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

Reference To Sequence Listing

5 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

10 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-
15 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
20 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
25 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
30 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

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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
5 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
10 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
15 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).

20 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
25 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
30 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

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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
5 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.

10 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
15 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-
20 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
25 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
30 a decreased risk of developing the MHC-I-opathy.

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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.

5 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
10 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).
15 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
20 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
25 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
30 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.

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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

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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.

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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

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

As used herein, the term “comprising” may be replaced with “consisting” or

5 “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.

10 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
15 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
20 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
25 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
30 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

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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⁺.

5 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.

10 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
15 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
20 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
25 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
30 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

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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
5 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
10 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.

15 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
20 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
25 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,
30 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

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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

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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 proteolysis-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

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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
5 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
10 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
15 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
20 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
proteolysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid
molecule. In some embodiments, the inhibitory nucleic acid molecule is an antisense nucleic
25 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
30 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.,

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Bioorg. Med. Chem. Lett., 2016, 26, 4122-4126). In some embodiments, the ERAP1 inhibitor is (N-(N-(2-(1H-indol-3-yl)ethyl)carbamidoyl)-2,5-difluorobenzenesulfonamide), (1-(1-(4-acetyl)piperazine-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 proteolysis-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

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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
5 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-
10 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
15 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
20 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
25 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
30 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

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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
5 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
10 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
15 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
20 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
25 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.

30 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

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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
5 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
10 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
15 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
20 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
25 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
30 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

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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
5 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 proteolysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid molecule. In some embodiments, the inhibitory nucleic acid molecule is
10 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
15 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
20 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
25 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
30 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.

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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.

5 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

10 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.

15 In any of the embodiments described herein, the ERAP1 inhibitor comprises a small molecule degrader, a proteolysis-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

20 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

25 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.,

30 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,

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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
5 (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
10 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
15 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
20 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
25 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
30 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*

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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).

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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, 5 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 10 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.

15 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 20 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 25 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 30

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- 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,
- 5 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
- 10 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
- 15 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
- 20 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
UCAUGCUCUCUCUUUGAUC	7
CUCAUGCUCUCUCUUUGAU	8
GGACUGUAUCUCAUGCUCAU	9
GGGACUGUAUCUCAUGCACA	10

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CGGGCAGCUUCUGUGAUCUU	11
UUUAAUCAAACACCUCCCGG	12
AUUUAAUCAAACACCUCCCG	13
CUCCAGUUAUGUCACAUGGG	14
GGCUCCAGUUAUGUCACAUG	15
CUGGCUCCAGUUAUGUCACA	16
AGUUCUUCAUGGCACUGCAC	17
UAGUUCUUCAUGGCACUGCA	18
AGACAAGUAAUAUCCAGGC	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

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UCCUCAGUGAAGUGAUACU	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.

5

Table 2

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

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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

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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

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ACUGAAGGGUGGCAUUCGUG	124
GACUGAAGGGUGGCAUUCGU	125
UGACUGAAGGGUGGCAUUCG	126
CUGACUGAAGGGUGGCAUUC	127
UCUGACUGAAGGGUGGCAUU	128
CUCUGACUGAAGGGUGGCAU	129
CCUCUGACUGAAGGGUGGCA	130
UCCUCUGACUGAAGGGUGGC	131
UUCCUCUGACUGAAGGGUGG	132
UUGAAUCUCCUCUGACUGA	133
CUUGAAUCUCCUCUGACUG	134
UCUUGAAUCUCCUCUGACU	135
GUAUCUUGAAUCUCCUCUG	136
UCCUGGUUUAUGUAUCUUG	137
GCAGGGUAAUCUAAAACUUU	138
AGCAGGGUAAUCUAAAACUU	139
GAGCAGGGUAAUCUAAAACU	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

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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
UGGAAGUCCAUAGCCACAU	179
GCUUGGAAGUCCAUAGCCAC	180
UUGGCUUGGAAGUCCAUAGC	181

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CACCUAACUUGGCUUGGAAG	182
AUCACCUAACUUGGCUUGGA	183
CAUCACCUAACUUGGCUUGG	184
CCAUCACCUAACUUGGCUUG	185
CAAAGCCAUCACCUAACUUG	186
UCAAAGCCAUCACCUAACUU	187
UUCAAAGCCAUCACCUAACU	188
CUUCAAGCCAUCACCUAAC	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
AAGCAUGCGUGCCUGGGUU	206
AAAGCAUGCGUGCCUGGGU	207
AGGGAAAGCCAUGCGUGCCU	208
AAGGGAAAGCCAUGCGUGCC	209
GCAAGGGAAAGCCAUGCGUG	210

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AAGCAAGGGAAAGCCAUGCG	211
CAAAGCAAGGGAAAGCCAUG	212
CAUCAAGCAAGGGAAAGCC	213
GUUCAUCAAGCAAGGGAAA	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
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CAAAAGACCUCCUUAAGUU	234
UCCAAAAGACCUCCUUAAG	235
CUUCCAAAAGACCUCCUUA	236
UCACAAACUAUGUAGGCUAC	237
AGAGAGUGGAAAUCACAAAC	238
UCAGAGAGUGGAAAUCACAA	239

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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
UGGAGAGUGGAUAGUAGUA	254
UUGGAGAGUGGAUAGUAGAU	255
UUUGGAGAGUGGAUAGUAGA	256
GUUUGGAGAGUGGAUAGUAG	257
CAGUUUGGAGAGUGGAUAGU	258
GCAAAGUCAGGAAUAGCAU	259
UGCAAAGUCAGGAAUAGCAA	260
GUGCAAAGUCAGGAAUAGCA	261
GGUGCAAAGUCAGGAAUAGC	262
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CAGGUGCAAAGUCAGGAAUA	264
CCAGGUGCAAAGUCAGGAAU	265
UCCAGGUGCAAAGUCAGGAA	266
CUCCAGGUGCAAAGUCAGGA	267
GCUCCAGGUGCAAAGUCAGG	268

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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

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UGGGCUAUGACUCUGGUGAC	298
AUGGGCUAUGACUCUGGUGA	299
GCGCCAGUUAUGGGCUAUG	300
GUGCGCCAGUUAUGGGCUA	301
UUGCCAAACCACUGGUGCGC	302
GUUGCCAAACCACUGGUGCG	303
UUGUGACCAGGUUGCCAAAC	304
AUUGUGACCAGGUUGCCAAA	305
CAUUGUGACCAGGUUGCCAA	306
UCCAUUGUGACCAGGUUGCC	307
UCCAUUGUGACCAGGUUGC	308
AUCCAUUGUGACCAGGUUG	309
CCAUCCAUUGUGACCAGGU	310
ACCAUCCAUUGUGACCAGG	311
CACCAUCCAUUGUGACCAG	312
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UACAGCGAUAAGUCCAUG	319
CAUUAACAGCGAUAAGUCC	320
GCAUUAACAGCGAUAAGUUC	321
GUAGCAUUAACAGCGAUAAG	322
GAUAUGUAGCAUUAACAGCG	323
GCUCUGGAUAUGUAGCAUUA	324
GUUUCGCGUGGUUUGGAGAU	325
GGUUUCGCGUGGUUUGGAGA	326

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GGGUUCCGCUUGGUUUGGAG	327
CAUUUCCUGUAUUUGAGUCG	328
CCCUUGUUAUAGGAAACUUC	329
CUCCCUUGUUAUAGGAAACU	330
GCUCCCUUGUUAUAGGAAAC	331
AGCUCCCUUGUUAUAGGAAA	332
AAGCUCCCUUGUUAUAGGAA	333
CCCAGAAAUCCUUGAGCAU	334
CUCACCCAGAAAUCCUUGA	335
CUCCUCACCCAGAAAUCCU	336
UCUCCUCACCCAGAAAUCC	337
CCACAAGUCAUUAUUCUAG	338
CUGCUCCACAAGUCAUUAU	339
ACUGCUCCACAAGUCAUUAU	340
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AUUUGACAGACUGCUCCACA	343
UAUUUGACAGACUGCUCCAC	344
CUAUUUUGACAGACUGCUCCA	345
ACUAUUUGACAGACUGCUCC	346
AACUAUUUGACAGACUGCUC	347
CAACUAUUUGACAGACUGCU	348
ACAACUAUUUGACAGACUGC	349
CCACCAGAUGUAAAAUCACU	350
UCCACCAGAUGUAAAAUCAC	351
GACAAACUCCACCAGAUGUA	352
CGAAUGACAAACUCCACCAG	353
CCGAAUGACAAACUCCACCA	354
GAUCCGAAUGACAAACUCCA	355

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AUGUUACUUGUCAUCUUGGG	356
GCAUGUUACUUGUCAUCUUG	357
GAGCAUGUUACUUGUCAUCU	358
CGAGCAUGUUACUUGUCAUC	359
GCGAGCAUGUUACUUGUCAU	360
GGCGAGCAUGUUACUUGUCA	361
AGGCGAGCAUGUUACUUGUC	362
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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

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

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AGAAUGUGUCUGUGGAUCAC	414
UAGAAUGUGUCUGUGGAUCA	415
UUUCAGGUAGAUCCAGAGUA	416
UUUUCAGGUAGAUCCAGAGU	417
UCUUUUCAGGUAGAUCCAGA	418
GUCUUUUCAGGUAGAUCCAG	419
GGUCUUUUCAGGUAGAUCCA	420
CUGGUCUUUUCAGGUAGAUUC	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

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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
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ACUCUGUCCUUAGGUCUGAG	461
UACUCUGUCCUUAGGUCUGA	462
CUACUCUGUCCUUAGGUCUG	463
UCAGUCUCCCUGCACCAACU	464
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GGUCAGUCUCCCUGCACCAA	466
UUGUCUAGGGUCAGUCUCCC	467
UUUGUCUAGGGUCAGUCUCC	468
CUUUGUCUAGGGUCAGUCUC	469
GCUUUGUCUAGGGUCAGUCU	470
AGCUUUGUCUAGGGUCAGUC	471

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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
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AACUCAGACCUUCGAGAAGU	495
UAACUCAGACCUUCGAGAAG	496
GUAACUCAGACCUUCGAGAA	497
AGUAACUCAGACCUUCGAGA	498
UCCAAGUAACUCAGACCUUC	499
UUCCAAGUAACUCAGACCUU	500

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GAUUCCAAGUAAACUCAGACC	501
CGAUUCCAAGUAAACUCAGAC	502
GUGGUAAAACGAUCCAAGU	503
UGUGGUAAAACGAUCCAAG	504
CAUGUGGUAAAACGAUCCA	505
UCAUGUGGUAAAACGAUCC	506
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CUGUCCAUCAUGUGGUAAA	508
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AACGCUUGAGGUUUUCAGAG	513
UAACGCUUGAGGUUUUCAGA	514
GUAACGCUUGAGGUUUUCAG	515
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GAAGGUAACGCUUGAGGUUU	519
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CUGAAGAAGGUAACGCUUGA	524
ACUGAAGAAGGUAACGCUUG	525
UACUGAAGAAGGUAACGCUU	526
CUGUCAAUCACUGGCUUAAA	527
CCUGUCAAUCACUGGCUUAA	528
GCCUGUCAAUCACUGGCUUA	529

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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
AGCAUCCUGUCCAGACUGA	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

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GCAGCUUUCUGGAUGCAAGG	559
AGCAGCUUUCUGGAUGCAAG	560
CAGCAGCUUUCUGGAUGCAA	561
UCAGCAGCUUUCUGGAUGCA	562
GAGUUCAGCAGCUUUCUGGA	563
AAGAGUUCAGCAGCUUUCUG	564
AGAAGAGUUCAGCAGCUUUC	565
GAGAAGAGUUCAGCAGCUUU	566
UGAGCACCCACAGAAUACAC	567
UGUUGUCUGAGCACCCACAG	568
CUGUUGUCUGAGCACCCACA	569
GCUGUUGUCUGAGCACCCAC	570
AAAAGGUAAUCCAUCUGC	571
CACUUGACAUUGACAGUUCA	572
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UGUUCAGCACUUGACAUUGA	576
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GAUGCUUGCUCGUUGACAAA	581
UGAUGCUUGCUCGUUGACAA	582
CUGAUGCUUGCUCGUUGACA	583
CCUGAUGCUUGCUCGUUGAC	584
UCCUGAUGCUUGCUCGUUGA	585
UUCUGAUGCUUGCUCGUUG	586
UUUCCUGAUGCUUGCUCGUU	587

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UUUUUCCUGAUGCUUGCUCGU	588
CUUUUCCUGAUGCUUGCUCG	589
CUUGAUAACCUUCCUUCCA	590
UCUUGAUAACCUUCCUUCC	591
GUCUUGAUAACCUUCCUUC	592
GUGUCUUGAUAACCUUCCU	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
UCUCUUACAAAUCCCAUGC	615
AGAAGAUGGGUCCAAUUUUC	616

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CAGAAGAUGGGUCCAAUUUU	617
UCAGAAGAUGGGUCCAAUUU	618
UUCAGAAGAUGGGUCCAAUU	619
AAGUGAGCUGUUGUGCCAGA	620
AGAAAAGUGAGCUGUUGUGC	621
GAAGAAAAGUGAGCUGUUGU	622
GAGCCUCAAGAGAUUCAAAA	623
UGAGCCUCAAGAGAUUCAAA	624
CAGAUGUGAUCCUUGAGCCU	625
CCAGAUGUGAUCCUUGAGCC	626
UCCAGAUGUGAUCCUUGAGC	627
GUUAUCGUUCCAGAACAGU	628
GGUUAUCGUUCCAGAACAG	629
UGGUUAUCGUUCCAGAAC	630
UUGGUUAUCGUUCCAGAAC	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

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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

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AUCUCGGCUCACUGCAAGCU	675
AAUCUCGGCUCACUGCAAGC	676
CAAUCUCGGCUCACUGCAAG	677
GCAAUCUCGGCUCACUGCAA	678
GUGCAAUCUCGGCUCACUGC	679
GGUGCAAUCUCGGCUCACUG	680
UGGUGCAAUCUCGGCUCACU	681
GUGGUGCAAUCUCGGCUCAC	682
AGUGGUGCAAUCUCGGCUCA	683
CAGUGGUGCAAUCUCGGCUC	684
GCAGUGGUGCAAUCUCGGCU	685
AGGUCUGGAAUGCAGUGGUGC	686
CAGGUCUGGAAUGCAGUGGUG	687
CCAGGUCUGGAAUGCAGUGGU	688
ACCCAGGUCUGGAAUGCAGUG	689
CACCCAGGUCUGGAAUGCAGU	690
UCACCCAGGUCUGGAAUGCAG	691
GUCACCCAGGUCUGGAAUGCA	692
AGUCACCCAGGUCUGGAAUGC	693
CAGUCACCCAGGUCUGGAAUG	694
UCAGUCACCCAGGUCUGGAU	695
CUCAGUCACCCAGGUCUGGAA	696
GACAGAGUCUCGCUCAGUCA	697
GUCAUGUCUGAUGUACCUUU	698
AGUCAUGUCUGAUGUACCUU	699
CAGUCAUGUCUGAUGUACCU	700
GCAGUCAUGUCUGAUGUACC	701
GGCAGUCAUGUCUGAUGUAC	702
AGGCAGUCAUGUCUGAUGUA	703

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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

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UUCUUGAGACUUCUUGUUGG	733
GCCUGAUUUCUUGAGACUUC	734
UGCCUGAUUUCUUGAGACUU	735
CAUCUUUUUGGCUGGAUACGA	736
GCAUCUUUUUGGCUGGAUACG	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

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GCAAAAUAGUGGCAUAGCGU	762
AGCAAAAUAGUGGCAUAGCG	763
AAGCAAAAUAGUGGCAUAGC	764
AACUGGUUGGGCAAACUAUA	765
AAACUGGUUGGGCAAACUAU	766
AAAACUGGUUGGGCAAACUA	767
UAAAACUGGUUGGGCAAACU	768
GUAAAACUGGUUGGGCAAAC	769
CGUAAAACUGGUUGGGCAA	770
GACGUAAAACUGGUUGGGCA	771
GGACGUAAAACUGGUUGGGC	772
UGGACGUAAAACUGGUUGGG	773
UUGGACGUAAAACUGGUUGG	774
CUUGGACGUAAAACUGGUUG	775
CCUUGGACGUAAAACUGGUU	776
UCCUUGGACGUAAAACUGGU	777
UUCCUUGGACGUAAAACUGG	778
UUUCCUUGGACGUAAAACUG	779
GGCUAAUUUCCUUGGACGU	780
UGGCUAAUUUCCUUGGACG	781
GCAUUGGCUAAUUUCCUUG	782
UUCCUGAUCCUUGCCUUUCA	783
UCUGGUUCCUGAUCCUUGC	784
UCUCUGGUUCCUGAUCCUU	785
GUCUCUGGUUCCUGAUCCU	786
AGUCUCUGGUUCCUGAUCC	787
AAGUCUCUGGUUCCUGAUC	788
CCUGACACCUAGUUUCUAAU	789
AACCCUGACACCUAGUUUCU	790

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AUAAACCCUGACACCUAGUU	791
GAUAAACCCUGACACCUAGU	792
UGAUAAACCCUGACACCUAG	793
CUUGAUAAACCCUGACACCU	794
UCUUGAUAAACCCUGACACC	795
UUCUUGAUAAACCCUGACAC	796
CUUCUUGAUAAACCCUGACA	797
CCUUCUUGAUAAACCCUGAC	798
GCCUUCUUGAUAAACCCUGA	799
GGCCUUCUUGAUAAACCCUG	800
UGGCCUUCUUGAUAAACCCU	801
UUCCUGGCCUUCUUGAUAAA	802
CAGAGACCAUUCAUUUUGGAA	803
CCAGAGACCAUUCAUUUUGGA	804
ACCAGAGACCAUUCAUUUUGG	805
UGACCAGAGACCAUUCAUUU	806
UUGACCAGAGACCAUUCAUU	807
UUUGACCAGAGACCAUUCAU	808
AUUUGACCAGAGACCAUUCA	809
CAUUUGACCAGAGACCAUUC	810
AUUCAUUUUGACCAGAGACCA	811
UUGUAUCUCUGUGAGGGCAG	812
GUAAGGCUUAAACCAAUUGG	813
CAGAUUCGACUUCAUUUUGGA	814
GGCAGAUUCGACUUCAUUUUG	815
GGGCAGAUUCGACUUCAUUU	816
AGGGCAGAUUCGACUUCAUU	817
GAGGGCAGAUUCGACUUCAU	818
UGAGGGCAGAUUCGACUUCA	819

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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
CUCUUGACCCAACAUCCAA	833
CCUCUUGACCCAACAUCCA	834
UGGAUUGACUAACACUUUCC	835
GUGGAUUGACUAACACUUUC	836
CUGUGGCAUCAAAAGAAAGGU	837
UCUGACUGUGGCAUCAAGA	838
UCUCUGACUGUGGCAUCAA	839
GGCCACCCAAACUGUAUUCU	840
ACCACCAAGUCAAGUUAGA	841
CACCACCAAGUCAAGUUAG	842
GUCCACCACCAAGUCAAGU	843
GGUCCACCACCAAGUCAAG	844
AGGAAGGUCCACCACCAAGU	845
AAGGAAGGUCCACCACCAAG	846
CAAGGAAGGUCCACCACCAA	847
CCAAGGAAGGUCCACCACCA	848

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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	UUAAUCAAACACCUCCCG	866
CGGGAGGUGUUUGAUUAAA	867	UUUAAUCAAACACCUCCG	868
GGGAGGUGUUUGAUUAAAU	869	AUUUAAUCAAACACCUCCC	870
GGAGGUGUUUGAUUAAAUU	871	AAUUUAAUCAAACACCUCC	872
GAGGUGUUUGAUUAAAUUC	873	GAAUUUAAUCAAACACCUUC	874
AUGUGACAUAAACUGGAGCC	875	GGCUCCAGUUAUGUCACAU	876
UGUGACAUAAACUGGAGCCA	877	UGGCUCCAGUUAUGUCACA	878
UGGAGCCAGUGCAGUGCCA	879	UGGCACUGCACUGGCUCCA	880
GCCAGUGCAGUGCCAUGAA	881	UUCAUGGCACUGCACUGGC	882
CCAGUGCAGUGCCAUGAAG	883	CUUCAUGGCACUGCACUGG	884
CAGUGCAGUGCCAUGAAGA	885	UCUUCAUGGCACUGCACUG	886
AGUGCAGUGCCAUGAAGAA	887	UUCUUCAUGGCACUGCACU	888

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AGAUUAGCCUGGAUUAUAA	889	UUAAUAUCCAGGCUAAUCU	890
GAUUAGCCUGGAUUAUAAAC	891	GUUAAUAUCCAGGCUAAUC	892
AUUAGCCUGGAUUAUAAACU	893	AGUUAAUAUCCAGGCUAAU	894
UUAGCCUGGAUUAUAAACUU	895	AAGUUAAUAUCCAGGCUAA	896
UAGCCUGGAUUAUAAACUUG	897	CAAGUUAAUAUCCAGGCUA	898
GCCUGGAUUAUAAACUUGUC	899	GACAAGUUAAUAUCCAGGC	900
CCUGGAUUAUAAACUUGUCU	901	AGACAAGUUAAUAUCCAGG	902
CUGGAUUAUAAACUUGUCUU	903	AAGACAAGUUAAUAUCCAG	904
UGGAUUAUAAACUUGUCUUC	905	GAAGACAAGUUAAUAUCCA	906
GGAUUAUAAACUUGUCUUCU	907	AGAAGACAAGUUAAUAUCC	908
AUUAACUUGUCUUCUAGAG	909	CUCUAGAAGACAAGUUAAU	910
AGAAUAGAUUUCAUGUUCC	911	GGAACAUGAAAUUCUAUUCU	912
GAAUAGAUUUCAUGUCCA	913	UGGAACAUGAAAUUCUAUUC	914
UAGAUUUCAUGUCCAUCUUC	915	GAAUGGAACAUGAAAUUCUA	916
GAUUUCAUGUCCAUCUUCU	917	AAGAAUGGAACAUGAAAUUC	918
AUUUCAUGUCCAUCUUCUUC	919	GAAGAAUGGAACAUGAAAU	920
UUUCAUGUCCAUCUUCUUCU	921	AGAAGAAUGGAACAUGAAA	922
UUCAUGUCCAUCUUCUUCUG	923	CAGAAGAAUGGAACAUGAA	924
UCAUGUCCAUCUUCUUCUGC	925	GCAGAAGAAUGGAACAUGA	926
CAUGUCCAUCUUCUUCUGCA	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	ACUGAGAACAAAUGCAUUAU	946
AUGCAUUUGUUCUCAGUUC	947	GAACUGAGAACAAAUGCAU	948
UUUGUUCUCAGUUCUCAGU	949	ACUGAGAACUGAGAACAAA	950

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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	UGAUAAUCUAGAUGGCACUG	964
AGUGCCAUCUAGUUAUCAC	965	GUGAUAAUCUAGAUGGCACU	966
GUGCCAUCUAGUUAUCACU	967	AGUGAUAAUCUAGAUGGCAC	968
UGCCAUCUAGUUAUCACUU	969	AAGUGAUAAUCUAGAUGGCA	970
GCCAUCUAGUUAUCACUUC	971	GAAGUGAUAAUCUAGAUGGC	972
CCAUCUAGUUAUCACUUCA	973	UGAAGUGAUAAUCUAGAUGG	974
CAUCUAGUUAUCACUUCAC	975	GUGAAGUGAUAAUCUAGAUG	976
AUCUAGUUAUCACUUCACU	977	AGUGAAGUGAUAAUCUAGAU	978
UCUAGUUAUCACUUCACUG	979	CAGUGAAGUGAUAAUCUAGA	980
CUAGUUAUCACUUCACUGA	981	UCAGUGAAGUGAUAAUCUAG	982
UAGUUAUCACUUCACUGAG	983	CUCAGUGAAGUGAUAAUCUA	984
AGUUAUCACUUCACUGAGG	985	CCUCAGUGAAGUGAUAAUCU	986
GUUAUCACUUCACUGAGGA	987	UCCUCAGUGAAGUGAUAAAC	988
UUAUCACUUCACUGAGGAU	989	AUCCUCAGUGAAGUGAUAA	990
UAUCACUUCACUGAGGAUC	991	GAUCCUCAGUGAAGUGAUAA	992
AUCACUUCACUGAGGAUCC	993	GGAUCCUCAGUGAAGUGAU	994
UCACUUCACUGAGGAUCCU	995	AGGAUCCUCAGUGAAGUGA	996
GCUUCCCCAGUAGCCACUA	997	UAGUGGCUACUGGGAAAGC	998
CUUCCCCAGUAGCCACUAA	999	UUAGUGGCUACUGGGAAAG	1000
UUUCCCCAGUAGCCACUAAU	1001	AUUAGUGGCUACUGGGAAA	1002
UUCCCAGUAGCCACUAAUG	1003	CAUUAGUGGCUACUGGGAA	1004
UCCCAGUAGCCACUAAUGG	1005	CCAUUAGUGGCUACUGGGA	1006
CUUGGCAGGAGCUAAGGCU	1007	AGCCUUAGCUCCUGCCAAG	1008

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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:
UCAAUCUGCAGCAGCAUG	1009	CAUGCUGCUGCAGAUUUGA	1010
CAAUCUGCAGCAGCAUGA	1011	UCAUGCUGCUGCAGAUUUG	1012
AAUCUGCAGCAGCAUGAU	1013	AUCAUGCUGCUGCAGAUUU	1014
AUGUGACUAACUGGAGCC	1015	GGCUCCAGUUAUGUCACAU	1016
UGUGACUAACUGGAGCCA	1017	UGGCUCCAGUUAUGUCACA	1018
UGGAGCCAGUGCAGUGCCA	1019	UGGCACUGCACUGGCUCCA	1020
GCCAGUGCAGUGCCAUGAA	1021	UUCAUGGCACUGCACUGGC	1022
CCAGUGCAGUGCCAUGAAG	1023	CUUCAUGGCACUGCACUGG	1024
CAGUGCAGUGCCAUGAAGA	1025	UCUUCAUGGCACUGCACUG	1026
AGUGCAGUGCCAUGAAGAA	1027	UUCUUCAUGGCACUGCACU	1028
AGAUUAGCCUGGAUAUUA	1029	UUAUAUCCAGGCUAAUCU	1030
GAUUAAGCCUGGAUAUUAAC	1031	GUUAAUAUCCAGGCUAAUC	1032
AUUAGCCUGGAUAUUAACU	1033	AGUUAUAUCCAGGCUAAU	1034
UUAGCCUGGAUAUUAACUU	1035	AAGUUAUAUCCAGGCUAA	1036
UAGCCUGGAUAUUAACUUG	1037	CAAGUUAUAUCCAGGCUA	1038
GCCUGGAUAUUAACUUGUC	1039	GACAAGUUAUAUCCAGGC	1040
CCUGGAUAUUAACUUGUCU	1041	AGACAAGUUAUAUCCAGG	1042
CUGGAUAUUAACUUGUCUU	1043	AAGACAAGUUAUAUCCAG	1044
UGGAUAUUAACUUGUCUUC	1045	GAAGACAAGUUAUAUCCA	1046
GGAUUAUUAACUUGUCUUCU	1047	AGAAGACAAGUUAUAUCC	1048
AUUAACUUGUCUUCUAGAG	1049	CUCUAGAAGACAAGUUAU	1050
AGAAUAGAUUUAUGUUC	1051	GGAACAUGAAUUAUUCU	1052
GAAUAGAUUUAUGUCCA	1053	UGGAACAUGAAUUAUUC	1054
UAGAUUUAUGUCCAUC	1055	GAAUGGAACAUGAAUUA	1056
GAUUUAUGUCCAUCUUC	1057	AAGAAUGGAACAUGAAU	1058
AUUUAUGUCCAUCUUC	1059	GAAGAAUGGAACAUGAAU	1060
UUUAUGUCCAUCUUCU	1061	AGAAGAAUGGAACAUGAA	1062

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UUCAUGUCCAUUCUUCUG	1063	CAGAAGAAUGGAACAUGAA	1064
UCAUGUCCAUUCUUCUGC	1065	GCAGAAGAAUGGAACAUGA	1066
CAUGUCCAUUCUUCUGCA	1067	UGCAGAAGAAUGGAACAUG	1068
UCUUCUGCAAUGGUUAAUU	1069	AAUUAACCAUUGCAGAAGA	1070
UUCUGCAAUGGUUAAUUA	1071	UGAAUUAACCAUUGCAGAA	1072
CAUUCACAGAGGAUUUUAC	1073	GUAAAAUCCUCUGUGAAUG	1074
AUUCACAGAGGAUUUUACU	1075	AGUAAAAUCCUCUGUGAAU	1076
ACAGAGGAUUUUACUGCUU	1077	AAGCAGUAAAAUCCUCUGU	1078
CAGAGGAUUUUACUGCUUA	1079	UAAGCAGUAAAAUCCUCUG	1080
AGAGGAUUUUACUGCUUAA	1081	UUAAGCAGUAAAAUCCUCU	1082
GAGGAUUUUACUGCUUAA	1083	GUUAAGCAGUAAAAUCCUC	1084
AUAUGCAUUUGUUCUCAGU	1085	ACUGAGAACAAUGCAUUA	1086
AUGCAUUUGUUCUCAGUUC	1087	GAACUGAGAACAAUGCAU	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

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AGUUAUCACUUCACUGAGG	1125	CCUCAGUGAAGUGAUAAU	1126
GUUAUCACUUCACUGAGGA	1127	UCCUCAGUGAAGUGAUAAU	1128
UUAUCACUUCACUGAGGAU	1129	AUCCUCAGUGAAGUGAUAA	1130
UAUCACUUCACUGAGGAUC	1131	GAUCCUCAGUGAAGUGAUAA	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
CCAGUGUGGUCAUUCUCU	1149	AGAGGAAUGACCACACUGG	1150
GUCAUUCUCUCCAUAUAUG	1151	CAUAAUGGAGAGGAAUGAC	1152
CAUUCUCUCCAUAUAUGAC	1153	GUCAUAAUGGAGAGGAAUG	1154
AUUCUCUCCAUAUAUGACC	1155	GGUCAUAAUGGAGAGGAAU	1156
CUCUCAUAUAUGACCUCUU	1157	AAGAGGUCAUAAUGGAGAG	1158
UCUCAUAUAUGACCUCUUU	1159	AAAGAGGUCAUAAUGGAGA	1160
CUCAUAUAUGACCUCUUUG	1161	CAAAGAGGUCAUAAUGGAG	1162
UCCAUAUAUGACCUCUUUGU	1163	ACAAAGAGGUCAUAAUGGA	1164
CCAUAUAUGACCUCUUUGUC	1165	GACAAAGAGGUCAUAAUGG	1166
CAUAUAUGACCUCUUUGUCC	1167	GGACAAAGAGGUCAUAAUG	1168
CCCAUUCACACCUCUCUGG	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

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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
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UCAGCAAUGCUACCCAGUU	1205	AACUGGGUAGCAUUGCUGA	1206
CAGCAAUGCUACCCAGUUU	1207	AAACUGGGUAGCAUUGCUG	1208
AGCAAUGCUACCCAGUUUA	1209	UAAACUGGGUAGCAUUGCU	1210
CAAUGCUACCCAGUUUAUC	1211	GAUAAACUGGGUAGCAUUG	1212
AAUGCUACCCAGUUUAUCA	1213	UGAUAAACUGGGUAGCAUU	1214
AUGCUACCCAGUUUAUCAU	1215	AUGAUAAACUGGGUAGCAU	1216
UGCUCACCCAGUUUAUCAUC	1217	GAUGAUAAACUGGGUAGCA	1218
GCUACCCAGUUUAUCAUCU	1219	AGAUGAUAAACUGGGUAGC	1220
CUACCCAGUUUAUCAUCUU	1221	AAGAUGAUAAACUGGGUAG	1222
UACCCAGUUUAUCAUCUUG	1223	CAAGAUGAUAAACUGGGUA	1224
ACCCAGUUUAUCAUCUUGC	1225	GCAAGAUGAUAAACUGGGU	1226
CCCAGUUUAUCAUCUUGCA	1227	UGCAAGAUGAUAAACUGGG	1228
GUUUUAUCAUCUUGCACAGC	1229	GCUGUGCAAGAUGAUAAAC	1230
UUUAUCAUCUUGCACAGCA	1231	UGCUGUGCAAGAUGAUAAA	1232
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CACGAAUGCCACCCUUCAG	1235	CUGAAGGGUGGCAUUCGUG	1236
ACGAAUGCCACCCUUCAGU	1237	ACUGAAGGGUGGCAUUCGU	1238
CGAAUGCCACCCUUCAGUC	1239	GACUGAAGGGUGGCAUUCG	1240
GAAUGCCACCCUUCAGUCA	1241	UGACUGAAGGGUGGCAUUC	1242
UUCAGUCAGAGGAAGAUUC	1243	GAAUCUCCUCUGACUGAA	1244
UCAGUCAGAGGAAGAUUCA	1245	UGAAUCUCCUCUGACUGA	1246
CAGUCAGAGGAAGAUUCAA	1247	UUGAAUCUCCUCUGACUG	1248

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AGUCAGAGGAAGAUUCAAG	1249	CUUGAAUCUCCUCUGACU	1250
GUCAGAGGAAGAUUCAAGA	1251	UCUUGAAUCUCCUCUGAC	1252
CAGAGGAAGAUUCAAGAU	1253	UAUCUUGAAUCUCCUCUG	1254
AGAGGAAGAUUCAAGAUAC	1255	GUUUCUUGAAUCUCCUCU	1256
GAGGAAGAUUCAAGAUACA	1257	UGUAUCUUGAAUCUCCUC	1258
AGGAAGAUUCAAGAUACA	1259	AUGUAUCUUGAAUCUCCU	1260
GGAAGAUUCAAGAUACAUG	1261	CAUGUAUCUUGAAUCUCC	1262
GAAGAUUCAAGAUACAUGA	1263	UCAUGUAUCUUGAAUCUUC	1264
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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	GGAAGUCCAUAGCCACAU	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	CUUGGCUUGGAAGUCCAU	1304
CUUCCAAGCCAAGUUAGGU	1305	ACCUAACUUGGCUUGGAAG	1306
UUCCAAGCCAAGUUAGGUG	1307	CACCUAACUUGGCUUGGAA	1308
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CCAAGCCAAGUUAGGUGAU	1311	AUCACCUAACUUGGCUUGG	1312
CAAGCCAAGUUAGGUGAUG	1313	CAUCACCUAACUUGGCUUG	1314
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CCAAGUUAGGUGAUGGCUU	1317	AAGCCAUCACCUAACUUGG	1318
CAAGUUAGGUGAUGGCUUU	1319	AAAGCCAUCACCUAACUUG	1320
UUAGGUGAUGGCUUUGAAG	1321	CUUCAAGCCAUCACCUAA	1322
GUGAUGGCUUUGAAGGGUU	1323	AACCCUUCAAAGCCAUCAC	1324
UGAUGGCUUUGAAGGGUUU	1325	AAACCCUUCAAAGCCAUCA	1326
GAUGGCUUUGAAGGGUUUU	1327	AAAACCCUUCAAAGCCAUC	1328
AUGGCUUUGAAGGGUUUUA	1329	UAAAACCCUUCAAAGCCAU	1330
UGGCUUUGAAGGGUUUUUAU	1331	AUAAAACCCUUCAAAGCCA	1332
UGAAGGGUUUUUAAAAAGC	1333	GCUUUUAUAAAACCCUUCA	1334
GAAGGGUUUUUAAAAAGCA	1335	UGCUIUUUAUAAAACCCUUC	1336
AAGGGUUUUUAAAAAGCAC	1337	GUGCUUUUAUAAAACCCUU	1338
AGAUUUUGAGCCAACCCAG	1339	CUGGGUUGGCUAAAAUCU	1340
GAUUUUUGAGCCAACCCAGG	1341	CCUGGGUUGGCUAAAAUC	1342
AUUUUUGAGCCAACCCAGGC	1343	GCCUGGGUUGGCUAAAAU	1344
AGCCAACCCAGGCACGCAU	1345	AUGCGUGCCUGGGUUGGCU	1346
AACCCAGGCACGCAUGGCU	1347	AGCCAUGCGUGCCUGGGUU	1348
ACCCAGGCACGCAUGGCUU	1349	AAGCCAUGCGUGCCUGGGU	1350
CCCAGGCACGCAUGGCUUU	1351	AAAGCCAUGCGUGCCUGGG	1352
CCAGGCACGCAUGGCUUUC	1353	GAAAGCCAUGCGUGCCUGG	1354
CAGGCACGCAUGGCUUUC	1355	GGAAAGCCAUGCGUGCCUG	1356
CACGCAUGGCUUUCUUUG	1357	CAAGGGAAAGCCAUGCGUG	1358
CAUGGCUUUCUUUGCUUU	1359	AAAGCAAGGGAAAGCCAUG	1360
GCUUUCCCUUGCUUUGAUG	1361	CAUCAAGCAAGGGAAAGC	1362
CUUUCUUUGCUUUGAUGA	1363	UCAUCAAGCAAGGGAAAG	1364
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AGCCAACUUUCAAUCAAG	1369	CUUGAUUGAAAAGUUGGCU	1370
GCCAACUUUCAAUCAAGA	1371	UCUUGAUUGAAAAGUUGGC	1372

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CCAACUUUUCAAUCAAGAU	1373	AUCUUGAUUGAAAAGUUGG	1374
ACUUUUCAAUCAAGAUACG	1375	CGUAUCUUGAUUGAAAAGU	1376
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UUCAAUCAAGAUACGAAGA	1381	UCUUCGUAUCUUGAUUGAA	1382
UCAAUCAAGAUACGAAGAG	1383	CUCUUCGUAUCUUGAUUGA	1384
GCAGGCAUUAUUGCACUAUC	1385	GAUAGUGCAAUAUGCCUGC	1386
CAGGCAUUAUUGCACUAUCC	1387	GGAUAGUGCAAUAUGCCUG	1388
CUUGAAGGAGGUCUUUUGG	1389	CCAAAAGACCUCCUUAAG	1390
UUGAAGGAGGUCUUUUGGA	1391	UCCAAAAGACCUCCUCAA	1392
GAAGGAGGUCUUUUGGAAG	1393	CUUCCAAAAGACCUCCUUC	1394
UUUGGAAGAUCACUUUGAA	1395	UUCAAAGUGAUCUCCAAA	1396
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AAAUGAGUACAUACCUUGU	1399	ACAAGGUAUGUACUCAUUU	1400
GUAGCCUACAUAGUUUGUG	1401	CACAAACUAUGUAGGCUAC	1402
AUAGUUUGUGAUUUCCACU	1403	AGUGGAAAUCACAAACUUA	1404
UAGUUUGUGAUUUCCACUC	1405	GAGUGGAAAUCACAAACUA	1406
AGUUUGUGAUUUCCACUCU	1407	AGAGUGGAAAUCACAAACU	1408
GUUUUGUGAUUUCCACUCUC	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

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UUGCAGGCAUCACUGAAGC	1435	GCUUCAGUGAUGCCUGCAA	1436
CAGGCAUCACUGAAGCUAC	1437	GUAGCUUCAGUGAUGCCUG	1438
AGGCAUCACUGAAGCUACU	1439	AGUAGCUUCAGUGAUGCCU	1440
GGCAUCACUGAAGCUACUU	1441	AAGUAGCUUCAGUGAUGCC	1442
AUAUCUACUAUCCACUCUC	1443	GAGAGUGGAUAGUAGAUUAU	1444
CUACUAUCCACUCUCCAAA	1445	UUUGGAGAGUGGAUAGUAG	1446
CUGGAUUUAAUUGCUAUUC	1447	GAAUAGCAAUUAAAUCCAG	1448
UGGAUUUAAUUGCUAUUCC	1449	GGAAUAGCAAUUAAAUCCA	1450
GGAUUUAAUUGCUAUUCCU	1451	AGGAAUAGCAAUUAAAUCC	1452
UUAAUUGCUAUUCCUGACU	1453	AGUCAGGAUAGCAAUUAA	1454
UAAUUGCUAUUCCUGACUU	1455	AAGUCAGGAUAGCAAUUA	1456
AAUUGCUAUUCCUGACUUU	1457	AAAGUCAGGAUAGCAAUU	1458
AUUUGCUAUUCCUGACUUUG	1459	CAAAGUCAGGAUAGCAAU	1460
UUGCUAUUCCUGACUUUGC	1461	GCAAAGUCAGGAUAGCAA	1462
UGCUAUUCCUGACUUUGCA	1463	UGCAAAGUCAGGAUAGCA	1464
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CUGACUUUGCACCUGGAGC	1467	GCUCAGGUGCAAAGUCAG	1468
GACUUUGCACCUGGAGCCA	1469	UGGCUCCAGGUGCAAAGUC	1470
UUGCACCUGGAGCCAUGGA	1471	UCCAUGGCUCCAGGUGCAA	1472
UGCACCUGGAGCCAUGGAA	1473	UUCCAUGGCUCCAGGUGCA	1474
GGGCCUCAUUAUUAUAGG	1475	CCUAUAUGUAAUGAGGCC	1476
GGCCUCAUUAUUAUAGGG	1477	CCCUAUAUGUAAUGAGGCC	1478
GCCUCAUUAUUAUAGGGA	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	UUUUCGGAAGCAGAAGAGG	1494
CUCUUCUGCUUCCGAUAAA	1495	UUUUCGGAAGCAGAAGAG	1496

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CUGUGGGUACACAGAGUCA	1497	UGACUCUGGUGACCCACAG	1498
UGUGGGUACACAGAGUCAU	1499	AUGACUCUGGUGACCCACA	1500
GUGGGUACACAGAGUCAUA	1501	UAUGACUCUGGUGACCCAC	1502
UGGGUACACAGAGUCAUAG	1503	CUAUGACUCUGGUGACCCA	1504
UCACAGAGUCAUAGCCCA	1505	UGGGCUAUGACUCUGGUGA	1506
ACCAGAGUCAUAGCCCAUG	1507	CAUGGGCUAUGACUCUGGU	1508
GCGACACAGUGGUUUGGCA	1509	UGCCAAACCACUGGUGCGC	1510
CGCACAGUGGUUUGGCAA	1511	UUGCCAAACCACUGGUGCG	1512
GCACAGUGGUUUGGCAAC	1513	GUUGCCAAACCACUGGUGC	1514
GUUUGGCAACUGGUCACA	1515	UGUGACCAGGUUGCCAAAC	1516
AAUGGUGGAAUGAUUUUG	1517	CAAAUAUCAUCCACCAUU	1518
AUGGUGGAAUGAUUUUGG	1519	CCAAUAUCAUCCACCAU	1520
UGGUGGAAUGAUUUUGGC	1521	GCCAAUAUCAUCCACCA	1522
GGUGGAAUGAUUUUGGCU	1523	AGCCAAUAUCAUCCACC	1524
GUGGAAUGAUUUUGGCUU	1525	AAGCCAAUAUCAUCCAC	1526
UGGAAUGAUUUUGGCUUA	1527	UAAGCCAAUAUCAUCCA	1528
GGAAUGAUUUUGGCUUAA	1529	UUAAGCCAAUAUCAUCC	1530
GAGGGUUUUGCAAAUACA	1531	UGUAUUUUGCAAAACCCUC	1532
AGGGUUUUGCAAAUACAU	1533	AUGUAUUUUGCAAAACCCU	1534
GGGUUUUUGCAAAUACAUG	1535	CAUGUAUUUUGCAAAACCC	1536
GGUUUUGCAAAUACAUGG	1537	CCAUGUAUUUUGCAAAACC	1538
GUUUUUGCAAAUACAUGGA	1539	UCCAUGUAUUUUGCAAAAC	1540
AACUUAUCGCGUUAUUGC	1541	GCAUUAACAGCGAUUAGUU	1542
ACUUAUCGCGUUAUUGCU	1543	AGCAUUAACAGCGAUUAGU	1544
CUUAUCGCGUUAUUGCUA	1545	UAGCAUUAACAGCGAUUAG	1546
UUAUCGCGUUAUUGCUAC	1547	GUAGCAUUAACAGCGAUAA	1548
UAUCGCGUUAUUGCUACA	1549	UGUAGCAUUAACAGCGAU	1550
UUGAAUGUGUGUUUUGAAG	1551	CUUCAAACACACAUUCAA	1552
UGAAUGUGUGUUUUGAAGU	1553	ACUCAAACACACAUUCA	1554
GAAUGUGUGUUUUGAAGUA	1555	UACUCAAACACACAUUC	1556
UUAUUGAAUUAUCCCGC	1557	GCGGGAUGAAUUAUUGAA	1558

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AAUGUUUGAUGAAGUUUCC	1559	GGAAACUUCAUCAAACAUU	1560
AAGGGAGCUUGUAUUUUGA	1561	UCAAAAUACAAGCUCCCUU	1562
GGGAGCUUGUAUUUUGAAU	1563	AUUCAAAAUACAAGCUCCC	1564
GAAUAUGCUC AAGGAUUUU	1565	AAAAUCCUUGAGCAUAUUC	1566
AAUAUGCUC AAGGAUUUUC	1567	GAAAAUCCUUGAGCAUAUU	1568
AUAUGCUC AAGGAUUUUCU	1569	AGAAAAUCCUUGAGCAUAU	1570
UAUGCUC AAGGAUUUUCUG	1571	CAGAAAAUCCUUGAGCAUA	1572
AUGCUC AAGGAUUUUCUGG	1573	CCAGAAAAUCCUUGAGCAU	1574
GCUC AAGGAUUUUCUGGGU	1575	ACCCAGAAAAUCCUUGAGC	1576
CUC AAGGAUUUUCUGGGUG	1577	CACCCAGAAAAUCCUUGAG	1578
UCAAGGAUUUUCUGGGUGA	1579	UCACCCAGAAAAUCCUUGA	1580
CAAGGAUUUUCUGGGUGAG	1581	CUCACCCAGAAAAUCCUUG	1582
AAGGAUUUUCUGGGUGAGG	1583	CCUCACCCAGAAAAUCCUU	1584
AGGAUUUUCUGGGUGAGGA	1585	UCCUCACCCAGAAAAUCCU	1586
GGAUUUUUCUGGGUGAGGAG	1587	CUCCUCACCCAGAAAAUCC	1588
UAAAGAAGUUCAGCUAUAG	1589	CUAUAGCUGAACUUCUUUA	1590
AAAGAAGUUCAGCUAUAGA	1591	UCUAUAGCUGAACUUCUUU	1592
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AAGAAUGAUGACUUGUGGA	1599	UCCACAAGUCAUCAUUCUU	1600
AGAAUGAUGACUUGUGGAG	1601	CUCCACAAGUCAUCAUUCU	1602
AAUGAUGACUUGUGGAGCA	1603	UGCUCACACAAGUCAUCAUU	1604
AUGAUGACUUGUGGAGCAG	1605	CUGCUCACACAAGUCAUCAU	1606
UGAUGACUUGUGGAGCAGU	1607	ACUGCUCACACAAGUCAUCA	1608
ACUUGUGGAGCAGUCUGUC	1609	GACAGACUGCUCACACAAGU	1610
CUUGUGGAGCAGUCUGUCA	1611	UGACAGACUGCUCACACAAG	1612
UUGUGGAGCAGUCUGUCAA	1613	UUGACAGACUGCUCACACA	1614
UGUGGAGCAGUCUGUCAAA	1615	UUUGACAGACUGCUCACACA	1616
GUGGAGCAGUCUGUCAAAU	1617	AUUUGACAGACUGCUCACAC	1618
UGGAGCAGUCUGUCAAAUA	1619	UAUUUGACAGACUGCUCCA	1620

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GCAGUCUGUCAAAUAGUUG	1621	CAACUAAUUGACAGACUGC	1622
CAGUCUGUCAAAUAGUUGU	1623	ACAACUAAUUGACAGACUG	1624
AGUCUGUCAAAUAGUUGUU	1625	AACAACUAAUUGACAGACU	1626
GUCUGUCAAAUAGUUGUUU	1627	AAACAACUAAUUGACAGAC	1628
CUGUCAAAUAGUUGUUUAG	1629	CUAAACAACUAAUUGACAG	1630
GUGAUUUUACAUCUGGUGG	1631	CCACCAGAUGUAAAAUCAC	1632
UGAUUUUACAUCUGGUGGA	1633	UCCACCAGAUGUAAAAUCA	1634
GAUUUUACAUCUGGUGGAG	1635	CUCCACCAGAUGUAAAAUC	1636
UACAUCUGGUGGAGUUUGU	1637	ACAAACUCCACCAGAUUA	1638
ACAUCUGGUGGAGUUUGUC	1639	GACAAACUCCACCAGAUU	1640
CAUCUGGUGGAGUUUGUCA	1641	UGACAAACUCCACCAGAU	1642
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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
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AAAAUGCAGAGGUCAAAGA	1671	UCUUUGACCUCUGCAUUUU	1672
AGAUGAGACUACAUGGAC	1673	GUCCAUGUAGUCAUCAUCU	1674
AUGAUGACUACAUGGACUC	1675	GAGUCCAUGUAGUCAUCAU	1676
UGAUGACUACAUGGACUCU	1677	AGAGUCCAUGUAGUCAUCA	1678
GAUGACUACAUGGACUCUC	1679	GAGAGUCCAUGUAGUCAUC	1680
GACGGGUGUUCACUCCGAC	1681	GUCGGAGUGAACACCCGUC	1682

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ACGGGUGUUCACUCCGACU	1683	AGUCGGAGUGAACACCCGU	1684
CGGGUGUUCACUCCGACUG	1685	CAGUCGGAGUGAACACCCG	1686
GGGUGUUCACUCCGACUGC	1687	GCAGUCGGAGUGAACACCC	1688
GGUGUUCACUCCGACUGCA	1689	UGCAGUCGGAGUGAACACC	1690
GUGUUCACUCCGACUGCAA	1691	UUGCAGUCGGAGUGAACAC	1692
UGUUCACUCCGACUGCAAC	1693	GUUGCAGUCGGAGUGAACA	1694
AGAGGUACCUGUGGCAUUAU	1695	AUAUGCCACAGGUACCUCU	1696
CCUGUGGCAUAUCCAUUG	1697	CAAUGGGAUUAGCCACAGG	1698
CUGUGGCAUAUCCAUUGA	1699	UCAAUGGGAUUAGCCACAG	1700
CAUAUCCAUUGACCUACU	1701	AGUAGGUCAAUGGGAUUAG	1702
AUAUCCAUUGACCUACUC	1703	GAGUAGGUCAAUGGGAUUAU	1704
UAUCCAUUGACCUACUCC	1705	GGAGUAGGUCAAUGGGAUUA	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
UUUAAUGUGGACUCAAUG	1723	CAUUUGAGUCCACAUUAAA	1724
UUAUGUGGACUCAAUGG	1725	CCAUUUGAGUCCACAUUAA	1726
UAAUGUGGACUCAAUGGU	1727	ACCAUUUGAGUCCACAUUA	1728
AAUGUGGACUCAAUGGUU	1729	AACCAUUUGAGUCCACAUU	1730
AUGUGGACUCAAUGGUUA	1731	UAACCAUUUGAGUCCACAU	1732
UGUGGACUCAAUGGUUAC	1733	GUAACCAUUUGAGUCCACA	1734
GUGGACUCAAUGGUUACU	1735	AGUAACCAUUUGAGUCCAC	1736
UGGACUCAAUGGUUACUA	1737	UAGUAACCAUUUGAGUCCA	1738
GGACUCAAUGGUUACUAC	1739	GUAGUAACCAUUUGAGUCC	1740
GACUCAAUGGUUACUACA	1741	UGUAGUAACCAUUUGAGUC	1742
CAAUGGUUACUACAUCGU	1743	ACGAUGUAGUAACCAUUUG	1744

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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	CCUAGGUCUGAGAAGUGU	1768
CACUUCUCAGACCUAAGGA	1769	UCCUAGGUCUGAGAAGUG	1770
ACUUCUCAGACCUAAGGAC	1771	GUCCUAGGUCUGAGAAGU	1772
UUCUCAGACCUAAGGACAG	1773	CUGUCCUAGGUCUGAGAA	1774
UCUCAGACCUAAGGACAGA	1775	UCUGUCCUAGGUCUGAGA	1776
CUCAGACCUAAGGACAGAG	1777	CUCUGUCCUAGGUCUGAG	1778
UCAGACCUAAGGACAGAGU	1779	ACUCUGUCCUAGGUCUGA	1780
CAGACCUAAGGACAGAGUA	1781	UACUCUGUCCUAGGUCUG	1782
AGACCUAAGGACAGAGUAG	1783	CUACUCUGUCCUAGGUCU	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

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CCGCACUUCUGAAGGUCU	1807	AGACCUUCGAGAAGUGCGG	1808
GCACUUCUGAAGGUCUGA	1809	UCAGACCUUCGAGAAGUGC	1810
CACUUCUGAAGGUCUGAG	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	UCCAAGUAACUCAGACCU	1824
GGUCUGAGUUACUUGGAAU	1825	AUCCAAGUAACUCAGACC	1826
GUCUGAGUUACUUGGAAUC	1827	GAUCCAAGUAACUCAGAC	1828
UCUGAGUUACUUGGAAUCG	1829	CGAUCCAAGUAACUCAGA	1830
CUGAGUUACUUGGAAUCGU	1831	ACGAUCCAAGUAACUCAG	1832
UGAGUUACUUGGAAUCGUU	1833	AACGAUCCAAGUAACUCA	1834
GAGUUACUUGGAAUCGUUU	1835	AAACGAUCCAAGUAACUC	1836
AGUUACUUGGAAUCGUUUU	1837	AAAACGAUCCAAGUAACU	1838
GUUACUUGGAAUCGUUUUA	1839	UAAAACGAUCCAAGUAAC	1840
UUACUUGGAAUCGUUUUAC	1841	GUAAAACGAUCCAAGUAA	1842
UACUUGGAAUCGUUUUACC	1843	GGUAAAACGAUCCAAGUA	1844
ACUUGGAAUCGUUUUACCA	1845	UGGUAAAACGAUCCAAGU	1846
CUUGGAAUCGUUUUACCAC	1847	GUGGUAAAACGAUCCAAG	1848
UUGGAAUCGUUUUACCACA	1849	UGUGGUAAAACGAUCCAA	1850
AAUCGUUUUACCACAUGAU	1851	AUCAUGUGGUAAAACGAU	1852
AUCGUUUUACCACAUGAUG	1853	CAUCAUGUGGUAAAACGAU	1854
UCGUUUUACCACAUGAUGG	1855	CCAUCAUGUGGUAAAACGA	1856
CGUUUUUACCACAUGAUGGA	1857	UCCAUCAUGUGGUAAAACG	1858
GUUUUUUACCACAUGAUGGAC	1859	GUCCAUCAUGUGGUAAAAC	1860
UUUACCACAUGAUGGACAG	1861	CUGUCCAUCAUGUGGUAAA	1862
UUACCACAUGAUGGACAGA	1863	UCUGUCCAUCAUGUGGUAA	1864
UACCACAUGAUGGACAGAA	1865	UUCUGUCCAUCAUGUGGUA	1866
ACCACAUGAUGGACAGAAG	1867	CUUCUGUCCAUCAUGUGGU	1868

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CAUGAUGGACAGAAGGAAU	1869	AUUCUUCUGUCCAUC	1870
UGAUGGACAGAAGGAAU	1871	AUAUUCUUCUGUCCA	1872
GAUGGACAGAAGGAAU	1873	AAUAUUCUUCUGUCCA	1874
AUGGACAGAAGGAAU	1875	AAUAUUCUUCUGUCCA	1876
UGGACAGAAGGAAU	1877	GAAUAUUCUUCUGUCCA	1878
CAGAAGGAAU	1879	AUCUGAAUAUUCUUCUG	1880
CUCAAGCGU	1881	GAAGAAGGUAACGCU	1882
AGCGU	1883	UACUGAAGAAGGUAACGCU	1884
GCGU	1885	AUACUGAAGAAGGUAACGC	1886
CCUUCU	1887	CUUAAAAUACUGAAGAAGG	1888
UUCU	1889	GGCUUAAAAUACUGAAGAA	1890
UCU	1891	UGGCUUAAAAUACUGAAGA	1892
AUUU	1893	UCAAUCACUGGCUUAAAA	1894
UUU	1895	GUCAAUCACUGGCUUAAAA	1896
UUU	1897	UGCAAUCACUGGCUUAAAA	1898
UUA	1899	CUGCAAUCACUGGCUUAA	1900
UA	1901	CCUGCAAUCACUGGCUUA	1902
AAG	1903	GCCUGCAAUCACUGGCUU	1904
CAGU	1905	CUUUGCCUGCAAUCACUG	1906
AGU	1907	GCUUUGCCUGCAAUCACU	1908
AU	1909	UCCAGCUUUGCCUGCAAU	1910
UUG	1911	CUCCAGCUUUGCCUGCAA	1912
GCU	1913	AGCUUCAAGAGAGCCGAGC	1914
UCG	1915	CCAGCUUCAAGAGAGCCGA	1916
CGG	1917	GCCAGCUUCAAGAGAGCCG	1918
GGC	1919	GGCCAGCUUCAAGAGAGCC	1920
GCU	1921	AGGCCAGCUUCAAGAGAGC	1922
CUC	1923	CAGGCCAGCUUCAAGAGAG	1924
UCU	1925	ACAGGCCAGCUUCAAGAGA	1926
AGC	1927	UUCAGGUCACAGGCCAGCU	1928
AGA	1929	CCCACAGAAUACACAAUCU	1930

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CAGCAGGAUGGAAUUACCU	1931	AGGUAAUCCAUCUGCUG	1932
CAGGAUGGAAUUACCUUUU	1933	AAAAGGUAAUCCAUCUG	1934
AGGAUGGAAUUACCUUUUA	1935	UAAAAGGUAAUCCAUCU	1936
GGAUGGAAUUACCUUUUAG	1937	CUAAAAGGUAAUCCAUC	1938
GAUGGAAUUACCUUUUAGA	1939	UCUAAAAGGUAAUCCAUC	1940
AUGGAAUUACCUUUUAGAG	1941	CUCUAAAAGGUAAUCCA	1942
GGAAUUACCUUUUAGAGCA	1943	UGCUCUAAAAGGUAAUCC	1944
GAAUUACCUUUUAGAGCAA	1945	UUGCUCUAAAAGGUAAUUC	1946
ACCUUUUAGAGCAAUAUGA	1947	UCAUAUUGCUCUAAAAGGU	1948
CCUUUUAGAGCAAUAUGAA	1949	UUCAUAUUGCUCUAAAAGG	1950
AACUGUCA AUGUCAAGUGC	1951	GCACUUGACAUUGACAGUU	1952
ACUGUCA AUGUCAAGUGCU	1953	AGCACUUGACAUUGACAGU	1954
AAUUCUGUAUGCUUUGUCA	1955	UGACAAAGCAUACAGAAU	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

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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
UAGCAUGGGAUUUUUGUAAG	2015	CUUACAAAUCCCAUGCUA	2016
GCAUGGGAUUUUUGUAAGAG	2017	CUCUACAAAUCCCAUGC	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	UCAUAUGAGCCCAAGUCA	2038
UGACUUGGGCUCAUAUGAC	2039	GUCAUAUGAGCCCAAGUCA	2040
GACUUGGGCUCAUAUGACA	2041	UGUCAUAUGAGCCCAAGUC	2042
ACUUGGGCUCAUAUGACAU	2043	AUGUCAUAUGAGCCCAAGU	2044
UUGGGCUCAUAUGACAUAA	2045	UUUAUGUCAUAUGAGCCCAA	2046
UGGGCUCAUAUGACAUAAAG	2047	CUUAUGUCAUAUGAGCCCAA	2048
GGGCUCAUAUGACAUAAAGG	2049	CCUUAUGUCAUAUGAGCCCC	2050
GGCUCAUAUGACAUAAAGGA	2051	UCCUUAUGUCAUAUGAGCCC	2052
CAUAUGACAUAAAGGAUGAU	2053	AUCAUCCUUAUGUCAUAUG	2054

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AUAUGACAU AAGGAUGAUC	2055	GAUCAUCCUUAUGUCAUUAU	2056
UAUGACAU AAGGAUGAUCA	2057	UGAUCAUCCUUAUGUCAUA	2058
AGCUCACUUUUUCUCCAAG	2059	CUUGGAAGAAAAGUGAGCU	2060
CUUUUCUCCAAGGAUAAG	2061	CUUAUCCUUGGAAGAAAAG	2062
UUUCUCCAAGGAUAAGUU	2063	AACUUAUCCUUGGAAGAAA	2064
UUCUCCAAGGAUAAGUUG	2065	CAACUUAUCCUUGGAAGAA	2066
UCUCCAAGGAUAAGUUGC	2067	GCAACUUAUCCUUGGAAGA	2068
CUCCAAGGAUAAGUUGCA	2069	UGCAACUUAUCCUUGGAAG	2070
UCCAAGGAUAAGUUGCAA	2071	UUGCAACUUAUCCUUGGAA	2072
UCCAAGGAUAAGUUGCAAG	2073	CUUGCAACUUAUCCUUGGA	2074
CCAAGGAUAAGUUGCAAGA	2075	UCUUGCAACUUAUCCUUGG	2076
CAAGGAUAAGUUGCAAGAG	2077	CUCUUGCAACUUAUCCUUG	2078
AAGGAUAAGUUGCAAGAGG	2079	CCUCUUGCAACUUAUCCUU	2080
AGGAUAAGUUGCAAGAGGU	2081	ACCUCUUGCAACUUAUCCU	2082
GGAU AAGUUGCAAGAGGUG	2083	CACCUCUUGCAACUUAUCC	2084
GAUAAGUUGCAAGAGGUGA	2085	UCACCUCUUGCAACUUAUC	2086
AUAAGUUGCAAGAGGUGAA	2087	UUCACCUCUUGCAACUUAU	2088
UUUUGAAUCUCUUGAGGCU	2089	AGCCUCAAGAGAUUCAAAA	2090
UUUGAAUCUCUUGAGGCUC	2091	GAGCCUCAAGAGAUUCAA	2092
UUGAAUCUCUUGAGGCUCA	2093	UGAGCCUCAAGAGAUUCAA	2094
GAGGCUCAAGGAUCACAUC	2095	GAUGUGAUCCUUGAGCCUC	2096
AGGCUCAAGGAUCACAUCU	2097	AGAUGUGAUCCUUGAGCCU	2098
GGCUCAAGGAUCACAUCUG	2099	CAGAUGUGAUCCUUGAGCC	2100
AGGAUCACAUCUGGAUAUU	2101	AAUAUCCAGAUUGAUCCU	2102
GAUCACAUCUGGAUAUUUU	2103	AAAAUAUCCAGAUUGAUUC	2104
AAAUUAUUUUUGGCUUGGAG	2105	CUCCAGCCAUUUUAUAUUU	2106
GAGGACUUGGCUAAUGGUU	2107	AACCAUUAGCCAAGUCCUC	2108
AGGACUUGGCUAAUGGUUA	2109	UAACCAUUAGCCAAGUCCU	2110
GGACUUGGCUAAUGGUUAA	2111	UUAACCAUUAGCCAAGUCC	2112
GACUUGGCUAAUGGUUAAU	2113	AUUAACCAUUAGCCAAGUC	2114
ACUUGGCUAAUGGUUAAUA	2115	UAUUAACCAUUAGCCAAGU	2116

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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	CUCAGCCUCCAAAGUGCU	2136
CAUGGUGGCAGGUGCCUGU	2137	ACAGGCACCUGCCACCAUG	2138
AUGGUGGCAGGUGCCUGUA	2139	UACAGGCACCUGCCACCAU	2140
UGGCAGGUGCCUGUAGUCC	2141	GGACUACAGGCACCUGCCA	2142
GCAGGUGCCUGUAGUCCCA	2143	UGGGACUACAGGCACCUGC	2144
GUGCCUGUAGUCCAGCUA	2145	UAGCUGGGACUACAGGCAC	2146
UAGUCCAGCUACUCGGCA	2147	UGCCGAGUAGCUGGGACUA	2148
AGUCCAGCUACUCGGCAG	2149	CUGCCGAGUAGCUGGGACU	2150
GAGCUUGCAGUGAGCCGAG	2151	CUCGGCUCACUGCAAGCUC	2152
ACUGCAUUCAGCCUGGGU	2153	ACCCAGGCUGGAAUGCAGU	2154
CUGCAUUCAGCCUGGGUG	2155	CACCCAGGCUGGAAUGCAG	2156
UGCAUUCAGCCUGGGUGA	2157	UCACCCAGGCUGGAAUGCA	2158
GCAUUCAGCCUGGGUGAC	2159	GUCACCCAGGCUGGAAUGC	2160
CAUUCAGCCUGGGUGACU	2161	AGUCACCCAGGCUGGAAUG	2162
AUUCAGCCUGGGUGACUG	2163	CAGUCACCCAGGCUGGAAU	2164
UUCAGCCUGGGUGACUGA	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

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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
AGUCAAGAGCUGUGGAUUA	2205	AUAUCCACAGCUCUUGACU	2206
GUCAAGAGCUGUGGAUAUU	2207	AAUAUCCACAGCUCUUGAC	2208
CAAGAGCUGUGGAUAUUUU	2209	AAAAUAUCCACAGCUCUUG	2210
AAGAGCUGUGGAUAUUUUG	2211	CAAAUAUCCACAGCUCUU	2212
AGAGCUGUGGAUAUUUUGU	2213	ACAAUAUCCACAGCUCU	2214
GAGCUGUGGAUAUUUUGUC	2215	GACAAUAUCCACAGCUC	2216
AGCUGUGGAUAUUUUGUCU	2217	AGACAAUAUCCACAGCU	2218
GCUGUGGAUAUUUUGUCUA	2219	UAGACAAUAUCCACAGC	2220
CUGUGGAUAUUUUGUCUAA	2221	UUAGACAAUAUCCACAG	2222
UGUGGAUAUUUUGUCUAA	2223	GUUAGACAAUAUCCACA	2224
GUGGAUAUUUUGUCUAA	2225	GGUUAGACAAUAUCCAC	2226
UGGAUAUUUUGUCUAA	2227	UGGUUAGACAAUAUCCA	2228
GGUAUAUUUUGUCUAA	2229	UUGGUUAGACAAUAUCC	2230
UCGUAUCCAGCCAAAAGAU	2231	AUCUUUUGGCUGGAUACGA	2232
CGUAUCCAGCCAAAAGAU	2233	CAUCUUUUGGCUGGAUACG	2234
GUAUCCAGCCAAAAGAU	2235	GCAUCUUUUGGCUGGAUAC	2236
UAUCCAGCCAAAAGAU	2237	UGCAUCUUUUGGCUGGAUA	2238
AUCCAGCCAAAAGAU	2239	AUGCAUCUUUUGGCUGGAU	2240

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AGCCAAAAGCAUGCAUGAUG	2241	CAUCAUGCAUCUUUUGGCU	2242
GCCAAAAGCAUGCAUGAUGA	2243	UCAUCAUGCAUCUUUUGGC	2244
CCAAAAGCAUGCAUGAUGAU	2245	AUCAUCAUGCAUCUUUUGG	2246
CAAAAGCAUGCAUGAUGAUG	2247	CAUCAUCAUGCAUCUUUUG	2248
AAAAGCAUGCAUGAUGAUGG	2249	CCAUCAUCAUGCAUCUUUU	2250
AAAGCAUGCAUGAUGAUGGA	2251	UCCAUCAUCAUGCAUCUUU	2252
GCAUGAUGAUGGAGUGGUG	2253	CACCACUCCAUCAUCAUGC	2254
CAUGAUGAUGGAGUGGUGG	2255	CCACCACUCCAUCAUCAUG	2256
AUGAUGAUGGAGUGGUGGG	2257	CCCACCACUCCAUCAUCAU	2258
GGAAGGCCAGUUCAGUAU	2259	AUACUGAACUGGCCUUCCC	2260
GGAAGGCCAGUUCAGUAUC	2261	GAUACUGAACUGGCCUCC	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
AACUCCUGAAUAAUGGAU	2275	AUCCAUAUUCAGGAAGUU	2276
ACUCCUGAAUAAUGGAUA	2277	UAUCCAUAUUCAGGAAGU	2278
CUUCCUGAAUAAUGGAUAU	2279	AUAUCCAUAUUCAGGAAG	2280
GAAUAAUGGAUAUAUGUGG	2281	CCACAUUAUCCAUAUUC	2282
AUAUAAUGGAUAUAUGUGGAG	2283	CUCCACAUUAUCCAUAU	2284
AGAUUAUAGAUACAGCUG	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

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AAGUGACUUUCUCCAUUGC	2303	GCAAUGGAGAAAGUCACUU	2304
AGUGACUUUCUCCAUUGC	2305	AGCAAUGGAGAAAGUCACU	2306
GUGACUUUCUCCAUUGC	2307	AAGCAAUGGAGAAAGUCAC	2308
UUUCUCCAUUGCUCACGC	2309	GCGUGAAGCAAUGGAGAAA	2310
UUCUCCAUUGCUCACGCU	2311	AGCGUGAAGCAAUGGAGAA	2312
UCUCCAUUGCUCACGCUA	2313	UAGCGUGAAGCAAUGGAGA	2314
CUCCAUUGCUCACGCUAU	2315	AUAGCGUGAAGCAAUGGAG	2316
UCCAUUGCUCACGCUAUG	2317	CAUAGCGUGAAGCAAUGGA	2318
CCAUUGCUCACGCUAUGC	2319	GCAUAGCGUGAAGCAAUGG	2320
CAUUGCUCACGCUAUGCC	2321	GGCAUAGCGUGAAGCAAUG	2322
AUUGCUCACGCUAUGCCA	2323	UGGCAUAGCGUGAAGCAAU	2324
UUGCUCACGCUAUGCCAC	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
CGCUAUGCCACUAUUUUUGC	2339	GCAAAAUAGUGGCAUAGCG	2340
GCUAUGCCACUAUUUUUGCU	2341	AGCAAAAUAGUGGCAUAGC	2342
CUAUGCCACUAUUUUUGCUU	2343	AAGCAAAAUAGUGGCAUAG	2344
UAUGCCACUAUUUUUGCUUC	2345	GAAGCAAAAUAGUGGCAUA	2346
AUGCCACUAUUUUUGCUUCU	2347	AGAAGCAAAAUAGUGGCAU	2348
UGCCACUAUUUUUGCUUCUU	2349	AAGAAGCAAAAUAGUGGCA	2350
AACCUUGCUCUAGUAUUCUA	2351	UAGAAUACUAAGCAAGGUU	2352
CCUUGCUCUAGUAUUCUAUA	2353	UAUAGAAUACUAAGCAAGG	2354
AGUAUUCUAUAGUUUGCCC	2355	GGGCAAACUAUAGAAUACU	2356
GUAUUCUAUAGUUUGCCCA	2357	UGGGCAAACUAUAGAAUAC	2358
UAUUCUAUAGUUUGCCCAA	2359	UUGGGCAAACUAUAGAAUA	2360
AUUCUAUAGUUUGCCCAAC	2361	GUUGGGCAAACUAUAGAAU	2362
UAUAGUUUGCCCAACCAGU	2363	ACUGGUUGGGCAAACUAUA	2364

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AUAGUUUGCCCAACCAGUU	2365	AACUGGUUGGGCAAACU	2366
UAGUUUGCCCAACCAGUUU	2367	AAACUGGUUGGGCAAACUA	2368
AGUUUGCCCAACCAGUUUU	2369	AAAACUGGUUGGGCAAACU	2370
GUUUUGCCCAACCAGUUUUA	2371	UAAAACUGGUUGGGCAAAC	2372
UUUGCCCAACCAGUUUUAC	2373	GUAAAACUGGUUGGGCAA	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
GCCAAUGCAUAAAUUAC	2389	GUUAUUUUUAUGCAUUGGC	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	GCCUCCUGGCCUUCUUGA	2414
GCCAGGAAGGCCUUUUGGG	2415	CCCAAAGGCCUUCCUGGC	2416
CCAGGAAGGCCUUUUGGGU	2417	ACCCAAAAGGCCUUCCUGG	2418
CAGGAAGGCCUUUUGGGUU	2419	AACCCAAAAGGCCUUCCUG	2420
AGGAAGGCCUUUUGGGUUA	2421	UAACCCAAAAGGCCUUCCU	2422
GGAAGGCCUUUUGGGUUA	2423	UUAACCCAAAAGGCCUUC	2424
GAAGGCCUUUUGGGUUAAG	2425	CUUAACCCAAAAGGCCUUC	2426

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AAGGCCUUUUGGGUUAAGC	2427	GCUUAACCCAAAAGGCCUU	2428
AGGCCUUUUGGGUUAAGCC	2429	GGCUUAACCCAAAAGGCCU	2430
GGCCUUUUGGGUUAAGCCU	2431	AGGCUUAACCCAAAAGGCC	2432
UUCCAAUGAAUGGUCUCU	2433	AGAGACCAUUCUUUGGAA	2434
UCCAAUGAAUGGUCUCUG	2435	CAGAGACCAUUCUUUGGA	2436
CCAAUGAAUGGUCUCUGG	2437	CCAGAGACCAUUCUUUGG	2438
CAAUGAAUGGUCUCUGGU	2439	ACCAGAGACCAUUCUUUG	2440
AAUGAAUGGUCUCUGGUC	2441	GACCAGAGACCAUUCUUU	2442
AAUGAAUGGUCUCUGGUCA	2443	UGACCAGAGACCAUUCUU	2444
AUGAAUGGUCUCUGGUCAA	2445	UUGACCAGAGACCAUUCU	2446
UGAAUGGUCUCUGGUCAA	2447	UUUGACCAGAGACCAUUC	2448
GAAUGGUCUCUGGUCAAU	2449	AUUUGACCAGAGACCAUUC	2450
AAUGGUCUCUGGUCAAUG	2451	CAUUUGACCAGAGACCAU	2452
GUCAAUGAAUGAAUGGUC	2453	GACCAUUCUUCAUUUGAC	2454
UCAAUGAAUGAAUGGUCA	2455	UGACCAUUCUUCAUUUGA	2456
CAAUGAAUGAAUGGUCAA	2457	UUGACCAUUCUUCAUUUG	2458
AUGAAUGAAUGGUCAAUG	2459	CAUUUGACCAUUCUUCAU	2460
GGUCAAUGAAUAAUCUG	2461	CAGAUUUUUAUUUUUGACC	2462
GUCAAUGAAUAAUCUGC	2463	GCAGAUUUUUAUUUUUGAC	2464
UCAAUGAAUAAUCUGCC	2465	GGCAGAUUUUUAUUUUUGA	2466
CAAUGAAUAAUCUGCCC	2467	GGGCAGAUUUUUAUUUUUG	2468
AAUGAAUAAUCUGCCCU	2469	AGGGCAGAUUUUUAUUUUU	2470
AAUGAAUAAUCUGCCUC	2471	GAGGGCAGAUUUUUAUUUU	2472
AUGAAUAAUCUGCCUCA	2473	UGAGGGCAGAUUUUUAUUU	2474
GAAUAAUCUGCCUCACA	2475	UGUGAGGGCAGAUUUUAUUC	2476
AAUAAUCUGCCUCACAG	2477	CUGUGAGGGCAGAUUUUAU	2478
UCAUACCAUUUGGUUUAAG	2479	CUUAAACCAAUGGUUAUGA	2480
AUACCAUUUGGUUUAAGCC	2481	GGCUUAAACCAAUGGUUAU	2482
UACCAUUUGGUUUAAGCCU	2483	AGGCUUAAACCAAUGGUA	2484
ACCAUUUGGUUUAAGCCUU	2485	AAGGCUUAAACCAAUGGU	2486
CCAUUUGGUUUAAGCCUUA	2487	UAAGGCUUAAACCAAUGG	2488

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CAUUUGGUUUUAAGCCUAC	2489	GUAAGGCUUAAACCAAUG	2490
AUUUGGUUUUAAGCCUACA	2491	UGUAAGGCUUAAACCAAU	2492
GUUUUAAGCCUUAUUAU	2493	AUGAAUGUAAGGCUUAAAC	2494
UUUAAGCCUUAUUAUUAUG	2495	CAUGAAUGUAAGGCUUAAA	2496
UUCCAAUGAAGUCGAAUC	2497	GAUUCGACUUAUUUGGAA	2498
UCCAAUGAAGUCGAAUCU	2499	AGAUUCGACUUAUUUGGA	2500
CCAAUGAAGUCGAAUCUG	2501	CAGAUUCGACUUAUUUGG	2502
AAAUGAAGUCGAAUCUGCC	2503	GGCAGAUUCGACUUAUUU	2504
AAUGAAGUCGAAUCUGCCC	2505	GGGCAGAUUCGACUUAUU	2506
AUGAAGUCGAAUCUGCCCU	2507	AGGGCAGAUUCGACUUAU	2508
UGAAGUCGAAUCUGCCCU	2509	GAGGCAGAUUCGACUUA	2510
GAAGUCGAAUCUGCCCUCA	2511	UGAGGCAGAUUCGACUUC	2512
AAGUCGAAUCUGCCCUAC	2513	GUGAGGCAGAUUCGACUU	2514
AGUCGAAUCUGCCCUACA	2515	UGUGAGGCAGAUUCGACU	2516
GUCGAAUCUGCCCUACAG	2517	CUGUGAGGCAGAUUCGAC	2518
UUGUAUUGUGUAUUUUCGG	2519	CCGAAAAUACACAAUACA	2520
UGUAUUGUGUAUUUUCGGU	2521	ACCGAAAAUACACAAUACA	2522
GUAUUGUGUAUUUUCGGUU	2523	AACCGAAAAUACACAAUAC	2524
AAAUUUUAGAUGCAGCAC	2525	GUGCUGCAUCUAAAUUUU	2526
AUUUAGAUGCAGCACCAUA	2527	UAUGGUGCUGCAUCUAAU	2528
UUUAGAUGCAGCACCAUAU	2529	AUAUGGUGCUGCAUCUAAA	2530
UUAGAUGCAGCACCAUAUU	2531	AAUAUGGUGCUGCAUCUAA	2532
UAGAUGCAGCACCAUAUUU	2533	AAUAUGGUGCUGCAUCUA	2534
AGAUGCAGCACCAUAUUUU	2535	AAAAUAUGGUGCUGCAUCU	2536
GAUGCAGCACCAUAUUUUA	2537	UAAAAUAUGGUGCUGCAUC	2538
AUGCAGCACCAUAUUUUUAU	2539	AUAAAAUAUGGUGCUGCAU	2540
AGCACCAUAUUUUUAUAACC	2541	GGUUUAUAAAAUAUGGUGCU	2542
GCACCAUAUUUUUAUAACCC	2543	GGGUUAUAAAAUAUGGUGC	2544
ACCAUAUUUUUAUAACCCAG	2545	CUGGGUUUAUAAAAUAUGGU	2546
CCAUAUUUUUAUAACCCAGC	2547	GCUGGGUUUAUAAAAUAUGG	2548
CAUAUUUUUAUAACCCAGCU	2549	AGCUGGGUUUAUAAAAUAUG	2550

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UUAUAACCCAGCUUUAGCA	2551	UGCUGAAAGCUGGGUUAUAA	2552
ACCCAGCUUUAGCAUUUCU	2553	AGAAAUGCUGAAAGCUGGGU	2554
CCAGCUUUAGCAUUUCUUC	2555	GAAGAAAUGCUGAAAGCUGG	2556
GGCGCUUCUUGCUCUCUGA	2557	UCAGAGAGCAAGAAGCGCC	2558
GCGCUUCUUGCUCUCUGAA	2559	UUCAGAGAGCAAGAAGCGC	2560
AAAUGCCUGCUAAAUGCU	2561	AGCAUUUAGCAGGGCAUUU	2562
AAUGCCUGCUAAAUGCUU	2563	AAGCAUUUAGCAGGGCAUU	2564
AUGCCUGCUAAAUGCUUC	2565	GAAGCAUUUAGCAGGGCAU	2566
UGCCUGCUAAAUGCUUCU	2567	AGAAGCAUUUAGCAGGGCA	2568
UUUGAAUAAGGUAGUUUGG	2569	CCAAACUACCUUAUUCAA	2570
UUGAAUAAGGUAGUUUGGA	2571	UCCAAACUACCUUAUUCAA	2572
UGAAUAAGGUAGUUUGGAA	2573	UCCAAACUACCUUAUUCA	2574
GAAUAAGGUAGUUUGGAAU	2575	AUCCAAACUACCUUAUUC	2576
AGGUAGUUUGGAAUAAAGA	2577	UCUUUAUCCAAACUACCU	2578
GAUCACUCUACAUACAGAU	2579	AUCUGUAUGUAGAGUGAUC	2580
AUCACUCUACAUACAGAU	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
GAUGUUUGCAUUAUUAAAGG	2599	CCUUAUAUAUGCAAACAUC	2600
ACUUGGGAUGUUGGGUCAA	2601	UUGACCCAACAUCCCAAGU	2602
UUGGGAUGUUGGGUCAAGA	2603	UCUUGACCCAACAUCCCAA	2604
UGGGAUGUUGGGUCAAGAG	2605	CUCUUGACCCAACAUCCCA	2606
GGGAUGUUGGGUCAAGAGG	2607	CCUCUUGACCCAACAUCCC	2608
AAAGUGUUAGUCAAUCCAC	2609	GUGGAUUGACUAACACUUU	2610
GAAGGUCAAUUUAUUUCC	2611	GGAAUUAUAUUUGACCUUC	2612

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CCAUAUACCUUUCUUUGAU	2613	AUCAAAGAAAGGUUAUUGG	2614
CAUAUACCUUUCUUUGAUG	2615	CAUCAAAGAAAGGUUAUUG	2616
AUAUACCUUUCUUUGAUGC	2617	GCAUCAAAGAAAGGUUAU	2618
UAUACCUUUCUUUGAUGCC	2619	GGCAUCAAAGAAAGGUUA	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	GAUCCAUGAAAUGAUCUG	2646
GAUCAUUUCAUGGAAUCUU	2647	AAGAUCCAUGAAAUGAUC	2648
AAGUAUCUUUGACUCUAAC	2649	GUUAGAGUCAAGAUACUU	2650
AGUAUCUUUGACUCUAACU	2651	AGUUAGAGUCAAGAUACU	2652
GUAUCUUUGACUCUAACUU	2653	AAGUUAGAGUCAAGAUAC	2654
AUCUUUGACUCUAACUUUG	2655	CAAAGUUAGAGUCAAGAU	2656
UCUUUGACUCUAACUUUGA	2657	UCAAGUUAGAGUCAAGA	2658
CUUUGACUCUAACUUUGAC	2659	GUCAAAGUUAGAGUCAAG	2660
UUUGACUCUAACUUUGACU	2661	AGUCAAGUUAGAGUCAA	2662
UUGACUCUAACUUUGACUU	2663	AAGUCAAGUUAGAGUCAA	2664
CUCUAACUUUGACUUGGUG	2665	CACCAAGUCAAGUUAGAG	2666
UCUAACUUUGACUUGGUGG	2667	CCACCAAGUCAAGUUAGA	2668
CUAACUUUGACUUGGUGGU	2669	ACCACCAAGUCAAGUUAG	2670
UAACUUUGACUUGGUGGUG	2671	CACCACCAAGUCAAGUUA	2672
ACUUUGACUUGGUGGUGGA	2673	UCCACCACCAAGUCAAGU	2674

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CUUUGACUUGGUGGUGGAC	2675	GUCCACCACCAAGUCAAG	2676
UUUGACUUGGUGGUGGACC	2677	GGUCCACCACCAAGUCAA	2678
UUGACUUGGUGGUGGACCU	2679	AGGUCCACCACCAAGUCA	2680
UGACUUGGUGGUGGACCUU	2681	AAGGUCCACCACCAAGUCA	2682
UUGGUGGUGGACCUUCCUU	2683	AAGGAAGGUCCACCACCA	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
UUCCAUAAAUAGCAGAGU	2709	ACUCUGCAUAUUUUAGGAA	2710
CCAUAUAAUAGCAGAGUUC	2711	GAACUCUGCAUAUUUUAGG	2712
UGAAUGCAUUUGCAAUUUC	2713	GAAAUUGCAAUUGCAUUCA	2714
GAAUGCAUUUGCAAUUUCU	2715	AGAAAUUGCAAUUGCAUUC	2716
AUGCAUUUGCAAUUUCUAG	2717	CUAGAAAUUGCAAUUGCAU	2718
UGCAUUUGCAAUUUCUAGG	2719	CCUAGAAAUUGCAAUUGCA	2720
GCAUUUGCAAUUUCUAGGA	2721	UCCUAGAAAUUGCAAUUGC	2722
CAUUUGCAAUUUCUAGGAU	2723	AUCCUAGAAAUUGCAAUUG	2724
UUUGCAAUUUCUAGGAUUC	2725	GAAUCCUAGAAAUUGCAAA	2726
UGCAAUUUCUAGGAUUCUA	2727	UAGAAUCCUAGAAAUUGCA	2728
GCAAUUUCUAGGAUUCUAA	2729	UUAGAAUCCUAGAAAUUGC	2730
UCUAAAGAAUUGAGUACAG	2731	CUGUACUCAAUUCUUUAGA	2732
CUAAAGAAUUGAGUACAGA	2733	UCUGUACUCAAUUCUUUAG	2734
AGAAUUACUGUGCCAUAUC	2735	GUUUUGGCACAGUAAUUCU	2736

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

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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
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UGAAGGAGUGGACACAGUUA	2786
AUGAAGGAGUGGACACAGUU	2787
ACCAUGAAGGAGUGGACACA	2788
ACACCAUGAAGGAGUGGACA	2789
GACACCAUGAAGGAGUGGAC	2790
UGACACCAUGAAGGAGUGGA	2791
CUGACACCAUGAAGGAGUGG	2792
CUCUGACACCAUGAAGGAGU	2793
GCUCUGACACCAUGAAGGAG	2794
UGCUCUGACACCAUGAAGGA	2795

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GUGCUCUGACACCAUGAAGG	2796
GGAGAUGCUUCAGUGCUCUG	2797
UGGAGAUGCUUCAGUGCUCU	2798
GUUUUGGAGAUGCUUCAGUG	2799
UACGUUUUGGAGAUGCUUCA	2800
CUACGUUUUGGAGAUGCUUC	2801
ACUACGUUUUGGAGAUGCUU	2802
CACUACGUUUUGGAGAUGCU	2803
AUCACUACGUUUUGGAGAUG	2804
CAUCACUACGUUUUGGAGAU	2805
CCAUCACUACGUUUUGGAGA	2806
CCCAUCACUACGUUUUGGAG	2807
UCCAUCACUACGUUUUGGA	2808
GUCCAUCACUACGUUUUGG	2809
UGUCCAUCACUACGUUUUG	2810
GUGUCCAUCACUACGUUUU	2811
GGUGUCCAUCACUACGUUU	2812
UGGUGUCCAUCACUACGUU	2813
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UAUCCAAGGAAAUGGUGUC	2815
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GAGAUCAUAAUGAACUGGGA	2817
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AAGGUCAGCGUGGUAAGGUU	2822
GAAGGUCAGCGUGGUAAGGU	2823
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CCAGAAGGUCAGCGUGGUAA	2825
CCCAGAAGGUCAGCGUGGUA	2826
UUUCUACUUUCGUGGUUCCC	2827
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GACUGGCUGUGAUUUCUACU	2832
CUGACUGGCUGUGAUUUCUA	2833
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AUGCAGGAUGAUGGUGCUGG	2835
CUAUGCAGGAUGAUGGUGCU	2836
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GUGGUGACUAUGCAGGAUGA	2841
GGUGGUGACUAUGCAGGAUG	2842
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CAGGUGGUGACUAUGCAGGA	2844
GCAGGUGGUGACUAUGCAGG	2845
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CUUCCGAUAGCCUCUCUCCA	2848
UCUCCGAUAGCCUCUCUCC	2849
UUCUCCGAUAGCCUCUCUC	2850
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GGUUCUCCGAUAGCCUCUC	2852
GGGUUCUCCGAUAGCCUCU	2853

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GAGCCAGCAGUGCAAUUUGC	2854
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UGUGUACGGGAGCCCGACAA	2856
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ACAACUGUGUACGGGAGCCC	2858
GACAACUGUGUACGGGAGCC	2859
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GCCAGCAUAGUGAAUGACAA	2870
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GUUCUGUAGGUGCUUUUGUA	2881
GGUUCUGUAGGUGCUUUUGU	2882

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UUCCUUGGUUCUGUAGGUGC	2883
CUUCCUUGGUUCUGUAGGUG	2884
CCCUUCCUUGGUUCUGUAGG	2885
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AUGCUAGUAUCCUCAGUUCC	2887
GAUGCUAGUAUCCUCAGUUC	2888
UGAUGCUAGUAUCCUCAGUU	2889
UUGAUGCUAGUAUCCUCAGU	2890
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AUGGCUAGGUGCCUUGGCUC	2910
GAUGGCUAGGUGCCUUGGCU	2911

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AGAUGGCUAGGUGCCUUGGC	2912
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GGAGAUGGCUAGGUGCCUUG	2914
UUGGAGAUGGCUAGGUGCCU	2915
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UUCUAUGAGUCCUUCAGCAA	2937
CUUCUAUGAGUCCUUCAGCA	2938
GUUCUAUGAGUCCUUCAG	2939
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GCUCAUCUUCACAGUGACAU	2944
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UGACUCCACUCUUGGUUAUC	2967
UUGACUCCACUCUUGGUUAU	2968
CUUGACUCCACUCUUGGUUA	2969

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CAGAAACCUUGACUCCACUC	2974
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AGAAGAGUCACCGCAGCAUC	2995
UAGAAGAGUCACCGCAGCAU	2996
CUAGAAGAGUCACCGCAGCA	2997
UCGGGAUAGCAGCAAGAUC	2998

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CUGAAAGUCGGGAUAGCAG	3003
ACUGAAAGUCGGGAUAGCA	3004
CAUAGCACCAGACUGAAAGU	3005
UCCAUGCACCAGACUGAAA	3006
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UUUCCAUGCACCAGACUGA	3008
UUUUCCAUGCACCAGACUG	3009
GUUUUCCAUGCACCAGACU	3010
AGUUUUCCAUGCACCAGAC	3011
CAGUUUUCCAUGCACCAGA	3012
CCAGUUUUCCAUGCACCAG	3013
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AAAGAUCAUCCACCAUCC	3034
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AGUUCAGGAUGGGUCACACU	3042
CAGUUCAGGAUGGGUCACAC	3043
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CUUUCAGUUCAGGAUGGGUC	3045
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UUCAGAAUACAAGCUCCCUU	3072
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CUCCCUUAGCAUAUUCAGAA	3074
ACUCCCUUAGCAUAUUCAGA	3075
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AUGCUCUGGAGAUACUGUA	3077
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CUUGCCAUACUAUCCACAG	3088
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CAUCUGUAGGGCAAUACUU	3094
CCAUCUGUAGGGCAAUACU	3095
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ACACCAUCUGUAGGGCAAU	3098
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CAUCCAUCCCUUUUACACCA	3101
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CUAGAGCAAAAGCCAUCCAU	3104
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UCA AUGGAACAUGCCACAGG	3140
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AAUUUGAUCCAUCCACCUC	3145
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AUCAUCCUCGUAAUGCACAA	3156
CAUCAUCCUCGUAAUGCACA	3157
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UCCAUCAUCCUCGUAAUGCA	3159
AUCCAUCAUCCUCGUAAUGC	3160
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AGUCAAAGAGUCCAUCCAU	3169
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UUCAUGGACAGCUUCCCAA	3187
UUUUCAAUGGACAGCUUCCC	3188
CUUUCAAUGGACAGCUUCC	3189
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AGUACAGGGAUAAAUCCAAG	3192
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GGCCUUGAAUUGAGUUUCCA	3209
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UCAAUGAGGUCCCUUAGCAG	3213
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UUAUCAAUGAGGUCCCUUAG	3216
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CUGCUUAUCAAUGAGGUCCC	3218
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UGUCUGCUUAUCAAUGAGGU	3221
CAUGUCUGCUUAUCAAUGAG	3222
CUGUCCAUGUCUGCUUAUCA	3223
UCUGUCCAUGUCUGCUUAUC	3224
UCGUCUGUCCAUGUCUGCUU	3225
CUCGUCUGUCCAUGUCUGCU	3226
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GAGCCCUCGUCUGUCCAUGU	3229
CUGAGCCCUCGUCUGUCCA	3230

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CACACAGGCGAGGAGUAGUA	3235
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GAAAUAGCCUUCUGCCCU CU	3240
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UUCCACUUUCUGAAAUAGCC	3243
GCUCAAGUUUCCA UUGGAUU	3244
GGCUCAAGUUUCCA UUGGAU	3245
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GUACUGGACAAAGAAAACUG	3254
UGCAGAGGGCAA AUUCAAUU	3255
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CUUUCAUCUAGUAGCCAUUG	3259

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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
GUUGUACCAUUAACCAUGUG	3287
UGUUGUACCAUUAACCAUGU	3288

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UUGUUGUACCAUUAACCAUG	3289
AAGCCGUGUUCUUGUGGAGA	3290
CCUCUUAAGCCGUGUUCUU	3291
ACCUCUUAAGCCGUGUUCU	3292
UACCUCUUAAGCCGUGUUC	3293
UUACCUCUUAAGCCGUGUU	3294
UUUACCUCUUAAGCCGUGU	3295
UUUUACCUCUUAAGCCGUG	3296
CUUUUACCUCUUAAGCCGU	3297
CCUUUUACCUCUUAAGCCG	3298
AUCCUUUUACCUCUUAAGC	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
ACCGAUGUUUUCUCAAUGG	3313
CCAACCGAUGUUUUCUCAA	3314
UCCAACCGAUGUUUUCUUA	3315
AUCCAACCGAUGUUUUCUUC	3316
UUCUUAUCCAUCCAACCGAU	3317

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AUUCUUAUCCAUCCAACCGA	3318
CAGCCACACUCUGAUUUUUAU	3319
UCACUUUGCAGCCACACUCU	3320
UUCACUUUGCAGCCACACUC	3321
CUUUUCACUUUGCAGCCACA	3322
GCUUUUCACUUUGCAGCCAC	3323
UUCAGGAUCAUGUUAAGCU	3324
CUUCAGGAUCAUGUUAAGC	3325
GCUUCAGGAUCAUGUUAAG	3326
CAGCUUCAGGAUCAUGUUA	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

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

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CUUCCUUGACUAAUCACCUG	3376
ACUUCCUUGACUAAUCACCU	3377
GACUUCCUUGACUAAUCACC	3378
AGACUUCCUUGACUAAUCAC	3379
CAGACUUCCUUGACUAAUCA	3380
AAGGCUUGUGGGACCAAAGCU	3381
GCAAGGCUUGUGGGACCAAAG	3382
GGCAAGGCUUGUGGGACCAAA	3383
UGCUGUGAGGCAAGGCUUG	3384
CAUGCUGUGAGGCAAGGCUG	3385
ACAUGCUGUGAGGCAAGGCU	3386
UUUACAUGCUGUGAGGCAAG	3387
AUUUACAUGCUGUGAGGCAA	3388
GAAGAACCUCAGCAUCAUA	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

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

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UGAUACCUCGGUAAGCAGCA	3434
GUGAUACCUCGGUAAGCAGC	3435
CGUGAUACCUCGGUAAGCAG	3436
CCGUGAUACCUCGGUAAGCA	3437
CCCGUGAUACCUCGGUAAGC	3438
UCAACGACCCAAGCUGGAGC	3439
UUCAACGACCCAAGCUGGAG	3440
CUUCAACGACCCAAGCUGGA	3441
CCCAGCUUCAACGACCCAAG	3442
UCUCUGAAGUGGUUUCCCA	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
CAAAAUUAUAGCCAGCACCAU	3462

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GCAAAAUUAGCCAGCACCA	3463
GCAACAUUUGAGAGGGCAGU	3464
AGCAACAUUUGAGAGGGCAG	3465
UAGCAACAUUUGAGAGGGCA	3466
CUAGCAACAUUUGAGAGGGC	3467
CCUAGCAACAUUUGAGAGGG	3468
UCCUAGCAACAUUUGAGAGG	3469
UUCUAGCAACAUUUGAGAG	3470
AAAUUCUGGCAAGCAAGGCC	3471
UCAAUUCUGGCAAGCAAGG	3472
AGUCAAUUCUGGCAAGCAA	3473
AAGUCAAUUCUGGCAAGCA	3474
AAAGUCAAUUCUGGCAAGC	3475
CUGAAACUGACACCGUAUA	3476
CCUGAAACUGACACCGUAU	3477
CCCUGAAACUGACACCGUA	3478
ACCCUGAAACUGACACCGU	3479
CACCAAAGAGUUCUGGACUU	3480
UCACCAAAGAGUUCUGGACU	3481
GUCACCAAAGAGUUCUGGAC	3482
AGUCACCAAAGAGUUCUGGA	3483
AAAACGGCUUUACAGGGUAU	3484
GACCAUAGGUUGUUUCAUAC	3485
CAGACCAUAGGUUGUUUCAU	3486
CCAGACCAUAGGUUGUUUCA	3487
UCCAGACCAUAGGUUGUUUC	3488
UUCAGACCAUAGGUUGUUU	3489
UUUCCAGACCAUAGGUUGUU	3490
AUUUCCAGACCAUAGGUUGU	3491

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AAUUUCCAGACCAUAGGUUG	3492
CACAUUAGCUUUGCGAUAC	3493
GCACAUUAGCUUUGCGAUA	3494
UGCACAUUAGCUUUGCGAU	3495
AUGCACAUUAGCUUUGCGA	3496
UAUGCACAUUAGCUUUGCG	3497
GCAAACUCAAGCAUAGAUC	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:
AAAGGCGUGCACUCCUAC	3499	GUAGGAAGUGCACGCCUUU	3500
AAGGCGUGCACUCCUACG	3501	CGUAGGAAGUGCACGCCUU	3502
CGUGCACUCCUACGCCUG	3503	CAGGCGUAGGAAGUGCACG	3504
GUGCACUCCUACGCCUGA	3505	UCAGGCGUAGGAAGUGCAC	3506
UGCACUCCUACGCCUGAU	3507	AUCAGGCGUAGGAAGUGCA	3508
UCGCAACCUCGCAGCUUCC	3509	GGAAGCUGCGAGGUUGCGA	3510
CGGCGUGCAGCGCUAUUU	3511	AAAUGAGCGCUGCACGCCG	3512
GGCGUGCAGCGCUAUUUA	3513	UAAAUGAGCGCUGCACGCC	3514
GCGUGCAGCGCUAUUUAC	3515	GUAAAUGAGCGCUGCACGC	3516
CGUGCAGCGCUAUUUACC	3517	GGUAAAUGAGCGCUGCACG	3518
GUGCAGCGCUAUUUACCA	3519	UGGUAAAUGAGCGCUGCAC	3520
UGCAGCGCUAUUUACCAA	3521	UUGGUAAAUGAGCGCUGCA	3522
GCAGCGCUAUUUACCAAU	3523	AUUGGUAAAUGAGCGCUGC	3524
CAGCGCUAUUUACCAAUU	3525	AAUUGGUAAAUGAGCGCUG	3526
GCUAUUUACCAAUUCCCU	3527	AGGGAAUUGGUAAAUGAGC	3528
CUAUUUACCAAUUCCCUU	3529	AAGGGAAUUGGUAAAUGAG	3530
UCAUUUACCAAUUCCCUUC	3531	GAAGGGAAUUGGUAAAUGA	3532
CAUUUACCAAUUCCCUUCC	3533	GGAAGGGAAUUGGUAAAUG	3534

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AUUUACCAAUUCCCUUCCU	3535	AGGAAGGGAAUUGGUAAAU	3536
CUUCCUGGGAGUUGCGGCU	3537	AGCCGCAACUCCAGGAAG	3538
UUCCUGGGAGUUGCGGCUU	3539	AAGCCGCAACUCCAGGAA	3540
UCCUGGGAGUUGCGGCUUC	3541	GAAGCCGCAACUCCAGGA	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
UCACUGUUGGCUCUCUUA	3573	UUAAGAGAGCCAACAGUGA	3574
CACUGUUGGCUCUCUUAAC	3575	GUUAAGAGAGCCAACAGUG	3576
ACUGUUGGCUCUCUUAACU	3577	AGUUAAGAGAGCCAACAGU	3578
GGCUCUCUUAACUGUGUCC	3579	GGACACAGUUAAGAGAGCC	3580
GCUCUCUUAACUGUGUCCA	3581	UGGACACAGUUAAGAGAGC	3582
UACUGUGUCCACUCCUUC	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

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UCCACUCCUUAUGGUGUC	3597	GACACCAUGAAGGAGUGGA	3598
CCACUCCUUAUGGUGUCA	3599	UGACACCAUGAAGGAGUGG	3600
CACUCCUUAUGGUGUCAG	3601	CUGACACCAUGAAGGAGUG	3602
ACUCCUUAUGGUGUCAGA	3603	UCUGACACCAUGAAGGAGU	3604
AGCACUGAAGCAUCUCCAA	3605	UUGGAGAUAGCUUCAGUGCU	3606
GCACUGAAGCAUCUCCAAA	3607	UUUGGAGAUAGCUUCAGUGC	3608
CACUGAAGCAUCUCCAAAA	3609	UUUUGGAGAUAGCUUCAGUG	3610
AACGUAGUGAUGGGACACC	3611	GGUGUCCCAUCACUACGUU	3612
ACGUAGUGAUGGGACACCA	3613	UGGUGUCCCAUCACUACGU	3614
GGACACCAUUUCCUUGGAA	3615	UUCCAAGGAAAUGGUGUCC	3616
GACACCAUUUCCUUGGAAU	3617	AUUCCAAGGAAAUGGUGUC	3618
ACACCAUUUCCUUGGAAUA	3619	UAUCCAAGGAAAUGGUGU	3620
CACCAUUUCCUUGGAAUAA	3621	UUAUCCAAGGAAAUGGUG	3622
CCAUUUCCUUGGAAUAAA	3623	UUUUUAUCCAAGGAAAUGG	3624
UUCCUUGGAAUAAAAUACG	3625	CGUAUUUUUAUCCAAGGAA	3626
UCCUUGGAAUAAAAUACGA	3627	UCGUAUUUUUAUCCAAGGA	3628
CCUUGGAAUAAAAUACGAC	3629	GUCGUAUUUUUAUCCAAGG	3630
UGGAAUAAAAUACGACUUC	3631	GAAGUCGUAUUUUUAUCCA	3632
GAAUAAAAUACGACUUCU	3633	AGGAAGUCGUAUUUUUAUUC	3634
GUCAUCCAGUUAUUAUG	3635	CAUAAUGAACUGGGAUGAC	3636
CCCAGUUAUUAUGAUCUC	3637	GAGAUCAUAAUGAACUGGG	3638
CCAGUUAUUAUGAUCUCU	3639	AGAGAUCAUAAUGAACUGG	3640
CAGUUAUUAUGAUCUCUU	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

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AGCACCAUCAUCCUGCAUA	3659	UAUGCAGGAUGAUGGUGCU	3660
GCACCAUCAUCCUGCAUAG	3661	CUAUGCAGGAUGAUGGUGC	3662
CACCAUCAUCCUGCAUAGU	3663	ACUAUGCAGGAUGAUGGUG	3664
ACCAUCAUCCUGCAUAGUC	3665	GACUAUGCAGGAUGAUGGU	3666
CCAUCAUCCUGCAUAGUCA	3667	UGACUAUGCAGGAUGAUGG	3668
CAUCCUGCAUAGUACCAC	3669	GUGGUGACUAUGCAGGAUG	3670
UAGUACCACCUGCAGAUUA	3671	UAUCUGCAGGUGGUGACUA	3672
AGUACCACCUGCAGAUUAU	3673	AUAUCUGCAGGUGGUGACU	3674
ACCACCUGCAGAUUUCUAG	3675	CUAGAUUUCUGCAGGUGGU	3676
CCACCUGCAGAUUUCUAGG	3677	CCUAGAUUUCUGCAGGUGG	3678
CACCUGCAGAUUUCUAGGG	3679	CCCUAGAUUUCUGCAGGUG	3680
ACCUGCAGAUUUCUAGGGC	3681	GCCCUAGAUUUCUGCAGGU	3682
CCUGCAGAUUUCUAGGGCC	3683	GGCCCUAGAUUUCUGCAGG	3684
CAAAUUGCACUGCUGGCUC	3685	GAGCCAGCAGUGCAAUUUG	3686
UCCUUGUCGGGCUCCGUUA	3687	UACGGGAGCCCGACAAGGA	3688
CUUGUCGGGCUCCGUACA	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
UUCACUAUGCUGGCAAUUCU	3705	AGAUUGCCAGCAUAGUGAA	3706
UCACUAUGCUGGCAAUUCU	3707	AAGAUUGCCAGCAUAGUGA	3708
CACUAUGCUGGCAAUUCUU	3709	AAAGAUUGCCAGCAUAGUG	3710
ACUAUGCUGGCAAUUCUUC	3711	GAAAGAUUGCCAGCAUAGU	3712
AGACUUUCCACGGAUUUUA	3713	UAAAAUCCGUGGAAAGUCU	3714
GACUUUCCACGGAUUUUAC	3715	GUAAAAUCCGUGGAAAGUC	3716
ACUUUCCACGGAUUUUACA	3717	UGUAAAAUCCGUGGAAAGU	3718
AACUGAGGAUACUAGCAUC	3719	GAUGCUAGUAUCCUCAGUU	3720

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ACUGAGGAUACUAGCAUCA	3721	UGAUGCUAGUAUCCUCAGU	3722
CUGAGGAUACUAGCAUCAA	3723	UUGAUGCUAGUAUCCUCAG	3724
UGAGGAUACUAGCAUCAAC	3725	GUUGAUGCUAGUAUCCUCA	3726
UGCAGCUAGAAUGGCCUUU	3727	AAAGGCCAUUCUAGCUGCA	3728
AAUGGCCUUUCCUGCUUU	3729	AAAGCAGGGAAAGGCCAUU	3730
GCCUUUCCUGCUUUGAUG	3731	CAUCAAGCAGGGAAAGGC	3732
CUUUCCUGCUUUGAUGAA	3733	UUCAUCAAGCAGGGAAAG	3734
ACCUGCCUUCAAAGCAAGU	3735	ACUUGCUUUGAAGGCAGGU	3736
CUGCCUUCAAAGCAAGUUU	3737	AAACUUGCUUUGAAGGCAG	3738
UGCCUUCAAAGCAAGUUUC	3739	GAAACUUGCUUUGAAGGCA	3740
GCCUUCAAAGCAAGUUUCU	3741	AGAAACUUGCUUUGAAGGC	3742
CAAAGCAAGUUUCUCAUC	3743	GAUUGAGAAACUUGCUUUG	3744
AAGCAAGUUUCUCAUCAA	3745	UUGAUUGAGAAACUUGCUU	3746
AGCAAGUUUCUCAUCAAA	3747	UUUGAUUGAGAAACUUGCU	3748
GCAAGUUUCUCAUCAAAA	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

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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	CAUCUUCACAGUGACAUA	3820
GAUGUCACUGUGAAGAUGA	3821	UCAUCUUCACAGUGACAUC	3822
AUGUCACUGUGAAGAUGAG	3823	CUCAUCUUCACAGUGACAU	3824
UGUGAAGAUGAGACCUAU	3825	AUAGGUGCUCUUCUACA	3826
GUGAAGAUGAGACCUAUC	3827	GAUAGGUGCUCUUCUAC	3828
ACCUAUCUGGUGGCCUUCA	3829	UGAAGGCCACCAGAUAGGU	3830
CCUAUCUGGUGGCCUUCAU	3831	AUGAAGGCCACCAGAUAGG	3832
CUAUCUGGUGGCCUUCAUC	3833	GAUGAAGGCCACCAGAUAG	3834
UAUCUGGUGGCCUUCAUCA	3835	UGAUGAAGGCCACCAGAU	3836
AUCUGGUGGCCUUCAUCAU	3837	AUGAUGAAGGCCACCAGAU	3838
UCUGGUGGCCUUCAUCAUU	3839	AAUGAUGAAGGCCACCAGA	3840
CUGGUGGCCUUCAUCAUUU	3841	AAAUGAUGAAGGCCACCAG	3842
UGGUGGCCUUCAUCAUUUC	3843	GAAUGAUGAAGGCCACCA	3844

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GGCCUUCAUCAUUUCAGAU	3845	AUCUGAAAUGAUGAAGGCC	3846
GCCUUCAUCAUUUCAGAUU	3847	AAUCUGAAAUGAUGAAGGC	3848
CCUUCAUCAUUUCAGAUUU	3849	AAAUCUGAAAUGAUGAAGG	3850
AGAUUUUGAGUCUGUCAGC	3851	GCUGACAGACUAAAAUCU	3852
UUUGAGUCUGUCAGCAAGA	3853	UCUUGCUGACAGACUAAA	3854
UUGAGUCUGUCAGCAAGAU	3855	AUCUUGCUGACAGACUAA	3856
UGAGUCUGUCAGCAAGAU	3857	UAUCUUGCUGACAGACUCA	3858
GAGUCUGUCAGCAAGAUAA	3859	UUAUCUUGCUGACAGACUC	3860
AGUCUGUCAGCAAGAUAAC	3861	GUUAUCUUGCUGACAGACU	3862
GUCUGUCAGCAAGAUACC	3863	GGUUAUCUUGCUGACAGAC	3864
UCUGUCAGCAAGAUACCA	3865	UGGUUAUCUUGCUGACAGA	3866
UGUCAGCAAGAUACCAAG	3867	CUUGGUUAUCUUGCUGACA	3868
GUCAGCAAGAUACCAAGA	3869	UCUUGGUUAUCUUGCUGAC	3870
UCAGCAAGAUACCAAGAG	3871	CUCUUGGUUAUCUUGCUGA	3872
CAGCAAGAUACCAAGAGU	3873	ACUCUUGGUUAUCUUGCUG	3874
AGCAAGAUACCAAGAGUG	3875	CACUCUUGGUUAUCUUGCUCU	3876
GCAAGAUACCAAGAGUGG	3877	CCACUCUUGGUUAUCUUGC	3878
CAAGAUACCAAGAGUGGA	3879	UCCACUCUUGGUUAUCUUG	3880
AAGAUACCAAGAGUGGAG	3881	CUCCACUCUUGGUUAUCU	3882
UAACCAAGAGUGGAGUCA	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

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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
GUUUUAUGCUGUGCCAGACA	3929	UGUCUGGCACAGCAUAAAC	3930
AUGCACUGGAUGCUGCGGU	3931	ACCGCAGCAUCCAGUGCAU	3932
UGCACUGGAUGCUGCGGUG	3933	CACCGCAGCAUCCAGUGCA	3934
GCACUGGAUGCUGCGGUGA	3935	UCACCGCAGCAUCCAGUGC	3936
CACUGGAUGCUGCGGUGAC	3937	GUCACCGCAGCAUCCAGUG	3938
ACUGGAUGCUGCGGUGACU	3939	AGUCACCGCAGCAUCCAGU	3940
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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
UGCUGGUGACUCUUCUAGAA	3957	UUCUAGAAGAGUCACCGCA	3958
GCGGUGACUCUUCUAGAAU	3959	AUUCUAGAAGAGUCACCGC	3960
CGGUGACUCUUCUAGAAUU	3961	AAUUCUAGAAGAGUCACCG	3962
CUUCUAGAAUUUUUAUGAGG	3963	CCUCAUAAAUAUCUAGAAG	3964
CAAGAUCUUGCUGCUAUUC	3965	GAAUAGCAGCAAGAUCUUG	3966
AAGAUCUUGCUGCUAUUCC	3967	GGAAUAGCAGCAAGAUCUU	3968

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AGAUCUUGCUGCUAUUCCC	3969	GGGAAUAGCAGCAAGAUUCU	3970
GAUCUUGCUGCUAUUCCCG	3971	CGGGAAUAGCAGCAAGAUUC	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	UCCAUAGCACCAGACUGA	3986
AAUCUGCUCUGUUGUUUGA	3987	UCAAACAACAGAGCAGAUU	3988
AUCUGCUCUGUUGUUUGAU	3989	AUCAAACAACAGAGCAGAU	3990
UCUGCUCUGUUGUUUGAUG	3991	CAUCAAACAACAGAGCAGA	3992
CUGCUCUGUUGUUUGAUGC	3993	GCAUCAAACAACAGAGCAG	3994
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AAGUCUUCUGCAUCAAGUA	3997	UACUUGAUGCAGAAGACUU	3998
AGUCUUCUGCAUCAAGUAA	3999	UUACUUGAUGCAGAAGACU	4000
GUCUUCUGCAUCAAGUAAG	4001	CUUACUUGAUGCAGAAGAC	4002
UCUUCUGCAUCAAGUAAGC	4003	GCUUACUUGAUGCAGAAGA	4004
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ACUGGUCACUAUGGAAUG	4007	CAUUCCAUAGUGACCAGGU	4008
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UGGUCACUAUGGAAUGGUG	4013	CACCAUCCAUAGUGACCA	4014
GGUCACUAUGGAAUGGUGG	4015	CCACCAUCCAUAGUGACC	4016
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UGGAAUGGUGGAAUGAUCU	4025	AGAUCAUCCACCAUCCA	4026
GGAAUGGUGGAAUGAUCUU	4027	AAGAUCAUCCACCAUCC	4028
GAAUGGUGGAAUGAUCUUU	4029	AAAGAUCAUCCACCAUUC	4030

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AAUGGUGGAAUGAUCUUUG	4031	CAAAGAUCAUCCACCAUU	4032
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UGGUGGAAUGAUCUUUGGC	4035	GCCAAAGAUCAUCCACCA	4036
GGUGGAAUGAUCUUUGGCU	4037	AGCCAAAGAUCAUCCACC	4038
GUGGAAUGAUCUUUGGCUA	4039	UAGCCAAAGAUCAUCCAC	4040
UGGAAUGAUCUUUGGCUAA	4041	UUAGCCAAAGAUCAUCCA	4042
GGAAUGAUCUUUGGCUAAA	4043	UUUAGCCAAAGAUCAUCC	4044
GAAUGAUCUUUGGCUAAAU	4045	AUUUAGCCAAAGAUCAUUC	4046
AAUGAUCUUUGGCUAAAUG	4047	CAUUUAGCCAAAGAUCAUU	4048
AAUUUAUGGAGUUUGUGUC	4049	GACACAAACUCCAUAUUU	4050
AUUUAUGGAGUUUGUGUCU	4051	AGACACAAACUCCAUAUU	4052
UUUAUGGAGUUUGUGUCUG	4053	CAGACACAAACUCCAUAUU	4054
UUAUGGAGUUUGUGUCUGU	4055	ACAGACACAAACUCCAUAU	4056
UAUGGAGUUUGUGUCUGUC	4057	GACAGACACAAACUCCAUA	4058
AUGGAGUUUGUGUCUGUCA	4059	UGACAGACACAAACUCCA	4060
UGGAGUUUGUGUCUGUCAG	4061	CUGACAGACACAAACUCCA	4062
GGAGUUUGUGUCUGUCAGU	4063	ACUGACAGACACAAACUCC	4064
GAGUUUGUGUCUGUCAGUG	4065	CACUGACAGACACAAACUC	4066
AGUUUGUGUCUGUCAGUGU	4067	ACACUGACAGACACAAACU	4068
CAGUGUGACCAUCCUGAA	4069	UUCAGGAUGGGUCACACUG	4070
GCAAUGGAGGUAGAUGCUU	4071	AAGCAUCUACCUCCAUUGC	4072
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GGUAGAUGCUUUAAAUUCC	4075	GGAAUUUAAAGCAUCUACC	4076
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UAGAUGCUUUAAAUUCCUC	4079	GAGGAAUUUAAAGCAUCUA	4080
CCUGUGUCUACACUGUGG	4081	CCACAGGUGUAGACACAGG	4082
UGUGUCUACACUGUGGAA	4083	UUCCACAGGUGUAGACACA	4084
UAUGAUAAAGGGAGCUUGUA	4085	UACAAGCUCCCUUAUCAUA	4086
AUAAGGGAGCUUGUAUUCU	4087	AGAAUACAAGCUCCCUUAU	4088
UAAGGGAGCUUGUAUUCUG	4089	CAGAAUACAAGCUCCCUUA	4090
AAGGGAGCUUGUAUUCUGA	4091	UCAGAAUACAAGCUCCCUU	4092

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AGGGAGCUUGUAUUCUGAA	4093	UUCAGAAUACAAGCUCCCU	4094
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AAUAUGCUAAGGGAGUAUC	4099	GAUACUCCCUUAGCAUAUU	4100
AUAUGCUAAGGGAGUAUCU	4101	AGAUACUCCCUUAGCAUAU	4102
UAUGCUAAGGGAGUAUCUU	4103	AAGAUACUCCCUUAGCAUA	4104
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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
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CUCCAGAAGCAUAGCUAUA	4141	UAUAGCUAUGCUUCUGGAG	4142
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CCAGAAGCAUAGCUAUAAA	4145	UUUAUAGCUAUGCUUCUGG	4146
ACGAGGACCUGUGGGAUAG	4147	CUAUCCCACAGGUCCUCGU	4148
CGAGGACCUGUGGGAUAGU	4149	ACUAUCCCACAGGUCCUCG	4150
GAGGACCUGUGGGAUAGUA	4151	UACUAUCCCACAGGUCCUC	4152
AGGACCUGUGGGAUAGUAU	4153	AUACUAUCCCACAGGUCCU	4154

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GGACCUGUGGGAUAGUAUG	4155	CAUACUAUCCACAGGUCC	4156
GACCUGUGGGAUAGUAUGG	4157	CCAUACUAUCCACAGGUC	4158
ACCUGUGGGAUAGUAUGGC	4159	GCCAUACUAUCCACAGGU	4160
CCUGUGGGAUAGUAUGGCA	4161	UGCCAUACUAUCCACAGG	4162
CUGUGGGAUAGUAUGGCAA	4163	UUGCCAUACUAUCCACAG	4164
UGUGGGAUAGUAUGGCAAG	4165	CUUGCCAUACUAUCCACA	4166
GUGGGAUAGUAUGGCAAGU	4167	ACUUGCCAUACUAUCCAC	4168
UGGGAUAGUAUGGCAAGUA	4169	UACUUGCCAUACUAUCCCA	4170
GGGAUAGUAUGGCAAGUAU	4171	AUACUUGCCAUACUAUCCC	4172
AAGUAUUUGCCCUACAGAU	4173	AUCUGUAGGGCAAUACUU	4174
AGUAUUUGCCCUACAGAU	4175	CAUCUGUAGGGCAAUACU	4176
GUUAUUUGCCCUACAGAU	4177	CCAUCUGUAGGGCAAUAC	4178
UAUUUGCCCUACAGAU	4179	ACCAUCUGUAGGGCAAUA	4180
AUUUGCCCUACAGAU	4181	CACCAUCUGUAGGGCAAU	4182
UUUGCCCUACAGAU	4183	ACACCAUCUGUAGGGCAA	4184
UGGUGUAAAAGGGAUGGAU	4185	AUCCAUCCCUUUUACACCA	4186
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UGGAUGGCUUUUGCUCUAG	4203	CUAGAGCAAAAGCCAUCCA	4204
GGAUGGCUUUUGCUCUAGA	4205	UCUAGAGCAAAAGCCAUCC	4206
GAUGGCUUUUGCUCUAGAA	4207	UUCUAGAGCAAAAGCCAUC	4208
AUGGCUUUUGCUCUAGAAG	4209	CUUCUAGAGCAAAAGCCA	4210
UGGCUUUUGCUCUAGAAGU	4211	ACUUCUAGAGCAAAAGCCA	4212
GGCUUUUGCUCUAGAAGUC	4213	GACUUCUAGAGCAAAAGCC	4214
GCUUUUGCUCUAGAAGUCA	4215	UGACUUCUAGAGCAAAAGC	4216

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CUUUUGCUCUAGAAGUCAA	4217	UUGACUUCUAGAGCAAAAG	4218
UUUUUGCUCUAGAAGUCAAC	4219	GUUGACUUCUAGAGCAAAA	4220
UUCAUCUUAUCCUCACAU	4221	AUGUGAGGAUGAAGAUGAA	4222
UCAUCUUAUCCUCACAUU	4223	AAUGUGAGGAUGAAGAUGA	4224
CAUCUUAUCCUCACAUUG	4225	CAAUGUGAGGAUGAAGAUG	4226
AUCUUAUCCUCACAUUGG	4227	CCAAUGUGAGGAUGAAGAU	4228
UCUUAUCCUCACAUUGGC	4229	GCCAAUGUGAGGAUGAAGA	4230
CUUAUCCUCACAUUGGCA	4231	UGCCAAUGUGAGGAUGAAG	4232
UUAUCCUCACAUUGGCAU	4233	AUGCCAAUGUGAGGAUGAA	4234
UAUCCUCACAUUGGCAUC	4235	GAUGCCAAUGUGAGGAUGA	4236
CAUCCUCACAUUGGCAUCA	4237	UGAUGCCAAUGUGAGGAUG	4238
CCCUAAUAACCAUCACAGU	4239	ACUGUGAUGGUUAUUAGGG	4240
CCUAAUAACCAUCACAGUG	4241	CACUGUGAUGGUUAUUAGG	4242
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CACUACAUGAAGGGCUCUG	4247	CAGAGCCCUUCAUGUAGUG	4248
ACUACAUGAAGGGCUCUGA	4249	UCAGAGCCCUUCAUGUAGU	4250
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CAUGAAGGGCUCUGACGGC	4257	GCCGUCAGAGCCCUUCAUG	4258
AUGAAGGGCUCUGACGGCG	4259	CGCCGUCAGAGCCCUUCAU	4260
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CGGACACUGGGUACCUUGUG	4263	CACAGGUACCCAGUGUCCG	4264
GGACACUGGGUACCUUGUGG	4265	CCACAGGUACCCAGUGUCC	4266
GACACUGGGUACCUUGUGGC	4267	GCCACAGGUACCCAGUGUC	4268
ACACUGGGUACCUUGUGGCA	4269	UGCCACAGGUACCCAGUGU	4270
CACUGGGUACCUUGUGGCAU	4271	AUGCCACAGGUACCCAGUG	4272
ACUGGGUACCUUGUGGCAUG	4273	CAUGCCACAGGUACCCAGU	4274
CUGGGUACCUUGUGGCAUGU	4275	ACAUGCCACAGGUACCCAG	4276
UGGGUACCUUGUGGCAUGUU	4277	AACAUGCCACAGGUACCCA	4278

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GGGUACCUGUGGCAUGUUC	4279	GAACAUGCCACAGGUACCC	4280
GGUACCUGUGGCAUGUUC	4281	GGAACAUGCCACAGGUACC	4282
GUACCUGUGGCAUGUCCA	4283	UGGAACAUGCCACAGGUAC	4284
UACCUGUGGCAUGUCCA	4285	AUGGAACAUGCCACAGGUA	4286
ACCUGUGGCAUGUCCA	4287	AAUGGAACAUGCCACAGGU	4288
CCUGUGGCAUGUCCA	4289	CAAUGGAACAUGCCACAGG	4290
CUGUGGCAUGUCCA	4291	UCAAUGGAACAUGCCACAG	4292
UGUGGCAUGUCCA	4293	GUCAAUGGAACAUGCCACA	4294
GUGGCAUGUCCA	4295	UGUCAAUGGAACAUGCCAC	4296
UGUCCAUGUCCA	4297	GAUGAAUGUCAUGGAACA	4298
UCCAUGUCCA	4299	GGUGAUGAAUGUCAUGGA	4300
CAUUGACAUGUCCA	4301	CUGGUGAUGAAUGUCAUG	4302
ACAUUGACAUGUCCA	4303	AUUUGCUGGUGAUGAAUGU	4304
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UCCAGAAGAGGUGGAAUG	4307	CAUCCACCUCUUCUGGGA	4308
CCCAGAAGAGGUGGAAUGG	4309	CCAUCCACCUCUUCUGGG	4310
CCAGAAGAGGUGGAAUGGA	4311	UCCAUCCACCUCUUCUGG	4312
CAGAAGAGGUGGAAUGGAU	4313	AUCCAUCCACCUCUUCUG	4314
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GAAGAGGUGGAAUGGAUCA	4317	UGAUCCAUCCACCUCUUC	4318
GAGGUGGAAUGGAUCAAU	4319	AUUUGAUCCAUCCACCUC	4320
AGGUGGAAUGGAUCAAUU	4321	AAUUUGAUCCAUCCACCU	4322
GGUGGAAUGGAUCAAUUU	4323	AAAUUGAUCCAUCCACC	4324
GUGGAAUGGAUCAAUUUA	4325	UAAAUUGAUCCAUCCAC	4326
GAUCAAUUUAAUGUGGGC	4327	GCCCACAUUAAAUUGAUC	4328
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UCAAAUUUAAUGUGGGCAU	4331	AUGCCCACAUUAAAUUGA	4332
CAAAUUUAAUGUGGGCAUG	4333	CAUGCCCACAUUAAAUUG	4334
AAAUUUAAUGUGGGCAUGA	4335	UCAUGCCCACAUUAAAUUU	4336
AAUUUAAUGUGGGCAUGAA	4337	UUCAUGCCCACAUUAAAUU	4338
UAUGUGGGCAUGAAUGGC	4339	GCCAUUCAUGCCCACAUUA	4340

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AAUGUGGGCAUGAAUGGCU	4341	AGCCAUUCAUGCCCACAUU	4342
AUGUGGGCAUGAAUGGCUA	4343	UAGCCAUUCAUGCCCACAU	4344
UGUGGGCAUGAAUGGCUAU	4345	AUAGCCAUUCAUGCCCACA	4346
GUGGGCAUGAAUGGCUAUU	4347	AAUAGCCAUUCAUGCCCAC	4348
UGGGCAUGAAUGGCUAUUA	4349	UAAUAGCCAUUCAUGCCCA	4350
GGGCAUGAAUGGCUAUUAC	4351	GUAAUAGCCAUUCAUGCCC	4352
GGAUGAAUGGCUAUUACA	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	CAUCCUCGUAAUGCACA AU	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

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GAUGGAUGGGACUCUUUGA	4403	UCAAAGAGUCCCAUCCAUC	4404
AUGGAUGGGACUCUUUGAC	4405	GUCAAAGAGUCCCAUCCAU	4406
UGGAUGGGACUCUUUGACU	4407	AGUCAAGAGUCCCAUCCA	4408
GGAUGGGACUCUUUGACUG	4409	CAGUCAAGAGUCCCAUCC	4410
GAUGGGACUCUUUGACUGG	4411	CCAGUCAAGAGUCCCAUC	4412
AUGGGACUCUUUGACUGGC	4413	GCCAGUCAAGAGUCCCAU	4414
UGGGACUCUUUGACUGGCC	4415	GGCCAGUCAAGAGUCCCA	4416
GGGACUCUUUGACUGGCCU	4417	AGGCCAGUCAAGAGUCCC	4418
GGACUCUUUGACUGGCCUU	4419	AAGGCCAGUCAAGAGUCC	4420
GACUCUUUGACUGGCCUUU	4421	AAAGGCCAGUCAAGAGUC	4422
ACUCUUUGACUGGCCUUUU	4423	AAAAGGCCAGUCAAGAGU	4424
CUCUUUGACUGGCCUUUUA	4425	UAAAAGGCCAGUCAAGAG	4426
UCUUUGACUGGCCUUUUAA	4427	UUAAAAGGCCAGUCAAGA	4428
CUUUGACUGGCCUUUUAAA	4429	UUUAAAAGGCCAGUCAAG	4430
UUUGACUGGCCUUUUAAAA	4431	UUUUAAAAGGCCAGUCAA	4432
UUGACUGGCCUUUUAAAAG	4433	CUUUUAAAAGGCCAGUCAA	4434
CACAGCAGUCAGCAGUAAU	4435	AUUACUGCUGACUGCUGU	4436
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CAGCAGUCAGCAGUAAUGA	4439	UCAUACUGCUGACUGCUG	4440
AGCAGUCAGCAGUAAUGAU	4441	AUCAUACUGCUGACUGCU	4442
GCAGUCAGCAGUAAUGAUC	4443	GAUCAUACUGCUGACUGC	4444
CAGUCAGCAGUAAUGAUCG	4445	CGAUCAUACUGCUGACUG	4446
AGUCAGCAGUAAUGAUCGG	4447	CCGAUCAUACUGCUGACU	4448
GUCAGCAGUAAUGAUCGGG	4449	CCCGAUCAUACUGCUGAC	4450
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AGCAUUGGGAAGCUGUCCA	4453	UGGACAGCUUCCCAAUGCU	4454
GCAUUGGGAAGCUGUCCAU	4455	AUGGACAGCUUCCCAAUGC	4456
CAUUGGGAAGCUGUCCAUI	4457	AAUGGACAGCUUCCCAAUG	4458
AUUGGGAAGCUGUCCAUIUG	4459	CAAUGGACAGCUUCCCAAU	4460
UUGGGAAGCUGUCCAUIUGA	4461	UCAAUGGACAGCUUCCCAA	4462
UGGGAAGCUGUCCAUIUGAA	4463	UCAAUGGACAGCUUCCCAA	4464

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AAAAGGCCUUGGAUUUAUC	4465	GAUAAAUCCAAGGCCUUUU	4466
AAAGGCCUUGGAUUUAUCC	4467	GGAUAAAUCCAAGGCCUUU	4468
AAGGCCUUGGAUUUAUCCC	4469	GGGAUAAAUCCAAGGCCUU	4470
CCUUGGAUUUAUCCUGUA	4471	UACAGGGAUAAAUCCAAGG	4472
CUUGGAUUUAUCCUGUAC	4473	GUACAGGGAUAAAUCCAAG	4474
UUGGAUUUAUCCUGUACU	4475	AGUACAGGGAUAAAUCCA	4476
UGGAUUUAUCCUGUACUU	4477	AAGUACAGGGAUAAAUCCA	4478
GGAUUUUAUCCUGUACUUG	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	UCAGCUCAUUAACCUUG	4492
CUGAUUCCUAUGUAUAAGU	4493	ACUUAUACAUAGGAAUCAG	4494
CCUAUGUAUAAGUUAUUGG	4495	CCAUUAACUUAUACAUAGG	4496
AACUCAAUUCAAGGCCUUC	4497	GAAGGCCUUGAAUUGAGUU	4498
ACUCAAUUCAAGGCCUUCC	4499	GGAAGGCCUUGAAUUGAGU	4500
CUCAAUUCAAGGCCUUCCU	4501	AGGAAGGCCUUGAAUUGAG	4502
UCAAUUCAAGGCCUUCCUC	4503	GAGGAAGGCCUUGAAUUGA	4504
UUCAAGGCCUUCCUCAUCA	4505	UGAUGAGGAAGGCCUUGAA	4506
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CCUCAUCAGGCUGCUAAGG	4509	CCUUAGCAGCCUGAUGAGG	4510
UCAGGCUGCUAAGGGACCU	4511	AGGUCCCUUAGCAGCCUGA	4512
CAGGCUGCUAAGGGACCUC	4513	GAGGUCCCUUAGCAGCCUG	4514
AGGCUGCUAAGGGACCUCA	4515	UGAGGUCCCUUAGCAGCCU	4516
GGCUGCUAAGGGACCUCU	4517	AUGAGGUCCCUUAGCAGCC	4518
GCUGCUAAGGGACCUCUUA	4519	AAUGAGGUCCCUUAGCAGC	4520
CUGCUAAGGGACCUCUUG	4521	CAAUGAGGUCCCUUAGCAG	4522
UGCUAAGGGACCUCUUGA	4523	UCAAUGAGGUCCCUUAGCA	4524
GCUAAGGGACCUCUUGAU	4525	AUCAUAGAGGUCCCUUAGC	4526

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CUAAGGGACCUCAUUGAUA	4527	UAUCAUAGAGGUCCCUAG	4528
AAGGGACCUCAUUGAUAAG	4529	CUUAUCAUAGAGGUCCCUU	4530
AGGGACCUCAUUGAUAAGC	4531	GCUUAUCAUAGAGGUCCCU	4532
GGGACCUCAUUGAUAAGCA	4533	UGCUUAUCAUAGAGGUCCC	4534
GGACCUCAUUGAUAAGCAG	4535	CUGCUUAUCAUAGAGGUCC	4536
GACCUCAUUGAUAAGCAGA	4537	UCUGCUUAUCAUAGAGGUC	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

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GCAGAAGGCUAUUUCAGAA	4589	UUCUGAAAUAGCCUUCUGC	4590
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CUGUCGACGUGACCUUGGC	4593	GCCAAGGUCACGUCGACAG	4594
UGUCGACGUGACCUUGGCA	4595	UGCCAAGGUCACGUCGACA	4596
GUCGACGUGACCUUGGCAG	4597	CUGCCAAGGUCACGUCGAC	4598
UCGACGUGACCUUGGCAGU	4599	ACUGCCAAGGUCACGUCGA	4600
UGACCUUGGCAGUGUUUUGC	4601	GCAAACACUGCCAAGGUCA	4602
CCUUGGCAGUGUUUUGCUGU	4603	ACAGCAAACACUGCCAAGG	4604
UUGGCAGUGUUUUGCUGUGG	4605	CCACAGCAAACACUGCCAA	4606
UGGCAGUGUUUUGCUGUGGG	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
AGUUUUUCUUUGUCCAGUAC	4621	GUACUGGACAAAGAAAACU	4622
GUUUUCUUUGUCCAGUACU	4623	AGUACUGGACAAAGAAAAC	4624
UUUUUCUUUGUCCAGUACUG	4625	CAGUACUGGACAAAGAAAA	4626
UUUCUUUGUCCAGUACUGA	4627	UCAGUACUGGACAAAGAAA	4628
UUCUUUGUCCAGUACUGAG	4629	CUCAGUACUGGACAAAGAA	4630
AAAAGCUUCAUUGGCUACU	4631	AGUAGCCAUUGAAGCUUUU	4632
AAAGCUUCAUUGGCUACUA	4633	UAGUAGCCAUUGAAGCUUU	4634
CUUCAUUGGCUACUAGAUG	4635	CAUCUAGUAGCCAUUGAAG	4636
UUCAUUGGCUACUAGAUGA	4637	UCAUCUAGUAGCCAUUGAA	4638
UCAUUGGCUACUAGAUGAA	4639	UUCAUCUAGUAGCCAUUGA	4640
CAAAUUCUUACACUCAUUG	4641	CAAUGAGUGUAAGAAUUUG	4642
AAAUUCUUACACUCAUUGG	4643	CCAAUGAGUGUAAGAAUUU	4644
AAUUCUUACACUCAUUGGC	4645	GCCAAUGAGUGUAAGAAUU	4646
AUUCUUACACUCAUUGGCA	4647	UGCCAAUGAGUGUAAGAAU	4648
UUCUUACACUCAUUGGCAG	4649	CUGCCAAUGAGUGUAAGAA	4650

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UCUACACUCAUUGGCAGG	4651	CCUGCCAAUGAGUGUAAGA	4652
CUUACACUCAUUGGCAGGA	4653	UCCUGCCAAUGAGUGUAAG	4654
UUACACUCAUUGGCAGGAA	4655	UUCUGCCAAUGAGUGUAA	4656
UGGCCUGGCAUUUCUGAG	4657	CUCAGAAAUUGCCAGGCCA	4658
GGCCUGGCAUUUCUGAGG	4659	CCUCAGAAAUUGCCAGGCC	4660
GCCUGGCAUUUCUGAGGA	4661	UCCUCAGAAAUUGCCAGGC	4662
ACUUGGCUCAUCUCCAUA	4663	UAUGGAAGAUAGCCAAGU	4664
CUUGGCUCAUCUCCAUAAG	4665	CUAUGGAAGAUAGCCAAG	4666
GCUCAUCUCCAUAAGCCCA	4667	UGGGCUAUGGAAGAUAGC	4668
CUCAUCUCCAUAAGCCAC	4669	GUGGGCUAUGGAAGAUAG	4670
CAUAGCCCACAUGGUAAUG	4671	CAUUACCAUGUGGGCUAUG	4672
AUAGCCCACAUGGUAAUGG	4673	CCAUUACCAUGUGGGCUAU	4674
CCACAUGGUAAUGGGUACA	4675	UGUACCAUUAACCAUGUGG	4676
ACACGGCUUGAAGAGGUAA	4677	UUACCUCUUAAGCCGUGU	4678
CACGGCUUGAAGAGGUAAA	4679	UUUACCUCUUAAGCCGUG	4680
ACGGCUUGAAGAGGUAAAA	4681	UUUUACCUCUUAAGCCGU	4682
CGGCUUGAAGAGGUAAAAG	4683	CUUUUACCUCUUAAGCCG	4684
GGCUUGAAGAGGUAAAAGG	4685	CCUUUUACCUCUUAAGCC	4686
GCUUGAAGAGGUAAAAGGA	4687	UCCUUUUACCUCUUAAGC	4688
GAAGAGGUAAAAGGAUUCU	4689	AGAAUCCUUUUACCUCUUC	4690
AGAGGUAAAAGGAUUCUUC	4691	GAAGAAUCCUUUUACCUCU	4692
GUAAAAGGAUUCUUCAGCU	4693	AGCUGAAGAAUCCUUUAC	4694
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AAAGGAUUCUUCAGCUCUU	4699	AAGAGCUGAAGAAUCCUUU	4700
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AGGAUUCUUCAGCUCUUUG	4703	CAAAGAGCUGAAGAAUCCU	4704
GGAUUCUUCAGCUCUUUGA	4705	UCAAAGAGCUGAAGAAUCC	4706
AAAUGGUUCUCAGCUCCG	4707	CGGAGCUGAGAACCAUUUU	4708
AAAUGGUUCUCAGCUCCGU	4709	ACGGAGCUGAGAACCAUUU	4710
GGUUCUCAGCUCCGUUGUG	4711	CACAACGGAGCUGAGAACC	4712

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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
GAUAAAUCAGAGUGUGGC	4733	GCCACACUCUGAUUUUAUC	4734
UAAAUCAGAGUGUGGCUG	4735	CAGCCACACUCUGAUUUUA	4736
AAAUCAGAGUGUGGCUGC	4737	GCAGCCACACUCUGAUUUU	4738
AAUCAGAGUGUGGCUGCA	4739	UGCAGCCACACUCUGAUUU	4740
AAUCAGAGUGUGGCUGCAA	4741	UUGCAGCCACACUCUGAUU	4742
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CAGAGUGUGGCUGCAAAGU	4745	ACUUUGCAGCCACACUCUG	4746
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GAGUGUGGCUGCAAAGUGA	4749	UCACUUUGCAGCCACACUC	4750
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ACAUGAUCCUGAAGCUGAC	4753	GUCAGCUUCAGGAUCAUGU	4754
CAUGAUCCUGAAGCUGACG	4755	CGUCAGCUUCAGGAUCAUG	4756
AUGAUCCUGAAGCUGACGC	4757	GCGUCAGCUUCAGGAUCAU	4758
UGAUCCUGAAGCUGACGCA	4759	UGCGUCAGCUUCAGGAUCA	4760
GAUCCUGAAGCUGACGCAA	4761	UUGCGUCAGCUUCAGGAUC	4762
AUCCUGAAGCUGACGCAAC	4763	GUUGCGUCAGCUUCAGGAU	4764
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CACUAAUAUGCUUUGAUG	4767	CAUCAAAAGCAUAAUUAGUG	4768
ACUAAUAUGCUUUGAUGC	4769	GCAUCAAAAGCAUAAUUAGU	4770
CUAAUAUGCUUUGAUGCU	4771	AGCAUCAAAAGCAUAAUUAG	4772
AAUAUGCUUUGAUGCUAC	4773	GUAGCAUCAAAAGCAUAAUU	4774

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AAUAUGCUUUGAUGCUACA	4775	UGUAGCAUCAAGCAUAUU	4776
CUUCGCUAAAGUUACUUCA	4777	UGAAGUAACUUUAGCGAAG	4778
UUCGCUAAAGUUACUUCAU	4779	AUGAAGUAACUUUAGCGAA	4780
UCGCUAAAGUUACUUCAUC	4781	GAUGAAGUAACUUUAGCGA	4782
CGCUAAAGUUACUUCAUCU	4783	AGAUGAAGUAACUUUAGCG	4784
UACUUAUCUCCAUCUAGC	4785	GCUAGAUGGAGAUGAAGUA	4786
ACUUAUCUCCAUCUAGCA	4787	UGCUAGAUGGAGAUGAAGU	4788
CUUAUCUCCAUCUAGCAA	4789	UUGCUAGAUGGAGAUGAAG	4790
UUAUCUCCAUCUAGCAAA	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
CUGUUCUCAACCAAGGAG	4805	CUCCUUUGGUUGAGAACAG	4806
CCUUUAUAAUUUGAUGUG	4807	CACAUCAAAUUAUAAAGGG	4808
CCUUUAUAAUUUGAUGUGC	4809	GCACAUCAAAUUAUAAAGG	4810
AUAAUUUGAUGUGCUGUGG	4811	CCACAGCACAUCAAAUUAU	4812
UUUGAUGUGCUGUGGUCUC	4813	GAGACCACAGCACAUCAA	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
UAAUUUGGUAAUUGCACAGG	4829	CCUGUGCAAUACCAAAUUA	4830
AAUUUGGUAAUUGCACAGGU	4831	ACCUUGCAAUACCAAAUU	4832
AUUUGGUAAUUGCACAGGUG	4833	CACCUUGCAAUACCAAAU	4834
UUUGGUAAUUGCACAGGUGA	4835	UCACCUUGCAAUACCAAA	4836

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UUGGUAUUGCACAGGUGAU	4837	AUCACCUGUGCAAUACCA	4838
UGGUAUUGCACAGGUGAUU	4839	AAUACCUGUGCAAUACCA	4840
GGUAUUGCACAGGUGAUUA	4841	UAAUACCUGUGCAAUACC	4842
GUUUUGCACAGGUGAUUAG	4843	CUAAUACCUGUGCAAUAC	4844
UAUUGCACAGGUGAUUAGU	4845	ACUAAUACCUGUGCAAUA	4846
AUUGCACAGGUGAUUAGUC	4847	GACUAAUACCUGUGCAAU	4848
UUGCACAGGUGAUUAGUCA	4849	UGACUAAUACCUGUGCAA	4850
UGCACAGGUGAUUAGUCAA	4851	UUGACUAAUACCUGUGCA	4852
GCACAGGUGAUUAGUCAAG	4853	CUUGACUAAUACCUGUGC	4854
CACAGGUGAUUAGUCAAGG	4855	CCUUGACUAAUACCUGUG	4856
ACAGGUGAUUAGUCAAGGA	4857	UCCUUGACUAAUACCUGU	4858
CAGGUGAUUAGUCAAGGAA	4859	UUCUUGACUAAUACCUG	4860
AGGUGAUUAGUCAAGGAAG	4861	CUUCCUUGACUAAUACCU	4862
GGUGAUUAGUCAAGGAAGU	4863	ACUCCUUGACUAAUACC	4864
GUGAUUAGUCAAGGAAGUC	4865	GACUCCUUGACUAAUAC	4866
UGAUUAGUCAAGGAAGUCU	4867	AGACUCCUUGACUAAUCA	4868
GAUUAGUCAAGGAAGUCUG	4869	CAGACUCCUUGACUAAUC	4870
UUAGUCAAGGAAGUCUGGA	4871	UCCAGACUCCUUGACUAA	4872
UAGUCAAGGAAGUCUGGAA	4873	UUCAGACUCCUUGACUA	4874
CCCACAGCCUUGCCUCACA	4875	UGUGAGGCAAGGCUGUGG	4876
CCACAGCCUUGCCUCACAG	4877	CUGUGAGGCAAGGCUGUG	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
GCCUCACAGCAUGUAAUA	4897	UAUUUACAUGCUGUGAGGC	4898

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CCUCACAGCAUGUAAAUAA	4899	UUUUUUACAUGCUGUGAGG	4900
CAAUUUUGAUGCUGAGGUU	4901	AACCUCAGCAUCAAUUUG	4902
AAUUAUGAUGCUGAGGUUC	4903	GAACCUCAGCAUCAAUUU	4904
AUAUUGAUGCUGAGGUUCU	4905	AGAACCUCAGCAUCAAUU	4906
UAUUGAUGCUGAGGUUCUU	4907	AAGAACCUCAGCAUCAUA	4908
AUUGAUGCUGAGGUUCUUC	4909	GAAGAACCUCAGCAUCAU	4910
UUGAUGCUGAGGUUCUUCU	4911	AGAAGAACCUCAGCAUCA	4912
UGAUGCUGAGGUUCUUCUA	4913	UAGAAGAACCUCAGCAUCA	4914
GAGGUUCUUCUACUGCUAG	4915	CUAGCAGUAGAAGAACCUC	4916
AGGUUCUUCUACUGCUAGU	4917	ACUAGCAGUAGAAGAACCU	4918
UUUUACUGGUGUGAAUUGG	4919	CCAAUUCACACCAGUAAA	4920
UUUACUGGUGUGAAUUGGG	4921	CCCAAUUCACACCAGUAAA	4922
UUACUGGUGUGAAUUGGGA	4923	UCCCAAUUCACACCAGUAA	4924
UACUGGUGUGAAUUGGGAA	4925	UCCCAAUUCACACCAGUA	4926
CUGGUGUGAAUUGGGAAGA	4927	UCUCCCAAUUCACACCAG	4928
UGGUGUGAAUUGGGAAGAA	4929	UUCUCCCAAUUCACACCA	4930
UGCUAUCCAUGACGUUUG	4931	CAAACGUCAUGGAAUAGCA	4932
GCUAUCCAUGACGUUUGU	4933	ACAAACGUCAUGGAAUAGC	4934
CUAUCCAUGACGUUUGUA	4935	UACAAACGUCAUGGAAUAG	4936
UAUCCAUGACGUUUGUAA	4937	UUACAAACGUCAUGGAAUA	4938
AUCCAUGACGUUUGUAAA	4939	UUUACAAACGUCAUGGAAU	4940
UUCCAUGACGUUUGUAAAA	4941	UUUUACAAACGUCAUGGAA	4942
UCCAUGACGUUUGUAAAAU	4943	AUUUUACAAACGUCAUGGA	4944
CCAUGACGUUUGUAAAAUG	4945	CAUUUUACAAACGUCAUGG	4946
CAUGACGUUUGUAAAAUGU	4947	ACAUUUUACAAACGUCAUG	4948
CUUGAGGUUAAAUAAUGGG	4949	CCCAUUUUUAACCUCAAG	4950
UUGAGGUUAAAUAAUGGGU	4951	ACCAUUUUUAACCUCAA	4952
UGAGGUUAAAUAAUGGGUA	4953	UACCAUUUUUAACCUCA	4954
GAGGUUAAAUAAUGGGUAG	4955	CUACCAUUUUUAACCUCA	4956
AGGUUAAAUAAUGGGUAGU	4957	ACUACCAUUUUUAACCU	4958
GGUUAAAUAAUGGGUAGUA	4959	UACUACCAUUUUUAACC	4960

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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
AGGUGCCUGAUCUUCUCAA	4993	UUAGGAAGAUCAAGGACCU	4994
GGUGCCUGAUCUUCUCAAU	4995	AUUAGGAAGAUCAAGCAC	4996
GUGCCUGAUCUUCUCAAUA	4997	UAUUAGGAAGAUCAAGCAC	4998
UGCCUGAUCUUCUCAAUAA	4999	UUAUUAGGAAGAUCAAGCA	5000
GAUCUUCUAAUAAUUCUG	5001	CAGAAUUAUUAGGAAGAU	5002
AUCUUCUAAUAAUUCUGC	5003	GCAGAAUUAUUAGGAAGAU	5004
UCUUCUAAUAAUUCUGCC	5005	GGCAGAAUUAUUAGGAAGA	5006
CUUCCUAAUAAUUCUGCCU	5007	AGGCAGAAUUAUUAGGAAG	5008
UUCCUAAUAAUUCUGCCUA	5009	UAGGCAGAAUUAUUAGGAA	5010
UCCUAAUAAUUCUGCCUAU	5011	AUAGGCAGAAUUAUUAGGA	5012
UUCUGCCUAAUUUCAUUUG	5013	CAAAUGAAAAUAGGCAGAA	5014
UCUGCCUAAUUUCAUUUGC	5015	GCAAAUGAAAAUAGGCAGA	5016
GCCUAAUUUCAUUUGCUUU	5017	AAAGCAAAUGAAAAUAGGC	5018
AUUUUCUUCUAGUUGUGG	5019	CCACAACUAGAAAGAAAAU	5020
UUUUCUUCUAGUUGUGGC	5021	GCCACAACUAGAAAGAAAA	5022

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UUCUUUCUAGUUGUGGCUG	5023	CAGCCACAACUAGAAAGAA	5024
UCUCCCAAUAAGAUGUGC	5025	GCACAUUUUUUUGGGAGA	5026
CUCCCAAUAAGAUGUGCU	5027	AGCACAUCUUAUUUGGGAG	5028
AAGAUGUGCUGCUUACCGA	5029	UCGGUAAGCAGCACAUUU	5030
AGAUGUGCUGCUUACCGAG	5031	CUCGGUAAGCAGCACAUUU	5032
GAUGUGCUGCUUACCGAGG	5033	CCUCGGUAAGCAGCACAU	5034
AUGUGCUGCUUACCGAGGU	5035	ACCUCGGUAAGCAGCACAU	5036
UGUGCUGCUUACCGAGGUA	5037	UACCUCGGUAAGCAGCACA	5038
CUGCUUACCGAGGUUACAC	5039	GUGAUACCUCGGUAAGCAG	5040
UGCUUACCGAGGUUACACG	5041	CGUGAUACCUCGGUAAGCA	5042
GCUUACCGAGGUUACACGG	5043	CCGUGAUACCUCGGUAAGC	5044
CUUACCGAGGUUACACGGG	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	GAAGAUGCUGAAACUUGCUG	5062
CAAUGCCAUCACUUAACUA	5063	UAGUUAAGUGAUGGCAUUG	5064
AUGCCAUCACUUAACUAUA	5065	UAUAGUUAAGUGAUGGCAU	5066
UGCCAUCACUUAACUAUAA	5067	UUUAUAGUUAAGUGAUGGCA	5068
GCCAUCACUUAACUAUAAC	5069	GUUAUAGUUAAGUGAUGGC	5070
CCAUCACUUAACUAUAACU	5071	AGUUUAUAGUUAAGUGAUGG	5072
CAUCACUUAACUAUAACUC	5073	GAGUUUAUAGUUAAGUGAUG	5074
UCUCUUGACCAAAUAGACU	5075	AGUCUAUUUGGUCAAGAGA	5076
CUCUUGACCAAAUAGACUC	5077	GAGUCUAUUUGGUCAAGAG	5078
UCUUGACCAAAUAGACUCA	5079	UGAGUCUAUUUGGUCAAGA	5080
CUUGACCAAAUAGACUCAU	5081	AUGAGUCUAUUUGGUCAAG	5082
UUGACCAAAUAGACUCAUA	5083	UAUGAGUCUAUUUGGUCAA	5084

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GACCAAUAGACUCAUAAU	5085	AUUAUGAGUCUAAUUGGUC	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
UGAGUUAUGGUGCUGGCCUA	5119	UAGCCAGCACCAUAACUCA	5120
GAGUUAUGGUGCUGGCCUAU	5121	AUAGCCAGCACCAUAACUC	5122
AGUUAUGGUGCUGGCCUAUA	5123	UAUAGCCAGCACCAUAACU	5124
GUUAUGGUGCUGGCCUAUAU	5125	AUAUAGCCAGCACCAUAAC	5126
UUAUGGUGCUGGCCUAUAUU	5127	AAUAUAGCCAGCACCAUAA	5128
UAUGGUGCUGGCCUAUAUUU	5129	AAAUUAUAGCCAGCACCAUA	5130
AUGGUGCUGGCCUAUAUUUU	5131	AAAAUAUAGCCAGCACCAU	5132
UGGUGCUGGCCUAUAUUUUG	5133	CAAAUAUAGCCAGCACCA	5134
GGUGCUGGCCUAUAUUUUGC	5135	GCAAAUAUAGCCAGCACCC	5136
UGCCUCUCAAAGUUGCU	5137	AGCAACAUUUGAGAGGGCA	5138
GCCUCUCAAAGUUGCUA	5139	UAGCAACAUUUGAGAGGGC	5140
CCCUCUCAAAGUUGCUAG	5141	CUAGCAACAUUUGAGAGGG	5142
CCUCUCAAAGUUGCUAGG	5143	CCUAGCAACAUUUGAGAGG	5144
CUCUCAAAUGUUGCUAGGA	5145	UCCUAGCAACAUUUGAGAG	5146

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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
AUAAGCAUGCCUGUUUCC	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	AGUAAAUUCUGGCAAGCA	5196
GCUUGCCAGAAUUUGACUU	5197	AAGUAAAUUCUGGCAAGC	5198
CUUGCCAGAAUUUGACUUU	5199	AAAGUAAAUUCUGGCAAG	5200
UUGCCAGAAUUUGACUUUU	5201	AAAAGUAAAUUCUGGCAA	5202
GAUAUACUACUUAUUGCUUG	5203	CAAGCAAUAGUAGUAUAUC	5204
AUAUUGUGGUAUACGGUGU	5205	ACACCGUAUACCACAAUAU	5206
UAUUGUGGUAUACGGUGUC	5207	GACACCGUAUACCACAAUA	5208

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AUUGUGGUAUACGGUGUCA	5209	UGACACCGUAUACCACAAU	5210
UUGUGGUAUACGGUGUCAG	5211	CUGACACCGUAUACCACAA	5212
UGUGGUAUACGGUGUCAGG	5213	CCUGACACCGUAUACCACA	5214
GUGGUAUACGGUGUCAGGU	5215	ACCUGACACCGUAUACCAC	5216
UAUACGGUGUCAGGUUUA	5217	UGAAACCGUACACCGUAUA	5218
AUACGGUGUCAGGUUUCAG	5219	CUGAAACCGUACACCGUAU	5220
UACGGUGUCAGGUUUCAGG	5221	CCUGAAACCGUACACCGUA	5222
UGUCAGGUUUCAGGGUUUU	5223	AAAACCGUAAACCGUACA	5224
UUCAUUCAAUACUCCCU	5225	AGGGAGUAUUUGAAAUGAA	5226
CAUUUCAAUACUCCCUUU	5227	AAAGGGAGUAUUUGAAAUG	5228
UAGGUUAACUGUUGAUGA	5229	UCAUCAACAGUUAUACCUA	5230
AGGUUAACUGUUGAUGAA	5231	UUCAUCAACAGUUAUACCU	5232
UUAUUGUCCAUAUUUACCC	5233	GGGUUAAAAUGGACAAUAA	5234
UAUUGUCCAUAUUUACCCU	5235	AGGGUAAAAUGGACAAUA	5236
AUUGUCCAUAUUUACCCUG	5237	CAGGGUAAAAUGGACAAU	5238
UUGUCCAUAUUUACCCUGU	5239	ACAGGGUAAAAUGGACAA	5240
UGUCCAUAUUUACCCUGUA	5241	UACAGGGUAAAAUGGACA	5242
GUCCAUAUUUACCCUGUAA	5243	UUACAGGGUAAAAUGGAC	5244
UAUACCCUGUAAAGCCGUU	5245	AACGGCUUUACAGGGUAUA	5246
AUACCCUGUAAAGCCGUUU	5247	AAACGGCUUUACAGGGUAU	5248
UACCCUGUAAAGCCGUUUU	5249	AAAACGGCUUUACAGGGUA	5250
AGCCGUUUUAGAAUGUAAU	5251	AUUACAUUCUAAAACGGCU	5252
GCCGUUUUAGAAUGUAAUA	5253	UAUUACAUUCUAAAACGGC	5254
AGGUAAUCCAAAUGUACU	5255	AGUACAUUUUGGAUUACCU	5256
GGUAAUCCAAAUGUACUA	5257	UAGUACAUUUUGGAUUACC	5258
ACAUUUGUAUUUGUCUCUUC	5259	GAAGAGACAAUACAAAUGU	5260
CAUUUGUAUUUGUCUCUUCU	5261	AGAAGAGACAAUACAAAUG	5262
UUGUAUCGCAAAGCUAUAU	5263	AUAUAGCUUUGCGAUACAA	5264
UGUAUCGCAAAGCUAUUG	5265	CAUAUAGCUUUGCGAUACA	5266
GUAUCGCAAAGCUAUUGU	5267	ACAUUAGCUUUGCGAUAC	5268
UAUCGCAAAGCUAUUGUG	5269	CACAUUAGCUUUGCGAUA	5270

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AUCGCAAAGCUAU AUGUGC	5271	GCACAU AUAGCUUUUGCGAU	5272
UCGCAAAGCUAU AUGUGCA	5273	UGCACAU AUAGCUUUUGCGA	5274
UGAUCUAUGCUUUAGUUUU	5275	AAACUCAAAGCAUAGAUA	5276
GAUCUAUGCUUUAGUUUG	5277	CAAACUCAAAGCAUAGAU	5278
AUCUAUGCUUUAGUUUUGC	5279	GCAAACUCAAAGCAUAGAU	5280
UCUAUGCUUUAGUUUUGCU	5281	AGCAAACUCAAAGCAUAGA	5282
CUAUGCUUUAGUUUUGCUU	5283	AAGCAAACUCAAAGCAUAG	5284
UAUGCUUUAGUUUUGCUUU	5285	AAAGCAAACUCAAAGCAUA	5286
AUGCUUUAGUUUUGCUUUC	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

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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

- 5 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

- 10 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.

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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.

5

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 peroxidase (HRP) to bind to the tag, and examined using a calorimetric substrate (such as, for example, tetramethylbenzidine (TMB)) or a

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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,
5 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,
10 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
15 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
20 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,
25 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.
30 Modifications to the sugar moiety include, but are not limited to, natural modifications of

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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 C₁₋₁₀alkyl or C₂₋₁₀alkenyl, and C₂₋₁₀alkynyl.

- 5 Exemplary 2' sugar modifications also include, but are not limited to, -O[(CH₂)_nO]_mCH₃, -O(CH₂)_nOCH₃, -O(CH₂)_nNH₂, -O(CH₂)_nCH₃, -O(CH₂)_n-ONH₂, and -O(CH₂)_nON[(CH₂)_nCH₃]₂, where n and m, independently, are from 1 to about 10. Other modifications at the 2' position include, but are not limited to, C₁₋₁₀alkyl, substituted lower alkyl, alkaryl, aralkyl, O-alkaryl or O-aralkyl, SH, SCH₃, OCN, Cl, Br, CN, CF₃, OCF₃, SOCH₃, SO₂CH₃, ONO₂, NO₂, N₃, NH₂, 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,
- 15 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 CH₂ and S. Nucleotide sugar analogs can also have sugar mimetics, such as cyclobutyl moieties in place of the pentofuranosyl sugar.
- 20 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,
- 25 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

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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.

10 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.

25 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

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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/

5 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.

10 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
15 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
20 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
25 comprise a carrier and/or excipient. Examples of carriers include, but are not limited to, poly(lactic acid) (PLA) microspheres, poly(D,L-lactic-co-glycolic-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
30 increased risk for developing an MHC-I-opathy and/or an MHC-II-opathy. The methods

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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

5 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

10 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-

15 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.

20 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-

25 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

30 BSCR has a copy of at least any three of HLA-A*29, HLA-A*30, HLA-A*31, or HLA-A*33. In

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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.

10 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 of HLA-A*33. In some
15 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
20 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
25 embodiments, the subject

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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

5 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

10 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

15 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

20 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

25 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,

30 the HLA-B*51 inhibitor comprises a small molecule degrader or an inhibitory nucleic acid

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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
5 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.
10 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
15 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
20 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
25 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.

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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 proteolysis-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-

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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.

5 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
10 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
15 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
20 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 proteolysis-targeting chimera, an immunomodulatory drug, or an inhibitory nucleic acid
25 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

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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

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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
5 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
10 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
15 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
20 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
25 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.

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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

5 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,

10 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

15 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

20 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

25 (1989), using commercially available reagents, except where otherwise noted.

Examples

Example 1: Methods

Study subjects and samples

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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 $\geq 0.1\%$, 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

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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,

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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.

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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

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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).

10 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.

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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

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HLA p-value = 8.98×10^{-7} , compared with $p = 6.6 \times 10^{-74}$ 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 ($p < 5 \times 10^{-8}$). Other than the remnant signal at HLA-A, only the *ERAP1/ERAP2-LNPEP* locus on chromosome 5 showed an association with disease at $p < 1 \times 10^{-6}$ (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), $p = 6.6 \times 10^{-7}$), 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, $p = 6.7 \times 10^{-6}$), Hap10 (OR=1.78, Cases AF=0.28, controls AF=0.17, $p = 8.0 \times 10^{-3}$), 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), $p = 5.8 \times 10^{-3}$). 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), $p = 4.07 \times 10^{-10}$) and *ERAP2* (rs10044354, OR (95% CI) = 1.95 (1.55-2.44), $p = 6.2 \times 10^{-9}$) 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 ($R^2 = 0.18$, $D' = 0.79$).

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

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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 ($R^2=0.8$, $D'=1$). 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.

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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

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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

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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.

5 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
10 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.

15 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
20 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
25 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
30 peptide presentation below the threshold and thus reduces the risk of generating the

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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-
5 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
10 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
15 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.
20 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,
25 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,
30 A33. When examining the differences in sequence between these Aw19 alleles, two main

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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
5 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
10 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
15 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
20 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.

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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 Amino peptidase 2 (ERAP2) inhibitor.
- 5 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
10 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⁺.
- 15 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⁺.
- 20 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.
- 25 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.

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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.
- 5 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.
- 10 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
- 15 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.
- 20 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
- 25 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.

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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⁺.
- 5 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.
- 10 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
- 15 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.
- 20 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-
- 25 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
- 30 antibody.

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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
5 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.
- 10 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-
15 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
20 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
25 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.

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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⁺.
- 5 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.
- 10 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
15 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
20 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
25 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.

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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.

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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,
5 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⁺.
- 10 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
15 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
20 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.
- 25 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
30 inhibitor is an antibody.

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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.
- 5 102. 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.
- 10 104. 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.
- 15 107. 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
- 20 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-
- 25 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
- 30 antibody.

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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
5 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.
- 10 119. 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.
- 15 122. 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.
- 20 124. 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.
- 25 126. 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.

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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
5 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.

10 133. 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.

15 135. 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
20 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
25 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-

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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

5 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.

10 142. 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.

15 145. 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

20 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;

25 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.

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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:

5 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;

10 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;

15 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
20 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,
25 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⁺.

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

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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
5 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.
- 10 159. 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
15 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
20 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
25 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
30 that hybridizes to an HLA-B*27 or an HLA-B*40.

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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.
- 5 170. 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
- 10 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
- 15 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.
- 20 177. 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
- 25 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
- 30 that hybridizes to an HLA-C*06.

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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.

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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

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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
5 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
10 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.

15 211. 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
20 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

25 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
30 an ERAP1 inhibitor to the subject having an increased risk of developing the MHC-I-opathy.

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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.