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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
03 February 2022 (03.02.2022)

WIPO | PCT

(10) International Publication Number
WO 2022/026336 A1

(51) International Patent Classification:
C07K 16/40 (2006.01) *A61P 27/00* (2006.01)
A61K 31/7088 (2006.01) *A61P 17/00* (2006.01)
C12N 9/48 (2006.01) *A61P 19/00* (2006.01)
A61P 37/02 (2006.01)

(21) International Application Number:
PCT/US2021/043062

(22) International Filing Date:
23 July 2021 (23.07.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/056,562 25 July 2020 (25.07.2020) US
63/171,672 07 April 2021 (07.04.2021) US

(71) Applicant: **REGENERON PHARMACEUTICALS, INC.** [US/US]; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US).

(72) Inventors: **GELFMAN, Sahar**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **LIGOCKI, Ann**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **COPPOLA, Giovanni**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **BARIS, Aris**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **MOSCATI, Arden**; 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US). **STAHL, Eli A.**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **KOSMICKI, Jack A.**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **FERREIRA, Manuel Allen Revez**; 777 Old Saw Mill River Road, Tarrytown, New York 10591 (US). **ROMANO, Carmelo**; 777 Old Saw Mill River Road, Tarrytown, NY 10591 (US).

(74) Agent: **LEGAARD, Paul K.**; Stradley Ronon Stevens & Young, LLP, 30 Valley Stream Parkway, Malvern, Pennsylvania 19355-1481 (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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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, ST, 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, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:
— *with international search report (Art. 21(3))*
— *with sequence listing part of description (Rule 5.2(a))*

(54) Title: MODULATION OF ENDOPLASMIC RETICULUM AMINOPEPTIDASE 2 (ERAP2)-MEDIATED IMMUNE RESPONSE

(57) Abstract: The present disclosure provides methods of treating subjects having an immune disorder by administering a therapeutically effective amount of an Endoplasmic Reticulum Aminopeptidase 2 (ERAP2) inhibitor to the subject, and optionally an Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) agonist or inhibitor and/or an HLA-Aw19 inhibitor, and also provides methods of identifying subjects having an increased risk for developing an MHC-I-opathy.

WO 2022/026336 A1

Modulation Of Endoplasmic Reticulum Aminopeptidase 2 (ERAP2)-Mediated Immune Response

Reference To Sequence Listing

This application includes a Sequence Listing filed electronically as a text file named 18923805102SEQ, created on July 23, 2021, with a size of 1,243 kilobytes. The Sequence Listing is incorporated herein by reference.

Field

The present disclosure is directed, in part, to methods of treating subjects having an immune disorder by administering a therapeutically effective amount of an Endoplasmic Reticulum Aminopeptidase 2 (ERAP2) inhibitor to the subject, and optionally an Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) agonist or inhibitor and/or an HLA-Aw19 inhibitor, and also provides methods of identifying subjects having an increased risk for developing an MHC-I-opathy.

Background

The cellular immune response in humans relies at least partly on the presentation of small peptides that are 8 to 10 amino acids long, which are bound proteins of the major histocompatibility complex (MHC) (i.e., class I MHC molecules). These small peptides are derived from the proteolytic degradation of proteins (foreign antigens and self-antigens). One source of these antigens come from infected or malignantly transformed cells that express particular protein molecules that, upon degradation, yield distinct antigenic peptides that are presented on the cell surface complexed with MHC class I molecules (MHCI). Cytotoxic T cells can recognize these complexes of MHC molecules with degraded protein antigens and induce apoptotic cell death. Aberrant generation of antigenic peptides can lead to immune system evasion or to autoimmune reactions.

Although most antigenic peptides are initially produced by the proteasome, many of them are larger than the final antigenic epitope and contain one or more additional amino acids at their N-termini. These antigenic peptide precursors are transported into the endoplasmic reticulum (ER), where they are further degraded by at least two different aminopeptidases, ERAP1 and ERAP2, to generate the mature antigenic peptides for complexing

with MHC class I molecules. Thus, the activity of ERAP1 and ERAP2 can directly affect the presentation of antigenic peptides complexed with particular MHC molecules in a beneficial or adverse manner, thus altering the immune response. Accordingly, there continues to be a need for identifying subjects that have particular MHC-I-opathies related to ERAP2 activity and treatment of the same.

Birdshot Chorioretinopathy (BSCR) is a rare autoimmune uveitis predominately affecting individuals over the age of 50 of European descent and treated with immunomodulatory therapies. The disease presents with vitritis and gradual decline in vision due to choroidal and retinal inflammatory lesions and atrophy. T cells have been identified in the retinal and choroidal tissues as well as the vitreous of affected BSCR eyes.

Summary

The present disclosure provides methods of treating a subject having an immune disorder, the methods comprising administering to the subject a therapeutically effective amount of an ERAP2 inhibitor. Optionally, an ERAP1 agonist or inhibitor and/or an HLA-Aw19 inhibitor is also administered to the subject. The immune disorder can be an MHC-I-opathy or an MHC-II-opathy. The MHC-I-opathy can be BSCR, Ankylosing Spondylitis (AS), Behçet's disease, psoriasis, Juvenile Idiopathic Arthritis (JIA), inflammatory bowel disease (IBD), or Crohn's disease (CD).

The present disclosure also provides methods of treating a subject having an MHC-I-opathy, the methods comprising: performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises: i) an MHC-I-opathy-related HLA genotype; and ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein; and administering to the subject a therapeutically effective amount of an ERAP2 inhibitor, wherein the subject comprises both an MHC-I-opathy-related HLA genotype and a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein; wherein the presence of both the MHC-I-opathy-related HLA genotype and the functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP2. The assay performed or having been performed on the biological sample from the subject can further determine whether the subject comprises a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein; and the methods can further comprise

administering to the subject a therapeutically effective amount of an ERAP1 agonist or inhibitor, wherein the subject comprises an MHC-I-opathy-related HLA genotype and does or does not comprise a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein; wherein the presence of an MHC-I-opathy-related HLA genotype and the absence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by activating ERAP1; wherein the presence of an MHC-I-opathy-related HLA genotype and the presence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP1.

The present disclosure also provides methods of identifying a subject having an increased risk for developing an MHC-I-opathy, the methods comprising: performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises: i) an MHC-I-opathy-related HLA genotype; and ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein; wherein: when the subject has both the MHC-I-opathy-related HLA genotype and the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, then the subject has an increased risk of developing the MHC-I-opathy; when the subject lacks the MHC-I-opathy-related HLA genotype, or lacks the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, or lacks both, then the subject has a decreased risk of developing the MHC-I-opathy; and when the subject comprises two copies of the MHC-I-opathy-related HLA genotype, then the subject has an increased risk of developing the MHC-I-opathy compared to comprising a single copy of the MHC-I-opathy-related HLA genotype. The assay performed or having been performed on the biological sample from the subject can further determine whether the subject comprises a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein. When the subject has the MHC-I-opathy-related HLA genotype and lacks the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, then the subject has an increased risk of developing the MHC-I-opathy; and when the subject lacks the MHC-I-opathy-related HLA genotype, or has the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, or both, then the subject has a decreased risk of developing the MHC-I-opathy.

Brief Description Of The Drawings

The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application publication with color drawing(s) will be provided by the Office upon request and payment of the necessary fee.

Figure 1 shows a table of HLA-A 2nd allele frequencies in the French cohort compared to UKB and GHS EUR A29 carriers. Alleles belonging to the Aw19 broad antigen group that increase risk are A29, A30, A31 and A33 (red) and A32 exhibits protection (green). A Fisher's exact test combining all Aw19 risk alleles presents the strongest enrichment in all comparisons. Only alleles that have three or more case carriers are presented. Table is sorted by p-values when comparing case frequencies against A29 controls in UKB.

Figure 2 shows Aw19 enrichment in Birdshot cases. Odds-ratio for BSCR, comparing frequencies of 14 HLA-A alleles that are present in three or more cases (>1%, x-axis) in 286 UParis cases compared with 108 UParis controls (Blue), GHS control cohort #1 (n= 4,014, dark green), GHS control cohort #2 (n= 2,829, bright green) and UKB controls (n= 38,543, yellow). Aw19 alleles show the highest ORs (red box) that replicates with large A29 control cohorts, with the exception of A32 that is depleted in cases (green box). * $p<0.01$

Figure 3 shows a table of HLA-A 2nd allele frequencies in the French cohort compared to UKB and GHS EUR A29 carriers. Alleles belonging to the Aw19 broad antigen group that increase risk are A29, A30, A31 and A33 (red) and A32 exhibits protection (green). A logistic regression test with covariates included for sex and six principal components, calculated based on genetic array data for each analytic set. Results are presented for all HLA-A alleles that have three or more case carriers. Alleles are sorted as in Figure 1. *Three principal components.

Figure 4 shows a table of haplotype analysis of ERAP1. Haplotype analysis examining the association of all eight ERAP1 haplotypes with the case-control status, showing that Hap1 and Hap2 are strongly associated with protection from BSCR.

Figure 5 shows a table of top SNPs in ERAP1 and ERAP2 regions. Variants in ERAP1 and ERAP2 are genome-wide significant when analyzed together with previous results (125 cases and 670 controls (Kuiper 2014). Rs10044354 is the top association in the ERAP1-ERAP2 locus in the previous GWAS of Dutch and Spanish cohorts, while rs27432 is the top association in the region in the current French cohort. The LD between the two loci is also presented. *The reference A-allele is the minor allele, risk is the G-allele.

Figure 6 shows ERAP2 splice region variant is protective for BSCR. The common ERAP2 splice region variant rs2248374 that disrupts ERAP2 expression is protective in the current BSCR cohort and the previous Spanish and Dutch cohorts.

Figure 7 shows the combined risk of ERAP1, ERAP2 and two copies of Aw19. Utilizing 286 Birdshot cases and 4,014 controls from GHS cohort #1 to calculate additive risk while combining risk factors in ERAP1, ERAP2 and Aw19. Panel A) An additive genotype model of ERAP2 risk signal tagged by rs10044354 and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination of rs10044354-CC and one copy of Aw19 allele (A29). Panel B) An additive genotype model of ERAP1 risk signal tagged by rs27432 and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination of rs27432 -AA and one copy of Aw19 allele (A29). Panel C) An additive genotype model of ERAP1 risk signal tagged by rs27432 and ERAP2 signal tagged by rs10044354 relative to lowest risk combination of rs27432-AA and rs10044354-CC. Panel D) An additive genotype model of ERAP1 and ERAP2 risk signals and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination. The genotypes are combined as following: 0 = ERAP1 and ERAP2 homozygous for protective allele. 1/[01],[01]/1 = either homozygous protective or heterozygous genotypes of both ERAP1 and ERAP2. 2/.,./2 = homozygous risk allele of either ERAP1 or ERAP2. 2/2 = homozygous risk allele of both ERAP1 and ERAP2.

Figure 8 shows a table of the combined risk of ERAP2 and Aw19. Utilizing 286 Birdshot cases and 4,014 controls from GHS cohort #1 to calculate additive risk while combining risk factors in ERAP2 and Aw19. An additive genotype model of ERAP2 risk signal tagged by rs10044354 and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination of rs10044354-CC and one copy of Aw19 allele (A29).

Figure 9 shows a table of the combined risk of ERAP1 and Aw19. Utilizing 286 Birdshot cases and 4,014 controls from GHS cohort #1 to calculate additive risk while combining risk factors in ERAP1 and Aw19. An additive genotype model of ERAP1 risk signal tagged by rs27432 and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination of rs27432-AA and one copy of Aw19 allele (A29).

Figure 10 shows a table of the combined risk of ERAP1 and ERAP2. Utilizing 286 Birdshot cases and 4,014 controls from GHS cohort #1 to calculate additive risk while combining risk factors in ERAP1 and ERAP2. An additive genotype model of ERAP1 risk signal tagged by

rs27432 and ERAP2 signal tagged by rs10044354 relative to lowest risk combination of rs27432-AA and rs10044354-CC.

Figure 11 shows a table of the combined risk of ERAP1, ERAP2 and Aw19. Utilizing 286 Birdshot cases and 4,014 controls from GHS cohort #1 to calculate additive risk while combining risk factors in ERAP1, ERAP2 and Aw19. An additive genotype model of ERAP1 and ERAP2 risk signals and single (A29/-) or double (A29/Aw19) Aw19 copies relative to lowest risk combination. The genotypes are combined as following: 0 = ERAP1 and ERAP2 homozygous for protective allele. 1/[01],[01]/1 = either homozygous protective or heterozygous genotypes of both ERAP1 and ERAP2. 2/.,./2 = homozygous risk allele of either ERAP1 or ERAP2. 2/2 = homozygous risk allele of both ERAP1 and ERAP2.

Figure 12 shows differences between risk Aw19 alleles and A32. Panel A) Sequence differences between risk Aw19 alleles (red) and protective A32 allele (green). A32 exhibits F at position 9 as is the reference A:01:01 allele, while risk alleles are either T or S at that position. The Bw4 epitope sequence is apparent at positions 79-83 or A32 only.

Description Of Embodiments

Various terms relating to aspects of the present disclosure are used throughout the specification and claims. Such terms are to be given their ordinary meaning in the art, unless otherwise indicated. Other specifically defined terms are to be construed in a manner consistent with the definitions provided herein.

Unless otherwise expressly stated, it is in no way intended that any method or aspect set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not specifically state in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that an order be inferred, in any respect. This holds for any possible non-expressed basis for interpretation, including matters of logic with respect to arrangement of steps or operational flow, plain meaning derived from grammatical organization or punctuation, or the number or type of aspects described in the specification.

As used herein, the singular forms “a,” “an” and “the” include plural referents unless the context clearly dictates otherwise.

As used herein, the term “about” means that the recited numerical value is approximate and small variations would not significantly affect the practice of the disclosed

embodiments. Where a numerical value is used, unless indicated otherwise by the context, the term "about" means the numerical value can vary by ±10% and remain within the scope of the disclosed embodiments.

As used herein, the term "comprising" may be replaced with "consisting" or "consisting essentially of" in particular embodiments as desired.

As used herein, the terms "nucleic acid", "nucleic acid molecule", "nucleic acid sequence", "polynucleotide", or "oligonucleotide" can comprise a polymeric form of nucleotides of any length, can comprise DNA and/or RNA, and can be single-stranded, double-stranded, or multiple stranded. One strand of a nucleic acid also refers to its complement.

As used herein, the term "subject" includes any animal, including mammals. Mammals include, but are not limited to, farm animals (such as, for example, horse, cow, pig), companion animals (such as, for example, dog, cat), laboratory animals (such as, for example, mouse, rat, rabbits), and non-human primates (such as, for example, apes and monkeys). In some embodiments, the subject is a human. In some embodiments, the subject is a patient under the care of a physician.

The present disclosure provides methods of treating a subject having an immune disorder, the methods comprising administering to the subject an ERAP2 inhibitor. In some embodiments, the immune disorder is an MHC-I-opathy. In some embodiments, the immune disorder is an MHC-II-opathy. In some embodiments, the MHC-I-opathy is Birdshot Chorioretinopathy (BSCR), Ankylosing Spondylitis (AS), Behçet's disease, psoriasis, Juvenile Idiopathic Arthritis (JIA), inflammatory bowel disease (IBD), or Crohn's disease (CD). In some embodiments, the MHC-I-opathy is BSCR. In some embodiments, the MHC-I-opathy is AS. In some embodiments, the MHC-I-opathy is Behçet's disease. In some embodiments, the MHC-I-opathy is psoriasis. In some embodiments, the MHC-I-opathy is JIA. In some embodiments, the MHC-I-opathy is IBD. In some embodiments, the MHC-I-opathy is CD.

In some embodiments, the MHC-I-opathy is BSCR. In some embodiments, the method further comprises detecting the presence or absence of an HLA-Aw19 allele in a biological sample obtained from the subject. In some embodiments, the subject is HLA-Aw19$^+$. In some embodiments, the subject is or is suspected of being HLA-A*29$^+$, HLA-A*30$^+$, HLA-A*31$^+$, or HLA-A*33$^+$, or any combination thereof. In some embodiments, the method further comprises determining whether the subject has one or two copies of an HLA-Aw19 allele. In some embodiments, the subject has a single copy of HLA-Aw19. In some embodiments, the subject

has two copies of HLA-Aw19. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*30$^+$. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*31$^+$. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*33$^+$.

In some embodiments, the subject having BSCR is not HLA-A*29$^+$.

In some embodiments, the subject having BSCR has a copy of at least any two of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In some embodiments, the subject having BSCR has a copy of at least any three of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In some embodiments, the subject having BSCR has a copy of all of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33.

In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*30. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*31 and HLA-A*33.

In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*30. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*31. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*30 and one copy of HLA-A*31. In some embodiments, the subject having BSCR has two copies of HLA-A*30 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*31 and one copy of HLA-A*33.

In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having

BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*33. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the method further comprises administering to the subject an HLA-Aw19 inhibitor. In some embodiments, the HLA-Aw19 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-A*29 antibody. In some embodiments, the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA (shRNA) that hybridizes to an HLA-Aw19. In some embodiments, the HLA-Aw19 is HLA-A*29.

In some embodiments, the MHC-I-opathy is AS. In some embodiments, the method further comprises detecting the presence or absence of HLA-B*27 or HLA-B*40 in a biological sample obtained from the subject. In some embodiments, the subject is or is suspected of being HLA-B*27$^+$. In some embodiments, the subject is or is suspected of being HLA-B*40$^+$. In some embodiments, the method further comprises determining whether the subject has one or two copies of HLA-B*27 or HLA-B*40. In some embodiments, the subject has a single copy of HLA-B*27 or HLA-B*40. In some embodiments, the subject has two copies of HLA-B*27 or HLA-B*40. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor or an HLA-B*40 inhibitor. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 or an HLA-B*40.

In some embodiments, the MHC-I-opathy is Behçet's disease. In some embodiments, the method further comprises detecting the presence or absence of HLA-B*51 in a biological sample obtained from the subject. In some embodiments, the subject is or is suspected of being HLA-B*51$^+$. In some embodiments, the method further comprises determining whether

the subject has one or two copies of HLA-B*51. In some embodiments, the subject has a single copy of HLA-B*51. In some embodiments, the subject has two copies of HLA-B*51. In some embodiments, the method further comprises administering to the subject an HLA-B*51 inhibitor. In some embodiments, the HLA-B*51 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*51 antibody. In some embodiments, the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*51.

In some embodiments, the MHC-I-opathy is psoriasis. In some embodiments, the method further comprises detecting the presence or absence of HLA-C*06 in a biological sample obtained from the subject. In some embodiments, the subject is or is suspected of being HLA-C*06$^+$. In some embodiments, the method further comprises determining whether the subject has one or two copies of HLA-C*06. In some embodiments, the subject has a single copy of HLA-C*06. In some embodiments, the subject has two copies of HLA-C*06. In some embodiments, the method further comprises administering to the subject an HLA-C*06 inhibitor. In some embodiments, the HLA-C*06 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*06 antibody. In some embodiments, the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*06.

In some embodiments, the MHC-I-opathy is JIA. In some embodiments, the method further comprises detecting the presence or absence of HLA-B*27 and/or DRB1 in a biological sample obtained from the subject. In some embodiments, the subject is or is suspected of being HLA-B*27$^+$ and/or DRB1$^+$. In some embodiments, the method further comprises determining whether the subject has one or two copies of HLA-B*27 and/or DRB1. In some embodiments, the subject has a single copy of HLA-B*27 and/or DRB1. In some embodiments, the subject has two copies of HLA-B*27 and/or DRB1. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor and/or a DRB1 inhibitor. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody or an anti-DRB1 antibody. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic

acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 and/or an DRB1.

In some embodiments, the MHC-I-opathy is IBD or CD. In some embodiments, the method further comprises detecting the presence or absence of HLA-C*07 in a biological sample obtained from the subject. In some embodiments, the subject is or is suspected of being HLA-C*07^{+}. In some embodiments, the method further comprises determining whether the subject has one or two copies of HLA-C*07. In some embodiments, the subject has a single copy of HLA-C*07. In some embodiments, the subject has two copies of HLA-C*07. In some embodiments, the method further comprises administering to the subject an HLA-C*07 inhibitor. In some embodiments, the HLA-C*07 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*07 antibody. In some embodiments, the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*07.

In some embodiments, the ERAP2 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the ERAP2 inhibitor comprises an anti-ERAP2 antibody. In some embodiments, the ERAP2 inhibitor comprises a pseudopeptide. In some embodiments, the pseudopeptide is a phosphinic pseudopeptide. In some embodiments, the phosphinic pseudopeptide is DG002 or DG013 (see, for example, Zervoudi et al., Proc. Natl. Acad. Sci. USA, 2013, 110, 19890-19895). In some embodiments, the phosphinic pseudopeptide is DG002. In some embodiments, the phosphinic pseudopeptide is DG013. In some embodiments, the ERAP2 inhibitor comprises a small molecule. In some embodiments, the ERAP2 inhibitor is compound 4, compound 15, compound 16, compound 5, or analogues of compound 5, which are drug-like carboxylic acids and bioisosters screened for enhanced selectivity for ERAP2 over ERAP1 (see, Medve et al., European Journal of Medicinal Chemistry, 2021, 211, 113053). In some embodiments, the ERAP2 inhibitor is a phosphonic or

phosphinic acid compound with higher affinity for ERAP2 than ERAP1 (see, Weglarz-Tomczak et al., Bioorg. Med. Chem. Lett., 2016, 26, 4122-4126). Additional ERAP2 inhibitors are described in, for example, Georgiadis et al., Curr. Medic. Chem., 2019, 26, 2715-2729.

In any of the embodiments described herein, the methods can further comprise administering to the subject an ERAP1 agonist or inhibitor, depending upon the MHC-I-opathy. For AS and psoriasis, an ERAP1 inhibitor can be administered. For the remaining MHC-I-opathies, an ERAP1 agonist can be administered.

In some embodiments, the ERAP1 agonist comprises an oligonucleotide. In some embodiments, the oligonucleotide is ODN1826. In some embodiments, the ERAP1 agonist comprises a peptide. In some embodiments, the ERAP1 agonist comprises a lipopeptide. In some embodiments, the lipopeptide is Pam3CSK4 or FSL-1. In some embodiments, the lipopeptide is Pam3CSK4. In some embodiments, the lipopeptide is FSL-1. In some embodiments, the ERAP1 agonist comprises a small molecule. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator, an ERAP1 protein stabilizer, an agonist of ERAP1 enzymatic activity, or an activator of ERAP1 secretion. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator. In some embodiments, the ERAP1 agonist can comprise an ERAP1 protein stabilizer. In some embodiments, the ERAP1 agonist can comprise an agonist of ERAP1 enzymatic activity. In some embodiments, the ERAP1 agonist can comprise an activator of ERAP1 secretion. Additional examples of ERAP1 agonists are described in, for example, Goto et al., J. Immunol., 2014, 192, 4443-4452.

In some embodiments, the ERAP1 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the ERAP1 inhibitor comprises an anti-ERAP1 antibody. In some embodiments, the ERAP1 inhibitor is DG002 and DG013 (see, Zervoudi et al., Proc. Nat'l Acad. Sci. USA, 2013, 110, 19890-19895). In some embodiments, the ERAP1 inhibitor is a phosphinic dipeptide or tripeptide analog (see, Weglarz-Tomczak et al.,

Bioorg. Med. Che, Lett., 2016, 26, 4122-4126). In some embodiments, the ERAP1 inhibitor is (N-(N-(2-(1H-indol-3-yl)ethyl)carbamimidoyl) -2,5-difluorobenzenesulfonamide), (1-(1-(4-acetylpiperazine-1-carbonyl)cyclohexyl) -3-(p-tolyl)urea), or (4-methoxy-3-(N-(2-(piperidin-1-yl)-5-(trifluoromethyl)phenyl) sulfamoyl)benzoic acid (see, Maben et al., J. Med. Chem., 2020, 63, 103-121). In some embodiments, the ERAP1 inhibitor is (4aR,5S,6R,8S,8aR)-5-(2-(Furan-3-yl)ethyl)-8-hydroxy-5,6,8a-trimethyl-3,4,4a,5,6,7,8,8a-octahydronaphthalene-1-carboxylic acid (see, Liddle et al., J. Med. Chem., 2020, 63, 3348-3358). In some embodiments, the ERAP1 inhibitor is DG013A or a phosphinic tripeptide or dipeptide or an aminophosphonic derivative, or 3,4-diaminobenzoic (DABA) derivative, or a derivative of thimerosal, (see, Georgiadis et al., Cur. Med. Chem., 2019, 26, 2715-2729). In some embodiments, the ERAP1 inhibitor is a benzofuran or 7-Benzofuran amide variation (see, Deddouche-Grass et al., ACS Med. Chem. Lett., 2021, 12, 1137-1142).

In any of the embodiments described herein, any of the inhibitors or other agents described herein can form a component of an antibody-drug-conjugate (ADC). For example, an ERAP1 inhibitor or an ERAP2 inhibitor can be conjugated to an antibody, or antigen-binding fragment thereof. The inhibitor can comprise a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule.

The present disclosure also provides methods of treating a subject having an MHC-I-opathy. In some embodiments, the method comprises performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises: i) an MHC-I-opathy-related HLA genotype; and ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein. In some embodiments, the method comprises administering to the subject a therapeutically effective amount of an ERAP2 inhibitor, wherein the subject comprises both an MHC-I-opathy-related HLA genotype and a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein. The presence of both the MHC-I-opathy-related HLA genotype and the functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP2.

In some embodiments, the MHC-I-opathy is BSCR and the MHC-I-opathy-related HLA genotype comprises an HLA-Aw19 allele. In some embodiments, the HLA-Aw19 allele is an HLA-A*29 allele, an HLA-A*30 allele, an HLA-A*31 allele, or an HLA-A*33 allele, or any combination thereof. In some embodiments, the subject has a single copy of the HLA-Aw19 allele. In some

embodiments, the HLA-Aw19 allele is an HLA-A*29 allele. In some embodiments, the HLA-Aw19 allele is an HLA-A*30 allele. In some embodiments, the HLA-Aw19 allele is an HLA-A*31 allele. In some embodiments, the HLA-Aw19 allele is an HLA-A*33 allele. In some embodiments, the subject has two copies of the HLA-Aw19 allele. In some embodiments, the subject is or is suspected of being HLA-A*29$^+$/HLA-A*30$^+$. In some embodiments, the subject is or is suspected of being HLA-A*29$^+$/HLA-A*31$^+$. In some embodiments, the subject is or is suspected of being HLA-A*29$^+$/HLA-A*33$^+$.

In some embodiments, the subject having BSCR is not HLA-A*29$^+$.

In some embodiments, the subject having BSCR has a copy of at least any two of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In some embodiments, the subject having BSCR has a copy of at least any three of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In some embodiments, the subject having BSCR has a copy of all of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33.

In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*30. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*31 and HLA-A*33.

In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*30. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*31. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*30 and one copy of HLA-A*31. In some embodiments, the subject having BSCR

has two copies of HLA-A*30 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*31 and one copy of HLA-A*33.

In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*33. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the method further comprises administering to the subject an HLA-Aw19 inhibitor. In some embodiments, the HLA-Aw19 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-A*29 antibody. In some embodiments, the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-Aw19. In some embodiments, the HLA-Aw19 is HLA-A*29.

In some embodiments, the MHC-I-opathy is AS and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27 allele or an HLA-B*40 allele. In some embodiments, the subject has a single copy of HLA-B*27 or HLA-B*40. In some embodiments, the subject has two copies of HLA-B*27 or HLA-B*40. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor or an HLA-B*40 inhibitor. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 or an HLA-B*40.

In some embodiments, the MHC-I-opathy is Behçet's disease and the MHC-I-opathy-related HLA genotype comprises an HLA-B*51 allele. In some embodiments, the subject has a single copy of HLA-B*51. In some embodiments, the subject has two copies of HLA-B*51. In

some embodiments, the method further comprises administering to the subject an HLA-B*51 inhibitor. In some embodiments, the HLA-B*51 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*51 antibody. In some embodiments, the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*51.

In some embodiments, the MHC-I-opathy is psoriasis and the MHC-I-opathy-related HLA genotype comprises an HLA-C*06 allele. In some embodiments, the subject has a single copy of HLA-C*06. In some embodiments, the subject has two copies of HLA-C*06. In some embodiments, the method further comprises administering to the subject an HLA-C*06 inhibitor. In some embodiments, the HLA-C*06 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*06 antibody. In some embodiments, the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*06.

In some embodiments, the MHC-I-opathy is JIA and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27 and/or DRB1. In some embodiments, the subject has a single copy of HLA-B*27 and/or DRB1. In some embodiments, the subject has two copies of HLA-B*27 and/or. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor and/or a DRB1 inhibitor. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody and/or a DRB1 antibody. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 or DRB1.

In some embodiments, the MHC-I-opathy is IBD or CD and the MHC-I-opathy-related HLA genotype comprises an HLA-C*07 allele. In some embodiments, the subject has a single copy of HLA-C*07. In some embodiments, the subject has two copies of HLA-C*07. In some embodiments, the method further comprising administering to the subject an HLA-C*07 inhibitor. In some embodiments, the HLA-C*07 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*07 antibody. In some embodiments, the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some

embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*07.

In any of the embodiments described herein, the nucleic acid molecule comprises genomic DNA, mRNA, or cDNA obtained from mRNA. In some embodiments, the nucleic acid molecule comprises genomic DNA. In some embodiments, the nucleic acid molecule comprises mRNA. In some embodiments, the nucleic acid molecule comprises cDNA obtained from mRNA.

In any of the embodiments described herein, the ERAP2 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the ERAP2 inhibitor comprises an anti-ERAP2 antibody. In some embodiments, the ERAP2 inhibitor comprises a pseudopeptide. In some embodiments, the pseudopeptide is a phosphinic pseudopeptide. In some embodiments, the phosphinic pseudopeptide is DG002 or DG013. In some embodiments, the ERAP2 inhibitor comprises a small molecule.

In any of the embodiments described herein, the assay performed or having been performed on the biological sample from the subject can further determine whether the subject comprises a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein. In some embodiments, the method further comprises administering to the subject a therapeutically effective amount of an ERAP1 agonist or inhibitor (depending upon the MHC-I-opathy), wherein the subject comprises an MHC-I-opathy-related HLA genotype and does or does not comprise a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein. The presence of an MHC-I-opathy-related HLA genotype and the absence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by activating ERAP1. The presence of an MHC-I-opathy-related HLA genotype and the presence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP1.

In any of the embodiments described herein, the ERAP1 agonist comprises an oligonucleotide. In some embodiments, the oligonucleotide is ODN1826. In some embodiments, the ERAP1 agonist comprises a peptide. In some embodiments, the ERAP1 agonist comprises a lipopeptide. In some embodiments, the lipopeptide is Pam3CSK4 or FSL-1. In some embodiments, the lipopeptide is Pam3CSK4. In some embodiments, the lipopeptide is FSL-1. In some embodiments, the ERAP1 agonist comprises a small molecule. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator, an ERAP1 protein stabilizer, an agonist of ERAP1 enzymatic activity, or an activator of ERAP1 secretion. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator. In some embodiments, the ERAP1 agonist can comprise an ERAP1 protein stabilizer. In some embodiments, the ERAP1 agonist can comprise an agonist of ERAP1 enzymatic activity. In some embodiments, the ERAP1 agonist can comprise an activator of ERAP1 secretion. Additional examples of ERAP1 agonists are described in, for example, Goto et al., J. Immunol., 2014, 192, 4443-4452.

In any of the embodiments described herein, the ERAP1 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the ERAP1 inhibitor comprises an anti-ERAP1 antibody.

HLA-class-I antibodies can be generated by numerous methodologies with different degrees of antigen/allele specificity attained and are reported to be used for *in vitro* assays. HLA-B*27 antibodies can be generated by numerous methodologies. In addition, three commercially available antibodies for HLA-B27 flow cytometric screening include the monoclonal mouse anti-human ABC-m3, FD705, and GS145.2 which have been shown to each have differing levels of cross-reactivity to other HLA-B antigens/alleles (Levering et al., Cytometry B Clin. Cytom., 2003, 54, 28-38). HLA-B*51 antibodies can also be generated by numerous methodologies. For example, antibodies to a broader HLA-Bw4 epitope can be obtained from clone REA274 (e.g., HLA-B members: B5, B5102, B5103, B13, B17, B37, B38, B44,

B47, B49, B51, B52, B53, B57, B58, B59, B63, and B77; HLA-A members: A9, A23, A24, A25, and A*32). In addition, antibodies to HLA-B*51/B*52/B*35 can be obtained from clone HDG8D9 (Drabbels et al., Blood, 2011, 118, e149-55). HLA-C*06 antibodies can also be generated by numerous methodologies. For example, pan HLA-C antibodies can be obtained from clone DT-9 (which also recognizes HLA-E) (Braud et al., Curr. Biol., 1998, 8, 1-10). Broad anti-HLA-C antibodies can be obtained from clone L31 (which also recognizes some HLA-B alleles) (Setini et al., Hum. Immunol., 1996, 46, 69-81). HLA-Cw6 scFv can also be generated which has weak binding to HLA-Cw2,4,5 (Marget et al., Mol. Immunol., 2005, 42, 643-649).

In some embodiments, the assay for determining whether the subject comprises an MHC-I-opathy-related and/or MHC-II-opathy-related HLA genotype and a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein, is a genotyping assay or sequencing assay. In some embodiments, the nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein comprises genomic DNA, mRNA, or cDNA obtained from mRNA. By comparing the nucleotide or protein sequence of the ERAP2 protein and/or ERAP1 protein in the sample from a subject to the wild type sequence for ERAP2 protein and/or ERAP1 protein or nucleic acid molecule, or to published sequences of variant ERAP2 proteins and/or ERAP1 proteins or nucleic acid molecules having reduced or no activity, a determination can be made whether the subject comprises a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein. In addition, although an individual ERAP2 protein and/or ERAP1 protein may have biological activity, the overall function of the ERAP2 protein and/or ERAP1 protein may not be functional due to reduced levels of expression. Thus, as used herein, an ERAP2 protein and/or ERAP1 protein can be determined not to be functional because the ERAP2 protein and/or ERAP1 protein lacks or had reduced biological activity or because the expression level is reduced.

Determining whether a subject has an MHC-I-opathy-related and/or MHC-II-opathy-related HLA genotype and/or a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein, in a biological sample from a subject can be carried out by any of the methods described herein. In some embodiments, these methods can be carried out *in vitro*. In some embodiments, these methods can be carried out *in situ*. In some embodiments, these methods can be carried out *in*

vivo. In any of these embodiments, the nucleic acid molecule can be present within a biological sample obtained from the subject.

The biological sample can be derived from any cell, tissue, or biological fluid from the subject. The biological sample may comprise any clinically relevant tissue, such as a bone marrow sample, a tumor biopsy, a fine needle aspirate, or a sample of bodily fluid, such as blood, gingival crevicular fluid, plasma, serum, lymph, ascitic fluid, cystic fluid, or urine. In some cases, the sample comprises a buccal swab. The biological sample used in the methods disclosed herein can vary based on the assay format, nature of the detection method, and the tissues, cells, or extracts that are used as the sample. A biological sample can be processed differently depending on the assay being employed. For example, when detecting any particular nucleic acid molecule, preliminary processing designed to isolate or enrich the biological sample for the particular nucleic acid molecule can be employed. A variety of techniques may be used for this purpose. Various methods to detect the presence or level of an mRNA molecule or the presence of a particular genomic DNA locus can be used.

In some embodiments, the biological sample comprises a cell or cell lysate. Such methods can further comprise, for example, obtaining a biological sample from the subject comprising genomic nucleic acid molecules or mRNA molecules, and if mRNA, optionally reverse transcribing the mRNA into cDNA. In some embodiments, the method is an *in vitro* method. In some embodiments, the assay comprises RNA sequencing (RNA-Seq). In some embodiments, the assays also comprise reverse transcribing mRNA into cDNA, such as by the reverse transcriptase polymerase chain reaction (RT-PCR).

Illustrative examples of nucleic acid sequencing techniques include, but are not limited to, chain terminator (Sanger) sequencing and dye terminator sequencing. Other methods involve nucleic acid hybridization methods other than sequencing, including using labeled primers or probes directed against purified DNA, amplified DNA, and fixed cell preparations (fluorescence in situ hybridization (FISH)). In some methods, a target nucleic acid molecule may be amplified prior to or simultaneous with detection. Illustrative examples of nucleic acid amplification techniques include, but are not limited to, polymerase chain reaction (PCR), ligase chain reaction (LCR), strand displacement amplification (SDA), and nucleic acid sequence based amplification (NASBA). Other methods include, but are not limited to, ligase chain reaction, strand displacement amplification, and thermophilic SDA (tSDA).

Administration of any of the therapeutic agents described herein (including the ERAP2 inhibitor, the ERAP1 agonist or inhibitor, and/or the HLA inhibitor) can be in a therapeutically effective amount to be determined by a health care professional. Administration of any of the therapeutic agents can be repeated, for example, after one day, two days, three days, five days, one week, two weeks, three weeks, one month, five weeks, six weeks, seven weeks, eight weeks, two months, or three months. The repeated administration can be at the same dose or at a different dose. The administration can be repeated once, twice, three times, four times, five times, six times, seven times, eight times, nine times, ten times, or more. For example, according to certain dosage regimens a subject can receive therapy for a prolonged period of time such as, for example, 6 months, 1 year, or more.

Administration of any of the therapeutic agents can occur by any suitable route including, but not limited to, parenteral, intravenous, oral, subcutaneous, intra-arterial, intracranial, intrathecal, intraperitoneal, topical, intranasal, intra-articular, intravitreal, intracameral, subretinal, suprachoroidal, or intramuscular.

Pharmaceutical compositions for administration are desirably sterile and substantially isotonic and manufactured under GMP conditions. Pharmaceutical compositions can be provided in unit dosage form (i.e., the dosage for a single administration). Pharmaceutical compositions can be formulated using one or more physiologically and pharmaceutically acceptable carriers, diluents, excipients or auxiliaries. The formulation depends on the route of administration chosen. The term “pharmaceutically acceptable” means that the carrier, diluent, excipient, or auxiliary is compatible with the other ingredients of the formulation and not substantially deleterious to the recipient thereof.

The terms “treat”, “treating”, and “treatment” and “prevent”, “preventing”, and “prevention” as used herein, refer to eliciting the desired biological response, such as a therapeutic and prophylactic effect, respectively. In some embodiments, a therapeutic effect comprises one or more of a decrease/reduction in an MHC-I-opathy and/or MHC-II-opathy, a decrease/reduction in the severity of an MHC-I-opathy and/or MHC-II-opathy (such as, for example, a reduction or inhibition of development of an MHC-I-opathy and/or MHC-II-opathy), a decrease/reduction in symptoms and MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, delaying the onset of symptoms and MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, reducing the severity of symptoms of MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, reducing the severity of an acute episode, reducing the

number of symptoms and MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, reducing the latency of symptoms and MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, an amelioration of symptoms and MHC-I-opathy-related effects and/or MHC-II-opathy-related effects, reducing secondary symptoms, reducing secondary infections, preventing relapse to an MHC-I-opathy and/or MHC-II-opathy, decreasing the number or frequency of relapse episodes, increasing latency between symptomatic episodes, increasing time to sustained progression, speeding recovery, or increasing efficacy of or decreasing resistance to alternative therapeutics, and/or an increased survival time of the subject, following administration of the agent or composition comprising the agent. A prophylactic effect may comprise a complete or partial avoidance/inhibition or a delay of an MHC-I-opathy and/or MHC-II-opathy development/progression (such as, for example, a complete or partial avoidance/inhibition or a delay), and an increased survival time of the affected subject, following administration of a therapeutic protocol. Treatment of an MHC-I-opathy and/or MHC-II-opathy encompasses the treatment of subjects already diagnosed as having any form of the MHC-I-opathy and/or MHC-II-opathy at any clinical stage or manifestation, the delay of the onset or evolution or aggravation or deterioration of the symptoms or signs of an MHC-I-opathy and/or MHC-II-opathy, and/or preventing and/or reducing the severity of an MHC-I-opathy and/or MHC-II-opathy.

In some embodiments, the antisense nucleic acid molecules targeted to ERAP2 comprise or consist of the nucleotide sequences shown in Table 1.

Table 1

Sequence	SEQ ID NO:
AUCUGCCUGUUUGAGUUGGG	1
UAUCUGCCUGUUUGAGUUGG	2
UUAUCUGCCUGUUUGAGUUG	3
CUUUAUCUGCCUGUUUGAGU	4
UGAUCUCUCUUUAUCUGCCU	5
UUGAUCUCUCUUUAUCUGCC	6
UCAUGCUCAUCUCUUUGAUC	7
CUCAUGCUCAUCUCUUUGAU	8
GGACUGUAUCUCAUGCUCAU	9
GGGACUGUAUCUCAUGCUCA	10

CGGGCAGCUUCUGUGAUCUU	11
UUUAAUCAAACACCUCCCGG	12
AUUUAAUCAAACACCUCCCG	13
CUCCAGUUAUGUCACAUGGG	14
GGCUCCAGUUAUGUCACAUG	15
CUGGCUCCAGUUAUGUCACA	16
AGUUCUUCAUGGCACUGCAC	17
UAGUUCUUCAUGGCACUGCA	18
AGACAAGUUAAUAUCCAGGC	19
GCAGAAGAAUGGAACAUGAA	20
GUGUGAAUUAACCAUUGCAG	21
CUGUGUGAAUUAACCAUUGC	22
AGCAGUAAAAUCCUCUGUGA	23
AAGCAGUAAAAUCCUCUGUG	24
GGCUGUUAAGCAGUAAAAUC	25
GAUGGCUGUUAAGCAGUAAA	26
AAGAUGGCUGUUAAGCAGUA	27
CAAGAUGGCUGUUAAGCAGU	28
CACUGAGAACUGAGAACAAA	29
AUGGCACUGAGAACUGAGAA	30
GAUGGCACUGAGAACUGAGA	31
UAGAUGGCACUGAGAACUGA	32
CUAGAUGGCACUGAGAACUG	33
GAUAACUAGAUGGCACUGAG	34
UGAUAACUAGAUGGCACUGA	35
GUGAUAACUAGAUGGCACUG	36
GAAGUGAUAACUAGAUGGCA	37
UGAAGUGAUAACUAGAUGGC	38
GUGAAGUGAUAACUAGAUGG	39
CUCAGUGAAGUGAUAACUAG	40
CCUCAGUGAAGUGAUAACUA	41

UCCUCAGUGAAGUGAUAACU	42
GAUCCUCAGUGAAGUGAUAA	43
UUAGUGGCUACUGGGAAAGC	44
AUUAGUGGCUACUGGGAAAG	45
CAUUAGUGGCUACUGGGAAA	46
CCAUUAGUGGCUACUGGGAA	47

In some embodiments, the antisense nucleic acid molecules targeted to ERAP2 comprise or consist of the nucleotide sequences shown in Table 2.

Table 2

Sequence	SEQ ID NO:
AUCUUAAAUCAUGCUGCUGC	48
CUCCAGUUAUGUCACAUGGG	49
GGCUCCAGUUAUGUCACAUG	50
CUGGCUCCAGUUAUGUCACA	51
AGUUCUUCAUGGCACUGCAC	52
UAGUUCUUCAUGGCACUGCA	53
AGACAAGUUAAUAUCCAGGC	54
GCAGAAGAAUGGAACAUGAA	55
GUGUGAAUUAACCAUUGCAG	56
CUGUGUGAAUUAACCAUUGC	57
AGCAGUAAAAUCCUCUGUGA	58
AAGCAGUAAAAUCCUCUGUG	59
GGCUGUUAAGCAGUAAAAUC	60
GAUGGCUGUUAAGCAGUAAA	61
AAGAUGGCUGUUAAGCAGUA	62
CAAGAUGGCUGUUAAGCAGU	63
CACUGAGAACUGAGAACAAA	64
AUGGCACUGAGAACUGAGAA	65

GAUGGCACUGAGAACUGAGA	66
UAGAUGGCACUGAGAACUGA	67
CUAGAUGGCACUGAGAACUG	68
GAUAACUAGAUGGCACUGAG	69
UGAUAACUAGAUGGCACUGA	70
GUGAUAACUAGAUGGCACUG	71
GAAGUGAUAACUAGAUGGCA	72
UGAAGUGAUAACUAGAUGGC	73
GUGAAGUGAUAACUAGAUGG	74
CUCAGUGAAGUGAUAACUAG	75
CCUCAGUGAAGUGAUAACUA	76
UCCUCAGUGAAGUGAUAACU	77
GAUCCUCAGUGAAGUGAUAA	78
UUAGUGGCUACUGGGAAAGC	79
AUUAGUGGCUACUGGGAAAG	80
CAUUAGUGGCUACUGGGAAA	81
CCAUUAGUGGCUACUGGGAA	82
UAAUGGAGAGGAAUGACCAC	83
AUAAUGGAGAGGAAUGACCA	84
AGAGGUCAUAAUGGAGAGGA	85
AAGAGGUCAUAAUGGAGAGG	86
AAAGAGGUCAUAAUGGAGAG	87
CAAAGAGGUCAUAAUGGAGA	88
ACAAAGAGGUCAUAAUGGAG	89
GGACAAAGAGGUCAUAAUGG	90
AAAGUCCAGAGAGGUGAGAU	91
CAAAGUCCAGAGAGGUGAGA	92
AUGCAACAAAGUCCAGAGAG	93
GAUGCAACAAAGUCCAGAGA	94

AGAUGCAACAAAGUCCAGAG	95
CUCAGAUGCAACAAAGUCCA	96
UUCUCAGAUGCAACAAAGUC	97
CUUCUCAGAUGCAACAAAGU	98
AGCAUUGCUGACCAAGACUU	99
UAGCAUUGCUGACCAAGACU	100
GUAGCAUUGCUGACCAAGAC	101
GGUAGCAUUGCUGACCAAGA	102
GGGUAGCAUUGCUGACCAAG	103
UGGGUAGCAUUGCUGACCAA	104
AAACUGGGUAGCAUUGCUGA	105
UAAACUGGGUAGCAUUGCUG	106
UGAUAAACUGGGUAGCAUUG	107
AGAUGAUAAACUGGGUAGCA	108
AAGAUGAUAAACUGGGUAGC	109
CAAGAUGAUAAACUGGGUAG	110
GCAAGAUGAUAAACUGGGUA	111
GUGCAAGAUGAUAAACUGGG	112
UGUGCAAGAUGAUAAACUGG	113
CUGUGCAAGAUGAUAAACUG	114
GCUGUGCAAGAUGAUAAACU	115
GGCAUUCGUGAUUUCAAGAU	116
UGGCAUUCGUGAUUUCAAGA	117
GUGGCAUUCGUGAUUUCAAG	118
GGUGGCAUUCGUGAUUUCAA	119
GGGUGGCAUUCGUGAUUUCA	120
AGGGUGGCAUUCGUGAUUUC	121
AAGGGUGGCAUUCGUGAUUU	122
CUGAAGGGUGGCAUUCGUGA	123

ACUGAAGGGUGGCAUUCGUG	124
GACUGAAGGGUGGCAUUCGU	125
UGACUGAAGGGUGGCAUUCG	126
CUGACUGAAGGGUGGCAUUC	127
UCUGACUGAAGGGUGGCAUU	128
CUCUGACUGAAGGGUGGCAU	129
CCUCUGACUGAAGGGUGGCA	130
UCCUCUGACUGAAGGGUGGC	131
UUCCUCUGACUGAAGGGUGG	132
UUGAAUCUUCCUCUGACUGA	133
CUUGAAUCUUCCUCUGACUG	134
UCUUGAAUCUUCCUCUGACU	135
GUAUCUUGAAUCUUCCUCUG	136
UCCUGGUUUCAUGUAUCUUG	137
GCAGGGUAACUCAAAACUUU	138
AGCAGGGUAACUCAAAACUU	139
GAGCAGGGUAACUCAAAACU	140
AGCAGUGCAAUUUGUUCAUG	141
CAGCAGUGCAAUUUGUUCAU	142
CCAGCAGUGCAAUUUGUUCA	143
ACCAGCAGUGCAAUUUGUUC	144
AACCAGCAGUGCAAUUUGUU	145
GAACCAGCAGUGCAAUUUGU	146
GGAACCAGCAGUGCAAUUUG	147
UCUGGAACCAGCAGUGCAAU	148
UCUCUGGAACCAGCAGUGCA	149
UUCUCUGGAACCAGCAGUGC	150
UUUCUCUGGAACCAGCAGUG	151
CGUAAGUUUCUCUGGAACCA	152

GCGUAAGUUUCUCUGGAACC	153
GGCGUAAGUUUCUCUGGAAC	154
AGGCGUAAGUUUCUCUGGAA	155
GAGGCGUAAGUUUCUCUGGA	156
UGAGGCGUAAGUUUCUCUGG	157
GUGAGGCGUAAGUUUCUCUG	158
GGUGAGGCGUAAGUUUCUCU	159
AGGUGAGGCGUAAGUUUCUC	160
CAGGUGAGGCGUAAGUUUCU	161
UCAGGUGAGGCGUAAGUUUC	162
UUCAGGUGAGGCGUAAGUUU	163
UUUCAGGUGAGGCGUAAGUU	164
AUUUCAGGUGAGGCGUAAGU	165
UAUUUCAGGUGAGGCGUAAG	166
GUAUUUCAGGUGAGGCGUAA	167
AGUAUUUCAGGUGAGGCGUA	168
AUAGUAUUUCAGGUGAGGCG	169
CAUAGUAUUUCAGGUGAGGC	170
CACAUAGUAUUUCAGGUGAG	171
AGCCACAUAGUAUUUCAGGU	172
UAGCCACAUAGUAUUUCAGG	173
CCAUAGCCACAUAGUAUUUC	174
AGUCCAUAGCCACAUAGUAU	175
AAGUCCAUAGCCACAUAGUA	176
GAAGUCCAUAGCCACAUAGU	177
GGAAGUCCAUAGCCACAUAG	178
UGGAAGUCCAUAGCCACAUA	179
GCUUGGAAGUCCAUAGCCAC	180
UUGGCUUGGAAGUCCAUAGC	181

CACCUAACUUGGCUUGGAAG	182
AUCACCUAACUUGGCUUGGA	183
CAUCACCUAACUUGGCUUGG	184
CCAUCACCUAACUUGGCUUG	185
CAAAGCCAUCACCUAACUUG	186
UCAAAGCCAUCACCUAACUU	187
UUCAAAGCCAUCACCUAACU	188
CUUCAAAGCCAUCACCUAAC	189
ACCCUUCAAAGCCAUCACCU	190
AACCCUUCAAAGCCAUCACC	191
CAAGAGUUCUGUAUGUGCUU	192
CCAAGAGUUCUGUAUGUGCU	193
ACCAAGAGUUCUGUAUGUGC	194
CACCAAGAGUUCUGUAUGUG	195
CCACCAAGAGUUCUGUAUGU	196
ACCACCAAGAGUUCUGUAUG	197
GGCUCAAAAUCUGUUACUGC	198
UGGCUCAAAAUCUGUUACUG	199
UGGGUUGGCUCAAAAUCUGU	200
CUGGGUUGGCUCAAAAUCUG	201
CCUGGGUUGGCUCAAAAUCU	202
UGCCUGGGUUGGCUCAAAAU	203
GUGCCUGGGUUGGCUCAAAA	204
CGUGCCUGGGUUGGCUCAAA	205
AAGCCAUGCGUGCCUGGGUU	206
AAAGCCAUGCGUGCCUGGGU	207
AGGGAAAGCCAUGCGUGCCU	208
AAGGGAAAGCCAUGCGUGCC	209
GCAAGGGAAAGCCAUGCGUG	210

AAGCAAGGGAAAGCCAUGCG	211
CAAAGCAAGGGAAAGCCAUG	212
CAUCAAAGCAAGGGAAAGCC	213
GUUCAUCAAAGCAAGGGAAA	214
CUCUCUUCGUAUCUUGAUUG	215
GCUCUCUCUUCGUAUCUUGA	216
CCUGCUCUCUCUUCGUAUCU	217
GCCUGCUCUCUCUUCGUAUC	218
GUGCAAUAUGCCUGCUCUCU	219
AGUGCAAUAUGCCUGCUCUC	220
UAGUGCAAUAUGCCUGCUCU	221
AUAGUGCAAUAUGCCUGCUC	222
UGGAUAGUGCAAUAUGCCUG	223
UUGGAUAGUGCAAUAUGCCU	224
GUUGGAUAGUGCAAUAUGCC	225
UGUUGGAUAGUGCAAUAUGC	226
GCAUGUUGGAUAGUGCAAUA	227
GGCAUGUUGGAUAGUGCAAU	228
UGGCAUGUUGGAUAGUGCAA	229
UUGGCAUGUUGGAUAGUGCA	230
UUUGGCAUGUUGGAUAGUGC	231
CUUUGGCAUGUUGGAUAGUG	232
GACCUCCUUCAAGUUCAAUU	233
CAAAAGACCUCCUUCAAGUU	234
UCCAAAAGACCUCCUUCAAG	235
CUUCCAAAAGACCUCCUUCA	236
UCACAAACUAUGUAGGCUAC	237
AGAGAGUGGAAAUCACAAAC	238
UCAGAGAGUGGAAAUCACAA	239

CCCUGAUGAAGUGAAGCCAC	240
AUAGAUGGACACCUUGACCC	241
CAUAGAUGGACACCUUGACC	242
GCAUAGAUGGACACCUUGAC	243
UGCAUAGAUGGACACCUUGA	244
UUUGAUUCCGUUUGUCUGGG	245
GUUUGAUUCCGUUUGUCUGG	246
UGUUUGAUUCCGUUUGUCUG	247
GUGUUUGAUUCCGUUUGUCU	248
GCAUAAUGUGUUUGAUUCCG	249
UCAGUGAUGCCUGCAAAGCA	250
GUAGCUUCAGUGAUGCCUGC	251
AGUAGCUUCAGUGAUGCCUG	252
GGAGAGUGGAUAGUAGAUAU	253
UGGAGAGUGGAUAGUAGAUA	254
UUGGAGAGUGGAUAGUAGAU	255
UUUGGAGAGUGGAUAGUAGA	256
GUUUGGAGAGUGGAUAGUAG	257
CAGUUUGGAGAGUGGAUAGU	258
GCAAAGUCAGGAAUAGCAAU	259
UGCAAAGUCAGGAAUAGCAA	260
GUGCAAAGUCAGGAAUAGCA	261
GGUGCAAAGUCAGGAAUAGC	262
AGGUGCAAAGUCAGGAAUAG	263
CAGGUGCAAAGUCAGGAAUA	264
CCAGGUGCAAAGUCAGGAAU	265
UCCAGGUGCAAAGUCAGGAA	266
CUCCAGGUGCAAAGUCAGGA	267
GCUCCAGGUGCAAAGUCAGG	268

GGCUCCAGGUGCAAAGUCAG	269
CUCCCUAUAUGUAAUGAGGC	270
GGAAGCAGAAGAGGUCUUGG	271
CGGAAGCAGAAGAGGUCUUG	272
UCGGAAGCAGAAGAGGUCUU	273
AUCGGAAGCAGAAGAGGUCU	274
UAUCGGAAGCAGAAGAGGUC	275
UUAUCGGAAGCAGAAGAGGU	276
UUUAUCGGAAGCAGAAGAGG	277
GUUUAUCGGAAGCAGAAGAG	278
AGUUUAUCGGAAGCAGAAGA	279
CAGUUUAUCGGAAGCAGAAG	280
CCACAGUUUAUCGGAAGCAG	281
CCCACAGUUUAUCGGAAGCA	282
ACCCACAGUUUAUCGGAAGC	283
GACCCACAGUUUAUCGGAAG	284
UGACCCACAGUUUAUCGGAA	285
GUGACCCACAGUUUAUCGGA	286
GGUGACCCACAGUUUAUCGG	287
UGGUGACCCACAGUUUAUCG	288
CUGGUGACCCACAGUUUAUC	289
CUCUGGUGACCCACAGUUUA	290
ACUCUGGUGACCCACAGUUU	291
GACUCUGGUGACCCACAGUU	292
AUGACUCUGGUGACCCACAG	293
UAUGACUCUGGUGACCCACA	294
CUAUGACUCUGGUGACCCAC	295
GGCUAUGACUCUGGUGACCC	296
GGGCUAUGACUCUGGUGACC	297

UGGGCUAUGACUCUGGUGAC	298
AUGGGCUAUGACUCUGGUGA	299
GCGCCAGUUCAUGGGCUAUG	300
GUGCGCCAGUUCAUGGGCUA	301
UUGCCAAACCACUGGUGCGC	302
GUUGCCAAACCACUGGUGCG	303
UUGUGACCAGGUUGCCAAAC	304
AUUGUGACCAGGUUGCCAAA	305
CAUUGUGACCAGGUUGCCAA	306
UCCAUUGUGACCAGGUUGCC	307
UUCCAUUGUGACCAGGUUGC	308
AUUCCAUUGUGACCAGGUUG	309
CCAUUCCAUUGUGACCAGGU	310
ACCAUUCCAUUGUGACCAGG	311
CACCAUUCCAUUGUGACCAG	312
CCACCAUUCCAUUGUGACCA	313
UCCACCAUUCCAUUGUGACC	314
UUCCACCAUUCCAUUGUGAC	315
CAGCGAUAAGUUCCAUGUAU	316
ACAGCGAUAAGUUCCAUGUA	317
AACAGCGAUAAGUUCCAUGU	318
UAACAGCGAUAAGUUCCAUG	319
CAUUAACAGCGAUAAGUUCC	320
GCAUUAACAGCGAUAAGUUC	321
GUAGCAUUAACAGCGAUAAG	322
GAUAUGUAGCAUUAACAGCG	323
GCUCUGGAUAUGUAGCAUUA	324
GUUUCCGCUGGUUUGGAGAU	325
GGUUUCCGCUGGUUUGGAGA	326

GGGUUUCCGCUGGUUUGGAG	327
CAUUUCCUGUAUUUGAGUCG	328
CCCUUGUUAUAGGAAACUUC	329
CUCCCUUGUUAUAGGAAACU	330
GCUCCCUUGUUAUAGGAAAC	331
AGCUCCCUUGUUAUAGGAAA	332
AAGCUCCCUUGUUAUAGGAA	333
CCCAGAAAAUCCUUGAGCAU	334
CUCACCCAGAAAAUCCUUGA	335
CUCCUCACCCAGAAAAUCCU	336
UCUCCUCACCCAGAAAAUCC	337
CCACAAGUCAUCAUUCUUAG	338
CUGCUCCACAAGUCAUCAUU	339
ACUGCUCCACAAGUCAUCAU	340
UGACAGACUGCUCCACAAGU	341
UUGACAGACUGCUCCACAAG	342
AUUUGACAGACUGCUCCACA	343
UAUUUGACAGACUGCUCCAC	344
CUAUUUGACAGACUGCUCCA	345
ACUAUUUGACAGACUGCUCC	346
AACUAUUUGACAGACUGCUC	347
CAACUAUUUGACAGACUGCU	348
ACAACUAUUUGACAGACUGC	349
CCACCAGAUGUAAAAUCACU	350
UCCACCAGAUGUAAAAUCAC	351
GACAAACUCCACCAGAUGUA	352
CGAAUGACAAACUCCACCAG	353
CCGAAUGACAAACUCCACCA	354
GAUCCGAAUGACAAACUCCA	355

AUGUUACUUGUCAUCUUGGG	356
GCAUGUUACUUGUCAUCUUG	357
GAGCAUGUUACUUGUCAUCU	358
CGAGCAUGUUACUUGUCAUC	359
GCGAGCAUGUUACUUGUCAU	360
GGCGAGCAUGUUACUUGUCA	361
AGGCGAGCAUGUUACUUGUC	362
AAGGCGAGCAUGUUACUUGU	363
AAAGGCGAGCAUGUUACUUG	364
GAAAGGCGAGCAUGUUACUU	365
AGAAAGGCGAGCAUGUUACU	366
CAGAAAGGCGAGCAUGUUAC	367
CCAGAAAGGCGAGCAUGUUA	368
CCCAGAAAGGCGAGCAUGUU	369
UCUUUGACCUCUGCAUUUUC	370
AUCAUCUCUUUGACCUCUGC	371
CCAUGUAGUCAUCAUCUCUU	372
AGAGUCCAUGUAGUCAUCAU	373
GAGAGUCCAUGUAGUCAUCA	374
GGAGAGUCCAUGUAGUCAUC	375
GAUUCCUUUCUGGAGAGUCC	376
UUGUUUAACCACCAGCAGGG	377
CUUGUUUAACCACCAGCAGG	378
UCUUGUUUAACCACCAGCAG	379
CGUCUUGUUUAACCACCAGC	380
CCGUCUUGUUUAACCACCAG	381
CCCGUCUUGUUUAACCACCA	382
ACCCGUCUUGUUUAACCACC	383
CACCCGUCUUGUUUAACCAC	384

ACACCCGUCUUGUUUAACCA	385
GGAGUGAACACCCGUCUUGU	386
CGGAGUGAACACCCGUCUUG	387
UCGGAGUGAACACCCGUCUU	388
GUCGGAGUGAACACCCGUCU	389
AGUCGGAGUGAACACCCGUC	390
CAGUCGGAGUGAACACCCGU	391
UGCAGUCGGAGUGAACACCC	392
UUGCAGUCGGAGUGAACACC	393
GUUGCAGUCGGAGUGAACAC	394
CCUCCAUUCAGGGUCUUCCU	395
AUGGGAUAUGCCACAGGUAC	396
AAUGGGAUAUGCCACAGGUA	397
CAAUGGGAUAUGCCACAGGU	398
UCAAUGGGAUAUGCCACAGG	399
GUAGGUCAAUGGGAUAUGCC	400
AGUAGGUCAAUGGGAUAUGC	401
GAGUAGGUCAAUGGGAUAUG	402
GGAGUAGGUCAAUGGGAUAU	403
UGGAGUAGGUCAAUGGGAUA	404
CGUGGAGUAGGUCAAUGGGA	405
UCGUGGAGUAGGUCAAUGGG	406
CUCGUGGAGUAGGUCAAUGG	407
CAUUAGAAGAACUCGUGGAG	408
ACAUUAGAAGAACUCGUGGA	409
UCACAUUAGAAGAACUCGUG	410
GAUCACAUUAGAAGAACUCG	411
GGAUCACAUUAGAAGAACUC	412
GUGGAUCACAUUAGAAGAAC	413

AGAAUGUGUCUGUGGAUCAC	414
UAGAAUGUGUCUGUGGAUCA	415
UUUCAGGUAGAUCCAGAGUA	416
UUUUCAGGUAGAUCCAGAGU	417
UCUUUUCAGGUAGAUCCAGA	418
GUCUUUUCAGGUAGAUCCAG	419
GGUCUUUUCAGGUAGAUCCA	420
CUGGUCUUUUCAGGUAGAUC	421
CCAACUGGUCUUUUCAGGUA	422
CCCAACUGGUCUUUUCAGGU	423
ACCCAACUGGUCUUUUCAGG	424
CACCCAACUGGUCUUUUCAG	425
UUCACCCAACUGGUCUUUUC	426
UUUCACCCAACUGGUCUUUU	427
AUUUCACCCAACUGGUCUUU	428
AAUUUCACCCAACUGGUCUU	429
GUAACCAUUUGAGUCCACAU	430
AGUAACCAUUUGAGUCCACA	431
GUAGUAACCAUUUGAGUCCA	432
UGUAGUAACCAUUUGAGUCC	433
CGAUGUAGUAACCAUUUGAG	434
AGUGAACGAUGUAGUAACCA	435
UAGUGAACGAUGUAGUAACC	436
CUCAUAGUGAACGAUGUAGU	437
CCUCAUAGUGAACGAUGUAG	438
CCCUCAUAGUGAACGAUGUA	439
ACCCUCAUAGUGAACGAUGU	440
GACCCUCAUAGUGAACGAUG	441
UGACCCUCAUAGUGAACGAU	442

GAGUUGGUCCCAUCCAUGAC	443
AUGAGUUGGUCCCAUCCAUG	444
AAUGAGUUGGUCCCAUCCAU	445
UAAUGAGUUGGUCCCAUCCA	446
GUAAUGAGUUGGUCCCAUCC	447
UGUAAUGAGUUGGUCCCAUC	448
GUGUAAUGAGUUGGUCCCAU	449
UGUGUAAUGAGUUGGUCCCA	450
CUGUGUAAUGAGUUGGUCCC	451
GCUGUGUAAUGAGUUGGUCC	452
AGCUGUGUAAUGAGUUGGUC	453
GUGUGUGGUUCUGAUUCAGC	454
AAGUGUGUGGUUCUGAUUCA	455
CUUAGGUCUGAGAAGUGUGU	456
CCUUAGGUCUGAGAAGUGUG	457
UCCUUAGGUCUGAGAAGUGU	458
GUCCUUAGGUCUGAGAAGUG	459
UGUCCUUAGGUCUGAGAAGU	460
ACUCUGUCCUUAGGUCUGAG	461
UACUCUGUCCUUAGGUCUGA	462
CUACUCUGUCCUUAGGUCUG	463
UCAGUCUCCCUGCACCAACU	464
GUCAGUCUCCCUGCACCAAC	465
GGUCAGUCUCCCUGCACCAA	466
UUGUCUAGGGUCAGUCUCCC	467
UUUGUCUAGGGUCAGUCUCC	468
CUUUGUCUAGGGUCAGUCUC	469
GCUUUGUCUAGGGUCAGUCU	470
AGCUUUGUCUAGGGUCAGUC	471

GAGCUUUGUCUAGGGUCAGU	472
AAGAGCUUUGUCUAGGGUCA	473
CAAGAGCUUUGUCUAGGGUC	474
UCAAGAGCUUUGUCUAGGGU	475
UGUCAAGAGCUUUGUCUAGG	476
AUGUCAAGAGCUUUGUCUAG	477
CAUGUCAAGAGCUUUGUCUA	478
GUCAUGUCAAGAGCUUUGUC	479
AAGUCAUGUCAAGAGCUUUG	480
GUAAGUCAUGUCAAGAGCUU	481
AGUAAGUCAUGUCAAGAGCU	482
UAGUAAGUCAUGUCAAGAGC	483
GUAGUAAGUCAUGUCAAGAG	484
GGUAGUAAGUCAUGUCAAGA	485
AGGUAGUAAGUCAUGUCAAG	486
GGAGGUAGUAAGUCAUGUCA	487
UGGAGGUAGUAAGUCAUGUC	488
UUGGAGGUAGUAAGUCAUGU	489
GUUGGAGGUAGUAAGUCAUG	490
UGUUGGAGGUAGUAAGUCAU	491
AGACCUUCGAGAAGUGCGGG	492
CAGACCUUCGAGAAGUGCGG	493
ACUCAGACCUUCGAGAAGUG	494
AACUCAGACCUUCGAGAAGU	495
UAACUCAGACCUUCGAGAAG	496
GUAACUCAGACCUUCGAGAA	497
AGUAACUCAGACCUUCGAGA	498
UCCAAGUAACUCAGACCUUC	499
UUCCAAGUAACUCAGACCUU	500

GAUUCCAAGUAACUCAGACC	501
CGAUUCCAAGUAACUCAGAC	502
GUGGUAAAACGAUUCCAAGU	503
UGUGGUAAAACGAUUCCAAG	504
CAUGUGGUAAAACGAUUCCA	505
UCAUGUGGUAAAACGAUUCC	506
CCAUCAUGUGGUAAAACGAU	507
CUGUCCAUCAUGUGGUAAAA	508
UCUGUCCAUCAUGUGGUAAA	509
UUCUGUCCAUCAUGUGGUAA	510
CCUUCUGUCCAUCAUGUGGU	511
CGCUUGAGGUUUUCAGAGAU	512
AACGCUUGAGGUUUUCAGAG	513
UAACGCUUGAGGUUUUCAGA	514
GUAACGCUUGAGGUUUUCAG	515
GGUAACGCUUGAGGUUUUCA	516
AGGUAACGCUUGAGGUUUUC	517
AAGGUAACGCUUGAGGUUUU	518
GAAGGUAACGCUUGAGGUUU	519
AGAAGGUAACGCUUGAGGUU	520
AAGAAGGUAACGCUUGAGGU	521
GAAGAAGGUAACGCUUGAGG	522
UGAAGAAGGUAACGCUUGAG	523
CUGAAGAAGGUAACGCUUGA	524
ACUGAAGAAGGUAACGCUUG	525
UACUGAAGAAGGUAACGCUU	526
CUGUCAAUCACUGGCUUAAA	527
CCUGUCAAUCACUGGCUUAA	528
GCCUGUCAAUCACUGGCUUA	529

UGCCUGUCAAUCACUGGCUU	530
UUGCCUGUCAAUCACUGGCU	531
UUUGCCUGUCAAUCACUGGC	532
GCUUUGCCUGUCAAUCACUG	533
AGCUUUGCCUGUCAAUCACU	534
CAGCUUUGCCUGUCAAUCAC	535
CCAGCUUUGCCUGUCAAUCA	536
UCCAGCUUUGCCUGUCAAUC	537
CUCCAGCUUUGCCUGUCAAU	538
CACUCCAGCUUUGCCUGUCA	539
UCACUCCAGCUUUGCCUGUC	540
UUGUCACUCCAGCUUUGCCU	541
CUUGUCACUCCAGCUUUGCC	542
AGCAUCCUGUCCCAGACUGA	543
UCACAGGCCAGCUUCAAGAG	544
GGUCACAGGCCAGCUUCAAG	545
AGGUCACAGGCCAGCUUCAA	546
UCAGGUCACAGGCCAGCUUC	547
GUUCAGGUCACAGGCCAGCU	548
UGGUUCAGGUCACAGGCCAG	549
AUGGUUCAGGUCACAGGCCA	550
CAUGGUUCAGGUCACAGGCC	551
GAGCAUGGUUCAGGUCACAG	552
GGAGCAUGGUUCAGGUCACA	553
CAAGGAGCAUGGUUCAGGUC	554
GCAAGGAGCAUGGUUCAGGU	555
UGCAAGGAGCAUGGUUCAGG	556
CUUUCUGGAUGCAAGGAGCA	557
GCUUUCUGGAUGCAAGGAGC	558

GCAGCUUUCUGGAUGCAAGG	559
AGCAGCUUUCUGGAUGCAAG	560
CAGCAGCUUUCUGGAUGCAA	561
UCAGCAGCUUUCUGGAUGCA	562
GAGUUCAGCAGCUUUCUGGA	563
AAGAGUUCAGCAGCUUUCUG	564
AGAAGAGUUCAGCAGCUUUC	565
GAGAAGAGUUCAGCAGCUUU	566
UGAGCACCCACAGAAUACAC	567
UGUUGUCUGAGCACCCACAG	568
CUGUUGUCUGAGCACCCACA	569
GCUGUUGUCUGAGCACCCAC	570
AAAAGGUAAUUCCAUCCUGC	571
CACUUGACAUUGACAGUUCA	572
GCACUUGACAUUGACAGUUC	573
AGCACUUGACAUUGACAGUU	574
UUCAGCACUUGACAUUGACA	575
UGUUCAGCACUUGACAUUGA	576
UUGUUCAGCACUUGACAUUG	577
CUCGUUGACAAAGCAUACAG	578
GCUCGUUGACAAAGCAUACA	579
AUGCUUGCUCGUUGACAAAG	580
GAUGCUUGCUCGUUGACAAA	581
UGAUGCUUGCUCGUUGACAA	582
CUGAUGCUUGCUCGUUGACA	583
CCUGAUGCUUGCUCGUUGAC	584
UCCUGAUGCUUGCUCGUUGA	585
UUCCUGAUGCUUGCUCGUUG	586
UUUCCUGAUGCUUGCUCGUU	587

UUUUCCUGAUGCUUGCUCGU	588
CUUUUCCUGAUGCUUGCUCG	589
CUUGAUAACCUUUCCUUCCA	590
UCUUGAUAACCUUUCCUUCC	591
GUCUUGAUAACCUUUCCUUC	592
GUGUCUUGAUAACCUUUCCU	593
GUUCUGUGUCUUGAUAACCU	594
GCUGCCAAGUUCUGUGUCUU	595
AGCUGCCAAGUUCUGUGUCU	596
AGAGCUGCCAAGUUCUGUGU	597
GGAGAGCUGCCAAGUUCUGU	598
AAGGAGAGCUGCCAAGUUCU	599
GAAGGAGAGCUGCCAAGUUC	600
AUGAAGGAGAGCUGCCAAGU	601
CAUGAAGGAGAGCUGCCAAG	602
GCAUGAAGGAGAGCUGCCAA	603
CGCAUGAAGGAGAGCUGCCA	604
UCGCAUGAAGGAGAGCUGCC	605
AUCGCAUGAAGGAGAGCUGC	606
CAAUCGCAUGAAGGAGAGCU	607
GCAAUCGCAUGAAGGAGAGC	608
GGCAAUCGCAUGAAGGAGAG	609
CUGGCAAUCGCAUGAAGGAG	610
UCUGGCAAUCGCAUGAAGGA	611
GUCUGGCAAUCGCAUGAAGG	612
CGUCUGGCAAUCGCAUGAAG	613
ACGUCUGGCAAUCGCAUGAA	614
UCUCUUACAAAAUCCCAUGC	615
AGAAGAUGGGUCCAAUUUUC	616

CAGAAGAUGGGUCCAAUUUU	617
UCAGAAGAUGGGUCCAAUUU	618
UUCAGAAGAUGGGUCCAAUU	619
AAGUGAGCUGUUGUGCCAGA	620
AGAAAAGUGAGCUGUUGUGC	621
GAAGAAAAGUGAGCUGUUGU	622
GAGCCUCAAGAGAUUCAAAA	623
UGAGCCUCAAGAGAUUCAAA	624
CAGAUGUGAUCCUUGAGCCU	625
CCAGAUGUGAUCCUUGAGCC	626
UCCAGAUGUGAUCCUUGAGC	627
GUUAUCGUUUCCAGAACAGU	628
GGUUAUCGUUUCCAGAACAG	629
UGGUUAUCGUUUCCAGAACA	630
UUGGUUAUCGUUUCCAGAAC	631
UAACCAUUAGCCAAGUCCUC	632
UUAACCAUUAGCCAAGUCCU	633
AUUAACCAUUAGCCAAGUCC	634
AUUACAGGCGUGAGCCACCG	635
GAUUACAGGCGUGAGCCACC	636
GGAUUACAGGCGUGAGCCAC	637
GGGAUUACAGGCGUGAGCCA	638
UGGGAUUACAGGCGUGAGCC	639
CUGGGAUUACAGGCGUGAGC	640
GCUGGGAUUACAGGCGUGAG	641
UGCUGGGAUUACAGGCGUGA	642
GUGCUGGGAUUACAGGCGUG	643
AGUGCUGGGAUUACAGGCGU	644
AAGUGCUGGGAUUACAGGCG	645

AAAGUGCUGGGAUUACAGGC	646
CAAAGUGCUGGGAUUACAGG	647
CCAAAGUGCUGGGAUUACAG	648
UCUCAGCCUCCCAAAGUGCU	649
UUCUCAGCCUCCCAAAGUGC	650
CUUCUCAGCCUCCCAAAGUG	651
CCUUCUCAGCCUCCCAAAGU	652
CCCUUCUCAGCCUCCCAAAG	653
AUCUCCUGACCUCGUGAUCC	654
CAUCUCCUGACCUCGUGAUC	655
CCAUCUCCUGACCUCGUGAU	656
UCCAUCUCCUGACCUCGUGA	657
CUCCAUCUCCUGACCUCGUG	658
UCUCCAUCUCCUGACCUCGU	659
CUCACCGUGUUAGCCAGGAU	660
UCUCACCGUGUUAGCCAGGA	661
GUCUCACCGUGUUAGCCAGG	662
GGUCUCACCGUGUUAGCCAG	663
GGGUCUCACCGUGUUAGCCA	664
UACAGGCACCUGCCACCAUG	665
CUACAGGCACCUGCCACCAU	666
ACUACAGGCACCUGCCACCA	667
AGCUGGGACUACAGGCACCU	668
UAGCUGGGACUACAGGCACC	669
CUGCCGAGUAGCUGGGACUA	670
CUCACUGCAAGCUCCACCUC	671
GCUCACUGCAAGCUCCACCU	672
UCGGCUCACUGCAAGCUCCA	673
UCUCGGCUCACUGCAAGCUC	674

AUCUCGGCUCACUGCAAGCU	675
AAUCUCGGCUCACUGCAAGC	676
CAAUCUCGGCUCACUGCAAG	677
GCAAUCUCGGCUCACUGCAA	678
GUGCAAUCUCGGCUCACUGC	679
GGUGCAAUCUCGGCUCACUG	680
UGGUGCAAUCUCGGCUCACU	681
GUGGUGCAAUCUCGGCUCAC	682
AGUGGUGCAAUCUCGGCUCA	683
CAGUGGUGCAAUCUCGGCUC	684
GCAGUGGUGCAAUCUCGGCU	685
AGGCUGGAAUGCAGUGGUGC	686
CAGGCUGGAAUGCAGUGGUG	687
CCAGGCUGGAAUGCAGUGGU	688
ACCCAGGCUGGAAUGCAGUG	689
CACCCAGGCUGGAAUGCAGU	690
UCACCCAGGCUGGAAUGCAG	691
GUCACCCAGGCUGGAAUGCA	692
AGUCACCCAGGCUGGAAUGC	693
CAGUCACCCAGGCUGGAAUG	694
UCAGUCACCCAGGCUGGAAU	695
CUCAGUCACCCAGGCUGGAA	696
GACAGAGUCUCGCUCAGUCA	697
GUCAUGUCUGAUGUACCUUU	698
AGUCAUGUCUGAUGUACCUU	699
CAGUCAUGUCUGAUGUACCU	700
GCAGUCAUGUCUGAUGUACC	701
GGCAGUCAUGUCUGAUGUAC	702
AGGCAGUCAUGUCUGAUGUA	703

CAGGCAGUCAUGUCUGAUGU	704
GCAGGCAGUCAUGUCUGAUG	705
UGCAGGCAGUCAUGUCUGAU	706
CUGUUUGACUUCAUGCAGGC	707
UACCCUGUUUGACUUCAUGC	708
GUUACCCUGUUUGACUUCAU	709
GGUGUUACCCUGUUUGACUU	710
UGGUGUUACCCUGUUUGACU	711
CUGGUGUUACCCUGUUUGAC	712
ACUGGUGUUACCCUGUUUGA	713
CACUGGUGUUACCCUGUUUG	714
UCACUGGUGUUACCCUGUUU	715
UUCACUGGUGUUACCCUGUU	716
CUUCACUGGUGUUACCCUGU	717
AGCUUCACUGGUGUUACCCU	718
UUGAGCUUCACUGGUGUUAC	719
CUUGAGCUUCACUGGUGUUA	720
ACUUGAGCUUCACUGGUGUU	721
GACUUGAGCUUCACUGGUGU	722
CUCUUGACUUGAGCUUCACU	723
UCCACAGCUCUUGACUUGAG	724
AUCCACAGCUCUUGACUUGA	725
UAUCCACAGCUCUUGACUUG	726
GACAAAAUAUCCACAGCUCU	727
AGACAAAAUAUCCACAGCUC	728
GACUUCUUGUUGGUUAGACA	729
UGAGACUUCUUGUUGGUUAG	730
CUUGAGACUUCUUGUUGGUU	731
UCUUGAGACUUCUUGUUGGU	732

UUCUUGAGACUUCUUGUUGG	733
GCCUGAUUUCUUGAGACUUC	734
UGCCUGAUUUCUUGAGACUU	735
CAUCUUUUGGCUGGAUACGA	736
GCAUCUUUUGGCUGGAUACG	737
CCACCACUCCAUCAUCAUGC	738
CCCACCACUCCAUCAUCAUG	739
GAUACUGAACUGGCCUUCCC	740
UAGGAUACUGAACUGGCCUU	741
AUAGGAUACUGAACUGGCCU	742
AAUAGGAUACUGAACUGGCC	743
AAAUAGGAUACUGAACUGGC	744
GGAGAAAGUCACUUGAGGCU	745
UGGAGAAAGUCACUUGAGGC	746
AAUGGAGAAAGUCACUUGAG	747
AGCAAUGGAGAAAGUCACUU	748
UAGCGUGAAGCAAUGGAGAA	749
AUAGCGUGAAGCAAUGGAGA	750
CAUAGCGUGAAGCAAUGGAG	751
GCAUAGCGUGAAGCAAUGGA	752
GGCAUAGCGUGAAGCAAUGG	753
UGGCAUAGCGUGAAGCAAUG	754
GUGGCAUAGCGUGAAGCAAU	755
AGUGGCAUAGCGUGAAGCAA	756
UAGUGGCAUAGCGUGAAGCA	757
AUAGUGGCAUAGCGUGAAGC	758
AAUAGUGGCAUAGCGUGAAG	759
AAAUAGUGGCAUAGCGUGAA	760
AAAAUAGUGGCAUAGCGUGA	761

GCAAAAUAGUGGCAUAGCGU	762
AGCAAAAUAGUGGCAUAGCG	763
AAGCAAAAUAGUGGCAUAGC	764
AACUGGUUGGGCAAACUAUA	765
AAACUGGUUGGGCAAACUAU	766
AAAACUGGUUGGGCAAACUA	767
UAAAACUGGUUGGGCAAACU	768
GUAAAACUGGUUGGGCAAAC	769
CGUAAAACUGGUUGGGCAAA	770
GACGUAAAACUGGUUGGGCA	771
GGACGUAAAACUGGUUGGGC	772
UGGACGUAAAACUGGUUGGG	773
UUGGACGUAAAACUGGUUGG	774
CUUGGACGUAAAACUGGUUG	775
CCUUGGACGUAAAACUGGUU	776
UCCUUGGACGUAAAACUGGU	777
UUCCUUGGACGUAAAACUGG	778
UUUCCUUGGACGUAAAACUG	779
GGCUAAUUUUCCUUGGACGU	780
UGGCUAAUUUUCCUUGGACG	781
GCAUUGGCUAAUUUUCCUUG	782
UUCCUGAUCCUUGCCUUUCA	783
UCUGGUUUCCUGAUCCUUGC	784
UCUCUGGUUUCCUGAUCCUU	785
GUCUCUGGUUUCCUGAUCCU	786
AGUCUCUGGUUUCCUGAUCC	787
AAGUCUCUGGUUUCCUGAUC	788
CCUGACACCUAGUUUCUAAU	789
AACCCUGACACCUAGUUUCU	790

AUAAACCCUGACACCUAGUU	791
GAUAAACCCUGACACCUAGU	792
UGAUAAACCCUGACACCUAG	793
CUUGAUAAACCCUGACACCU	794
UCUUGAUAAACCCUGACACC	795
UUCUUGAUAAACCCUGACAC	796
CUUCUUGAUAAACCCUGACA	797
CCUUCUUGAUAAACCCUGAC	798
GCCUUCUUGAUAAACCCUGA	799
GGCCUUCUUGAUAAACCCUG	800
UGGCCUUCUUGAUAAACCCU	801
UUCCUGGCCUUCUUGAUAAA	802
CAGAGACCAUUCAUUUGGAA	803
CCAGAGACCAUUCAUUUGGA	804
ACCAGAGACCAUUCAUUUGG	805
UGACCAGAGACCAUUCAUUU	806
UUGACCAGAGACCAUUCAUU	807
UUUGACCAGAGACCAUUCAU	808
AUUUGACCAGAGACCAUUCA	809
CAUUUGACCAGAGACCAUUC	810
AUUCAUUUGACCAGAGACCA	811
UUGUAUCUCUGUGAGGGCAG	812
GUAAGGCUUAAACCAAAUGG	813
CAGAUUCGACUUCAUUUGGA	814
GGCAGAUUCGACUUCAUUUG	815
GGGCAGAUUCGACUUCAUUU	816
AGGGCAGAUUCGACUUCAUU	817
GAGGGCAGAUUCGACUUCAU	818
UGAGGGCAGAUUCGACUUCA	819

GUGAGGGCAGAUUCGACUUC	820
UGUGAGGGCAGAUUCGACUU	821
CUGUGAGGGCAGAUUCGACU	822
CUUGUGUCUCUGUGAGGGCA	823
UUCUUGUGUCUCUGUGAGGG	824
AUUUCAGAGAGCAAGAAGCG	825
CAUUUCAGAGAGCAAGAAGC	826
GGCAUUUCAGAGAGCAAGAA	827
CAUUUAGCAGGGCAUUUCAG	828
GCAUUUAGCAGGGCAUUUCA	829
AGCAUUUAGCAGGGCAUUUC	830
AGAAGCAUUUAGCAGGGCAU	831
GAGAAGCAUUUAGCAGGGCA	832
CUCUUGACCCAACAUCCCAA	833
CCUCUUGACCCAACAUCCCA	834
UGGAUUGACUAACACUUUCC	835
GUGGAUUGACUAACACUUUC	836
CUGUGGCAUCAAAGAAAGGU	837
UCUGACUGUGGCAUCAAAGA	838
UCUCUGACUGUGGCAUCAAA	839
GGCCACCCAAACUGUAUUCU	840
ACCACCAAGUCAAAGUUAGA	841
CACCACCAAGUCAAAGUUAG	842
GUCCACCACCAAGUCAAAGU	843
GGUCCACCACCAAGUCAAAG	844
AGGAAGGUCCACCACCAAGU	845
AAGGAAGGUCCACCACCAAG	846
CAAGGAAGGUCCACCACCAA	847
CCAAGGAAGGUCCACCACCA	848

ACCAAGGAAGGUCCACCACC	849
AACCAAGGAAGGUCCACCAC	850
AAACCAAGGAAGGUCCACCA	851
GUUGAUGGUACAGUUCUACU	852
UGUUGAUGGUACAGUUCUAC	853
CAUUGUUGAUGGUACAGUUC	854
GGAAACAUUGUUGAUGGUAC	855
GUAUUGGCACAGUAAUUCUC	856
CAGUAUUGGCACAGUAAUUC	857
UCAAAACAGUAUUGGCACAG	858

In some embodiments, the siRNA molecules targeted to ERAP2 comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 3.

Table 3

Sense Sequence	**SEQ ID NO:**	**Antisense Sequence**	**SEQ ID NO:**
AAAGAUCACAGAAGCUGCC	859	GGCAGCUUCUGUGAUCUUU	860
AAGAUCACAGAAGCUGCCC	861	GGGCAGCUUCUGUGAUCUU	862
AGAUCACAGAAGCUGCCCG	863	CGGGCAGCUUCUGUGAUCU	864
CCGGGAGGUGUUUGAUUAA	865	UUAAUCAAACACCUCCCGG	866
CGGGAGGUGUUUGAUUAAA	867	UUUAAUCAAACACCUCCCG	868
GGGAGGUGUUUGAUUAAAU	869	AUUUAAUCAAACACCUCCC	870
GGAGGUGUUUGAUUAAAUU	871	AAUUUAAUCAAACACCUCC	872
GAGGUGUUUGAUUAAAUUC	873	GAAUUUAAUCAAACACCUC	874
AUGUGACAUAACUGGAGCC	875	GGCUCCAGUUAUGUCACAU	876
UGUGACAUAACUGGAGCCA	877	UGGCUCCAGUUAUGUCACA	878
UGGAGCCAGUGCAGUGCCA	879	UGGCACUGCACUGGCUCCA	880
GCCAGUGCAGUGCCAUGAA	881	UUCAUGGCACUGCACUGGC	882
CCAGUGCAGUGCCAUGAAG	883	CUUCAUGGCACUGCACUGG	884
CAGUGCAGUGCCAUGAAGA	885	UCUUCAUGGCACUGCACUG	886
AGUGCAGUGCCAUGAAGAA	887	UUCUUCAUGGCACUGCACU	888

AGAUUAGCCUGGAUAUUAA	889	UUAAUAUCCAGGCUAAUCU	890
GAUUAGCCUGGAUAUUAAC	891	GUUAAUAUCCAGGCUAAUC	892
AUUAGCCUGGAUAUUAACU	893	AGUUAAUAUCCAGGCUAAU	894
UUAGCCUGGAUAUUAACUU	895	AAGUUAAUAUCCAGGCUAA	896
UAGCCUGGAUAUUAACUUG	897	CAAGUUAAUAUCCAGGCUA	898
GCCUGGAUAUUAACUUGUC	899	GACAAGUUAAUAUCCAGGC	900
CCUGGAUAUUAACUUGUCU	901	AGACAAGUUAAUAUCCAGG	902
CUGGAUAUUAACUUGUCUU	903	AAGACAAGUUAAUAUCCAG	904
UGGAUAUUAACUUGUCUUC	905	GAAGACAAGUUAAUAUCCA	906
GGAUAUUAACUUGUCUUCU	907	AGAAGACAAGUUAAUAUCC	908
AUUAACUUGUCUUCUAGAG	909	CUCUAGAAGACAAGUUAAU	910
AGAAUAGAUUUCAUGUUCC	911	GGAACAUGAAAUCUAUUCU	912
GAAUAGAUUUCAUGUUCCA	913	UGGAACAUGAAAUCUAUUC	914
UAGAUUUCAUGUUCCAUUC	915	GAAUGGAACAUGAAAUCUA	916
GAUUUCAUGUUCCAUUCUU	917	AAGAAUGGAACAUGAAAUC	918
AUUUCAUGUUCCAUUCUUC	919	GAAGAAUGGAACAUGAAAU	920
UUUCAUGUUCCAUUCUUCU	921	AGAAGAAUGGAACAUGAAA	922
UUCAUGUUCCAUUCUUCUG	923	CAGAAGAAUGGAACAUGAA	924
UCAUGUUCCAUUCUUCUGC	925	GCAGAAGAAUGGAACAUGA	926
CAUGUUCCAUUCUUCUGCA	927	UGCAGAAGAAUGGAACAUG	928
UCUUCUGCAAUGGUUAAUU	929	AAUUAACCAUUGCAGAAGA	930
UUCUGCAAUGGUUAAUUCA	931	UGAAUUAACCAUUGCAGAA	932
CAUUCACAGAGGAUUUUAC	933	GUAAAAUCCUCUGUGAAUG	934
AUUCACAGAGGAUUUUACU	935	AGUAAAAUCCUCUGUGAAU	936
ACAGAGGAUUUUACUGCUU	937	AAGCAGUAAAAUCCUCUGU	938
CAGAGGAUUUUACUGCUUA	939	UAAGCAGUAAAAUCCUCUG	940
AGAGGAUUUUACUGCUUAA	941	UUAAGCAGUAAAAUCCUCU	942
GAGGAUUUUACUGCUUAAC	943	GUUAAGCAGUAAAAUCCUC	944
AUAUGCAUUUGUUCUCAGU	945	ACUGAGAACAAAUGCAUAU	946
AUGCAUUUGUUCUCAGUUC	947	GAACUGAGAACAAAUGCAU	948
UUUGUUCUCAGUUCUCAGU	949	ACUGAGAACUGAGAACAAA	950

UUGUUCUCAGUUCUCAGUG	951	CACUGAGAACUGAGAACAA	952
GUUCUCAGUUCUCAGUGCC	953	GGCACUGAGAACUGAGAAC	954
UUCUCAGUUCUCAGUGCCA	955	UGGCACUGAGAACUGAGAA	956
CAGUUCUCAGUGCCAUCUA	957	UAGAUGGCACUGAGAACUG	958
AGUUCUCAGUGCCAUCUAG	959	CUAGAUGGCACUGAGAACU	960
UCAGUGCCAUCUAGUUAUC	961	GAUAACUAGAUGGCACUGA	962
CAGUGCCAUCUAGUUAUCA	963	UGAUAACUAGAUGGCACUG	964
AGUGCCAUCUAGUUAUCAC	965	GUGAUAACUAGAUGGCACU	966
GUGCCAUCUAGUUAUCACU	967	AGUGAUAACUAGAUGGCAC	968
UGCCAUCUAGUUAUCACUU	969	AAGUGAUAACUAGAUGGCA	970
GCCAUCUAGUUAUCACUUC	971	GAAGUGAUAACUAGAUGGC	972
CCAUCUAGUUAUCACUUCA	973	UGAAGUGAUAACUAGAUGG	974
CAUCUAGUUAUCACUUCAC	975	GUGAAGUGAUAACUAGAUG	976
AUCUAGUUAUCACUUCACU	977	AGUGAAGUGAUAACUAGAU	978
UCUAGUUAUCACUUCACUG	979	CAGUGAAGUGAUAACUAGA	980
CUAGUUAUCACUUCACUGA	981	UCAGUGAAGUGAUAACUAG	982
UAGUUAUCACUUCACUGAG	983	CUCAGUGAAGUGAUAACUA	984
AGUUAUCACUUCACUGAGG	985	CCUCAGUGAAGUGAUAACU	986
GUUAUCACUUCACUGAGGA	987	UCCUCAGUGAAGUGAUAAC	988
UUAUCACUUCACUGAGGAU	989	AUCCUCAGUGAAGUGAUAA	990
UAUCACUUCACUGAGGAUC	991	GAUCCUCAGUGAAGUGAUA	992
AUCACUUCACUGAGGAUCC	993	GGAUCCUCAGUGAAGUGAU	994
UCACUUCACUGAGGAUCCU	995	AGGAUCCUCAGUGAAGUGA	996
GCUUUCCCAGUAGCCACUA	997	UAGUGGCUACUGGGAAAGC	998
CUUUCCCAGUAGCCACUAA	999	UUAGUGGCUACUGGGAAAG	1000
UUUCCCAGUAGCCACUAAU	1001	AUUAGUGGCUACUGGGAAA	1002
UUCCCAGUAGCCACUAAUG	1003	CAUUAGUGGCUACUGGGAA	1004
UCCCAGUAGCCACUAAUGG	1005	CCAUUAGUGGCUACUGGGA	1006
CUUGGCAGGAGCUAAGGCU	1007	AGCCUUAGCUCCUGCCAAG	1008

In some embodiments, the siRNA molecules targeted to ERAP2 comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 4.

Table 4

Sense Sequence	SEQ ID NO:	Antisense Sequence	SEQ ID NO:
UCAAAUCUGCAGCAGCAUG	1009	CAUGCUGCUGCAGAUUUGA	1010
CAAAUCUGCAGCAGCAUGA	1011	UCAUGCUGCUGCAGAUUUG	1012
AAAUCUGCAGCAGCAUGAU	1013	AUCAUGCUGCUGCAGAUUU	1014
AUGUGACAUAACUGGAGCC	1015	GGCUCCAGUUAUGUCACAU	1016
UGUGACAUAACUGGAGCCA	1017	UGGCUCCAGUUAUGUCACA	1018
UGGAGCCAGUGCAGUGCCA	1019	UGGCACUGCACUGGCUCCA	1020
GCCAGUGCAGUGCCAUGAA	1021	UUCAUGGCACUGCACUGGC	1022
CCAGUGCAGUGCCAUGAAG	1023	CUUCAUGGCACUGCACUGG	1024
CAGUGCAGUGCCAUGAAGA	1025	UCUUCAUGGCACUGCACUG	1026
AGUGCAGUGCCAUGAAGAA	1027	UUCUUCAUGGCACUGCACU	1028
AGAUUAGCCUGGAUAUUAA	1029	UUAAUAUCCAGGCUAAUCU	1030
GAUUAGCCUGGAUAUUAAC	1031	GUUAAUAUCCAGGCUAAUC	1032
AUUAGCCUGGAUAUUAACU	1033	AGUUAAUAUCCAGGCUAAU	1034
UUAGCCUGGAUAUUAACUU	1035	AAGUUAAUAUCCAGGCUAA	1036
UAGCCUGGAUAUUAACUUG	1037	CAAGUUAAUAUCCAGGCUA	1038
GCCUGGAUAUUAACUUGUC	1039	GACAAGUUAAUAUCCAGGC	1040
CCUGGAUAUUAACUUGUCU	1041	AGACAAGUUAAUAUCCAGG	1042
CUGGAUAUUAACUUGUCUU	1043	AAGACAAGUUAAUAUCCAG	1044
UGGAUAUUAACUUGUCUUC	1045	GAAGACAAGUUAAUAUCCA	1046
GGAUAUUAACUUGUCUUCU	1047	AGAAGACAAGUUAAUAUCC	1048
AUUAACUUGUCUUCUAGAG	1049	CUCUAGAAGACAAGUUAAU	1050
AGAAUAGAUUUCAUGUUCC	1051	GGAACAUGAAAUCUAUUCU	1052
GAAUAGAUUUCAUGUUCCA	1053	UGGAACAUGAAAUCUAUUC	1054
UAGAUUUCAUGUUCCAUUC	1055	GAAUGGAACAUGAAAUCUA	1056
GAUUUCAUGUUCCAUUCUU	1057	AAGAAUGGAACAUGAAAUC	1058
AUUUCAUGUUCCAUUCUUC	1059	GAAGAAUGGAACAUGAAAU	1060
UUUCAUGUUCCAUUCUUCU	1061	AGAAGAAUGGAACAUGAAA	1062

UUCAUGUUCCAUUCUUCUG	1063	CAGAAGAAUGGAACAUGAA	1064
UCAUGUUCCAUUCUUCUGC	1065	GCAGAAGAAUGGAACAUGA	1066
CAUGUUCCAUUCUUCUGCA	1067	UGCAGAAGAAUGGAACAUG	1068
UCUUCUGCAAUGGUUAAUU	1069	AAUUAACCAUUGCAGAAGA	1070
UUCUGCAAUGGUUAAUUCA	1071	UGAAUUAACCAUUGCAGAA	1072
CAUUCACAGAGGAUUUUAC	1073	GUAAAAUCCUCUGUGAAUG	1074
AUUCACAGAGGAUUUUACU	1075	AGUAAAAUCCUCUGUGAAU	1076
ACAGAGGAUUUUACUGCUU	1077	AAGCAGUAAAAUCCUCUGU	1078
CAGAGGAUUUUACUGCUUA	1079	UAAGCAGUAAAAUCCUCUG	1080
AGAGGAUUUUACUGCUUAA	1081	UUAAGCAGUAAAAUCCUCU	1082
GAGGAUUUUACUGCUUAAC	1083	GUUAAGCAGUAAAAUCCUC	1084
AUAUGCAUUUGUUCUCAGU	1085	ACUGAGAACAAAUGCAUAU	1086
AUGCAUUUGUUCUCAGUUC	1087	GAACUGAGAACAAAUGCAU	1088
UUUGUUCUCAGUUCUCAGU	1089	ACUGAGAACUGAGAACAAA	1090
UUGUUCUCAGUUCUCAGUG	1091	CACUGAGAACUGAGAACAA	1092
GUUCUCAGUUCUCAGUGCC	1093	GGCACUGAGAACUGAGAAC	1094
UUCUCAGUUCUCAGUGCCA	1095	UGGCACUGAGAACUGAGAA	1096
CAGUUCUCAGUGCCAUCUA	1097	UAGAUGGCACUGAGAACUG	1098
AGUUCUCAGUGCCAUCUAG	1099	CUAGAUGGCACUGAGAACU	1100
UCAGUGCCAUCUAGUUAUC	1101	GAUAACUAGAUGGCACUGA	1102
CAGUGCCAUCUAGUUAUCA	1103	UGAUAACUAGAUGGCACUG	1104
AGUGCCAUCUAGUUAUCAC	1105	GUGAUAACUAGAUGGCACU	1106
GUGCCAUCUAGUUAUCACU	1107	AGUGAUAACUAGAUGGCAC	1108
UGCCAUCUAGUUAUCACUU	1109	AAGUGAUAACUAGAUGGCA	1110
GCCAUCUAGUUAUCACUUC	1111	GAAGUGAUAACUAGAUGGC	1112
CCAUCUAGUUAUCACUUCA	1113	UGAAGUGAUAACUAGAUGG	1114
CAUCUAGUUAUCACUUCAC	1115	GUGAAGUGAUAACUAGAUG	1116
AUCUAGUUAUCACUUCACU	1117	AGUGAAGUGAUAACUAGAU	1118
UCUAGUUAUCACUUCACUG	1119	CAGUGAAGUGAUAACUAGA	1120
CUAGUUAUCACUUCACUGA	1121	UCAGUGAAGUGAUAACUAG	1122
UAGUUAUCACUUCACUGAG	1123	CUCAGUGAAGUGAUAACUA	1124

AGUUAUCACUUCACUGAGG	1125	CCUCAGUGAAGUGAUAACU	1126
GUUAUCACUUCACUGAGGA	1127	UCCUCAGUGAAGUGAUAAC	1128
UUAUCACUUCACUGAGGAU	1129	AUCCUCAGUGAAGUGAUAA	1130
UAUCACUUCACUGAGGAUC	1131	GAUCCUCAGUGAAGUGAUA	1132
AUCACUUCACUGAGGAUCC	1133	GGAUCCUCAGUGAAGUGAU	1134
UCACUUCACUGAGGAUCCU	1135	AGGAUCCUCAGUGAAGUGA	1136
GCUUUCCCAGUAGCCACUA	1137	UAGUGGCUACUGGGAAAGC	1138
CUUUCCCAGUAGCCACUAA	1139	UUAGUGGCUACUGGGAAAG	1140
UUUCCCAGUAGCCACUAAU	1141	AUUAGUGGCUACUGGGAAA	1142
UUCCCAGUAGCCACUAAUG	1143	CAUUAGUGGCUACUGGGAA	1144
UCCCAGUAGCCACUAAUGG	1145	CCAUUAGUGGCUACUGGGA	1146
CUUGGCAGGAGCUAAGGCU	1147	AGCCUUAGCUCCUGCCAAG	1148
CCAGUGUGGUCAUUCCUCU	1149	AGAGGAAUGACCACACUGG	1150
GUCAUUCCUCUCCAUUAUG	1151	CAUAAUGGAGAGGAAUGAC	1152
CAUUCCUCUCCAUUAUGAC	1153	GUCAUAAUGGAGAGGAAUG	1154
AUUCCUCUCCAUUAUGACC	1155	GGUCAUAAUGGAGAGGAAU	1156
CUCUCCAUUAUGACCUCUU	1157	AAGAGGUCAUAAUGGAGAG	1158
UCUCCAUUAUGACCUCUUU	1159	AAAGAGGUCAUAAUGGAGA	1160
CUCCAUUAUGACCUCUUUG	1161	CAAAGAGGUCAUAAUGGAG	1162
UCCAUUAUGACCUCUUUGU	1163	ACAAAGAGGUCAUAAUGGA	1164
CCAUUAUGACCUCUUUGUC	1165	GACAAAGAGGUCAUAAUGG	1166
CAUUAUGACCUCUUUGUCC	1167	GGACAAAGAGGUCAUAAUG	1168
CCCAAUCUCACCUCUCUGG	1169	CCAGAGAGGUGAGAUUGGG	1170
UCUCACCUCUCUGGACUUU	1171	AAAGUCCAGAGAGGUGAGA	1172
CUCACCUCUCUGGACUUUG	1173	CAAAGUCCAGAGAGGUGAG	1174
UCACCUCUCUGGACUUUGU	1175	ACAAAGUCCAGAGAGGUGA	1176
UCUCUGGACUUUGUUGCAU	1177	AUGCAACAAAGUCCAGAGA	1178
CUCUGGACUUUGUUGCAUC	1179	GAUGCAACAAAGUCCAGAG	1180
CUGGACUUUGUUGCAUCUG	1181	CAGAUGCAACAAAGUCCAG	1182
GGACUUUGUUGCAUCUGAG	1183	CUCAGAUGCAACAAAGUCC	1184
GAAGUCUUGGUCAGCAAUG	1185	CAUUGCUGACCAAGACUUC	1186

AAGUCUUGGUCAGCAAUGC	1187	GCAUUGCUGACCAAGACUU	1188
AGUCUUGGUCAGCAAUGCU	1189	AGCAUUGCUGACCAAGACU	1190
GUCUUGGUCAGCAAUGCUA	1191	UAGCAUUGCUGACCAAGAC	1192
UCUUGGUCAGCAAUGCUAC	1193	GUAGCAUUGCUGACCAAGA	1194
CUUGGUCAGCAAUGCUACC	1195	GGUAGCAUUGCUGACCAAG	1196
UUGGUCAGCAAUGCUACCC	1197	GGGUAGCAUUGCUGACCAA	1198
UGGUCAGCAAUGCUACCCA	1199	UGGGUAGCAUUGCUGACCA	1200
GGUCAGCAAUGCUACCCAG	1201	CUGGGUAGCAUUGCUGACC	1202
GUCAGCAAUGCUACCCAGU	1203	ACUGGGUAGCAUUGCUGAC	1204
UCAGCAAUGCUACCCAGUU	1205	AACUGGGUAGCAUUGCUGA	1206
CAGCAAUGCUACCCAGUUU	1207	AAACUGGGUAGCAUUGCUG	1208
AGCAAUGCUACCCAGUUUA	1209	UAAACUGGGUAGCAUUGCU	1210
CAAUGCUACCCAGUUUAUC	1211	GAUAAACUGGGUAGCAUUG	1212
AAUGCUACCCAGUUUAUCA	1213	UGAUAAACUGGGUAGCAUU	1214
AUGCUACCCAGUUUAUCAU	1215	AUGAUAAACUGGGUAGCAU	1216
UGCUACCCAGUUUAUCAUC	1217	GAUGAUAAACUGGGUAGCA	1218
GCUACCCAGUUUAUCAUCU	1219	AGAUGAUAAACUGGGUAGC	1220
CUACCCAGUUUAUCAUCUU	1221	AAGAUGAUAAACUGGGUAG	1222
UACCCAGUUUAUCAUCUUG	1223	CAAGAUGAUAAACUGGGUA	1224
ACCCAGUUUAUCAUCUUGC	1225	GCAAGAUGAUAAACUGGGU	1226
CCCAGUUUAUCAUCUUGCA	1227	UGCAAGAUGAUAAACUGGG	1228
GUUUAUCAUCUUGCACAGC	1229	GCUGUGCAAGAUGAUAAAC	1230
UUUAUCAUCUUGCACAGCA	1231	UGCUGUGCAAGAUGAUAAA	1232
UCACGAAUGCCACCCUUCA	1233	UGAAGGGUGGCAUUCGUGA	1234
CACGAAUGCCACCCUUCAG	1235	CUGAAGGGUGGCAUUCGUG	1236
ACGAAUGCCACCCUUCAGU	1237	ACUGAAGGGUGGCAUUCGU	1238
CGAAUGCCACCCUUCAGUC	1239	GACUGAAGGGUGGCAUUCG	1240
GAAUGCCACCCUUCAGUCA	1241	UGACUGAAGGGUGGCAUUC	1242
UUCAGUCAGAGGAAGAUUC	1243	GAAUCUUCCUCUGACUGAA	1244
UCAGUCAGAGGAAGAUUCA	1245	UGAAUCUUCCUCUGACUGA	1246
CAGUCAGAGGAAGAUUCAA	1247	UUGAAUCUUCCUCUGACUG	1248

AGUCAGAGGAAGAUUCAAG	1249	CUUGAAUCUUCCUCUGACU	1250
GUCAGAGGAAGAUUCAAGA	1251	UCUUGAAUCUUCCUCUGAC	1252
CAGAGGAAGAUUCAAGAUA	1253	UAUCUUGAAUCUUCCUCUG	1254
AGAGGAAGAUUCAAGAUAC	1255	GUAUCUUGAAUCUUCCUCU	1256
GAGGAAGAUUCAAGAUACA	1257	UGUAUCUUGAAUCUUCCUC	1258
AGGAAGAUUCAAGAUACAU	1259	AUGUAUCUUGAAUCUUCCU	1260
GGAAGAUUCAAGAUACAUG	1261	CAUGUAUCUUGAAUCUUCC	1262
GAAGAUUCAAGAUACAUGA	1263	UCAUGUAUCUUGAAUCUUC	1264
AAAGUUUUGAGUUACCCUG	1265	CAGGGUAACUCAAAACUUU	1266
CAAAUUGCACUGCUGGUUC	1267	GAACCAGCAGUGCAAUUUG	1268
AAAUUGCACUGCUGGUUCC	1269	GGAACCAGCAGUGCAAUUU	1270
AAUUGCACUGCUGGUUCCA	1271	UGGAACCAGCAGUGCAAUU	1272
AUUGCACUGCUGGUUCCAG	1273	CUGGAACCAGCAGUGCAAU	1274
UUGCACUGCUGGUUCCAGA	1275	UCUGGAACCAGCAGUGCAA	1276
AAAUACUAUGUGGCUAUGG	1277	CCAUAGCCACAUAGUAUUU	1278
AAUACUAUGUGGCUAUGGA	1279	UCCAUAGCCACAUAGUAUU	1280
AUACUAUGUGGCUAUGGAC	1281	GUCCAUAGCCACAUAGUAU	1282
UACUAUGUGGCUAUGGACU	1283	AGUCCAUAGCCACAUAGUA	1284
ACUAUGUGGCUAUGGACUU	1285	AAGUCCAUAGCCACAUAGU	1286
CUAUGUGGCUAUGGACUUC	1287	GAAGUCCAUAGCCACAUAG	1288
UAUGUGGCUAUGGACUUCC	1289	GGAAGUCCAUAGCCACAUA	1290
AUGUGGCUAUGGACUUCCA	1291	UGGAAGUCCAUAGCCACAU	1292
UGUGGCUAUGGACUUCCAA	1293	UUGGAAGUCCAUAGCCACA	1294
GUGGCUAUGGACUUCCAAG	1295	CUUGGAAGUCCAUAGCCAC	1296
UGGCUAUGGACUUCCAAGC	1297	GCUUGGAAGUCCAUAGCCA	1298
GCUAUGGACUUCCAAGCCA	1299	UGGCUUGGAAGUCCAUAGC	1300
CUAUGGACUUCCAAGCCAA	1301	UUGGCUUGGAAGUCCAUAG	1302
UAUGGACUUCCAAGCCAAG	1303	CUUGGCUUGGAAGUCCAUA	1304
CUUCCAAGCCAAGUUAGGU	1305	ACCUAACUUGGCUUGGAAG	1306
UUCCAAGCCAAGUUAGGUG	1307	CACCUAACUUGGCUUGGAA	1308
UCCAAGCCAAGUUAGGUGA	1309	UCACCUAACUUGGCUUGGA	1310

CCAAGCCAAGUUAGGUGAU	1311	AUCACCUAACUUGGCUUGG	1312
CAAGCCAAGUUAGGUGAUG	1313	CAUCACCUAACUUGGCUUG	1314
AAGCCAAGUUAGGUGAUGG	1315	CCAUCACCUAACUUGGCUU	1316
CCAAGUUAGGUGAUGGCUU	1317	AAGCCAUCACCUAACUUGG	1318
CAAGUUAGGUGAUGGCUUU	1319	AAAGCCAUCACCUAACUUG	1320
UUAGGUGAUGGCUUUGAAG	1321	CUUCAAAGCCAUCACCUAA	1322
GUGAUGGCUUUGAAGGGUU	1323	AACCCUUCAAAGCCAUCAC	1324
UGAUGGCUUUGAAGGGUUU	1325	AAACCCUUCAAAGCCAUCA	1326
GAUGGCUUUGAAGGGUUUU	1327	AAAACCCUUCAAAGCCAUC	1328
AUGGCUUUGAAGGGUUUUA	1329	UAAAACCCUUCAAAGCCAU	1330
UGGCUUUGAAGGGUUUUAU	1331	AUAAAACCCUUCAAAGCCA	1332
UGAAGGGUUUUAUAAAAGC	1333	GCUUUUAUAAAACCCUUCA	1334
GAAGGGUUUUAUAAAAGCA	1335	UGCUUUUAUAAAACCCUUC	1336
AAGGGUUUUAUAAAAGCAC	1337	GUGCUUUUAUAAAACCCUU	1338
AGAUUUUGAGCCAACCCAG	1339	CUGGGUUGGCUCAAAAUCU	1340
GAUUUUGAGCCAACCCAGG	1341	CCUGGGUUGGCUCAAAAUC	1342
AUUUUGAGCCAACCCAGGC	1343	GCCUGGGUUGGCUCAAAAU	1344
AGCCAACCCAGGCACGCAU	1345	AUGCGUGCCUGGGUUGGCU	1346
AACCCAGGCACGCAUGGCU	1347	AGCCAUGCGUGCCUGGGUU	1348
ACCCAGGCACGCAUGGCUU	1349	AAGCCAUGCGUGCCUGGGU	1350
CCCAGGCACGCAUGGCUUU	1351	AAAGCCAUGCGUGCCUGGG	1352
CCAGGCACGCAUGGCUUUC	1353	GAAAGCCAUGCGUGCCUGG	1354
CAGGCACGCAUGGCUUUCC	1355	GGAAAGCCAUGCGUGCCUG	1356
CACGCAUGGCUUUCCCUUG	1357	CAAGGGAAAGCCAUGCGUG	1358
CAUGGCUUUCCCUUGCUUU	1359	AAAGCAAGGGAAAGCCAUG	1360
GCUUUCCCUUGCUUUGAUG	1361	CAUCAAAGCAAGGGAAAGC	1362
CUUUCCCUUGCUUUGAUGA	1363	UCAUCAAAGCAAGGGAAAG	1364
UUUCCCUUGCUUUGAUGAA	1365	UUCAUCAAAGCAAGGGAAA	1366
AAGCCAACUUUUCAAUCAA	1367	UUGAUUGAAAAGUUGGCUU	1368
AGCCAACUUUUCAAUCAAG	1369	CUUGAUUGAAAAGUUGGCU	1370
GCCAACUUUUCAAUCAAGA	1371	UCUUGAUUGAAAAGUUGGC	1372

CCAACUUUUCAAUCAAGAU	1373	AUCUUGAUUGAAAAGUUGG	1374
ACUUUUCAAUCAAGAUACG	1375	CGUAUCUUGAUUGAAAAGU	1376
CUUUUCAAUCAAGAUACGA	1377	UCGUAUCUUGAUUGAAAAG	1378
UUUCAAUCAAGAUACGAAG	1379	CUUCGUAUCUUGAUUGAAA	1380
UUCAAUCAAGAUACGAAGA	1381	UCUUCGUAUCUUGAUUGAA	1382
UCAAUCAAGAUACGAAGAG	1383	CUCUUCGUAUCUUGAUUGA	1384
GCAGGCAUAUUGCACUAUC	1385	GAUAGUGCAAUAUGCCUGC	1386
CAGGCAUAUUGCACUAUCC	1387	GGAUAGUGCAAUAUGCCUG	1388
CUUGAAGGAGGUCUUUUGG	1389	CCAAAAGACCUCCUUCAAG	1390
UUGAAGGAGGUCUUUUGGA	1391	UCCAAAAGACCUCCUUCAA	1392
GAAGGAGGUCUUUUGGAAG	1393	CUUCCAAAAGACCUCCUUC	1394
UUUGGAAGAUCACUUUGAA	1395	UUCAAAGUGAUCUUCCAAA	1396
AAAAUGAGUACAUACCUUG	1397	CAAGGUAUGUACUCAUUUU	1398
AAAUGAGUACAUACCUUGU	1399	ACAAGGUAUGUACUCAUUU	1400
GUAGCCUACAUAGUUUGUG	1401	CACAAACUAUGUAGGCUAC	1402
AUAGUUUGUGAUUUCCACU	1403	AGUGGAAAUCACAAACUAU	1404
UAGUUUGUGAUUUCCACUC	1405	GAGUGGAAAUCACAAACUA	1406
AGUUUGUGAUUUCCACUCU	1407	AGAGUGGAAAUCACAAACU	1408
GUUUGUGAUUUCCACUCUC	1409	GAGAGUGGAAAUCACAAAC	1410
UUUGUGAUUUCCACUCUCU	1411	AGAGAGUGGAAAUCACAAA	1412
UUGUGAUUUCCACUCUCUG	1413	CAGAGAGUGGAAAUCACAA	1414
UGUGAUUUCCACUCUCUGA	1415	UCAGAGAGUGGAAAUCACA	1416
GUGAUUUCCACUCUCUGAG	1417	CUCAGAGAGUGGAAAUCAC	1418
GGGUCAAGGUGUCCAUCUA	1419	UAGAUGGACACCUUGACCC	1420
GGUCAAGGUGUCCAUCUAU	1421	AUAGAUGGACACCUUGACC	1422
GUCAAGGUGUCCAUCUAUG	1423	CAUAGAUGGACACCUUGAC	1424
UCAAGGUGUCCAUCUAUGC	1425	GCAUAGAUGGACACCUUGA	1426
UGCUUUGCAGGCAUCACUG	1427	CAGUGAUGCCUGCAAAGCA	1428
GCUUUGCAGGCAUCACUGA	1429	UCAGUGAUGCCUGCAAAGC	1430
CUUUGCAGGCAUCACUGAA	1431	UUCAGUGAUGCCUGCAAAG	1432
UUUGCAGGCAUCACUGAAG	1433	CUUCAGUGAUGCCUGCAAA	1434

UUGCAGGCAUCACUGAAGC	1435	GCUUCAGUGAUGCCUGCAA	1436
CAGGCAUCACUGAAGCUAC	1437	GUAGCUUCAGUGAUGCCUG	1438
AGGCAUCACUGAAGCUACU	1439	AGUAGCUUCAGUGAUGCCU	1440
GGCAUCACUGAAGCUACUU	1441	AAGUAGCUUCAGUGAUGCC	1442
AUAUCUACUAUCCACUCUC	1443	GAGAGUGGAUAGUAGAUAU	1444
CUACUAUCCACUCUCCAAA	1445	UUUGGAGAGUGGAUAGUAG	1446
CUGGAUUUAAUUGCUAUUC	1447	GAAUAGCAAUUAAAUCCAG	1448
UGGAUUUAAUUGCUAUUCC	1449	GGAAUAGCAAUUAAAUCCA	1450
GGAUUUAAUUGCUAUUCCU	1451	AGGAAUAGCAAUUAAAUCC	1452
UUAAUUGCUAUUCCUGACU	1453	AGUCAGGAAUAGCAAUUAA	1454
UAAUUGCUAUUCCUGACUU	1455	AAGUCAGGAAUAGCAAUUA	1456
AAUUGCUAUUCCUGACUUU	1457	AAAGUCAGGAAUAGCAAUU	1458
AUUGCUAUUCCUGACUUUG	1459	CAAAGUCAGGAAUAGCAAU	1460
UUGCUAUUCCUGACUUUGC	1461	GCAAAGUCAGGAAUAGCAA	1462
UGCUAUUCCUGACUUUGCA	1463	UGCAAAGUCAGGAAUAGCA	1464
CCUGACUUUGCACCUGGAG	1465	CUCCAGGUGCAAAGUCAGG	1466
CUGACUUUGCACCUGGAGC	1467	GCUCCAGGUGCAAAGUCAG	1468
GACUUUGCACCUGGAGCCA	1469	UGGCUCCAGGUGCAAAGUC	1470
UUGCACCUGGAGCCAUGGA	1471	UCCAUGGCUCCAGGUGCAA	1472
UGCACCUGGAGCCAUGGAA	1473	UUCCAUGGCUCCAGGUGCA	1474
GGGCCUCAUUACAUAUAGG	1475	CCUAUAUGUAAUGAGGCCC	1476
GGCCUCAUUACAUAUAGGG	1477	CCCUAUAUGUAAUGAGGCC	1478
GCCUCAUUACAUAUAGGGA	1479	UCCCUAUAUGUAAUGAGGC	1480
CCAAGACCUCUUCUGCUUC	1481	GAAGCAGAAGAGGUCUUGG	1482
CAAGACCUCUUCUGCUUCC	1483	GGAAGCAGAAGAGGUCUUG	1484
AAGACCUCUUCUGCUUCCG	1485	CGGAAGCAGAAGAGGUCUU	1486
AGACCUCUUCUGCUUCCGA	1487	UCGGAAGCAGAAGAGGUCU	1488
GACCUCUUCUGCUUCCGAU	1489	AUCGGAAGCAGAAGAGGUC	1490
ACCUCUUCUGCUUCCGAUA	1491	UAUCGGAAGCAGAAGAGGU	1492
CCUCUUCUGCUUCCGAUAA	1493	UUAUCGGAAGCAGAAGAGG	1494
CUCUUCUGCUUCCGAUAAA	1495	UUUAUCGGAAGCAGAAGAG	1496

CUGUGGGUCACCAGAGUCA	1497	UGACUCUGGUGACCCACAG	1498
UGUGGGUCACCAGAGUCAU	1499	AUGACUCUGGUGACCCACA	1500
GUGGGUCACCAGAGUCAUA	1501	UAUGACUCUGGUGACCCAC	1502
UGGGUCACCAGAGUCAUAG	1503	CUAUGACUCUGGUGACCCA	1504
UCACCAGAGUCAUAGCCCA	1505	UGGGCUAUGACUCUGGUGA	1506
ACCAGAGUCAUAGCCCAUG	1507	CAUGGGCUAUGACUCUGGU	1508
GCGCACCAGUGGUUUGGCA	1509	UGCCAAACCACUGGUGCGC	1510
CGCACCAGUGGUUUGGCAA	1511	UUGCCAAACCACUGGUGCG	1512
GCACCAGUGGUUUGGCAAC	1513	GUUGCCAAACCACUGGUGC	1514
GUUUGGCAACCUGGUCACA	1515	UGUGACCAGGUUGCCAAAC	1516
AAUGGUGGAAUGAUAUUUG	1517	CAAAUAUCAUUCCACCAUU	1518
AUGGUGGAAUGAUAUUUGG	1519	CCAAAUAUCAUUCCACCAU	1520
UGGUGGAAUGAUAUUUGGC	1521	GCCAAAUAUCAUUCCACCA	1522
GGUGGAAUGAUAUUUGGCU	1523	AGCCAAAUAUCAUUCCACC	1524
GUGGAAUGAUAUUUGGCUU	1525	AAGCCAAAUAUCAUUCCAC	1526
UGGAAUGAUAUUUGGCUUA	1527	UAAGCCAAAUAUCAUUCCA	1528
GGAAUGAUAUUUGGCUUAA	1529	UUAAGCCAAAUAUCAUUCC	1530
GAGGGUUUUGCAAAAUACA	1531	UGUAUUUUGCAAAACCCUC	1532
AGGGUUUUGCAAAAUACAU	1533	AUGUAUUUUGCAAAACCCU	1534
GGGUUUUGCAAAAUACAUG	1535	CAUGUAUUUUGCAAAACCC	1536
GGUUUUGCAAAAUACAUGG	1537	CCAUGUAUUUUGCAAAACC	1538
GUUUUGCAAAAUACAUGGA	1539	UCCAUGUAUUUUGCAAAAC	1540
AACUUAUCGCUGUUAAUGC	1541	GCAUUAACAGCGAUAAGUU	1542
ACUUAUCGCUGUUAAUGCU	1543	AGCAUUAACAGCGAUAAGU	1544
CUUAUCGCUGUUAAUGCUA	1545	UAGCAUUAACAGCGAUAAG	1546
UUAUCGCUGUUAAUGCUAC	1547	GUAGCAUUAACAGCGAUAA	1548
UAUCGCUGUUAAUGCUACA	1549	UGUAGCAUUAACAGCGAUA	1550
UUGAAUGUGUGUUUUGAAG	1551	CUUCAAAACACACAUUCAA	1552
UGAAUGUGUGUUUUGAAGU	1553	ACUUCAAAACACACAUUCA	1554
GAAUGUGUGUUUUGAAGUA	1555	UACUUCAAAACACACAUUC	1556
UUCAUUGAAUUCAUCCCGC	1557	GCGGGAUGAAUUCAAUGAA	1558

AAUGUUUGAUGAAGUUUCC	1559	GGAAACUUCAUCAAACAUU	1560
AAGGGAGCUUGUAUUUUGA	1561	UCAAAAUACAAGCUCCCUU	1562
GGGAGCUUGUAUUUUGAAU	1563	AUUCAAAAUACAAGCUCCC	1564
GAAUAUGCUCAAGGAUUUU	1565	AAAAUCCUUGAGCAUAUUC	1566
AAUAUGCUCAAGGAUUUUC	1567	GAAAAUCCUUGAGCAUAUU	1568
AUAUGCUCAAGGAUUUUCU	1569	AGAAAAUCCUUGAGCAUAU	1570
UAUGCUCAAGGAUUUUCUG	1571	CAGAAAAUCCUUGAGCAUA	1572
AUGCUCAAGGAUUUUCUGG	1573	CCAGAAAAUCCUUGAGCAU	1574
GCUCAAGGAUUUUCUGGGU	1575	ACCCAGAAAAUCCUUGAGC	1576
CUCAAGGAUUUUCUGGGUG	1577	CACCCAGAAAAUCCUUGAG	1578
UCAAGGAUUUUCUGGGUGA	1579	UCACCCAGAAAAUCCUUGA	1580
CAAGGAUUUUCUGGGUGAG	1581	CUCACCCAGAAAAUCCUUG	1582
AAGGAUUUUCUGGGUGAGG	1583	CCUCACCCAGAAAAUCCUU	1584
AGGAUUUUCUGGGUGAGGA	1585	UCCUCACCCAGAAAAUCCU	1586
GGAUUUUCUGGGUGAGGAG	1587	CUCCUCACCCAGAAAAUCC	1588
UAAAGAAGUUCAGCUAUAG	1589	CUAUAGCUGAACUUCUUUA	1590
AAAGAAGUUCAGCUAUAGA	1591	UCUAUAGCUGAACUUCUUU	1592
AAGAAGUUCAGCUAUAGAA	1593	UUCUAUAGCUGAACUUCUU	1594
AAAUGCUAAGAAUGAUGAC	1595	GUCAUCAUUCUUAGCAUUU	1596
AAUGCUAAGAAUGAUGACU	1597	AGUCAUCAUUCUUAGCAUU	1598
AAGAAUGAUGACUUGUGGA	1599	UCCACAAGUCAUCAUUCUU	1600
AGAAUGAUGACUUGUGGAG	1601	CUCCACAAGUCAUCAUUCU	1602
AAUGAUGACUUGUGGAGCA	1603	UGCUCCACAAGUCAUCAUU	1604
AUGAUGACUUGUGGAGCAG	1605	CUGCUCCACAAGUCAUCAU	1606
UGAUGACUUGUGGAGCAGU	1607	ACUGCUCCACAAGUCAUCA	1608
ACUUGUGGAGCAGUCUGUC	1609	GACAGACUGCUCCACAAGU	1610
CUUGUGGAGCAGUCUGUCA	1611	UGACAGACUGCUCCACAAG	1612
UUGUGGAGCAGUCUGUCAA	1613	UUGACAGACUGCUCCACAA	1614
UGUGGAGCAGUCUGUCAAA	1615	UUUGACAGACUGCUCCACA	1616
GUGGAGCAGUCUGUCAAAU	1617	AUUUGACAGACUGCUCCAC	1618
UGGAGCAGUCUGUCAAAUA	1619	UAUUUGACAGACUGCUCCA	1620

GCAGUCUGUCAAAUAGUUG	1621	CAACUAUUUGACAGACUGC	1622
CAGUCUGUCAAAUAGUUGU	1623	ACAACUAUUUGACAGACUG	1624
AGUCUGUCAAAUAGUUGUU	1625	AACAACUAUUUGACAGACU	1626
GUCUGUCAAAUAGUUGUUU	1627	AAACAACUAUUUGACAGAC	1628
CUGUCAAAUAGUUGUUUAG	1629	CUAAACAACUAUUUGACAG	1630
GUGAUUUUACAUCUGGUGG	1631	CCACCAGAUGUAAAAUCAC	1632
UGAUUUUACAUCUGGUGGA	1633	UCCACCAGAUGUAAAAUCA	1634
GAUUUUACAUCUGGUGGAG	1635	CUCCACCAGAUGUAAAAUC	1636
UACAUCUGGUGGAGUUUGU	1637	ACAAACUCCACCAGAUGUA	1638
ACAUCUGGUGGAGUUUGUC	1639	GACAAACUCCACCAGAUGU	1640
CAUCUGGUGGAGUUUGUCA	1641	UGACAAACUCCACCAGAUG	1642
UGGUGGAGUUUGUCAUUCG	1643	CGAAUGACAAACUCCACCA	1644
GGUGGAGUUUGUCAUUCGG	1645	CCGAAUGACAAACUCCACC	1646
GUGGAGUUUGUCAUUCGGA	1647	UCCGAAUGACAAACUCCAC	1648
UGGAGUUUGUCAUUCGGAU	1649	AUCCGAAUGACAAACUCCA	1650
GGAGUUUGUCAUUCGGAUC	1651	GAUCCGAAUGACAAACUCC	1652
GAGUUUGUCAUUCGGAUCC	1653	GGAUCCGAAUGACAAACUC	1654
AGUUUGUCAUUCGGAUCCC	1655	GGGAUCCGAAUGACAAACU	1656
UGUCAUUCGGAUCCCAAGA	1657	UCUUGGGAUCCGAAUGACA	1658
GUCAUUCGGAUCCCAAGAU	1659	AUCUUGGGAUCCGAAUGAC	1660
UCAUUCGGAUCCCAAGAUG	1661	CAUCUUGGGAUCCGAAUGA	1662
CAUUCGGAUCCCAAGAUGA	1663	UCAUCUUGGGAUCCGAAUG	1664
AUUCGGAUCCCAAGAUGAC	1665	GUCAUCUUGGGAUCCGAAU	1666
UUCGGAUCCCAAGAUGACA	1667	UGUCAUCUUGGGAUCCGAA	1668
ACAUGCUCGCCUUUCUGGG	1669	CCCAGAAAGGCGAGCAUGU	1670
AAAAUGCAGAGGUCAAAGA	1671	UCUUUGACCUCUGCAUUUU	1672
AGAUGAUGACUACAUGGAC	1673	GUCCAUGUAGUCAUCAUCU	1674
AUGAUGACUACAUGGACUC	1675	GAGUCCAUGUAGUCAUCAU	1676
UGAUGACUACAUGGACUCU	1677	AGAGUCCAUGUAGUCAUCA	1678
GAUGACUACAUGGACUCUC	1679	GAGAGUCCAUGUAGUCAUC	1680
GACGGGUGUUCACUCCGAC	1681	GUCGGAGUGAACACCCGUC	1682

ACGGGUGUUCACUCCGACU	1683	AGUCGGAGUGAACACCCGU	1684
CGGGUGUUCACUCCGACUG	1685	CAGUCGGAGUGAACACCCG	1686
GGGUGUUCACUCCGACUGC	1687	GCAGUCGGAGUGAACACCC	1688
GGUGUUCACUCCGACUGCA	1689	UGCAGUCGGAGUGAACACC	1690
GUGUUCACUCCGACUGCAA	1691	UUGCAGUCGGAGUGAACAC	1692
UGUUCACUCCGACUGCAAC	1693	GUUGCAGUCGGAGUGAACA	1694
AGAGGUACCUGUGGCAUAU	1695	AUAUGCCACAGGUACCUCU	1696
CCUGUGGCAUAUCCCAUUG	1697	CAAUGGGAUAUGCCACAGG	1698
CUGUGGCAUAUCCCAUUGA	1699	UCAAUGGGAUAUGCCACAG	1700
CAUAUCCCAUUGACCUACU	1701	AGUAGGUCAAUGGGAUAUG	1702
AUAUCCCAUUGACCUACUC	1703	GAGUAGGUCAAUGGGAUAU	1704
UAUCCCAUUGACCUACUCC	1705	GGAGUAGGUCAAUGGGAUA	1706
CCAUUGACCUACUCCACGA	1707	UCGUGGAGUAGGUCAAUGG	1708
CAUUGACCUACUCCACGAG	1709	CUCGUGGAGUAGGUCAAUG	1710
CUCCACGAGUUCUUCUAAU	1711	AUUAGAAGAACUCGUGGAG	1712
UCCACGAGUUCUUCUAAUG	1713	CAUUAGAAGAACUCGUGGA	1714
AGUUCUUCUAAUGUGAUCC	1715	GGAUCACAUUAGAAGAACU	1716
GUUCUUCUAAUGUGAUCCA	1717	UGGAUCACAUUAGAAGAAC	1718
UUCUUCUAAUGUGAUCCAC	1719	GUGGAUCACAUUAGAAGAA	1720
AAAAGACCAGUUGGGUGAA	1721	UUCACCCAACUGGUCUUUU	1722
UUUAAUGUGGACUCAAAUG	1723	CAUUUGAGUCCACAUUAAA	1724
UUAAUGUGGACUCAAAUGG	1725	CCAUUUGAGUCCACAUUAA	1726
UAAUGUGGACUCAAAUGGU	1727	ACCAUUUGAGUCCACAUUA	1728
AAUGUGGACUCAAAUGGUU	1729	AACCAUUUGAGUCCACAUU	1730
AUGUGGACUCAAAUGGUUA	1731	UAACCAUUUGAGUCCACAU	1732
UGUGGACUCAAAUGGUUAC	1733	GUAACCAUUUGAGUCCACA	1734
GUGGACUCAAAUGGUUACU	1735	AGUAACCAUUUGAGUCCAC	1736
UGGACUCAAAUGGUUACUA	1737	UAGUAACCAUUUGAGUCCA	1738
GGACUCAAAUGGUUACUAC	1739	GUAGUAACCAUUUGAGUCC	1740
GACUCAAAUGGUUACUACA	1741	UGUAGUAACCAUUUGAGUC	1742
CAAAUGGUUACUACAUCGU	1743	ACGAUGUAGUAACCAUUUG	1744

AAUGGUUACUACAUCGUUC	1745	GAACGAUGUAGUAACCAUU	1746
AUGGUUACUACAUCGUUCA	1747	UGAACGAUGUAGUAACCAU	1748
UGGUUACUACAUCGUUCAC	1749	GUGAACGAUGUAGUAACCA	1750
GGUUACUACAUCGUUCACU	1751	AGUGAACGAUGUAGUAACC	1752
GUUACUACAUCGUUCACUA	1753	UAGUGAACGAUGUAGUAAC	1754
UUACUACAUCGUUCACUAU	1755	AUAGUGAACGAUGUAGUAA	1756
UACUACAUCGUUCACUAUG	1757	CAUAGUGAACGAUGUAGUA	1758
ACAUCGUUCACUAUGAGGG	1759	CCCUCAUAGUGAACGAUGU	1760
CAUCGUUCACUAUGAGGGU	1761	ACCCUCAUAGUGAACGAUG	1762
UGAGGGUCAUGGAUGGGAC	1763	GUCCCAUCCAUGACCCUCA	1764
CACACUUCUCAGACCUAAG	1765	CUUAGGUCUGAGAAGUGUG	1766
ACACUUCUCAGACCUAAGG	1767	CCUUAGGUCUGAGAAGUGU	1768
CACUUCUCAGACCUAAGGA	1769	UCCUUAGGUCUGAGAAGUG	1770
ACUUCUCAGACCUAAGGAC	1771	GUCCUUAGGUCUGAGAAGU	1772
UUCUCAGACCUAAGGACAG	1773	CUGUCCUUAGGUCUGAGAA	1774
UCUCAGACCUAAGGACAGA	1775	UCUGUCCUUAGGUCUGAGA	1776
CUCAGACCUAAGGACAGAG	1777	CUCUGUCCUUAGGUCUGAG	1778
UCAGACCUAAGGACAGAGU	1779	ACUCUGUCCUUAGGUCUGA	1780
CAGACCUAAGGACAGAGUA	1781	UACUCUGUCCUUAGGUCUG	1782
AGACCUAAGGACAGAGUAG	1783	CUACUCUGUCCUUAGGUCU	1784
UCUGAUUCAUGAUGUGUUU	1785	AAACACAUCAUGAAUCAGA	1786
AUUCAUGAUGUGUUUCAGC	1787	GCUGAAACACAUCAUGAAU	1788
CAAAGCUCUUGACAUGACU	1789	AGUCAUGUCAAGAGCUUUG	1790
AAAGCUCUUGACAUGACUU	1791	AAGUCAUGUCAAGAGCUUU	1792
AAGCUCUUGACAUGACUUA	1793	UAAGUCAUGUCAAGAGCUU	1794
AGCUCUUGACAUGACUUAC	1795	GUAAGUCAUGUCAAGAGCU	1796
GCUCUUGACAUGACUUACU	1797	AGUAAGUCAUGUCAAGAGC	1798
CUCUUGACAUGACUUACUA	1799	UAGUAAGUCAUGUCAAGAG	1800
UCUUGACAUGACUUACUAC	1801	GUAGUAAGUCAUGUCAAGA	1802
CUUGACAUGACUUACUACC	1803	GGUAGUAAGUCAUGUCAAG	1804
CCCGCACUUCUCGAAGGUC	1805	GACCUUCGAGAAGUGCGGG	1806

CCGCACUUCUCGAAGGUCU	1807	AGACCUUCGAGAAGUGCGG	1808
GCACUUCUCGAAGGUCUGA	1809	UCAGACCUUCGAGAAGUGC	1810
CACUUCUCGAAGGUCUGAG	1811	CUCAGACCUUCGAGAAGUG	1812
UCUCGAAGGUCUGAGUUAC	1813	GUAACUCAGACCUUCGAGA	1814
CUCGAAGGUCUGAGUUACU	1815	AGUAACUCAGACCUUCGAG	1816
UCGAAGGUCUGAGUUACUU	1817	AAGUAACUCAGACCUUCGA	1818
CGAAGGUCUGAGUUACUUG	1819	CAAGUAACUCAGACCUUCG	1820
AAGGUCUGAGUUACUUGGA	1821	UCCAAGUAACUCAGACCUU	1822
AGGUCUGAGUUACUUGGAA	1823	UUCCAAGUAACUCAGACCU	1824
GGUCUGAGUUACUUGGAAU	1825	AUUCCAAGUAACUCAGACC	1826
GUCUGAGUUACUUGGAAUC	1827	GAUUCCAAGUAACUCAGAC	1828
UCUGAGUUACUUGGAAUCG	1829	CGAUUCCAAGUAACUCAGA	1830
CUGAGUUACUUGGAAUCGU	1831	ACGAUUCCAAGUAACUCAG	1832
UGAGUUACUUGGAAUCGUU	1833	AACGAUUCCAAGUAACUCA	1834
GAGUUACUUGGAAUCGUUU	1835	AAACGAUUCCAAGUAACUC	1836
AGUUACUUGGAAUCGUUUU	1837	AAAACGAUUCCAAGUAACU	1838
GUUACUUGGAAUCGUUUUA	1839	UAAAACGAUUCCAAGUAAC	1840
UUACUUGGAAUCGUUUUAC	1841	GUAAAACGAUUCCAAGUAA	1842
UACUUGGAAUCGUUUUACC	1843	GGUAAAACGAUUCCAAGUA	1844
ACUUGGAAUCGUUUUACCA	1845	UGGUAAAACGAUUCCAAGU	1846
CUUGGAAUCGUUUUACCAC	1847	GUGGUAAAACGAUUCCAAG	1848
UUGGAAUCGUUUUACCACA	1849	UGUGGUAAAACGAUUCCAA	1850
AAUCGUUUUACCACAUGAU	1851	AUCAUGUGGUAAAACGAUU	1852
AUCGUUUUACCACAUGAUG	1853	CAUCAUGUGGUAAAACGAU	1854
UCGUUUUACCACAUGAUGG	1855	CCAUCAUGUGGUAAAACGA	1856
CGUUUUACCACAUGAUGGA	1857	UCCAUCAUGUGGUAAAACG	1858
GUUUUACCACAUGAUGGAC	1859	GUCCAUCAUGUGGUAAAAC	1860
UUUACCACAUGAUGGACAG	1861	CUGUCCAUCAUGUGGUAAA	1862
UUACCACAUGAUGGACAGA	1863	UCUGUCCAUCAUGUGGUAA	1864
UACCACAUGAUGGACAGAA	1865	UUCUGUCCAUCAUGUGGUA	1866
ACCACAUGAUGGACAGAAG	1867	CUUCUGUCCAUCAUGUGGU	1868

CAUGAUGGACAGAAGGAAU	1869	AUUCCUUCUGUCCAUCAUG	1870
UGAUGGACAGAAGGAAUAU	1871	AUAUUCCUUCUGUCCAUCA	1872
GAUGGACAGAAGGAAUAUU	1873	AAUAUUCCUUCUGUCCAUC	1874
AUGGACAGAAGGAAUAUUU	1875	AAAUAUUCCUUCUGUCCAU	1876
UGGACAGAAGGAAUAUUUC	1877	GAAAUAUUCCUUCUGUCCA	1878
CAGAAGGAAUAUUUCAGAU	1879	AUCUGAAAUAUUCCUUCUG	1880
CUCAAGCGUUACCUUCUUC	1881	GAAGAAGGUAACGCUUGAG	1882
AGCGUUACCUUCUUCAGUA	1883	UACUGAAGAAGGUAACGCU	1884
GCGUUACCUUCUUCAGUAU	1885	AUACUGAAGAAGGUAACGC	1886
CCUUCUUCAGUAUUUUAAG	1887	CUUAAAAUACUGAAGAAGG	1888
UUCUUCAGUAUUUUAAGCC	1889	GGCUUAAAAUACUGAAGAA	1890
UCUUCAGUAUUUUAAGCCA	1891	UGGCUUAAAAUACUGAAGA	1892
AUUUUAAGCCAGUGAUUGA	1893	UCAAUCACUGGCUUAAAAU	1894
UUUUAAGCCAGUGAUUGAC	1895	GUCAAUCACUGGCUUAAAA	1896
UUUAAGCCAGUGAUUGACA	1897	UGUCAAUCACUGGCUUAAA	1898
UUAAGCCAGUGAUUGACAG	1899	CUGUCAAUCACUGGCUUAA	1900
UAAGCCAGUGAUUGACAGG	1901	CCUGUCAAUCACUGGCUUA	1902
AAGCCAGUGAUUGACAGGC	1903	GCCUGUCAAUCACUGGCUU	1904
CAGUGAUUGACAGGCAAAG	1905	CUUUGCCUGUCAAUCACUG	1906
AGUGAUUGACAGGCAAAGC	1907	GCUUUGCCUGUCAAUCACU	1908
AUUGACAGGCAAAGCUGGA	1909	UCCAGCUUUGCCUGUCAAU	1910
UUGACAGGCAAAGCUGGAG	1911	CUCCAGCUUUGCCUGUCAA	1912
GCUCGGCUCUCUUGAAGCU	1913	AGCUUCAAGAGAGCCGAGC	1914
UCGGCUCUCUUGAAGCUGG	1915	CCAGCUUCAAGAGAGCCGA	1916
CGGCUCUCUUGAAGCUGGC	1917	GCCAGCUUCAAGAGAGCCG	1918
GGCUCUCUUGAAGCUGGCC	1919	GGCCAGCUUCAAGAGAGCC	1920
GCUCUCUUGAAGCUGGCCU	1921	AGGCCAGCUUCAAGAGAGC	1922
CUCUCUUGAAGCUGGCCUG	1923	CAGGCCAGCUUCAAGAGAG	1924
UCUCUUGAAGCUGGCCUGU	1925	ACAGGCCAGCUUCAAGAGA	1926
AGCUGGCCUGUGACCUGAA	1927	UUCAGGUCACAGGCCAGCU	1928
AGAUUGUGUAUUCUGUGGG	1929	CCCACAGAAUACACAAUCU	1930

CAGCAGGAUGGAAUUACCU	1931	AGGUAAUUCCAUCCUGCUG	1932
CAGGAUGGAAUUACCUUUU	1933	AAAAGGUAAUUCCAUCCUG	1934
AGGAUGGAAUUACCUUUUA	1935	UAAAAGGUAAUUCCAUCCU	1936
GGAUGGAAUUACCUUUUAG	1937	CUAAAAGGUAAUUCCAUCC	1938
GAUGGAAUUACCUUUUAGA	1939	UCUAAAAGGUAAUUCCAUC	1940
AUGGAAUUACCUUUUAGAG	1941	CUCUAAAAGGUAAUUCCAU	1942
GGAAUUACCUUUUAGAGCA	1943	UGCUCUAAAAGGUAAUUCC	1944
GAAUUACCUUUUAGAGCAA	1945	UUGCUCUAAAAGGUAAUUC	1946
ACCUUUUAGAGCAAUAUGA	1947	UCAUAUUGCUCUAAAAGGU	1948
CCUUUUAGAGCAAUAUGAA	1949	UUCAUAUUGCUCUAAAAGG	1950
AACUGUCAAUGUCAAGUGC	1951	GCACUUGACAUUGACAGUU	1952
ACUGUCAAUGUCAAGUGCU	1953	AGCACUUGACAUUGACAGU	1954
AAUUCUGUAUGCUUUGUCA	1955	UGACAAAGCAUACAGAAUU	1956
CUGUAUGCUUUGUCAACGA	1957	UCGUUGACAAAGCAUACAG	1958
UGUAUGCUUUGUCAACGAG	1959	CUCGUUGACAAAGCAUACA	1960
GUAUGCUUUGUCAACGAGC	1961	GCUCGUUGACAAAGCAUAC	1962
CUUUGUCAACGAGCAAGCA	1963	UGCUUGCUCGUUGACAAAG	1964
UUUGUCAACGAGCAAGCAU	1965	AUGCUUGCUCGUUGACAAA	1966
UUGUCAACGAGCAAGCAUC	1967	GAUGCUUGCUCGUUGACAA	1968
UGUCAACGAGCAAGCAUCA	1969	UGAUGCUUGCUCGUUGACA	1970
AACUUGGCAGCUCUCCUUC	1971	GAAGGAGAGCUGCCAAGUU	1972
CUUGGCAGCUCUCCUUCAU	1973	AUGAAGGAGAGCUGCCAAG	1974
UUGGCAGCUCUCCUUCAUG	1975	CAUGAAGGAGAGCUGCCAA	1976
UGGCAGCUCUCCUUCAUGC	1977	GCAUGAAGGAGAGCUGCCA	1978
GGCAGCUCUCCUUCAUGCG	1979	CGCAUGAAGGAGAGCUGCC	1980
GCAGCUCUCCUUCAUGCGA	1981	UCGCAUGAAGGAGAGCUGC	1982
CAGCUCUCCUUCAUGCGAU	1983	AUCGCAUGAAGGAGAGCUG	1984
AGCUCUCCUUCAUGCGAUU	1985	AAUCGCAUGAAGGAGAGCU	1986
GCUCUCCUUCAUGCGAUUG	1987	CAAUCGCAUGAAGGAGAGC	1988
CUCUCCUUCAUGCGAUUGC	1989	GCAAUCGCAUGAAGGAGAG	1990
UCUCCUUCAUGCGAUUGCC	1991	GGCAAUCGCAUGAAGGAGA	1992

CUCCUUCAUGCGAUUGCCA	1993	UGGCAAUCGCAUGAAGGAG	1994
UCCUUCAUGCGAUUGCCAG	1995	CUGGCAAUCGCAUGAAGGA	1996
CCUUCAUGCGAUUGCCAGA	1997	UCUGGCAAUCGCAUGAAGG	1998
CUUCAUGCGAUUGCCAGAC	1999	GUCUGGCAAUCGCAUGAAG	2000
UUCAUGCGAUUGCCAGACG	2001	CGUCUGGCAAUCGCAUGAA	2002
UCAUGCGAUUGCCAGACGU	2003	ACGUCUGGCAAUCGCAUGA	2004
CAUGCGAUUGCCAGACGUC	2005	GACGUCUGGCAAUCGCAUG	2006
AUGCGAUUGCCAGACGUCC	2007	GGACGUCUGGCAAUCGCAU	2008
UGCGAUUGCCAGACGUCCA	2009	UGGACGUCUGGCAAUCGCA	2010
GCGAUUGCCAGACGUCCAA	2011	UUGGACGUCUGGCAAUCGC	2012
CGAUUGCCAGACGUCCAAA	2013	UUUGGACGUCUGGCAAUCG	2014
UAGCAUGGGAUUUUGUAAG	2015	CUUACAAAAUCCCAUGCUA	2016
GCAUGGGAUUUUGUAAGAG	2017	CUCUUACAAAAUCCCAUGC	2018
AAAAUUGGACCCAUCUUCU	2019	AGAAGAUGGGUCCAAUUUU	2020
AAAUUGGACCCAUCUUCUG	2021	CAGAAGAUGGGUCCAAUUU	2022
AAUUGGACCCAUCUUCUGA	2023	UCAGAAGAUGGGUCCAAUU	2024
AUUGGACCCAUCUUCUGAA	2025	UUCAGAAGAUGGGUCCAAU	2026
AAAAUUUGACUUGGGCUCA	2027	UGAGCCCAAGUCAAAUUUU	2028
AAAUUUGACUUGGGCUCAU	2029	AUGAGCCCAAGUCAAAUUU	2030
AAUUUGACUUGGGCUCAUA	2031	UAUGAGCCCAAGUCAAAUU	2032
AUUUGACUUGGGCUCAUAU	2033	AUAUGAGCCCAAGUCAAAU	2034
UUUGACUUGGGCUCAUAUG	2035	CAUAUGAGCCCAAGUCAAA	2036
UUGACUUGGGCUCAUAUGA	2037	UCAUAUGAGCCCAAGUCAA	2038
UGACUUGGGCUCAUAUGAC	2039	GUCAUAUGAGCCCAAGUCA	2040
GACUUGGGCUCAUAUGACA	2041	UGUCAUAUGAGCCCAAGUC	2042
ACUUGGGCUCAUAUGACAU	2043	AUGUCAUAUGAGCCCAAGU	2044
UUGGGCUCAUAUGACAUAA	2045	UUAUGUCAUAUGAGCCCAA	2046
UGGGCUCAUAUGACAUAAG	2047	CUUAUGUCAUAUGAGCCCA	2048
GGGCUCAUAUGACAUAAGG	2049	CCUUAUGUCAUAUGAGCCC	2050
GGCUCAUAUGACAUAAGGA	2051	UCCUUAUGUCAUAUGAGCC	2052
CAUAUGACAUAAGGAUGAU	2053	AUCAUCCUUAUGUCAUAUG	2054

AUAUGACAUAAGGAUGAUC	2055	GAUCAUCCUUAUGUCAUAU	2056
UAUGACAUAAGGAUGAUCA	2057	UGAUCAUCCUUAUGUCAUA	2058
AGCUCACUUUUCUUCCAAG	2059	CUUGGAAGAAAAGUGAGCU	2060
CUUUUCUUCCAAGGAUAAG	2061	CUUAUCCUUGGAAGAAAAG	2062
UUUCUUCCAAGGAUAAGUU	2063	AACUUAUCCUUGGAAGAAA	2064
UUCUUCCAAGGAUAAGUUG	2065	CAACUUAUCCUUGGAAGAA	2066
UCUUCCAAGGAUAAGUUGC	2067	GCAACUUAUCCUUGGAAGA	2068
CUUCCAAGGAUAAGUUGCA	2069	UGCAACUUAUCCUUGGAAG	2070
UUCCAAGGAUAAGUUGCAA	2071	UUGCAACUUAUCCUUGGAA	2072
UCCAAGGAUAAGUUGCAAG	2073	CUUGCAACUUAUCCUUGGA	2074
CCAAGGAUAAGUUGCAAGA	2075	UCUUGCAACUUAUCCUUGG	2076
CAAGGAUAAGUUGCAAGAG	2077	CUCUUGCAACUUAUCCUUG	2078
AAGGAUAAGUUGCAAGAGG	2079	CCUCUUGCAACUUAUCCUU	2080
AGGAUAAGUUGCAAGAGGU	2081	ACCUCUUGCAACUUAUCCU	2082
GGAUAAGUUGCAAGAGGUG	2083	CACCUCUUGCAACUUAUCC	2084
GAUAAGUUGCAAGAGGUGA	2085	UCACCUCUUGCAACUUAUC	2086
AUAAGUUGCAAGAGGUGAA	2087	UUCACCUCUUGCAACUUAU	2088
UUUUGAAUCUCUUGAGGCU	2089	AGCCUCAAGAGAUUCAAAA	2090
UUUGAAUCUCUUGAGGCUC	2091	GAGCCUCAAGAGAUUCAAA	2092
UUGAAUCUCUUGAGGCUCA	2093	UGAGCCUCAAGAGAUUCAA	2094
GAGGCUCAAGGAUCACAUC	2095	GAUGUGAUCCUUGAGCCUC	2096
AGGCUCAAGGAUCACAUCU	2097	AGAUGUGAUCCUUGAGCCU	2098
GGCUCAAGGAUCACAUCUG	2099	CAGAUGUGAUCCUUGAGCC	2100
AGGAUCACAUCUGGAUAUU	2101	AAUAUCCAGAUGUGAUCCU	2102
GAUCACAUCUGGAUAUUUU	2103	AAAAUAUCCAGAUGUGAUC	2104
AAAUAUAAAAUGGCUGGAG	2105	CUCCAGCCAUUUUAUAUUU	2106
GAGGACUUGGCUAAUGGUU	2107	AACCAUUAGCCAAGUCCUC	2108
AGGACUUGGCUAAUGGUUA	2109	UAACCAUUAGCCAAGUCCU	2110
GGACUUGGCUAAUGGUUAA	2111	UUAACCAUUAGCCAAGUCC	2112
GACUUGGCUAAUGGUUAAU	2113	AUUAACCAUUAGCCAAGUC	2114
ACUUGGCUAAUGGUUAAUA	2115	UAUUAACCAUUAGCCAAGU	2116

CUUGGCUAAUGGUUAAUAC	2117	GUAUUAACCAUUAGCCAAG	2118
UUGGCUAAUGGUUAAUACU	2119	AGUAUUAACCAUUAGCCAA	2120
UGGCUAAUGGUUAAUACUU	2121	AAGUAUUAACCAUUAGCCA	2122
CGGUGGCUCACGCCUGUAA	2123	UUACAGGCGUGAGCCACCG	2124
GGUGGCUCACGCCUGUAAU	2125	AUUACAGGCGUGAGCCACC	2126
GUGGCUCACGCCUGUAAUC	2127	GAUUACAGGCGUGAGCCAC	2128
UGGCUCACGCCUGUAAUCC	2129	GGAUUACAGGCGUGAGCCA	2130
GGCUCACGCCUGUAAUCCC	2131	GGGAUUACAGGCGUGAGCC	2132
ACGCCUGUAAUCCCAGCAC	2133	GUGCUGGGAUUACAGGCGU	2134
AGCACUUUGGGAGGCUGAG	2135	CUCAGCCUCCCAAAGUGCU	2136
CAUGGUGGCAGGUGCCUGU	2137	ACAGGCACCUGCCACCAUG	2138
AUGGUGGCAGGUGCCUGUA	2139	UACAGGCACCUGCCACCAU	2140
UGGCAGGUGCCUGUAGUCC	2141	GGACUACAGGCACCUGCCA	2142
GCAGGUGCCUGUAGUCCCA	2143	UGGGACUACAGGCACCUGC	2144
GUGCCUGUAGUCCCAGCUA	2145	UAGCUGGGACUACAGGCAC	2146
UAGUCCCAGCUACUCGGCA	2147	UGCCGAGUAGCUGGGACUA	2148
AGUCCCAGCUACUCGGCAG	2149	CUGCCGAGUAGCUGGGACU	2150
GAGCUUGCAGUGAGCCGAG	2151	CUCGGCUCACUGCAAGCUC	2152
ACUGCAUUCCAGCCUGGGU	2153	ACCCAGGCUGGAAUGCAGU	2154
CUGCAUUCCAGCCUGGGUG	2155	CACCCAGGCUGGAAUGCAG	2156
UGCAUUCCAGCCUGGGUGA	2157	UCACCCAGGCUGGAAUGCA	2158
GCAUUCCAGCCUGGGUGAC	2159	GUCACCCAGGCUGGAAUGC	2160
CAUUCCAGCCUGGGUGACU	2161	AGUCACCCAGGCUGGAAUG	2162
AUUCCAGCCUGGGUGACUG	2163	CAGUCACCCAGGCUGGAAU	2164
UUCCAGCCUGGGUGACUGA	2165	UCAGUCACCCAGGCUGGAA	2166
UCCAGCCUGGGUGACUGAG	2167	CUCAGUCACCCAGGCUGGA	2168
AAGGUACAUCAGACAUGAC	2169	GUCAUGUCUGAUGUACCUU	2170
AGGUACAUCAGACAUGACU	2171	AGUCAUGUCUGAUGUACCU	2172
GGUACAUCAGACAUGACUG	2173	CAGUCAUGUCUGAUGUACC	2174
GUACAUCAGACAUGACUGC	2175	GCAGUCAUGUCUGAUGUAC	2176
AUCAGACAUGACUGCCUGC	2177	GCAGGCAGUCAUGUCUGAU	2178

UCAGACAUGACUGCCUGCA	2179	UGCAGGCAGUCAUGUCUGA	2180
CAGACAUGACUGCCUGCAU	2181	AUGCAGGCAGUCAUGUCUG	2182
AUGACUGCCUGCAUGAAGU	2183	ACUUCAUGCAGGCAGUCAU	2184
ACUGCCUGCAUGAAGUCAA	2185	UUGACUUCAUGCAGGCAGU	2186
CUGCCUGCAUGAAGUCAAA	2187	UUUGACUUCAUGCAGGCAG	2188
ACACCAGUGAAGCUCAAGU	2189	ACUUGAGCUUCACUGGUGU	2190
CACCAGUGAAGCUCAAGUC	2191	GACUUGAGCUUCACUGGUG	2192
ACCAGUGAAGCUCAAGUCA	2193	UGACUUGAGCUUCACUGGU	2194
GUGAAGCUCAAGUCAAGAG	2195	CUCUUGACUUGAGCUUCAC	2196
CUCAAGUCAAGAGCUGUGG	2197	CCACAGCUCUUGACUUGAG	2198
UCAAGUCAAGAGCUGUGGA	2199	UCCACAGCUCUUGACUUGA	2200
CAAGUCAAGAGCUGUGGAU	2201	AUCCACAGCUCUUGACUUG	2202
AAGUCAAGAGCUGUGGAUA	2203	UAUCCACAGCUCUUGACUU	2204
AGUCAAGAGCUGUGGAUAU	2205	AUAUCCACAGCUCUUGACU	2206
GUCAAGAGCUGUGGAUAUU	2207	AAUAUCCACAGCUCUUGAC	2208
CAAGAGCUGUGGAUAUUUU	2209	AAAAUAUCCACAGCUCUUG	2210
AAGAGCUGUGGAUAUUUUG	2211	CAAAAUAUCCACAGCUCUU	2212
AGAGCUGUGGAUAUUUUGU	2213	ACAAAAUAUCCACAGCUCU	2214
GAGCUGUGGAUAUUUUGUC	2215	GACAAAAUAUCCACAGCUC	2216
AGCUGUGGAUAUUUUGUCU	2217	AGACAAAAUAUCCACAGCU	2218
GCUGUGGAUAUUUUGUCUA	2219	UAGACAAAAUAUCCACAGC	2220
CUGUGGAUAUUUUGUCUAA	2221	UUAGACAAAAUAUCCACAG	2222
UGUGGAUAUUUUGUCUAAC	2223	GUUAGACAAAAUAUCCACA	2224
GUGGAUAUUUUGUCUAACC	2225	GGUUAGACAAAAUAUCCAC	2226
UGGAUAUUUUGUCUAACCA	2227	UGGUUAGACAAAAUAUCCA	2228
GGAUAUUUUGUCUAACCAA	2229	UUGGUUAGACAAAAUAUCC	2230
UCGUAUCCAGCCAAAAGAU	2231	AUCUUUUGGCUGGAUACGA	2232
CGUAUCCAGCCAAAAGAUG	2233	CAUCUUUUGGCUGGAUACG	2234
GUAUCCAGCCAAAAGAUGC	2235	GCAUCUUUUGGCUGGAUAC	2236
UAUCCAGCCAAAAGAUGCA	2237	UGCAUCUUUUGGCUGGAUA	2238
AUCCAGCCAAAAGAUGCAU	2239	AUGCAUCUUUUGGCUGGAU	2240

AGCCAAAAGAUGCAUGAUG	2241	CAUCAUGCAUCUUUUGGCU	2242
GCCAAAAGAUGCAUGAUGA	2243	UCAUCAUGCAUCUUUUGGC	2244
CCAAAAGAUGCAUGAUGAU	2245	AUCAUCAUGCAUCUUUUGG	2246
CAAAAGAUGCAUGAUGAUG	2247	CAUCAUCAUGCAUCUUUUG	2248
AAAAGAUGCAUGAUGAUGG	2249	CCAUCAUCAUGCAUCUUUU	2250
AAAGAUGCAUGAUGAUGGA	2251	UCCAUCAUCAUGCAUCUUU	2252
GCAUGAUGAUGGAGUGGUG	2253	CACCACUCCAUCAUCAUGC	2254
CAUGAUGAUGGAGUGGUGG	2255	CCACCACUCCAUCAUCAUG	2256
AUGAUGAUGGAGUGGUGGG	2257	CCCACCACUCCAUCAUCAU	2258
GGGAAGGCCAGUUCAGUAU	2259	AUACUGAACUGGCCUUCCC	2260
GGAAGGCCAGUUCAGUAUC	2261	GAUACUGAACUGGCCUUCC	2262
GAAGGCCAGUUCAGUAUCC	2263	GGAUACUGAACUGGCCUUC	2264
AGGCCAGUUCAGUAUCCUA	2265	UAGGAUACUGAACUGGCCU	2266
GGCCAGUUCAGUAUCCUAU	2267	AUAGGAUACUGAACUGGCC	2268
GCCAGUUCAGUAUCCUAUU	2269	AAUAGGAUACUGAACUGGC	2270
CCAGUUCAGUAUCCUAUUU	2271	AAAUAGGAUACUGAACUGG	2272
CAGUUCAGUAUCCUAUUUA	2273	UAAAUAGGAUACUGAACUG	2274
AACUUCCUGAAUAAUGGAU	2275	AUCCAUUAUUCAGGAAGUU	2276
ACUUCCUGAAUAAUGGAUA	2277	UAUCCAUUAUUCAGGAAGU	2278
CUUCCUGAAUAAUGGAUAU	2279	AUAUCCAUUAUUCAGGAAG	2280
GAAUAAUGGAUAUAUGUGG	2281	CCACAUAUAUCCAUUAUUC	2282
AUAAUGGAUAUAUGUGGAG	2283	CUCCACAUAUAUCCAUUAU	2284
AGAUAUAUAGAUACAGCUG	2285	CAGCUGUAUCUAUAUAUCU	2286
GAUAUAUAGAUACAGCUGU	2287	ACAGCUGUAUCUAUAUAUC	2288
ACAGCUGUAAUUAUUUAGC	2289	GCUAAAUAAUUACAGCUGU	2290
CAGCUGUAAUUAUUUAGCC	2291	GGCUAAAUAAUUACAGCUG	2292
AGCUGUAAUUAUUUAGCCU	2293	AGGCUAAAUAAUUACAGCU	2294
GUAAUUAUUUAGCCUCAAG	2295	CUUGAGGCUAAAUAAUUAC	2296
AAUUAUUUAGCCUCAAGUG	2297	CACUUGAGGCUAAAUAAUU	2298
AUUAUUUAGCCUCAAGUGA	2299	UCACUUGAGGCUAAAUAAU	2300
UUUAGCCUCAAGUGACUUU	2301	AAAGUCACUUGAGGCUAAA	2302

AAGUGACUUUCUCCAUUGC	2303	GCAAUGGAGAAAGUCACUU	2304
AGUGACUUUCUCCAUUGCU	2305	AGCAAUGGAGAAAGUCACU	2306
GUGACUUUCUCCAUUGCUU	2307	AAGCAAUGGAGAAAGUCAC	2308
UUUCUCCAUUGCUUCACGC	2309	GCGUGAAGCAAUGGAGAAA	2310
UUCUCCAUUGCUUCACGCU	2311	AGCGUGAAGCAAUGGAGAA	2312
UCUCCAUUGCUUCACGCUA	2313	UAGCGUGAAGCAAUGGAGA	2314
CUCCAUUGCUUCACGCUAU	2315	AUAGCGUGAAGCAAUGGAG	2316
UCCAUUGCUUCACGCUAUG	2317	CAUAGCGUGAAGCAAUGGA	2318
CCAUUGCUUCACGCUAUGC	2319	GCAUAGCGUGAAGCAAUGG	2320
CAUUGCUUCACGCUAUGCC	2321	GGCAUAGCGUGAAGCAAUG	2322
AUUGCUUCACGCUAUGCCA	2323	UGGCAUAGCGUGAAGCAAU	2324
UUGCUUCACGCUAUGCCAC	2325	GUGGCAUAGCGUGAAGCAA	2326
UGCUUCACGCUAUGCCACU	2327	AGUGGCAUAGCGUGAAGCA	2328
GCUUCACGCUAUGCCACUA	2329	UAGUGGCAUAGCGUGAAGC	2330
CUUCACGCUAUGCCACUAU	2331	AUAGUGGCAUAGCGUGAAG	2332
UUCACGCUAUGCCACUAUU	2333	AAUAGUGGCAUAGCGUGAA	2334
UCACGCUAUGCCACUAUUU	2335	AAAUAGUGGCAUAGCGUGA	2336
CACGCUAUGCCACUAUUUU	2337	AAAAUAGUGGCAUAGCGUG	2338
CGCUAUGCCACUAUUUUGC	2339	GCAAAAUAGUGGCAUAGCG	2340
GCUAUGCCACUAUUUUGCU	2341	AGCAAAAUAGUGGCAUAGC	2342
CUAUGCCACUAUUUUGCUU	2343	AAGCAAAAUAGUGGCAUAG	2344
UAUGCCACUAUUUUGCUUC	2345	GAAGCAAAAUAGUGGCAUA	2346
AUGCCACUAUUUUGCUUCU	2347	AGAAGCAAAAUAGUGGCAU	2348
UGCCACUAUUUUGCUUCUU	2349	AAGAAGCAAAAUAGUGGCA	2350
AACCUUGCUUAGUAUUCUA	2351	UAGAAUACUAAGCAAGGUU	2352
CCUUGCUUAGUAUUCUAUA	2353	UAUAGAAUACUAAGCAAGG	2354
AGUAUUCUAUAGUUUGCCC	2355	GGGCAAACUAUAGAAUACU	2356
GUAUUCUAUAGUUUGCCCA	2357	UGGGCAAACUAUAGAAUAC	2358
UAUUCUAUAGUUUGCCCAA	2359	UUGGGCAAACUAUAGAAUA	2360
AUUCUAUAGUUUGCCCAAC	2361	GUUGGGCAAACUAUAGAAU	2362
UAUAGUUUGCCCAACCAGU	2363	ACUGGUUGGGCAAACUAUA	2364

AUAGUUUGCCCAACCAGUU	2365	AACUGGUUGGGCAAACUAU	2366
UAGUUUGCCCAACCAGUUU	2367	AAACUGGUUGGGCAAACUA	2368
AGUUUGCCCAACCAGUUUU	2369	AAAACUGGUUGGGCAAACU	2370
GUUUGCCCAACCAGUUUUA	2371	UAAAACUGGUUGGGCAAAC	2372
UUUGCCCAACCAGUUUUAC	2373	GUAAAACUGGUUGGGCAAA	2374
UUGCCCAACCAGUUUUACG	2375	CGUAAAACUGGUUGGGCAA	2376
UGCCCAACCAGUUUUACGU	2377	ACGUAAAACUGGUUGGGCA	2378
GCCCAACCAGUUUUACGUC	2379	GACGUAAAACUGGUUGGGC	2380
CCCAACCAGUUUUACGUCC	2381	GGACGUAAAACUGGUUGGG	2382
CCAACCAGUUUUACGUCCA	2383	UGGACGUAAAACUGGUUGG	2384
CAACCAGUUUUACGUCCAA	2385	UUGGACGUAAAACUGGUUG	2386
AACCAGUUUUACGUCCAAG	2387	CUUGGACGUAAAACUGGUU	2388
GCCAAUGCAUAAAAUAUAC	2389	GUAUAUUUUAUGCAUUGGC	2390
AACUAGGUGUCAGGGUUUA	2391	UAAACCCUGACACCUAGUU	2392
ACUAGGUGUCAGGGUUUAU	2393	AUAAACCCUGACACCUAGU	2394
CUAGGUGUCAGGGUUUAUC	2395	GAUAAACCCUGACACCUAG	2396
UAGGUGUCAGGGUUUAUCA	2397	UGAUAAACCCUGACACCUA	2398
AGGUGUCAGGGUUUAUCAA	2399	UUGAUAAACCCUGACACCU	2400
GGUGUCAGGGUUUAUCAAG	2401	CUUGAUAAACCCUGACACC	2402
GUGUCAGGGUUUAUCAAGA	2403	UCUUGAUAAACCCUGACAC	2404
UGUCAGGGUUUAUCAAGAA	2405	UUCUUGAUAAACCCUGACA	2406
GUCAGGGUUUAUCAAGAAG	2407	CUUCUUGAUAAACCCUGAC	2408
GGUUUAUCAAGAAGGCCAG	2409	CUGGCCUUCUUGAUAAACC	2410
UAUCAAGAAGGCCAGGAAG	2411	CUUCCUGGCCUUCUUGAUA	2412
UCAAGAAGGCCAGGAAGGC	2413	GCCUUCCUGGCCUUCUUGA	2414
GCCAGGAAGGCCUUUUGGG	2415	CCCAAAAGGCCUUCCUGGC	2416
CCAGGAAGGCCUUUUGGGU	2417	ACCCAAAAGGCCUUCCUGG	2418
CAGGAAGGCCUUUUGGGUU	2419	AACCCAAAAGGCCUUCCUG	2420
AGGAAGGCCUUUUGGGUUA	2421	UAACCCAAAAGGCCUUCCU	2422
GGAAGGCCUUUUGGGUUAA	2423	UUAACCCAAAAGGCCUUCC	2424
GAAGGCCUUUUGGGUUAAG	2425	CUUAACCCAAAAGGCCUUC	2426

AAGGCCUUUUGGGUUAAGC	2427	GCUUAACCCAAAAGGCCUU	2428
AGGCCUUUUGGGUUAAGCC	2429	GGCUUAACCCAAAAGGCCU	2430
GGCCUUUUGGGUUAAGCCU	2431	AGGCUUAACCCAAAAGGCC	2432
UUCCAAAUGAAUGGUCUCU	2433	AGAGACCAUUCAUUUGGAA	2434
UCCAAAUGAAUGGUCUCUG	2435	CAGAGACCAUUCAUUUGGA	2436
CCAAAUGAAUGGUCUCUGG	2437	CCAGAGACCAUUCAUUUGG	2438
CAAAUGAAUGGUCUCUGGU	2439	ACCAGAGACCAUUCAUUUG	2440
AAAUGAAUGGUCUCUGGUC	2441	GACCAGAGACCAUUCAUUU	2442
AAUGAAUGGUCUCUGGUCA	2443	UGACCAGAGACCAUUCAUU	2444
AUGAAUGGUCUCUGGUCAA	2445	UUGACCAGAGACCAUUCAU	2446
UGAAUGGUCUCUGGUCAAA	2447	UUUGACCAGAGACCAUUCA	2448
GAAUGGUCUCUGGUCAAAU	2449	AUUUGACCAGAGACCAUUC	2450
AAUGGUCUCUGGUCAAAUG	2451	CAUUUGACCAGAGACCAUU	2452
GUCAAAUGAAUGAAUGGUC	2453	GACCAUUCAUUCAUUUGAC	2454
UCAAAUGAAUGAAUGGUCA	2455	UGACCAUUCAUUCAUUUGA	2456
CAAAUGAAUGAAUGGUCAA	2457	UUGACCAUUCAUUCAUUUG	2458
AUGAAUGAAUGGUCAAAUG	2459	CAUUUGACCAUUCAUUCAU	2460
GGUCAAAUGAAUAAAUCUG	2461	CAGAUUUAUUCAUUUGACC	2462
GUCAAAUGAAUAAAUCUGC	2463	GCAGAUUUAUUCAUUUGAC	2464
UCAAAUGAAUAAAUCUGCC	2465	GGCAGAUUUAUUCAUUUGA	2466
CAAAUGAAUAAAUCUGCCC	2467	GGGCAGAUUUAUUCAUUUG	2468
AAAUGAAUAAAUCUGCCCU	2469	AGGGCAGAUUUAUUCAUUU	2470
AAUGAAUAAAUCUGCCCUC	2471	GAGGGCAGAUUUAUUCAUU	2472
AUGAAUAAAUCUGCCCUCA	2473	UGAGGGCAGAUUUAUUCAU	2474
GAAUAAAUCUGCCCUCACA	2475	UGUGAGGGCAGAUUUAUUC	2476
AAUAAAUCUGCCCUCACAG	2477	CUGUGAGGGCAGAUUUAUU	2478
UCAUACCAUUUGGUUUAAG	2479	CUUAAACCAAAUGGUAUGA	2480
AUACCAUUUGGUUUAAGCC	2481	GGCUUAAACCAAAUGGUAU	2482
UACCAUUUGGUUUAAGCCU	2483	AGGCUUAAACCAAAUGGUA	2484
ACCAUUUGGUUUAAGCCUU	2485	AAGGCUUAAACCAAAUGGU	2486
CCAUUUGGUUUAAGCCUUA	2487	UAAGGCUUAAACCAAAUGG	2488

CAUUUGGUUUAAGCCUUAC	2489	GUAAGGCUUAAACCAAAUG	2490
AUUUGGUUUAAGCCUUACA	2491	UGUAAGGCUUAAACCAAAU	2492
GUUUAAGCCUUACAUUCAU	2493	AUGAAUGUAAGGCUUAAAC	2494
UUUAAGCCUUACAUUCAUG	2495	CAUGAAUGUAAGGCUUAAA	2496
UUCCAAAUGAAGUCGAAUC	2497	GAUUCGACUUCAUUUGGAA	2498
UCCAAAUGAAGUCGAAUCU	2499	AGAUUCGACUUCAUUUGGA	2500
CCAAAUGAAGUCGAAUCUG	2501	CAGAUUCGACUUCAUUUGG	2502
AAAUGAAGUCGAAUCUGCC	2503	GGCAGAUUCGACUUCAUUU	2504
AAUGAAGUCGAAUCUGCCC	2505	GGGCAGAUUCGACUUCAUU	2506
AUGAAGUCGAAUCUGCCCU	2507	AGGGCAGAUUCGACUUCAU	2508
UGAAGUCGAAUCUGCCCUC	2509	GAGGGCAGAUUCGACUUCA	2510
GAAGUCGAAUCUGCCCUCA	2511	UGAGGGCAGAUUCGACUUC	2512
AAGUCGAAUCUGCCCUCAC	2513	GUGAGGGCAGAUUCGACUU	2514
AGUCGAAUCUGCCCUCACA	2515	UGUGAGGGCAGAUUCGACU	2516
GUCGAAUCUGCCCUCACAG	2517	CUGUGAGGGCAGAUUCGAC	2518
UUGUAUUGUGUAUUUUCGG	2519	CCGAAAAUACACAAUACAA	2520
UGUAUUGUGUAUUUUCGGU	2521	ACCGAAAAUACACAAUACA	2522
GUAUUGUGUAUUUUCGGUU	2523	AACCGAAAAUACACAAUAC	2524
AAAUAUUUAGAUGCAGCAC	2525	GUGCUGCAUCUAAAUAUUU	2526
AUUUAGAUGCAGCACCAUA	2527	UAUGGUGCUGCAUCUAAAU	2528
UUUAGAUGCAGCACCAUAU	2529	AUAUGGUGCUGCAUCUAAA	2530
UUAGAUGCAGCACCAUAUU	2531	AAUAUGGUGCUGCAUCUAA	2532
UAGAUGCAGCACCAUAUUU	2533	AAAUAUGGUGCUGCAUCUA	2534
AGAUGCAGCACCAUAUUUU	2535	AAAAUAUGGUGCUGCAUCU	2536
GAUGCAGCACCAUAUUUUA	2537	UAAAAUAUGGUGCUGCAUC	2538
AUGCAGCACCAUAUUUUAU	2539	AUAAAAUAUGGUGCUGCAU	2540
AGCACCAUAUUUUAUAACC	2541	GGUUAUAAAAUAUGGUGCU	2542
GCACCAUAUUUUAUAACCC	2543	GGGUUAUAAAAUAUGGUGC	2544
ACCAUAUUUUAUAACCCAG	2545	CUGGGUUAUAAAAUAUGGU	2546
CCAUAUUUUAUAACCCAGC	2547	GCUGGGUUAUAAAAUAUGG	2548
CAUAUUUUAUAACCCAGCU	2549	AGCUGGGUUAUAAAAUAUG	2550

UUAUAACCCAGCUUUAGCA	2551	UGCUAAAGCUGGGUUAUAA	2552
ACCCAGCUUUAGCAUUUCU	2553	AGAAAUGCUAAAGCUGGGU	2554
CCAGCUUUAGCAUUUCUUC	2555	GAAGAAAUGCUAAAGCUGG	2556
GGCGCUUCUUGCUCUCUGA	2557	UCAGAGAGCAAGAAGCGCC	2558
GCGCUUCUUGCUCUCUGAA	2559	UUCAGAGAGCAAGAAGCGC	2560
AAAUGCCCUGCUAAAUGCU	2561	AGCAUUUAGCAGGGCAUUU	2562
AAUGCCCUGCUAAAUGCUU	2563	AAGCAUUUAGCAGGGCAUU	2564
AUGCCCUGCUAAAUGCUUC	2565	GAAGCAUUUAGCAGGGCAU	2566
UGCCCUGCUAAAUGCUUCU	2567	AGAAGCAUUUAGCAGGGCA	2568
UUUGAAUAAGGUAGUUUGG	2569	CCAAACUACCUUAUUCAAA	2570
UUGAAUAAGGUAGUUUGGA	2571	UCCAAACUACCUUAUUCAA	2572
UGAAUAAGGUAGUUUGGAA	2573	UUCCAAACUACCUUAUUCA	2574
GAAUAAGGUAGUUUGGAAU	2575	AUUCCAAACUACCUUAUUC	2576
AGGUAGUUUGGAAUAAAGA	2577	UCUUUAUUCCAAACUACCU	2578
GAUCACUCUACAUACAGAU	2579	AUCUGUAUGUAGAGUGAUC	2580
AUCACUCUACAUACAGAUA	2581	UAUCUGUAUGUAGAGUGAU	2582
UCACUCUACAUACAGAUAG	2583	CUAUCUGUAUGUAGAGUGA	2584
CACUCUACAUACAGAUAGU	2585	ACUAUCUGUAUGUAGAGUG	2586
ACUCUACAUACAGAUAGUA	2587	UACUAUCUGUAUGUAGAGU	2588
CUCUACAUACAGAUAGUAA	2589	UUACUAUCUGUAUGUAGAG	2590
UGUAAAUGACUGAUGUUUG	2591	CAAACAUCAGUCAUUUACA	2592
GUAAAUGACUGAUGUUUGC	2593	GCAAACAUCAGUCAUUUAC	2594
UAAAUGACUGAUGUUUGCA	2595	UGCAAACAUCAGUCAUUUA	2596
AAAUGACUGAUGUUUGCAU	2597	AUGCAAACAUCAGUCAUUU	2598
GAUGUUUGCAUUAUUAAGG	2599	CCUUAAUAAUGCAAACAUC	2600
ACUUGGGAUGUUGGGUCAA	2601	UUGACCCAACAUCCCAAGU	2602
UUGGGAUGUUGGGUCAAGA	2603	UCUUGACCCAACAUCCCAA	2604
UGGGAUGUUGGGUCAAGAG	2605	CUCUUGACCCAACAUCCCA	2606
GGGAUGUUGGGUCAAGAGG	2607	CCUCUUGACCCAACAUCCC	2608
AAAGUGUUAGUCAAUCCAC	2609	GUGGAUUGACUAACACUUU	2610
GAAGGUCAAUUAUAAUUCC	2611	GGAAUUAUAAUUGACCUUC	2612

CCAUAUACCUUUCUUUGAU	2613	AUCAAAGAAAGGUAUAUGG	2614
CAUAUACCUUUCUUUGAUG	2615	CAUCAAAGAAAGGUAUAUG	2616
AUAUACCUUUCUUUGAUGC	2617	GCAUCAAAGAAAGGUAUAU	2618
UAUACCUUUCUUUGAUGCC	2619	GGCAUCAAAGAAAGGUAUA	2620
ACCUUUCUUUGAUGCCACA	2621	UGUGGCAUCAAAGAAAGGU	2622
AGAAUACAGUUUGGGUGGC	2623	GCCACCCAAACUGUAUUCU	2624
GAAUACAGUUUGGGUGGCC	2625	GGCCACCCAAACUGUAUUC	2626
AAUACAGUUUGGGUGGCCA	2627	UGGCCACCCAAACUGUAUU	2628
AUACAGUUUGGGUGGCCAU	2629	AUGGCCACCCAAACUGUAU	2630
UACAGUUUGGGUGGCCAUG	2631	CAUGGCCACCCAAACUGUA	2632
ACAGUUUGGGUGGCCAUGG	2633	CCAUGGCCACCCAAACUGU	2634
CAGUUUGGGUGGCCAUGGA	2635	UCCAUGGCCACCCAAACUG	2636
AGUUUGGGUGGCCAUGGAU	2637	AUCCAUGGCCACCCAAACU	2638
GUUUGGGUGGCCAUGGAUG	2639	CAUCCAUGGCCACCCAAAC	2640
UUUGGGUGGCCAUGGAUGU	2641	ACAUCCAUGGCCACCCAAA	2642
UCAGAUCAUUUCAUGGAAU	2643	AUUCCAUGAAAUGAUCUGA	2644
CAGAUCAUUUCAUGGAAUC	2645	GAUUCCAUGAAAUGAUCUG	2646
GAUCAUUUCAUGGAAUCUU	2647	AAGAUUCCAUGAAAUGAUC	2648
AAGUAUCUUUGACUCUAAC	2649	GUUAGAGUCAAAGAUACUU	2650
AGUAUCUUUGACUCUAACU	2651	AGUUAGAGUCAAAGAUACU	2652
GUAUCUUUGACUCUAACUU	2653	AAGUUAGAGUCAAAGAUAC	2654
AUCUUUGACUCUAACUUUG	2655	CAAAGUUAGAGUCAAAGAU	2656
UCUUUGACUCUAACUUUGA	2657	UCAAAGUUAGAGUCAAAGA	2658
CUUUGACUCUAACUUUGAC	2659	GUCAAAGUUAGAGUCAAAG	2660
UUUGACUCUAACUUUGACU	2661	AGUCAAAGUUAGAGUCAAA	2662
UUGACUCUAACUUUGACUU	2663	AAGUCAAAGUUAGAGUCAA	2664
CUCUAACUUUGACUUGGUG	2665	CACCAAGUCAAAGUUAGAG	2666
UCUAACUUUGACUUGGUGG	2667	CCACCAAGUCAAAGUUAGA	2668
CUAACUUUGACUUGGUGGU	2669	ACCACCAAGUCAAAGUUAG	2670
UAACUUUGACUUGGUGGUG	2671	CACCACCAAGUCAAAGUUA	2672
ACUUUGACUUGGUGGUGGA	2673	UCCACCACCAAGUCAAAGU	2674

CUUUGACUUGGUGGUGGAC	2675	GUCCACCACCAAGUCAAAG	2676
UUUGACUUGGUGGUGGACC	2677	GGUCCACCACCAAGUCAAA	2678
UUGACUUGGUGGUGGACCU	2679	AGGUCCACCACCAAGUCAA	2680
UGACUUGGUGGUGGACCUU	2681	AAGGUCCACCACCAAGUCA	2682
UUGGUGGUGGACCUUCCUU	2683	AAGGAAGGUCCACCACCAA	2684
UGGUGGUGGACCUUCCUUG	2685	CAAGGAAGGUCCACCACCA	2686
GGUGGUGGACCUUCCUUGG	2687	CCAAGGAAGGUCCACCACC	2688
GUGGUGGACCUUCCUUGGU	2689	ACCAAGGAAGGUCCACCAC	2690
UGGUGGACCUUCCUUGGUU	2691	AACCAAGGAAGGUCCACCA	2692
GGUGGACCUUCCUUGGUUU	2693	AAACCAAGGAAGGUCCACC	2694
GUGGACCUUCCUUGGUUUU	2695	AAAACCAAGGAAGGUCCAC	2696
CAUGUAUUUUAGCAUAAGG	2697	CCUUAUGCUAAAAUACAUG	2698
AAAUGUGUAUGAGUUUCAG	2699	CUGAAACUCAUACACAUUU	2700
AAUGUGUAUGAGUUUCAGU	2701	ACUGAAACUCAUACACAUU	2702
AUGUGUAUGAGUUUCAGUA	2703	UACUGAAACUCAUACACAU	2704
GUGUAUGAGUUUCAGUAGA	2705	UCUACUGAAACUCAUACAC	2706
UGUAUGAGUUUCAGUAGAA	2707	UUCUACUGAAACUCAUACA	2708
UUCCAUAAAUAUGCAGAGU	2709	ACUCUGCAUAUUUAUGGAA	2710
CCAUAAAUAUGCAGAGUUC	2711	GAACUCUGCAUAUUUAUGG	2712
UGAAUGCAUUUGCAAUUUC	2713	GAAAUUGCAAAUGCAUUCA	2714
GAAUGCAUUUGCAAUUUCU	2715	AGAAAUUGCAAAUGCAUUC	2716
AUGCAUUUGCAAUUUCUAG	2717	CUAGAAAUUGCAAAUGCAU	2718
UGCAUUUGCAAUUUCUAGG	2719	CCUAGAAAUUGCAAAUGCA	2720
GCAUUUGCAAUUUCUAGGA	2721	UCCUAGAAAUUGCAAAUGC	2722
CAUUUGCAAUUUCUAGGAU	2723	AUCCUAGAAAUUGCAAAUG	2724
UUUGCAAUUUCUAGGAUUC	2725	GAAUCCUAGAAAUUGCAAA	2726
UGCAAUUUCUAGGAUUCUA	2727	UAGAAUCCUAGAAAUUGCA	2728
GCAAUUUCUAGGAUUCUAA	2729	UUAGAAUCCUAGAAAUUGC	2730
UCUAAAGAAUUGAGUACAG	2731	CUGUACUCAAUUCUUUAGA	2732
CUAAAGAAUUGAGUACAGA	2733	UCUGUACUCAAUUCUUUAG	2734
AGAAUUACUGUGCCAAUAC	2735	GUAUUGGCACAGUAAUUCU	2736

GAAUUACUGUGCCAAUACU	2737	AGUAUUGGCACAGUAAUUC	2738
AAUUACUGUGCCAAUACUG	2739	CAGUAUUGGCACAGUAAUU	2740
CUGUGCCAAUACUGUUUUG	2741	CAAAACAGUAUUGGCACAG	2742
UGUGCCAAUACUGUUUUGA	2743	UCAAAACAGUAUUGGCACA	2744
GUGCCAAUACUGUUUUGAU	2745	AUCAAAACAGUAUUGGCAC	2746
GCCAAUACUGUUUUGAUAA	2747	UUAUCAAAACAGUAUUGGC	2748

In some embodiments, the antisense nucleic acid molecules targeted to ERAP1 comprise or consist of the nucleotide sequences shown in Table 5.

Table 5

Sequence	**SEQ ID NO:**
CGCCUUUCUGAACGCGGAUC	2749
ACGCCUUUCUGAACGCGGAU	2750
CACGCCUUUCUGAACGCGGA	2751
UGCACGCCUUUCUGAACGCG	2752
GAUCAGGCGUAGGAAGUGCA	2753
GGAUCAGGCGUAGGAAGUGC	2754
GGGAUCAGGCGUAGGAAGUG	2755
GAAGCUGCGAGGUUGCGAUG	2756
GGAAGCUGCGAGGUUGCGAU	2757
GGGAAUUGGUAAAUGAGCGC	2758
AGGGAAUUGGUAAAUGAGCG	2759
GAAGGGAAUUGGUAAAUGAG	2760
GGAAGGGAAUUGGUAAAUGA	2761
CCAGGAAGGGAAUUGGUAAA	2762
CCCAGGAAGGGAAUUGGUAA	2763
AAGCCGCAACUCCCAGGAAG	2764
GAAGCCGCAACUCCCAGGAA	2765
AAAGGGUAAACGGGAGUGGG	2766

GAAAGGGUAAACGGGAGUGG	2767
GGAAAGGGUAAACGGGAGUG	2768
GAAAGUGAAAGUGGAGCCCG	2769
GGACCGAAAGUGAAAGUGGA	2770
AGGACCGAAAGUGAAAGUGG	2771
CAGGACCGAAAGUGAAAGUG	2772
CCAGGACCGAAAGUGAAAGU	2773
UCUUGCUCUACCUACCUGGG	2774
UUCUUGCUCUACCUACCUGG	2775
CUUCUUGCUCUACCUACCUG	2776
CACCAUCUUCUUGCUCUACC	2777
ACACCAUCUUCUUGCUCUAC	2778
AACACCAUCUUCUUGCUCUA	2779
AAACACCAUCUUCUUGCUCU	2780
GUUAAGAGAGCCAACAGUGA	2781
AGUUAAGAGAGCCAACAGUG	2782
ACACAGUUAAGAGAGCCAAC	2783
UGGACACAGUUAAGAGAGCC	2784
AGUGGACACAGUUAAGAGAG	2785
UGAAGGAGUGGACACAGUUA	2786
AUGAAGGAGUGGACACAGUU	2787
ACCAUGAAGGAGUGGACACA	2788
ACACCAUGAAGGAGUGGACA	2789
GACACCAUGAAGGAGUGGAC	2790
UGACACCAUGAAGGAGUGGA	2791
CUGACACCAUGAAGGAGUGG	2792
CUCUGACACCAUGAAGGAGU	2793
GCUCUGACACCAUGAAGGAG	2794
UGCUCUGACACCAUGAAGGA	2795

GUGCUCUGACACCAUGAAGG	2796
GGAGAUGCUUCAGUGCUCUG	2797
UGGAGAUGCUUCAGUGCUCU	2798
GUUUUGGAGAUGCUUCAGUG	2799
UACGUUUUGGAGAUGCUUCA	2800
CUACGUUUUGGAGAUGCUUC	2801
ACUACGUUUUGGAGAUGCUU	2802
CACUACGUUUUGGAGAUGCU	2803
AUCACUACGUUUUGGAGAUG	2804
CAUCACUACGUUUUGGAGAU	2805
CCAUCACUACGUUUUGGAGA	2806
CCCAUCACUACGUUUUGGAG	2807
UCCCAUCACUACGUUUUGGA	2808
GUCCCAUCACUACGUUUUGG	2809
UGUCCCAUCACUACGUUUUG	2810
GUGUCCCAUCACUACGUUUU	2811
GGUGUCCCAUCACUACGUUU	2812
UGGUGUCCCAUCACUACGUU	2813
AUUCCAAGGAAAUGGUGUCC	2814
UAUUCCAAGGAAAUGGUGUC	2815
GAUCAUAAUGAACUGGGAUG	2816
GAGAUCAUAAUGAACUGGGA	2817
AGAGAUCAUAAUGAACUGGG	2818
GUCAGCGUGGUAAGGUUUGC	2819
GGUCAGCGUGGUAAGGUUUG	2820
AGGUCAGCGUGGUAAGGUUU	2821
AAGGUCAGCGUGGUAAGGUU	2822
GAAGGUCAGCGUGGUAAGGU	2823
AGAAGGUCAGCGUGGUAAGG	2824

CCAGAAGGUCAGCGUGGUAA	2825
CCCAGAAGGUCAGCGUGGUA	2826
UUUCUACUUUCGUGGUUCCC	2827
AUUUCUACUUUCGUGGUUCC	2828
GAUUUCUACUUUCGUGGUUC	2829
GUGAUUUCUACUUUCGUGGU	2830
ACUGGCUGUGAUUUCUACUU	2831
GACUGGCUGUGAUUUCUACU	2832
CUGACUGGCUGUGAUUUCUA	2833
UGCAGGAUGAUGGUGCUGGU	2834
AUGCAGGAUGAUGGUGCUGG	2835
CUAUGCAGGAUGAUGGUGCU	2836
UGACUAUGCAGGAUGAUGGU	2837
GUGACUAUGCAGGAUGAUGG	2838
GGUGACUAUGCAGGAUGAUG	2839
UGGUGACUAUGCAGGAUGAU	2840
GUGGUGACUAUGCAGGAUGA	2841
GGUGGUGACUAUGCAGGAUG	2842
AGGUGGUGACUAUGCAGGAU	2843
CAGGUGGUGACUAUGCAGGA	2844
GCAGGUGGUGACUAUGCAGG	2845
UCCGAUAGCCUCUCUCCAGC	2846
UUCCGAUAGCCUCUCUCCAG	2847
CUUCCGAUAGCCUCUCUCCA	2848
UCUUCCGAUAGCCUCUCUCC	2849
UUCUUCCGAUAGCCUCUCUC	2850
GUUCUUCCGAUAGCCUCUCU	2851
GGUUCUUCCGAUAGCCUCUC	2852
GGGUUCUUCCGAUAGCCUCU	2853

GAGCCAGCAGUGCAAUUUGC	2854
UCGGGAGCCAGCAGUGCAAU	2855
UGUGUACGGGAGCCCGACAA	2856
AACUGUGUACGGGAGCCCGA	2857
ACAACUGUGUACGGGAGCCC	2858
GACAACUGUGUACGGGAGCC	2859
UGACAACUGUGUACGGGAGC	2860
AUGACAACUGUGUACGGGAG	2861
AAUGACAACUGUGUACGGGA	2862
GAAUGACAACUGUGUACGGG	2863
GUGAAUGACAACUGUGUACG	2864
CAUAGUGAAUGACAACUGUG	2865
GCAUAGUGAAUGACAACUGU	2866
AGCAUAGUGAAUGACAACUG	2867
CAGCAUAGUGAAUGACAACU	2868
CCAGCAUAGUGAAUGACAAC	2869
GCCAGCAUAGUGAAUGACAA	2870
UGCCAGCAUAGUGAAUGACA	2871
UUGCCAGCAUAGUGAAUGAC	2872
AAAGAUUGCCAGCAUAGUGA	2873
GAAAGAUUGCCAGCAUAGUG	2874
UAAAAUCCGUGGAAAGUCUC	2875
GUAAAAUCCGUGGAAAGUCU	2876
UGUAAAAUCCGUGGAAAGUC	2877
GCUUUUGUAAAAUCCGUGGA	2878
UGCUUUUGUAAAAUCCGUGG	2879
AGGUGCUUUUGUAAAAUCCG	2880
GUUCUGUAGGUGCUUUUGUA	2881
GGUUCUGUAGGUGCUUUUGU	2882

UUCCUUGGUUCUGUAGGUGC	2883
CUUCCUUGGUUCUGUAGGUG	2884
CCCUUCCUUGGUUCUGUAGG	2885
UGCUAGUAUCCUCAGUUCCC	2886
AUGCUAGUAUCCUCAGUUCC	2887
GAUGCUAGUAUCCUCAGUUC	2888
UGAUGCUAGUAUCCUCAGUU	2889
UUGAUGCUAGUAUCCUCAGU	2890
GUUGAUGCUAGUAUCCUCAG	2891
UGUUGAUGCUAGUAUCCUCA	2892
GUGUUGAUGCUAGUAUCCUC	2893
AGGGAAAGGCCAUUCUAGCU	2894
CAGGGAAAGGCCAUUCUAGC	2895
AAAGCAGGGAAAGGCCAUUC	2896
CAUCAAAGCAGGGAAAGGCC	2897
GUUCAUCAAAGCAGGGAAAG	2898
CAGGUUCAUCAAAGCAGGGA	2899
AGGCAGGUUCAUCAAAGCAG	2900
AAGGCAGGUUCAUCAAAGCA	2901
GAAGGCAGGUUCAUCAAAGC	2902
AAACUUGCUUUGAAGGCAGG	2903
GAAACUUGCUUUGAAGGCAG	2904
AGAAACUUGCUUUGAAGGCA	2905
UGCCUUGGCUCUCUUCUAAU	2906
GUGCCUUGGCUCUCUUCUAA	2907
UAGGUGCCUUGGCUCUCUUC	2908
UGGCUAGGUGCCUUGGCUCU	2909
AUGGCUAGGUGCCUUGGCUC	2910
GAUGGCUAGGUGCCUUGGCU	2911

AGAUGGCUAGGUGCCUUGGC	2912
GAGAUGGCUAGGUGCCUUGG	2913
GGAGAUGGCUAGGUGCCUUG	2914
UUGGAGAUGGCUAGGUGCCU	2915
AUUGGAGAUGGCUAGGUGCC	2916
UAUUGGAGAUGGCUAGGUGC	2917
CAUAUUGGAGAUGGCUAGGU	2918
GCAUAUUGGAGAUGGCUAGG	2919
GGCAUAUUGGAGAUGGCUAG	2920
AUGGCAUAUUGGAGAUGGCU	2921
CAGAUUUCACCAAUGGCAUA	2922
ACAGAUUUCACCAAUGGCAU	2923
CACAGAUUUCACCAAUGGCA	2924
UCACAGAUUUCACCAAUGGC	2925
GUCACAGAUUUCACCAAUGG	2926
AGUCACAGAUUUCACCAAUG	2927
CAGUCACAGAUUUCACCAAU	2928
ACAGUCACAGAUUUCACCAA	2929
UUCAGCAACAGUCACAGAUU	2930
CUUCAGCAACAGUCACAGAU	2931
GUCCUUCAGCAACAGUCACA	2932
AGUCCUUCAGCAACAGUCAC	2933
GAGUCCUUCAGCAACAGUCA	2934
CUAUGAGUCCUUCAGCAACA	2935
UCUAUGAGUCCUUCAGCAAC	2936
UUCUAUGAGUCCUUCAGCAA	2937
CUUCUAUGAGUCCUUCAGCA	2938
GUCUUCUAUGAGUCCUUCAG	2939
AAUGGUCUUCUAUGAGUCCU	2940

AAAUGGUCUUCUAUGAGUCC	2941
UCACAGUGACAUCAAAAUGG	2942
UCAUCUUCACAGUGACAUCA	2943
GCUCAUCUUCACAGUGACAU	2944
UGCUCAUCUUCACAGUGACA	2945
GGUGCUCAUCUUCACAGUGA	2946
AGGUGCUCAUCUUCACAGUG	2947
AUAGGUGCUCAUCUUCACAG	2948
GAUAGGUGCUCAUCUUCACA	2949
AUGAAGGCCACCAGAUAGGU	2950
UGAUGAAGGCCACCAGAUAG	2951
AUGAUGAAGGCCACCAGAUA	2952
AAUGAUGAAGGCCACCAGAU	2953
GAAAUGAUGAAGGCCACCAG	2954
UGAAAUGAUGAAGGCCACCA	2955
UGCUGACAGACUCAAAAUCU	2956
UCUUGCUGACAGACUCAAAA	2957
GUUAUCUUGCUGACAGACUC	2958
GGUUAUCUUGCUGACAGACU	2959
UGGUUAUCUUGCUGACAGAC	2960
CUUGGUUAUCUUGCUGACAG	2961
CUCUUGGUUAUCUUGCUGAC	2962
ACUCUUGGUUAUCUUGCUGA	2963
CACUCUUGGUUAUCUUGCUG	2964
CCACUCUUGGUUAUCUUGCU	2965
GACUCCACUCUUGGUUAUCU	2966
UGACUCCACUCUUGGUUAUC	2967
UUGACUCCACUCUUGGUUAU	2968
CUUGACUCCACUCUUGGUUA	2969

ACCUUGACUCCACUCUUGGU	2970
AACCUUGACUCCACUCUUGG	2971
AAACCUUGACUCCACUCUUG	2972
AGAAACCUUGACUCCACUCU	2973
CAGAAACCUUGACUCCACUC	2974
AAACAGAAACCUUGACUCCA	2975
UAAACAGAAACCUUGACUCC	2976
GCAUAAACAGAAACCUUGAC	2977
CAGCAUAAACAGAAACCUUG	2978
UCUUGUCUGGCACAGCAUAA	2979
CAGUGCAUAAUCUGCUUGAU	2980
CCAGUGCAUAAUCUGCUUGA	2981
UCCAGUGCAUAAUCUGCUUG	2982
AUCCAGUGCAUAAUCUGCUU	2983
CAUCCAGUGCAUAAUCUGCU	2984
GCAUCCAGUGCAUAAUCUGC	2985
AGCAUCCAGUGCAUAAUCUG	2986
CGCAGCAUCCAGUGCAUAAU	2987
CACCGCAGCAUCCAGUGCAU	2988
UCACCGCAGCAUCCAGUGCA	2989
AGUCACCGCAGCAUCCAGUG	2990
GAGUCACCGCAGCAUCCAGU	2991
AGAGUCACCGCAGCAUCCAG	2992
AAGAGUCACCGCAGCAUCCA	2993
GAAGAGUCACCGCAGCAUCC	2994
AGAAGAGUCACCGCAGCAUC	2995
UAGAAGAGUCACCGCAGCAU	2996
CUAGAAGAGUCACCGCAGCA	2997
UCGGGAAUAGCAGCAAGAUC	2998

AAGUCGGGAAUAGCAGCAAG	2999
AAAGUCGGGAAUAGCAGCAA	3000
GAAAGUCGGGAAUAGCAGCA	3001
UGAAAGUCGGGAAUAGCAGC	3002
CUGAAAGUCGGGAAUAGCAG	3003
ACUGAAAGUCGGGAAUAGCA	3004
CAUAGCACCAGACUGAAAGU	3005
UCCAUAGCACCAGACUGAAA	3006
UUCCAUAGCACCAGACUGAA	3007
UUUCCAUAGCACCAGACUGA	3008
UUUUCCAUAGCACCAGACUG	3009
GUUUUCCAUAGCACCAGACU	3010
AGUUUUCCAUAGCACCAGAC	3011
CAGUUUUCCAUAGCACCAGA	3012
CCAGUUUUCCAUAGCACCAG	3013
CUCUAUAUGUUGUCAGUCCC	3014
CUUGAUGCAGAAGACUUUUC	3015
GCUUACUUGAUGCAGAAGAC	3016
CAGUUCAUGGGCCACAGUCA	3017
GCCAGUUCAUGGGCCACAGU	3018
UAGUGACCAGGUUCCCAAAC	3019
AUAGUGACCAGGUUCCCAAA	3020
UCCAUAGUGACCAGGUUCCC	3021
UUCCAUAGUGACCAGGUUCC	3022
AUUCCAUAGUGACCAGGUUC	3023
CAUUCCAUAGUGACCAGGUU	3024
CCAUUCCAUAGUGACCAGGU	3025
ACCAUUCCAUAGUGACCAGG	3026
CACCAUUCCAUAGUGACCAG	3027

CCACCAUUCCAUAGUGACCA	3028
UCCACCAUUCCAUAGUGACC	3029
AUUCCACCAUUCCAUAGUGA	3030
AUCAUUCCACCAUUCCAUAG	3031
GAUCAUUCCACCAUUCCAUA	3032
AAGAUCAUUCCACCAUUCCA	3033
AAAGAUCAUUCCACCAUUCC	3034
CAAAGAUCAUUCCACCAUUC	3035
CCAAAGAUCAUUCCACCAUU	3036
GCCAAAGAUCAUUCCACCAU	3037
AGCCAAAGAUCAUUCCACCA	3038
UAGCCAAAGAUCAUUCCACC	3039
GACAGACACAAACUCCAUAA	3040
GUUCAGGAUGGGUCACACUG	3041
AGUUCAGGAUGGGUCACACU	3042
CAGUUCAGGAUGGGUCACAC	3043
UCAGUUCAGGAUGGGUCACA	3044
CUUUCAGUUCAGGAUGGGUC	3045
AAAGCAUCUACCUCCAUUGC	3046
UUUCCACAGGUGUAGACACA	3047
UUUUCCACAGGUGUAGACAC	3048
AUUUUCCACAGGUGUAGACA	3049
AGGAUUUUCCACAGGUGUAG	3050
GCAGGAUUUUCCACAGGUGU	3051
AGCAGGAUUUUCCACAGGUG	3052
GAGCAGGAUUUUCCACAGGU	3053
UGAGCAGGAUUUUCCACAGG	3054
CUGAGCAGGAUUUUCCACAG	3055
CGGAUCUGAGCAGGAUUUUC	3056

CUCCCGGAUCUGAGCAGGAU	3057
ACAUCUCCCGGAUCUGAGCA	3058
AAACAUCUCCCGGAUCUGAG	3059
CAAACAUCUCCCGGAUCUGA	3060
UCAAACAUCUCCCGGAUCUG	3061
AUCAAACAUCUCCCGGAUCU	3062
CAUCAAACAUCUCCCGGAUC	3063
UCAUCAAACAUCUCCCGGAU	3064
CAUCAUCAAACAUCUCCCGG	3065
ACAUCAUCAAACAUCUCCCG	3066
AACAUCAUCAAACAUCUCCC	3067
GAAUACAAGCUCCCUUAUCA	3068
AGAAUACAAGCUCCCUUAUC	3069
CAGAAUACAAGCUCCCUUAU	3070
UCAGAAUACAAGCUCCCUUA	3071
UUCAGAAUACAAGCUCCCUU	3072
AUUCAGAAUACAAGCUCCCU	3073
CUCCCUUAGCAUAUUCAGAA	3074
ACUCCCUUAGCAUAUUCAGA	3075
UGCUUCUGGAGAUACUGUAC	3076
AUGCUUCUGGAGAUACUGUA	3077
UAUGCUUCUGGAGAUACUGU	3078
AUCCCACAGGUCCUCGUUUU	3079
UAUCCCACAGGUCCUCGUUU	3080
CUAUCCCACAGGUCCUCGUU	3081
UACUAUCCCACAGGUCCUCG	3082
AUACUAUCCCACAGGUCCUC	3083
CCAUACUAUCCCACAGGUCC	3084
GCCAUACUAUCCCACAGGUC	3085

UGCCAUACUAUCCCACAGGU	3086
UUGCCAUACUAUCCCACAGG	3087
CUUGCCAUACUAUCCCACAG	3088
ACUUGCCAUACUAUCCCACA	3089
UACUUGCCAUACUAUCCCAC	3090
AUACUUGCCAUACUAUCCCA	3091
AAUACUUGCCAUACUAUCCC	3092
AUCUGUAGGGCAAAUACUUG	3093
CAUCUGUAGGGCAAAUACUU	3094
CCAUCUGUAGGGCAAAUACU	3095
ACCAUCUGUAGGGCAAAUAC	3096
CACCAUCUGUAGGGCAAAUA	3097
ACACCAUCUGUAGGGCAAAU	3098
AUCCCUUUUACACCAUCUGU	3099
AUCCAUCCCUUUUACACCAU	3100
CAUCCAUCCCUUUUACACCA	3101
CCAUCCAUCCCUUUUACACC	3102
UAGAGCAAAAGCCAUCCAUC	3103
CUAGAGCAAAAGCCAUCCAU	3104
CAAUGUGAGGAUGAAGAUGA	3105
CCAAUGUGAGGAUGAAGAUG	3106
GCCAAUGUGAGGAUGAAGAU	3107
UGCCAAUGUGAGGAUGAAGA	3108
AUGCCAAUGUGAGGAUGAAG	3109
GAUGCCAAUGUGAGGAUGAA	3110
CUGAUGCCAAUGUGAGGAUG	3111
CCUGAUGCCAAUGUGAGGAU	3112
UCAUGGUUUUCACAUCCACC	3113
AUCAUGGUUUUCACAUCCAC	3114

CAUCAUGGUUUUCACAUCCA	3115
UCAUCAUGGUUUUCACAUCC	3116
CCAAGUGUUCAUCAUGGUUU	3117
UCCAAGUGUUCAUCAUGGUU	3118
CACUGUGAUGGUUAUUAGGG	3119
CUCACUGUGAUGGUUAUUAG	3120
GUGCUCUUGCUUCAUGUGUA	3121
AGUGCUCUUGCUUCAUGUGU	3122
UAGUGCUCUUGCUUCAUGUG	3123
GUAGUGCUCUUGCUUCAUGU	3124
UGUAGUGCUCUUGCUUCAUG	3125
AUGUAGUGCUCUUGCUUCAU	3126
CAUGUAGUGCUCUUGCUUCA	3127
CCUUCAUGUAGUGCUCUUGC	3128
CCCUUCAUGUAGUGCUCUUG	3129
GCCCUUCAUGUAGUGCUCUU	3130
AGCCCUUCAUGUAGUGCUCU	3131
AGAGCCCUUCAUGUAGUGCU	3132
CAGAGCCCUUCAUGUAGUGC	3133
UCAGAGCCCUUCAUGUAGUG	3134
CGUCAGAGCCCUUCAUGUAG	3135
CCGUCAGAGCCCUUCAUGUA	3136
AUGGAACAUGCCACAGGUAC	3137
AAUGGAACAUGCCACAGGUA	3138
CAAUGGAACAUGCCACAGGU	3139
UCAAUGGAACAUGCCACAGG	3140
GUCAAUGGAACAUGCCACAG	3141
UGUCAAUGGAACAUGCCACA	3142
UUGCUGGUGAUGAAUGUCAA	3143

CCAUUCCACCUCUUCUGGGA	3144
AAUUUGAUCCAUUCCACCUC	3145
CCAUUCAUGCCCACAUUAAA	3146
GCCAUUCAUGCCCACAUUAA	3147
AGCCAUUCAUGCCCACAUUA	3148
UAGCCAUUCAUGCCCACAUU	3149
AUAGCCAUUCAUGCCCACAU	3150
GUAAUAGCCAUUCAUGCCCA	3151
UCCUCGUAAUGCACAAUGUA	3152
AUCCUCGUAAUGCACAAUGU	3153
CAUCCUCGUAAUGCACAAUG	3154
UCAUCCUCGUAAUGCACAAU	3155
AUCAUCCUCGUAAUGCACAA	3156
CAUCAUCCUCGUAAUGCACA	3157
CCAUCAUCCUCGUAAUGCAC	3158
UCCAUCAUCCUCGUAAUGCA	3159
AUCCAUCAUCCUCGUAAUGC	3160
CAUCCAUCAUCCUCGUAAUG	3161
CCAUCCAUCAUCCUCGUAAU	3162
CCCAUCCAUCAUCCUCGUAA	3163
GUCCCAUCCAUCAUCCUCGU	3164
AGUCCCAUCCAUCAUCCUCG	3165
GAGUCCCAUCCAUCAUCCUC	3166
CAAAGAGUCCCAUCCAUCAU	3167
UCAAAGAGUCCCAUCCAUCA	3168
AGUCAAAGAGUCCCAUCCAU	3169
CAGUCAAAGAGUCCCAUCCA	3170
CCAGUCAAAGAGUCCCAUCC	3171
GCCAGUCAAAGAGUCCCAUC	3172

GGCCAGUCAAAGAGUCCCAU	3173
AGGCCAGUCAAAGAGUCCCA	3174
AAGGCCAGUCAAAGAGUCCC	3175
AAAGGCCAGUCAAAGAGUCC	3176
UAAAAGGCCAGUCAAAGAGU	3177
UUAAAAGGCCAGUCAAAGAG	3178
UUACUGCUGACUGCUGUGUG	3179
CAUUACUGCUGACUGCUGUG	3180
UCAUUACUGCUGACUGCUGU	3181
AUCAUUACUGCUGACUGCUG	3182
GAUCAUUACUGCUGACUGCU	3183
CGAUCAUUACUGCUGACUGC	3184
CCGAUCAUUACUGCUGACUG	3185
UCAAUGGACAGCUUCCCAAU	3186
UUCAAUGGACAGCUUCCCAA	3187
UUUUCAAUGGACAGCUUCCC	3188
CUUUUCAAUGGACAGCUUCC	3189
UACAGGGAUAAAUCCAAGGC	3190
GUACAGGGAUAAAUCCAAGG	3191
AGUACAGGGAUAAAUCCAAG	3192
CAAGUACAGGGAUAAAUCCA	3193
UCAAGUACAGGGAUAAAUCC	3194
CGGGCAUAAUUUCAGUUUCA	3195
ACGGGCAUAAUUUCAGUUUC	3196
CACGGGCAUAAUUUCAGUUU	3197
ACACGGGCAUAAUUUCAGUU	3198
AACACGGGCAUAAUUUCAGU	3199
AAACACGGGCAUAAUUUCAG	3200
CUUGAAACACGGGCAUAAUU	3201

CCUUGAAACACGGGCAUAAU	3202
ACCUUGAAACACGGGCAUAA	3203
AACCUUGAAACACGGGCAUA	3204
AAACCUUGAAACACGGGCAU	3205
CAAACCUUGAAACACGGGCA	3206
CCUUGAAUUGAGUUUCCACU	3207
GCCUUGAAUUGAGUUUCCAC	3208
GGCCUUGAAUUGAGUUUCCA	3209
UUAGCAGCCUGAUGAGGAAG	3210
GAGGUCCCUUAGCAGCCUGA	3211
AUGAGGUCCCUUAGCAGCCU	3212
UCAAUGAGGUCCCUUAGCAG	3213
AUCAAUGAGGUCCCUUAGCA	3214
UAUCAAUGAGGUCCCUUAGC	3215
UUAUCAAUGAGGUCCCUUAG	3216
UGCUUAUCAAUGAGGUCCCU	3217
CUGCUUAUCAAUGAGGUCCC	3218
UCUGCUUAUCAAUGAGGUCC	3219
GUCUGCUUAUCAAUGAGGUC	3220
UGUCUGCUUAUCAAUGAGGU	3221
CAUGUCUGCUUAUCAAUGAG	3222
CUGUCCAUGUCUGCUUAUCA	3223
UCUGUCCAUGUCUGCUUAUC	3224
UCGUCUGUCCAUGUCUGCUU	3225
CUCGUCUGUCCAUGUCUGCU	3226
GCCCUCGUCUGUCCAUGUCU	3227
AGCCCUCGUCUGUCCAUGUC	3228
GAGCCCUCGUCUGUCCAUGU	3229
CUGAGCCCUCGUCUGUCCAU	3230

ACUGAGCCCUCGUCUGUCCA	3231
ACAGGCGAGGAGUAGUAGUU	3232
CACAGGCGAGGAGUAGUAGU	3233
ACACAGGCGAGGAGUAGUAG	3234
CACACAGGCGAGGAGUAGUA	3235
GCACACAGGCGAGGAGUAGU	3236
UGCACACAGGCGAGGAGUAG	3237
UAGCCUUCUGCCCUCUGUAC	3238
AAAUAGCCUUCUGCCCUCUG	3239
GAAAUAGCCUUCUGCCCUCU	3240
CUGAAAUAGCCUUCUGCCCU	3241
UUUCUGAAAUAGCCUUCUGC	3242
UUCCACUUUCUGAAAUAGCC	3243
GCUCAAGUUUCCAUUGGAUU	3244
GGCUCAAGUUUCCAUUGGAU	3245
AGGCUCAAGUUUCCAUUGGA	3246
CACUGCCAAGGUCACGUCGA	3247
ACACUGCCAAGGUCACGUCG	3248
AACACUGCCAAGGUCACGUC	3249
AAACACUGCCAAGGUCACGU	3250
CAGCAAACACUGCCAAGGUC	3251
CCACAGCAAACACUGCCAAG	3252
UAAAGAAAAUCCCAGCCUUC	3253
GUACUGGACAAAGAAAACUG	3254
UGCAGAGGGCAAAUUCAAUU	3255
AUCUAGUAGCCAUUGAAGCU	3256
CAUCUAGUAGCCAUUGAAGC	3257
UCAUCUAGUAGCCAUUGAAG	3258
CUUUCAUCUAGUAGCCAUUG	3259

GCUUUCAUCUAGUAGCCAUU	3260
AGCUUUCAUCUAGUAGCCAU	3261
CUGCCAAUGAGUGUAAGAAU	3262
CCUGCCAAUGAGUGUAAGAA	3263
UCCUGCCAAUGAGUGUAAGA	3264
UUCCUGCCAAUGAGUGUAAG	3265
GUUCCUGCCAAUGAGUGUAA	3266
GGUUCCUGCCAAUGAGUGUA	3267
GGGUUCCUGCCAAUGAGUGU	3268
UGGGUUCCUGCCAAUGAGUG	3269
UACUGGGUUCCUGCCAAUGA	3270
AUCCUACUGGGUUCCUGCCA	3271
UAUCCUACUGGGUUCCUGCC	3272
GUAUCCUACUGGGUUCCUGC	3273
GGUAUCCUACUGGGUUCCUG	3274
GGGUAUCCUACUGGGUUCCU	3275
UGGGUAUCCUACUGGGUUCC	3276
UCCUCAGAAAUUGCCAGGCC	3277
UUCCUCAGAAAUUGCCAGGC	3278
AGAUGAGCCAAGUUCAAACU	3279
AAGAUGAGCCAAGUUCAAAC	3280
GAAGAUGAGCCAAGUUCAAA	3281
GGAAGAUGAGCCAAGUUCAA	3282
UGGAAGAUGAGCCAAGUUCA	3283
AUGGAAGAUGAGCCAAGUUC	3284
UGUGGGCUAUGGAAGAUGAG	3285
CCAUUACCAUGUGGGCUAUG	3286
GUUGUACCCAUUACCAUGUG	3287
UGUUGUACCCAUUACCAUGU	3288

UUGUUGUACCCAUUACCAUG	3289
AAGCCGUGUUCUUGUGGAGA	3290
CCUCUUCAAGCCGUGUUCUU	3291
ACCUCUUCAAGCCGUGUUCU	3292
UACCUCUUCAAGCCGUGUUC	3293
UUACCUCUUCAAGCCGUGUU	3294
UUUACCUCUUCAAGCCGUGU	3295
UUUUACCUCUUCAAGCCGUG	3296
CUUUUACCUCUUCAAGCCGU	3297
CCUUUUACCUCUUCAAGCCG	3298
AUCCUUUUACCUCUUCAAGC	3299
CUGAAGAAUCCUUUUACCUC	3300
GCUGAAGAAUCCUUUUACCU	3301
AGCUGAAGAAUCCUUUUACC	3302
ACGGAGCUGAGAACCAUUUU	3303
AACGGAGCUGAGAACCAUUU	3304
CAACGGAGCUGAGAACCAUU	3305
ACAACGGAGCUGAGAACCAU	3306
CACAACGGAGCUGAGAACCA	3307
ACACAACGGAGCUGAGAACC	3308
GACACAACGGAGCUGAGAAC	3309
GGACACAACGGAGCUGAGAA	3310
UGGACACAACGGAGCUGAGA	3311
UUGGACACAACGGAGCUGAG	3312
ACCGAUGUUUUCUUCAAUGG	3313
CCAACCGAUGUUUUCUUCAA	3314
UCCAACCGAUGUUUUCUUCA	3315
AUCCAACCGAUGUUUUCUUC	3316
UUCUUAUCCAUCCAACCGAU	3317

AUUCUUAUCCAUCCAACCGA	3318
CAGCCACACUCUGAUUUUAU	3319
UCACUUUGCAGCCACACUCU	3320
UUCACUUUGCAGCCACACUC	3321
CUUUUCACUUUGCAGCCACA	3322
GCUUUUCACUUUGCAGCCAC	3323
UUCAGGAUCAUGUUCAAGCU	3324
CUUCAGGAUCAUGUUCAAGC	3325
GCUUCAGGAUCAUGUUCAAG	3326
CAGCUUCAGGAUCAUGUUCA	3327
UCAGCUUCAGGAUCAUGUUC	3328
GUCAGCUUCAGGAUCAUGUU	3329
GCGUCAGCUUCAGGAUCAUG	3330
UGCGUCAGCUUCAGGAUCAU	3331
UUGCGUCAGCUUCAGGAUCA	3332
GUUGCGUCAGCUUCAGGAUC	3333
UGUUGCGUCAGCUUCAGGAU	3334
CUGUUGCGUCAGCUUCAGGA	3335
UCCUGUUGCGUCAGCUUCAG	3336
AUCCUGUUGCGUCAGCUUCA	3337
UCAUCCUGUUGCGUCAGCUU	3338
UUCAUCCUGUUGCGUCAGCU	3339
UUUCAUCCUGUUGCGUCAGC	3340
UUUUCAUCCUGUUGCGUCAG	3341
AUUUUCAUCCUGUUGCGUCA	3342
CAUUCCGUUUGAUGUAGCAU	3343
UUGCUAGAUGGAGAUGAAGU	3344
UUUGCUAGAUGGAGAUGAAG	3345
CAUUUGCUAGAUGGAGAUGA	3346

UCAUUUGCUAGAUGGAGAUG	3347
GCCUCAUUUGCUAGAUGGAG	3348
UGCCUCAUUUGCUAGAUGGA	3349
GUGCCUCAUUUGCUAGAUGG	3350
AGAACAGUGCCUCAUUUGCU	3351
GAGAACAGUGCCUCAUUUGC	3352
UUGGUUGAGAACAGUGCCUC	3353
UUUGGUUGAGAACAGUGCCU	3354
CUUUGGUUGAGAACAGUGCC	3355
GACCACAGCACAUCAAAUUA	3356
CAAGGAGACCACAGCACAUC	3357
CCAAGGAGACCACAGCACAU	3358
ACCAAGGAGACCACAGCACA	3359
UUACCAAGGAGACCACAGCA	3360
CAUUACCAAGGAGACCACAG	3361
ACAUUACCAAGGAGACCACA	3362
UACAUUACCAAGGAGACCAC	3363
AUACAUUACCAAGGAGACCA	3364
CACCUGUGCAAUACCAAAUU	3365
UCACCUGUGCAAUACCAAAU	3366
AUCACCUGUGCAAUACCAAA	3367
AAUCACCUGUGCAAUACCAA	3368
ACUAAUCACCUGUGCAAUAC	3369
GACUAAUCACCUGUGCAAUA	3370
UGACUAAUCACCUGUGCAAU	3371
UUGACUAAUCACCUGUGCAA	3372
CCUUGACUAAUCACCUGUGC	3373
UCCUUGACUAAUCACCUGUG	3374
UUCCUUGACUAAUCACCUGU	3375

CUUCCUUGACUAAUCACCUG	3376
ACUUCCUUGACUAAUCACCU	3377
GACUUCCUUGACUAAUCACC	3378
AGACUUCCUUGACUAAUCAC	3379
CAGACUUCCUUGACUAAUCA	3380
AAGGCUGUGGGACCAAAGCU	3381
GCAAGGCUGUGGGACCAAAG	3382
GGCAAGGCUGUGGGACCAAA	3383
UGCUGUGAGGCAAGGCUGUG	3384
CAUGCUGUGAGGCAAGGCUG	3385
ACAUGCUGUGAGGCAAGGCU	3386
UUUACAUGCUGUGAGGCAAG	3387
AUUUACAUGCUGUGAGGCAA	3388
GAAGAACCUCAGCAUCAAUA	3389
AGAAGAACCUCAGCAUCAAU	3390
UAGAAGAACCUCAGCAUCAA	3391
CAGUAGAAGAACCUCAGCAU	3392
CUAGCAGUAGAAGAACCUCA	3393
ACUAGCAGUAGAAGAACCUC	3394
GUCACUUUCAUACUAGCAGU	3395
CCCAAUUCACACCAGUAAAA	3396
UCCCAAUUCACACCAGUAAA	3397
CUUCCCAAUUCACACCAGUA	3398
CGUCAUGGAAUAGCAUUGUU	3399
ACGUCAUGGAAUAGCAUUGU	3400
CAAACGUCAUGGAAUAGCAU	3401
ACAAACGUCAUGGAAUAGCA	3402
UACAAACGUCAUGGAAUAGC	3403
CACAUAGUCAAGGACCUUAA	3404

ACACAUAGUCAAGGACCUUA	3405
UACACAUAGUCAAGGACCUU	3406
GUACACAUAGUCAAGGACCU	3407
CGAGAUGGCAGAGAUUAACU	3408
GCGAGAUGGCAGAGAUUAAC	3409
AUUUAGCGAGAUGGCAGAGA	3410
GAUUUAGCGAGAUGGCAGAG	3411
UGAUUUAGCGAGAUGGCAGA	3412
AUGAUUUAGCGAGAUGGCAG	3413
GAUGAUUUAGCGAGAUGGCA	3414
UGAUGAUUUAGCGAGAUGGC	3415
CUGAUGAUUUAGCGAGAUGG	3416
ACUGAUGAUUUAGCGAGAUG	3417
GACUGAUGAUUUAGCGAGAU	3418
AGACUGAUGAUUUAGCGAGA	3419
GAUCAGGCACCUUCUAUUUC	3420
AGAUCAGGCACCUUCUAUUU	3421
UUAGGAAGAUCAGGCACCUU	3422
AUUAGGAAGAUCAGGCACCU	3423
UAUUAGGAAGAUCAGGCACC	3424
GCAGCACAUCUUAUUUGGGA	3425
AGCAGCACAUCUUAUUUGGG	3426
AAGCAGCACAUCUUAUUUGG	3427
CUCGGUAAGCAGCACAUCUU	3428
CCUCGGUAAGCAGCACAUCU	3429
ACCUCGGUAAGCAGCACAUC	3430
UACCUCGGUAAGCAGCACAU	3431
AUACCUCGGUAAGCAGCACA	3432
GAUACCUCGGUAAGCAGCAC	3433

UGAUACCUCGGUAAGCAGCA	3434
GUGAUACCUCGGUAAGCAGC	3435
CGUGAUACCUCGGUAAGCAG	3436
CCGUGAUACCUCGGUAAGCA	3437
CCCGUGAUACCUCGGUAAGC	3438
UCAACGACCCAAGCUGGAGC	3439
UUCAACGACCCAAGCUGGAG	3440
CUUCAACGACCCAAGCUGGA	3441
CCCAGCUUCAACGACCCAAG	3442
UCUCUGAAGUGGUUUCCCAA	3443
AUCUCUGAAGUGGUUUCCCA	3444
CAUCUCUGAAGUGGUUUCCC	3445
GAUGGCAUUGUGCUCAUAAU	3446
UGAUGGCAUUGUGCUCAUAA	3447
GUGAUGGCAUUGUGCUCAUA	3448
GUUAAGUGAUGGCAUUGUGC	3449
AGUUAAGUGAUGGCAUUGUG	3450
GAGUCUAUUUGGUCAAGAGA	3451
UGAGUCUAUUUGGUCAAGAG	3452
CCAUAACUCACUCACUAGAA	3453
AGCACCAUAACUCACUCACU	3454
CCAGCACCAUAACUCACUCA	3455
GCCAGCACCAUAACUCACUC	3456
AGCCAGCACCAUAACUCACU	3457
UAGCCAGCACCAUAACUCAC	3458
AUAGCCAGCACCAUAACUCA	3459
UAUAGCCAGCACCAUAACUC	3460
AAUAUAGCCAGCACCAUAAC	3461
CAAAAUAUAGCCAGCACCAU	3462

GCAAAAUAUAGCCAGCACCA	3463
GCAACAUUUGAGAGGGCAGU	3464
AGCAACAUUUGAGAGGGCAG	3465
UAGCAACAUUUGAGAGGGCA	3466
CUAGCAACAUUUGAGAGGGC	3467
CCUAGCAACAUUUGAGAGGG	3468
UCCUAGCAACAUUUGAGAGG	3469
UUCCUAGCAACAUUUGAGAG	3470
AAAUUCUGGCAAGCAAGGCC	3471
UCAAAUUCUGGCAAGCAAGG	3472
AGUCAAAUUCUGGCAAGCAA	3473
AAGUCAAAUUCUGGCAAGCA	3474
AAAGUCAAAUUCUGGCAAGC	3475
CUGAAACCUGACACCGUAUA	3476
CCUGAAACCUGACACCGUAU	3477
CCCUGAAACCUGACACCGUA	3478
ACCCUGAAACCUGACACCGU	3479
CACCAAAGAGUUCUGGACUU	3480
UCACCAAAGAGUUCUGGACU	3481
GUCACCAAAGAGUUCUGGAC	3482
AGUCACCAAAGAGUUCUGGA	3483
AAAACGGCUUUACAGGGUAU	3484
GACCAUAGGUUGUUUCAUAC	3485
CAGACCAUAGGUUGUUUCAU	3486
CCAGACCAUAGGUUGUUUCA	3487
UCCAGACCAUAGGUUGUUUC	3488
UUCCAGACCAUAGGUUGUUU	3489
UUUCCAGACCAUAGGUUGUU	3490
AUUUCCAGACCAUAGGUUGU	3491

AAUUUCCAGACCAUAGGUUG	3492
CACAUAUAGCUUUGCGAUAC	3493
GCACAUAUAGCUUUGCGAUA	3494
UGCACAUAUAGCUUUGCGAU	3495
AUGCACAUAUAGCUUUGCGA	3496
UAUGCACAUAUAGCUUUGCG	3497
GCAAACUCAAAGCAUAGAUC	3498

In some embodiments, the siRNA molecules targeted to ERAP1 comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 6.

Table 6

Sense Sequence	**SEQ ID NO:**	**Antisense Sequence**	**SEQ ID NO:**
AAAGGCGUGCACUUCCUAC	3499	GUAGGAAGUGCACGCCUUU	3500
AAGGCGUGCACUUCCUACG	3501	CGUAGGAAGUGCACGCCUU	3502
CGUGCACUUCCUACGCCUG	3503	CAGGCGUAGGAAGUGCACG	3504
GUGCACUUCCUACGCCUGA	3505	UCAGGCGUAGGAAGUGCAC	3506
UGCACUUCCUACGCCUGAU	3507	AUCAGGCGUAGGAAGUGCA	3508
UCGCAACCUCGCAGCUUCC	3509	GGAAGCUGCGAGGUUGCGA	3510
CGGCGUGCAGCGCUCAUUU	3511	AAAUGAGCGCUGCACGCCG	3512
GGCGUGCAGCGCUCAUUUA	3513	UAAAUGAGCGCUGCACGCC	3514
GCGUGCAGCGCUCAUUUAC	3515	GUAAAUGAGCGCUGCACGC	3516
CGUGCAGCGCUCAUUUACC	3517	GGUAAAUGAGCGCUGCACG	3518
GUGCAGCGCUCAUUUACCA	3519	UGGUAAAUGAGCGCUGCAC	3520
UGCAGCGCUCAUUUACCAA	3521	UUGGUAAAUGAGCGCUGCA	3522
GCAGCGCUCAUUUACCAAU	3523	AUUGGUAAAUGAGCGCUGC	3524
CAGCGCUCAUUUACCAAUU	3525	AAUUGGUAAAUGAGCGCUG	3526
GCUCAUUUACCAAUUCCCU	3527	AGGGAAUUGGUAAAUGAGC	3528
CUCAUUUACCAAUUCCCUU	3529	AAGGGAAUUGGUAAAUGAG	3530
UCAUUUACCAAUUCCCUUC	3531	GAAGGGAAUUGGUAAAUGA	3532
CAUUUACCAAUUCCCUUCC	3533	GGAAGGGAAUUGGUAAAUG	3534

AUUUACCAAUUCCCUUCCU	3535	AGGAAGGGAAUUGGUAAAU	3536
CUUCCUGGGAGUUGCGGCU	3537	AGCCGCAACUCCCAGGAAG	3538
UUCCUGGGAGUUGCGGCUU	3539	AAGCCGCAACUCCCAGGAA	3540
UCCUGGGAGUUGCGGCUUC	3541	GAAGCCGCAACUCCCAGGA	3542
CCCACUCCCGUUUACCCUU	3543	AAGGGUAAACGGGAGUGGG	3544
CCACUCCCGUUUACCCUUU	3545	AAAGGGUAAACGGGAGUGG	3546
GCUCCACUUUCACUUUCGG	3547	CCGAAAGUGAAAGUGGAGC	3548
CUCCACUUUCACUUUCGGU	3549	ACCGAAAGUGAAAGUGGAG	3550
ACUUUCACUUUCGGUCCUG	3551	CAGGACCGAAAGUGAAAGU	3552
CCCAGGUAGGUAGAGCAAG	3553	CUUGCUCUACCUACCUGGG	3554
CCAGGUAGGUAGAGCAAGA	3555	UCUUGCUCUACCUACCUGG	3556
CAGGUAGGUAGAGCAAGAA	3557	UUCUUGCUCUACCUACCUG	3558
AGGUAGGUAGAGCAAGAAG	3559	CUUCUUGCUCUACCUACCU	3560
GGUAGAGCAAGAAGAUGGU	3561	ACCAUCUUCUUGCUCUACC	3562
GUAGAGCAAGAAGAUGGUG	3563	CACCAUCUUCUUGCUCUAC	3564
UAGAGCAAGAAGAUGGUGU	3565	ACACCAUCUUCUUGCUCUA	3566
AGAGCAAGAAGAUGGUGUU	3567	AACACCAUCUUCUUGCUCU	3568
GAGCAAGAAGAUGGUGUUU	3569	AAACACCAUCUUCUUGCUC	3570
GAAGAUGGUGUUUCUGCCC	3571	GGGCAGAAACACCAUCUUC	3572
UCACUGUUGGCUCUCUUAA	3573	UUAAGAGAGCCAACAGUGA	3574
CACUGUUGGCUCUCUUAAC	3575	GUUAAGAGAGCCAACAGUG	3576
ACUGUUGGCUCUCUUAACU	3577	AGUUAAGAGAGCCAACAGU	3578
GGCUCUCUUAACUGUGUCC	3579	GGACACAGUUAAGAGAGCC	3580
GCUCUCUUAACUGUGUCCA	3581	UGGACACAGUUAAGAGAGC	3582
UAACUGUGUCCACUCCUUC	3583	GAAGGAGUGGACACAGUUA	3584
AACUGUGUCCACUCCUUCA	3585	UGAAGGAGUGGACACAGUU	3586
ACUGUGUCCACUCCUUCAU	3587	AUGAAGGAGUGGACACAGU	3588
UGUGUCCACUCCUUCAUGG	3589	CCAUGAAGGAGUGGACACA	3590
GUGUCCACUCCUUCAUGGU	3591	ACCAUGAAGGAGUGGACAC	3592
UGUCCACUCCUUCAUGGUG	3593	CACCAUGAAGGAGUGGACA	3594
GUCCACUCCUUCAUGGUGU	3595	ACACCAUGAAGGAGUGGAC	3596

UCCACUCCUUCAUGGUGUC	3597	GACACCAUGAAGGAGUGGA	3598
CCACUCCUUCAUGGUGUCA	3599	UGACACCAUGAAGGAGUGG	3600
CACUCCUUCAUGGUGUCAG	3601	CUGACACCAUGAAGGAGUG	3602
ACUCCUUCAUGGUGUCAGA	3603	UCUGACACCAUGAAGGAGU	3604
AGCACUGAAGCAUCUCCAA	3605	UUGGAGAUGCUUCAGUGCU	3606
GCACUGAAGCAUCUCCAAA	3607	UUUGGAGAUGCUUCAGUGC	3608
CACUGAAGCAUCUCCAAAA	3609	UUUUGGAGAUGCUUCAGUG	3610
AACGUAGUGAUGGGACACC	3611	GGUGUCCCAUCACUACGUU	3612
ACGUAGUGAUGGGACACCA	3613	UGGUGUCCCAUCACUACGU	3614
GGACACCAUUUCCUUGGAA	3615	UUCCAAGGAAAUGGUGUCC	3616
GACACCAUUUCCUUGGAAU	3617	AUUCCAAGGAAAUGGUGUC	3618
ACACCAUUUCCUUGGAAUA	3619	UAUUCCAAGGAAAUGGUGU	3620
CACCAUUUCCUUGGAAUAA	3621	UUAUUCCAAGGAAAUGGUG	3622
CCAUUUCCUUGGAAUAAAA	3623	UUUUAUUCCAAGGAAAUGG	3624
UUCCUUGGAAUAAAAUACG	3625	CGUAUUUUAUUCCAAGGAA	3626
UCCUUGGAAUAAAAUACGA	3627	UCGUAUUUUAUUCCAAGGA	3628
CCUUGGAAUAAAAUACGAC	3629	GUCGUAUUUUAUUCCAAGG	3630
UGGAAUAAAAUACGACUUC	3631	GAAGUCGUAUUUUAUUCCA	3632
GAAUAAAAUACGACUUCCU	3633	AGGAAGUCGUAUUUUAUUC	3634
GUCAUCCCAGUUCAUUAUG	3635	CAUAAUGAACUGGGAUGAC	3636
CCCAGUUCAUUAUGAUCUC	3637	GAGAUCAUAAUGAACUGGG	3638
CCAGUUCAUUAUGAUCUCU	3639	AGAGAUCAUAAUGAACUGG	3640
CAGUUCAUUAUGAUCUCUU	3641	AAGAGAUCAUAAUGAACUG	3642
UACCACGCUGACCUUCUGG	3643	CCAGAAGGUCAGCGUGGUA	3644
ACCACGCUGACCUUCUGGG	3645	CCCAGAAGGUCAGCGUGGU	3646
AAUCACAGCCAGUCAGCCC	3647	GGGCUGACUGGCUGUGAUU	3648
AUCACAGCCAGUCAGCCCA	3649	UGGGCUGACUGGCUGUGAU	3650
CACCAGCACCAUCAUCCUG	3651	CAGGAUGAUGGUGCUGGUG	3652
ACCAGCACCAUCAUCCUGC	3653	GCAGGAUGAUGGUGCUGGU	3654
CCAGCACCAUCAUCCUGCA	3655	UGCAGGAUGAUGGUGCUGG	3656
CAGCACCAUCAUCCUGCAU	3657	AUGCAGGAUGAUGGUGCUG	3658

AGCACCAUCAUCCUGCAUA	3659	UAUGCAGGAUGAUGGUGCU	3660
GCACCAUCAUCCUGCAUAG	3661	CUAUGCAGGAUGAUGGUGC	3662
CACCAUCAUCCUGCAUAGU	3663	ACUAUGCAGGAUGAUGGUG	3664
ACCAUCAUCCUGCAUAGUC	3665	GACUAUGCAGGAUGAUGGU	3666
CCAUCAUCCUGCAUAGUCA	3667	UGACUAUGCAGGAUGAUGG	3668
CAUCCUGCAUAGUCACCAC	3669	GUGGUGACUAUGCAGGAUG	3670
UAGUCACCACCUGCAGAUA	3671	UAUCUGCAGGUGGUGACUA	3672
AGUCACCACCUGCAGAUAU	3673	AUAUCUGCAGGUGGUGACU	3674
ACCACCUGCAGAUAUCUAG	3675	CUAGAUAUCUGCAGGUGGU	3676
CCACCUGCAGAUAUCUAGG	3677	CCUAGAUAUCUGCAGGUGG	3678
CACCUGCAGAUAUCUAGGG	3679	CCCUAGAUAUCUGCAGGUG	3680
ACCUGCAGAUAUCUAGGGC	3681	GCCCUAGAUAUCUGCAGGU	3682
CCUGCAGAUAUCUAGGGCC	3683	GGCCCUAGAUAUCUGCAGG	3684
CAAAUUGCACUGCUGGCUC	3685	GAGCCAGCAGUGCAAUUUG	3686
UCCUUGUCGGGCUCCCGUA	3687	UACGGGAGCCCGACAAGGA	3688
CUUGUCGGGCUCCCGUACA	3689	UGUACGGGAGCCCGACAAG	3690
CACAGUUGUCAUUCACUAU	3691	AUAGUGAAUGACAACUGUG	3692
ACAGUUGUCAUUCACUAUG	3693	CAUAGUGAAUGACAACUGU	3694
CAGUUGUCAUUCACUAUGC	3695	GCAUAGUGAAUGACAACUG	3696
AGUUGUCAUUCACUAUGCU	3697	AGCAUAGUGAAUGACAACU	3698
GUUGUCAUUCACUAUGCUG	3699	CAGCAUAGUGAAUGACAAC	3700
CAUUCACUAUGCUGGCAAU	3701	AUUGCCAGCAUAGUGAAUG	3702
AUUCACUAUGCUGGCAAUC	3703	GAUUGCCAGCAUAGUGAAU	3704
UUCACUAUGCUGGCAAUCU	3705	AGAUUGCCAGCAUAGUGAA	3706
UCACUAUGCUGGCAAUCUU	3707	AAGAUUGCCAGCAUAGUGA	3708
CACUAUGCUGGCAAUCUUU	3709	AAAGAUUGCCAGCAUAGUG	3710
ACUAUGCUGGCAAUCUUUC	3711	GAAAGAUUGCCAGCAUAGU	3712
AGACUUUCCACGGAUUUUA	3713	UAAAAUCCGUGGAAAGUCU	3714
GACUUUCCACGGAUUUUAC	3715	GUAAAAUCCGUGGAAAGUC	3716
ACUUUCCACGGAUUUUACA	3717	UGUAAAAUCCGUGGAAAGU	3718
AACUGAGGAUACUAGCAUC	3719	GAUGCUAGUAUCCUCAGUU	3720

ACUGAGGAUACUAGCAUCA	3721	UGAUGCUAGUAUCCUCAGU	3722
CUGAGGAUACUAGCAUCAA	3723	UUGAUGCUAGUAUCCUCAG	3724
UGAGGAUACUAGCAUCAAC	3725	GUUGAUGCUAGUAUCCUCA	3726
UGCAGCUAGAAUGGCCUUU	3727	AAAGGCCAUUCUAGCUGCA	3728
AAUGGCCUUUCCCUGCUUU	3729	AAAGCAGGGAAAGGCCAUU	3730
GCCUUUCCCUGCUUUGAUG	3731	CAUCAAAGCAGGGAAAGGC	3732
CUUUCCCUGCUUUGAUGAA	3733	UUCAUCAAAGCAGGGAAAG	3734
ACCUGCCUUCAAAGCAAGU	3735	ACUUGCUUUGAAGGCAGGU	3736
CUGCCUUCAAAGCAAGUUU	3737	AAACUUGCUUUGAAGGCAG	3738
UGCCUUCAAAGCAAGUUUC	3739	GAAACUUGCUUUGAAGGCA	3740
GCCUUCAAAGCAAGUUUCU	3741	AGAAACUUGCUUUGAAGGC	3742
CAAAGCAAGUUUCUCAAUC	3743	GAUUGAGAAACUUGCUUUG	3744
AAGCAAGUUUCUCAAUCAA	3745	UUGAUUGAGAAACUUGCUU	3746
AGCAAGUUUCUCAAUCAAA	3747	UUUGAUUGAGAAACUUGCU	3748
GCAAGUUUCUCAAUCAAAA	3749	UUUUGAUUGAGAAACUUGC	3750
GAGCCAAGGCACCUAGCCA	3751	UGGCUAGGUGCCUUGGCUC	3752
GGCACCUAGCCAUCUCCAA	3753	UUGGAGAUGGCUAGGUGCC	3754
GCACCUAGCCAUCUCCAAU	3755	AUUGGAGAUGGCUAGGUGC	3756
CACCUAGCCAUCUCCAAUA	3757	UAUUGGAGAUGGCUAGGUG	3758
ACCUAGCCAUCUCCAAUAU	3759	AUAUUGGAGAUGGCUAGGU	3760
CCUAGCCAUCUCCAAUAUG	3761	CAUAUUGGAGAUGGCUAGG	3762
CUAGCCAUCUCCAAUAUGC	3763	GCAUAUUGGAGAUGGCUAG	3764
UAGCCAUCUCCAAUAUGCC	3765	GGCAUAUUGGAGAUGGCUA	3766
AGCCAUCUCCAAUAUGCCA	3767	UGGCAUAUUGGAGAUGGCU	3768
AAAUCUGUGACUGUUGCUG	3769	CAGCAACAGUCACAGAUUU	3770
AAUCUGUGACUGUUGCUGA	3771	UCAGCAACAGUCACAGAUU	3772
AUCUGUGACUGUUGCUGAA	3773	UUCAGCAACAGUCACAGAU	3774
UCUGUGACUGUUGCUGAAG	3775	CUUCAGCAACAGUCACAGA	3776
UGACUGUUGCUGAAGGACU	3777	AGUCCUUCAGCAACAGUCA	3778
ACUGUUGCUGAAGGACUCA	3779	UGAGUCCUUCAGCAACAGU	3780
CUGUUGCUGAAGGACUCAU	3781	AUGAGUCCUUCAGCAACAG	3782

UGUUGCUGAAGGACUCAUA	3783	UAUGAGUCCUUCAGCAACA	3784
GUUGCUGAAGGACUCAUAG	3785	CUAUGAGUCCUUCAGCAAC	3786
UUGCUGAAGGACUCAUAGA	3787	UCUAUGAGUCCUUCAGCAA	3788
UGCUGAAGGACUCAUAGAA	3789	UUCUAUGAGUCCUUCAGCA	3790
GCUGAAGGACUCAUAGAAG	3791	CUUCUAUGAGUCCUUCAGC	3792
CUGAAGGACUCAUAGAAGA	3793	UCUUCUAUGAGUCCUUCAG	3794
UGAAGGACUCAUAGAAGAC	3795	GUCUUCUAUGAGUCCUUCA	3796
AAGGACUCAUAGAAGACCA	3797	UGGUCUUCUAUGAGUCCUU	3798
AGGACUCAUAGAAGACCAU	3799	AUGGUCUUCUAUGAGUCCU	3800
GGACUCAUAGAAGACCAUU	3801	AAUGGUCUUCUAUGAGUCC	3802
GACUCAUAGAAGACCAUUU	3803	AAAUGGUCUUCUAUGAGUC	3804
ACUCAUAGAAGACCAUUUU	3805	AAAAUGGUCUUCUAUGAGU	3806
CUCAUAGAAGACCAUUUUG	3807	CAAAAUGGUCUUCUAUGAG	3808
UCAUAGAAGACCAUUUUGA	3809	UCAAAAUGGUCUUCUAUGA	3810
CAUAGAAGACCAUUUUGAU	3811	AUCAAAAUGGUCUUCUAUG	3812
AUAGAAGACCAUUUUGAUG	3813	CAUCAAAAUGGUCUUCUAU	3814
UAGAAGACCAUUUUGAUGU	3815	ACAUCAAAAUGGUCUUCUA	3816
AGAAGACCAUUUUGAUGUC	3817	GACAUCAAAAUGGUCUUCU	3818
UGAUGUCACUGUGAAGAUG	3819	CAUCUUCACAGUGACAUCA	3820
GAUGUCACUGUGAAGAUGA	3821	UCAUCUUCACAGUGACAUC	3822
AUGUCACUGUGAAGAUGAG	3823	CUCAUCUUCACAGUGACAU	3824
UGUGAAGAUGAGCACCUAU	3825	AUAGGUGCUCAUCUUCACA	3826
GUGAAGAUGAGCACCUAUC	3827	GAUAGGUGCUCAUCUUCAC	3828
ACCUAUCUGGUGGCCUUCA	3829	UGAAGGCCACCAGAUAGGU	3830
CCUAUCUGGUGGCCUUCAU	3831	AUGAAGGCCACCAGAUAGG	3832
CUAUCUGGUGGCCUUCAUC	3833	GAUGAAGGCCACCAGAUAG	3834
UAUCUGGUGGCCUUCAUCA	3835	UGAUGAAGGCCACCAGAUA	3836
AUCUGGUGGCCUUCAUCAU	3837	AUGAUGAAGGCCACCAGAU	3838
UCUGGUGGCCUUCAUCAUU	3839	AAUGAUGAAGGCCACCAGA	3840
CUGGUGGCCUUCAUCAUUU	3841	AAAUGAUGAAGGCCACCAG	3842
UGGUGGCCUUCAUCAUUUC	3843	GAAAUGAUGAAGGCCACCA	3844

GGCCUUCAUCAUUUCAGAU	3845	AUCUGAAAUGAUGAAGGCC	3846
GCCUUCAUCAUUUCAGAUU	3847	AAUCUGAAAUGAUGAAGGC	3848
CCUUCAUCAUUUCAGAUUU	3849	AAAUCUGAAAUGAUGAAGG	3850
AGAUUUUGAGUCUGUCAGC	3851	GCUGACAGACUCAAAAUCU	3852
UUUGAGUCUGUCAGCAAGA	3853	UCUUGCUGACAGACUCAAA	3854
UUGAGUCUGUCAGCAAGAU	3855	AUCUUGCUGACAGACUCAA	3856
UGAGUCUGUCAGCAAGAUA	3857	UAUCUUGCUGACAGACUCA	3858
GAGUCUGUCAGCAAGAUAA	3859	UUAUCUUGCUGACAGACUC	3860
AGUCUGUCAGCAAGAUAAC	3861	GUUAUCUUGCUGACAGACU	3862
GUCUGUCAGCAAGAUAACC	3863	GGUUAUCUUGCUGACAGAC	3864
UCUGUCAGCAAGAUAACCA	3865	UGGUUAUCUUGCUGACAGA	3866
UGUCAGCAAGAUAACCAAG	3867	CUUGGUUAUCUUGCUGACA	3868
GUCAGCAAGAUAACCAAGA	3869	UCUUGGUUAUCUUGCUGAC	3870
UCAGCAAGAUAACCAAGAG	3871	CUCUUGGUUAUCUUGCUGA	3872
CAGCAAGAUAACCAAGAGU	3873	ACUCUUGGUUAUCUUGCUG	3874
AGCAAGAUAACCAAGAGUG	3875	CACUCUUGGUUAUCUUGCU	3876
GCAAGAUAACCAAGAGUGG	3877	CCACUCUUGGUUAUCUUGC	3878
CAAGAUAACCAAGAGUGGA	3879	UCCACUCUUGGUUAUCUUG	3880
AAGAUAACCAAGAGUGGAG	3881	CUCCACUCUUGGUUAUCUU	3882
UAACCAAGAGUGGAGUCAA	3883	UUGACUCCACUCUUGGUUA	3884
AACCAAGAGUGGAGUCAAG	3885	CUUGACUCCACUCUUGGUU	3886
ACCAAGAGUGGAGUCAAGG	3887	CCUUGACUCCACUCUUGGU	3888
CCAAGAGUGGAGUCAAGGU	3889	ACCUUGACUCCACUCUUGG	3890
CAAGAGUGGAGUCAAGGUU	3891	AACCUUGACUCCACUCUUG	3892
AAGAGUGGAGUCAAGGUUU	3893	AAACCUUGACUCCACUCUU	3894
AGAGUGGAGUCAAGGUUUC	3895	GAAACCUUGACUCCACUCU	3896
GAGUGGAGUCAAGGUUUCU	3897	AGAAACCUUGACUCCACUC	3898
AGUGGAGUCAAGGUUUCUG	3899	CAGAAACCUUGACUCCACU	3900
GUGGAGUCAAGGUUUCUGU	3901	ACAGAAACCUUGACUCCAC	3902
UGGAGUCAAGGUUUCUGUU	3903	AACAGAAACCUUGACUCCA	3904
GGAGUCAAGGUUUCUGUUU	3905	AAACAGAAACCUUGACUCC	3906

GAGUCAAGGUUUCUGUUUA	3907	UAAACAGAAACCUUGACUC	3908
AGUCAAGGUUUCUGUUUAU	3909	AUAAACAGAAACCUUGACU	3910
GUCAAGGUUUCUGUUUAUG	3911	CAUAAACAGAAACCUUGAC	3912
UCAAGGUUUCUGUUUAUGC	3913	GCAUAAACAGAAACCUUGA	3914
CAAGGUUUCUGUUUAUGCU	3915	AGCAUAAACAGAAACCUUG	3916
AAGGUUUCUGUUUAUGCUG	3917	CAGCAUAAACAGAAACCUU	3918
AGGUUUCUGUUUAUGCUGU	3919	ACAGCAUAAACAGAAACCU	3920
UUUCUGUUUAUGCUGUGCC	3921	GGCACAGCAUAAACAGAAA	3922
UUCUGUUUAUGCUGUGCCA	3923	UGGCACAGCAUAAACAGAA	3924
CUGUUUAUGCUGUGCCAGA	3925	UCUGGCACAGCAUAAACAG	3926
UGUUUAUGCUGUGCCAGAC	3927	GUCUGGCACAGCAUAAACA	3928
GUUUAUGCUGUGCCAGACA	3929	UGUCUGGCACAGCAUAAAC	3930
AUGCACUGGAUGCUGCGGU	3931	ACCGCAGCAUCCAGUGCAU	3932
UGCACUGGAUGCUGCGGUG	3933	CACCGCAGCAUCCAGUGCA	3934
GCACUGGAUGCUGCGGUGA	3935	UCACCGCAGCAUCCAGUGC	3936
CACUGGAUGCUGCGGUGAC	3937	GUCACCGCAGCAUCCAGUG	3938
ACUGGAUGCUGCGGUGACU	3939	AGUCACCGCAGCAUCCAGU	3940
CUGGAUGCUGCGGUGACUC	3941	GAGUCACCGCAGCAUCCAG	3942
UGGAUGCUGCGGUGACUCU	3943	AGAGUCACCGCAGCAUCCA	3944
GGAUGCUGCGGUGACUCUU	3945	AAGAGUCACCGCAGCAUCC	3946
GAUGCUGCGGUGACUCUUC	3947	GAAGAGUCACCGCAGCAUC	3948
AUGCUGCGGUGACUCUUCU	3949	AGAAGAGUCACCGCAGCAU	3950
UGCUGCGGUGACUCUUCUA	3951	UAGAAGAGUCACCGCAGCA	3952
GCUGCGGUGACUCUUCUAG	3953	CUAGAAGAGUCACCGCAGC	3954
CUGCGGUGACUCUUCUAGA	3955	UCUAGAAGAGUCACCGCAG	3956
UGCGGUGACUCUUCUAGAA	3957	UUCUAGAAGAGUCACCGCA	3958
GCGGUGACUCUUCUAGAAU	3959	AUUCUAGAAGAGUCACCGC	3960
CGGUGACUCUUCUAGAAUU	3961	AAUUCUAGAAGAGUCACCG	3962
CUUCUAGAAUUUUAUGAGG	3963	CCUCAUAAAAUUCUAGAAG	3964
CAAGAUCUUGCUGCUAUUC	3965	GAAUAGCAGCAAGAUCUUG	3966
AAGAUCUUGCUGCUAUUCC	3967	GGAAUAGCAGCAAGAUCUU	3968

AGAUCUUGCUGCUAUUCCC	3969	GGGAAUAGCAGCAAGAUCU	3970
GAUCUUGCUGCUAUUCCCG	3971	CGGGAAUAGCAGCAAGAUC	3972
UUGCUGCUAUUCCCGACUU	3973	AAGUCGGGAAUAGCAGCAA	3974
UGCUGCUAUUCCCGACUUU	3975	AAAGUCGGGAAUAGCAGCA	3976
GCUGCUAUUCCCGACUUUC	3977	GAAAGUCGGGAAUAGCAGC	3978
CUUUCAGUCUGGUGCUAUG	3979	CAUAGCACCAGACUGAAAG	3980
UUUCAGUCUGGUGCUAUGG	3981	CCAUAGCACCAGACUGAAA	3982
UUCAGUCUGGUGCUAUGGA	3983	UCCAUAGCACCAGACUGAA	3984
UCAGUCUGGUGCUAUGGAA	3985	UUCCAUAGCACCAGACUGA	3986
AAUCUGCUCUGUUGUUUGA	3987	UCAAACAACAGAGCAGAUU	3988
AUCUGCUCUGUUGUUUGAU	3989	AUCAAACAACAGAGCAGAU	3990
UCUGCUCUGUUGUUUGAUG	3991	CAUCAAACAACAGAGCAGA	3992
CUGCUCUGUUGUUUGAUGC	3993	GCAUCAAACAACAGAGCAG	3994
AAAAGUCUUCUGCAUCAAG	3995	CUUGAUGCAGAAGACUUUU	3996
AAGUCUUCUGCAUCAAGUA	3997	UACUUGAUGCAGAAGACUU	3998
AGUCUUCUGCAUCAAGUAA	3999	UUACUUGAUGCAGAAGACU	4000
GUCUUCUGCAUCAAGUAAG	4001	CUUACUUGAUGCAGAAGAC	4002
UCUUCUGCAUCAAGUAAGC	4003	GCUUACUUGAUGCAGAAGA	4004
AACCUGGUCACUAUGGAAU	4005	AUUCCAUAGUGACCAGGUU	4006
ACCUGGUCACUAUGGAAUG	4007	CAUUCCAUAGUGACCAGGU	4008
CCUGGUCACUAUGGAAUGG	4009	CCAUUCCAUAGUGACCAGG	4010
CUGGUCACUAUGGAAUGGU	4011	ACCAUUCCAUAGUGACCAG	4012
UGGUCACUAUGGAAUGGUG	4013	CACCAUUCCAUAGUGACCA	4014
GGUCACUAUGGAAUGGUGG	4015	CCACCAUUCCAUAGUGACC	4016
GUCACUAUGGAAUGGUGGA	4017	UCCACCAUUCCAUAGUGAC	4018
UCACUAUGGAAUGGUGGAA	4019	UUCCACCAUUCCAUAGUGA	4020
CACUAUGGAAUGGUGGAAU	4021	AUUCCACCAUUCCAUAGUG	4022
ACUAUGGAAUGGUGGAAUG	4023	CAUUCCACCAUUCCAUAGU	4024
UGGAAUGGUGGAAUGAUCU	4025	AGAUCAUUCCACCAUUCCA	4026
GGAAUGGUGGAAUGAUCUU	4027	AAGAUCAUUCCACCAUUCC	4028
GAAUGGUGGAAUGAUCUUU	4029	AAAGAUCAUUCCACCAUUC	4030

AAUGGUGGAAUGAUCUUUG	4031	CAAAGAUCAUUCCACCAUU	4032
AUGGUGGAAUGAUCUUUGG	4033	CCAAAGAUCAUUCCACCAU	4034
UGGUGGAAUGAUCUUUGGC	4035	GCCAAAGAUCAUUCCACCA	4036
GGUGGAAUGAUCUUUGGCU	4037	AGCCAAAGAUCAUUCCACC	4038
GUGGAAUGAUCUUUGGCUA	4039	UAGCCAAAGAUCAUUCCAC	4040
UGGAAUGAUCUUUGGCUAA	4041	UUAGCCAAAGAUCAUUCCA	4042
GGAAUGAUCUUUGGCUAAA	4043	UUUAGCCAAAGAUCAUUCC	4044
GAAUGAUCUUUGGCUAAAU	4045	AUUUAGCCAAAGAUCAUUC	4046
AAUGAUCUUUGGCUAAAUG	4047	CAUUUAGCCAAAGAUCAUU	4048
AAUUUAUGGAGUUUGUGUC	4049	GACACAAACUCCAUAAAUU	4050
AUUUAUGGAGUUUGUGUCU	4051	AGACACAAACUCCAUAAAU	4052
UUUAUGGAGUUUGUGUCUG	4053	CAGACACAAACUCCAUAAA	4054
UUAUGGAGUUUGUGUCUGU	4055	ACAGACACAAACUCCAUAA	4056
UAUGGAGUUUGUGUCUGUC	4057	GACAGACACAAACUCCAUA	4058
AUGGAGUUUGUGUCUGUCA	4059	UGACAGACACAAACUCCAU	4060
UGGAGUUUGUGUCUGUCAG	4061	CUGACAGACACAAACUCCA	4062
GGAGUUUGUGUCUGUCAGU	4063	ACUGACAGACACAAACUCC	4064
GAGUUUGUGUCUGUCAGUG	4065	CACUGACAGACACAAACUC	4066
AGUUUGUGUCUGUCAGUGU	4067	ACACUGACAGACACAAACU	4068
CAGUGUGACCCAUCCUGAA	4069	UUCAGGAUGGGUCACACUG	4070
GCAAUGGAGGUAGAUGCUU	4071	AAGCAUCUACCUCCAUUGC	4072
AGGUAGAUGCUUUAAAUUC	4073	GAAUUUAAAGCAUCUACCU	4074
GGUAGAUGCUUUAAAUUCC	4075	GGAAUUUAAAGCAUCUACC	4076
GUAGAUGCUUUAAAUUCCU	4077	AGGAAUUUAAAGCAUCUAC	4078
UAGAUGCUUUAAAUUCCUC	4079	GAGGAAUUUAAAGCAUCUA	4080
CCUGUGUCUACACCUGUGG	4081	CCACAGGUGUAGACACAGG	4082
UGUGUCUACACCUGUGGAA	4083	UUCCACAGGUGUAGACACA	4084
UAUGAUAAGGGAGCUUGUA	4085	UACAAGCUCCCUUAUCAUA	4086
AUAAGGGAGCUUGUAUUCU	4087	AGAAUACAAGCUCCCUUAU	4088
UAAGGGAGCUUGUAUUCUG	4089	CAGAAUACAAGCUCCCUUA	4090
AAGGGAGCUUGUAUUCUGA	4091	UCAGAAUACAAGCUCCCUU	4092

AGGGAGCUUGUAUUCUGAA	4093	UUCAGAAUACAAGCUCCCU	4094
AUUCUGAAUAUGCUAAGGG	4095	CCCUUAGCAUAUUCAGAAU	4096
GAAUAUGCUAAGGGAGUAU	4097	AUACUCCCUUAGCAUAUUC	4098
AAUAUGCUAAGGGAGUAUC	4099	GAUACUCCCUUAGCAUAUU	4100
AUAUGCUAAGGGAGUAUCU	4101	AGAUACUCCCUUAGCAUAU	4102
UAUGCUAAGGGAGUAUCUU	4103	AAGAUACUCCCUUAGCAUA	4104
GCUGACGCAUUUAAAAGUG	4105	CACUUUUAAAUGCGUCAGC	4106
CUGACGCAUUUAAAAGUGG	4107	CCACUUUUAAAUGCGUCAG	4108
UGACGCAUUUAAAAGUGGU	4109	ACCACUUUUAAAUGCGUCA	4110
GACGCAUUUAAAAGUGGUA	4111	UACCACUUUUAAAUGCGUC	4112
ACGCAUUUAAAAGUGGUAU	4113	AUACCACUUUUAAAUGCGU	4114
CGCAUUUAAAAGUGGUAUU	4115	AAUACCACUUUUAAAUGCG	4116
GCAUUUAAAAGUGGUAUUG	4117	CAAUACCACUUUUAAAUGC	4118
AAAGUGGUAUUGUACAGUA	4119	UACUGUACAAUACCACUUU	4120
AAGUGGUAUUGUACAGUAU	4121	AUACUGUACAAUACCACUU	4122
AGUGGUAUUGUACAGUAUC	4123	GAUACUGUACAAUACCACU	4124
GUGGUAUUGUACAGUAUCU	4125	AGAUACUGUACAAUACCAC	4126
UGGUAUUGUACAGUAUCUC	4127	GAGAUACUGUACAAUACCA	4128
GGUAUUGUACAGUAUCUCC	4129	GGAGAUACUGUACAAUACC	4130
GUAUUGUACAGUAUCUCCA	4131	UGGAGAUACUGUACAAUAC	4132
UAUUGUACAGUAUCUCCAG	4133	CUGGAGAUACUGUACAAUA	4134
AUUGUACAGUAUCUCCAGA	4135	UCUGGAGAUACUGUACAAU	4136
UUGUACAGUAUCUCCAGAA	4137	UUCUGGAGAUACUGUACAA	4138
UGUACAGUAUCUCCAGAAG	4139	CUUCUGGAGAUACUGUACA	4140
CUCCAGAAGCAUAGCUAUA	4141	UAUAGCUAUGCUUCUGGAG	4142
UCCAGAAGCAUAGCUAUAA	4143	UUAUAGCUAUGCUUCUGGA	4144
CCAGAAGCAUAGCUAUAAA	4145	UUUAUAGCUAUGCUUCUGG	4146
ACGAGGACCUGUGGGAUAG	4147	CUAUCCCACAGGUCCUCGU	4148
CGAGGACCUGUGGGAUAGU	4149	ACUAUCCCACAGGUCCUCG	4150
GAGGACCUGUGGGAUAGUA	4151	UACUAUCCCACAGGUCCUC	4152
AGGACCUGUGGGAUAGUAU	4153	AUACUAUCCCACAGGUCCU	4154

GGACCUGUGGGAUAGUAUG	4155	CAUACUAUCCCACAGGUCC	4156
GACCUGUGGGAUAGUAUGG	4157	CCAUACUAUCCCACAGGUC	4158
ACCUGUGGGAUAGUAUGGC	4159	GCCAUACUAUCCCACAGGU	4160
CCUGUGGGAUAGUAUGGCA	4161	UGCCAUACUAUCCCACAGG	4162
CUGUGGGAUAGUAUGGCAA	4163	UUGCCAUACUAUCCCACAG	4164
UGUGGGAUAGUAUGGCAAG	4165	CUUGCCAUACUAUCCCACA	4166
GUGGGAUAGUAUGGCAAGU	4167	ACUUGCCAUACUAUCCCAC	4168
UGGGAUAGUAUGGCAAGUA	4169	UACUUGCCAUACUAUCCCA	4170
GGGAUAGUAUGGCAAGUAU	4171	AUACUUGCCAUACUAUCCC	4172
AAGUAUUUGCCCUACAGAU	4173	AUCUGUAGGGCAAAUACUU	4174
AGUAUUUGCCCUACAGAUG	4175	CAUCUGUAGGGCAAAUACU	4176
GUAUUUGCCCUACAGAUGG	4177	CCAUCUGUAGGGCAAAUAC	4178
UAUUUGCCCUACAGAUGGU	4179	ACCAUCUGUAGGGCAAAUA	4180
AUUUGCCCUACAGAUGGUG	4181	CACCAUCUGUAGGGCAAAU	4182
UUUGCCCUACAGAUGGUGU	4183	ACACCAUCUGUAGGGCAAA	4184
UGGUGUAAAAGGGAUGGAU	4185	AUCCAUCCCUUUUACACCA	4186
GGUGUAAAAGGGAUGGAUG	4187	CAUCCAUCCCUUUUACACC	4188
GUGUAAAAGGGAUGGAUGG	4189	CCAUCCAUCCCUUUUACAC	4190
UGUAAAAGGGAUGGAUGGC	4191	GCCAUCCAUCCCUUUUACA	4192
AAGGGAUGGAUGGCUUUUG	4193	CAAAAGCCAUCCAUCCCUU	4194
AGGGAUGGAUGGCUUUUGC	4195	GCAAAAGCCAUCCAUCCCU	4196
GGGAUGGAUGGCUUUUGCU	4197	AGCAAAAGCCAUCCAUCCC	4198
GAUGGAUGGCUUUUGCUCU	4199	AGAGCAAAAGCCAUCCAUC	4200
AUGGAUGGCUUUUGCUCUA	4201	UAGAGCAAAAGCCAUCCAU	4202
UGGAUGGCUUUUGCUCUAG	4203	CUAGAGCAAAAGCCAUCCA	4204
GGAUGGCUUUUGCUCUAGA	4205	UCUAGAGCAAAAGCCAUCC	4206
GAUGGCUUUUGCUCUAGAA	4207	UUCUAGAGCAAAAGCCAUC	4208
AUGGCUUUUGCUCUAGAAG	4209	CUUCUAGAGCAAAAGCCAU	4210
UGGCUUUUGCUCUAGAAGU	4211	ACUUCUAGAGCAAAAGCCA	4212
GGCUUUUGCUCUAGAAGUC	4213	GACUUCUAGAGCAAAAGCC	4214
GCUUUUGCUCUAGAAGUCA	4215	UGACUUCUAGAGCAAAAGC	4216

CUUUUGCUCUAGAAGUCAA	4217	UUGACUUCUAGAGCAAAAG	4218
UUUUGCUCUAGAAGUCAAC	4219	GUUGACUUCUAGAGCAAAA	4220
UUCAUCUUCAUCCUCACAU	4221	AUGUGAGGAUGAAGAUGAA	4222
UCAUCUUCAUCCUCACAUU	4223	AAUGUGAGGAUGAAGAUGA	4224
CAUCUUCAUCCUCACAUUG	4225	CAAUGUGAGGAUGAAGAUG	4226
AUCUUCAUCCUCACAUUGG	4227	CCAAUGUGAGGAUGAAGAU	4228
UCUUCAUCCUCACAUUGGC	4229	GCCAAUGUGAGGAUGAAGA	4230
CUUCAUCCUCACAUUGGCA	4231	UGCCAAUGUGAGGAUGAAG	4232
UUCAUCCUCACAUUGGCAU	4233	AUGCCAAUGUGAGGAUGAA	4234
UCAUCCUCACAUUGGCAUC	4235	GAUGCCAAUGUGAGGAUGA	4236
CAUCCUCACAUUGGCAUCA	4237	UGAUGCCAAUGUGAGGAUG	4238
CCCUAAUAACCAUCACAGU	4239	ACUGUGAUGGUUAUUAGGG	4240
CCUAAUAACCAUCACAGUG	4241	CACUGUGAUGGUUAUUAGG	4242
AGCAAGAGCACUACAUGAA	4243	UUCAUGUAGUGCUCUUGCU	4244
GCAAGAGCACUACAUGAAG	4245	CUUCAUGUAGUGCUCUUGC	4246
CACUACAUGAAGGGCUCUG	4247	CAGAGCCCUUCAUGUAGUG	4248
ACUACAUGAAGGGCUCUGA	4249	UCAGAGCCCUUCAUGUAGU	4250
CUACAUGAAGGGCUCUGAC	4251	GUCAGAGCCCUUCAUGUAG	4252
UACAUGAAGGGCUCUGACG	4253	CGUCAGAGCCCUUCAUGUA	4254
ACAUGAAGGGCUCUGACGG	4255	CCGUCAGAGCCCUUCAUGU	4256
CAUGAAGGGCUCUGACGGC	4257	GCCGUCAGAGCCCUUCAUG	4258
AUGAAGGGCUCUGACGGCG	4259	CGCCGUCAGAGCCCUUCAU	4260
CCGGACACUGGGUACCUGU	4261	ACAGGUACCCAGUGUCCGG	4262
CGGACACUGGGUACCUGUG	4263	CACAGGUACCCAGUGUCCG	4264
GGACACUGGGUACCUGUGG	4265	CCACAGGUACCCAGUGUCC	4266
GACACUGGGUACCUGUGGC	4267	GCCACAGGUACCCAGUGUC	4268
ACACUGGGUACCUGUGGCA	4269	UGCCACAGGUACCCAGUGU	4270
CACUGGGUACCUGUGGCAU	4271	AUGCCACAGGUACCCAGUG	4272
ACUGGGUACCUGUGGCAUG	4273	CAUGCCACAGGUACCCAGU	4274
CUGGGUACCUGUGGCAUGU	4275	ACAUGCCACAGGUACCCAG	4276
UGGGUACCUGUGGCAUGUU	4277	AACAUGCCACAGGUACCCA	4278

GGGUACCUGUGGCAUGUUC	4279	GAACAUGCCACAGGUACCC	4280
GGUACCUGUGGCAUGUUCC	4281	GGAACAUGCCACAGGUACC	4282
GUACCUGUGGCAUGUUCCA	4283	UGGAACAUGCCACAGGUAC	4284
UACCUGUGGCAUGUUCCAU	4285	AUGGAACAUGCCACAGGUA	4286
ACCUGUGGCAUGUUCCAUU	4287	AAUGGAACAUGCCACAGGU	4288
CCUGUGGCAUGUUCCAUUG	4289	CAAUGGAACAUGCCACAGG	4290
CUGUGGCAUGUUCCAUUGA	4291	UCAAUGGAACAUGCCACAG	4292
UGUGGCAUGUUCCAUUGAC	4293	GUCAAUGGAACAUGCCACA	4294
GUGGCAUGUUCCAUUGACA	4295	UGUCAAUGGAACAUGCCAC	4296
UGUUCCAUUGACAUUCAUC	4297	GAUGAAUGUCAAUGGAACA	4298
UCCAUUGACAUUCAUCACC	4299	GGUGAUGAAUGUCAAUGGA	4300
CAUUGACAUUCAUCACCAG	4301	CUGGUGAUGAAUGUCAAUG	4302
ACAUUCAUCACCAGCAAAU	4303	AUUUGCUGGUGAUGAAUGU	4304
CUCCCAGAAGAGGUGGAAU	4305	AUUCCACCUCUUCUGGGAG	4306
UCCCAGAAGAGGUGGAAUG	4307	CAUUCCACCUCUUCUGGGA	4308
CCCAGAAGAGGUGGAAUGG	4309	CCAUUCCACCUCUUCUGGG	4310
CCAGAAGAGGUGGAAUGGA	4311	UCCAUUCCACCUCUUCUGG	4312
CAGAAGAGGUGGAAUGGAU	4313	AUCCAUUCCACCUCUUCUG	4314
AGAAGAGGUGGAAUGGAUC	4315	GAUCCAUUCCACCUCUUCU	4316
GAAGAGGUGGAAUGGAUCA	4317	UGAUCCAUUCCACCUCUUC	4318
GAGGUGGAAUGGAUCAAAU	4319	AUUUGAUCCAUUCCACCUC	4320
AGGUGGAAUGGAUCAAAUU	4321	AAUUUGAUCCAUUCCACCU	4322
GGUGGAAUGGAUCAAAUUU	4323	AAAUUUGAUCCAUUCCACC	4324
GUGGAAUGGAUCAAAUUUA	4325	UAAAUUUGAUCCAUUCCAC	4326
GAUCAAAUUUAAUGUGGGC	4327	GCCCACAUUAAAUUUGAUC	4328
AUCAAAUUUAAUGUGGGCA	4329	UGCCCACAUUAAAUUUGAU	4330
UCAAAUUUAAUGUGGGCAU	4331	AUGCCCACAUUAAAUUUGA	4332
CAAAUUUAAUGUGGGCAUG	4333	CAUGCCCACAUUAAAUUUG	4334
AAAUUUAAUGUGGGCAUGA	4335	UCAUGCCCACAUUAAAUUU	4336
AAUUUAAUGUGGGCAUGAA	4337	UUCAUGCCCACAUUAAAUU	4338
UAAUGUGGGCAUGAAUGGC	4339	GCCAUUCAUGCCCACAUUA	4340

AAUGUGGGCAUGAAUGGCU	4341	AGCCAUUCAUGCCCACAUU	4342
AUGUGGGCAUGAAUGGCUA	4343	UAGCCAUUCAUGCCCACAU	4344
UGUGGGCAUGAAUGGCUAU	4345	AUAGCCAUUCAUGCCCACA	4346
GUGGGCAUGAAUGGCUAUU	4347	AAUAGCCAUUCAUGCCCAC	4348
UGGGCAUGAAUGGCUAUUA	4349	UAAUAGCCAUUCAUGCCCA	4350
GGGCAUGAAUGGCUAUUAC	4351	GUAAUAGCCAUUCAUGCCC	4352
GGCAUGAAUGGCUAUUACA	4353	UGUAAUAGCCAUUCAUGCC	4354
AUGGCUAUUACAUUGUGCA	4355	UGCACAAUGUAAUAGCCAU	4356
AUUACAUUGUGCAUUACGA	4357	UCGUAAUGCACAAUGUAAU	4358
UUACAUUGUGCAUUACGAG	4359	CUCGUAAUGCACAAUGUAA	4360
UACAUUGUGCAUUACGAGG	4361	CCUCGUAAUGCACAAUGUA	4362
ACAUUGUGCAUUACGAGGA	4363	UCCUCGUAAUGCACAAUGU	4364
CAUUGUGCAUUACGAGGAU	4365	AUCCUCGUAAUGCACAAUG	4366
AUUGUGCAUUACGAGGAUG	4367	CAUCCUCGUAAUGCACAAU	4368
UUGUGCAUUACGAGGAUGA	4369	UCAUCCUCGUAAUGCACAA	4370
UGUGCAUUACGAGGAUGAU	4371	AUCAUCCUCGUAAUGCACA	4372
GUGCAUUACGAGGAUGAUG	4373	CAUCAUCCUCGUAAUGCAC	4374
UGCAUUACGAGGAUGAUGG	4375	CCAUCAUCCUCGUAAUGCA	4376
GCAUUACGAGGAUGAUGGA	4377	UCCAUCAUCCUCGUAAUGC	4378
CAUUACGAGGAUGAUGGAU	4379	AUCCAUCAUCCUCGUAAUG	4380
AUUACGAGGAUGAUGGAUG	4381	CAUCCAUCAUCCUCGUAAU	4382
UUACGAGGAUGAUGGAUGG	4383	CCAUCCAUCAUCCUCGUAA	4384
UACGAGGAUGAUGGAUGGG	4385	CCCAUCCAUCAUCCUCGUA	4386
ACGAGGAUGAUGGAUGGGA	4387	UCCCAUCCAUCAUCCUCGU	4388
CGAGGAUGAUGGAUGGGAC	4389	GUCCCAUCCAUCAUCCUCG	4390
GAGGAUGAUGGAUGGGACU	4391	AGUCCCAUCCAUCAUCCUC	4392
AGGAUGAUGGAUGGGACUC	4393	GAGUCCCAUCCAUCAUCCU	4394
GGAUGAUGGAUGGGACUCU	4395	AGAGUCCCAUCCAUCAUCC	4396
GAUGAUGGAUGGGACUCUU	4397	AAGAGUCCCAUCCAUCAUC	4398
AUGAUGGAUGGGACUCUUU	4399	AAAGAGUCCCAUCCAUCAU	4400
UGAUGGAUGGGACUCUUUG	4401	CAAAGAGUCCCAUCCAUCA	4402

GAUGGAUGGGACUCUUUGA	4403	UCAAAGAGUCCCAUCCAUC	4404
AUGGAUGGGACUCUUUGAC	4405	GUCAAAGAGUCCCAUCCAU	4406
UGGAUGGGACUCUUUGACU	4407	AGUCAAAGAGUCCCAUCCA	4408
GGAUGGGACUCUUUGACUG	4409	CAGUCAAAGAGUCCCAUCC	4410
GAUGGGACUCUUUGACUGG	4411	CCAGUCAAAGAGUCCCAUC	4412
AUGGGACUCUUUGACUGGC	4413	GCCAGUCAAAGAGUCCCAU	4414
UGGGACUCUUUGACUGGCC	4415	GGCCAGUCAAAGAGUCCCA	4416
GGGACUCUUUGACUGGCCU	4417	AGGCCAGUCAAAGAGUCCC	4418
GGACUCUUUGACUGGCCUU	4419	AAGGCCAGUCAAAGAGUCC	4420
GACUCUUUGACUGGCCUUU	4421	AAAGGCCAGUCAAAGAGUC	4422
ACUCUUUGACUGGCCUUUU	4423	AAAAGGCCAGUCAAAGAGU	4424
CUCUUUGACUGGCCUUUUA	4425	UAAAAGGCCAGUCAAAGAG	4426
UCUUUGACUGGCCUUUUAA	4427	UUAAAAGGCCAGUCAAAGA	4428
CUUUGACUGGCCUUUUAAA	4429	UUUAAAAGGCCAGUCAAAG	4430
UUUGACUGGCCUUUUAAAA	4431	UUUUAAAAGGCCAGUCAAA	4432
UUGACUGGCCUUUUAAAAG	4433	CUUUUAAAAGGCCAGUCAA	4434
CACAGCAGUCAGCAGUAAU	4435	AUUACUGCUGACUGCUGUG	4436
ACAGCAGUCAGCAGUAAUG	4437	CAUUACUGCUGACUGCUGU	4438
CAGCAGUCAGCAGUAAUGA	4439	UCAUUACUGCUGACUGCUG	4440
AGCAGUCAGCAGUAAUGAU	4441	AUCAUUACUGCUGACUGCU	4442
GCAGUCAGCAGUAAUGAUC	4443	GAUCAUUACUGCUGACUGC	4444
CAGUCAGCAGUAAUGAUCG	4445	CGAUCAUUACUGCUGACUG	4446
AGUCAGCAGUAAUGAUCGG	4447	CCGAUCAUUACUGCUGACU	4448
GUCAGCAGUAAUGAUCGGG	4449	CCCGAUCAUUACUGCUGAC	4450
UCAGCAGUAAUGAUCGGGC	4451	GCCCGAUCAUUACUGCUGA	4452
AGCAUUGGGAAGCUGUCCA	4453	UGGACAGCUUCCCAAUGCU	4454
GCAUUGGGAAGCUGUCCAU	4455	AUGGACAGCUUCCCAAUGC	4456
CAUUGGGAAGCUGUCCAUU	4457	AAUGGACAGCUUCCCAAUG	4458
AUUGGGAAGCUGUCCAUUG	4459	CAAUGGACAGCUUCCCAAU	4460
UUGGGAAGCUGUCCAUUGA	4461	UCAAUGGACAGCUUCCCAA	4462
UGGGAAGCUGUCCAUUGAA	4463	UUCAAUGGACAGCUUCCCA	4464

AAAAGGCCUUGGAUUUAUC	4465	GAUAAAUCCAAGGCCUUUU	4466
AAAGGCCUUGGAUUUAUCC	4467	GGAUAAAUCCAAGGCCUUU	4468
AAGGCCUUGGAUUUAUCCC	4469	GGGAUAAAUCCAAGGCCUU	4470
CCUUGGAUUUAUCCCUGUA	4471	UACAGGGAUAAAUCCAAGG	4472
CUUGGAUUUAUCCCUGUAC	4473	GUACAGGGAUAAAUCCAAG	4474
UUGGAUUUAUCCCUGUACU	4475	AGUACAGGGAUAAAUCCAA	4476
UGGAUUUAUCCCUGUACUU	4477	AAGUACAGGGAUAAAUCCA	4478
GGAUUUAUCCCUGUACUUG	4479	CAAGUACAGGGAUAAAUCC	4480
AUUAUGCCCGUGUUUCAAG	4481	CUUGAAACACGGGCAUAAU	4482
UUAUGCCCGUGUUUCAAGG	4483	CCUUGAAACACGGGCAUAA	4484
UAUGCCCGUGUUUCAAGGU	4485	ACCUUGAAACACGGGCAUA	4486
AUGCCCGUGUUUCAAGGUU	4487	AACCUUGAAACACGGGCAU	4488
UGCCCGUGUUUCAAGGUUU	4489	AAACCUUGAAACACGGGCA	4490
CAAGGUUUGAAUGAGCUGA	4491	UCAGCUCAUUCAAACCUUG	4492
CUGAUUCCUAUGUAUAAGU	4493	ACUUAUACAUAGGAAUCAG	4494
CCUAUGUAUAAGUUAAUGG	4495	CCAUUAACUUAUACAUAGG	4496
AACUCAAUUCAAGGCCUUC	4497	GAAGGCCUUGAAUUGAGUU	4498
ACUCAAUUCAAGGCCUUCC	4499	GGAAGGCCUUGAAUUGAGU	4500
CUCAAUUCAAGGCCUUCCU	4501	AGGAAGGCCUUGAAUUGAG	4502
UCAAUUCAAGGCCUUCCUC	4503	GAGGAAGGCCUUGAAUUGA	4504
UUCAAGGCCUUCCUCAUCA	4505	UGAUGAGGAAGGCCUUGAA	4506
UCCUCAUCAGGCUGCUAAG	4507	CUUAGCAGCCUGAUGAGGA	4508
CCUCAUCAGGCUGCUAAGG	4509	CCUUAGCAGCCUGAUGAGG	4510
UCAGGCUGCUAAGGGACCU	4511	AGGUCCCUUAGCAGCCUGA	4512
CAGGCUGCUAAGGGACCUC	4513	GAGGUCCCUUAGCAGCCUG	4514
AGGCUGCUAAGGGACCUCA	4515	UGAGGUCCCUUAGCAGCCU	4516
GGCUGCUAAGGGACCUCAU	4517	AUGAGGUCCCUUAGCAGCC	4518
GCUGCUAAGGGACCUCAUU	4519	AAUGAGGUCCCUUAGCAGC	4520
CUGCUAAGGGACCUCAUUG	4521	CAAUGAGGUCCCUUAGCAG	4522
UGCUAAGGGACCUCAUUGA	4523	UCAAUGAGGUCCCUUAGCA	4524
GCUAAGGGACCUCAUUGAU	4525	AUCAAUGAGGUCCCUUAGC	4526

CUAAGGGACCUCAUUGAUA	4527	UAUCAAUGAGGUCCCUUAG	4528
AAGGGACCUCAUUGAUAAG	4529	CUUAUCAAUGAGGUCCCUU	4530
AGGGACCUCAUUGAUAAGC	4531	GCUUAUCAAUGAGGUCCCU	4532
GGGACCUCAUUGAUAAGCA	4533	UGCUUAUCAAUGAGGUCCC	4534
GGACCUCAUUGAUAAGCAG	4535	CUGCUUAUCAAUGAGGUCC	4536
GACCUCAUUGAUAAGCAGA	4537	UCUGCUUAUCAAUGAGGUC	4538
AUUGAUAAGCAGACAUGGA	4539	UCCAUGUCUGCUUAUCAAU	4540
GAUAAGCAGACAUGGACAG	4541	CUGUCCAUGUCUGCUUAUC	4542
AUAAGCAGACAUGGACAGA	4543	UCUGUCCAUGUCUGCUUAU	4544
UAAGCAGACAUGGACAGAC	4545	GUCUGUCCAUGUCUGCUUA	4546
AGCAGACAUGGACAGACGA	4547	UCGUCUGUCCAUGUCUGCU	4548
GCAGACAUGGACAGACGAG	4549	CUCGUCUGUCCAUGUCUGC	4550
CAGACAUGGACAGACGAGG	4551	CCUCGUCUGUCCAUGUCUG	4552
AGACAUGGACAGACGAGGG	4553	CCCUCGUCUGUCCAUGUCU	4554
GACAUGGACAGACGAGGGC	4555	GCCCUCGUCUGUCCAUGUC	4556
UGGACAGACGAGGGCUCAG	4557	CUGAGCCCUCGUCUGUCCA	4558
GACAGACGAGGGCUCAGUC	4559	GACUGAGCCCUCGUCUGUC	4560
GACGAGGGCUCAGUCUCAG	4561	CUGAGACUGAGCCCUCGUC	4562
ACGAGGGCUCAGUCUCAGA	4563	UCUGAGACUGAGCCCUCGU	4564
AACUACUACUCCUCGCCUG	4565	CAGGCGAGGAGUAGUAGUU	4566
ACUACUACUCCUCGCCUGU	4567	ACAGGCGAGGAGUAGUAGU	4568
CUACUACUCCUCGCCUGUG	4569	CACAGGCGAGGAGUAGUAG	4570
UACUACUCCUCGCCUGUGU	4571	ACACAGGCGAGGAGUAGUA	4572
ACUACUCCUCGCCUGUGUG	4573	CACACAGGCGAGGAGUAGU	4574
CUACUCCUCGCCUGUGUGC	4575	GCACACAGGCGAGGAGUAG	4576
UACUCCUCGCCUGUGUGCA	4577	UGCACACAGGCGAGGAGUA	4578
ACUCCUCGCCUGUGUGCAC	4579	GUGCACACAGGCGAGGAGU	4580
UACAGAGGGCAGAAGGCUA	4581	UAGCCUUCUGCCCUCUGUA	4582
ACAGAGGGCAGAAGGCUAU	4583	AUAGCCUUCUGCCCUCUGU	4584
AGAGGGCAGAAGGCUAUUU	4585	AAAUAGCCUUCUGCCCUCU	4586
GAGGGCAGAAGGCUAUUUC	4587	GAAAUAGCCUUCUGCCCUC	4588

GCAGAAGGCUAUUUCAGAA	4589	UUCUGAAAUAGCCUUCUGC	4590
CCUGUCGACGUGACCUUGG	4591	CCAAGGUCACGUCGACAGG	4592
CUGUCGACGUGACCUUGGC	4593	GCCAAGGUCACGUCGACAG	4594
UGUCGACGUGACCUUGGCA	4595	UGCCAAGGUCACGUCGACA	4596
GUCGACGUGACCUUGGCAG	4597	CUGCCAAGGUCACGUCGAC	4598
UCGACGUGACCUUGGCAGU	4599	ACUGCCAAGGUCACGUCGA	4600
UGACCUUGGCAGUGUUUGC	4601	GCAAACACUGCCAAGGUCA	4602
CCUUGGCAGUGUUUGCUGU	4603	ACAGCAAACACUGCCAAGG	4604
UUGGCAGUGUUUGCUGUGG	4605	CCACAGCAAACACUGCCAA	4606
UGGCAGUGUUUGCUGUGGG	4607	CCCACAGCAAACACUGCCA	4608
CAGAGCACAGAAGGCUGGG	4609	CCCAGCCUUCUGUGCUCUG	4610
AGAGCACAGAAGGCUGGGA	4611	UCCCAGCCUUCUGUGCUCU	4612
GAGCACAGAAGGCUGGGAU	4613	AUCCCAGCCUUCUGUGCUC	4614
AGCACAGAAGGCUGGGAUU	4615	AAUCCCAGCCUUCUGUGCU	4616
GCACAGAAGGCUGGGAUUU	4617	AAAUCCCAGCCUUCUGUGC	4618
ACAGAAGGCUGGGAUUUUC	4619	GAAAAUCCCAGCCUUCUGU	4620
AGUUUUCUUUGUCCAGUAC	4621	GUACUGGACAAAGAAAACU	4622
GUUUUCUUUGUCCAGUACU	4623	AGUACUGGACAAAGAAAAC	4624
UUUUCUUUGUCCAGUACUG	4625	CAGUACUGGACAAAGAAAA	4626
UUUCUUUGUCCAGUACUGA	4627	UCAGUACUGGACAAAGAAA	4628
UUCUUUGUCCAGUACUGAG	4629	CUCAGUACUGGACAAAGAA	4630
AAAAGCUUCAAUGGCUACU	4631	AGUAGCCAUUGAAGCUUUU	4632
AAAGCUUCAAUGGCUACUA	4633	UAGUAGCCAUUGAAGCUUU	4634
CUUCAAUGGCUACUAGAUG	4635	CAUCUAGUAGCCAUUGAAG	4636
UUCAAUGGCUACUAGAUGA	4637	UCAUCUAGUAGCCAUUGAA	4638
UCAAUGGCUACUAGAUGAA	4639	UUCAUCUAGUAGCCAUUGA	4640
CAAAUUCUUACACUCAUUG	4641	CAAUGAGUGUAAGAAUUUG	4642
AAAUUCUUACACUCAUUGG	4643	CCAAUGAGUGUAAGAAUUU	4644
AAUUCUUACACUCAUUGGC	4645	GCCAAUGAGUGUAAGAAUU	4646
AUUCUUACACUCAUUGGCA	4647	UGCCAAUGAGUGUAAGAAU	4648
UUCUUACACUCAUUGGCAG	4649	CUGCCAAUGAGUGUAAGAA	4650

UCUUACACUCAUUGGCAGG	4651	CCUGCCAAUGAGUGUAAGA	4652
CUUACACUCAUUGGCAGGA	4653	UCCUGCCAAUGAGUGUAAG	4654
UUACACUCAUUGGCAGGAA	4655	UUCCUGCCAAUGAGUGUAA	4656
UGGCCUGGCAAUUUCUGAG	4657	CUCAGAAAUUGCCAGGCCA	4658
GGCCUGGCAAUUUCUGAGG	4659	CCUCAGAAAUUGCCAGGCC	4660
GCCUGGCAAUUUCUGAGGA	4661	UCCUCAGAAAUUGCCAGGC	4662
ACUUGGCUCAUCUUCCAUA	4663	UAUGGAAGAUGAGCCAAGU	4664
CUUGGCUCAUCUUCCAUAG	4665	CUAUGGAAGAUGAGCCAAG	4666
GCUCAUCUUCCAUAGCCCA	4667	UGGGCUAUGGAAGAUGAGC	4668
CUCAUCUUCCAUAGCCCAC	4669	GUGGGCUAUGGAAGAUGAG	4670
CAUAGCCCACAUGGUAAUG	4671	CAUUACCAUGUGGGCUAUG	4672
AUAGCCCACAUGGUAAUGG	4673	CCAUUACCAUGUGGGCUAU	4674
CCACAUGGUAAUGGGUACA	4675	UGUACCCAUUACCAUGUGG	4676
ACACGGCUUGAAGAGGUAA	4677	UUACCUCUUCAAGCCGUGU	4678
CACGGCUUGAAGAGGUAAA	4679	UUUACCUCUUCAAGCCGUG	4680
ACGGCUUGAAGAGGUAAAA	4681	UUUUACCUCUUCAAGCCGU	4682
CGGCUUGAAGAGGUAAAAG	4683	CUUUUACCUCUUCAAGCCG	4684
GGCUUGAAGAGGUAAAAGG	4685	CCUUUUACCUCUUCAAGCC	4686
GCUUGAAGAGGUAAAAGGA	4687	UCCUUUUACCUCUUCAAGC	4688
GAAGAGGUAAAAGGAUUCU	4689	AGAAUCCUUUUACCUCUUC	4690
AGAGGUAAAAGGAUUCUUC	4691	GAAGAAUCCUUUUACCUCU	4692
GUAAAAGGAUUCUUCAGCU	4693	AGCUGAAGAAUCCUUUUAC	4694
UAAAAGGAUUCUUCAGCUC	4695	GAGCUGAAGAAUCCUUUUA	4696
AAAAGGAUUCUUCAGCUCU	4697	AGAGCUGAAGAAUCCUUUU	4698
AAAGGAUUCUUCAGCUCUU	4699	AAGAGCUGAAGAAUCCUUU	4700
AAGGAUUCUUCAGCUCUUU	4701	AAAGAGCUGAAGAAUCCUU	4702
AGGAUUCUUCAGCUCUUUG	4703	CAAAGAGCUGAAGAAUCCU	4704
GGAUUCUUCAGCUCUUUGA	4705	UCAAAGAGCUGAAGAAUCC	4706
AAAAUGGUUCUCAGCUCCG	4707	CGGAGCUGAGAACCAUUUU	4708
AAAUGGUUCUCAGCUCCGU	4709	ACGGAGCUGAGAACCAUUU	4710
GGUUCUCAGCUCCGUUGUG	4711	CACAACGGAGCUGAGAACC	4712

GUUCUCAGCUCCGUUGUGU	4713	ACACAACGGAGCUGAGAAC	4714
UUCUCAGCUCCGUUGUGUC	4715	GACACAACGGAGCUGAGAA	4716
UCUCAGCUCCGUUGUGUCC	4717	GGACACAACGGAGCUGAGA	4718
CUCAGCUCCGUUGUGUCCA	4719	UGGACACAACGGAGCUGAG	4720
UCAGCUCCGUUGUGUCCAA	4721	UUGGACACAACGGAGCUGA	4722
AUCGGUUGGAUGGAUAAGA	4723	UCUUAUCCAUCCAACCGAU	4724
UCGGUUGGAUGGAUAAGAA	4725	UUCUUAUCCAUCCAACCGA	4726
CGGUUGGAUGGAUAAGAAU	4727	AUUCUUAUCCAUCCAACCG	4728
GGUUGGAUGGAUAAGAAUU	4729	AAUUCUUAUCCAUCCAACC	4730
GGAUGGAUAAGAAUUUUGA	4731	UCAAAAUUCUUAUCCAUCC	4732
GAUAAAAUCAGAGUGUGGC	4733	GCCACACUCUGAUUUUAUC	4734
UAAAAUCAGAGUGUGGCUG	4735	CAGCCACACUCUGAUUUUA	4736
AAAAUCAGAGUGUGGCUGC	4737	GCAGCCACACUCUGAUUUU	4738
AAAUCAGAGUGUGGCUGCA	4739	UGCAGCCACACUCUGAUUU	4740
AAUCAGAGUGUGGCUGCAA	4741	UUGCAGCCACACUCUGAUU	4742
UCAGAGUGUGGCUGCAAAG	4743	CUUUGCAGCCACACUCUGA	4744
CAGAGUGUGGCUGCAAAGU	4745	ACUUUGCAGCCACACUCUG	4746
AGAGUGUGGCUGCAAAGUG	4747	CACUUUGCAGCCACACUCU	4748
GAGUGUGGCUGCAAAGUGA	4749	UCACUUUGCAGCCACACUC	4750
AGUGUGGCUGCAAAGUGAA	4751	UUCACUUUGCAGCCACACU	4752
ACAUGAUCCUGAAGCUGAC	4753	GUCAGCUUCAGGAUCAUGU	4754
CAUGAUCCUGAAGCUGACG	4755	CGUCAGCUUCAGGAUCAUG	4756
AUGAUCCUGAAGCUGACGC	4757	GCGUCAGCUUCAGGAUCAU	4758
UGAUCCUGAAGCUGACGCA	4759	UGCGUCAGCUUCAGGAUCA	4760
GAUCCUGAAGCUGACGCAA	4761	UUGCGUCAGCUUCAGGAUC	4762
AUCCUGAAGCUGACGCAAC	4763	GUUGCGUCAGCUUCAGGAU	4764
AAAAUCCAUCAGAAUCUCA	4765	UGAGAUUCUGAUGGAUUUU	4766
CACUAAAUAUGCUUUGAUG	4767	CAUCAAAGCAUAUUUAGUG	4768
ACUAAAUAUGCUUUGAUGC	4769	GCAUCAAAGCAUAUUUAGU	4770
CUAAAUAUGCUUUGAUGCU	4771	AGCAUCAAAGCAUAUUUAG	4772
AAAUAUGCUUUGAUGCUAC	4773	GUAGCAUCAAAGCAUAUUU	4774

AAUAUGCUUUGAUGCUACA	4775	UGUAGCAUCAAAGCAUAUU	4776
CUUCGCUAAAGUUACUUCA	4777	UGAAGUAACUUUAGCGAAG	4778
UUCGCUAAAGUUACUUCAU	4779	AUGAAGUAACUUUAGCGAA	4780
UCGCUAAAGUUACUUCAUC	4781	GAUGAAGUAACUUUAGCGA	4782
CGCUAAAGUUACUUCAUCU	4783	AGAUGAAGUAACUUUAGCG	4784
UACUUCAUCUCCAUCUAGC	4785	GCUAGAUGGAGAUGAAGUA	4786
ACUUCAUCUCCAUCUAGCA	4787	UGCUAGAUGGAGAUGAAGU	4788
CUUCAUCUCCAUCUAGCAA	4789	UUGCUAGAUGGAGAUGAAG	4790
UUCAUCUCCAUCUAGCAAA	4791	UUUGCUAGAUGGAGAUGAA	4792
UCAUCUCCAUCUAGCAAAU	4793	AUUUGCUAGAUGGAGAUGA	4794
CAUCUCCAUCUAGCAAAUG	4795	CAUUUGCUAGAUGGAGAUG	4796
UCCAUCUAGCAAAUGAGGC	4797	GCCUCAUUUGCUAGAUGGA	4798
CCAUCUAGCAAAUGAGGCA	4799	UGCCUCAUUUGCUAGAUGG	4800
CAUCUAGCAAAUGAGGCAC	4801	GUGCCUCAUUUGCUAGAUG	4802
GGCACUGUUCUCAACCAAA	4803	UUUGGUUGAGAACAGUGCC	4804
CUGUUCUCAACCAAAGGAG	4805	CUCCUUUGGUUGAGAACAG	4806
CCCUUUAUAAUUUGAUGUG	4807	CACAUCAAAUUAUAAAGGG	4808
CCUUUAUAAUUUGAUGUGC	4809	GCACAUCAAAUUAUAAAGG	4810
AUAAUUUGAUGUGCUGUGG	4811	CCACAGCACAUCAAAUUAU	4812
UUUGAUGUGCUGUGGUCUC	4813	GAGACCACAGCACAUCAAA	4814
AUGUGCUGUGGUCUCCUUG	4815	CAAGGAGACCACAGCACAU	4816
UGUGCUGUGGUCUCCUUGG	4817	CCAAGGAGACCACAGCACA	4818
GUGCUGUGGUCUCCUUGGU	4819	ACCAAGGAGACCACAGCAC	4820
UGCUGUGGUCUCCUUGGUA	4821	UACCAAGGAGACCACAGCA	4822
GCUGUGGUCUCCUUGGUAA	4823	UUACCAAGGAGACCACAGC	4824
CUGUGGUCUCCUUGGUAAU	4825	AUUACCAAGGAGACCACAG	4826
UGUGGUCUCCUUGGUAAUG	4827	CAUUACCAAGGAGACCACA	4828
UAAUUUGGUAUUGCACAGG	4829	CCUGUGCAAUACCAAAUUA	4830
AAUUUGGUAUUGCACAGGU	4831	ACCUGUGCAAUACCAAAUU	4832
AUUUGGUAUUGCACAGGUG	4833	CACCUGUGCAAUACCAAAU	4834
UUUGGUAUUGCACAGGUGA	4835	UCACCUGUGCAAUACCAAA	4836

UUGGUAUUGCACAGGUGAU	4837	AUCACCUGUGCAAUACCAA	4838
UGGUAUUGCACAGGUGAUU	4839	AAUCACCUGUGCAAUACCA	4840
GGUAUUGCACAGGUGAUUA	4841	UAAUCACCUGUGCAAUACC	4842
GUAUUGCACAGGUGAUUAG	4843	CUAAUCACCUGUGCAAUAC	4844
UAUUGCACAGGUGAUUAGU	4845	ACUAAUCACCUGUGCAAUA	4846
AUUGCACAGGUGAUUAGUC	4847	GACUAAUCACCUGUGCAAU	4848
UUGCACAGGUGAUUAGUCA	4849	UGACUAAUCACCUGUGCAA	4850
UGCACAGGUGAUUAGUCAA	4851	UUGACUAAUCACCUGUGCA	4852
GCACAGGUGAUUAGUCAAG	4853	CUUGACUAAUCACCUGUGC	4854
CACAGGUGAUUAGUCAAGG	4855	CCUUGACUAAUCACCUGUG	4856
ACAGGUGAUUAGUCAAGGA	4857	UCCUUGACUAAUCACCUGU	4858
CAGGUGAUUAGUCAAGGAA	4859	UUCCUUGACUAAUCACCUG	4860
AGGUGAUUAGUCAAGGAAG	4861	CUUCCUUGACUAAUCACCU	4862
GGUGAUUAGUCAAGGAAGU	4863	ACUUCCUUGACUAAUCACC	4864
GUGAUUAGUCAAGGAAGUC	4865	GACUUCCUUGACUAAUCAC	4866
UGAUUAGUCAAGGAAGUCU	4867	AGACUUCCUUGACUAAUCA	4868
GAUUAGUCAAGGAAGUCUG	4869	CAGACUUCCUUGACUAAUC	4870
UUAGUCAAGGAAGUCUGGA	4871	UCCAGACUUCCUUGACUAA	4872
UAGUCAAGGAAGUCUGGAA	4873	UUCCAGACUUCCUUGACUA	4874
CCCACAGCCUUGCCUCACA	4875	UGUGAGGCAAGGCUGUGGG	4876
CCACAGCCUUGCCUCACAG	4877	CUGUGAGGCAAGGCUGUGG	4878
CACAGCCUUGCCUCACAGC	4879	GCUGUGAGGCAAGGCUGUG	4880
ACAGCCUUGCCUCACAGCA	4881	UGCUGUGAGGCAAGGCUGU	4882
CAGCCUUGCCUCACAGCAU	4883	AUGCUGUGAGGCAAGGCUG	4884
AGCCUUGCCUCACAGCAUG	4885	CAUGCUGUGAGGCAAGGCU	4886
GCCUUGCCUCACAGCAUGU	4887	ACAUGCUGUGAGGCAAGGC	4888
CCUUGCCUCACAGCAUGUA	4889	UACAUGCUGUGAGGCAAGG	4890
CUUGCCUCACAGCAUGUAA	4891	UUACAUGCUGUGAGGCAAG	4892
UUGCCUCACAGCAUGUAAA	4893	UUUACAUGCUGUGAGGCAA	4894
UGCCUCACAGCAUGUAAAU	4895	AUUUACAUGCUGUGAGGCA	4896
GCCUCACAGCAUGUAAAUA	4897	UAUUUACAUGCUGUGAGGC	4898

CCUCACAGCAUGUAAAUAA	4899	UUAUUUACAUGCUGUGAGG	4900
CAAUAUUGAUGCUGAGGUU	4901	AACCUCAGCAUCAAUAUUG	4902
AAUAUUGAUGCUGAGGUUC	4903	GAACCUCAGCAUCAAUAUU	4904
AUAUUGAUGCUGAGGUUCU	4905	AGAACCUCAGCAUCAAUAU	4906
UAUUGAUGCUGAGGUUCUU	4907	AAGAACCUCAGCAUCAAUA	4908
AUUGAUGCUGAGGUUCUUC	4909	GAAGAACCUCAGCAUCAAU	4910
UUGAUGCUGAGGUUCUUCU	4911	AGAAGAACCUCAGCAUCAA	4912
UGAUGCUGAGGUUCUUCUA	4913	UAGAAGAACCUCAGCAUCA	4914
GAGGUUCUUCUACUGCUAG	4915	CUAGCAGUAGAAGAACCUC	4916
AGGUUCUUCUACUGCUAGU	4917	ACUAGCAGUAGAAGAACCU	4918
UUUUACUGGUGUGAAUUGG	4919	CCAAUUCACACCAGUAAAA	4920
UUUACUGGUGUGAAUUGGG	4921	CCCAAUUCACACCAGUAAA	4922
UUACUGGUGUGAAUUGGGA	4923	UCCCAAUUCACACCAGUAA	4924
UACUGGUGUGAAUUGGGAA	4925	UUCCCAAUUCACACCAGUA	4926
CUGGUGUGAAUUGGGAAGA	4927	UCUUCCCAAUUCACACCAG	4928
UGGUGUGAAUUGGGAAGAA	4929	UUCUUCCCAAUUCACACCA	4930
UGCUAUUCCAUGACGUUUG	4931	CAAACGUCAUGGAAUAGCA	4932
GCUAUUCCAUGACGUUUGU	4933	ACAAACGUCAUGGAAUAGC	4934
CUAUUCCAUGACGUUUGUA	4935	UACAAACGUCAUGGAAUAG	4936
UAUUCCAUGACGUUUGUAA	4937	UUACAAACGUCAUGGAAUA	4938
AUUCCAUGACGUUUGUAAA	4939	UUUACAAACGUCAUGGAAU	4940
UUCCAUGACGUUUGUAAAA	4941	UUUUACAAACGUCAUGGAA	4942
UCCAUGACGUUUGUAAAAU	4943	AUUUUACAAACGUCAUGGA	4944
CCAUGACGUUUGUAAAAUG	4945	CAUUUUACAAACGUCAUGG	4946
CAUGACGUUUGUAAAAUGU	4947	ACAUUUUACAAACGUCAUG	4948
CUUGAGGUUAAAUAAUGGG	4949	CCCAUUAUUUAACCUCAAG	4950
UUGAGGUUAAAUAAUGGGU	4951	ACCCAUUAUUUAACCUCAA	4952
UGAGGUUAAAUAAUGGGUA	4953	UACCCAUUAUUUAACCUCA	4954
GAGGUUAAAUAAUGGGUAG	4955	CUACCCAUUAUUUAACCUC	4956
AGGUUAAAUAAUGGGUAGU	4957	ACUACCCAUUAUUUAACCU	4958
GGUUAAAUAAUGGGUAGUA	4959	UACUACCCAUUAUUUAACC	4960

UAAUAUUAAGGUCCUUGAC	4961	GUCAAGGACCUUAAUAUUA	4962
AAUAUUAAGGUCCUUGACU	4963	AGUCAAGGACCUUAAUAUU	4964
AUAUUAAGGUCCUUGACUA	4965	UAGUCAAGGACCUUAAUAU	4966
UAUUAAGGUCCUUGACUAU	4967	AUAGUCAAGGACCUUAAUA	4968
AUUAAGGUCCUUGACUAUG	4969	CAUAGUCAAGGACCUUAAU	4970
AGGUCCUUGACUAUGUGUA	4971	UACACAUAGUCAAGGACCU	4972
GGUCCUUGACUAUGUGUAC	4973	GUACACAUAGUCAAGGACC	4974
UAAUCUCUGCCAUCUCGCU	4975	AGCGAGAUGGCAGAGAUUA	4976
AUCUCUGCCAUCUCGCUAA	4977	UUAGCGAGAUGGCAGAGAU	4978
UCUCUGCCAUCUCGCUAAA	4979	UUUAGCGAGAUGGCAGAGA	4980
CUCUGCCAUCUCGCUAAAU	4981	AUUUAGCGAGAUGGCAGAG	4982
UCUGCCAUCUCGCUAAAUC	4983	GAUUUAGCGAGAUGGCAGA	4984
CUGCCAUCUCGCUAAAUCA	4985	UGAUUUAGCGAGAUGGCAG	4986
UGCCAUCUCGCUAAAUCAU	4987	AUGAUUUAGCGAGAUGGCA	4988
GCCAUCUCGCUAAAUCAUC	4989	GAUGAUUUAGCGAGAUGGC	4990
CCAUCUCGCUAAAUCAUCA	4991	UGAUGAUUUAGCGAGAUGG	4992
AGGUGCCUGAUCUUCCUAA	4993	UUAGGAAGAUCAGGCACCU	4994
GGUGCCUGAUCUUCCUAAU	4995	AUUAGGAAGAUCAGGCACC	4996
GUGCCUGAUCUUCCUAAUA	4997	UAUUAGGAAGAUCAGGCAC	4998
UGCCUGAUCUUCCUAAUAA	4999	UUAUUAGGAAGAUCAGGCA	5000
GAUCUUCCUAAUAAUUCUG	5001	CAGAAUUAUUAGGAAGAUC	5002
AUCUUCCUAAUAAUUCUGC	5003	GCAGAAUUAUUAGGAAGAU	5004
UCUUCCUAAUAAUUCUGCC	5005	GGCAGAAUUAUUAGGAAGA	5006
CUUCCUAAUAAUUCUGCCU	5007	AGGCAGAAUUAUUAGGAAG	5008
UUCCUAAUAAUUCUGCCUA	5009	UAGGCAGAAUUAUUAGGAA	5010
UCCUAAUAAUUCUGCCUAU	5011	AUAGGCAGAAUUAUUAGGA	5012
UUCUGCCUAUUUUCAUUUG	5013	CAAAUGAAAAUAGGCAGAA	5014
UCUGCCUAUUUUCAUUUGC	5015	GCAAAUGAAAAUAGGCAGA	5016
GCCUAUUUUCAUUUGCUUU	5017	AAAGCAAAUGAAAAUAGGC	5018
AUUUUCUUUCUAGUUGUGG	5019	CCACAACUAGAAAGAAAAU	5020
UUUUCUUUCUAGUUGUGGC	5021	GCCACAACUAGAAAGAAAA	5022

UUCUUUCUAGUUGUGGCUG	5023	CAGCCACAACUAGAAAGAA	5024
UCUCCCAAAUAAGAUGUGC	5025	GCACAUCUUAUUUGGGAGA	5026
CUCCCAAAUAAGAUGUGCU	5027	AGCACAUCUUAUUUGGGAG	5028
AAGAUGUGCUGCUUACCGA	5029	UCGGUAAGCAGCACAUCUU	5030
AGAUGUGCUGCUUACCGAG	5031	CUCGGUAAGCAGCACAUCU	5032
GAUGUGCUGCUUACCGAGG	5033	CCUCGGUAAGCAGCACAUC	5034
AUGUGCUGCUUACCGAGGU	5035	ACCUCGGUAAGCAGCACAU	5036
UGUGCUGCUUACCGAGGUA	5037	UACCUCGGUAAGCAGCACA	5038
CUGCUUACCGAGGUAUCAC	5039	GUGAUACCUCGGUAAGCAG	5040
UGCUUACCGAGGUAUCACG	5041	CGUGAUACCUCGGUAAGCA	5042
GCUUACCGAGGUAUCACGG	5043	CCGUGAUACCUCGGUAAGC	5044
CUUACCGAGGUAUCACGGG	5045	CCCGUGAUACCUCGGUAAG	5046
GGCUCCAGCUUGGGUCGUU	5047	AACGACCCAAGCUGGAGCC	5048
GCUCCAGCUUGGGUCGUUG	5049	CAACGACCCAAGCUGGAGC	5050
CUCCAGCUUGGGUCGUUGA	5051	UCAACGACCCAAGCUGGAG	5052
UCCAGCUUGGGUCGUUGAA	5053	UUCAACGACCCAAGCUGGA	5054
CCAGCUUGGGUCGUUGAAG	5055	CUUCAACGACCCAAGCUGG	5056
CUUGGGUCGUUGAAGCUGG	5057	CCAGCUUCAACGACCCAAG	5058
UUGGGUCGUUGAAGCUGGG	5059	CCCAGCUUCAACGACCCAA	5060
CAGCAAGUUUAGCAUCUUC	5061	GAAGAUGCUAAACUUGCUG	5062
CAAUGCCAUCACUUAACUA	5063	UAGUUAAGUGAUGGCAUUG	5064
AUGCCAUCACUUAACUAUA	5065	UAUAGUUAAGUGAUGGCAU	5066
UGCCAUCACUUAACUAUAA	5067	UUAUAGUUAAGUGAUGGCA	5068
GCCAUCACUUAACUAUAAC	5069	GUUAUAGUUAAGUGAUGGC	5070
CCAUCACUUAACUAUAACU	5071	AGUUAUAGUUAAGUGAUGG	5072
CAUCACUUAACUAUAACUC	5073	GAGUUAUAGUUAAGUGAUG	5074
UCUCUUGACCAAAUAGACU	5075	AGUCUAUUUGGUCAAGAGA	5076
CUCUUGACCAAAUAGACUC	5077	GAGUCUAUUUGGUCAAGAG	5078
UCUUGACCAAAUAGACUCA	5079	UGAGUCUAUUUGGUCAAGA	5080
CUUGACCAAAUAGACUCAU	5081	AUGAGUCUAUUUGGUCAAG	5082
UUGACCAAAUAGACUCAUA	5083	UAUGAGUCUAUUUGGUCAA	5084

GACCAAAUAGACUCAUAAU	5085	AUUAUGAGUCUAUUUGGUC	5086
UUUCCUGUUGUACAUUUAG	5087	CUAAAUGUACAACAGGAAA	5088
GGUUAUUCAAAGUUUUCAG	5089	CUGAAAACUUUGAAUAACC	5090
UAUUCAAAGUUUUCAGCUC	5091	GAGCUGAAAACUUUGAAUA	5092
AUUCAAAGUUUUCAGCUCU	5093	AGAGCUGAAAACUUUGAAU	5094
UCAGCUCUUUUAAAAUUGC	5095	GCAAUUUUAAAAGAGCUGA	5096
CAGCUCUUUUAAAAUUGCU	5097	AGCAAUUUUAAAAGAGCUG	5098
AGCUCUUUUAAAAUUGCUC	5099	GAGCAAUUUUAAAAGAGCU	5100
GCUCUUUUAAAAUUGCUCU	5101	AGAGCAAUUUUAAAAGAGC	5102
AAUUGCUCUGAAUAAGUUC	5103	GAACUUAUUCAGAGCAAUU	5104
AUUGCUCUGAAUAAGUUCU	5105	AGAACUUAUUCAGAGCAAU	5106
UUGCUCUGAAUAAGUUCUA	5107	UAGAACUUAUUCAGAGCAA	5108
UGCUCUGAAUAAGUUCUAG	5109	CUAGAACUUAUUCAGAGCA	5110
CUGAAUAAGUUCUAGUGAG	5111	CUCACUAGAACUUAUUCAG	5112
AUAAGUUCUAGUGAGUGAG	5113	CUCACUCACUAGAACUUAU	5114
UUCUAGUGAGUGAGUUAUG	5115	CAUAACUCACUCACUAGAA	5116
UCUAGUGAGUGAGUUAUGG	5117	CCAUAACUCACUCACUAGA	5118
UGAGUUAUGGUGCUGGCUA	5119	UAGCCAGCACCAUAACUCA	5120
GAGUUAUGGUGCUGGCUAU	5121	AUAGCCAGCACCAUAACUC	5122
AGUUAUGGUGCUGGCUAUA	5123	UAUAGCCAGCACCAUAACU	5124
GUUAUGGUGCUGGCUAUAU	5125	AUAUAGCCAGCACCAUAAC	5126
UUAUGGUGCUGGCUAUAUU	5127	AAUAUAGCCAGCACCAUAA	5128
UAUGGUGCUGGCUAUAUUU	5129	AAAUAUAGCCAGCACCAUA	5130
AUGGUGCUGGCUAUAUUUU	5131	AAAAUAUAGCCAGCACCAU	5132
UGGUGCUGGCUAUAUUUUG	5133	CAAAAUAUAGCCAGCACCA	5134
GGUGCUGGCUAUAUUUUGC	5135	GCAAAAUAUAGCCAGCACC	5136
UGCCCUCUCAAAUGUUGCU	5137	AGCAACAUUUGAGAGGGCA	5138
GCCCUCUCAAAUGUUGCUA	5139	UAGCAACAUUUGAGAGGGC	5140
CCCUCUCAAAUGUUGCUAG	5141	CUAGCAACAUUUGAGAGGG	5142
CCUCUCAAAUGUUGCUAGG	5143	CCUAGCAACAUUUGAGAGG	5144
CUCUCAAAUGUUGCUAGGA	5145	UCCUAGCAACAUUUGAGAG	5146

AAAUGUUGCUAGGAAUUCA	5147	UGAAUUCCUAGCAACAUUU	5148
AAUGUUGCUAGGAAUUCAU	5149	AUGAAUUCCUAGCAACAUU	5150
AUGUUGCUAGGAAUUCAUA	5151	UAUGAAUUCCUAGCAACAU	5152
UGUUGCUAGGAAUUCAUAC	5153	GUAUGAAUUCCUAGCAACA	5154
GUUGCUAGGAAUUCAUACU	5155	AGUAUGAAUUCCUAGCAAC	5156
UUGCUAGGAAUUCAUACUG	5157	CAGUAUGAAUUCCUAGCAA	5158
UGCUAGGAAUUCAUACUGC	5159	GCAGUAUGAAUUCCUAGCA	5160
AAAGCAAUGAAUAAGCAUG	5161	CAUGCUUAUUCAUUGCUUU	5162
AAGCAAUGAAUAAGCAUGC	5163	GCAUGCUUAUUCAUUGCUU	5164
AGCAAUGAAUAAGCAUGCC	5165	GGCAUGCUUAUUCAUUGCU	5166
GCAAUGAAUAAGCAUGCCU	5167	AGGCAUGCUUAUUCAUUGC	5168
AAUGAAUAAGCAUGCCUGU	5169	ACAGGCAUGCUUAUUCAUU	5170
AUGAAUAAGCAUGCCUGUU	5171	AACAGGCAUGCUUAUUCAU	5172
UGAAUAAGCAUGCCUGUUU	5173	AAACAGGCAUGCUUAUUCA	5174
GAAUAAGCAUGCCUGUUUU	5175	AAAACAGGCAUGCUUAUUC	5176
AUAAGCAUGCCUGUUUUCC	5177	GGAAAACAGGCAUGCUUAU	5178
AUGCCUGUUUUCCCAUGGC	5179	GCCAUGGGAAAACAGGCAU	5180
UGCCUGUUUUCCCAUGGCC	5181	GGCCAUGGGAAAACAGGCA	5182
GCCUGUUUUCCCAUGGCCU	5183	AGGCCAUGGGAAAACAGGC	5184
CCUGUUUUCCCAUGGCCUU	5185	AAGGCCAUGGGAAAACAGG	5186
CUGUUUUCCCAUGGCCUUG	5187	CAAGGCCAUGGGAAAACAG	5188
UUCCCAUGGCCUUGCUUGC	5189	GCAAGCAAGGCCAUGGGAA	5190
GGCCUUGCUUGCCAGAAUU	5191	AAUUCUGGCAAGCAAGGCC	5192
UUGCUUGCCAGAAUUUGAC	5193	GUCAAAUUCUGGCAAGCAA	5194
UGCUUGCCAGAAUUUGACU	5195	AGUCAAAUUCUGGCAAGCA	5196
GCUUGCCAGAAUUUGACUU	5197	AAGUCAAAUUCUGGCAAGC	5198
CUUGCCAGAAUUUGACUUU	5199	AAAGUCAAAUUCUGGCAAG	5200
UUGCCAGAAUUUGACUUUU	5201	AAAAGUCAAAUUCUGGCAA	5202
GAUAUACUACUAUUGCUUG	5203	CAAGCAAUAGUAGUAUAUC	5204
AUAUUGUGGUAUACGGUGU	5205	ACACCGUAUACCACAAUAU	5206
UAUUGUGGUAUACGGUGUC	5207	GACACCGUAUACCACAAUA	5208

AUUGUGGUAUACGGUGUCA	5209	UGACACCGUAUACCACAAU	5210
UUGUGGUAUACGGUGUCAG	5211	CUGACACCGUAUACCACAA	5212
UGUGGUAUACGGUGUCAGG	5213	CCUGACACCGUAUACCACA	5214
GUGGUAUACGGUGUCAGGU	5215	ACCUGACACCGUAUACCAC	5216
UAUACGGUGUCAGGUUUCA	5217	UGAAACCUGACACCGUAUA	5218
AUACGGUGUCAGGUUUCAG	5219	CUGAAACCUGACACCGUAU	5220
UACGGUGUCAGGUUUCAGG	5221	CCUGAAACCUGACACCGUA	5222
UGUCAGGUUUCAGGGUUUU	5223	AAAACCCUGAAACCUGACA	5224
UUCAUUUCAAAUACUCCCU	5225	AGGGAGUAUUUGAAAUGAA	5226
CAUUUCAAAUACUCCCUUU	5227	AAAGGGAGUAUUUGAAAUG	5228
UAGGUAUAACUGUUGAUGA	5229	UCAUCAACAGUUAUACCUA	5230
AGGUAUAACUGUUGAUGAA	5231	UUCAUCAACAGUUAUACCU	5232
UUAUUGUCCAUUUAUACCC	5233	GGGUAUAAAUGGACAAUAA	5234
UAUUGUCCAUUUAUACCCU	5235	AGGGUAUAAAUGGACAAUA	5236
AUUGUCCAUUUAUACCCUG	5237	CAGGGUAUAAAUGGACAAU	5238
UUGUCCAUUUAUACCCUGU	5239	ACAGGGUAUAAAUGGACAA	5240
UGUCCAUUUAUACCCUGUA	5241	UACAGGGUAUAAAUGGACA	5242
GUCCAUUUAUACCCUGUAA	5243	UUACAGGGUAUAAAUGGAC	5244
UAUACCCUGUAAAGCCGUU	5245	AACGGCUUUACAGGGUAUA	5246
AUACCCUGUAAAGCCGUUU	5247	AAACGGCUUUACAGGGUAU	5248
UACCCUGUAAAGCCGUUUU	5249	AAAACGGCUUUACAGGGUA	5250
AGCCGUUUUAGAAUGUAAU	5251	AUUACAUUCUAAAACGGCU	5252
GCCGUUUUAGAAUGUAAUA	5253	UAUUACAUUCUAAAACGGC	5254
AGGUAAUCCAAAAUGUACU	5255	AGUACAUUUUGGAUUACCU	5256
GGUAAUCCAAAAUGUACUA	5257	UAGUACAUUUUGGAUUACC	5258
ACAUUUGUAUUGUCUCUUC	5259	GAAGAGACAAUACAAAUGU	5260
CAUUUGUAUUGUCUCUUCU	5261	AGAAGAGACAAUACAAAUG	5262
UUGUAUCGCAAAGCUAUAU	5263	AUAUAGCUUUGCGAUACAA	5264
UGUAUCGCAAAGCUAUAUG	5265	CAUAUAGCUUUGCGAUACA	5266
GUAUCGCAAAGCUAUAUGU	5267	ACAUAUAGCUUUGCGAUAC	5268
UAUCGCAAAGCUAUAUGUG	5269	CACAUAUAGCUUUGCGAUA	5270

AUCGCAAAGCUAUAUGUGC	5271	GCACAUAUAGCUUUGCGAU	5272
UCGCAAAGCUAUAUGUGCA	5273	UGCACAUAUAGCUUUGCGA	5274
UGAUCUAUGCUUUGAGUUU	5275	AAACUCAAAGCAUAGAUCA	5276
GAUCUAUGCUUUGAGUUUG	5277	CAAACUCAAAGCAUAGAUC	5278
AUCUAUGCUUUGAGUUUGC	5279	GCAAACUCAAAGCAUAGAU	5280
UCUAUGCUUUGAGUUUGCU	5281	AGCAAACUCAAAGCAUAGA	5282
CUAUGCUUUGAGUUUGCUU	5283	AAGCAAACUCAAAGCAUAG	5284
UAUGCUUUGAGUUUGCUUU	5285	AAAGCAAACUCAAAGCAUA	5286
AUGCUUUGAGUUUGCUUUC	5287	GAAAGCAAACUCAAAGCAU	5288
AUCUUACCUAAAAGUACUG	5289	CAGUACUUUUAGGUAAGAU	5290
CUUACCUAAAAGUACUGAA	5291	UUCAGUACUUUUAGGUAAG	5292

In some embodiments, the antisense nucleic acid molecules targeted to HLA-A comprise or consist of the nucleotide sequences shown in Table 7.

Table 7

Sequence	**SEQ ID NO:**
GUCACUGCUUGCAGCCUGAG	5293
UGUCACUGCUUGCAGCCUGA	5294
CUGUCACUGCUUGCAGCCUG	5295
ACUGUCACUGCUUGCAGCCU	5296
CACUGUCACUGCUUGCAGCC	5297
GCACUGUCACUGCUUGCAGC	5298
GGCACUGUCACUGCUUGCAG	5299
GGGCACUGUCACUGCUUGCA	5300
UGGGCACUGUCACUGCUUGC	5301
UCUCACACUUUACAAGCUGU	5302
GUCUCACACUUUACAAGCUG	5303
UGUCUCACACUUUACAAGCU	5304
CUGUCUCACACUUUACAAGC	5305
GCUGUCUCACACUUUACAAG	5306
AGCUGUCUCACACUUUACAA	5307

In some embodiments, the siRNA molecules targeted to HLA-A comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 8.

Table 8

Sense Sequence	SEQ ID NO:	Antisense Sequence	SEQ ID NO:
GGCUGCAAGCAGUGACAGU	5308	ACUGUCACUGCUUGCAGCC	5309
GCUGCAAGCAGUGACAGUG	5310	CACUGUCACUGCUUGCAGC	5311
CUGCAAGCAGUGACAGUGC	5312	GCACUGUCACUGCUUGCAG	5313
UGCAAGCAGUGACAGUGCC	5314	GGCACUGUCACUGCUUGCA	5315
GCAAGCAGUGACAGUGCCC	5316	GGGCACUGUCACUGCUUGC	5317
CAAGCAGUGACAGUGCCCA	5318	UGGGCACUGUCACUGCUUG	5319
CUCACAGCUUGUAAAGUGU	5320	ACACUUUACAAGCUGUGAG	5321

In some embodiments, the antisense nucleic acid molecules targeted to HLA-B comprise or consist of the nucleotide sequences shown in Table 9.

Table 9

Sequence	SEQ ID NO:
UGCACGCAGCCUGAGAGUAG	5322
CUGCACGCAGCCUGAGAGUA	5323

In some embodiments, the siRNA molecules targeted to HLA-B comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 10.

Table 10

Sense Sequence	SEQ ID NO:	Antisense Sequence	SEQ ID NO:
CUACUCUCAGGCUGCGUGC	5324	GCACGCAGCCUGAGAGUAG	5325
UACUCUCAGGCUGCGUGCA	5326	UGCACGCAGCCUGAGAGUA	5327

In some embodiments, the antisense nucleic acid molecules targeted to HLA-C comprise or consist of the nucleotide sequences shown in Table 11.

Table 11

Sequence	SEQ ID NO:
GCUGUCUCAGGCUUUACAAG	5328
AGCUGUCUCAGGCUUUACAA	5329

In some embodiments, the siRNA molecules targeted to HLA-C comprise or consist of the nucleotide sequences (sense and antisense strands) shown in Table 12.

Table 12

Sense Sequence	SEQ ID NO:	Antisense Sequence	SEQ ID NO:
UGCUCUCAGGCUGCGUGCA	5330	UGCACGCAGCCUGAGAGCA	5331

The inhibitory nucleic acid molecules disclosed herein can comprise RNA, DNA, or both RNA and DNA. The inhibitory nucleic acid molecules can also be linked or fused to a heterologous nucleic acid sequence, such as in a vector, or a heterologous label. For example, the inhibitory nucleic acid molecules disclosed herein can be within a vector or as an exogenous donor sequence comprising the inhibitory nucleic acid molecule and a heterologous nucleic acid sequence. The inhibitory nucleic acid molecules can also be linked or fused to a heterologous label. The label can be directly detectable (such as, for example, fluorophore) or indirectly detectable (such as, for example, hapten, enzyme, or fluorophore quencher). Such labels can be detectable by spectroscopic, photochemical, biochemical, immunochemical, or chemical means. Such labels include, for example, radiolabels, pigments, dyes, chromogens, spin labels, and fluorescent labels. The label can also be, for example, a chemiluminescent substance; a metal-containing substance; or an enzyme, where there occurs an enzyme-dependent secondary generation of signal. The term “label” can also refer to a “tag” or hapten that can bind selectively to a conjugated molecule such that the conjugated molecule, when added subsequently along with a substrate, is used to generate a detectable signal. For example, biotin can be used as a tag along with an avidin or streptavidin conjugate of horseradish peroxidate (HRP) to bind to the tag, and examined using a calorimetric substrate (such as, for example, tetramethylbenzidine (TMB)) or a

fluorogenic substrate to detect the presence of HRP. Exemplary labels that can be used as tags to facilitate purification include, but are not limited to, myc, HA, FLAG or 3XFLAG, 6XHis or polyhistidine, glutathione-S-transferase (GST), maltose binding protein, an epitope tag, or the Fc portion of immunoglobulin. Numerous labels include, for example, particles, fluorophores, haptens, enzymes and their calorimetric, fluorogenic and chemiluminescent substrates and other labels.

The disclosed inhibitory nucleic acid molecules can comprise, for example, nucleotides or non-natural or modified nucleotides, such as nucleotide analogs or nucleotide substitutes. Such nucleotides include a nucleotide that contains a modified base, sugar, or phosphate group, or that incorporates a non-natural moiety in its structure. Examples of non-natural nucleotides include, but are not limited to, dideoxynucleotides, biotinylated, aminated, deaminated, alkylated, benzylated, and fluorophor-labeled nucleotides.

The inhibitory nucleic acid molecules disclosed herein can also comprise one or more nucleotide analogs or substitutions. A nucleotide analog is a nucleotide which contains a modification to either the base, sugar, or phosphate moieties. Modifications to the base moiety include, but are not limited to, natural and synthetic modifications of A, C, G, and T/U, as well as different purine or pyrimidine bases such as, for example, pseudouridine, uracil-5-yl, hypoxanthin-9-yl (I), and 2-aminoadenin-9-yl. Modified bases include, but are not limited to, 5-methylcytosine (5-me-C), 5-hydroxymethyl cytosine, xanthine, hypoxanthine, 2-aminoadenine, 6-methyl and other alkyl derivatives of adenine and guanine, 2-propyl and other alkyl derivatives of adenine and guanine, 2-thiouracil, 2-thiothymine and 2-thiocytosine, 5-halouracil and cytosine, 5-propynyl uracil and cytosine, 6-azo uracil, cytosine and thymine, 5-uracil (pseudouracil), 4-thiouracil, 8-halo, 8-amino, 8-thiol, 8-thioalkyl, 8-hydroxyl and other 8-substituted adenines and guanines, 5-halo (such as, for example, 5-bromo), 5-trifluoromethyl and other 5-substituted uracils and cytosines, 7-methylguanine, 7-methyladenine, 8-azaguanine, 8-azaadenine, 7-deazaguanine, 7-deazaadenine, 3-deazaguanine, and 3-deazaadenine.

Nucleotide analogs can also include modifications of the sugar moiety. Modifications to the sugar moiety include, but are not limited to, natural modifications of

the ribose and deoxy ribose as well as synthetic modifications. Sugar modifications include, but are not limited to, the following modifications at the 2' position: OH; F; O-, S-, or N-alkyl; O-, S-, or N-alkenyl; O-, S- or N-alkynyl; or O-alkyl-O-alkyl, wherein the alkyl, alkenyl, and alkynyl may be substituted or unsubstituted C_{1-10}alkyl or C_{2-10}alkenyl, and C_{2-10}alkynyl. Exemplary 2' sugar modifications also include, but are not limited to, $-O[(CH_2)_nO]_mCH_3$, $-O(CH_2)_nOCH_3$, $-O(CH_2)_nNH_2$, $-O(CH_2)_nCH_3$, $-O(CH_2)_n$-ONH_2, and $-O(CH_2)_nON[(CH_2)_nCH_3)]_2$, where n and m, independently, are from 1 to about 10. Other modifications at the 2' position include, but are not limited to, C_{1-10}alkyl, substituted lower alkyl, alkaryl, aralkyl, O-alkaryl or O-aralkyl, SH, SCH_3, OCN, Cl, Br, CN, CF_3, OCF_3, $SOCH_3$, SO_2CH_3, ONO_2, NO_2, N_3, NH_2, heterocycloalkyl, heterocycloalkaryl, aminoalkylamino, polyalkylamino, substituted silyl, an RNA cleaving group, a reporter group, an intercalator, a group for improving the pharmacokinetic properties of an oligonucleotide, or a group for improving the pharmacodynamic properties of an oligonucleotide, and other substituents having similar properties. Similar modifications may also be made at other positions on the sugar, particularly the 3' position of the sugar on the 3' terminal nucleotide or in 2'-5' linked oligonucleotides and the 5' position of 5' terminal nucleotide. Modified sugars can also include those that contain modifications at the bridging ring oxygen, such as CH_2 and S. Nucleotide sugar analogs can also have sugar mimetics, such as cyclobutyl moieties in place of the pentofuranosyl sugar.

Nucleotide analogs can also be modified at the phosphate moiety. Modified phosphate moieties include, but are not limited to, those that can be modified so that the linkage between two nucleotides contains a phosphorothioate, chiral phosphorothioate, phosphorodithioate, phosphotriester, aminoalkylphosphotriester, methyl and other alkyl phosphonates including 3'-alkylene phosphonate and chiral phosphonates, phosphinates, phosphoramidates including 3'-amino phosphoramidate and aminoalkylphosphoramidates, thionophosphoramidates, thionoalkylphosphonates, thionoalkylphosphotriesters, and boranophosphates. These phosphate or modified phosphate linkage between two nucleotides can be through a 3'-5' linkage or a 2'-5' linkage, and the linkage can contain inverted polarity such as 3'-5' to 5'-3' or 2'-5' to 5'-2'. Various salts, mixed salts, and free

acid forms are also included. Nucleotide substitutes also include peptide nucleic acids (PNAs).

In some embodiments, the antisense nucleic acid molecules are gapmers, whereby the first one to seven nucleotides at the 5' and 3' ends each have 2'-methoxyethyl (2'-MOE) modifications. In some embodiments, the first five nucleotides at the 5' and 3' ends each have 2'-MOE modifications. In some embodiments, the first one to seven nucleotides at the 5' and 3' ends are RNA nucleotides. In some embodiments, the first five nucleotides at the 5' and 3' ends are RNA nucleotides. In some embodiments, each of the backbone linkages between the nucleotides is a phosphorothioate linkage.

In some embodiments, the siRNA molecules have termini modifications. In some embodiments, the 5' end of the antisense strand is phosphorylated. In some embodiments, 5'-phosphate analogs that cannot be hydrolyzed, such as 5'-(E)-vinyl-phosphonate are used.

In some embodiments, the siRNA molecules have backbone modifications. In some embodiments, the modified phosphodiester groups that link consecutive ribose nucleosides have been shown to enhance the stability and *in vivo* bioavailability of siRNAs The non-ester groups (-OH, =O) of the phosphodiester linkage can be replaced with sulfur, boron, or acetate to give phosphorothioate, boranophosphate, and phosphonoacetate linkages. In addition, substituting the phosphodiester group with a phosphotriester can facilitate cellular uptake of siRNAs and retention on serum components by eliminating their negative charge. In some embodiments, the siRNA molecules have sugar modifications. In some embodiments, the sugars are deprotonated (reaction catalyzed by exo- and endonucleases) whereby the 2'-hydroxyl can act as a nucleophile and attack the adjacent phosphorous in the phosphodiester bond. Such alternatives include 2'-O-methyl, 2'-O-methoxyethyl, and 2'-fluoro modifications.

In some embodiments, the siRNA molecules have base modifications. In some embodiments, the bases can be substituted with modified bases such as pseudouridine, 5'-methylcytidine, N6-methyladenosine, inosine, and N7-methylguanosine.

In some embodiments, the siRNA molecules are conjugated to lipids. Lipids can be conjugated to the 5' or 3' termini of siRNA to improve their *in vivo* bioavailability by allowing

them to associate with serum lipoproteins. Representative lipids include, but are not limited to, cholesterol and vitamin E, and fatty acids, such as palmitate and tocopherol.

In some embodiments, a representative siRNA has the following formula:

Sense: mN*mN*/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/

i2FN/*mN*/32FN/

Antisense: /52FN/*/i2FN/*mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/i2FN/mN/

i2FN/mN/i2FN/mN*N*N

wherein: "N" is the base; "2F" is a 2'-F modification; "m" is a 2'-O-methyl modification, "I" is an internal base; and "*" is a phosphorothioate backbone linkage.

The present disclosure also provides vectors comprising any one or more of the inhibitory nucleic acid molecules disclosed herein. In some embodiments, the vectors comprise any one or more of the inhibitory nucleic acid molecules disclosed herein and a heterologous nucleic acid. The vectors can be viral or nonviral vectors capable of transporting a nucleic acid molecule. In some embodiments, the vector is a plasmid or cosmid (such as, for example, a circular double-stranded DNA into which additional DNA segments can be ligated). In some embodiments, the vector is a viral vector, wherein additional DNA segments can be ligated into the viral genome. Expression vectors include, but are not limited to, plasmids, cosmids, retroviruses, adenoviruses, adeno-associated viruses (AAV), plant viruses such as cauliflower mosaic virus and tobacco mosaic virus, yeast artificial chromosomes (YACs), Epstein-Barr (EBV)-derived episomes, and other expression vectors known in the art.

The present disclosure also provides compositions comprising any one or more of the inhibitory nucleic acid molecules disclosed herein. In some embodiments, the composition is a pharmaceutical composition. In some embodiments, the compositions comprise a carrier and/or excipient. Examples of carriers include, but are not limited to, poly(lactic acid) (PLA) microspheres, poly(D,L-lactic-coglycolic-acid) (PLGA) microspheres, liposomes, micelles, inverse micelles, lipid cochleates, and lipid microtubules. A carrier may comprise a buffered salt solution such as PBS, HBSS, etc.

The present disclosure also provides methods of identifying a subject having an increased risk for developing an MHC-I-opathy and/or an MHC-II-opathy. The methods

comprise performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises: i) an MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype; and ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein. When the subject has both the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype and the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, then the subject has an increased risk of developing the MHC-I-opathy and/or an MHC-II-opathy. When the subject lacks the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype, or lacks the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, or lacks both, then the subject has a decreased risk of developing the MHC-I-opathy and/or an MHC-II-opathy. In some embodiments, the method further comprises determining whether the subject has a single copy of the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype or two copies of the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype. When the subject comprises two copies of the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype, then the subject has an increased risk of developing the MHC-I-opathy and/or an MHC-II-opathy compared to comprising a single copy of the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy-related HLA genotype.

In some embodiments, the MHC-I-opathy is BSCR. In some embodiments, the subject is HLA-Aw19$^+$. In some embodiments, the subject is or is suspected of being HLA-A*29$^+$, HLA-A*30$^+$, HLA-A*31$^+$, or HLA-A*33$^+$, or any combination thereof. In some embodiments, the subject has a single copy of HLA-Aw19. In some embodiments, the subject has two copies of HLA-Aw19. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*30$^+$. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*31$^+$. In some embodiments, the subject is HLA-A*29$^+$/HLA-A*33$^+$.

In some embodiments, the subject having BSCR is not HLA-A*29$^+$.

In some embodiments, the subject having BSCR has a copy of at least any two of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In some embodiments, the subject having BSCR has a copy of at least any three of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In

some embodiments, the subject having BSCR has a copy of all of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33.

In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*30. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*29 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*31. In some embodiments, the subject having BSCR has one copy of each HLA-A*30 and HLA-A*33. In some embodiments, the subject having BSCR has one copy of each HLA-A*31 and HLA-A*33.

In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR has one copy of HLA-A*30 and two copies HLA-A*33. In some embodiments, the subject having BSCR has one copy of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*30. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*31. In some embodiments, the subject having BSCR has two copies of HLA-A*29 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*30 and one copy of HLA-A*31. In some embodiments, the subject having BSCR has two copies of HLA-A*30 and one copy of HLA-A*33. In some embodiments, the subject having BSCR has two copies of HLA-A*31 and one copy of HLA-A*33.

In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*30. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*29 and two copies of HLA-A*33. In some embodiments, the subject

having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*31. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*30 and two copies of HLA-A*33. In some embodiments, the subject having BSCR or suspected of having BSCR has two copies of HLA-A*31 and two copies of HLA-A*33.

In some embodiments, the method further comprises administering to the subject an HLA-Aw19 inhibitor. In some embodiments, the HLA-Aw19 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-A*29 antibody. In some embodiments, the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA (shRNA) that hybridizes to an HLA-Aw19. In some embodiments, the HLA-Aw19 is HLA-A*29.

In some embodiments, the MHC-I-opathy is AS. In some embodiments, the subject is or is suspected of being HLA-B*27$^+$ or HLA-B*40$^+$. In some embodiments, the subject has a single copy of HLA-B*27 or HLA-B*40. In some embodiments, the subject has two copies of HLA-B*27 or HLA-B*40. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor or an HLA-B*40 inhibitor. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody. In some embodiments, the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 or HLA-B*40.

In some embodiments, the MHC-I-opathy is Behçet's disease. In some embodiments, the subject is or is suspected of being HLA-B*51$^+$. In some embodiments, the subject has a single copy of HLA-B*51. In some embodiments, the subject has two copies of HLA-B*51. In some embodiments, the method further comprises administering to the subject an HLA-B*51 inhibitor. In some embodiments, the HLA-B*51 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*51 antibody. In some embodiments, the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid

molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*51.

In some embodiments, the MHC-I-opathy is psoriasis. In some embodiments, the subject is or is suspected of being HLA-C*06^{+}. In some embodiments, the subject has a single copy of HLA-C*06. In some embodiments, the subject has two copies of HLA-C*06. In some embodiments, the method further comprises administering to the subject an HLA-C*06 inhibitor. In some embodiments, the HLA-C*06 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*06 antibody. In some embodiments, the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*06.

In some embodiments, the MHC-I-opathy is JIA. In some embodiments, the subject is or is suspected of being HLA-B*27^{+} and/or DRB1^{+}. In some embodiments, the subject has a single copy of HLA-B*27 and/or DRB1. In some embodiments, the subject has two copies of HLA-B*27 and/or DRB1. In some embodiments, the method further comprises administering to the subject an HLA-B*27 inhibitor and/or a DRB1 inhibitor. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-B*27 antibody or an anti-DRB1 antibody. In some embodiments, the HLA-B*27 inhibitor and/or DRB1 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-B*27 and/or an DRB1.

In some embodiments, the MHC-I-opathy is IBD or CD. In some embodiments, the subject is or is suspected of being HLA-C*07^{+}. In some embodiments, the subject has a single copy of HLA-C*07. In some embodiments, the subject has two copies of HLA-C*07. In some embodiments, the method further comprises administering to the subject an HLA-C*07 inhibitor. In some embodiments, the HLA-C*07 inhibitor is an antibody. In some embodiments, the antibody is an anti-HLA-C*07 antibody. In some embodiments, the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to an HLA-C*07.

In any of the embodiments described herein, the methods can further comprise administering to the subject having an increased risk of developing the MHC-I-opathy-related HLA genotype and/or an MHC-II-opathy an ERAP2 inhibitor. In some embodiments, the ERAP2 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP2 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an shRNA that hybridizes to ERAP2 mRNA. In some embodiments, the ERAP2 inhibitor comprises an anti-ERAP2 antibody. In some embodiments, the ERAP2 inhibitor comprises a pseudopeptide. In some embodiments, the pseudopeptide is a phosphinic pseudopeptide. In some embodiments, the phosphinic pseudopeptide is DG002 or DG013. In some embodiments, the phosphinic pseudopeptide is DG002. In some embodiments, the phosphinic pseudopeptide is DG013. In some embodiments, the ERAP2 inhibitor comprises a small molecule.

In any of the embodiments described herein, the assay performed or having been performed on the biological sample from the subject can further determine whether the subject comprises a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein. When the subject has the MHC-I-opathy-related HLA genotype and/or MHC-II-opathy-related HLA genotype and lacks the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, then the subject has an increased risk of developing the MHC-I-opathy (for MHC-I-opathies except AS and psoriasis) and/or MHC-II-opathy. When the subject has the MHC-I-opathy-related HLA genotype and/or MHC-II-opathy-related HLA genotype and has a functional ERAP1 protein or a nucleic acid molecule encoding the functional ERAP1 protein, then the subject has an increased risk of developing the MHC-I-opathy (for AS and psoriasis). When the subject lacks the MHC-I-

opathy-related HLA genotype and/or MHC-II-opathy-related HLA genotype, or has the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, or both, then the subject has a decreased risk of developing the MHC-I-opathy and/or MHC-II-opathy.

In any of the embodiments described herein, the methods can further comprise administering to the subject an ERAP1 agonist or inhibitor, depending upon the MHC-I-opathy. For AS and psoriasis, an ERAP1 inhibitor can be administered. For the remaining MHC-I-opathies, an ERAP1 agonist can be administered.

In some embodiments, the ERAP1 agonist comprises an oligonucleotide. In some embodiments, the oligonucleotide is ODN1826. In some embodiments, the ERAP1 agonist comprises a peptide. In some embodiments, the ERAP1 agonist comprises a lipopeptide. In some embodiments, the lipopeptide is Pam3CSK4 or FSL-1. In some embodiments, the lipopeptide is Pam3CSK4. In some embodiments, the lipopeptide is FSL-1. In some embodiments, the ERAP1 agonist comprises a small molecule. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator, an ERAP1 protein stabilizer, an agonist of ERAP1 enzymatic activity, or an activator of ERAP1 secretion. In some embodiments, the ERAP1 agonist can comprise an ERAP1-specific transcriptional activator. In some embodiments, the ERAP1 agonist can comprise an ERAP1 protein stabilizer. In some embodiments, the ERAP1 agonist can comprise an agonist of ERAP1 enzymatic activity. In some embodiments, the ERAP1 agonist can comprise an activator of ERAP1 secretion. Additional examples of ERAP1 agonists are described in, for example, Goto et al., J. Immunol., 2014, 192, 4443-4452.

In some embodiments, the ERAP1 inhibitor comprises a small molecule degrader, a proteoloysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, an siRNA, or an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic acid molecule that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid molecule is an siRNA that hybridizes to ERAP1 mRNA. In some embodiments, the inhibitory nucleic acid

molecule is an shRNA that hybridizes to ERAP1 mRNA. In some embodiments, the ERAP1 inhibitor comprises an anti-ERAP1 antibody.

In some embodiments, the assay for determining whether the subject comprises an MHC-I-opathy-related and/or MHC-II-opathy-related HLA genotype and a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein, is a genotyping assay or sequencing assay. In some embodiments, the nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein comprises genomic DNA, mRNA, or cDNA obtained from mRNA. By comparing the nucleotide or protein sequence of the ERAP2 protein and/or ERAP1 protein in the sample from a subject to the wild type sequence for ERAP2 protein and/or ERAP1 protein or nucleic acid molecule, or to published sequences of variant ERAP2 proteins and/or ERAP1 proteins or nucleic acid molecules having reduced or no activity, a determination can be made whether the subject comprises a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein. In addition, although an individual ERAP2 protein and/or ERAP1 protein may have biological activity, the overall function of the ERAP2 protein and/or ERAP1 protein may not be functional due to reduced levels of expression. Thus, as used herein, an ERAP2 protein and/or ERAP1 protein can be determined not to be functional because the ERAP2 protein and/or ERAP1 protein lacks or had reduced biological activity or because the expression level is reduced.

Determining whether a subject has an MHC-I-opathy-related and/or MHC-II-opathy-related HLA genotype and/or a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein, in a biological sample from a subject can be carried out by any of the methods described herein. In some embodiments, these methods can be carried out *in vitro*. In some embodiments, these methods can be carried out *in situ*. In some embodiments, these methods can be carried out *in vivo*. In any of these embodiments, the nucleic acid molecule can be present within a biological sample obtained from the subject.

The biological sample can be derived from any cell, tissue, or biological fluid from the subject. The biological sample may comprise any clinically relevant tissue, such as a

bone marrow sample, a tumor biopsy, a fine needle aspirate, or a sample of bodily fluid, such as blood, gingival crevicular fluid, plasma, serum, lymph, ascitic fluid, cystic fluid, or urine. In some cases, the sample comprises a buccal swab. The biological sample used in the methods disclosed herein can vary based on the assay format, nature of the detection method, and the tissues, cells, or extracts that are used as the sample. A biological sample can be processed differently depending on the assay being employed. For example, when detecting any particular nucleic acid molecule, preliminary processing designed to isolate or enrich the biological sample for the particular nucleic acid molecule can be employed. A variety of techniques may be used for this purpose. Various methods to detect the presence or level of an mRNA molecule or the presence of a particular genomic DNA locus can be used.

In some embodiments, the biological sample comprises a cell or cell lysate. Such methods can further comprise, for example, obtaining a biological sample from the subject comprising genomic nucleic acid molecules or mRNA molecules, and if mRNA, optionally reverse transcribing the mRNA into cDNA. In some embodiments, the method is an *in vitro* method. In some embodiments, the assay comprises RNA sequencing (RNA-Seq). In some embodiments, the assays also comprise reverse transcribing mRNA into cDNA, such as by the reverse transcriptase polymerase chain reaction (RT-PCR).

Detecting the presence or absence of any particular HLA allele can be carried out by numerous techniques. Detection of HLA-A alleles on a 2-digit and 4-digit resolution can be carried out. For example, an assay that targets the HLA region in high resolution (all class-I and class-II genes) can be used. In some embodiments, the assay amplifies the full HLA gene (in this case HLA-A) from the 5'UTR to the 3'UTR and provides genetic variants across the full amplicon (the DNA that is the product of this amplification of the gene). A method can then be used to call the HLA-A alleles with high accuracy (e.g., PHLAT2; Bai et al., Methods Mol. Biol., 2018, 1802, 193-201). The output of PHLAT2 provides the HLA-A 4-digits allele data for each sample, which can be used for the analysis that identified other Aw19 alleles as enriched in Birdshot cases. In addition, commercial sources of HLA typing are available.

Detecting the presence or absence a functional ERAP2 protein and/or ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP2 protein and/or ERAP1 protein, can be carried out by numerous techniques. For example, detection of presence or absence of ERAP2 protein and the relevant nucleotide sequence can be carried out as described in Andres et al., PLoS Genetics, 2010, 6, 1-13. For example, a subject having an ERAP2 intronic variant designated rs2248374-A has a functional ERAP2 protein, or a nucleic acid molecule encoding a functional ERAP2 protein, and has an increased risk of developing the MHC-I-opathy. A subject having an ERAP2 variant designated rs10044354, HapA has a functional ERAP2 protein, or a nucleic acid molecule encoding a functional ERAP2 protein, and has an increased risk of developing the MHC-I-opathy. In addition, a subject having an ERAP1 intronic variant designated rs27432-G does not have a functional ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP1 protein, and has an increased risk of developing the MHC-I-opathy. A subject having an ERAP1 variant designated rs2287987, Hap 10 does not have a functional ERAP1 protein, or a nucleic acid molecule encoding a functional ERAP1 protein, and has an increased risk of developing the MHC-I-opathy. A subject having an ERAP2 splice variant designated rs2248374-G does not have a functional ERAP2 protein, or a nucleic acid molecule encoding a functional ERAP2 protein, and has a decreased risk of developing the MHC-I-opathy.

In order that the subject matter disclosed herein may be more efficiently understood, examples are provided below. It should be understood that these examples are for illustrative purposes only and are not to be construed as limiting the claimed subject matter in any manner. Throughout these examples, molecular cloning reactions, and other standard recombinant DNA techniques, were carried out according to methods described in Maniatis et al., Molecular Cloning - A Laboratory Manual, 2nd ed., Cold Spring Harbor Press (1989), using commercially available reagents, except where otherwise noted.

Examples

Example 1: Methods

Study subjects and samples

The genomic DNA samples from 286 patients with BSCR and 108 unrelated healthy local French volunteers that exhibited HLA tissue typing common in the French population were included in this study. The patients were recruited at Hôpital Cochin, Paris, France. All patients met the criteria for diagnosis of BSCR as defined both by an international consensus conference held in 2002 and by the Standardization of Uveitis Nomenclature (SUN) Working Group. In brief, all patients had a posterior bilateral uveitis with multifocal cream-colored or yellow-orange, oval or round choroidal lesions ("birdshot spots"). Although the presence of the HLA-A*29 allele was not a requirement for the diagnosis of BSCR according to the international criteria, all patients included in the current study carried the HLA-A*29 allele. The control DNA samples were collected from volunteer donors recruited by the hematopoietic stem cell donor center of Rheims for France Greffe de Moelle Registry, and local control healthy individuals of the Registry. The DNA samples were isolated from peripheral blood samples using a standard salting out method or QIAamp Blood Kit (Qiagen, Chatsworth, CA, USA). Quality and quantity of DNA was determined by UV spectrophotometry and the concentration was adjusted to 100 ng/ml. Signed informed consent documentation was obtained from all participants, and all research adhered to the tenets set forth in the Declaration of Helsinki. All study-related data acquisitions were approved by the Paris Cochin institutional review board.

Genetic data

A comprehensive approach was taken to both sequence the exomes and genotype all samples, to allow for identification of common and rare variants filtered based on high quality calls. DNA from participants was genotyped on the Illumina Global Screening Array (GSA) and imputed to the HRC reference panel. Prior to imputation, the variants that had a MAF >= 0.1%, missingness < 1% and HWE p-value > 10^{-15} were retained. Imputation using the HRC reference panel yielded 8,385,561 variants with imputation INFO>0.3 and MAF>0.5%.

Exome sequencing was performed to a mean depth of 31X, followed by variant calling and quality control as reported previously (Van Hout et al., Nature, 2020, 586, 749-756), resulting in 238,942 variants. When integrated, this produced an overall dataset with

8,459,907 variants: 65.5% common (MAF > 5%), 34.5% low-frequency (0.5% < MAF < 5%) and 0.01% rare (MAF < 0.5%).

HLA genotyping

HLA Class I genes (HLA-A, -B, and -C) were amplified in a multiplex PCR reaction with primers encompassing the full genomic loci for each target. The resulting amplicons were enzymatically fragmented to an average size of 250 base pairs and prepared for Illumina sequencing (New England Biolabs, Ipswich, MA). The libraries were sequenced on the Illumina HiSeq 2500 platform on a rapid run flow cell using paired-end 125 base pair reads with dual 10 base pair indexes. Upon completion of sequencing, raw data from each Illumina HiSeq run was gathered in local buffer storage and uploaded to the DNAnexus platform (Reid et al., BMC Bioinformatics, 2014, 15, 30) for automated analysis. The FASTQ-formatted reads were converted from the BCL files and assigned to samples identified by specific barcodes using the bcl2fastq conversion software (Illumina Inc., San Diego, CA). All the reads in sample-specific FASTQ files were subject to HLA typing analysis using an updated version of PHLAT program (Bai et al., BMC Genomics, 2014, 15, 325) with the reference sequences consisting of GRCh38 genomic sequences and HLA type reference sequences in the IPD-IMGT/HLA database v3.30.0 (Robinson et al., Hum. Immunol., 2016, 77, 233-237).

In addition, HLA allele imputation was performed following SNP2HLA (Jia et al., PLoS One, 2013, 8, e64683) with the T1DGC HLA allele reference panel (Rich et al., Ann. N.Y. Acad. Sci., 2006, 1079, 1-8). HRC-imputed genotypes in the extended Major Histocompatibility Complex (MHC) region (chr6:25-35Mb) were filtered for high INFO score (>0.9) and certainty (maximum GP>0.8 for all genotyped), in order to increase overlap with the T1DGC reference panel, were re-phased along with chromosome 6 array genotypes using SHAPEIT4 (Delaneau et al., Nat. Commun., 2019, 10, 5436), and were imputed using Minimac4 (Das et al., Nat. Genet., 2016, 48, 1284-1287). HLA allele imputation quality was assessed by examining INFO score vs MAF, and imputed vs reference panel MAF.

Genetic association analyses

Association analyses in each study were performed using the genome-wide Firth logistic regression test implemented in SAIGE (Mbatchou et al., bioRxiv, 2020,

2020.2006.2019.162354, doi:10.1101/2020.06.19.162354; and Zhou et al., Nat. Genet., 2018, 50, 1335-1341). In this implementation, Firth's approach is applied when the p-value from standard logistic regression score test is below 0.05. The directly genotyped variants with a minor allele frequency (MAF) >1%, <10% missingness, Hardy-Weinberg equilibrium test *P*-value>10^{-15} and linkage-disequilibrium (LD) pruning (1000 variant windows, 100 variant sliding windows and r^2<0.1) were included for GRM for SAIGE. The association model included as covariates sex and the first 10 ancestry-informative principal components (PCs) derived from the GRM dataset. Haplotype analyses were performed using PLINK 1.0 (Purcell et al., Am. J. Hum. Genet., 2007, 81, 559-575) *--chap* and *--hap-assoc* and *--hap-logistic*, and in *R*. High haplotype imputation and phasing quality was indicated by PLINK *--hap-phase* maximum likelihood haplotype genotypes' posterior probabilities all equal to one.

HLA-A allele association analyses

Association of HLA-A alleles was performed as follows: for each sample, both HLA-A alleles were typed as described above. Following HLA allele typing, related samples were removed. For the remaining cohort of 282 cases and 106 controls, one HLA-A allele that is not A*29 (the "second" allele) was obtained next. Samples carrying two copies of A*29, were considered having A*29 as the second allele. The cohort was then subjected to a Fisher's exact test, which tested the association of each allele that was identified in three or more BSCR cases, with the case-control status. To answer the question of whether the A19 allele group is also associated with the case-control status, the samples were combined, and tested together in two different ways: carrying all Aw19 alleles (A*29, A*30, A*31, A*32 and A*33). Since A*32 is biologically different than the other Aw19 alleles in its peptide binding domain, a group that is made of samples carrying all Aw19 alleles excluding A*32 was also constructed and tested. The final odds-ratios and p-values are presented in the table in Figure 1.

Example 2: HLA-Aw19 Broad Antigen Serotype Alleles and BSCR Risk

The HLA-A29-controlled cohort allowed for examination of the HLA region while controlling for the strong association of HLA-A29 with BSCR, and therefore to detect possible additional association signals in the HLA region.

First, it was asked whether rare variants on the HLA-A29 background were enriched in BSCR cases. No significant enrichments of rare single or aggregated variants were identified either within or outside the MHC region.

Second, the question was whether other HLA-A alleles in addition to the HLA-A29 allele increased BSCR risk. An assay to type HLA-A alleles in this cohort (see Methods) was constructed, and tested the second HLA-A allele (other than the known first HLA-A29) was tested for association with BSCR. Additional HLA-A alleles were found to be associated with BSCR, and those with the largest effects belonged to the same HLA-Aw19 broad antigen serotype group: HLA-A29:02, A30:02, A31:01 and A33:01 (Figure 1). As a group, HLA-Aw19 alleles were significantly enriched in the second allele of BSCR patients (OR=4.44, p=2.2e-03, Figure 2, blue bars). This result suggests, for example, that individuals carrying two copies of HLA-A29 would be at a greater risk of developing BSCR compared to those carrying one copy. It also suggests that other Aw19 allele may play a role in BSCR co-susceptibility or pathogenesis in concert with A29. The sole exception within the HLA-Aw19 serotype group is HLA-A32, which has been reported not to share the defining Aw19 binding domain (McKenzie et al., Genes Immun., 1999, 1, 120-129); HLA-A32 appears to be depleted in BSCR cases and thus protective against BSCR (OR=0.28, p=0.1).

The above results presented two issues due to the small numbers of controls in UParis (n=108): 1) The frequency of alleles might not represent the frequency of HLA-A alleles in general EUR population. 2) While the high ORs replicate in several HLA-Aw19 alleles, the numbers are not sufficient to support significant associations. To tackle these concerns, the frequency of HLA-A alleles in three other large European (EUR) ancestry control populations, two cohorts from the Geisinger Health System (GHS cohort #1, n=77,198 and GHS cohort #2, n=59,072) and the UK Biobank (UKB, n=463,315) were examined. In all three datasets, the EUR samples carrying at least one HLA-A29 allele were selected, matching the BSCR cohort: 4,014 A29 carriers from GHS cohort #1 (5.2% of all EUR subjects), 2,829 A29 carriers from GHS cohort #2 (4.8% of all EUR), and 38,543 A29 carriers from UKB (8.3% of all EUR). The frequencies of the second HLA-A alleles in these cohorts were compared to those observed in the BSCR cohort (Figure 2, Figure 1). The results support the enrichment of four of the five HLA-Aw19 alleles in BSCR cases, with highest

increased risk for HLA-A30:02 (GHS cohort #1 OR=4.31, GHS cohort #2 OR=6.6, UKB OR= 4.6) and HLA-A33 (GHS cohort #1 OR=3.4, GHS cohort #2 OR=2.8, UKB OR= 4.9). When combining samples carrying the four co-susceptibility alleles A29, A30, A31 and A33, was found a highly significant enrichment in BSCR cases was found a when compared with the larger control cohorts (GHS cohort #1 p-val= 1.29E-06, GHS cohort #2 p-val= 1.07E-06, UKB p-val= 9.62E-07, Figure 1 top row). This analysis excludes A32 because of its biological difference in the sequence of the peptide binding domain as previously reported. The additional analyses with all Aw19 alleles including A32 showed that the enrichment in cases is reduced when it is included (Figure 1 bottom row).

In order to test whether these associations are affected by measurable confounders, logistic regression tests were conducted to evaluate the effects of the second HLA-A allele in HLA-A29 carriers, in UParis BSCR cases compared with each control cohort, with covariates included for sex and principal components, calculated based on genetic array data for each analytic set (Figure 3). The results were consistent with increased risk for the HLA-Aw19 co-susceptibility alleles, A29, A30, A31, and A33.

Example 3: HLA-A32 Exhibits Protection from BSCR in an HLA-A29 Positive Cohort

HLA-A32 is underrepresented in BSCR cases (3/286, ~1%) versus A29 carrier controls (4/108, 3.7%), corresponding to a nominally significant protection from risk (OR=0.28, p=0.1; Figure 1). When compared with the larger control cohorts, the trend protection is maintained with both UKB controls (3.4%, OR=0.3, p=0.02) and GHS controls (cohort #1: 3.8%, OR=0.27, p=0.01; cohort #2: 3.7%, OR=0.27, p=0.02). While nominally significant, this result does not pass the threshold of multiple test correction (p=3.57e-03) and will need to be further validated with additional case cohorts.

Example 4: ERAP1 and ERAP2 are Independently Associated with BSCR

All variants and gene burdens were tested for association with case-control status, while controlling for sex and ten principal components, using a generalized linear mixed model (SAIGE). Due to the fact that both cases and controls were A29 allele carriers, the expected strong HLA-A signal was at least partially controlled, as evidenced by the strongest

HLA p-value = 8.98E-07, compared with p=6.6e-74 with 125 cases in the previous BSCR report (Kuiper et al., Hum. Mol. Genet., 2014, 23, 6081-6087). Overall, no locus passed the genome wide significance threshold (p< 5e-8). Other than the remnant signal at HLA-A, only the *ERAP1/ERAP2-LNPEP* locus on chromosome 5 showed an association with disease at p<1e-6 (Figure 2).

The top association within the *ERAP1/ERAP2-LNPEP* locus is the *ERAP1* intronic variant rs27432 (OR (95% CI)= 2.58 (1.78 – 3.76), p= 6.6e-7), a strong eQTL associated with decreased ERAP1 expression (Kuiper et al., Hum. Mol. Genet., 2018, 27, 4333-4343; and Paladini et al., Sci. Rep., 2018, 8, 10398), which also tags the risk-increasing common ERAP1 haplotype. A haplotype analysis was further performed to assess *ERAP1* haplotype associations with BSCR status in the present data. The results were consistent with three levels of risk differentiated by nonsynonymous ERAP1 variant haplotypes corresponding to Kuiper et al. Haps 1+2 (OR=0.41, Cases AF=0.17, controls AF=0.35, p=6.7e-06), Hap10 (OR=1.78, Cases AF=0.28, controls AF=0.17, p=8.0e-03), and haplotypes 3-8 (OR=1.32, Cases AF=0.55, controls AF=0.48, p=0.11) (Figure 4).

The previously reported top association for BSCR at this locus tags a common variant near ERAP2/LNPEP, rs10044354. This reported risk allele is in a strong linkage disequilibrium (D'=0.99, R^2=0.76), with a strong eQTL increasing *ERAP2* expression. The results show a nominal association of rs10044354 with increased risk for Birdshot (OR (95% CI) = 1.55 (1.13 - 2.11), p= 5.8e-3). Furthermore, no significant evidence was found for an interaction of rs10044354 with rs27432-rs2287987 haplotypes (conditional haplotype test p=0.46).

Next, a meta-analysis of the results with the published results from Kuiper et al. was carried out, which yielded genome-wide significant associations for both ERAP1 (rs27432, OR (95% CI)=2.46 (1.85-3.26), p=4.07e-10) and ERAP2 (rs10044354, OR (95% CI)=1.95 (1.55-2.44), p=6.2e-09) loci with BSCR (Figure 1). Both previous and current studies showed consistent directionality for both variants, which, separated by over 201,222 bp, show low linkage disequilibrium (LD) in the present cohort (R2=0.18, D'=0.79).

The expression of *ERAP2* has been previously reported to be disrupted by a common splice region variant (rs2248374, AF=0.53) that causes mis-splicing of intron 10 and

eventual transcript degradation via nonsense-mediated decay (Andres et al., PLoS Genet., 2010, 6, e1001157; and Coulombe-Huntington et al., PLoS Genet., 2009, 5, e1000766), and which is in high LD with rs10044354 (R2=0.8, D'=1). Thus, about 25% of the population of most ancestries (including European, AF=0.53; African, AF=0.57 and South Asian, AF=0.58) is estimated to be lacking an active ERAP2 protein. Both datasets were examined for rs2248374 associations and found that it is protective for BSCR with nominal significance in both datasets (Figure 5). Furthermore, ERAP2-rs2248374 that disrupts ERAP2 expression is protective (OR 0.56; 95% CI [0.45-0.70]; p=2.39e-07; Figure 6). In summary, higher expression of ERAP2 protein increases risk for BSCR and a lower expression is protective.

Example 5: Cumulative Effect of HLA-Aw19 Alleles and *ERAP1/ERAP2* Haplotypes on BSCR Risk

The potential interactions between the *ERAP1* and *ERAP2* association signals and between HLA-Aw19 and *ERAP1/ERAP2* signals was examined by calculating the cumulative effects of HLA-Aw19, ERAP1 and ERAP2 genotypes on BSCR risk using the 286 cases and the 4,014 A29 carriers from the GHS cohort #1. First, an analysis of ERAP2-rs10044354 risk haplotype, the top non-MHC signal in Kuiper et al. was performed, stratified by single (A29/-) versus double (A29/AW19) Aw19 background, which yielded a trend of increased risk with additional ERAP2-rs10044354-T variant alleles, particularly on the double A29/AW19 background (Figure 7, Panel A). The combination of rs10044354-TT and two copies of Aw19 with 12 cases and 34 controls was found to have the highest risk (OR=9.9 [4.4-21.2], p=1.66e-07, Figure 8).

A similar analysis of the ERAP1-rs27432 risk haplotype, the top non-MHC association, stratified by single (A29/-) versus double (A29/AW19) Aw19 background, yielded the same trend of increased risk with additional ERAP1-rs27432-G variant alleles, particularly on the double A29/AW19 background (OR=6.2 [2.7-15.51], p=1.54e-06, Figure 7, Panel B and Figure 9).

The combined effects of the ERAP1 risk haplotype tagged by rs27432, and the ERAP2 risk haplotype tagged by rs10044354 were calculated next (Figure 7, Panel C). It was found that the highest risk is conferred by the combination of ERAP1-rs27432-GG and

ERAP2-rs10044354-TT (OR=3.6 [1.62-9.45], p=4.03e-04, Figure 10), and as mentioned above, these data are consistent with additive effects of the variants/haplotypes.

Next, all risk haplotypes were combined to a single risk analysis. Due to the small number of cases, the genotypes of intermediate genotypes were combined into four main groups: 1) homozygous to the protective alleles in both ERAP1 and ERAP2, homozygous in one and 2) heterozygous in the other, 3) homozygous risk allele in either ERAP1 or ERAP2, and 4) homozygous risk allele in both ERAP1 or ERAP2 (Figure 7, Panel D and Figure 11). A gradual increase in risk with the addition of each risk allele was observed, with the highest risk presented when carrying homozygous risk alleles in both ERAP1 and ERAP2, on top of two copies of A19 alleles (OR=13.53 [3.79-54.77], p=1.17e-05). These results suggest that both ERAP1 and/or ERAP2 confer greater BSCR risk, which is further increased in the double Aw19 background.

Example 6: Absolute BSCR Risk

The calculation of the absolute risk of BSCR when considering all risk alleles is presented in Figure 7, Panel D. Since the prevalence of BSCR in general population is estimated at 0.2-1.7:100,000 (Minos et al., Orphanet J. Rare Dis., 2016, 11, 61), 1:100,000 was used as an approximation. The absolute risk was further calculated when carrying one A29 carrier based on the frequency of A29 in UKB EUR population of 8%, and reach an absolute risk of 1:29,000 (Figure 11). It was observed that the absolute risk climbs with each risk genotype presented in Figure 7, Panel D, reaching the most prominent risk at 1:2,160 for cases that carry homozygous risk alleles for both ERAP1 and ERAP2, and two copies of Aw19 alleles. Exhibiting a significant increase in absolute risk of disease when carrying all three risk haplotypes.

Example 7: Discussion

The sequencing of a new large BSCR patient cohort and HLA-A*29 controls has confirmed the importance of the ERAP1 and ERAP2 polymorphisms in increasing risk for developing BSCR. ERAP1 and ERAP2 reside back-to-back on chromosome five in opposite orientation and share the regulatory regions, which upregulate one and downregulate the

other, and vice versa. The association of both ERAP1 and ERAP2 haplotypes is consistent with a mechanism in which coordinated decreased ERAP1 and increased ERAP2 expression contribute to disease risk. Several studies have reported that the ERAP1 and ERAP2 haplotypes affect their expression as well as the resulting peptidome (Kuiper et al., Hum. Mol. Genet., 2018, 27, 4333-4343; Paladini et al., Sci. Rep., 2018, 8, 10398; and Sanz-Bravo et al., Mol. Cell Proteomics, 2018, 17, 1564-1577).

The present study found that several other HLA-Aw19 family alleles (HLA- A29, A30, A31, A33) contribute additional risk as the second HLA-A allele, in addition to HLA-A29 risk allele. HLA-Aw19 family alleles have a similar antigen-binding sequence and therefore would bind similar peptide motifs. Hence, the enrichment of Aw19 alleles in cases supports the inferred mechanism underlying activation of the immune response in BSCR: having two copies of these alleles may increase the cell-surface presentation of specific types of peptides in BSCR cases compared to HLA-A29 positive controls. Furthermore, it was found that the HLA-A32 allele within the Aw19 family is potentially protective.

These results indicate that a decreased expression of ERAP1 and an increased expression of ERAP2 confer stronger risk for BSCR than each one separately. Furthermore, this effect is increased in the presence of two copies of HLA-Aw19. The combined and additive effect of risk factors associated with peptide processing and presentation is suggestive of a peptide presentation threshold hypothesis as a driving mechanism for the immune response underlying development of BSCR disease. Results from this and other studies suggest that increased ERAP2 along with decreased ERAP1 expression in BSCR cases would lead to higher availability of ERAP2-processed peptides for presentation onto HLA class I proteins. Additional HLA-Aw19 alleles, with similar peptide-binding properties, would increase presentation of similar peptides. Therefore, both the production of a unique peptide pool by dominant ERAP2 activity and the increased expression of HLA-Aw19 risk allele proteins presenting these peptides may increase the likelihood that a putative ocular autoantigen would be processed and presented above a certain threshold to activate an immune response. On the other hand, having lower expression of ERAP2 (and higher expression of ERAP1), along with a single HLA-A*29 allele, lowers the ocular antigenic peptide presentation below the threshold and thus reduces the risk of generating the

immunological response leading to BSCR in HLA-A*29 healthy control carriers. This further highlights the importance of the shaping and generation of the available peptide pool by ERAPs to be presented by specific HLA class I proteins in promoting the generation of an immune response or, in the case of autoimmune disease, an aberrant response to a self-antigen.

ERAP1 and ERAP2 polymorphisms and risk haplotypes have also been reported in other HLA class I-associated autoimmune diseases (Babaie et al., Mol. Immunol., 2020, 121, 7-19; and Yao et al., Hum. Immunol., 2019, 80, 325-334). Polymorphisms in ERAP1 increase risk for Ankylosing Spondylitis in HLA-B*27 carriers, for psoriasis vulgaris in HLA-C*06 carriers, and for Behçet's disease in HLA-B*51 carriers, further supporting the combinatorial impact of peptide trimming and HLA class I allele in initiating autoimmune responses (Evans et al., Nat. Genet., 2011, 43, 761-767; Wisniewski et al., Hum. Immunol., 2018, 79, 109-116; Nat. Genet., 2010, 42, 985-990; and Takeuchi et al., Ann. Rheum. Dis., 2016, 75, 2208-2211). Ankylosing Spondylitis and Behçet's disease-associated ERAP1 variants have also been experimentally shown to shape the resulting HLA-B*27 and HLA-B*51 peptidome, respectively (Sanz-Bravo et al., Mol. Cell Proteomics, 2018, 17, 1308-1323; and Guasp et al., J. Biol. Chem., 2017, 292, 9680-9689). Therefore, it is possible that the combination of risk ERAP1/ERAP2 haplotypes and specific risk HLA class I alleles can predispose an individual to develop an HLA class I associated disease in a similar fashion as it is hypothesized for BSCR. This implies that the peptide threshold hypothesis may have broader implications as a disease mechanism in HLA class I associated immunological diseases.

HLA-A32 is the only HLA-Aw19 member that is found at lower rates in BSCR patients compared to controls, suggesting that it could be protective. The HLA-Aw19 serotype was initially identified by antibody binding to related family members; however, this identifies the HLA-A proteins based on structure outside of the peptide-binding groove. Serofamilies have since been re-analyzed by overall and peptide binding region sequences (McKenzie et al., Genes Immun. 1999, 1, 120-129). Comparison of the sequences in the peptide binding region reveals that HLA-A32 is more distantly related than the other Aw19 alleles which are identified as novel risk factors in this present study: HLA-A29, A30, A31, A33. When examining the differences in sequence between these Aw19 alleles, two main

differences are evident: at position 9, which is part of the peptide binding domain, and a stretch of amino-acids at positions 79-83 that is only found in HLA-A32 and not the other Aw19 alleles (Figure 12). Theoretically, the peptide pool bound by HLA-A32 would differ from the remaining members of the Aw19 family and would not activate the same subset of responding CD8 T cells. This adds further evidence supporting the hypothesis of the threshold requirement of an increased concentration of the driving autoantigenic peptide pool presented on high-risk HLA-A proteins as a driving component for development of BSCR uveitis.

In summary, the combinatorial impact of ERAP1/2 shaping the immunopeptidome along with differential peptide selection by the key residues in HLA-A29 and HLA-Aw19 family members supports the immunological hypothesis of a peptide pool that is generated by this combination and available for immune cell recognition and activation initiating an inflammatory cascade. Avenues to reduce the expression and recognition of ERAP2-processed and HLA-Aw19-presented peptides in the eye may be beneficial against BSCR disease and/or progression.

Various modifications of the described subject matter, in addition to those described herein, will be apparent to those skilled in the art from the foregoing description. Such modifications are also intended to fall within the scope of the appended claims. Each reference (including, but not limited to, journal articles, U.S. and non-U.S. patents, patent application publications, international patent application publications, gene bank accession numbers, and the like) cited in the present application is incorporated herein by reference in its entirety.

DOCKET NO.: 189238.05102 (3358) (10814WO01)

What Is Claimed Is:

1. A method of treating a subject having an immune disorder, the method comprising administering to the subject a therapeutically effective amount of an Endoplasmic Reticulum Aminopeptidase 2 (ERAP2) inhibitor.

2. The method according to claim 1, wherein the immune disorder is an MHC-I-opathy.

3. The method according to claim 2, wherein the MHC-I-opathy is Birdshot Chorioretinopathy (BSCR).

4. The method according to claim 3, the method further comprising detecting the presence or absence of an HLA-Aw19 allele in a biological sample obtained from the subject.

5. The method according to claim 4, the method further comprising determining whether the subject has one or two copies of an HLA-Aw19 allele.

6. The method according to any one of claims 3 to 5, wherein the subject is HLA-Aw19$^+$.

7. The method according to claim 6, wherein the subject is HLA-A*29$^+$, HLA-A*30$^+$, HLA-A*31$^+$, or HLA-A*33$^+$, or any combination thereof.

8. The method according to claim 6 or claim 7, wherein the subject has two copies of HLA-Aw19.

9. The method according to claim 8, wherein the subject is HLA-A*29$^+$/HLA-A*30$^+$.

10. The method according to claim 8, wherein the subject is HLA-A*29$^+$/HLA-A*31$^+$.

11. The method according to claim 8, wherein the subject is HLA-A*29$^+$/HLA-A*33$^+$.

12. The method according to any one of claims 3 to 11, the method further comprising administering to the subject an HLA-Aw19 inhibitor.

13. The method according to claim 12, wherein the HLA-Aw19 inhibitor is an antibody.

14. The method according to claim 13, wherein the antibody is an anti-HLA-A*29 antibody.

15. The method according to claim 12, wherein the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

16. The method according to claim 15, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-Aw19.

17. The method according to claim 16, wherein the HLA-Aw19 is HLA-A*29.

18. The method according to claim 2, wherein the MHC-I-opathy is Ankylosing Spondylitis (AS).

19. The method according to claim 18, the method further comprising detecting the presence or absence of HLA-B*27 or HLA-B*40 in a biological sample obtained from the subject.

20. The method according to claim 19, the method further comprising determining whether the subject has one or two copies of HLA-B*27 or HLA-B*40.

21. The method according to any one of claims 18 to 20, wherein the subject is HLA-B*27$^+$ or HLA-B*40$^+$.

22. The method according to claim 21, wherein the subject has two copies of HLA-B*27 or HLA-B*40.

23. The method according to any one of claims 18 to 22, the method further comprising administering to the subject an HLA-B*27 inhibitor or an HLA-B*40 inhibitor.

24. The method according to claim 23, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody.

25. The method according to claim 24, wherein the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody.

26. The method according to claim 23, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

27. The method according to claim 26, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27 or an HLA-B*40.

28. The method according to claim 2, wherein the MHC-I-opathy is Behçet's disease.

29. The method according to claim 28, the method further comprising detecting the presence or absence of HLA-B*51 in a biological sample obtained from the subject.

30. The method according to claim 29, the method further comprising determining whether the subject has one or two copies of HLA-B*51.

31. The method according to any one of claims 28 to 30, wherein the subject is HLA-B*51^{+}.

32. The method according to claim 31, wherein the subject has two copies of HLA-B*51.

33. The method according to any one of claims 28 to 32, the method further comprising administering to the subject an HLA-B*51 inhibitor.

34. The method according to claim 33, wherein the HLA-B*51 inhibitor is an antibody.

35. The method according to claim 34, wherein the antibody is an anti-HLA-B*51 antibody.

36. The method according to claim 33, wherein the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

37. The method according to claim 36, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*51.

38. The method according to claim 2, wherein the MHC-I-opathy is psoriasis.

39. The method according to claim 38, the method further comprising detecting the presence or absence of HLA-C*06 in a biological sample obtained from the subject.

40. The method according to claim 39, the method further comprising determining whether the subject has one or two copies of HLA-C*06.

41. The method according to any one of claims 38 to 40, wherein the subject is HLA-C*06^{+}.

42. The method according to claim 41, wherein the subject has two copies of HLA-C*06.

43. The method according to any one of claims 38 to 42, the method further comprising administering to the subject an HLA-C*06 inhibitor.

44. The method according to claim 43, wherein the HLA-C*06 inhibitor is an antibody.

45. The method according to claim 44, wherein the antibody is an anti-HLA-C*06 antibody.

46. The method according to claim 43, wherein the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

47. The method according to claim 46, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*06.

48. The method according to claim 2, wherein the MHC-I-opathy is Juvenile Idiopathic Arthritis (JIA).

49. The method according to claim 48, the method further comprising detecting the presence or absence of HLA-B*27 in a biological sample obtained from the subject.

50. The method according to claim 49, the method further comprising determining whether the subject has one or two copies of HLA-B*27.

51. The method according to any one of claims 48 to 50, wherein the subject is HLA-B*27^{+}.

52. The method according to claim 51, wherein the subject has two copies of HLA-B*27.

53. The method according to any one of claims 48 to 52, the method further comprising administering to the subject an HLA-B*27 inhibitor.

54. The method according to claim 53, wherein the HLA-B*27 inhibitor is an antibody.

55. The method according to claim 54, wherein the antibody is an anti-HLA-B*27 antibody.

56. The method according to claim 53, wherein the HLA-B*27 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

57. The method according to claim 56, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27.

58. The method according to claim 2, wherein the MHC-I-opathy is inflammatory bowel disease (IBD) or Crohn's disease (CD).

59. The method according to claim 58, the method further comprising detecting the presence or absence of HLA-C*07 in a biological sample obtained from the subject.

60. The method according to claim 59, the method further comprising determining whether the subject has one or two copies of HLA-C*07.

61. The method according to any one of claims 58 to 60, wherein the subject is HLA-C*07^{+}.

62. The method according to claim 61, wherein the subject has two copies of HLA-C*07.

63. The method according to any one of claims 58 to 62, the method further comprising administering to the subject an HLA-C*07 inhibitor.

64. The method according to claim 63, wherein the HLA-C*07 inhibitor is an antibody.

65. The method according to claim 64, wherein the antibody is an anti-HLA-C*07 antibody.

66. The method according to claim 63, wherein the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

67. The method according to claim 66, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*07.

68. The method according to any one of claims 1 to 67, wherein the ERAP2 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

69. The method according to claim 68, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to ERAP2 mRNA.

70. The method according to any one of claims 1 to 67, wherein the ERAP2 inhibitor comprises an anti-ERAP2 antibody.

71. The method according to any one of claims 1 to 67, wherein the ERAP2 inhibitor comprises a pseudopeptide.

72. The method according to claim 71, wherein the pseudopeptide is a phosphinic pseudopeptide.

73. The method according to claim 72, wherein the phosphinic pseudopeptide is DG002 or DG013.

74. The method according to any one of claims 1 to 67, wherein the ERAP2 inhibitor comprises a small molecule.

75. The method according to any one of claims 1 to 74, further comprising administering to the subject a therapeutically effective amount of an Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) agonist or inhibitor.

76. The method according to claim 75, wherein the ERAP1 agonist comprises an oligonucleotide.

77. The method according to claim 76, wherein the oligonucleotide is ODN1826.

78. The method according to claim 75, wherein the ERAP1 agonist comprises a lipopeptide.

79. The method according to claim 78, wherein the lipopeptide is Pam3CSK4 or FSL-1.

80. The method according to claim 75, wherein the ERAP1 agonist comprises a small molecule.

81. The method according to claim 75, wherein the ERAP1 inhibitor comprises an inhibitory nucleic acid molecule.

82. The method according to claim 75, wherein the ERAP1 inhibitor comprises a small molecule.

83. A method of treating a subject having an MHC-I-opathy, the method comprising:

performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises:

i) an MHC-I-opathy-related HLA genotype; and

ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein; and

administering to the subject a therapeutically effective amount of an ERAP2 inhibitor, wherein the subject comprises both an MHC-I-opathy-related HLA genotype and a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein;

wherein the presence of both the MHC-I-opathy-related HLA genotype and the functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP2.

84. The method according to claim 83, wherein the MHC-I-opathy is Birdshot Chorioretinopathy (BSCR) and the MHC-I-opathy-related HLA genotype comprises an HLA-Aw19 allele.

85. The method according to claim 84, wherein HLA-Aw19 allele is an HLA-A*29 allele, an HLA-A*30 allele, an HLA-A*31 allele, or an HLA-A*33 allele, or any combination thereof.

86. The method according to claim 84 or claim 85, wherein the subject has two copies of the HLA-Aw19 allele.

87. The method according to claim 86, wherein the subject is HLA-A*29$^+$/HLA-A*30$^+$.

88. The method according to claim 86, wherein the subject is HLA-A*29$^+$/HLA-A*31$^+$.

89. The method according to claim 86, wherein the subject is HLA-A*29$^+$/HLA-A*33$^+$.

90. The method according to any one of claims 84 to 89, the method further comprising administering to the subject an HLA-Aw19 inhibitor.

91. The method according to claim 90, wherein the HLA-Aw19 inhibitor is an antibody.

92. The method according to claim 91, wherein the antibody is an anti-HLA-A*29 antibody.

93. The method according to claim 90, wherein the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

94. The method according to claim 93, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-Aw19.

95. The method according to claim 94, wherein the HLA-Aw19 is HLA-A*29.

96. The method according to claim 83, wherein the MHC-I-opathy is Ankylosing Spondylitis (AS) and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27 allele or an HLA-B*40 allele.

97. The method according to claim 96, wherein the subject has two copies of HLA-B*27 or HLA-B*40.

98. The method according to claim 96 or claim 97, the method further comprising administering to the subject an HLA-B*27 inhibitor or an HLA-B*40 inhibitor.

99. The method according to claim 96, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody.

100. The method according to claim 99, wherein the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody.

101. The method according to claim 98, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

102. The method according to claim 101, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27 or an HLA-B*40.

103. The method according to claim 83, wherein the MHC-I-opathy is Behçet's disease and the MHC-I-opathy-related HLA genotype comprises an HLA-B*51 allele.

104. The method according to claim 103, wherein the subject has two copies of HLA-B*51.

105. The method according to claim 103 or claim 104, the method further comprising administering to the subject an HLA-B*51 inhibitor.

106. The method according to claim 105, wherein the HLA-B*51 inhibitor is an antibody.

107. The method according to claim 106, wherein the antibody is an anti-HLA-B*51 antibody.

108. The method according to claim 105, wherein the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

109. The method according to claim 108, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*51.

110. The method according to claim 83, wherein the MHC-I-opathy is psoriasis and the MHC-I-opathy-related HLA genotype comprises an HLA-C*06 allele.

111. The method according to claim 110, wherein the subject has two copies of HLA-C*06.

112. The method according to claim 110 or claim 111, the method further comprising administering to the subject an HLA-C*06 inhibitor.

113. The method according to claim 112, wherein the HLA-C*06 inhibitor is an antibody.

114. The method according to claim 113, wherein the antibody is an anti-HLA-C*06 antibody.

115. The method according to claim 112, wherein the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

116. The method according to claim 115, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*06.

117. The method according to claim 83, wherein the MHC-I-opathy is Juvenile Idiopathic Arthritis (JIA) and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27.

118. The method according to claim 117, wherein the subject has two copies of HLA-B*27.

119. The method according to claim 117 or claim 118, the method further comprising administering to the subject an HLA-B*27 inhibitor.

120. The method according to claim 119, wherein the HLA-B*27 inhibitor is an antibody.

121. The method according to claim 120, wherein the antibody is an anti-HLA-B*27 antibody.

122. The method according to claim 119, wherein the HLA-B*27 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

123. The method according to claim 122, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27.

124. The method according to claim 83, wherein the MHC-I-opathy is inflammatory bowel disease (IBD) or Crohn's disease (CD) and the MHC-I-opathy-related HLA genotype comprises an HLA-C*07 allele.

125. The method according to claim 124, wherein the subject has two copies of HLA-C*07.

126. The method according to claim 124 or claim 125, the method further comprising administering to the subject an HLA-C*07 inhibitor.

127. The method according to claim 126, wherein the HLA-C*07 inhibitor is an antibody.

128. The method according to claim 127, wherein the antibody is an anti-HLA-C*07 antibody.

129. The method according to claim 126, wherein the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

130. The method according to claim 129, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*07.

131. The method according to any one of claims 83 to 130, wherein the nucleic acid molecule comprises genomic DNA, mRNA, or cDNA obtained from mRNA.

132. The method according to any one of claims 83 to 131, wherein the ERAP2 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

133. The method according to claim 132, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to ERAP2 mRNA.

134. The method according to any one of claims 83 to 131, wherein the ERAP2 inhibitor comprises an anti-ERAP2 antibody.

135. The method according to any one of claims 83 to 131, wherein the ERAP2 inhibitor comprises a pseudopeptide.

136. The method according to claim 135, wherein the pseudopeptide is a phosphinic pseudopeptide.

137. The method according to claim 136, wherein the phosphinic pseudopeptide is DG002 or DG013.

138. The method according to any one of claims 83 to 131, wherein the ERAP2 inhibitor comprises a small molecule.

139. The method according to any one of claims 83 to 138, wherein:

the assay performed or having been performed on the biological sample from the subject further determines whether the subject comprises a functional Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) protein or a nucleic acid molecule encoding a functional ERAP1 protein; and

the method further comprises administering to the subject a therapeutically effective amount of an ERAP1 agonist, wherein the subject comprises an MHC-I-opathy-

related HLA genotype and does not comprise a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein;

wherein the presence of an MHC-I-opathy-related HLA genotype and the absence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by activating ERAP1.

140. The method according to claim 139, wherein the ERAP1 agonist comprises a comprises an oligonucleotide.

141. The method according to claim 140, wherein the oligonucleotide is ODN1826.

142. The method according to claim 139, wherein the ERAP1 agonist comprises a lipopeptide.

143. The method according to claim 142, wherein the lipopeptide is Pam3CSK4 or FSL-1.

144. The method according to claim 139, wherein the ERAP1 agonist comprises a small molecule.

145. The method according to any one of claims 83 to 138, wherein:

the assay performed or having been performed on the biological sample from the subject further determines whether the subject comprises a functional Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) protein or a nucleic acid molecule encoding a functional ERAP1 protein; and

the method further comprises administering to the subject a therapeutically effective amount of an ERAP1 inhibitor, wherein the subject comprises an MHC-I-opathy-related HLA genotype and comprises a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein;

wherein the presence of an MHC-I-opathy-related HLA genotype and the presence of a functional ERAP1 protein or a nucleic acid molecule encoding a functional ERAP1 protein indicates that the subject is a candidate for treating the MHC-I-opathy by inhibiting ERAP1.

146. The method according to claim 145, wherein the ERAP1 inhibitor comprises an oligonucleotide.

147. The method according to claim 145, wherein the ERAP1 inhibitor comprises a small molecule.

148. A method of identifying a subject having an increased risk for developing an MHC-I-opathy, the method comprising:

performing or having performed an assay on a biological sample from the subject to determine whether the subject comprises:

i) an MHC-I-opathy-related HLA genotype; and

ii) a functional ERAP2 protein or a nucleic acid molecule encoding a functional ERAP2 protein;

wherein:

when the subject has both the MHC-I-opathy-related HLA genotype and the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, then the subject has an increased risk of developing the MHC-I-opathy;

when the subject lacks the MHC-I-opathy-related HLA genotype, or lacks the functional ERAP2 protein or the nucleic acid molecule encoding the functional ERAP2 protein, or lacks both, then the subject has a decreased risk of developing the MHC-I-opathy; and

when the subject comprises two copies of the MHC-I-opathy-related HLA genotype, then the subject has an increased risk of developing the MHC-I-opathy compared to comprising a single copy of the MHC-I-opathy-related HLA genotype.

149. The method according to claim 148, wherein the MHC-I-opathy is Birdshot Chorioretinopathy (BSCR) and the MHC-I-opathy-related HLA genotype comprises an HLA-Aw19 allele.

150. The method according to claim 149, wherein HLA-Aw19 allele is an HLA-A*29 allele, an HLA-A*30 allele, an HLA-A*31 allele, or an HLA-A*33 allele, or any combination thereof.

151. The method according to claim 149 or claim 150, wherein the subject has two copies of the HLA-Aw19 allele.

152. The method according to claim 151, wherein the subject is HLA-A*29^{+}/HLA-A*30^{+}.

153. The method according to claim 151, wherein the subject is HLA-A*29^{+}/HLA-A*31^{+}.

154. The method according to claim 151, wherein the subject is HLA-A*29^{+}/HLA-A*33^{+}.

155. The method according to any one of claims 149 to 154, the method further comprising administering an HLA-Aw19 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

156. The method according to claim 155, wherein the HLA-Aw19 inhibitor is an antibody.

157. The method according to claim 156, wherein the antibody is an anti-HLA-A*29 antibody.

158. The method according to claim 155, wherein the HLA-Aw19 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

159. The method according to claim 158, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-Aw19.

160. The method according to claim 159, wherein the HLA-Aw19 is HLA-A*29.

161. The method according to claim 148, wherein the MHC-I-opathy is Ankylosing Spondylitis (AS) and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27 allele or an HLA-B*40 allele.

162. The method according to claim 161, wherein the subject has two copies of HLA-B*27 or HLA-B*40.

163. The method according to claim 161 or claim 162, the method further comprising administering an HLA-B*27 inhibitor or an HLA-B*40 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

164. The method according to claim 163, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor is an antibody.

165. The method according to claim 164, wherein the antibody is an anti-HLA-B*27 antibody or an anti-HLA-B*40 antibody.

166. The method according to claim 163, wherein the HLA-B*27 inhibitor or HLA-B*40 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

167. The method according to claim 166, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27 or an HLA-B*40.

168. The method according to claim 148, wherein the MHC-I-opathy is Behçet's disease and the MHC-I-opathy-related HLA genotype comprises an HLA-B*51 allele.

169. The method according to claim 168, wherein the subject has two copies of HLA-B*51.

170. The method according to claim 168 or claim 169, the method further comprising administering an HLA-B*51 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

171. The method according to claim 170, wherein the HLA-B*51 inhibitor is an antibody.

172. The method according to claim 170, wherein the antibody is an anti-HLA-B*51 antibody.

173. The method according to claim 170, wherein the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

174. The method according to claim 173, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*51.

175. The method according to claim 148, wherein the MHC-I-opathy is psoriasis and the MHC-I-opathy-related HLA genotype comprises an HLA-C*06 allele.

176. The method according to claim 175, wherein the subject has two copies of HLA-C*06.

177. The method according to claim 175 or claim 176, the method further comprising administering an HLA-C*06 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

178. The method according to claim 177, wherein the HLA-C*06 inhibitor is an antibody.

179. The method according to claim 178, wherein the antibody is an anti-HLA-C*06 antibody.

180. The method according to claim 177, wherein the HLA-C*06 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

181. The method according to claim 180, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*06.

182. The method according to claim 148, wherein the MHC-I-opathy is Juvenile Idiopathic Arthritis (JIA) and the MHC-I-opathy-related HLA genotype comprises an HLA-B*27.

183. The method according to claim 182, wherein the subject has two copies of HLA-B*27.

184. The method according to claim 182 or claim 183, the method further comprising administering an HLA-B*27 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

185. The method according to claim 184, wherein the HLA-B*27 inhibitor is an antibody.

186. The method according to claim 185, wherein the antibody is an anti-HLA-B*27 antibody.

187. The method according to claim 184, wherein the HLA-B*27 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

188. The method according to claim 187, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-B*27.

189. The method according to claim 148, wherein the MHC-I-opathy is inflammatory bowel disease (IBD) or Crohn's disease (CD) and the MHC-I-opathy-related HLA genotype comprises an HLA-C*07 allele.

190. The method according to claim 189, wherein the subject has two copies of HLA-C*07.

191. The method according to claim 189 or claim 190, the method further comprising administering an HLA-C*07 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

192. The method according to claim 191, wherein the HLA-C*07 inhibitor is an antibody.

193. The method according to claim 192, wherein the antibody is an anti-HLA-C*07 antibody.

194. The method according to claim 191, wherein the HLA-C*07 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

195. The method according to claim 194, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to an HLA-C*07.

196. The method according to any one of claims 148 to 195, wherein the nucleic acid molecule comprises genomic DNA, mRNA, or cDNA obtained from mRNA.

197. The method according to any one of claims 148 to 196, the method further comprising administering an ERAP2 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

198. The method according to claim 197, wherein the ERAP2 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid molecule.

199. The method according to claim 198, wherein the inhibitory nucleic acid molecule is an antisense nucleic acid molecule, a small interfering RNA (siRNA), or a short hairpin RNA that hybridizes to ERAP2 mRNA.

200. The method according to claim 197, wherein the ERAP2 inhibitor comprises an anti-ERAP2 antibody.

201. The method according to claim 197, wherein the ERAP2 inhibitor comprises a pseudopeptide.

202. The method according to claim 201, wherein the pseudopeptide is a phosphinic pseudopeptide.

203. The method according to claim 202, wherein the phosphinic pseudopeptide is DG002 or DG013.

204. The method according to claim 197, wherein the ERAP2 inhibitor comprises a small molecule.

205. The method according to any one of claims 148 to 204, wherein:

the assay performed or having been performed on the biological sample from the subject further determines whether the subject comprises a functional Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) protein or a nucleic acid molecule encoding a functional ERAP1 protein; and

when the subject has the MHC-I-opathy-related HLA genotype and lacks the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, then the subject has an increased risk of developing the MHC-I-opathy; and

when the subject lacks the MHC-I-opathy-related HLA genotype, or has the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, or both, then the subject has a decreased risk of developing the MHC-I-opathy.

206. The method according to claim 205, the method further comprising administering an ERAP1 agonist to the subject having an increased risk of developing the MHC-I-opathy.

207. The method according to claim 206, wherein the ERAP1 agonist comprises a comprises an oligonucleotide.

208. The method according to claim 207, wherein the oligonucleotide is ODN1826.

209. The method according to claim 206, wherein the ERAP1 agonist comprises a lipopeptide.

210. The method according to claim 209, wherein the lipopeptide is Pam3CSK4 or FSL-1.

211. The method according to claim 206, wherein the ERAP1 agonist comprises a small molecule.

212. The method according to any one of claims 148 to 204, wherein:

the assay performed or having been performed on the biological sample from the subject further determines whether the subject comprises a functional Endoplasmic Reticulum Aminopeptidase 1 (ERAP1) protein or a nucleic acid molecule encoding a functional ERAP1 protein; and

when the subject has the MHC-I-opathy-related HLA genotype and has the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, then the subject has an increased risk of developing the MHC-I-opathy; and

when the subject lacks the MHC-I-opathy-related HLA genotype, or does not comprise the functional ERAP1 protein or the nucleic acid molecule encoding the functional ERAP1 protein, or both, then the subject has a decreased risk of developing the MHC-I-opathy.

213. The method according to claim 212, the method further comprising administering an ERAP1 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

214. The method according to claim 213, wherein the ERAP1 inhibitor comprises an inhibitory nucleic acid molecule.

215. The method according to claim 213, wherein the ERAP1 inhibitor comprises a small molecule.

5

	UParis (A29 EUR Carriers)				GHS cohort #1 (A29 EUR)		
Second HLA-A Allele	**Cases n=286**	**Ctrls n=108**	**OR (LCI-UCI)**	**p-val**	**Carriers n=4014**	**OR (LCI-UCI)**	**p-val**
Aw19 co-susceptible (29,30,31,33)	**41**	**4**	**4.44 (1.55-17.53)**	**2.20E-03**	**247**	**2.63 (1.80-3.78)**	**1.29E-06**
A3002	**13**	**1**	**5.19 (0.76-222.84)**	**0.12**	**45**	**4.31 (2.11-8.26)**	**6.15E-05**
A3301	**9**	**0**	**Inf (0.77-Inf)**	**0.07**	**39**	**3.40 (1.43-7.23)**	**3.2E-03**
A0301	26	15	0.63 (0.31-1.35)	0.20	592	0.59 (0.38-0.90)	0.01
A0101	71	17	1.81 (0.99-3.48)	0.04	662	1.73 (1.29-2.31)	2.67E-04
A3201	**3**	**4**	**0.28 (0.04-1.70)**	**0.10**	**152**	**0.28 (0.06-0.83)**	**0.01**
A0201	64	24	1.03 (0.59-1.85)	1.00	1085	0.80 (0.59-1.08)	0.14
A2902	**10**	**1**	**3.95 (0.55-173.12)**	**0.30**	**48**	**3.07 (1.37-6.24)**	**3.6E-03**
A2601	8	3	1.03 (0.24-6.13)	1.00	115	1.00 (0.42-2.07)	1.00

Figure 1

	UParis (A29 EUR Carriers)				GHS cohort #1 (A29 EUR)		
Second HLA-A Allele	**Cases n=286**	**Ctrls n=108**	**OR (LCI-UCI)**	**p-val**	**Carriers n=4014**	**OR (LCI-UCI)**	**p-val**
A2501	3	2	0.57 (0.06-6.96)	0.62	101	0.42 (0.08-1.28)	0.16
A2402	23	11	0.79 (0.35-1.86)	0.55	356	0.92 (0.57-1.44)	0.83
A3101	**9**	**2**	**1.75 (0.35-16.95)**	**0.73**	**115**	**1.13 (0.50-2.26)**	**0.71**
A1101	14	10	0.52 (0.21-1.34)	0.16	255	0.78 (0.41-1.36)	0.44
A2301	6	2	1.16 (0.20-11.91)	1.00	94	0.92 (0.33-2.10)	1.00
A6801	9	8	0.42 (0.14-1.27)	0.09	128	1.01 (0.45-2.01)	0.86
A19 all (29,30,31,32,33)	44	8	2.07 (0.92-4.64)	0.08	399	1.49 (1.02-2.18)	0.04

Figure 1 (cont.)

	GHS cohort #2 (A29 EUR)			UKB (A29 EUR)		
Second HLA-A Allele	Carriers n=2829	OR (LCI-UCI)	p-val	Carriers n=38,543	OR (LCI-UCI)	p-val
Aw19 co-susceptible (29,30,31,33	**164**	**2.69 (1.81-3.92)**	**1.07E-06**	**2416**	**2.51 (1.75-3.52)**	**9.62E-07**
A3002	**20**	**6.60 (2.98-14.13)**	**3.03E-06**	**396**	**4.60 (2.39-8.09)**	**1.25E-05**
A3301	**32**	**2.80 (1.16-6.09)**	**0.01**	**255**	**4.89 (2.19-9.56)**	**1.63E-04**
A0301	380	0.63 (0.40-0.97)	0.03	5497	0.60 (0.38-0.90)	0.01
A0101	448	1.74 (1.28-2.33)	3.21E-04	7411	1.39 (1.05-1.83)	0.02
A3201	**105**	**0.27 (0.05-0.82)**	**0.02**	**1323**	**0.30 (0.06-0.88)**	**0.02**
A0201	756	0.78 (0.57-1.04)	0.09	10680	0.75 (0.56-1.00)	0.05
A2902	**37**	**2.70 (1.18-5.61)**	**9.43E-03**	**750**	**1.83 (0.86-3.43)**	**0.08**

Figure 1 (cont.)

	GHS cohort #2 (A29 EUR)			UKB (A29 EUR)		
Second HLA-A Allele	**Carriers n=2829**	**OR (LCI-UCI)**	**p-val**	**Carriers n=38,543**	**OR (LCI-UCI)**	**p-val**
A2601	91	0.85 (0.35-1.78)	0.86	834	1.30 (0.55-2.62)	0.41
A2501	47	0.62 (0.12-1.94)	0.62	673	0.60 (0.12-1.77)	0.50
A2402	249	0.89 (0.55-1.40)	0.74	2801	1.12 (0.69-1.72)	0.57
A3101	**75**	**1.18 (0.51-2.39)**	**0.57**	**1015**	**1.20 (0.54-2.33)**	**0.58**
A1101	177	0.76 (0.40-1.33)	0.44	2278	0.82 (0.44-1.40)	0.61
A2301	61	0.96 (0.34-2.24)	1.00	672	1.21 (0.44-2.68)	0.65
A6801	100	0.87 (0.38-1.76)	0.87	1142	1.07 (0.48-2.06)	0.86
A19 all (29,30,31,32,33)	269	1.58 (1.07-2.34)	0.02	3739	1.51 (1.04-2.18)	0.03

Figure 1 (cont.)

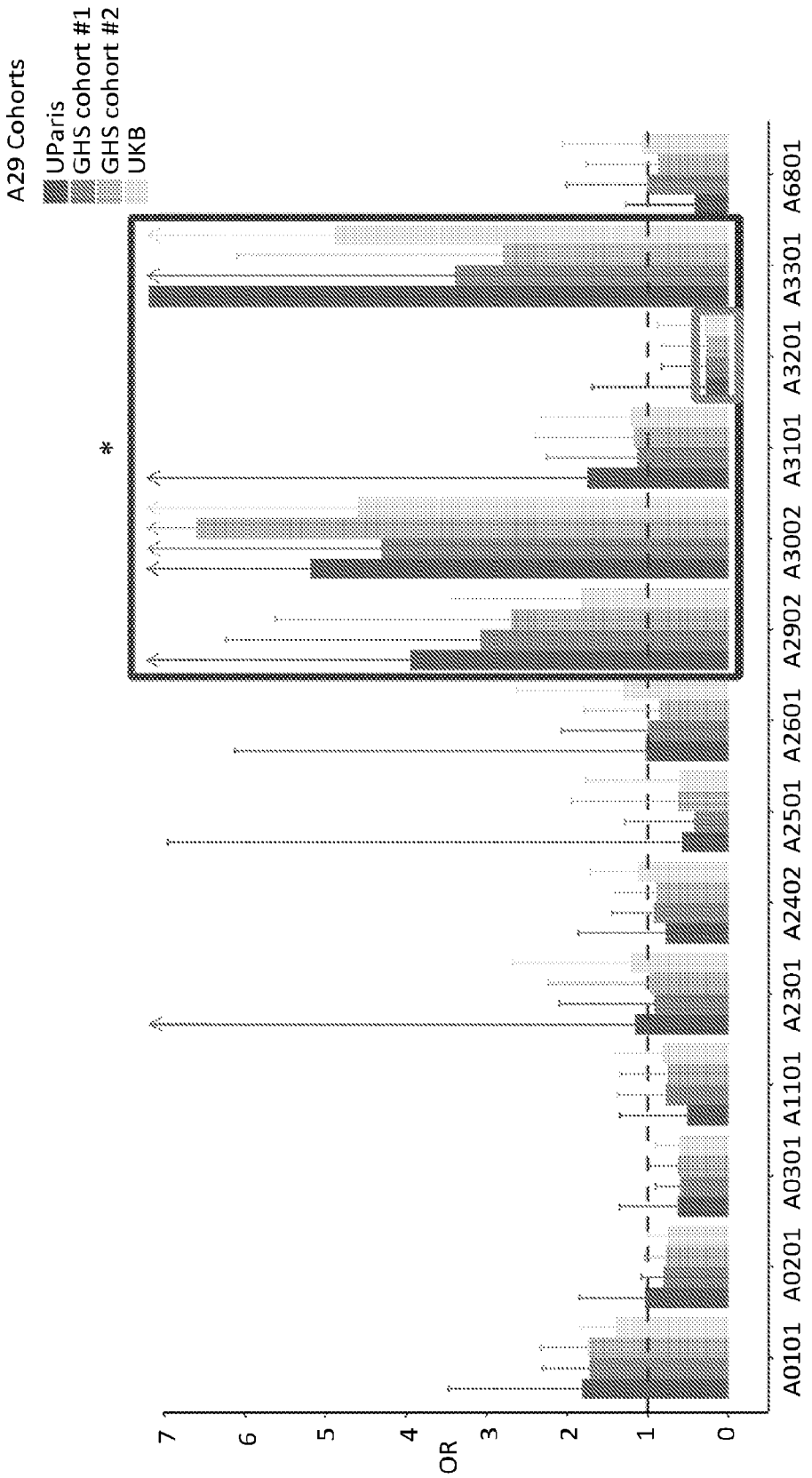

A29 Cohorts
UParis
GHS cohort #1
GHS cohort #2
UKB
*
OR
0
1
2
3
4
5
6
7
A0101
A0201
A0301
A1101
A2301
A2402
A2501
A2601
A2902
A3002
A3101
A3201
A3301
A6801
HLA-A alleles

Figure 2

	UParis (A29 EUR Carriers)				GHS cohort #1 (A29 EUR)		
Second HLA-A Allele	**Cases n=286**	**Ctrls n=108**	**OR (LCI-UCI)**	**p-val**	**Carriers n=4014**	**OR (LCI-UCI)**	**p-val**
Aw19 co-susceptible (29,30,31,33)	**41**	**4**	**4.05 (1.40-11.77)**	**0.01**	**247**	**2.21 (1.47-3.33)**	**1.55E-04**
A3002	**13**	**1**	**4.32 (0.55-33.79)**	**0.16**	**45**	**2.78 (1.31-5.88)**	**7.66E-03**
A3301	**9**	**0**	**6204540.00 (0.00-Inf)**	**0.98**	**39**	**3.12 (1.29-7.58)**	**0.01**
A0301	26	15	0.71 (0.35-1.45)	0.35	592	0.69 (0.45-1.08)	0.11
A0101	71	17	1.84 (1.01-3.35)	0.05	662	1.57 (1.15-2.16)	0.00
A3201	**3**	**4**	**0.22 (0.05-1.04)**	**0.06**	**152**	**0.30 (0.09-0.97)**	**4.38E-02**
A0201	64	24	0.97 (0.56-1.68)	0.92	1085	0.87 (0.64-1.20)	0.41
A2902	**10**	**1**	**3.26 (0.40-26.32)**	**0.27**	**48**	**1.83 (0.80-4.20)**	**0.15**
A2601	8	3	1.09 (0.28-4.26)	0.90	115	0.87 (0.39-1.91)	0.72

Figure 3

SUBSTITUTE SHEET (RULE 26)

	UParis (A29 EUR Carriers)				GHS cohort #1 (A29 EUR)		
Second HLA-A Allele	**Cases n=286**	**Ctrls n=108**	**OR (LCI-UCI)**	**p-val**	**Carriers n=4014**	**OR (LCI-UCI)**	**p-val**
A2501	3	2	0.55 (0.08-3.61)	0.54	101	0.57 (0.16-2.01)	0.38
A2402	23	11	0.85 (0.39-1.85)	0.67	356	0.99 (0.61-1.61)	0.97
A3101	**9**	**2**	**1.75 (0.37-8.33)**	**0.48**	**115**	**1.42 (0.68-2.97)**	**0.35**
A1101	14	10	0.55 (0.23-1.34)	0.19	255	0.81 (0.45-1.48)	0.50
A2301	6	2	1.06 (0.21-5.47)	094	94	0.85 (0.34-2.17)	074
A6801	9	8	0.42 (0.16-1.15)	0.09	128	0.95 (0.45-2.04)	0.90
A19 all (29,30,31,32,33)	**44**	**8**	**2.07 (0.92-4.64)**	**0.08**	**399**	**1.49 (1.02-2.18)**	**0.04**

Figure 3 (cont.)

	GHS cohort #2 (A29 EUR)			UKB (A29 EUR)		
Second HLA-A Allele	Carriers n=2829	OR (LCI-UCI)	p-val	Carriers n=38,543	OR (LCI-UCI)	p-val
Aw19 co-susceptible (29,30,31,33	**164**	**2.49 (1.63-3.81)**	**2.34E-05**	**2416**	**2.24 (1.52-3.30)**	**4.57E-05**
A3002	**20**	**4.26 (1.83-9.92)**	**7.68E-04**	**396**	**4.01 (2.05-7.84)**	**4.99E-05**
A3301	**32**	**2.69 (1.15-6.28)**	**0.02**	**255**	**2.00 (0.80-5.01)**	**0.14**
A0301	380	0.72 (0.46-1.14)	0.16	5497	0.65 (0.43-1.01)	0.05
A0101	448	1.59 (1.15-2.19)	0.01	7411	1.82 (1.35-2.45)	0.00
A3201	**105**	**0.22 (0.06-0.83)**	**2.52E-02**	**1323**	**0.28 (0.08-0.90)**	**3.33E-02**
A0201	756	0.87 (0.63-1.20)	0.41	10680	0.82 (0.61-1.11)	0.20
A2902	**37**	**1.94 (0.84-4.46)**	**0.12**	**750**	**2.10 (1.05-4.23)**	**0.04**

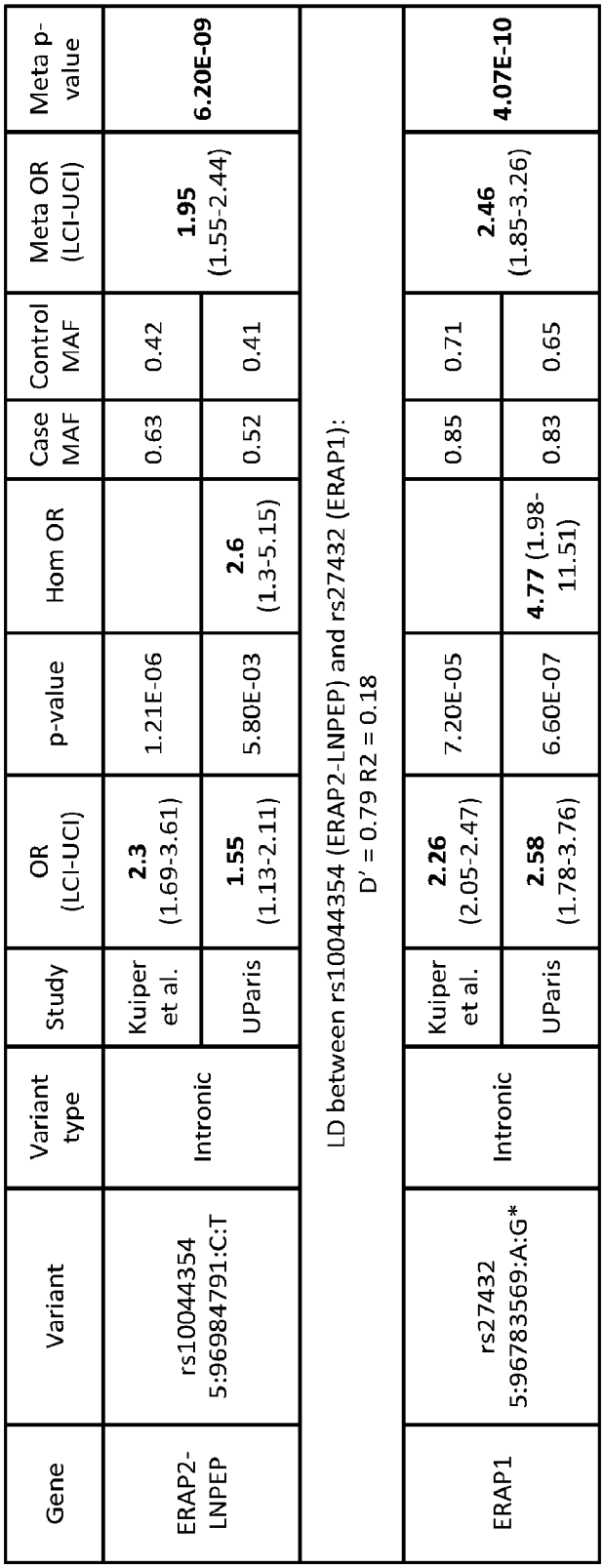
Figure 3 (cont.)

	GHS cohort #2 (A29 EUR)			UKB (A29 EUR)		
Second HLA-A Allele	**Carriers n=2829**	**OR (LCI-UCI)**	**p-val**	**Carriers n=38,543**	**OR (LCI-UCI)**	**p-val**
A2601	91	0.91 (0.40-2.09)	0.82	834	0.73 (0.33-1.61)	0.44
A2501	47	0.69 (0.18-2.62)	0.59	673	0.66 (0.20-2.15)	0.49
A2402	249	1.06 (0.65-1.74)	0.81	2801	1.00 (0.63-1.59)	0.99
A3101	**75**	**1.57 (0.72-3.41)**	**0.25**	**1015**	**1.24 (0.58-2.64)**	**0.57**
A1101	177	0.83 (0.45-1.53)	0.54	2278	0.82 (0.46-1.45)	0.49
A2301	61	0.73 (0.28-1.95)	0.53	672	0.85 (0.35-2.10)	0.73
A6801	100	0.76 (0.35-1.67)	0.50	1142	1.43 (0.70-2.91)	0.33
A19 all (29,30,31,32,33)	**269**	**1.58 (1.07-2.34)**	**0.02**	**3739**	**1.51 (1.04-2.18)**	**0.03**

Figure 3 (cont.)

UParis											
F cases		0.17		0.55							**0.28**
F controls		0.35		0.48							**0.17**
OR		0.41		1.32							**1.78**
P		**6.7E-6**		0.11							**8.0E-3**
ERAP1	**Function**	Hap 1	Hap 2	Hap 3	Hap 5	Hap 6	Hap 7	Hap 8	**Hap 10**		
rs72773968 5:96803892:G:A	I12T	I	T	T	T	T	T	T	**T**		
rs3734016 5:96803761:C:T	E56K	E	E	E	E	E	K	E	**E**		
rs26618 5:96795133:T:C	I276M	I	I	I	I	I	I	M	**I**		
rs27895 5:96793840:C:T	G346D	G	G	G	D	G	G	G	**G**		
rs2287987 5:96793832:T:C	M349V	M	M	M	M	M	M	M	**V**		
rs30187 5:96788627:T:C	K528R	K	K	K	R	R	R	R	**R**		
rs10050860 5:96786506:C:T	D575N	D	D	D	D	D	D	D	**N**		
rs17482078 5:96783162:C:G	R725Q	R	R	R	R	R	R	R	**Q**		
rs27044 5:96783148:C:G	Q730E	Q	Q	E	E	E	E	E	**E**		

Figure 4



Gene	Variant	Variant type	Study	OR (LCI-UCI)	p-value	Hom OR	Case MAF	Control MAF	Meta OR (LCI-UCI)	Meta p-value
ERAP2-LNPEP	rs10044354 5:96984791:C:T	Intronic	Kuiper et al.	**2.3** (1.69-3.61)	1.21E-06		0.63	0.42	**1.95** (1.55-2.44)	**6.20E-09**
			UParis	**1.55** (1.13-2.11)	5.80E-03	**2.6** (1.3-5.15)	0.52	0.41		
LD between rs10044354 (ERAP2-LNPEP) and rs27432 (ERAP1): D' = 0.79 R2 = 0.18										
ERAP1	rs27432 5:96783569:A:G*	Intronic	Kuiper et al.	**2.26** (2.05-2.47)	7.20E-05		0.85	0.71	**2.46** (1.85-3.26)	**4.07E-10**
			UParis	**2.58** (1.78-3.76)	6.60E-07	**4.77** (1.98-11.51)	0.83	0.65		

Figure 5

Gene	Variant	Variant type	Study	OR (LCI-UCI)	p-value	Hom OR	Case MAF	Control MAF	Meta OR (LCI-UCI)	Meta p-value
ERAP2	rs2248374 5:96900192:A:G	Splice region	Kuiper et al.	**0.44** (0.31-0.63)	6.60E-06		0.33	0.53	**0.56** (0.45-0.70)	**2.39E-07**
			UParis	**0.68** (0.5-0.92)	1.40E-02	**0.45** (0.23-0.87)	0.43	0.53		

Figure 6

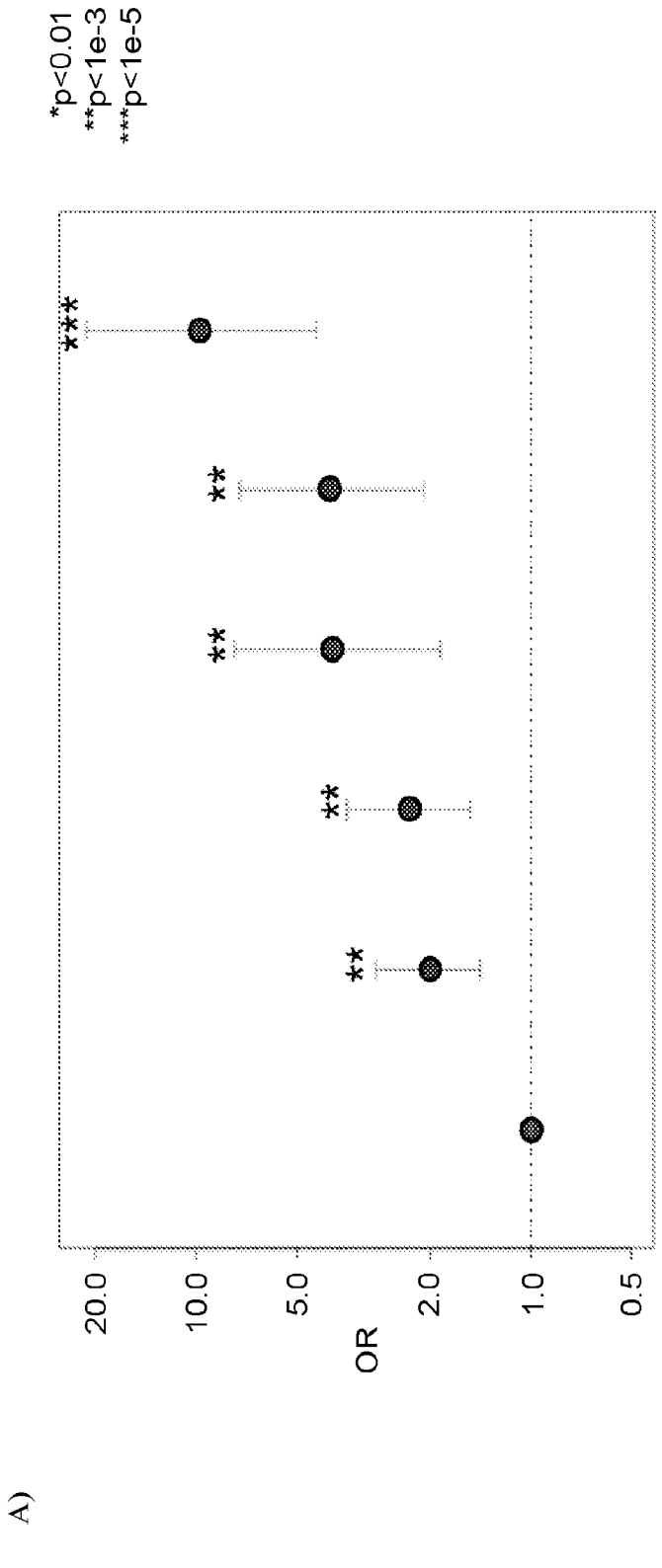
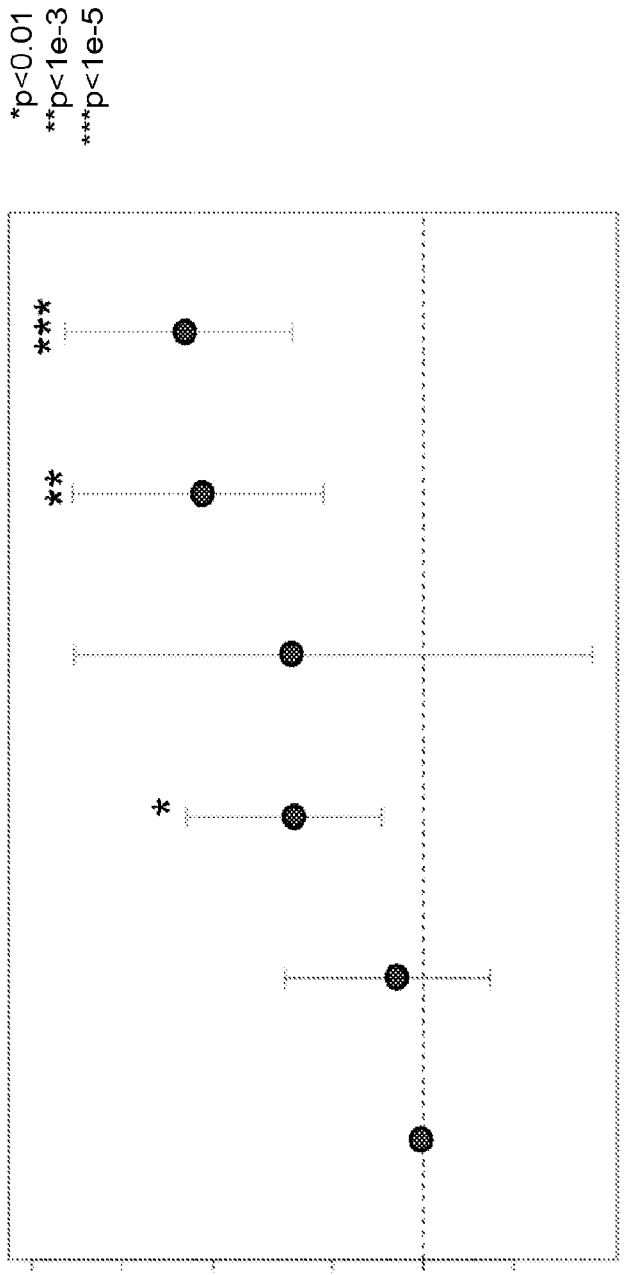

A)
*p<0.01
**p<1e-3
***p<1e-5
OR
20.0
10.0
5.0
2.0
1.0
0.5
HLA-Aw19 A29/- A29/- A29/- A29/Aw19 A29/Aw19 A29/Aw19
ERAP2-rs10044354 CC CT TT CC CT TT
Controls (%) 32 45 17 2 3 1
Cases (%) 17 48 20 5 6 4

Figure 7

B)



HLA-Aw19	A29/-	A29/-	A29/-	A29/Aw19	A29/Aw19	A29/Aw19
ERAP1-rs27432	AA	AG	GG	AA	AG	GG
Controls (%)	7	38	49	1	2	3
Cases (%)	3	21	60	1	5	9

Figure 7 (cont.)

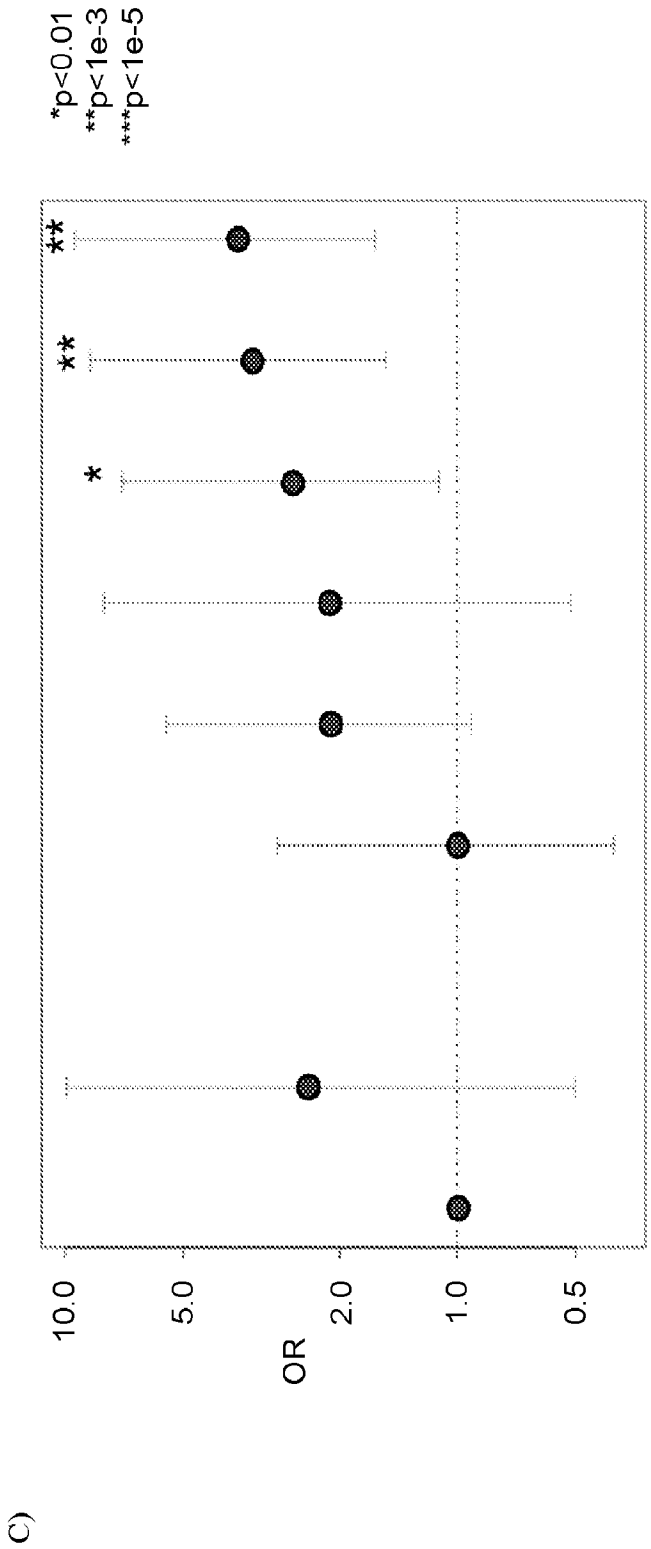
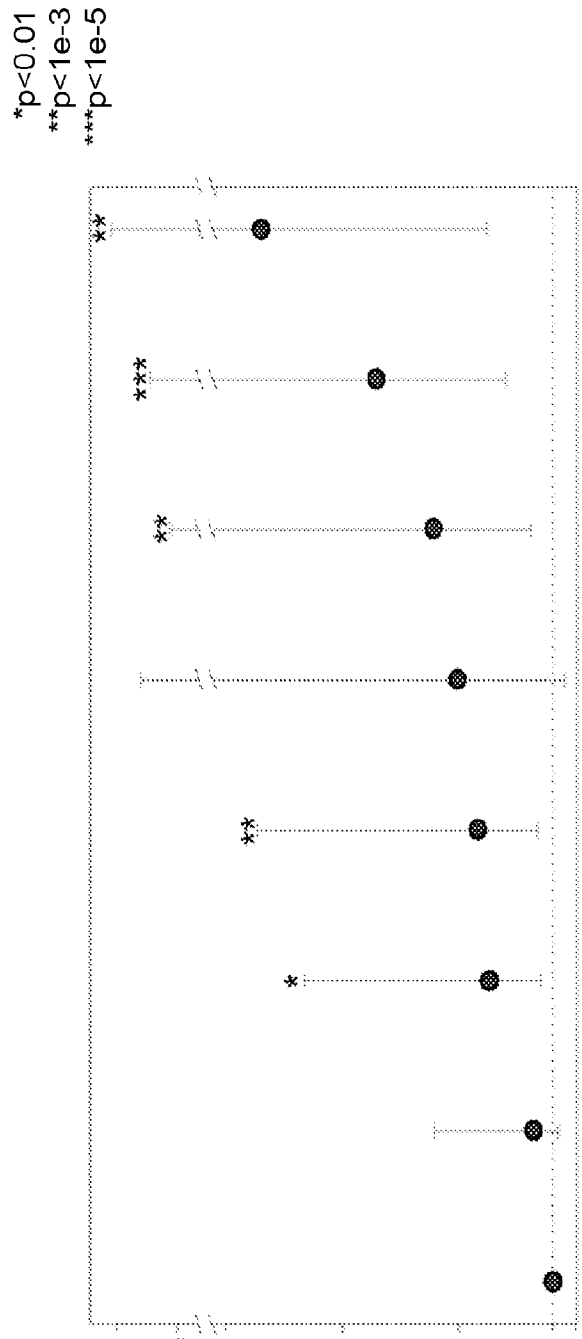


Figure 7 (cont.)

D)



HLA-Aw19	A29/-	A29/-	A29/-	A29/-	A29/Aw19	A29/Aw19	A29/Aw19	A29/Aw19
ERAP1-rs27432 *ERAP2*-rs10044354	0/0	1/[01],[01]/1	2/.,./2	2/2	0/0	1/[01],[01]/1	2/.,./2	2/2
Controls (%)	5.9	37.3	36	14.7	0.4	2.3	2.6	0.8
Cases (%)	1.8	22	41.4	19.4	0.7	4.4	4.4	3.3

Figure 7 (cont.)

Aw19	ERAP2-rs10044354	Case_n	Contr_n	Case_F	ControlF	OR	OR CI_low	OR CI_high	P
A29/-	CC	46	1296	0.167	0.319	1.000	NA	NA	NA
A29/-	CT	132	1842	0.478	0.453	2.019	1.421	2.911	3.95E-05
A29/-	TT	56	681	0.203	0.167	2.316	1.522	3.539	4.51E-05
A29/Aw19	CC	13	94	0.047	0.023	3.891	1.861	7.644	2.13E-04
A29/Aw19	CT	17	119	0.062	0.029	4.019	2.092	7.413	2.32E-05
A29/Aw19	TT	12	34	0.043	0.008	9.902	4.378	21.197	1.16E-07

Figure 8

Aw19	ERAP1-rs27432	Cases number	Control number	Case freq.	Controls freq.	OR	OR CI_low	OR CI_high	P
A29/-	AA	9	298	0.033	0.073	1.000	NA	NA	NA
A29/-	AG	58	1550	0.212	0.378	1.239	0.601	2.876	0.734
A29/-	GG	164	2001	0.601	0.488	2.713	1.374	6.105	1.72E-03
A29/Aw19	AA	2	24	0.007	0.006	2.747	0.274	14.391	0.209
A29/Aw19	AG	15	91	0.055	0.022	5.430	2.144	14.579	9.32E-05
A29/Aw19	GG	25	133	0.092	0.032	6.196	2.708	15.515	1.54E-06

Figure 9

ERAP1-rs27432	ERAP2-rs10044354	Cases number	Control number	Cases freq.	Controls freq.	OR	OR_Cllo	OR_Clhi	P
AA	CC	7	255	0.026	0.063	1.000	NA	NA	NA
AA	CT	4	60	0.015	0.015	2.420	0.503	9.885	0.236
AA	TT	0	2	0.000	0.000	0.000	0.000	208.116	1.000
AG	CC	19	687	0.070	0.170	1.007	0.400	2.871	1.000
AG	CT	49	856	0.180	0.212	2.084	0.924	5.521	0.072
AG	TT	5	86	0.018	0.021	2.113	0.515	7.964	0.197
GG	CC	32	443	0.118	0.109	2.628	1.118	7.160	0.024
GG	CT	94	1030	0.346	0.255	3.323	1.525	8.594	8.29E-04
GG	TT	62	627	0.228	0.155	3.598	1.617	9.446	4.03E-04

Figure 10

AW19	ERAP1-rs27432	ERAP2-rs10044354	Cases number	Control number	Cases freq.	Controls freq.	OR	OR_Cllo	OR_Clhi	P	Absolute risk
A29/-	0	0	5	237	0.018	0.059	NA	NA	NA	NA	3.43E-05
A29/-	0/1	0/1	60	1510	0.220	0.373	1.883	0.752	6.071	0.197	6.45E-05
A29/-	2_either	2_either	113	1457	0.414	0.360	3.674	1.506	11.653	1.16E-03	1.26E-04
A29/-	2_both	2_both	53	596	0.194	0.147	4.211	1.666	13.665	6.26E-04	1.44E-04
A29/Aw19	0	0	2	18	0.007	0.004	5.204	0.465	34.701	0.092	1.78E-04
A29/Aw19	0/1	0/1	12	93	0.044	0.023	6.079	1.929	22.651	5.23E-04	2.08E-04
A29/Aw19	2_either	2_either	19	104	0.070	0.026	8.604	3.002	30.314	3.09E-06	2.95E-04
A29/Aw19	2_both	2_both	9	31	0.033	0.008	13.527	3.791	54.766	1.17E-05	4.63E-04

Figure 11

Allele/position	9	17	56	62	63	70	73	76	77	79	80	81	82	83	97	105	109	114	116	152	
A*01:01:01:01	F	R	G	Q	E	H	T	A	N	G	T	L	R	G	I	P	F	R	D	A	Ex2
A*29:02:01:01	T	-	-	L	Q	Q	-	-	-	-	-	-	-	-	M	S	-	-	-	V	Ex3
A*30:02:01:01	S	S	R	-	-	-	-	E	-	-	-	-	-	-	-	S	-	E	H	R	
A*31:01:02:01	T	-	R	-	-	-	I	V	D	-	-	-	-	-	M	S	-	Q	-	V	
A*32:01:01:01	-	-	-	-	-	-	-	E	S	R	I	A	L	R	M	-	L	Q	-	V	
A*33:01:01:01	T	-	-	R	N	-	I	V	D	-	-	-	-	-	M	S	-	Q	-	V	
A*74:01:01:01	-	-	-	-	-	-	-	V	D	-	-	-	-	-	M	-	L	Q	-	V	

Figure 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2021/043062

A. CLASSIFICATION OF SUBJECT MATTER
INV. C07K16/40 A61K31/7088 C12N9/48 A61P37/02 A61P27/00
A61P17/00 A61P19/00
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C07K A61K C12N A61P

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GEORGIADIS DIMITRIS ET AL: "Inhibitors of ER Aminopeptidase 1 and 2: From Design to Clinical Application", CURRENT MEDICINAL CHEMISTRY, vol. 26, no. 15, 25 July 2019 (2019-07-25) , pages 2715-2729, XP055794307, NL ISSN: 0929-8673, DOI: 10.2174/0929867325666180214111849 page 2722 ----- -/--	1-215

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 October 2021	19/10/2021

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Weisser, Dagmar

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	LÓPEZ DE CASTRO JOSÉ A ET AL: "Molecular and pathogenic effects of endoplasmic reticulum aminopeptidases ERAP1 and ERAP2 in MHC-I-associated inflammatory disorders: Towards a unifying view", MOLECULAR IMMUNOLOGY, PERGAMON, GB, vol. 77, 11 August 2016 (2016-08-11), pages 193-204, XP029708117, ISSN: 0161-5890, DOI: 10.1016/J.MOLIMM.2016.08.005 page 200 - page 201	1-215
Y	AGRAWAL N ET AL: "Genetic associations and functional characterization of M1 aminopeptidases and immune-mediated diseases", GENES AND IMMUNITY, vol. 15, no. 8, 21 August 2014 (2014-08-21), pages 521-527, XP55849007, GB ISSN: 1466-4879, DOI: 10.1038/gene.2014.46 Retrieved from the Internet: URL:http://www.nature.com/articles/gene201446> page 522 - pages 523,526	1-215
Y	DIMOPOULOU CHRYSOULA ET AL: "Variant in ERAP1 promoter region is associated with low expression in a patient with a Behçet-like MHC-I-opathy", JOURNAL OF HUMAN GENETICS, NATURE PUBLISHING GROUP, GB; JP, vol. 65, no. 3, 23 December 2019 (2019-12-23), pages 325-335, XP036998293, ISSN: 1434-5161, DOI: 10.1038/S10038-019-0709-Y [retrieved on 2019-12-23] pages 327,333	1-215
Y	BABAIE FARHAD ET AL: "The roles of ERAP1 and ERAP2 in autoimmunity and cancer immunity: New insights and perspective", MOLECULAR IMMUNOLOGY, PERGAMON, GB, vol. 121, 2 March 2020 (2020-03-02), pages 7-19, XP086137735, ISSN: 0161-5890, DOI: 10.1016/J.MOLIMM.2020.02.020 [retrieved on 2020-03-02] the whole document	1-215

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2021/043062

Box No. I Nucleotide and/or amino acid sequence(s) (Continuation of item 1.c of the first sheet)

1. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of a sequence listing:

   a. [X] forming part of the international application as filed:

      [X] in the form of an Annex C/ST.25 text file.

      [ ] on paper or in the form of an image file.

   b. [ ] furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. [ ] furnished subsequent to the international filing date for the purposes of international search only:

      [ ] in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      [ ] on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

2. [ ] In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

3. Additional comments: