region or polypeptide encoded, respectively. Addition of these sequences result in trafficking of the encoded polypeptide to the endoplasmic reticulum through one or more secretory pathways. Some signal peptides are cleaved from the protein by signal peptidase after the proteins are transported.

[000226] Table 5 is a representative listing of protein signal sequences which may be incorporated for encoding by the polynucleotides, primary constructs or mmRNA of the invention.

Table 5. Signal Sequences

ID	Description	NUCLEOTIDE SEQUENCE (5′-3′)	SEQ ID NO.	ENCODED PEPTIDE	SEQ ID NO.
SS-001	α-1-antitrypsin	ATGATGCCATCCTCAGTCTCATGGGGTATTTTGCTCTTGGCGGGTCTGTGCTGTCTCGTGCCGGTGTCGCTCGCA	32	MMPSSVSWGILLAGLCCLVPVSLA	94

SS-002	G-CSF	ATGGCCGGACCGGCGAC TCAGTCGCCCATGAAACT CATGGCCCTGCAGTTGTT GCTTTGGCACTCAGCCCT CTGGACCGTCCAAGAGG CG	33	MAGPATQSP MKLMALQLL LWHSALWTV QEA	95
SS-003	Factor IX	ATGCAGAGAGTGAACAT GATTATGGCCGAGTCCCC ATCGCTCATCACAATCTG CCTGCTTGGTACCTGCTT TCCGCCGAATGCACTGTC TTTCTGGATCACGAGAAT GCGAATAAGATCTTGAAC CGACCCAAACGG	34	MQRVNMIMA ESPSLITICLLG YLLSAECTVF LDHENANKIL NRPKR	96
SS-004	Prolactin	ATGAAAGGATCATTGCTG TTGCTCCTCGTGTCGAAC CTTCTGCTTTGCCAGTCC GTAGCCCCC	35	MKGSLLLLLV SNLLLCQSVA P	97
SS-005	Albumin	ATGAAATGGGTGACGTTC ATCTCACTGTTGTTTTTGT TCTCGTCCGCCTACTCCA GGGGAGTATTCCGCCGA	36	MKWVTFISLL FLFSSAYSRG VFRR	98
SS-006	HMMSP38	ATGTGGTGGCGGCTCTGG TGGCTGCTCCTGTTGCTC CTCTTGCTGTGGCCCATG GTGTGGGCA	37	MWWRLWWL LLLLLLLPMW A	99
MLS-001	ornithine carbamoyltransferase	TGCTCTTTAACCTCCGCA TCCTGTTGAATAACGCTG CGTTCCGAAATGGGCATA ACTTCATGGTACGCAACT TCAGATGCGGCCAGCCAC TCCAG	38	MLFNLRILLN NAAFRNGHN FMVRNFRCG QPLQ	100
MLS-002	Cytochrome C Oxidase subunit 8A	ATGTCCGTCTTGACACCC CTGCTCTTGAGAGGGCTG ACGGGGTCCGCTAGACG CCTGCCGGTACCGCGAGC GAAGATCCACTCCCTG	39	MSVLTPLLLR GLTGSARRLP VPRAKIHSL	101
MLS-003	Cytochrome C Oxidase subunit 8A	ATGAGCGTGCTCACTCCG TTGCTTCTTCGAGGGCTT ACGGGATCGGCTCGGAG GTTGCCCGTCCCGAGAGC GAAGATCCATTCGTTG	40	MSVLTPLLLR GLTGSARRLP VPRAKIHSL	102
SS-007	Type III, bacterial	TGACAAAAATAACTTTAT CTCCCCAGAATTTTAGAA TCCAAAAACAGGAAACC ACACTACTAAAAGAAAA ATCAACCGAGAAAAATT CTTTAGCAAAAAGTATTC TCGCAGTAAAAATCACTT CATCGAATTAAGGTCAAA	41	MVTKITLSPQ NFRIQKQETT LLKEKSTEKN SLAKSILAVK NHFIELRSKLS ERFISHKNT	103

		ATTATCGGAACGTTTTAT TTCGCATAAGAACACT			
SS-008	Viral	ATGCTGAGCTTTGTGGAT ACCCGCACCCTGCTGCTG CTGGCGGTGACCAGCTGC CTGGCGACCTGCCAG	42	MLSFVDTRTL LLLAVTSCLA TCQ	104
SS-009	viral	ATGGGCAGCAGCCAGGC GCCGCGCATGGGCAGCG TGGGCGGCCATGGCCTGA TGGCGCTGCTGATGGCGG GCCTGATTCTGCCGGGCA TTCTGGCG	43	MGSSQAPRM GSVGGHGLM ALLMAGLILP GILA	105
SS-010	Viral	ATGGCGGGCATTTTTTAT TTTCTGTTTAGCTTTCTGT TTGGCATTTGCGAT	44	MAGIFYFLFSF LFGICD	106
SS-011	Viral	ATGGAAAACCGCCTGCTG CGCGTGTTTCTGGTGTGG GCGGCGCTGACCATGGAT GGCGCGAGCGCG	45	MENRLLRVFL VWAALTMDG ASA	107
SS-012	Viral	ATGGCGCGCCAGGGCTG CTTTGGCAGCTATCAGGT GATTAGCCTGTTTACCTT TGCGATTGGCGTGAACCT GTGCCTGGGC	46	MARQGCFGS YQVISLFTFAI GVNLCLG	108
SS-013	*Bacillus*	ATGAGCCGCCTGCCGGTG CTGCTGCTGCTGCAGCTG CTGGTGCGCCCGGGCCTG CAG	47	MSRLPVLLLL QLLVRPGLQ	109
SS-014	*Bacillus*	ATGAAACAGCAGAAACG CCTGTATGCGCGCCTGCT GACCCTGCTGTTTGCGCT GATTTTTCTGCTGCCGCA TAGCAGCGCGAGCGCG	48	MKQQKRLYA RLLTLLFALIF LLPHSSASA	110
SS-015	Secretion signal	ATGGCGACGCCGCTGCCT CCGCCCTCCCCGCGGCAC CTGCGGCTGCTGCGGCTG CTGCTCTCCGCCCTCGTC CTCGGC	49	MATPLPPPSP RHLRLLRLLL SG	111
SS-016	Secretion signal	ATGAAGGCTCCGGGTCG GCTCGTGCTCATCATCCT GTGCTCCGTGGTCTTCTC T	50	MKAPGRLVLI ILCSVVFS	112
SS-017	Secretion signal	ATGCTTCAGCTTTGGAAA CTTGTTCTCCTGTGCGGC GTGCTCACT	51	MLQLWKLLC GVLT	113
SS-018	Secretion signal	ATGCTTTATCTCCAGGGT TGGAGCATGCCTGCTGTG GCA	52	MLYLQGWSM PAVA	114
SS-019	Secretion signal	ATGGATAACGTGCAGCC GAAAATAAAACATCGCC	53	MDNVQPKIK HRPFCFSVKG	115

		CCTTCTGCTTCAGTGTGA AAGGCCACGTGAAGATG CTGCGGCTGGATATTATC AACTCACTGGTAACAACA GTATTCATGCTCATCGTA TCTGTGTTGGCACTGATA CCA		HVKMLRLDII NSLVTTVFML IVSVLALIP	
SS-020	Secretion signal	ATGCCCTGCCTAGACCAA CAGCTCACTGTTCATGCC CTACCCTGCCCTGCCCAG CCCTCCTCTCTGGCCTTCT GCCAAGTGGGGTTCTTAA CAGCA	54	MPCLDQQLT VHALPCPAQP SSLAFCQVGF LTA	116
SS-021	Secretion signal	ATGAAAACCTTGTTCAAT CCAGCCCCTGCCATTGCT GACCTGGATCCCCAGTTC TACACCCTCTCAGATGTG TTCTGCTGCAATGAAAGT GAGGCTGAGATTTTAACT GGCCTCACGGTGGGCAG CGCTGCAGATGCT	55	MKTLFNPAPA IADLDPQFYT LSDVFCCNES EAEILTGLTV GSAADA	117
SS-022	Secretion signal	ATGAAGCCTCTCCTTGTT GTGTTTGTCTTTCTTTTCC TTTGGGATCCAGTGCTGG CA	56	MKPLLVVFVF LFLWDPVLA	118
SS-023	Secretion signal	ATGTCCTGTTCCCTAAAG TTTACTTTGATTGTAATTT TTTTTTACTGTTGGCTTTC ATCCAGC	57	MSCSLKFTLI VIFFTCTLSSS	119
SS-024	Secretion signal	ATGGTTCTTACTAAACCT CTTCAAAGAAATGGCAG CATGATGAGCTTTGAAAA TGTGAAAGAAAAGAGCA GAGAAGGAGGGCCCCAT GCACACACACCCGAAGA AGAATTGTGTTTCGTGGT AACACACTACCCTCAGGT TCAGACCACACTCAACCT GTTTTTCCATATATTCAA GGTTCTTACTCAACCACT TTCCCTTCTGTGGGGT	58	MVLTKPLQR NGSMMSFEN VKEKSREGGP HAHTPEEELC FVVTHTPQVQ TTLNLFFHIFK VLTQPLSLLW G	120
SS-025	Secretion signal	ATGGCCACCCCGCCATTC CGGCTGATAAGGAAGAT GTTTTCCTTCAAGGTGAG CAGATGGATGGGGCTTGC CTGCTTCCGGTCCCTGGC GGCATCC	59	MATPPFRLIR KMFSFKVSR WMGLACFRS LAAS	121
SS-026	Secretion signal	ATGAGCTTTTTCCAACTC CTGATGAAAAGGAAGGA ACTCATTCCCTTGGTGGT	60	MSFFQLLMKR KELIPLVVFM TVAAGGASS	122

		GTTCATGACTGTGGCGGC GGGTGGAGCCTCATCT			
SS-027	Secretion signal	ATGGTCTCAGCTCTGCGG GGAGCACCCCTGATCAG GGTGCACTCAAGCCCTGT TTCTTCTCCTTCTGTGAGT GGACCACGGAGGCTGGT GAGCTGCCTGTCATCCCA AAGCTCAGCTCTGAGC	61	MVSALRGAPL IRVHSSPVSSP SVSGPAALVS CLSSQSSALS	123
SS-028	Secretion signal	ATGATGGGGTCCCCAGTG AGTCATCTGCTGGCCGGC TTCTGTGTGTGGGTCGTC TTGGGC	62	MMGSPVSHL LAGFCVWVV LG	124
SS-029	Secretion signal	ATGGCAAGCATGGCTGCC GTGCTCACCTGGGCTCTG GCTCTTCTTTCAGCGTTTT CGGCCACCCAGGCA	63	MASMAAVLT WALALLSAFS ATQA	125
SS-030	Secretion signal	ATGGTGCTCATGTGGACC AGTGGTGACGCCTTCAAG ACGGCCTACTTCCTGCTG AAGGGTGCCCCTCTGCAG TTCTCCGTGTGCGGCCTG CTGCAGGTGCTGGTGGAC CTGGCCATCCTGGGGCAG GCCTACGCC	64	MVLMWTSGD AFKTAYFLLK GAPLQFSVCG LLQVLVDLAI LGQATA	126
SS-031	Secretion signal	ATGGATTTTGTCGCTGGA GCCATCGGAGGCGTCTGC GGTGTTGCTGTGGGCTAC CCCCTGGACACGGTGAA GGTCAGGATCCAGACGG AGCCAAAGTACACAGGC ATCTGGCACTGCGTCCGG GATACGTATCACCGAGA GCGCGTGTGGG GCTTCTACCGGGGCCTCT CGCTGCCCGTGTGCACGG TGTCCCTGGTATCTTCC	65	MDFVAGAIG GVCGVAVGY PLDTVKVRIQ TEPLYTGIWH CVRDTYHRER VWGFYRGLS LPVCTVSLVS S	127
SS-032	Secretion signal	ATGGAGAAGCCCCTCTTC CCATTAGTGCCTTTGCAT TGGTTTGGCTTTGGCTAC ACAGCACTGGTTGTTTCT GGTGGGATCGTTGGCTAT GTAAAAACAGGCAGCGT GCCGTCCCTGGCTGCAGG GCTGCTCTTCGGCAGTCT AGCC	66	MEKPLFPLVP LHWFGFGYT ALVVSGGIVG YVKTGSVPSL AAGLLFGSLA	128
SS-033	Secretion signal	ATGGGTCTGCTCCTTCCC CTGGCACTCTGCATCCTA GTCCTGTGC	67	MGLLLPLALC ILVLC	129

SS-034	Secretion signal	ATGGGGATCCAGACGAG CCCCGTCCTGCTGGCCTC CCTGGGGGTGGGGCTGGT CACTCTGCTCGGCCTGGC TGTGGGC	68	MGIQTSPVLL ASLGVGLVTL LGLAVG	130
SS-035	Secretion signal	ATGTCGGACCTGCTACTA CTGGGCCTGATTGGGGGC CTGACTCTCTTACTGCTG CTGACGCTGCTAGCCTTT GCC	69	MSDLLLLGLI GGLTLLLLLT LLAFA	131
SS-036	Secretion signal	ATGGAGACTGTGGTGATT GTTGCCATAGGTGTGCTG GCCACCATGTTTCTGGCT TCGTTTGCAGCCTTGGTG CTGGTTTGCAGGCAG	70	METVVIVAIG VLATIFLASFA ALVLVCRQ	132
SS-037	Secretion signal	ATGCGCGGCTCTGTGGAG TGCACCTGGGGTTGGGGG CACTGTGCCCCCAGCCCC CTGCTCCTTTGGACTCTA CTTCTGTTTGCAGCCCCA TTTGGCCTGCTGGGG	71	MAGSVECTW GWGHCAPSPL LLWTLLLFAA PFGLLG	133
SS-038	Secretion signal	ATGATGCCGTCCCGTACC AACCTGGCTACTGGAATC CCCAGTAGTAAAGTGAA ATATTCAAGGCTCTCCAG CACAGACGATGGCTACAT TGACCTTCAGTTTAAGAA AACCCCTCCTAAGATCCC TTATAAGGCCATCGCACT TGCCACTGTGCTGTTTTT GATTGGCGCC	72	MMPSRTNLA TGIPSSKVKYS RLSSTDDGYI DLQFKKTPPK IPYKAIALATV LFLIGA	134
SS-039	Secretion signal	ATGGCCCTGCCCCAGATG TGTGACGGGAGCCACTTG GCCTCCACCCTCCGCTAT TGCATGACAGTCAGCGGC ACAGTGGTTCTGGTGGCC GGGACGCTCTGCTTCGCT	73	MALPQMCDG SHLASTLRYC MTVSGTVVL VAGTLCFA	135
SS-041	Vrg-6	TGAAAAAGTGGTTCGTTG CTGCCGGCATCGGCGCTG CCGGACTCATGCTCTCCA GCGCCGCCA	74	MKKWFVAAG IGAGLLMLSS AA	136
SS-042	PhoA	ATGAAACAGAGCACCAT TGCGCTGGCGCTGCTGCC GCTGCTGTTTACCCCGGT GACCAAAGCG	75	MKQSTIALAL LPLLFTPVTK A	137
SS-043	OmpA	ATGAAAAAAACCGCGAT TGCGATTGCGGTGGCGCT GGCGGGCTTTGCGACCGT GGCGCAGGCG	76	MKKTAIAIAV ALAGFATVA QA	138

SS-044	STI	ATGAAAAAACTGATGCTGGCGATTTTTTTTAGCGTGCTGAGCTTTCCGAGCTTTAGCCAGAGC	77	MKKLMLAIFFSVLSFPSFSQS	139
SS-045	STII	ATGAAAAAAAACATTGCGTTTCTGCTGGCGAGCATGTTTGTGTTTAGCATTGCGACCAACGCGTATGCG	78	MKKNIAFLLASMFVFSIATNAYA	140
SS-046	Amylase	ATGTTTGCGAAACGCTTTAAAACCAGCCTGCTGCCGCTGTTTGCGGGCTTTCTGCTGCTGTTTCATCTGGTGCTGGCGGGCCCGGCGGCGGCGAGC	79	MFAKRFKTSLLPLFAGFLLLFHLVLAGPAAAS	141
SS-047	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCGCGGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	80	MRFPSIFTAVLFAASSALA	142
SS-048	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCACCGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	81	MRFPSIFTTVLFAASSALA	143
SS-049	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCAGCGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	82	MRFPSIFTSVLFAASSALA	144
SS-050	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCCATGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	83	MRFPSIFTHVLFAASSALA	145
SS-051	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCATTGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	84	MRFPSIFTIVLFAASSALA	146
SS-052	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCTTTGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	85	MRFPSIFTFVLFAASSALA	147
SS-053	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCGAAGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	86	MRFPSIFTEVLFAASSALA	148
SS-054	Alpha Factor	ATGCGCTTTCCGAGCATTTTTACCGGCGTGCTGTTTGCGGCGAGCAGCGCGCTGGCG	87	MRFPSIFTGVLFAASSALA	149
SS-055	Endoglucanase V	ATGCGTTCCTCCCCCCTCCTCCGCTCCGCCGTTGTGGCCGCCCTGCCGGTGTTGGCCCTTGCC	88	MRSSPLLRSAVVAALPVLALA	150

SS-056	Secretion signal	ATGGGCGCGGCGGCCGT GCGCTGGCACTTGTGCGT GCTGCTGGCCCTGGGCAC ACGCGGGCGGCTG	89	MGAAAVRW HLCVLLALGT RGRL	151
SS-057	Fungal	ATGAGGAGCTCCCTTGTG CTGTTCTTTGTCTCTGCGT GGACGGCCTTGGCCAG	90	MRSSLVLFFV SAWTALA	152
SS-058	Fibronectin	ATGCTCAGGGGTCCGGG ACCCGGGCGGCTGCTGCT GCTAGCAGTCCTGTGCCT GGGGACATCGGTGCGCT GCACCGAAACCGGGAAG AGCAAGAGG	91	MLRGPGPGRL LLLAVLCLGT SVRCTETGKS KR	153
SS-059	Fibronectin	ATGCTTAGGGGTCCGGGG CCCGGGCTGCTGCTGCTG GCCGTCCAGCTGGGGAC AGCGGTGCCCTCCACG	92	MLRGPGPGLL LLAVQCLGTA VPSTGA	154
SS-060	Fibronectin	ATGCGCCGGGGGGCCCT GACCGGGCTGCTCCTGGT CCTGTGCCTGAGTGTTGT GCTACGTGCAGCCCCCTC TGCAACAAGCAAGAAGC GCAGG	93	MRRGALTGL LLVLCLSVVL RAAPSATSKK RR	155

[000227] In the table, SS is secretion signal and MLS is mitochondrial leader signal. The primary constructs or mmRNA of the present invention may be designed to encode any of the signal sequences of SEQ ID NOs 94-155, or fragments or variants thereof. These sequences may be included at the beginning of the polypeptide coding region, in the middle or at the terminus or alternatively into a flanking region. Further, any of the polynucleotide primary constructs of the present invention may also comprise one or more of the sequences defined by SEQ ID NOs 32-93. These may be in the first region or either flanking region.

[000228] Additional signal sequences which may be utilized in the present invention include those taught in, for example, databases such as those found at http://www.signalpeptide.de/ or http://proline.bic.nus.edu.sg/spdb/. Those described in US Patents 8,124,379; 7,413,875 and 7,385,034 are also within the scope of the invention and the contents of each are incorporated herein by reference in their entirety.

Target Selection

[000229] According to the present invention, the primary constructs comprise at least a first region of linked nucleosides encoding at least one polypeptide of interest. The

polypeptides of interest or "Targets" of the present invention are listed in Table 6. Shown in Table 6, in addition to the name and description of the gene encoding the polypeptide of interest (Target Description) are the ENSEMBL Transcript ID (ENST), the ENSEMBL Protein ID (ENSP) and when available the optimized open reading frame sequence ID (Optimized ORF SEQ ID). For any particular gene there may exist one or more variants or isoforms. Where these exist, they are shown in the table as well. It will be appreciated by those of skill in the art that disclosed in the Table are potential flanking regions. These are encoded in each ENST transcript either to the 5′ (upstream) or 3′ (downstream) of the ORF or coding region. The coding region is definitively and specifically disclosed by teaching the ENSP sequence. Consequently, the sequences taught flanking that encoding the protein are considered flanking regions. It is also possible to further characterize the 5′ and 3′ flanking regions by utilizing one or more available databases or algorithms. Databases have annotated the features contained in the flanking regions of the ENST transcripts and these are available in the art.

Table 6. Membrane Protein Targets

Target No	Target Description	ENST	Trans SEQ ID NO	ENSP	Peptide SEQ ID NO	Optimized ORF SEQ ID
1	1-acylglycerol-3-phosphate O-acyltransferase 3	291572	156	291572	8144	16132, 24120, 32108, 40096, 48084
2	1-acylglycerol-3-phosphate O-acyltransferase 3	327505	157	332989	8145	16133, 24121, 32109, 40097, 48085
3	1-acylglycerol-3-phosphate O-acyltransferase 3	398058	158	381135	8146	16134, 24122, 32110, 40098, 48086
4	1-acylglycerol-3-phosphate O-acyltransferase 3	398061	159	381138	8147	16135, 24123, 32111, 40099, 48087
5	1-acylglycerol-3-phosphate O-acyltransferase 3	398063	160	381140	8148	16136, 24124, 32112, 40100, 48088
6	1-acylglycerol-3-phosphate O-acyltransferase 3	422850	161	414440	8149	16137, 24125, 32113, 40101, 48089
7	1-acylglycerol-3-phosphate O-acyltransferase 3	438598	162	394881	8150	16138, 24126, 32114, 40102, 48090
8	1-acylglycerol-3-phosphate O-acyltransferase 3	445582	163	412079	8151	16139, 24127, 32115, 40103, 48091

9	1-acylglycerol-3-phosphate O-acyltransferase 3	448287	164	389318	8152	16140, 24128, 32116, 40104, 48092
10	1-acylglycerol-3-phosphate O-acyltransferase 3	448845	165	394102	8153	16141, 24129, 32117, 40105, 48093
11	1-acylglycerol-3-phosphate O-acyltransferase 3	457068	166	413906	8154	16142, 24130, 32118, 40106, 48094
12	1-acylglycerol-3-phosphate O-acyltransferase 3	546158	167	443510	8155	16143, 24131, 32119, 40107, 48095
13	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	320285	168	314036	8156	16144, 24132, 32120, 40108, 48096
14	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	366905	169	355872	8157	16145, 24133, 32121, 40109, 48097
15	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	366906	170	355873	8158	16146, 24134, 32122, 40110, 48098
16	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	366908	171	355875	8159	16147, 24135, 32123, 40111, 48099
17	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	366911	172	355878	8160	16148, 24136, 32124, 40112, 48100
18	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	437165	173	400211	8161	16149, 24137, 32125, 40113, 48101
19	1-acylglycerol-3-phosphate O-acyltransferase 4 (lysophosphatidic acid acyltransferase, delta)	457520	174	407007	8162	16150, 24138, 32126, 40114, 48102

20	1-acylglycerol-3-phosphate O-acyltransferase 5 (lysophosphatidic acid acyltransferase, epsilon)	285518	175	285518	8163	16151, 24139, 32127, 40115, 48103
21	2,4-dienoyl CoA reductase 2, peroxisomal	219481	176	219481	8164	16152, 24140, 32128, 40116, 48104
22	2,4-dienoyl CoA reductase 2, peroxisomal	397710	177	380822	8165	16153, 24141, 32129, 40117, 48105
23	2-aminoethanethiol (cysteamine) dioxygenase	373783	178	362888	8166	16154, 24142, 32130, 40118, 48106
24	3-hydroxybutyrate dehydrogenase, type 1	358186	179	350914	8167	16155, 24143, 32131, 40119, 48107
25	3-hydroxybutyrate dehydrogenase, type 1	392378	180	376183	8168	16156, 24144, 32132, 40120, 48108
26	3-hydroxybutyrate dehydrogenase, type 1	392379	181	376184	8169	16157, 24145, 32133, 40121, 48109
27	3-hydroxybutyrate dehydrogenase, type 1	431056	182	396149	8170	16158, 24146, 32134, 40122, 48110
28	3-hydroxybutyrate dehydrogenase, type 1	441275	183	411014	8171	16159, 24147, 32135, 40123, 48111
29	3-hydroxybutyrate dehydrogenase, type 1	445160	184	405462	8172	16160, 24148, 32136, 40124, 48112
30	3-hydroxyisobutyrate dehydrogenase	265395	185	265395	8173	16161, 24149, 32137, 40125, 48113
31	3-oxoacid CoA transferase 2	327582	186	361914	8174	16162, 24150, 32138, 40126, 48114
32	3-oxoacid CoA transferase 2	542949	187	438055	8175	16163, 24151, 32139, 40127, 48115
33	4-hydroxy-2-oxoglutarate aldolase 1	370646	188	359680	8176	16164, 24152, 32140, 40128, 48116
34	4-hydroxy-2-oxoglutarate aldolase 1	370647	189	359681	8177	16165, 24153, 32141, 40129, 48117
35	5,10-methenyltetrahydrofolate synthetase (5-formyltetrahydrofolate cyclo-ligase)	258874	190	258874	8178	16166, 24154, 32142, 40130, 48118

36	5-hydroxytryptamine (serotonin) receptor 3A	299961	191	299961	8179	16167, 24155, 32143, 40131, 48119
37	5-hydroxytryptamine (serotonin) receptor 3A	355556	192	347754	8180	16168, 24156, 32144, 40132, 48120
38	5-hydroxytryptamine (serotonin) receptor 3A	375498	193	364648	8181	16169, 24157, 32145, 40133, 48121
39	5-hydroxytryptamine (serotonin) receptor 3A	504030	194	424189	8182	16170, 24158, 32146, 40134, 48122
40	5-hydroxytryptamine (serotonin) receptor 3A	506841	195	424776	8183	16171, 24159, 32147, 40135, 48123
41	5-hydroxytryptamine (serotonin) receptor 3A	510849	196	423653	8184	16172, 24160, 32148, 40136, 48124
42	5-hydroxytryptamine (serotonin) receptor 3A	535865	197	437776	8185	16173, 24161, 32149, 40137, 48125
43	A kinase (PRKA) anchor protein 12	253332	198	253332	8186	16174, 24162, 32150, 40138, 48126
44	A kinase (PRKA) anchor protein 12	354675	199	346702	8187	16175, 24163, 32151, 40139, 48127
45	A kinase (PRKA) anchor protein 12	359755	200	352794	8188	16176, 24164, 32152, 40140, 48128
46	A kinase (PRKA) anchor protein 12	402676	201	384537	8189	16177, 24165, 32153, 40141, 48129
47	A kinase (PRKA) anchor protein 5	320636	202	315615	8190	16178, 24166, 32154, 40142, 48130
48	A kinase (PRKA) anchor protein 5	394718	203	378207	8191	16179, 24167, 32155, 40143, 48131
49	A kinase (PRKA) anchor protein 6	280979	204	280979	8192	16180, 24168, 32156, 40144, 48132
50	A kinase (PRKA) anchor protein 6	557102	205	451146	8193	16181, 24169, 32157, 40145, 48133
51	A kinase (PRKA) anchor protein 7	342266	206	345149	8194	16182, 24170, 32158, 40146, 48134

52	A kinase (PRKA) anchor protein 7	368123	207	357105	8195	16183, 24171, 32159, 40147, 48135
53	A kinase (PRKA) anchor protein 7	431975	208	405252	8196	16184, 24172, 32160, 40148, 48136
54	A kinase (PRKA) anchor protein 7	474850	209	418208	8197	16185, 24173, 32161, 40149, 48137
55	A kinase (PRKA) anchor protein 8	537303	210	442114	8198	16186, 24174, 32162, 40150, 48138
56	A kinase (PRKA) anchor protein 8	269701	211	269701	8199	16187, 24175, 32163, 40151, 48139
57	aarF domain containing kinase 2	72869	212	72869	8200	16188, 24176, 32164, 40152, 48140, 56072, 56105
58	aarF domain containing kinase 4	243583	213	243583	8201	16189, 24177, 32165, 40153, 48141
59	aarF domain containing kinase 4	324464	214	315118	8202	16190, 24178, 32166, 40154, 48142
60	aarF domain containing kinase 4	450541	215	412839	8203	16191, 24179, 32167, 40155, 48143
61	aarF domain containing kinase 5	308860	216	310547	8204	16192, 24180, 32168, 40156, 48144
62	abhydrolase domain containing 10	273359	217	273359	8205	16193, 24181, 32169, 40157, 48145
63	abhydrolase domain containing 10	534857	218	442932	8206	16194, 24182, 32170, 40158, 48146
64	abhydrolase domain containing 11	222800	219	222800	8207	16195, 24183, 32171, 40159, 48147
65	abhydrolase domain containing 11	322862	220	317293	8208	16196, 24184, 32172, 40160, 48148
66	abhydrolase domain containing 11	395147	221	378579	8209	16197, 24185, 32173, 40161, 48149
67	abhydrolase domain containing 11	437775	222	416970	8210	16198, 24186, 32174, 40162, 48150
68	abhydrolase domain containing 13	375898	223	365063	8211	16199, 24187, 32175, 40163, 48151
69	abhydrolase domain containing 14A	273596	224	273596	8212	16200, 24188, 32176, 40164, 48152

70	abhydrolase domain containing 14A	360889	225	354140	8213	16201, 24189, 32177, 40165, 48153
71	abhydrolase domain containing 14A	452452	226	395914	8214	16202, 24190, 32178, 40166, 48154
72	abhydrolase domain containing 14A	538216	227	439603	8215	16203, 24191, 32179, 40167, 48155
73	abhydrolase domain containing 6	295962	228	295962	8216	16204, 24192, 32180, 40168, 48156
74	abhydrolase domain containing 6	463756	229	420408	8217	16205, 24193, 32181, 40169, 48157
75	abhydrolase domain containing 6	478253	230	420315	8218	16206, 24194, 32182, 40170, 48158
76	abhydrolase domain containing 6	485900	231	418934	8219	16207, 24195, 32183, 40171, 48159
77	abhydrolase domain containing 6	511761	232	442448	8220	16208, 24196, 32184, 40172, 48160
78	acetyl-CoA acyltransferase 2	285093	233	285093	8221	16209, 24197, 32185, 40173, 48161
79	ACN9 homolog (S. cerevisiae)	432641	234	414066	8222	16210, 24198, 32186, 40174, 48162
80	acyl-CoA binding domain containing 5	375888	235	365049	8223	16211, 24199, 32187, 40175, 48163
81	acyl-CoA binding domain containing 5	375889	236	365050	8224	16212, 24200, 32188, 40176, 48164
82	acyl-CoA binding domain containing 5	375897	237	365062	8225	16213, 24201, 32189, 40177, 48165
83	acyl-CoA binding domain containing 5	375901	238	365066	8226	16214, 24202, 32190, 40178, 48166
84	acyl-CoA binding domain containing 5	375905	239	365070	8227	16215, 24203, 32191, 40179, 48167
85	acyl-CoA binding domain containing 5	396271	240	379568	8228	16216, 24204, 32192, 40180, 48168
86	acyl-CoA binding domain containing 5	412279	241	393398	8229	16217, 24205, 32193, 40181, 48169
87	acyl-CoA binding domain containing 5	426079	242	401591	8230	16218, 24206, 32194, 40182, 48170

88	acyl-CoA wax alcohol acyltransferase 1	374521	243	363645	8231	16219, 24207, 32195, 40183, 48171
89	acyl-CoA wax alcohol acyltransferase 2	276101	244	421172	8232	16220, 24208, 32196, 40184, 48172
90	ADAM metallopeptidase domain 18	265707	245	265707	8233	16221, 24209, 32197, 40185, 48173
91	ADAM metallopeptidase domain 18	379866	246	369195	8234	16222, 24210, 32198, 40186, 48174
92	ADAM metallopeptidase domain 18	541111	247	444729	8235	16223, 24211, 32199, 40187, 48175
93	ADAM metallopeptidase domain 18	520772	248	429908	8236	16224, 24212, 32200, 40188, 48176
94	ADAM metallopeptidase domain 32	379907	249	369238	8237	16225, 24213, 32201, 40189, 48177
95	ADAM metallopeptidase domain 32	399826	250	382722	8238	16226, 24214, 32202, 40190, 48178
96	adaptor-related protein complex 1, gamma 2 subunit	308724	251	312442	8239	16227, 24215, 32203, 40191, 48179
97	adaptor-related protein complex 1, gamma 2 subunit	397120	252	380309	8240	16228, 24216, 32204, 40192, 48180
98	adaptor-related protein complex 1, gamma 2 subunit	535852	253	445313	8241	16229, 24217, 32205, 40193, 48181
99	adaptor-related protein complex 1, gamma 2 subunit	545295	254	442716	8242	16230, 24218, 32206, 40194, 48182
100	adaptor-related protein complex 1, gamma 2 subunit	556843	255	451504	8243	16231, 24219, 32207, 40195, 48183
101	adaptor-related protein complex 1, gamma 2 subunit	557189	256	452153	8244	16232, 24220, 32208, 40196, 48184
102	adaptor-related protein complex 1, sigma 3 subunit	396654	257	379891	8245	16233, 24221, 32209, 40197, 48185
103	adaptor-related protein complex 1, sigma 3 subunit	423110	258	406686	8246	16234, 24222, 32210, 40198, 48186
104	adaptor-related protein complex 1, sigma 3 subunit	443700	259	397155	8247	16235, 24223, 32211, 40199, 48187
105	adaptor-related protein complex 1, sigma 3 subunit	446015	260	388738	8248	16236, 24224, 32212, 40200, 48188

106	adaptor-related protein complex 3, beta 2 subunit	261722	261	261722	8249	16237, 24225, 32213, 40201, 48189
107	adaptor-related protein complex 3, beta 2 subunit	535348	262	438721	8250	16238, 24226, 32214, 40202, 48190
108	adaptor-related protein complex 3, beta 2 subunit	535359	263	440984	8251	16239, 24227, 32215, 40203, 48191
109	adaptor-related protein complex 3, delta 1 subunit	343722	264	341579	8252	16240, 24228, 32216, 40204, 48192
110	adaptor-related protein complex 3, delta 1 subunit	345016	265	344055	8253	16241, 24229, 32217, 40205, 48193
111	adaptor-related protein complex 3, delta 1 subunit	350812	266	342321	8254	16242, 24230, 32218, 40206, 48194
112	adaptor-related protein complex 3, delta 1 subunit	355272	267	347416	8255	16243, 24231, 32219, 40207, 48195
113	adaptor-related protein complex 3, delta 1 subunit	356926	268	349398	8256	16244, 24232, 32220, 40208, 48196
114	adaptor-related protein complex 3, mu 1 subunit	355264	269	347408	8257	16245, 24233, 32221, 40209, 48197
115	adaptor-related protein complex 3, mu 1 subunit	372745	270	361831	8258	16246, 24234, 32222, 40210, 48198
116	adaptor-related protein complex 3, mu 2 subunit	174653	271	174653	8259	16247, 24235, 32223, 40211, 48199
117	adaptor-related protein complex 3, mu 2 subunit	396926	272	380132	8260	16248, 24236, 32224, 40212, 48200
118	adaptor-related protein complex 3, mu 2 subunit	517969	273	430538	8261	16249, 24237, 32225, 40213, 48201
119	adaptor-related protein complex 3, mu 2 subunit	518421	274	428787	8262	16250, 24238, 32226, 40214, 48202
120	adaptor-related protein complex 3, mu 2 subunit	522288	275	429515	8263	16251, 24239, 32227, 40215, 48203
121	adaptor-related protein complex 3, mu 2 subunit	530375	276	431918	8264	16252, 24240, 32228, 40216, 48204
122	adaptor-related protein complex 3, sigma 2 subunit	336418	277	338777	8265	16253, 24241, 32229, 40217, 48205
123	adaptor-related protein complex 3, sigma 2 subunit	423566	278	394170	8266	16254, 24242, 32230, 40218, 48206

124	adaptor-related protein complex 3, sigma 2 subunit	560251	279	453288	8267	16255, 24243, 32231, 40219, 48207
125	adenomatosis polyposis coli down-regulated 1-like	371149	280	360191	8268	16256, 24244, 32232, 40220, 48208
126	adenomatosis polyposis coli down-regulated 1-like	439429	281	413261	8269	16257, 24245, 32233, 40221, 48209
127	adenosylhomocysteinase-like 1	359172	282	352092	8270	16258, 24246, 32234, 40222, 48210
128	adenosylhomocysteinase-like 1	369799	283	358814	8271	16259, 24247, 32235, 40223, 48211
129	adenosylhomocysteinase-like 1	393614	284	377238	8272	16260, 24248, 32236, 40224, 48212
130	adenylate cyclase 10 (soluble)	271426	285	271426	8273	16261, 24249, 32237, 40225, 48213
131	adenylate cyclase 10 (soluble)	367848	286	356822	8274	16262, 24250, 32238, 40226, 48214
132	adenylate cyclase 10 (soluble)	367851	287	356825	8275	16263, 24251, 32239, 40227, 48215
133	adenylate cyclase 10 (soluble)	545172	288	441992	8276	16264, 24252, 32240, 40228, 48216
134	adenylate kinase 4	327299	289	322175	8277	16265, 24253, 32241, 40229, 48217
135	adenylate kinase 4	395334	290	378743	8278	16266, 24254, 32242, 40230, 48218
136	adenylate kinase 4	545314	291	445912	8279	16267, 24255, 32243, 40231, 48219
137	adhesion molecule with Ig-like domain 1	369862	292	358878	8280	16268, 24256, 32244, 40232, 48220
138	adhesion molecule with Ig-like domain 1	369864	293	358880	8281	16269, 24257, 32245, 40233, 48221
139	adhesion molecule with Ig-like domain 2	266581	294	266581	8282	16270, 24258, 32246, 40234, 48222
140	adhesion molecule with Ig-like domain 2	321382	295	320848	8283	16271, 24259, 32247, 40235, 48223
141	adhesion molecule with Ig-like domain 2	429635	296	406020	8284	16272, 24260, 32248, 40236, 48224

142	adhesion molecule with Ig-like domain 2	550413	297	449034	8285	16273, 24261, 32249, 40237, 48225
143	adhesion molecule with Ig-like domain 3	320431	298	323096	8286	16274, 24262, 32250, 40238, 48226
144	adhesion molecule with Ig-like domain 3	535833	299	439268	8287	16275, 24263, 32251, 40239, 48227
145	adhesion regulating molecule 1	253003	300	253003	8288	16276, 24264, 32252, 40240, 48228
146	adhesion regulating molecule 1	370744	301	359780	8289	16277, 24265, 32253, 40241, 48229
147	adipogenin	470147	302	434385	8290	16278, 24266, 32254, 40242, 48230
148	adipogenin	537425	303	440331	8291	16279, 24267, 32255, 40243, 48231
149	ADP-ribosylation factor interacting protein 2	254584	304	254584	8292	16280, 24268, 32256, 40244, 48232
150	ADP-ribosylation factor interacting protein 2	396777	305	379998	8293	16281, 24269, 32257, 40245, 48233
151	ADP-ribosylation factor interacting protein 2	423813	306	398375	8294	16282, 24270, 32258, 40246, 48234
152	ADP-ribosylation factor interacting protein 2	445086	307	391427	8295	16283, 24271, 32259, 40247, 48235
153	ADP-ribosylation factor-like 17A	329240	308	331563	8296	16284, 24272, 32260, 40248, 48236
154	ADP-ribosylation factor-like 17A	336125	309	337478	8297	16285, 24273, 32261, 40249, 48237
155	ADP-ribosylation factor-like 17A	337845	310	338611	8298	16286, 24274, 32262, 40250, 48238
156	ADP-ribosylation factor-like 17A	358484	311	351272	8299	16287, 24275, 32263, 40251, 48239
157	ADP-ribosylation factor-like 17A	445552	312	416535	8300	16288, 24276, 32264, 40252, 48240
158	ADP-ribosylation factor-like 17B	434041	313	391751	8301	16289, 24277, 32265, 40253, 48241
159	ADP-ribosylation factor-like 17B	448026	314	395866	8302	16290, 24278, 32266, 40254, 48242

160	ADP-ribosylation factor-like 17B	450673	315	404247	8303	16291, 24279, 32267, 40255, 48243
161	ADP-ribosylation factor-like 17-like isoform a	549665	316	446857	8304	16292, 24280, 32268, 40256, 48244
162	ADP-ribosylation factor-like 17-like isoform a	549904	317	449445	8305	16293, 24281, 32269, 40257, 48245
163	ADP-ribosylation factor-like 17-like isoform a	550273	318	449219	8306	16294, 24282, 32270, 40258, 48246
164	ADP-ribosylation factor-like 17-like isoform a	553155	319	447187	8307	16295, 24283, 32271, 40259, 48247
165	ADP-ribosylation factor-like 4A	356797	320	349250	8308	16296, 24284, 32272, 40260, 48248
166	ADP-ribosylation factor-like 4A	396662	321	379897	8309	16297, 24285, 32273, 40261, 48249
167	ADP-ribosylation factor-like 4A	396663	322	379898	8310	16298, 24286, 32274, 40262, 48250
168	ADP-ribosylation factor-like 4A	396664	323	379899	8311	16299, 24287, 32275, 40263, 48251
169	ADP-ribosylation factor-like 4A	404894	324	385236	8312	16300, 24288, 32276, 40264, 48252
170	ADP-ribosylation factor-like 4A	439721	325	397651	8313	16301, 24289, 32277, 40265, 48253
171	ADP-ribosylation factor-like 4C	339728	326	339754	8314	16302, 24290, 32278, 40266, 48254
172	ADP-ribosylation factor-like 4C	390645	327	375057	8315	16303, 24291, 32279, 40267, 48255
173	ADP-ribosylation factor-like 6 interacting protein 1	304414	328	306788	8316	16304, 24292, 32280, 40268, 48256
174	ADP-ribosylation factor-like 6 interacting protein 1	545430	329	440010	8317	16305, 24293, 32281, 40269, 48257
175	ADP-ribosylation factor-like 6 interacting protein 1	546206	330	440048	8318	16306, 24294, 32282, 40270, 48258
176	ADP-ribosylation factor-like 8A	272217	331	272217	8319	16307, 24295, 32283, 40271, 48259
177	ADP-ribosylation factor-like 8B	256496	332	256496	8320	16308, 24296, 32284, 40272, 48260

178	ADP-ribosylation factor-like 8B	419534	333	402996	8321	16309, 24297, 32285, 40273, 48261
179	ADP-ribosylation factor-like 8B	438743	334	414192	8322	16310, 24298, 32286, 40274, 48262
180	ADP-ribosylation-like factor 6 interacting protein 6	326446	335	315357	8323	16311, 24299, 32287, 40275, 48263
181	AF4/FMR2 family, member 4	265343	336	265343	8324	16312, 24300, 32288, 40276, 48264
182	AF4/FMR2 family, member 4	421773	337	395268	8325	16313, 24301, 32289, 40277, 48265
183	agmatine ureohydrolase (agmatinase)	375826	338	364986	8326	16314, 24302, 32290, 40278, 48266
184	ajuba LIM protein	262713	339	262713	8327	16315, 24303, 32291, 40279, 48267
185	ajuba LIM protein	361265	340	354491	8328	16316, 24304, 32292, 40280, 48268
186	ajuba LIM protein	397388	341	380543	8329	16317, 24305, 32293, 40281, 48269
187	ajuba LIM protein	553592	342	452369	8330	16318, 24306, 32294, 40282, 48270
188	ajuba LIM protein	553911	343	452325	8331	16319, 24307, 32295, 40283, 48271
189	ajuba LIM protein	556731	344	451649	8332	16320, 24308, 32296, 40284, 48272
190	AL138831.1	356722	345	369622	8333	16321, 24309, 32297, 40285, 48273
191	alanine-glyoxylate aminotransferase 2-like 1	296486	346	296486	8334	16322, 24310, 32298, 40286, 48274
192	alanine-glyoxylate aminotransferase 2-like 1	411864	347	392269	8335	16323, 24311, 32299, 40287, 48275
193	alanine-glyoxylate aminotransferase 2-like 1	512646	348	427065	8336	16324, 24312, 32300, 40288, 48276
194	alanine-glyoxylate aminotransferase 2-like 2	308158	349	310978	8337	16325, 24313, 32301, 40289, 48277
195	alkaline ceramidase 3	526597	350	431149	8338	16326, 24314, 32302, 40290, 48278

196	alkaline ceramidase 3	532485	351	434480	8339	16327, 24315, 32303, 40291, 48279
197	alkaline ceramidase 3	533873	352	436252	8340	16328, 24316, 32304, 40292, 48280
198	alkaline ceramidase 3	538157	353	440916	8341	16329, 24317, 32305, 40293, 48281
199	alkaline ceramidase 3	544113	354	440663	8342	16330, 24318, 32306, 40294, 48282
200	allograft inflammatory factor 1-like	247291	355	247291	8343	16331, 24319, 32307, 40295, 48283
201	allograft inflammatory factor 1-like	372300	356	361374	8344	16332, 24320, 32308, 40296, 48284
202	allograft inflammatory factor 1-like	372301	357	361375	8345	16333, 24321, 32309, 40297, 48285
203	allograft inflammatory factor 1-like	372302	358	361376	8346	16334, 24322, 32310, 40298, 48286
204	allograft inflammatory factor 1-like	372309	359	361383	8347	16335, 24323, 32311, 40299, 48287
205	allograft inflammatory factor 1-like	372312	360	361386	8348	16336, 24324, 32312, 40300, 48288
206	alpha-1,4-N-acetylglucosaminyltransferase	236709	361	236709	8349	16337, 24325, 32313, 40301, 48289
207	amiloride-sensitive cation channel 5, intestinal	537611	362	442477	8350	16338, 24326, 32314, 40302, 48290
208	Aminopeptidase Q	357872	363	350541	8351	16339, 24327, 32315, 40303, 48291
209	Aminopeptidase Q	379578	364	368897	8352	16340, 24328, 32316, 40304, 48292
210	Aminopeptidase Q	395528	365	378899	8353	16341, 24329, 32317, 40305, 48293
211	amyloid beta (A4) precursor protein-binding, family B, member 1 interacting protein	356785	366	349237	8354	16342, 24330, 32318, 40306, 48294
212	amyloid beta (A4) precursor protein-binding, family B, member 1 interacting protein	376236	367	365411	8355	16343, 24331, 32319, 40307, 48295

213	amyloid beta (A4) precursor protein-binding, family B, member 1 interacting protein	445780	368	412699	8356	16344, 24332, 32320, 40308, 48296
214	androgen-induced 1	275235	369	275235	8357	16345, 24333, 32321, 40309, 48297
215	androgen-induced 1	344492	370	340090	8358	16346, 24334, 32322, 40310, 48298
216	androgen-induced 1	357847	371	350509	8359	16347, 24335, 32323, 40311, 48299
217	androgen-induced 1	367596	372	356568	8360	16348, 24336, 32324, 40312, 48300
218	androgen-induced 1	367598	373	356570	8361	16349, 24337, 32325, 40313, 48301
219	androgen-induced 1	367601	374	356573	8362	16350, 24338, 32326, 40314, 48302
220	androgen-induced 1	419072	375	398080	8363	16351, 24339, 32327, 40315, 48303
221	androgen-induced 1	447498	376	405048	8364	16352, 24340, 32328, 40316, 48304
222	androgen-induced 1	458219	377	407817	8365	16353, 24341, 32329, 40317, 48305
223	angio-associated, migratory cell protein	248450	378	248450	8366	16354, 24342, 32330, 40318, 48306
224	angiomotin like 1	317829	379	320968	8367	16355, 24343, 32331, 40319, 48307
225	angiomotin like 1	317837	380	323474	8368	16356, 24344, 32332, 40320, 48308
226	angiomotin like 1	433060	381	387739	8369	16357, 24345, 32333, 40321, 48309
227	angiomotin like 1	542840	382	442286	8370	16358, 24346, 32334, 40322, 48310
228	angiomotin like 2	249883	383	249883	8371	16359, 24347, 32335, 40323, 48311
229	angiomotin like 2	422605	384	409999	8372	16360, 24348, 32336, 40324, 48312

230	angiomotin like 2	502491	385	421521	8373	16361, 24349, 32337, 40325, 48313
231	angiomotin like 2	504234	386	424910	8374	16362, 24350, 32338, 40326, 48314
232	angiomotin like 2	505596	387	427292	8375	16363, 24351, 32339, 40327, 48315
233	angiomotin like 2	506107	388	422658	8376	16364, 24352, 32340, 40328, 48316
234	angiomotin like 2	510560	389	427184	8377	16365, 24353, 32341, 40329, 48317
235	angiomotin like 2	513145	390	425475	8378	16366, 24354, 32342, 40330, 48318
236	angiomotin like 2	514516	391	424765	8379	16367, 24355, 32343, 40331, 48319
237	angiomotin like 2	515172	392	427482	8380	16368, 24356, 32344, 40332, 48320
238	angiotensin II receptor-associated protein	314340	393	319713	8381	16369, 24357, 32345, 40333, 48321
239	angiotensin II receptor-associated protein	376629	394	365816	8382	16370, 24358, 32346, 40334, 48322
240	angiotensin II receptor-associated protein	376637	395	365824	8383	16371, 24359, 32347, 40335, 48323
241	angiotensin II receptor-associated protein	400895	396	383688	8384	16372, 24360, 32348, 40336, 48324
242	angiotensin II receptor-associated protein	452018	397	408505	8385	16373, 24361, 32349, 40337, 48325
243	ankyrin and armadillo repeat containing	281412	398	281412	8386	16374, 24362, 32350, 40338, 48326
244	ankyrin and armadillo repeat containing	313581	399	313513	8387	16375, 24363, 32351, 40339, 48327
245	ankyrin and armadillo repeat containing	374838	400	363971	8388	16376, 24364, 32352, 40340, 48328
246	ankyrin and armadillo repeat containing	431575	401	393043	8389	16377, 24365, 32353, 40341, 48329
247	ankyrin and armadillo repeat containing	438402	402	397243	8390	16378, 24366, 32354, 40342, 48330

248	ankyrin and armadillo repeat containing	520309	403	427882	8391	16379, 24367, 32355, 40343, 48331
249	ankyrin repeat and FYVE domain containing 1	341657	404	343362	8392	16380, 24368, 32356, 40344, 48332
250	ankyrin repeat and FYVE domain containing 1	433651	405	416005	8393	16381, 24369, 32357, 40345, 48333
251	ankyrin repeat and FYVE domain containing 1	535427	406	442785	8394	16382, 24370, 32358, 40346, 48334
252	ankyrin repeat and FYVE domain containing 1	574367	407	459775	8395	16383, 24371, 32359, 40347, 48335
253	ankyrin repeat domain 20 family, member A1	377477	408	366697	8396	16384, 24372, 32360, 40348, 48336
254	ankyrin repeat domain 33	301190	409	301190	8397	16385, 24373, 32361, 40349, 48337
255	ankyrin repeat domain 46	335659	410	335287	8398	16386, 24374, 32362, 40350, 48338
256	ankyrin repeat domain 46	358990	411	351881	8399	16387, 24375, 32363, 40351, 48339
257	ankyrin repeat domain 46	519597	412	430056	8400	16388, 24376, 32364, 40352, 48340
258	ankyrin repeat domain 46	520311	413	428388	8401	16389, 24377, 32365, 40353, 48341
259	ankyrin repeat domain 46	520552	414	429015	8402	16390, 24378, 32366, 40354, 48342
260	ankyrin repeat domain 46	521345	415	429647	8403	16391, 24379, 32367, 40355, 48343
261	ankyrin repeat domain 46	523000	416	430800	8404	16392, 24380, 32368, 40356, 48344
262	ankyrin repeat domain 46	524072	417	430357	8405	16393, 24381, 32369, 40357, 48345
263	annexin A13	262219	418	262219	8406	16394, 24382, 32370, 40358, 48346
264	annexin A13	419625	419	390809	8407	16395, 24383, 32371, 40359, 48347
265	anoctamin 3	256737	420	256737	8408	16396, 24384, 32372, 40360, 48348

266	anoctamin 3	525139	421	432576	8409	16397, 24385, 32373, 40361, 48349
267	anoctamin 3	531568	422	432394	8410	16398, 24386, 32374, 40362, 48350
268	anoctamin 3	537978	423	440737	8411	16399, 24387, 32375, 40363, 48351
269	anoctamin 3	538001	424	442241	8412	16400, 24388, 32376, 40364, 48352
270	anoctamin 4	299222	425	299222	8413	16401, 24389, 32377, 40365, 48353
271	anoctamin 4	392977	426	376703	8414	16402, 24390, 32378, 40366, 48354
272	anoctamin 4	392979	427	376705	8415	16403, 24391, 32379, 40367, 48355
273	anoctamin 4	538618	428	443751	8416	16404, 24392, 32380, 40368, 48356
274	anoctamin 4	546991	429	447867	8417	16405, 24393, 32381, 40369, 48357
275	anoctamin 4	550015	430	450192	8418	16406, 24394, 32382, 40370, 48358
276	anoctamin 7	274979	431	274979	8419	16407, 24395, 32383, 40371, 48359
277	anoctamin 7	402430	432	385418	8420	16408, 24396, 32384, 40372, 48360
278	anoctamin 7	402530	433	383985	8421	16409, 24397, 32385, 40373, 48361
279	anoctamin 8	159087	434	159087	8422	16410, 24398, 32386, 40374, 48362, 56073, 56106
280	anoctamin 9	332826	435	332788	8423	16411, 24399, 32387, 40375, 48363
281	AP2 associated kinase 1	406297	436	385181	8424	16412, 24400, 32388, 40376, 48364
282	AP2 associated kinase 1	409085	437	386456	8425	16413, 24401, 32389, 40377, 48365
283	apelin receptor	257254	438	257254	8426	16414, 24402, 32390, 40378, 48366

284	apelin receptor	326830	439	322708	8427	16415, 24403, 32391, 40379, 48367
285	apelin receptor	444275	440	399748	8428	16416, 24404, 32392, 40380, 48368
286	apoptogenic 1	409074	441	386485	8429	16417, 24405, 32393, 40381, 48369
287	apoptosis-inducing factor, mitochondrion-associated, 2	307864	442	312370	8430	16418, 24406, 32394, 40382, 48370
288	apoptosis-inducing factor, mitochondrion-associated, 2	373248	443	362345	8431	16419, 24407, 32395, 40383, 48371
289	apoptosis-inducing factor, mitochondrion-associated, 2	395039	444	378480	8432	16420, 24408, 32396, 40384, 48372
290	aquaporin 10	324978	445	318355	8433	16421, 24409, 32397, 40385, 48373
291	aquaporin 10	484864	446	420341	8434	16422, 24410, 32398, 40386, 48374
292	ArfGAP with dual PH domains 1	265846	447	265846	8435	16423, 24411, 32399, 40387, 48375
293	ArfGAP with dual PH domains 1	449296	448	407267	8436	16424, 24412, 32400, 40388, 48376
294	ArfGAP with dual PH domains 1	449929	449	392174	8437	16425, 24413, 32401, 40389, 48377
295	ArfGAP with dual PH domains 1	538188	450	442254	8438	16426, 24414, 32402, 40390, 48378
296	ArfGAP with dual PH domains 1	539900	451	442682	8439	16427, 24415, 32403, 40391, 48379
297	ArfGAP with dual PH domains 2	330889	452	329468	8440	16428, 24416, 32404, 40392, 48380
298	ArfGAP with SH3 domain, ankyrin repeat and PH domain 2	281419	453	281419	8441	16429, 24417, 32405, 40393, 48381
299	ArfGAP with SH3 domain, ankyrin repeat and PH domain 2	315273	454	316404	8442	16430, 24418, 32406, 40394, 48382

300	armadillo repeat containing 1	276569	455	276569	8443	16431, 24419, 32407, 40395, 48383
301	armadillo repeat containing 1	458464	456	388572	8444	16432, 24420, 32408, 40396, 48384
302	armadillo repeat containing X-linked 4	423738	457	404304	8445	16433, 24421, 32409, 40397, 48385
303	armadillo repeat containing, X-linked 4	433011	458	424452	8446	16434, 24422, 32410, 40398, 48386
304	armadillo repeat containing, X-linked 4	452188	459	425302	8447	16435, 24423, 32411, 40399, 48387
305	armadillo repeat containing, X-linked 6	361910	460	354708	8448	16436, 24424, 32412, 40400, 48388
306	armadillo repeat containing, X-linked 6	538627	461	440648	8449	16437, 24425, 32413, 40401, 48389
307	armadillo repeat containing, X-linked 6	539247	462	444537	8450	16438, 24426, 32414, 40402, 48390
308	arrestin domain containing 1	371421	463	360475	8451	16439, 24427, 32415, 40403, 48391
309	arrestin domain containing 1	419386	464	406833	8452	16440, 24428, 32416, 40404, 48392
310	arrestin domain containing 1	431925	465	406247	8453	16441, 24429, 32417, 40405, 48393
311	arylacetamide deacetylase-like 4	376221	466	365395	8454	16442, 24430, 32418, 40406, 48394
312	ash1 (absent, small, or homeotic)-like (Drosophila)	368346	467	357330	8455	16443, 24431, 32419, 40407, 48395
313	ash1 (absent, small, or homeotic)-like (Drosophila)	392403	468	376204	8456	16444, 24432, 32420, 40408, 48396
314	asialoglycoprotein receptor 2	254850	469	254850	8457	16445, 24433, 32421, 40409, 48397
315	asialoglycoprotein receptor 2	355035	470	347140	8458	16446, 24434, 32422, 40410, 48398
316	asialoglycoprotein receptor 2	380952	471	370339	8459	16447, 24435, 32423, 40411, 48399
317	asialoglycoprotein receptor 2	446679	472	405844	8460	16448, 24436, 32424, 40412, 48400

318	asialoglycoprotein receptor 2	450034	473	411881	8461	16449, 24437, 32425, 40413, 48401
319	asparagine-linked glycosylation 10, alpha-1,2-glucosyltransferase homolog B (yeast)	308742	474	310120	8462	16450, 24438, 32426, 40414, 48402
320	asparagine-linked glycosylation 3, alpha-1,3-mannosyltransferase homolog (S. cerevisiae)	445626	475	402744	8463	16451, 24439, 32427, 40415, 48403
321	asparagine-linked glycosylation 5, dolichyl-phosphate beta-glucosyltransferase homolog (S. cerevisiae)	239891	476	239891	8464	16452, 24440, 32428, 40416, 48404
322	asparagine-linked glycosylation 5, dolichyl-phosphate beta-glucosyltransferase homolog (S. cerevisiae)	413537	477	389647	8465	16453, 24441, 32429, 40417, 48405
323	asparagine-linked glycosylation 5, dolichyl-phosphate beta-glucosyltransferase homolog (S. cerevisiae)	443765	478	390533	8466	16454, 24442, 32430, 40418, 48406
324	aspartate beta-hydroxylase domain containing 1	308748	479	311447	8467	16455, 24443, 32431, 40419, 48407
325	aspartate beta-hydroxylase domain containing 1	414952	480	388036	8468	16456, 24444, 32432, 40420, 48408
326	aspartate beta-hydroxylase domain containing 2	215906	481	215906	8469	16457, 24445, 32433, 40421, 48409
327	aspartyl-tRNA synthetase	264161	482	264161	8470	16458, 24446, 32434, 40422, 48410
328	aspartyl-tRNA synthetase	537273	483	444192	8471	16459, 24447, 32435, 40423, 48411
329	ATG12 autophagy related 12 homolog (S. cerevisiae)	274459	484	274459	8472	16460, 24448, 32436, 40424, 48412
330	ATG12 autophagy related 12 homolog	500945	485	425164	8473	16461, 24449, 32437, 40425,

	(S. cerevisiae)					48413
331	ATG12 autophagy related 12 homolog (S. cerevisiae)	509910	486	425107	8474	16462, 24450, 32438, 40426, 48414
332	ATG14 autophagy related 14 homolog (S. cerevisiae)	247178	487	247178	8475	16463, 24451, 32439, 40427, 48415
333	ATG5 autophagy related 5 homolog (S. cerevisiae)	343245	488	343313	8476	16464, 24452, 32440, 40428, 48416
334	ATG5 autophagy related 5 homolog (S. cerevisiae)	360666	489	353884	8477	16465, 24453, 32441, 40429, 48417
335	ATG5 autophagy related 5 homolog (S. cerevisiae)	369070	490	358066	8478	16466, 24454, 32442, 40430, 48418
336	ATG5 autophagy related 5 homolog (S. cerevisiae)	369076	491	358072	8479	16467, 24455, 32443, 40431, 48419
337	ATP synthase H+ transporting mitochondrial Fo complex subunit s (factor B)	245448	492	245448	8480	16468, 24456, 32444, 40432, 48420
338	ATP synthase H+ transporting mitochondrial Fo complex subunit s (factor B)	426751	493	389246	8481	16469, 24457, 32445, 40433, 48421
339	ATP synthase mitochondrial F1 complex assembly factor 1	329231	494	330685	8482	16470, 24458, 32446, 40434, 48422
340	ATP synthase mitochondrial F1 complex assembly factor 1	371937	495	361005	8483	16471, 24459, 32447, 40435, 48423
341	ATP synthase mitochondrial F1 complex assembly factor 1	532925	496	435732	8484	16472, 24460, 32448, 40436, 48424
342	ATP synthase mitochondrial F1 complex assembly factor 1	542495	497	443588	8485	16473, 24461, 32449, 40437, 48425
343	ATP synthase mitochondrial F1 complex assembly factor 1	529214	498	436267	8486	16474, 24462, 32450, 40438, 48426
344	ATP synthase mitochondrial F1 complex assembly factor 1	574428	499	459167	8487	16475, 24463, 32451, 40439, 48427

345	ATP synthase protein 8	361851	500	355265	8488	16476, 24464, 32452, 40440, 48428
346	ATP synthase, H+ transporting, mitochondrial F1 complex, delta subunit	215375	501	215375	8489	16477, 24465, 32453, 40441, 48429
347	ATP synthase, H+ transporting, mitochondrial F1 complex, delta subunit	395633	502	378995	8490	16478, 24466, 32454, 40442, 48430
348	ATP synthase, H+ transporting, mitochondrial F1 complex, epsilon subunit pseudogene 2	381026	503	370414	8491	16479, 24467, 32455, 40443, 48431
349	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit B1	369722	504	358737	8492	16480, 24468, 32456, 40444, 48432
350	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit B1	483994	505	420366	8493	16481, 24469, 32457, 40445, 48433
351	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit d	301587	506	301587	8494	16482, 24470, 32458, 40446, 48434
352	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit d	344546	507	344230	8495	16483, 24471, 32459, 40447, 48435
353	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit d	538432	508	437996	8496	16484, 24472, 32460, 40448, 48436
354	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit F2	292475	509	292475	8497	16485, 24473, 32461, 40449, 48437
355	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit F2	359832	510	352890	8498	16486, 24474, 32462, 40450, 48438
356	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit F2	394186	511	377740	8499	16487, 24475, 32463, 40451, 48439
357	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit F2	488775	512	418197	8500	16488, 24476, 32464, 40452, 48440

358	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit F2	544611	513	444922	8501	16489, 24477, 32465, 40453, 48441
359	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit G	300688	514	300688	8502	16490, 24478, 32466, 40454, 48442
360	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit G2	505920	515	421076	8503	16491, 24479, 32467, 40455, 48443
361	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit s (factor B)	311459	516	308334	8504	16492, 24480, 32468, 40456, 48444
362	ATP synthase, H+ transporting, mitochondrial Fo complex, subunit s (factor B)	358473	517	351258	8505	16493, 24481, 32469, 40457, 48445
363	ATPase H+ transporting lysosomal 14kDa V1 subunit F	492758	518	417378	8506	16494, 24482, 32470, 40458, 48446
364	ATPase inhibitory factor 1	335514	519	335203	8507	16495, 24483, 32471, 40459, 48447
365	ATPase inhibitory factor 1	465645	520	437337	8508	16496, 24484, 32472, 40460, 48448
366	ATPase inhibitory factor 1	497986	521	435579	8509	16497, 24485, 32473, 40461, 48449
367	ATPase type 13A1	291503	522	291503	8510	16498, 24486, 32474, 40462, 48450
368	ATPase type 13A1	357324	523	349877	8511	16499, 24487, 32475, 40463, 48451
369	ATPase type 13A3	256031	524	256031	8512	16500, 24488, 32476, 40464, 48452
370	ATPase type 13A3	310773	525	311019	8513	16501, 24489, 32477, 40465, 48453
371	ATPase type 13A3	439040	526	416508	8514	16502, 24490, 32478, 40466, 48454
372	ATPase type 13A3	446356	527	410767	8515	16503, 24491, 32479, 40467, 48455

373	ATPase type 13A3	457986	528	406234	8516	16504, 24492, 32480, 40468, 48456
374	ATPase type 13A4	295548	529	295548	8517	16505, 24493, 32481, 40469, 48457
375	ATPase type 13A4	342695	530	339182	8518	16506, 24494, 32482, 40470, 48458
376	ATPase type 13A4	400270	531	383129	8519	16507, 24495, 32483, 40471, 48459
377	ATPase type 13A5	342358	532	341942	8520	16508, 24496, 32484, 40472, 48460
378	ATPase, aminophospholipid transporter (APLT), class I, type 8A, member 1	264449	533	264449	8521	16509, 24497, 32485, 40473, 48461
379	ATPase, aminophospholipid transporter (APLT), class I, type 8A, member 1	381668	534	371084	8522	16510, 24498, 32486, 40474, 48462
380	ATPase, class I, type 8B, member 4	284509	535	284509	8523	16511, 24499, 32487, 40475, 48463
381	ATPase, class I, type 8B, member 4	558829	536	453539	8524	16512, 24500, 32488, 40476, 48464
382	ATPase, class I, type 8B, member 4	559829	537	453169	8525	16513, 24501, 32489, 40477, 48465
383	ATPase, class II, type 9A	311637	538	309086	8526	16514, 24502, 32490, 40478, 48466
384	ATPase, class II, type 9A	338821	539	342481	8527	16515, 24503, 32491, 40479, 48467
385	ATPase, class II, type 9A	402822	540	385875	8528	16516, 24504, 32492, 40480, 48468
386	ATPase, class V, type 10B	327245	541	313600	8529	16517, 24505, 32493, 40481, 48469
387	ATPase, class V, type 10D	273859	542	273859	8530	16518, 24506, 32494, 40482, 48470
388	ATPase, class V, type 10D	504445	543	420909	8531	16519, 24507, 32495, 40483, 48471
389	ATPase, class VI, type 11C	327569	544	332756	8532	16520, 24508, 32496, 40484, 48472

390	ATPase, class VI, type 11C	359686	545	352715	8533	16521, 24509, 32497, 40485, 48473
391	ATPase, class VI, type 11C	361648	546	355165	8534	16522, 24510, 32498, 40486, 48474
392	ATPase, class VI, type 11C	370543	547	359574	8535	16523, 24511, 32499, 40487, 48475
393	ATPase, class VI, type 11C	370557	548	359588	8536	16524, 24512, 32500, 40488, 48476
394	ATPase, class VI, type 11C	422228	549	394573	8537	16525, 24513, 32501, 40489, 48477
395	ATPase, class VI, type 11C	433868	550	397923	8538	16526, 24514, 32502, 40490, 48478
396	ATPase, class VI, type 11C	450801	551	391259	8539	16527, 24515, 32503, 40491, 48479
397	ATPase, H+ transporting, lysosomal 13kDa, V1 subunit G3	281087	552	281087	8540	16528, 24516, 32504, 40492, 48480
398	ATPase, H+ transporting, lysosomal 13kDa, V1 subunit G3	309309	553	309574	8541	16529, 24517, 32505, 40493, 48481
399	ATPase, H+ transporting, lysosomal 13kDa, V1 subunit G3	367381	554	356351	8542	16530, 24518, 32506, 40494, 48482
400	ATPase, H+ transporting, lysosomal 13kDa, V1 subunit G3	367382	555	356352	8543	16531, 24519, 32507, 40495, 48483
401	ATPase, H+ transporting, lysosomal 13kDa, V1 subunit G3	489986	556	417171	8544	16532, 24520, 32508, 40496, 48484
402	ATPase, H+ transporting, lysosomal 14kDa, V1 subunit F	249289	557	249289	8545	16533, 24521, 32509, 40497, 48485
403	ATPase, H+ transporting, lysosomal 31kDa, V1 subunit E2	306448	558	304891	8546	16534, 24522, 32510, 40498, 48486
404	ATPase, H+ transporting, lysosomal 31kDa, V1 subunit E2	522587	559	428141	8547	16535, 24523, 32511, 40499, 48487

405	ATPase, H+ transporting, lysosomal 34kDa, V1 subunit D	216442	560	216442	8548	16536, 24524, 32512, 40500, 48488
406	ATPase, H+ transporting, lysosomal 34kDa, V1 subunit D	554087	561	451167	8549	16537, 24525, 32513, 40501, 48489
407	ATPase, H+ transporting, lysosomal 34kDa, V1 subunit D	555012	562	451031	8550	16538, 24526, 32514, 40502, 48490
408	ATPase, H+ transporting, lysosomal 38kDa, V0 subunit d2	285393	563	285393	8551	16539, 24527, 32515, 40503, 48491
409	ATPase, H+ transporting, lysosomal 38kDa, V0 subunit d2	521564	564	429731	8552	16540, 24528, 32516, 40504, 48492
410	ATPase, H+ transporting, lysosomal 38kDa, V0 subunit d2	523635	565	428382	8553	16541, 24529, 32517, 40505, 48493
411	ATPase, H+ transporting, lysosomal 42kDa, V1 subunit C2	272238	566	272238	8554	16542, 24530, 32518, 40506, 48494
412	ATPase, H+ transporting, lysosomal 42kDa, V1 subunit C2	381661	567	371077	8555	16543, 24531, 32519, 40507, 48495
413	ATPase, H+ transporting, lysosomal 50/57kDa, V1 subunit H	355221	568	347359	8556	16544, 24532, 32520, 40508, 48496
414	ATPase, H+ transporting, lysosomal 50/57kDa, V1 subunit H	359530	569	352522	8557	16545, 24533, 32521, 40509, 48497
415	ATPase, H+ transporting, lysosomal 50/57kDa, V1 subunit H	396774	570	379995	8558	16546, 24534, 32522, 40510, 48498
416	ATPase, H+ transporting, lysosomal 50/57kDa, V1 subunit H	521275	571	429786	8559	16547, 24535, 32523, 40511, 48499
417	ATPase, H+ transporting, lysosomal	524234	572	427835	8560	16548, 24536, 32524, 40512, 48500

	50/57kDa, V1 subunit H					
418	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B1	234396	573	234396	8561	16549, 24537, 32525, 40513, 48501
419	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B1	412314	574	388353	8562	16550, 24538, 32526, 40514, 48502
420	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B1	483246	575	443856	8563	16551, 24539, 32527, 40515, 48503
421	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B2	276390	576	276390	8564	16552, 24540, 32528, 40516, 48504
422	ATPase, H+ transporting, lysosomal 56/58kDa, V1 subunit B2	542368	577	439953	8565	16553, 24541, 32529, 40517, 48505
423	ATPase, H+ transporting, lysosomal 70kDa, V1 subunit A	273398	578	273398	8566	16554, 24542, 32530, 40518, 48506
424	ATPase, H+ transporting, lysosomal 70kDa, V1 subunit A	475322	579	419294	8567	16555, 24543, 32531, 40519, 48507
425	ATPase, H+ transporting, lysosomal 70kDa, V1 subunit A	538620	580	439874	8568	16556, 24544, 32532, 40520, 48508
426	ATPase, H+ transporting, lysosomal 70kDa, V1 subunit A	545842	581	441031	8569	16557, 24545, 32533, 40521, 48509
427	ATPase, H+ transporting, lysosomal 9kDa, V0 subunit e1	517669	582	427941	8570	16558, 24546, 32534, 40522, 48510
428	ATPase, H+ transporting, lysosomal 9kDa, V0 subunit e1	519374	583	429690	8571	16559, 24547, 32535, 40523, 48511
429	ATPase, H+ transporting, lysosomal accessory protein 1	369762	584	358777	8572	16560, 24548, 32536, 40524, 48512

430	ATPase, H+ transporting, lysosomal accessory protein 1	422890	585	398511	8573	16561, 24549, 32537, 40525, 48513
431	ATPase, H+ transporting, lysosomal accessory protein 1	445849	586	388546	8574	16562, 24550, 32538, 40526, 48514
432	ATPase, H+ transporting, lysosomal accessory protein 1	449556	587	392375	8575	16563, 24551, 32539, 40527, 48515
433	ATPase, H+ transporting, lysosomal accessory protein 1-like	380167	588	369513	8576	16564, 24552, 32540, 40528, 48516
434	ATPase, H+ transporting, lysosomal accessory protein 1-like	439350	589	391381	8577	16565, 24553, 32541, 40529, 48517
435	ATPase, Na+/K+ transporting, beta 4 polypeptide	218008	590	218008	8578	16566, 24554, 32542, 40530, 48518
436	ATPase, Na+/K+ transporting, beta 4 polypeptide	361319	591	355346	8579	16567, 24555, 32543, 40531, 48519
437	ATPase, Na+/K+ transporting, beta 4 polypeptide	539306	592	443334	8580	16568, 24556, 32544, 40532, 48520
438	ATP-binding cassette sub-family B (MDR/TAP) member 5	406935	593	383899	8581	16569, 24557, 32545, 40533, 48521
439	ATP-binding cassette, sub-family B (MDR/TAP), member 5	258738	594	258738	8582	16570, 24558, 32546, 40534, 48522
440	ATP-binding cassette, sub-family B (MDR/TAP), member 5	404938	595	384881	8583	16571, 24559, 32547, 40535, 48523
441	ATP-binding cassette, sub-family B (MDR/TAP), member 5	443026	596	406730	8584	16572, 24560, 32548, 40536, 48524
442	ATP-binding cassette, sub-family C (CFTR/MRP), member 8	302539	597	303960	8585	16573, 24561, 32549, 40537, 48525
443	ATP-binding cassette, sub-family C (CFTR/MRP), member 8	379493	598	368807	8586	16574, 24562, 32550, 40538, 48526

444	ATP-binding cassette, sub-family C (CFTR/MRP), member 8	389817	599	374467	8587	16575, 24563, 32551, 40539, 48527
445	ATP-binding cassette, sub-family C (CFTR/MRP), member 8	527905	600	431653	8588	16576, 24564, 32552, 40540, 48528
446	ATP-binding cassette, sub-family C, member 6 pseudogene 1	546162	601	443361	8589	16577, 24565, 32553, 40541, 48529
447	aurora kinase A interacting protein 1	321751	602	319778	8590	16578, 24566, 32554, 40542, 48530
448	aurora kinase A interacting protein 1	338338	603	340656	8591	16579, 24567, 32555, 40543, 48531
449	aurora kinase A interacting protein 1	338370	604	342676	8592	16580, 24568, 32556, 40544, 48532
450	aurora kinase A interacting protein 1	378853	605	368130	8593	16581, 24569, 32557, 40545, 48533
451	B and T lymphocyte associated	334529	606	333919	8594	16582, 24570, 32558, 40546, 48534
452	B and T lymphocyte associated	383680	607	373178	8595	16583, 24571, 32559, 40547, 48535
453	B7 homolog 6	338965	608	341637	8596	16584, 24572, 32560, 40548, 48536
454	B7 homolog 6	530403	609	434394	8597	16585, 24573, 32561, 40549, 48537
455	BAI1-associated protein 2-like 2	332536	610	328876	8598	16586, 24574, 32562, 40550, 48538
456	BAI1-associated protein 2-like 2	381669	611	371085	8599	16587, 24575, 32563, 40551, 48539
457	BAI1-associated protein 2-like 2	402500	612	384877	8600	16588, 24576, 32564, 40552, 48540
458	B-cell receptor-associated protein 29	5259	613	5259	8601	16589, 24577, 32565, 40553, 48541, 56074, 56107
459	B-cell receptor-associated protein 29	379117	614	368412	8602	16590, 24578, 32566, 40554, 48542
460	B-cell receptor-associated protein 29	379119	615	368414	8603	16591, 24579, 32567, 40555, 48543

461	B-cell receptor-associated protein 29	379121	616	368416	8604	16592, 24580, 32568, 40556, 48544
462	B-cell receptor-associated protein 29	421217	617	395828	8605	16593, 24581, 32569, 40557, 48545
463	B-cell receptor-associated protein 29	436699	618	414164	8606	16594, 24582, 32570, 40558, 48546
464	B-cell receptor-associated protein 29	445771	619	400718	8607	16595, 24583, 32571, 40559, 48547
465	B-cell receptor-associated protein 29	457837	620	409350	8608	16596, 24584, 32572, 40560, 48548
466	B-cell receptor-associated protein 29	465919	621	418993	8609	16597, 24585, 32573, 40561, 48549
467	B-cell receptor-associated protein 29	473124	622	420313	8610	16598, 24586, 32574, 40562, 48550
468	B-cell receptor-associated protein 29	479917	623	418816	8611	16599, 24587, 32575, 40563, 48551
469	B-cell receptor-associated protein 31	345046	624	343458	8612	16600, 24588, 32576, 40564, 48552
470	B-cell receptor-associated protein 31	416815	625	394270	8613	16601, 24589, 32577, 40565, 48553
471	B-cell receptor-associated protein 31	423827	626	389740	8614	16602, 24590, 32578, 40566, 48554
472	B-cell receptor-associated protein 31	426131	627	387751	8615	16603, 24591, 32579, 40567, 48555
473	B-cell receptor-associated protein 31	429550	628	409888	8616	16604, 24592, 32580, 40568, 48556
474	B-cell receptor-associated protein 31	430088	629	402342	8617	16605, 24593, 32581, 40569, 48557
475	B-cell receptor-associated protein 31	441714	630	405417	8618	16606, 24594, 32582, 40570, 48558
476	B-cell receptor-associated protein 31	442093	631	400345	8619	16607, 24595, 32583, 40571, 48559
477	B-cell receptor-associated protein 31	458587	632	392330	8620	16608, 24596, 32584, 40572, 48560
478	BCL2/adenovirus E1B 19kDa interacting protein 1	231668	633	231668	8621	16609, 24597, 32585, 40573, 48561

479	BCL2/adenovirus E1B 19kDa interacting protein 1	351486	634	239215	8622	16610, 24598, 32586, 40574, 48562
480	BCL2/adenovirus E1B 19kDa interacting protein 1	352523	635	239214	8623	16611, 24599, 32587, 40575, 48563
481	BCL2/adenovirus E1B 19kDa interacting protein 1	393770	636	377365	8624	16612, 24600, 32588, 40576, 48564
482	BCL2-like 13 (apoptosis facilitator)	317582	637	318883	8625	16613, 24601, 32589, 40577, 48565
483	BCL2-like 13 (apoptosis facilitator)	337612	638	338932	8626	16614, 24602, 32590, 40578, 48566
484	BCL2-like 13 (apoptosis facilitator)	399782	639	382682	8627	16615, 24603, 32591, 40579, 48567
485	BCL2-like 13 (apoptosis facilitator)	418951	640	410019	8628	16616, 24604, 32592, 40580, 48568
486	BCL2-like 13 (apoptosis facilitator)	493680	641	434764	8629	16617, 24605, 32593, 40581, 48569
487	BCL2-like 13 (apoptosis facilitator)	538149	642	441344	8630	16618, 24606, 32594, 40582, 48570
488	BCL2-like 13 (apoptosis facilitator)	543133	643	437667	8631	16619, 24607, 32595, 40583, 48571
489	BCL2-like 13 (apoptosis facilitator)	355028	644	347133	8632	16620, 24608, 32596, 40584, 48572
490	BEN domain containing 5	294347	645	294347	8633	16621, 24609, 32597, 40585, 48573
491	BEN domain containing 5	371833	646	360899	8634	16622, 24610, 32598, 40586, 48574
492	beta-1,3-glucuronyltransferase 2 (glucuronosyltransferase S)	230053	647	230053	8635	16623, 24611, 32599, 40587, 48575
493	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	320474	648	323479	8636	16624, 24612, 32600, 40588, 48576
494	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	392779	649	376530	8637	16625, 24613, 32601, 40589, 48577

495	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	392780	650	376531	8638	16626, 24614, 32602, 40590, 48578
496	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	392781	651	376532	8639	16627, 24615, 32603, 40591, 48579
497	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	417187	652	407027	8640	16628, 24616, 32604, 40592, 48580
498	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	468268	653	419476	8641	16629, 24617, 32605, 40593, 48581
499	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	473142	654	420604	8642	16630, 24618, 32606, 40594, 48582
500	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	473285	655	418226	8643	16631, 24619, 32607, 40595, 48583
501	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	484127	656	420059	8644	16632, 24620, 32608, 40596, 48584
502	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	488170	657	420163	8645	16633, 24621, 32609, 40597, 48585
503	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	492353	658	418567	8646	16634, 24622, 32610, 40598, 48586
504	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	494173	659	419127	8647	16635, 24623, 32611, 40599, 48587
505	beta-1,3-N-acetylgalactosaminyl transferase 1 (globoside blood group)	498216	660	417643	8648	16636, 24624, 32612, 40600, 48588

506	beta-1,3-N-acetylgalactosaminyl transferase 2	313984	661	315678	8649	16637, 24625, 32613, 40601, 48589
507	beta-1,3-N-acetylgalactosaminyl transferase 2	366599	662	355558	8650	16638, 24626, 32614, 40602, 48590
508	beta-1,3-N-acetylgalactosaminyl transferase 2	366600	663	355559	8651	16639, 24627, 32615, 40603, 48591
509	beta-1,4-N-acetyl-galactosaminyl transferase 1	341156	664	341562	8652	16640, 24628, 32616, 40604, 48592
510	beta-1,4-N-acetyl-galactosaminyl transferase 1	548888	665	447945	8653	16641, 24629, 32617, 40605, 48593
511	beta-1,4-N-acetyl-galactosaminyl transferase 1	551220	666	446566	8654	16642, 24630, 32618, 40606, 48594
512	beta-1,4-N-acetyl-galactosaminyl transferase 2	300404	667	300404	8655	16643, 24631, 32619, 40607, 48595
513	beta-1,4-N-acetyl-galactosaminyl transferase 2	393354	668	377022	8656	16644, 24632, 32620, 40608, 48596
514	beta-1,4-N-acetyl-galactosaminyl transferase 2	504681	669	425510	8657	16645, 24633, 32621, 40609, 48597
515	beta-1,4-N-acetyl-galactosaminyl transferase 4	329962	670	328277	8658	16646, 24634, 32622, 40610, 48598
516	blocked early in transport 1 homolog (S. cerevisiae)	222547	671	222547	8659	16647, 24635, 32623, 40611, 48599
517	blocked early in transport 1 homolog (S. cerevisiae)-like	325147	672	339093	8660	16648, 24636, 32624, 40612, 48600
518	blocked early in transport 1 homolog (S. cerevisiae)-like	382762	673	372210	8661	16649, 24637, 32625, 40613, 48601
519	Boc homolog (mouse)	273395	674	273395	8662	16650, 24638, 32626, 40614, 48602
520	Boc homolog (mouse)	355385	675	347546	8663	16651, 24639, 32627, 40615, 48603
521	Boc homolog (mouse)	462425	676	418118	8664	16652, 24640, 32628, 40616, 48604
522	Boc homolog (mouse)	464546	677	417362	8665	16653, 24641, 32629, 40617, 48605
523	Boc homolog (mouse)	484034	678	417337	8666	16654, 24642, 32630, 40618, 48606

524	Boc homolog (mouse)	485230	679	420154	8667	16655, 24643, 32631, 40619, 48607
525	Boc homolog (mouse)	494687	680	418260	8668	16656, 24644, 32632, 40620, 48608
526	Boc homolog (mouse)	495514	681	418663	8669	16657, 24645, 32633, 40621, 48609
527	brain expressed associated with NEDD4 1	561796	682	455212	8670	16658, 24646, 32634, 40622, 48610
528	brain expressed, associated with NEDD4, 1	299694	683	299694	8671	16659, 24647, 32635, 40623, 48611
529	brain expressed, associated with NEDD4, 1	536005	684	442793	8672	16660, 24648, 32636, 40624, 48612
530	brain protein 44	271373	685	271373	8673	16661, 24649, 32637, 40625, 48613
531	brain protein 44	367846	686	356820	8674	16662, 24650, 32638, 40626, 48614
532	brain protein 44	458574	687	392874	8675	16663, 24651, 32639, 40627, 48615
533	brain protein 44-like	341756	688	340784	8676	16664, 24652, 32640, 40628, 48616
534	brain protein 44-like	360961	689	354223	8677	16665, 24653, 32641, 40629, 48617
535	brain protein 44-like	392123	690	375970	8678	16666, 24654, 32642, 40630, 48618
536	branched chain ketoacid dehydrogenase kinase	219794	691	219794	8679	16667, 24655, 32643, 40631, 48619
537	branched chain ketoacid dehydrogenase kinase	287507	692	287507	8680	16668, 24656, 32644, 40632, 48620
538	branched chain ketoacid dehydrogenase kinase	394950	693	378404	8681	16669, 24657, 32645, 40633, 48621
539	branched chain ketoacid dehydrogenase kinase	394951	694	378405	8682	16670, 24658, 32646, 40634, 48622
540	BRI3 binding protein	341446	695	340761	8683	16671, 24659, 32647, 40635, 48623

541	BRO1 domain and CAAX motif containing	340934	696	343742	8684	16672, 24660, 32648, 40636, 48624
542	BRO1 domain and CAAX motif containing	426638	697	398862	8685	16673, 24661, 32649, 40637, 48625
543	BRO1 domain and CAAX motif containing	537020	698	440041	8686	16674, 24662, 32650, 40638, 48626
544	BRO1 domain and CAAX motif containing	539697	699	441080	8687	16675, 24663, 32651, 40639, 48627
545	bromodomain containing 8	230901	700	230901	8688	16676, 24664, 32652, 40640, 48628
546	bromodomain containing 8	239899	701	239899	8689	16677, 24665, 32653, 40641, 48629
547	bromodomain containing 8	254900	702	254900	8690	16678, 24666, 32654, 40642, 48630
548	bromodomain containing 8	411594	703	394330	8691	16679, 24667, 32655, 40643, 48631
549	bromodomain containing 8	418329	704	398873	8692	16680, 24668, 32656, 40644, 48632
550	bromodomain containing 8	454473	705	398067	8693	16681, 24669, 32657, 40645, 48633
551	bromodomain containing 8	455658	706	408396	8694	16682, 24670, 32658, 40646, 48634
552	BTB (POZ) domain containing 11	280758	707	280758	8695	16683, 24671, 32659, 40647, 48635
553	BTB (POZ) domain containing 11	357167	708	349690	8696	16684, 24672, 32660, 40648, 48636
554	BTB (POZ) domain containing 11	420571	709	413889	8697	16685, 24673, 32661, 40649, 48637
555	BTB (POZ) domain containing 11	490090	710	447319	8698	16686, 24674, 32662, 40650, 48638
556	BTB (POZ) domain containing 11	494235	711	448322	8699	16687, 24675, 32663, 40651, 48639
557	butyrophilin-like 8	231229	712	231229	8700	16688, 24676, 32664, 40652, 48640
558	butyrophilin-like 8	340184	713	342197	8701	16689, 24677, 32665, 40653, 48641

559	butyrophilin-like 8	533815	714	435098	8702	16690, 24678, 32666, 40654, 48642
560	butyrophilin-like 8	400707	715	383543	8703	16691, 24679, 32667, 40655, 48643
561	butyrophilin-like 8	508408	716	424585	8704	16692, 24680, 32668, 40656, 48644
562	butyrophilin-like 8	511704	717	425207	8705	16693, 24681, 32669, 40657, 48645
563	butyrophilin-like 9	327705	718	330200	8706	16694, 24682, 32670, 40658, 48646
564	butyrophilin-like 9	376841	719	366037	8707	16695, 24683, 32671, 40659, 48647
565	butyrophilin-like 9	376842	720	366038	8708	16696, 24684, 32672, 40660, 48648
566	butyrophilin-like 9	376850	721	366046	8709	16697, 24685, 32673, 40661, 48649
567	cache domain containing 1	290039	722	290039	8710	16698, 24686, 32674, 40662, 48650
568	cache domain containing 1	371073	723	360113	8711	16699, 24687, 32675, 40663, 48651
569	cadherin 24, type 2	267383	724	267383	8712	16700, 24688, 32676, 40664, 48652
570	cadherin 24, type 2	397359	725	380517	8713	16701, 24689, 32677, 40665, 48653
571	cadherin 24, type 2	422751	726	392742	8714	16702, 24690, 32678, 40666, 48654
572	cadherin 24, type 2	487137	727	434821	8715	16703, 24691, 32679, 40667, 48655
573	cadherin 24, type 2	554034	728	452493	8716	16704, 24692, 32680, 40668, 48656
574	cadherin 26	244047	729	244047	8717	16705, 24693, 32681, 40669, 48657
575	cadherin 26	244049	730	244049	8718	16706, 24694, 32682, 40670, 48658
576	cadherin 26	348616	731	339390	8719	16707, 24695, 32683, 40671, 48659

577	cadherin 26	350849	732	310845	8720	16708, 24696, 32684, 40672, 48660
578	cadherin 26	370991	733	360030	8721	16709, 24697, 32685, 40673, 48661
579	cadherin-related family member 2	261944	734	261944	8722	16710, 24698, 32686, 40674, 48662
580	cadherin-related family member 2	506348	735	421078	8723	16711, 24699, 32687, 40675, 48663
581	cadherin-related family member 2	510636	736	424565	8724	16712, 24700, 32688, 40676, 48664
582	cadherin-related family member 3	317716	737	325954	8725	16713, 24701, 32689, 40677, 48665
583	cadherin-related family member 4	343366	738	341302	8726	16714, 24702, 32690, 40678, 48666
584	cadherin-related family member 4	412678	739	391409	8727	16715, 24703, 32691, 40679, 48667
585	calcium binding protein 1	288616	740	288616	8728	16716, 24704, 32692, 40680, 48668
586	calcium binding protein 1	316803	741	317310	8729	16717, 24705, 32693, 40681, 48669
587	calcium binding protein 1	351200	742	288615	8730	16718, 24706, 32694, 40682, 48670
588	calcium binding protein 7	216144	743	216144	8731	16719, 24707, 32695, 40683, 48671
589	calcium channel, voltage-dependent, alpha 2/delta subunit 1	284088	744	284088	8732	16720, 24708, 32696, 40684, 48672
590	calcium channel, voltage-dependent, alpha 2/delta subunit 1	356253	745	348589	8733	16721, 24709, 32697, 40685, 48673
591	calcium channel, voltage-dependent, alpha 2/delta subunit 1	356860	746	349320	8734	16722, 24710, 32698, 40686, 48674
592	calcium channel, voltage-dependent, alpha 2/delta subunit 1	535308	747	443124	8735	16723, 24711, 32699, 40687, 48675
593	calcium channel, voltage-dependent, gamma subunit 4	262138	748	262138	8736	16724, 24712, 32700, 40688, 48676

594	calcium channel, voltage-dependent, L type, alpha 1C subunit	322367	749	323129	8737	16725, 24713, 32701, 40689, 48677
595	calcium channel, voltage-dependent, L type, alpha 1C subunit	327702	750	329877	8738	16726, 24714, 32702, 40690, 48678
596	calcium channel, voltage-dependent, L type, alpha 1C subunit	335762	751	336982	8739	16727, 24715, 32703, 40691, 48679
597	calcium channel, voltage-dependent, T type, alpha 1G subunit	352832	752	339302	8740	16728, 24716, 32704, 40692, 48680
598	calcium channel, voltage-dependent, T type, alpha 1G subunit	354983	753	347078	8741	16729, 24717, 32705, 40693, 48681
599	calcium channel, voltage-dependent, T type, alpha 1G subunit	358244	754	350979	8742	16730, 24718, 32706, 40694, 48682
600	calcium channel, voltage-dependent, T type, alpha 1G subunit	359106	755	352011	8743	16731, 24719, 32707, 40695, 48683
601	calcium channel, voltage-dependent, T type, alpha 1G subunit	360761	756	353990	8744	16732, 24720, 32708, 40696, 48684
602	calcium channel, voltage-dependent, T type, alpha 1G subunit	416767	757	392390	8745	16733, 24721, 32709, 40697, 48685
603	calcium channel, voltage-dependent, T type, alpha 1G subunit	429973	758	414388	8746	16734, 24722, 32710, 40698, 48686
604	calcium channel, voltage-dependent, T type, alpha 1G subunit	442258	759	409759	8747	16735, 24723, 32711, 40699, 48687
605	calcium channel, voltage-dependent, T type, alpha 1G subunit	502264	760	425522	8748	16736, 24724, 32712, 40700, 48688
606	calcium channel, voltage-dependent, T type, alpha 1G subunit	503436	761	427231	8749	16737, 24725, 32713, 40701, 48689

607	calcium channel, voltage-dependent, T type, alpha 1G subunit	503485	762	427238	8750	16738, 24726, 32714, 40702, 48690
608	calcium channel, voltage-dependent, T type, alpha 1G subunit	503607	763	426558	8751	16739, 24727, 32715, 40703, 48691
609	calcium channel, voltage-dependent, T type, alpha 1G subunit	504076	764	425153	8752	16740, 24728, 32716, 40704, 48692
610	calcium channel, voltage-dependent, T type, alpha 1G subunit	505165	765	422268	8753	16741, 24729, 32717, 40705, 48693
611	calcium channel, voltage-dependent, T type, alpha 1G subunit	506406	766	426313	8754	16742, 24730, 32718, 40706, 48694
612	calcium channel, voltage-dependent, T type, alpha 1G subunit	507336	767	420918	8755	16743, 24731, 32719, 40707, 48695
613	calcium channel, voltage-dependent, T type, alpha 1G subunit	507510	768	423112	8756	16744, 24732, 32720, 40708, 48696
614	calcium channel, voltage-dependent, T type, alpha 1G subunit	507609	769	423045	8757	16745, 24733, 32721, 40709, 48697
615	calcium channel, voltage-dependent, T type, alpha 1G subunit	507896	770	421518	8758	16746, 24734, 32722, 40710, 48698
616	calcium channel, voltage-dependent, T type, alpha 1G subunit	510115	771	427173	8759	16747, 24735, 32723, 40711, 48699
617	calcium channel, voltage-dependent, T type, alpha 1G subunit	510366	772	426814	8760	16748, 24736, 32724, 40712, 48700
618	calcium channel, voltage-dependent, T type, alpha 1G subunit	511765	773	427247	8761	16749, 24737, 32725, 40713, 48701
619	calcium channel, voltage-dependent, T type, alpha 1G subunit	511768	774	424664	8762	16750, 24738, 32726, 40714, 48702

620	calcium channel, voltage-dependent, T type, alpha 1G subunit	512389	775	426261	8763	16751, 24739, 32727, 40715, 48703
621	calcium channel, voltage-dependent, T type, alpha 1G subunit	513689	776	426172	8764	16752, 24740, 32728, 40716, 48704
622	calcium channel, voltage-dependent, T type, alpha 1G subunit	513964	777	425451	8765	16753, 24741, 32729, 40717, 48705
623	calcium channel, voltage-dependent, T type, alpha 1G subunit	514079	778	423317	8766	16754, 24742, 32730, 40718, 48706
624	calcium channel, voltage-dependent, T type, alpha 1G subunit	514181	779	425698	8767	16755, 24743, 32731, 40719, 48707
625	calcium channel, voltage-dependent, T type, alpha 1G subunit	514717	780	422407	8768	16756, 24744, 32732, 40720, 48708
626	calcium channel, voltage-dependent, T type, alpha 1G subunit	515165	781	426098	8769	16757, 24745, 32733, 40721, 48709
627	calcium channel, voltage-dependent, T type, alpha 1G subunit	515411	782	423155	8770	16758, 24746, 32734, 40722, 48710
628	calcium channel, voltage-dependent, T type, alpha 1G subunit	515765	783	426232	8771	16759, 24747, 32735, 40723, 48711
629	calcium homeostasis modulator 3	369783	784	358798	8772	16760, 24748, 32736, 40724, 48712
630	calcium/calmodulin-dependent protein kinase IG	9105	785	9105	8773	16761, 24749, 32737, 40725, 48713, 56075, 56108
631	calcium/calmodulin-dependent protein kinase IG	361322	786	354861	8774	16762, 24750, 32738, 40726, 48714
632	calcyon neuron-specific vesicular protein	252939	787	252939	8775	16763, 24751, 32739, 40727, 48715
633	calcyon neuron-specific vesicular protein	368555	788	357543	8776	16764, 24752, 32740, 40728, 48716
634	calcyon neuron-specific vesicular protein	368556	789	357544	8777	16765, 24753, 32741, 40729, 48717

635	calcyon neuron-specific vesicular protein	368558	790	357546	8778	16766, 24754, 32742, 40730, 48718
636	calmegin	325617	791	326699	8779	16767, 24755, 32743, 40731, 48719
637	calmegin	414773	792	392782	8780	16768, 24756, 32744, 40732, 48720
638	calmegin	509477	793	424593	8781	16769, 24757, 32745, 40733, 48721
639	calmegin	537281	794	439381	8782	16770, 24758, 32746, 40734, 48722
640	calmegin	545667	795	445139	8783	16771, 24759, 32747, 40735, 48723
641	calmodulin regulated spectrin-associated protein family, member 3	160298	796	160298	8784	16772, 24760, 32748, 40736, 48724, 56076, 56109
642	calmodulin regulated spectrin-associated protein family, member 3	446248	797	416797	8785	16773, 24761, 32749, 40737, 48725
643	calneuron 1	329008	798	332498	8786	16774, 24762, 32750, 40738, 48726
644	calneuron 1	395275	799	378690	8787	16775, 24763, 32751, 40739, 48727
645	calneuron 1	395276	800	378691	8788	16776, 24764, 32752, 40740, 48728
646	calneuron 1	405452	801	384354	8789	16777, 24765, 32753, 40741, 48729
647	calneuron 1	412588	802	391882	8790	16778, 24766, 32754, 40742, 48730
648	calneuron 1	431984	803	410704	8791	16779, 24767, 32755, 40743, 48731
649	calneuron 1	446128	804	411806	8792	16780, 24768, 32756, 40744, 48732
650	calpain, small subunit 2	457326	805	400882	8793	16781, 24769, 32757, 40745, 48733
651	calsyntenin 2	458420	806	402460	8794	16782, 24770, 32758, 40746, 48734

652	calsyntenin 3	266546	807	266546	8795	16783, 24771, 32759, 40747, 48735
653	calsyntenin 3	537408	808	440679	8796	16784, 24772, 32760, 40748, 48736
654	calsyntenin 3	541953	809	443959	8797	16785, 24773, 32761, 40749, 48737
655	CaM kinase-like vesicle-associated	296471	810	296471	8798	16786, 24774, 32762, 40750, 48738
656	CaM kinase-like vesicle-associated	477224	811	419195	8799	16787, 24775, 32763, 40751, 48739
657	CaM kinase-like vesicle-associated	488336	812	418809	8800	16788, 24776, 32764, 40752, 48740
658	cAMP responsive element binding protein 3-like 1	288400	813	288400	8801	16789, 24777, 32765, 40753, 48741
659	cAMP responsive element binding protein 3-like 1	446415	814	407420	8802	16790, 24778, 32766, 40754, 48742
660	cAMP responsive element binding protein 3-like 1	529193	815	434939	8803	16791, 24779, 32767, 40755, 48743
661	cAMP responsive element binding protein 3-like 2	330387	816	329140	8804	16792, 24780, 32768, 40756, 48744
662	cAMP responsive element binding protein 3-like 2	417785	817	414123	8805	16793, 24781, 32769, 40757, 48745
663	cAMP responsive element binding protein 3-like 2	452463	818	410314	8806	16794, 24782, 32770, 40758, 48746
664	cAMP responsive element binding protein 3-like 2	456390	819	403550	8807	16795, 24783, 32771, 40759, 48747
665	cAMP responsive element binding protein 3-like 2	544877	820	443915	8808	16796, 24784, 32772, 40760, 48748
666	cancer susceptibility candidate 4	299957	821	299957	8809	16797, 24785, 32773, 40761, 48749
667	cancer susceptibility candidate 4	345795	822	335063	8810	16798, 24786, 32774, 40762, 48750
668	cancer susceptibility candidate 4	360824	823	354067	8811	16799, 24787, 32775, 40763, 48751
669	cancer susceptibility candidate 4	416522	824	411192	8812	16800, 24788, 32776, 40764, 48752

670	cancer susceptibility candidate 4	561305	825	452833	8813	16801, 24789, 32777, 40765, 48753
671	cancer susceptibility candidate 4	561459	826	452807	8814	16802, 24790, 32778, 40766, 48754
672	canopy 2 homolog (zebrafish)	273308	827	273308	8815	16803, 24791, 32779, 40767, 48755
673	canopy 2 homolog (zebrafish)	551475	828	448809	8816	16804, 24792, 32780, 40768, 48756
674	CAP-GLY domain containing linker protein 3	360535	829	353732	8817	16805, 24793, 32781, 40769, 48757
675	CAP-GLY domain containing linker protein 3	534959	830	445491	8818	16806, 24794, 32782, 40770, 48758
676	CAP-GLY domain containing linker protein 3	544037	831	438218	8819	16807, 24795, 32783, 40771, 48759
677	carbohydrate (chondroitin 4) sulfotransferase 11	303694	832	305725	8820	16808, 24796, 32784, 40772, 48760
678	carbohydrate (chondroitin 4) sulfotransferase 11	549260	833	450004	8821	16809, 24797, 32785, 40773, 48761
679	carbohydrate (chondroitin 4) sulfotransferase 12	258711	834	258711	8822	16810, 24798, 32786, 40774, 48762
680	carbohydrate (chondroitin 4) sulfotransferase 12	432336	835	411207	8823	16811, 24799, 32787, 40775, 48763
681	carbohydrate (chondroitin 4) sulfotransferase 13	319340	836	317404	8824	16812, 24800, 32788, 40776, 48764
682	carbohydrate (chondroitin 4) sulfotransferase 13	383575	837	373069	8825	16813, 24801, 32789, 40777, 48765
683	carbohydrate (N-acetylglucosamine 6-O) sulfotransferase 4	338482	838	341206	8826	16814, 24802, 32790, 40778, 48766
684	carbohydrate (N-acetylglucosamine 6-O) sulfotransferase 4	539698	839	441204	8827	16815, 24803, 32791, 40779, 48767
685	carbonic anhydrase VA, mitochondrial	309893	840	309649	8828	16816, 24804, 32792, 40780, 48768
686	carbonyl reductase 4	306193	841	303525	8829	16817, 24805, 32793, 40781, 48769

687	carbonyl reductase 4	504480	842	427615	8830	16818, 24806, 32794, 40782, 48770
688	carboxylesterase 2	317091	843	317842	8831	16819, 24807, 32795, 40783, 48771
689	carboxylesterase 2	417689	844	394452	8832	16820, 24808, 32796, 40784, 48772
690	carcinoembryonic antigen-related cell adhesion molecule 19	403660	845	384887	8833	16821, 24809, 32797, 40785, 48773
691	carcinoembryonic antigen-related cell adhesion molecule 19	358777	846	351627	8834	16822, 24810, 32798, 40786, 48774
692	carcinoembryonic antigen-related cell adhesion molecule 21	187608	847	187608	8835	16823, 24811, 32799, 40787, 48775
693	carcinoembryonic antigen-related cell adhesion molecule 21	401445	848	385739	8836	16824, 24812, 32800, 40788, 48776
694	carcinoembryonic antigen-related cell adhesion molecule 3	221999	849	221999	8837	16825, 24813, 32801, 40789, 48777
695	carcinoembryonic antigen-related cell adhesion molecule 3	344550	850	341725	8838	16826, 24814, 32802, 40790, 48778
696	carcinoembryonic antigen-related cell adhesion molecule 3	357396	851	349971	8839	16827, 24815, 32803, 40791, 48779
697	carcinoembryonic antigen-related cell adhesion molecule 3	389667	852	374318	8840	16828, 24816, 32804, 40792, 48780
698	carcinoembryonic antigen-related cell adhesion molecule 4	221954	853	221954	8841	16829, 24817, 32805, 40793, 48781
699	carcinoembryonic antigen-related cell adhesion molecule 7	6724	854	6724	8842	16830, 24818, 32806, 40794, 48782, 56077, 56110
700	carcinoembryonic antigen-related cell adhesion molecule 7	338196	855	343286	8843	16831, 24819, 32807, 40795, 48783
701	carcinoembryonic antigen-related cell adhesion molecule 7	401731	856	385932	8844	16832, 24820, 32808, 40796, 48784
702	carcinoembryonic antigen-related cell adhesion molecule 7	412062	857	399253	8845	16833, 24821, 32809, 40797, 48785

703	Cas scaffolding protein family member 4	360314	858	353462	8846	16834, 24822, 32810, 40798, 48786
704	Cas scaffolding protein family member 4	371336	859	360387	8847	16835, 24823, 32811, 40799, 48787
705	Cas scaffolding protein family member 4	434344	860	410027	8848	16836, 24824, 32812, 40800, 48788
706	casein kinase 2, beta polypeptide	375880	861	365040	8849	16837, 24825, 32813, 40801, 48789
707	cat eye syndrome chromosome region, candidate 5	155674	862	155674	8850	16838, 24826, 32814, 40802, 48790, 56078, 56111
708	cat eye syndrome chromosome region, candidate 5	336737	863	337358	8851	16839, 24827, 32815, 40803, 48791
709	catechol-O-methyltransferase domain containing 1	372538	864	361616	8852	16840, 24828, 32816, 40804, 48792
710	catechol-O-methyltransferase domain containing 1	536650	865	444168	8853	16841, 24829, 32817, 40805, 48793
711	cathepsin O	433477	866	414904	8854	16842, 24830, 32818, 40806, 48794
712	cation channel, sperm associated 2	299989	867	299989	8855	16843, 24831, 32819, 40807, 48795
713	cation channel, sperm associated 2	321596	868	321463	8856	16844, 24832, 32820, 40808, 48796
714	cation channel, sperm associated 2	354127	869	339137	8857	16845, 24833, 32821, 40809, 48797
715	cation channel, sperm associated 2	355438	870	347613	8858	16846, 24834, 32822, 40810, 48798
716	cation channel, sperm associated 2	396879	871	380088	8859	16847, 24835, 32823, 40811, 48799
717	cation channel, sperm associated 2	409481	872	386595	8860	16848, 24836, 32824, 40812, 48800
718	cation channel, sperm associated 2	419473	873	399035	8861	16849, 24837, 32825, 40813, 48801
719	cation channel, sperm associated 2	432420	874	407694	8862	16850, 24838, 32826, 40814, 48802

720	CCZ1 vacuolar protein trafficking and biogenesis associated homolog (S. cerevisiae)	325974	875	325681	8863	16851, 24839, 32827, 40815, 48803
721	CCZ1 vacuolar protein trafficking and biogenesis associated homolog (S. cerevisiae)	537980	876	444661	8864	16852, 24840, 32828, 40816, 48804
722	CCZ1 vacuolar protein trafficking and biogenesis associated homolog B (S. cerevisiae)	316731	877	314544	8865	16853, 24841, 32829, 40817, 48805
723	CCZ1 vacuolar protein trafficking and biogenesis associated homolog B (S. cerevisiae)	538180	878	444720	8866	16854, 24842, 32830, 40818, 48806
724	CD101 molecule	256652	879	256652	8867	16855, 24843, 32831, 40819, 48807
725	CD101 molecule	369470	880	358482	8868	16856, 24844, 32832, 40820, 48808
726	CD160 molecule	235933	881	235933	8869	16857, 24845, 32833, 40821, 48809
727	CD160 molecule	369288	882	358294	8870	16858, 24846, 32834, 40822, 48810
728	CD160 molecule	369290	883	358296	8871	16859, 24847, 32835, 40823, 48811
729	CD160 molecule	401557	884	385199	8872	16860, 24848, 32836, 40824, 48812
730	CD164 sialomucin-like 2	374025	885	363137	8873	16861, 24849, 32837, 40825, 48813
731	CD164 sialomucin-like 2	374027	886	363139	8874	16862, 24850, 32838, 40826, 48814
732	CD164 sialomucin-like 2	374030	887	363142	8875	16863, 24851, 32839, 40827, 48815
733	CD180 molecule	256447	888	256447	8876	16864, 24852, 32840, 40828, 48816
734	CD200 receptor 1-like	398214	889	381272	8877	16865, 24853, 32841, 40829, 48817

735	CD200 receptor 1-like	448932	890	415132	8878	16866, 24854, 32842, 40830, 48818
736	CD200 receptor 1-like	488794	891	418413	8879	16867, 24855, 32843, 40831, 48819
737	CD274 molecule	381573	892	370985	8880	16868, 24856, 32844, 40832, 48820
738	CD274 molecule	381577	893	370989	8881	16869, 24857, 32845, 40833, 48821
739	CD300 molecule-like family member d	375352	894	364501	8882	16870, 24858, 32846, 40834, 48822
740	CD300 molecule-like family member g	293396	895	293396	8883	16871, 24859, 32847, 40835, 48823
741	CD300 molecule-like family member g	317310	896	321005	8884	16872, 24860, 32848, 40836, 48824
742	CD300 molecule-like family member g	377203	897	366408	8885	16873, 24861, 32849, 40837, 48825
743	CD300 molecule-like family member g	539718	898	442368	8886	16874, 24862, 32850, 40838, 48826
744	CD300a molecule	310828	899	308188	8887	16875, 24863, 32851, 40839, 48827
745	CD300a molecule	360141	900	353259	8888	16876, 24864, 32852, 40840, 48828
746	CD300a molecule	361933	901	354564	8889	16877, 24865, 32853, 40841, 48829
747	CD300a molecule	392625	902	376401	8890	16878, 24866, 32854, 40842, 48830
748	CD300c molecule	330793	903	329507	8891	16879, 24867, 32855, 40843, 48831
749	CD300e molecule	328630	904	329942	8892	16880, 24868, 32856, 40844, 48832
750	CD300e molecule	392619	905	376395	8893	16881, 24869, 32857, 40845, 48833
751	CD300e molecule	412268	906	415488	8894	16882, 24870, 32858, 40846, 48834
752	CD300e molecule	426295	907	416642	8895	16883, 24871, 32859, 40847, 48835

753	CD36 molecule (thrombospondin receptor)	441034	908	396258	8896	16884, 24872, 32860, 40848, 48836
754	CD52 molecule	374213	909	363330	8897	16885, 24873, 32861, 40849, 48837
755	CD84 molecule	311224	910	312367	8898	16886, 24874, 32862, 40850, 48838
756	CD84 molecule	360056	911	353163	8899	16887, 24875, 32863, 40851, 48839
757	CD84 molecule	368047	912	357026	8900	16888, 24876, 32864, 40852, 48840
758	CD84 molecule	368048	913	357027	8901	16889, 24877, 32865, 40853, 48841
759	CD84 molecule	368051	914	357030	8902	16890, 24878, 32866, 40854, 48842
760	CD84 molecule	368054	915	357033	8903	16891, 24879, 32867, 40855, 48843
761	CD84 molecule	534968	916	442845	8904	16892, 24880, 32868, 40856, 48844
762	CD93 molecule	246006	917	246006	8905	16893, 24881, 32869, 40857, 48845
763	CD93 molecule	413585	918	414935	8906	16894, 24882, 32870, 40858, 48846
764	CDC42 effector protein (Rho GTPase binding) 5	301200	919	301200	8907	16895, 24883, 32871, 40859, 48847
765	CDC42 small effector 1	357235	920	349773	8908	16896, 24884, 32872, 40860, 48848
766	CDC42 small effector 1	540998	921	445647	8909	16897, 24885, 32873, 40861, 48849
767	CDC42 small effector 2	360515	922	353706	8910	16898, 24886, 32874, 40862, 48850
768	CDC42 small effector 2	395246	923	378667	8911	16899, 24887, 32875, 40863, 48851
769	CDC42 small effector 2	505065	924	427421	8912	16900, 24888, 32876, 40864, 48852
770	CDP-diacylglycerol--inositol 3-phosphatidyltransferase	219789	925	219789	8913	16901, 24889, 32877, 40865, 48853

771	CDP-diacylglycerol--inositol 3-phosphatidyltransferase	403894	926	386065	8914	16902, 24890, 32878, 40866, 48854
772	cell adhesion molecule 2	383699	927	373200	8915	16903, 24891, 32879, 40867, 48855
773	cell adhesion molecule 2	405615	928	384193	8916	16904, 24892, 32880, 40868, 48856
774	cell adhesion molecule 2	407528	929	384575	8917	16905, 24893, 32881, 40869, 48857
775	cell adhesion molecule 3	368124	930	357106	8918	16906, 24894, 32882, 40870, 48858
776	cell adhesion molecule 3	368125	931	357107	8919	16907, 24895, 32883, 40871, 48859
777	cell adhesion molecule 3	416746	932	387802	8920	16908, 24896, 32884, 40872, 48860
778	cell cycle associated protein 1	341394	933	340329	8921	16909, 24897, 32885, 40873, 48861
779	cell cycle associated protein 1	532820	934	434150	8922	16910, 24898, 32886, 40874, 48862
780	cell cycle associated protein 1	389645	935	374296	8923	16911, 24899, 32887, 40875, 48863
781	cell cycle progression 1	310958	936	311656	8924	16912, 24900, 32888, 40876, 48864
782	cell cycle progression 1	425574	937	415128	8925	16913, 24901, 32889, 40877, 48865
783	cell cycle progression 1	442196	938	403400	8926	16914, 24902, 32890, 40878, 48866
784	cell death-inducing DFFA-like effector c	336832	939	338642	8927	16915, 24903, 32891, 40879, 48867
785	cell death-inducing DFFA-like effector c	383817	940	373328	8928	16916, 24904, 32892, 40880, 48868
786	cell death-inducing DFFA-like effector c	423850	941	400649	8929	16917, 24905, 32893, 40881, 48869
787	cell death-inducing DFFA-like effector c	455015	942	392975	8930	16918, 24906, 32894, 40882, 48870
788	cell death-inducing DFFA-like effector c	430427	943	408631	8931	16919, 24907, 32895, 40883, 48871

789	cell wall biogenesis 43 C-terminal homolog (S. cerevisiae)	226432	944	226432	8932	16920, 24908, 32896, 40884, 48872
790	centrin, EF-hand protein, 3	283122	945	283122	8933	16921, 24909, 32897, 40885, 48873
791	ceramide kinase	216264	946	216264	8934	16922, 24910, 32898, 40886, 48874
792	ceramide kinase	541677	947	438659	8935	16923, 24911, 32899, 40887, 48875
793	ceramide synthase 1	427170	948	402697	8936	16924, 24912, 32900, 40888, 48876
794	ceramide synthase 1	429504	949	389044	8937	16925, 24913, 32901, 40889, 48877
795	ceramide synthase 1	542296	950	437648	8938	16926, 24914, 32902, 40890, 48878
796	ceramide synthase 2	271688	951	271688	8939	16927, 24915, 32903, 40891, 48879
797	ceramide synthase 2	345896	952	337842	8940	16928, 24916, 32904, 40892, 48880
798	ceramide synthase 2	361419	953	355020	8941	16929, 24917, 32905, 40893, 48881
799	ceramide synthase 2	368949	954	357945	8942	16930, 24918, 32906, 40894, 48882
800	ceramide synthase 2	368954	955	357950	8943	16931, 24919, 32907, 40895, 48883
801	ceramide synthase 2	421609	956	393239	8944	16932, 24920, 32908, 40896, 48884
802	ceramide synthase 2	457392	957	394012	8945	16933, 24921, 32909, 40897, 48885
803	ceramide synthase 2	558062	958	452810	8946	16934, 24922, 32910, 40898, 48886
804	ceramide synthase 3	284382	959	284382	8947	16935, 24923, 32911, 40899, 48887
805	ceramide synthase 3	394113	960	377672	8948	16936, 24924, 32912, 40900, 48888
806	ceramide synthase 3	538112	961	437640	8949	16937, 24925, 32913, 40901, 48889

807	ceramide synthase 3	558884	962	453816	8950	16938, 24926, 32914, 40902, 48890
808	ceramide synthase 3	559639	963	453598	8951	16939, 24927, 32915, 40903, 48891
809	ceramide synthase 3	560233	964	452661	8952	16940, 24928, 32916, 40904, 48892
810	ceramide synthase 4	251363	965	251363	8953	16941, 24929, 32917, 40905, 48893
811	ceramide synthase 4	558268	966	453388	8954	16942, 24930, 32918, 40906, 48894
812	ceramide synthase 4	558877	967	454122	8955	16943, 24931, 32919, 40907, 48895
813	ceramide synthase 4	559450	968	453509	8956	16944, 24932, 32920, 40908, 48896
814	ceramide synthase 4	560412	969	452920	8957	16945, 24933, 32921, 40909, 48897
815	ceramide synthase 4	561008	970	453796	8958	16946, 24934, 32922, 40910, 48898
816	ceramide synthase 5	317551	971	325485	8959	16947, 24935, 32923, 40911, 48899
817	ceramide synthase 5	380189	972	369536	8960	16948, 24936, 32924, 40912, 48900
818	ceramide synthase 5	422340	973	389050	8961	16949, 24937, 32925, 40913, 48901
819	ceramide synthase 5	542320	974	442918	8962	16950, 24938, 32926, 40914, 48902
820	ceramide synthase 6	305747	975	306579	8963	16951, 24939, 32927, 40915, 48903
821	ceramide synthase 6	392687	976	376453	8964	16952, 24940, 32928, 40916, 48904
822	cerebellin 2 precursor	269503	977	269503	8965	16953, 24941, 32929, 40917, 48905
823	cerebral endothelial cell adhesion molecule	372838	978	361929	8966	16954, 24942, 32930, 40918, 48906
824	cerebral endothelial cell adhesion molecule	372842	979	361933	8967	16955, 24943, 32931, 40919, 48907

825	cerebral endothelial cell adhesion molecule	411852	980	403766	8968	16956, 24944, 32932, 40920, 48908
826	cerebral endothelial cell adhesion molecule	413863	981	388593	8969	16957, 24945, 32933, 40921, 48909
827	cerebral endothelial cell adhesion molecule	420034	982	402508	8970	16958, 24946, 32934, 40922, 48910
828	cerebral endothelial cell adhesion molecule	420512	983	416676	8971	16959, 24947, 32935, 40923, 48911
829	cerebral endothelial cell adhesion molecule	447915	984	402928	8972	16960, 24948, 32936, 40924, 48912
830	CGRP receptor component	338592	985	340044	8973	16961, 24949, 32937, 40925, 48913
831	CGRP receptor component	395326	986	378736	8974	16962, 24950, 32938, 40926, 48914
832	CGRP receptor component	398684	987	381674	8975	16963, 24951, 32939, 40927, 48915
833	CGRP receptor component	415001	988	398605	8976	16964, 24952, 32940, 40928, 48916
834	CGRP receptor component	431089	989	388653	8977	16965, 24953, 32941, 40929, 48917
835	charged multivesicular body protein 4C	297265	990	297265	8978	16966, 24954, 32942, 40930, 48918
836	chloride channel CLIC-like 1	302500	991	306552	8979	16967, 24955, 32943, 40931, 48919
837	chloride channel CLIC-like 1	348264	992	337243	8980	16968, 24956, 32944, 40932, 48920
838	chloride channel CLIC-like 1	356970	993	349456	8981	16969, 24957, 32945, 40933, 48921
839	chloride channel CLIC-like 1	369968	994	358985	8982	16970, 24958, 32946, 40934, 48922
840	chloride channel CLIC-like 1	369969	995	358986	8983	16971, 24959, 32947, 40935, 48923
841	chloride channel CLIC-like 1	369970	996	358987	8984	16972, 24960, 32948, 40936, 48924
842	chloride channel CLIC-like 1	369971	997	358988	8985	16973, 24961, 32949, 40937, 48925

843	chloride channel CLIC-like 1	369976	998	358993	8986	16974, 24962, 32950, 40938, 48926
844	chloride channel CLIC-like 1	415331	999	411591	8987	16975, 24963, 32951, 40939, 48927
845	chloride intracellular channel 1	375779	1000	364934	8988	16976, 24964, 32952, 40940, 48928
846	chloride intracellular channel 1	375780	1001	364935	8989	16977, 24965, 32953, 40941, 48929
847	chloride intracellular channel 1	375784	1002	364940	8990	16978, 24966, 32954, 40942, 48930
848	chloride intracellular channel 1	383404	1003	372896	8991	16979, 24967, 32955, 40943, 48931
849	chloride intracellular channel 1	383405	1004	372897	8992	16980, 24968, 32956, 40944, 48932
850	chloride intracellular channel 1	395892	1005	379229	8993	16981, 24969, 32957, 40945, 48933
851	chloride intracellular channel 1	400052	1006	382926	8994	16982, 24970, 32958, 40946, 48934
852	chloride intracellular channel 1	400058	1007	382931	8995	16983, 24971, 32959, 40947, 48935
853	chloride intracellular channel 1	415179	1008	409247	8996	16984, 24972, 32960, 40948, 48936
854	chloride intracellular channel 1	418285	1009	407791	8997	16985, 24973, 32961, 40949, 48937
855	chloride intracellular channel 1	420458	1010	410965	8998	16986, 24974, 32962, 40950, 48938
856	chloride intracellular channel 1	422167	1011	407429	8999	16987, 24975, 32963, 40951, 48939
857	chloride intracellular channel 1	423055	1012	406968	9000	16988, 24976, 32964, 40952, 48940
858	chloride intracellular channel 1	423143	1013	404589	9001	16989, 24977, 32965, 40953, 48941
859	chloride intracellular channel 1	423804	1014	409979	9002	16990, 24978, 32966, 40954, 48942
860	chloride intracellular channel 1	425464	1015	401292	9003	16991, 24979, 32967, 40955, 48943

861	chloride intracellular channel 1	431921	1016	408357	9004	16992, 24980, 32968, 40956, 48944
862	chloride intracellular channel 1	433916	1017	391395	9005	16993, 24981, 32969, 40957, 48945
863	chloride intracellular channel 1	434202	1018	400532	9006	16994, 24982, 32970, 40958, 48946
864	chloride intracellular channel 1	435242	1019	412217	9007	16995, 24983, 32971, 40959, 48947
865	chloride intracellular channel 1	438708	1020	406088	9008	16996, 24984, 32972, 40960, 48948
866	chloride intracellular channel 1	442045	1021	400280	9009	16997, 24985, 32973, 40961, 48949
867	chloride intracellular channel 1	447338	1022	413330	9010	16998, 24986, 32974, 40962, 48950
868	chloride intracellular channel 1	447369	1023	408094	9011	16999, 24987, 32975, 40963, 48951
869	chloride intracellular channel 1	451546	1024	416211	9012	17000, 24988, 32976, 40964, 48952
870	chloride intracellular channel 1	456863	1025	406335	9013	17001, 24989, 32977, 40965, 48953
871	chloride intracellular channel 1	457485	1026	398056	9014	17002, 24990, 32978, 40966, 48954
872	chloride intracellular channel 2	369449	1027	358460	9015	17003, 24991, 32979, 40967, 48955
873	chloride intracellular channel 4	374379	1028	363500	9016	17004, 24992, 32980, 40968, 48956
874	chloride intracellular channel 4	444041	1029	445699	9017	17005, 24993, 32981, 40969, 48957
875	chloride intracellular channel 4	488683	1030	436538	9018	17006, 24994, 32982, 40970, 48958
876	chloride intracellular channel 6	349499	1031	290332	9019	17007, 24995, 32983, 40971, 48959
877	chloride intracellular channel 6	360731	1032	353959	9020	17008, 24996, 32984, 40972, 48960
878	choline dehydrogenase	315251	1033	319851	9021	17009, 24997, 32985, 40973, 48961

879	choline dehydrogenase	467802	1034	419863	9022	17010, 24998, 32986, 40974, 48962
880	choline dehydrogenase	481668	1035	418273	9023	17011, 24999, 32987, 40975, 48963
881	choline phosphotransferase 1	229266	1036	229266	9024	17012, 25000, 32988, 40976, 48964
882	choline phosphotransferase 1	543999	1037	444102	9025	17013, 25001, 32989, 40977, 48965
883	choline/ethanolamine phosphotransferase 1	357172	1038	349696	9026	17014, 25002, 32990, 40978, 48966
884	choline/ethanolamine phosphotransferase 1	545121	1039	441980	9027	17015, 25003, 32991, 40979, 48967
885	chondroitin sulfate N-acetylgalactosaminyl transferase 1	311540	1040	310891	9028	17016, 25004, 32992, 40980, 48968
886	chondroitin sulfate N-acetylgalactosaminyl transferase 1	332246	1041	330805	9029	17017, 25005, 32993, 40981, 48969
887	chondroitin sulfate N-acetylgalactosaminyl transferase 1	454498	1042	411816	9030	17018, 25006, 32994, 40982, 48970
888	chondroitin sulfate N-acetylgalactosaminyl transferase 1	517494	1043	429130	9031	17019, 25007, 32995, 40983, 48971
889	chondroitin sulfate N-acetylgalactosaminyl transferase 1	520003	1044	428774	9032	17020, 25008, 32996, 40984, 48972
890	chondroitin sulfate N-acetylgalactosaminyl transferase 1	522854	1045	429809	9033	17021, 25009, 32997, 40985, 48973
891	chondroitin sulfate N-acetylgalactosaminyl transferase 1	523262	1046	428089	9034	17022, 25010, 32998, 40986, 48974
892	chondroitin sulfate N-acetylgalactosaminyl transferase 1	524213	1047	427740	9035	17023, 25011, 32999, 40987, 48975
893	chondroitin sulfate N-acetylgalactosaminyl transferase 1	544602	1048	442155	9036	17024, 25012, 33000, 40988, 48976

894	chondroitin sulfate N-acetylgalactosaminyl transferase 2	374464	1049	363588	9037	17025, 25013, 33001, 40989, 48977
895	chondroitin sulfate N-acetylgalactosaminyl transferase 2	374466	1050	363590	9038	17026, 25014, 33002, 40990, 48978
896	chondroitin sulfate proteoglycan 5 (neuroglycan C)	264723	1051	264723	9039	17027, 25015, 33003, 40991, 48979
897	chondroitin sulfate proteoglycan 5 (neuroglycan C)	383738	1052	373244	9040	17028, 25016, 33004, 40992, 48980
898	chondroitin sulfate proteoglycan 5 (neuroglycan C)	456150	1053	392096	9041	17029, 25017, 33005, 40993, 48981
899	chondrolectin	299295	1054	299295	9042	17030, 25018, 33006, 40994, 48982
900	chondrolectin	338326	1055	339975	9043	17031, 25019, 33007, 40995, 48983
901	chondrolectin	400127	1056	382992	9044	17032, 25020, 33008, 40996, 48984
902	chondrolectin	400128	1057	382993	9045	17033, 25021, 33009, 40997, 48985
903	chondrolectin	400131	1058	382996	9046	17034, 25022, 33010, 40998, 48986
904	chondrolectin	400135	1059	383001	9047	17035, 25023, 33011, 40999, 48987
905	chondrolectin	427223	1060	390957	9048	17036, 25024, 33012, 41000, 48988
906	chondrolectin	452759	1061	415566	9049	17037, 25025, 33013, 41001, 48989
907	chondrolectin	465099	1062	417423	9050	17038, 25026, 33014, 41002, 48990
908	chondrolectin	543733	1063	443566	9051	17039, 25027, 33015, 41003, 48991
909	CHRNA7 (cholinergic receptor, nicotinic, alpha 7, exons 5-10) and FAM7A (family with sequence similarity 7A, exons A-E) fusion	299847	1064	299847	9052	17040, 25028, 33016, 41004, 48992

910	CHRNA7 (cholinergic receptor, nicotinic, alpha 7, exons 5-10) and FAM7A (family with sequence similarity 7A, exons A-E) fusion	397827	1065	380927	9053	17041, 25029, 33017, 41005, 48993
911	CHRNA7 (cholinergic receptor, nicotinic, alpha 7, exons 5-10) and FAM7A (family with sequence similarity 7A, exons A-E) fusion	401522	1066	385389	9054	17042, 25030, 33018, 41006, 48994
912	chromodomain protein, Y-linked, 2A	250838	1067	250838	9055	17043, 25031, 33019, 41007, 48995
913	chromodomain protein, Y-linked, 2A	426790	1068	402280	9056	17044, 25032, 33020, 41008, 48996
914	chromosome 1 open reading frame 101	366531	1069	355489	9057	17045, 25033, 33021, 41009, 48997
915	chromosome 1 open reading frame 101	366533	1070	355491	9058	17046, 25034, 33022, 41010, 48998
916	chromosome 1 open reading frame 101	366534	1071	355492	9059	17047, 25035, 33023, 41011, 48999
917	chromosome 1 open reading frame 101	391841	1072	375716	9060	17048, 25036, 33024, 41012, 49000
918	chromosome 1 open reading frame 101	428042	1073	395796	9061	17049, 25037, 33025, 41013, 49001
919	chromosome 1 open reading frame 130	374392	1074	363513	9062	17050, 25038, 33026, 41014, 49002
920	chromosome 1 open reading frame 159	294576	1075	294576	9063	17051, 25039, 33027, 41015, 49003
921	chromosome 1 open reading frame 159	379319	1076	368623	9064	17052, 25040, 33028, 41016, 49004
922	chromosome 1 open reading frame 159	379339	1077	368644	9065	17053, 25041, 33029, 41017, 49005
923	chromosome 1 open reading frame 159	421241	1078	400736	9066	17054, 25042, 33030, 41018, 49006
924	chromosome 1 open reading frame 159	437760	1079	399027	9067	17055, 25043, 33031, 41019, 49007

925	chromosome 1 open reading frame 159	442117	1080	416740	9068	17056, 25044, 33032, 41020, 49008
926	chromosome 1 open reading frame 159	448924	1081	392290	9069	17057, 25045, 33033, 41021, 49009
927	chromosome 1 open reading frame 159	457999	1082	414929	9070	17058, 25046, 33034, 41022, 49010
928	chromosome 1 open reading frame 162	343534	1083	344218	9071	17059, 25047, 33035, 41023, 49011
929	chromosome 1 open reading frame 162	369718	1084	358732	9072	17060, 25048, 33036, 41024, 49012
930	chromosome 1 open reading frame 185	371759	1085	360824	9073	17061, 25049, 33037, 41025, 49013
931	chromosome 1 open reading frame 186	331555	1086	356093	9074	17062, 25050, 33038, 41026, 49014
932	chromosome 1 open reading frame 210	423420	1087	429399	9075	17063, 25051, 33039, 41027, 49015
933	chromosome 1 open reading frame 210	523677	1088	430918	9076	17064, 25052, 33040, 41028, 49016
934	chromosome 1 open reading frame 27	287859	1089	287859	9077	17065, 25053, 33041, 41029, 49017
935	chromosome 1 open reading frame 27	367470	1090	356440	9078	17066, 25054, 33042, 41030, 49018
936	chromosome 1 open reading frame 27	419367	1091	395084	9079	17067, 25055, 33043, 41031, 49019
937	chromosome 1 open reading frame 27	432021	1092	402029	9080	17068, 25056, 33044, 41032, 49020
938	chromosome 1 open reading frame 31	366612	1093	355571	9081	17069, 25057, 33045, 41033, 49021
939	chromosome 1 open reading frame 31	366613	1094	355572	9082	17070, 25058, 33046, 41034, 49022
940	chromosome 1 open reading frame 31	366615	1095	355574	9083	17071, 25059, 33047, 41035, 49023
941	chromosome 1 open reading frame 31	424237	1096	392376	9084	17072, 25060, 33048, 41036, 49024
942	chromosome 1 open reading frame 43	350592	1097	271925	9085	17073, 25061, 33049, 41037, 49025

943	chromosome 1 open reading frame 43	362076	1098	354496	9086	17074, 25062, 33050, 41038, 49026
944	chromosome 1 open reading frame 43	368516	1099	357502	9087	17075, 25063, 33051, 41039, 49027
945	chromosome 1 open reading frame 43	368518	1100	357504	9088	17076, 25064, 33052, 41040, 49028
946	chromosome 1 open reading frame 43	368519	1101	357505	9089	17077, 25065, 33053, 41041, 49029
947	chromosome 1 open reading frame 43	368521	1102	357507	9090	17078, 25066, 33054, 41042, 49030
948	chromosome 1 open reading frame 85	362007	1103	354553	9091	17079, 25067, 33055, 41043, 49031
949	chromosome 1 open reading frame 9	263688	1104	263688	9092	17080, 25068, 33056, 41044, 49032
950	chromosome 1 open reading frame 9	367723	1105	356696	9093	17081, 25069, 33057, 41045, 49033
951	chromosome 1 open reading frame 94	373374	1106	362472	9094	17082, 25070, 33058, 41046, 49034
952	chromosome 1 open reading frame 94	488417	1107	435634	9095	17083, 25071, 33059, 41047, 49035
953	chromosome 1 open reading frame 95	366788	1108	355752	9096	17084, 25072, 33060, 41048, 49036
954	chromosome 1 open reading frame 95	366789	1109	355753	9097	17085, 25073, 33061, 41049, 49037
955	chromosome 10 open reading frame 10	298295	1110	298295	9098	17086, 25074, 33062, 41050, 49038
956	chromosome 10 open reading frame 10	432283	1111	392803	9099	17087, 25075, 33063, 41051, 49039
957	chromosome 10 open reading frame 10	448778	1112	414494	9100	17088, 25076, 33064, 41052, 49040
958	chromosome 10 open reading frame 105	398786	1113	381766	9101	17089, 25077, 33065, 41053, 49041
959	chromosome 10 open reading frame 105	441508	1114	403151	9102	17090, 25078, 33066, 41054, 49042
960	chromosome 10 open reading frame 105	545760	1115	440187	9103	17091, 25079, 33067, 41055, 49043

961	chromosome 10 open reading frame 111	378207	1116	367449	9104	17092, 25080, 33068, 41056, 49044
962	chromosome 10 open reading frame 112	377265	1117	366476	9105	17093, 25081, 33069, 41057, 49045
963	chromosome 10 open reading frame 112	377266	1118	366477	9106	17094, 25082, 33070, 41058, 49046
964	chromosome 10 open reading frame 112	441070	1119	404330	9107	17095, 25083, 33071, 41059, 49047
965	chromosome 10 open reading frame 112	454679	1120	412763	9108	17096, 25084, 33072, 41060, 49048
966	chromosome 10 open reading frame 112	455457	1121	391253	9109	17097, 25085, 33073, 41061, 49049
967	chromosome 10 open reading frame 128	474718	1122	417246	9110	17098, 25086, 33074, 41062, 49050
968	chromosome 10 open reading frame 129	341686	1123	340296	9111	17099, 25087, 33075, 41063, 49051
969	chromosome 10 open reading frame 129	394005	1124	377573	9112	17100, 25088, 33076, 41064, 49052
970	chromosome 10 open reading frame 129	430183	1125	400368	9113	17101, 25089, 33077, 41065, 49053
971	chromosome 10 open reading frame 129	539707	1126	438774	9114	17102, 25090, 33078, 41066, 49054
972	chromosome 10 open reading frame 35	373279	1127	362376	9115	17103, 25091, 33079, 41067, 49055
973	chromosome 10 open reading frame 35	421716	1128	398621	9116	17104, 25092, 33080, 41068, 49056
974	chromosome 10 open reading frame 54	263569	1129	263569	9117	17105, 25093, 33081, 41069, 49057
975	chromosome 10 open reading frame 54	394957	1130	378409	9118	17106, 25094, 33082, 41070, 49058
976	chromosome 10 open reading frame 57	372273	1131	361347	9119	17107, 25095, 33083, 41071, 49059
977	chromosome 10 open reading frame 57	372274	1132	361348	9120	17108, 25096, 33084, 41072, 49060
978	chromosome 10 open reading frame 57	372275	1133	361349	9121	17109, 25097, 33085, 41073, 49061

979	chromosome 10 open reading frame 57	372277	1134	361351	9122	17110, 25098, 33086, 41074, 49062
980	chromosome 10 open reading frame 57	372281	1135	361355	9123	17111, 25099, 33087, 41075, 49063
981	chromosome 10 open reading frame 57	450179	1136	393450	9124	17112, 25100, 33088, 41076, 49064
982	chromosome 10 open reading frame 76	263485	1137	263485	9125	17113, 25101, 33089, 41077, 49065
983	chromosome 10 open reading frame 76	311122	1138	312408	9126	17114, 25102, 33090, 41078, 49066
984	chromosome 10 open reading frame 76	370033	1139	359050	9127	17115, 25103, 33091, 41079, 49067
985	chromosome 10 open reading frame 76	456149	1140	413473	9128	17116, 25104, 33092, 41080, 49068
986	chromosome 11 open reading frame 10	257262	1141	257262	9129	17117, 25105, 33093, 41081, 49069
987	chromosome 11 open reading frame 10	537328	1142	443216	9130	17118, 25106, 33094, 41082, 49070
988	chromosome 11 open reading frame 2	279281	1143	279281	9131	17119, 25107, 33095, 41083, 49071
989	chromosome 11 open reading frame 87	327419	1144	331581	9132	17120, 25108, 33096, 41084, 49072
990	chromosome 12 open reading frame 10	267103	1145	267103	9133	17121, 25109, 33097, 41085, 49073
991	chromosome 12 open reading frame 10	545214	1146	437921	9134	17122, 25110, 33098, 41086, 49074
992	chromosome 12 open reading frame 23	280756	1147	280756	9135	17123, 25111, 33099, 41087, 49075
993	chromosome 12 open reading frame 23	547081	1148	449106	9136	17124, 25112, 33100, 41088, 49076
994	chromosome 12 open reading frame 23	547242	1149	446537	9137	17125, 25113, 33101, 41089, 49077
995	chromosome 12 open reading frame 23	548125	1150	449785	9138	17126, 25114, 33102, 41090, 49078
996	chromosome 12 open reading frame 23	550344	1151	446717	9139	17127, 25115, 33103, 41091, 49079

997	chromosome 12 open reading frame 23	551813	1152	450350	9140	17128, 25116, 33104, 41092, 49080
998	chromosome 12 open reading frame 51	377560	1153	366783	9141	17129, 25117, 33105, 41093, 49081
999	chromosome 12 open reading frame 51	430131	1154	404379	9142	17130, 25118, 33106, 41094, 49082
1000	chromosome 12 open reading frame 53	320591	1155	317818	9143	17131, 25119, 33107, 41095, 49083
1001	chromosome 12 open reading frame 53	439553	1156	391992	9144	17132, 25120, 33108, 41096, 49084
1002	chromosome 12 open reading frame 53	534837	1157	443919	9145	17133, 25121, 33109, 41097, 49085
1003	chromosome 12 open reading frame 53	540656	1158	442157	9146	17134, 25122, 33110, 41098, 49086
1004	chromosome 12 open reading frame 59	298530	1159	298530	9147	17135, 25123, 33111, 41099, 49087
1005	chromosome 12 open reading frame 59	381923	1160	371348	9148	17136, 25124, 33112, 41100, 49088
1006	chromosome 12 open reading frame 59	536952	1161	446102	9149	17137, 25125, 33113, 41101, 49089
1007	chromosome 12 open reading frame 59	543484	1162	445582	9150	17138, 25126, 33114, 41102, 49090
1008	chromosome 12 open reading frame 62	317943	1163	326052	9151	17139, 25127, 33115, 41103, 49091
1009	chromosome 12 open reading frame 62	548985	1164	447776	9152	17140, 25128, 33116, 41104, 49092
1010	chromosome 12 open reading frame 62	550487	1165	446524	9153	17141, 25129, 33117, 41105, 49093
1011	chromosome 12 open reading frame 62	550654	1166	450331	9154	17142, 25130, 33118, 41106, 49094
1012	chromosome 12 open reading frame 69	316048	1167	381895	9155	17143, 25131, 33119, 41107, 49095
1013	chromosome 13 open reading frame 16	283547	1168	283547	9156	17144, 25132, 33120, 41108, 49096
1014	chromosome 13 open reading frame 44	400419	1169	383270	9157	17145, 25133, 33121, 41109, 49097

1015	chromosome 14 open reading frame 101	261556	1170	261556	9158	17146, 25134, 33122, 41110, 49098
1016	chromosome 14 open reading frame 101	536419	1171	438742	9159	17147, 25135, 33123, 41111, 49099
1017	chromosome 14 open reading frame 101	538838	1172	441934	9160	17148, 25136, 33124, 41112, 49100
1018	chromosome 14 open reading frame 109	283534	1173	283534	9161	17149, 25137, 33125, 41113, 49101
1019	chromosome 14 open reading frame 109	415050	1174	388431	9162	17150, 25138, 33126, 41114, 49102
1020	chromosome 14 open reading frame 132	421193	1175	440920	9163	17151, 25139, 33127, 41115, 49103
1021	chromosome 14 open reading frame 132	555004	1176	451731	9164	17152, 25140, 33128, 41116, 49104
1022	chromosome 14 open reading frame 135	317623	1177	317396	9165	17153, 25141, 33129, 41117, 49105
1023	chromosome 14 open reading frame 135	404681	1178	385713	9166	17154, 25142, 33130, 41118, 49106
1024	chromosome 14 open reading frame 135	406854	1179	384801	9167	17155, 25143, 33131, 41119, 49107
1025	chromosome 14 open reading frame 135	535349	1180	445644	9168	17156, 25144, 33132, 41120, 49108
1026	chromosome 14 open reading frame 135	555740	1181	450441	9169	17157, 25145, 33133, 41121, 49109
1027	chromosome 14 open reading frame 159	256324	1182	256324	9170	17158, 25146, 33134, 41122, 49110
1028	chromosome 14 open reading frame 159	298858	1183	298858	9171	17159, 25147, 33135, 41123, 49111
1029	chromosome 14 open reading frame 159	412671	1184	404196	9172	17160, 25148, 33136, 41124, 49112
1030	chromosome 14 open reading frame 159	428926	1185	404343	9173	17161, 25149, 33137, 41125, 49113
1031	chromosome 14 open reading frame 159	517362	1186	429806	9174	17162, 25150, 33138, 41126, 49114
1032	chromosome 14 open reading frame 159	517518	1187	428652	9175	17163, 25151, 33139, 41127, 49115

1033	chromosome 14 open reading frame 159	518665	1188	429098	9176	17164, 25152, 33140, 41128, 49116
1034	chromosome 14 open reading frame 159	518868	1189	428263	9177	17165, 25153, 33141, 41129, 49117
1035	chromosome 14 open reading frame 159	518871	1190	429189	9178	17166, 25154, 33142, 41130, 49118
1036	chromosome 14 open reading frame 159	519950	1191	428296	9179	17167, 25155, 33143, 41131, 49119
1037	chromosome 14 open reading frame 159	520328	1192	429453	9180	17168, 25156, 33144, 41132, 49120
1038	chromosome 14 open reading frame 159	521064	1193	429392	9181	17169, 25157, 33145, 41133, 49121
1039	chromosome 14 open reading frame 159	521077	1194	430137	9182	17170, 25158, 33146, 41134, 49122
1040	chromosome 14 open reading frame 159	521081	1195	428997	9183	17171, 25159, 33147, 41135, 49123
1041	chromosome 14 open reading frame 159	521334	1196	430022	9184	17172, 25160, 33148, 41136, 49124
1042	chromosome 14 open reading frame 159	522170	1197	430666	9185	17173, 25161, 33149, 41137, 49125
1043	chromosome 14 open reading frame 159	522322	1198	427953	9186	17174, 25162, 33150, 41138, 49126
1044	chromosome 14 open reading frame 159	522837	1199	427971	9187	17175, 25163, 33151, 41139, 49127
1045	chromosome 14 open reading frame 159	523771	1200	429655	9188	17176, 25164, 33152, 41140, 49128
1046	chromosome 14 open reading frame 159	523816	1201	428974	9189	17177, 25165, 33153, 41141, 49129
1047	chromosome 14 open reading frame 159	523879	1202	428122	9190	17178, 25166, 33154, 41142, 49130
1048	chromosome 14 open reading frame 159	523894	1203	429459	9191	17179, 25167, 33155, 41143, 49131
1049	chromosome 14 open reading frame 159	524232	1204	429097	9192	17180, 25168, 33156, 41144, 49132
1050	chromosome 14 open reading frame 159	525393	1205	435459	9193	17181, 25169, 33157, 41145, 49133

1051	chromosome 14 open reading frame 180	410013	1206	386487	9194	17182, 25170, 33158, 41146, 49134
1052	chromosome 14 open reading frame 180	557649	1207	452502	9195	17183, 25171, 33159, 41147, 49135
1053	chromosome 14 open reading frame 37	267485	1208	267485	9196	17184, 25172, 33160, 41148, 49136
1054	chromosome 15 open reading frame 24	256545	1209	256545	9197	17185, 25173, 33161, 41149, 49137
1055	chromosome 15 open reading frame 27	388942	1210	373594	9198	17186, 25174, 33162, 41150, 49138
1056	chromosome 15 open reading frame 48	344300	1211	341610	9199	17187, 25175, 33163, 41151, 49139
1057	chromosome 15 open reading frame 48	396650	1212	379887	9200	17188, 25176, 33164, 41152, 49140
1058	chromosome 15 open reading frame 62	344320	1213	341178	9201	17189, 25177, 33165, 41153, 49141
1059	chromosome 15 open reading frame 62	559319	1214	453366	9202	17190, 25178, 33166, 41154, 49142
1060	chromosome 16 open reading frame 54	329410	1215	327506	9203	17191, 25179, 33167, 41155, 49143
1061	chromosome 16 open reading frame 58	327237	1216	317579	9204	17192, 25180, 33168, 41156, 49144
1062	chromosome 16 open reading frame 58	430477	1217	398074	9205	17193, 25181, 33169, 41157, 49145
1063	chromosome 16 open reading frame 58	452223	1218	414614	9206	17194, 25182, 33170, 41158, 49146
1064	chromosome 16 open reading frame 58	541442	1219	440050	9207	17195, 25183, 33171, 41159, 49147
1065	chromosome 16 open reading frame 62	251143	1220	251143	9208	17196, 25184, 33172, 41160, 49148
1066	chromosome 16 open reading frame 62	417362	1221	395973	9209	17197, 25185, 33173, 41161, 49149
1067	chromosome 16 open reading frame 62	438132	1222	400815	9210	17198, 25186, 33174, 41162, 49150
1068	chromosome 16 open reading frame 62	448695	1223	398009	9211	17199, 25187, 33175, 41163, 49151

1069	chromosome 16 open reading frame 62	538853	1224	444363	9212	17200, 25188, 33176, 41164, 49152
1070	chromosome 16 open reading frame 62	542263	1225	442468	9213	17201, 25189, 33177, 41165, 49153
1071	chromosome 16 open reading frame 70	219139	1226	219139	9214	17202, 25190, 33178, 41166, 49154
1072	chromosome 16 open reading frame 91	310355	1227	311390	9215	17203, 25191, 33179, 41167, 49155
1073	chromosome 16 open reading frame 91	442039	1228	413100	9216	17204, 25192, 33180, 41168, 49156
1074	chromosome 16 open reading frame 92	300575	1229	300575	9217	17205, 25193, 33181, 41169, 49157
1075	chromosome 17 open reading frame 101	313056	1230	320116	9218	17206, 25194, 33182, 41170, 49158
1076	chromosome 17 open reading frame 101	329197	1231	330075	9219	17207, 25195, 33183, 41171, 49159
1077	chromosome 17 open reading frame 109	375215	1232	364363	9220	17208, 25196, 33184, 41172, 49160
1078	chromosome 17 open reading frame 56	300714	1233	300714	9221	17209, 25197, 33185, 41173, 49161
1079	chromosome 17 open reading frame 56	374769	1234	363901	9222	17210, 25198, 33186, 41174, 49162
1080	chromosome 17 open reading frame 59	389017	1235	373669	9223	17211, 25199, 33187, 41175, 49163
1081	chromosome 17 open reading frame 61	302422	1236	301939	9224	17212, 25200, 33188, 41176, 49164
1082	chromosome 17 open reading frame 62	306645	1237	307765	9225	17213, 25201, 33189, 41177, 49165
1083	chromosome 17 open reading frame 62	336995	1238	337560	9226	17214, 25202, 33190, 41178, 49166
1084	chromosome 17 open reading frame 62	342572	1239	342228	9227	17215, 25203, 33191, 41179, 49167
1085	chromosome 17 open reading frame 62	434650	1240	401626	9228	17216, 25204, 33192, 41180, 49168
1086	chromosome 17 open reading frame 62	437807	1241	388909	9229	17217, 25205, 33193, 41181, 49169

1087	chromosome 17 open reading frame 62	536759	1242	439100	9230	17218, 25206, 33194, 41182, 49170
1088	chromosome 17 open reading frame 78	300618	1243	300618	9231	17219, 25207, 33195, 41183, 49171
1089	chromosome 17 open reading frame 78	321564	1244	318689	9232	17220, 25208, 33196, 41184, 49172
1090	chromosome 17 open reading frame 80	255557	1245	255557	9233	17221, 25209, 33197, 41185, 49173
1091	chromosome 17 open reading frame 80	268942	1246	268942	9234	17222, 25210, 33198, 41186, 49174
1092	chromosome 17 open reading frame 80	359042	1247	351937	9235	17223, 25211, 33199, 41187, 49175
1093	chromosome 17 open reading frame 80	426147	1248	396970	9236	17224, 25212, 33200, 41188, 49176
1094	chromosome 17 open reading frame 80	535032	1249	440551	9237	17225, 25213, 33201, 41189, 49177
1095	chromosome 17 open reading frame 89	431388	1250	400184	9238	17226, 25214, 33202, 41190, 49178
1096	chromosome 17 open reading frame 90	374741	1251	363873	9239	17227, 25215, 33203, 41191, 49179
1097	chromosome 18 open reading frame 26	321600	1252	315265	9240	17228, 25216, 33204, 41192, 49180
1098	chromosome 18 open reading frame 62	382638	1253	372083	9241	17229, 25217, 33205, 41193, 49181
1099	chromosome 18 open reading frame 62	579022	1254	462106	9242	17230, 25218, 33206, 41194, 49182
1100	chromosome 19 open reading frame 18	314391	1255	321519	9243	17231, 25219, 33207, 41195, 49183
1101	chromosome 19 open reading frame 26	382477	1256	371917	9244	17232, 25220, 33208, 41196, 49184
1102	chromosome 19 open reading frame 38	397820	1257	380920	9245	17233, 25221, 33209, 41197, 49185
1103	chromosome 19 open reading frame 46	324444	1258	316130	9246	17234, 25222, 33210, 41198, 49186
1104	chromosome 19 open reading frame 46	340477	1259	343152	9247	17235, 25223, 33211, 41199, 49187

1105	chromosome 19 open reading frame 59	333598	1260	329920	9248	17236, 25224, 33212, 41200, 49188
1106	chromosome 19 open reading frame 70	309324	1261	309561	9249	17237, 25225, 33213, 41201, 49189
1107	chromosome 19 open reading frame 75	316401	1262	321249	9250	17238, 25226, 33214, 41202, 49190
1108	chromosome 19 open reading frame 77	215531	1263	215531	9251	17239, 25227, 33215, 41203, 49191
1109	chromosome 2 open reading frame 18	344420	1264	345528	9252	17240, 25228, 33216, 41204, 49192
1110	chromosome 2 open reading frame 18	416475	1265	413413	9253	17241, 25229, 33217, 41205, 49193
1111	chromosome 2 open reading frame 28	380171	1266	369518	9254	17242, 25230, 33218, 41206, 49194
1112	chromosome 2 open reading frame 28	405489	1267	384033	9255	17243, 25231, 33219, 41207, 49195
1113	chromosome 2 open reading frame 28	419744	1268	397319	9256	17244, 25232, 33220, 41208, 49196
1114	chromosome 2 open reading frame 47	295079	1269	295079	9257	17245, 25233, 33221, 41209, 49197
1115	chromosome 2 open reading frame 47	392290	1270	376111	9258	17246, 25234, 33222, 41210, 49198
1116	chromosome 2 open reading frame 56	2125	1271	2125	9259	17247, 25235, 33223, 41211, 49199, 56079, 56112
1117	chromosome 2 open reading frame 65	290536	1272	290536	9260	17248, 25236, 33224, 41212, 49200
1118	chromosome 2 open reading frame 65	358434	1273	351213	9261	17249, 25237, 33225, 41213, 49201
1119	chromosome 2 open reading frame 65	421985	1274	414882	9262	17250, 25238, 33226, 41214, 49202
1120	chromosome 2 open reading frame 65	536235	1275	445662	9263	17251, 25239, 33227, 41215, 49203
1121	chromosome 2 open reading frame 73	398634	1276	381631	9264	17252, 25240, 33228, 41216, 49204
1122	chromosome 2 open reading frame 82	331342	1277	333208	9265	17253, 25241, 33229, 41217, 49205

1123	chromosome 2 open reading frame 82	409230	1278	386804	9266	17254, 25242, 33230, 41218, 49206
1124	chromosome 2 open reading frame 82	409533	1279	387130	9267	17255, 25243, 33231, 41219, 49207
1125	chromosome 2 open reading frame 89	335459	1280	335004	9268	17256, 25244, 33232, 41220, 49208
1126	chromosome 2 open reading frame 89	409520	1281	387075	9269	17257, 25245, 33233, 41221, 49209
1127	chromosome 20 open reading frame 118	217320	1282	217320	9270	17258, 25246, 33234, 41222, 49210
1128	chromosome 20 open reading frame 123	279028	1283	279028	9271	17259, 25247, 33235, 41223, 49211
1129	chromosome 20 open reading frame 24	342422	1284	341213	9272	17260, 25248, 33236, 41224, 49212
1130	chromosome 20 open reading frame 24	344795	1285	340164	9273	17261, 25249, 33237, 41225, 49213
1131	chromosome 20 open reading frame 24	373852	1286	362958	9274	17262, 25250, 33238, 41226, 49214
1132	chromosome 20 open reading frame 3	217456	1287	217456	9275	17263, 25251, 33239, 41227, 49215
1133	chromosome 20 open reading frame 3	447138	1288	415373	9276	17264, 25252, 33240, 41228, 49216
1134	chromosome 20 open reading frame 3	451442	1289	395874	9277	17265, 25253, 33241, 41229, 49217
1135	chromosome 20 open reading frame 30	202834	1290	202834	9278	17266, 25254, 33242, 41230, 49218
1136	chromosome 20 open reading frame 30	342308	1291	341364	9279	17267, 25255, 33243, 41231, 49219
1137	chromosome 20 open reading frame 30	379276	1292	368578	9280	17268, 25256, 33244, 41232, 49220
1138	chromosome 20 open reading frame 30	379277	1293	368579	9281	17269, 25257, 33245, 41233, 49221
1139	chromosome 20 open reading frame 30	379279	1294	368581	9282	17270, 25258, 33246, 41234, 49222
1140	chromosome 20 open reading frame 30	379283	1295	368585	9283	17271, 25259, 33247, 41235, 49223

1141	chromosome 20 open reading frame 30	379286	1296	368588	9284	17272, 25260, 33248, 41236, 49224
1142	chromosome 20 open reading frame 30	379299	1297	368601	9285	17273, 25261, 33249, 41237, 49225
1143	chromosome 20 open reading frame 72	377704	1298	366933	9286	17274, 25262, 33250, 41238, 49226
1144	chromosome 20 open reading frame 72	377709	1299	366938	9287	17275, 25263, 33251, 41239, 49227
1145	chromosome 20 open reading frame 72	377710	1300	366939	9288	17276, 25264, 33252, 41240, 49228
1146	chromosome 21 open reading frame 63	300255	1301	300255	9289	17277, 25265, 33253, 41241, 49229
1147	chromosome 21 open reading frame 67	330551	1302	331610	9290	17278, 25266, 33254, 41242, 49230
1148	chromosome 21 open reading frame 67	380070	1303	369410	9291	17279, 25267, 33255, 41243, 49231
1149	chromosome 22 open reading frame 24	248984	1304	248984	9292	17280, 25268, 33256, 41244, 49232
1150	chromosome 22 open reading frame 24	543051	1305	437643	9293	17281, 25269, 33257, 41245, 49233
1151	chromosome 22 open reading frame 25	327374	1306	332721	9294	17282, 25270, 33258, 41246, 49234
1152	chromosome 22 open reading frame 25	398042	1307	381122	9295	17283, 25271, 33259, 41247, 49235
1153	chromosome 22 open reading frame 25	401886	1308	385662	9296	17284, 25272, 33260, 41248, 49236
1154	chromosome 22 open reading frame 25	420290	1309	396182	9297	17285, 25273, 33261, 41249, 49237
1155	chromosome 22 open reading frame 25	432198	1310	413850	9298	17286, 25274, 33262, 41250, 49238
1156	chromosome 22 open reading frame 25	432883	1311	402926	9299	17287, 25275, 33263, 41251, 49239
1157	chromosome 22 open reading frame 25	434168	1312	411602	9300	17288, 25276, 33264, 41252, 49240
1158	chromosome 22 open reading frame 25	434570	1313	391262	9301	17289, 25277, 33265, 41253, 49241

1159	chromosome 22 open reading frame 25	447208	1314	389797	9302	17290, 25278, 33266, 41254, 49242
1160	chromosome 22 open reading frame 25	450664	1315	415450	9303	17291, 25279, 33267, 41255, 49243
1161	chromosome 22 open reading frame 25	456048	1316	403645	9304	17292, 25280, 33268, 41256, 49244
1162	chromosome 22 open reading frame 32	331479	1317	327467	9305	17293, 25281, 33269, 41257, 49245
1163	chromosome 3 open reading frame 17	314400	1318	320251	9306	17294, 25282, 33270, 41258, 49246
1164	chromosome 3 open reading frame 17	383675	1319	373173	9307	17295, 25283, 33271, 41259, 49247
1165	chromosome 3 open reading frame 17	393857	1320	377438	9308	17296, 25284, 33272, 41260, 49248
1166	chromosome 3 open reading frame 17	412848	1321	411150	9309	17297, 25285, 33273, 41261, 49249
1167	chromosome 3 open reading frame 18	357203	1322	349732	9310	17298, 25286, 33274, 41262, 49250
1168	chromosome 3 open reading frame 18	426034	1323	387606	9311	17299, 25287, 33275, 41263, 49251
1169	chromosome 3 open reading frame 18	441239	1324	414124	9312	17300, 25288, 33276, 41264, 49252
1170	chromosome 3 open reading frame 18	449241	1325	404913	9313	17301, 25289, 33277, 41265, 49253
1171	chromosome 3 open reading frame 20	253697	1326	253697	9314	17302, 25290, 33278, 41266, 49254
1172	chromosome 3 open reading frame 20	412910	1327	396081	9315	17303, 25291, 33279, 41267, 49255
1173	chromosome 3 open reading frame 20	435614	1328	402933	9316	17304, 25292, 33280, 41268, 49256
1174	chromosome 3 open reading frame 23	342649	1329	341539	9317	17305, 25293, 33281, 41269, 49257
1175	chromosome 3 open reading frame 23	383746	1330	373252	9318	17306, 25294, 33282, 41270, 49258
1176	chromosome 3 open reading frame 23	396078	1331	379388	9319	17307, 25295, 33283, 41271, 49259

1177	chromosome 3 open reading frame 23	417237	1332	402581	9320	17308, 25296, 33284, 41272, 49260
1178	chromosome 3 open reading frame 33	340171	1333	342512	9321	17309, 25297, 33285, 41273, 49261
1179	chromosome 3 open reading frame 33	534941	1334	445446	9322	17310, 25298, 33286, 41274, 49262
1180	chromosome 3 open reading frame 33	537385	1335	444116	9323	17311, 25299, 33287, 41275, 49263
1181	chromosome 3 open reading frame 35	328376	1336	331625	9324	17312, 25300, 33288, 41276, 49264
1182	chromosome 3 open reading frame 35	425564	1337	414104	9325	17313, 25301, 33289, 41277, 49265
1183	chromosome 3 open reading frame 35	425932	1338	395513	9326	17314, 25302, 33290, 41278, 49266
1184	chromosome 3 open reading frame 35	426078	1339	392399	9327	17315, 25303, 33291, 41279, 49267
1185	chromosome 3 open reading frame 35	452017	1340	413537	9328	17316, 25304, 33292, 41280, 49268
1186	chromosome 3 open reading frame 43	397537	1341	380671	9329	17317, 25305, 33293, 41281, 49269
1187	chromosome 3 open reading frame 45	316436	1342	315081	9330	17318, 25306, 33294, 41282, 49270
1188	chromosome 3 open reading frame 55	459838	1343	420317	9331	17319, 25307, 33295, 41283, 49271
1189	chromosome 3 open reading frame 71	408959	1344	386193	9332	17320, 25308, 33296, 41284, 49272
1190	chromosome 3 open reading frame 78	477703	1345	417806	9333	17321, 25309, 33297, 41285, 49273
1191	chromosome 4 open reading frame 21	309071	1346	309095	9334	17322, 25310, 33298, 41286, 49274
1192	chromosome 4 open reading frame 21	445203	1347	390505	9335	17323, 25311, 33299, 41287, 49275
1193	chromosome 4 open reading frame 21	503172	1348	424995	9336	17324, 25312, 33300, 41288, 49276
1194	chromosome 4 open reading frame 3	399075	1349	382026	9337	17325, 25313, 33301, 41289, 49277

1195	chromosome 4 open reading frame 3	504110	1350	427214	9338	17326, 25314, 33302, 41290, 49278
1196	chromosome 4 open reading frame 32	309733	1351	310182	9339	17327, 25315, 33303, 41291, 49279
1197	chromosome 4 open reading frame 34	295958	1352	295958	9340	17328, 25316, 33304, 41292, 49280
1198	chromosome 4 open reading frame 34	505729	1353	422904	9341	17329, 25317, 33305, 41293, 49281
1199	chromosome 4 open reading frame 49	398955	1354	381928	9342	17330, 25318, 33306, 41294, 49282
1200	chromosome 5 open reading frame 15	231512	1355	231512	9343	17331, 25319, 33307, 41295, 49283
1201	chromosome 5 open reading frame 15	451255	1356	389086	9344	17332, 25320, 33308, 41296, 49284
1202	chromosome 5 open reading frame 28	397080	1357	380270	9345	17333, 25321, 33309, 41297, 49285
1203	chromosome 5 open reading frame 28	500337	1358	426067	9346	17334, 25322, 33310, 41298, 49286
1204	chromosome 5 open reading frame 28	506860	1359	424720	9347	17335, 25323, 33311, 41299, 49287
1205	chromosome 5 open reading frame 28	512085	1360	422881	9348	17336, 25324, 33312, 41300, 49288
1206	chromosome 5 open reading frame 28	537319	1361	443629	9349	17337, 25325, 33313, 41301, 49289
1207	chromosome 5 open reading frame 4	326080	1362	320604	9350	17338, 25326, 33314, 41302, 49290
1208	chromosome 5 open reading frame 4	517938	1363	430286	9351	17339, 25327, 33315, 41303, 49291
1209	chromosome 5 open reading frame 4	519501	1364	429837	9352	17340, 25328, 33316, 41304, 49292
1210	chromosome 5 open reading frame 4	520461	1365	431015	9353	17341, 25329, 33317, 41305, 49293
1211	chromosome 5 open reading frame 43	339020	1366	339324	9354	17342, 25330, 33318, 41306, 49294
1212	chromosome 5 open reading frame 43	507416	1367	421336	9355	17343, 25331, 33319, 41307, 49295

1213	chromosome 5 open reading frame 62	526627	1368	436897	9356	17344, 25332, 33320, 41308, 49296
1214	chromosome 6 open reading frame 10	305725	1369	303292	9357	17345, 25333, 33321, 41309, 49297
1215	chromosome 6 open reading frame 10	375002	1370	364141	9358	17346, 25334, 33322, 41310, 49298
1216	chromosome 6 open reading frame 10	375007	1371	364146	9359	17347, 25335, 33323, 41311, 49299
1217	chromosome 6 open reading frame 10	383130	1372	372611	9360	17348, 25336, 33324, 41312, 49300
1218	chromosome 6 open reading frame 10	447241	1373	415517	9361	17349, 25337, 33325, 41313, 49301
1219	chromosome 6 open reading frame 10	448986	1374	410514	9362	17350, 25338, 33326, 41314, 49302
1220	chromosome 6 open reading frame 10	547550	1375	449235	9363	17351, 25339, 33327, 41315, 49303
1221	chromosome 6 open reading frame 10	548927	1376	448472	9364	17352, 25340, 33328, 41316, 49304
1222	chromosome 6 open reading frame 10	548975	1377	449655	9365	17353, 25341, 33329, 41317, 49305
1223	chromosome 6 open reading frame 10	551961	1378	447564	9366	17354, 25342, 33330, 41318, 49306
1224	chromosome 6 open reading frame 125	374214	1379	363331	9367	17355, 25343, 33331, 41319, 49307
1225	chromosome 6 open reading frame 125	374231	1380	363348	9368	17356, 25344, 33332, 41320, 49308
1226	chromosome 6 open reading frame 136	293604	1381	293604	9369	17357, 25345, 33333, 41321, 49309
1227	chromosome 6 open reading frame 136	376471	1382	365654	9370	17358, 25346, 33334, 41322, 49310
1228	chromosome 6 open reading frame 136	376473	1383	365656	9371	17359, 25347, 33335, 41323, 49311
1229	chromosome 6 open reading frame 136	528347	1384	431811	9372	17360, 25348, 33336, 41324, 49312
1230	chromosome 6 open reading frame 138	339488	1385	341914	9373	17361, 25349, 33337, 41325, 49313

1231	chromosome 6 open reading frame 138	398738	1386	381722	9374	17362, 25350, 33338, 41326, 49314
1232	chromosome 6 open reading frame 138	543600	1387	439864	9375	17363, 25351, 33339, 41327, 49315
1233	chromosome 6 open reading frame 162	229570	1388	229570	9376	17364, 25352, 33340, 41328, 49316
1234	chromosome 6 open reading frame 162	392863	1389	376603	9377	17365, 25353, 33341, 41329, 49317
1235	chromosome 6 open reading frame 174	368268	1390	357251	9378	17366, 25354, 33342, 41330, 49318
1236	chromosome 6 open reading frame 174	467753	1391	431662	9379	17367, 25355, 33343, 41331, 49319
1237	chromosome 6 open reading frame 174	525778	1392	434570	9380	17368, 25356, 33344, 41332, 49320
1238	chromosome 6 open reading frame 174	556132	1393	451768	9381	17369, 25357, 33345, 41333, 49321
1239	chromosome 6 open reading frame 191	368143	1394	357125	9382	17370, 25358, 33346, 41334, 49322
1240	chromosome 6 open reading frame 191	438392	1395	403755	9383	17371, 25359, 33347, 41335, 49323
1241	chromosome 6 open reading frame 203	311381	1396	310951	9384	17372, 25360, 33348, 41336, 49324
1242	chromosome 6 open reading frame 203	405204	1397	384867	9385	17373, 25361, 33349, 41337, 49325
1243	chromosome 6 open reading frame 203	443043	1398	390153	9386	17374, 25362, 33350, 41338, 49326
1244	chromosome 6 open reading frame 25	375804	1399	364962	9387	17375, 25363, 33351, 41339, 49327
1245	chromosome 6 open reading frame 25	375805	1400	364963	9388	17376, 25364, 33352, 41340, 49328
1246	chromosome 6 open reading frame 25	375806	1401	364964	9389	17377, 25365, 33353, 41341, 49329
1247	chromosome 6 open reading frame 25	375809	1402	364967	9390	17378, 25366, 33354, 41342, 49330
1248	chromosome 6 open reading frame 25	375810	1403	364968	9391	17379, 25367, 33355, 41343, 49331

1249	chromosome 6 open reading frame 25	375814	1404	364972	9392	17380, 25368, 33356, 41344, 49332
1250	chromosome 6 open reading frame 25	383410	1405	372902	9393	17381, 25369, 33357, 41345, 49333
1251	chromosome 6 open reading frame 25	383411	1406	372903	9394	17382, 25370, 33358, 41346, 49334
1252	chromosome 6 open reading frame 25	383412	1407	372904	9395	17383, 25371, 33359, 41347, 49335
1253	chromosome 6 open reading frame 25	400067	1408	382940	9396	17384, 25372, 33360, 41348, 49336
1254	chromosome 6 open reading frame 25	400071	1409	382944	9397	17385, 25373, 33361, 41349, 49337
1255	chromosome 6 open reading frame 25	415728	1410	408430	9398	17386, 25374, 33362, 41350, 49338
1256	chromosome 6 open reading frame 25	415984	1411	394082	9399	17387, 25375, 33363, 41351, 49339
1257	chromosome 6 open reading frame 25	417610	1412	412747	9400	17388, 25376, 33364, 41352, 49340
1258	chromosome 6 open reading frame 25	422012	1413	398061	9401	17389, 25377, 33365, 41353, 49341
1259	chromosome 6 open reading frame 25	425998	1414	392917	9402	17390, 25378, 33366, 41354, 49342
1260	chromosome 6 open reading frame 25	426729	1415	390272	9403	17391, 25379, 33367, 41355, 49343
1261	chromosome 6 open reading frame 25	428302	1416	404519	9404	17392, 25380, 33368, 41356, 49344
1262	chromosome 6 open reading frame 25	431888	1417	390821	9405	17393, 25381, 33369, 41357, 49345
1263	chromosome 6 open reading frame 25	435007	1418	401892	9406	17394, 25382, 33370, 41358, 49346
1264	chromosome 6 open reading frame 25	436030	1419	406706	9407	17395, 25383, 33371, 41359, 49347
1265	chromosome 6 open reading frame 25	437153	1420	412937	9408	17396, 25384, 33372, 41360, 49348
1266	chromosome 6 open reading frame 25	440063	1421	388982	9409	17397, 25385, 33373, 41361, 49349

1267	chromosome 6 open reading frame 25	444404	1422	415282	9410	17398, 25386, 33374, 41362, 49350
1268	chromosome 6 open reading frame 25	445381	1423	396823	9411	17399, 25387, 33375, 41363, 49351
1269	chromosome 6 open reading frame 25	447587	1424	416447	9412	17400, 25388, 33376, 41364, 49352
1270	chromosome 6 open reading frame 25	449633	1425	388484	9413	17401, 25389, 33377, 41365, 49353
1271	chromosome 6 open reading frame 25	451549	1426	395801	9414	17402, 25390, 33378, 41366, 49354
1272	chromosome 6 open reading frame 25	455185	1427	414824	9415	17403, 25391, 33379, 41367, 49355
1273	chromosome 6 open reading frame 25	457450	1428	395279	9416	17404, 25392, 33380, 41368, 49356
1274	chromosome 6 open reading frame 25	457884	1429	391097	9417	17405, 25393, 33381, 41369, 49357
1275	chromosome 6 open reading frame 70	366771	1430	355733	9418	17406, 25394, 33382, 41370, 49358
1276	chromosome 6 open reading frame 70	366772	1431	355734	9419	17407, 25395, 33383, 41371, 49359
1277	chromosome 6 open reading frame 70	366773	1432	355735	9420	17408, 25396, 33384, 41372, 49360
1278	chromosome 6 open reading frame 70	392095	1433	375945	9421	17409, 25397, 33385, 41373, 49361
1279	chromosome 6 open reading frame 70	418781	1434	397661	9422	17410, 25398, 33386, 41374, 49362
1280	chromosome 6 open reading frame 72	367419	1435	356389	9423	17411, 25399, 33387, 41375, 49363
1281	chromosome 6 open reading frame 72	367423	1436	356393	9424	17412, 25400, 33388, 41376, 49364
1282	chromosome 6 open reading frame 72	433539	1437	407343	9425	17413, 25401, 33389, 41377, 49365
1283	chromosome 6 open reading frame 89	355190	1438	347322	9426	17414, 25402, 33390, 41378, 49366
1284	chromosome 6 open reading frame 89	359359	1439	352316	9427	17415, 25403, 33391, 41379, 49367

1285	chromosome 6 open reading frame 89	373685	1440	362789	9428	17416, 25404, 33392, 41380, 49368
1286	chromosome 6 open reading frame 89	416621	1441	387562	9429	17417, 25405, 33393, 41381, 49369
1287	chromosome 6 open reading frame 89	510325	1442	445655	9430	17418, 25406, 33394, 41382, 49370
1288	chromosome 6 open reading frame 89	540072	1443	443462	9431	17419, 25407, 33395, 41383, 49371
1289	chromosome 7 open reading frame 13	333319	1444	331784	9432	17420, 25408, 33396, 41384, 49372
1290	chromosome 7 open reading frame 23	257637	1445	257637	9433	17421, 25409, 33397, 41385, 49373
1291	chromosome 7 open reading frame 23	433078	1446	398083	9434	17422, 25410, 33398, 41386, 49374
1292	chromosome 7 open reading frame 23	455575	1447	401897	9435	17423, 25411, 33399, 41387, 49375
1293	chromosome 7 open reading frame 30	466681	1448	419370	9436	17424, 25412, 33400, 41388, 49376
1294	chromosome 7 open reading frame 42	341567	1449	340668	9437	17425, 25413, 33401, 41389, 49377
1295	chromosome 7 open reading frame 42	413593	1450	410505	9438	17426, 25414, 33402, 41390, 49378
1296	chromosome 7 open reading frame 42	418375	1451	413824	9439	17427, 25415, 33403, 41391, 49379
1297	chromosome 7 open reading frame 42	424964	1452	394507	9440	17428, 25416, 33404, 41392, 49380
1298	chromosome 7 open reading frame 44	223336	1453	223336	9441	17429, 25417, 33405, 41393, 49381
1299	chromosome 7 open reading frame 44	310564	1454	312100	9442	17430, 25418, 33406, 41394, 49382
1300	chromosome 7 open reading frame 44	395879	1455	379218	9443	17431, 25419, 33407, 41395, 49383
1301	chromosome 7 open reading frame 44	395880	1456	379219	9444	17432, 25420, 33408, 41396, 49384
1302	chromosome 7 open reading frame 44	415076	1457	400759	9445	17433, 25421, 33409, 41397, 49385

1303	chromosome 7 open reading frame 44	415798	1458	405582	9446	17434, 25422, 33410, 41398, 49386
1304	chromosome 7 open reading frame 44	431651	1459	417046	9447	17435, 25423, 33411, 41399, 49387
1305	chromosome 7 open reading frame 44	438444	1460	395586	9448	17436, 25424, 33412, 41400, 49388
1306	chromosome 7 open reading frame 44	446330	1461	416406	9449	17437, 25425, 33413, 41401, 49389
1307	chromosome 7 open reading frame 44	446564	1462	413777	9450	17438, 25426, 33414, 41402, 49390
1308	chromosome 7 open reading frame 45	297819	1463	297819	9451	17439, 25427, 33415, 41403, 49391
1309	chromosome 7 open reading frame 53	312849	1464	323304	9452	17440, 25428, 33416, 41404, 49392
1310	chromosome 7 open reading frame 53	429049	1465	415047	9453	17441, 25429, 33417, 41405, 49393
1311	chromosome 7 open reading frame 53	439068	1466	389278	9454	17442, 25430, 33418, 41406, 49394
1312	chromosome 7 open reading frame 55	297534	1467	297534	9455	17443, 25431, 33419, 41407, 49395
1313	chromosome 7 open reading frame 58	310396	1468	309772	9456	17444, 25432, 33420, 41408, 49396
1314	chromosome 7 open reading frame 58	340646	1469	345235	9457	17445, 25433, 33421, 41409, 49397
1315	chromosome 7 open reading frame 58	428526	1470	398082	9458	17446, 25434, 33422, 41410, 49398
1316	chromosome 7 open reading frame 58	450913	1471	406122	9459	17447, 25435, 33423, 41411, 49399
1317	chromosome 7 open reading frame 66	379007	1472	368292	9460	17448, 25436, 33424, 41412, 49400
1318	chromosome 8 open reading frame 17	507535	1473	428230	9461	17449, 25437, 33425, 41413, 49401
1319	chromosome 8 open reading frame 40	414154	1474	408997	9462	17450, 25438, 33426, 41414, 49402
1320	chromosome 8 open reading frame 40	416469	1475	390750	9463	17451, 25439, 33427, 41415, 49403

1321	chromosome 8 open reading frame 40	417410	1476	405694	9464	17452, 25440, 33428, 41416, 49404
1322	chromosome 8 open reading frame 40	438528	1477	391549	9465	17453, 25441, 33429, 41417, 49405
1323	chromosome 8 open reading frame 40	490331	1478	429586	9466	17454, 25442, 33430, 41418, 49406
1324	chromosome 8 open reading frame 82	524821	1479	436621	9467	17455, 25443, 33431, 41419, 49407
1325	chromosome 8 open reading frame 83	378861	1480	368138	9468	17456, 25444, 33432, 41420, 49408
1326	chromosome 8 open reading frame 83	517751	1481	430683	9469	17457, 25445, 33433, 41421, 49409
1327	chromosome 8 open reading frame 83	518748	1482	430837	9470	17458, 25446, 33434, 41422, 49410
1328	chromosome 8 open reading frame 83	519969	1483	429381	9471	17459, 25447, 33435, 41423, 49411
1329	chromosome 8 open reading frame 83	520430	1484	428822	9472	17460, 25448, 33436, 41424, 49412
1330	chromosome 8 open reading frame 83	520686	1485	429822	9473	17461, 25449, 33437, 41425, 49413
1331	chromosome 8 open reading frame 83	521617	1486	430992	9474	17462, 25450, 33438, 41426, 49414
1332	chromosome 8 open reading frame 83	521988	1487	429517	9475	17463, 25451, 33439, 41427, 49415
1333	chromosome 8 open reading frame 83	522903	1488	429302	9476	17464, 25452, 33440, 41428, 49416
1334	chromosome 8 open reading frame 83	524107	1489	429742	9477	17465, 25453, 33441, 41429, 49417
1335	chromosome 8 open reading frame 83	537541	1490	442030	9478	17466, 25454, 33442, 41430, 49418
1336	chromosome 9 open reading frame 11	380031	1491	369370	9479	17467, 25455, 33443, 41431, 49419
1337	chromosome 9 open reading frame 11	380032	1492	369371	9480	17468, 25456, 33444, 41432, 49420
1338	chromosome 9 open reading frame 11	537675	1493	441630	9481	17469, 25457, 33445, 41433, 49421

1339	chromosome 9 open reading frame 123	358227	1494	350961	9482	17470, 25458, 33446, 41434, 49422
1340	chromosome 9 open reading frame 125	374847	1495	363980	9483	17471, 25459, 33447, 41435, 49423
1341	chromosome 9 open reading frame 125	374848	1496	363981	9484	17472, 25460, 33448, 41436, 49424
1342	chromosome 9 open reading frame 125	374851	1497	363984	9485	17473, 25461, 33449, 41437, 49425
1343	chromosome 9 open reading frame 135	377197	1498	366402	9486	17474, 25462, 33450, 41438, 49426
1344	chromosome 9 open reading frame 167	357503	1499	350102	9487	17475, 25463, 33451, 41439, 49427
1345	chromosome 9 open reading frame 174	357054	1500	349562	9488	17476, 25464, 33452, 41440, 49428
1346	chromosome 9 open reading frame 174	375202	1501	364348	9489	17477, 25465, 33453, 41441, 49429
1347	chromosome 9 open reading frame 174	375205	1502	364351	9490	17478, 25466, 33454, 41442, 49430
1348	chromosome 9 open reading frame 174	395220	1503	378646	9491	17479, 25467, 33455, 41443, 49431
1349	chromosome 9 open reading frame 174	411667	1504	414000	9492	17480, 25468, 33456, 41444, 49432
1350	chromosome 9 open reading frame 174	529487	1505	434727	9493	17481, 25469, 33457, 41445, 49433
1351	chromosome 9 open reading frame 174	541524	1506	437666	9494	17482, 25470, 33458, 41446, 49434
1352	chromosome 9 open reading frame 40	376854	1507	366050	9495	17483, 25471, 33459, 41447, 49435
1353	chromosome 9 open reading frame 46	223864	1508	223864	9496	17484, 25472, 33460, 41448, 49436
1354	chromosome 9 open reading frame 57	377024	1509	366223	9497	17485, 25473, 33461, 41449, 49437
1355	chromosome 9 open reading frame 57	424431	1510	412956	9498	17486, 25474, 33462, 41450, 49438
1356	chromosome 9 open reading frame 71	377311	1511	366528	9499	17487, 25475, 33463, 41451, 49439

1357	chromosome 9 open reading frame 79	325643	1512	322640	9500	17488, 25476, 33464, 41452, 49440
1358	chromosome 9 open reading frame 79	539327	1513	443171	9501	17489, 25477, 33465, 41453, 49441
1359	chromosome 9 open reading frame 91	288502	1514	288502	9502	17490, 25478, 33466, 41454, 49442
1360	chromosome 9 open reading frame 91	374049	1515	363161	9503	17491, 25479, 33467, 41455, 49443
1361	chromosome X open reading frame 23	379682	1516	369004	9504	17492, 25480, 33468, 41456, 49444
1362	chromosome X open reading frame 59	313548	1517	324767	9505	17493, 25481, 33469, 41457, 49445
1363	chromosome X open reading frame 59	378660	1518	367929	9506	17494, 25482, 33470, 41458, 49446
1364	chromosome X open reading frame 59	397458	1519	380599	9507	17495, 25483, 33471, 41459, 49447
1365	chromosome X open reading frame 59	449698	1520	414151	9508	17496, 25484, 33472, 41460, 49448
1366	chromosome X open reading frame 66	370540	1521	359571	9509	17497, 25485, 33473, 41461, 49449
1367	chromosome X open reading frame 68	369529	1522	358542	9510	17498, 25486, 33474, 41462, 49450
1368	ciliary rootlet coiled-coil, rootletin	375541	1523	364691	9511	17499, 25487, 33475, 41463, 49451
1369	ciliary rootlet coiled-coil, rootletin	445545	1524	402626	9512	17500, 25488, 33476, 41464, 49452
1370	cingulin	271636	1525	271636	9513	17501, 25489, 33477, 41465, 49453
1371	cingulin	427934	1526	410836	9514	17502, 25490, 33478, 41466, 49454
1372	cingulin	502442	1527	422299	9515	17503, 25491, 33479, 41467, 49455
1373	cingulin	505188	1528	425532	9516	17504, 25492, 33480, 41468, 49456
1374	clarin 2	511148	1529	424711	9517	17505, 25493, 33481, 41469, 49457

1375	clarin 3	368671	1530	357660	9518	17506, 25494, 33482, 41470, 49458
1376	claudin 10	299339	1531	299339	9519	17507, 25495, 33483, 41471, 49459
1377	claudin 10	376855	1532	366051	9520	17508, 25496, 33484, 41472, 49460
1378	claudin 10	376873	1533	366069	9521	17509, 25497, 33485, 41473, 49461
1379	claudin 12	287916	1534	287916	9522	17510, 25498, 33486, 41474, 49462
1380	claudin 12	394604	1535	378102	9523	17511, 25499, 33487, 41475, 49463
1381	claudin 12	394605	1536	378103	9524	17512, 25500, 33488, 41476, 49464
1382	claudin 12	416322	1537	411399	9525	17513, 25501, 33489, 41477, 49465
1383	claudin 12	422604	1538	394444	9526	17514, 25502, 33490, 41478, 49466
1384	claudin 12	427904	1539	391062	9527	17515, 25503, 33491, 41479, 49467
1385	claudin 12	496677	1540	419053	9528	17516, 25504, 33492, 41480, 49468
1386	claudin 12	535571	1541	443476	9529	17517, 25505, 33493, 41481, 49469
1387	claudin 15	308344	1542	308870	9530	17518, 25506, 33494, 41482, 49470
1388	claudin 15	401528	1543	385300	9531	17519, 25507, 33495, 41483, 49471
1389	claudin 17	286808	1544	286808	9532	17520, 25508, 33496, 41484, 49472
1390	claudin 2	336803	1545	336571	9533	17521, 25509, 33497, 41485, 49473
1391	claudin 2	540876	1546	443230	9534	17522, 25510, 33498, 41486, 49474
1392	claudin 2	541806	1547	441283	9535	17523, 25511, 33499, 41487, 49475

1393	claudin 20	367165	1548	356133	9536	17524, 25512, 33500, 41488, 49476
1394	claudin 22	323319	1549	318113	9537	17525, 25513, 33501, 41489, 49477
1395	claudin 23	519106	1550	428780	9538	17526, 25514, 33502, 41490, 49478
1396	claudin 25	453129	1551	396304	9539	17527, 25515, 33503, 41491, 49479
1397	claudin 6	328796	1552	328674	9540	17528, 25516, 33504, 41492, 49480
1398	claudin 6	396925	1553	380131	9541	17529, 25517, 33505, 41493, 49481
1399	claudin 7	360325	1554	353475	9542	17530, 25518, 33506, 41494, 49482
1400	claudin 7	397317	1555	396638	9543	17531, 25519, 33507, 41495, 49483
1401	claudin 7	538261	1556	445131	9544	17532, 25520, 33508, 41496, 49484
1402	claudin 8	286809	1557	286809	9545	17533, 25521, 33509, 41497, 49485
1403	claudin 8	399899	1558	382783	9546	17534, 25522, 33510, 41498, 49486
1404	claudin 8	536721	1559	439258	9547	17535, 25523, 33511, 41499, 49487
1405	claudin 9	445369	1560	398017	9548	17536, 25524, 33512, 41500, 49488
1406	claudin domain containing 1	341181	1561	340247	9549	17537, 25525, 33513, 41501, 49489
1407	claudin domain containing 1	394180	1562	377734	9550	17538, 25526, 33514, 41502, 49490
1408	claudin domain containing 1	394181	1563	377735	9551	17539, 25527, 33515, 41503, 49491
1409	claudin domain containing 1	394185	1564	377739	9552	17540, 25528, 33516, 41504, 49492
1410	claudin domain containing 1	437922	1565	388457	9553	17541, 25529, 33517, 41505, 49493

1411	claudin domain containing 1	502299	1566	420913	9554	17542, 25530, 33518, 41506, 49494
1412	claudin domain containing 1	503004	1567	421226	9555	17543, 25531, 33519, 41507, 49495
1413	claudin domain containing 1	506575	1568	427042	9556	17544, 25532, 33520, 41508, 49496
1414	claudin domain containing 1	507944	1569	425204	9557	17545, 25533, 33521, 41509, 49497
1415	claudin domain containing 1	508071	1570	425256	9558	17546, 25534, 33522, 41510, 49498
1416	claudin domain containing 1	508659	1571	427658	9559	17547, 25535, 33523, 41511, 49499
1417	claudin domain containing 1	508902	1572	421413	9560	17548, 25536, 33524, 41512, 49500
1418	claudin domain containing 1	510545	1573	423590	9561	17549, 25537, 33525, 41513, 49501
1419	claudin domain containing 1	511081	1574	424669	9562	17550, 25538, 33526, 41514, 49502
1420	claudin domain containing 1	513130	1575	426079	9563	17551, 25539, 33527, 41515, 49503
1421	claudin domain containing 1	513287	1576	426869	9564	17552, 25540, 33528, 41516, 49504
1422	claudin domain containing 1	513452	1577	425539	9565	17553, 25541, 33529, 41517, 49505
1423	claudin domain containing 1	514537	1578	423151	9566	17554, 25542, 33530, 41518, 49506
1424	claudin domain containing 1	515620	1579	423093	9567	17555, 25543, 33531, 41519, 49507
1425	claudin domain containing 2	291715	1580	291715	9568	17556, 25544, 33532, 41520, 49508
1426	clavesin 1	325897	1581	325506	9569	17557, 25545, 33533, 41521, 49509
1427	clavesin 1	519846	1582	428402	9570	17558, 25546, 33534, 41522, 49510
1428	clavesin 1	522621	1583	428986	9571	17559, 25547, 33535, 41523, 49511

1429	clavesin 2	275162	1584	275162	9572	17560, 25548, 33536, 41524, 49512
1430	clavesin 2	368438	1585	357423	9573	17561, 25549, 33537, 41525, 49513
1431	cleft lip and palate associated transmembrane protein 1	337392	1586	336994	9574	17562, 25550, 33538, 41526, 49514
1432	cleft lip and palate associated transmembrane protein 1	347493	1587	270281	9575	17563, 25551, 33539, 41527, 49515
1433	cleft lip and palate associated transmembrane protein 1	541297	1588	442011	9576	17564, 25552, 33540, 41528, 49516
1434	cleft lip and palate associated transmembrane protein 1	546079	1589	443192	9577	17565, 25553, 33541, 41529, 49517
1435	ClpB caseinolytic peptidase B homolog (E. coli)	294053	1590	294053	9578	17566, 25554, 33542, 41530, 49518
1436	ClpB caseinolytic peptidase B homolog (E. coli)	437826	1591	407296	9579	17567, 25555, 33543, 41531, 49519
1437	ClpB caseinolytic peptidase B homolog (E. coli)	538039	1592	441518	9580	17568, 25556, 33544, 41532, 49520
1438	ClpB caseinolytic peptidase B homolog (E. coli)	543042	1593	439746	9581	17569, 25557, 33545, 41533, 49521
1439	ClpX caseinolytic peptidase X homolog (E. coli)	300107	1594	300107	9582	17570, 25558, 33546, 41534, 49522
1440	ClpX caseinolytic peptidase X homolog (E. coli)	546194	1595	440853	9583	17571, 25559, 33547, 41535, 49523
1441	coatomer protein complex, subunit gamma	314797	1596	325002	9584	17572, 25560, 33548, 41536, 49524
1442	coatomer protein complex, subunit zeta 1	262061	1597	262061	9585	17573, 25561, 33549, 41537, 49525
1443	coatomer protein complex, subunit zeta 1	416254	1598	388141	9586	17574, 25562, 33550, 41538, 49526
1444	coatomer protein complex, subunit zeta 1	455864	1599	410620	9587	17575, 25563, 33551, 41539, 49527
1445	coatomer protein complex, subunit zeta 1	552848	1600	449414	9588	17576, 25564, 33552, 41540, 49528

1446	coenzyme Q10 homolog A (S. cerevisiae)	308197	1601	312587	9589	17577, 25565, 33553, 41541, 49529
1447	coenzyme Q10 homolog A (S. cerevisiae)	433805	1602	407843	9590	17578, 25566, 33554, 41542, 49530
1448	coenzyme Q10 homolog A (S. cerevisiae)	546544	1603	446723	9591	17579, 25567, 33555, 41543, 49531
1449	coenzyme Q10 homolog A (S. cerevisiae)	551814	1604	447964	9592	17580, 25568, 33556, 41544, 49532
1450	coenzyme Q10 homolog B (S. cerevisiae)	263960	1605	263960	9593	17581, 25569, 33557, 41545, 49533
1451	coenzyme Q10 homolog B (S. cerevisiae)	409010	1606	387223	9594	17582, 25570, 33558, 41546, 49534
1452	coenzyme Q10 homolog B (S. cerevisiae)	545340	1607	442520	9595	17583, 25571, 33559, 41547, 49535
1453	coenzyme Q5 homolog, methyltransferase (S. cerevisiae)	288532	1608	288532	9596	17584, 25572, 33560, 41548, 49536
1454	coenzyme Q5 homolog, methyltransferase (S. cerevisiae)	302223	1609	302233	9597	17585, 25573, 33561, 41549, 49537
1455	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	238709	1610	238709	9598	17586, 25574, 33562, 41550, 49538
1456	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	334571	1611	333946	9599	17587, 25575, 33563, 41551, 49539
1457	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	394026	1612	377594	9600	17588, 25576, 33564, 41552, 49540
1458	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	545052	1613	439592	9601	17589, 25577, 33565, 41553, 49541
1459	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	554153	1614	451685	9602	17590, 25578, 33566, 41554, 49542
1460	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	554320	1615	451123	9603	17591, 25579, 33567, 41555, 49543

1461	coenzyme Q6 homolog, monooxygenase (S. cerevisiae)	555376	1616	450526	9604	17592, 25580, 33568, 41556, 49544
1462	coiled-coil domain containing 107	327351	1617	330327	9605	17593, 25581, 33569, 41557, 49545
1463	coiled-coil domain containing 107	378406	1618	367661	9606	17594, 25582, 33570, 41558, 49546
1464	coiled-coil domain containing 107	378407	1619	367662	9607	17595, 25583, 33571, 41559, 49547
1465	coiled-coil domain containing 107	378409	1620	367665	9608	17596, 25584, 33572, 41560, 49548
1466	coiled-coil domain containing 107	421582	1621	413003	9609	17597, 25585, 33573, 41561, 49549
1467	coiled-coil domain containing 107	426546	1622	414964	9610	17598, 25586, 33574, 41562, 49550
1468	coiled-coil domain containing 109B	394650	1623	378145	9611	17599, 25587, 33575, 41563, 49551
1469	coiled-coil domain containing 155	447857	1624	404220	9612	17600, 25588, 33576, 41564, 49552
1470	coiled-coil domain containing 167	373405	1625	362504	9613	17601, 25589, 33577, 41565, 49553
1471	coiled-coil domain containing 167	373408	1626	362507	9614	17602, 25590, 33578, 41566, 49554
1472	coiled-coil domain containing 167	411755	1627	407966	9615	17603, 25591, 33579, 41567, 49555
1473	coiled-coil domain containing 47	225726	1628	225726	9616	17604, 25592, 33580, 41568, 49556
1474	coiled-coil domain containing 47	403162	1629	384888	9617	17605, 25593, 33581, 41569, 49557
1475	coiled-coil domain containing 51	395694	1630	379047	9618	17606, 25594, 33582, 41570, 49558
1476	coiled-coil domain containing 51	395696	1631	379049	9619	17607, 25595, 33583, 41571, 49559
1477	coiled-coil domain containing 51	412398	1632	401194	9620	17608, 25596, 33584, 41572, 49560
1478	coiled-coil domain containing 51	438370	1633	408197	9621	17609, 25597, 33585, 41573, 49561

1479	coiled-coil domain containing 51	442740	1634	392898	9622	17610, 25598, 33586, 41574, 49562
1480	coiled-coil domain containing 51	446140	1635	409494	9623	17611, 25599, 33587, 41575, 49563
1481	coiled-coil domain containing 51	447018	1636	412300	9624	17612, 25600, 33588, 41576, 49564
1482	coiled-coil domain containing 56	328434	1637	354762	9625	17613, 25601, 33589, 41577, 49565
1483	coiled-coil domain containing 58	291458	1638	291458	9626	17614, 25602, 33590, 41578, 49566
1484	coiled-coil domain containing 90A	359495	1639	352475	9627	17615, 25603, 33591, 41579, 49567
1485	coiled-coil domain containing 90A	379170	1640	368468	9628	17616, 25604, 33592, 41580, 49568
1486	coiled-coil domain containing 90B	455220	1641	390990	9629	17617, 25605, 33593, 41581, 49569
1487	coiled-coil domain containing 90B	525503	1642	431424	9630	17618, 25606, 33594, 41582, 49570
1488	coiled-coil domain containing 90B	529611	1643	431345	9631	17619, 25607, 33595, 41583, 49571
1489	coiled-coil domain containing 90B	529689	1644	434724	9632	17620, 25608, 33596, 41584, 49572
1490	coiled-coil domain containing 91	306172	1645	305075	9633	17621, 25609, 33597, 41585, 49573
1491	coiled-coil domain containing 91	381256	1646	370655	9634	17622, 25610, 33598, 41586, 49574
1492	coiled-coil domain containing 91	381259	1647	370658	9635	17623, 25611, 33599, 41587, 49575
1493	coiled-coil domain containing 91	536442	1648	445660	9636	17624, 25612, 33600, 41588, 49576
1494	coiled-coil domain containing 91	538586	1649	440194	9637	17625, 25613, 33601, 41589, 49577
1495	coiled-coil domain containing 91	539107	1650	440513	9638	17626, 25614, 33602, 41590, 49578
1496	coiled-coil domain containing 91	543534	1651	446045	9639	17627, 25615, 33603, 41591, 49579

1497	coiled-coil domain containing 91	545336	1652	438040	9640	17628, 25616, 33604, 41592, 49580
1498	coiled-coil-helix-coiled-coil-helix domain containing 1	372833	1653	361923	9641	17629, 25617, 33605, 41593, 49581
1499	coiled-coil-helix-coiled-coil-helix domain containing 1	372837	1654	361928	9642	17630, 25618, 33606, 41594, 49582
1500	coiled-coil-helix-coiled-coil-helix domain containing 10	484558	1655	418428	9643	17631, 25619, 33607, 41595, 49583
1501	coiled-coil-helix-coiled-coil-helix domain containing 2	395422	1656	378812	9644	17632, 25620, 33608, 41596, 49584
1502	coiled-coil-helix-coiled-coil-helix domain containing 4	295767	1657	295767	9645	17633, 25621, 33609, 41597, 49585
1503	coiled-coil-helix-coiled-coil-helix domain containing 4	396914	1658	380122	9646	17634, 25622, 33610, 41598, 49586
1504	complement component 3a receptor 1	307637	1659	302079	9647	17635, 25623, 33611, 41599, 49587
1505	complement component 3a receptor 1	546241	1660	444500	9648	17636, 25624, 33612, 41600, 49588
1506	complement component 5a receptor 1	355085	1661	347197	9649	17637, 25625, 33613, 41601, 49589
1507	complexin 3	395018	1662	378464	9650	17638, 25626, 33614, 41602, 49590
1508	connector enhancer of kinase suppressor of Ras 1	361530	1663	354609	9651	17639, 25627, 33615, 41603, 49591
1509	connector enhancer of kinase suppressor of Ras 1	374253	1664	363371	9652	17640, 25628, 33616, 41604, 49592
1510	connector enhancer of kinase suppressor of Ras 1	422547	1665	390945	9653	17641, 25629, 33617, 41605, 49593
1511	contactin associated protein 1	264638	1666	264638	9654	17642, 25630, 33618, 41606, 49594
1512	contactin associated protein-like 3B	276974	1667	276974	9655	17643, 25631, 33619, 41607, 49595
1513	contactin associated protein-like 3B	341990	1668	340890	9656	17644, 25632, 33620, 41608, 49596
1514	contactin associated protein-like 3B	377555	1669	366778	9657	17645, 25633, 33621, 41609, 49597

1515	contactin associated protein-like 3B	377561	1670	366784	9658	17646, 25634, 33622, 41610, 49598
1516	contactin associated protein-like 3B	377564	1671	366787	9659	17647, 25635, 33623, 41611, 49599
1517	contactin associated protein-like 3B	403166	1672	385153	9660	17648, 25636, 33624, 41612, 49600
1518	contactin associated protein-like 5	431078	1673	399013	9661	17649, 25637, 33625, 41613, 49601
1519	corin, serine peptidase	273857	1674	273857	9662	17650, 25638, 33626, 41614, 49602
1520	corin, serine peptidase	502252	1675	424212	9663	17651, 25639, 33627, 41615, 49603
1521	corin, serine peptidase	505909	1676	425401	9664	17652, 25640, 33628, 41616, 49604
1522	cornichon homolog (Drosophila)	216416	1677	216416	9665	17653, 25641, 33629, 41617, 49605
1523	cornichon homolog (Drosophila)	395573	1678	378940	9666	17654, 25642, 33630, 41618, 49606
1524	cornichon homolog 2 (Drosophila)	311445	1679	310003	9667	17655, 25643, 33631, 41619, 49607
1525	cornichon homolog 3 (Drosophila)	272133	1680	272133	9668	17656, 25644, 33632, 41620, 49608
1526	cornichon homolog 4 (Drosophila)	366856	1681	355821	9669	17657, 25645, 33633, 41621, 49609
1527	cornichon homolog 4 (Drosophila)	366857	1682	355822	9670	17658, 25646, 33634, 41622, 49610
1528	cornichon homolog 4 (Drosophila)	366858	1683	355823	9671	17659, 25647, 33635, 41623, 49611
1529	cornichon homolog 4 (Drosophila)	465271	1684	420443	9672	17660, 25648, 33636, 41624, 49612
1530	cortexin 3	379445	1685	368758	9673	17661, 25649, 33637, 41625, 49613
1531	cortexin 3	395322	1686	378732	9674	17662, 25650, 33638, 41626, 49614
1532	corticotropin-releasing factor receptor 1 isoform 1 precursor	547258	1687	448155	9675	17663, 25651, 33639, 41627, 49615

1533	corticotropin-releasing factor receptor 1 isoform 1 precursor	548394	1688	449671	9676	17664, 25652, 33640, 41628, 49616
1534	corticotropin-releasing factor receptor 1 isoform 1 precursor	548791	1689	448783	9677	17665, 25653, 33641, 41629, 49617
1535	corticotropin-releasing factor receptor 1 isoform 1 precursor	550606	1690	448894	9678	17666, 25654, 33642, 41630, 49618
1536	corticotropin-releasing factor receptor 1 isoform 1 precursor	551221	1691	446568	9679	17667, 25655, 33643, 41631, 49619
1537	corticotropin-releasing factor receptor 1 isoform 1 precursor	551817	1692	447617	9680	17668, 25656, 33644, 41632, 49620
1538	corticotropin-releasing factor receptor 1 isoform 1 precursor	552616	1693	448216	9681	17669, 25657, 33645, 41633, 49621
1539	corticotropin-releasing factor receptor 1 isoform 1 precursor	552724	1694	448734	9682	17670, 25658, 33646, 41634, 49622
1540	COX assembly mitochondrial protein homolog (S. cerevisiae)	466830	1695	418348	9683	17671, 25659, 33647, 41635, 49623
1541	COX16 cytochrome c oxidase assembly homolog (S. cerevisiae)	389912	1696	374562	9684	17672, 25660, 33648, 41636, 49624
1542	COX18 cytochrome c oxidase assembly homolog (S. cerevisiae)	295890	1697	295890	9685	17673, 25661, 33649, 41637, 49625
1543	COX18 cytochrome c oxidase assembly homolog (S. cerevisiae)	507544	1698	425261	9686	17674, 25662, 33650, 41638, 49626
1544	CTAGE family, member 4	486333	1699	419539	9687	17675, 25663, 33651, 41639, 49627
1545	CTAGE family, member 8	487179	1700	417289	9688	17676, 25664, 33652, 41640, 49628
1546	CTAGE family, member 9	314099	1701	395587	9689	17677, 25665, 33653, 41641, 49629

1547	CTD nuclear envelope phosphatase 1	318988	1702	321732	9690	17678, 25666, 33654, 41642, 49630
1548	CTD nuclear envelope phosphatase 1	574322	1703	460683	9691	17679, 25667, 33655, 41643, 49631
1549	C-type lectin domain family 1, member B	298527	1704	298527	9692	17680, 25668, 33656, 41644, 49632
1550	C-type lectin domain family 1, member B	348658	1705	327169	9693	17681, 25669, 33657, 41645, 49633
1551	C-type lectin domain family 1, member B	398939	1706	381912	9694	17682, 25670, 33658, 41646, 49634
1552	C-type lectin domain family 1, member B	428126	1707	406338	9695	17683, 25671, 33659, 41647, 49635
1553	C-type lectin domain family 12, member B	338896	1708	344563	9696	17684, 25672, 33660, 41648, 49636
1554	C-type lectin domain family 12, member B	396502	1709	379759	9697	17685, 25673, 33661, 41649, 49637
1555	C-type lectin domain family 14, member A	342213	1710	353013	9698	17686, 25674, 33662, 41650, 49638
1556	C-type lectin domain family 14, member A	546356	1711	443662	9699	17687, 25675, 33663, 41651, 49639
1557	C-type lectin domain family 17, member A	397439	1712	380581	9700	17688, 25676, 33664, 41652, 49640
1558	C-type lectin domain family 17, member A	417570	1713	393719	9701	17689, 25677, 33665, 41653, 49641
1559	C-type lectin domain family 17, member A	547437	1714	450065	9702	17690, 25678, 33666, 41654, 49642
1560	C-type lectin domain family 4, member F	272367	1715	272367	9703	17691, 25679, 33667, 41655, 49643
1561	C-type lectin domain family 4, member G	328853	1716	327599	9704	17692, 25680, 33668, 41656, 49644
1562	C-type lectin domain family 4, member G	381308	1717	370709	9705	17693, 25681, 33669, 41657, 49645
1563	C-type lectin domain family 9, member A	355819	1718	348074	9706	17694, 25682, 33670, 41658, 49646
1564	C-type lectin-like 1	327839	1719	331766	9707	17695, 25683, 33671, 41659, 49647

1565	C-type lectin-like 1	540988	1720	444947	9708	17696, 25684, 33672, 41660, 49648
1566	CUB and zona pellucida-like domains 1	338948	1721	340905	9709	17697, 25685, 33673, 41661, 49649
1567	CUB and zona pellucida-like domains 1	368899	1722	357895	9710	17698, 25686, 33674, 41662, 49650
1568	CUB and zona pellucida-like domains 1	368900	1723	357896	9711	17699, 25687, 33675, 41663, 49651
1569	CUB and zona pellucida-like domains 1	368901	1724	357897	9712	17700, 25688, 33676, 41664, 49652
1570	CUB and zona pellucida-like domains 1	368904	1725	357900	9713	17701, 25689, 33677, 41665, 49653
1571	cutaneous T-cell lymphoma-associated antigen 1	391403	1726	375220	9714	17702, 25690, 33678, 41666, 49654
1572	Cutaneous T-cell lymphoma-associated antigen 1	525417	1727	436900	9715	17703, 25691, 33679, 41667, 49655
1573	cut-like homeobox 1	292535	1728	292535	9716	17704, 25692, 33680, 41668, 49656
1574	cut-like homeobox 1	292538	1729	292538	9717	17705, 25693, 33681, 41669, 49657
1575	cut-like homeobox 1	360264	1730	353401	9718	17706, 25694, 33682, 41670, 49658
1576	cut-like homeobox 1	393824	1731	377410	9719	17707, 25695, 33683, 41671, 49659
1577	cut-like homeobox 1	425244	1732	409745	9720	17708, 25696, 33684, 41672, 49660
1578	cut-like homeobox 1	437600	1733	414091	9721	17709, 25697, 33685, 41673, 49661
1579	cut-like homeobox 1	546411	1734	450125	9722	17710, 25698, 33686, 41674, 49662
1580	cut-like homeobox 1	547394	1735	449371	9723	17711, 25699, 33687, 41675, 49663
1581	cut-like homeobox 1	549414	1736	446630	9724	17712, 25700, 33688, 41676, 49664
1582	cut-like homeobox 1	550008	1737	447373	9725	17713, 25701, 33689, 41677, 49665

1583	cut-like homeobox 1	556210	1738	451558	9726	17714, 25702, 33690, 41678, 49666
1584	cut-like homeobox 1	558836	1739	453088	9727	17715, 25703, 33691, 41679, 49667
1585	cut-like homeobox 1	560541	1740	453533	9728	17716, 25704, 33692, 41680, 49668
1586	CXXC finger protein 11	343216	1741	345374	9729	17717, 25705, 33693, 41681, 49669
1587	cyclic nucleotide gated channel alpha 4	379936	1742	369268	9730	17718, 25706, 33694, 41682, 49670
1588	cyclin J-like	257536	1743	257536	9731	17719, 25707, 33695, 41683, 49671
1589	cyclin J-like	393977	1744	377547	9732	17720, 25708, 33696, 41684, 49672
1590	cyclin J-like	505287	1745	444778	9733	17721, 25709, 33697, 41685, 49673
1591	cyclin J-like	519673	1746	427960	9734	17722, 25710, 33698, 41686, 49674
1592	cyclin J-like	541762	1747	446367	9735	17723, 25711, 33699, 41687, 49675
1593	cyclin Pas1/PHO80 domain containing 1	360507	1748	353698	9736	17724, 25712, 33700, 41688, 49676
1594	cyclin Pas1/PHO80 domain containing 1	409789	1749	386277	9737	17725, 25713, 33701, 41689, 49677
1595	cyclin Pas1/PHO80 domain containing 1	453038	1750	410109	9738	17726, 25714, 33702, 41690, 49678
1596	cyclin-dependent kinase 14	265741	1751	265741	9739	17727, 25715, 33703, 41691, 49679
1597	cyclin-dependent kinase 14	380050	1752	369390	9740	17728, 25716, 33704, 41692, 49680
1598	cyclin-dependent kinase 14	436577	1753	398936	9741	17729, 25717, 33705, 41693, 49681
1599	cyclin-dependent kinase 20	286878	1754	286878	9742	17730, 25718, 33706, 41694, 49682
1600	cyclin-dependent kinase 20	325303	1755	322343	9743	17731, 25719, 33707, 41695, 49683

1601	cyclin-dependent kinase 20	336654	1756	338975	9744	17732, 25720, 33708, 41696, 49684
1602	cyclin-dependent kinase 20	375871	1757	365031	9745	17733, 25721, 33709, 41697, 49685
1603	cyclin-dependent kinase 20	375883	1758	365043	9746	17734, 25722, 33710, 41698, 49686
1604	cysteine/tyrosine-rich 1	299340	1759	299340	9747	17735, 25723, 33711, 41699, 49687
1605	cysteine/tyrosine-rich 1	435845	1760	401313	9748	17736, 25724, 33712, 41700, 49688
1606	cysteine-rich hydrophobic domain 1	373502	1761	362601	9749	17737, 25725, 33713, 41701, 49689
1607	cysteine-rich hydrophobic domain 1	373504	1762	362603	9750	17738, 25726, 33714, 41702, 49690
1608	cysteine-rich PAK1 inhibitor	324803	1763	323978	9751	17739, 25727, 33715, 41703, 49691
1609	cysteine-rich PAK1 inhibitor	382944	1764	372402	9752	17740, 25728, 33716, 41704, 49692
1610	cytochrome b reductase 1	321348	1765	319141	9753	17741, 25729, 33717, 41705, 49693
1611	cytochrome b reductase 1	375252	1766	364401	9754	17742, 25730, 33718, 41706, 49694
1612	cytochrome b reductase 1	409484	1767	386739	9755	17743, 25731, 33719, 41707, 49695
1613	cytochrome b, ascorbate dependent 3	294072	1768	294072	9756	17744, 25732, 33720, 41708, 49696
1614	cytochrome b, ascorbate dependent 3	426130	1769	398979	9757	17745, 25733, 33721, 41709, 49697
1615	cytochrome b, ascorbate dependent 3	536915	1770	437390	9758	17746, 25734, 33722, 41710, 49698
1616	cytochrome b, ascorbate dependent 3	537364	1771	438725	9759	17747, 25735, 33723, 41711, 49699
1617	cytochrome b, ascorbate dependent 3	537680	1772	439702	9760	17748, 25736, 33724, 41712, 49700
1618	cytochrome b, ascorbate dependent 3	539128	1773	443005	9761	17749, 25737, 33725, 41713, 49701

1619	cytochrome b, ascorbate dependent 3	542361	1774	443321	9762	17750, 25738, 33726, 41714, 49702
1620	cytochrome b, ascorbate dependent 3	545361	1775	437819	9763	17751, 25739, 33727, 41715, 49703
1621	cytochrome b5 reductase 1	367249	1776	356218	9764	17752, 25740, 33728, 41716, 49704
1622	cytochrome b5 reductase 1	446185	1777	396382	9765	17753, 25741, 33729, 41717, 49705
1623	cytochrome b-561 domain containing 1	310611	1778	309324	9766	17754, 25742, 33730, 41718, 49706
1624	cytochrome b-561 domain containing 1	369868	1779	358884	9767	17755, 25743, 33731, 41719, 49707
1625	cytochrome b-561 domain containing 1	393709	1780	377312	9768	17756, 25744, 33732, 41720, 49708
1626	cytochrome b-561 domain containing 1	420578	1781	413530	9769	17757, 25745, 33733, 41721, 49709
1627	cytochrome b-561 domain containing 1	430195	1782	416898	9770	17758, 25746, 33734, 41722, 49710
1628	cytochrome C oxidase assembly factor 5	328709	1783	330730	9771	17759, 25747, 33735, 41723, 49711
1629	cytochrome c oxidase subunit VIa polypeptide 1 pseudogene 2	423336	1784	404078	9772	17760, 25748, 33736, 41724, 49712
1630	cytochrome c oxidase subunit VIa polypeptide 2	287490	1785	287490	9773	17761, 25749, 33737, 41725, 49713
1631	cytochrome c oxidase subunit VIb polypeptide 2 (testis)	326529	1786	320672	9774	17762, 25750, 33738, 41726, 49714
1632	cytochrome c oxidase subunit VIIb	481445	1787	417656	9775	17763, 25751, 33739, 41727, 49715
1633	cytochrome c oxidase subunit VIIIA (ubiquitous)	314133	1788	321260	9776	17764, 25752, 33740, 41728, 49716
1634	cytochrome c oxidase subunit VIIIC	342144	1789	340568	9777	17765, 25753, 33741, 41729, 49717
1635	cytochrome P450 family 11 subfamily A polypeptide 1	358632	1790	351455	9778	17766, 25754, 33742, 41730, 49718
1636	cytochrome P450, family 11, subfamily A, polypeptide 1	268053	1791	268053	9779	17767, 25755, 33743, 41731, 49719

1637	cytochrome P450, family 11, subfamily A, polypeptide 1	419019	1792	405488	9780	17768, 25756, 33744, 41732, 49720
1638	cytochrome P450, family 11, subfamily A, polypeptide 1	435365	1793	391081	9781	17769, 25757, 33745, 41733, 49721
1639	cytochrome P450, family 11, subfamily A, polypeptide 1	452422	1794	391041	9782	17770, 25758, 33746, 41734, 49722
1640	cytochrome P450, family 11, subfamily A, polypeptide 1	541301	1795	439750	9783	17771, 25759, 33747, 41735, 49723
1641	cytochrome P450, family 2, subfamily C, polypeptide 18	285979	1796	285979	9784	17772, 25760, 33748, 41736, 49724
1642	cytochrome P450, family 2, subfamily C, polypeptide 18	339022	1797	341293	9785	17773, 25761, 33749, 41737, 49725
1643	cytochrome P450, family 2, subfamily W, polypeptide 1	308919	1798	310149	9786	17774, 25762, 33750, 41738, 49726
1644	cytochrome P450, family 20, subfamily A, polypeptide 1	356079	1799	348380	9787	17775, 25763, 33751, 41739, 49727
1645	cytochrome P450, family 20, subfamily A, polypeptide 1	421618	1800	397114	9788	17776, 25764, 33752, 41740, 49728
1646	cytochrome P450, family 26, subfamily B, polypeptide 1	1146	1801	1146	9789	17777, 25765, 33753, 41741, 49729, 56080, 56113
1647	cytochrome P450, family 26, subfamily B, polypeptide 1	546307	1802	443304	9790	17778, 25766, 33754, 41742, 49730
1648	cytochrome P450, family 4, subfamily A, polypeptide 22	294337	1803	294337	9791	17779, 25767, 33755, 41743, 49731
1649	cytochrome P450, family 4, subfamily A, polypeptide 22	371890	1804	360957	9792	17780, 25768, 33756, 41744, 49732
1650	cytochrome P450, family 4, subfamily A, polypeptide 22	371891	1805	360958	9793	17781, 25769, 33757, 41745, 49733
1651	cytochrome P450, family 4, subfamily B, polypeptide 1	271153	1806	271153	9794	17782, 25770, 33758, 41746, 49734
1652	cytochrome P450, family 4, subfamily B, polypeptide 1	371919	1807	360987	9795	17783, 25771, 33759, 41747, 49735
1653	cytochrome P450, family 4, subfamily B, polypeptide 1	371923	1808	360991	9796	17784, 25772, 33760, 41748, 49736

1654	cytochrome P450, family 4, subfamily F, polypeptide 2	11989	1809	11989	9797	17785, 25773, 33761, 41749, 49737, 56081, 56114
1655	cytochrome P450, family 4, subfamily F, polypeptide 2	221700	1810	221700	9798	17786, 25774, 33762, 41750, 49738
1656	cytochrome P450, family 4, subfamily F, polypeptide 2	392846	1811	376588	9799	17787, 25775, 33763, 41751, 49739
1657	cytochrome P450, family 4, subfamily X, polypeptide 1	371901	1812	360968	9800	17788, 25776, 33764, 41752, 49740
1658	cytochrome P450, family 4, subfamily X, polypeptide 1	538609	1813	445965	9801	17789, 25777, 33765, 41753, 49741
1659	cytochrome P450, family 4, subfamily Z, polypeptide 1	334194	1814	334246	9802	17790, 25778, 33766, 41754, 49742
1660	cytoskeleton-associated protein 4	378026	1815	367265	9803	17791, 25779, 33767, 41755, 49743
1661	dachsous 1 (Drosophila)	299441	1816	299441	9804	17792, 25780, 33768, 41756, 49744
1662	dachsous 1 (Drosophila)	442153	1817	390601	9805	17793, 25781, 33769, 41757, 49745
1663	DC-STAMP domain containing 1	295542	1818	295542	9806	17794, 25782, 33770, 41758, 49746
1664	DC-STAMP domain containing 1	368419	1819	357404	9807	17795, 25783, 33771, 41759, 49747
1665	DC-STAMP domain containing 1	392480	1820	376271	9808	17796, 25784, 33772, 41760, 49748
1666	DC-STAMP domain containing 1	423025	1821	387369	9809	17797, 25785, 33773, 41761, 49749
1667	DC-STAMP domain containing 2	295536	1822	295536	9810	17798, 25786, 33774, 41762, 49750
1668	DC-STAMP domain containing 2	368424	1823	357409	9811	17799, 25787, 33775, 41763, 49751
1669	DDB1 and CUL4 associated factor 17	375255	1824	364404	9812	17800, 25788, 33776, 41764, 49752
1670	DDB1 and CUL4 associated factor 17	429466	1825	389290	9813	17801, 25789, 33777, 41765, 49753
1671	DDB1 and CUL4 associated factor 17	539783	1826	442238	9814	17802, 25790, 33778, 41766, 49754

1672	DDRGK domain containing 1	354488	1827	346483	9815	17803, 25791, 33779, 41767, 49755
1673	DDRGK domain containing 1	380201	1828	369548	9816	17804, 25792, 33780, 41768, 49756
1674	DDRGK domain containing 1	380213	1829	369561	9817	17805, 25793, 33781, 41769, 49757
1675	death associated protein-like 1	309950	1830	309538	9818	17806, 25794, 33782, 41770, 49758
1676	dehydrogenase E1 and transketolase domain containing 1	263035	1831	263035	9819	17807, 25795, 33783, 41771, 49759
1677	dehydrogenase E1 and transketolase domain containing 1	415935	1832	400625	9820	17808, 25796, 33784, 41772, 49760
1678	dehydrogenase E1 and transketolase domain containing 1	437298	1833	388163	9821	17809, 25797, 33785, 41773, 49761
1679	dehydrogenase E1 and transketolase domain containing 1	448829	1834	398482	9822	17810, 25798, 33786, 41774, 49762
1680	dehydrogenase/reductase (SDR family) member 1	288111	1835	288111	9823	17811, 25799, 33787, 41775, 49763
1681	dehydrogenase/reductase (SDR family) member 1	396813	1836	380027	9824	17812, 25800, 33788, 41776, 49764
1682	dehydrogenase/reductase (SDR family) member 7B	346603	1837	320352	9825	17813, 25801, 33789, 41777, 49765
1683	dehydrogenase/reductase (SDR family) member 7B	395511	1838	378887	9826	17814, 25802, 33790, 41778, 49766
1684	deleted in liver cancer 1	276297	1839	276297	9827	17815, 25803, 33791, 41779, 49767
1685	deleted in liver cancer 1	316609	1840	321034	9828	17816, 25804, 33792, 41780, 49768
1686	deleted in liver cancer 1	358919	1841	351797	9829	17817, 25805, 33793, 41781, 49769
1687	delta(4)-desaturase, sphingolipid 1	323699	1842	316476	9830	17818, 25806, 33794, 41782, 49770
1688	delta(4)-desaturase, sphingolipid 1	391877	1843	375749	9831	17819, 25807, 33795, 41783, 49771
1689	delta(4)-desaturase, sphingolipid 1	415210	1844	400545	9832	17820, 25808, 33796, 41784, 49772

1690	delta-like 2 homolog (Drosophila)	357338	1845	349893	9833	17821, 25809, 33797, 41785, 49773
1691	delta-like 2 homolog (Drosophila)	372485	1846	361563	9834	17822, 25810, 33798, 41786, 49774
1692	delta-like 2 homolog (Drosophila)	372488	1847	361566	9835	17823, 25811, 33799, 41787, 49775
1693	delta-like 2 homolog (Drosophila)	372496	1848	361574	9836	17824, 25812, 33800, 41788, 49776
1694	delta-like 2 homolog (Drosophila)	414245	1849	398906	9837	17825, 25813, 33801, 41789, 49777
1695	delta-like 2 homolog (Drosophila)	430324	1850	399829	9838	17826, 25814, 33802, 41790, 49778
1696	DENN/MADD domain containing 4C	307015	1851	305795	9839	17827, 25815, 33803, 41791, 49779
1697	DENN/MADD domain containing 4C	361024	1852	354301	9840	17828, 25816, 33804, 41792, 49780
1698	DENN/MADD domain containing 4C	380424	1853	369789	9841	17829, 25817, 33805, 41793, 49781
1699	DENN/MADD domain containing 4C	380427	1854	369792	9842	17830, 25818, 33806, 41794, 49782
1700	DENN/MADD domain containing 4C	380432	1855	369797	9843	17831, 25819, 33807, 41795, 49783
1701	DENN/MADD domain containing 4C	380437	1856	369802	9844	17832, 25820, 33808, 41796, 49784
1702	DENN/MADD domain containing 4C	453857	1857	394407	9845	17833, 25821, 33809, 41797, 49785
1703	DENN/MADD domain containing 4C	540671	1858	443804	9846	17834, 25822, 33810, 41798, 49786
1704	DENN/MADD domain containing 5A	328194	1859	328524	9847	17835, 25823, 33811, 41799, 49787
1705	DENN/MADD domain containing 5A	527700	1860	432549	9848	17836, 25824, 33812, 41800, 49788
1706	DENN/MADD domain containing 5A	530044	1861	435866	9849	17837, 25825, 33813, 41801, 49789
1707	DENN/MADD domain containing 5B	306833	1862	306482	9850	17838, 25826, 33814, 41802, 49790

1708	DENN/MADD domain containing 5B	354285	1863	346238	9851	17839, 25827, 33815, 41803, 49791
1709	DENN/MADD domain containing 5B	389082	1864	373734	9852	17840, 25828, 33816, 41804, 49792
1710	DENN/MADD domain containing 5B	536562	1865	444889	9853	17841, 25829, 33817, 41805, 49793
1711	dephospho-CoA kinase domain containing	310604	1866	308515	9854	17842, 25830, 33818, 41806, 49794
1712	dephospho-CoA kinase domain containing	342350	1867	341504	9855	17843, 25831, 33819, 41807, 49795
1713	dephospho-CoA kinase domain containing	452796	1868	413483	9856	17844, 25832, 33820, 41808, 49796
1714	Der1-like domain family, member 1	259512	1869	259512	9857	17845, 25833, 33821, 41809, 49797
1715	Der1-like domain family, member 1	405944	1870	384289	9858	17846, 25834, 33822, 41810, 49798
1716	Der1-like domain family, member 1	419562	1871	389965	9859	17847, 25835, 33823, 41811, 49799
1717	Der1-like domain family, member 2	158771	1872	158771	9860	17848, 25836, 33824, 41812, 49800, 56082, 56115
1718	Der1-like domain family, member 3	318109	1873	315303	9861	17849, 25837, 33825, 41813, 49801
1719	Der1-like domain family, member 3	476077	1874	419399	9862	17850, 25838, 33826, 41814, 49802
1720	derlin 3	406855	1875	384744	9863	17851, 25839, 33827, 41815, 49803
1721	diacylglycerol kinase zeta	343674	1876	343065	9864	17852, 25840, 33828, 41816, 49804
1722	diacylglycerol kinase zeta	527911	1877	436291	9865	17853, 25841, 33829, 41817, 49805
1723	diacylglycerol kinase, eta	261491	1878	261491	9866	17854, 25842, 33830, 41818, 49806
1724	diacylglycerol kinase, eta	337343	1879	337572	9867	17855, 25843, 33831, 41819, 49807
1725	diacylglycerol kinase, eta	379274	1880	368576	9868	17856, 25844, 33832, 41820, 49808

1726	diacylglycerol kinase, eta	536612	1881	445114	9869	17857, 25845, 33833, 41821, 49809
1727	diacylglycerol kinase, eta	538674	1882	441308	9870	17858, 25846, 33834, 41822, 49810
1728	diacylglycerol kinase, eta	540693	1883	440823	9871	17859, 25847, 33835, 41823, 49811
1729	diacylglycerol kinase, zeta	318201	1884	320340	9872	17860, 25848, 33836, 41824, 49812
1730	diacylglycerol kinase, zeta	395574	1885	378941	9873	17861, 25849, 33837, 41825, 49813
1731	diacylglycerol kinase, zeta	421244	1886	391021	9874	17862, 25850, 33838, 41826, 49814
1732	diacylglycerol kinase, zeta	454345	1887	412178	9875	17863, 25851, 33839, 41827, 49815
1733	diacylglycerol kinase, zeta	456247	1888	395684	9876	17864, 25852, 33840, 41828, 49816
1734	diacylglycerol kinase, zeta	543978	1889	438417	9877	17865, 25853, 33841, 41829, 49817
1735	diacylglycerol O-acyltransferase 2-like 6	333026	1890	328036	9878	17866, 25854, 33842, 41830, 49818
1736	diazepam binding inhibitor (GABA receptor modulator acyl-CoA binding protein)	393103	1891	376815	9879	17867, 25855, 33843, 41831, 49819
1737	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	311521	1892	311117	9880	17868, 25856, 33844, 41832, 49820
1738	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	355857	1893	348116	9881	17869, 25857, 33845, 41833, 49821
1739	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	409094	1894	386486	9882	17870, 25858, 33846, 41834, 49822
1740	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	535617	1895	442917	9883	17871, 25859, 33847, 41835, 49823

1741	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	535757	1896	439012	9884	17872, 25860, 33848, 41836, 49824
1742	diazepam binding inhibitor (GABA receptor modulator, acyl-CoA binding protein)	542275	1897	440698	9885	17873, 25861, 33849, 41837, 49825
1743	dihydrofolate reductase-like 1	314636	1898	319170	9886	17874, 25862, 33850, 41838, 49826
1744	dihydrofolate reductase-like 1	394221	1899	377768	9887	17875, 25863, 33851, 41839, 49827
1745	dihydrofolate reductase-like 1	461173	1900	418415	9888	17876, 25864, 33852, 41840, 49828
1746	dihydrofolate reductase-like 1	496983	1901	420810	9889	17877, 25865, 33853, 41841, 49829
1747	DIRAS family, GTP-binding RAS-like 1	323469	1902	325836	9890	17878, 25866, 33854, 41842, 49830
1748	DIRAS family, GTP-binding RAS-like 2	375765	1903	364919	9891	17879, 25867, 33855, 41843, 49831
1749	DIRAS family, GTP-binding RAS-like 3	370981	1904	360020	9892	17880, 25868, 33856, 41844, 49832
1750	DIRAS family, GTP-binding RAS-like 3	395201	1905	378627	9893	17881, 25869, 33857, 41845, 49833
1751	discoidin domain receptor tyrosine kinase 1	413044	1906	396609	9894	17882, 25870, 33858, 41846, 49834
1752	discoidin domain receptor tyrosine kinase 1	413115	1907	414878	9895	17883, 25871, 33859, 41847, 49835
1753	discoidin domain receptor tyrosine kinase 1	414077	1908	395405	9896	17884, 25872, 33860, 41848, 49836
1754	discoidin domain receptor tyrosine kinase 1	421499	1909	402013	9897	17885, 25873, 33861, 41849, 49837
1755	discoidin domain receptor tyrosine kinase 1	421672	1910	403454	9898	17886, 25874, 33862, 41850, 49838
1756	discoidin domain receptor tyrosine kinase 1	422275	1911	393056	9899	17887, 25875, 33863, 41851, 49839
1757	discoidin domain receptor tyrosine kinase 1	422628	1912	396187	9900	17888, 25876, 33864, 41852, 49840

1758	discoidin domain receptor tyrosine kinase 1	426303	1913	401304	9901	17889, 25877, 33865, 41853, 49841
1759	discoidin domain receptor tyrosine kinase 1	429955	1914	402647	9902	17890, 25878, 33866, 41854, 49842
1760	discoidin domain receptor tyrosine kinase 1	430486	1915	404054	9903	17891, 25879, 33867, 41855, 49843
1761	discoidin domain receptor tyrosine kinase 1	433322	1916	398904	9904	17892, 25880, 33868, 41856, 49844
1762	discoidin domain receptor tyrosine kinase 1	433393	1917	389085	9905	17893, 25881, 33869, 41857, 49845
1763	discoidin domain receptor tyrosine kinase 1	434428	1918	388866	9906	17894, 25882, 33870, 41858, 49846
1764	discoidin domain receptor tyrosine kinase 1	439604	1919	398343	9907	17895, 25883, 33871, 41859, 49847
1765	discoidin domain receptor tyrosine kinase 1	439772	1920	402992	9908	17896, 25884, 33872, 41860, 49848
1766	discoidin domain receptor tyrosine kinase 1	440427	1921	414928	9909	17897, 25885, 33873, 41861, 49849
1767	discoidin domain receptor tyrosine kinase 1	444160	1922	391895	9910	17898, 25886, 33874, 41862, 49850
1768	discoidin domain receptor tyrosine kinase 1	445749	1923	395136	9911	17899, 25887, 33875, 41863, 49851
1769	discoidin domain receptor tyrosine kinase 1	448537	1924	412396	9912	17900, 25888, 33876, 41864, 49852
1770	discoidin domain receptor tyrosine kinase 1	454377	1925	406865	9913	17901, 25889, 33877, 41865, 49853
1771	discoidin domain receptor tyrosine kinase 1	458576	1926	406688	9914	17902, 25890, 33878, 41866, 49854
1772	discoidin domain receptor tyrosine kinase 1	549169	1927	447523	9915	17903, 25891, 33879, 41867, 49855
1773	discoidin, CUB and LCCL domain containing 1	296955	1928	296955	9916	17904, 25892, 33880, 41868, 49856
1774	discoidin, CUB and LCCL domain containing 1	338728	1929	342422	9917	17905, 25893, 33881, 41869, 49857
1775	discoidin, CUB and LCCL domain containing 1	368503	1930	357489	9918	17906, 25894, 33882, 41870, 49858

1776	discoidin, CUB and LCCL domain containing 1	392504	1931	376292	9919	17907, 25895, 33883, 41871, 49859
1777	discoidin, CUB and LCCL domain containing 2	326840	1932	321573	9920	17908, 25896, 33884, 41872, 49860
1778	discoidin, CUB and LCCL domain containing 2	326857	1933	321646	9921	17909, 25897, 33885, 41873, 49861
1779	discoidin, CUB and LCCL domain containing 2	404023	1934	385656	9922	17910, 25898, 33886, 41874, 49862
1780	discs large (Drosophila) homolog-associated protein 1	400145	1935	383010	9923	17911, 25899, 33887, 41875, 49863
1781	discs large (Drosophila) homolog-associated protein 1	400150	1936	383014	9924	17912, 25900, 33888, 41876, 49864
1782	discs large (Drosophila) homolog-associated protein 1	400155	1937	383019	9925	17913, 25901, 33889, 41877, 49865
1783	discs large (Drosophila) homolog-associated protein 1	581527	1938	463864	9926	17914, 25902, 33890, 41878, 49866
1784	discs, large (Drosophila) homolog-associated protein 1	315677	1939	316377	9927	17915, 25903, 33891, 41879, 49867
1785	discs, large (Drosophila) homolog-associated protein 1	400147	1940	383011	9928	17916, 25904, 33892, 41880, 49868
1786	discs, large (Drosophila) homolog-associated protein 1	515196	1941	445973	9929	17917, 25905, 33893, 41881, 49869
1787	discs, large (Drosophila) homolog-associated protein 1	534970	1942	437817	9930	17918, 25906, 33894, 41882, 49870
1788	discs, large (Drosophila) homolog-associated protein 1	539435	1943	446312	9931	17919, 25907, 33895, 41883, 49871
1789	discs, large (Drosophila) homolog-associated protein 3	235180	1944	235180	9932	17920, 25908, 33896, 41884, 49872
1790	discs, large (Drosophila) homolog-associated	373347	1945	362444	9933	17921, 25909, 33897, 41885, 49873

	protein 3					
1791	discs, large (Drosophila) homolog-associated protein 3	542913	1946	445209	9934	17922, 25910, 33898, 41886, 49874
1792	dishevelled, dsh homolog 2 (Drosophila)	5340	1947	5340	9935	17923, 25911, 33899, 41887, 49875, 56083, 56116
1793	dispatched homolog 1 (Drosophila)	284476	1948	284476	9936	17924, 25912, 33900, 41888, 49876
1794	dispatched homolog 1 (Drosophila)	360254	1949	355848	9937	17925, 25913, 33901, 41889, 49877
1795	dispatched homolog 2 (Drosophila)	267889	1950	267889	9938	17926, 25914, 33902, 41890, 49878
1796	DIX domain containing 1	315253	1951	314068	9939	17927, 25915, 33903, 41891, 49879
1797	DIX domain containing 1	440460	1952	394352	9940	17928, 25916, 33904, 41892, 49880
1798	DIX domain containing 1	531396	1953	432959	9941	17929, 25917, 33905, 41893, 49881
1799	DnaJ (Hsp40) homolog, subfamily B, member 14	442697	1954	404381	9942	17930, 25918, 33906, 41894, 49882
1800	DnaJ (Hsp40) homolog, subfamily B, member 4	370763	1955	359799	9943	17931, 25919, 33907, 41895, 49883
1801	DnaJ (Hsp40) homolog, subfamily B, member 4	426517	1956	399494	9944	17932, 25920, 33908, 41896, 49884
1802	DnaJ (Hsp40) homolog, subfamily C , member 25	313525	1957	320650	9945	17933, 25921, 33909, 41897, 49885
1803	DnaJ (Hsp40) homolog, subfamily C , member 25	556107	1958	451984	9946	17934, 25922, 33910, 41898, 49886
1804	DnaJ (Hsp40) homolog, subfamily C, member 1	376946	1959	366145	9947	17935, 25923, 33911, 41899, 49887
1805	DnaJ (Hsp40) homolog, subfamily C, member 1	376980	1960	366179	9948	17936, 25924, 33912, 41900, 49888
1806	DnaJ (Hsp40) homolog, subfamily C, member 1	447548	1961	398185	9949	17937, 25925, 33913, 41901, 49889
1807	DnaJ (Hsp40) homolog, subfamily	294401	1962	294401	9950	17938, 25926, 33914, 41902,

	C, member 11					49890
1808	DnaJ (Hsp40) homolog, subfamily C, member 11	349363	1963	326304	9951	17939, 25927, 33915, 41903, 49891
1809	DnaJ (Hsp40) homolog, subfamily C, member 11	377573	1964	366796	9952	17940, 25928, 33916, 41904, 49892
1810	DnaJ (Hsp40) homolog, subfamily C, member 11	377577	1965	366800	9953	17941, 25929, 33917, 41905, 49893
1811	DnaJ (Hsp40) homolog, subfamily C, member 11	426784	1966	410194	9954	17942, 25930, 33918, 41906, 49894
1812	DnaJ (Hsp40) homolog, subfamily C, member 11	451196	1967	415871	9955	17943, 25931, 33919, 41907, 49895
1813	DnaJ (Hsp40) homolog, subfamily C, member 11	542246	1968	444020	9956	17944, 25932, 33920, 41908, 49896
1814	DnaJ (Hsp40) homolog, subfamily C, member 14	317269	1969	316240	9957	17945, 25933, 33921, 41909, 49897
1815	DnaJ (Hsp40) homolog, subfamily C, member 14	317287	1970	317500	9958	17946, 25934, 33922, 41910, 49898
1816	DnaJ (Hsp40) homolog, subfamily C, member 14	357606	1971	350223	9959	17947, 25935, 33923, 41911, 49899
1817	DnaJ (Hsp40) homolog, subfamily C, member 14	537962	1972	443945	9960	17948, 25936, 33924, 41912, 49900
1818	DnaJ (Hsp40) homolog, subfamily C, member 14	540330	1973	441495	9961	17949, 25937, 33925, 41913, 49901
1819	DnaJ (Hsp40) homolog, subfamily C, member 14	546957	1974	448876	9962	17950, 25938, 33926, 41914, 49902
1820	DnaJ (Hsp40) homolog, subfamily C, member 14	547445	1975	450196	9963	17951, 25939, 33927, 41915, 49903
1821	DnaJ (Hsp40) homolog, subfamily C, member 15	379221	1976	368523	9964	17952, 25940, 33928, 41916, 49904
1822	DnaJ (Hsp40) homolog, subfamily C, member 16	375838	1977	364998	9965	17953, 25941, 33929, 41917, 49905
1823	DnaJ (Hsp40) homolog, subfamily C, member 16	375847	1978	365007	9966	17954, 25942, 33930, 41918, 49906
1824	DnaJ (Hsp40) homolog, subfamily C, member 16	375849	1979	365009	9967	17955, 25943, 33931, 41919, 49907

1825	DnaJ (Hsp40) homolog, subfamily C, member 16	546230	1980	440636	9968	17956, 25944, 33932, 41920, 49908
1826	DnaJ (Hsp40) homolog, subfamily C, member 18	302060	1981	302843	9969	17957, 25945, 33933, 41921, 49909
1827	DnaJ (Hsp40) homolog, subfamily C, member 18	512473	1982	426819	9970	17958, 25946, 33934, 41922, 49910
1828	DnaJ (Hsp40) homolog, subfamily C, member 18	515277	1983	425523	9971	17959, 25947, 33935, 41923, 49911
1829	DnaJ (Hsp40) homolog, subfamily C, member 18	515581	1984	424572	9972	17960, 25948, 33936, 41924, 49912
1830	DnaJ (Hsp40) homolog, subfamily C, member 22	395069	1985	378508	9973	17961, 25949, 33937, 41925, 49913
1831	DnaJ (Hsp40) homolog, subfamily C, member 22	549441	1986	446830	9974	17962, 25950, 33938, 41926, 49914
1832	DnaJ (Hsp40) homolog, subfamily C, member 30	395176	1987	378605	9975	17963, 25951, 33939, 41927, 49915
1833	DnaJ (Hsp40) homolog, subfamily C, member 30	539255	1988	443739	9976	17964, 25952, 33940, 41928, 49916
1834	DnaJ (Hsp40) homolog, subfamily C, member 4	321685	1989	396896	9977	17965, 25953, 33941, 41929, 49917
1835	DNL-type zinc finger	371738	1990	360803	9978	17966, 25954, 33942, 41930, 49918
1836	dolichol kinase	372586	1991	361667	9979	17967, 25955, 33943, 41931, 49919
1837	dolichol kinase	515348	1992	445830	9980	17968, 25956, 33944, 41932, 49920
1838	dolichyl pyrophosphate phosphatase 1	372546	1993	361625	9981	17969, 25957, 33945, 41933, 49921
1839	dolichyl pyrophosphate phosphatase 1	406974	1994	384043	9982	17970, 25958, 33946, 41934, 49922
1840	dolichyl pyrophosphate phosphatase 1	540102	1995	440218	9983	17971, 25959, 33947, 41935, 49923
1841	dolichyl-phosphate (UDP-N-acetylglucosamine) N-acetylglucosamineph osphotransferase 1 (GlcNAc-1-P	354202	1996	346142	9984	17972, 25960, 33948, 41936, 49924

	transferase)					
1842	dolichyl-phosphate (UDP-N-acetylglucosamine) N-acetylglucosaminephosphotransferase 1 (GlcNAc-1-P transferase)	409993	1997	386597	9985	17973, 25961, 33949, 41937, 49925
1843	dolichyl-phosphate (UDP-N-acetylglucosamine) N-acetylglucosaminephosphotransferase 1 (GlcNAc-1-P transferase)	432443	1998	404036	9986	17974, 25962, 33950, 41938, 49926
1844	dolichyl-phosphate mannosyltransferase polypeptide 2, regulatory subunit	314392	1999	322181	9987	17975, 25963, 33951, 41939, 49927
1845	dolichyl-phosphate mannosyltransferase polypeptide 2, regulatory subunit	373110	2000	362202	9988	17976, 25964, 33952, 41940, 49928
1846	dopey family member 1	237163	2001	237163	9989	17977, 25965, 33953, 41941, 49929
1847	dopey family member 1	349129	2002	195654	9990	17978, 25966, 33954, 41942, 49930
1848	dopey family member 1	369739	2003	358754	9991	17979, 25967, 33955, 41943, 49931
1849	dopey family member 1	536812	2004	439675	9992	17980, 25968, 33956, 41944, 49932
1850	dual specificity phosphatase 10	323825	2005	322015	9993	17981, 25969, 33957, 41945, 49933
1851	dual specificity phosphatase 10	366899	2006	355866	9994	17982, 25970, 33958, 41946, 49934
1852	dual specificity phosphatase 10	418487	2007	390238	9995	17983, 25971, 33959, 41947, 49935
1853	dual specificity phosphatase 10	544095	2008	441302	9996	17984, 25972, 33960, 41948, 49936

1854	dual specificity phosphatase 15	278979	2009	278979	9997	17985, 25973, 33961, 41949, 49937
1855	dual specificity phosphatase 15	339738	2010	341658	9998	17986, 25974, 33962, 41950, 49938
1856	dual specificity phosphatase 15	375953	2011	365120	9999	17987, 25975, 33963, 41951, 49939
1857	dual specificity phosphatase 15	375966	2012	365133	10000	17988, 25976, 33964, 41952, 49940
1858	dual specificity phosphatase 15	398083	2013	381157	10001	17989, 25977, 33965, 41953, 49941
1859	dual specificity phosphatase 15	398084	2014	381158	10002	17990, 25978, 33966, 41954, 49942
1860	dual specificity phosphatase 15	447647	2015	397486	10003	17991, 25979, 33967, 41955, 49943
1861	dual specificity phosphatase 15	486996	2016	419818	10004	17992, 25980, 33968, 41956, 49944
1862	dynein, axonemal, assembly factor 2	298292	2017	298292	10005	17993, 25981, 33969, 41957, 49945
1863	dynein, axonemal, assembly factor 2	406043	2018	384862	10006	17994, 25982, 33970, 41958, 49946
1864	dynein, axonemal, light chain 4	216068	2019	216068	10007	17995, 25983, 33971, 41959, 49947
1865	dynein, cytoplasmic 1, light intermediate chain 1	273130	2020	273130	10008	17996, 25984, 33972, 41960, 49948
1866	dynein, light chain, Tctex-type 3	378578	2021	367841	10009	17997, 25985, 33973, 41961, 49949
1867	dynein, light chain, Tctex-type 3	378581	2022	367844	10010	17998, 25986, 33974, 41962, 49950
1868	dynein, light chain, Tctex-type 3	432389	2023	402695	10011	17999, 25987, 33975, 41963, 49951
1869	dystrotelin	452335	2024	396593	10012	18000, 25988, 33976, 41964, 49952
1870	E2F-associated phosphoprotein	250454	2025	250454	10013	18001, 25989, 33977, 41965, 49953
1871	early endosome antigen 1	322349	2026	317955	10014	18002, 25990, 33978, 41966, 49954

1872	early endosome antigen 1	540777	2027	441243	10015	18003, 25991, 33979, 41967, 49955
1873	ectonucleoside triphosphate diphosphohydrolase 4	356206	2028	348536	10016	18004, 25992, 33980, 41968, 49956
1874	ectonucleoside triphosphate diphosphohydrolase 4	358689	2029	351520	10017	18005, 25993, 33981, 41969, 49957
1875	ectonucleoside triphosphate diphosphohydrolase 4	417069	2030	408573	10018	18006, 25994, 33982, 41970, 49958
1876	ectonucleoside triphosphate diphosphohydrolase 7	370489	2031	359520	10019	18007, 25995, 33983, 41971, 49959
1877	ectonucleoside triphosphate diphosphohydrolase 8	344119	2032	344089	10020	18008, 25996, 33984, 41972, 49960
1878	ectonucleoside triphosphate diphosphohydrolase 8	371506	2033	360561	10021	18009, 25997, 33985, 41973, 49961
1879	ectonucleoside triphosphate diphosphohydrolase 8	472938	2034	420531	10022	18010, 25998, 33986, 41974, 49962
1880	ectonucleotide pyrophosphatase/phosphodiesterase 4 (putative)	321037	2035	318066	10023	18011, 25999, 33987, 41975, 49963
1881	ectonucleotide pyrophosphatase/phosphodiesterase 4 (putative)	371401	2036	360454	10024	18012, 26000, 33988, 41976, 49964
1882	ectonucleotide pyrophosphatase/phosphodiesterase 7	328313	2037	332656	10025	18013, 26001, 33989, 41977, 49965
1883	EF-hand domain family, member A1	382374	2038	371811	10026	18014, 26002, 33990, 41978, 49966
1884	EF-hand domain family, member A2	318063	2039	321455	10027	18015, 26003, 33991, 41979, 49967
1885	EF-hand domain family, member D2	375975	2040	365142	10028	18016, 26004, 33992, 41980, 49968
1886	EF-hand domain family, member D2	375980	2041	365147	10029	18017, 26005, 33993, 41981, 49969

1887	EF-hand domain family, member D2	445566	2042	395153	10030	18018, 26006, 33994, 41982, 49970
1888	EGF, latrophilin and seven transmembrane domain containing 1	370742	2043	359778	10031	18019, 26007, 33995, 41983, 49971
1889	EGF, latrophilin and seven transmembrane domain containing 1	401034	2044	383813	10032	18020, 26008, 33996, 41984, 49972
1890	egf-like module containing mucin-like hormone receptor-like 2	596991	2045	472280	10033	18021, 26009, 33997, 41985, 49973
1891	egf-like module containing, mucin-like, hormone receptor-like 2	315576	2046	319883	10034	18022, 26010, 33998, 41986, 49974
1892	egf-like module containing, mucin-like, hormone receptor-like 2	346057	2047	263380	10035	18023, 26011, 33999, 41987, 49975
1893	egf-like module containing, mucin-like, hormone receptor-like 2	353005	2048	319838	10036	18024, 26012, 34000, 41988, 49976
1894	egf-like module containing, mucin-like, hormone receptor-like 2	353876	2049	319454	10037	18025, 26013, 34001, 41989, 49977
1895	egf-like module containing, mucin-like, hormone receptor-like 2	360222	2050	353356	10038	18026, 26014, 34002, 41990, 49978
1896	egf-like module containing, mucin-like, hormone receptor-like 2	392962	2051	376689	10039	18027, 26015, 34003, 41991, 49979
1897	egf-like module containing, mucin-like, hormone receptor-like 2	392964	2052	376691	10040	18028, 26016, 34004, 41992, 49980
1898	egf-like module containing, mucin-like, hormone receptor-like 2	392965	2053	376692	10041	18029, 26017, 34005, 41993, 49981
1899	egf-like module containing, mucin-like, hormone receptor-like 2	392967	2054	376694	10042	18030, 26018, 34006, 41994, 49982
1900	ELKS/RAB6-interacting/CAST family member 2	288221	2055	288221	10043	18031, 26019, 34007, 41995, 49983

1901	ELKS/RAB6-interacting/CAST family member 2	460849	2056	417445	10044	18032, 26020, 34008, 41996, 49984
1902	ELKS/RAB6-interacting/CAST family member 2	492584	2057	417280	10045	18033, 26021, 34009, 41997, 49985
1903	embigin	303221	2058	302289	10046	18034, 26022, 34010, 41998, 49986
1904	emopamil binding protein-like	242827	2059	242827	10047	18035, 26023, 34011, 41999, 49987
1905	emopamil binding protein-like	378274	2060	367523	10048	18036, 26024, 34012, 42000, 49988
1906	Enah/Vasp-like	392920	2061	376652	10049	18037, 26025, 34013, 42001, 49989
1907	Enah/Vasp-like	402714	2062	384720	10050	18038, 26026, 34014, 42002, 49990
1908	Enah/Vasp-like	539470	2063	440743	10051	18039, 26027, 34015, 42003, 49991
1909	Enah/Vasp-like	544450	2064	437904	10052	18040, 26028, 34016, 42004, 49992
1910	Enah/Vasp-like	554695	2065	451821	10053	18041, 26029, 34017, 42005, 49993
1911	endogenous retrovirus group FRD, member 1	472091	2066	420174	10054	18042, 26030, 34018, 42006, 49994
1912	endogenous retrovirus group FRD, member 1	542862	2067	444461	10055	18043, 26031, 34019, 42007, 49995
1913	endogenous retrovirus group W, member 1	493463	2068	419945	10056	18044, 26032, 34020, 42008, 49996
1914	endonuclease/exonuclease/phosphatase family domain containing 1	242108	2069	242108	10057	18045, 26033, 34021, 42009, 49997
1915	endonuclease/exonuclease/phosphatase family domain containing 1	534978	2070	442692	10058	18046, 26034, 34022, 42010, 49998
1916	endoplasmic reticulum protein 27	266397	2071	266397	10059	18047, 26035, 34023, 42011, 49999
1917	endoplasmic reticulum to nucleus signaling 1	433197	2072	401445	10060	18048, 26036, 34024, 42012, 50000

1918	endoplasmic reticulum-golgi intermediate compartment (ERGIC) 1	393784	2073	377374	10061	18049, 26037, 34025, 42013, 50001
1919	endothelial cell-specific chemotaxis regulator	510908	2074	421010	10062	18050, 26038, 34026, 42014, 50002
1920	endothelial cell-specific chemotaxis regulator	515823	2075	421364	10063	18051, 26039, 34027, 42015, 50003
1921	endothelin converting enzyme 2	324557	2076	314295	10064	18052, 26040, 34028, 42016, 50004
1922	endothelin converting enzyme 2	359140	2077	352052	10065	18053, 26041, 34029, 42017, 50005
1923	endothelin converting enzyme 2	402825	2078	384223	10066	18054, 26042, 34030, 42018, 50006
1924	endothelin converting enzyme 2	404464	2079	385846	10067	18055, 26043, 34031, 42019, 50007
1925	endothelin converting enzyme 2	357474	2080	350066	10068	18056, 26044, 34032, 42020, 50008
1926	enoyl CoA hydratase domain containing 2	358358	2081	351125	10069	18057, 26045, 34033, 42021, 50009
1927	enoyl CoA hydratase domain containing 2	371522	2082	360577	10070	18058, 26046, 34034, 42022, 50010
1928	enoyl CoA hydratase domain containing 2	536120	2083	439264	10071	18059, 26047, 34035, 42023, 50011
1929	enoyl CoA hydratase domain containing 2	541281	2084	445358	10072	18060, 26048, 34036, 42024, 50012
1930	enoyl CoA hydratase domain containing 2	467988	2085	441962	10073	18061, 26049, 34037, 42025, 50013
1931	enoyl CoA hydratase domain containing 3	379215	2086	368517	10074	18062, 26050, 34038, 42026, 50014
1932	enoyl CoA hydratase domain containing 3	420401	2087	405584	10075	18063, 26051, 34039, 42027, 50015
1933	enoyl CoA hydratase domain containing 3	422887	2088	398429	10076	18064, 26052, 34040, 42028, 50016
1934	enoyl-CoA delta isomerase 1	301729	2089	301729	10077	18065, 26053, 34041, 42029, 50017

1935	enoyl-CoA delta isomerase 1	562238	2090	456319	10078	18066, 26054, 34042, 42030, 50018
1936	enoyl-CoA delta isomerase 2	361538	2091	354737	10079	18067, 26055, 34043, 42031, 50019
1937	enoyl-CoA delta isomerase 2	380118	2092	369461	10080	18068, 26056, 34044, 42032, 50020
1938	enoyl-CoA delta isomerase 2	380125	2093	369468	10081	18069, 26057, 34045, 42033, 50021
1939	enoyl-CoA delta isomerase 2	413766	2094	406969	10082	18070, 26058, 34046, 42034, 50022
1940	enoyl-CoA delta isomerase 2	465828	2095	420309	10083	18071, 26059, 34047, 42035, 50023
1941	EPH receptor A4	281821	2096	281821	10084	18072, 26060, 34048, 42036, 50024
1942	EPH receptor A4	392071	2097	375923	10085	18073, 26061, 34049, 42037, 50025
1943	EPH receptor A4	409854	2098	386276	10086	18074, 26062, 34050, 42038, 50026
1944	EPH receptor A4	409938	2099	386829	10087	18075, 26063, 34051, 42039, 50027
1945	EPH receptor A4	434266	2100	404089	10088	18076, 26064, 34052, 42040, 50028
1946	EPH receptor A4	541600	2101	444085	10089	18077, 26065, 34053, 42041, 50029
1947	EPH receptor A7	369297	2102	358303	10090	18078, 26066, 34054, 42042, 50030
1948	EPH receptor A7	369303	2103	358309	10091	18079, 26067, 34055, 42043, 50031
1949	ephrin-A5	333274	2104	328777	10092	18080, 26068, 34056, 42044, 50032
1950	epidermal growth factor receptor pathway substrate 15-like 1	248070	2105	248070	10093	18081, 26069, 34057, 42045, 50033
1951	epidermal growth factor receptor pathway substrate 15-like 1	455140	2106	393313	10094	18082, 26070, 34058, 42046, 50034

1952	epidermal growth factor receptor pathway substrate 15-like 1	535753	2107	440103	10095	18083, 26071, 34059, 42047, 50035
1953	epidermal growth factor receptor pathway substrate 15-like 1	597937	2108	472267	10096	18084, 26072, 34060, 42048, 50036
1954	EPM2A (laforin) interacting protein 1	322716	2109	406027	10097	18085, 26073, 34061, 42049, 50037
1955	epoxide hydrolase 4	370383	2110	359410	10098	18086, 26074, 34062, 42050, 50038
1956	ER degradation enhancer, mannosidase alpha-like 1	256497	2111	256497	10099	18087, 26075, 34063, 42051, 50039
1957	ER degradation enhancer, mannosidase alpha-like 1	419550	2112	402075	10100	18088, 26076, 34064, 42052, 50040
1958	ER degradation enhancer, mannosidase alpha-like 1	445686	2113	394099	10101	18089, 26077, 34065, 42053, 50041
1959	ER degradation enhancer, mannosidase alpha-like 3	318130	2114	318147	10102	18090, 26078, 34066, 42054, 50042
1960	ER degradation enhancer, mannosidase alpha-like 3	367512	2115	356482	10103	18091, 26079, 34067, 42055, 50043
1961	Era G-protein-like 1 (E. coli)	254928	2116	254928	10104	18092, 26080, 34068, 42056, 50044
1962	Era G-protein-like 1 (E. coli)	412138	2117	396125	10105	18093, 26081, 34069, 42057, 50045
1963	ERGIC and golgi 3	279052	2118	279052	10106	18094, 26082, 34070, 42058, 50046
1964	ERGIC and golgi 3	348547	2119	341358	10107	18095, 26083, 34071, 42059, 50047
1965	ERGIC and golgi 3	355563	2120	347762	10108	18096, 26084, 34072, 42060, 50048
1966	ERGIC and golgi 3	357394	2121	349970	10109	18097, 26085, 34073, 42061, 50049
1967	ERGIC and golgi 3	447986	2122	392341	10110	18098, 26086, 34074, 42062, 50050

1968	ERO1-like (S. cerevisiae)	395686	2123	379042	10111	18099, 26087, 34075, 42063, 50051
1969	ERO1-like beta (S. cerevisiae)	264181	2124	264181	10112	18100, 26088, 34076, 42064, 50052
1970	ERO1-like beta (S. cerevisiae)	327333	2125	377574	10113	18101, 26089, 34077, 42065, 50053
1971	ERO1-like beta (S. cerevisiae)	354619	2126	346635	10114	18102, 26090, 34078, 42066, 50054
1972	ERO1-like beta (S. cerevisiae)	366589	2127	355548	10115	18103, 26091, 34079, 42067, 50055
1973	ES cell expressed Ras	338270	2128	339136	10116	18104, 26092, 34080, 42068, 50056
1974	exocyst complex component 8	360394	2129	353564	10117	18105, 26093, 34081, 42069, 50057
1975	exocyst complex component 8	366645	2130	355605	10118	18106, 26094, 34082, 42070, 50058
1976	extended synaptotagmin-like protein 1	267113	2131	267113	10119	18107, 26095, 34083, 42071, 50059
1977	extended synaptotagmin-like protein 1	394048	2132	377612	10120	18108, 26096, 34084, 42072, 50060
1978	extended synaptotagmin-like protein 1	402331	2133	386045	10121	18109, 26097, 34085, 42073, 50061
1979	extended synaptotagmin-like protein 1	541590	2134	445952	10122	18110, 26098, 34086, 42074, 50062
1980	extended synaptotagmin-like protein 3	389567	2135	374218	10123	18111, 26099, 34087, 42075, 50063
1981	extracellular leucine-rich repeat and fibronectin type III domain containing 2	349653	2136	300147	10124	18112, 26100, 34088, 42076, 50064
1982	extracellular leucine-rich repeat and fibronectin type III domain containing 2	402918	2137	385277	10125	18113, 26101, 34089, 42077, 50065
1983	FAM18B2-CDRT4 readthrough	557349	2138	450826	10126	18114, 26102, 34090, 42078, 50066
1984	family with sequence similarity 118, member A	216214	2139	216214	10127	18115, 26103, 34091, 42079, 50067

1985	family with sequence similarity 118, member A	405548	2140	384836	10128	18116, 26104, 34092, 42080, 50068
1986	family with sequence similarity 118, member A	427777	2141	395194	10129	18117, 26105, 34093, 42081, 50069
1987	family with sequence similarity 118, member A	441876	2142	395892	10130	18118, 26106, 34094, 42082, 50070
1988	family with sequence similarity 125, member A	317040	2143	324810	10131	18119, 26107, 34095, 42083, 50071
1989	family with sequence similarity 125, member A	392702	2144	376466	10132	18120, 26108, 34096, 42084, 50072
1990	family with sequence similarity 125, member A	543795	2145	444653	10133	18121, 26109, 34097, 42085, 50073
1991	family with sequence similarity 125, member B	361171	2146	354772	10134	18122, 26110, 34098, 42086, 50074
1992	family with sequence similarity 125, member B	402437	2147	384751	10135	18123, 26111, 34099, 42087, 50075
1993	family with sequence similarity 125, member B	436593	2148	401379	10136	18124, 26112, 34100, 42088, 50076
1994	family with sequence similarity 125, member B	535766	2149	442846	10137	18125, 26113, 34101, 42089, 50077
1995	family with sequence similarity 125, member B	545391	2150	441988	10138	18126, 26114, 34102, 42090, 50078
1996	family with sequence similarity 129, member A	367511	2151	356481	10139	18127, 26115, 34103, 42091, 50079
1997	family with sequence similarity 129, member A	417056	2152	414039	10140	18128, 26116, 34104, 42092, 50080
1998	family with sequence similarity 134, member A	430297	2153	395249	10141	18129, 26117, 34105, 42093, 50081
1999	family with sequence similarity 134, member A	443518	2154	398910	10142	18130, 26118, 34106, 42094, 50082
2000	family with sequence similarity 134, member C	309428	2155	309432	10143	18131, 26119, 34107, 42095, 50083
2001	family with sequence similarity 134, member C	543197	2156	446235	10144	18132, 26120, 34108, 42096, 50084
2002	family with sequence similarity 135, member A	361499	2157	354913	10145	18133, 26121, 34109, 42097, 50085

2003	family with sequence similarity 135, member A	370479	2158	359510	10146	18134, 26122, 34110, 42098, 50086
2004	family with sequence similarity 135, member A	418814	2159	410768	10147	18135, 26123, 34111, 42099, 50087
2005	family with sequence similarity 135, member A	457062	2160	409201	10148	18136, 26124, 34112, 42100, 50088
2006	family with sequence similarity 135, member A	507085	2161	425101	10149	18137, 26125, 34113, 42101, 50089
2007	family with sequence similarity 135, member A	515280	2162	421505	10150	18138, 26126, 34114, 42102, 50090
2008	family with sequence similarity 135, member A	515323	2163	422406	10151	18139, 26127, 34115, 42103, 50091
2009	family with sequence similarity 135, member B	160713	2164	160713	10152	18140, 26128, 34116, 42104, 50092, 56084, 56117
2010	family with sequence similarity 135, member B	395297	2165	378710	10153	18141, 26129, 34117, 42105, 50093
2011	family with sequence similarity 135, member B	520380	2166	428017	10154	18142, 26130, 34118, 42106, 50094
2012	family with sequence similarity 151, member A	294370	2167	294370	10155	18143, 26131, 34119, 42107, 50095
2013	family with sequence similarity 151, member A	302250	2168	306888	10156	18144, 26132, 34120, 42108, 50096
2014	family with sequence similarity 151, member A	371304	2169	360353	10157	18145, 26133, 34121, 42109, 50097
2015	family with sequence similarity 155, member A	375915	2170	365080	10158	18146, 26134, 34122, 42110, 50098
2016	family with sequence similarity 155, member B	252338	2171	252338	10159	18147, 26135, 34123, 42111, 50099
2017	family with sequence similarity 156, member A	316310	2172	318182	10160	18148, 26136, 34124, 42112, 50100
2018	family with sequence similarity 156, member A	330025	2173	328443	10161	18149, 26137, 34125, 42113, 50101
2019	family with sequence similarity 156, member A	356333	2174	348687	10162	18150, 26138, 34126, 42114, 50102
2020	family with sequence similarity 156, member A	375473	2175	364622	10163	18151, 26139, 34127, 42115, 50103

2021	family with sequence similarity 156, member A	411516	2176	427693	10164	18152, 26140, 34128, 42116, 50104
2022	family with sequence similarity 156, member A	414076	2177	405771	10165	18153, 26141, 34129, 42117, 50105
2023	family with sequence similarity 156, member A	416923	2178	412234	10166	18154, 26142, 34130, 42118, 50106
2024	family with sequence similarity 156, member A	438003	2179	398565	10167	18155, 26143, 34131, 42119, 50107
2025	family with sequence similarity 156, member A	447562	2180	414701	10168	18156, 26144, 34132, 42120, 50108
2026	family with sequence similarity 156, member A	451084	2181	412585	10169	18157, 26145, 34133, 42121, 50109
2027	family with sequence similarity 156, member A	503775	2182	421939	10170	18158, 26146, 34134, 42122, 50110
2028	family with sequence similarity 156, member A	505988	2183	424378	10171	18159, 26147, 34135, 42123, 50111
2029	family with sequence similarity 156, member A	510517	2184	425216	10172	18160, 26148, 34136, 42124, 50112
2030	family with sequence similarity 156, member A	512364	2185	426868	10173	18161, 26149, 34137, 42125, 50113
2031	family with sequence similarity 156, member B	412319	2186	422884	10174	18162, 26150, 34138, 42126, 50114
2032	family with sequence similarity 156, member B	416841	2187	424864	10175	18163, 26151, 34139, 42127, 50115
2033	family with sequence similarity 156, member B	430150	2188	425174	10176	18164, 26152, 34140, 42128, 50116
2034	family with sequence similarity 156, member B	452021	2189	426113	10177	18165, 26153, 34141, 42129, 50117
2035	family with sequence similarity 156, member B	452154	2190	420954	10178	18166, 26154, 34142, 42130, 50118
2036	family with sequence similarity 156, member B	509613	2191	422411	10179	18167, 26155, 34143, 42131, 50119
2037	family with sequence similarity 159, member A	517870	2192	429726	10180	18168, 26156, 34144, 42132, 50120
2038	family with sequence similarity 162, member A	440333	2193	405770	10181	18169, 26157, 34145, 42133, 50121

2039	family with sequence similarity 162, member A	477892	2194	419088	10182	18170, 26158, 34146, 42134, 50122
2040	family with sequence similarity 162, member B	368557	2195	357545	10183	18171, 26159, 34147, 42135, 50123
2041	family with sequence similarity 163, member A	341785	2196	354891	10184	18172, 26160, 34148, 42136, 50124
2042	family with sequence similarity 163, member B	356873	2197	349336	10185	18173, 26161, 34149, 42137, 50125
2043	family with sequence similarity 163, member B	496132	2198	419867	10186	18174, 26162, 34150, 42138, 50126
2044	family with sequence similarity 165, member A	369586	2199	358599	10187	18175, 26163, 34151, 42139, 50127
2045	family with sequence similarity 165, member B	399292	2200	382231	10188	18176, 26164, 34152, 42140, 50128
2046	family with sequence similarity 165, member B	399295	2201	382234	10189	18177, 26165, 34153, 42141, 50129
2047	family with sequence similarity 171, member A1	378114	2202	367354	10190	18178, 26166, 34154, 42142, 50130
2048	family with sequence similarity 171, member A1	378116	2203	367356	10191	18179, 26167, 34155, 42143, 50131
2049	family with sequence similarity 171, member A1	396781	2204	380001	10192	18180, 26168, 34156, 42144, 50132
2050	family with sequence similarity 171, member A1	455654	2205	407796	10193	18181, 26169, 34157, 42145, 50133
2051	family with sequence similarity 171, member A2	293443	2206	293443	10194	18182, 26170, 34158, 42146, 50134
2052	family with sequence similarity 171, member B	272804	2207	272804	10195	18183, 26171, 34159, 42147, 50135
2053	family with sequence similarity 171, member B	304698	2208	304108	10196	18184, 26172, 34160, 42148, 50136
2054	family with sequence similarity 173 member A	569529	2209	454380	10197	18185, 26173, 34161, 42149, 50137
2055	family with sequence similarity 173, member A	219535	2210	219535	10198	18186, 26174, 34162, 42150, 50138
2056	family with sequence similarity 173, member B	511437	2211	422338	10199	18187, 26175, 34163, 42151, 50139

2057	family with sequence similarity 174, member A	312637	2212	307954	10200	18188, 26176, 34164, 42152, 50140
2058	family with sequence similarity 174, member B	327355	2213	329040	10201	18189, 26177, 34165, 42153, 50141
2059	family with sequence similarity 176, member A	233712	2214	233712	10202	18190, 26178, 34166, 42154, 50142
2060	family with sequence similarity 176, member A	393913	2215	377490	10203	18191, 26179, 34167, 42155, 50143
2061	family with sequence similarity 176, member A	410071	2216	386930	10204	18192, 26180, 34168, 42156, 50144
2062	family with sequence similarity 176, member A	410113	2217	386435	10205	18193, 26181, 34169, 42157, 50145
2063	family with sequence similarity 176, member A	432649	2218	398249	10206	18194, 26182, 34170, 42158, 50146
2064	family with sequence similarity 176, member A	452003	2219	388105	10207	18195, 26183, 34171, 42159, 50147
2065	family with sequence similarity 18 member B2	518321	2220	464052	10208	18196, 26184, 34172, 42160, 50148
2066	family with sequence similarity 18, member A	299866	2221	299866	10209	18197, 26185, 34173, 42161, 50149
2067	family with sequence similarity 18, member A	456096	2222	411972	10210	18198, 26186, 34174, 42162, 50150
2068	family with sequence similarity 18, member B1	307767	2223	305654	10211	18199, 26187, 34175, 42163, 50151
2069	family with sequence similarity 18, member B2	225576	2224	225576	10212	18200, 26188, 34176, 42164, 50152
2070	family with sequence similarity 18, member B2	428082	2225	406387	10213	18201, 26189, 34177, 42165, 50153
2071	family with sequence similarity 18, member B2	519970	2226	428961	10214	18202, 26190, 34178, 42166, 50154
2072	family with sequence similarity 187, member B	324675	2227	323355	10215	18203, 26191, 34179, 42167, 50155
2073	family with sequence similarity 189, member A1	261275	2228	261275	10216	18204, 26192, 34180, 42168, 50156
2074	family with sequence similarity 189, member A2	257515	2229	257515	10217	18205, 26193, 34181, 42169, 50157

2075	family with sequence similarity 189, member A2	303068	2230	304435	10218	18206, 26194, 34182, 42170, 50158
2076	family with sequence similarity 189, member A2	377216	2231	366422	10219	18207, 26195, 34183, 42171, 50159
2077	family with sequence similarity 189, member A2	377225	2232	366432	10220	18208, 26196, 34184, 42172, 50160
2078	family with sequence similarity 189, member A2	455972	2233	395675	10221	18209, 26197, 34185, 42173, 50161
2079	family with sequence similarity 189, member B	323361	2234	323164	10222	18210, 26198, 34186, 42174, 50162
2080	family with sequence similarity 189, member B	333966	2235	333944	10223	18211, 26199, 34187, 42175, 50163
2081	family with sequence similarity 189, member B	350210	2236	307128	10224	18212, 26200, 34188, 42176, 50164
2082	family with sequence similarity 189, member B	361361	2237	354958	10225	18213, 26201, 34189, 42177, 50165
2083	family with sequence similarity 189, member B	368368	2238	357352	10226	18214, 26202, 34190, 42178, 50166
2084	family with sequence similarity 189, member B	487649	2239	427520	10227	18215, 26203, 34191, 42179, 50167
2085	family with sequence similarity 198 member B	585682	2240	465976	10228	18216, 26204, 34192, 42180, 50168
2086	family with sequence similarity 198, member B	296530	2241	296530	10229	18217, 26205, 34193, 42181, 50169
2087	family with sequence similarity 198, member B	337222	2242	338886	10230	18218, 26206, 34194, 42182, 50170
2088	family with sequence similarity 198, member B	393807	2243	377396	10231	18219, 26207, 34195, 42183, 50171
2089	family with sequence similarity 198, member B	417442	2244	409135	10232	18220, 26208, 34196, 42184, 50172
2090	family with sequence similarity 200, member A	408938	2245	386191	10233	18221, 26209, 34197, 42185, 50173
2091	family with sequence similarity 200, member A	449309	2246	411372	10234	18222, 26210, 34198, 42186, 50174
2092	family with sequence similarity 205, member A	378788	2247	417711	10235	18223, 26211, 34199, 42187, 50175

2093	family with sequence similarity 209, member A	371328	2248	360379	10236	18224, 26212, 34200, 42188, 50176
2094	family with sequence similarity 209, member B	371325	2249	360376	10237	18225, 26213, 34201, 42189, 50177
2095	family with sequence similarity 21, member A	282633	2250	282633	10238	18226, 26214, 34202, 42190, 50178
2096	family with sequence similarity 21, member A	314664	2251	314417	10239	18227, 26215, 34203, 42191, 50179
2097	family with sequence similarity 21, member A	351071	2252	344037	10240	18228, 26216, 34204, 42192, 50180
2098	family with sequence similarity 21, member A	399339	2253	382277	10241	18229, 26217, 34205, 42193, 50181
2099	family with sequence similarity 21, member A	434114	2254	403781	10242	18230, 26218, 34206, 42194, 50182
2100	family with sequence similarity 21, member A	454806	2255	398095	10243	18231, 26219, 34207, 42195, 50183
2101	family with sequence similarity 21, member B	355876	2256	348138	10244	18232, 26220, 34208, 42196, 50184
2102	family with sequence similarity 21, member B	358474	2257	351259	10245	18233, 26221, 34209, 42197, 50185
2103	family with sequence similarity 21, member B	430074	2258	416073	10246	18234, 26222, 34210, 42198, 50186
2104	family with sequence similarity 21, member B	535219	2259	438386	10247	18235, 26223, 34211, 42199, 50187
2105	family with sequence similarity 21, member B	543972	2260	440306	10248	18236, 26224, 34212, 42200, 50188
2106	family with sequence similarity 210, member A	322247	2261	323635	10249	18237, 26225, 34213, 42201, 50189
2107	family with sequence similarity 210, member A	402563	2262	386115	10250	18238, 26226, 34214, 42202, 50190
2108	family with sequence similarity 210, member B	371384	2263	360437	10251	18239, 26227, 34215, 42203, 50191
2109	family with sequence similarity 26, member D	368596	2264	357585	10252	18240, 26228, 34216, 42204, 50192
2110	family with sequence similarity 26, member D	368597	2265	357586	10253	18241, 26229, 34217, 42205, 50193

2111	family with sequence similarity 26, member D	405399	2266	385836	10254	18242, 26230, 34218, 42206, 50194
2112	family with sequence similarity 26, member D	416171	2267	416976	10255	18243, 26231, 34219, 42207, 50195
2113	family with sequence similarity 26, member D	452373	2268	409556	10256	18244, 26232, 34220, 42208, 50196
2114	family with sequence similarity 26, member E	368599	2269	357588	10257	18245, 26233, 34221, 42209, 50197
2115	family with sequence similarity 26, member F	368605	2270	357594	10258	18246, 26234, 34222, 42210, 50198
2116	family with sequence similarity 27, member C	377542	2271	366765	10259	18247, 26235, 34223, 42211, 50199
2117	family with sequence similarity 36, member A	366528	2272	355486	10260	18248, 26236, 34224, 42212, 50200
2118	family with sequence similarity 36, member A	411948	2273	406327	10261	18249, 26237, 34225, 42213, 50201
2119	family with sequence similarity 55, member B	389586	2274	374237	10262	18250, 26238, 34226, 42214, 50202
2120	family with sequence similarity 55, member B	505358	2275	439889	10263	18251, 26239, 34227, 42215, 50203
2121	family with sequence similarity 57, member B	279389	2276	279389	10264	18252, 26240, 34228, 42216, 50204
2122	family with sequence similarity 57, member B	380495	2277	369863	10265	18253, 26241, 34229, 42217, 50205
2123	family with sequence similarity 69, member A	370310	2278	359333	10266	18254, 26242, 34230, 42218, 50206
2124	family with sequence similarity 69, member A	401027	2279	383809	10267	18255, 26243, 34231, 42219, 50207
2125	family with sequence similarity 69, member B	371691	2280	360756	10268	18256, 26244, 34232, 42220, 50208
2126	family with sequence similarity 69, member B	371692	2281	360757	10269	18257, 26245, 34233, 42221, 50209
2127	family with sequence similarity 69, member C	343998	2282	344331	10270	18258, 26246, 34234, 42222, 50210
2128	family with sequence similarity 70, member A	309720	2283	310110	10271	18259, 26247, 34235, 42223, 50211

2129	family with sequence similarity 70, member A	371352	2284	360403	10272	18260, 26248, 34236, 42224, 50212
2130	family with sequence similarity 70, member A	371369	2285	360420	10273	18261, 26249, 34237, 42225, 50213
2131	family with sequence similarity 70, member A	440464	2286	405781	10274	18262, 26250, 34238, 42226, 50214
2132	family with sequence similarity 70, member B	375353	2287	364502	10275	18263, 26251, 34239, 42227, 50215
2133	family with sequence similarity 73, member A	370791	2288	359827	10276	18264, 26252, 34240, 42228, 50216
2134	family with sequence similarity 73, member A	443751	2289	393675	10277	18265, 26253, 34241, 42229, 50217
2135	family with sequence similarity 73, member B	277475	2290	277475	10278	18266, 26254, 34242, 42230, 50218
2136	family with sequence similarity 73, member B	358369	2291	351138	10279	18267, 26255, 34243, 42231, 50219
2137	family with sequence similarity 73, member B	406926	2292	384662	10280	18268, 26256, 34244, 42232, 50220
2138	family with sequence similarity 73, member B	450073	2293	409348	10281	18269, 26257, 34245, 42233, 50221
2139	family with sequence similarity 74, member A1	434519	2294	388519	10282	18270, 26258, 34246, 42234, 50222
2140	family with sequence similarity 74, member A2	427006	2295	415978	10283	18271, 26259, 34247, 42235, 50223
2141	family with sequence similarity 75, member A1	377647	2296	366875	10284	18272, 26260, 34248, 42236, 50224
2142	family with sequence similarity 75, member A2	456183	2297	406957	10285	18273, 26261, 34249, 42237, 50225
2143	family with sequence similarity 75, member A3	356699	2298	349132	10286	18274, 26262, 34250, 42238, 50226
2144	family with sequence similarity 75, member A4	377509	2299	366731	10287	18275, 26263, 34251, 42239, 50227
2145	family with sequence similarity 75, member A4	429767	2300	411237	10288	18276, 26264, 34252, 42240, 50228
2146	family with sequence similarity 75, member A5	377621	2301	366847	10289	18277, 26265, 34253, 42241, 50229

2147	family with sequence similarity 75, member A6	332857	2302	329825	10290	18278, 26266, 34254, 42242, 50230
2148	family with sequence similarity 75, member A7	355045	2303	347153	10291	18279, 26267, 34255, 42243, 50231
2149	family with sequence similarity 75, member D1	344803	2304	341988	10292	18280, 26268, 34256, 42244, 50232
2150	family with sequence similarity 8, member A1	259963	2305	259963	10293	18281, 26269, 34257, 42245, 50233
2151	family with sequence similarity 8, member A1	542476	2306	446393	10294	18282, 26270, 34258, 42246, 50234
2152	family with sequence similarity 92, member B	393246	2307	376937	10295	18283, 26271, 34259, 42247, 50235
2153	family with sequence similarity 92, member B	539556	2308	443411	10296	18284, 26272, 34260, 42248, 50236
2154	Fas (TNFRSF6) binding factor 1	319129	2309	324292	10297	18285, 26273, 34261, 42249, 50237
2155	Fas (TNFRSF6) binding factor 1	337792	2310	337039	10298	18286, 26274, 34262, 42250, 50238
2156	Fas (TNFRSF6) binding factor 1	389570	2311	374221	10299	18287, 26275, 34263, 42251, 50239
2157	Fas (TNFRSF6) binding factor 1	427433	2312	401215	10300	18288, 26276, 34264, 42252, 50240
2158	FAST kinase domains 1	445210	2313	399551	10301	18289, 26277, 34265, 42253, 50241
2159	FAST kinase domains 1	453153	2314	400513	10302	18290, 26278, 34266, 42254, 50242
2160	FAST kinase domains 1	453929	2315	403229	10303	18291, 26279, 34267, 42255, 50243
2161	FAST kinase domains 3	264669	2316	264669	10304	18292, 26280, 34268, 42256, 50244
2162	FAST kinase domains 3	504695	2317	426008	10305	18293, 26281, 34269, 42257, 50245
2163	fat storage-inducing transmembrane protein 1	267426	2318	267426	10306	18294, 26282, 34270, 42258, 50246
2164	fat storage-inducing transmembrane protein 2	396825	2319	380037	10307	18295, 26283, 34271, 42259, 50247

2165	fatty acid desaturase domain family, member 6	310226	2320	307821	10308	18296, 26284, 34272, 42260, 50248
2166	fatty acid desaturase domain family, member 6	413142	2321	396743	10309	18297, 26285, 34273, 42261, 50249
2167	fatty acyl CoA reductase 1	354817	2322	346874	10310	18298, 26286, 34274, 42262, 50250
2168	fatty acyl CoA reductase 1	355107	2323	347226	10311	18299, 26287, 34275, 42263, 50251
2169	fatty acyl CoA reductase 2	182377	2324	182377	10312	18300, 26288, 34276, 42264, 50252
2170	fatty acyl CoA reductase 2	536681	2325	443291	10313	18301, 26289, 34277, 42265, 50253
2171	Fc receptor-like 2	292389	2326	292389	10314	18302, 26290, 34278, 42266, 50254
2172	Fc receptor-like 2	361516	2327	355157	10315	18303, 26291, 34279, 42267, 50255
2173	Fc receptor-like 2	368181	2328	357163	10316	18304, 26292, 34280, 42268, 50256
2174	Fc receptor-like 2	392274	2329	376100	10317	18305, 26293, 34281, 42269, 50257
2175	Fc receptor-like 2	469986	2330	417393	10318	18306, 26294, 34282, 42270, 50258
2176	Fc receptor-like 3	292392	2331	292392	10319	18307, 26295, 34283, 42271, 50259
2177	Fc receptor-like 3	368184	2332	357167	10320	18308, 26296, 34284, 42272, 50260
2178	Fc receptor-like 3	368186	2333	357169	10321	18309, 26297, 34285, 42273, 50261
2179	Fc receptor-like 3	485028	2334	434331	10322	18310, 26298, 34286, 42274, 50262
2180	Fc receptor-like 4	271532	2335	271532	10323	18311, 26299, 34287, 42275, 50263
2181	Fc receptor-like 5	356953	2336	349434	10324	18312, 26300, 34288, 42276, 50264
2182	Fc receptor-like 5	361835	2337	354691	10325	18313, 26301, 34289, 42277, 50265

2183	Fc receptor-like 5	368188	2338	357171	10326	18314, 26302, 34290, 42278, 50266
2184	Fc receptor-like 5	368189	2339	357172	10327	18315, 26303, 34291, 42279, 50267
2185	Fc receptor-like 5	368190	2340	357173	10328	18316, 26304, 34292, 42280, 50268
2186	Fc receptor-like 5	368191	2341	357174	10329	18317, 26305, 34293, 42281, 50269
2187	Fc receptor-like 6	339348	2342	340949	10330	18318, 26306, 34294, 42282, 50270
2188	Fc receptor-like 6	368106	2343	357086	10331	18319, 26307, 34295, 42283, 50271
2189	Fc receptor-like 6	392235	2344	376068	10332	18320, 26308, 34296, 42284, 50272
2190	Feline leukemia virus subgroup C receptor-related protein 2	238667	2345	238667	10333	18321, 26309, 34297, 42285, 50273
2191	Feline leukemia virus subgroup C receptor-related protein 2	539311	2346	443439	10334	18322, 26310, 34298, 42286, 50274
2192	fer-1-like 6 (C. elegans)	399018	2347	381982	10335	18323, 26311, 34299, 42287, 50275
2193	fer-1-like 6 (C. elegans)	522917	2348	428280	10336	18324, 26312, 34300, 42288, 50276
2194	FERM and PDZ domain containing 1	359927	2349	439868	10337	18325, 26313, 34301, 42289, 50277
2195	FERM and PDZ domain containing 1	377765	2350	366995	10338	18326, 26314, 34302, 42290, 50278
2196	FERM and PDZ domain containing 1	536622	2351	437762	10339	18327, 26315, 34303, 42291, 50279
2197	FERM and PDZ domain containing 1	539465	2352	444411	10340	18328, 26316, 34304, 42292, 50280
2198	FERM and PDZ domain containing 1	541302	2353	444804	10341	18329, 26317, 34305, 42293, 50281
2199	FERM domain containing 5	417257	2354	403067	10342	18330, 26318, 34306, 42294, 50282

2200	FERM domain containing 5	484674	2355	452968	10343	18331, 26319, 34307, 42295, 50283
2201	FERM domain containing 6	344768	2356	343899	10344	18332, 26320, 34308, 42296, 50284
2202	FERM domain containing 6	356218	2357	348550	10345	18333, 26321, 34309, 42297, 50285
2203	FERM domain containing 6	395718	2358	379068	10346	18334, 26322, 34310, 42298, 50286
2204	FERM domain containing 6	553556	2359	452529	10347	18335, 26323, 34311, 42299, 50287
2205	FERM domain containing 6	554778	2360	452122	10348	18336, 26324, 34312, 42300, 50288
2206	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	319562	2361	322926	10349	18337, 26325, 34313, 42301, 50289
2207	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	376581	2362	365765	10350	18338, 26326, 34314, 42302, 50290
2208	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	376584	2363	365768	10351	18339, 26327, 34315, 42303, 50291
2209	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	376586	2364	365771	10352	18340, 26328, 34316, 42304, 50292
2210	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	423063	2365	410930	10353	18341, 26329, 34317, 42305, 50293
2211	FERM, RhoGEF (ARHGEF) and pleckstrin domain protein 1 (chondrocyte-derived)	457029	2366	406623	10354	18342, 26330, 34318, 42306, 50294

2212	FERM, RhoGEF and pleckstrin domain protein 2	264042	2367	264042	10355	18343, 26331, 34319, 42307, 50295
2213	FERM, RhoGEF and pleckstrin domain protein 2	373287	2368	362384	10356	18344, 26332, 34320, 42308, 50296
2214	FERM, RhoGEF and pleckstrin domain protein 2	412332	2369	403437	10357	18345, 26333, 34321, 42309, 50297
2215	FERM, RhoGEF and pleckstrin domain protein 2	418082	2370	393376	10358	18346, 26334, 34322, 42310, 50298
2216	FERM, RhoGEF and pleckstrin domain protein 2	445489	2371	388167	10359	18347, 26335, 34323, 42311, 50299
2217	FERM, RhoGEF and pleckstrin domain protein 2	545004	2372	443876	10360	18348, 26336, 34324, 42312, 50300
2218	fermitin family member 1	217289	2373	217289	10361	18349, 26337, 34325, 42313, 50301
2219	fermitin family member 1	339538	2374	342074	10362	18350, 26338, 34326, 42314, 50302
2220	fermitin family member 1	378844	2375	368121	10363	18351, 26339, 34327, 42315, 50303
2221	fermitin family member 1	536936	2376	441063	10364	18352, 26340, 34328, 42316, 50304
2222	ferredoxin 1-like	393708	2377	377311	10365	18353, 26341, 34329, 42317, 50305
2223	ferredoxin 1-like	541276	2378	441093	10366	18354, 26342, 34330, 42318, 50306
2224	fetal and adult testis expressed 1	370350	2379	359375	10367	18355, 26343, 34331, 42319, 50307
2225	fibroblast growth factor receptor substrate 2	299293	2380	299293	10368	18356, 26344, 34332, 42320, 50308
2226	fibroblast growth factor receptor substrate 2	397997	2381	381083	10369	18357, 26345, 34333, 42321, 50309
2227	fibroblast growth factor receptor substrate 2	547219	2382	447724	10370	18358, 26346, 34334, 42322, 50310
2228	fibroblast growth factor receptor substrate 2	548154	2383	449105	10371	18359, 26347, 34335, 42323, 50311
2229	fibroblast growth factor receptor substrate 2	549092	2384	449111	10372	18360, 26348, 34336, 42324, 50312

2230	fibroblast growth factor receptor substrate 2	549921	2385	450048	10373	18361, 26349, 34337, 42325, 50313
2231	fibroblast growth factor receptor substrate 2	550169	2386	447978	10374	18362, 26350, 34338, 42326, 50314
2232	fibroblast growth factor receptor substrate 2	550316	2387	450000	10375	18363, 26351, 34339, 42327, 50315
2233	fibroblast growth factor receptor substrate 2	550389	2388	447241	10376	18364, 26352, 34340, 42328, 50316
2234	fibroblast growth factor receptor substrate 2	550937	2389	447804	10377	18365, 26353, 34341, 42329, 50317
2235	fibroblast growth factor receptor substrate 2	551325	2390	449432	10378	18366, 26354, 34342, 42330, 50318
2236	fibroblast growth factor receptor substrate 3	259748	2391	259748	10379	18367, 26355, 34343, 42331, 50319
2237	fibroblast growth factor receptor substrate 3	373018	2392	362109	10380	18368, 26356, 34344, 42332, 50320
2238	fibroblast growth factor receptor substrate 3	422888	2393	413214	10381	18369, 26357, 34345, 42333, 50321
2239	fibroblast growth factor receptor substrate 3	426290	2394	396715	10382	18370, 26358, 34346, 42334, 50322
2240	fibronectin type III domain containing 3A	337156	2395	338579	10383	18371, 26359, 34347, 42335, 50323
2241	fibronectin type III domain containing 3A	398316	2396	381362	10384	18372, 26360, 34348, 42336, 50324
2242	fibronectin type III domain containing 3A	492622	2397	417257	10385	18373, 26361, 34349, 42337, 50325
2243	fibronectin type III domain containing 3A	541916	2398	441831	10386	18374, 26362, 34350, 42338, 50326
2244	fibronectin type III domain containing 3A	484074	2399	420275	10387	18375, 26363, 34351, 42339, 50327
2245	fibronectin type III domain containing 9	312349	2400	310594	10388	18376, 26364, 34352, 42340, 50328
2246	fibronectin type III domain containing 9	520782	2401	429434	10389	18377, 26365, 34353, 42341, 50329
2247	fibrous sheath interacting protein 2	326147	2402	321903	10390	18378, 26366, 34354, 42342, 50330

2248	fibrous sheath interacting protein 2	343098	2403	344403	10391	18379, 26367, 34355, 42343, 50331
2249	fibrous sheath interacting protein 2	424728	2404	401306	10392	18380, 26368, 34356, 42344, 50332
2250	fibrous sheath interacting protein 2	429412	2405	395888	10393	18381, 26369, 34357, 42345, 50333
2251	fibrous sheath interacting protein 2	546113	2406	439530	10394	18382, 26370, 34358, 42346, 50334
2252	FIC domain containing	552695	2407	446479	10395	18383, 26371, 34359, 42347, 50335
2253	filamin binding LIM protein 1	332305	2408	364920	10396	18384, 26372, 34360, 42348, 50336
2254	filamin binding LIM protein 1	375766	2409	364921	10397	18385, 26373, 34361, 42349, 50337
2255	filamin binding LIM protein 1	375771	2410	364926	10398	18386, 26374, 34362, 42350, 50338
2256	filamin binding LIM protein 1	400773	2411	383584	10399	18387, 26375, 34363, 42351, 50339
2257	filamin binding LIM protein 1	430076	2412	387595	10400	18388, 26376, 34364, 42352, 50340
2258	filamin binding LIM protein 1	431771	2413	402401	10401	18389, 26377, 34365, 42353, 50341
2259	filamin binding LIM protein 1	441801	2414	416387	10402	18390, 26378, 34366, 42354, 50342
2260	filamin binding LIM protein 1	483633	2415	427052	10403	18391, 26379, 34367, 42355, 50343
2261	filamin binding LIM protein 1	496928	2416	422862	10404	18392, 26380, 34368, 42356, 50344
2262	filamin binding LIM protein 1	502638	2417	422075	10405	18393, 26381, 34369, 42357, 50345
2263	filamin binding LIM protein 1	502739	2418	424920	10406	18394, 26382, 34370, 42358, 50346
2264	filamin binding LIM protein 1	508310	2419	423471	10407	18395, 26383, 34371, 42359, 50347
2265	filamin binding LIM protein 1	510393	2420	421885	10408	18396, 26384, 34372, 42360, 50348

2266	filamin binding LIM protein 1	510929	2421	421764	10409	18397, 26385, 34373, 42361, 50349
2267	FK506 binding protein 11, 19 kDa	444214	2422	412403	10410	18398, 26386, 34374, 42362, 50350
2268	FK506 binding protein 11, 19 kDa	453172	2423	396874	10411	18399, 26387, 34375, 42363, 50351
2269	FK506 binding protein 11, 19 kDa	550765	2424	449751	10412	18400, 26388, 34376, 42364, 50352
2270	FK506 binding protein 14, 22 kDa	222803	2425	222803	10413	18401, 26389, 34377, 42365, 50353
2271	FK506 binding protein 9, 63 kDa	242209	2426	242209	10414	18402, 26390, 34378, 42366, 50354
2272	FK506 binding protein 9, 63 kDa	490776	2427	441317	10415	18403, 26391, 34379, 42367, 50355
2273	FK506 binding protein 9, 63 kDa	538336	2428	439250	10416	18404, 26392, 34380, 42368, 50356
2274	FK506 binding protein 9, 63 kDa	538443	2429	437504	10417	18405, 26393, 34381, 42369, 50357
2275	formin 1	320930	2430	325166	10418	18406, 26394, 34382, 42370, 50358
2276	formin 1	334528	2431	333950	10419	18407, 26395, 34383, 42371, 50359
2277	formin 1	558197	2432	452984	10420	18408, 26396, 34384, 42372, 50360
2278	formin 1	559047	2433	454047	10421	18409, 26397, 34385, 42373, 50361
2279	fragile X mental retardation 1 neighbor	370467	2434	359498	10422	18410, 26398, 34386, 42374, 50362
2280	free fatty acid receptor 1	246553	2435	246553	10423	18411, 26399, 34387, 42375, 50363
2281	free fatty acid receptor 2	246549	2436	246549	10424	18412, 26400, 34388, 42376, 50364
2282	free fatty acid receptor 3	327809	2437	328230	10425	18413, 26401, 34389, 42377, 50365
2283	frizzled family receptor 5	295417	2438	354607	10426	18414, 26402, 34390, 42378, 50366

2284	FtsJ methyltransferase domain containing 1	338099	2439	337512	10427	18415, 26403, 34391, 42379, 50367
2285	FtsJ methyltransferase domain containing 1	434935	2440	411148	10428	18416, 26404, 34392, 42380, 50368
2286	fucosyltransferase 10 (alpha (1,3) fucosyltransferase)	327671	2441	332757	10429	18417, 26405, 34393, 42381, 50369
2287	fucosyltransferase 10 (alpha (1,3) fucosyltransferase)	335589	2442	334997	10430	18418, 26406, 34394, 42382, 50370
2288	fucosyltransferase 10 (alpha (1,3) fucosyltransferase)	380081	2443	369421	10431	18419, 26407, 34395, 42383, 50371
2289	fucosyltransferase 11 (alpha (1,3) fucosyltransferase)	372841	2444	361932	10432	18420, 26408, 34396, 42384, 50372
2290	fucosyltransferase 11 (alpha (1,3) fucosyltransferase)	394790	2445	378270	10433	18421, 26409, 34397, 42385, 50373
2291	FUN14 domain containing 2	369498	2446	358510	10434	18422, 26410, 34398, 42386, 50374
2292	furry homolog (Drosophila)	267067	2447	267067	10435	18423, 26411, 34399, 42387, 50375
2293	furry homolog (Drosophila)	380217	2448	369565	10436	18424, 26412, 34400, 42388, 50376
2294	furry homolog (Drosophila)	380235	2449	369584	10437	18425, 26413, 34401, 42389, 50377
2295	furry homolog (Drosophila)	380250	2450	369600	10438	18426, 26414, 34402, 42390, 50378
2296	furry homolog (Drosophila)	380257	2451	369607	10439	18427, 26415, 34403, 42391, 50379
2297	furry homolog (Drosophila)	436046	2452	398010	10440	18428, 26416, 34404, 42392, 50380
2298	furry homolog (Drosophila)	542859	2453	445043	10441	18429, 26417, 34405, 42393, 50381
2299	FXYD domain containing ion transport regulator 4	374451	2454	363575	10442	18430, 26418, 34406, 42394, 50382
2300	FXYD domain containing ion transport regulator 4	458363	2455	388004	10443	18431, 26419, 34407, 42395, 50383
2301	G elongation factor, mitochondrial 2	296805	2456	296805	10444	18432, 26420, 34408, 42396, 50384

2302	G elongation factor, mitochondrial 2	345239	2457	296804	10445	18433, 26421, 34409, 42397, 50385
2303	G elongation factor, mitochondrial 2	427854	2458	405808	10446	18434, 26422, 34410, 42398, 50386
2304	G elongation factor, mitochondrial 2	509430	2459	427004	10447	18435, 26423, 34411, 42399, 50387
2305	G elongation factor, mitochondrial 2	546082	2460	437810	10448	18436, 26424, 34412, 42400, 50388
2306	G kinase anchoring protein 1	376365	2461	365544	10449	18437, 26425, 34413, 42401, 50389
2307	G kinase anchoring protein 1	376371	2462	365550	10450	18438, 26426, 34414, 42402, 50390
2308	G kinase anchoring protein 1	388782	2463	373434	10451	18439, 26427, 34415, 42403, 50391
2309	G kinase anchoring protein 1	485742	2464	417621	10452	18440, 26428, 34416, 42404, 50392
2310	G protein regulated inducer of neurite outgrowth 1	303991	2465	305839	10453	18441, 26429, 34417, 42405, 50393
2311	G protein regulated inducer of neurite outgrowth 1	335532	2466	335279	10454	18442, 26430, 34418, 42406, 50394
2312	G protein-coupled receptor 107	347136	2467	336988	10455	18443, 26431, 34419, 42407, 50395
2313	G protein-coupled receptor 107	372406	2468	361483	10456	18444, 26432, 34420, 42408, 50396
2314	G protein-coupled receptor 107	372410	2469	361487	10457	18445, 26433, 34421, 42409, 50397
2315	G protein-coupled receptor 107	455412	2470	402109	10458	18446, 26434, 34422, 42410, 50398
2316	G protein-coupled receptor 108	264080	2471	264080	10459	18447, 26435, 34423, 42411, 50399
2317	G protein-coupled receptor 108	430424	2472	401284	10460	18448, 26436, 34424, 42412, 50400
2318	G protein-coupled receptor 110	283297	2473	283297	10461	18449, 26437, 34425, 42413, 50401
2319	G protein-coupled receptor 110	371243	2474	360289	10462	18450, 26438, 34426, 42414, 50402

2320	G protein-coupled receptor 110	371252	2475	360298	10463	18451, 26439, 34427, 42415, 50403
2321	G protein-coupled receptor 110	371253	2476	360299	10464	18452, 26440, 34428, 42416, 50404
2322	G protein-coupled receptor 111	296862	2477	296862	10465	18453, 26441, 34429, 42417, 50405
2323	G protein-coupled receptor 111	398742	2478	381727	10466	18454, 26442, 34430, 42418, 50406
2324	G protein-coupled receptor 111	467205	2479	425269	10467	18455, 26443, 34431, 42419, 50407
2325	G protein-coupled receptor 112	287534	2480	287534	10468	18456, 26444, 34432, 42420, 50408
2326	G protein-coupled receptor 112	370652	2481	359686	10469	18457, 26445, 34433, 42421, 50409
2327	G protein-coupled receptor 112	394143	2482	377699	10470	18458, 26446, 34434, 42422, 50410
2328	G protein-coupled receptor 112	412101	2483	416526	10471	18459, 26447, 34435, 42423, 50411
2329	G protein-coupled receptor 113	311519	2484	307831	10472	18460, 26448, 34436, 42424, 50412
2330	G protein-coupled receptor 113	333478	2485	327396	10473	18461, 26449, 34437, 42425, 50413
2331	G protein-coupled receptor 113	541401	2486	445729	10474	18462, 26450, 34438, 42426, 50414
2332	G protein-coupled receptor 113	421160	2487	388537	10475	18463, 26451, 34439, 42427, 50415
2333	G protein-coupled receptor 114	340339	2488	342981	10476	18464, 26452, 34440, 42428, 50416
2334	G protein-coupled receptor 114	349457	2489	290823	10477	18465, 26453, 34441, 42429, 50417
2335	G protein-coupled receptor 114	394361	2490	377888	10478	18466, 26454, 34442, 42430, 50418
2336	G protein-coupled receptor 116	265417	2491	265417	10479	18467, 26455, 34443, 42431, 50419
2337	G protein-coupled receptor 116	283296	2492	283296	10480	18468, 26456, 34444, 42432, 50420

2338	G protein-coupled receptor 116	362015	2493	354563	10481	18469, 26457, 34445, 42433, 50421
2339	G protein-coupled receptor 116	452370	2494	394590	10482	18470, 26458, 34446, 42434, 50422
2340	G protein-coupled receptor 116	456426	2495	412866	10483	18471, 26459, 34447, 42435, 50423
2341	G protein-coupled receptor 116	545557	2496	440867	10484	18472, 26460, 34448, 42436, 50424
2342	G protein-coupled receptor 116	545669	2497	441581	10485	18473, 26461, 34449, 42437, 50425
2343	G protein-coupled receptor 119	276218	2498	276218	10486	18474, 26462, 34450, 42438, 50426
2344	G protein-coupled receptor 135	395116	2499	378548	10487	18475, 26463, 34451, 42439, 50427
2345	G protein-coupled receptor 135	481661	2500	432696	10488	18476, 26464, 34452, 42440, 50428
2346	G protein-coupled receptor 135	539022	2501	444314	10489	18477, 26465, 34453, 42441, 50429
2347	G protein-coupled receptor 137	313074	2502	321698	10490	18478, 26466, 34454, 42442, 50430
2348	G protein-coupled receptor 137	377702	2503	366931	10491	18479, 26467, 34455, 42443, 50431
2349	G protein-coupled receptor 137	411458	2504	411827	10492	18480, 26468, 34456, 42444, 50432
2350	G protein-coupled receptor 137	438980	2505	415698	10493	18481, 26469, 34457, 42445, 50433
2351	G protein-coupled receptor 137	535675	2506	446342	10494	18482, 26470, 34458, 42446, 50434
2352	G protein-coupled receptor 137	538032	2507	445000	10495	18483, 26471, 34459, 42447, 50435
2353	G protein-coupled receptor 137	538244	2508	442322	10496	18484, 26472, 34460, 42448, 50436
2354	G protein-coupled receptor 137	539833	2509	438716	10497	18485, 26473, 34461, 42449, 50437
2355	G protein-coupled receptor 137	539851	2510	442792	10498	18486, 26474, 34462, 42450, 50438

2356	G protein-coupled receptor 137	540370	2511	446387	10499	18487, 26475, 34463, 42451, 50439
2357	G protein-coupled receptor 137	540969	2512	437739	10500	18488, 26476, 34464, 42452, 50440
2358	G protein-coupled receptor 137	543383	2513	441003	10501	18489, 26477, 34465, 42453, 50441
2359	G protein-coupled receptor 137B	366591	2514	355550	10502	18490, 26478, 34466, 42454, 50442
2360	G protein-coupled receptor 137B	366592	2515	355551	10503	18491, 26479, 34467, 42455, 50443
2361	G protein-coupled receptor 137B	391852	2516	375725	10504	18492, 26480, 34468, 42456, 50444
2362	G protein-coupled receptor 137B	419162	2517	401841	10505	18493, 26481, 34469, 42457, 50445
2363	G protein-coupled receptor 137B	454895	2518	395814	10506	18494, 26482, 34470, 42458, 50446
2364	G protein-coupled receptor 137C	321662	2519	315106	10507	18495, 26483, 34471, 42459, 50447
2365	G protein-coupled receptor 139	326571	2520	370779	10508	18496, 26484, 34472, 42460, 50448
2366	G protein-coupled receptor 139	570682	2521	458791	10509	18497, 26485, 34473, 42461, 50449
2367	G protein-coupled receptor 141	334425	2522	334540	10510	18498, 26486, 34474, 42462, 50450
2368	G protein-coupled receptor 141	447769	2523	390410	10511	18499, 26487, 34475, 42463, 50451
2369	G protein-coupled receptor 141	450180	2524	396300	10512	18500, 26488, 34476, 42464, 50452
2370	G protein-coupled receptor 142	335666	2525	335158	10513	18501, 26489, 34477, 42465, 50453
2371	G protein-coupled receptor 144	334810	2526	335156	10514	18502, 26490, 34478, 42466, 50454
2372	G protein-coupled receptor 144	439837	2527	405734	10515	18503, 26491, 34479, 42467, 50455
2373	G protein-coupled receptor 144	446588	2528	414478	10516	18504, 26492, 34480, 42468, 50456

2374	G protein-coupled receptor 144	536897	2529	443708	10517	18505, 26493, 34481, 42469, 50457
2375	G protein-coupled receptor 146	297468	2530	297468	10518	18506, 26494, 34482, 42470, 50458
2376	G protein-coupled receptor 146	397095	2531	380283	10519	18507, 26495, 34483, 42471, 50459
2377	G protein-coupled receptor 146	444847	2532	410743	10520	18508, 26496, 34484, 42472, 50460
2378	G protein-coupled receptor 146	500070	2533	444126	10521	18509, 26497, 34485, 42473, 50461
2379	G protein-coupled receptor 148	309926	2534	308908	10522	18510, 26498, 34486, 42474, 50462
2380	G protein-coupled receptor 149	389740	2535	374390	10523	18511, 26499, 34487, 42475, 50463
2381	G protein-coupled receptor 150	380007	2536	369344	10524	18512, 26500, 34488, 42476, 50464
2382	G protein-coupled receptor 151	311104	2537	308733	10525	18513, 26501, 34489, 42477, 50465
2383	G protein-coupled receptor 152	312457	2538	310255	10526	18514, 26502, 34490, 42478, 50466
2384	G protein-coupled receptor 155	295500	2539	295500	10527	18515, 26503, 34491, 42479, 50467
2385	G protein-coupled receptor 155	392551	2540	376334	10528	18516, 26504, 34492, 42480, 50468
2386	G protein-coupled receptor 155	392552	2541	376335	10529	18517, 26505, 34493, 42481, 50469
2387	G protein-coupled receptor 155	510236	2542	446160	10530	18518, 26506, 34494, 42482, 50470
2388	G protein-coupled receptor 157	377408	2543	366625	10531	18519, 26507, 34495, 42483, 50471
2389	G protein-coupled receptor 157	377411	2544	366628	10532	18520, 26508, 34496, 42484, 50472
2390	G protein-coupled receptor 157	414642	2545	411172	10533	18521, 26509, 34497, 42485, 50473
2391	G protein-coupled receptor 158	376351	2546	365529	10534	18522, 26510, 34498, 42486, 50474

2392	G protein-coupled receptor 160	355897	2547	348161	10535	18523, 26511, 34499, 42487, 50475
2393	G protein-coupled receptor 160	473675	2548	420751	10536	18524, 26512, 34500, 42488, 50476
2394	G protein-coupled receptor 160	482710	2549	419400	10537	18525, 26513, 34501, 42489, 50477
2395	G protein-coupled receptor 160	492492	2550	418531	10538	18526, 26514, 34502, 42490, 50478
2396	G protein-coupled receptor 162	311268	2551	311528	10539	18527, 26515, 34503, 42491, 50479
2397	G protein-coupled receptor 162	428545	2552	399670	10540	18528, 26516, 34504, 42492, 50480
2398	G protein-coupled receptor 171	309180	2553	308479	10541	18529, 26517, 34505, 42493, 50481
2399	G protein-coupled receptor 171	480322	2554	420109	10542	18530, 26518, 34506, 42494, 50482
2400	G protein-coupled receptor 173	332582	2555	331600	10543	18531, 26519, 34507, 42495, 50483
2401	G protein-coupled receptor 173	375466	2556	364615	10544	18532, 26520, 34508, 42496, 50484
2402	G protein-coupled receptor 174	276077	2557	276077	10545	18533, 26521, 34509, 42497, 50485
2403	G protein-coupled receptor 179	342292	2558	345060	10546	18534, 26522, 34510, 42498, 50486
2404	G protein-coupled receptor 180	376958	2559	366157	10547	18535, 26523, 34511, 42499, 50487
2405	G protein-coupled receptor 182	300098	2560	300098	10548	18536, 26524, 34512, 42500, 50488
2406	G protein-coupled receptor 37 like 1	367282	2561	356251	10549	18537, 26525, 34513, 42501, 50489
2407	G protein-coupled receptor 37 like 1	541334	2562	439451	10550	18538, 26526, 34514, 42502, 50490
2408	G protein-coupled receptor 77	257267	2563	257267	10551	18539, 26527, 34515, 42503, 50491
2409	G protein-coupled receptor 77	600626	2564	471184	10552	18540, 26528, 34516, 42504, 50492

2410	G protein-coupled receptor 88	315033	2565	314223	10553	18541, 26529, 34517, 42505, 50493
2411	G protein-coupled receptor 89C	447947	2566	399563	10554	18542, 26530, 34518, 42506, 50494
2412	G protein-coupled receptor 97	327655	2567	331199	10555	18543, 26531, 34519, 42507, 50495
2413	G protein-coupled receptor 97	333493	2568	332900	10556	18544, 26532, 34520, 42508, 50496
2414	G protein-coupled receptor 97	450388	2569	404803	10557	18545, 26533, 34521, 42509, 50497
2415	G protein-coupled receptor, family C, group 5, member A	14914	2570	14914	10558	18546, 26534, 34522, 42510, 50498, 56085, 56118
2416	G protein-coupled receptor, family C, group 5, member A	534831	2571	441627	10559	18547, 26535, 34523, 42511, 50499
2417	G protein-coupled receptor, family C, group 6, member A	310357	2572	309493	10560	18548, 26536, 34524, 42512, 50500
2418	G protein-coupled receptor, family C, group 6, member A	368549	2573	357537	10561	18549, 26537, 34525, 42513, 50501
2419	G protein-coupled receptor, family C, group 6, member A	530250	2574	433465	10562	18550, 26538, 34526, 42514, 50502
2420	gametogenetin binding protein 1	374458	2575	363582	10563	18551, 26539, 34527, 42515, 50503
2421	gamma-aminobutyric acid (GABA) B receptor, 1	418225	2576	416731	10564	18552, 26540, 34528, 42516, 50504
2422	gamma-aminobutyric acid (GABA) B receptor, 1	440316	2577	412044	10565	18553, 26541, 34529, 42517, 50505
2423	gamma-aminobutyric acid (GABA) B receptor, 1	448754	2578	405709	10566	18554, 26542, 34530, 42518, 50506
2424	gamma-aminobutyric acid (GABA) B receptor, 1	458612	2579	416903	10567	18555, 26543, 34531, 42519, 50507
2425	gamma-aminobutyric acid (GABA) B receptor, 1	550820	2580	448763	10568	18556, 26544, 34532, 42520, 50508

2426	gamma-glutamyltransferase 7	336431	2581	338964	10569	18557, 26545, 34533, 42521, 50509
2427	GDNF family receptor alpha like	340465	2582	343636	10570	18558, 26546, 34534, 42522, 50510
2428	GH3 domain containing	301671	2583	301671	10571	18559, 26547, 34535, 42523, 50511
2429	GH3 domain containing	393854	2584	377436	10572	18560, 26548, 34536, 42524, 50512
2430	GH3 domain containing	414034	2585	399952	10573	18561, 26549, 34537, 42525, 50513
2431	GH3 domain containing	428494	2586	410945	10574	18562, 26550, 34538, 42526, 50514
2432	GH3 domain containing	436923	2587	402654	10575	18563, 26551, 34539, 42527, 50515
2433	GH3 domain containing	587427	2588	467585	10576	18564, 26552, 34540, 42528, 50516
2434	GIPC PDZ domain containing family, member 1	345425	2589	340698	10577	18565, 26553, 34541, 42529, 50517
2435	GIPC PDZ domain containing family, member 1	351277	2590	341425	10578	18566, 26554, 34542, 42530, 50518
2436	GIPC PDZ domain containing family, member 1	393028	2591	376748	10579	18567, 26555, 34543, 42531, 50519
2437	GIPC PDZ domain containing family, member 1	393029	2592	376749	10580	18568, 26556, 34544, 42532, 50520
2438	GIPC PDZ domain containing family, member 1	393033	2593	376753	10581	18569, 26557, 34545, 42533, 50521
2439	GLI pathogenesis-related 1 like 2	320460	2594	317385	10582	18570, 26558, 34546, 42534, 50522
2440	GLI pathogenesis-related 1 like 2	378689	2595	367960	10583	18571, 26559, 34547, 42535, 50523
2441	GLI pathogenesis-related 1 like 2	378692	2596	367963	10584	18572, 26560, 34548, 42536, 50524
2442	GLI pathogenesis-related 1 like 2	435775	2597	398328	10585	18573, 26561, 34549, 42537, 50525
2443	GLI pathogenesis-related 1 like 2	441218	2598	405273	10586	18574, 26562, 34550, 42538, 50526

2444	GLI pathogenesis-related 1 like 2	550916	2599	448248	10587	18575, 26563, 34551, 42539, 50527
2445	glucosamine-phosphate N-acetyltransferase 1	216410	2600	216410	10588	18576, 26564, 34552, 42540, 50528
2446	glucosamine-phosphate N-acetyltransferase 1	557604	2601	452032	10589	18577, 26565, 34553, 42541, 50529
2447	glucosaminyl (N-acetyl) transferase 4, core 2	322348	2602	317027	10590	18578, 26566, 34554, 42542, 50530
2448	glucosaminyl (N-acetyl) transferase family member 7	243913	2603	243913	10591	18579, 26567, 34555, 42543, 50531
2449	glucosidase, beta (bile acid) 2	378088	2604	367328	10592	18580, 26568, 34556, 42544, 50532
2450	glucosidase, beta (bile acid) 2	378094	2605	367334	10593	18581, 26569, 34557, 42545, 50533
2451	glucosidase, beta (bile acid) 2	378103	2606	367343	10594	18582, 26570, 34558, 42546, 50534
2452	glucosidase, beta (bile acid) 2	545786	2607	442372	10595	18583, 26571, 34559, 42547, 50535
2453	glutamate receptor, ionotropic, delta 2 (Grid2) interacting protein	457091	2608	397351	10596	18584, 26572, 34560, 42548, 50536
2454	glutamate receptor, ionotropic, N-methyl-D-aspartate 3B	234389	2609	234389	10597	18585, 26573, 34561, 42549, 50537
2455	glutamate receptor, metabotropic 5	305432	2610	305905	10598	18586, 26574, 34562, 42550, 50538
2456	glutamate receptor, metabotropic 5	305447	2611	306138	10599	18587, 26575, 34563, 42551, 50539
2457	glutamate receptor, metabotropic 5	393297	2612	376975	10600	18588, 26576, 34564, 42552, 50540
2458	glutamate receptor, metabotropic 5	418177	2613	402912	10601	18589, 26577, 34565, 42553, 50541
2459	glutamate receptor, metabotropic 5	455756	2614	405690	10602	18590, 26578, 34566, 42554, 50542
2460	glutaminyl-peptide cyclotransferase-like	12049	2615	12049	10603	18591, 26579, 34567, 42555, 50543, 56086, 56119

2461	glutaminyl-peptide cyclotransferase-like	366382	2616	387944	10604	18592, 26580, 34568, 42556, 50544
2462	glutaminyl-tRNA synthase (glutamine-hydrolyzing)-like 1	369044	2617	358040	10605	18593, 26581, 34569, 42557, 50545
2463	glutaminyl-tRNA synthase (glutamine-hydrolyzing)-like 1	369046	2618	358042	10606	18594, 26582, 34570, 42558, 50546
2464	Glutamyl-tRNA(Gln) amidotransferase subunit C, mitochondrial	551765	2619	446872	10607	18595, 26583, 34571, 42559, 50547
2465	glutathione peroxidase 8 (putative)	503787	2620	423822	10608	18596, 26584, 34572, 42560, 50548
2466	glycerol-3-phosphate acyltransferase 2, mitochondrial	359548	2621	352547	10609	18597, 26585, 34573, 42561, 50549
2467	glycerol-3-phosphate acyltransferase 2, mitochondrial	377137	2622	366341	10610	18598, 26586, 34574, 42562, 50550
2468	glycerol-3-phosphate acyltransferase 2, mitochondrial	434632	2623	389395	10611	18599, 26587, 34575, 42563, 50551
2469	glycerol-3-phosphate acyltransferase 2, mitochondrial	439254	2624	401334	10612	18600, 26588, 34576, 42564, 50552
2470	glycerol-3-phosphate acyltransferase, mitochondrial	348367	2625	265276	10613	18601, 26589, 34577, 42565, 50553
2471	glycerol-3-phosphate acyltransferase, mitochondrial	369425	2626	358433	10614	18602, 26590, 34578, 42566, 50554
2472	glycerol-3-phosphate acyltransferase, mitochondrial	423155	2627	409242	10615	18603, 26591, 34579, 42567, 50555
2473	glycerophosphodiester phosphodiesterase domain containing 1	284116	2628	284116	10616	18604, 26592, 34580, 42568, 50556
2474	glycerophosphodiester phosphodiesterase domain containing 1	581140	2629	463273	10617	18605, 26593, 34581, 42569, 50557

2475	glycerophosphodiester phosphodiesterase domain containing 1	581276	2630	464690	10618	18606, 26594, 34582, 42570, 50558
2476	glycerophosphodiester phosphodiesterase domain containing 2	374382	2631	363503	10619	18607, 26595, 34583, 42571, 50559
2477	glycerophosphodiester phosphodiesterase domain containing 2	453994	2632	414019	10620	18608, 26596, 34584, 42572, 50560
2478	glycerophosphodiester phosphodiesterase domain containing 2	536730	2633	445982	10621	18609, 26597, 34585, 42573, 50561
2479	glycerophosphodiester phosphodiesterase domain containing 2	538649	2634	444601	10622	18610, 26598, 34586, 42574, 50562
2480	glycerophosphodiester phosphodiesterase domain containing 3	360688	2635	353909	10623	18611, 26599, 34587, 42575, 50563
2481	glycerophosphodiester phosphodiesterase domain containing 3	406256	2636	384363	10624	18612, 26600, 34588, 42576, 50564
2482	glycerophosphodiester phosphodiesterase domain containing 4	315938	2637	320815	10625	18613, 26601, 34589, 42577, 50565
2483	glycerophosphodiester phosphodiesterase domain containing 4	376217	2638	365390	10626	18614, 26602, 34590, 42578, 50566
2484	glycine receptor, alpha 4	372617	2639	361700	10627	18615, 26603, 34591, 42579, 50567
2485	glycine-N-acyltransferase-like 1	300079	2640	300079	10628	18616, 26604, 34592, 42580, 50568
2486	glycine-N-acyltransferase-like 1	317391	2641	322223	10629	18617, 26605, 34593, 42581, 50569
2487	glycine-N-acyltransferase-like 1	444580	2642	401353	10630	18618, 26606, 34594, 42582, 50570
2488	glycine-N-acyltransferase-like 1	525608	2643	433716	10631	18619, 26607, 34595, 42583, 50571
2489	glycine-N-acyltransferase-like 1	532726	2644	436116	10632	18620, 26608, 34596, 42584, 50572

2490	glycine-N-acyltransferase-like 2	287275	2645	287275	10633	18621, 26609, 34597, 42585, 50573
2491	glycine-N-acyltransferase-like 2	532258	2646	434277	10634	18622, 26610, 34598, 42586, 50574
2492	glycine-N-acyltransferase-like 3	371197	2647	360240	10635	18623, 26611, 34599, 42587, 50575
2493	glycine-N-acyltransferase-like 3	545705	2648	440029	10636	18624, 26612, 34600, 42588, 50576
2494	glycoprotein (transmembrane) nmb	258733	2649	258733	10637	18625, 26613, 34601, 42589, 50577
2495	glycoprotein (transmembrane) nmb	381990	2650	371420	10638	18626, 26614, 34602, 42590, 50578
2496	glycoprotein (transmembrane) nmb	409458	2651	386476	10639	18627, 26615, 34603, 42591, 50579
2497	glycoprotein (transmembrane) nmb	425903	2652	396994	10640	18628, 26616, 34604, 42592, 50580
2498	glycoprotein (transmembrane) nmb	435486	2653	409199	10641	18629, 26617, 34605, 42593, 50581
2499	glycoprotein (transmembrane) nmb	453162	2654	405586	10642	18630, 26618, 34606, 42594, 50582
2500	glycoprotein (transmembrane) nmb	539136	2655	445266	10643	18631, 26619, 34607, 42595, 50583
2501	glycoprotein A33 (transmembrane)	367868	2656	356842	10644	18632, 26620, 34608, 42596, 50584
2502	glycoprotein V (platelet)	323007	2657	319286	10645	18633, 26621, 34609, 42597, 50585
2503	glycoprotein V (platelet)	401815	2658	383931	10646	18634, 26622, 34610, 42598, 50586
2504	glycosyltransferase 25 domain containing 1	252599	2659	252599	10647	18635, 26623, 34611, 42599, 50587
2505	glycosyltransferase 25 domain containing 1	379714	2660	369036	10648	18636, 26624, 34612, 42600, 50588
2506	glycosyltransferase 25 domain containing 2	361927	2661	354960	10649	18637, 26625, 34613, 42601, 50589
2507	glycosyltransferase 25 domain containing 2	367520	2662	356490	10650	18638, 26626, 34614, 42602, 50590

2508	glycosyltransferase 25 domain containing 2	367521	2663	356491	10651	18639, 26627, 34615, 42603, 50591
2509	glycosyltransferase 25 domain containing 2	546159	2664	439112	10652	18640, 26628, 34616, 42604, 50592
2510	glycosyltransferase 8 domain containing 2	360814	2665	354053	10653	18641, 26629, 34617, 42605, 50593
2511	glycosyltransferase 8 domain containing 2	546436	2666	449750	10654	18642, 26630, 34618, 42606, 50594
2512	glycosyltransferase 8 domain containing 2	548660	2667	447450	10655	18643, 26631, 34619, 42607, 50595
2513	glyoxalase domain containing 4	301328	2668	301328	10656	18644, 26632, 34620, 42608, 50596
2514	glyoxalase domain containing 4	301329	2669	301329	10657	18645, 26633, 34621, 42609, 50597
2515	glyoxalase domain containing 4	397393	2670	380548	10658	18646, 26634, 34622, 42610, 50598
2516	glyoxalase domain containing 4	536578	2671	444315	10659	18647, 26635, 34623, 42611, 50599
2517	golgi reassembly stacking protein 2, 55kDa	234160	2672	234160	10660	18648, 26636, 34624, 42612, 50600
2518	golgi reassembly stacking protein 2, 55kDa	452526	2673	410208	10661	18649, 26637, 34625, 42613, 50601
2519	golgi transport 1A	308302	2674	308535	10662	18650, 26638, 34626, 42614, 50602
2520	golgi transport 1B	229314	2675	229314	10663	18651, 26639, 34627, 42615, 50603
2521	golgi-associated, gamma adaptin ear containing, ARF binding protein 2	309859	2676	311962	10664	18652, 26640, 34628, 42616, 50604
2522	golgi-associated, gamma adaptin ear containing, ARF binding protein 2	498959	2677	442062	10665	18653, 26641, 34629, 42617, 50605
2523	golgin A2	342583	2678	342692	10666	18654, 26642, 34630, 42618, 50606
2524	golgin A2	421699	2679	416097	10667	18655, 26643, 34631, 42619, 50607

2525	golgin A2	450617	2680	409271	10668	18656, 26644, 34632, 42620, 50608
2526	golgin A7	357743	2681	350378	10669	18657, 26645, 34633, 42621, 50609
2527	golgin A7	405786	2682	386030	10670	18658, 26646, 34634, 42622, 50610
2528	golgin A7	518270	2683	429329	10671	18659, 26647, 34635, 42623, 50611
2529	golgin A7	520817	2684	429480	10672	18660, 26648, 34636, 42624, 50612
2530	G-protein signaling modulator 1	291775	2685	291775	10673	18661, 26649, 34637, 42625, 50613
2531	G-protein signaling modulator 1	354753	2686	346797	10674	18662, 26650, 34638, 42626, 50614
2532	G-protein signaling modulator 1	392944	2687	376673	10675	18663, 26651, 34639, 42627, 50615
2533	G-protein signaling modulator 1	392945	2688	376674	10676	18664, 26652, 34640, 42628, 50616
2534	G-protein signaling modulator 1	429455	2689	390705	10677	18665, 26653, 34641, 42629, 50617
2535	G-protein signaling modulator 1	440944	2690	392828	10678	18666, 26654, 34642, 42630, 50618
2536	GRAM domain containing 1A	317991	2691	441032	10679	18667, 26655, 34643, 42631, 50619
2537	GRAM domain containing 1A	411896	2692	439267	10680	18668, 26656, 34644, 42632, 50620
2538	GRAM domain containing 1A	453966	2693	441346	10681	18669, 26657, 34645, 42633, 50621
2539	GRAM domain containing 1A	504615	2694	423728	10682	18670, 26658, 34646, 42634, 50622
2540	GRAM domain containing 1B	322282	2695	325628	10683	18671, 26659, 34647, 42635, 50623
2541	GRAM domain containing 1B	529750	2696	436500	10684	18672, 26660, 34648, 42636, 50624
2542	GRAM domain containing 1B	539133	2697	444667	10685	18673, 26661, 34649, 42637, 50625

2543	GRAM domain containing 1C	358160	2698	350881	10686	18674, 26662, 34650, 42638, 50626
2544	GRAM domain containing 1C	440446	2699	408135	10687	18675, 26663, 34651, 42639, 50627
2545	GRAM domain containing 1C	452134	2700	399844	10688	18676, 26664, 34652, 42640, 50628
2546	GRAM domain containing 1C	462838	2701	418302	10689	18677, 26665, 34653, 42641, 50629
2547	GRAM domain containing 2	309731	2702	311657	10690	18678, 26666, 34654, 42642, 50630
2548	GRB2-binding adaptor protein, transmembrane	318469	2703	323075	10691	18679, 26667, 34655, 42643, 50631
2549	GRB2-binding adaptor protein, transmembrane	396776	2704	379997	10692	18680, 26668, 34656, 42644, 50632
2550	GRB2-binding adaptor protein, transmembrane	502276	2705	423113	10693	18681, 26669, 34657, 42645, 50633
2551	GRB2-binding adaptor protein, transmembrane	511930	2706	422645	10694	18682, 26670, 34658, 42646, 50634
2552	growth differentiation factor 5 opposite strand	374375	2707	363495	10695	18683, 26671, 34659, 42647, 50635
2553	growth hormone inducible transmembrane protein	339736	2708	342214	10696	18684, 26672, 34660, 42648, 50636
2554	growth hormone inducible transmembrane protein	372134	2709	361207	10697	18685, 26673, 34661, 42649, 50637
2555	growth hormone inducible transmembrane protein	436406	2710	397663	10698	18686, 26674, 34662, 42650, 50638
2556	growth hormone inducible transmembrane protein	538477	2711	444366	10699	18687, 26675, 34663, 42651, 50639
2557	growth regulation by estrogen in breast cancer-like	269218	2712	269218	10700	18688, 26676, 34664, 42652, 50640
2558	growth regulation by estrogen in breast cancer-like	400483	2713	383331	10701	18689, 26677, 34665, 42653, 50641
2559	growth regulation by estrogen in breast cancer-like	424526	2714	412060	10702	18690, 26678, 34666, 42654, 50642

2560	growth regulation by estrogen in breast cancer-like	431264	2715	393125	10703	18691, 26679, 34667, 42655, 50643
2561	GSG1-like	380897	2716	370282	10704	18692, 26680, 34668, 42656, 50644
2562	GSG1-like	380898	2717	370283	10705	18693, 26681, 34669, 42657, 50645
2563	GSG1-like	395724	2718	379074	10706	18694, 26682, 34670, 42658, 50646
2564	GSG1-like	447459	2719	394954	10707	18695, 26683, 34671, 42659, 50647
2565	GTP binding protein 3 (mitochondrial)	324894	2720	313818	10708	18696, 26684, 34672, 42660, 50648
2566	GTP binding protein 3 (mitochondrial)	358792	2721	351644	10709	18697, 26685, 34673, 42661, 50649
2567	GTP binding protein 3 (mitochondrial)	361619	2722	354598	10710	18698, 26686, 34674, 42662, 50650
2568	GTP binding protein 3 (mitochondrial)	546035	2723	438301	10711	18699, 26687, 34675, 42663, 50651
2569	GTP binding protein 3 (mitochondrial)	600625	2724	473150	10712	18700, 26688, 34676, 42664, 50652
2570	GTP binding protein 4	360059	2725	353168	10713	18701, 26689, 34677, 42665, 50653
2571	GTP binding protein 4	360803	2726	354040	10714	18702, 26690, 34678, 42666, 50654
2572	GTP binding protein 4	538293	2727	444277	10715	18703, 26691, 34679, 42667, 50655
2573	GTP binding protein 4	545048	2728	445473	10716	18704, 26692, 34680, 42668, 50656
2574	GTPase, IMAP family member 8	307271	2729	305107	10717	18705, 26693, 34681, 42669, 50657
2575	GTP-binding protein 8 (putative)	305485	2730	303802	10718	18706, 26694, 34682, 42670, 50658
2576	GTP-binding protein 8 (putative)	383677	2731	373175	10719	18707, 26695, 34683, 42671, 50659
2577	GTP-binding protein 8 (putative)	383678	2732	373176	10720	18708, 26696, 34684, 42672, 50660

2578	GTP-binding protein 8 (putative)	467752	2733	417632	10721	18709, 26697, 34685, 42673, 50661
2579	GTP-binding protein 8 (putative)	473129	2734	418514	10722	18710, 26698, 34686, 42674, 50662
2580	GTP-binding protein 8 (putative)	485330	2735	418877	10723	18711, 26699, 34687, 42675, 50663
2581	guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1	456394	2736	394470	10724	18712, 26700, 34688, 42676, 50664
2582	guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1	512805	2737	426909	10725	18713, 26701, 34689, 42677, 50665
2583	guanine nucleotide binding protein (G protein), gamma 10	374293	2738	363411	10726	18714, 26702, 34690, 42678, 50666
2584	guanine nucleotide binding protein (G protein), gamma 12	370982	2739	360021	10727	18715, 26703, 34691, 42679, 50667
2585	guanine nucleotide binding protein (G protein), gamma 3	294117	2740	294117	10728	18716, 26704, 34692, 42680, 50668
2586	guanine nucleotide binding protein (G protein), gamma 4	366597	2741	355556	10729	18717, 26705, 34693, 42681, 50669
2587	guanine nucleotide binding protein (G protein), gamma 4	366598	2742	355557	10730	18718, 26706, 34694, 42682, 50670
2588	guanine nucleotide binding protein (G protein), gamma 4	391854	2743	375727	10731	18719, 26707, 34695, 42683, 50671
2589	guanine nucleotide binding protein (G protein), gamma 4	450593	2744	398629	10732	18720, 26708, 34696, 42684, 50672
2590	guanine nucleotide binding protein (G protein), gamma 7	382159	2745	371594	10733	18721, 26709, 34697, 42685, 50673
2591	guanine nucleotide binding protein (G protein), gamma transducing activity polypeptide 1	428834	2746	401781	10734	18722, 26710, 34698, 42686, 50674
2592	guanine nucleotide binding protein (G protein), gamma transducing activity polypeptide 1	430875	2747	395756	10735	18723, 26711, 34699, 42687, 50675
2593	guanine nucleotide binding protein (G protein), gamma transducing activity	455502	2748	395857	10736	18724, 26712, 34700, 42688, 50676

	polypeptide 1					
2594	guanine nucleotide binding protein, alpha transducing 3	398291	2749	381339	10737	18725, 26713, 34701, 42689, 50677
2595	guanine nucleotide binding protein-like 3 (nucleolar)-like	336470	2750	338573	10738	18726, 26714, 34702, 42690, 50678
2596	guanine nucleotide binding protein-like 3 (nucleolar)-like	360845	2751	354091	10739	18727, 26715, 34703, 42691, 50679
2597	GUF1 GTPase homolog (S. cerevisiae)	281543	2752	281543	10740	18728, 26716, 34704, 42692, 50680
2598	haloacid dehalogenase-like hydrolase domain containing 3	238379	2753	238379	10741	18729, 26717, 34705, 42693, 50681
2599	haloacid dehalogenase-like hydrolase domain containing 3	374180	2754	363295	10742	18730, 26718, 34706, 42694, 50682
2600	HCG2044188Seven transmembrane helix receptorUncharacterized protein	316517	2755	321173	10743	18731, 26719, 34707, 42695, 50683
2601	HD domain containing 2	318787	2756	316242	10744	18732, 26720, 34708, 42696, 50684
2602	HD domain containing 2	398153	2757	381220	10745	18733, 26721, 34709, 42697, 50685
2603	HEAT repeat containing 8	339553	2758	343211	10746	18734, 26722, 34710, 42698, 50686
2604	HEAT repeat containing 8	371287	2759	360336	10747	18735, 26723, 34711, 42699, 50687
2605	HEAT repeat containing 8	395690	2760	379044	10748	18736, 26724, 34712, 42700, 50688
2606	HEAT repeat containing 8	414867	2761	403054	10749	18737, 26725, 34713, 42701, 50689
2607	HEAT repeat containing 8	421030	2762	396622	10750	18738, 26726, 34714, 42702, 50690
2608	HEAT repeat containing 8	454855	2763	401130	10751	18739, 26727, 34715, 42703, 50691
2609	HEAT repeat containing 8	545244	2764	442333	10752	18740, 26728, 34716, 42704, 50692

2610	heat shock protein 70kDa family, member 13	285667	2765	285667	10753	18741, 26729, 34717, 42705, 50693
2611	heat shock protein 70kDa family, member 13	544452	2766	441986	10754	18742, 26730, 34718, 42706, 50694
2612	hedgehog acyltransferase-like	310417	2767	310621	10755	18743, 26731, 34719, 42707, 50695
2613	hedgehog acyltransferase-like	341477	2768	341177	10756	18744, 26732, 34720, 42708, 50696
2614	hedgehog acyltransferase-like	416756	2769	395779	10757	18745, 26733, 34721, 42709, 50697
2615	hedgehog acyltransferase-like	441594	2770	405423	10758	18746, 26734, 34722, 42710, 50698
2616	hematopoietic cell signal transducer	246551	2771	246551	10759	18747, 26735, 34723, 42711, 50699
2617	hematopoietic cell signal transducer	437550	2772	400516	10760	18748, 26736, 34724, 42712, 50700
2618	heparan sulfate (glucosamine) 3-O-sulfotransferase 1	2596	2773	2596	10761	18749, 26737, 34725, 42713, 50701, 56087, 56120
2619	heparan sulfate (glucosamine) 3-O-sulfotransferase 1	510712	2774	422629	10762	18750, 26738, 34726, 42714, 50702
2620	heparan sulfate (glucosamine) 3-O-sulfotransferase 1	514690	2775	425673	10763	18751, 26739, 34727, 42715, 50703
2621	heparan sulfate (glucosamine) 3-O-sulfotransferase 6	293937	2776	293937	10764	18752, 26740, 34728, 42716, 50704
2622	heparan sulfate (glucosamine) 3-O-sulfotransferase 6	443547	2777	390354	10765	18753, 26741, 34729, 42717, 50705
2623	heparan sulfate (glucosamine) 3-O-sulfotransferase 6	454677	2778	416741	10766	18754, 26742, 34730, 42718, 50706
2624	hepatitis A virus cellular receptor 2	307851	2779	312002	10767	18755, 26743, 34731, 42719, 50707
2625	hephaestin-like 1	315765	2780	313699	10768	18756, 26744, 34732, 42720, 50708
2626	HERPUD family member 2	311350	2781	310729	10769	18757, 26745, 34733, 42721, 50709
2627	HERPUD family member 2	396081	2782	379390	10770	18758, 26746, 34734, 42722, 50710

2628	HERV-H LTR-associating 2	357759	2783	350402	10771	18759, 26747, 34735, 42723, 50711
2629	HERV-H LTR-associating 2	462629	2784	419911	10772	18760, 26748, 34736, 42724, 50712
2630	HERV-H LTR-associating 2	463019	2785	419940	10773	18761, 26749, 34737, 42725, 50713
2631	HERV-H LTR-associating 2	467761	2786	419207	10774	18762, 26750, 34738, 42726, 50714
2632	HERV-H LTR-associating 2	482430	2787	418174	10775	18763, 26751, 34739, 42727, 50715
2633	HERV-H LTR-associating 2	489514	2788	417856	10776	18764, 26752, 34740, 42728, 50716
2634	heterogeneous nuclear ribonucleoprotein M	325495	2789	325376	10777	18765, 26753, 34741, 42729, 50717
2635	heterogeneous nuclear ribonucleoprotein M	348943	2790	325732	10778	18766, 26754, 34742, 42730, 50718
2636	heterogeneous nuclear ribonucleoprotein M	539473	2791	443840	10779	18767, 26755, 34743, 42731, 50719
2637	heterogeneous nuclear ribonucleoprotein M	544159	2792	442876	10780	18768, 26756, 34744, 42732, 50720
2638	hexokinase domain containing 1	354624	2793	346643	10781	18769, 26757, 34745, 42733, 50721
2639	hexokinase domain containing 1	395086	2794	378521	10782	18770, 26758, 34746, 42734, 50722
2640	hexokinase domain containing 1	395087	2795	378522	10783	18771, 26759, 34747, 42735, 50723
2641	HIG1 hypoxia inducible domain family, member 1A	321331	2796	319393	10784	18772, 26760, 34748, 42736, 50724
2642	HIG1 hypoxia inducible domain family, member 1A	418900	2797	402160	10785	18773, 26761, 34749, 42737, 50725
2643	HIG1 hypoxia inducible domain family, member 1A	452906	2798	398064	10786	18774, 26762, 34750, 42738, 50726
2644	HIG1 hypoxia inducible domain family, member 1B	253410	2799	253410	10787	18775, 26763, 34751, 42739, 50727
2645	HIG1 hypoxia inducible domain family, member 2A	274787	2800	274787	10788	18776, 26764, 34752, 42740, 50728

2646	HIG1 hypoxia inducible domain family, member 2B	311755	2801	307951	10789	18777, 26765, 34753, 42741, 50729
2647	hippocampus abundant transcript 1	370152	2802	359171	10790	18778, 26766, 34754, 42742, 50730
2648	hippocampus abundant transcript 1	421661	2803	411185	10791	18779, 26767, 34755, 42743, 50731
2649	hippocampus abundant transcript-like 1	277183	2804	277183	10792	18780, 26768, 34756, 42744, 50732
2650	hippocampus abundant transcript-like 1	375344	2805	364493	10793	18781, 26769, 34757, 42745, 50733
2651	hippocampus abundant transcript-like 1	428393	2806	405909	10794	18782, 26770, 34758, 42746, 50734
2652	hippocampus abundant transcript-like 2	375223	2807	364371	10795	18783, 26771, 34759, 42747, 50735
2653	histidine rich carboxyl terminus 1	354323	2808	346283	10796	18784, 26772, 34760, 42748, 50736
2654	hydroxycarboxylic acid receptor 1	356987	2809	349478	10797	18785, 26773, 34761, 42749, 50737
2655	hydroxycarboxylic acid receptor 1	432564	2810	389255	10798	18786, 26774, 34762, 42750, 50738
2656	hydroxycarboxylic acid receptor 1	436083	2811	409980	10799	18787, 26775, 34763, 42751, 50739
2657	hydroxycarboxylic acid receptor 2	328880	2812	375066	10800	18788, 26776, 34764, 42752, 50740
2658	hydroxycarboxylic acid receptor 2	536970	2813	443556	10801	18789, 26777, 34765, 42753, 50741
2659	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	322165	2814	318631	10802	18790, 26778, 34766, 42754, 50742
2660	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	554150	2815	452273	10803	18791, 26779, 34767, 42755, 50743
2661	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	554155	2816	451497	10804	18792, 26780, 34768, 42756, 50744
2662	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	554643	2817	451406	10805	18793, 26781, 34769, 42757, 50745
2663	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	555159	2818	450698	10806	18794, 26782, 34770, 42758, 50746

2664	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	555805	2819	451753	10807	18795, 26783, 34771, 42759, 50747
2665	hydroxysteroid (17-beta) dehydrogenase 6 homolog (mouse)	556650	2820	452103	10808	18796, 26784, 34772, 42760, 50748
2666	hydroxysteroid dehydrogenase like 1	219439	2821	219439	10809	18797, 26785, 34773, 42761, 50749
2667	hydroxysteroid dehydrogenase like 1	434463	2822	407437	10810	18798, 26786, 34774, 42762, 50750
2668	hyperpolarization activated cyclic nucleotide-gated potassium channel 1	303230	2823	307342	10811	18799, 26787, 34775, 42763, 50751
2669	hypocretin (orexin) receptor 1	373705	2824	362809	10812	18800, 26788, 34776, 42764, 50752
2670	hypocretin (orexin) receptor 1	373706	2825	362810	10813	18801, 26789, 34777, 42765, 50753
2671	hypocretin (orexin) receptor 1	403528	2826	384387	10814	18802, 26790, 34778, 42766, 50754
2672	hypocretin (orexin) receptor 2	370862	2827	359899	10815	18803, 26791, 34779, 42767, 50755
2673	IKBKB interacting protein	299157	2828	299157	10816	18804, 26792, 34780, 42768, 50756
2674	IKBKB interacting protein	342502	2829	343471	10817	18805, 26793, 34781, 42769, 50757
2675	IKBKB interacting protein	393042	2830	376762	10818	18806, 26794, 34782, 42770, 50758
2676	IKBKB interacting protein	420861	2831	398023	10819	18807, 26795, 34783, 42771, 50759
2677	immunoglobulin superfamily, DCC subclass, member 3	327987	2832	332773	10820	18808, 26796, 34784, 42772, 50760
2678	immunoglobulin superfamily, DCC subclass, member 3	443278	2833	388643	10821	18809, 26797, 34785, 42773, 50761
2679	immunoglobulin superfamily, DCC subclass, member 4	352385	2834	319623	10822	18810, 26798, 34786, 42774, 50762
2680	immunoglobulin superfamily, DCC subclass, member 4	356152	2835	348473	10823	18811, 26799, 34787, 42775, 50763
2681	immunoglobulin superfamily, member 11	354673	2836	346700	10824	18812, 26800, 34788, 42776, 50764

2682	immunoglobulin superfamily, member 11	393775	2837	377370	10825	18813, 26801, 34789, 42777, 50765
2683	immunoglobulin superfamily, member 11	425327	2838	406092	10826	18814, 26802, 34790, 42778, 50766
2684	immunoglobulin superfamily, member 23	402988	2839	385592	10827	18815, 26803, 34791, 42779, 50767
2685	immunoglobulin superfamily, member 5	380588	2840	369962	10828	18816, 26804, 34792, 42780, 50768
2686	immunoglobulin-like domain containing receptor 2	271417	2841	271417	10829	18817, 26805, 34793, 42781, 50769
2687	inositol 1,4,5-trisphosphate receptor interacting protein	278071	2842	278071	10830	18818, 26806, 34794, 42782, 50770
2688	inositol 1,4,5-trisphosphate receptor interacting protein	337478	2843	337178	10831	18819, 26807, 34795, 42783, 50771
2689	inositol 1,4,5-trisphosphate receptor interacting protein	358187	2844	350915	10832	18820, 26808, 34796, 42784, 50772
2690	inositol 1,4,5-trisphosphate receptor interacting protein	458723	2845	414141	10833	18821, 26809, 34797, 42785, 50773
2691	inositol 1,4,5-trisphosphate receptor interacting protein-like 1	361124	2846	355121	10834	18822, 26810, 34798, 42786, 50774
2692	inositol 1,4,5-trisphosphate receptor interacting protein-like 1	439118	2847	389308	10835	18823, 26811, 34799, 42787, 50775
2693	inositol 1,4,5-trisphosphate receptor interacting protein-like 1	536814	2848	439566	10836	18824, 26812, 34800, 42788, 50776
2694	inositol 1,4,5-trisphosphate receptor interacting protein-like 1	542887	2849	438212	10837	18825, 26813, 34801, 42789, 50777
2695	inositol 1,4,5-trisphosphate receptor interacting protein-like 2	381440	2850	370849	10838	18826, 26814, 34802, 42790, 50778
2696	insulin receptor substrate 4	372129	2851	361202	10839	18827, 26815, 34803, 42791, 50779

2697	integrator complex subunit 1	389470	2852	374121	10840	18828, 26816, 34804, 42792, 50780
2698	integrator complex subunit 1	404767	2853	385722	10841	18829, 26817, 34805, 42793, 50781
2699	integrator complex subunit 2	251334	2854	251334	10842	18830, 26818, 34806, 42794, 50782
2700	integrator complex subunit 2	444766	2855	414237	10843	18831, 26819, 34807, 42795, 50783
2701	integrator complex subunit 5	330574	2856	327889	10844	18832, 26820, 34808, 42796, 50784
2702	integrin alpha FG-GAP repeat containing 3	301678	2857	301678	10845	18833, 26821, 34809, 42797, 50785
2703	integrin alpha FG-GAP repeat containing 3	399932	2858	382814	10846	18834, 26822, 34810, 42798, 50786
2704	integrin alpha FG-GAP repeat containing 3	417499	2859	405659	10847	18835, 26823, 34811, 42799, 50787
2705	integrin alpha FG-GAP repeat containing 3	419173	2860	388726	10848	18836, 26824, 34812, 42800, 50788
2706	integrin alpha FG-GAP repeat containing 3	420046	2861	398433	10849	18837, 26825, 34813, 42801, 50789
2707	integrin alpha FG-GAP repeat containing 3	426695	2862	392612	10850	18838, 26826, 34814, 42802, 50790
2708	integrin alpha FG-GAP repeat containing 3	442458	2863	397477	10851	18839, 26827, 34815, 42803, 50791
2709	integrin alpha FG-GAP repeat containing 3	447499	2864	395334	10852	18840, 26828, 34816, 42804, 50792
2710	integrin alpha FG-GAP repeat containing 3	450082	2865	411394	10853	18841, 26829, 34817, 42805, 50793
2711	integrin alpha FG-GAP repeat containing 3	453430	2866	399150	10854	18842, 26830, 34818, 42806, 50794
2712	integrin, alpha 10	369304	2867	358310	10855	18843, 26831, 34819, 42807, 50795
2713	integrin, alpha 10	538811	2868	440011	10856	18844, 26832, 34820, 42808, 50796
2714	integrin, alpha 10	539363	2869	439894	10857	18845, 26833, 34821, 42809, 50797

2715	integrin, alpha 10	543043	2870	439105	10858	18846, 26834, 34822, 42810, 50798
2716	integrin, alpha 8	378076	2871	367316	10859	18847, 26835, 34823, 42811, 50799
2717	integrin, alpha 8	538044	2872	443785	10860	18848, 26836, 34824, 42812, 50800
2718	integrin, alpha E (antigen CD103, human mucosal lymphocyte antigen 1; alpha polypeptide)	263087	2873	263087	10861	18849, 26837, 34825, 42813, 50801
2719	integrin, beta 5	296181	2874	296181	10862	18850, 26838, 34826, 42814, 50802
2720	integrin, beta 8	222573	2875	222573	10863	18851, 26839, 34827, 42815, 50803
2721	integrin, beta 8	537992	2876	441561	10864	18852, 26840, 34828, 42816, 50804
2722	interaction protein for cytohesin exchange factors 1	265198	2877	265198	10865	18853, 26841, 34829, 42817, 50805
2723	interaction protein for cytohesin exchange factors 1	367220	2878	356189	10866	18854, 26842, 34830, 42818, 50806
2724	interaction protein for cytohesin exchange factors 1	422970	2879	394751	10867	18855, 26843, 34831, 42819, 50807
2725	interaction protein for cytohesin exchange factors 1	520261	2880	431004	10868	18856, 26844, 34832, 42820, 50808
2726	interferon alpha responsive protein isoform a	553856	2881	452581	10869	18857, 26845, 34833, 42821, 50809
2727	interferon induced transmembrane protein 10	340134	2882	344430	10870	18858, 26846, 34834, 42822, 50810
2728	interferon induced transmembrane protein 5	382614	2883	372059	10871	18859, 26847, 34835, 42823, 50811
2729	interferon regulatory factor 7	330243	2884	329411	10872	18860, 26848, 34836, 42824, 50812
2730	interferon regulatory factor 7	348655	2885	331803	10873	18861, 26849, 34837, 42825, 50813
2731	interferon regulatory factor 7	397562	2886	380693	10874	18862, 26850, 34838, 42826, 50814

2732	interferon regulatory factor 7	397566	2887	380697	10875	18863, 26851, 34839, 42827, 50815
2733	interferon regulatory factor 7	397570	2888	380700	10876	18864, 26852, 34840, 42828, 50816
2734	interferon regulatory factor 7	397574	2889	380704	10877	18865, 26853, 34841, 42829, 50817
2735	interferon, alpha-inducible protein 27-like 1	393115	2890	376824	10878	18866, 26854, 34842, 42830, 50818
2736	interferon, alpha-inducible protein 27-like 1	555523	2891	451851	10879	18867, 26855, 34843, 42831, 50819
2737	interferon, alpha-inducible protein 27-like 2	238609	2892	238609	10880	18868, 26856, 34844, 42832, 50820
2738	interferon, alpha-inducible protein 6	339145	2893	342513	10881	18869, 26857, 34845, 42833, 50821
2739	interferon, alpha-inducible protein 6	361157	2894	354736	10882	18870, 26858, 34846, 42834, 50822
2740	interferon, alpha-inducible protein 6	362020	2895	355152	10883	18871, 26859, 34847, 42835, 50823
2741	interleukin 10 receptor, beta	290200	2896	290200	10884	18872, 26860, 34848, 42836, 50824
2742	interleukin 10 receptor, beta	539894	2897	442753	10885	18873, 26861, 34849, 42837, 50825
2743	interleukin 20 receptor beta	309741	2898	311979	10886	18874, 26862, 34850, 42838, 50826
2744	interleukin 20 receptor beta	329582	2899	328133	10887	18875, 26863, 34851, 42839, 50827
2745	interleukin 22 receptor, alpha 1	270800	2900	270800	10888	18876, 26864, 34852, 42840, 50828
2746	interleukin 27 receptor, alpha	263379	2901	263379	10889	18877, 26865, 34853, 42841, 50829
2747	interleukin 7 receptor	511982	2902	425309	10890	18878, 26866, 34854, 42842, 50830
2748	interleukin 7 receptor	514217	2903	427688	10891	18879, 26867, 34855, 42843, 50831
2749	IQ motif containing E	325979	2904	313772	10892	18880, 26868, 34856, 42844, 50832

2750	IQ motif containing E	402050	2905	385597	10893	18881, 26869, 34857, 42845, 50833
2751	IQ motif containing E	404984	2906	385945	10894	18882, 26870, 34858, 42846, 50834
2752	IQ motif containing E	422276	2907	402108	10895	18883, 26871, 34859, 42847, 50835
2753	IQ motif containing E	423395	2908	413570	10896	18884, 26872, 34860, 42848, 50836
2754	IQ motif containing E	438376	2909	396178	10897	18885, 26873, 34861, 42849, 50837
2755	IQ motif containing GTPase activating protein 3	361170	2910	354451	10898	18886, 26874, 34862, 42850, 50838
2756	iron-sulfur cluster assembly 2 homolog (S. cerevisiae)	556816	2911	452007	10899	18887, 26875, 34863, 42851, 50839
2757	IZUMO family member 2	293405	2912	293405	10900	18888, 26876, 34864, 42852, 50840
2758	IZUMO family member 2	377000	2913	366199	10901	18889, 26877, 34865, 42853, 50841
2759	IZUMO family member 3	543880	2914	438895	10902	18890, 26878, 34866, 42854, 50842
2760	izumo sperm-egg fusion 1	332955	2915	327786	10903	18891, 26879, 34867, 42855, 50843
2761	jagunal homolog 1 (Drosophila)	307768	2916	306106	10904	18892, 26880, 34868, 42856, 50844
2762	jagunal homolog 1 (Drosophila)	543379	2917	442889	10905	18893, 26881, 34869, 42857, 50845
2763	janus kinase and microtubule interacting protein 1	282924	2918	282924	10906	18894, 26882, 34870, 42858, 50846
2764	janus kinase and microtubule interacting protein 1	409021	2919	386711	10907	18895, 26883, 34871, 42859, 50847
2765	janus kinase and microtubule interacting protein 1	409371	2920	387042	10908	18896, 26884, 34872, 42860, 50848
2766	janus kinase and microtubule interacting protein 1	409831	2921	386925	10909	18897, 26885, 34873, 42861, 50849
2767	janus kinase and microtubule interacting protein 1	418227	2922	406526	10910	18898, 26886, 34874, 42862, 50850

2768	janus kinase and microtubule interacting protein 1	425341	2923	401449	10911	18899, 26887, 34875, 42863, 50851
2769	janus kinase and microtubule interacting protein 1	429819	2924	398750	10912	18900, 26888, 34876, 42864, 50852
2770	janus kinase and microtubule interacting protein 2	265272	2925	265272	10913	18901, 26889, 34877, 42865, 50853
2771	janus kinase and microtubule interacting protein 2	333010	2926	328989	10914	18902, 26890, 34878, 42866, 50854
2772	janus kinase and microtubule interacting protein 2	507386	2927	421398	10915	18903, 26891, 34879, 42867, 50855
2773	janus kinase and microtubule interacting protein 2	539401	2928	439220	10916	18904, 26892, 34880, 42868, 50856
2774	Janus kinase and microtubule interacting protein 3	298622	2929	298622	10917	18905, 26893, 34881, 42869, 50857
2775	junctional sarcoplasmic reticulum protein 1	300961	2930	300961	10918	18906, 26894, 34882, 42870, 50858
2776	junctophilin 4	356300	2931	348648	10919	18907, 26895, 34883, 42871, 50859
2777	junctophilin 4	397118	2932	380307	10920	18908, 26896, 34884, 42872, 50860
2778	junctophilin 4	543864	2933	445800	10921	18909, 26897, 34885, 42873, 50861
2779	KDEL (Lys-Asp-Glu-Leu) containing 2	323468	2934	315386	10922	18910, 26898, 34886, 42874, 50862
2780	KDEL (Lys-Asp-Glu-Leu) containing 2	375648	2935	364799	10923	18911, 26899, 34887, 42875, 50863
2781	KDEL (Lys-Asp-Glu-Leu) containing 2	434945	2936	413429	10924	18912, 26900, 34888, 42876, 50864
2782	KDEL (Lys-Asp-Glu-Leu) endoplasmic reticulum protein retention receptor 1	330720	2937	329471	10925	18913, 26901, 34889, 42877, 50865
2783	KDEL (Lys-Asp-Glu-Leu) endoplasmic reticulum protein retention receptor 2	258739	2938	258739	10926	18914, 26902, 34890, 42878, 50866

2784	KDEL (Lys-Asp-Glu-Leu) endoplasmic reticulum protein retention receptor 2	490996	2939	420501	10927	18915, 26903, 34891, 42879, 50867
2785	KDEL (Lys-Asp-Glu-Leu) endoplasmic reticulum protein retention receptor 3	216014	2940	216014	10928	18916, 26904, 34892, 42880, 50868
2786	KDEL (Lys-Asp-Glu-Leu) endoplasmic reticulum protein retention receptor 3	409006	2941	386918	10929	18917, 26905, 34893, 42881, 50869
2787	kelch domain containing 7A	400664	2942	383505	10930	18918, 26906, 34894, 42882, 50870
2788	kelch domain containing 7A	540290	2943	439465	10931	18919, 26907, 34895, 42883, 50871
2789	kelch-like 17 (Drosophila)	338591	2944	343930	10932	18920, 26908, 34896, 42884, 50872
2790	kelch-like 17 (Drosophila)	455747	2945	389373	10933	18921, 26909, 34897, 42885, 50873
2791	kelch-like 17 (Drosophila)	540863	2946	439107	10934	18922, 26910, 34898, 42886, 50874
2792	keratinocyte associated protein 2	295682	2947	295682	10935	18923, 26911, 34899, 42887, 50875
2793	keratinocyte associated protein 3	288873	2948	288873	10936	18924, 26912, 34900, 42888, 50876
2794	keratinocyte associated protein 3	407293	2949	384689	10937	18925, 26913, 34901, 42889, 50877
2795	keratinocyte associated protein 3	452499	2950	388115	10938	18926, 26914, 34902, 42890, 50878
2796	keratinocyte associated protein 3	543753	2951	442400	10939	18927, 26915, 34903, 42891, 50879
2797	KIAA0090	477853	2952	420608	10940	18928, 26916, 34904, 42892, 50880
2798	KIAA0195	314256	2953	313885	10941	18929, 26917, 34905, 42893, 50881
2799	KIAA0247	342745	2954	344424	10942	18930, 26918, 34906, 42894, 50882

2800	KIAA0317	356357	2955	348714	10943	18931, 26919, 34907, 42895, 50883
2801	KIAA0319-like	325722	2956	318406	10944	18932, 26920, 34908, 42896, 50884
2802	KIAA0922	409663	2957	386574	10945	18933, 26921, 34909, 42897, 50885
2803	KIAA1009	403245	2958	385215	10946	18934, 26922, 34910, 42898, 50886
2804	KIAA1024	305428	2959	307461	10947	18935, 26923, 34911, 42899, 50887
2805	KIAA1244	251691	2960	251691	10948	18936, 26924, 34912, 42900, 50888
2806	KIAA1324	369939	2961	358955	10949	18937, 26925, 34913, 42901, 50889
2807	KIAA1467	197268	2962	197268	10950	18938, 26926, 34914, 42902, 50890
2808	KIAA1467	416494	2963	394063	10951	18939, 26927, 34915, 42903, 50891
2809	KIAA1644	381176	2964	370568	10952	18940, 26928, 34916, 42904, 50892
2810	KIAA1683	359737	2965	352774	10953	18941, 26929, 34917, 42905, 50893
2811	KIAA1797	338382	2966	344307	10954	18942, 26930, 34918, 42906, 50894
2812	KIAA1797	380249	2967	369599	10955	18943, 26931, 34919, 42907, 50895
2813	KIAA1919	368847	2968	357840	10956	18944, 26932, 34920, 42908, 50896
2814	KIAA2013	376572	2969	365756	10957	18945, 26933, 34921, 42909, 50897
2815	killer cell immunoglobulin-like receptor, three domains, long cytoplasmic tail, 3	291860	2970	291860	10958	18946, 26934, 34922, 42910, 50898
2816	killer cell lectin-like receptor subfamily F, member 2	535540	2971	438244	10959	18947, 26935, 34923, 42911, 50899

2817	killer cell lectin-like receptor subfamily G, member 2	340940	2972	339356	10960	18948, 26936, 34924, 42912, 50900
2818	killer cell lectin-like receptor subfamily G, member 2	393039	2973	376759	10961	18949, 26937, 34925, 42913, 50901
2819	kin of IRRE like (Drosophila)	359209	2974	352138	10962	18950, 26938, 34926, 42914, 50902
2820	kin of IRRE like (Drosophila)	360089	2975	353202	10963	18951, 26939, 34927, 42915, 50903
2821	kin of IRRE like (Drosophila)	368173	2976	357155	10964	18952, 26940, 34928, 42916, 50904
2822	kin of IRRE like (Drosophila)	392272	2977	376098	10965	18953, 26941, 34929, 42917, 50905
2823	kin of IRRE like (Drosophila)	416935	2978	389674	10966	18954, 26942, 34930, 42918, 50906
2824	kinase D-interacting substrate, 220kDa	256707	2979	256707	10967	18955, 26943, 34931, 42919, 50907
2825	kinase D-interacting substrate, 220kDa	319688	2980	319947	10968	18956, 26944, 34932, 42920, 50908
2826	kinase D-interacting substrate, 220kDa	418530	2981	414923	10969	18957, 26945, 34933, 42921, 50909
2827	kinase D-interacting substrate, 220kDa	427284	2982	411849	10970	18958, 26946, 34934, 42922, 50910
2828	kinase D-interacting substrate, 220kDa	473731	2983	418974	10971	18959, 26947, 34935, 42923, 50911
2829	kinase D-interacting substrate, 220kDa	541927	2984	446229	10972	18960, 26948, 34936, 42924, 50912
2830	kinesin family member 16B	354981	2985	347076	10973	18961, 26949, 34937, 42925, 50913
2831	kinesin family member 16B	355755	2986	347995	10974	18962, 26950, 34938, 42926, 50914
2832	kinesin family member 16B	377997	2987	367236	10975	18963, 26951, 34939, 42927, 50915
2833	kinesin family member 16B	378003	2988	367242	10976	18964, 26952, 34940, 42928, 50916
2834	kinesin family member 16B	408042	2989	384164	10977	18965, 26953, 34941, 42929, 50917

2835	kinesin family member 18A	263181	2990	263181	10978	18966, 26954, 34942, 42930, 50918
2836	kringle containing transmembrane protein 1	327813	2991	331242	10979	18967, 26955, 34943, 42931, 50919
2837	kringle containing transmembrane protein 1	400335	2992	383189	10980	18968, 26956, 34944, 42932, 50920
2838	kringle containing transmembrane protein 1	400338	2993	383192	10981	18969, 26957, 34945, 42933, 50921
2839	kringle containing transmembrane protein 1	407188	2994	385431	10982	18970, 26958, 34946, 42934, 50922
2840	lactamase, beta 2	276590	2995	276590	10983	18971, 26959, 34947, 42935, 50923
2841	lactamase, beta 2	522447	2996	428801	10984	18972, 26960, 34948, 42936, 50924
2842	lactase-like	341509	2997	343490	10985	18973, 26961, 34949, 42937, 50925
2843	lactase-like	537670	2998	445419	10986	18974, 26962, 34950, 42938, 50926
2844	lactation elevated 1	368977	2999	357973	10987	18975, 26963, 34951, 42939, 50927
2845	late endosomal/lysosomal adaptor, MAPK and MTOR activator 1	278671	3000	278671	10988	18976, 26964, 34952, 42940, 50928
2846	late endosomal/lysosomal adaptor, MAPK and MTOR activator 2	368302	3001	357285	10989	18977, 26965, 34953, 42941, 50929
2847	late endosomal/lysosomal adaptor, MAPK and MTOR activator 2	368304	3002	357287	10990	18978, 26966, 34954, 42942, 50930
2848	late endosomal/lysosomal adaptor, MAPK and MTOR activator 2	368305	3003	357288	10991	18979, 26967, 34955, 42943, 50931
2849	late endosomal/lysosomal adaptor, MAPK and MTOR activator 3	499666	3004	424183	10992	18980, 26968, 34956, 42944, 50932

2850	latrophilin 1	340736	3005	340688	10993	18981, 26969, 34957, 42945, 50933
2851	latrophilin 1	361434	3006	355328	10994	18982, 26970, 34958, 42946, 50934
2852	latrophilin 2	271029	3007	271029	10995	18983, 26971, 34959, 42947, 50935
2853	latrophilin 2	319517	3008	322270	10996	18984, 26972, 34960, 42948, 50936
2854	latrophilin 2	335786	3009	337306	10997	18985, 26973, 34961, 42949, 50937
2855	latrophilin 2	359929	3010	353006	10998	18986, 26974, 34962, 42950, 50938
2856	latrophilin 2	370713	3011	359748	10999	18987, 26975, 34963, 42951, 50939
2857	latrophilin 2	370715	3012	359750	11000	18988, 26976, 34964, 42952, 50940
2858	latrophilin 2	370717	3013	359752	11001	18989, 26977, 34965, 42953, 50941
2859	latrophilin 2	370721	3014	359756	11002	18990, 26978, 34966, 42954, 50942
2860	latrophilin 2	370723	3015	359758	11003	18991, 26979, 34967, 42955, 50943
2861	latrophilin 2	370725	3016	359760	11004	18992, 26980, 34968, 42956, 50944
2862	latrophilin 2	370727	3017	359762	11005	18993, 26981, 34969, 42957, 50945
2863	latrophilin 2	370728	3018	359763	11006	18994, 26982, 34970, 42958, 50946
2864	latrophilin 2	370730	3019	359765	11007	18995, 26983, 34971, 42959, 50947
2865	latrophilin 2	394879	3020	378344	11008	18996, 26984, 34972, 42960, 50948
2866	latrophilin 2	402328	3021	385853	11009	18997, 26985, 34973, 42961, 50949
2867	latrophilin 2	449420	3022	397740	11010	18998, 26986, 34974, 42962, 50950

2868	latrophilin 3	280009	3023	280009	11011	18999, 26987, 34975, 42963, 50951
2869	latrophilin 3	295349	3024	295349	11012	19000, 26988, 34976, 42964, 50952
2870	latrophilin 3	502815	3025	424402	11013	19001, 26989, 34977, 42965, 50953
2871	latrophilin 3	504896	3026	423434	11014	19002, 26990, 34978, 42966, 50954
2872	latrophilin 3	506700	3027	424120	11015	19003, 26991, 34979, 42967, 50955
2873	latrophilin 3	506720	3028	420931	11016	19004, 26992, 34980, 42968, 50956
2874	latrophilin 3	506746	3029	425884	11017	19005, 26993, 34981, 42969, 50957
2875	latrophilin 3	507164	3030	421476	11018	19006, 26994, 34982, 42970, 50958
2876	latrophilin 3	507625	3031	421372	11019	19007, 26995, 34983, 42971, 50959
2877	latrophilin 3	508693	3032	424030	11020	19008, 26996, 34984, 42972, 50960
2878	latrophilin 3	508946	3033	421627	11021	19009, 26997, 34985, 42973, 50961
2879	latrophilin 3	509896	3034	423787	11022	19010, 26998, 34986, 42974, 50962
2880	latrophilin 3	511324	3035	425033	11023	19011, 26999, 34987, 42975, 50963
2881	latrophilin 3	512091	3036	423388	11024	19012, 27000, 34988, 42976, 50964
2882	latrophilin 3	514157	3037	425201	11025	19013, 27001, 34989, 42977, 50965
2883	latrophilin 3	514591	3038	422533	11026	19014, 27002, 34990, 42978, 50966
2884	latrophilin 3	514996	3039	424258	11027	19015, 27003, 34991, 42979, 50967
2885	latrophilin 3	534975	3040	437800	11028	19016, 27004, 34992, 42980, 50968

2886	latrophilin 3	545650	3041	439831	11029	19017, 27005, 34993, 42981, 50969
2887	layilin	375614	3042	364764	11030	19018, 27006, 34994, 42982, 50970
2888	layilin	375615	3043	364765	11031	19019, 27007, 34995, 42983, 50971
2889	layilin	436913	3044	392942	11032	19020, 27008, 34996, 42984, 50972
2890	layilin	541011	3045	439524	11033	19021, 27009, 34997, 42985, 50973
2891	layilin	525866	3046	434300	11034	19022, 27010, 34998, 42986, 50974
2892	lectin, mannose-binding 2	303127	3047	303366	11035	19023, 27011, 34999, 42987, 50975
2893	lectin, mannose-binding 2	539488	3048	445179	11036	19024, 27012, 35000, 42988, 50976
2894	lectin, mannose-binding 2-like	264963	3049	264963	11037	19025, 27013, 35001, 42989, 50977
2895	lectin, mannose-binding 2-like	377079	3050	366280	11038	19026, 27014, 35002, 42990, 50978
2896	lectin, mannose-binding 2-like	426463	3051	396391	11039	19027, 27015, 35003, 42991, 50979
2897	lectin, mannose-binding 2-like	534882	3052	438501	11040	19028, 27016, 35004, 42992, 50980
2898	lectin, mannose-binding 2-like	537039	3053	441701	11041	19029, 27017, 35005, 42993, 50981
2899	lectin, mannose-binding, 1 like	309664	3054	310431	11042	19030, 27018, 35006, 42994, 50982
2900	lectin, mannose-binding, 1 like	379709	3055	369031	11043	19031, 27019, 35007, 42995, 50983
2901	lectin, mannose-binding, 1 like	456603	3056	407216	11044	19032, 27020, 35008, 42996, 50984
2902	LEM domain containing 1	367149	3057	356117	11045	19033, 27021, 35009, 42997, 50985
2903	LEM domain containing 1	367151	3058	356119	11046	19034, 27022, 35010, 42998, 50986

2904	LEM domain containing 1	367152	3059	356120	11047	19035, 27023, 35011, 42999, 50987
2905	LEM domain containing 1	367153	3060	356121	11048	19036, 27024, 35012, 43000, 50988
2906	LEM domain containing 1	367154	3061	356122	11049	19037, 27025, 35013, 43001, 50989
2907	LEM domain containing 1	391936	3062	375801	11050	19038, 27026, 35014, 43002, 50990
2908	LEM domain containing 2	293760	3063	293760	11051	19039, 27027, 35015, 43003, 50991
2909	LEM domain containing 2	508327	3064	421704	11052	19040, 27028, 35016, 43004, 50992
2910	LEM domain containing 2	513701	3065	423619	11053	19041, 27029, 35017, 43005, 50993
2911	lemur tyrosine kinase 3	270238	3066	270238	11054	19042, 27030, 35018, 43006, 50994
2912	leprecan-like 2	290510	3067	290510	11055	19043, 27031, 35019, 43007, 50995
2913	leprecan-like 2	396725	3068	379951	11056	19044, 27032, 35020, 43008, 50996
2914	leprecan-like 2	451242	3069	410202	11057	19045, 27033, 35021, 43009, 50997
2915	LETM1 domain containing 1	262055	3070	262055	11058	19046, 27034, 35022, 43010, 50998
2916	LETM1 domain containing 1	380123	3071	369466	11059	19047, 27035, 35023, 43011, 50999
2917	LETM1 domain containing 1	448283	3072	397107	11060	19048, 27036, 35024, 43012, 51000
2918	LETM1 domain containing 1	550929	3073	450163	11061	19049, 27037, 35025, 43013, 51001
2919	LETM1 domain containing 1	418425	3074	389903	11062	19050, 27038, 35026, 43014, 51002
2920	leucine rich repeat and Ig domain containing 4	368820	3075	357810	11063	19051, 27039, 35027, 43015, 51003
2921	leucine rich repeat containing 15	347624	3076	306276	11064	19052, 27040, 35028, 43016, 51004

2922	leucine rich repeat containing 15	428839	3077	413707	11065	19053, 27041, 35029, 43017, 51005
2923	leucine rich repeat containing 15	439944	3078	389128	11066	19054, 27042, 35030, 43018, 51006
2924	leucine rich repeat containing 19	380055	3079	369395	11067	19055, 27043, 35031, 43019, 51007
2925	leucine rich repeat containing 24	529415	3080	434849	11068	19056, 27044, 35032, 43020, 51008
2926	leucine rich repeat containing 3	291592	3081	291592	11069	19057, 27045, 35033, 43021, 51009
2927	leucine rich repeat containing 3	471776	3082	441142	11070	19058, 27046, 35034, 43022, 51010
2928	leucine rich repeat containing 32	260061	3083	260061	11071	19059, 27047, 35035, 43023, 51011
2929	leucine rich repeat containing 32	404995	3084	385766	11072	19060, 27048, 35036, 43024, 51012
2930	leucine rich repeat containing 32	407242	3085	384126	11073	19061, 27049, 35037, 43025, 51013
2931	leucine rich repeat containing 32	421973	3086	413331	11074	19062, 27050, 35038, 43026, 51014
2932	leucine rich repeat containing 33	328557	3087	328625	11075	19063, 27051, 35039, 43027, 51015
2933	leucine rich repeat containing 37 member A3	584306	3088	464535	11076	19064, 27052, 35040, 43028, 51016
2934	leucine rich repeat containing 37, member A3	319651	3089	325713	11077	19065, 27053, 35041, 43029, 51017
2935	leucine rich repeat containing 37, member A3	334962	3090	335617	11078	19066, 27054, 35042, 43030, 51018
2936	leucine rich repeat containing 37, member A3	339474	3091	344298	11079	19067, 27055, 35043, 43031, 51019
2937	leucine rich repeat containing 37, member A3	400877	3092	383674	11080	19068, 27056, 35044, 43032, 51020
2938	leucine rich repeat containing 37A	320254	3093	326324	11081	19069, 27057, 35045, 43033, 51021
2939	leucine rich repeat containing 37A	393466	3094	377109	11082	19070, 27058, 35046, 43034, 51022

2940	leucine rich repeat containing 37B	327564	3095	332536	11083	19071, 27059, 35047, 43035, 51023
2941	leucine rich repeat containing 37B	341671	3096	340519	11084	19072, 27060, 35048, 43036, 51024
2942	leucine rich repeat containing 37B	394713	3097	378202	11085	19073, 27061, 35049, 43037, 51025
2943	leucine rich repeat containing 37B	543378	3098	443345	11086	19074, 27062, 35050, 43038, 51026
2944	leucine rich repeat containing 38	376085	3099	365253	11087	19075, 27063, 35051, 43039, 51027
2945	leucine rich repeat containing 3B	396641	3100	379880	11088	19076, 27064, 35052, 43040, 51028
2946	leucine rich repeat containing 3B	414619	3101	389764	11089	19077, 27065, 35053, 43041, 51029
2947	leucine rich repeat containing 3B	417744	3102	406370	11090	19078, 27066, 35054, 43042, 51030
2948	leucine rich repeat containing 3B	432040	3103	398184	11091	19079, 27067, 35055, 43043, 51031
2949	leucine rich repeat containing 3B	456208	3104	394940	11092	19080, 27068, 35056, 43044, 51032
2950	leucine rich repeat containing 3C	377924	3105	367157	11093	19081, 27069, 35057, 43045, 51033
2951	leucine rich repeat containing 4	249363	3106	249363	11094	19082, 27070, 35058, 43046, 51034
2952	leucine rich repeat containing 4	476782	3107	418093	11095	19083, 27071, 35059, 43047, 51035
2953	leucine rich repeat containing 4	478726	3108	417795	11096	19084, 27072, 35060, 43048, 51036
2954	leucine rich repeat containing 4B	389201	3109	373853	11097	19085, 27073, 35061, 43049, 51037
2955	leucine rich repeat containing 4B	535879	3110	440583	11098	19086, 27074, 35062, 43050, 51038
2956	leucine rich repeat containing 52	294818	3111	294818	11099	19087, 27075, 35063, 43051, 51039
2957	leucine rich repeat containing 55	497933	3112	419542	11100	19088, 27076, 35064, 43052, 51040

2958	leucine rich repeat containing 59	225972	3113	225972	11101	19089, 27077, 35065, 43053, 51041
2959	leucine rich repeat containing 66	343457	3114	341944	11102	19090, 27078, 35066, 43054, 51042
2960	leucine rich repeat containing 70	334994	3115	399441	11103	19091, 27079, 35067, 43055, 51043
2961	leucine rich repeat neuronal 1	319331	3116	314901	11104	19092, 27080, 35068, 43056, 51044
2962	leucine rich repeat neuronal 2	367175	3117	356143	11105	19093, 27081, 35069, 43057, 51045
2963	leucine rich repeat neuronal 2	367176	3118	356144	11106	19094, 27082, 35070, 43058, 51046
2964	leucine rich repeat neuronal 2	367177	3119	356145	11107	19095, 27083, 35071, 43059, 51047
2965	leucine rich repeat neuronal 3	308478	3120	312001	11108	19096, 27084, 35072, 43060, 51048
2966	leucine rich repeat neuronal 3	422987	3121	412417	11109	19097, 27085, 35073, 43061, 51049
2967	leucine rich repeat neuronal 3	451085	3122	397312	11110	19098, 27086, 35074, 43062, 51050
2968	leucine rich repeat neuronal 4	378858	3123	368135	11111	19099, 27087, 35075, 43063, 51051
2969	leucine zipper-EF-hand containing transmembrane protein 2	297720	3124	297720	11112	19100, 27088, 35076, 43064, 51052
2970	leucine zipper-EF-hand containing transmembrane protein 2	379957	3125	369291	11113	19101, 27089, 35077, 43065, 51053
2971	leucine zipper-EF-hand containing transmembrane protein 2	524874	3126	431211	11114	19102, 27090, 35078, 43066, 51054
2972	leucine zipper-EF-hand containing transmembrane protein 2	526356	3127	432955	11115	19103, 27091, 35079, 43067, 51055
2973	leucine zipper-EF-hand containing transmembrane protein 2	527334	3128	432080	11116	19104, 27092, 35080, 43068, 51056

2974	leucine zipper-EF-hand containing transmembrane protein 2	527710	3129	434867	11117	19105, 27093, 35081, 43069, 51057
2975	leucine zipper-EF-hand containing transmembrane protein 2	518883	3130	429019	11118	19106, 27094, 35082, 43070, 51058
2976	leucine zipper-EF-hand containing transmembrane protein 2	523983	3131	428765	11119	19107, 27095, 35083, 43071, 51059
2977	leucine-rich repeat, immunoglobulin-like and transmembrane domains 1	372105	3132	361177	11120	19108, 27096, 35084, 43072, 51060
2978	leucine-rich repeat, immunoglobulin-like and transmembrane domains 3	327908	3133	328222	11121	19109, 27097, 35085, 43073, 51061
2979	leucine-rich repeat, immunoglobulin-like and transmembrane domains 3	379920	3134	369252	11122	19110, 27098, 35086, 43074, 51062
2980	leucine-rich repeat, immunoglobulin-like and transmembrane domains 3	409621	3135	386734	11123	19111, 27099, 35087, 43075, 51063
2981	leucine-rich repeats and immunoglobulin-like domains 3	320743	3136	326759	11124	19112, 27100, 35088, 43076, 51064
2982	leucine-rich repeats and immunoglobulin-like domains 3	379141	3137	368436	11125	19113, 27101, 35089, 43077, 51065
2983	leucine-rich repeats and transmembrane domains 1	273286	3138	273286	11126	19114, 27102, 35090, 43078, 51066
2984	leucine-rich repeats and transmembrane domains 1	493075	3139	419772	11127	19115, 27103, 35091, 43079, 51067
2985	leucine-rich repeats and transmembrane domains 2	299194	3140	299194	11128	19116, 27104, 35092, 43080, 51068
2986	leucine-rich repeats and transmembrane domains 2	424079	3141	394967	11129	19117, 27105, 35093, 43081, 51069
2987	leucine-rich repeats and transmembrane domains 2	535041	3142	444737	11130	19118, 27106, 35094, 43082, 51070

2988	leucine-rich repeats and transmembrane domains 2	543818	3143	446278	11131	19119, 27107, 35095, 43083, 51071
2989	leukocyte immunoglobulin-like receptor, subfamily A (with TM domain), member 4	291759	3144	291759	11132	19120, 27108, 35096, 43084, 51072
2990	LIM and senescent cell antigen-like domains 1	332345	3145	331775	11133	19121, 27109, 35097, 43085, 51073
2991	LIM and senescent cell antigen-like domains 1	338045	3146	337598	11134	19122, 27110, 35098, 43086, 51074
2992	LIM and senescent cell antigen-like domains 1	393310	3147	376987	11135	19123, 27111, 35099, 43087, 51075
2993	LIM and senescent cell antigen-like domains 1	393314	3148	376990	11136	19124, 27112, 35100, 43088, 51076
2994	LIM and senescent cell antigen-like domains 1	409441	3149	387264	11137	19125, 27113, 35101, 43089, 51077
2995	LIM and senescent cell antigen-like domains 1	410093	3150	386926	11138	19126, 27114, 35102, 43090, 51078
2996	LIM and senescent cell antigen-like domains 1	542845	3151	446121	11139	19127, 27115, 35103, 43091, 51079
2997	LIM and senescent cell antigen-like domains 1	544547	3152	437912	11140	19128, 27116, 35104, 43092, 51080
2998	LIM and senescent cell antigen-like domains 2	324938	3153	326888	11141	19129, 27117, 35105, 43093, 51081
2999	LIM and senescent cell antigen-like domains 2	342067	3154	339689	11142	19130, 27118, 35106, 43094, 51082
3000	LIM and senescent cell antigen-like domains 2	355119	3155	347240	11143	19131, 27119, 35107, 43095, 51083
3001	LIM and senescent cell antigen-like domains 2	409254	3156	386907	11144	19132, 27120, 35108, 43096, 51084
3002	LIM and senescent cell antigen-like domains 2	409286	3157	386252	11145	19133, 27121, 35109, 43097, 51085
3003	LIM and senescent cell antigen-like domains 2	409455	3158	386383	11146	19134, 27122, 35110, 43098, 51086
3004	LIM and senescent cell antigen-like domains 2	409754	3159	386345	11147	19135, 27123, 35111, 43099, 51087

3005	LIM and senescent cell antigen-like domains 2	409808	3160	386637	11148	19136, 27124, 35112, 43100, 51088
3006	LIM and senescent cell antigen-like domains 2	410011	3161	387002	11149	19137, 27125, 35113, 43101, 51089
3007	LIM and senescent cell antigen-like domains 2	410038	3162	386570	11150	19138, 27126, 35114, 43102, 51090
3008	LIM and senescent cell antigen-like domains 2	410109	3163	386240	11151	19139, 27127, 35115, 43103, 51091
3009	LIM and senescent cell antigen-like domains 2	422034	3164	416224	11152	19140, 27128, 35116, 43104, 51092
3010	LIM and senescent cell antigen-like domains 2	537572	3165	446212	11153	19141, 27129, 35117, 43105, 51093
3011	LIM and senescent cell antigen-like domains 2	544917	3166	437681	11154	19142, 27130, 35118, 43106, 51094
3012	LIM and senescent cell antigen-like domains 2	545738	3167	443794	11155	19143, 27131, 35119, 43107, 51095
3013	lin-7 homolog A (C. elegans)	552864	3168	447488	11156	19144, 27132, 35120, 43108, 51096
3014	lipase maturation factor 2	216080	3169	216080	11157	19145, 27133, 35121, 43109, 51097
3015	lipase maturation factor 2	380796	3170	370173	11158	19146, 27134, 35122, 43110, 51098
3016	lipase maturation factor 2	474879	3171	424381	11159	19147, 27135, 35123, 43111, 51099
3017	Lipid phosphate phosphatase-related protein type 1	374871	3172	364005	11160	19148, 27136, 35124, 43112, 51100
3018	Lipid phosphate phosphatase-related protein type 1	374874	3173	364008	11161	19149, 27137, 35125, 43113, 51101
3019	Lipid phosphate phosphatase-related protein type 1	395056	3174	378496	11162	19150, 27138, 35126, 43114, 51102
3020	Lipid phosphate phosphatase-related protein type 1	456287	3175	410223	11163	19151, 27139, 35127, 43115, 51103
3021	Lipid phosphate phosphatase-related protein type 2	251473	3176	251473	11164	19152, 27140, 35128, 43116, 51104
3022	Lipid phosphate phosphatase-related protein type 2	591608	3177	466898	11165	19153, 27141, 35129, 43117, 51105

3023	Lipid phosphate phosphatase-related protein type 3	300947	3178	300947	11166	19154, 27142, 35130, 43118, 51106
3024	Lipid phosphate phosphatase-related protein type 3	359894	3179	352962	11167	19155, 27143, 35131, 43119, 51107
3025	Lipid phosphate phosphatase-related protein type 3	520876	3180	430297	11168	19156, 27144, 35132, 43120, 51108
3026	Lipid phosphate phosphatase-related protein type 4	263178	3181	263178	11169	19157, 27145, 35133, 43121, 51109
3027	Lipid phosphate phosphatase-related protein type 4	370184	3182	359203	11170	19158, 27146, 35134, 43122, 51110
3028	Lipid phosphate phosphatase-related protein type 4	370185	3183	359204	11171	19159, 27147, 35135, 43123, 51111
3029	Lipid phosphate phosphatase-related protein type 4	457765	3184	394913	11172	19160, 27148, 35136, 43124, 51112
3030	Lipid phosphate phosphatase-related protein type 5	263177	3185	263177	11173	19161, 27149, 35137, 43125, 51113
3031	Lipid phosphate phosphatase-related protein type 5	370188	3186	359207	11174	19162, 27150, 35138, 43126, 51114
3032	lipoma HMGIC fusion partner-like 4	287585	3187	287585	11175	19163, 27151, 35139, 43127, 51115
3033	LMBR1 domain containing 2	296603	3188	296603	11176	19164, 27152, 35140, 43128, 51116
3034	LMBR1 domain containing 2	546130	3189	444863	11177	19165, 27153, 35141, 43129, 51117
3035	low density lipoprotein receptor class A domain containing 1	371360	3190	360411	11178	19166, 27154, 35142, 43130, 51118
3036	low density lipoprotein receptor class A domain containing 1	371362	3191	360413	11179	19167, 27155, 35143, 43131, 51119
3037	low density lipoprotein receptor class A domain containing 2	344642	3192	340988	11180	19168, 27156, 35144, 43132, 51120
3038	low density lipoprotein receptor class A domain containing 2	543870	3193	444097	11181	19169, 27157, 35145, 43133, 51121
3039	low density lipoprotein receptor class A domain	315571	3194	318607	11182	19170, 27158, 35146, 43134, 51122

	containing 3					
3040	low density lipoprotein receptor class A domain containing 3	545142	3195	438737	11183	19171, 27159, 35147, 43135, 51123
3041	low density lipoprotein receptor-related protein 11	239367	3196	239367	11184	19172, 27160, 35148, 43136, 51124
3042	low density lipoprotein receptor-related protein 11	367368	3197	356338	11185	19173, 27161, 35149, 43137, 51125
3043	low density lipoprotein receptor-related protein 11	546019	3198	440196	11186	19174, 27162, 35150, 43138, 51126
3044	low density lipoprotein receptor-related protein 12	276654	3199	276654	11187	19175, 27163, 35151, 43139, 51127
3045	low density lipoprotein receptor-related protein 12	424843	3200	399148	11188	19176, 27164, 35152, 43140, 51128
3046	LPS-responsive vesicle trafficking, beach and anchor containing	357115	3201	349629	11189	19177, 27165, 35153, 43141, 51129
3047	LPS-responsive vesicle trafficking, beach and anchor containing	535741	3202	446299	11190	19178, 27166, 35154, 43142, 51130
3048	LRRN4 C-terminal like	317449	3203	325808	11191	19179, 27167, 35155, 43143, 51131
3049	LY6/PLAUR domain containing 1	345008	3204	340563	11192	19180, 27168, 35156, 43144, 51132
3050	LY6/PLAUR domain containing 1	397463	3205	380605	11193	19181, 27169, 35157, 43145, 51133
3051	LY6/PLAUR domain containing 1	409034	3206	386311	11194	19182, 27170, 35158, 43146, 51134
3052	LY6/PLAUR domain containing 2	359228	3207	352163	11195	19183, 27171, 35159, 43147, 51135
3053	LY6/PLAUR domain containing 4	330743	3208	328737	11196	19184, 27172, 35160, 43148, 51136
3054	LY6/PLAUR domain containing 4	343055	3209	339568	11197	19185, 27173, 35161, 43149, 51137
3055	LY6/PLAUR domain containing 5	377950	3210	367185	11198	19186, 27174, 35162, 43150, 51138

3056	LY6/PLAUR domain containing 5	414615	3211	408433	11199	19187, 27175, 35163, 43151, 51139
3057	LY6/PLAUR domain containing 6B	280115	3212	280115	11200	19188, 27176, 35164, 43152, 51140
3058	LY6/PLAUR domain containing 6B	409029	3213	386650	11201	19189, 27177, 35165, 43153, 51141
3059	LY6/PLAUR domain containing 6B	409642	3214	387077	11202	19190, 27178, 35166, 43154, 51142
3060	LY6/PLAUR domain containing 6B	409876	3215	386479	11203	19191, 27179, 35167, 43155, 51143
3061	lymphocyte antigen 6 complex, locus G6C	375819	3216	364978	11204	19192, 27180, 35168, 43156, 51144
3062	lymphocyte antigen 6 complex, locus G6C	383413	3217	372905	11205	19193, 27181, 35169, 43157, 51145
3063	lymphocyte antigen 6 complex, locus G6C	419939	3218	388591	11206	19194, 27182, 35170, 43158, 51146
3064	lymphocyte antigen 6 complex, locus G6C	428121	3219	411365	11207	19195, 27183, 35171, 43159, 51147
3065	lymphocyte antigen 6 complex, locus G6C	428498	3220	410398	11208	19196, 27184, 35172, 43160, 51148
3066	lymphocyte antigen 6 complex, locus G6C	434915	3221	415732	11209	19197, 27185, 35173, 43161, 51149
3067	lymphocyte antigen 6 complex, locus G6C	448386	3222	409428	11210	19198, 27186, 35174, 43162, 51150
3068	lymphocyte antigen 6 complex, locus G6C	495859	3223	433207	11211	19199, 27187, 35175, 43163, 51151
3069	lymphocyte antigen 6 complex, locus G6C	497123	3224	431133	11212	19200, 27188, 35176, 43164, 51152
3070	lymphocyte antigen 6 complex, locus G6F	375832	3225	364992	11213	19201, 27189, 35177, 43165, 51153
3071	lymphocyte antigen 6 complex, locus G6F	446062	3226	404884	11214	19202, 27190, 35178, 43166, 51154
3072	lymphocyte antigen 6 complex, locus G6F	447811	3227	409959	11215	19203, 27191, 35179, 43167, 51155
3073	lymphocyte antigen 6 complex, locus G6F	453044	3228	389102	11216	19204, 27192, 35180, 43168, 51156

3074	lymphocyte antigen 6 complex, locus G6F	455632	3229	407535	11217	19205, 27193, 35181, 43169, 51157
3075	lymphocyte antigen 6 complex, locus G6F	554860	3230	451668	11218	19206, 27194, 35182, 43170, 51158
3076	lymphocyte antigen 6 complex, locus G6F	556581	3231	452432	11219	19207, 27195, 35183, 43171, 51159
3077	lymphocyte antigen 6 complex, locus G6F	557698	3232	452228	11220	19208, 27196, 35184, 43172, 51160
3078	lymphocyte antigen 75	263636	3233	263636	11221	19209, 27197, 35185, 43173, 51161
3079	lymphocyte antigen 75	553424	3234	451446	11222	19210, 27198, 35186, 43174, 51162
3080	lymphocyte antigen 75	554112	3235	451511	11223	19211, 27199, 35187, 43175, 51163
3081	lymphocyte transmembrane adaptor 1	367217	3236	356186	11224	19212, 27200, 35188, 43176, 51164
3082	lymphocyte transmembrane adaptor 1	442561	3237	406970	11225	19213, 27201, 35189, 43177, 51165
3083	LYR motif containing 1	219168	3238	219168	11226	19214, 27202, 35190, 43178, 51166
3084	LYR motif containing 1	396052	3239	379367	11227	19215, 27203, 35191, 43179, 51167
3085	LYR motif containing 1	412082	3240	396868	11228	19216, 27204, 35192, 43180, 51168
3086	LYR motif containing 1	439021	3241	407883	11229	19217, 27205, 35193, 43181, 51169
3087	LYR motif containing 2	523377	3242	430025	11230	19218, 27206, 35194, 43182, 51170
3088	LYR motif containing 5	381356	3243	370761	11231	19219, 27207, 35195, 43183, 51171
3089	LYR motif containing 5	556198	3244	452130	11232	19220, 27208, 35196, 43184, 51172
3090	LYR motif containing 5	556351	3245	452146	11233	19221, 27209, 35197, 43185, 51173
3091	LYR motif containing 5	556885	3246	451494	11234	19222, 27210, 35198, 43186, 51174

3092	LYR motif containing 5	556927	3247	450443	11235	19223, 27211, 35199, 43187, 51175
3093	LYR motif containing 5	557540	3248	450584	11236	19224, 27212, 35200, 43188, 51176
3094	Lyrm7 homolog (mouse)	379380	3249	368688	11237	19225, 27213, 35201, 43189, 51177
3095	lysM and putative peptidoglycan-binding domain-containing protein 3	554351	3250	451382	11238	19226, 27214, 35202, 43190, 51178
3096	LysM, putative peptidoglycan-binding, domain containing 3	315948	3251	314518	11239	19227, 27215, 35203, 43191, 51179
3097	LysM, putative peptidoglycan-binding, domain containing 3	509384	3252	427683	11240	19228, 27216, 35204, 43192, 51180
3098	LysM, putative peptidoglycan-binding, domain containing 4	332728	3253	333008	11241	19229, 27217, 35205, 43193, 51181
3099	LysM, putative peptidoglycan-binding, domain containing 4	344791	3254	342840	11242	19230, 27218, 35206, 43194, 51182
3100	LysM, putative peptidoglycan-binding, domain containing 4	409796	3255	386283	11243	19231, 27219, 35207, 43195, 51183
3101	LysM, putative peptidoglycan-binding, domain containing 4	545021	3256	445357	11244	19232, 27220, 35208, 43196, 51184
3102	lysophosphatidylcholine acyltransferase 2	262134	3257	262134	11245	19233, 27221, 35209, 43197, 51185
3103	lysophosphatidylglycerol acyltransferase 1	366996	3258	355963	11246	19234, 27222, 35210, 43198, 51186
3104	lysophosphatidylglycerol acyltransferase 1	366997	3259	355964	11247	19235, 27223, 35211, 43199, 51187
3105	lysosomal protein transmembrane 4 alpha	175091	3260	175091	11248	19236, 27224, 35212, 43200, 51188
3106	lysosomal-associated membrane protein 3	265598	3261	265598	11249	19237, 27225, 35213, 43201, 51189
3107	lysosomal-associated membrane protein 3	476015	3262	419059	11250	19238, 27226, 35214, 43202, 51190

3108	lysosomal-associated membrane protein family, member 5	246070	3263	246070	11251	19239, 27227, 35215, 43203, 51191
3109	lysosomal-associated membrane protein family, member 5	427562	3264	406360	11252	19240, 27228, 35216, 43204, 51192
3110	MACRO domain containing 1	255681	3265	255681	11253	19241, 27229, 35217, 43205, 51193
3111	macrophage expressed 1	361050	3266	354335	11254	19242, 27230, 35218, 43206, 51194
3112	macrophage expressed 1	545098	3267	444560	11255	19243, 27231, 35219, 43207, 51195
3113	major facilitator superfamily domain containing 1	264266	3268	264266	11256	19244, 27232, 35220, 43208, 51196
3114	major facilitator superfamily domain containing 1	361159	3269	355227	11257	19245, 27233, 35221, 43209, 51197
3115	major facilitator superfamily domain containing 1	392813	3270	376560	11258	19246, 27234, 35222, 43210, 51198
3116	major facilitator superfamily domain containing 1	415822	3271	403117	11259	19247, 27235, 35223, 43211, 51199
3117	major facilitator superfamily domain containing 10	329687	3272	332646	11260	19248, 27236, 35224, 43212, 51200
3118	major facilitator superfamily domain containing 10	355443	3273	347619	11261	19249, 27237, 35225, 43213, 51201
3119	major facilitator superfamily domain containing 11	336509	3274	337240	11262	19250, 27238, 35226, 43214, 51202
3120	major facilitator superfamily domain containing 11	355954	3275	348225	11263	19251, 27239, 35227, 43215, 51203
3121	major facilitator superfamily domain containing 12	355415	3276	347583	11264	19252, 27240, 35228, 43216, 51204
3122	major facilitator superfamily domain containing 12	389395	3277	374046	11265	19253, 27241, 35229, 43217, 51205
3123	major facilitator superfamily domain containing 12	398558	3278	381566	11266	19254, 27242, 35230, 43218, 51206
3124	major facilitator superfamily domain containing 3	301327	3279	301327	11267	19255, 27243, 35231, 43219, 51207

3125	major facilitator superfamily domain containing 4	367147	3280	356115	11268	19256, 27244, 35232, 43220, 51208
3126	major facilitator superfamily domain containing 4	536357	3281	440183	11269	19257, 27245, 35233, 43221, 51209
3127	major facilitator superfamily domain containing 4	539267	3282	445329	11270	19258, 27246, 35234, 43222, 51210
3128	major facilitator superfamily domain containing 5	328704	3283	331231	11271	19259, 27247, 35235, 43223, 51211
3129	major facilitator superfamily domain containing 5	329548	3284	332624	11272	19260, 27248, 35236, 43224, 51212
3130	major facilitator superfamily domain containing 5	534842	3285	442688	11273	19261, 27249, 35237, 43225, 51213
3131	major facilitator superfamily domain containing 5	551660	3286	449354	11274	19262, 27250, 35238, 43226, 51214
3132	major facilitator superfamily domain containing 6-like	329805	3287	330051	11275	19263, 27251, 35239, 43227, 51215
3133	major facilitator superfamily domain containing 7	322224	3288	320234	11276	19264, 27252, 35240, 43228, 51216
3134	major facilitator superfamily domain containing 7	347950	3289	307545	11277	19265, 27253, 35241, 43229, 51217
3135	major facilitator superfamily domain containing 7	404286	3290	384616	11278	19266, 27254, 35242, 43230, 51218
3136	major facilitator superfamily domain containing 9	258436	3291	258436	11279	19267, 27255, 35243, 43231, 51219
3137	major histocompatibility complex, class I, A	355767	3292	348012	11280	19268, 27256, 35244, 43232, 51220
3138	major histocompatibility complex, class I, A	376802	3293	365998	11281	19269, 27257, 35245, 43233, 51221
3139	major histocompatibility complex, class I, A	376806	3294	366002	11282	19270, 27258, 35246, 43234, 51222
3140	major histocompatibility complex, class I, A	376809	3295	366005	11283	19271, 27259, 35247, 43235, 51223
3141	major histocompatibility complex, class I, A	376822	3296	366018	11284	19272, 27260, 35248, 43236, 51224
3142	major histocompatibility complex, class I, A	383605	3297	373100	11285	19273, 27261, 35249, 43237, 51225

3143	major histocompatibility complex, class I, A	383619	3298	373114	11286	19274, 27262, 35250, 43238, 51226
3144	major histocompatibility complex, class I, A	396634	3299	379873	11287	19275, 27263, 35251, 43239, 51227
3145	major histocompatibility complex, class I, A	413609	3300	390225	11288	19276, 27264, 35252, 43240, 51228
3146	major histocompatibility complex, class I, A	414592	3301	394582	11289	19277, 27265, 35253, 43241, 51229
3147	major histocompatibility complex, class I, A	416096	3302	394889	11290	19278, 27266, 35254, 43242, 51230
3148	major histocompatibility complex, class I, A	417978	3303	388724	11291	19279, 27267, 35255, 43243, 51231
3149	major histocompatibility complex, class I, A	431930	3304	406366	11292	19280, 27268, 35256, 43244, 51232
3150	major histocompatibility complex, class I, A	438861	3305	388526	11293	19281, 27269, 35257, 43245, 51233
3151	major histocompatibility complex, class I, A	442939	3306	397962	11294	19282, 27270, 35258, 43246, 51234
3152	major histocompatibility complex, class I, A	443552	3307	404678	11295	19283, 27271, 35259, 43247, 51235
3153	major histocompatibility complex, class I, A	444289	3308	398188	11296	19284, 27272, 35260, 43248, 51236
3154	major histocompatibility complex, class I, A	450342	3309	391738	11297	19285, 27273, 35261, 43249, 51237
3155	major histocompatibility complex, class I, A	453057	3310	403922	11298	19286, 27274, 35262, 43250, 51238
3156	major histocompatibility complex, class I, A	453975	3311	392547	11299	19287, 27275, 35263, 43251, 51239
3157	major histocompatibility complex, class I, A	454091	3312	410645	11300	19288, 27276, 35264, 43252, 51240
3158	major histocompatibility complex, class I, A	455882	3313	416233	11301	19289, 27277, 35265, 43253, 51241
3159	major histocompatibility complex, class I, A	456012	3314	408986	11302	19290, 27278, 35266, 43254, 51242
3160	major histocompatibility complex, class I, A	457879	3315	403575	11303	19291, 27279, 35267, 43255, 51243

3161	major histocompatibility complex, class I, A	470780	3316	432736	11304	19292, 27280, 35268, 43256, 51244
3162	major histocompatibility complex, class I, A	536480	3317	440033	11305	19293, 27281, 35269, 43257, 51245
3163	major histocompatibility complex, class I, A	547112	3318	448887	11306	19294, 27282, 35270, 43258, 51246
3164	major histocompatibility complex, class I, A	547271	3319	447962	11307	19295, 27283, 35271, 43259, 51247
3165	major histocompatibility complex, class I, A	547522	3320	448077	11308	19296, 27284, 35272, 43260, 51248
3166	major histocompatibility complex, class I, A	549224	3321	447990	11309	19297, 27285, 35273, 43261, 51249
3167	major histocompatibility complex, class I, A	549835	3322	446814	11310	19298, 27286, 35274, 43262, 51250
3168	major histocompatibility complex, class I, A	549869	3323	447635	11311	19299, 27287, 35275, 43263, 51251
3169	major histocompatibility complex, class I, A	550707	3324	450284	11312	19300, 27288, 35276, 43264, 51252
3170	major histocompatibility complex, class I, A	550728	3325	450169	11313	19301, 27289, 35277, 43265, 51253
3171	major histocompatibility complex, class I, A	551120	3326	449453	11314	19302, 27290, 35278, 43266, 51254
3172	major histocompatibility complex, class I, A	551190	3327	450314	11315	19303, 27291, 35279, 43267, 51255
3173	major histocompatibility complex, class I, A	551578	3328	448239	11316	19304, 27292, 35280, 43268, 51256
3174	major histocompatibility complex, class I, A	552193	3329	447614	11317	19305, 27293, 35281, 43269, 51257
3175	major histocompatibility complex, class I, A	552493	3330	448992	11318	19306, 27294, 35282, 43270, 51258
3176	major histocompatibility complex, class I, A	552498	3331	448516	11319	19307, 27295, 35283, 43271, 51259
3177	major histocompatibility complex, class I, B	359635	3332	352656	11320	19308, 27296, 35284, 43272, 51260
3178	major histocompatibility complex, class I, B	412585	3333	399168	11321	19309, 27297, 35285, 43273, 51261

3179	major histocompatibility complex, class I, B	416726	3334	392099	11322	19310, 27298, 35286, 43274, 51262
3180	major histocompatibility complex, class I, B	418147	3335	411954	11323	19311, 27299, 35287, 43275, 51263
3181	major histocompatibility complex, class I, B	421349	3336	405365	11324	19312, 27300, 35288, 43276, 51264
3182	major histocompatibility complex, class I, B	425798	3337	401443	11325	19313, 27301, 35289, 43277, 51265
3183	major histocompatibility complex, class I, B	425848	3338	400842	11326	19314, 27302, 35290, 43278, 51266
3184	major histocompatibility complex, class I, B	426590	3339	392626	11327	19315, 27303, 35291, 43279, 51267
3185	major histocompatibility complex, class I, B	428231	3340	401183	11328	19316, 27304, 35292, 43280, 51268
3186	major histocompatibility complex, class I, B	430299	3341	416672	11329	19317, 27305, 35293, 43281, 51269
3187	major histocompatibility complex, class I, B	434333	3342	405931	11330	19318, 27306, 35294, 43282, 51270
3188	major histocompatibility complex, class I, B	435618	3343	405178	11331	19319, 27307, 35295, 43283, 51271
3189	major histocompatibility complex, class I, B	436729	3344	403471	11332	19320, 27308, 35296, 43284, 51272
3190	major histocompatibility complex, class I, B	437265	3345	398100	11333	19321, 27309, 35297, 43285, 51273
3191	major histocompatibility complex, class I, B	437866	3346	392235	11334	19322, 27310, 35298, 43286, 51274
3192	major histocompatibility complex, class I, B	445222	3347	399675	11335	19323, 27311, 35299, 43287, 51275
3193	major histocompatibility complex, class I, B	445610	3348	396397	11336	19324, 27312, 35300, 43288, 51276
3194	major histocompatibility complex, class I, B	450871	3349	388208	11337	19325, 27313, 35301, 43289, 51277
3195	major histocompatibility complex, class I, B	452596	3350	396980	11338	19326, 27314, 35302, 43290, 51278
3196	major histocompatibility complex, class I, B	461583	3351	436637	11339	19327, 27315, 35303, 43291, 51279

3197	major histocompatibility complex, class I, B	471639	3352	435221	11340	19328, 27316, 35304, 43292, 51280
3198	major histocompatibility complex, class I, B	479203	3353	433363	11341	19329, 27317, 35305, 43293, 51281
3199	major histocompatibility complex, class I, B	481283	3354	435817	11342	19330, 27318, 35306, 43294, 51282
3200	major histocompatibility complex, class I, B	498484	3355	435083	11343	19331, 27319, 35307, 43295, 51283
3201	major histocompatibility complex, class I, B	546599	3356	446558	11344	19332, 27320, 35308, 43296, 51284
3202	major histocompatibility complex, class I, B	550965	3357	449246	11345	19333, 27321, 35309, 43297, 51285
3203	major histocompatibility complex, class I, B	553172	3358	447662	11346	19334, 27322, 35310, 43298, 51286
3204	major histocompatibility complex, class I, E	376630	3359	365817	11347	19335, 27323, 35311, 43299, 51287
3205	major histocompatibility complex, class I, E	383597	3360	373091	11348	19336, 27324, 35312, 43300, 51288
3206	major histocompatibility complex, class I, E	415289	3361	409910	11349	19337, 27325, 35313, 43301, 51289
3207	major histocompatibility complex, class I, E	415649	3362	390707	11350	19338, 27326, 35314, 43302, 51290
3208	major histocompatibility complex, class I, E	425603	3363	402694	11351	19339, 27327, 35315, 43303, 51291
3209	major histocompatibility complex, class I, E	427936	3364	397420	11352	19340, 27328, 35316, 43304, 51292
3210	major histocompatibility complex, class I, E	444683	3365	400458	11353	19341, 27329, 35317, 43305, 51293
3211	major histocompatibility complex, class I, E	547304	3366	450038	11354	19342, 27330, 35318, 43306, 51294
3212	major histocompatibility complex, class I, F	259951	3367	259951	11355	19343, 27331, 35319, 43307, 51295
3213	major histocompatibility complex, class I, F	334668	3368	334263	11356	19344, 27332, 35320, 43308, 51296
3214	major histocompatibility complex, class I, F	342322	3369	345828	11357	19345, 27333, 35321, 43309, 51297

3215	major histocompatibility complex, class I, F	359076	3370	351977	11358	19346, 27334, 35322, 43310, 51298
3216	major histocompatibility complex, class I, F	376844	3371	366040	11359	19347, 27335, 35323, 43311, 51299
3217	major histocompatibility complex, class I, F	376848	3372	366044	11360	19348, 27336, 35324, 43312, 51300
3218	major histocompatibility complex, class I, F	376861	3373	366057	11361	19349, 27337, 35325, 43313, 51301
3219	major histocompatibility complex, class I, F	383515	3374	373007	11362	19350, 27338, 35326, 43314, 51302
3220	major histocompatibility complex, class I, F	383516	3375	373008	11363	19351, 27339, 35327, 43315, 51303
3221	major histocompatibility complex, class I, F	383626	3376	373121	11364	19352, 27340, 35328, 43316, 51304
3222	major histocompatibility complex, class I, F	383627	3377	373123	11365	19353, 27341, 35329, 43317, 51305
3223	major histocompatibility complex, class I, F	399258	3378	382201	11366	19354, 27342, 35330, 43318, 51306
3224	major histocompatibility complex, class I, F	414333	3379	389590	11367	19355, 27343, 35331, 43319, 51307
3225	major histocompatibility complex, class I, F	414958	3380	409934	11368	19356, 27344, 35332, 43320, 51308
3226	major histocompatibility complex, class I, F	418017	3381	405190	11369	19357, 27345, 35333, 43321, 51309
3227	major histocompatibility complex, class I, F	420024	3382	416426	11370	19358, 27346, 35334, 43322, 51310
3228	major histocompatibility complex, class I, F	420067	3383	393535	11371	19359, 27347, 35335, 43323, 51311
3229	major histocompatibility complex, class I, F	420414	3384	407836	11372	19360, 27348, 35336, 43324, 51312
3230	major histocompatibility complex, class I, F	420923	3385	400112	11373	19361, 27349, 35337, 43325, 51313
3231	major histocompatibility complex, class I, F	422439	3386	414318	11374	19362, 27350, 35338, 43326, 51314
3232	major histocompatibility complex, class I, F	422711	3387	395853	11375	19363, 27351, 35339, 43327, 51315

3233	major histocompatibility complex, class I, F	425139	3388	412140	11376	19364, 27352, 35340, 43328, 51316
3234	major histocompatibility complex, class I, F	426470	3389	404395	11377	19365, 27353, 35341, 43329, 51317
3235	major histocompatibility complex, class I, F	426675	3390	415401	11378	19366, 27354, 35342, 43330, 51318
3236	major histocompatibility complex, class I, F	428296	3391	387786	11379	19367, 27355, 35343, 43331, 51319
3237	major histocompatibility complex, class I, F	429294	3392	416998	11380	19368, 27356, 35344, 43332, 51320
3238	major histocompatibility complex, class I, F	430472	3393	397705	11381	19369, 27357, 35345, 43333, 51321
3239	major histocompatibility complex, class I, F	433515	3394	398913	11382	19370, 27358, 35346, 43334, 51322
3240	major histocompatibility complex, class I, F	434407	3395	397376	11383	19371, 27359, 35347, 43335, 51323
3241	major histocompatibility complex, class I, F	435058	3396	408540	11384	19372, 27360, 35348, 43336, 51324
3242	major histocompatibility complex, class I, F	437020	3397	396776	11385	19373, 27361, 35349, 43337, 51325
3243	major histocompatibility complex, class I, F	437226	3398	400299	11386	19374, 27362, 35350, 43338, 51326
3244	major histocompatibility complex, class I, F	440587	3399	404130	11387	19375, 27363, 35351, 43339, 51327
3245	major histocompatibility complex, class I, F	440590	3400	399835	11388	19376, 27364, 35352, 43340, 51328
3246	major histocompatibility complex, class I, F	441200	3401	405198	11389	19377, 27365, 35353, 43341, 51329
3247	major histocompatibility complex, class I, F	444057	3402	389555	11390	19378, 27366, 35354, 43342, 51330
3248	major histocompatibility complex, class I, F	444621	3403	392251	11391	19379, 27367, 35355, 43343, 51331
3249	major histocompatibility complex, class I, F	444891	3404	402853	11392	19380, 27368, 35356, 43344, 51332
3250	major histocompatibility complex, class I, F	445657	3405	414905	11393	19381, 27369, 35357, 43345, 51333

3251	major histocompatibility complex, class I, F	447400	3406	388133	11394	19382, 27370, 35358, 43346, 51334
3252	major histocompatibility complex, class I, F	448064	3407	399120	11395	19383, 27371, 35359, 43347, 51335
3253	major histocompatibility complex, class I, F	449921	3408	415312	11396	19384, 27372, 35360, 43348, 51336
3254	major histocompatibility complex, class I, F	452916	3409	415017	11397	19385, 27373, 35361, 43349, 51337
3255	major histocompatibility complex, class I, F	454646	3410	414500	11398	19386, 27374, 35362, 43350, 51338
3256	major histocompatibility complex, class I, F	454779	3411	390887	11399	19387, 27375, 35363, 43351, 51339
3257	major histocompatibility complex, class I, F	458026	3412	399043	11400	19388, 27376, 35364, 43352, 51340
3258	major histocompatibility complex, class I, F	547126	3413	450176	11401	19389, 27377, 35365, 43353, 51341
3259	major histocompatibility complex, class I, F	547128	3414	450179	11402	19390, 27378, 35366, 43354, 51342
3260	major histocompatibility complex, class I, F	547132	3415	446947	11403	19391, 27379, 35367, 43355, 51343
3261	major histocompatibility complex, class I, F	547503	3416	450111	11404	19392, 27380, 35368, 43356, 51344
3262	major histocompatibility complex, class I, F	547953	3417	449390	11405	19393, 27381, 35369, 43357, 51345
3263	major histocompatibility complex, class I, F	548879	3418	446526	11406	19394, 27382, 35370, 43358, 51346
3264	major histocompatibility complex, class I, F	549067	3419	450053	11407	19395, 27383, 35371, 43359, 51347
3265	major histocompatibility complex, class I, F	549166	3420	450301	11408	19396, 27384, 35372, 43360, 51348
3266	major histocompatibility complex, class I, F	549254	3421	446505	11409	19397, 27385, 35373, 43361, 51349
3267	major histocompatibility complex, class I, F	549422	3422	450119	11410	19398, 27386, 35374, 43362, 51350
3268	major histocompatibility complex, class I, F	550237	3423	448113	11411	19399, 27387, 35375, 43363, 51351

3269	major histocompatibility complex, class I, F	550932	3424	450300	11412	19400, 27388, 35376, 43364, 51352
3270	major histocompatibility complex, class I, F	550980	3425	447195	11413	19401, 27389, 35377, 43365, 51353
3271	major histocompatibility complex, class I, F	551026	3426	450148	11414	19402, 27390, 35378, 43366, 51354
3272	major histocompatibility complex, class I, F	551205	3427	449164	11415	19403, 27391, 35379, 43367, 51355
3273	major histocompatibility complex, class I, F	551347	3428	447078	11416	19404, 27392, 35380, 43368, 51356
3274	major histocompatibility complex, class I, F	551780	3429	447401	11417	19405, 27393, 35381, 43369, 51357
3275	major histocompatibility complex, class I, F	552082	3430	447228	11418	19406, 27394, 35382, 43370, 51358
3276	major histocompatibility complex, class I, F	552732	3431	448096	11419	19407, 27395, 35383, 43371, 51359
3277	major histocompatibility complex, class I, F	552880	3432	448638	11420	19408, 27396, 35384, 43372, 51360
3278	major histocompatibility complex, class I, G	360323	3433	353472	11421	19409, 27397, 35385, 43373, 51361
3279	major histocompatibility complex, class I, G	376815	3434	366011	11422	19410, 27398, 35386, 43374, 51362
3280	major histocompatibility complex, class I, G	376818	3435	366014	11423	19411, 27399, 35387, 43375, 51363
3281	major histocompatibility complex, class I, G	376828	3436	366024	11424	19412, 27400, 35388, 43376, 51364
3282	major histocompatibility complex, class I, G	383621	3437	373116	11425	19413, 27401, 35389, 43377, 51365
3283	major histocompatibility complex, class I, G	383622	3438	373117	11426	19414, 27402, 35390, 43378, 51366
3284	major histocompatibility complex, class I, G	383623	3439	373118	11427	19415, 27403, 35391, 43379, 51367
3285	major histocompatibility complex, class I, G	400665	3440	383506	11428	19416, 27404, 35392, 43380, 51368
3286	major histocompatibility complex, class I, G	400682	3441	383521	11429	19417, 27405, 35393, 43381, 51369

3287	major histocompatibility complex, class I, G	412263	3442	397733	11430	19418, 27406, 35394, 43382, 51370
3288	major histocompatibility complex, class I, G	415687	3443	389969	11431	19419, 27407, 35395, 43383, 51371
3289	major histocompatibility complex, class I, G	420559	3444	397331	11432	19420, 27408, 35396, 43384, 51372
3290	major histocompatibility complex, class I, G	422371	3445	387624	11433	19421, 27409, 35397, 43385, 51373
3291	major histocompatibility complex, class I, G	423011	3446	389522	11434	19422, 27410, 35398, 43386, 51374
3292	major histocompatibility complex, class I, G	423373	3447	405238	11435	19423, 27411, 35399, 43387, 51375
3293	major histocompatibility complex, class I, G	426863	3448	392075	11436	19424, 27412, 35400, 43388, 51376
3294	major histocompatibility complex, class I, G	428701	3449	412927	11437	19425, 27413, 35401, 43389, 51377
3295	major histocompatibility complex, class I, G	428952	3450	388176	11438	19426, 27414, 35402, 43390, 51378
3296	major histocompatibility complex, class I, G	429890	3451	401326	11439	19427, 27415, 35403, 43391, 51379
3297	major histocompatibility complex, class I, G	430253	3452	396594	11440	19428, 27416, 35404, 43392, 51380
3298	major histocompatibility complex, class I, G	434881	3453	392347	11441	19429, 27417, 35405, 43393, 51381
3299	major histocompatibility complex, class I, G	434907	3454	408461	11442	19430, 27418, 35406, 43394, 51382
3300	major histocompatibility complex, class I, G	444098	3455	398200	11443	19431, 27419, 35407, 43395, 51383
3301	major histocompatibility complex, class I, G	445373	3456	416408	11444	19432, 27420, 35408, 43396, 51384
3302	major histocompatibility complex, class I, G	448306	3457	413926	11445	19433, 27421, 35409, 43397, 51385
3303	major histocompatibility complex, class I, G	449127	3458	408773	11446	19434, 27422, 35410, 43398, 51386
3304	major histocompatibility complex, class I, G	450984	3459	409132	11447	19435, 27423, 35411, 43399, 51387

3305	major histocompatibility complex, class I, G	452577	3460	415905	11448	19436, 27424, 35412, 43400, 51388
3306	major histocompatibility complex, class I, G	452715	3461	390678	11449	19437, 27425, 35413, 43401, 51389
3307	major histocompatibility complex, class I, G	457132	3462	410247	11450	19438, 27426, 35414, 43402, 51390
3308	major histocompatibility complex, class I, G	466488	3463	433426	11451	19439, 27427, 35415, 43403, 51391
3309	major histocompatibility complex, class I, G	467814	3464	434622	11452	19440, 27428, 35416, 43404, 51392
3310	major histocompatibility complex, class I, G	469347	3465	437036	11453	19441, 27429, 35417, 43405, 51393
3311	major histocompatibility complex, class I, G	469472	3466	432220	11454	19442, 27430, 35418, 43406, 51394
3312	major histocompatibility complex, class I, G	478519	3467	436375	11455	19443, 27431, 35419, 43407, 51395
3313	major histocompatibility complex, class I, G	486553	3468	432239	11456	19444, 27432, 35420, 43408, 51396
3314	major histocompatibility complex, class I, G	546545	3469	447762	11457	19445, 27433, 35421, 43409, 51397
3315	major histocompatibility complex, class I, G	546634	3470	447780	11458	19446, 27434, 35422, 43410, 51398
3316	major histocompatibility complex, class I, G	547241	3471	448085	11459	19447, 27435, 35423, 43411, 51399
3317	major histocompatibility complex, class I, G	547931	3472	448363	11460	19448, 27436, 35424, 43412, 51400
3318	major histocompatibility complex, class I, G	550897	3473	449903	11461	19449, 27437, 35425, 43413, 51401
3319	major histocompatibility complex, class I, G	553052	3474	449291	11462	19450, 27438, 35426, 43414, 51402
3320	major histocompatibility complex, class II, DM alpha	341486	3475	345804	11463	19451, 27439, 35427, 43415, 51403
3321	major histocompatibility complex, class II, DM alpha	374843	3476	363976	11464	19452, 27440, 35428, 43416, 51404

3322	major histocompatibility complex, class II, DM alpha	383227	3477	372714	11465	19453, 27441, 35429, 43417, 51405
3323	major histocompatibility complex, class II, DM alpha	383228	3478	372715	11466	19454, 27442, 35430, 43418, 51406
3324	major histocompatibility complex, class II, DM alpha	383230	3479	372717	11467	19455, 27443, 35431, 43419, 51407
3325	major histocompatibility complex, class II, DM alpha	395303	3480	378714	11468	19456, 27444, 35432, 43420, 51408
3326	major histocompatibility complex, class II, DM alpha	395305	3481	378716	11469	19457, 27445, 35433, 43421, 51409
3327	major histocompatibility complex, class II, DM alpha	412394	3482	412550	11470	19458, 27446, 35434, 43422, 51410
3328	major histocompatibility complex, class II, DM alpha	416297	3483	398728	11471	19459, 27447, 35435, 43423, 51411
3329	major histocompatibility complex, class II, DM alpha	416806	3484	405637	11472	19460, 27448, 35436, 43424, 51412
3330	major histocompatibility complex, class II, DM alpha	418042	3485	395579	11473	19461, 27449, 35437, 43425, 51413
3331	major histocompatibility complex, class II, DM alpha	419041	3486	394366	11474	19462, 27450, 35438, 43426, 51414
3332	major histocompatibility complex, class II, DM alpha	419231	3487	407671	11475	19463, 27451, 35439, 43427, 51415
3333	major histocompatibility complex, class II, DM alpha	420299	3488	414945	11476	19464, 27452, 35440, 43428, 51416
3334	major histocompatibility complex, class II, DM alpha	420931	3489	402739	11477	19465, 27453, 35441, 43429, 51417
3335	major histocompatibility complex, class II,	422196	3490	409144	11478	19466, 27454, 35442, 43430, 51418

	DM alpha					
3336	major histocompatibility complex, class II, DM alpha	422832	3491	403122	11479	19467, 27455, 35443, 43431, 51419
3337	major histocompatibility complex, class II, DM alpha	426176	3492	395056	11480	19468, 27456, 35444, 43432, 51420
3338	major histocompatibility complex, class II, DM alpha	432991	3493	389962	11481	19469, 27457, 35445, 43433, 51421
3339	major histocompatibility complex, class II, DM alpha	433630	3494	411774	11482	19470, 27458, 35446, 43434, 51422
3340	major histocompatibility complex, class II, DM alpha	434337	3495	407198	11483	19471, 27459, 35447, 43435, 51423
3341	major histocompatibility complex, class II, DM alpha	435503	3496	390001	11484	19472, 27460, 35448, 43436, 51424
3342	major histocompatibility complex, class II, DM alpha	437285	3497	399386	11485	19473, 27461, 35449, 43437, 51425
3343	major histocompatibility complex, class II, DM alpha	439054	3498	403906	11486	19474, 27462, 35450, 43438, 51426
3344	major histocompatibility complex, class II, DM alpha	440717	3499	415844	11487	19475, 27463, 35451, 43439, 51427
3345	major histocompatibility complex, class II, DM alpha	441171	3500	400783	11488	19476, 27464, 35452, 43440, 51428
3346	major histocompatibility complex, class II, DM alpha	441375	3501	410591	11489	19477, 27465, 35453, 43441, 51429
3347	major histocompatibility complex, class II, DM alpha	443447	3502	398951	11490	19478, 27466, 35454, 43442, 51430
3348	major histocompatibility complex, class II, DM alpha	450601	3503	392842	11491	19479, 27467, 35455, 43443, 51431

3349	major histocompatibility complex, class II, DM alpha	451148	3504	414016	11492	19480, 27468, 35456, 43444, 51432
3350	major histocompatibility complex, class II, DM alpha	451753	3505	409734	11493	19481, 27469, 35457, 43445, 51433
3351	major histocompatibility complex, class II, DM alpha	452330	3506	398742	11494	19482, 27470, 35458, 43446, 51434
3352	major histocompatibility complex, class II, DM alpha	452434	3507	412100	11495	19483, 27471, 35459, 43447, 51435
3353	major histocompatibility complex, class II, DM alpha	452615	3508	395349	11496	19484, 27472, 35460, 43448, 51436
3354	major histocompatibility complex, class II, DM alpha	452703	3509	405208	11497	19485, 27473, 35461, 43449, 51437
3355	major histocompatibility complex, class II, DM alpha	453490	3510	404018	11498	19486, 27474, 35462, 43450, 51438
3356	major histocompatibility complex, class II, DM alpha	454298	3511	414631	11499	19487, 27475, 35463, 43451, 51439
3357	major histocompatibility complex, class II, DM alpha	456486	3512	408520	11500	19488, 27476, 35464, 43452, 51440
3358	major histocompatibility complex, class II, DM alpha	456800	3513	409668	11501	19489, 27477, 35465, 43453, 51441
3359	major histocompatibility complex, class II, DM alpha	457285	3514	399032	11502	19490, 27478, 35466, 43454, 51442
3360	major histocompatibility complex, class II, DM alpha	458066	3515	408141	11503	19491, 27479, 35467, 43455, 51443
3361	major histocompatibility complex, class II, DM beta	383231	3516	372718	11504	19492, 27480, 35468, 43456, 51444
3362	major histocompatibility complex, class II,	395312	3517	378723	11505	19493, 27481, 35469, 43457, 51445

	DM beta					
3363	major histocompatibility complex, class II, DM beta	412948	3518	413471	11506	19494, 27482, 35470, 43458, 51446
3364	major histocompatibility complex, class II, DM beta	413038	3519	410077	11507	19495, 27483, 35471, 43459, 51447
3365	major histocompatibility complex, class II, DM beta	413617	3520	394789	11508	19496, 27484, 35472, 43460, 51448
3366	major histocompatibility complex, class II, DM beta	413696	3521	405790	11509	19497, 27485, 35473, 43461, 51449
3367	major histocompatibility complex, class II, DM beta	414017	3522	411276	11510	19498, 27486, 35474, 43462, 51450
3368	major histocompatibility complex, class II, DM beta	415090	3523	398843	11511	19499, 27487, 35475, 43463, 51451
3369	major histocompatibility complex, class II, DM beta	415927	3524	414153	11512	19500, 27488, 35476, 43464, 51452
3370	major histocompatibility complex, class II, DM beta	416244	3525	391010	11513	19501, 27489, 35477, 43465, 51453
3371	major histocompatibility complex, class II, DM beta	418107	3526	398890	11514	19502, 27490, 35478, 43466, 51454
3372	major histocompatibility complex, class II, DM beta	418759	3527	394997	11515	19503, 27491, 35479, 43467, 51455
3373	major histocompatibility complex, class II, DM beta	421456	3528	410609	11516	19504, 27492, 35480, 43468, 51456
3374	major histocompatibility complex, class II, DM beta	424822	3529	414817	11517	19505, 27493, 35481, 43469, 51457
3375	major histocompatibility complex, class II, DM beta	424874	3530	394737	11518	19506, 27494, 35482, 43470, 51458

3376	major histocompatibility complex, class II, DM beta	428420	3531	393646	11519	19507, 27495, 35483, 43471, 51459
3377	major histocompatibility complex, class II, DM beta	428864	3532	402800	11520	19508, 27496, 35484, 43472, 51460
3378	Major histocompatibility complex, class II, DM beta	429234	3533	412457	11521	19509, 27497, 35485, 43473, 51461
3379	major histocompatibility complex, class II, DM beta	430099	3534	412415	11522	19510, 27498, 35486, 43474, 51462
3380	major histocompatibility complex, class II, DM beta	430115	3535	401587	11523	19511, 27499, 35487, 43475, 51463
3381	major histocompatibility complex, class II, DM beta	433242	3536	401238	11524	19512, 27500, 35488, 43476, 51464
3382	major histocompatibility complex, class II, DM beta	435056	3537	410908	11525	19513, 27501, 35489, 43477, 51465
3383	major histocompatibility complex, class II, DM beta	435204	3538	391679	11526	19514, 27502, 35490, 43478, 51466
3384	major histocompatibility complex, class II, DM beta	437382	3539	391352	11527	19515, 27503, 35491, 43479, 51467
3385	major histocompatibility complex, class II, DM beta	437583	3540	405746	11528	19516, 27504, 35492, 43480, 51468
3386	major histocompatibility complex, class II, DM beta	438310	3541	399634	11529	19517, 27505, 35493, 43481, 51469
3387	major histocompatibility complex, class II, DM beta	438510	3542	390848	11530	19518, 27506, 35494, 43482, 51470
3388	major histocompatibility complex, class II, DM beta	439344	3543	413062	11531	19519, 27507, 35495, 43483, 51471
3389	major histocompatibility complex, class II,	440078	3544	411321	11532	19520, 27508, 35496, 43484, 51472

	DM beta					
3390	major histocompatibility complex, class II, DM beta	440269	3545	406776	11533	19521, 27509, 35497, 43485, 51473
3391	major histocompatibility complex, class II, DM beta	441177	3546	393285	11534	19522, 27510, 35498, 43486, 51474
3392	major histocompatibility complex, class II, DM beta	446948	3547	393569	11535	19523, 27511, 35499, 43487, 51475
3393	major histocompatibility complex, class II, DM beta	447454	3548	396075	11536	19524, 27512, 35500, 43488, 51476
3394	major histocompatibility complex, class II, DM beta	448590	3549	389736	11537	19525, 27513, 35501, 43489, 51477
3395	major histocompatibility complex, class II, DM beta	448798	3550	398332	11538	19526, 27514, 35502, 43490, 51478
3396	major histocompatibility complex, class II, DM beta	449417	3551	410329	11539	19527, 27515, 35503, 43491, 51479
3397	major histocompatibility complex, class II, DM beta	449679	3552	404072	11540	19528, 27516, 35504, 43492, 51480
3398	major histocompatibility complex, class II, DM beta	450897	3553	408453	11541	19529, 27517, 35505, 43493, 51481
3399	major histocompatibility complex, class II, DM beta	451921	3554	399759	11542	19530, 27518, 35506, 43494, 51482
3400	major histocompatibility complex, class II, DM beta	452407	3555	399130	11543	19531, 27519, 35507, 43495, 51483
3401	major histocompatibility complex, class II, DM beta	456428	3556	416157	11544	19532, 27520, 35508, 43496, 51484
3402	major histocompatibility complex, class II, DM beta	546470	3557	447781	11545	19533, 27521, 35509, 43497, 51485

3403	major histocompatibility complex, class II, DM beta	546855	3558	450237	11546	19534, 27522, 35510, 43498, 51486
3404	major histocompatibility complex, class II, DM beta	547313	3559	449487	11547	19535, 27523, 35511, 43499, 51487
3405	major histocompatibility complex, class II, DM beta	547391	3560	449127	11548	19536, 27524, 35512, 43500, 51488
3406	major histocompatibility complex, class II, DM beta	547478	3561	448541	11549	19537, 27525, 35513, 43501, 51489
3407	major histocompatibility complex, class II, DM beta	548183	3562	450057	11550	19538, 27526, 35514, 43502, 51490
3408	major histocompatibility complex, class II, DM beta	548290	3563	446674	11551	19539, 27527, 35515, 43503, 51491
3409	major histocompatibility complex, class II, DM beta	548611	3564	448875	11552	19540, 27528, 35516, 43504, 51492
3410	major histocompatibility complex, class II, DM beta	549152	3565	449375	11553	19541, 27529, 35517, 43505, 51493
3411	major histocompatibility complex, class II, DM beta	549556	3566	446912	11554	19542, 27530, 35518, 43506, 51494
3412	major histocompatibility complex, class II, DM beta	549676	3567	448564	11555	19543, 27531, 35519, 43507, 51495
3413	major histocompatibility complex, class II, DM beta	550052	3568	450287	11556	19544, 27532, 35520, 43508, 51496
3414	major histocompatibility complex, class II, DM beta	550933	3569	447570	11557	19545, 27533, 35521, 43509, 51497
3415	major histocompatibility complex, class II, DM beta	551036	3570	446547	11558	19546, 27534, 35522, 43510, 51498
3416	major histocompatibility complex, class II,	551481	3571	447325	11559	19547, 27535, 35523, 43511, 51499

	DM beta					
3417	major histocompatibility complex, class II, DM beta	551515	3572	446560	11560	19548, 27536, 35524, 43512, 51500
3418	major histocompatibility complex, class II, DM beta	552299	3573	449810	11561	19549, 27537, 35525, 43513, 51501
3419	major histocompatibility complex, class II, DM beta	552389	3574	447573	11562	19550, 27538, 35526, 43514, 51502
3420	major histocompatibility complex, class II, DM beta	553199	3575	449606	11563	19551, 27539, 35527, 43515, 51503
3421	major histocompatibility complex, class II, DO alpha	229829	3576	229829	11564	19552, 27540, 35528, 43516, 51504
3422	major histocompatibility complex, class II, DO alpha	374813	3577	363946	11565	19553, 27541, 35529, 43517, 51505
3423	major histocompatibility complex, class II, DO alpha	383225	3578	372712	11566	19554, 27542, 35530, 43518, 51506
3424	major histocompatibility complex, class II, DO alpha	383226	3579	372713	11567	19555, 27543, 35531, 43519, 51507
3425	major histocompatibility complex, class II, DO alpha	416763	3580	402076	11568	19556, 27544, 35532, 43520, 51508
3426	major histocompatibility complex, class II, DO alpha	418857	3581	405153	11569	19557, 27545, 35533, 43521, 51509
3427	major histocompatibility complex, class II, DO alpha	426070	3582	401504	11570	19558, 27546, 35534, 43522, 51510
3428	major histocompatibility complex, class II, DO alpha	426685	3583	397945	11571	19559, 27547, 35535, 43523, 51511
3429	major histocompatibility complex, class II, DO alpha	432150	3584	412819	11572	19560, 27548, 35536, 43524, 51512

3430	major histocompatibility complex, class II, DO alpha	434335	3585	416448	11573	19561, 27549, 35537, 43525, 51513
3431	major histocompatibility complex, class II, DO alpha	438987	3586	395737	11574	19562, 27550, 35538, 43526, 51514
3432	major histocompatibility complex, class II, DO alpha	444109	3587	402347	11575	19563, 27551, 35539, 43527, 51515
3433	major histocompatibility complex, class II, DO alpha	450833	3588	403896	11576	19564, 27552, 35540, 43528, 51516
3434	major histocompatibility complex, class II, DO alpha	452598	3589	398819	11577	19565, 27553, 35541, 43529, 51517
3435	major histocompatibility complex, class II, DO alpha	455325	3590	402487	11578	19566, 27554, 35542, 43530, 51518
3436	major histocompatibility complex, class II, DO alpha	457663	3591	409491	11579	19567, 27555, 35543, 43531, 51519
3437	major histocompatibility complex, class II, DO alpha	546375	3592	447202	11580	19568, 27556, 35544, 43532, 51520
3438	major histocompatibility complex, class II, DO alpha	547284	3593	446715	11581	19569, 27557, 35545, 43533, 51521
3439	major histocompatibility complex, class II, DO alpha	547661	3594	449987	11582	19570, 27558, 35546, 43534, 51522
3440	major histocompatibility complex, class II, DO alpha	548708	3595	448280	11583	19571, 27559, 35547, 43535, 51523
3441	major histocompatibility complex, class II, DO alpha	549720	3596	446832	11584	19572, 27560, 35548, 43536, 51524
3442	major histocompatibility complex, class II, DO alpha	549845	3597	449183	11585	19573, 27561, 35549, 43537, 51525
3443	major histocompatibility complex, class II,	549849	3598	449760	11586	19574, 27562, 35550, 43538, 51526

	DO alpha					
3444	major histocompatibility complex, class II, DO alpha	549880	3599	448865	11587	19575, 27563, 35551, 43539, 51527
3445	major histocompatibility complex, class II, DO alpha	549881	3600	446500	11588	19576, 27564, 35552, 43540, 51528
3446	major histocompatibility complex, class II, DO alpha	550072	3601	449395	11589	19577, 27565, 35553, 43541, 51529
3447	major histocompatibility complex, class II, DO alpha	552368	3602	449656	11590	19578, 27566, 35554, 43542, 51530
3448	major histocompatibility complex, class II, DO alpha	553212	3603	449347	11591	19579, 27567, 35555, 43543, 51531
3449	major histocompatibility complex, class II, DO beta	413252	3604	390574	11592	19580, 27568, 35556, 43544, 51532
3450	major histocompatibility complex, class II, DO beta	426644	3605	395780	11593	19581, 27569, 35557, 43545, 51533
3451	major histocompatibility complex, class II, DO beta	438763	3606	390020	11594	19582, 27570, 35558, 43546, 51534
3452	major histocompatibility complex, class II, DO beta	439310	3607	401290	11595	19583, 27571, 35559, 43547, 51535
3453	major histocompatibility complex, class II, DO beta	447178	3608	405108	11596	19584, 27572, 35560, 43548, 51536
3454	major histocompatibility complex, class II, DO beta	447394	3609	394860	11597	19585, 27573, 35561, 43549, 51537
3455	major histocompatibility complex, class II, DO beta	448690	3610	413915	11598	19586, 27574, 35562, 43550, 51538
3456	major histocompatibility complex, class II, DO beta	453971	3611	391708	11599	19587, 27575, 35563, 43551, 51539

3457	major histocompatibility complex, class II, DO beta	454286	3612	397268	11600	19588, 27576, 35564, 43552, 51540
3458	major histocompatibility complex, class II, DO beta	454969	3613	410390	11601	19589, 27577, 35565, 43553, 51541
3459	major histocompatibility complex, class II, DO beta	455155	3614	406128	11602	19590, 27578, 35566, 43554, 51542
3460	major histocompatibility complex, class II, DO beta	456406	3615	394783	11603	19591, 27579, 35567, 43555, 51543
3461	major histocompatibility complex, class II, DQ beta 1	490862	3616	433300	11604	19592, 27580, 35568, 43556, 51544
3462	major histocompatibility complex, class II, DQ beta 2	323109	3617	322293	11605	19593, 27581, 35569, 43557, 51545
3463	major histocompatibility complex, class II, DQ beta 2	399658	3618	382566	11606	19594, 27582, 35570, 43558, 51546
3464	major histocompatibility complex, class II, DQ beta 2	399661	3619	382569	11607	19595, 27583, 35571, 43559, 51547
3465	major histocompatibility complex, class II, DQ beta 2	411527	3620	390431	11608	19596, 27584, 35572, 43560, 51548
3466	major histocompatibility complex, class II, DQ beta 2	415137	3621	387578	11609	19597, 27585, 35573, 43561, 51549
3467	major histocompatibility complex, class II, DQ beta 2	416131	3622	396323	11610	19598, 27586, 35574, 43562, 51550
3468	major histocompatibility complex, class II, DQ beta 2	417780	3623	394016	11611	19599, 27587, 35575, 43563, 51551
3469	major histocompatibility complex, class II, DQ beta 2	418419	3624	411739	11612	19600, 27588, 35576, 43564, 51552
3470	major histocompatibility complex, class II,	419109	3625	414496	11613	19601, 27589, 35577, 43565, 51553

	DQ beta 2					
3471	major histocompatibility complex, class II, DQ beta 2	419519	3626	406872	11614	19602, 27590, 35578, 43566, 51554
3472	major histocompatibility complex, class II, DQ beta 2	419685	3627	416466	11615	19603, 27591, 35579, 43567, 51555
3473	major histocompatibility complex, class II, DQ beta 2	421468	3628	403201	11616	19604, 27592, 35580, 43568, 51556
3474	major histocompatibility complex, class II, DQ beta 2	424579	3629	401270	11617	19605, 27593, 35581, 43569, 51557
3475	major histocompatibility complex, class II, DQ beta 2	426733	3630	393969	11618	19606, 27594, 35582, 43570, 51558
3476	major histocompatibility complex, class II, DQ beta 2	427449	3631	415997	11619	19607, 27595, 35583, 43571, 51559
3477	major histocompatibility complex, class II, DQ beta 2	428972	3632	407691	11620	19608, 27596, 35584, 43572, 51560
3478	major histocompatibility complex, class II, DQ beta 2	429783	3633	388849	11621	19609, 27597, 35585, 43573, 51561
3479	major histocompatibility complex, class II, DQ beta 2	430668	3634	392299	11622	19610, 27598, 35586, 43574, 51562
3480	major histocompatibility complex, class II, DQ beta 2	430849	3635	389067	11623	19611, 27599, 35587, 43575, 51563
3481	major histocompatibility complex, class II, DQ beta 2	432486	3636	410132	11624	19612, 27600, 35588, 43576, 51564
3482	major histocompatibility complex, class II, DQ beta 2	433114	3637	400295	11625	19613, 27601, 35589, 43577, 51565
3483	major histocompatibility complex, class II, DQ beta 2	433801	3638	391938	11626	19614, 27602, 35590, 43578, 51566

3484	major histocompatibility complex, class II, DQ beta 2	435081	3639	403893	11627	19615, 27603, 35591, 43579, 51567
3485	major histocompatibility complex, class II, DQ beta 2	435145	3640	410512	11628	19616, 27604, 35592, 43580, 51568
3486	major histocompatibility complex, class II, DQ beta 2	437316	3641	396330	11629	19617, 27605, 35593, 43581, 51569
3487	major histocompatibility complex, class II, DQ beta 2	438757	3642	408884	11630	19618, 27606, 35594, 43582, 51570
3488	major histocompatibility complex, class II, DQ beta 2	442043	3643	394272	11631	19619, 27607, 35595, 43583, 51571
3489	major histocompatibility complex, class II, DQ beta 2	442806	3644	394759	11632	19620, 27608, 35596, 43584, 51572
3490	major histocompatibility complex, class II, DQ beta 2	447979	3645	397883	11633	19621, 27609, 35597, 43585, 51573
3491	major histocompatibility complex, class II, DQ beta 2	455520	3646	409159	11634	19622, 27610, 35598, 43586, 51574
3492	major histocompatibility complex, class II, DQ beta 2	456529	3647	399594	11635	19623, 27611, 35599, 43587, 51575
3493	major histocompatibility complex, class II, DQ beta 2	457432	3648	396502	11636	19624, 27612, 35600, 43588, 51576
3494	major histocompatibility complex, class II, DQ beta 2	547371	3649	449924	11637	19625, 27613, 35601, 43589, 51577
3495	major histocompatibility complex, class II, DQ beta 2	547495	3650	447469	11638	19626, 27614, 35602, 43590, 51578
3496	major histocompatibility complex, class II, DQ beta 2	547938	3651	447018	11639	19627, 27615, 35603, 43591, 51579
3497	major histocompatibility complex, class II,	548910	3652	449156	11640	19628, 27616, 35604, 43592, 51580

	DQ beta 2					
3498	major histocompatibility complex, class II, DQ beta 2	549204	3653	449357	11641	19629, 27617, 35605, 43593, 51581
3499	major histocompatibility complex, class II, DQ beta 2	549642	3654	447790	11642	19630, 27618, 35606, 43594, 51582
3500	major histocompatibility complex, class II, DQ beta 2	549667	3655	450007	11643	19631, 27619, 35607, 43595, 51583
3501	major histocompatibility complex, class II, DQ beta 2	550427	3656	449451	11644	19632, 27620, 35608, 43596, 51584
3502	major histocompatibility complex, class II, DQ beta 2	551426	3657	450184	11645	19633, 27621, 35609, 43597, 51585
3503	major histocompatibility complex, class II, DQ beta 2	551510	3658	450207	11646	19634, 27622, 35610, 43598, 51586
3504	major histocompatibility complex, class II, DQ beta 2	552751	3659	446755	11647	19635, 27623, 35611, 43599, 51587
3505	major histocompatibility complex, class II, DR alpha	374982	3660	364121	11648	19636, 27624, 35612, 43600, 51588
3506	major histocompatibility complex, class II, DR alpha	383127	3661	372608	11649	19637, 27625, 35613, 43601, 51589
3507	major histocompatibility complex, class II, DR alpha	383258	3662	372745	11650	19638, 27626, 35614, 43602, 51590
3508	major histocompatibility complex, class II, DR alpha	383259	3663	372746	11651	19639, 27627, 35615, 43603, 51591
3509	major histocompatibility complex, class II, DR alpha	395388	3664	378786	11652	19640, 27628, 35616, 43604, 51592
3510	major histocompatibility complex, class II, DR alpha	411505	3665	411610	11653	19641, 27629, 35617, 43605, 51593

3511	major histocompatibility complex, class II, DR alpha	411524	3666	405295	11654	19642, 27630, 35618, 43606, 51594
3512	major histocompatibility complex, class II, DR alpha	414698	3667	402951	11655	19643, 27631, 35619, 43607, 51595
3513	major histocompatibility complex, class II, DR alpha	415767	3668	392789	11656	19644, 27632, 35620, 43608, 51596
3514	major histocompatibility complex, class II, DR alpha	416883	3669	410443	11657	19645, 27633, 35621, 43609, 51597
3515	major histocompatibility complex, class II, DR alpha	418111	3670	412562	11658	19646, 27634, 35622, 43610, 51598
3516	major histocompatibility complex, class II, DR alpha	427753	3671	398838	11659	19647, 27635, 35623, 43611, 51599
3517	major histocompatibility complex, class II, DR alpha	434866	3672	403385	11660	19648, 27636, 35624, 43612, 51600
3518	major histocompatibility complex, class II, DR alpha	442960	3673	404533	11661	19649, 27637, 35625, 43613, 51601
3519	major histocompatibility complex, class II, DR alpha	542549	3674	443327	11662	19650, 27638, 35626, 43614, 51602
3520	major histocompatibility complex, class II, DR alpha	546379	3675	447577	11663	19651, 27639, 35627, 43615, 51603
3521	major histocompatibility complex, class II, DR alpha	546550	3676	447027	11664	19652, 27640, 35628, 43616, 51604
3522	major histocompatibility complex, class II, DR alpha	546589	3677	448422	11665	19653, 27641, 35629, 43617, 51605
3523	major histocompatibility complex, class II, DR alpha	547499	3678	446911	11666	19654, 27642, 35630, 43618, 51606
3524	major histocompatibility complex, class II,	547909	3679	449599	11667	19655, 27643, 35631, 43619, 51607

	DR alpha					
3525	major histocompatibility complex, class II, DR alpha	548099	3680	448765	11668	19656, 27644, 35632, 43620, 51608
3526	major histocompatibility complex, class II, DR alpha	548168	3681	447052	11669	19657, 27645, 35633, 43621, 51609
3527	major histocompatibility complex, class II, DR alpha	549449	3682	447849	11670	19658, 27646, 35634, 43622, 51610
3528	major histocompatibility complex, class II, DR alpha	549531	3683	449251	11671	19659, 27647, 35635, 43623, 51611
3529	major histocompatibility complex, class II, DR alpha	550055	3684	450200	11672	19660, 27648, 35636, 43624, 51612
3530	major histocompatibility complex, class II, DR alpha	550966	3685	450172	11673	19661, 27649, 35637, 43625, 51613
3531	major histocompatibility complex, class II, DR alpha	551689	3686	446751	11674	19662, 27650, 35638, 43626, 51614
3532	major histocompatibility complex, class II, DR alpha	551750	3687	447755	11675	19663, 27651, 35639, 43627, 51615
3533	major histocompatibility complex, class II, DR alpha	552078	3688	446742	11676	19664, 27652, 35640, 43628, 51616
3534	major histocompatibility complex, class II, DR alpha	552804	3689	447375	11677	19665, 27653, 35641, 43629, 51617
3535	major histocompatibility complex, class II, DR alpha	553193	3690	446750	11678	19666, 27654, 35642, 43630, 51618
3536	major histocompatibility complex, class II, DR beta 4	411565	3691	410857	11679	19667, 27655, 35643, 43631, 51619
3537	major histocompatibility complex, class II, DR beta 4	411959	3692	410046	11680	19668, 27656, 35644, 43632, 51620

3538	major histocompatibility complex, class II, DR beta 4	457451	3693	412031	11681	19669, 27657, 35645, 43633, 51621
3539	malonyl CoA:ACP acyltransferase (mitochondrial)	290429	3694	290429	11682	19670, 27658, 35646, 43634, 51622
3540	malonyl CoA:ACP acyltransferase (mitochondrial)	327555	3695	331306	11683	19671, 27659, 35647, 43635, 51623
3541	MAM domain containing 4	317446	3696	319388	11684	19672, 27660, 35648, 43636, 51624
3542	MAM domain containing 4	413647	3697	400009	11685	19673, 27661, 35649, 43637, 51625
3543	MAM domain containing 4	445819	3698	411339	11686	19674, 27662, 35650, 43638, 51626
3544	mannosidase, alpha, class 1C, member 1	263979	3699	263979	11687	19675, 27663, 35651, 43639, 51627
3545	mannosidase, alpha, class 1C, member 1	374329	3700	363449	11688	19676, 27664, 35652, 43640, 51628
3546	mannosidase, alpha, class 1C, member 1	374331	3701	363451	11689	19677, 27665, 35653, 43641, 51629
3547	mannosidase, alpha, class 1C, member 1	374332	3702	363452	11690	19678, 27666, 35654, 43642, 51630
3548	mannosidase, beta A, lysosomal-like	373605	3703	362707	11691	19679, 27667, 35655, 43643, 51631
3549	mannosidase, beta A, lysosomal-like	373606	3704	362708	11692	19680, 27668, 35656, 43644, 51632
3550	mannosidase, beta A, lysosomal-like	397150	3705	380337	11693	19681, 27669, 35657, 43645, 51633
3551	mannosidase, beta A, lysosomal-like	397151	3706	380338	11694	19682, 27670, 35658, 43646, 51634
3552	mannosidase, beta A, lysosomal-like	397152	3707	380339	11695	19683, 27671, 35659, 43647, 51635
3553	mannosidase, beta A, lysosomal-like	397156	3708	380342	11696	19684, 27672, 35660, 43648, 51636
3554	mannosidase, endo-alpha-like	329006	3709	328770	11697	19685, 27673, 35661, 43649, 51637
3555	mannosidase, endo-alpha-like	373045	3710	362136	11698	19686, 27674, 35662, 43650, 51638

3556	mannosidase, endo-alpha-like	397631	3711	380755	11699	19687, 27675, 35663, 43651, 51639
3557	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	332156	3712	331664	11700	19688, 27676, 35664, 43652, 51640
3558	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	393205	3713	376900	11701	19689, 27677, 35665, 43653, 51641
3559	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	547225	3714	449172	11702	19690, 27678, 35666, 43654, 51642
3560	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	548651	3715	447253	11703	19691, 27679, 35667, 43655, 51643
3561	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	549405	3716	449022	11704	19692, 27680, 35668, 43656, 51644
3562	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	550460	3717	448690	11705	19693, 27681, 35669, 43657, 51645
3563	mannosyl (alpha-1,3-)-glycoprotein beta-1,4-N-acetylglucosaminyltransferase, isozyme C (putative)	552808	3718	446647	11706	19694, 27682, 35670, 43658, 51646
3564	mannosyl-oligosaccharide glucosidase	233616	3719	233616	11707	19695, 27683, 35671, 43659, 51647
3565	mannosyl-oligosaccharide glucosidase	452063	3720	388201	11708	19696, 27684, 35672, 43660, 51648
3566	mannosyl-oligosaccharide glucosidase	535045	3721	439971	11709	19697, 27685, 35673, 43661, 51649

3567	MANSC domain containing 1	535902	3722	438205	11710	19698, 27686, 35674, 43662, 51650
3568	MANSC domain containing 1	543314	3723	437624	11711	19699, 27687, 35675, 43663, 51651
3569	matrix-remodelling associated 7	355797	3724	348050	11712	19700, 27688, 35676, 43664, 51652
3570	matrix-remodelling associated 7	375036	3725	364176	11713	19701, 27689, 35677, 43665, 51653
3571	matrix-remodelling associated 7	392488	3726	376279	11714	19702, 27690, 35678, 43666, 51654
3572	matrix-remodelling associated 7	449428	3727	391466	11715	19703, 27691, 35679, 43667, 51655
3573	matrix-remodelling associated 8	309212	3728	307887	11716	19704, 27692, 35680, 43668, 51656
3574	matrix-remodelling associated 8	342753	3729	344998	11717	19705, 27693, 35681, 43669, 51657
3575	matrix-remodelling associated 8	378864	3730	368141	11718	19706, 27694, 35682, 43670, 51658
3576	matrix-remodelling associated 8	445648	3731	399229	11719	19707, 27695, 35683, 43671, 51659
3577	mature T-cell proliferation 1 neighbor	369479	3732	358491	11720	19708, 27696, 35684, 43672, 51660
3578	mature T-cell proliferation 1 neighbor	369484	3733	358496	11721	19709, 27697, 35685, 43673, 51661
3579	melanocortin 2 receptor accessory protein 2	257776	3734	257776	11722	19710, 27698, 35686, 43674, 51662
3580	melanoma antigen family A, 1 (directs expression of antigen MZ2-E)	356661	3735	349085	11723	19711, 27699, 35687, 43675, 51663
3581	membrane associated guanylate kinase, WW and PDZ domain containing 2	354212	3736	346151	11724	19712, 27700, 35688, 43676, 51664
3582	membrane associated guanylate kinase, WW and PDZ domain containing 2	419488	3737	405766	11725	19713, 27701, 35689, 43677, 51665

3583	membrane associated guanylate kinase, WW and PDZ domain containing 2	535697	3738	441603	11726	19714, 27702, 35690, 43678, 51666
3584	membrane associated guanylate kinase, WW and PDZ domain containing 2	536298	3739	445041	11727	19715, 27703, 35691, 43679, 51667
3585	membrane associated guanylate kinase, WW and PDZ domain containing 2	536571	3740	441584	11728	19716, 27704, 35692, 43680, 51668
3586	membrane bound O-acyltransferase domain containing 7	245615	3741	245615	11729	19717, 27705, 35693, 43681, 51669
3587	membrane bound O-acyltransferase domain containing 7	338624	3742	344377	11730	19718, 27706, 35694, 43682, 51670
3588	membrane bound O-acyltransferase domain containing 7	391754	3743	375634	11731	19719, 27707, 35695, 43683, 51671
3589	membrane bound O-acyltransferase domain containing 7	414665	3744	388250	11732	19720, 27708, 35696, 43684, 51672
3590	membrane bound O-acyltransferase domain containing 7	431666	3745	410503	11733	19721, 27709, 35697, 43685, 51673
3591	membrane bound O-acyltransferase domain containing 7	453320	3746	410320	11734	19722, 27710, 35698, 43686, 51674
3592	Membrane frizzled-related protein	449574	3747	391664	11735	19723, 27711, 35699, 43687, 51675
3593	Membrane frizzled-related protein	555262	3748	450509	11736	19724, 27712, 35700, 43688, 51676
3594	membrane magnesium transporter 1	305963	3749	306220	11737	19725, 27713, 35701, 43689, 51677
3595	membrane magnesium transporter 1	433339	3750	411359	11738	19726, 27714, 35702, 43690, 51678
3596	membrane-spanning 4-domains subfamily A member 14	531783	3751	433761	11739	19727, 27715, 35703, 43691, 51679

3597	membrane-spanning 4-domains, subfamily A, member 13	378185	3752	367427	11740	19728, 27716, 35704, 43692, 51680
3598	membrane-spanning 4-domains, subfamily A, member 13	378186	3753	367428	11741	19729, 27717, 35705, 43693, 51681
3599	membrane-spanning 4-domains, subfamily A, member 13	437058	3754	415535	11742	19730, 27718, 35706, 43694, 51682
3600	membrane-spanning 4-domains, subfamily A, member 14	300187	3755	300187	11743	19731, 27719, 35707, 43695, 51683
3601	membrane-spanning 4-domains, subfamily A, member 14	395001	3756	378449	11744	19732, 27720, 35708, 43696, 51684
3602	membrane-spanning 4-domains, subfamily A, member 14	395005	3757	378453	11745	19733, 27721, 35709, 43697, 51685
3603	membrane-spanning 4-domains, subfamily A, member 14	531787	3758	437222	11746	19734, 27722, 35710, 43698, 51686
3604	membrane-spanning 4-domains, subfamily A, member 15	337911	3759	338692	11747	19735, 27723, 35711, 43699, 51687
3605	membrane-spanning 4-domains, subfamily A, member 15	405633	3760	386022	11748	19736, 27724, 35712, 43700, 51688
3606	mesothelin-like	293892	3761	293892	11749	19737, 27725, 35713, 43701, 51689
3607	mesothelin-like	442466	3762	415767	11750	19738, 27726, 35714, 43702, 51690
3608	metaxin 2	249442	3763	249442	11751	19739, 27727, 35715, 43703, 51691
3609	metaxin 2	392529	3764	376314	11752	19740, 27728, 35716, 43704, 51692
3610	metaxin 3	328496	3765	331672	11753	19741, 27729, 35717, 43705, 51693
3611	metaxin 3	418095	3766	392181	11754	19742, 27730, 35718, 43706, 51694

3612	metaxin 3	509852	3767	423302	11755	19743, 27731, 35719, 43707, 51695
3613	metaxin 3	512528	3768	424798	11756	19744, 27732, 35720, 43708, 51696
3614	metaxin 3	512560	3769	423600	11757	19745, 27733, 35721, 43709, 51697
3615	methionyl aminopeptidase type 1D (mitochondrial)	315796	3770	315152	11758	19746, 27734, 35722, 43710, 51698
3616	methylenetetrahydrofolate dehydrogenase (NADP+ dependent) 2, methenyltetrahydrofolate cyclohydrolase	264090	3771	264090	11759	19747, 27735, 35723, 43711, 51699
3617	methylenetetrahydrofolate dehydrogenase (NADP+ dependent) 2, methenyltetrahydrofolate cyclohydrolase	394050	3772	377614	11760	19748, 27736, 35724, 43712, 51700
3618	methylenetetrahydrofolate dehydrogenase (NADP+ dependent) 2, methenyltetrahydrofolate cyclohydrolase	394053	3773	377617	11761	19749, 27737, 35725, 43713, 51701
3619	methylsterol monooxygenase 1	261507	3774	261507	11762	19750, 27738, 35726, 43714, 51702
3620	methylsterol monooxygenase 1	393766	3775	377361	11763	19751, 27739, 35727, 43715, 51703
3621	methylsterol monooxygenase 1	505270	3776	425112	11764	19752, 27740, 35728, 43716, 51704
3622	methylsterol monooxygenase 1	507013	3777	425241	11765	19753, 27741, 35729, 43717, 51705
3623	methyltransferase like 12	532971	3778	431287	11766	19754, 27742, 35730, 43718, 51706
3624	methyltransferase like 21A	406927	3779	385481	11767	19755, 27743, 35731, 43719, 51707
3625	methyltransferase like 21A	411432	3780	415115	11768	19756, 27744, 35732, 43720, 51708

3626	methyltransferase like 21A	425132	3781	400730	11769	19757, 27745, 35733, 43721, 51709
3627	methyltransferase like 21A	426075	3782	403317	11770	19758, 27746, 35734, 43722, 51710
3628	methyltransferase like 21A	442521	3783	392062	11771	19759, 27747, 35735, 43723, 51711
3629	methyltransferase like 21A	448007	3784	407622	11772	19760, 27748, 35736, 43724, 51712
3630	methyltransferase like 21A	458426	3785	389684	11773	19761, 27749, 35737, 43725, 51713
3631	methyltransferase like 21B	300209	3786	300209	11774	19762, 27750, 35738, 43726, 51714
3632	methyltransferase like 21B	333012	3787	327425	11775	19763, 27751, 35739, 43727, 51715
3633	methyltransferase like 23	317409	3788	316862	11776	19764, 27752, 35740, 43728, 51716
3634	methyltransferase like 23	341249	3789	341543	11777	19765, 27753, 35741, 43729, 51717
3635	methyltransferase like 23	586752	3790	466203	11778	19766, 27754, 35742, 43730, 51718
3636	methyltransferase like 23	588822	3791	465430	11779	19767, 27755, 35743, 43731, 51719
3637	methyltransferase like 23	590964	3792	465890	11780	19768, 27756, 35744, 43732, 51720
3638	MICAL-like 2	297508	3793	297508	11781	19769, 27757, 35745, 43733, 51721
3639	MICAL-like 2	405088	3794	385928	11782	19770, 27758, 35746, 43734, 51722
3640	microfibrillar-associated protein 3-like	361618	3795	354583	11783	19771, 27759, 35747, 43735, 51723
3641	microfibrillar-associated protein 3-like	393704	3796	377307	11784	19772, 27760, 35748, 43736, 51724
3642	microfibrillar-associated protein 3-like	502832	3797	423722	11785	19773, 27761, 35749, 43737, 51725
3643	microfibrillar-associated protein 3-like	504999	3798	425303	11786	19774, 27762, 35750, 43738, 51726

3644	microfibrillar-associated protein 3-like	506764	3799	426247	11787	19775, 27763, 35751, 43739, 51727
3645	microfibrillar-associated protein 3-like	510306	3800	423549	11788	19776, 27764, 35752, 43740, 51728
3646	microfibrillar-associated protein 3-like	512698	3801	422791	11789	19777, 27765, 35753, 43741, 51729
3647	microtubule-associated protein 1 light chain 3 alpha	360668	3802	353886	11790	19778, 27766, 35754, 43742, 51730
3648	microtubule-associated protein 1 light chain 3 alpha	397709	3803	380821	11791	19779, 27767, 35755, 43743, 51731
3649	microtubule-associated protein 1 light chain 3 alpha	374837	3804	363970	11792	19780, 27768, 35756, 43744, 51732
3650	microtubule-associated protein 1 light chain 3 beta	268607	3805	268607	11793	19781, 27769, 35757, 43745, 51733
3651	microtubule-associated protein 1 light chain 3 beta	534986	3806	441125	11794	19782, 27770, 35758, 43746, 51734
3652	microtubule-associated protein 1 light chain 3 gamma	357246	3807	349785	11795	19783, 27771, 35759, 43747, 51735
3653	microtubule-associated protein 7	345567	3808	344217	11796	19784, 27772, 35760, 43748, 51736
3654	microtubule-associated protein 7	354570	3809	346581	11797	19785, 27773, 35761, 43749, 51737
3655	microtubule-associated protein 7	432797	3810	414879	11798	19786, 27774, 35762, 43750, 51738
3656	microtubule-associated protein 7	438100	3811	400790	11799	19787, 27775, 35763, 43751, 51739
3657	microtubule-associated protein 7	454590	3812	414712	11800	19788, 27776, 35764, 43752, 51740
3658	microtubule-associated protein 7	544465	3813	445737	11801	19789, 27777, 35765, 43753, 51741
3659	mindbomb homolog 1 (Drosophila)	261537	3814	261537	11802	19790, 27778, 35766, 43754, 51742
3660	MIT, microtubule interacting and transport, domain containing 1	289359	3815	289359	11803	19791, 27779, 35767, 43755, 51743
3661	MIT, microtubule interacting and transport, domain	422537	3816	413371	11804	19792, 27780, 35768, 43756, 51744

	containing 1					
3662	mitochondrial calcium uptake 1	361114	3817	354415	11805	19793, 27781, 35769, 43757, 51745
3663	mitochondrial calcium uptake 1	398761	3818	381745	11806	19794, 27782, 35770, 43758, 51746
3664	mitochondrial calcium uptake 1	398763	3819	381747	11807	19795, 27783, 35771, 43759, 51747
3665	mitochondrial calcium uptake 1	401998	3820	384068	11808	19796, 27784, 35772, 43760, 51748
3666	mitochondrial calcium uptake 1	418483	3821	402470	11809	19797, 27785, 35773, 43761, 51749
3667	mitochondrial carrier 1	337855	3822	338712	11810	19798, 27786, 35774, 43762, 51750
3668	mitochondrial carrier 1	373550	3823	362651	11811	19799, 27787, 35775, 43763, 51751
3669	mitochondrial carrier 1	373565	3824	362666	11812	19800, 27788, 35776, 43764, 51752
3670	mitochondrial carrier 1	373616	3825	362718	11813	19801, 27789, 35777, 43765, 51753
3671	mitochondrial carrier 1	373627	3826	362730	11814	19802, 27790, 35778, 43766, 51754
3672	mitochondrial carrier 1	418541	3827	399187	11815	19803, 27791, 35779, 43767, 51755
3673	mitochondrial carrier 1	460219	3828	419739	11816	19804, 27792, 35780, 43768, 51756
3674	mitochondrial carrier 1	538808	3829	437660	11817	19805, 27793, 35781, 43769, 51757
3675	mitochondrial carrier triple repeat 1	242275	3830	242275	11818	19806, 27794, 35782, 43770, 51758
3676	mitochondrial carrier triple repeat 1	377716	3831	366945	11819	19807, 27795, 35783, 43771, 51759
3677	mitochondrial carrier triple repeat 1	380590	3832	369964	11820	19808, 27796, 35784, 43772, 51760
3678	mitochondrial carrier triple repeat 2	269205	3833	372612	11821	19809, 27797, 35785, 43773, 51761

3679	mitochondrial carrier triple repeat 2	535708	3834	443889	11822	19810, 27798, 35786, 43774, 51762
3680	mitochondrial carrier triple repeat 6	357421	3835	361681	11823	19811, 27799, 35787, 43775, 51763
3681	mitochondrial fission factor	304593	3836	304898	11824	19812, 27800, 35788, 43776, 51764
3682	mitochondrial fission factor	337110	3837	338412	11825	19813, 27801, 35789, 43777, 51765
3683	mitochondrial fission factor	349901	3838	304134	11826	19814, 27802, 35790, 43778, 51766
3684	mitochondrial fission factor	353339	3839	302037	11827	19815, 27803, 35791, 43779, 51767
3685	mitochondrial fission factor	354503	3840	346498	11828	19816, 27804, 35792, 43780, 51768
3686	mitochondrial fission factor	392059	3841	375912	11829	19817, 27805, 35793, 43781, 51769
3687	mitochondrial fission factor	409565	3842	386964	11830	19818, 27806, 35794, 43782, 51770
3688	mitochondrial fission factor	409616	3843	386641	11831	19819, 27807, 35795, 43783, 51771
3689	mitochondrial fission factor	418961	3844	407547	11832	19820, 27808, 35796, 43784, 51772
3690	mitochondrial fission factor	423098	3845	390165	11833	19821, 27809, 35797, 43785, 51773
3691	mitochondrial fission factor	436237	3846	411386	11834	19822, 27810, 35798, 43786, 51774
3692	mitochondrial fission factor	443428	3847	391829	11835	19823, 27811, 35799, 43787, 51775
3693	mitochondrial fission factor	452930	3848	415996	11836	19824, 27812, 35800, 43788, 51776
3694	mitochondrial fission factor	525195	3849	436920	11837	19825, 27813, 35801, 43789, 51777
3695	mitochondrial fission process 1	266263	3850	266263	11838	19826, 27814, 35802, 43790, 51778
3696	mitochondrial fission process 1	355143	3851	347267	11839	19827, 27815, 35803, 43791, 51779

3697	mitochondrial fission regulator 1	262146	3852	262146	11840	19828, 27816, 35804, 43792, 51780
3698	mitochondrial fission regulator 1	458689	3853	391502	11841	19829, 27817, 35805, 43793, 51781
3699	Mitochondrial GTPase 1	317502	3854	323047	11842	19830, 27818, 35806, 43794, 51782
3700	Mitochondrial GTPase 1	432508	3855	393480	11843	19831, 27819, 35807, 43795, 51783
3701	Mitochondrial GTPase 1	537620	3856	438503	11844	19832, 27820, 35808, 43796, 51784
3702	mitochondrial inner membrane organizing system 1	322753	3857	325562	11845	19833, 27821, 35809, 43797, 51785
3703	Mitochondrial ribonuclease P protein 3	250377	3858	250377	11846	19834, 27822, 35810, 43798, 51786
3704	Mitochondrial ribonuclease P protein 3	321130	3859	324697	11847	19835, 27823, 35811, 43799, 51787
3705	Mitochondrial ribonuclease P protein 3	534898	3860	440915	11848	19836, 27824, 35812, 43800, 51788
3706	Mitochondrial ribonuclease P protein 3	553978	3861	451940	11849	19837, 27825, 35813, 43801, 51789
3707	Mitochondrial ribonuclease P protein 3	554727	3862	452604	11850	19838, 27826, 35814, 43802, 51790
3708	Mitochondrial ribonuclease P protein 3	554896	3863	450779	11851	19839, 27827, 35815, 43803, 51791
3709	Mitochondrial ribonuclease P protein 3	556115	3864	452471	11852	19840, 27828, 35816, 43804, 51792
3710	Mitochondrial ribonuclease P protein 3	556121	3865	452094	11853	19841, 27829, 35817, 43805, 51793
3711	mitochondrial ribonuclease P protein 3 isoform 2	556912	3866	451707	11854	19842, 27830, 35818, 43806, 51794
3712	mitochondrial ribosome recycling factor	297908	3867	297908	11855	19843, 27831, 35819, 43807, 51795
3713	mitochondrial ribosome recycling factor	344641	3868	343867	11856	19844, 27832, 35820, 43808, 51796
3714	mitochondrial ribosome recycling factor	373723	3869	362828	11857	19845, 27833, 35821, 43809, 51797

3715	mitochondrial ribosome recycling factor	373724	3870	362829	11858	19846, 27834, 35822, 43810, 51798
3716	mitochondrial ribosome recycling factor	373727	3871	362832	11859	19847, 27835, 35823, 43811, 51799
3717	mitochondrial ribosome recycling factor	373728	3872	362833	11860	19848, 27836, 35824, 43812, 51800
3718	mitochondrial ribosome recycling factor	373729	3873	362834	11861	19849, 27837, 35825, 43813, 51801
3719	mitochondrial ribosome recycling factor	373730	3874	362835	11862	19850, 27838, 35826, 43814, 51802
3720	mitochondrial ribosome recycling factor	394315	3875	377850	11863	19851, 27839, 35827, 43815, 51803
3721	mitochondrial ribosome recycling factor	441707	3876	395072	11864	19852, 27840, 35828, 43816, 51804
3722	mitochondrial ribosome recycling factor	546115	3877	445588	11865	19853, 27841, 35829, 43817, 51805
3723	mitochondrial rRNA methyltransferase 1 homolog (S. cerevisiae)	250156	3878	250156	11866	19854, 27842, 35830, 43818, 51806
3724	mitochondrial translational initiation factor 3	381116	3879	370508	11867	19855, 27843, 35831, 43819, 51807
3725	mitochondrial translational initiation factor 3	381120	3880	370512	11868	19856, 27844, 35832, 43820, 51808
3726	mitochondrial translational initiation factor 3	405591	3881	384659	11869	19857, 27845, 35833, 43821, 51809
3727	mitochondrial translational initiation factor 3	431572	3882	400084	11870	19858, 27846, 35834, 43822, 51810
3728	mitochondrially encoded ATP synthase 6	361899	3883	354632	11871	19859, 27847, 35835, 43823, 51811
3729	mitochondrially encoded cytochrome b	361789	3884	354554	11872	19860, 27848, 35836, 43824, 51812
3730	mitochondrially encoded cytochrome c oxidase I	361624	3885	354499	11873	19861, 27849, 35837, 43825, 51813
3731	mitochondrially encoded cytochrome c oxidase II	361739	3886	354876	11874	19862, 27850, 35838, 43826, 51814
3732	mitochondrially encoded cytochrome c oxidase III	362079	3887	354982	11875	19863, 27851, 35839, 43827, 51815

3733	mitochondrially encoded NADH dehydrogenase 1	361390	3888	354687	11876	19864, 27852, 35840, 43828, 51816
3734	mitochondrially encoded NADH dehydrogenase 2	361453	3889	355046	11877	19865, 27853, 35841, 43829, 51817
3735	mitochondrially encoded NADH dehydrogenase 3	361227	3890	355206	11878	19866, 27854, 35842, 43830, 51818
3736	mitochondrially encoded NADH dehydrogenase 4	361381	3891	354961	11879	19867, 27855, 35843, 43831, 51819
3737	mitochondrially encoded NADH dehydrogenase 4L	361335	3892	354728	11880	19868, 27856, 35844, 43832, 51820
3738	mitochondrially encoded NADH dehydrogenase 5	361567	3893	354813	11881	19869, 27857, 35845, 43833, 51821
3739	mitochondrially encoded NADH dehydrogenase 6	361681	3894	354665	11882	19870, 27858, 35846, 43834, 51822
3740	mitofusin 1	263969	3895	263969	11883	19871, 27859, 35847, 43835, 51823
3741	mitofusin 1	280653	3896	280653	11884	19872, 27860, 35848, 43836, 51824
3742	mitofusin 1	467174	3897	419134	11885	19873, 27861, 35849, 43837, 51825
3743	mitofusin 1	471841	3898	420617	11886	19874, 27862, 35850, 43838, 51826
3744	mitofusin 1	539169	3899	445566	11887	19875, 27863, 35851, 43839, 51827
3745	mitogen-activated protein kinase 8 interacting protein 3	250894	3900	250894	11888	19876, 27864, 35852, 43840, 51828
3746	mitogen-activated protein kinase 8 interacting protein 3	356010	3901	348290	11889	19877, 27865, 35853, 43841, 51829
3747	mitogen-activated protein kinase associated protein 1	265960	3902	265960	11890	19878, 27866, 35854, 43842, 51830
3748	mitogen-activated protein kinase associated protein 1	350766	3903	265961	11891	19879, 27867, 35855, 43843, 51831
3749	mitogen-activated protein kinase associated protein 1	373496	3904	362595	11892	19880, 27868, 35856, 43844, 51832
3750	mitogen-activated protein kinase associated protein 1	373497	3905	362596	11893	19881, 27869, 35857, 43845, 51833

3751	mitogen-activated protein kinase associated protein 1	373498	3906	362597	11894	19882, 27870, 35858, 43846, 51834
3752	mitogen-activated protein kinase associated protein 1	373503	3907	362602	11895	19883, 27871, 35859, 43847, 51835
3753	mitogen-activated protein kinase associated protein 1	373505	3908	362604	11896	19884, 27872, 35860, 43848, 51836
3754	mitogen-activated protein kinase associated protein 1	373511	3909	362610	11897	19885, 27873, 35861, 43849, 51837
3755	mitogen-activated protein kinase associated protein 1	394063	3910	377627	11898	19886, 27874, 35862, 43850, 51838
3756	mitogen-activated protein kinase associated protein 1	433483	3911	390024	11899	19887, 27875, 35863, 43851, 51839
3757	mitogen-activated protein kinase associated protein 1	444226	3912	412485	11900	19888, 27876, 35864, 43852, 51840
3758	mitogen-activated protein kinase associated protein 1	394060	3913	377624	11901	19889, 27877, 35865, 43853, 51841
3759	monoacylglycerol O-acyltransferase 1	446656	3914	406674	11902	19890, 27878, 35866, 43854, 51842
3760	monoacylglycerol O-acyltransferase 2	198801	3915	198801	11903	19891, 27879, 35867, 43855, 51843
3761	monoacylglycerol O-acyltransferase 2	526712	3916	436283	11904	19892, 27880, 35868, 43856, 51844
3762	monoacylglycerol O-acyltransferase 3	223114	3917	223114	11905	19893, 27881, 35869, 43857, 51845
3763	monoacylglycerol O-acyltransferase 3	379423	3918	368734	11906	19894, 27882, 35870, 43858, 51846
3764	monoacylglycerol O-acyltransferase 3	440203	3919	403756	11907	19895, 27883, 35871, 43859, 51847
3765	motile sperm domain containing 1	370777	3920	359813	11908	19896, 27884, 35872, 43860, 51848
3766	motile sperm domain containing 1	370779	3921	359815	11909	19897, 27885, 35873, 43861, 51849
3767	motile sperm domain containing 1	370783	3922	359819	11910	19898, 27886, 35874, 43862, 51850
3768	motile sperm domain containing 2	380492	3923	369860	11911	19899, 27887, 35875, 43863, 51851

3769	motile sperm domain containing 3	223054	3924	223054	11912	19900, 27888, 35876, 43864, 51852
3770	motile sperm domain containing 3	379527	3925	368842	11913	19901, 27889, 35877, 43865, 51853
3771	motile sperm domain containing 3	393950	3926	377522	11914	19902, 27890, 35878, 43866, 51854
3772	motile sperm domain containing 3	393953	3927	377525	11915	19903, 27891, 35879, 43867, 51855
3773	motile sperm domain containing 3	424091	3928	404626	11916	19904, 27892, 35880, 43868, 51856
3774	MPV17 mitochondrial membrane protein-like	287594	3929	287594	11917	19905, 27893, 35881, 43869, 51857
3775	MPV17 mitochondrial membrane protein-like	396385	3930	379669	11918	19906, 27894, 35882, 43870, 51858
3776	MPV17 mitochondrial membrane protein-like 2	247712	3931	247712	11919	19907, 27895, 35883, 43871, 51859
3777	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	274747	3932	274747	11920	19908, 27896, 35884, 43872, 51860
3778	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	378353	3933	367604	11921	19909, 27897, 35885, 43873, 51861
3779	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	378386	3934	367637	11922	19910, 27898, 35886, 43874, 51862
3780	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	443868	3935	399585	11923	19911, 27899, 35887, 43875, 51863
3781	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	446191	3936	387441	11924	19912, 27900, 35888, 43876, 51864
3782	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	535061	3937	441839	11925	19913, 27901, 35889, 43877, 51865
3783	MRS2 magnesium homeostasis factor homolog (S. cerevisiae)	543597	3938	438118	11926	19914, 27902, 35890, 43878, 51866

3784	MTERF domain containing 1	287025	3939	287025	11927	19915, 27903, 35891, 43879, 51867
3785	MTERF domain containing 3	240050	3940	240050	11928	19916, 27904, 35892, 43880, 51868
3786	MTERF domain containing 3	392830	3941	376575	11929	19917, 27905, 35893, 43881, 51869
3787	MTERF domain containing 3	548101	3942	448343	11930	19918, 27906, 35894, 43882, 51870
3788	MTERF domain containing 3	550496	3943	448246	11931	19919, 27907, 35895, 43883, 51871
3789	MTERF domain containing 3	550736	3944	448854	11932	19920, 27908, 35896, 43884, 51872
3790	MTERF domain containing 3	552029	3945	447651	11933	19921, 27909, 35897, 43885, 51873
3791	mucin 21, cell surface associated	376296	3946	365473	11934	19922, 27910, 35898, 43886, 51874
3792	mucin 21, cell surface associated	450707	3947	402251	11935	19923, 27911, 35899, 43887, 51875
3793	mucosal vascular addressin cell adhesion molecule 1	215637	3948	215637	11936	19924, 27912, 35900, 43888, 51876
3794	mucosal vascular addressin cell adhesion molecule 1	346144	3949	304247	11937	19925, 27913, 35901, 43889, 51877
3795	mucosal vascular addressin cell adhesion molecule 1	382683	3950	372130	11938	19926, 27914, 35902, 43890, 51878
3796	mucosal vascular addressin cell adhesion molecule 1	537731	3951	444768	11939	19927, 27915, 35903, 43891, 51879
3797	mucosal vascular addressin cell adhesion molecule 1	542525	3952	438655	11940	19928, 27916, 35904, 43892, 51880
3798	mucosal vascular addressin cell adhesion molecule 1	543297	3953	443089	11941	19929, 27917, 35905, 43893, 51881
3799	multiple C2 domains transmembrane 2	557742	3954	454847	11942	19930, 27918, 35906, 43894, 51882
3800	multiple C2 domains, transmembrane 1	312216	3955	308957	11943	19931, 27919, 35907, 43895, 51883
3801	multiple C2 domains, transmembrane 1	415885	3956	405735	11944	19932, 27920, 35908, 43896, 51884

3802	multiple C2 domains, transmembrane 1	429576	3957	391639	11945	19933, 27921, 35909, 43897, 51885
3803	multiple C2 domains, transmembrane 1	505078	3958	426417	11946	19934, 27922, 35910, 43898, 51886
3804	multiple C2 domains, transmembrane 1	505208	3959	426438	11947	19935, 27923, 35911, 43899, 51887
3805	multiple C2 domains, transmembrane 1	505465	3960	422317	11948	19936, 27924, 35912, 43900, 51888
3806	multiple C2 domains, transmembrane 1	515393	3961	424126	11949	19937, 27925, 35913, 43901, 51889
3807	multiple C2 domains, transmembrane 2	331706	3962	329646	11950	19938, 27926, 35914, 43902, 51890
3808	multiple C2 domains, transmembrane 2	357742	3963	350377	11951	19939, 27927, 35915, 43903, 51891
3809	multiple C2 domains, transmembrane 2	451018	3964	395109	11952	19940, 27928, 35916, 43904, 51892
3810	multiple C2 domains, transmembrane 2	543482	3965	438521	11953	19941, 27929, 35917, 43905, 51893
3811	murine retrovirus integration site 1 homolog	308763	3966	307885	11954	19942, 27930, 35918, 43906, 51894
3812	murine retrovirus integration site 1 homolog	421747	3967	414598	11955	19943, 27931, 35919, 43907, 51895
3813	murine retrovirus integration site 1 homolog	424001	3968	401205	11956	19944, 27932, 35920, 43908, 51896
3814	murine retrovirus integration site 1 homolog	436272	3969	412229	11957	19945, 27933, 35921, 43909, 51897
3815	murine retrovirus integration site 1 homolog	527509	3970	432067	11958	19946, 27934, 35922, 43910, 51898
3816	murine retrovirus integration site 1 homolog	545852	3971	441971	11959	19947, 27935, 35923, 43911, 51899
3817	murine retrovirus integration site 1 homolog	547195	3972	448278	11960	19948, 27936, 35924, 43912, 51900
3818	murine retrovirus integration site 1 homolog	552103	3973	446764	11961	19949, 27937, 35925, 43913, 51901
3819	murine retrovirus integration site 1 homolog	558540	3974	453013	11962	19950, 27938, 35926, 43914, 51902

3820	murine retrovirus integration site 1 homolog	423302	3975	412130	11963	19951, 27939, 35927, 43915, 51903
3821	murine retrovirus integration site 1 homolog	531107	3976	432436	11964	19952, 27940, 35928, 43916, 51904
3822	murine retrovirus integration site 1 homolog	541483	3977	437784	11965	19953, 27941, 35929, 43917, 51905
3823	myelin expression factor 2	267836	3978	267836	11966	19954, 27942, 35930, 43918, 51906
3824	myelin expression factor 2	324324	3979	316950	11967	19955, 27943, 35931, 43919, 51907
3825	myelin expression factor 2	454655	3980	406195	11968	19956, 27944, 35932, 43920, 51908
3826	myelin expression factor 2	560172	3981	452918	11969	19957, 27945, 35933, 43921, 51909
3827	myelin protein zero-like 1	359523	3982	352513	11970	19958, 27946, 35934, 43922, 51910
3828	myelin protein zero-like 1	474859	3983	420455	11971	19959, 27947, 35935, 43923, 51911
3829	myelin protein zero-like 1	392121	3984	375968	11972	19960, 27948, 35936, 43924, 51912
3830	myoferlin	358334	3985	351094	11973	19961, 27949, 35937, 43925, 51913
3831	myoferlin	359263	3986	352208	11974	19962, 27950, 35938, 43926, 51914
3832	myoferlin	371488	3987	360543	11975	19963, 27951, 35939, 43927, 51915
3833	myoferlin	371489	3988	360544	11976	19964, 27952, 35940, 43928, 51916
3834	myoferlin	371501	3989	360556	11977	19965, 27953, 35941, 43929, 51917
3835	myoferlin	371502	3990	360557	11978	19966, 27954, 35942, 43930, 51918
3836	myo-inositol oxygenase	216075	3991	216075	11979	19967, 27955, 35943, 43931, 51919
3837	myo-inositol oxygenase	395732	3992	379081	11980	19968, 27956, 35944, 43932, 51920

3838	myo-inositol oxygenase	395733	3993	379082	11981	19969, 27957, 35945, 43933, 51921
3839	myo-inositol oxygenase	451761	3994	409894	11982	19970, 27958, 35946, 43934, 51922
3840	myosin XVI	251041	3995	251041	11983	19971, 27959, 35947, 43935, 51923
3841	myosin XVI	356711	3996	349145	11984	19972, 27960, 35948, 43936, 51924
3842	myosin XVI	357550	3997	350160	11985	19973, 27961, 35949, 43937, 51925
3843	myosin XVI	375857	3998	365017	11986	19974, 27962, 35950, 43938, 51926
3844	myosin XVI	397258	3999	380429	11987	19975, 27963, 35951, 43939, 51927
3845	myosin XVI	457511	4000	401633	11988	19976, 27964, 35952, 43940, 51928
3846	myosin, light chain 10, regulatory	223167	4001	223167	11989	19977, 27965, 35953, 43941, 51929
3847	myristoylated alanine-rich protein kinase C substrate	368635	4002	357624	11990	19978, 27966, 35954, 43942, 51930
3848	N(alpha)-acetyltransferase 30, NatC catalytic subunit	395257	4003	378676	11991	19979, 27967, 35955, 43943, 51931
3849	N(alpha)-acetyltransferase 30, NatC catalytic subunit	556492	4004	452521	11992	19980, 27968, 35956, 43944, 51932
3850	N(alpha)-acetyltransferase 35, NatC auxiliary subunit	361671	4005	354972	11993	19981, 27969, 35957, 43945, 51933
3851	N(alpha)-acetyltransferase 35, NatC auxiliary subunit	376040	4006	365208	11994	19982, 27970, 35958, 43946, 51934
3852	N(alpha)-acetyltransferase 35, NatC auxiliary subunit	416045	4007	399595	11995	19983, 27971, 35959, 43947, 51935
3853	N-acetyltransferase 14 (GCN5-related, putative)	205194	4008	205194	11996	19984, 27972, 35960, 43948, 51936

3854	N-acylsphingosine amidohydrolase (non-lysosomal ceramidase) 2	329428	4009	329886	11997	19985, 27973, 35961, 43949, 51937
3855	N-acylsphingosine amidohydrolase (non-lysosomal ceramidase) 2	374028	4010	363140	11998	19986, 27974, 35962, 43950, 51938
3856	N-acylsphingosine amidohydrolase (non-lysosomal ceramidase) 2	395526	4011	378897	11999	19987, 27975, 35963, 43951, 51939
3857	N-acylsphingosine amidohydrolase (non-lysosomal ceramidase) 2	443575	4012	392766	12000	19988, 27976, 35964, 43952, 51940
3858	N-acylsphingosine amidohydrolase (non-lysosomal ceramidase) 2	447815	4013	388206	12001	19989, 27977, 35965, 43953, 51941
3859	NAD kinase domain containing 1	282512	4014	282512	12002	19990, 27978, 35966, 43954, 51942
3860	NAD kinase domain containing 1	381937	4015	371362	12003	19991, 27979, 35967, 43955, 51943
3861	NAD kinase domain containing 1	397338	4016	380499	12004	19992, 27980, 35968, 43956, 51944
3862	NAD kinase domain containing 1	506945	4017	422250	12005	19993, 27981, 35969, 43957, 51945
3863	NAD kinase domain containing 1	514504	4018	421029	12006	19994, 27982, 35970, 43958, 51946
3864	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex 12	547986	4019	450130	12007	19995, 27983, 35971, 43959, 51947
3865	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 12	327772	4020	330737	12008	19996, 27984, 35972, 43960, 51948
3866	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 3, 9kDa	417328	4021	410363	12009	19997, 27985, 35973, 43961, 51949
3867	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 3, 9kDa	419113	4022	398290	12010	19998, 27986, 35974, 43962, 51950

3868	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 3, 9kDa	485876	4023	418438	12011	19999, 27987, 35975, 43963, 51951
3869	NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 4, 9kDa	339600	4024	339720	12012	20000, 27988, 35976, 43964, 51952
3870	NADH dehydrogenase (ubiquinone) 1 beta subcomplex 5 16kDa	471112	4025	419501	12013	20001, 27989, 35977, 43965, 51953
3871	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 1, 7kDa	329559	4026	330787	12014	20002, 27990, 35978, 43966, 51954
3872	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 1, 7kDa	553377	4027	451293	12015	20003, 27991, 35979, 43967, 51955
3873	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 1, 7kDa	555441	4028	450776	12016	20004, 27992, 35980, 43968, 51956
3874	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 2, 8kDa	204307	4029	204307	12017	20005, 27993, 35981, 43969, 51957
3875	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 2, 8kDa	247866	4030	247866	12018	20006, 27994, 35982, 43970, 51958
3876	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 2, 8kDa	464566	4031	419479	12019	20007, 27995, 35983, 43971, 51959
3877	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 2, 8kDa	465506	4032	419357	12020	20008, 27996, 35984, 43972, 51960
3878	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 2, 8kDa	476279	4033	419087	12021	20009, 27997, 35985, 43973, 51961

3879	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 4, 15kDa	184266	4034	184266	12022	20010, 27998, 35986, 43974, 51962
3880	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 4, 15kDa	485064	4035	419578	12023	20011, 27999, 35987, 43975, 51963
3881	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 5, 16kDa	259037	4036	259037	12024	20012, 28000, 35988, 43976, 51964
3882	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 5, 16kDa	493866	4037	419656	12025	20013, 28001, 35989, 43977, 51965
3883	NADH dehydrogenase (ubiquinone) 1 beta subcomplex, 6, 17kDa	350021	4038	297983	12026	20014, 28002, 35990, 43978, 51966
3884	NADH dehydrogenase (ubiquinone) 1 subcomplex unknown 2 14.5kDa	525085	4039	434262	12027	20015, 28003, 35991, 43979, 51967
3885	NADH dehydrogenase (ubiquinone) 1 subcomplex unknown 2 14.5kDa	527806	4040	432739	12028	20016, 28004, 35992, 43980, 51968
3886	NADH dehydrogenase (ubiquinone) 1, subcomplex unknown, 2, 14.5kDa	281031	4041	281031	12029	20017, 28005, 35993, 43981, 51969
3887	NADH dehydrogenase (ubiquinone) 1, subcomplex unknown, 2, 14.5kDa	324742	4042	316370	12030	20018, 28006, 35994, 43982, 51970
3888	NADH dehydrogenase (ubiquinone) complex I assembly factor 7	336237	4043	337431	12031	20019, 28007, 35995, 43983, 51971
3889	NADPH oxidase activator 1	341349	4044	342848	12032	20020, 28008, 35996, 43984, 51972

3890	NADPH oxidase activator 1	392815	4045	376562	12033	20021, 28009, 35997, 43985, 51973
3891	NADPH oxidase organizer 1	354249	4046	346195	12034	20022, 28010, 35998, 43986, 51974
3892	NADPH oxidase organizer 1	356120	4047	348435	12035	20023, 28011, 35999, 43987, 51975
3893	NADPH oxidase organizer 1	397280	4048	380450	12036	20024, 28012, 36000, 43988, 51976
3894	naked cuticle homolog 1 (Drosophila)	268459	4049	268459	12037	20025, 28013, 36001, 43989, 51977
3895	naked cuticle homolog 2 (Drosophila)	296849	4050	296849	12038	20026, 28014, 36002, 43990, 51978
3896	naked cuticle homolog 2 (Drosophila)	382730	4051	372177	12039	20027, 28015, 36003, 43991, 51979
3897	naked cuticle homolog 2 (Drosophila)	537972	4052	440925	12040	20028, 28016, 36004, 43992, 51980
3898	naked cuticle homolog 2 (Drosophila)	274150	4053	274150	12041	20029, 28017, 36005, 43993, 51981
3899	natural killer cell group 7 sequence	221978	4054	221978	12042	20030, 28018, 36006, 43994, 51982
3900	NCK adaptor protein 1	288986	4055	288986	12043	20031, 28019, 36007, 43995, 51983
3901	NCK adaptor protein 1	476286	4056	418513	12044	20032, 28020, 36008, 43996, 51984
3902	NCK adaptor protein 1	481752	4057	417273	12045	20033, 28021, 36009, 43997, 51985
3903	NCK adaptor protein 1	485096	4058	419677	12046	20034, 28022, 36010, 43998, 51986
3904	NCK adaptor protein 1	491539	4059	419302	12047	20035, 28023, 36011, 43999, 51987
3905	NCK adaptor protein 1	469404	4060	419631	12048	20036, 28024, 36012, 44000, 51988
3906	NCK-associated protein 1-like	293373	4061	293373	12049	20037, 28025, 36013, 44001, 51989
3907	NCK-associated protein 1-like	545638	4062	445596	12050	20038, 28026, 36014, 44002, 51990

3908	N-deacetylase/N-sulfotransferase (heparan glucosaminyl) 3	296499	4063	296499	12051	20039, 28027, 36015, 44003, 51991
3909	N-deacetylase/N-sulfotransferase (heparan glucosaminyl) 3	433996	4064	396625	12052	20040, 28028, 36016, 44004, 51992
3910	N-deacetylase/N-sulfotransferase (heparan glucosaminyl) 4	264363	4065	264363	12053	20041, 28029, 36017, 44005, 51993
3911	NEDD4 binding protein 3	274605	4066	274605	12054	20042, 28030, 36018, 44006, 51994
3912	N-ethylmaleimide-sensitive factor attachment protein, gamma	322897	4067	324628	12055	20043, 28031, 36019, 44007, 51995
3913	N-ethylmaleimide-sensitive factor attachment protein, gamma	542979	4068	442849	12056	20044, 28032, 36020, 44008, 51996
3914	netrin G2	360670	4069	353888	12057	20045, 28033, 36021, 44009, 51997
3915	netrin G2	372179	4070	361252	12058	20046, 28034, 36022, 44010, 51998
3916	netrin G2	393228	4071	376920	12059	20047, 28035, 36023, 44011, 51999
3917	netrin G2	393229	4072	376921	12060	20048, 28036, 36024, 44012, 52000
3918	neuralized homolog 2 (Drosophila)	372518	4073	361596	12061	20049, 28037, 36025, 44013, 52001
3919	neurensin 1	378475	4074	367736	12062	20050, 28038, 36026, 44014, 52002
3920	neurensin 1	378477	4075	367738	12063	20051, 28039, 36027, 44015, 52003
3921	neurensin 1	378478	4076	367739	12064	20052, 28040, 36028, 44016, 52004
3922	neurensin 1	378491	4077	367752	12065	20053, 28041, 36029, 44017, 52005
3923	neuritin 1-like	339176	4078	342411	12066	20054, 28042, 36030, 44018, 52006

3924	neuroligin 4, X-linked	275857	4079	275857	12067	20055, 28043, 36031, 44019, 52007
3925	neuroligin 4, X-linked	381092	4080	370482	12068	20056, 28044, 36032, 44020, 52008
3926	neuroligin 4, X-linked	381093	4081	370483	12069	20057, 28045, 36033, 44021, 52009
3927	neuroligin 4, X-linked	381095	4082	370485	12070	20058, 28046, 36034, 44022, 52010
3928	neuroligin 4, X-linked	538097	4083	439203	12071	20059, 28047, 36035, 44023, 52011
3929	Neuron-specific protein family member 1	397958	4084	381049	12072	20060, 28048, 36036, 44024, 52012
3930	Neuron-specific protein family member 1	421177	4085	388823	12073	20061, 28049, 36037, 44025, 52013
3931	Neuron-specific protein family member 1	433139	4086	408833	12074	20062, 28050, 36038, 44026, 52014
3932	Neuron-specific protein family member 1	504171	4087	425803	12075	20063, 28051, 36039, 44027, 52015
3933	Neuron-specific protein family member 1	505246	4088	421841	12076	20064, 28052, 36040, 44028, 52016
3934	Neuron-specific protein family member 1	506380	4089	425423	12077	20065, 28053, 36041, 44029, 52017
3935	Neuron-specific protein family member 1	513555	4090	426358	12078	20066, 28054, 36042, 44030, 52018
3936	Neuron-specific protein family member 1	513829	4091	425345	12079	20067, 28055, 36043, 44031, 52019
3937	Neuron-specific protein family member 2	303177	4092	307722	12080	20068, 28056, 36044, 44032, 52020
3938	Neuron-specific protein family member 2	519717	4093	431119	12081	20069, 28057, 36045, 44033, 52021
3939	Neuron-specific protein family member 2	519867	4094	429689	12082	20070, 28058, 36046, 44034, 52022
3940	Neuron-specific protein family member 2	521278	4095	430208	12083	20071, 28059, 36047, 44035, 52023
3941	neuropeptide FF receptor 1	277942	4096	277942	12084	20072, 28060, 36048, 44036, 52024

3942	neuropeptide FF receptor 1	449957	4097	401171	12085	20073, 28061, 36049, 44037, 52025
3943	neuropeptide FF receptor 2	308744	4098	307822	12086	20074, 28062, 36050, 44038, 52026
3944	neuropeptide FF receptor 2	344413	4099	340789	12087	20075, 28063, 36051, 44039, 52027
3945	neuropeptide FF receptor 2	358749	4100	351599	12088	20076, 28064, 36052, 44040, 52028
3946	neuropeptide FF receptor 2	395999	4101	379321	12089	20077, 28065, 36053, 44041, 52029
3947	neuropeptides B/W receptor 2	369768	4102	358783	12090	20078, 28066, 36054, 44042, 52030
3948	neuropilin (NRP) and tolloid (TLL)-like 2	303155	4103	306726	12091	20079, 28067, 36055, 44043, 52031
3949	neuropilin (NRP) and tolloid (TLL)-like 2	562435	4104	455169	12092	20080, 28068, 36056, 44044, 52032
3950	neurotensin receptor 2	306928	4105	303686	12093	20081, 28069, 36057, 44045, 52033
3951	nicalin	246117	4106	246117	12094	20082, 28070, 36058, 44046, 52034
3952	NIPA-like domain containing 1	295461	4107	295461	12095	20083, 28071, 36059, 44047, 52035
3953	NIPA-like domain containing 2	341166	4108	339256	12096	20084, 28072, 36060, 44048, 52036
3954	NIPA-like domain containing 3	3912	4109	3912	12097	20085, 28073, 36061, 44049, 52037, 56088, 56121
3955	NIPA-like domain containing 3	339255	4110	343549	12098	20086, 28074, 36062, 44050, 52038
3956	NIPA-like domain containing 3	358028	4111	350722	12099	20087, 28075, 36063, 44051, 52039
3957	NIPA-like domain containing 3	374399	4112	363520	12100	20088, 28076, 36064, 44052, 52040
3958	NIPA-like domain containing 3	428131	4113	406509	12101	20089, 28077, 36065, 44053, 52041
3959	NIPA-like domain containing 3	432012	4114	392170	12102	20090, 28078, 36066, 44054, 52042

3960	nischarin	345716	4115	339958	12103	20091, 28079, 36067, 44055, 52043
3961	nischarin	414197	4116	410462	12104	20092, 28080, 36068, 44056, 52044
3962	nischarin	433196	4117	398513	12105	20093, 28081, 36069, 44057, 52045
3963	nischarin	479054	4118	418232	12106	20094, 28082, 36070, 44058, 52046
3964	nischarin	488380	4119	417812	12107	20095, 28083, 36071, 44059, 52047
3965	nitric oxide associated 1	264230	4120	264230	12108	20096, 28084, 36072, 44060, 52048
3966	NODAL modulator 1	287667	4121	287667	12109	20097, 28085, 36073, 44061, 52049
3967	NODAL modulator 1	456867	4122	405450	12110	20098, 28086, 36074, 44062, 52050
3968	NODAL modulator 1	536948	4123	441154	12111	20099, 28087, 36075, 44063, 52051
3969	NODAL modulator 2	330537	4124	331851	12112	20100, 28088, 36076, 44064, 52052
3970	NODAL modulator 2	381474	4125	370883	12113	20101, 28089, 36077, 44065, 52053
3971	NODAL modulator 2	543392	4126	439970	12114	20102, 28090, 36078, 44066, 52054
3972	NODAL modulator 3	263012	4127	263012	12115	20103, 28091, 36079, 44067, 52055
3973	NODAL modulator 3	399336	4128	382274	12116	20104, 28092, 36080, 44068, 52056
3974	NODAL modulator 3	538468	4129	443768	12117	20105, 28093, 36081, 44069, 52057
3975	non-SMC condensin I complex, subunit D2	315579	4130	325017	12118	20106, 28094, 36082, 44070, 52058
3976	non-SMC condensin I complex, subunit D2	535602	4131	445103	12119	20107, 28095, 36083, 44071, 52059
3977	non-SMC condensin I complex, subunit D2	545962	4132	444417	12120	20108, 28096, 36084, 44072, 52060

DEMANDE OU BREVET VOLUMINEUX

LA PRÉSENTE PARTIE DE CETTE DEMANDE OU CE BREVET COMPREND PLUS D'UN TOME.

CECI EST LE TOME	1	DE	4
CONTENANT LES PAGES	1	À	338

NOTE : Pour les tomes additionels, veuillez contacter le Bureau canadien des brevets

JUMBO APPLICATIONS/PATENTS

THIS SECTION OF THE APPLICATION/PATENT CONTAINS MORE THAN ONE VOLUME

THIS IS VOLUME	1	OF	4
CONTAINING PAGES	1	TO	338

NOTE: For additional volumes, please contact the Canadian Patent Office

NOM DU FICHIER / FILE NAME :

NOTE POUR LE TOME / VOLUME NOTE:

Claims

We claim:

1. An isolated polynucleotide comprising;

(a) a first region of linked nucleosides, said first region encoding a polypeptide of interest, said polypeptide of interest selected from the group consisting of SEQ ID NOs 8144-16131;

(b) a first flanking region located at the 5′ terminus of said first region comprising;

(i) a sequence of linked nucleosides selected from the group consisting of the native 5′ UTR of any of the nucleic acids that encode any of SEQ ID NOs 8144-16131, SEQ ID NOs: 1-4 and functional variants thereof; and

(ii) at least one 5′ terminal cap;

(c) a second flanking region located at the 3′ terminus of said first region comprising;

(i') a sequence of linked nucleosides selected from the group consisting of the native 3′ UTR of any of the nucleic acids that encode any of SEQ ID NOs 8144-16131, SEQ ID NOs 5-21 and functional variants thereof; and

(ii') a 3′ tailing sequence of linked nucleosides.

2. The isolated polynucleotide of claim 1 wherein the first region of linked nucleosides comprises at least an open reading frame of a nucleic acid sequence, wherein the nucleic acid sequence selected from the group consisting of SEQ ID NOs: 16132-56137.

3. The isolated polynucleotide of claim 1, wherein the 3′tailing sequence of linked nucleosides is selected from the group consisting of a poly-A tail of approximately 160 nucleotides and a polyA-G quartet.

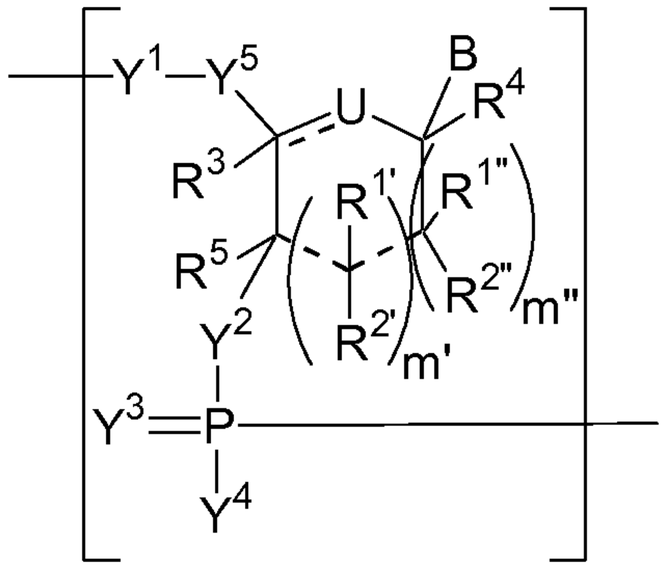
4. The isolated polynucleotide of any one of claims 1-3 which is purified.

5. The isolated polynucleotide of any one of claims 1-4, wherein the at least one 5′ terminal cap is selected from the group consisting of Cap0, Cap1, ARCA, inosine, N1-methyl-guanosine, 2′fluoro-guanosine, 7-deaza-guanosine, 8-oxo-guanosine, 2-amino-guanosine, LNA-guanosine, and 2-azido-guanosine.

6. The isolated polynucleotide of any preceding claim, wherein at least one of said linked nucleosides comprises at least one modification as compared to the chemical structure of an A, G, U or C ribonucleotide.

7. The isolated polynucleotide of claim 6, wherein at least one said modification is located in a nucleoside base and/or sugar portion.

8. The isolated polynucleotide of any one of claims 1-7, wherein said first region comprises n number of linked nucleosides having Formula (Ia):



(Ia), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

U is O, S, $N(R^U)_{nu}$, or $C(R^U)_{nu}$, wherein nu is an integer from 0 to 2 and each R^U is, independently, H, halo, or optionally substituted alkyl;

 is a single or double bond;

--- is a single bond or absent;

each of $R^{1'}$, $R^{2'}$, $R^{1''}$, $R^{2''}$, R^3, R^4, and R^5 is, independently, H, halo, hydroxy, thiol, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted aminoalkoxy, optionally substituted alkoxyalkoxy, optionally substituted hydroxyalkoxy, optionally

substituted amino, azido, optionally substituted aryl, optionally substituted aminoalkyl, or absent; wherein the combination of R^3 with one or more of $R^{1'}$, $R^{1''}$, $R^{2'}$, $R^{2''}$, or R^5 can join together to form optionally substituted alkylene or optionally substituted heteroalkylene and, taken together with the carbons to which they are attached, provide an optionally substituted heterocyclyl; wherein the combination of R^5 with one or more of $R^{1'}$, $R^{1''}$, $R^{2'}$, or $R^{2''}$ can join together to form optionally substituted alkylene or optionally substituted heteroalkylene and, taken together with the carbons to which they are attached, provide an optionally substituted heterocyclyl; and wherein the combination of R^4 and one or more of $R^{1'}$, $R^{1''}$, $R^{2'}$, $R^{2''}$, R^3, or R^5 can join together to form optionally substituted alkylene or optionally substituted heteroalkylene and, taken together with the carbons to which they are attached, provide an optionally substituted heterocyclyl;

each of Y^1, Y^2, and Y^3, is, independently, O, S, $-NR^{N1}-$, optionally substituted alkylene, or optionally substituted heteroalkylene, wherein R^{N1} is H, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted aryl, or absent;

each Y^4 is, independently, H, hydroxy, thiol, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted thioalkoxy, optionally substituted alkoxyalkoxy, or optionally substituted amino;

each Y^5 is, independently, O, S, optionally substituted alkylene, or optionally substituted heteroalkylene;

n is an integer from 1 to 100,000; and

B is a nucleobase, wherein the combination of B and $R^{1'}$, the combination of B and $R^{2'}$, the combination of B and $R^{1''}$, or the combination of B and $R^{2''}$ can, taken together with the carbons to which they are attached, optionally form a bicyclic group or wherein the combination of B, $R^{1''}$, and R^3 or the combination of B, $R^{2''}$, and R^3 can optionally form a tricyclic or tetracyclic group.

9. The isolated polynucleotide of claim 8, wherein B is not pseudouridine (ψ) or 5-methyl-cytidine (m^5C).

10. The isolated polynucleotide of any one of claims 8-9, wherein

U is O or $C(R^U)_{nu}$, wherein nu is an integer from 1 to 2 and each R^U is, independently, H, halo, or optionally substituted alkyl;

each of R^1, $R^{1'}$, $R^{1''}$, R^2, $R^{2'}$, and $R^{2''}$, if present, is, independently, H, halo, hydroxy, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted aminoalkoxy, optionally substituted alkoxyalkoxy, optionally substituted amino, azido, optionally substituted aryl, or optionally substituted aminoalkyl;

each of R^3 and R^4 is, independently, H, halo, hydroxy, optionally substituted alkyl, or optionally substituted alkoxyalkoxy;

each of Y^1, Y^2, and Y^3, is, independently, O, S, $-NR^{N1}-$, optionally substituted alkylene, or optionally substituted heteroalkylene, wherein R^{N1} is H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl;

each Y^4 is, independently, H, hydroxy, thiol, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted thioalkoxy, or optionally substituted amino;

each Y^5 is, independently, O or optionally substituted alkylene; and

n is an integer from 10 to 10,000.

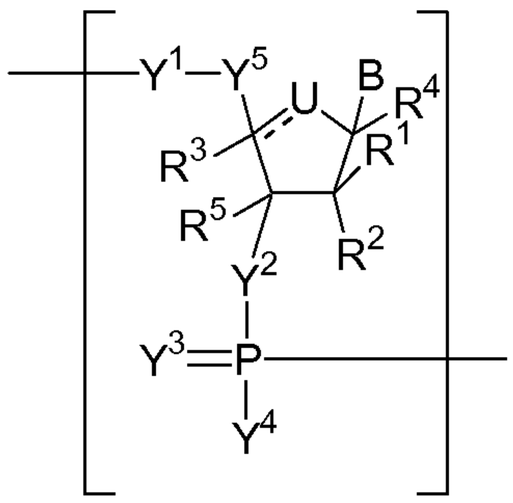
11. The isolated polynucleotide of claim 10, wherein each of R^1, $R^{1'}$, and $R^{1''}$, if present, is H.

12. The isolated polynucleotide of claim 11, wherein each of R^2, $R^{2'}$, and $R^{2''}$, if present, is, independently, H, halo, hydroxy, optionally substituted alkoxy, or optionally substituted alkoxyalkoxy.

13. The isolated polynucleotide of claim 10, wherein each of R^2, $R^{2'}$, and $R^{2''}$, if present, is H.

14. The isolated polynucleotide of claim 13, wherein each of R^1, $R^{1'}$, and $R^{1''}$, if present, is, independently, H, halo, hydroxy, optionally substituted alkoxy, or optionally substituted alkoxyalkoxy.

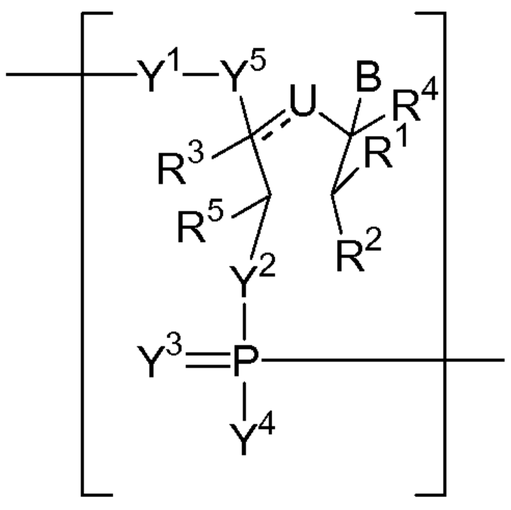
15. The isolated polynucleotide of claim 8, wherein said first region comprises n number of linked nucleotides having Formula (IIa):



(IIa), or a pharmaceutically acceptable salt or stereoisomer thereof.

16. isolated The polypeptide of claim 15, wherein said first region comprises n number of linked nucleosides having Formula (IIb) or (IIc), or a pharmaceutically acceptable salt thereof.

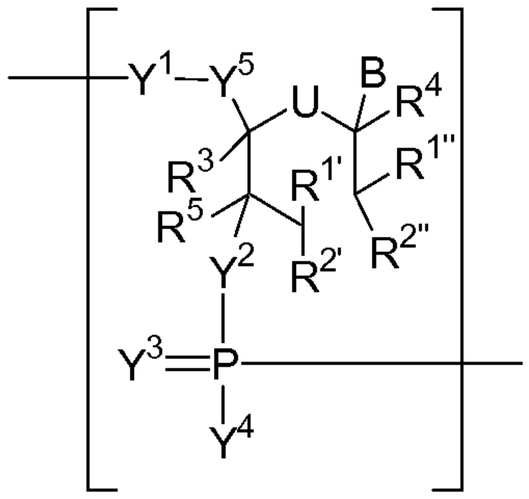
17. The isolated polynucleotide of claim 8, wherein said first region comprises n number of linked nucleosides having Formula (IId):

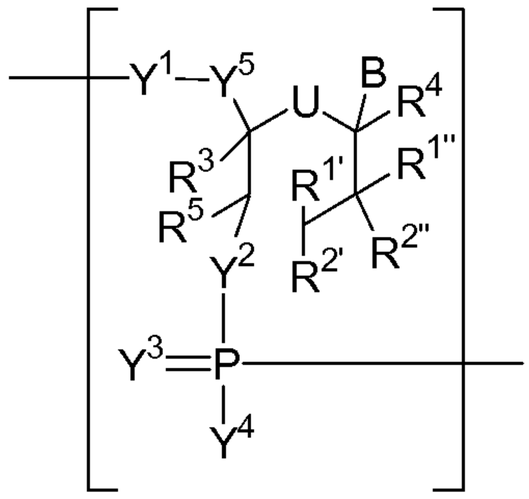


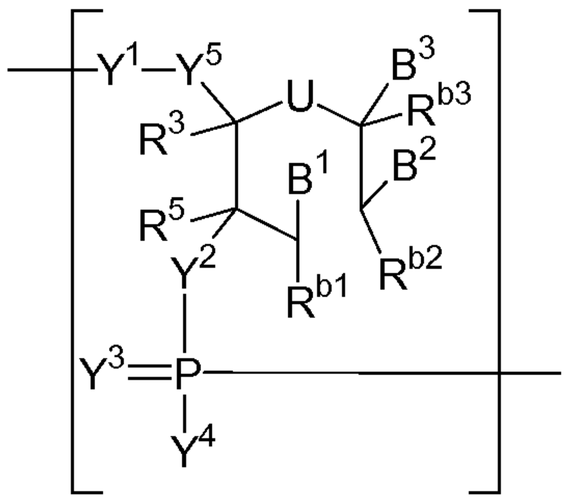
(IId), or a pharmaceutically acceptable salt or stereoisomer thereof.

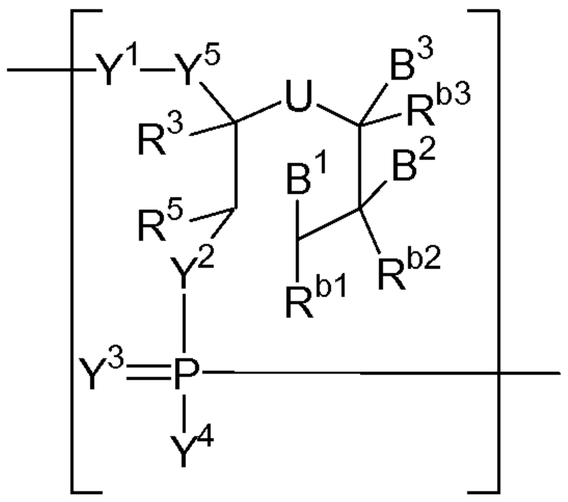
18. The isolated polypeptide of claim 17, wherein said first region comprises n number of linked nucleosides having Formula (IIe) or (IIf), or a pharmaceutically acceptable salt thereof.

19. The isolated polynucleotide of claim 8, wherein said first region comprises n number of linked nucleotides, each of said linked nucleotides independently having one of Formulas (IIg)-(IIj):

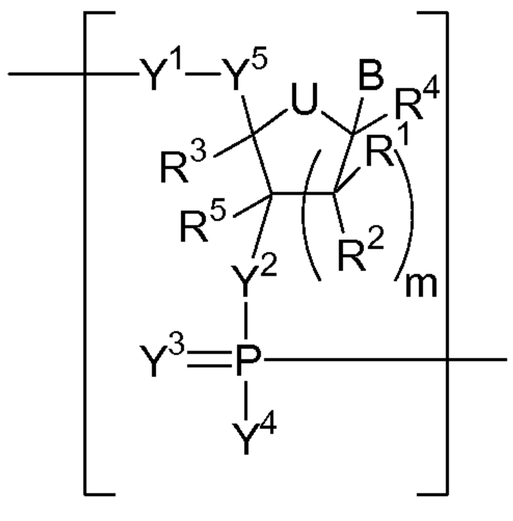

(IIg),


(IIh),

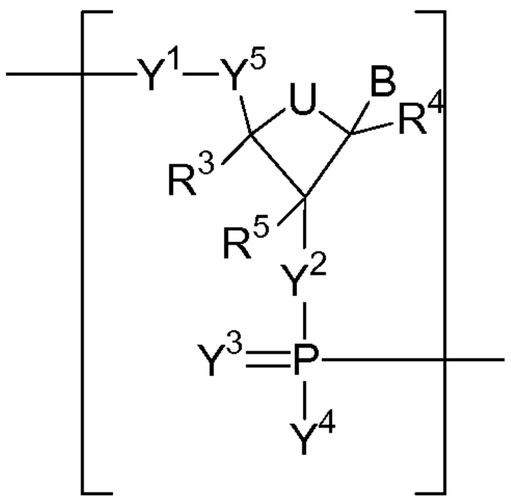

(IIi), or


(IIj), or a pharmaceutically acceptable salt or stereoisomer thereof.

20. The isolated polynucleotide of claim 8, wherein said first region comprises n number of linked nucleosides having Formula (IIk):

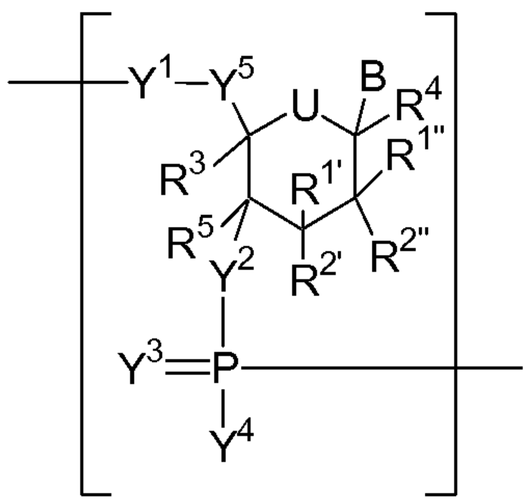

(IIk) , or a pharmaceutically acceptable salt or stereoisomer thereof.

21. The isolated polynucleotide of claim 20, wherein said first region comprises n number of linked nucleosides having Formula (III):



(III), or a pharmaceutically acceptable salt or stereoisomer thereof.

22. The isolated polynucleotide of claim 20, wherein said first region comprises n number of linked nucleosides having Formula (IIm):



(IIm), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

each of $R^{1'}$, $R^{1''}$, $R^{2'}$, and $R^{2''}$ is, independently, H, halo, hydroxy, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted aminoalkoxy, optionally substituted alkoxyalkoxy, or absent; and wherein the combination of $R^{2'}$ and R^3 or the combination of $R^{2''}$ and R^3 can be taken together to form optionally substituted alkylene or optionally substituted heteroalkylene.

23. The isolated polynucleotide of any one of claims 11-22, wherein

U is O or $C(R^U)_{nu}$, wherein nu is an integer from 1 to 2 and each R^U is, independently, H, halo, or optionally substituted alkyl;

each of R^1 and R^2 is, independently, H, halo, hydroxy, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted aminoalkoxy, optionally substituted

alkoxyalkoxy, optionally substituted amino, azido, optionally substituted aryl, or optionally substituted aminoalkyl;

each of R^3 and R^4 is, independently, H or optionally substituted alkyl;

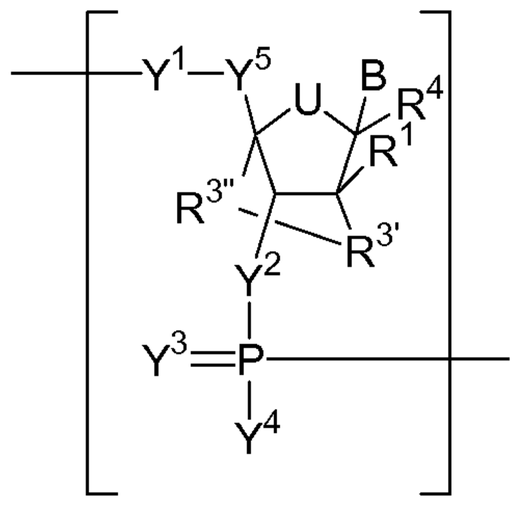
each of Y^1, Y^2, and Y^3, is, independently, O, S, $-NR^{N1}-$, optionally substituted alkylene, or optionally substituted heteroalkylene, wherein R^{N1} is H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl;

each Y^4 is, independently, H, hydroxy, thiol, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted thioalkoxy, or optionally substituted amino;

each Y^5 is, independently, O or optionally substituted alkylene; and

n is an integer from 10 to 10,000.

24. The isolated polynucleotide of claim 8, wherein said first region comprises n number of linked nucleosides having Formula (IIn):



(IIn), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

U is O or $C(R^U)_{nu}$, wherein nu is an integer from 1 to 2 and each R^U is, independently, H, halo, or optionally substituted alkyl;

each of R^1 and R^4 is, independently, H, halo, hydroxy, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted aminoalkoxy, optionally substituted alkoxyalkoxy, optionally substituted amino, azido, optionally substituted aryl, or optionally substituted aminoalkyl;

$R^{3'}$ is O, S, or -NR^{N1}-, wherein R^{N1} is H, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, or optionally substituted aryl;

$R^{3"}$ is optionally substituted alkylene or optionally substituted heteroalkylene;

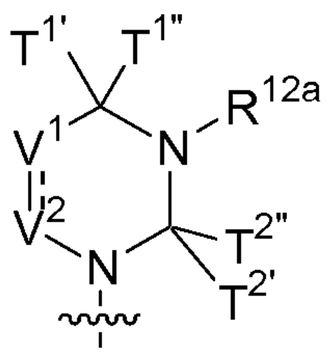
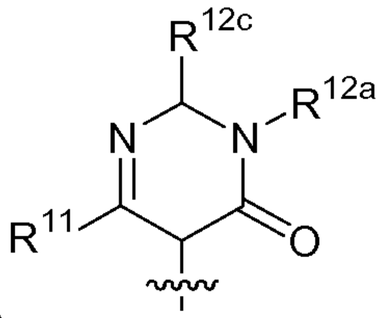
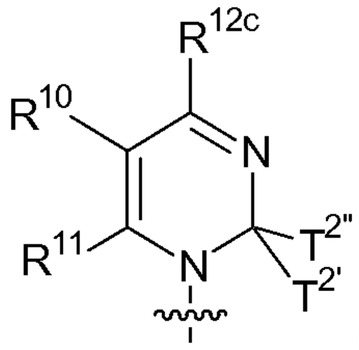
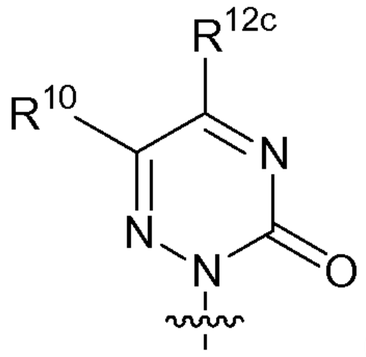
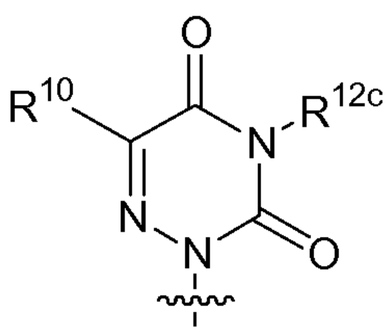
each of Y^1, Y^2, and Y^3, is, independently, O, S, -NR^{N1}-, optionally substituted alkylene, or optionally substituted heteroalkylene, wherein R^{N1} is H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl;

each Y^4 is, independently, H, hydroxy, thiol, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy, optionally substituted thioalkoxy, or optionally substituted amino;

each Y^5 is, independently, O, S, optionally substituted alkylene (e.g., methylene), or optionally substituted heteroalkylene; and

n is an integer from 10 to 10,000.

25. The isolated polynucleotide of any one of claims 8-24, wherein in said n number of B has, each B independently has a formula selected from Formula (b1)-(b5):


(b1),

(b2),

(b3),

(b4),

(b5), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

 connecting V^1 and V^2 in formula (b1) is a single or double bond;

each of $T^{1'}$, $T^{1"}$, $T^{2'}$, and $T^{2"}$ is, independently, H, optionally substituted alkyl, optionally substituted alkoxy, or optionally substituted thioalkoxy, or the combination of

$T^{1'}$ and $T^{1''}$ or the combination of $T^{2'}$ and $T^{2''}$ join together to form O (oxo), S (thio), or Se (seleno);

each of V^1 and V^2 is, independently, O, S, $N(R^{Vb})_{nv}$, or $C(R^{Vb})_{nv}$, wherein nv is an integer from 0 to 2 and each R^{Vb} is, independently, H, halo, optionally substituted amino acid, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, or optionally substituted alkynyloxy;

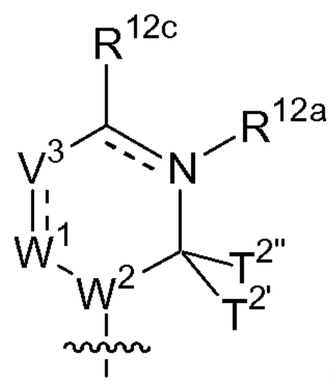
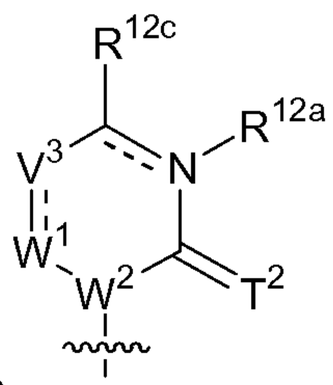
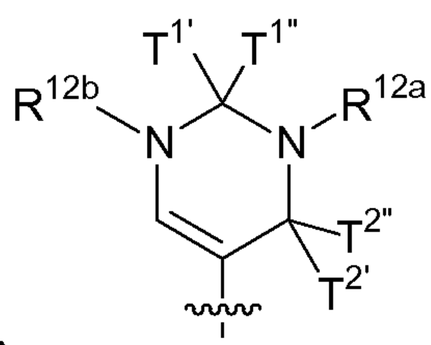
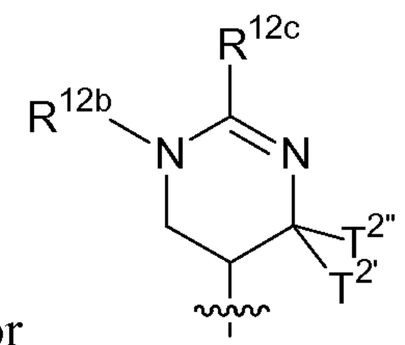
R^{10} is H, halo, optionally substituted amino acid, hydroxy, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted aminoalkyl, optionally substituted alkoxy, optionally substituted alkoxycarbonylalkyl, optionally substituted alkoxycarbonylalkoxy, optionally substituted carboxyalkoxy, optionally substituted carboxyalkyl, or optionally substituted carbamoylalkyl;

R^{11} is H or optionally substituted alkyl;

R^{12a} is H, optionally substituted alkyl, or optionally substituted aminoalkyl; and

R^{12c} is H, halo, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted thioalkoxy, optionally substituted amino, or optionally substituted aminoalkyl.

26. The isolated polynucleotide of any one of claims 8-25, wherein n number of B has Formula (b6)-(b9):


(b6),

(b7),

(b8), or

(b9), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

⩫ is a single or double bond;

each of $T^{1'}$, $T^{1''}$, $T^{2'}$, and $T^{2''}$ is, independently, H, optionally substituted alkyl, optionally substituted alkoxy, or optionally substituted thioalkoxy, or the combination of

$T^{1'}$ and $T^{1''}$ or the combination of $T^{2'}$ and $T^{2''}$ join together to form O (oxo), S (thio), or Se (seleno);

each of W^1 and W^2 is, independently, $N(R^{Wa})_{nw}$ or $C(R^{Wa})_{nw}$, wherein nw is an integer from 0 to 2 and each R^{Wa} is, independently, H, optionally substituted alkyl, or optionally substituted alkoxy;

each V^3 is, independently, O, S, $N(R^{Va})_{nv}$, or $C(R^{Va})_{nv}$, wherein nv is an integer from 0 to 2 and each R^{Va} is, independently, H, halo, optionally substituted amino acid, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted heterocyclyl, optionally substituted alkheterocyclyl, optionally substituted alkoxy, optionally substituted alkenyloxy, or optionally substituted alkynyloxy, and wherein R^{Va} and R^{12c} taken together with the carbon atoms to which they are attached can form optionally substituted cycloalkyl, optionally substituted aryl, or optionally substituted heterocyclyl;

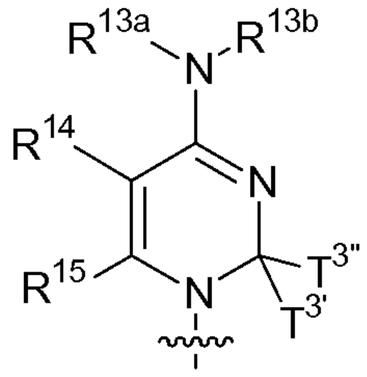
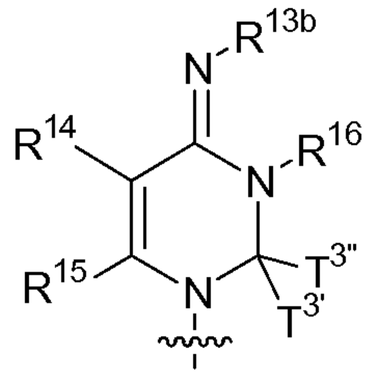
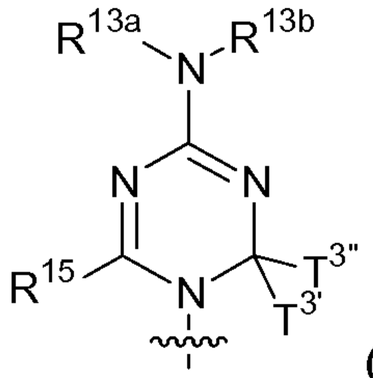
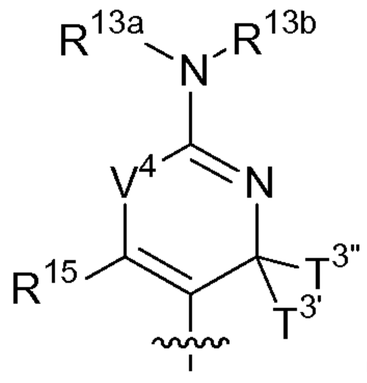
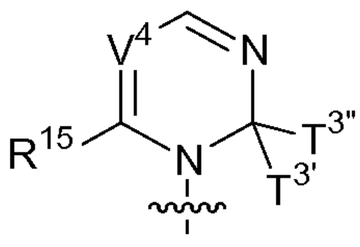
R^{12a} is H, optionally substituted alkyl, optionally substituted aminoalkyl, or absent;

R^{12b} is H, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkaryl, optionally substituted heterocyclyl, optionally substituted alkheterocyclyl, or optionally substituted amino acid, wherein the combination of R^{12b} and $T^{1'}$ or the combination of R^{12b} and R^{12c} can join together to form optionally substituted heterocyclyl; and

R^{12c} is H, halo, optionally substituted alkyl, optionally substituted alkoxy, optionally substituted thioalkoxy, optionally substituted amino, or optionally substituted aminoalkyl.

27. The isolated polynucleotide of claim 26, wherein R^{12a}, R^{12b}, R^{12c}, or R^{Va} is substituted with $-(CH_2)_{s2}(OCH_2CH_2)_{s1}(CH_2)_{s3}OR'$, wherein s1 is an integer from 1 to 10, each of s2 and s3, independently, is an integer from 0 to 10, and R' is H or C_{1-20} alkyl); or $-NR^{N1}(CH_2)_{s2}(CH_2CH_2O)_{s1}(CH_2)_{s3}NR^{N1}$, wherein s1 is an integer from 1 to 10, each of s2 and s3, independently, is an integer from 0 to 10, and each R^{N1} is, independently, hydrogen or optionally substituted C_{1-6} alkyl.

28. The isolated polynucleotide of any one of claims 8-27, wherein n number of B has Formula (b10)-(b14):


(b10),

(b11),

(b12),

(b13), or

(b14), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

each of $T^{3'}$ and $T^{3''}$ is, independently, H, optionally substituted alkyl, optionally substituted alkoxy, or optionally substituted thioalkoxy, or the combination of $T^{3'}$ and $T^{3''}$ join together to form O (oxo), S (thio), or Se (seleno);

each V^4 is, independently, O, S, $N(R^{Vc})_{nv}$, or $C(R^{Vc})_{nv}$, wherein nv is an integer from 0 to 2 and each R^{Vc} is, independently, H, halo, optionally substituted amino acid, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted heterocyclyl, optionally substituted alkheterocyclyl, or optionally substituted alkynyloxy, wherein the combination of R^{13b} and R^{Vc} can be taken together to form optionally substituted heterocyclyl;

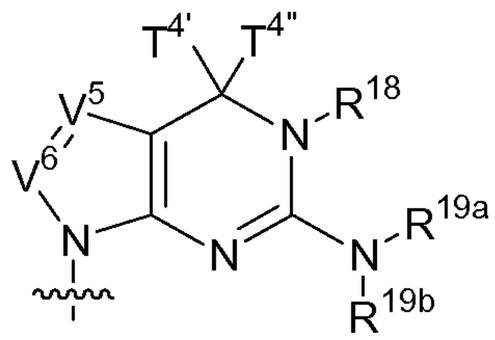
each of R^{13a} and R^{13b} is, independently, H, optionally substituted acyl, optionally substituted alkyl, or optionally substituted alkoxy, wherein the combination of R^{13b} and R^{14} can be taken together to form optionally substituted heterocyclyl;

each R^{14} is, independently, H, halo, hydroxy, thiol, optionally substituted acyl, optionally substituted amino acid, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted hydroxyalkyl, optionally substituted alkoxy, optionally substituted alkenyloxy, optionally substituted alkynyloxy,

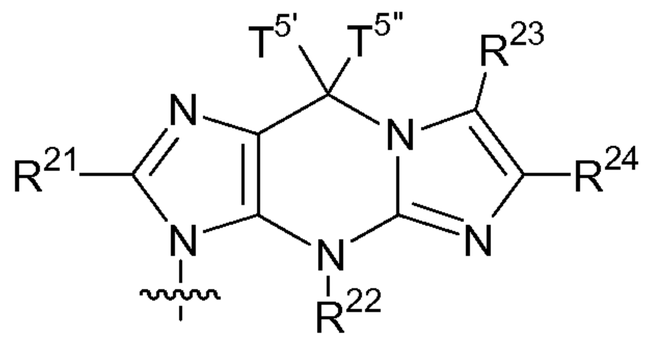
optionally substituted aminoalkoxy, optionally substituted alkoxyalkoxy, optionally substituted amino, azido, optionally substituted aryl, optionally substituted heterocyclyl, optionally substituted alkheterocyclyl, or optionally substituted aminoalkyl; and

each of R^{15} and R^{16} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl.

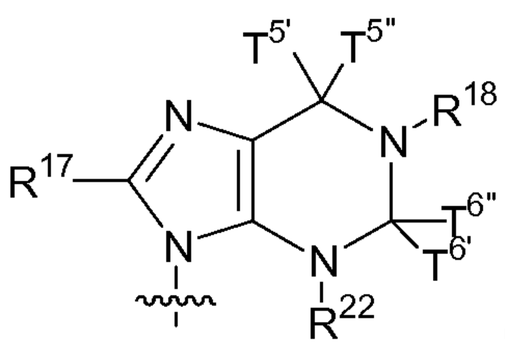
29. The isolated polynucleotide of any one of claims 7-27, wherein n number of B has Formula (b15)-(b17):



(b15),



(b16), or



(b17), or a pharmaceutically acceptable salt or stereoisomer thereof,

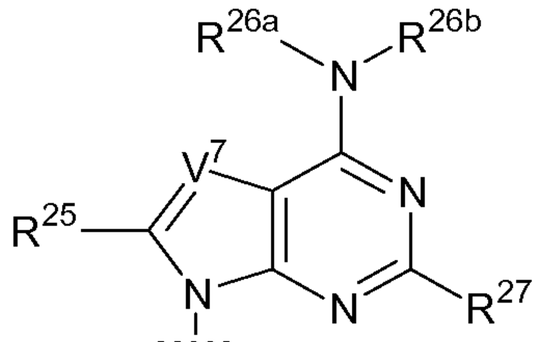
wherein

each of $T^{4'}$, $T^{4''}$, $T^{5'}$, $T^{5''}$, $T^{6'}$, and $T^{6''}$ is, independently, H, optionally substituted alkyl, or optionally substituted alkoxy, and wherein the combination of $T^{4'}$ and $T^{4''}$ or the combination of $T^{5'}$ and $T^{5''}$ or the combination of $T^{6'}$ and $T^{6''}$ together form O, S, or Se;

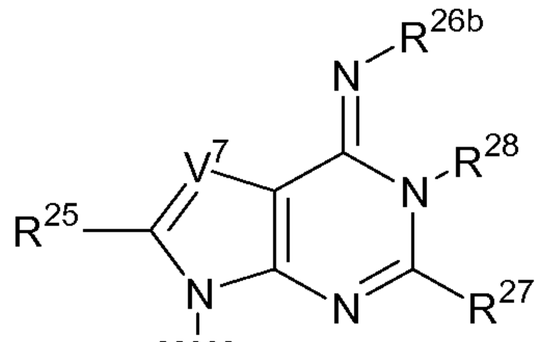
each of V^5 and V^6 is, independently, O, S, $N(R^{Vd})_{nv}$, or $C(R^{Vd})_{nv}$, wherein nv is an integer from 0 to 2 and each R^{Vd} is, independently, H, halo, optionally substituted amino acid, cyano, amidine, optionally substituted aminoalkyl, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, or optionally substituted alkynyloxy; and

each of R^{17}, R^{18}, R^{19a}, R^{19b}, R^{21}, R^{22}, R^{23}, and R^{24} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, or optionally substituted amino acid.

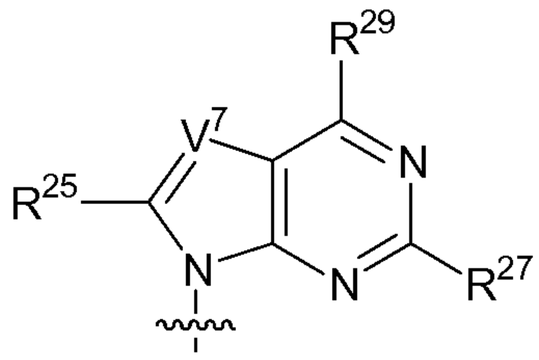
30. The polynucleotide of any one of claims 8-29, wherein n number of B has Formula (b18)-(b20):



(b18),



(b19), or



(b20), or a pharmaceutically acceptable salt or stereoisomer thereof,

wherein

each V^7 is, independently, O, S, $N(R^{Ve})_{nv}$, or $C(R^{Ve})_{nv}$, wherein nv is an integer from 0 to 2 and each R^{Ve} is, independently, H, halo, optionally substituted amino acid, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, optionally substituted alkenyloxy, or optionally substituted alkynyloxy;

each R^{25} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl;

each of R^{26a} and R^{26b} is, independently, H, optionally substituted acyl, optionally substituted amino acid, optionally substituted carbamoylalkyl, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted hydroxyalkyl, optionally substituted hydroxyalkenyl, or optionally substituted alkoxy;

each R^{27} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted alkoxy, or optionally substituted amino;

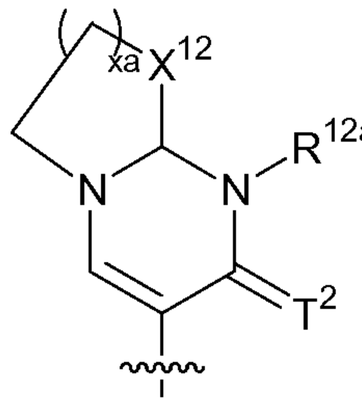
each R^{28} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl; and

each R^{29} is, independently, H, optionally substituted acyl, optionally substituted amino acid, optionally substituted carbamoylalkyl, optionally substituted alkyl, optionally

substituted alkenyl, optionally substituted alkynyl, optionally substituted hydroxyalkyl, optionally substituted hydroxyalkenyl, optionally substituted alkoxy, or optionally substituted amino.

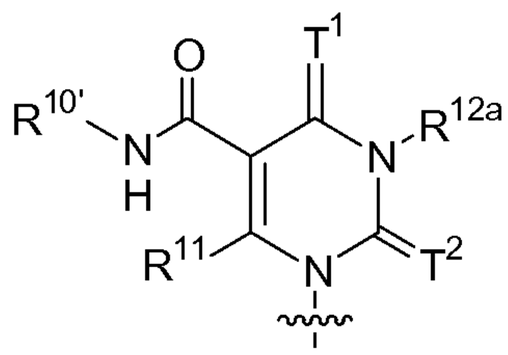
31. The isolated polynucleotide of claim 30, wherein R^{26a}, R^{26b}, or R^{29} is substituted with $-(CH_2)_{s2}(OCH_2CH_2)_{s1}(CH_2)_{s3}OR'$, wherein s1 is an integer from 1 to 10, each of s2 and s3, independently, is an integer from 0 to 10, and R' is H or C_{1-20} alkyl); or $-NR^{N1}(CH_2)_{s2}(CH_2CH_2O)_{s1}(CH_2)_{s3}NR^{N1}$, wherein s1 is an integer from 1 to 10, each of s2 and s3, independently, is an integer from 0 to 10, and each R^{N1} is, independently, hydrogen or optionally substituted C_{1-6} alkyl.

32. The isolated polynucleotide of any one of claims 8-31, wherein n number of B has Formula (b21):



(b21), or a pharmaceutically acceptable salt or stereoisomer thereof, wherein X^{12} is, independently, O, S, optionally substituted alkylene, or optionally substituted heteroalkylene; xa is an integer from 0 to 3; R^{12a} is H, optionally substituted alkyl, optionally substituted aminoalkyl, or absent; and T^2 is O, S, or Se.

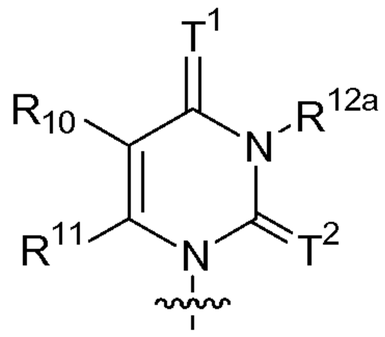
33. The isolated polynucleotide of any one of claims 8-32, wherein n number of B has Formula (b22):



(b22), or a pharmaceutically acceptable salt or stereoisomer thereof, wherein $R^{10'}$ is, independently, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted aryl, optionally substituted heterocyclyl, optionally substituted aminoalkyl, optionally

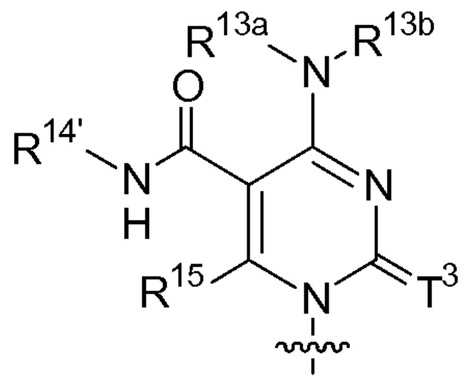
substituted alkoxy, optionally substituted alkoxycarbonylalkyl, optionally substituted alkoxycarbonylalkoxy, optionally substituted carboxyalkoxy, optionally substituted carboxyalkyl, or optionally substituted carbamoylalkyl; R^{11} is H or optionally substituted alkyl; R^{12a} is H, optionally substituted alkyl, optionally substituted aminoalkyl, or absent; and each of T^1 and T^2 is, independently, O, S, or Se.

34. The isolated polynucleotide of any one of claims 8-33, wherein n number of B has Formula (b23):



(b23), wherein R^{10} is optionally substituted heterocyclyl or optionally substituted aryl; R^{11} is H or optionally substituted alkyl; R^{12a} is H, optionally substituted alkyl, optionally substituted aminoalkyl, or absent; and each of T^1 and T^2 is, independently, O, S, or Se.

35. The isolated polynucleotide of any one of claims 8-34, wherein n number of B has Formula (b24):



(b24), wherein

T^3 is O, S, or Se;

each of R^{13a} and R^{13b} is, independently, H, optionally substituted acyl, optionally substituted alkyl, or optionally substituted alkoxy, wherein the combination of R^{13b} and R^{14} can be taken together to form optionally substituted heterocyclyl;

$R^{14'}$ is, independently, optionally substituted alkyl, optionally substituted alkenyl, optionally substituted alkynyl, optionally substituted aryl, optionally substituted heterocyclyl, optionally substituted alkheterocyclyl, optionally substituted alkaryl,

optionally substituted aminoalkyl, optionally substituted alkoxy, optionally substituted alkoxycarbonylalkyl, optionally substituted alkoxycarbonylalkoxy, optionally substituted carboxyalkoxy, optionally substituted carboxyalkyl, or optionally substituted carbamoylalkyl; and

each R^{15} is, independently, H, optionally substituted alkyl, optionally substituted alkenyl, or optionally substituted alkynyl.

36. The isolated polynucleotide of any one of claims 1-35, further comprising a targeting moiety, wherein said targeting moiety is covalently bound to said polynucleotide.

37. The isolated polynucleotide of claim 36, wherein said targeting moiety is an antibody, thyrotropin, melanotropin, lectin, glycoprotein, surfactant protein A, Mucin carbohydrate, multivalent lactose, multivalent galactose, N-acetyl-galactosamine, N-acetyl-gulucosamine multivalent mannose, multivalent fucose, glycosylated polyaminoacids, multivalent galactose, transferrin, bisphosphonate, polyglutamate, polyaspartate, a lipid, cholesterol, a steroid, bile acid, folate, vitamin B12, biotin, an RGD peptide, an RGD peptide mimetic, or an aptamer.

38. A pharmaceutical composition comprising the isolated polynucleotide of any one of claims 1-37.

39. A pharmaceutical composition comprising the isolated polynucleotide of any one of claims 1-37 and a pharmaceutically acceptable excipient.

40. The pharmaceutical composition of claim 39, wherein the excipient is selected from a solvent, aqueous solvent, non-aqueous solvent, dispersion media, diluent, dispersion, suspension aid, surface active agent, isotonic agent, thickening or emulsifying agent, preservative, lipid, lipidoids liposome, lipid nanoparticle, core-shell nanoparticles, polymer, lipoplexe peptide, protein, cell, hyaluronidase, and mixtures thereof.

41. The pharmaceutical composition of claim 40, where the pharmaceutical composition comprises a lipid and wherein said lipid is selected from DLin-DMA, DLin-K-DMA, DLin-KC2-DMA, 98N12-5, C12-200, DLin-MC3-DMA, DODMA, DSDMA, DLenDMA, reLNPs, PLGA and PEGylated lipids and mixtures thereof.

42. A method of producing a polypeptide of interest in a mammalian cell, tissue or organism comprising administering to said cell, tissue or organism the isolated polynucleotide of any one of claims 1-37 or the pharmaceutical composition of any of claims 38-41.

43. The method of claim 42, wherein the isolated polynucleotide is formulated.

44. The method of claim 43, wherein the formulation comprises a lipid which is selected from one of DLin-DMA, DLin-K-DMA, DLin-KC2-DMA, 98N12-5, C12-200, DLin-MC3-DMA, DODMA, DSDMA, DLenDMA, reLNPs, PLGA, PEGylated lipids and mixtures or combinations thereof.

45. The method of claim 44, wherein the isolated polynucleotide is administered at a total daily dose of between 1 ug and 150 ug.

46. The method of claim 45, wheriein administration is by injection.

47. The method of claim 46, wherein administration is intradermal or subcutaneous or intramuscular or intravitreal.

48. The method of claim 45, wherein levels of the polypeptide of interest in the serum of the mammal are at least 50 pg/mL at least two hours after administration.

49. The method of claim 45, wherein the levels of the polypeptide of interest in the serum of the mammal remain above 50 pg/mL for at least 72 hours after administration.

50. The method of claim 49, wherein the levels of the polypeptide of interest in the serum of the mammal remain above 60 pg/mL for at least 72 hours after administration.

51. The method of claim 44, wherein the resulting polynucleotide formulation has a mean particle size of 80 nm-160 nm, a PDI of between 0.02 and 0.20 and a lipid to polnucleotide ratio (wt/wt) of between 10-20.

52. A method for producing an increased level of a polypeptide of interest selected from the group consisting of SEQ ID NOs 8144-16131in a mammalian cell, tissue or organism, comprising administering to said cell, tissue or organism a total daily dose of the isolated polynucleotide of any one of claims 4-37 or the pharmaceutical composition of any one of claims 38-41 in two or more equal or unequal split doses.

53. The method of claim 52, wherein the level of the polypeptide produced in response to said administration is greater than the levels produced by administering the same total daily dose of the isolated polynucleotide or pharmaceutical composition as a single administration.

54. The method of claim 52, wherein the mammalian organism is a human patient in need of an increased level of the polypeptide of interest.

55. The method of claim 54, wherein the increased level of the polypeptide of interest is detectable in a bodily fluid of said patient.

56. The method of claim 55, wherein the bodily fluid is selected from the group consisting of peripheral blood, serum, plasma, ascites, urine, cerebrospinal fluid (CSF), sputum, saliva, bone marrow, synovial fluid, aqueous humor, amniotic fluid, cerumen, breast milk, broncheoalveolar lavage fluid, semen, prostatic fluid, cowper's fluid or pre-ejaculatory fluid, sweat, fecal matter, hair, tears, cyst fluid, pleural and peritoneal fluid, pericardial fluid, lymph, chyme, chyle, bile, interstitial fluid, menses, pus, sebum, vomit, vaginal secretions, mucosal secretion, stool water, pancreatic juice, lavage fluids from

sinus cavities, bronchopulmonary aspirates, blastocyl cavity fluid, and umbilical cord blood.

57. The method of claim 56, wherein the bodily fluid is serum and the polpeptide per unit drug (PUD) is greater than 1.

58. The method of claim 57, wherein the dose splitting factor (DSF) is greater than 4.

59. The method of claim 55, wherein administration is transdermal.

60. The method of claim 59, wherein transdermal administration comprises utilization of one or more members selected from the group consisting of a patch, cream, ointment, mechanical device, needle, sponge, depot and fabric.

61. The method of claim 59, wherein administration is according to a dosing regimen which occurs over the course of hours, days, weeks, months, or years.

62. The method of claim 52, wherein said two or more split doses comprise a first dose of the polynucleotide or pharmaceutical composition administered at a time T1 followed by a second dose of the polynucleotide or pharmaceutical composition administered at a time T2, wherein said time T1 and said time T2 are separated by no more than 1 minute and wherein said first dose and said second dose are administered in amounts that result in higher levels of the polypeptide of interest in said subject than if the amounts of polynucleotide or pharmaceutical composition were administered together in a single unit dose.

63. The method of claim 62, further comprising administering a plurality of doses of said polynucleotide or pharmaceutical composition, Nx at times Tn, wherein x and n are independently selected from 3 to about 1000 and where the time between Tn and Tn+1 is separated by increments of no more than 10 seconds.

64. The method of claim 63, wherein administration occurs by direct injection.

65. The method of claim 64, wherein direct injection is selected from the group consisting of intravenous, intradermal, subcutaneous, intramuscular and intravitreal.

66. The method of claim 64, wherein said first dose is administered proximal to said second or plurality of doses.

67. The method of claim 64, wherein said first dose is administered distal to said second or plurality of doses.

68. The method of claim 64, wherein the distance between the site of injection of said first dose and the site of injection of any second or plurality of doses is from about 1mm to about 10 cm.

69. The method of claim 64, wherein injection is made at a depth of from 0.1mm to about 1cm.

70. The method of claim 65, wherein direct injection is achieved by using one or more devices selected from multineedle injection systems, catheter or lumen systems, and ultrasound, electrical or radiation based systems.

71. The method of claim 63, wherein the amount polynucleotide or pharmaceutical composition administered in any dose is substantially equal.

72. The method of claim 63, wherein time T1 and time T2 are separated by no more than 30 seconds.

73. The method of claim 63, wherein time T1 and time T2 are separated by no more than 10 seconds.

74. The method of claim 63, wherein the first dose, the second dose and any of a plurality of doses are administered at substantially the same time.

75. The method of claim 63, wherein the single unit dose is between about 10 mg/kg and about 500 mg/kg.

76. The method of claim 63, wherein the single unit dose is between about 1.0 mg/kg and about 10 mg/kg.

77. The method of claim 63, wherein the single unit dose is between about 0.001 mg/kg and about 1.0 mg/kg.

78. A method of preparing a lipid nanopartical formulation of a polynucleotide encoding a polypeptide of interest comprising rapidly injecting a first ethanolic solution into a second aqueous solution wherein,

(a) said first ethanolic solution comprises a mixture of lipid:DSPC: Cholesterol: PEG-c-DOMG to yield a molar ratio of 50:10:38.5:1.5 and having a final lipid concentration of approximately 25mM, and

(b) said second aqueous solution comprises a sodium citrate buffered solution of the polynucleotide encoding the polypeptide of interest having a concentration of 1-2 mg/mL and a pH of approximately 3,

wherein the rapid injection results in a suspension containing 33% ethanol and a total lipid to polynucleotide weight ratio of at least 10:1.

79. The method of claim 78, wherein the rapid injection is performed either manually (MI) or by the aid of a syringe pump (SP).

80. The method of claim 79, further comprising dialyzing the resultant suspension against phosphate buffered saline (PBS) at pH 7.4.

81. The method of claim 80, wherein dialysis is performed more than once.

82. The method of claim 81, further comprising filtering the dialyzed suspension through a 0.2 μm sterile filter.

83. The method of any of claims 78-82, wherein the lipid is selected from the group consisting of DLin-DMA, DLin-K-DMA, DLin-KC2-DMA, 98N12-5, C12-200, DLin-MC3-DMA, DODMA, DSDMA, DLenDMA, reLNPs, PLGA and PEGylated lipids.

84. The method of any of claims 78-83, wherein the polynucleotide is selected from the polynucleotide of any of claims 1-37.

85. A lipid nanopartical formulation of a polynucleotide encoding a polypeptide of interest produced by the method of any of claims 78-84 and having a particle size of 80 nm-160 nm, a PDI of between 0.02 and 0.20 and a lipid to polnucleotide ratio (wt/wt) of between 10-30.

86. A lipid nanopartical formulation of claim 85, wherein the polynucleotide is selected from the polynucleotide of any of claims 1-37.

87. A reLNP formulation of a polynucleotide said polynucleotide encoding a polypeptide of interest.

88. A reLNP formulation of claim 87, wherein the polynucleotide is selected from the polynucleotide of any of claims 1-36.

89. A sustained release formulation of a polynucleotide said polynucleotide encoding a polypeptide of interest.

90. A sustained release formulation of claim 89, wherein the polynucleotide is selected from the polynucleotide of any of claims 1-36.

91. A polynucleotide encoding a fusion protein said fusion protein comprising a first polypeptide and a second polypeptide.

92. The polynucleotide of claim 91 where the first polypeptide is selected from the group consisting of Fc receptor, Fab fragment, Fab' fragment, $F(ab')_2$ fragment, Fv fragment, IgA domain, IgD domain, IgE domain, IgD domain, IgM domain, IgV domain, IgC1 domain, IgC2 domain and IgI domain and the second polypeptide is a polypeptide of interest.

FIGURE 1

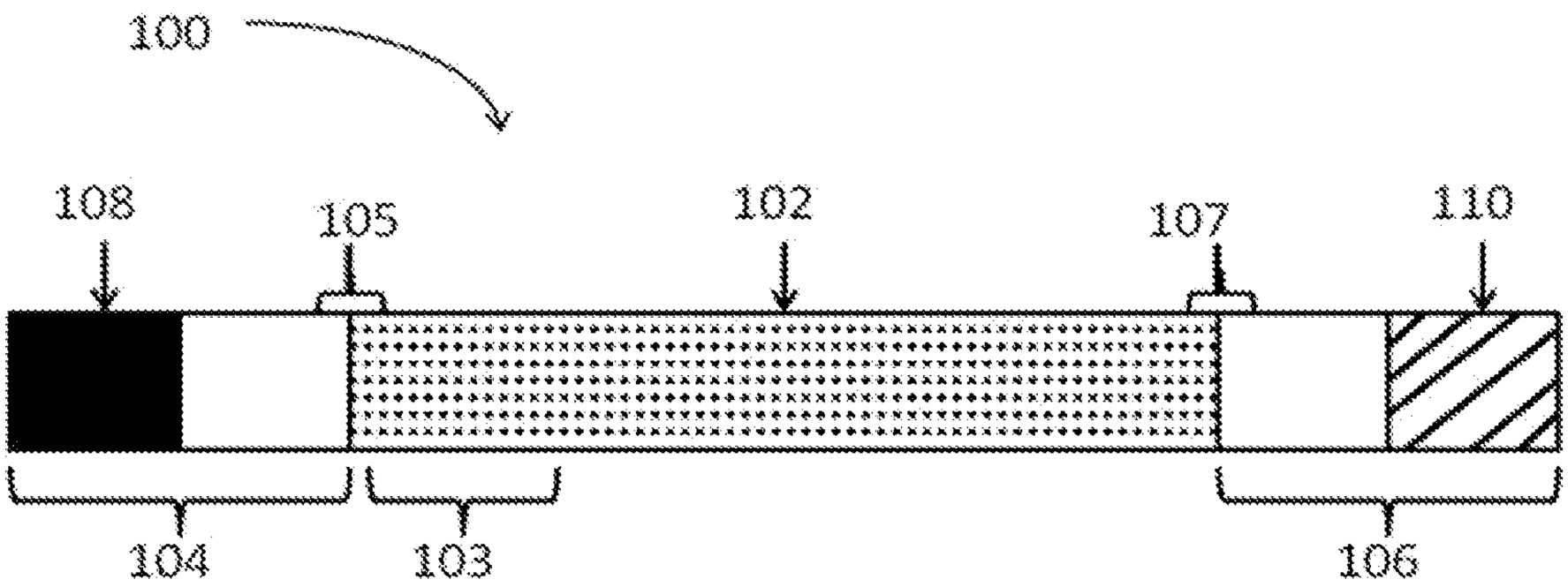
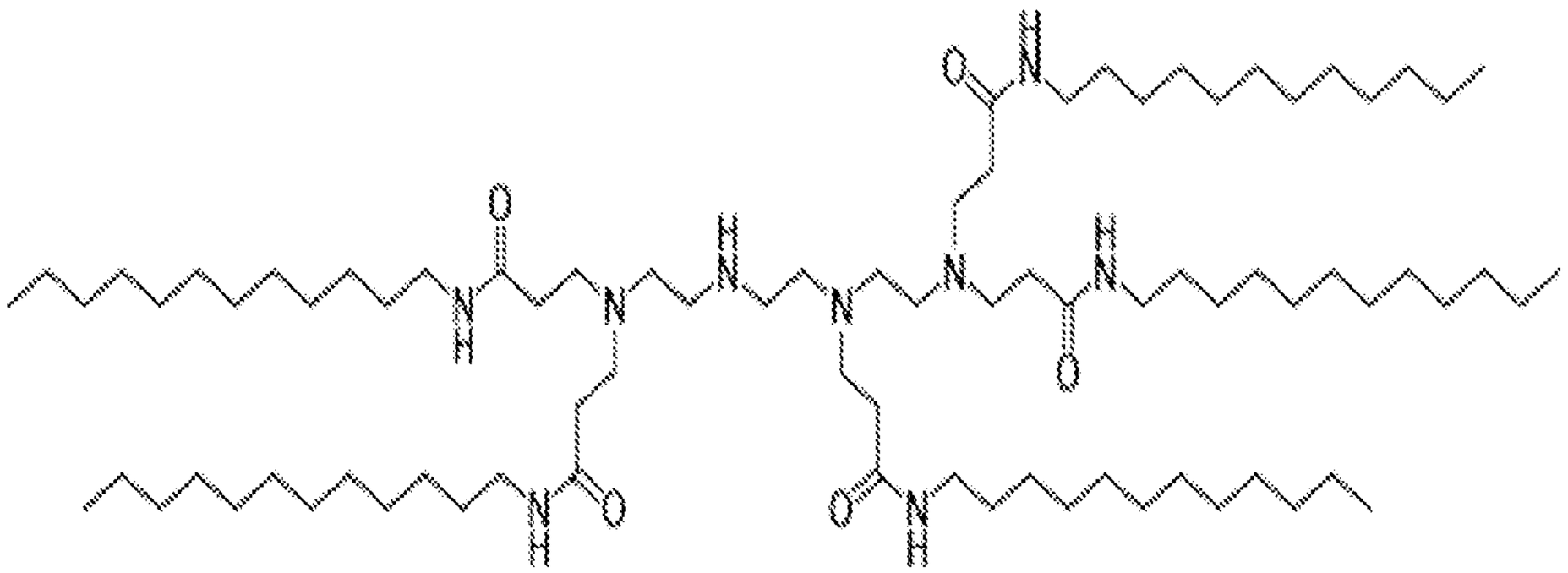
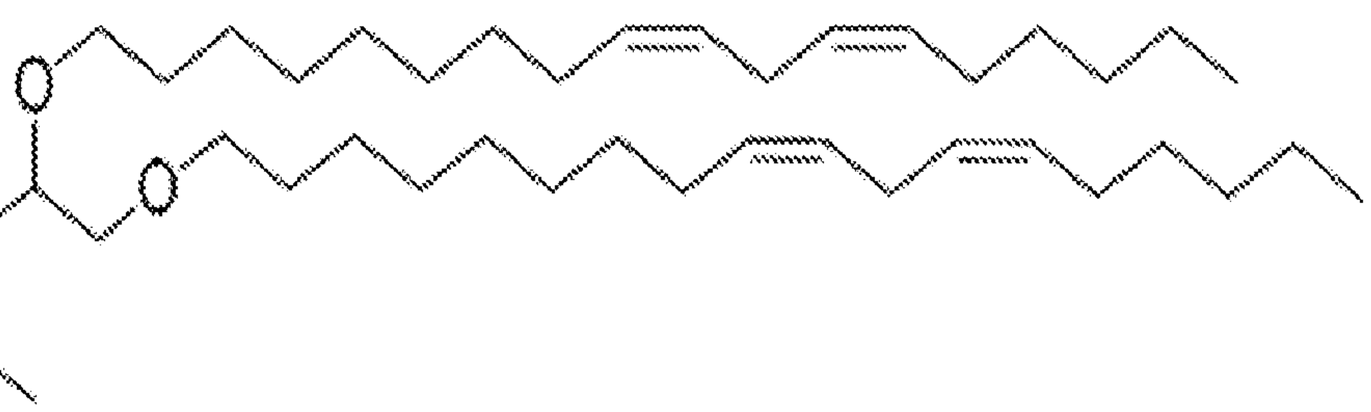


FIGURE 2

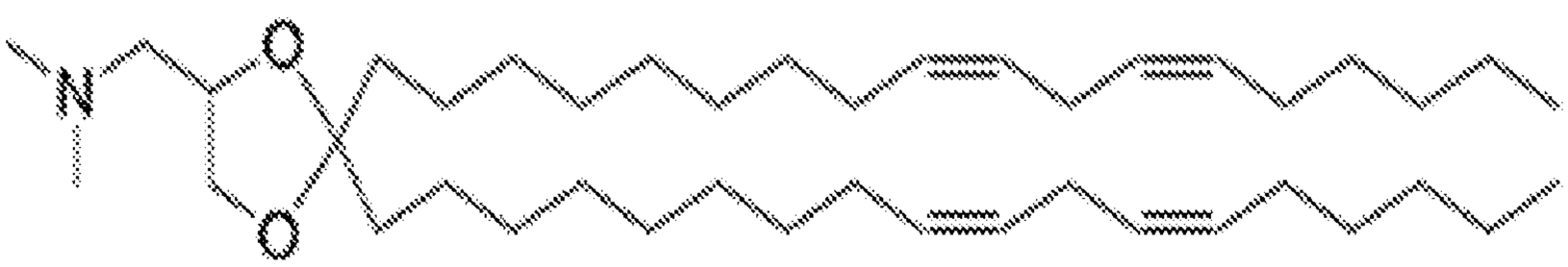
98N12-5 (TETA5-LAP)



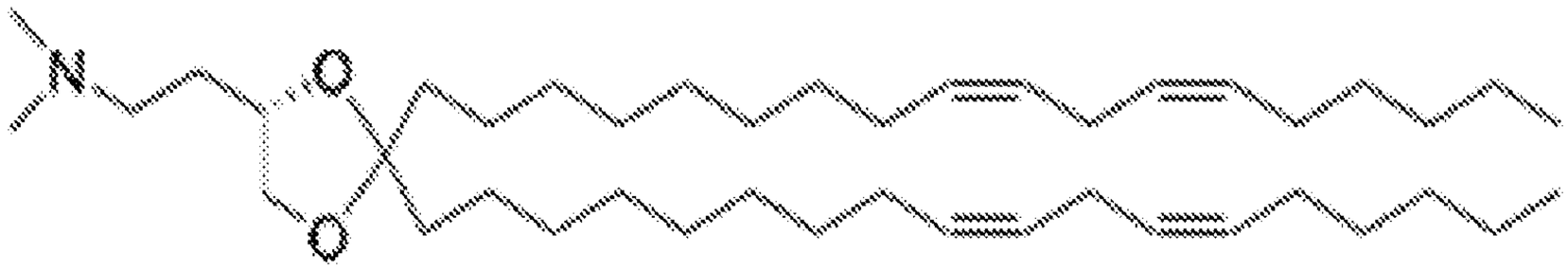
DLin-DMA



DLin-K-DMA (2,2-Dilinoleyl-4-dimethylaminomethyl-[1,3]-dioxolane)



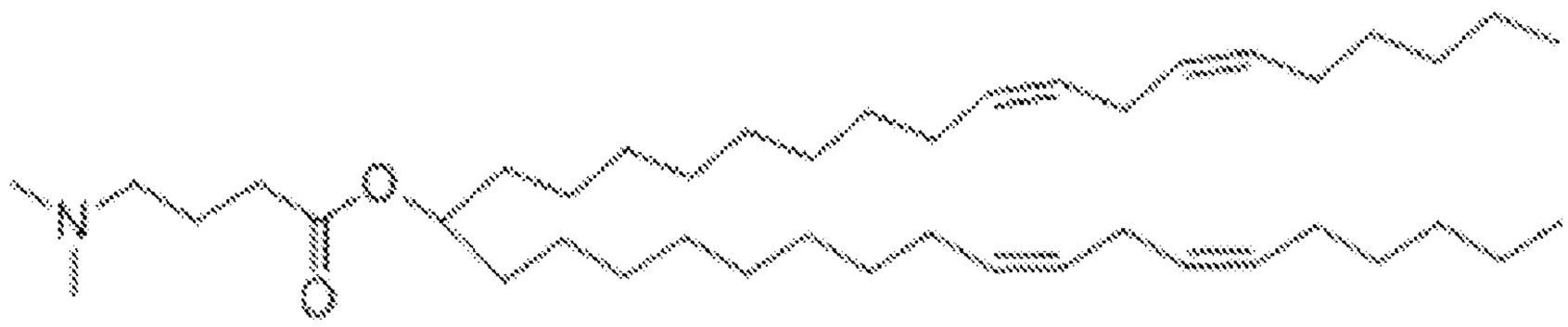
DLin-KC2-DMA



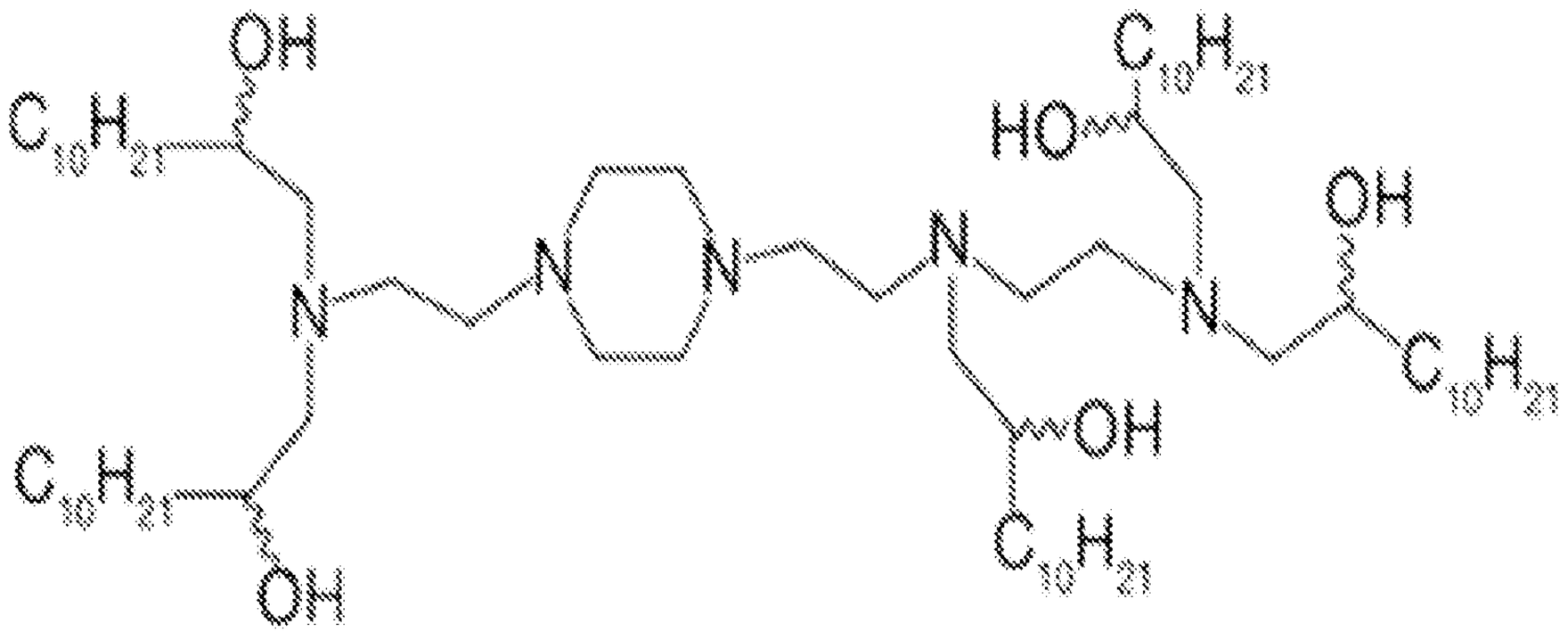
PRIOR ART

FIGURE 2 CONT.

DLin-MC3-DMA

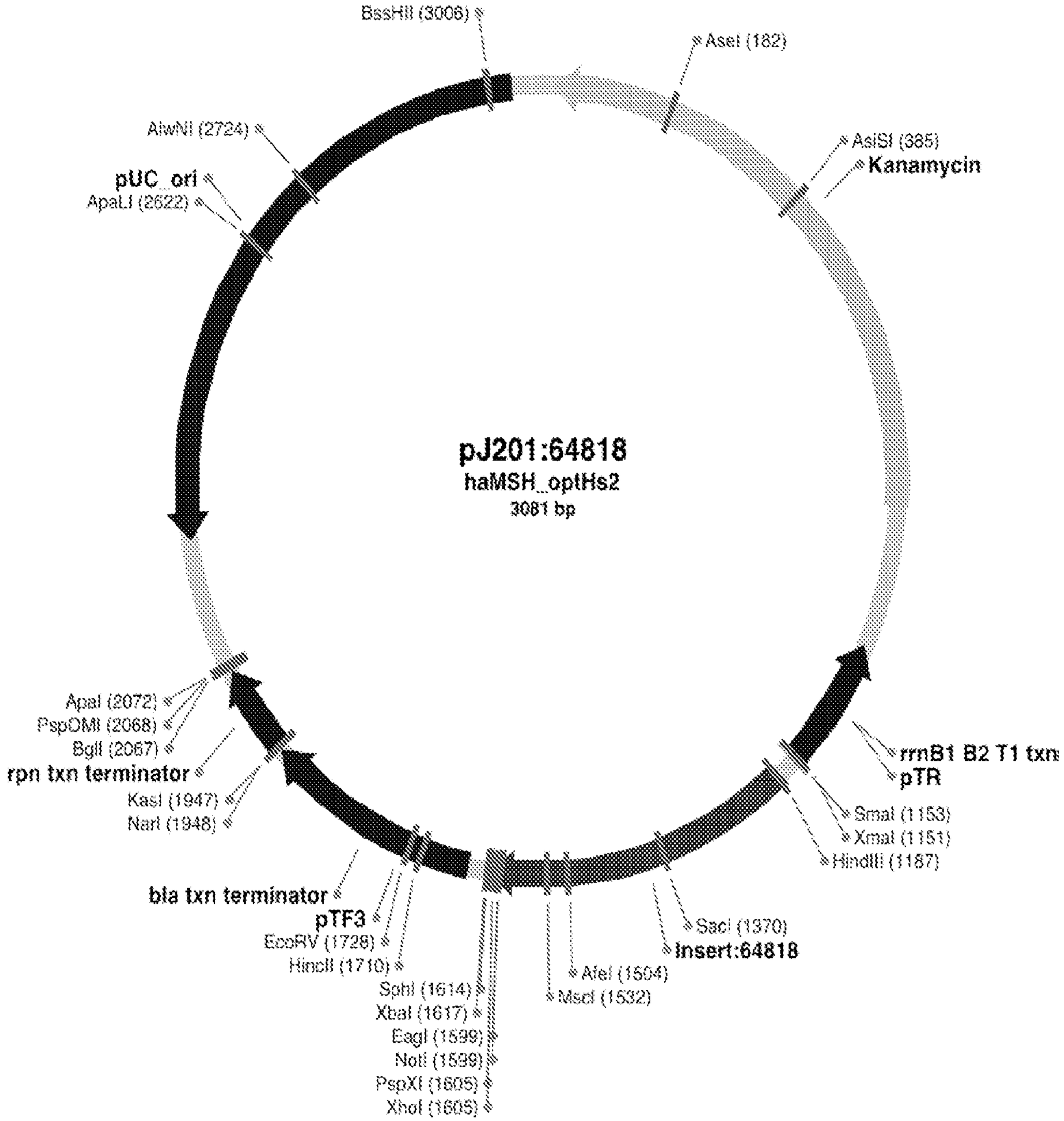


C12-200



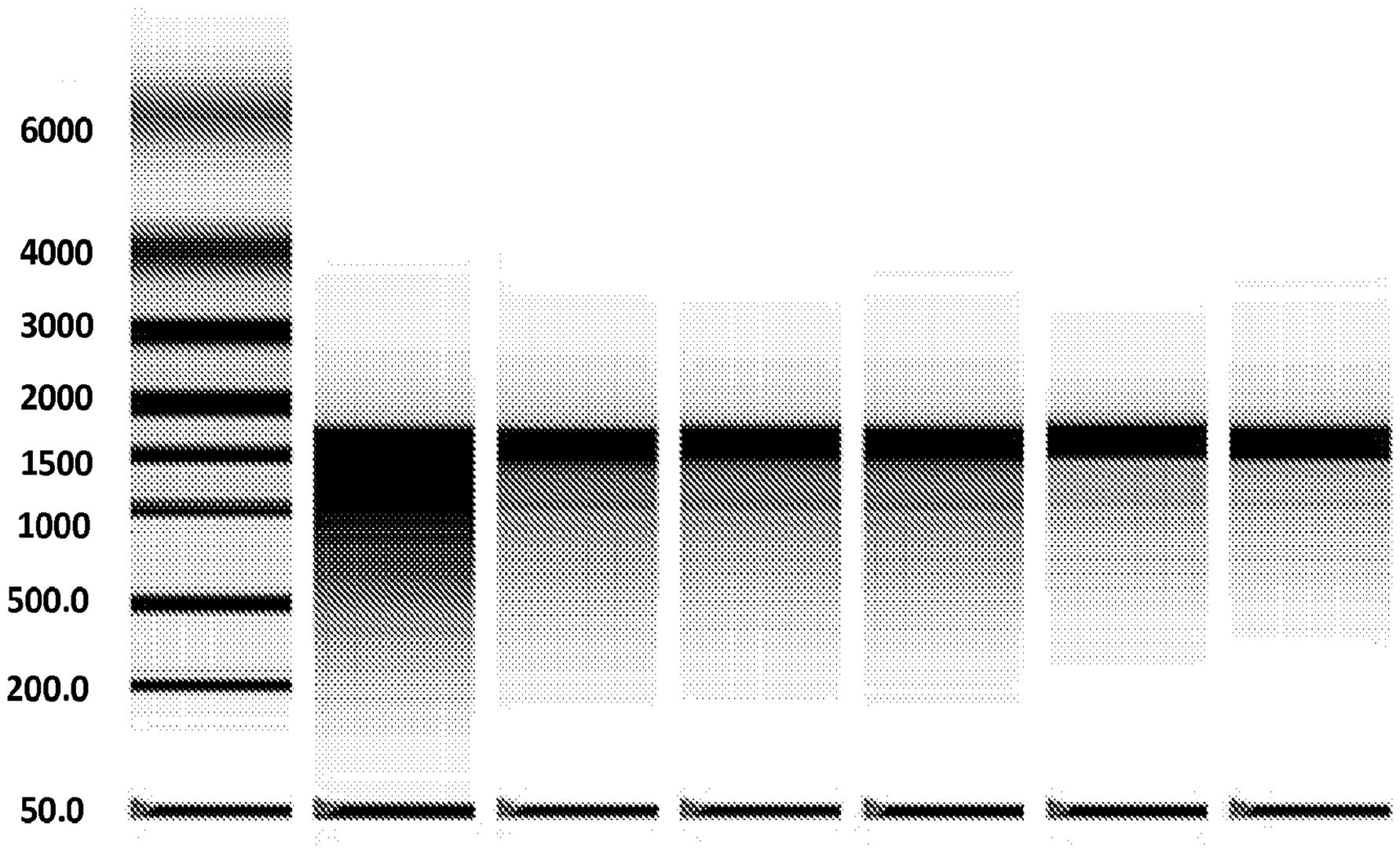
PRIOR ART

FIGURE 3



PRIOR ART

FIGURE 4



BATCH	A	B	C	D	DEFORM	UNFORM
WT%	0.05	0.10	0.20	0.40	CONTROL	CONTROL

FIGURE 5

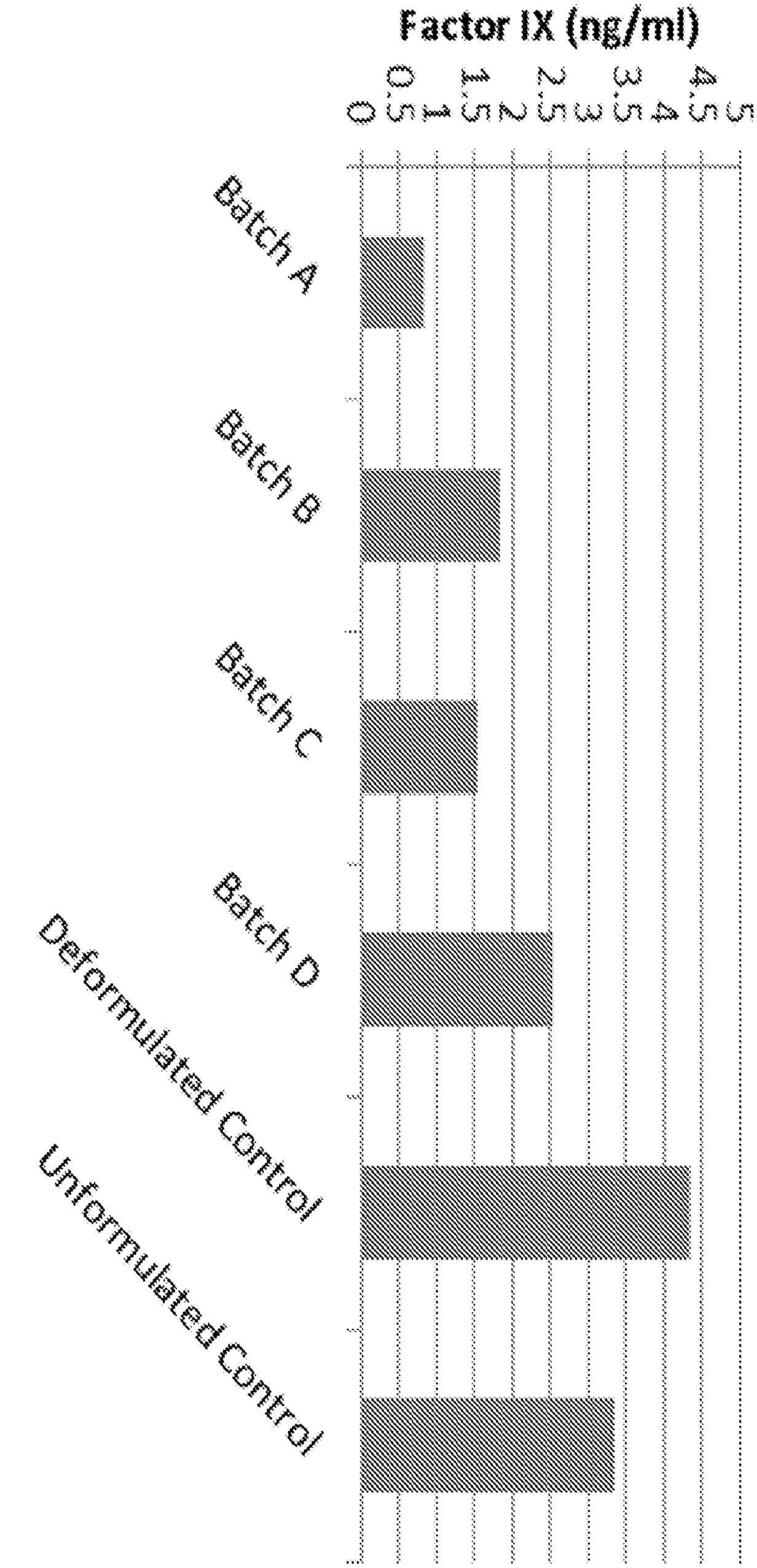

Factor IX (ng/ml)
0
3
6
9
12
15
18
Factor IX Protein Expression
Batch A
Batch B
Batch C
Batch D
Deformulated Control
Unformulated Control

FIGURE 6

A.

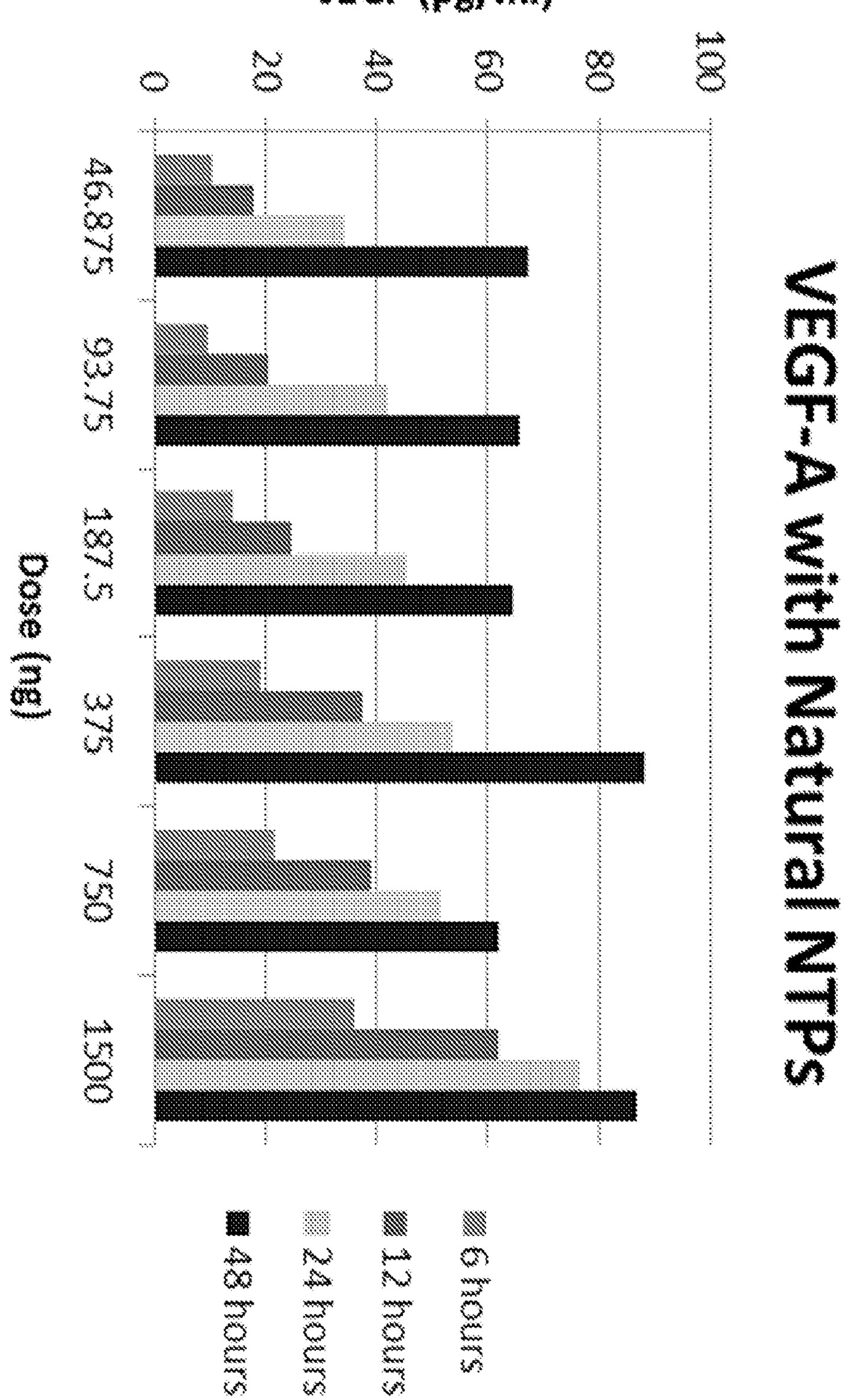

VEGF (pg/ml)
0
20
40
60
80
100
VEGF-A with Natural NTPs
Dose (nM)
46.875
93.75
187.5
375
750
1500
6 hours
12 hours
24 hours
48 hours

FIGURE 6 CONT.

B.

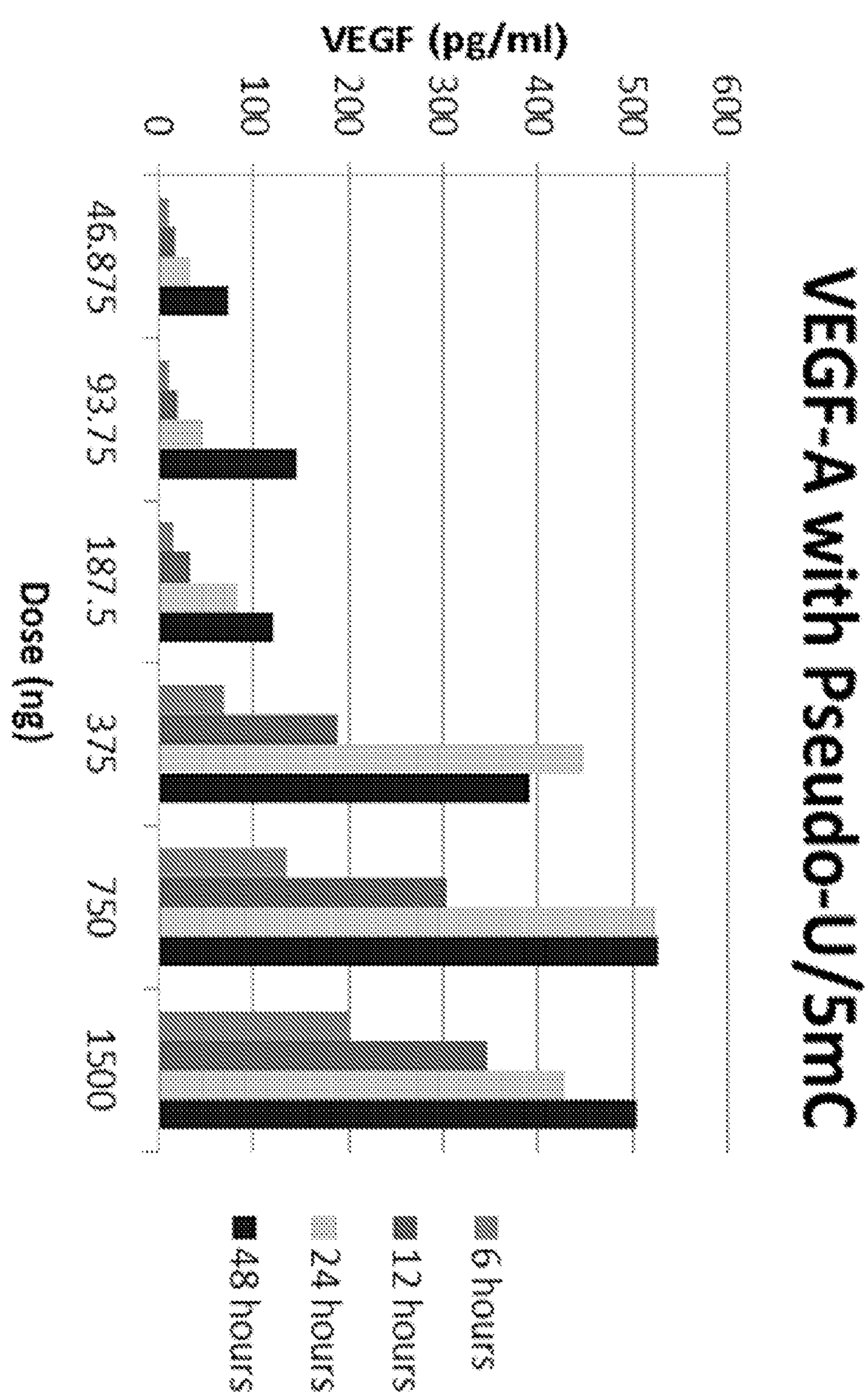


FIGURE 6 CONT.

C.

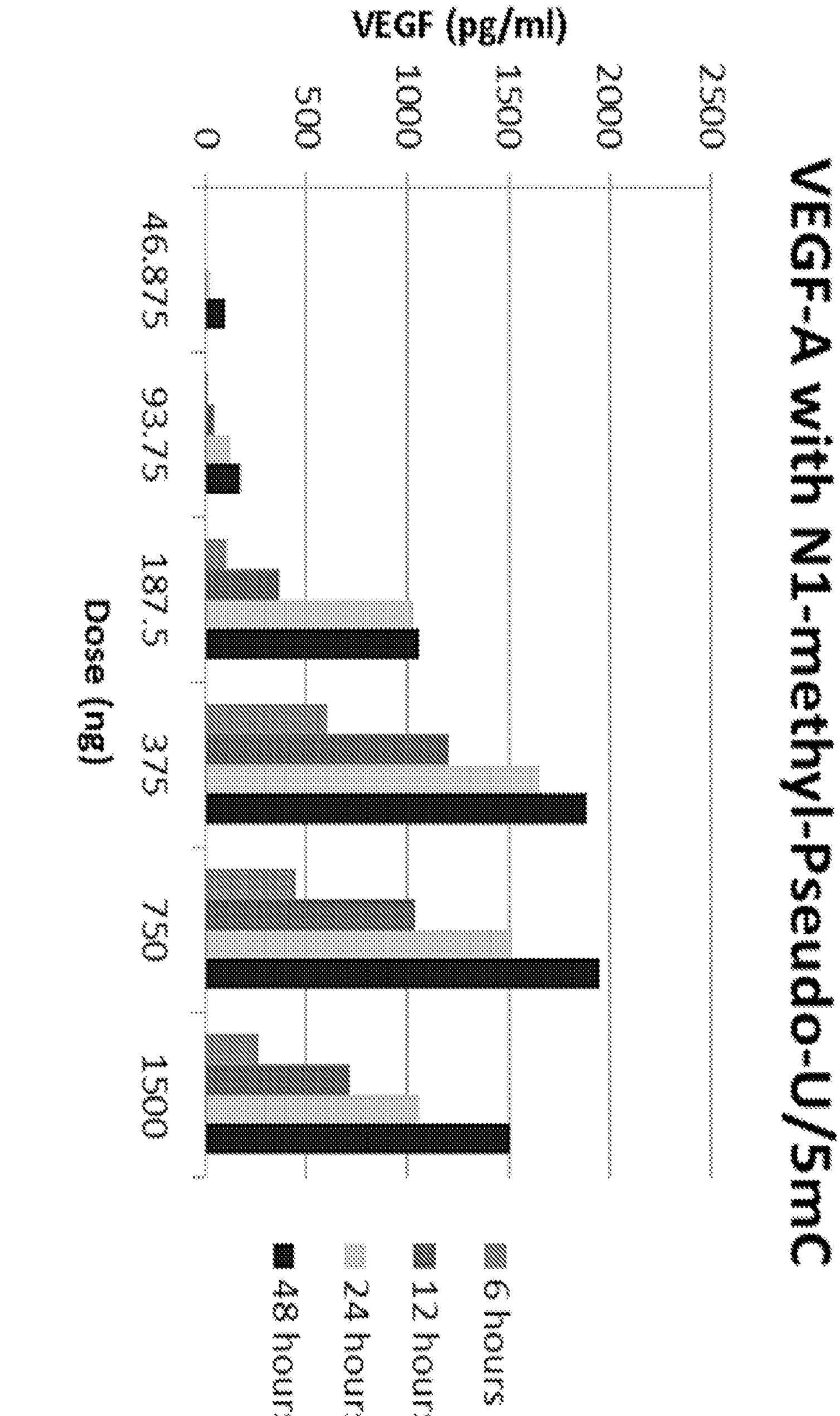


FIGURE 7

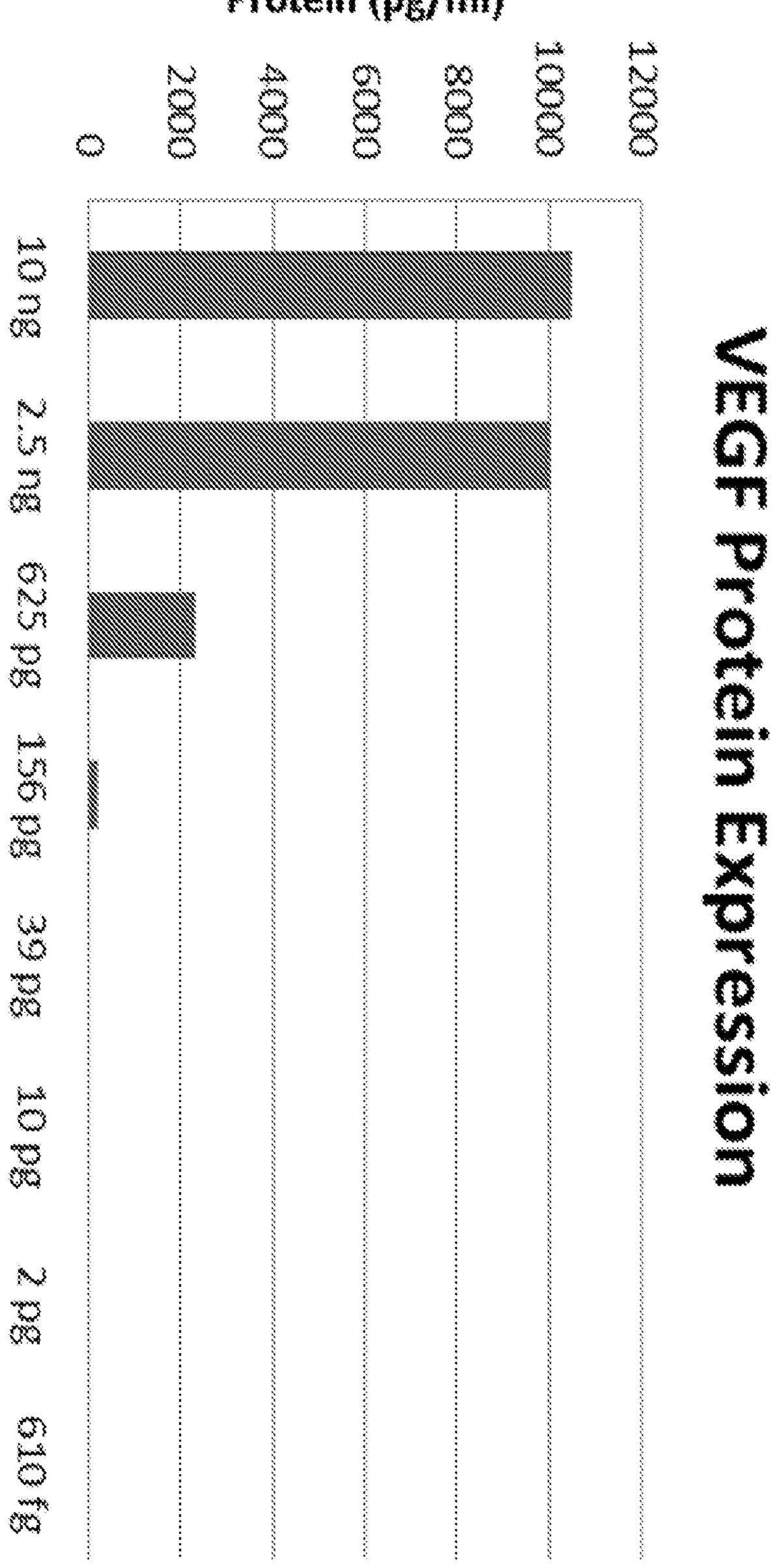

VEGF Protein Expression
Protein (pg/ml)
0
2000
4000
6000
8000
10000
12000
Amount Transfected
10 ng
2.5 ng
625 pg
156 pg
39 pg
10 pg
2 pg
610 fg

FIGURE 8

A.

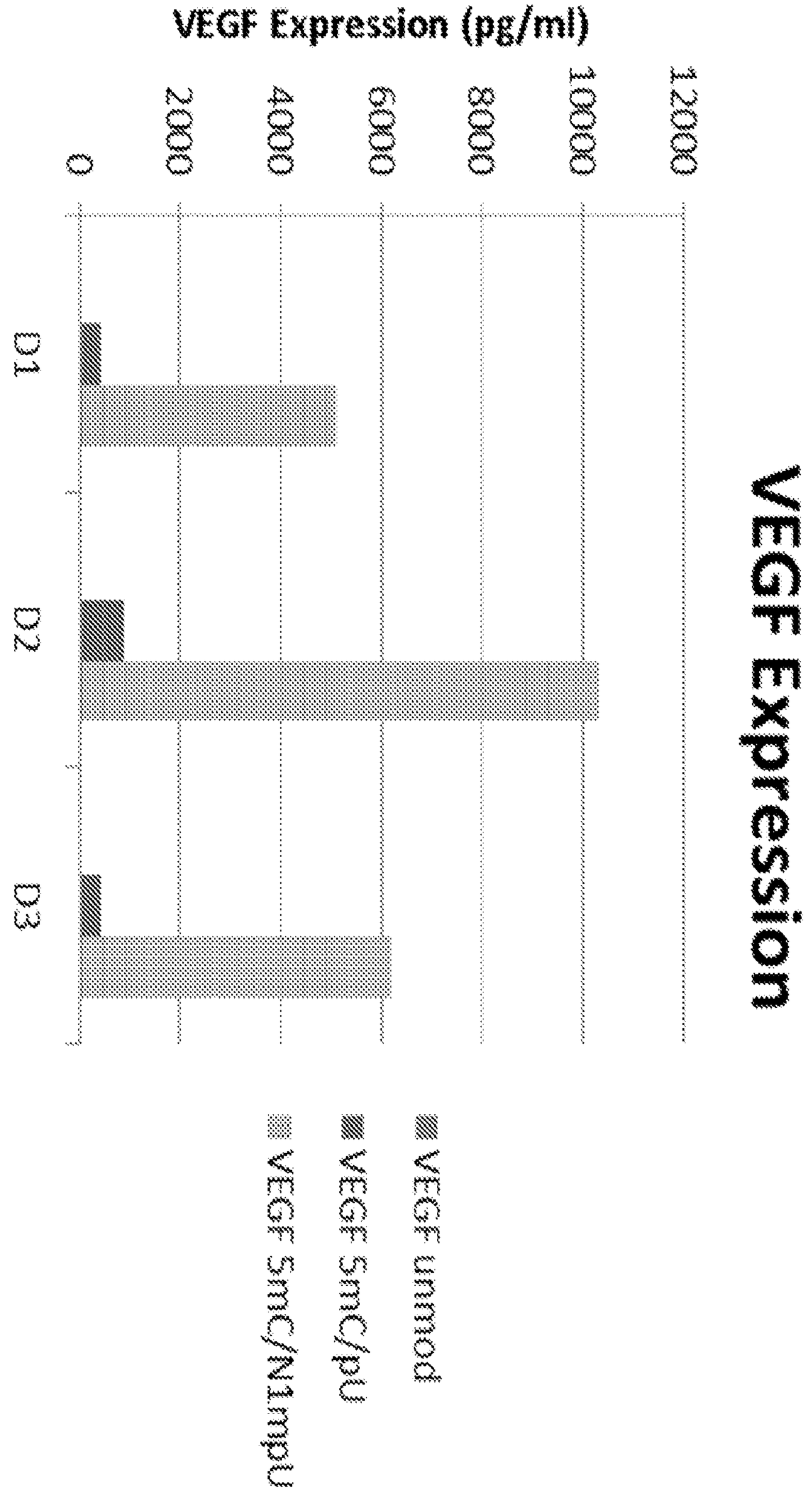

VEGF Expression (pg/ml)
0
2000
4000
6000
8000
10000
12000
D1
D2
D3
VEGF Expression
unmod
sNuc/pu
nNuc/pu

FIGURE 8 CONT.

B.

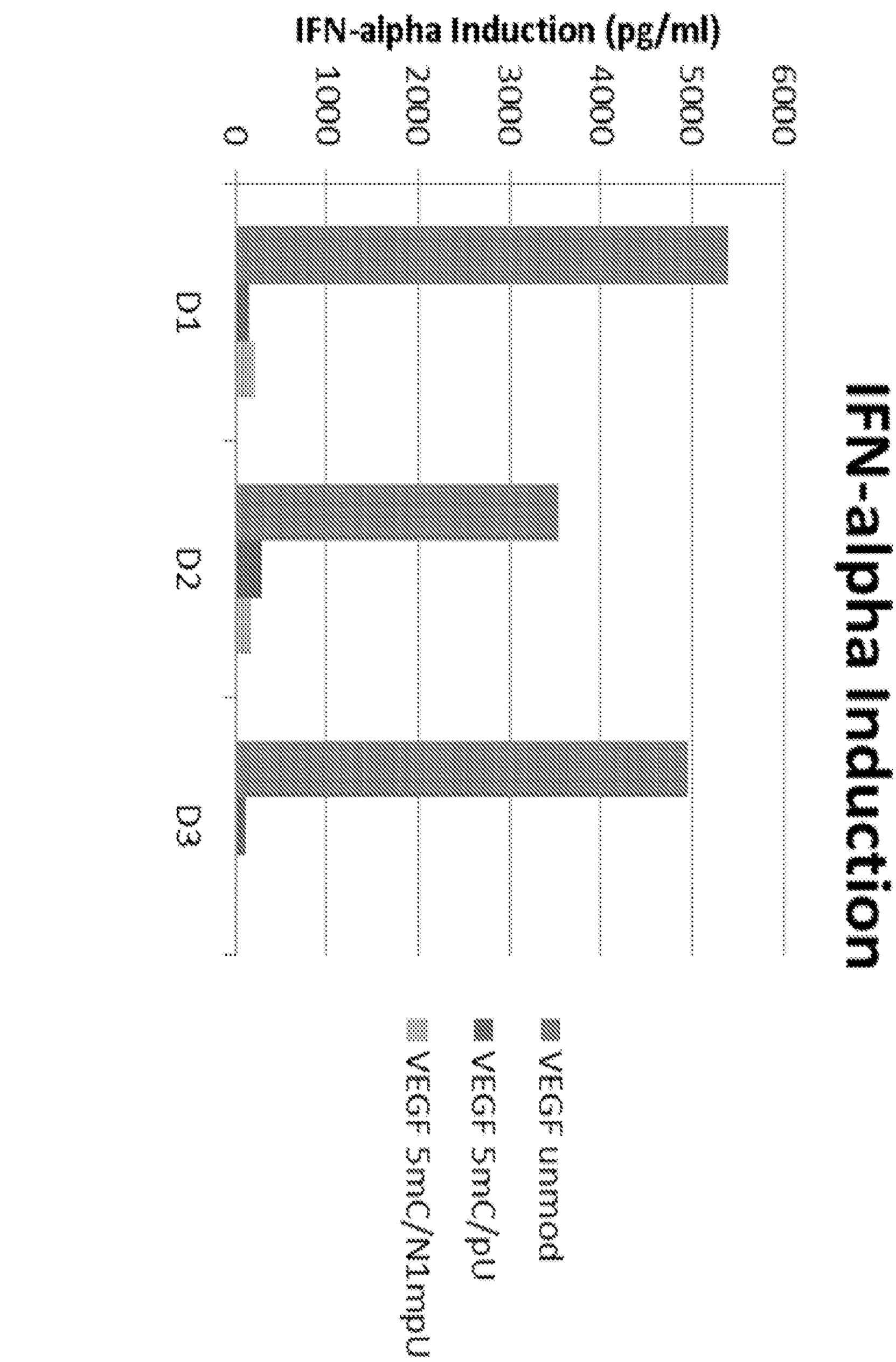


FIGURE 9

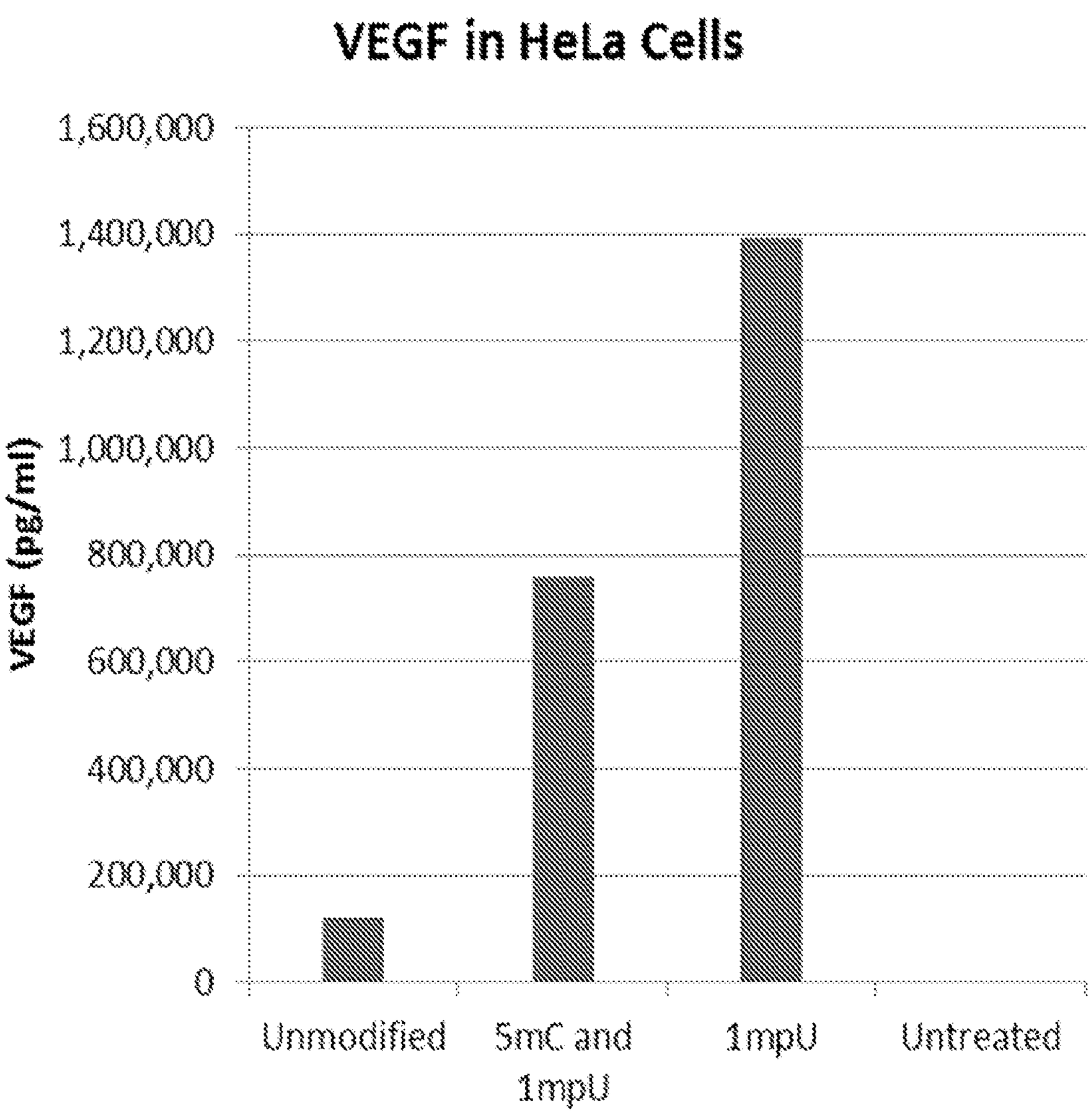

VEGF in HeLa Cells
VEGF (pg/ml)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Unmodified
5mC and 1mpU
1mpU
Untreated

FIGURE 10

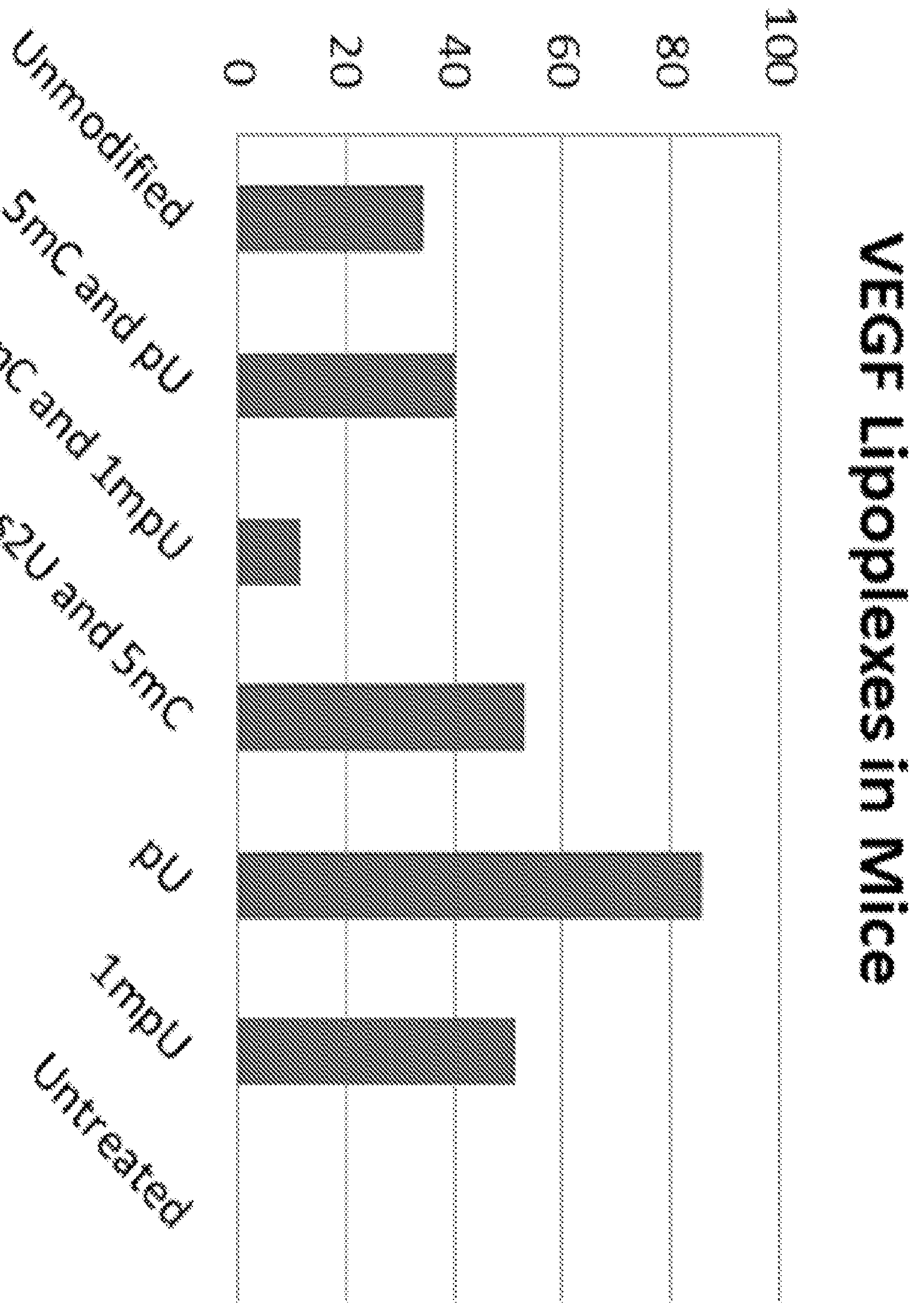

VEGF (pg/ml)
0
20
40
60
80
100
VEGF Lipoplexes in Mice
Untreated
1mpU
pU
5mC and pU
5mC and 1mpU
s2U and 5mC
Unmodified

FIGURE 11

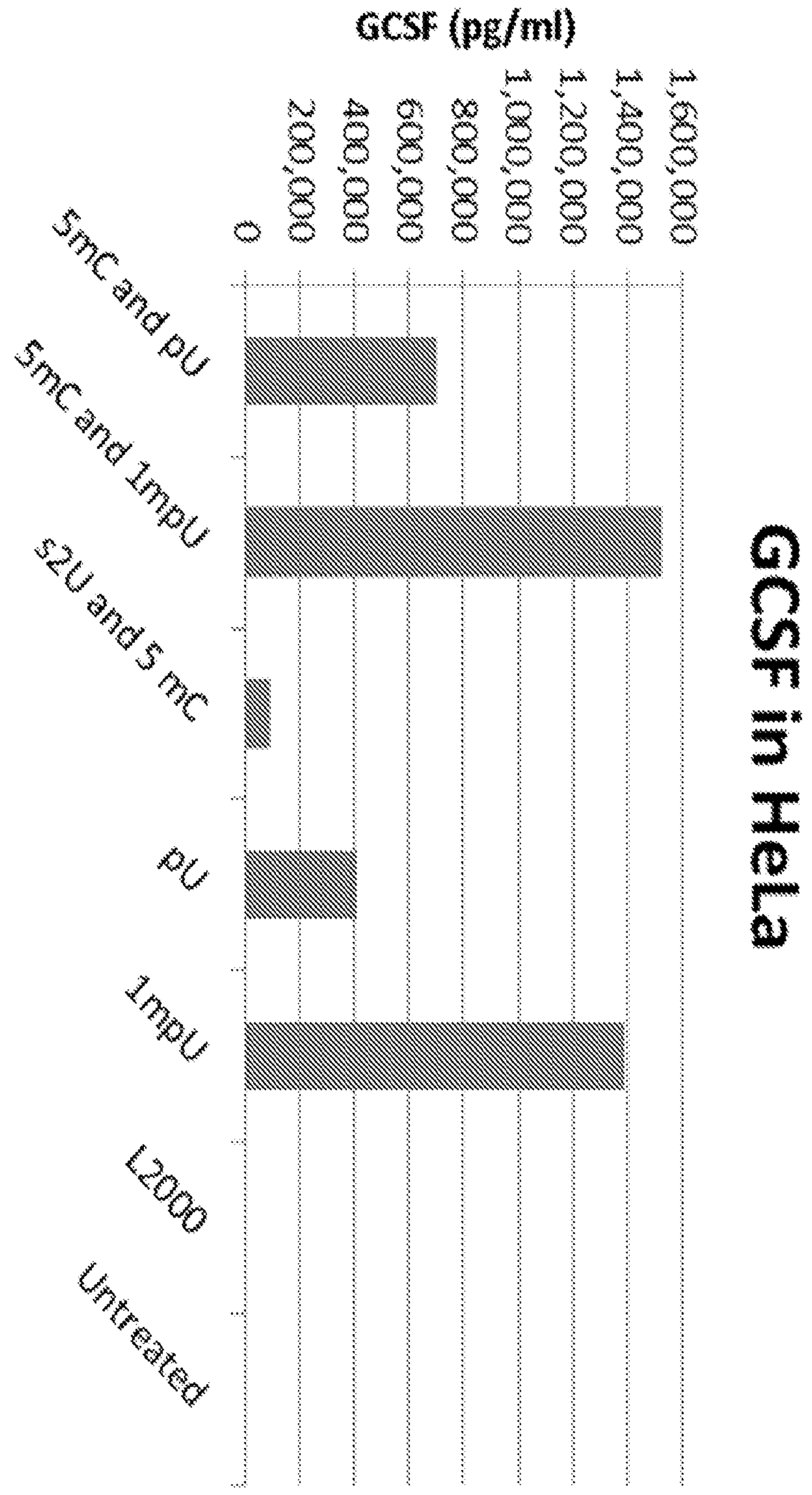

GCSF (pg/ml)
0
200,000
400,000
600,000
800,000
1,000,000
1,200,000
1,400,000
1,600,000
GCSF in HeLa
5mC and pU
5mC and 1mpU
s2U and 5 mC
pU
1mpU
L2000
Untreated

FIGURE 12

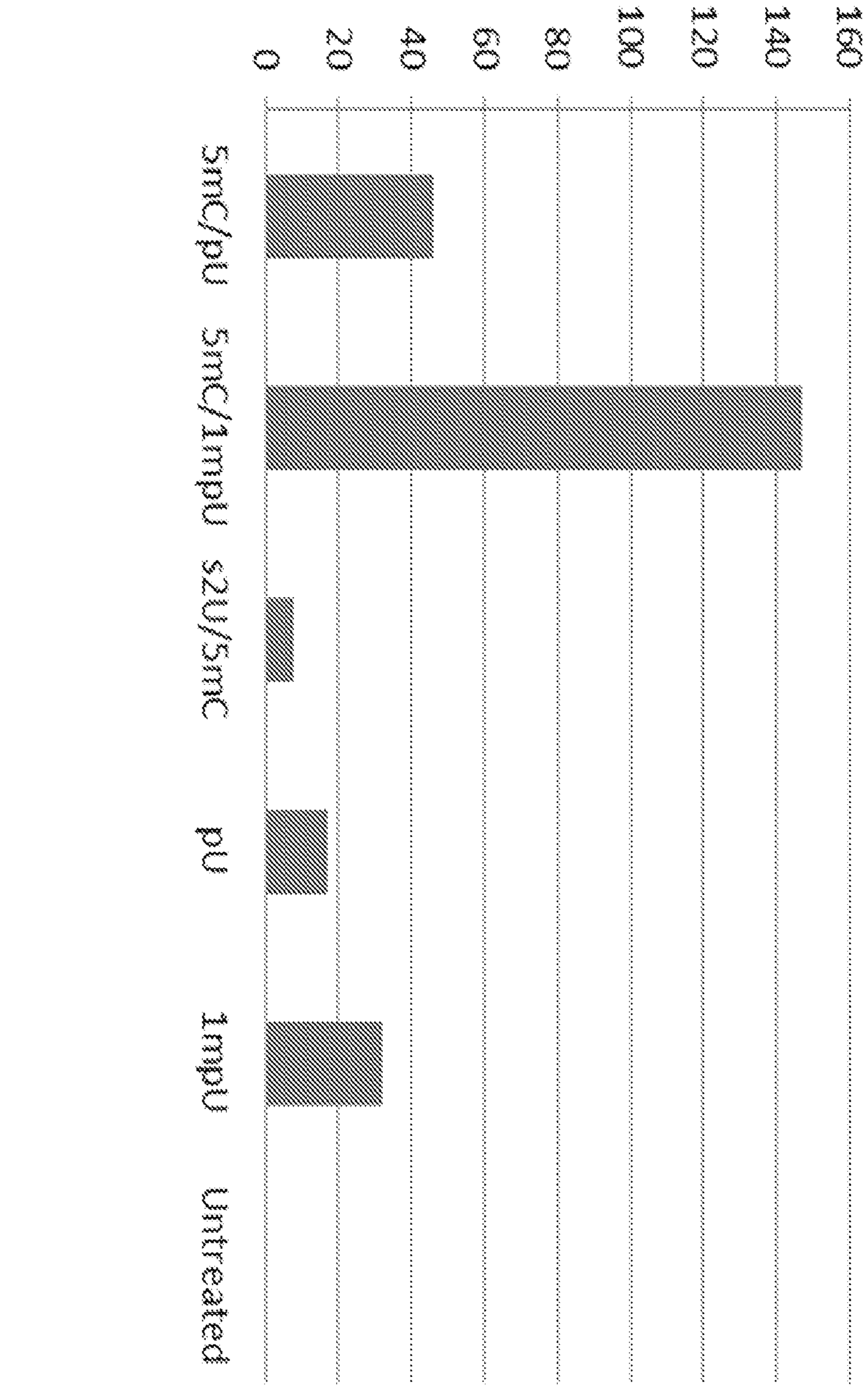

Factor IX in HeLa Supernatant
Factor IX (ng/ml)
0
20
40
60
80
100
120
140
160
untreated
1mpu
pu
1mpu/5mc
5mc/pu
5mc/1mpu
5mc/5mc

FIGURE 1