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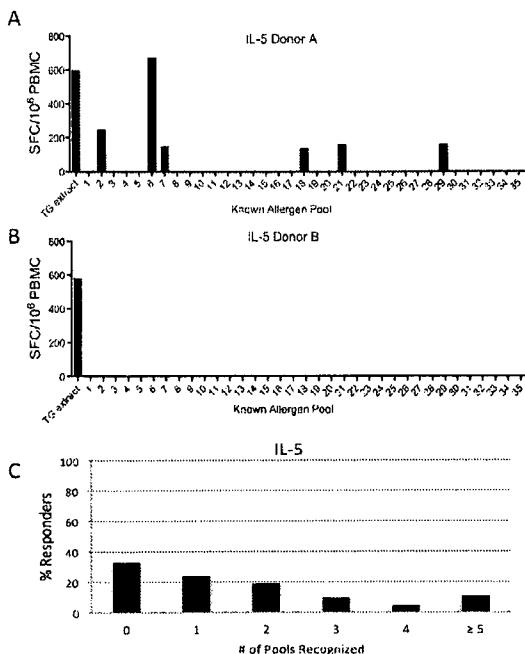
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[Continued on next page]

(54) Title: TIMOTHY GRASS ALLERGENS AND METHODS AND USES FOR IMMUNE RESPONSE MODULATION



(57) Abstract: The invention relates to Timothy Grass proteins and peptides, subsequences, portions, homologues, variants and derivatives thereof, and methods and uses of Timothy Grass proteins and peptides. Methods include, for example, modulating an immune response; protecting a subject against or treating a subject for an allergic response, allergic disorder or allergic disease; and inducing immunological tolerance to the allergen in a subject.



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**TIMOTHY GRASS ALLERGENS AND METHODS AND USES FOR IMMUNE RESPONSE MODULATION**

**RELATED APPLICATION INFORMATION**

**[0001]** This application claims priority to application serial no. 61/596,156, filed February 7, 2012, and application serial no. 61/734,886, filed December 7, 2012, both of which applications are expressly incorporated herein by reference in their entirety.

**GOVERNMENT SUPPORT**

**[0002]** This invention received government support from the National Institutes Health contract NIH-NIAIDHHSN272200700048C. The government has certain rights in the invention.

**SEQUENCE LISTING**

**[0003]** The instant application contains a Sequence Listing which has been submitted in ASCII format via EFS-Web and is hereby incorporated by reference in its entirety. Said ASCII copy, created on February 6, 2013, is named 051501-0420334\_SL.txt and is 1,444,840 bytes in size.

**FIELD OF THE INVENTION**

**[0004]** The invention relates to Timothy Grass (TG) proteins and peptides, subsequences, portions, homologues, variants and derivatives thereof, and methods and uses of such proteins and peptides, including methods of modulating an immune response, protecting a subject against or treating a subject for an allergic response, allergic disorder or allergic disease and inducing immunological tolerance to the allergen in a subject.

**INTRODUCTION**

**[0005]** Allergic diseases such as rhinitis and asthma pose a significant burden to both patients and society as a whole (1). Recent studies have estimated that up to 20% of the population in the US and Western Europe suffers from these diseases, (2, 3). Despite this high incidence, existing therapy is mostly symptomatic, and immunotherapy treatments are successful in only a fraction of patients and can be associated with significant safety concerns (4). Consequently, much effort in allergy research has been devoted to the development of safer and more effective immunological treatments.

**[0006]** T cells play an important role in the pathogenesis of allergic diseases. However, the proteins considered as potential immunogens of allergenic T cell responses have traditionally been limited to those that induce IgE responses. Allergic respiratory diseases are associated with high levels of IgE antibodies to certain allergenic proteins

and elevated levels of eosinophils that infiltrate the target tissue (5). Production of Th2 cytokines (IL-4, IL-5 and IL-13;(6)) regulates these events as they are critical for the switch to IgE production by differentiating B cells and promote the influx of eosinophils and other inflammatory cells that contribute to airway pathology.

**[0007]** Despite the importance of Th2 cells and their associated cytokines in the pathogenesis of allergic respiratory disease, studies of antigens considered as triggers of T cell responses have so far been mostly limited to those known to bind IgE antibodies (7, 8) and induce IgE-mediated immediate hypersensitivity reactions (9). Timothy grass (TG) pollen is an inhaled allergen for which major IgE-reactive allergens have been shown to trigger Th2 responses. As disclosed herein, surprisingly Timothy Grass proteins have been discovered that are recognized by Th2 responses independent of IgE-reactivity, including IgG reactive proteins.

#### SUMMARY

**[0008]** Disclosed herein are novel Timothy Grass (TG) proteins and peptides, as well as methods and uses of such novel Timothy Grass proteins and peptides. Timothy Grass proteins and peptides described include antigens and allergens. Also disclosed herein are Timothy Grass proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof, and methods and uses of such Timothy Grass proteins and peptides.

**[0009]** In accordance with the invention, there are provided proteins and peptides including, consisting of or consisting essentially of an amino acid sequence of a Timothy Grass protein or a subsequence, portion, homologue, variant or derivative thereof. In certain embodiments a Timothy Grass protein comprises, consists of or consists essentially of an amino acid sequence of a protein or peptide set out in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance) Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof. In other embodiments a Timothy Grass protein or peptide does not consist of the sequence set forth in Table 1 as SEQ ID NOS:204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 282, 283, 284, 285, 286, 287, 289, 290, 291, 292, 293, 294, 295, 296, 489, 490 or 491; and/or does not consist of the sequence set forth in Table 4 as SEQ ID NOS:1517, 1542, 1598, 1679, 1761, 1849, 1850, 1851, 1935, 2040, 2116, 2133 or 2134.

**[0010]** In certain embodiments, a protein or peptide elicits, stimulates, induces, promotes, increases or enhances an anti-allergen immune response. In other certain embodiments, a protein or peptide decreases, reduces, inhibits, suppresses or disrupts an anti-allergen immune response. In particular aspects of the proteins and peptides

described herein, an anti-allergen immune response is an anti-Timothy Grass allergen response. In further certain embodiments, a protein or peptide elicits, stimulates, induces, promotes, increases or enhances immunological tolerance (desensitizes) to an allergen, for example, a Timothy Grass allergen such as an amino acid sequence set forth Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof. In certain aspects, an anti-allergen response or immunological tolerance comprises a T cell response, for example a Th2 cell response (e.g., memory T cell response). In particular embodiments a protein or peptide is an IgG antigen.

**[0011]** In different embodiments, a protein or peptide includes, consists of or consists essentially of an amino acid sequence of a protein or peptide with open reading frame identification M.693, M.692, M.125, M.714, M.721, M.705, M.591, M.418, M.689, M.644, M.414, M.624, M.617, M.704, M.331, M.604, M.291, M.151, M.498, M.561, M.399, M.603, M.226, M.636, M.473, M.437, M.634, M.676, M.422, M.431, M.387, M.722, M.610, M.574, M.531, M.305, M.282, M.271, M.159, M.83, M.348, M.285, M.288, M.287, M.212, M.715, M.725, M.694, M.701, M.595, M.718, M.720, M.723, M.648, M.662, M.576, M.618, M.631, M.682, M.421, M.654, M.393, M.669, M.625, M.655, M.524, M.570, M.341, M.342, M.450, M.343, M.639, M.555, M.546, M.606, M.628, M.248, M.466, M.328, M.695, M.658, M.560, M.548, M.269, M.728, M.653, M.759, M.765, M.747, M.763, M.733, M.651, M.677, M.597, M.547, M.761, M.571, M.562, M.657, M.738, M.734, M.621, M.741, M.177, M.579, M.513, M.446, M.388, M.391, M.593, M.506, M.395, M.381, M.372, M.619, M.656, M.525, M.698, M.699, M.439, M.630, M.708, M.620, M.758, M.764, M.746, M.762, M.716, M.726, M.66, M.717, M.727, M.719, M.724, M.577, M.8, M.235, M.678, M.675, M.641, M.499, M.583, M.649, M.6, M.29, M.34, M.183, M.101, M.149, M.164, M.129, M.45, M.116, M.165, M.146, M.69, M.123, M.107, M.3, M.113, M.204, M.174, M.178, M.191, M.580, M.587, M.594, M.539, M.569, M.588, M.615, M.578, M.352, M.514, M.419, M.443, M.540, M.640, M.642, M.646, M.627, M.626, M.645, M.652, M.650, M.559, M.622, M.565, M.567, M.581, M.609, M.182, M.134, M.283, M.297, M.367, M.84, M.189, M.586, M.496, M.255, M.471, M.575, M.163, M.314, M.194, M.294, M.472, M.369, M.104, M.206, M.24, M.469, M.420, M.444, M.697, M.687, M.713, M.638, M.673, M.700, M.702, M.707, M.710, M.683, M.670, M.643, M.663, M.664, M.666, M.748, M.731, M.735, M.750, M.752, M.756, M.754, M.608, M.740, M.39, M.303, M.389,

M.390, M.284, M.201, M.28, M.364, M.344, M.74, M.180, M.317, M.298, M.192, M.77, M.92, M.144, M.9, M.296, M.187, M.172, M.72, M.38, M.239, M.289, M.240, M.214, M.365, M.614, M.598, M.632, M.633, M.616, M.690, M.607, M.672, M.545, M.671, M.272, M.301, M.202, M.492, M.647, M.457, M.686, M.495, M.486, M.729, M.760, M.668, M.599, M.417, M.635, M.584, M.592, M.709, M.489, M.392, M.347, M.458, M.464, M.415, M.520, M.410, M.467, M.494, M.374, M.118, M.346, M.318, M.519, M.600, M.254, M.438, M.479, M.523, M.380, M.480, M.371, M.482, M.261, M.108, M.260, M.556, M.461, M.400, M.474, M.490, M.491, M.401, M.470, M.409, M.435, M.553, M.537, M.402, M.481, M.483, M.554, M.538, M.234, M.237, M.264, M.563, M.566, M.532, M.557, M.573, M.549, M.550, M.551, M.558, M.463, M.684, M.739, M.637, M.517, M.712, M.732, M.711, M.730, M.736, M.737, M.247, M.13, M.57, M.61, M.47, M.43, M.32, M.518, M.267, M.73, M.270, M.150, M.366, M.679, M.680, M.230, M.530, M.667, M.505, M.488, M.445, M.436, M.508, M.688, M.613, M.487, M.552, M.572, M.336, M.534, M.213, M.384, M.220, M.147, M.127, M.145, M.33, M.110, M.173, M.50, M.249, M.18, M.5, M.25, M.394, M.329, M.330, M.345, M.323, M.316, M.130, M.131, M.203, M.227, M.128, M.70, M.292, M.526, M.585, M.681, M.685, M.596, M.660, M.674, M.703, M.504, M.515, M.521, M.493, M.497, M.509, M.533, M.484, M.302, M.478, M.222, M.691, M.510, M.119, M.535, M.543, M.528, M.529, M.373, M.590, M.361, M.432, M.477, M.408, M.568, M.589, M.462, M.516, M.522, M.412, M.4, M.256, M.56, M.55, M.64, M.22, M.148, M.205, M.332, M.171, ME.3566, ME.4276, ME.4056, ME.3805, ME.3720, ME.3916, ME.3855, ME.1412, ME.4234, ME.4088, ME.4115, ME.4210, ME.3897, ME.4229, ME.4231, ME.4280, ME.4281, ME.1571, ME.4190, ME.4230, ME.3882, MN.82, MN.124, MN.169, MN.185, MN.140, MN.201, MN.193, MN.183, MN.184, MN.173, MN.210, MN.206, MN.136, MN.94, MN.83, MN.14, MN.3, MN.46, MN.17, MN.20, MN.12, MN.35, MN.15, MN.38, MN.74, MN.41, MN.67, MN.27, MN.75, MN.47, MN.33, MN.86, MN.59, MN.8, MN.51, MN.62, MN.56, MN.30, MN.81, MN.91, MN.36, MN.71, MN.80, MN.76, MN.96, MN.106, MN.90, MN.57, MN.25, MN.108, MN.186, MN.58, MN.6, MN.77, MN.107, MN.203, MN.204, MN.211, MN.205, MN.68, MN.98, MN.93, MN.113, MN.123, MN.69, MN.178, MN.182, MN.4, MN.166, MN.167, MN.172, MN.168, MN.105, MN.39, MN.194, MN.195, MN.101, MN.116, MN.181, MN.97, MN.54, MN.156, MN.117, MN.163, MN.175, MN.102, MN.202, MN.157, MN.119, MN.114, MN.92, MN.88, MN.153, MN.95, MN.128, MN.122, MN.118, MN.99, MN.72, MN.214, MN.219, MN.220, MN.199, MN.224, MN.218, MN.215, MN.207, MN.223, MN.221, MN.222, MN.216, MN.162, MN.142, MN.158, MN.141, MN.53, MN.111, MN.112, MN.120, MN.130,

MN.132, MN.127, MN.121, MN.139, MN.146, MN.64, MN.87, MN.89, MN.37 or MN.164, or subsequence, portion, homologue, variant or derivative thereof.

**[0012]** As disclosed herein, in certain embodiments proteins and peptides have a length in a range of about 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 45-50, 50-60, 60-70, 70-80, 90-100, 100-125, 125-150, 150-175, 175-200, 200-250, 250-300, or more amino acid residues. In other embodiments, proteins and peptides have a length in a range of up to 25 amino acids in length, or from about 7 to 20; 8 to 30; 8 to 25; 8 to 20; 9 to 30; 9 to 25; 9 to 20; 10 to 30; 10 to 25; 10 to 30 amino acid residues.

**[0013]** Proteins and peptides include isolated and purified forms. Proteins and peptides also include those immobilized on a substrate, as well as amino acid sequences, subsequences, portions, homologues, variants, and derivatives immobilized on a substrate.

**[0014]** Proteins and peptides can be included in compositions, for example, a pharmaceutical composition. In particular embodiments, a pharmaceutical composition is suitable for specific or non-specific immunotherapy, or is a vaccine composition.

**[0015]** Isolated nucleic acid (including isolated nucleic acid) encoding a protein or peptide (TG protein or peptide), or a subsequence, portion, homologue, variant or derivative thereof are provided. In one embodiment, a nucleic acid encodes an amino acid sequence of a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof.

**[0016]** Also provided are cells expressing a protein or peptide described herein. In various embodiments, a cell expresses a Timothy Grass protein that includes, consists of or consists essentially of an amino acid sequence of a protein or peptide set out in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance) Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof. In certain aspects, a cell is a eukaryotic or prokaryotic cell and may be a mammalian, insect, fungal or bacterium cell.

**[0017]** Methods and uses and medicaments of proteins and peptides of the invention are included. In various embodiments, there are provided methods and uses of modulating an immune response against an allergen in a subject. In one embodiment, a method or use includes administering (delivering) an allergen to a subject an amount of

the protein described herein sufficient to modulate the immune response against the allergen in the subject.

**[0018]** Such methods, uses and medicaments also include modulating immune activity of a cell against an allergen; and desensitizing, inducing, eliciting, increasing or improving in the cell immunological tolerance to an allergen. In particular embodiments, a method or use includes contacting a cell with an amount of the protein or peptide of any one of the above-mentioned embodiments, sufficient to modulate the immune activity of the cell against the allergen (e.g., against an allergen from which the peptide or protein derives), or administering to a subject an allergen from which the peptide or protein derives in order to desensitize, induce, elicit, increase or improve immunological tolerance to the allergen or to modulate an immune response against an allergen in a subject (e.g., an allergen from which the peptide or protein derives).

**[0019]** Invention proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof are suitable as a reagent for example, for specific immunotherapy. In particular embodiments, a protein or peptide suitable as a reagent includes, consists of or consists essentially of an amino acid sequence of a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof.

**[0020]** Such methods, uses and medicaments further include reducing risk or providing a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease. In one embodiment, a method or use includes administering to the subject an amount of the protein or peptide sufficient to reduce risk or provide the subject with protection against the allergic reaction, allergic response, allergic disorder or allergic disease. Non-limiting examples of an allergic reaction or allergic response include allergic alveolitis, allergic bronchopulmonary aspergillosis, allergic conjunctivitis, allergic coryza, allergic dermatitis, allergic vasculitis, and allergic rhinitis.

**[0021]** Such methods, uses and medicaments additionally include treating an allergic reaction, allergic response, allergic disorder or allergic disease. In one embodiment, a method or use includes administering to the subject an amount of the protein or peptide, sufficient to treat the subject for the allergic response, allergic disorder or allergic disease.

**[0022]** In such methods, uses and medicaments, a peptide or protein can be derived from or based upon the allergen or can be derived from or based upon an allergen originating from the same organism as the allergen. More particularly, for example, a

protein or peptide can be derived from or based upon an allergen causing the allergic reaction, allergic response, allergic disorder or allergic disease or said peptide derives from an allergen belonging to the same organism as the allergen causing said allergic reaction, allergic response, allergic disorder or allergic disease. Additionally, for example, a protein or peptide can be based upon or derived from an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof.

**[0023]** In various embodiments, a method or use desensitizes or induces, elicits, increases or improves immunological tolerance of a subject to an allergen in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6. In various other embodiments, a method or use desensitizes or induces, elicits, increases or improves immunological tolerance of a subject to an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof.

**[0024]** As set forth herein a protein, peptide, method, use or medicament can include administration or delivery by any means, systemically, regionally or locally. In particular aspects, a protein or peptide is administered cutaneously, subcutaneously, epicutaneously, intracutaneously, intramuscularly, intravenously, orally, mucosally, by inhalation or nasally. As also set forth herein a protein, peptide, method, use or medicament can include repeatedly contacting a cell with, or administering to a subject, the protein or peptide, multiple times.

**[0025]** Proteins and peptides can be used in diagnostic and detection methods and uses. In one embodiment, detecting an allergic response, or diagnosing an allergy in a subject, a method or use includes contacting a cell from the subject (which may be an *ex vivo* or *in vivo* cell) with a protein or peptide as set forth herein; and determining if the protein or peptide modulates an immune response or activity from the contacted cell. If the protein or peptide modulates an immune response or activity from the contacted cell (which may be an *ex vivo* or *in vivo* cell) detects an allergic response or indicates that the subject has an allergic response or an allergy. In particular aspects, modulation of

immune response or activity is determined by assaying for a hypersensitive reaction or response, such as a cutaneous immunological hypersensitive reaction.

**[0026]** Subjects in accordance with invention include mammals, such as humans. In particular embodiments, a subject has exhibited a symptom of, or suffers from, an allergic reaction, allergic response, allergic disorder or allergic disease. In more particular embodiments, a subject has had an allergic reaction or allergic response to a Timothy Grass allergen or another Grass of the order Poales. In additional particular embodiments, a subject has had an allergic reaction or allergic response to an allergen derived from or produced by Timothy Grass, such as an allergen or an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof. In further particular embodiments, a subject has had an allergic reaction or allergic response to an allergen derived from or produced by Timothy Grass selected from Phl p 1, Phl p 5, Phl p6 or a homologous allergen or antigen thereto.

#### DESCRIPTION OF DRAWINGS

**[0027]** **Figure 1** shows that known allergens do not account for the total T cell response against whole pollen extract. 35 pools (average 20 peptides/pool) of overlapping peptides spanning the ten major TG allergens along with whole TG extract were screened for recognition by PBMCs from allergic donors using IL-5 ELISPOT assays. The majority of donors who had an IL-5 T cell response to TG extract of  $\geq 100$  SFC per million input PBMCs showed a response pattern similar to that shown in panel A, with several pools eliciting strong IL-5 responses. However, some donors showed a response pattern as depicted in panel B, where a vigorous response was detected against extract but no response was detected against peptides from known allergens. In total, as shown in panel C, 33% of donors reacted to none of the peptide pools despite strong extract responses (n=21).

**[0028]** **Figures 2A-2B** show a 2D gel electrophoresis and immunoblot analysis of TG extract using pooled sera from allergic donors. TG pollen extract was run on a 2D gel and stained with Coomassie brilliant blue (A). A second gel run in parallel was blotted and probed with a serum pool from 8 TG-allergic donors to identify proteins reactive with human IgE and IgG. Anti IgE- red, anti IgG- green, dual reactivity- yellow (B).

**[0029]** **Figures 3A-3B** show that a majority of TG specific T cells target novel antigens. A) Bar chart indicating the IL-5 response rate of PBMCs from allergic and non-allergic donors to peptide pools from known and novel antigens. Open bars indicate

response rates from allergic donors, solid bars indicate responses from normal donors (n=20 per donor group). B) Bar chart showing the total number of IL-5 producing T cells targeting novel antigens (light grey) vs. known allergens (dark grey) in normal and allergic patients.

[0030] **Figure 4** shows percentage recognition of novel Timothy grass antigens (NTGA) by TG allergic donors. Bar chart showing percentage of donors producing IL-5 in response to novel Timothy grass antigens (NTGA) –derived peptide stimulation. NTGAs are categorized according to antibody reactivity as indicated on the X-axis. The dashed line indicates the minimum threshold of  $\geq 20\%$  recognition to be considered an allergen.

[0031] **Figure 5** shows that memory T cells are the source of IL-5 T cell responses after *in vitro* expansion. IL-5 production in naïve and memory T cells in response to TG extract (TG), the dominant known (TG P20) and novel peptide pools (NTGA P19) were measured after 14 days of expansion following TG stimulation *in vitro* (n=6).

[0032] **Figures 6A-6B** show T cell responses against conventional and novel TG antigens can be detected directly *ex vivo*. **A)** FACS plot showing the Th2 T cell subset sorted based on expression of CXCR3 (Th1) and CCR4 (Th2). **B)** IL-5 production by Th2 cells from allergic donors in response to TG extract, the dominant known (TG P20) and novel (NTGA P19) peptide pools as measured *ex vivo* (n=8).

[0033] **Figure 7** shows production of IL-4, IL-5, IL-13 and all Th2 cytokines (IL-4, 5 and 13 combined) in response to TG extract, PHA, TG P20 and NTGA P19. TG stimulated cells were cultured *in vitro* with IL-2 for 14 days. Cells were re-stimulated with TG extract, the dominant known and novel TG peptide pools (TG P20 and NTGA P19) and PHA. Th2 cytokine production was measured by ELISPOT to determine the best read-out system.

[0034] **Figures 8A-8B** show deconvolution of positive peptide pools to identify T-cell reactive antigens and epitopes. IL-5 production from PBMC of allergic individuals in response to single peptides was measured. **A)** Number of recognition events (defined as one peptide recognized by at least one patient with a magnitude of  $\geq 20$  SFC) per antigen tested. **B)** Sum of the magnitudes of IL-5 responses against peptides from each positive antigen.

#### DETAILED DESCRIPTION

[0035] As disclosed herein, T cell responses against Timothy Grass (TG) allergen do not correlate with IgE levels and T cell responses in TG pollen allergic individuals. Furthermore, as also disclosed herein a third of the patients studied had no Th2 cell

response against any of the known IgE reactive proteins despite having strong responses against whole TG extract. The invention relates to in part to the discovery that TG pollen extract contains novel T cell antigens in addition to the known IgE-inducing allergens.

**[0036]** Thus, in accordance with the invention, there are provided novel Timothy grass proteins and novel Timothy grass peptides, and subsequences, portions, homologues, variants and derivatives thereof. A Timothy grass protein or peptide as described herein may include any Timothy grass protein or peptide, or a subsequence, portion, homologue, variant or derivative thereof. In certain embodiments, a Timothy grass protein or peptide as described herein may include a novel Timothy grass protein or peptide, or a subsequence, portion, homologue, variant or derivative thereof.

**[0037]** In particular embodiments, a Timothy grass protein or peptide described herein includes, consists or consists essentially of a protein or peptide having an open reading frame amino acid sequence set out in Table 1 (SEQ ID NOS:1-620, respectively, in order of appearance), or a subsequence, portion, homologue, variant or derivative thereof (e.g., of all or a part of an amino acid sequence in Table 1 (SEQ ID NOS:1-620, respectively, in order of appearance)). In other embodiments, a Timothy grass protein or peptide, includes, consists or consists essentially of an amino acid sequence of a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof (e.g., of all or a part of an amino acid sequence in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6. In certain embodiments, a Timothy grass protein, peptide, subsequence, portion, homologue, variant or derivative thereof, includes, consists of or consists essentially of an amino acid sequence of a protein or peptide with open reading frame identification M.693, M.692, M.125, M.714, M.721, M.705, M.591, M.418, M.689, M.644, M.414, M.624, M.617, M.704, M.331, M.604, M.291, M.151, M.498, M.561, M.399, M.603, M.226, M.636, M.473, M.437, M.634, M.676, M.422, M.431, M.387, M.722, M.610, M.574, M.531, M.305, M.282, M.271, M.159, M.83, M.348, M.285, M.288, M.287, M.212, M.715, M.725, M.694, M.701, M.595, M.718, M.720, M.723, M.648, M.662, M.576, M.618, M.631, M.682, M.421, M.654, M.393, M.669, M.625, M.655, M.524, M.570, M.341, M.342, M.450, M.343, M.639, M.555, M.546, M.606, M.628, M.248, M.466, M.328, M.695, M.658, M.560, M.548, M.269, M.728, M.653, M.759, M.765, M.747, M.763, M.733, M.651, M.677,

M.597, M.547, M.761, M.571, M.562, M.657, M.738, M.734, M.621, M.741, M.177, M.579, M.513, M.446, M.388, M.391, M.593, M.506, M.395, M.381, M.372, M.619, M.656, M.525, M.698, M.699, M.439, M.630, M.708, M.620, M.758, M.764, M.746, M.762, M.716, M.726, MN.66, M.717, M.727, M.719, M.724, M.577, M.8, M.235, M.678, M.675, M.641, M.499, M.583, M.649, M.6, M.29, M.34, M.183, M.101, M.149, M.164, M.129, M.45, M.116, M.165, M.146, M.69, M.123, M.107, M.3, M.113, M.204, M.174, M.178, M.191, M.580, M.587, M.594, M.539, M.569, M.588, M.615, M.578, M.352, M.514, M.419, M.443, M.540, M.640, M.642, M.646, M.627, M.626, M.645, M.652, M.650, M.559, M.622, M.565, M.567, M.581, M.609, M.182, M.134, M.283, M.297, M.367, M.84, M.189, M.586, M.496, M.255, M.471, M.575, M.163, M.314, M.194, M.294, M.472, M.369, M.104, M.206, M.24, M.469, M.420, M.444, M.697, M.687, M.713, M.638, M.673, M.700, M.702, M.707, M.710, M.683, M.670, M.643, M.663, M.664, M.666, M.748, M.731, M.735, M.750, M.752, M.756, M.754, M.608, M.740, M.39, M.303, M.389, M.390, M.284, M.201, M.28, M.364, M.344, M.74, M.180, M.317, M.298, M.192, M.77, M.92, M.144, M.9, M.296, M.187, M.172, M.72, M.38, M.239, M.289, M.240, M.214, M.365, M.614, M.598, M.632, M.633, M.616, M.690, M.607, M.672, M.545, M.671, M.272, M.301, M.202, M.492, M.647, M.457, M.686, M.495, M.486, M.729, M.760, M.668, M.599, M.417, M.635, M.584, M.592, M.709, M.489, M.392, M.347, M.458, M.464, M.415, M.520, M.410, M.467, M.494, M.374, M.118, M.346, M.318, M.519, M.600, M.254, M.438, M.479, M.523, M.380, M.480, M.371, M.482, M.261, M.108, M.260, M.556, M.461, M.400, M.474, M.490, M.491, M.401, M.470, M.409, M.435, M.553, M.537, M.402, M.481, M.483, M.554, M.538, M.234, M.237, M.264, M.563, M.566, M.532, M.557, M.573, M.549, M.550, M.551, M.558, M.463, M.684, M.739, M.637, M.517, M.712, M.732, M.711, M.730, M.736, M.737, M.247, M.13, M.57, M.61, M.47, M.43, M.32, M.518, M.267, M.73, M.270, M.150, M.366, M.679, M.680, M.230, M.530, M.667, M.505, M.488, M.445, M.436, M.508, M.688, M.613, M.487, M.552, M.572, M.336, M.534, M.213, M.384, M.220, M.147, M.127, M.145, M.33, M.110, M.173, M.50, M.249, M.18, M.5, M.25, M.394, M.329, M.330, M.345, M.323, M.316, M.130, M.131, M.203, M.227, M.128, M.70, M.292, M.526, M.585, M.681, M.685, M.596, M.660, M.674, M.703, M.504, M.515, M.521, M.493, M.497, M.509, M.533, M.484, M.302, M.478, M.222, M.691, M.510, M.119, M.535, M.543, M.528, M.529, M.373, M.590, M.361, M.432, M.477, M.408, M.568, M.589, M.462, M.516, M.522, M.412, M.4, M.256, M.56, M.55, M.64, M.22, M.148, M.205, M.332, M.171, ME.3566, ME.4276, ME.4056, ME.3805, ME.3720, ME.3916, ME.3855, ME.1412, ME.4234, ME.4088, ME.4115, ME.4210, ME.3897,

ME.4229, ME.4231, ME.4280, ME.4281, ME.1571, ME.4190, ME.4230, ME.3882, MN.82, MN.124, MN.169, MN.185, MN.140, MN.201, MN.193, MN.183, MN.184, MN.173, MN.210, MN.206, MN.136, MN.94, MN.83, MN.14, MN.3, MN.46, MN.17, MN.20, MN.12, MN.35, MN.15, MN.38, MN.74, MN.41, MN.67, MN.27, MN.75, MN.47, MN.33, MN.86, MN.59, MN.8, MN.51, MN.62, MN.56, MN.30, MN.81, MN.91, MN.36, MN.71, MN.80, MN.76, MN.96, MN.106, MN.90, MN.57, MN.25, MN.108, MN.186, MN.58, MN.6, MN.77, MN.107, MN.203, MN.204, MN.211, MN.205, MN.68, MN.98, MN.93, MN.113, MN.123, MN.69, MN.178, MN.182, MN.4, MN.166, MN.167, MN.172, MN.168, MN.105, MN.39, MN.194, MN.195, MN.101, MN.116, MN.181, MN.97, MN.54, MN.156, MN.117, MN.163, MN.175, MN.102, MN.202, MN.157, MN.119, MN.114, MN.92, MN.88, MN.153, MN.95, MN.128, MN.122, MN.118, MN.99, MN.72, MN.214, MN.219, MN.220, MN.199, MN.224, MN.218, MN.215, MN.207, MN.223, MN.221, MN.222, MN.216, MN.162, MN.142, MN.158, MN.141, MN.53, MN.111, MN.112, MN.120, MN.130, MN.132, MN.127, MN.121, MN.139, MN.146, MN.64, MN.87, MN.89, MN.37 or MN.164, or subsequence, portion, homologue, variant or derivative thereof. The foregoing and other TG proteins and peptides set forth herein may be used in the methods and uses, including methods and uses disclosed herein.

**[0038]** In particular embodiments, a protein or peptide includes, consists of or consists essentially of a Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), or a subsequence, portion, homologue, variant or derivative thereof. Said homologues may have at least 65%, 70, 75, 80, 85, 90 or 95% homology or identity to the corresponding Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Such subsequences may be 7 to 30 amino acids in length, and optionally further where at least 7 amino acids has at least 75%, or at least 80%, 85%, 90% identity or homology to at least 7 contiguous amino acids of the corresponding Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Moreover, a subsequence may be 7 to 25 amino acids in length, such as 7 to 20; 8 to 30; 8 to 25; 8 to 20; 9 to 30; 9 to 25; 9 to 20; 10 to 30; 10 to 25; 10 to 30 amino acids in length and wherein at least 8, such as at least 9, 10, 11, 12, 13, 14 or 15 amino acids of the subsequence has at least 75%, such as at least 80%, 85%, 90% identity or homology to at least 8, such as at least 9, 10, 11, 12, 13, 14 or 15 amino acids, respectively, contiguous amino acids of said corresponding Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In various aspects, a

protein or peptide does not consist of a sequence set forth in Table 1 as SEQ ID NOS:204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 282, 283, 284, 285, 286, 287, 289, 290, 291, 292, 293, 294, 295, 296, 489, 490 and/or 491.

**[0039]** In additional particular embodiments, a protein or peptide includes, consists of or consists essentially of an amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264), Table 6 or a variant or derivative thereof. A variant may be a longer peptide, for example, of up to 30 amino acids in length and which includes a corresponding amino acid sequence as set forth in Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. A variant may also include a peptide of 7 to 30 amino acids in length and which includes a subsequence of at least 7 amino acids having at least 75% identity or homology, such as at least 80 or 85% identity or homology, to at least 7 contiguous amino acids of the corresponding amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. A longer variant peptide may be up to 25 amino acids in length, such as up to 24, 23, 22, 21, 20, 19 or 19 amino acids in length. The variant may be a peptide of 7 to 25 amino acids in length, such as 7 to 20; 8 to 30; 8 to 25; 8 to 20; 9 to 30; 9 to 25; 9 to 20; 10 to 30; 10 to 25; 10 to 30 amino acids in length and wherein said subsequence is of at least 8, 9 or 10 amino acids having at least 75% (such as at least 80% or 85%) identity or homology to at least 8, 9 or 10 contiguous amino acids, respectively, of said corresponding amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In various aspects, a protein or peptide does not consist of sequences set forth in Table 4 as SEQ ID NOS:1517, 1542, 1598, 1679, 1761, 1849, 1850, 1851, 1935, 2040, 2116, 2133 and/or 2134.

**[0040]** As used herein, an “antigen” refers to a substance, including but not limited to a protein or peptide that elicits, induces, stimulates, promotes or enhances an immune response when administered to a subject. An immune response elicited by an antigen may include, but is not limited to, a B cell or a T cell response. An immune response can include a cellular response with a particular pattern of lymphokine/cytokine production (e.g., Th1, Th2), a humoral response (e.g., antibody production), or a combination thereof, to a particular antigen. For example, if a subject previously exposed to an allergen (i.e., is sensitized or is hypersensitive) comes into contact with the allergen again, allergic asthma may develop due to a Th2 response characterized by an increased production of type 2 cytokines (e.g., IL-4, IL-5, IL-9, and/or IL-13) secreted by CD4+ T lymphocytes.

**[0041]** As used herein an “epitope” refers to a region or part of an antigen that elicits an immune response when administered to a subject. In particular embodiments, an

epitope may be comprised of a region or part of a Timothy grass protein or peptide (e.g., of all or a part of an amino acid sequence in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6. In more particular embodiments, an epitope may be comprised of a region or part of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6. In particular aspects, an epitope is a T cell epitope, i.e., an epitope that elicits, stimulates, induces, promotes, increases or enhances a T cell activity, function or response .

**[0042]** An antigen, epitope, allergen, or composition thereof can modulate an undesired or abnormal inflammatory response. An antigen, epitope, allergen, or composition thereof as described herein may alter the Th2 response by, for example, shifting the immune response toward a Th1 phenotype that is less damaging. That is, an altered (or modulated) immune response can decrease, inhibit, suppress, or reduce sensitivity (desensitize) to an antigen, epitope, or allergen, or against inflammatory responses (e.g., allergy, asthma, rash, wheezing, coughing, eye irritation, etc.) caused by an antigen, epitope, or allergen (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6).

**[0043]** Accordingly, non-limiting examples of antigens, allergens are peptides and proteins having defined amino acid sequences and which comprise T cell epitopes, i.e., elicit, stimulate, induce, promote, increase or enhance a T cell response or activity. Antigens and allergens can be analyzed to determine whether they include at least one T cell epitope using any number of assays (e.g. T cell proliferation assays, lymphokine secretion assays, T cell non-responsiveness studies, etc.).

**[0044]** The term “allergen” refers to an antigen which elicits, induces, stimulates, or enhances an immune response by a cell or the immune system of an exposed animal (e.g., human). An antigen is an allergen when the specific immune response is the development of enhanced sensitivity or a hypersensitivity to the antigen, but the antigen itself is not typically innately harmful. An allergen is therefore a particular type of antigen that can cause development of enhanced or increased sensitivity or hypersensitivity in a subject. For example, an allergen can elicit production of IgE antibodies in predisposed subjects. However, as disclosed herein an allergen need not

elicit production of IgE antibodies. Other examples of responses elicited by allergens include T cell responses or activity, such as production of a lymphokine, cytokine, or effector function on other cells. Responses caused by allergens are also described, for example, in Mol. Biol. of Allergy and Immunology, ed. R. Bush, Immunology and Allergy Clinics of North American Series (August 1996). Although the terms "allergen" and "antigen" have a different meaning, reference to "allergen" herein includes reference to "antigen" and reference to "antigen" herein includes reference to "allergen."

**[0045]** Typically, allergens are organic substances, such as proteins, peptides, nucleotides, carbohydrates, lipids, fats, nucleic acid, and combinations or mixtures thereof. Allergen(s) as used herein include, but are not limited to a specific allergen protein, mixture of allergen proteins, an extract of an allergen, chemically or genetically manufactured allergen, or any combination thereof (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6).

**[0046]** In certain embodiments, proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof, described herein (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) stimulate, induce, promote, increase or enhance an immune response. In particular embodiments, a protein or peptide is a T cell antigen, allergen or epitope. In additional particular embodiments, a protein or peptide, a subsequence, portion, homologue, variant or derivative thereof, elicit, stimulate, promote, induce or enhance a T cell response, which may include but is not limited to a Th2 cell response. In further particular embodiments, a TG protein or peptide, a subsequence, portion, homologue, variant or derivative thereof, modulates, inhibits, or reduces T cell response, which may include but is not limited to a Th2 cell response. In certain embodiments, a T cell response is an anti-allergen immune response, including but not limited to an anti-TG immune response.

**[0047]** As used herein, the term "immune response" includes T cell (cellular) mediated and/or B cell (humoral) mediated immune responses, or both cellular and humoral responses. Exemplary immune responses include T cell responses, e.g., lymphokine production, cytokine production and cellular cytotoxicity. T-cell responses include Th1 and/or Th2 responses. In addition, the term immune response includes responses that are indirectly effected by T cell activation, e.g., antibody production (humoral responses) and activation of cytokine responsive cells, e.g., eosinophils, macrophages. Immune cells involved in the immune response include lymphocytes, such

as T cells (CD4+, CD8+, Th1 and Th2 cells, memory T cells) and B cells; antigen presenting cells (e.g., professional antigen presenting cells such as dendritic cells, macrophages, B lymphocytes, Langerhans cells, and non-professional antigen presenting cells such as keratinocytes, endothelial cells, astrocytes, fibroblasts, oligodendrocytes); natural killer (NK) cells; myeloid cells, such as macrophages, eosinophils, mast cells, basophils, and granulocytes.

**[0048]** As set forth herein, a particular immunoglobulin (Ig) isotype may be produced in response to an antigen (allergen). For example, an “IgG antigen” refers to an antigen that induces an IgG antibody response. Likewise, an “IgE antigen” refers to an antigen that induces an IgE antibody response; an “IgA antigen” refers to an antigen that induces an IgA antibody response, and so forth. In certain embodiments, such an immunoglobulin (Ig) isotype produced in response to an antigen may also elicit production of other isotypes. For example, an IgG antigen may induce an IgG antibody response in combination with one or more of an IgE, IgA, IgM or IgD antibody response. Accordingly, in certain embodiments, an IgG antigen may induce an IgG antibody response without inducing an IgE, IgA, IgM or IgD antibody response.

**[0049]** The invention encompasses methods and uses for reducing, decreasing, preventing the development of sensitization or hypersensitization to an antigen(s) or allergen(s), such as a TG antigen or allergen. Accordingly, in other embodiments, a protein or peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), decreases, inhibits, suppresses or reduces a T cell response, which may include but is not limited to a Th2 cell response. In certain embodiments, the T cell response is an anti-allergen immune response, such as a memory T cell response.

**[0050]** In accordance with another aspect of the invention there are provided a TG protein or peptide, a subsequence, portion, homologue, variant or derivative thereof, wherein the protein or peptide elicits, stimulates, induces, promotes, increases or enhances an anti-allergen immune response. In another aspect, there are provided a TG protein or peptide, subsequence, portion, homologue, variant or derivative thereof, wherein the protein or peptide decreases, reduces, inhibits, suppresses or disrupts an anti-allergen immune response.

**[0051]** As will be understood by a person of skill in the art, a protein or a subsequence, portion, homologue, variant or derivative thereof as described herein (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS

621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), may elicit, stimulate, induce, promote, increase or enhance certain elements of an anti-allergen immune response while decreasing, reducing, inhibiting, suppressing or reducing other elements of the anti-allergen response, either contemporaneously or sequentially. In one non-limiting example, a protein or a subsequence, portion, homologue, variant or derivative thereof (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) may elicit, stimulate, induce, promote, increase or enhance proliferation of regulatory T cells while decreasing, reducing, inhibiting, suppressing or reducing production of proinflammatory lymphokines/cytokines.

**[0052]** An “anti-allergen,” “anti-protein,” or “anti-peptide immune response” refers to an immune response that is particular or specific for the protein or peptide, e.g., allergen. In such instances, the response is specifically triggered (elicited, stimulated, increased, induced, or promoted) by the protein or peptide, e.g., allergen (e.g., a TG protein or peptide). Although an “anti-allergen” immune response is specifically triggered by a given allergen, the immune response itself can be characterized by general features of immune responses, such as T cell (cellular) and/or B cell (humoral) immune responses, as set forth herein.

**[0053]** As disclosed herein, a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof, may elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an antigen, including an allergen (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). In certain embodiments, a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof, described herein may elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an allergen. Thus in certain embodiments a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, described herein may be effective in use or treatment (e.g., therapeutic) of an allergic reaction or allergic immune response, including but not limited to an allergic response following a secondary or subsequent exposure of a subject to an antigen or allergen. In particular embodiments, immunological tolerance elicited, stimulated, induced, promoted, increased or enhanced from use or administration of a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof, may involve modulation of T cell activity, including but not limited to CD4+ T cells, CD8+ T cells, Th1 cells, Th2 cells and regulatory T cells (Tregs), and memory T cells. For example, immunological tolerance elicited, stimulated, induced, promoted, increased

or enhanced from use or administration of a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6)-inflammatory lymphokines/cytokines produced by T cells. Thus, in accordance with certain aspects of the invention, there are provided TG proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof, that elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an antigen or allergen (e.g., a TG protein or peptide)..

**[0054]** Accordingly, methods and uses of inducing immunological tolerance in a subject to an allergen are provided. In one embodiment, a method or use reduces occurrence, frequency, severity, progression, or duration of physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated an allergic response to the allergen in the subject. Thus, in various embodiments, inducing immunological tolerance can protect a subject against or treat a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen.

**[0055]** As disclosed herein, surprisingly TG proteins and antigens that elicit Th2 immune responses are not a priori IgE reactive. Thus, there are provided methods and uses of providing specific immunotherapy to a subject, in which a subject is administered an amount of a protein or peptide that is an IgG, IgA, IgM or IgD antigen. In a particular embodiment, a method or use includes administering to the subject an amount of a protein or peptide that is an IgG antigen.

**[0056]** In certain embodiments of the invention methods and uses, the allergen is a TG protein or peptide. In more particular embodiments, the allergen is an amino acid sequence of a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof. In other non-limiting embodiments, the allergen includes, consists of or consists essentially of an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6.

**[0057]** In other embodiments of invention methods and uses, the allergen is not a Timothy grass protein or peptide. Non-limiting examples of such allergens include

proteins and peptides from grass, trees, dust mites, insects, pollen, including but not limited to alder, Alternaria rot fungus, American cockroach, American house dust mite, Ash, Aspergillus fumigatus, Bermuda grass, Birch, Canary grass, Cat, Cladosporium herbarum, Common cypress, Cypress, Date palm, Dog, English plantain, European house dust mite, Giant ragweed, Japanese cypress, Kentucky blue grass, Lolium perenne, Orchard grass, Penicillium chrysogenum, Prickly juniper, Russian thistle, Rye grass, Sweet vernal grass or White oak.

**[0058]** An allergic reaction refers to a local or general reaction in a subject following contact with a specific antigen (e.g., allergen) to which the subject had been previously exposed and had become sensitized. The immunologic interaction of antigen (e.g., allergen) with sensitized lymphocytes (T cells) and/or antibody can give rise to inflammation and tissue damage. An allergy is an undesirable immune response or reaction that can therefore produce damage to self-tissues and cells, usually through inflammatory reactions.

**[0059]** One non-limiting example of an allergy is asthma. Asthma, which can be extrinsic or allergic asthma (also referred to as reactive airway disease), is an inflammatory disease of the lungs characterized by a generally reversible airway obstruction. Non-limiting features of allergic asthma include elevated concentrations of serum IgE, pulmonary eosinophilia, airway hyper-responsiveness, excessive airway mucus production, and airway remodeling marked by peribronchiolar collagen deposition and increases in airway smooth muscle mass. Other exemplary allergic reactions or inflammatory conditions include allergic alveolitis, allergic bronchopulmonary aspergillosis, allergic dermatitis, eczema, allergic conjunctivitis, allergic coryza, allergic vasculitis, rhinosinusitis, and allergic rhinitis.

**[0060]** Hypersensitivity or hyper-responsiveness used in reference to an immune response means an abnormal response or condition in which an antigen or allergen elicits an exaggerated immune response. For example, allergic asthma can result from repeated exposure to airborne allergens that trigger detrimental immunological responses, such as persistent inflammation in the bronchial wall, which can in turn cause structural and functional changes in the respiratory system. After allergen contact by sensitized subjects (i.e., those subjects that have already been exposed to the allergen), the immune response is dependent on CD4+ T lymphocytes that are skewed to a T helper (Th) 2 phenotype. Th2 cytokines, for example, IL-4, IL-5, IL-9, and IL-13 are produced and are believed to contribute to asthma pathogenesis. For example, IL-4 drives the T helper response in favor of Th2, resulting in enhanced production of IgE; IL-5, which with granulocyte

macrophage colony stimulating factor (GM-CSF) and IL-3, is important for the production of eosinophils; and IL-13, which is required for airway hyper-responsiveness and mucous metaplasia, which are downstream pathophysiological features that are closely linked with clinical asthma. All of these cytokines, together with TGF-beta have been implicated in airway remodeling. Increased numbers of airway eosinophils is also associated with disease severity, although the role of eosinophils in the pathology of asthma is not entirely understood, (see, e.g., Lee et al., *Science* 305:1773 (2004); Humbles et al., *Science* 305:1776 (2004)). The resulting structural and morphometric changes (remodeling) include subepithelial fibrosis, goblet cell hyperplasia and metaplasia, which result in functional consequences such as loss of distensibility of asthmatic airways, bronchial hyper-reactivity (even in the absence of the allergen), and an accelerated progressive decrease in forced expiratory volume at 1 second time intervals. Th2 cytokines may also prime and activate eosinophils to release proinflammatory agents, lipid mediators, and other cytokines thought to contribute to the observed tissue damage, remodeling, and hyper-responsiveness.

**[0061]** As used herein, the term “tolerance,” “anergy,” or “antigen (allergen)-specific tolerance” refers to a reduction, loss, inhibition, suppression or decrease, of T cells to T cell receptor-mediated stimulation by an allergen or antigen. The reduction can lead to reduced or non-responsiveness (insensitivity) of T cells to an allergen or antigen. Such insensitivity is generally antigen-specific and persists after exposure to the antigenic peptide has ceased. For example, tolerance in T cells is characterized by lack of lymphokine/cytokine production, e.g., IL-2, IFN- $\gamma$ , or TNF- $\beta$ . T-cell anergy occurs when T cells are exposed to antigen or allergen and receive a first signal (a T cell receptor or CD-3 mediated signal) in the absence of a second signal (a costimulatory signal). Under these conditions, re-exposure of the cells to the same antigen or allergen (even if re-exposure occurs in the presence of a costimulatory molecule) results in failure to produce cytokines and subsequently failure of T cells to proliferate. Thus, a failure to produce lymphokines/cytokines prevents proliferation. Tolerized T cells can, however, proliferate if cultured with cytokines (e.g., IL-2). For example, T cell anergy can also be observed by the lack of IL-2 production by T lymphocytes as measured by ELISA or by a proliferation assay using an indicator cell line.

**[0062]** As used herein, the term “immunological tolerance” refers to a) a decreased or reduced level of a specific immunological response (thought to be mediated at least in part by antigen-specific effector T lymphocytes, B lymphocytes, antibody, a combination); b) a delay in the onset or progression of a specific immunological response; or c) a

reduced risk of the onset or progression of a specific immunological response to an antigen or allergen. “Specific” immunological tolerance occurs when tolerance is preferentially invoked against certain antigens (allergens) in comparison with other antigens (allergens). Tolerance is an active antigen dependent process and differs from non-specific immunosuppression and immunodeficiency.

**[0063]** An increase, improvement, enhancement or induction of “tolerance” refers to a decrease, reduction, inhibition, suppression, or limiting or controlling or clearing of specific immunological reactivity to an antigen as compared to reactivity to the antigen in a previous exposure to the same antigen. Thus in certain embodiments, a method or use of inducing immunological tolerance in a subject to an allergen includes elimination of an allergic response of the subject to the allergen. Immunological tolerance in a subject to an allergen can also be reflected by reducing the occurrence, frequency, severity, progression, or duration of an allergic response of the subject to the antigen or allergen.

**[0064]** While desirably tolerance can refer to non-reactivity to an antigen or allergen, tolerance need not be complete non-reactivity and can only be partial, and in any event is reflected by a decrease, inhibition, suppression or reduction in specific immunological reactivity to an antigen or allergen as compared to reactivity to the antigen or allergen in a previous exposure to the same antigen or allergen (or epitope thereof). Thus, in another embodiment, a method or use of inducing immunological tolerance in a subject to an allergen includes stabilizing or maintaining the level of an allergic response in the subject to the allergen.

**[0065]** Induction of immune tolerance (also referred to as desensitization), and the relative amount of immune tolerance, can be measured by methods disclosed herein or known to the skilled artisan. For example, induction of immune tolerance can be measured by modulation of lymphokine and/or cytokine level in said animal. As such, modulation can be an increase of a cytokine level, for instance an increase of a cytokine level at least 1.5, 2, 3 times or more relative to before said induction. Alternatively, modulation can be a decrease of the level of a particular cytokine level, for instance a decrease of the cytokine level is at least 1.5, 2, 3 times or more relative to before said induction. The lymphokines/cytokines chosen to measure can be from any relevant lymphokines/cytokines, such as IL-2, IL-5, IL-4, IL-6, IL-10, IL-12, IL-13, TNF- $\alpha$ , IFN- $\gamma$ , IFN- $\alpha$ , TGF- $\beta$ , MCP-1, RANK-L and Flt3L.

**[0066]** As disclosed herein, peptides and proteins of the invention are useful in methods and uses, for example, of “specific” immunotherapy. The term “specific” immunotherapy refers to a therapy particular or specific for the protein or peptide, e.g.,

allergen. To achieve "specific immunotherapy" an antigen is administered to a subject in order to achieve immunological tolerance of the subject to an antigen, including for example, an allergen.

**[0067]** More particularly, specific immunotherapy may be conducted by administering an antigen derived from the antigen (e.g. allergen) against which immunological tolerance is sought. Alternatively, immunotherapy can be conducted by "non-specific" immunotherapy using a different antigen or protein than the antigen against which immunological tolerance is sought. For example as described in US patent application publication US2012/0100164A1, which relates to the treatment of a hypersensitivity immune response, such as allergic rhinitis or asthma, via bystander suppression by use of an antigen unrelated to the allergen triggering the hypersensitivity immune response in an individual to be treated provided that the antigen is obtainable from the source material, e.g. Grass pollen, comprising the "triggering" allergen (e.g. Phl p 1, 5 or 6).

**[0068]** Thus, in different embodiments, the TG antigen administered and antigen (e.g. allergen) against which immunological tolerance is sought may be the same or a different TG protein. In one embodiment, a method or use includes administering to a subject an amount of a TG protein or peptide, or subsequence, portion, homologue, variant or derivative thereof sufficient to elicit, stimulate, induce, promote, increase, enhance or augment immunological tolerance to an allergen in the subject. In one aspect, a TG antigen is administered to a subject during specific immunotherapy to treat the subject for an allergic reaction to the same TG antigen. In a different aspect, a TG antigen is administered to a subject during specific immunotherapy to treat the subject for an allergic reaction to a different TG antigen. In another embodiment, a method includes administering to a subject an amount of a nucleic acid encoding all or a portion (e.g., a T cell epitope) of a Timothy grass protein or peptide, or subsequence, portion, homologue, variant or derivative thereof sufficient to elicit, stimulate, induce, promote, increase, enhance or augment immunological tolerance to an allergen in the subject. In various embodiments, a method or use of specific immunotherapy reduces, inhibits, suppresses or decreases sensitivity or (hyper)sensitivity to the protein or peptide, e.g., allergen, or elicits, stimulates, increases, induces, promotes or improves tolerance of the protein or peptide, e.g., allergen. Typically a subject is administered a protein or peptide, e.g., allergen, for example, via a subcutaneous injection.

**[0069]** Methods and uses include multi-dose regimens. For example, a method or use can begin with small doses of allergen, and the doses are increased for repeated contact or administration.

**[0070]** A variant or derivative of an antigen (e.g., a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), including an allergen as described herein, or a subsequence or portion of an antigen or allergen, include molecules that are structurally similar and functionally similar (e.g., of all or a part of an amino acid sequence in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6). A variant, derivative or subsequence of antigen or allergen is functionally similar to the antigen or allergen sequence if the variant, derivative or subsequence is capable of eliciting a detectable or measurable immune response, even if it is a reduced immune response compared to the nonvariant/non-derived or native sequence, which may be determined using methods, including animal models and *in vitro* assays, described herein and known to one of skill in the art. For example, an immune response may be determined by quantitative and/or qualitative determination of lymphokine/cytokine production (e.g., by T cells), antibody production (including class and/or isotype), cellular mobilization, migration or motility, and optionally *in vivo*, such as an animal model of antigen/allergen immune responsiveness. An immune response of variant, derivative or subsequence of antigen or allergen compared to the non-variant/non-derivatized/native full length antigen or allergen may be ascertained by analysis of a particular measure (such as lymphokine/cytokine production, immunoglobulin production, cell mobilization, migration, motility, etc.) and may be greater, less than or comparable, e.g., within 5%, 10%, 15%, or 20% or 25% of the immune response of non-variant/non-derivatized/native full length antigen or allergen. For example, levels of Th1 lymphokines/cytokines, such as IFN- $\gamma$  IL-2, and TNF- $\beta$  and Th2 cytokines, such as IL-4, IL-5, IL-9, IL-10, and IL-13, may be determined according to methods described herein or known to one of skill in the art.

**[0071]** As disclosed herein, proteins and peptides, or a subsequence, portion, homologue, variant or derivative thereof include those having all or at least partial sequence identity to one or more exemplary proteins and peptides, or a subsequence, portion, homologue, variant or derivative thereof (e.g., TG sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). The term “identity” and “identical” and grammatical variations thereof,

mean that two or more referenced entities are the same (e.g., peptides or polynucleotide molecules). Thus, where two proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof are identical, they have the same amino acid sequence. The identity can be over a defined area (region or domain) of the sequence. "Areas, regions or domains" of homology or identity mean that a portion of two or more referenced entities share homology or are the same.

[0072] Identity can be determined by comparing each position in aligned sequences. A degree of identity between amino acid sequences is a function of the number of identical or matching amino acids at positions shared by the sequences, i.e. over a specified region. Optimal alignment of sequences for comparisons of identity may be conducted using a variety of algorithms, as are known in the art, including the ClustalW program, available at <http://clustalw.genome.ad.jp>, the local homology algorithm of Smith and Waterman, 1981, *Adv. Appl. Math.* 2: 482, the homology alignment algorithm of Needleman and Wunsch, 1970, *J. Mol. Biol.* 48:443, the search for similarity method of Pearson and Lipman, 1988, *Proc. Natl. Acad. Sci. USA* 85: 2444, and the computerized implementations of these algorithms (such as GAP, BESTFIT, FASTA and TFASTA in the Wisconsin Genetics Software Package, Genetics Computer Group, Madison, WI, U.S.A.). Sequence identity may also be determined using the BLAST algorithm, described in Altschul *et al.*, 1990, *J. Mol. Biol.* 215:403-10 (using the published default settings). Software for performing BLAST analysis may be available through the National Center for Biotechnology Information (through the internet at <http://www.ncbi.nlm.nih.gov/>). Such algorithms that calculate percent sequence identity (homology) generally account for sequence gaps and mismatches over the comparison region or area. For example, a BLAST (e.g., BLAST 2.0) search algorithm (see, e.g., Altschul *et al.*, *J. Mol. Biol.* 215:403 (1990), publicly available through NCBI) has exemplary search parameters as follows: Mismatch -2; gap open 5; gap extension 2. For polypeptide sequence comparisons, a BLASTP algorithm is typically used in combination with a scoring matrix, such as PAM100, PAM 250, BLOSUM 62 or BLOSUM 50. FASTA (e.g., FASTA2 and FASTA3) and SSEARCH sequence comparison programs are also used to quantitate the extent of identity (Pearson *et al.*, *Proc. Natl. Acad. Sci. USA* 85:2444 (1988); Pearson, *Methods Mol Biol.* 132:185 (2000); and Smith *et al.*, *J. Mol. Biol.* 147:195 (1981)). Programs for quantitating protein structural similarity using Delaunay-based topological mapping have also been developed (Bostick *et al.*, *Biochem Biophys Res Commun.* 304:320 (2003)).

**[0073]** As described herein, TG proteins and peptides include homologues of TG proteins and peptides (e.g., of all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. A polypeptide sequence or polynucleotide sequence is a “homologue” of, or is “homologous” to, another sequence if the two sequences have substantial identity over a specified region and a functional activity of the sequences is preserved or conserved, at least in part (as used herein, the term ‘homologous’ does not infer nor exclude evolutionary relatedness).

**[0074]** Examples of “homologues” of invention peptides and proteins include proteins or peptides of non-Timothy grass allergens, including for example other grass allergens such as grasses of the order Poales, that are homologous to a Timothy grass peptide or protein described herein. For example, in particular embodiments, proteins or peptides of the present invention may be proteins or peptides of grasses of the order of Poales, *Panicum virgatum*, *Zea mays*, *Oryza sativa*, *Ricinus communis*, *Alnus glutinosa*, *Spinacia oleracea*, *Sorghum bicolor*, *Arabidopsis thaliana*, *Triticum aestivum*, *Capsella bursa-pastoris*, *Brassica napus*, *Mesembryanthemum crystallinum*, *Gossypium hirsutum*, *Brassica rapa* subsp. *chinensis*, *Solanum lycopersicum*, *Solanum tuberosum*, *Populus trichocarpa* or *Chara corallina*.

**[0075]** Accordingly, in particular embodiments, methods and uses of the invention include homologues of peptides and proteins from non-Timothy grass allergens, including for example other grass antigens and allergens, such non-TG proteins and peptides considered to be homologous as set forth herein. Thus, as a non-limiting example, peptide and protein homologues from non-Timothy grass antigens or allergens may be administered to modulate immune activity or immune response against a Timothy grass allergen or antigen or to treat an allergic reaction, allergic response, allergic disorder or allergic disease associated with a Timothy grass allergen or antigen. As another non-limiting example, peptide and protein homologues from non-Timothy grass antigens or allergens may be administered to modulate immune activity or immune response against a non-Timothy grass allergen or antigen or to treat an allergic reaction, allergic response, allergic disorder or allergic disease associated with a non-Timothy grass allergen or antigen.

**[0076]** Two polypeptide sequences or polynucleotide sequences are considered to be substantially identity if, when optimally aligned (with gaps permitted), they share at least about 40% sequence identity or greater (e.g. 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%, etc. identify over a specific region), for example,

over all or a part of any amino acid sequence in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, or if the sequences share defined functional motifs (e.g., epitopes). The percent identity can extend over the entire sequence length or a portion of the sequence (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In particular aspects, the length of the sequence sharing the percent identity is 2, 3, 4, 5 or more contiguous amino acids, e.g., 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, etc. contiguous amino acids (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In additional particular aspects, the length of the sequence sharing the percent identity is 20 or more contiguous amino acids, e.g., 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, etc. contiguous amino acids (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In further particular aspects, the length of the sequence sharing the percent identity is 35 or more contiguous amino acids, e.g., 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 45, 47, 48, 49, 50, etc., contiguous amino acids (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In yet further particular aspects, the length of the sequence sharing the percent identity is 50 or more contiguous amino acids, e.g., 50-55, 55-60, 60-65, 65-70, 70-75, 75-80, 80-85, 85-90, 90-95, 95-100, etc. contiguous amino acids (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6.

**[0077]** An “unrelated” or “non-homologous” sequence shares less than 30% identity. More particularly, shares less than about 25 % identity, with a protein, peptide or polynucleotide of the invention over a specified region of homology.

**[0078]** A variant or derivative of a protein or peptide refers to a modified or variant form of the protein or peptide, or subsequence, portion or homologue thereof (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). Such modified forms, such as amino acid deletions, additions and substitutions, of the proteins and peptides can also be used in the invention uses, methods and compositions, including methods for modulating an immune response, eliciting, stimulating, inducing, promoting,

increasing, or enhancing immunological tolerance and protecting and treating subjects against an allergic reaction or response, as set forth herein.

**[0079]** Thus, in accordance with the invention, modified, variant and derivative forms of proteins and peptides, subsequences, portions, and homologues thereof (e.g., of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) are provided that have one or more functions or activities of unmodified, non-variant and non-derivatized forms of proteins and peptides. Such forms, referred to as “modifications”, “variants” or “derivatives” and grammatical variations thereof deviate from a reference sequence. For example, as described herein, a protein, peptide, subsequence, portion, or homologue thereof may comprise, consist or consist essentially of an amino acid sequence that is a modification, variant, or derivative of a TG protein or an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Such modifications, variants, or derivatives may have greater or less activity or function than a reference protein or peptide, such as ability to elicit, stimulate, induce, promote, increase, enhance, activate, modulate, inhibit, decreases, suppress, or reduce an immune response (e.g. a T cell response) or elicit, stimulate, induce, promote, increase or enhance immunological tolerance (desensitize) to an antigen or allergen. Thus, proteins, peptides, or subsequences, portions or homologues thereof include sequences having substantially the same, greater or less relative activity or function as a reference antigen or allergen (e.g., any of the TG proteins or peptides set forth in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) for example, an ability to elicit, stimulate, induce, promote, increase, enhance, activate, modulate, inhibit, suppress, decrease or reduce an immune response (e.g. a T cell response) or elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an antigen or allergen *in vitro* or *in vivo*.

**[0080]** A variant or derivative therefore includes deletions, including truncations and fragments; insertions and additions, including tagged polypeptides and fusion proteins; substitutions, for example conservative substitutions, site-directed mutants and allelic variants; and modifications, including peptoids having one or more non-amino acyl groups (q.v., sugar, lipid, etc.) covalently linked to the peptide and post-translational modifications.

**[0081]** Non-limiting examples of modifications include one or more amino acid substitutions (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 20-25, 25-30, 30-50, 50-100, or more residues), additions and insertions (e.g., 1, 2, 3, 4, 5, 6, 7, 8,

9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 20-25, 25-30, 30-50, 50-100, or more residues) and deletions (e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 20-25, 25-30, 30-50, 50-100) of a reference protein, peptide, or subsequence or portion thereof (e.g., over all or a part of any amino acid sequence in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). In particular embodiments, a modified or variant sequence retains at least part of a function or an activity of unmodified sequence, and can have less than, comparable, or greater, but at least a part of, a function or activity of a reference sequence, for example, the ability elicit, stimulate, induce, promote, increase, enhance, activate, modulate, inhibit, suppress, decrease, or reduce an immune response (e.g. a T cell response) or elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an allergen. Such immune responses include, for example, among others, induced, increased, enhanced, stimulated, activated, modulated, inhibited, suppressed, decreased or reduced expression, production or activity of a cytokine (e.g., IL-5), an antibody (e.g. increase production of IgG antibodies, decrease production of IgE) or an immune cell (e.g. CD4+ T cell, CD8+ T cell, Th1 cell, Th2 cell or regulatory T cell).

**[0082]** Variants and derivatives of proteins and peptides include naturally-occurring polymorphisms or allelic variants, strain variants, as well as synthetic proteins and peptides that contain a limited number of conservative amino acid substitutions of the amino acid sequence. A variety of criteria can be used to indicate whether amino acids at a particular position in a protein or peptide are similar. In making such changes, substitutions of like amino acid residues can be made on the basis of relative similarity of side-chain substituents, for example, their size, charge, hydrophobicity, hydrophilicity, and the like, and such substitutions may be assayed for their effect on the function of the peptide by routine testing.

**[0083]** Specific non-limiting examples of substitutions include conservative and non-conservative amino acid substitutions. A “conservative substitution” is the replacement of one amino acid by a biologically, chemically or structurally similar residue. Biologically similar means that the substitution does not destroy a biological activity. Structurally similar means that the amino acids have side chains with similar length, such as alanine, glycine and serine, or a similar size. Chemical similarity means that the residues have the same charge, or are both hydrophilic or hydrophobic. For example, a conservative amino acid substitution is one in which an amino acid residue is replaced with an amino acid residue having a similar side chain, which include amino acids with basic side chains (e.g., lysine, arginine, histidine); acidic side chains (e.g., aspartic acid,

glutamic acid); uncharged polar side chains (e.g., glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine, histidine); nonpolar side chains (e.g., alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan); beta-branched side chains (e.g., threonine, valine, isoleucine), and aromatic side chains (e.g., tyrosine, phenylalanine, tryptophan). Particular examples include the substitution of one hydrophobic residue, such as isoleucine, valine, leucine or methionine for another, or the substitution of one polar residue for another, such as the substitution of arginine for lysine, glutamic for aspartic acids, or glutamine for asparagine, serine for threonine, and the like. Proline, which is considered more difficult to classify, shares properties with amino acids that have aliphatic side chains (e.g., Leu, Val, Ile, and Ala). In certain circumstances, substitution of glutamine for glutamic acid or asparagine for aspartic acid may be considered a similar substitution in that glutamine and asparagine are amide derivatives of glutamic acid and aspartic acid, respectively. Conservative changes can also include the substitution of a chemically derivatized moiety for a non-derivatized residue, for example, by reaction of a functional side group of an amino acid. Variants and derivatives of proteins and peptides include forms having a limited number of one or more substituted residues.

**[0084]** An addition can be a covalent or non-covalent attachment of any type of molecule. Specific examples of additions include glycosylation, acetylation, phosphorylation, amidation, formylation, ubiquitination, and derivatization by protecting/blocking groups and any of numerous chemical modifications. Additional specific non-limiting examples of an addition are one or more additional amino acid residues. Accordingly, proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, can be a part of or contained within a larger molecule, such as another protein or peptide sequence, such as a fusion or chimera with a different (distinct) sequence.

**[0085]** In particular embodiments, an addition is a fusion (chimeric) sequence, an amino acid sequence having one or more molecules not normally present in a reference native (wild type) sequence covalently attached to the sequence. The term “chimeric” and grammatical variations thereof, when used in reference to a sequence, means that the sequence contains one or more portions that are derived from, obtained or isolated from, or based upon other physical or chemical entities. For example, a chimera of two or more different proteins may have one part a protein, peptide, subsequence, portion, homologue or variant thereof, and a second part of the chimera may be from a different sequence, or unrelated protein sequence.

**[0086]** Another particular example of a sequence having an amino acid addition is one in which a second heterologous sequence, i.e., heterologous functional domain is attached (covalent or non-covalent binding) that confers a distinct or complementary function. Heterologous functional domains are not restricted to amino acid residues. Thus, a heterologous functional domain can consist of any of a variety of different types of small or large functional moieties. Such moieties include nucleic acid, peptide, carbohydrate, lipid or small organic compounds, such as a drug (e.g., an antiviral), a metal (gold, silver), and radioisotope. For example, a tag such as T7 or polyhistidine can be attached in order to facilitate purification or detection of a protein, peptide, etc. Accordingly, there are provided proteins, peptides, subsequences, portions and homologues thereof (e.g., a TG protein or peptide set forth in Table 1, Table 2, Table 4 or Table 6), and a heterologous domain, wherein the heterologous functional domain confers a distinct function on the protein, peptide, subsequence, portion or homologue thereof.

**[0087]** Linkers, such as amino acid or peptidomimetic sequences may be inserted between the sequence and the addition (e.g., heterologous functional domain) so that the two entities maintain, at least in part, a distinct function or activity. Linkers may have one or more properties that include a flexible conformation, an inability to form an ordered secondary structure or a hydrophobic or charged character, which could promote or interact with either domain. Amino acids typically found in flexible protein regions include Gly, Asn and Ser. Other near neutral amino acids, such as Thr and Ala, may also be used in the linker sequence. The length of the linker sequence may vary without significantly affecting a function or activity of the fusion protein (see, e.g., U.S. Patent No. 6,087,329). Linkers further include chemical moieties and conjugating agents, such as sulfo-succinimidyl derivatives (sulfo-SMCC, sulfo-SMPB), disuccinimidyl suberate (DSS), disuccinimidyl glutarate (DSG) and disuccinimidyl tartrate (DST).

**[0088]** Further non-limiting examples of additions are detectable labels. Thus, in another embodiment, the invention provides proteins, peptides, subsequences, portions and homologues thereof, that are detectably labeled. Specific examples of detectable labels include fluorophores, chromophores, radioactive isotopes (e.g., S<sup>35</sup>, P<sup>32</sup>, I<sup>125</sup>), electron-dense reagents, enzymes, ligands and receptors. Enzymes are typically detected by their activity. For example, horseradish peroxidase is usually detected by its ability to convert a substrate such as 3,3'-,5,5'-tetramethylbenzidine (TMB) to a blue pigment, which can be quantified.

**[0089]** Another non-limiting example of an addition is an insertion of an amino acid within any protein, peptide, subsequence, portion or homologue thereof (e.g., any protein

or sequence set forth herein, such as in any amino acid sequence of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). In particular embodiments, an insertion is of one or more amino acid residues inserted into the amino acid sequence of a protein or peptide, or subsequence, portion or homologue thereof, such as any TG protein or sequence set forth herein, such as in as in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6.

**[0090]** Modified and variant proteins, peptides, subsequences, portions or homologues thereof also include one or more D-amino acids substituted for L-amino acids (and mixtures thereof), structural and functional analogues, for example, peptidomimetics having synthetic or non-natural amino acids or amino acid analogues and derivatized forms. Modifications include cyclic structures such as an end-to-end amide bond between the amino and carboxy-terminus of the molecule or intra- or inter-molecular disulfide bond. Proteins, peptides, subsequences, portions and homologues thereof may be modified *in vitro* or *in vivo*, e.g., post-translationally modified to include, for example, sugar residues, phosphate groups, ubiquitin, fatty acids, lipids, etc.

**[0091]** Specific non-limiting examples of modified and variant proteins, peptides, subsequences, portions and homologues thereof include proteins or peptides comprising, consisting or consisting essentially of an amino acid sequence comprising at least one amino acid deletion from a full length TG protein or amino acid sequence set forth in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In particular embodiments, a protein, peptide, or subsequence, portion or homologue thereof is from about 2 to up to one amino acid less than the full length protein sequence. In additional particular embodiments, a protein subsequence or portion is from about 2 to 5, 5 to 10, 10 to 15, 15 to 20, 20 to 25, 25 to 50, 50 to 100 amino acids in length, provided that said subsequence or portion is at least one amino acid less in length than the full-length protein sequence.

**[0092]** The term “subsequence” or “portion” means a fragment or part of the full length molecule. A subsequence or portion therefore consists of one or more amino acids less than the full length protein or peptide. A subsequence or portion can have one or more amino acids less than the full length protein or peptide internally or terminal amino acid deletions from either amino or carboxy-termini. Subsequences and portions can vary in size. For example, a subsequence or portion of a protein or peptide can be as small as an epitope capable of binding an antibody (*i.e.*, about five amino acids) up to a

polypeptide that is one amino acid less than the entire length of a reference protein or peptide.

**[0093]** As used herein, subsequences and portions may also include or consist of one or more amino acid additions or deletions, wherein the subsequence or portion does not comprise the full length native/wild type protein or peptide sequence. Accordingly, total subsequence or portion lengths can be greater than the length of the full length native/wild type protein or peptide, for example, where a protein or peptide subsequence is fused or forms a chimera with another polypeptide.

**[0094]** The invention provides isolated and/or purified proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof. In particular embodiments, isolated and/or purified proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, comprise, consist of or consist essentially of an amino acid sequence of a TG protein or peptide set forth in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In particular embodiments, the isolated and/or purified proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof include a T cell epitope (e.g., Th2 cell epitope).

**[0095]** The term “isolated,” when used as a modifier of a composition, means that the compositions are made by the hand of man or are separated, completely or at least in part, from their naturally occurring *in vivo* environment. Generally, isolated compositions are substantially free of one or more materials with which they normally associate with in nature, for example, one or more protein, nucleic acid, lipid, carbohydrate, cell membrane. The term “isolated” does not exclude alternative physical forms of the composition, such as fusions/chimeras, multimers/oligomers, modifications (e.g., phosphorylation, glycosylation, lipidation) or derivatized forms, or forms expressed in host cells produced by the hand of man.

**[0096]** An “isolated” composition (e.g., proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of any TG protein or sequence set forth herein, such as in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) can also be “substantially pure” or “purified” when free of most or all of the materials with which it typically associates with in nature. Thus, an isolated protein, peptide, subsequence, portion, homologue, variant or derivative thereof, that also is substantially pure or purified does not include polypeptides or polynucleotides present among millions of other sequences, such as peptides of a peptide library or nucleic acids in a genomic or cDNA library, for example.

**[0097]** A “substantially pure” or “purified” composition can be combined with one or more other molecules. Thus, “substantially pure” or “purified” does not exclude combinations of compositions, such as combinations of proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof (e.g., multiple proteins, peptides, subsequences, etc.), and other antigens, agents, drugs or therapies.

**[0098]** Proteins and peptide (e.g., antigens and allergens) can be prepared recombinantly, chemically synthesized, isolated from a biological material or source, and optionally modified, or any combination thereof. A biological material or source would include an organism that produced or possessed any proteins or peptide (e.g., antigen or allergen) set forth herein (e.g., as listed in any of Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 3, Table 4 (SEQ ID NOS 1443-2264) or Table 6). A biological material or source may further refer to a preparation in which the morphological integrity or physical state has been altered, modified or disrupted, for example, by dissection, dissociation, solubilization, fractionation, homogenization, biochemical or chemical extraction, pulverization, lyophilization, sonication or any other means of manipulating or processing a biological source or material. Subsequences, variants, homologues and derivatives can be prepared, for example, by substituting, deleting or adding one or more amino acid residues in the amino acid sequence of a protein, peptide, subsequence, portion or homologue thereof, and screening for biological activity, for example eliciting an immune response. A skilled person will understand how to make such derivatives or variants, using standard molecular biology techniques and methods, described for example in Sambrook et al. (2001) Molecular Cloning: a Laboratory Manual, 3<sup>rd</sup> ed., Cold Spring Harbour Laboratory Press).

**[0099]** The invention also provides protein or peptide (e.g., proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of any TG protein or sequence set forth herein, such as in as in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, immobilized on or attached to a substrate. The protein or peptide (e.g., proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of any TG protein or sequence set forth herein, such as in as in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6 can optionally have a unique or distinct position or address on the substrate.

**[00100]** Substrates to which protein or peptide (e.g., proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of any TG protein or sequence set forth herein, such as in as in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID

NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, can be immobilized or attached include essentially any physical entity such as a two dimensional surface that is permeable, semi-permeable or impermeable, either rigid or pliable and capable of either storing, binding to or having attached thereto or impregnated.

**[00101]** Substrates include dry solid medium (e.g., cellulose, polyester, nylon, or mixtures thereof etc.), such as glass, silica, plastic, polyethylene, polystyrene, polypropylene, polyacetate, polycarbonate, polyamide, polyester, polyurethane, or polyvinylchloride. Substrates include structures having sections, compartments, wells, containers, vessels or tubes, separated from each other to avoid or prevent cross-contamination or mixing with each other or with other reagents. Multi-well plates, which typically contain 6, 12, 26, 48, 96, to 1000 wells, are one particular non-limiting example of such a structure.

**[00102]** Substrates also include supports used for two- or three-dimensional arrays of sequences. The sequences are typically attached to the surface of the substrate (e.g., via a covalent bond) at defined positions (locations or addresses). Substrates can include a number of sequences, for example, 1, 2, 3, 4, 5, 5 to 10, 10 to 15, 15 to 20, 20 to 25, 25 to 30, 30 to 35, 35 to 40, 40 to 45, 45 to 50, 50 to 75, 75 to 100, 100 to 150, 150 to 200, 200 to 250, 250 to 300, up to all proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, such as in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Such substrates, also referred to as “arrays,” can have any protein density; the greater the density the greater the number of sequences that can be screened on a given chip. Substrates that include a two- or three-dimensional array of sequences, and individual protein sequences therein, may be coded in accordance with the invention.

**[00103]** The invention also provides nucleic acids encoding proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Such nucleic acid sequences encode a sequence at least 40% or more (e.g., 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, 99%) identical to an exemplary protein, peptide, subsequence, portion, homologue, variant or derivative thereof, for example, of any amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In an additional embodiment, a nucleic acid encodes a sequence having a modification, such as one or more amino acid additions (insertions), deletions or substitutions of protein, peptide, subsequence, portion,

homologue, variant or derivative thereof, for example, of an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6.

**[00104]** The terms “nucleic acid,” “polynucleotide” and “polynucleoside” and the like refer to at least two or more ribo- or deoxy-ribonucleic acid base pairs (nucleotides/nucleosides) that are linked through a phosphoester bond or equivalent.

Nucleic acids include polynucleotides and polynucleosides. Nucleic acids include single, double or triple, circular or linear, molecules. Exemplary nucleic acids include but are not limited to: RNA, DNA, cDNA, genomic nucleic acid, naturally occurring and non-naturally occurring nucleic acid, e.g., synthetic nucleic acid.

**[00105]** Nucleic acids can be of various lengths. Nucleic acid lengths typically range from about 20 bases to 20 Kilobases (Kb), or any numerical value or range within or encompassing such lengths, 10 bases to 10Kb, 1 to 5 Kb or less, 1000 to about 500 bases or less in length. Nucleic acids can also be shorter, for example, 100 to about 500 bases, or from about 12 to 24, 24 to 45, 45 to 90, 90 to 250, or about 250 to 500 bases in length, or any numerical value or range or value within or encompassing such lengths. In particular aspects, a nucleic acid sequence has a length from about 10-20, 20-30, 30-50, 50-100, 100-150, 150-200, 200-250, 250-300, 300-400, 400-500, 500-1000, 1000-2000 bases, or any numerical value or range within or encompassing such lengths. Shorter nucleic acids are commonly referred to as “oligonucleotides” or “probes” of single- or double-stranded DNA. However, there is no upper limit to the length of such oligonucleotides.

**[00106]** Nucleic acid sequences further include nucleotide and nucleoside substitutions, additions and deletions, as well as derivatized forms and fusion/chimeric sequences (e.g., encoding recombinant polypeptide). For example, due to the degeneracy of the genetic code, nucleic acids include sequences and subsequences degenerate with respect to nucleic acids that encode proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, (e.g., substitutions, additions, insertions and deletions), for example, of amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6.

**[00107]** Nucleic acids can be produced using various standard cloning and chemical synthesis techniques. Techniques include, but are not limited to nucleic acid amplification, e.g., polymerase chain reaction (PCR), with genomic DNA or cDNA targets using primers (e.g., a degenerate primer mixture) capable of annealing to the encoding sequence. Nucleic acids can also be produced by chemical synthesis (e.g., solid

phase phosphoramidite synthesis) or transcription from a gene. The sequences produced can then be translated *in vitro*, or cloned into a plasmid and propagated and then expressed in a cell (e.g., a host cell such as eukaryote or mammalian cell, yeast or bacteria, in an animal or in a plant).

**[00108]** Nucleic acid may be inserted into a nucleic acid construct in which expression of the nucleic acid is influenced or regulated by an “expression control element.” An “expression control element” refers to a nucleic acid sequence element that regulates or influences expression of a nucleic acid sequence to which it is operatively linked. Expression control elements include, as appropriate, promoters, enhancers, transcription terminators, gene silencers, a start codon (e.g., ATG) in front of a protein-encoding gene, etc.

**[00109]** An expression control element operatively linked to a nucleic acid sequence controls transcription and, as appropriate, translation of the nucleic acid sequence. Expression control elements include elements that activate transcription constitutively, that are inducible (i.e., require an external signal for activation), or derepressible (i.e., require a signal to turn transcription off; when the signal is no longer present, transcription is activated or “derepressed”), or specific for cell-types or tissues (i.e., tissue-specific control elements).

**[00110]** Nucleic acid can also be inserted into a plasmid for propagation into a host cell and for subsequent genetic manipulation. A plasmid is a nucleic acid that can be propagated in a host cell, plasmids may optionally contain expression control elements in order to drive expression of the nucleic acid encoding proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof in the host cell. A vector is used herein synonymously with a plasmid and may also include an expression control element for expression in a host cell (e.g., expression vector). Plasmids and vectors generally contain at least an origin of replication for propagation in a cell and a promoter. Plasmids and vectors are therefore useful for genetic manipulation and expression of proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Accordingly, vectors that include nucleic acids encoding or complementary to proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, are provided.

**[00111]** In accordance with the invention, there are provided particles (e.g., viral particles) and transformed host cells that express and/or are transformed with a nucleic acid that encodes and/or express proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Particles and transformed host cells include but are not limited to virions, and prokaryotic and eukaryotic cells such as bacteria, fungi (yeast), plant, insect, and animal (e.g., mammalian, including primate and human, CHO cells and hybridomas) cells. For example, bacteria transformed with recombinant bacteriophage nucleic acid, plasmid nucleic acid or cosmid nucleic acid expression vectors; yeast transformed with recombinant yeast expression vectors; plant cell systems infected with recombinant virus expression vectors (e.g., cauliflower mosaic virus, CaMV; tobacco mosaic virus, TMV) or transformed with recombinant plasmid expression vectors (e.g., Ti plasmid); insect cell systems infected with recombinant virus expression vectors (e.g., baculovirus); and animal cell systems infected with recombinant virus expression vectors (e.g., retroviruses, adenovirus, vaccinia virus), or transformed animal cell systems engineered for stable expression. The cells may be a primary cell isolate, cell culture (e.g., passaged, established or immortalized cell line), or part of a plurality of cells, or a tissue or organ *ex vivo* or in a subject (*in vivo*).

**[00112]** The term “transformed” or “transfected” when used in reference to a cell (e.g., a host cell) or organism, means a genetic change in a cell following incorporation of an exogenous molecule, for example, a protein or nucleic acid (e.g., a transgene) into the cell. Thus, a “transfected” or “transformed” cell is a cell into which, or a progeny thereof in which an exogenous molecule has been introduced by the hand of man, for example, by recombinant DNA techniques.

**[00113]** The nucleic acid or protein can be stably or transiently transfected or transformed (expressed) in the host cell and progeny thereof. The cell(s) can be propagated and the introduced protein expressed, or nucleic acid transcribed. A progeny of a transfected or transformed cell may not be identical to the parent cell, since there may be mutations that occur during replication.

**[0100]** Expression of proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof and nucleic acid in particles or introduction into target cells (e.g., host cells) can also be carried out by methods known in the art. Non-limiting examples include osmotic shock (e.g., calcium phosphate), electroporation, microinjection, cell fusion, etc. Introduction of nucleic acid and polypeptide *in vitro*, *ex*

*vivo* and *in vivo* can also be accomplished using other techniques. For example, a polymeric substance, such as polyesters, polyamine acids, hydrogel, polyvinyl pyrrolidone, ethylene-vinylacetate, methylcellulose, carboxymethylcellulose, protamine sulfate, or lactide/glycolide copolymers, polylactide/glycolide copolymers, or ethylenevinylacetate copolymers. A nucleic acid can be entrapped in microcapsules prepared by coacervation techniques or by interfacial polymerization, for example, by the use of hydroxymethylcellulose or gelatin-microcapsules, or poly (methylmethacrolate) microcapsules, respectively, or in a colloid system. Colloidal dispersion systems include macromolecule complexes, nano-capsules, microspheres, beads, and lipid-based systems, including oil-in-water emulsions, micelles, mixed micelles, and liposomes.

**[0101]** Liposomes for introducing various compositions into cells are known in the art and include, for example, phosphatidylcholine, phosphatidylserine, lipofectin and DOTAP (e.g., U.S. Patent Nos. 4,844,904, 5,000,959, 4,863,740, and 4,975,282; and GIBCO-BRL, Gaithersburg, MD). Piperazine based amphilic cationic lipids useful for gene therapy also are known (see, e.g., U.S. Patent No. 5,861,397). Cationic lipid systems also are known (see, e.g., U.S. Patent No. 5,459,127). Polymeric substances, microcapsules and colloidal dispersion systems such as liposomes are collectively referred to herein as “vesicles.” Accordingly, viral and non-viral vector means delivery into cells are included.

**[0102]** TG proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, for example, of TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, are provided, can be employed in various methods and uses. Such methods and uses include, for example, administration *in vitro* and *in vivo* of one or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, such as the TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, or subsequences, portions, homologues, variants or derivatives thereof. The methods and uses provided include methods and uses of modulating an immune response, including, among others, methods and uses of protecting and treating subjects against a disorder, disease; and methods and uses of providing specific immunotherapy; and methods and uses of diagnosis.

**[0103]** In particular embodiments, methods and uses include administration or delivery of a protein, peptide, subsequence, portion, homologue, variants or derivative thereof described herein (e.g., of any TG amino acid sequences set forth in Table 1 (SEQ

ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) to modulate an immune response in a subject, including, for example, modulating an immune response to an allergen or antigen.

**[0104]** As used herein, the term “modulate,” means an alteration or effect on the term modified. For example, the term modulate can be used in various contexts to refer to an alteration or effect of an activity, a function, or expression of a polypeptide, gene or signaling pathway, or a physiological condition or response of an organism. In certain embodiments, modulating involves decreasing, reducing, inhibiting, suppressing or disrupting an immune response of a subject to an antigen or allergen. In other embodiments, modulating involves eliciting, stimulating, inducing, promoting, increasing or enhancing an immune response of a subject to an antigen or allergen. Thus, where the term “modulate” is used to modify the term “immune response against an allergen in a subject” this means that the immune response in the subject to the allergen is altered or affected (e.g., decreased, reduced, inhibited, suppressed, limited, controlled, prevented, elicited, promoted, stimulated, increased, induced, enhanced, etc.).

**[0105]** Methods and uses of modulating an immune response against an antigen or allergen as described herein may be used to provide a subject with protection against an allergic response or reaction to the allergen, or allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen. Accordingly, in other embodiments, methods and uses include administering a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., of any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) to protect or treat a subject against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. In still other embodiments, methods and uses include administering or delivering a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., of any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) to elicit, stimulate, induce, promote, increase or enhance immunological tolerance of a subject to an antigen or allergen.

**[0106]** In various embodiments, there are provided methods and uses of providing a subject with protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or

complications caused by or associated with an allergen. In various aspects, a method or use includes administering to the subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., of any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) sufficient to provide the subject with protection against the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen.

**[0107]** Methods and uses of the invention include providing a subject with protection against an antigen or allergen, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the exposure to the antigen or allergen, for example, vaccinating the subject to protect against an allergic response to the allergen, for example with any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In certain embodiments, methods and uses include protecting the subject against an allergic response or reaction by inducing tolerance of the subject (desensitizing) to the allergen.

**[0108]** As used herein, the terms “protection,” “protect” and grammatical variations thereof, when used in reference to an allergic response or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the exposure to allergen, means preventing an allergic response, reaction, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the exposure to the allergen, or reducing or decreasing susceptibility to an allergic response, reaction, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the exposure to the allergen.

**[0109]** An allergic response includes but is not limited to an allergic reaction, hypersensitivity, an inflammatory response or inflammation. In certain embodiments allergic response may involve one or more of cell infiltration, production of antibodies, production of cytokines, lymphokines, chemokines, interferons and interleukins, cell growth and maturation factors (e.g., differentiation factors), cell proliferation, cell differentiation, cell accumulation or migration (chemotaxis) and cell, tissue or organ damage or remodeling. In particular aspects, an allergic response may include Allergic rhinitis; Onchocercal dermatitis; Atopic dermatitis; allergic conjunctivitis; Drug reactions;

Nodules, eosinophilia, rheumatism, dermatitis, rashes, hives, and swelling (NERDS); esophageal and a gastrointestinal allergy.

**[0110]** Allergic responses can occur systemically, or locally in any region, organ, tissue, or cell. In particular aspects, an allergic response occurs in the skin, the upper respiratory tract, the lower respiratory tract, pancreas, thymus, kidney, liver, spleen, muscle, nervous system, skeletal joints, eye, mucosal tissue, gut or bowel.

**[0111]** Methods and uses herein include treating a subject for an allergic response, allergic disorder or allergic disease, as well as one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. Such methods and uses include administering to a subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) sufficient to treat the subject for the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen.

**[0112]** As will be understood by a person skilled in the art, treating an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen may include decreasing, reducing, inhibiting, suppressing, limiting, controlling or clearing an allergic response, an allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen. Thus in certain embodiments, a method or use of treating a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen comprises elimination of the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen from a subject. In other embodiments, a method or use of treating a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen includes reducing occurrence, frequency, severity, progression, or duration of the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen in the subject. In yet another

embodiment, a method or use of treating a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, includes stabilizing the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with the allergen in a subject by preventing an increase in the occurrence, frequency, severity, progression, or duration of the allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with contact of the subject with an allergen.

**[0113]** Methods and uses of the invention include treating or administering a subject previously exposed to an antigen or allergen. Thus, in certain embodiments, methods and uses are for treating or protecting a subject from an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with secondary or subsequent exposure to an antigen or allergen.

**[0114]** Physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen treatable in accordance with the invention methods and uses include but are not limited to asthma, allergic asthma, bronchiolitis and pleuritis, Allergic rhinitis; Onchocercal dermatitis; Atopic dermatitis; allergic conjunctivitis; Drug reactions; Nodules, eosinophilia, rheumatism, dermatitis, rashes, hives, and swelling (NERDS); esophageal and a gastrointestinal allergy, Airway Obstruction, Apnea, Asbestosis, Atelectasis, Berylliosis, Bronchiectasis, Bronchiolitis, Bronchiolitis Obliterans Organizing Pneumonia, Bronchitis, Bronchopulmonary Dysplasia, Empyema, Pleural Empyema, Pleural Epiglottitis, Hemoptysis, Hypertension, Kartagener Syndrome, Meconium Aspiration, Pleural Effusion, Pleurisy, Pneumonia, Pneumothorax, Respiratory Distress Syndrome, Respiratory Hypersensitivity, Rhinoscleroma, Scimitar Syndrome, Severe Acute Respiratory Syndrome, Silicosis, Tracheal Stenosis, eosinophilic pleural effusions, Histiocytosis; chronic eosinophilic pneumonia; hypersensitivity pneumonitis; Allergic bronchopulmonary aspergillosis; Sarcoidosis; Idiopathic pulmonary fibrosis; pulmonary edema; pulmonary embolism; pulmonary emphysema; Pulmonary Hyperventilation; Pulmonary Alveolar Proteinosis; Chronic Obstructive Pulmonary Disease (COPD); Interstitial Lung Disease; and Topical eosinophilia.

**[0115]** Timothy grass proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof, described herein may elicit, stimulate, induce, promote, increase or enhance immunological tolerance to an antigen, including an allergen. Methods and uses of the invention therefore further include inducing immunological tolerance of a subject to an antigen or allergen. Thus, for example, Timothy grass proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof, described herein can be effective in treatment (e.g., therapeutic) of an allergic immune response, including but not limited to an allergic immune response following a secondary or subsequent exposure of a subject to an antigen. In one embodiment, a method or use includes administering to the subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6) sufficient to induce tolerance in the subject to the antigen or allergen. In particular aspects, the immunological tolerance elicited, stimulated, induced, promoted, increased or enhanced may involve modulation of T cell activity, including but not limited to CD4+ T cells, CD8+ T cells, Th1 cells, Th2 cells and regulatory T cells. For example, immunological tolerance elicited, stimulated, induced, promoted, increased or enhanced from administration of the Timothy grass proteins or peptides, or subsequence, portion, homologue, variant or derivative thereof, may involve modulation of the production or activity of pro-inflammatory or anti-inflammatory cytokines produced by T cells.

**[0116]** In additional embodiments, a method or use of inducing immunological tolerance in a subject to an allergen includes a reduction in occurrence, frequency, severity, progression, or duration of physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated an allergic response to the allergen in the subject. Thus, in certain embodiments, inducing immunological tolerance can protect a subject against or treat a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen or allergen.

**[0117]** Methods and uses of inducing immunological tolerance described herein may include eliciting, stimulating, inducing, promoting, increasing or enhancing an immune response. In certain embodiments, inducing immunological tolerance may include eliciting, stimulating, inducing, promoting, increasing or enhancing an immune response that decreases, reduces, inhibits, suppresses, limits, controls or clears an allergic response. For example, in certain embodiments inducing immunological tolerance may include

eliciting, stimulating, inducing, promoting, increasing or enhancing proliferation or activity of regulatory T cells. In other embodiments, inducing immunological tolerance may include eliciting, stimulating, inducing, promoting, increasing or enhancing an immune response that promotes an allergic response. As will be understood by a person of skill in the art, a method or use that elicits, stimulates, induces, promotes, increases or enhances an immune response that promotes an allergic response may still induce immunological tolerance by also eliciting, stimulating, inducing, promoting, increasing or enhancing an immune response that decreases, reduces, inhibits, suppresses, limits, controls or clears an allergic response. In particular embodiments, inducing immunological tolerance includes eliciting, stimulating, inducing, promoting, increasing or enhancing an immune responses that decreases, reduces, inhibits, suppresses, limits, controls or clears an allergic response that is stronger than the immune response that promotes an allergic response. In other embodiments, inducing immunological tolerance includes eliciting, stimulating, inducing, promoting, increasing or enhancing more immune responses that decrease, reduce, inhibit, suppress, limit, controls or clear an allergic response than immune responses that promote an allergic response.

**[0118]** Methods and uses of the invention include treating a subject via specific immunotherapy. In one embodiment, a method or use includes administering to the subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof described herein (e.g., any TG amino acid sequences set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. In one aspect, an antigen (allergen) administered to a subject during specific immunotherapy to treat the subject is the same antigen (allergen) to which the subject has been sensitized or is hypersensitive (e.g., allergic). In another non-limiting aspect, an antigen (allergen) administered to a subject to treat the subject is a different antigen (allergen) to which the subject has been sensitized or is hypersensitive (e.g., allergic). Thus in different embodiments, the antigen administered and antigen (e.g., allergen) against which immunological tolerance is sought may be the same protein (antigen, allergen), may be proteins (antigens, allergens) of the same organism or may be proteins (antigens, allergens) of different organisms.

**[0119]** In accordance with the invention, methods and uses include therapeutic (following antigen/allergen exposure) and prophylactic (prior to antigen/allergen exposure) uses and methods. For example, therapeutic and prophylactic methods and uses of treating a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or

complications caused by or associated with an allergen, include but are not limited to treatment of a subject having or at risk of having an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen; treating a subject with an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen; and methods and uses of protecting a subject from an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen (e.g., provide the subject with protection against an allergic reaction to an allergen), to decrease or reduce the probability of an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, in a subject and to decrease or reduce susceptibility of a subject to an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, to inhibit or prevent an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, in a subject. Accordingly, methods and uses can treat an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, or provide a subject with protection from an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen (e.g., prophylactic protection).

**[0120]** As described herein, proteins, peptides, subsequences, portions, homologues, variants and derivatives thereof include T cell epitopes, such as Th2 cell epitopes. Accordingly, methods and uses of the invention include administering an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., a T cell epitope) to a subject sufficient to provide the subject with protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. In another embodiment, a method includes administering an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., a T cell epitope, such as a Th2 cell epitope) to a subject sufficient to treat,

vaccinate or immunize the subject against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen.

**[0121]** In accordance with the invention, methods and uses of modulating anti-allergen activity of T cells, including but not limited to CD8<sup>+</sup> T cells, CD4<sup>+</sup> T cells, Th1 cells or Th2 cells, in a subject are provided. In one embodiment, a method or use includes administering to a subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, such as a T cell epitope, sufficient to modulate Th2 cell activity in the subject.

**[0122]** In all methods and uses of the invention, any appropriate protein, peptide, subsequence, portion, homologue, variant or derivative thereof can be used or administered. In particular non-limiting examples, the protein, peptide, subsequence, portion, homologue, variant or derivative thereof comprises, consists of or consists essentially of a TG amino acid sequence of a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, or a subsequence, portion, homologue, variant or derivative thereof.

**[0123]** In certain embodiments, two or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, may be administered to a subject. In particular embodiments, a protein, peptide, subsequence, portion, homologue, variant or derivative thereof consists of or consists essentially of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6, or subsequence, portion, homologue, variant or derivative thereof, and is administered with one or more other proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof. Two or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof may be administered as a combination composition, or administered separately, such as concurrently or in series or sequentially. Different proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, may be administered to a subject in the same amount, volume or concentration, or different amounts, volumes or concentrations. Thus, in certain embodiments, the subject may be administered the same amount of two or more different proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof; and in other embodiments, the subject may be administered one protein, peptide, subsequence, portion, homologue, variant or derivative thereof in an amount, volume or concentration greater than one or more other

protein, peptide, subsequence, portion, homologue, variant or derivative thereof administered to the subject.

**[0124]** Methods and uses of the invention include a favorable response or an improvement in one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen. In particular embodiments, a favorable response or improvement includes but is not limited to reduce, decrease, suppress, limit, control or inhibit an allergic response including reducing, decreasing, suppressing, limiting, controlling or inhibiting immune cell proliferation, function or activity, or eliciting, stimulating, inducing, promoting, increasing or enhancing immune cell proliferation or activity (e.g. regulatory T cells); or reduce, decrease, suppress, limit, control or inhibit the amount of allergen. In additional particular embodiments, an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof is sufficient to elicit, stimulate, induce, promote, increase or enhance or augment immunological tolerance to an allergen; or decrease, reduce, inhibit, suppress, prevent, control, or limit an allergic reaction or response. In further particular embodiments, an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof is sufficient to protect a subject from an allergic response or reduce, decrease, limit, control or inhibit susceptibility to an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen.

**[0125]** Methods and uses of the invention therefore include any therapeutic or beneficial effect. In various methods embodiments, an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen is reduced, decreased, inhibited, limited, delayed or prevented. Physiological conditions, disorders, illnesses and diseases associated with an antigen/allergen include but are not limited to asthma, allergic asthma, bronchiolitis and pleuritis, Allergic rhinitis; Onchocercal dermatitis; Atopic dermatitis; allergic conjunctivitis; Drug reactions; Nodules, eosinophilia, rheumatism, dermatitis, rashes, hives, and swelling (NERDS); esophageal and a gastrointestinal allergy, Airway Obstruction, Apnea, Asbestosis, Atelectasis, Berylliosis, Bronchiectasis, Bronchiolitis, Bronchiolitis Obliterans Organizing Pneumonia, Bronchitis, Bronchopulmonary Dysplasia, Empyema, Pleural Empyema, Pleural Epiglottitis, Hemoptysis, Hypertension, Kartagener Syndrome, Meconium Aspiration, Pleural Effusion, Pleurisy, Pneumonia, Pneumothorax, Respiratory Distress

Syndrome, Respiratory Hypersensitivity, Rhinoscleroma, Scimitar Syndrome, Severe Acute Respiratory Syndrome, Silicosis, Tracheal Stenosis, eosinophilic pleural effusions, Histiocytosis; chronic eosinophilic pneumonia; hypersensitivity pneumonitis; Allergic bronchopulmonary aspergillosis; Sarcoidosis; Idiopathic pulmonary fibrosis; pulmonary edema; pulmonary embolism; pulmonary emphysema; Pulmonary Hyperventilation; Pulmonary Alveolar Proteinosis; Chronic Obstructive Pulmonary Disease (COPD); Interstitial Lung Disease; and Topical eosinophilia. Symptoms and complications associated with an allergen include but are not limited to cell infiltration, production of antibodies, production of cytokines, lymphokines, chemokines, interferons and interleukins, cell growth and maturation factors (e.g., differentiation factors), cell proliferation, cell differentiation, cell accumulation or migration and cell, tissue or organ damage or remodelling, allergic rhinitis; Onchocercal dermatitis; Atopic dermatitis; allergic conjunctivitis; Drug reactions; Nodules, eosinophilia, rheumatism, dermatitis, rashes, hives, and swelling (NERDS); esophageal and a gastrointestinal allergy.

Additional symptoms of antigen/allergen exposure are known to one of skill in the art and treatment thereof in accordance with the invention is provided.

**[0126]** Methods and uses of the invention moreover include reducing, decreasing, inhibiting, delaying or preventing onset, progression, frequency, duration, severity, probability or susceptibility of one or more adverse symptoms, disorders, illnesses, diseases or complications caused by or associated with an antigen/allergen. In further various particular embodiments, methods and uses include improving, accelerating, facilitating, enhancing, augmenting, or hastening recovery of a subject from an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen. In yet additional various embodiments, methods and uses include stabilizing an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen.

**[0127]** A therapeutic or beneficial effect is therefore any objective or subjective measurable or detectable improvement or benefit provided to a particular subject. A therapeutic or beneficial effect can but need not be complete ablation of all or any allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. Thus, a satisfactory clinical endpoint is achieved when there is an incremental improvement or a partial reduction in an allergic response, allergic disorder or allergic

disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, or an inhibition, decrease, reduction, suppression, prevention, limit or control of worsening or progression of an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, over a short or long duration (hours, days, weeks, months, etc.).

**[0128]** A therapeutic or beneficial effect also includes reducing or eliminating the need, dosage frequency or amount of a second therapeutic protocol or active such as another drug or other agent (e.g., anti-inflammatory) used for treating a subject having or at risk of having an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. For example, reducing an amount of an adjunct therapy, such as a reduction or decrease of a treatment for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, or a specific immunotherapy, vaccination or immunization protocol is considered a beneficial effect. In addition, reducing or decreasing an amount of protein, peptide, subsequence, portion, homologue, variant or derivative thereof, used for specific immunotherapy, vaccination or immunization of a subject to provide protection to the subject is considered a beneficial effect.

**[0129]** As disclosed herein, invention proteins, peptides, subsequences, etc., can be used in methods of providing specific immunotherapy to a subject, such as a subject with or at risk of an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. In one embodiment, a method or use includes administering to a subject an amount of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof sufficient to elicit, stimulate, induce, promote, increase, enhance or augment immunological tolerance in the subject to an antigen/allergen. In another embodiment, a method includes administering to a subject an amount of a nucleic acid encoding all or a portion (e.g., a T cell epitope) of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof sufficient to elicit, stimulate, induce, promote, increase, enhance or augment immunological tolerance of the subject to an allergen.

**[0130]** When an antigen(s) or allergen(s) is administered to induce tolerance, an amount or dose of the antigen or allergen to be administered, and the period of time required to achieve a desired outcome or result (e.g., to desensitize or develop tolerance to the antigen or allergen) can be determined by one skilled in the art. The antigen or allergen may be administered to the patient through any route known in the art, including, but not limited to oral, inhalation, sublingual, epicutaneous, intranasal, and/or parenteral routes (intravenous, intramuscular, subcutaneously, and intraperitoneal).

**[0131]** Methods and uses of the invention include administration of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof to a subject prior to contact by or exposure to an allergen; administration prior to, substantially contemporaneously with or after a subject has been contacted by or exposed to an allergen; and administration prior to, substantially contemporaneously with or after an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. A subject contacted by or exposed to an allergen may have contact or exposure over a period of 1-5, 5-10, 10-20, 20-30, 30-50, 50-100 hours, days, months, or years.

**[0132]** Invention compositions (e.g., proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, including T cell epitopes, for example, of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), methods and uses can be combined with any compound, agent, drug, treatment or other therapeutic regimen or protocol having a desired therapeutic, beneficial, additive, synergistic or complementary activity or effect. Exemplary combination compositions and treatments include multiple proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof such as T cell epitopes as described herein (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), and second actives, such as anti-allergen compounds, agents, drugs, treatments and therapies, including but not limited to anti-histamines, anti-inflammatories, decongestants and corticosteroids as well as agents that assist, promote, stimulate or enhance efficacy. Such anti-allergen drugs, agents, treatments and therapies can be administered or performed prior to, substantially contemporaneously with or following any method or use described herein, for example, a therapeutic use or method of treating a subject for an allergic response, allergic disorder or allergic disease, or one or more physiological conditions,

disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, or a method or use of providing specific immunotherapy to a subject.

**[0133]** Accordingly, methods and uses include combinations of TG proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof and second actives, and administering as a combination with a second active, or administered separately, such as concurrently or in series or sequentially (prior to or following) to administering a second active to a subject. The invention therefore provides combinations of one or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, in combination with a second active, including but not limited to any compound, agent, drug, therapeutic regimen, treatment protocol, process, remedy or composition, such as anti-histamine, anti-inflammatory, decongestant and corticosteroid, or immune tolerance stimulating, enhancing or augmenting protocol, or specific immunotherapy protocol set forth herein or known in the art. The compound, agent, drug, therapeutic regimen, treatment protocol, process, remedy or composition can be administered or performed prior to, substantially contemporaneously with or following administration of one or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, or a nucleic acid encoding all or a portion (e.g., a T cell epitope) of a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, to a subject. Specific non-limiting examples of combination embodiments therefore include the foregoing or other compound, agent, drug, therapeutic regimen, treatment protocol, process, remedy or composition.

**[0134]** An exemplary combination is a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof, and a different protein, peptide, or subsequence, portion, homologue, variant or derivative thereof, of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6. Another exemplary combination is a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, and an immunological tolerance inducing molecule.

**[0135]** In invention methods and uses in which there is a desired outcome or effect, such as a therapeutic or prophylactic method or use that provides a benefit from treatment, protection, inducing immunological tolerance, vaccination or specific immunotherapy, a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof can be administered in a sufficient or effective amount. As used herein, a "sufficient amount" or "effective amount" or an "amount sufficient" or an "amount effective" refers to an amount that provides, in single (e.g., primary) or multiple (e.g.,

booster) doses, alone or in combination with one or more other compounds, treatments, therapeutic regimens or agents (e.g., a drug), a long term or a short term detectable or measurable improvement in a given subject or any objective or subjective benefit to a given subject of any degree or for any time period or duration (e.g., for minutes, hours, days, months, years, or cured).

[0136] An amount sufficient or an amount effective can but need not be provided in a single administration and can but need not be achieved by a particular protein, peptide, subsequence, portion, homologue, variant or derivative thereof, alone, optionally in a combination composition or method or use that includes a second active. In addition, an amount sufficient or an amount effective need not be sufficient or effective if given in single or multiple doses without a second or additional administration or dosage, since additional doses, amounts or duration above and beyond such doses, or additional antigens, compounds, drugs, agents, treatment or therapeutic regimens may be included in order to provide a given subject with a detectable or measurable improvement or benefit to the subject. For example, to increase, enhance, improve or optimize specific immunotherapy, after an initial or primary administration of one or more proteins, peptides, subsequences, portions, homologues, variants or derivative thereof, the subject can be administered one or more additional "boosters" of one or more proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof. Such subsequent "booster" administrations can be of the same or a different type, formulation, dose, concentration, route, etc.

[0137] An amount sufficient or an amount effective need not be therapeutically or prophylactically effective in each and every subject treated, nor a majority of subjects treated in a given group or population. An amount sufficient or an amount effective means sufficiency or effectiveness in a particular subject, not a group of subjects or the general population. As is typical for such methods, different subjects will exhibit varied responses to a method of the invention, such as immunization, vaccination, specific immunotherapy and therapeutic treatments.

[0138] The term "subject" includes but is not limited to a subject at risk of allergen contact or exposure as well as a subject that has been contacted by or exposed to an allergen. A subject also includes those having or at risk of having or developing an immune response to an antigen or an allergen. Such subjects include mammalian animals (mammals), such as a non-human primate (apes, gibbons, gorillas, chimpanzees, orangutans, macaques), a domestic animal (dogs and cats), a farm animal (poultry such as chickens and ducks, horses, cows, goats, sheep, pigs), experimental animal (mouse, rat,

rabbit, guinea pig) and humans. Subjects include animal disease models, for example, mouse and other animal models of allergic response known in the art.

**[0139]** Accordingly, subjects appropriate for treatment include those having or at risk of exposure to an antigen or allergen, also referred to as subjects in need of treatment. Subjects in need of treatment therefore include subjects that have been exposed to or contacted with an antigen or allergen, or that have an ongoing contact or exposure or have developed one or more adverse symptoms caused by or associated with an antigen or allergen, regardless of the type, timing or degree of onset, progression, severity, frequency, duration of the symptoms.

**[0140]** Target subjects and subjects in need of treatment also include those at risk of allergen exposure or contact or at risk of having exposure or contact to an allergen. Accordingly, subjects include those at increased or elevated (high) risk of an allergic reaction; has, or has previously had or is at risk of developing hypersensitivity to an allergen; and those that have or have previously had or is at risk of developing asthma.

**[0141]** More particular target subjects include subjects allergic to particular Timothy Grass antigens and/or allergens. In particular embodiments, a subject is allergic to a Timothy grass pollen allergen, such as a Phl p 1, Phl p 5, and/or Phl p 6 allergen, or is allergic to a homologous allergen, such as a Group 1, Group 5 and/or Group 6 Grass Pollen allergen, e.g. Grass Pollen from Grass of the order *Poales*.

**[0142]** Invention compositions, methods and uses are therefore applicable to treating a subject who is at risk of allergen exposure or contact but has not yet been exposed to or contacted with the allergen. Prophylactic uses and methods are therefore included. Target subjects for prophylaxis may be at increased risk (probability or susceptibility) of allergen exposure or contact as set forth herein. Such subjects are considered in need of treatment due to being at risk.

**[0143]** Subjects for prophylaxis need not be at increased risk but may be from the general population in which it is desired to protect a subject against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen or to provide specific immunotherapy, for example. Such a subject that is desired to be protected against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen or to be provided specific immunotherapy can be administered a protein, peptide, subsequence, portion, homologue, variant or derivative thereof. In another non-limiting example, a subject that is not specifically at risk of

exposure to or contact by an allergen, but nevertheless desires protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, can be administered a protein, peptide, subsequence, portion, homologue, variant or derivative thereof. Such subjects are also considered in need of treatment.

**[0144]** “Prophylaxis” and grammatical variations thereof mean a method or use in which contact, administration or *in vivo* delivery to a subject is prior to contact with or exposure to an allergen. In certain situations it may not be known that a subject has been contacted with or exposed to an allergen, but administration or *in vivo* delivery to a subject can be performed prior to manifestation of an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. For example, a subject can be provided protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen or provided specific immunotherapy with a protein, peptide, subsequence, portion, homologue, variant or derivative thereof. In such case, a method or use can eliminate, prevent, inhibit, suppress, limit, decrease or reduce the probability of or susceptibility towards an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen.

**[0145]** “Prophylaxis” can also refer to a method or use in which contact, administration or *in vivo* delivery to a subject is prior to a secondary or subsequent exposure to an antigen/ allergen. In such a situation, a subject may have had a prior contact or exposure to an allergen. In such subjects, an acute allergic reaction may but need not be resolved. Such a subject typically may have developed anti-allergen antibodies due to the prior exposure. Immunization or vaccination, by administration or *in vivo* delivery to such a subject, can be performed prior to a secondary or subsequent allergen exposure. Such a method or use can eliminate, prevent, inhibit, suppress, limit, decrease or reduce the probability of or susceptibility towards a secondary or subsequent allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. In certain embodiments, such a method or use includes providing specific immunotherapy to the subject to eliminate, prevent, inhibit, suppress,

limit, decrease or reduce the probability of or susceptibility towards a secondary or subsequent allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen.

**[0146]** Treatment of an allergic reaction or response can be at any time during the reaction or response. A protein, peptide, subsequence, portion, homologue, variant or derivative thereof, can be administered as a combination (e.g., with a second active), or separately concurrently or in sequence (sequentially) in accordance with the methods and uses described herein as a single or multiple dose e.g., one or more times hourly, daily, weekly, monthly or annually or between about 1 to 10 weeks, or for as long as appropriate, for example, to achieve a reduction in the onset, progression, severity, frequency, duration of one or more symptoms or complications associated with or caused by an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen.

**[0147]** Accordingly, methods and uses of the invention can be practiced one or more times (e.g., 1-10, 1-5 or 1-3 times) an hour, day, week, month, or year. The skilled artisan will know when it is appropriate to delay or discontinue administration. A non-limiting dosage schedule is 1-7 times per week, for 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20 or more weeks.

**[0148]** Doses can be based upon current existing protocols, empirically determined, using animal disease models or optionally in human clinical trials. Initial study doses can be based upon animal studies, e.g. a mouse, and the amount of protein, peptide, subsequence, portion, homologue, variant or derivative thereof, administered that is determined to be effective. Exemplary non-limiting amounts (doses) are in a range of about 0.1 mg/kg to about 100 mg/kg, and any numerical value or range or value within such ranges. Greater or lesser amounts (doses) can be administered, for example, 0.01-500 mg/kg, and any numerical value or range or value within such ranges. The dose can be adjusted according to the mass of a subject, and will generally be in a range from about 1-10 ug/kg, 10-25 ug/kg, 25-50 ug/kg, 50-100 ug/kg, 100-500 ug/kg, 500-1,000 ug/kg, 1-5 mg/kg, 5-10 mg/kg, 10-20 mg/kg, 20-50 mg/kg, 50-100 mg/kg, 100-250 mg/kg, 250-500 mg/kg, or more, two, three, four, or more times per hour, day, week, month or annually. A typical range will be from about 0.3 mg/kg to about 50 mg/kg, 0-25 mg/kg, or 1.0-10 mg/kg, or any numerical value or range or value within such ranges.

**[0149]** Doses can vary and depend upon whether the treatment is prophylactic or therapeutic, whether a subject has been previously exposed to the antigen/allergen, the onset, progression, severity, frequency, duration, probability of or susceptibility of the symptom, condition, pathology or complication, or vaccination or specific immunotherapy to which treatment is directed, the clinical endpoint desired, previous or simultaneous treatments, the general health, age, gender, race or immunological competency of the subject and other factors that will be appreciated by the skilled artisan. The skilled artisan will appreciate the factors that may influence the dosage and timing required to provide an amount sufficient for providing a therapeutic or prophylactic benefit.

**[0150]** Typically, for treatment, a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, will be administered as soon as practical, typically within 1-2, 2-4, 4-12, 12-24 or 24-72 hours after a subject is exposed to or contacted with an allergen, or within 1-2, 2-4, 4-12, 12-24 or 24-48 hours after onset or development of one or more of an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an antigen/allergen.

**[0151]** For prophylactic treatment in connection with vaccination or specific immunotherapy, proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, can be administered for a duration of 0-4 weeks, e.g., 2-3 weeks, prior to exposure to or contact by an allergen or at least within 1-2, 2-4, 4-12, 12-24, 24-48 or 48-72 hours prior to exposure to or contact by an allergen. For an acute allergic reaction, proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof may be administered at any appropriate time.

**[0152]** The dose amount, number, frequency or duration may be proportionally increased or reduced, as indicated by the status of the subject. For example, whether the subject has an allergic response, whether the subject has been exposed to or contacted by an allergen or is merely at risk of allergen contact or exposure, whether the subject is a candidate for or will be vaccinated or provided specific immunotherapy. The dose amount, number, frequency or duration may be proportionally increased or reduced, as indicated by any adverse side effects, complications or other risk factors of the treatment or therapy.

**[0153]** In methods and uses of the invention, the route, dose, number and frequency of administrations, treatments, vaccinations and specific immunotherapy, and timing/intervals between treatment, vaccination and specific immunotherapy, and allergen

exposure can be modified. Although rapid induction of immune responses or immunological tolerance is desired for developing protective emergency vaccines against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, in certain embodiments, a desirable treatment will elicit robust, long-lasting protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. Thus, in certain embodiments, invention compositions, methods and uses provide long-lasting protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen. Specific immunotherapy strategies can provide long-lived protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen depending on the level of induced immunological tolerance or a T cell response or activity.

**[0154]** TG proteins or peptides, or subsequences, portions, homologues, variants or derivatives thereof can be provided in compositions, and in turn such compositions can be used in accordance with the invention methods and uses. Such compositions, methods and uses include pharmaceutical compositions and formulations. In certain embodiments, a pharmaceutical composition includes one or more TG proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof described herein (e.g., an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). In particular, aspects, such compositions and formulations may be a vaccine, including but not limited to a vaccine to protect against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen.

**[0155]** As used herein the term “pharmaceutically acceptable” and “physiologically acceptable” mean a biologically acceptable formulation, gaseous, liquid or solid, or mixture thereof, which is suitable for one or more routes of administration, *in vivo* delivery or contact. Such formulations include solvents (aqueous or non-aqueous), solutions (aqueous or non-aqueous), emulsions (e.g., oil-in-water or water-in-oil), suspensions, syrups, elixirs, dispersion and suspension media, coatings, isotonic and absorption promoting or delaying agents, compatible with pharmaceutical administration

or *in vivo* contact or delivery. Aqueous and non-aqueous solvents, solutions and suspensions may include suspending agents and thickening agents. Such pharmaceutically acceptable carriers include tablets (coated or uncoated), capsules (hard or soft), microbeads, powder, granules and crystals. Supplementary active compounds (e.g., preservatives, antibacterial, antiviral and antifungal agents) can also be incorporated into the compositions.

**[0156]** To increase an immune response, immunological tolerance or protection against an allergic response, allergic disorder or allergic disease, or one or more physiological conditions, disorders, illnesses, diseases, symptoms or complications caused by or associated with an allergen, proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof, can be coupled to another protein such as ovalbumin or keyhole limpet hemocyanin (KLH), thyroglobulin or a toxin such as tetanus or cholera toxin. Proteins, peptides, subsequences, portions, homologues, variants or derivatives thereof can also be mixed with adjuvants.

**[0157]** Adjuvants include, for example: oil (mineral or organic) emulsion adjuvants such as Freund's complete (CFA) and incomplete adjuvant (IFA) (WO 95/17210; WO 98/56414; WO 99/12565; WO 99/11241; and U.S. Patent No. 5,422,109); metal and metallic salts, such as aluminum and aluminum salts, such as aluminum phosphate or aluminum hydroxide, alum (hydrated potassium aluminum sulfate); bacterially derived compounds, such as Monophosphoryl lipid A and derivatives thereof (e.g., 3 De-O-acylated monophosphoryl lipid A, aka 3D-MPL or d3-MPL, to indicate that position 3 of the reducing end glucosamine is de-O-acylated, 3D-MPL consisting of the tri and tetra acyl congeners), and enterobacterial lipopolysaccharides (LPS); plant derived saponins and derivatives thereof, for example Quil A (isolated from the Quilaja Saponaria Molina tree, see, e.g., "Saponin adjuvants", Archiv. fur die gesamte Virusforschung, Vol. 44, Springer Verlag, Berlin, p243-254; U.S. Patent No. 5,057,540), and fragments of Quil A which retain adjuvant activity without associated toxicity, for example QS7 and QS21 (also known as QA7 and QA21), as described in WO96/33739, for example; surfactants such as, soya lecithin and oleic acid; sorbitan esters such as sorbitan trioleate; and polyvinylpyrrolidone; oligonucleotides such as CpG (WO 96/02555, and WO 98/16247), polyriboA and polyriboU; block copolymers; and immunostimulatory cytokines such as GM-CSF and IL-1, and Muramyl tripeptide (MTP). Additional examples of adjuvants are described, for example, in "Vaccine Design--the subunit and adjuvant approach" (Edited by Powell, M. F. and Newman, M. J.; 1995, Pharmaceutical Biotechnology (Plenum

Press, New York and London, ISBN 0-306-44867-X) entitled "Compendium of vaccine adjuvants and excipients" by Powell, M. F. and Newman M.

**[0158]** Cosolvents may be added to a protein, peptide, subsequence, portion, homologue, variant or derivative thereof, composition or formulation. Non-limiting examples of cosolvents contain hydroxyl groups or other polar groups, for example, alcohols, such as isopropyl alcohol; glycols, such as propylene glycol, polyethyleneglycol, polypropylene glycol, glycol ether; glycerol; polyoxyethylene alcohols and polyoxyethylene fatty acid esters. Non-limiting examples of cosolvents contain hydroxyl groups or other polar groups, for example, alcohols, such as isopropyl alcohol; glycols, such as propylene glycol, polyethyleneglycol, polypropylene glycol, glycol ether; glycerol; polyoxyethylene alcohols and polyoxyethylene fatty acid esters.

**[0159]** Supplementary compounds (e.g., preservatives, antioxidants, antimicrobial agents including biocides and biostats such as antibacterial, antiviral and antifungal agents) can also be incorporated into the compositions. Pharmaceutical compositions may therefore include preservatives, anti-oxidants and antimicrobial agents.

**[0160]** Preservatives can be used to inhibit microbial growth or increase stability of ingredients thereby prolonging the shelf life of the pharmaceutical formulation. Suitable preservatives are known in the art and include, for example, EDTA, EGTA, benzalkonium chloride or benzoic acid or benzoates, such as sodium benzoate. Antioxidants include, for example, ascorbic acid, vitamin A, vitamin E, tocopherols, and similar vitamins or provitamins.

**[0161]** An antimicrobial agent or compound directly or indirectly inhibits, reduces, delays, halts, eliminates, arrests, suppresses or prevents contamination by or growth, infectivity, replication, proliferation, reproduction, of a pathogenic or non-pathogenic microbial organism. Classes of antimicrobials include antibacterial, antiviral, antifungal and antiparasitics. Antimicrobials include agents and compounds that kill or destroy (-cidal) or inhibit (-static) contamination by or growth, infectivity, replication, proliferation, reproduction of the microbial organism.

**[0162]** Exemplary antibacterials (antibiotics) include penicillins (e.g., penicillin G, ampicillin, methicillin, oxacillin, and amoxicillin), cephalosporins (e.g., cefadroxil, ceforanid, cefotaxime, and ceftriaxone), tetracyclines (e.g., doxycycline, chlortetracycline, minocycline, and tetracycline), aminoglycosides (e.g., amikacin, gentamycin, kanamycin, neomycin, streptomycin, netilmicin, paromomycin and tobramycin), macrolides (e.g., azithromycin, clarithromycin, and erythromycin), fluoroquinolones (e.g., ciprofloxacin, lomefloxacin, and norfloxacin), and other

antibiotics including chloramphenicol, clindamycin, cycloserine, isoniazid, rifampin, vancomycin, aztreonam, clavulanic acid, imipenem, polymyxin, bacitracin, amphotericin and nystatin.

**[0163]** Particular non-limiting classes of anti-virals include reverse transcriptase inhibitors; protease inhibitors; thymidine kinase inhibitors; sugar or glycoprotein synthesis inhibitors; structural protein synthesis inhibitors; nucleoside analogues; and viral maturation inhibitors. Specific non-limiting examples of anti-virals include nevirapine, delavirdine, efavirenz, saquinavir, ritonavir, indinavir, nelfinavir, amprenavir, zidovudine (AZT), stavudine (d4T), lamivudine (3TC), didanosine (DDI), zalcitabine (ddC), abacavir, acyclovir, penciclovir, ribavirin, valacyclovir, ganciclovir, 1-D-ribofuranosyl-1,2,4-triazole-3 carboxamide, 9->2-hydroxy-ethoxy methylguanine, adamantanamine, 5-iodo-2'-deoxyuridine, trifluorothymidine, interferon and adenine arabinoside.

**[0164]** Pharmaceutical formulations and delivery systems appropriate for the compositions, methods and uses of the invention are known in the art (see, *e.g.*, Remington: The Science and Practice of Pharmacy (2003) 20<sup>th</sup> ed., Mack Publishing Co., Easton, PA; Remington's Pharmaceutical Sciences (1990) 18<sup>th</sup> ed., Mack Publishing Co., Easton, PA; The Merck Index (1996) 12<sup>th</sup> ed., Merck Publishing Group, Whitehouse, NJ; Pharmaceutical Principles of Solid Dosage Forms (1993), Technomic Publishing Co., Inc., Lancaster, Pa.; Ansel ad Soklosa, Pharmaceutical Calculations (2001) 11<sup>th</sup> ed., Lippincott Williams & Wilkins, Baltimore, MD; and Poznansky et al., Drug Delivery Systems (1980), R. L. Juliano, ed., Oxford, N.Y., pp. 253-315).

**[0165]** Pharmaceutical compositions can be formulated to be compatible with a particular route of administration. Thus, pharmaceutical compositions include carriers, diluents, or excipients suitable for administration by various routes. Exemplary routes of administration for contact or *in vivo* delivery which a composition can optionally be formulated include inhalation, respiration, intranasal, intubation, intrapulmonary instillation, oral, buccal, intrapulmonary, intradermal, topical, dermal, parenteral, sublingual, subcutaneous, intravascular, intrathecal, intraarticular, intracavity, transdermal, iontophoretic, intraocular, ophthalmic, optical, intravenous (i.v.), intramuscular, intraglandular, intraorgan, or intralymphatic.

**[0166]** Formulations suitable for parenteral administration include aqueous and non-aqueous solutions, suspensions or emulsions of the active compound, which preparations are typically sterile and can be isotonic with the blood of the intended recipient. Non-

limiting illustrative examples include water, saline, dextrose, fructose, ethanol, animal, vegetable or synthetic oils.

**[0167]** Methods and uses of the invention may be practiced by any mode of administration or delivery, or by any route, systemic, regional and local administration or delivery. Exemplary administration and delivery routes include intravenous (i.v.), intraperitoneal (i.p.), intrarterial, intramuscular, parenteral, subcutaneous, intra-pleural, topical, dermal, intradermal, transdermal, transmucosal, intra-cranial, intra-spinal, rectal, oral (alimentary), mucosal, inhalation, respiration, intranasal, intubation, intrapulmonary, intrapulmonary instillation, buccal, sublingual, intravascular, intrathecal, intracavity, iontophoretic, intraocular, ophthalmic, optical, intraglandular, intraorgan, or intralymphatic.

**[0168]** For oral administration, a composition can take the form of, for example, tablets or capsules prepared by conventional means with pharmaceutically acceptable excipients such as binding agents (for example, pregelatinised maize starch, polyvinylpyrrolidone or hydroxypropyl methylcellulose); fillers (for example, lactose, microcrystalline cellulose or calcium hydrogen phosphate); lubricants (for example, magnesium stearate, talc or silica); disintegrants (for example, potato starch or sodium starch glycolate); or wetting agents (for example, sodium lauryl sulphate). The tablets can be coated by methods known in the art. Liquid preparations for oral administration can take the form of, for example, solutions, syrups or suspensions, or they can be presented as a dry product for constitution with water or other suitable vehicle before use. Such liquid preparations can be prepared by conventional means with pharmaceutically acceptable additives such as suspending agents (for example, sorbitol syrup, cellulose derivatives or hydrogenated edible fats); emulsifying agents (for example, lecithin or acacia); non-aqueous vehicles (for example, almond oil, oily esters, ethyl alcohol or fractionated vegetable oils); and preservatives (for example, methyl or propyl-p-hydroxybenzoates or sorbic acid). The preparations can also contain buffer salts, flavoring, coloring, and sweetening agents as appropriate.

**[0169]** For administration by inhalation, a composition can be delivered in the form of an aerosol spray presentation from pressurized packs or a nebulizer, with the use of a suitable propellant, for example, dichlorodifluoromethane, trichlorofluoromethane, dichlorotetrafluoroethane, carbon dioxide or other suitable gas. In the case of a pressurized aerosol, the dosage unit can be determined by providing a valve to deliver a metered amount. Capsules and cartridges for use in an inhaler or insufflator can be

formulated containing a powder mix of the compound and a suitable powder base such as lactose or starch.

**[0170]** Invention TG proteins and peptides, e.g., a protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), subsequences, portions, homologues, variants or derivatives thereof optionally along with any adjunct agent, compound, drug, composition, whether active or inactive, etc., can be packaged in unit dosage form (capsules, tablets, troches, cachets, lozenges) for ease of administration and uniformity of dosage. A “unit dosage form” as used herein refers to physically discrete units suited as unitary dosages for the subject to be treated; each unit containing a predetermined quantity of active ingredient optionally in association with a pharmaceutical carrier (excipient, diluent, vehicle or filling agent) which, when administered in one or more doses, is calculated to produce a desired effect (e.g., prophylactic or therapeutic effect). Unit dosage forms also include, for example, ampules and vials, which may include a composition in a freeze-dried or lyophilized state; a sterile liquid carrier, for example, can be added prior to administration or delivery *in vivo*. Unit dosage forms additionally include, for example, ampules and vials with liquid compositions disposed therein. Individual unit dosage forms can be included in multi-dose kits or containers. Pharmaceutical formulations can be packaged in single or multiple unit dosage form for ease of administration and uniformity of dosage.

**[0171]** The invention also provides methods of diagnosing and detecting an allergic response or allergy in a subject. The methods can be performed in solution, in solid phase, in silica, *in vitro*, in a cell, and *in vivo*. In one embodiment, a method includes contacting a cell (e.g., T cell) from the subject with a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof, as described herein (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6); and determining if the protein or peptide modulates an immune response or activity of the contacted cell (e.g., T cell). A determination that the TG protein or peptide modulates an immune response or immune activity of the contacted cell indicates that the subject has an allergic response or an allergy, in particular, an allergy to the protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6). In a particular aspect, the immune activity determined is Th2 cell reactivity. In another particular

aspect, immune response or activity is determined by assaying for a cutaneous immunological hypersensitive reaction.

**[0172]** The terms “determining,” “assaying” and “measuring” and grammatical variations thereof are used interchangeably herein and refer to either qualitative or quantitative determinations, or both qualitative and quantitative determinations, that involve manipulation or processing. When the terms are used in reference to measurement or detection, any means of assessing the relative amount, including the various methods set forth herein and known in the art, performed by the hand of man, is contemplated.

**[0173]** The invention provides kits including TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), combination compositions and pharmaceutical formulations thereof, packaged into suitable packaging material. Kits can be used in various *in vitro*, *ex vivo* and *in vivo* methods and uses, for example a treatment method or use as disclosed herein.

**[0174]** A kit typically includes a label or packaging insert including a description of the components or instructions for use *in vitro*, *in vivo*, or *ex vivo*, of the components therein. A kit can contain a collection of such components, e.g., a TG protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), alone, or in combination with another therapeutically useful composition (e.g., an immune modulatory drug).

**[0175]** The term “packaging material” refers to a physical structure housing the components of the kit. The packaging material can maintain the components steriley, and can be made of material commonly used for such purposes (e.g., paper, corrugated fiber, glass, plastic, foil, ampules, vials, tubes, etc.).

**[0176]** Kits of the invention can include labels or inserts. Labels or inserts include “printed matter,” e.g., paper or cardboard, or separate or affixed to a component, a kit or packing material (e.g., a box), or attached to an ampule, tube or vial containing a kit component. Labels or inserts can additionally include a computer readable medium, such as a disk (e.g., hard disk), optical disk such as CD- or DVD-ROM/RAM, DVD, MP3, magnetic tape, or an electrical storage media such as RAM and ROM or hybrids of these such as magnetic/optical storage media, FLASH media or memory type cards.

**[0177]** Labels or inserts can include identifying information of one or more components therein, dose amounts, clinical pharmacology of the active ingredient(s) including mechanism of action, pharmacokinetics and pharmacodynamics. Labels or inserts can include information identifying manufacturer information, lot numbers, manufacturer location and date.

**[0178]** Labels or inserts can include information on a condition, disorder, disease or symptom for which a kit component may be used. Labels or inserts can include instructions for the clinician or for a subject for using one or more of the kit components in a method, use, treatment protocol or therapeutic regimen. Instructions can include dosage amounts, frequency or duration, and instructions for practicing any of the methods and uses, treatment protocols or therapeutic regimes set forth herein. Exemplary instructions include, instructions for modulating an immune response or activity of a cell against an allergen; modulating an immune response against an allergen in a subject; desensitizing, or inducing, eliciting, increasing or improving immunological tolerance to a protein or peptide allergen; reducing risk or providing a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease; treating an allergic reaction, allergic response, allergic disorder or allergic disease; or detecting an allergic response or diagnosing an allergy in a subject.

**[0179]** Labels or inserts can include information on any benefit that a component may provide, such as a prophylactic or therapeutic benefit. Labels or inserts can include information on potential adverse side effects, such as warnings to the subject or clinician regarding situations where it would not be appropriate to use a particular composition. Adverse side effects could also occur when the subject has, will be or is currently taking one or more other medications that may be incompatible with the composition, or the subject has, will be or is currently undergoing another treatment protocol or therapeutic regimen which would be incompatible with the composition and, therefore, instructions could include information regarding such incompatibilities.

**[0180]** Invention kits can additionally include other components. Each component of the kit can be enclosed within an individual container and all of the various containers can be within a single package. Invention kits can be designed for cold storage. Invention kits can further be designed to contain to the protein, peptide, subsequence, portion, homologue, variant or derivative thereof (e.g., of an amino acid sequence of a TG protein or peptide set forth in Table 1 (SEQ ID NOS 1-620), Table 2 (SEQ ID NOS 621-1442), Table 4 (SEQ ID NOS 1443-2264) or Table 6), or combination compositions or pharmaceutical compositions.

**[0181]** Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described herein.

**[0182]** All publications and patent applications cited in this specification are herein incorporated by reference as if each individual publication or patent application were specifically and individually indicated to be incorporated by reference. The citation of any publication is for its disclosure prior to the filing date and should not be construed as an admission that the invention is not entitled to antedate such publication by virtue of prior invention.

**[0183]** As used in this specification and the appended claims, the use of an indefinite article or the singular forms “a,” “an” and “the” include plural reference unless the context clearly dictates otherwise. In addition, it should be understood that the individual peptides, proteins, antigens, allergens (referred to collectively as compositions), or groups of compositions, modeled or derived from the various components or combinations of the compositions, and substituents described herein, are disclosed by the application to the same extent as if each composition or group of compositions was set forth individually. Thus, selection of particular peptides, proteins, antigens, allergens, etc. is clearly within the scope of the invention.

**[0184]** As used in this specification and the appended claims, the terms “comprise”, “comprising”, “comprises” and other forms of these terms are intended in the non-limiting inclusive sense, that is, to include particular recited elements or components without excluding any other element or component. Unless defined otherwise all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this invention belongs. As used herein, “about” means + or - 5%. The use of the alternative (e.g., “or”) should be understood to mean one, both, or any combination thereof of the alternatives, i.e., “or” can also refer to “and.”

**[0185]** As used in this specification and the appended claims, any concentration range, percentage range, ratio range or other integer range is to be understood to include the value of any integer within the recited range and, when appropriate, fractions thereof (such as one tenth and one hundredth of an integer), unless otherwise indicated. For example, although numerical values are often presented in a range format throughout this document, a range format is merely for convenience and brevity and should not be

construed as an inflexible limitation on the scope of the invention. Accordingly, the use of a range expressly includes all possible subranges, all individual numerical values within that range, and all numerical values or numerical ranges including integers within such ranges and fractions of the values or the integers within ranges unless the context clearly indicates otherwise. This construction applies regardless of the breadth of the range and in all contexts throughout this patent document. Thus, to illustrate, reference to a range of 90-100% includes 91-99%, 92-98%, 93-95%, 91-98%, 91-97%, 91-96%, 91-95%, 91-94%, 91-93%, and so forth. Reference to a range of 90-100%, includes 91%, 92%, 93%, 94%, 95%, 96%, 97%, etc., as well as 91.1%, 91.2%, 91.3%, 91.4%, 91.5%, etc., 92.1%, 92.2%, 92.3%, 92.4%, 92.5%, etc., and so forth. Reference to a range of 5-10, 10-20, 20-30, 30-40, 40-50, 50-75, 75-100, 100-150, and 150-175, includes ranges such as 5-20, 5-30, 5-40, 5-50, 5-75, 5-100, 5-150, 5-171, and 10-30, 10-40, 10-50, 10-75, 10-100, 10-150, 10-175, and 20-40, 20-50, 20-75, 20-100, 20-150, 20-175, and so forth. Further, for example, reference to a series of ranges of 2-72 hours, 2-48 hours, 4-24 hours, 4-18 hours and 6-12 hours, includes ranges of 2-6 hours, 2, 12 hours, 2-18 hours, 2-24 hours, etc., and 4-27 hours, 4-48 hours, 4-6 hours, etc.

**[0186]** Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is readily apparent to those of ordinary skill in the art in light of the teachings of this invention that certain changes and modifications may be made thereto without departing from the spirit or scope of the appended claims. The invention is further exemplified by way of the following non-limited examples.

## EXAMPLES

### Example 1

**[0187]** This example includes a description of materials and methods.

**[0188]** **Donor population.** Each donor was recruited following Institutional Review Board approval (Federal Wide Assurance number 00000032) and informed consent and assigned a study identification number. Donors were tested for allergen reactivity by skin prick tests to extracts from 32 common allergens. TG allergic donors were identified as having a skin reaction with a wheal of  $\geq 5$  mm in diameter to TG and a clinical history consistent with seasonal grass pollen allergy. Donors that had received specific immunotherapy were excluded. Non-allergic donors were identified as having negative skin prick tests to all allergens and no clinical history of allergy.

**[0189] Identification of novel TG pollen proteins.** Novel TG pollen proteins were identified as follows:

**[0190] Assembly of TG pollen transcriptome.** Novel Timothy grass (TG) pollen proteins that are potential T cell antigens were identified by a combination of 2D gel/immunoblot analysis and cDNA sequence analysis of soluble pollen extract. Total RNA of TG pollen was isolated as previously described (Allergon AB, Ängelholm, Sweden) (31). In brief, 1 mg ground pollen was homogenized in 20 ml 4.2 M guanidine hiocyanate, 50 mM of BES pH 7.2, 4 mM EDTA followed by centrifugation at 15000 g for 15 min. Total RNA was prepared from the supernatant using the TRIzol LS Reagent (Invitrogen, Carlsbad, CA, USA) according to the manufacturer's instructions. The RNA was then analyzed by high-throughput sequencing on an Illumina Genome Analyzer. First, double stranded cDNA was constructed from total RNA using the Illumina TotalPrep RNA Amplification kit (Ambion). The cDNA was then converted into fragments of approximately 200 bp using NEBNext® dsDNA Fragmentase™ (New England Biolabs). The ends were repaired, dA tails were added to the fragmented DNA using NEBNext® DNA Sample Preparation kit, and adaptors were added. Sequencing was performed on an Illumina Genome Analyzer IIx (GAIIX). Briefly, adaptor ligated cDNA was loaded into an Illumina flow cell. DNA was then bridge-amplified within the flowcell to generate millions of DNA clusters, using specific reagents and enzymes (Illumina Paired-End Cluster Generation Kit). The flow cell was then loaded onto the GAIIX equipped with a paired-end module, and 72 sequencing cycles were performed to generate sequence in both directions using Illumina Sequencing Kit v4. Replicate samples were run in 7 of the 8 lanes on the flow cell, producing over 280 million raw sequence reads of 72bp in length. Reads went through several preprocessing steps using the FastX toolkit (33) before they were assembled into contigs: 1) the 3' terminal base was removed; 2) low-complexity reads were removed; 3) portions of reads downstream of a low quality score were removed; 4) portions of reads corresponding to adapter sequencers were removed. The remaining reads were assembled into contigs using Velvet version 1.0.15 (32). Due to the excessive memory requirements inherent to de novo sequence assembly, the reads for each lane were considered separately and were each run with five different values for the word size parameter (k=21, 23, 25, 27, 29). The present inventors and others (33) have observed that different sets of contigs are obtained for each value for k. The contigs were further merged with Oases version 0.18.1 (D. R. Zerbino, European Bioinformatics Institute) into 1,764,158 putative transcripts. After redundancy reduction,

1,016,285 transcripts remained (including isoforms and other variants) with an average length of 245 bp and a maximum length of 6,884 bp.

**[0191]** *2D DIGE (Difference Gel Electrophoresis) analysis.* The complete 2D DIGE analysis was performed by Applied Bioscience (Hayward, California, US). Briefly, TG extract was run on two 2D gels (3-10 pH range, 12% SDS-acrylamide gel), one was Coomassie blue stained, the other was blotted onto a nitrocellulose membrane. The membrane was then incubated with 5% dried milk in PBS/0.05% Tween to block non-specific binding and subsequently probed with a serum pool from 8 TG-allergic individuals at a dilution of 1:250. IgE and IgG binding was detected using goat anti-human IgE and rabbit anti-human IgG (Sigma-Aldrich, St. Louis, MO) and visualized using Cy2-conjugated donkey anti-goat IgG and Cy5-conjugated donkey anti-mouse IgG antibodies (Biotium, Hayward, CA).

**[0192]** *Pollen protein identification by mass spectrometry.* Mass spectral protein identification was performed by Applied Bioscience (Hayward, California, US). Briefly, spots of interest were selected from the 2D blot and the corresponding spots were identified on the stained SDS gel and cut out, washed several times to remove staining dye and other inhibitory chemicals. The spots were then dried to absorb maximum digestion buffer. Dried 2D gel spots were rehydrated in digestion buffer containing trypsin. Proteins were digested in-gel at 37°C and then extracted from the gel with TFA extraction buffer. Subsequently the peptides were desalting using C-18 Zip-tips (Millipore) and mixed with CHCA matrix (alpha-cyano-4-hydroxycinnamic acid) and spotted into wells of a MALDI plate. Mass spectra of the peptides in each sample were obtained using an Applied Biosystems Proteomics Analyzer. The spectra were compared to the amino acid sequences encoded by putative ORFs from the de novo assembled TG pollen transcripts. All ORFs encoding for 15 amino acid residues or longer that had a >95% confidence hit as evaluated by the Mascot software package (Matrix science) were considered hits (Table 1). The amino acid sequences encoded by these ORFs were clustered using a custom script at a sequence similarity threshold of 90% to group together highly similar protein sequences. These sequences are encoded by different transcripts from the current assembly, which could arise from splice variants, allelic variation between cells of TG pollen, and from gene families with multiple members. Amino acid sequences that form one cluster are assigned one putative protein ID (Table 1).

**[0193]** *Assembly of a peptide set predicted to promiscuously bind HLA class II molecules.* For each 15-mer peptide encoded in the ORFs in Table 2, the binding affinity

to a panel of 25 HLA class II molecules was predicted (Table 3) using a consensus prediction approach (21, 22). Peptides with predicted binding scores in the top 20% for a given allele were considered potential binders. Peptides predicted to bind 13 or more HLA molecules at this threshold were considered promiscuous binders, and selected for synthesis (after eliminating peptides overlapping by more than 9 contiguous residues). If less than 5 peptides from a given protein met this threshold, the top 5 peptides were chosen, and up to 4 peptides in proteins where length was prohibitive. In total, this resulted in the selection of 822 peptides from a total of 21,506 distinct 15-mers encoded in 620 ORFs (Table 2). As a control, a set of 105 peptides was derived from the known TG allergens using the same prediction approach. The selected peptides were purchased from A and A (San Diego, CA) as crude material on a small (1 mg) scale. Peptides that tested positive and were included in the dominant epitope pools were purchased as purified material (>95% pure) on a 5-10 mg scale.

**[0194] PBMC isolation and in vitro expansion of TG extract-specific T cells.**

PBMCs were isolated by density gradient centrifugation from one unit of blood (~450 ml) and cryo-preserved as described previously (12). For in vitro expansions, PBMCs were thawed and cultured in RPMI 1640 (Ω Scientific, Tarzana, CA) supplemented with 5% human AB serum (Cellgro, Herndon, VA) at a density of 2 x 10<sup>6</sup> cells/ml in 24-well plates (BD Biosciences, San Jose, CA) and stimulated with TG pollen extract (50 µg/ml) (Greer, Lenoir, NC). Cells were kept at 37°C, 5% CO<sub>2</sub> and additional IL-2 and IL-7 (10U/ml, eBioscience, San Diego, CA) was added every 3 d after initial antigenic stimulation. On day 14, cells were harvested and screened for reactivity against TG-specific peptide pools (16-25 peptides/pool, averaging 20 peptides/pool). On day 17, peptides from positive pools were tested individually to identify the reactive epitopes.

**[0195] ELISPOT assays.** The production of IL-5 from cultured PBMCs in response to antigen stimulation was measured by ELISPOT as described previously (12). Briefly, 1 x 10<sup>5</sup> cells/well were incubated with peptide, peptide pool or TG extract (10 µg/ml, 5 µg/ml and 50 µg/ml, respectively). After 24 h, cells were removed and plates were incubated with 2 µg/ml biotinylated anti-human IL-5 Ab (Mabtech) at 37 °C. After 2 h, plates were washed and avidin-peroxidase-complex was added (Vector Laboratories, Burlingame, CA) for 1 h at RT. Peroxidase-conjugated spots were developed with 3-amino-9-ethylcarbazole solution (Sigma-Aldrich, St. Louis, MO). Criteria for peptide pool positivity were 100 SFCs/10<sup>6</sup> PBMCs, p≤ 0.05, and a stimulation index (SI) ≥ 2. Criteria for individual peptides were the same except a minimum of 20 SFCs was counted as positive.

**[0196]** **FACS sorting of T cell subpopulations.** PBMCs were thawed, washed and counted. CD4+ T cells were isolated using a CD4+ T cell isolation Kit II (Miltenyi Biotec, Auburn, CA) according to manufacturer's instructions and subsequently stained with antibodies to sort desired T cell subpopulations. Memory and naïve T cell populations were sorted from CD4+ cells stained with CD45RA-FITC and CCR7-BL421. The naïve population was sorted as CD45RA+CCR7+ and the memory population was sorted as CD45RA- CCR7-/. CD45RA+ CCR7- cells were not collected. Subsequently these subpopulations were put into culture with irradiated PBMC and stimulated with TG pollen extract and cultured for 14 days with IL-2 and IL-7 added every 3 days. IL-5 production in response to stimuli was assessed by ELISPOT. For Th1 and Th2 subpopulations, cells were sorted from CD4+ cells stained with CCR4-PECy7, CCR6-PE and CXCR3-APC. Th2 cells were sorted as CCR4+CCR6-CXCR3- T cells and Th1 cells were sorted as CCR4-CCR6+CXCR3+ T cells. Sorted cells were plated into ELISPOT plates with stimulus and CD4 depleted, irradiated PBMC as APC. IL-5 production was assessed after 24 h incubation.

**Example 2**

**[0197]** This example includes a description of studies showing that a significant fraction of TG reactive T cells in allergic donors do not target the major IgE reactive allergens.

**[0198]** In a previous study (12), the T cell epitopes in the ten known major IgE reactive allergens present in TG pollen were determined. Using 15-mer peptides overlapping by 10 residues that spanned the entire protein sequence of each of these allergens, 20 dominant epitopic regions accounting for the majority of T cell responses were identified. However, despite this comprehensive panel of peptides and the sensitivity of the T cell assays used, this study did not identify any IL-5 producing T cells responding to these ten allergens in 33% of the allergic donors tested despite strong responses ( $\geq 100$  Spot Forming Cells (SFC)) to the whole TG extract (Figure 1). These data suggested that a significant portion of the T cell response to TG was directed against antigens other than the known major IgE reactive allergens.

**Example 3**

**[0199]** This example includes a description of studies showing identification of novel TG pollen proteins through a combined transcriptomics and proteomics analysis.

**[0200]** As few proteins apart from IgE reactive allergens have been identified in TG (or any other allergenic grasses), the identification of all proteins with significant

expression in TG pollen were pursued so that a more comprehensive analysis of T cell responses to TG could be performed. mRNA of TG pollen was isolated and analyzed by high-throughput sequencing on an Illumina Genome Analyzer. A total of 1,016,285 unique, putative transcripts (including allelic variants and isoforms) were identified. Of the ten known TG allergen proteins considered in the previous study (Phl p 1, 2, 3, 4, 5, 6, 7, 11, 12 and 13), all but one (Phl p 6) were identified in the transcriptome analysis with large fragments or entire sequences matching at >90% identity. Interestingly, one transcript matched the published Phl p 6 sequence with very high significance (Blast E-value of 4E-16) but much lower sequence identity (61%). This demonstrated that the transcripts identified from TG pollen mRNA recovered the vast majority of known allergens, but the approach herein also identified putative new variants of known allergens.

**[0201]** Next, a proteomics approach was utilized to determine which of the newly identified transcripts encoded proteins detectable in TG pollen. For this purpose, TG pollen extract was separated by 2D gel electrophoresis and either stained with Coomassie blue or immuno-blotted using a pool of sera from 8 TG allergic donors (Figure 2) to detect proteins reactive with IgE and/or IgG antibodies. Spots were cut out from unstained gels, trypsin digested, and analyzed by peptide fingerprint mass mapping (using MS data) and peptide fragmentation mapping (using MS/MS data) to obtain amino acid sequences. Of 131 spots picked from the 2D gels, 119 could be assigned with high confidence to one or more open reading frames (ORFs) from the transcript sequences. After clustering ORFs with >90% sequence identity, it was found that the 119 identifiable spots corresponded to 89 non-redundant protein sequences including 6 of the known TG allergens. This left 83 distinct protein sequences corresponding to previously unidentified proteins identified by spots on the gel. To these was added another 10 proteins not identified in any spots cut out of the gel, but rather in a mass spec analysis of the whole TG extract. In total, this resulted in a set of 93 novel proteins from TG pollen that was further analyzed for T cell reactivity (Table 1).

**[0202]** To determine if any of the proteins identified were derived from contaminants (such as bacteria) possibly present in the TG pollen extract, the amino acid sequences were ran through NCBI BLAST. Two proteins (#27 and #38) had high homology to previously identified TG proteins that are not considered allergens. Of the remaining proteins, #76, had highly homologous (BLAST E value < 10-10) matches in the rice genome (the closest to TG of all fully sequenced genomes available). Of the remaining proteins, none had similarly high homology to any publicly available sequence. Overall,

based on similarity to known protein sequences, it was unlikely that the sets of protein sequences contained non-plant contaminants, indicating that the sequences were from bona fide TG proteins.

**Example 4**

**[0203]** This example includes a description of studies showing that T cells respond vigorously to epitopes from novel TG pollen proteins.

**[0204]** The 93 novel protein sequences were scanned for peptides predicted to bind to multiple HLA class II molecules. For each protein, all overlapping 15-mer peptides were analyzed and their binding affinity predicted to a panel of 25 HLA DR, DP and DQ molecules (Table 3) using a consensus approach of multiple machine learning methods (21,22). Non-overlapping peptides that were predicted to promiscuously bind multiple HLA class II molecules were selected from each protein. In total, this resulted in the selection of 822 peptides from a total of 21,506 distinct 15-mers (Table 2).

**[0205]** The 822 peptides were assembled into 42 pools of about 20 peptides each, which were analyzed for recognition by PBMCs from 20 TG allergic and 20 normal donors (Table 4). IL-5 ELISPOT assays were used to measure T cell reactivity because Th2 responses are important in allergy pathogenesis. In the studies herein, IL-5 is a more sensitive read-out in ELISPOT assays compared to other Th2 cytokines, namely IL-4 and IL-13 (Figure 7) (15). In addition to peptide pools from novel allergens, 5 peptide pools from the ten known TG allergens assembled using the same prediction strategy were analyzed. Of the novel peptide pools 13/42 pools stimulated IL-5 production in PBMCs in over 20% of allergic donors. For the known allergen pools, 4/5 pools were recognized by over 20% of allergic donors. In contrast, none of the peptide pools elicited an IL-5 response in more than 10% of the non-allergic donors (Figure 3a).

**[0206]** When comparing the combined magnitude of responses directed against the known allergens vs. the Novel Timothy Grass Antigens (NTGA), it was evident that a very significant fraction of the T cell response to TG targeted the novel antigens. In fact, 61% of responding T cells (2,101 SFC, Figure 3b) recognized novel peptides while the response directed against the control panel of peptides from major known allergens only accounted for 39% of the T cell responses (1,345 SFC, Figure 3b). In the non-allergic population, the IL-5 responses were much weaker. However, the difference in response magnitude between the known allergens and novel antigens was even more pronounced, with 88.4% of the response targeting the novel antigens (574 SFC) and 11.6% targeting the known allergens (75 SFC). Overall, these data showed that a majority of Th2 cell

responses against TG extract were directed against antigens other than the known IgE-reactive allergens.

**Example 5**

[0207] This example includes a description of studies showing identification of T cell reactive antigens and correlation with antibody reactivity.

[0208] Next, the positive peptide pools were deconvoluted to determine which individual peptides elicited the responses. IL-5 production was detected in at least one allergic donor for peptides from 54 of the 93 proteins analyzed with a total magnitude of 23,860 SFC (Figure 8). To exclude spurious responses, T cell antigens for this study are defined as those proteins recognized in 20% or more of allergic donors, which is an established response threshold to define allergenic proteins when using skin test reactivity testing (23,24). Based on this cutoff, a total of thirteen novel T cell antigens were identified. Four of these T cell antigens were proteins targeted by both IgE and IgG, one protein was targeted by IgE only, five proteins were targeted by IgG only, and three proteins were not targeted by antibodies of either Ig class (Figure 4). This means that eight of the novel T cell antigens were not targeted by IgE compared to five that were. The same holds true when comparing responses on the peptide level, or when considering the total number of responding T cells (Table 5). Overall, these data indicated that a sizeable fraction of the response against NTGAs is directed at proteins not recognized by IgE.

**Example 6**

[0209] This example includes a description of studies showing that IL-5 responses to novel antigens are made by memory T cells that can be detected directly *ex vivo*.

[0210] The data presented above indicated that almost two thirds (61%) of IL-5 producing T cell responses directed against pollen proteins were directed against the novel antigens, and that a majority of those responses targeted antigens not recognized by IgE. These responses were presumably the result of in vivo priming of T cells in the allergic patients, following pollen exposure. To exclude the possibility that these T cell response may be due to in vitro priming of T cells cultured with TG extract, it was examined whether the responding T cells were associated with either a memory or naïve phenotype. For this purpose two peptide pools were assembled: The TG P20 pool comprising the 20 most dominant peptides from known TG allergens identified in a previous study (12), accounting for about 90% of IL-5 responses detected against conventional IgE-reactive TG allergens in the study population; and an NTGA P19 pool

comprising 19 of the most dominant peptides selected from IgE-unreactive Novel TG Antigens. These 19 peptides account for about 40% of the total IL-5 response against all novel antigens tested in our study population.

**[0211]** PBMC from 6 allergic donors were sorted into memory (CD45RA-) and naïve (CD45RA+CCR7+) T cell subsets. Subsequently, cells from both subpopulations were stimulated in vitro with TG pollen extract, and tested after expansion for IL-5 production (Figure 5). Responses to each stimulus were significantly higher in the memory population compared to the naïve population. In response to TG extract stimulation, the median SFC detected was 80 and 1,108 in the naïve and memory populations, respectively. The TG P20 elicited no response in the naïve population and a median of 350 SFC in the memory population. Stimulation with NTGA P19 resulted in a median of 12 SFC in the naïve and 540 in the memory subset. As expected, high amounts of IL-5 were detected in the naïve and memory population in response to PHA, indicating that the cells were viable and responsive to T cell stimulation. Thus, overall far fewer antigen-specific IL-5 producing cells were found in the naïve T cell subset compared to the memory subset ( $p=0.0002$ ), signifying that the T cell responses to both the TG P20 and NTGA P19 peptide pools were derived from memory T cells. Of note, the two pools of peptides cover different fractions of the total response against the sets of antigens from which they were derived. The dominant known peptide pool (TG P20) is made up of the 20 most dominant peptides, which account for >90% of the total IL5 response detected against all known peptides. In contrast the dominant novel peptide pool (NTGA P19) only accounts for 40% of the total IL5 response directed against all novel peptides screened. Thus a direct quantitative comparison of the response against them is not possible.

**[0212]** To further substantiate that the reactivity against the novel antigens was reflective of in vivo exposure, and not from primary responses induced in vitro, it was examined if responses against novel antigens could be detected directly ex vivo without any in vitro culture expansion. Since the frequency of antigen-specific precursor cells is very low, PBMCs from eight donors were presorted to obtain enriched Th1 or Th2 subpopulations, and cells were assessed for IL-5 production in response to TG extract and the dominant known and novel peptide pools in ELISPOT assays. As expected, IL-5 production for the Th1 subpopulation was not detectable for any of the stimuli except PHA. In contrast, as shown in Figure 6, the Th2 subpopulation (CCR4+, CXCR3-) showed significant responses to each allergen stimulus compared to media alone (extract:  $p=0.01$ , TG20:  $p=0.03$ , NTGA19:  $p=0.01$ , Wilcoxon signed rank tests).

**Example 7**

**[0213]** This example includes a description of methods of determining *in vivo* efficacy of proteins and peptides of the invention, in particular, for treatment of allergy.

**[0214]** Peptides of the invention are evaluated for efficacy in treatment of allergy in a mouse model. In brief, six groups of BALB/cJ or HLA-transgenic mice are sensitized with repeat dosing of 1.5 micrograms of whole Timothy Grass (TG) allergen intranasally (in 25  $\mu$ L) for 5 $\times$ 2 days over 2 weeks. This serves as a model system for investigation of allergic asthma caused by whole TG allergen.

**[0215]** The sensitized mice are left for one week before treatment with peptides of the invention. The treatment comprises intranasal delivery of TG peptides followed 30 minutes later by intranasal delivery of TG peptides daily for 5 days. Approximately 4 weeks later the mice are challenged with whole TG allergen for 2 days (2 $\times$ 15  $\mu$ g/25  $\mu$ L intranasally) and outcomes are measured 48 hours later. 5 doses of TG peptides are evaluated (10, 1, 0.1, 0.01 & 0.001  $\mu$ g per peptide). Appropriate control experiments are conducted.

**[0216]** The outcomes measured are bronchial airway resistance following methacholine lung challenge (cm H<sub>2</sub>O/mL/s), a measure of respiratory function, and a quantitation of inflammatory cells in the bronchoalveolar lavage (BAL) fluid.

**[0217]** For measurement of airway resistance, 48 hours after intranasal challenge over 2 days (2 $\times$ 15  $\mu$ g) with Timothy Grass whole allergen, total respiratory system resistance (Rrs) is measured in response to intranasal saline and increasing doses of intravenous methacholine (MCh) using the Flexivent rodent ventilator. Using the resulting Rrs-MCh dose-response curves, indices of airway reactivity (Slope Rrs) and maximal degree of bronchoconstriction at 25 MCh mg/mL (Max Rrs @ 25 mg/mL) are measured. Values are means $\pm$ SE.

**[0218]** For quantitation of inflammatory cells, bronchoalveolar lavage fluid (BALF) is assessed for total and differential inflammatory cell counts. Sections of lung tissue are stained with hematoxylin and eosin (H&E) and morphometrically quantified using a custom computerized analysis system (Northern Eclipse).

**Example 8**

**[0219]** This example includes a description of a clinical trial protocol of proteins and peptides of the invention for treatment of allergy.

**[0220]** Peptides of the invention are analyzed in a randomized, placebo-controlled, blind clinical trial for efficacy in reducing allergic symptoms. The study design of the clinical trial is in accordance with good clinical practice guidelines.

**[0221]** Baseline skin responses to Timothy Grass allergen for all subjects are established using a Baseline Challenge between 6 and 8 days prior to study medication administration. Two intradermal injections of 0.010 HEP (histamine equivalent prick) units of commercially available standard Timothy Grass allergen is administered, separated by a 30 minute time interval, into the volar surface of the left and right forearms respectively. Subjects are assessed to ensure that they experience a Late-Phase Skin Response (LPSR) to whole Timothy Grass allergen. The magnitude of the baseline reaction is recorded as follows: Eight hours after each injection the outline of any late-phase response is drawn onto the skin with a ballpoint pen. The longest and orthogonal diameters are measured and recorded for each response, and the area of the response in each arm is calculated. The average area of response in both arms of each subject is then calculated to provide the baseline reaction. Subjects who produced a suitable baseline reaction are assigned to dosing groups, randomized and entered into the Treatment Phase.

**[0222]** The Treatment Phase consists of a period of 21 days for each subject. During this period one group of subjects receives a single intradermal injection of either peptides of the invention (0.03, 0.3, 3, 12 nmol of each peptide per dose) or diluent placebo at Treatment Phase Visit 1 on day one. A cohort of 8 subjects receives treatment at each dose level (6 receives the peptides of the invention and 2 placebo). The first cohort of the intradermal group receives 0.03 nmol of each peptide in the mixture and each subsequent cohort in the group receives the next higher dose level.

**[0223]** Intradermal injections are made into the flexor surface of the left forearm. The total volume of the injection is 60  $\mu$ L for all injections. After treatment, subjects have their skin response to whole allergen retested at Treatment Phase Visit 2 on day 21 ( $\pm 3$  days). Skin responses to Timothy Grass allergen are assessed by measurement of the late-phase responses 8 hours following intradermal administration of 0.010 HEP (histamine equivalent prick) units of commercially available standard Timothy Grass allergen as described above. The average area of response for both arms of each subject is then calculated as described above.

**[0224]** This average LPSR area after treatment is then compared to the baseline LPSR area for each subject. The overall change in LPSR area for all eight patients in each cohort is then evaluated.

**Example 9**

**[0225]** This example includes a discussion of results.

**[0226]** As disclosed herein, a third of TG allergic donors did not recognize any peptides derived from the 10 known IgE reactive TG allergens. This was puzzling as T cells from the same donors gave strong responses against the whole TG extract in the same sensitive ELISPOT assays. As a first explanation, the possibility that post-translational modifications might be essential for the recognition of some epitopes was considered. Such modifications would not be present in the peptides synthesized for our screening. However, a pilot study of peptides with hydroxylated prolines, which are thought to be prominent in some TG allergens (25), did not show any T cell reactivity at all. While this does not exclude that other post-translational modifications are present in T cell epitopes of TG, another hypothesis was analyzed, namely that T cells target conventional peptides from antigens other than the 10 known IgE reactive allergens. Analysis of T cells as disclosed herein led to the identification of 93 novel TG proteins, out of which 54 elicited Th2 responses. The recognition of these novel T cell antigens provides an explanation for the originally observed gap in reactivity between known allergens and whole TG extract.

**[0227]** Immunological characterization of the novel TG proteins revealed that a majority were both antibody and T cell reactive. Of prime interest, it was demonstrated that T cell responses against peptides derived from these novel antigens were potent inducers of IL-5 responses in PBMCs from TG allergic patients. The T cell population that produced IL-5 against these novel antigens originated from the memory Th2 cell subset and could be detected by direct ex vivo analysis. This demonstrated the relevance of these novel T cell antigens as targets of in vivo allergic responses. Interestingly, in contrast to the findings in allergic individuals, non-allergic donors had no or very weak IL-5 responses to both the known TG allergens and the novel antigens. Without being limited to any particular theory, this may also be true for other types of T cell responses, or non-allergic individuals may show an increased magnitude of 'tolerogenic' responses against novel TG antigens such as IL-10 producing Tregs.

**[0228]** Remarkably, strong IL-5 production was seen not only in response to IgE-reactive antigens but also to several antigens that were not targeted by IgE. This suggested that Th2 responses to an antigen were not necessarily linked to IgE reactivity. The idea of unlinked T cell help, meaning that T cells display a different antigen specificity than the B cells they affect, has been discussed in previous studies (18,20) and is also of great relevance to the immune response directed against the NTGAs. The natural structure of a pollen particle (or micro sized particles released upon hydration) provides physical linkage of various proteins, which are recognized by the immune

system. Therefore, without being limited to any particular theory, the way in which pollen proteins are presented to B and T cells may allow for unlinked T cell help since the T cell-specific epitope derived from one antigen can be present on the same physical pollen particle as a second antigen recognized by B cells. As a result, the Th2 cell immune response directed against NTGAs may provide help for the allergic response directed against the major known IgE-reactive allergens present on the same pollen particle as the NTGAs.

**[0229]** The issue of whether T cell recognition is always necessarily linked to antibody recognition has broader significance in terms of the classic notion of linked recognition of an antigen by both helper T cells and antigen specific B cells. According to this notion, specific B cells internalize and process the antigen, leading to the presentation of antigen fragments bound by surface MHC class II molecules that can be recognized by specific T cells. This guarantees that the T cells deliver help to B cells specific for the same antigen (linked help). While in some instances it has been shown that T cells can only or preferentially provide help to B cells specific for the same protein (17,18) in other systems this was not the case (19, 20). It was found that two proteins that are present on the same particle could function together and T cells specific for one protein could provide help for B cells specific for the second protein (20). Therefore, it may be possible that as long as the antigen recognized by T cells is in some physical association with the target of B cell recognition (as in the case of a small virus, or a pollen particle), the integrity of the “antigenic bridge” is preserved.

**[0230]** Though the direct mechanisms by which such an immune-modulation may occur are unknown at this point, without being limited to any particular theory, there are several potential mechanism by which unlinked T cell help could potentially lead to the improvement of allergic symptoms. First, the data herein indicate that the majority of IL-5 responses are directed against NTGAs. Therefore down-regulating these responses should be of significant benefit in terms of reducing Th2-induced pathogenic effects. Secondly, induction of NTGA-specific Tregs or Th1 cells may help in the regulation, through by-stander mechanisms (26), of Th2 responses directed against known TG allergens present in the same pollen particle. Thirdly, the regulation of NTGA-specific Th2 responses may also result in downstream regulation of IgE and induction of blocking IgG antibody responses to known TG allergens, a hallmark of SIT treatment (27,28). Finally, induction of NTGA-specific Th1 or Treg cells may lead to NTGA-specific IgG production, which may interfere with IgE-induced mediator release and other immediate-type reactions by mechanisms such as steric hindrance, competition for antigen binding

and inhibitory signaling through Fc $\gamma$ RIIB (29,30). Overall, the data herein demonstrates that the novel antigens described herein are promising targets for a T cell focused specific immunotherapy, which could be safe for administration to higher risk patients such as asthmatics. As a result, therapies that specifically target T cell reactivity may provide a more efficacious and safer way to treat allergic patients, especially those suffering from severe asthma to whom current SIT regimens pose a significant risk of deleterious reactions.

**[0231]** This study is the first comprehensive transcriptomic- and proteomic- analysis of an inhaled allergen. 93 novel TG proteins were identified for which expression in the pollen itself was established, expanding the previously known set of such proteins by about an order of magnitude. The fact that 24 novel TG proteins targeted by IgE that do not overlap with the known IgE-reactive allergens were identified demonstrates this approach is a powerful tool for allergen discovery.

**Example 10**

**[0232]** This example includes a description of methods of determining *in vivo* efficacy of proteins and peptides of the invention, in particular, for treatment of allergy caused by an allergen unrelated to a protein disclosed herein, such as treatment of allergy by bystander suppression. A more complete description of such methods may be found in US patent application publication US2012/0100164A1 (e.g., examples 3, 4, 5 and 6).

**[0233]** Proteins/Peptides of the invention are evaluated for efficacy in prevention sensitization to Timothy Grass Pollen in a mouse model. In brief, naïve BALB/cJ or HLA-transgenic mice are treated daily by sublingual immunotherapy (SLIT) with about 10  $\mu$ g of a protein or peptide of the invention for 2 weeks. Subsequently, the mice were immunized (made sensitized) by three weekly i.p. injections of either a mix of 10  $\mu$ g of a protein or peptide of the invention and about 10  $\mu$ g Timothy Grass Pollen extract or 10  $\mu$ g of a protein or peptide of the invention alone, both adsorbed to aluminium hydroxide.

**[0234]** Subsequently, the mice are challenged intra-nasally (IN) with about 10  $\mu$ g of Timothy Grass Pollen extract for four days so as to induce clinically relevant readouts of a Th2-driven immune response. The mice are sacrificed one day after the last challenge and blood, bronchoalveolar fluid (BAL), spleen and cervical lymph nodes are collected for analysis. This serves as a model system for investigation of preventing allergic rhinitis by bystander suppression of an allergic response caused by Timothy Grass allergens.

**[0235]** Clinically relevant readouts, such as airway hyper-reactivity and the fraction of eosinophils, are obtained on the last day of IN challenge. *Airway hyper-reactivity is tested by using a whole body plethysmograph.* Airflow obstruction was induced by challenging the mice with increasing concentrations of aerosolized metacholine. Pulmonary airflow obstruction was measured by enhanced pause (penh) in a period of 6 minutes after administration of metacholine. *Differential counting of BAL fluid is performed by centrifuging BAL fluid and remove the supernatant.* The remaining pellet was re-suspended in PBS and the fraction of eosinophils was determined by an automated cell counter (Sysmex).

**[0236]** T-cell proliferation assay is conducted by teasing spleen cells into single cell suspension and wash three times in medium. Cells are counted and adjusted to  $1.67 \times 10^6$  cells/mL.  $3 \times 10^5$  cells are added to each well of a 96 well flat-bottomed culture plate and the cells are stimulated by 0, 5, 25 and 125  $\mu\text{g}/\text{mL}$  of a protein/peptide of the invention. The cells were cultured for 6 days at 37 °C and 5% CO<sub>2</sub>. Proliferation was measured by adding 0.5  $\mu\text{Ci}$  of 3H-thymidine to each well for the last 18 hours of the culture period, followed by harvesting the cells and counting the incorporated radiolabel.

**[0237]** Down-regulation of T-cell response via bystander suppression is observed in groups of mice treated sublingually by a protein/peptide of the invention and where mice are co-sensitized with the protein/peptide of the invention and Timothy grass extract.

#### **Example 11**

**[0238]** This example includes a description of methods of determining *in vivo* efficacy of proteins and peptides of the invention, in particular, for treatment of allergy caused by an allergen unrelated to a protein disclosed herein, such as treatment of allergy by bystander suppression. A more complete description of the methods may be found in US patent application publication US2012/0100164A1 (e.g., examples 3, 4, 5 and 6).

**[0239]** Proteins/Peptides of the invention are evaluated for efficacy in treating allergy caused by Timothy Grass Pollen in a mouse model. In brief, naïve BALB/cJ or HLA-transgenic mice are sensitized by three weekly i.p. injections of about 10  $\mu\text{g}$  Timothy Grass Pollen extract adsorbed to aluminium hydroxide. Subsequently, the mice are treated by sublingual immunotherapy (SLIT) with 100 to 250  $\mu\text{g}$  of a protein/peptide of the invention for 4 weeks, followed by 2 weeks of intranasal challenge with 10  $\mu\text{g}$  Timothy Grass Pollen extract together with about 10  $\mu\text{g}$  of a protein/peptide of the invention or 10  $\mu\text{g}$  Timothy Grass Pollen alone.

**[0240]** In both sets of studies, the mice were sacrificed one day after the last challenge and blood, bronchoalveolar fluid (BAL), spleen and cervical lymph nodes were collected for analysis.

**[0241]** Evaluating clinically relevant readouts: Clinically relevant readouts, such as sneezes, airway hyper-reactivity and presence of eosinophils, are obtained on the last day of IN challenge.

**[0242]** *Sneezing:* The mice are observed in an 8 min-period after intranasal administration of Timothy Grass Pollen Extract and the numbers of sneezes are counted during this period.

**[0243]** *Airway hyper-reactivity:* Using a whole body pletysmograph, airflow obstruction is induced by increasing concentrations of aerosolized metacholine. Pulmonary airflow obstruction is measured by enhanced pause (penh) in a period of 6 minutes after administration of metacholine.

**[0244]** *Differential counting of BAL fluid:* The BAL fluid is centrifuged and the supernatant is removed. The pellet was re-suspended in PBS and the fraction of eosinophils is determined by an automated cell counter (Sysmex).

**[0245]** Down-regulation of clinically relevant readouts (such as no of eosinophils in BAL) via bystander suppression are observed in groups of mice treated sublingually by a protein/peptide of the invention and where the mice are intranasally challenged to both the protein/peptide of the invention and Timothy grass extract.

**Table 1: Panel of open reading frames corresponding to protein clusters identified by transcriptomic analysis of Timothy Grass (TG) pollen.**

Protein	Accession	Protein Name	Sequence
1	M.693	RAPVEP	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.692	RAPVEP	DYLGKGVVKAVDNVNSII
1	M.125	RA	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.714	RA	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.723	RAPVEP	DYLGKGVVKAVDNVNSII
1	M.705	RAPVEP	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.491	RA	DYLGKGVVKAVDNVNSII
1	M.438	RA	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.689	RAPVEP	DYLGKGVVKAVDNVNSII
1	M.844	RA	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.444	RA	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.624	NALL	DYLGKGVVKAVDNVNSII
1	M.617	NALL	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF
1	M.704	NALL	DYLGKGVVKAVDNVNSII
1	M.331	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF	
1	M.604	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF	
1	M.291	SPALIGKDPTEQIILDNFMVHQLDGTKNEWMCKQKLGANAILAVSLAVCKAGALVKIPLYQHIANLAGNK1LVLPPAPFNVINGSHAG NKLAMQEMFILPTGASSPKRACKMVGVEVYHNLKSVIKKKYQODATINVGDGGFAPIQKPLNQKEGLELLKTAIEKAGYTKVIGRVVIGDAASEZ YGEKDQTYDLNFKEEENNDSQK1GDSLKNVYKSFSEYPIVS1IEDPFQDQDWHYAMKTEIEGEQVQIVGDLLVINVTPRVARAKAEKSC NALLLKVNQIGSVIESIEAVKMSKRAGHGVMTSHRSGETEDTFIADLAVGLTSQ01KIGAPCRSERLAKYQNLRIEEELGAAAVYAGLKF	













23	M.419	KISSNGSGASCKKRRRELVIRIYIGEL
23	M.443	RISNGSGASLKKRRELVIRIYIGEL
24	M.540	...LWRSRSPADLRLTAAVANATRSGVGTIIGADLNPKVLLPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.640	...SRSP1886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.642	...SRSP1886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.646	...RERFRRFDLPLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.627	...SRSP1886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.626	...SRSP1886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.645	...SRSP1886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.652	...LPRPDRRFDPFGF872QAAAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.650	...LSPRDPFDPFGF872QAAAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.559	...FOGRKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.623	...APR31886FLHAAVAMTRSGVGTIIGADLKGGKVKFLRADLNVPDLQDQK1TDDTRIASIPIKPLLEKAKVILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.565	...VILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.567	...VILAS HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
24	M.581	...LDAQK1TDDTRIASIPIKPLLEKAKVILAS
25	M.609	...HLGRPKGVTPKFSLKLPLVPRSELLGVEVVMNDCIGEEVEKLAALPFGGVLLLENVREYKEEKNPDEFAKKLASVADLVDNDAFGTAH RAHASTEGVIRFLRPSVAGFIMOKELDYLVGVAVANPKPAAIVGGSKVSKIGIVIESLLAKVDL1L1LGGGMIFTYKAGKAVGNSLVEE DKLELATSLIETAKAGVSL1LPTDVVADKFAPDAS5KTVSDA1PDCWMLDVGPD5K1TFSALDITKTV1WNGPMGEPEFEKFAAG
26	M.182	KAGIALNDNFVKLVSKYIUNEWGTSIRVVD
26	M.334	...VRAIKESESEGNIKAG1LGYD6DLVSTDFQGDSRS51FD
26	M.283	KAGIALNDNFVKLVSKYIUNEWGTSIRVVDI1RHHWTH
26	M.287	...VRAIKESESEGNIKAG1LGYD6DLVSTDFQGDSRS51FD
26	M.367	...A10K1VDPSSKURGCRASFN1 IPSS1GAKAKGVK1LEVPLVNGRL1GMA1F1VETVDVSVVVDLTVRLKAA1YEQ1KA1A1K2ESEGNLKG1LGYD6DLVSTDFQGDSRS51FD KAGNALNDNFVKLV
26	M.364	...VRAIKESESEGNIKAG1LGYD6DLVSTDFQGDSRS51FD T1GNG100V1234567890V1234567890V1234567890V1234567890V1234567890V1234567890V1234567890V1234567890
26	M.186	...K9C1L1N1H3C644H
26	M.187	...VRAIKESESEGNIKAG1LGYD6DLVSTDFQGDSRS51FD
26	M.188	...VRAIKESESEGNIKAG1LGYD6DLVSTDFQGDSRS51FD







34	M.607			LNSPFWICACVRAANVANEAGHPLSIEEVVEVAPPQANEVRVKIIPTALCHTOVYFWEAKGOTPVPPRIFGHEAGCIVESVGEGVTDVAPGD HVLPVETGEZCKECRCKSAESENNMCILLRINIDORGWMSDGKRESIDGPKIPEHVGISIFSEXTVMVHGCVAKINPEALDRCVLSCLG TGLGASTVAKPEKGSIVAJTGLCAVGLAAECAARIAGASRIIGJDLNANRFEARKYGCITZVNPKCHTPVQ2VIAEZMTDCGVDRSVEC TGNNINAMIOAEFECVHOGKGVAVIYGVPHKDAEEKTHPNFLNER
34	M.672			YANZANPKPLSIEEVVEVAPPQANEVRVKIETALCHTOVYFWEAKGOTPVPPRIFGHEAGCIVESVGEGVTDVAPGD HVLPVETGEZCKECRCKSAESENNMCILLRINIDORGWMSDGKRESIDGPKIPEHVGISIFSEXTVMVHGCVAKINPEALDRCVLSCLG TGLGASIMVANPEKGSIVAJTGLCAVGLAAECAARIAGASRIIGJDLNANRFEARKYGCITZVNPKCHTPVQ2VIAEZMTDCGVDRSVEC TGNNINAMIOAEFECVHOGKGVAVIYGVPHKDAEEKTHPNFLNER
34	M.545			VETOGZCKECRCKSAESENNMCILLRINIDORGWMSDGKRESIDGPKIPEHVGISIFSEXTVMVHGCVAKINPEALDRCVLSCLG TGLGASIMVANPEKGSIVAJTGLCAVGLAAECAARIAGASRIIGJDLNANRFEARKYGCITZVNPKCHTPVQ2VIAEZMTDCGVDRSVEC TGNNINAMIOAEFECVHOGKGVAVIYGVPHKDAEEKTHPNFLNER
34	M.671			
35	M.272			ALRWNLQHGSVLPK3VSEERIKQWLVYDMSIPDDLLARYFSEIKQTRLLNGNPIVNRDSVYKTHEELWDGSI
35	M.301			CDPXXYNEVYKTFPSAFMSTYVWVLSRDLHIECIAL
36	M.202			QDFKVNIEYAKITPSAPARSTYQVARLZDARIECIAL
37	M.492			YASDDEPAASZDSELESSSTI
38	M.647			VRWAVDVATIMPALSE TARESGNDAGVSEKISGAEVEMGFLGAGADADGPWSNAMLQNRIGFICFOPKNNMNDPNCVFTYRGWYRFLFQYNPEGAVGNIAWGA VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.457			AGIAMYVYKTRIVYVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.686			GGSRGKDGAVSEKISGAEVEMGFLGAGADADGPWSNAMLQNRIGFICFOPKNNMNDPNCVFTYRGWYRFLFQYNPEGAVGNIAWGA VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.493			
38	M.486			LGDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.729			GLDFP GTTTAEGDSDQIWTYIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.760			GLDFP GTTTAEGDSDQIWTYIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.668			GLDFP GTTTAEGDSDQIWTYIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.447			GLDFP GTTTAEGDSDQIWTYIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.635			MPALCP TARSRGKDAGVSEKISGAEVEMGFLGAGADADGPWSNAMLQNRIGFICFOPKNNMNDPNCVFTYRGWYRFLFQYNPEGAVGNIAWGA VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK
38	M.584			MPALCP TARSRGKDAGVSEKISGAEVEMGFLGAGADADGPWSNAMLQNRIGFICFOPKNNMNDPNCVFTYRGWYRFLFQYNPEGAVGNIAWGA VSRDLIHWRLPLAMWDOYDINGWVIGSATVFPDGSLNMLYIGSTINASVQVOCALAVPDPDSDSLRWNWTHFANPVLLPPGIGLKDFR DPTIAWFD3D3DTWTRIVIGSKDONGHAGIAMVYKTKDFVSYELIPGLLHRVGDGTMNECIFXPVGNSGEELYVKESSDDDRHDYYALG SYDAANWKWIPQDPEADLGICLGRYDNKHFYASKTFYDPAKKRRLVNGWIAEIDSERADVTKGWASLMSIPRIVDLDKTRINLQMPVEEL ETLRINSTDLCVIIIDHGSVTPPLRHTQDIEAK

38	M.592	M1QWGRIGFHEQFEKNNMNDPNPGVYFTRGWIHLFQYWFEGAVVGNIAKHA VSRLD1HWRHPLAMVPDQWYDINGWMTGSAEATVPPDGS6LNMLYIGSTNAVQVOQCLAVPZEDPNDSSLRNRNTIKHPPANPVL1LPPPG1GLKDFR DPT2IAWEDDSQDTWRTV1GSKRDNGHAGIAVYKIKDFV5YEL1PGL1HRV2DTGMNEC1DPEVPGGNSGEELYVIKESSDDRHDYTALEG SYDAANKWNPQDPEADLGIGLRYDWGFTYASK1T2PDKPKEWV1NSWIAETDSEADWVTHG14SLM
38	M.709	IVFPGOSLNMLYIGSTNAVQVOQCLAVPZEDPNDSSLRNRNTIKHPPANPVL1LPPPG1GLKDFR DETTIAWEDDSQDTWRTV1GSKRDNGHAGIAVYKIKDFV5YEL1PGL1HRV2DTGMNEC1DPEVPGGNSGEELYVIKESSDDRHDYTALEG SYDAANKWNPQDPEADLGIGLRYDWGFTYASK1T2PDKPKEWV1NSWIAETDSEADWVTHG14SLM
38	M.489	IVFPGOSLNMLYIGSTNAVQVOQCLAVPZEDPNDSSLRNRNTIKHPPANPVL1LPPPG1GLKDFR DETTIAWEDDSQDTWRTV1GSKRDNGHAGIAVYKIKDFV5YEL1PGL1HRV2DTGMNEC1DPEVPGGNSGEELYVIKESSDDRHDYTALEG SYDAANKWNPQDPEADLGIGLRYDWGFTYASK1T2PDKPKEWV1NSWIAETDSEADWVTHG14SLM
39	M.392	IVFPGOSLNMLYIGSTNAVQVOQCLAVPZEDPNDSSLRNRNTIKHPPANPVL1LPPPG1GLKDFR DETTIAWEDDSQDTWRTV1GSKRDNGHAGIAVYKIKDFV5YEL1PGL1HRV2DTGMNEC1DPEVPGGNSGEELYVIKESSDDRHDYTALEG SYDAANKWNPQDPEADLGIGLRYDWGFTYASK1T2PDKPKEWV1NSWIAETDSEADWVTHG14SLM
39	M.347	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.458	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.464	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.423	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.520	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.448	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.467	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.494	YALAQGLKVIACVGETLEOPZAGSTMTWVABQTKAIADK1TDWINVVIAYEPVWA1G1CK VATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
39	M.374	YATPAQAOQEVHANL1DNLKTNVSPVAETITRILYGGSVIGASANELAAQPDVDFCL
40	M.318	SYNCHORV11A0D0S9R1TPE92V2A72052E51D0A1K0N9A9P1W72P0L1TC01P1X3
43	M.346	SSTRGWC5SRBRAGRE159
43	M.319	SSTRGWC5SRBRAGRE159
43	M.519	SSTRGWC5SRBRAGRE159
43	M.600	SSTRGWC5SRBRAGRE159
43	M.254	SSTRGWC5SRBRAGRE159
43	M.438	SSTRGWC5SRBRAGRE159
43	M.479	SSTRGWC5SRBRAGRE159
43	M.523	SSTRGWC5SRBRAGRE159
43	M.380	SSTRGWC5SRBRAGRE159
43	M.480	SSTRGWC5SRBRAGRE159
43	M.371	SSTRGWC5SRBRAGRE159
43	M.492	SSTRGWC5SRBRAGRE159
43	M.261	SSTRGWC5SRBRAGRE159
43	M.398	SSTRGWC5SRBRAGRE159
43	M.260	SSTRGWC5SRBRAGRE159
43	M.358	SSTRGWC5SRBRAGRE159
43	M.461	SSTRGWC5SRBRAGRE159

44.	M.400	....YDIDIPKEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.474	....YDIDIPKEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.495	....YDIDIPKEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.491	....YDIDIPKEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.401	....YDIDIPKEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.470	....KEVTPDAKNPEDMDSEEDGEWTAFTIPNPEYKGPWKQKIKENPNYQGKWKAPM1ANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.405	....MIAANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.435	....MIAANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.553	....MIAANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
44.	M.537	....MIAANPDFKODPYIYAFDSLKYIGIELWQVKSGTILFDN1L1TDAALAKTFAETINAKHDKAFADEAKKKEEEDASKAGEDDD0DDEDADEDCKDKAESDAED83DEKDEL
45.	M.402	....MAMMKRPPRCCQDLVVIPL
45.	M.481	....MNNMSSR
45.	M.483	....MNNMSSR
45.	M.554	....MAMMKRPPRCCQDLVVIPL
45.	M.528	....MAMMKRPPRCCQDLVVIPL
46.	M.334	....QARCLLRRARGGPIHRRGQAHRRVPLRPLHRRVVRVGQEGRAFKLXAGEV10FRRVKCKYPEG1KV1FHVKGSPN
46.	M.237	....QARCLLRRARGGPIHRRGQAHRRVPLRPLHRRVVRVGQEGRAFKLXAGEV10FRRVKCKYPEG1KV1FHVKGSPN
46.	M.264	....QARCLLRRARGGPIHRRGQAHRRVPLRPLHRRVVRVGQEGRAFKLXAGEV10FRRVKCKYPEG1KV1FHVKGSPN
47.	M.363	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.566	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.533	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.557	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.573	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.549	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.551	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.538	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
47.	M.483	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
48.	M.584	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE
48.	M.739	....TDAAAAPAAAACKNN1L1TDEEDVAVSLAKYTAELSGKFAAERGFTV1L1SGC711D1L1RKL1AEPPL1ETVQNSKHN1VWYDERRVPKQHVDNSYKLAVDG1L1SKVP1PIDQV1AIND1L1AEGAAADYETV1KOLV1SGV1LMS1ATGEPFRLMLGCPDGH1LAS1LFGPH1LINE







62	M.491	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.510	MRPLSILLAAAALLAAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTV
63	M.129	AGV1LRVFFHDCFVSGC
62	M.535	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.543	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.528	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.533	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.373	PPHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
62	M.390	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP HSNFTVGR1IELSTAKGETIV02MVALSGAHIL
63	M.361	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP KSTL1AEVFPKRDKTYKLGTEDINGWFAVDETAASLBNNT
63	M.432	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP KSTL1AEVFPKRDKTYKLGTEDINGWFAVDETAASLBNNT
63	M.477	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP KSTL1AEVFPKRDKTYKLGTEDINGWFAVDETAASLBNNT
63	M.408	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP KSTL1AEVFPKRDKTYKLGTEDINGWFAVDETAASLBNNT
64	M.568	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
64	M.389	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
64	M.462	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
64	M.510	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
64	M.522	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
64	M.412	PKSHTRVGSIYQPAAMRRSLIILLAAANLAANAAVSAEPPGAPK1SPDFYSQTCPRAEI1IAEVVOSKCMANPITAAGVLRLVFFHDCFVSGC DASVLIAPTHYAKSEKSENDADINHSLPGDAFDAVVRSKLALE1ECPGV9SCAD1LA1ASRVLV1MTGGPRYVPLGRKDLS5SNPAAPDVELP GHTLGRCHKERSGEGPWIKNPLKEFDNTYFTELLSGDKEGLQIQLPDKTLLIDPVPFRPLVKEVYIAADEKAFFEDYKEAHLRLS5C1GAYEA
65	M.4	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.295	KEVILGASLILVQVAVGMSPPFSCISAYWVTVYRGMRKQVYGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.56	SKLAK
65	M.55	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.64	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.22	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.146	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.305	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1
65	M.321	PKVQVGPDRGKRVLETRIEGGSLFIVPFRHVVSKIADASGMWESI1ITPNP1







83	MN.211	<p>ATPEAC3FLVYAVSNYEVNLLQERLKKLKSERHGKVQLQNTIVDMVLLGGIGMIGMLNETSLDPEEGIIRPGLSIPPECQKVLPVAKG GEPPEGGLVLLTGVVPTKIGODAALKLRSRSTVPGVYKAI DALPVVIAHMIQITIGVNLQVESEFAKAYDKGMPSKWPPTIEDC LNLIJARLPOVRSVYVYRTRFKDGTIAADN2LSDYAAAFSHMLCPDPEKMLELVRIYITIHTDHEGGNVBARIGHLVLGSALSDEYLSEAZALN GLAGPLAGLANSQVLLN1K8VMEZGSMIIIDQKLKEVNKT1KGSVYVPGVGHALRUDOPRYSQRSFALKHLPEDPFLQLV3KLYEV/P GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA</p>
83	MN.205	
83	MN.68	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
83	MN.98	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
83	MN.99	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
83	MN.113	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
83	MN.123	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
83	MN.69	GILTELGVKVNEMPNVDAHSVLLNHPGLVEARY2IVLFGVSRSMHIC6Q1JWDRALGLPLERPKSVIMZLGNHCKKGA
84	MN.378	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>KGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.4	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.166	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.367	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.358	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.305	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
84	MN.39	<p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p> <p>PREMKGMLTGPVTT1NNSPVRNDOPRFICQYQIALAIKKVEVEDLEAGGIQVQI01DEAA1REGLPLRKSEHAYLDMAVNSFRITMCVQD1 TQ1H3HMCY5MPNDI1R1STINNADVVT1NSNSDEKLLSVFREGVYAG1GPVYD1NSPPIPIAET1ADRVNKNLAVLD1N1LWNP0 CGLKTRKVAEVMPALINMVTAAKLIRQLASTK</p>
86	MN.194	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p>
86	MN.316	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p>
86	MN.281	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p>
86	MN.97	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p>
86	MN.54	<p>FSVEYY1E1LNSPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>ZHAKLACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL</p>
86	MN.156	<p>GLALNFSVYVYELINSEPDACNLAKQZDEA1ELDSLGESY1D2SL1MOLLRLN1LWNSDNEGGEDEIKEASPEGECH</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL</p>
86	MN.217	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL</p> <p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL</p>
86	MN.343	<p>MSFACATREENVYKLLAKACAFREPEMVEFMEKVKVIAIDVGEVLTVEERNIL3VAYKVNIGARRASWIISS1DQKEFGRNEAYVA SIKEYTRIETELSKICDC1LKLLESHLVEPSATAAEKSVY1KQDGY1HHLAKAGERAERKAAENTLVAK1SQQDIALADLPT1HPIRL</p>





		MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
91	MN_139	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
91	MN_148	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
91	MN_54	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
91	MN_87	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
91	MN_89	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
93	MN_37	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL
93	MN_364	MADNPKVYEDFJLIGAPGSRIVMELYADVYPKTAENFRALCIGEKVCKMKCPFLHYKGSSFRV1PGFMQCGDFIAGNGGGESEYGAKFADENFVKKH1GPGVL5MANAGPGCINGQFFLCTAKTAWLDDKHVVYFGQVVEGMDVVKAVEVKVGSQSCRC5KPVVIAADCQOL

**Table 2: Panel of peptides predicted from protein sequences identified by transcriptomic analysis of Timothy Grass (TG) pollen.**

YNLRRHFGA3PPSMIA	58	M.345 (25-39)
RKALVYITASAXEGCI	58	M.323 (40-54); M.345 (40-54)
QEMAYWSLAAIEIG	33	M.365 (0-14)
DRASGLLPLHESLPR	33	M.365 (39-33)
GYNISLASM1PDYDI	33	M.214 (0-14); M.289 (1-15)
YDYYIYKMYKSDAVAA	33	M.172 (0-14); M.214 (12-26); M.239 (9-23); M.240 (7-21); M.289 (33-27); M.296 (26-40); M.365 (73-85); M.72 (0-14)
LEKIVAILSAPEVDAA	33	M.172 (44-58); M.214 (56-70); M.240 (51-65); M.289 (57-71); M.38 (35-49)
WVRRSIALAVAKKOHLLA	33	M.172 (0-20); M.214 (18-32); M.239 (15-29); M.240 (33-27); M.289 (39-93); M.296 (53-40); M.365 (77-91); M.72 (0-10); M.172 (13-27); M.187 (13-27); M.214 (25-39); M.239 (22-36); M.240 (20-34); M.289 (26-40); M.296 (39-53); M.365 (84-98)
VARKNHALAWNCERCR	33	M.38 (4-18); M.72 (13-27)
LAQNCERCRKQESKWK	33	M.172 (19-33); M.187 (19-33); M.214 (31-49); M.239 (28-42); M.240 (36-40); M.289 (32-46); M.296 (45-59); M.365 (50-104); M.38 (10-38); M.72 (19-33)
KKIVDIAL9AFVDAA	33	M.72 (32-46)
GGGCFPIKKEKSLAKV	21	M.178 (0-16); M.191 (0-14); M.29 (0-15); M.107 (9-23); M.113 (7-21); M.116 (10-24); M.123 (9-23); M.129 (10-24); M.149 (10-24); M.164 (10-24); M.174 (3-17); M.178 (21-35); M.191 (21-35); M.29 (22-36); M.3 (4-18)
MYVVMYIKECTYKEYV	21	M.107 (19-33); M.113 (17-32); M.116 (10-34); M.123 (19-33); M.129 (20-34); M.149 (20-24); M.164 (20-34); M.174 (13-23); M.178 (31-45); M.191 (31-45); M.29 (32-48); M.3 (38-38)
TYEYVYUQHGVIVYVQV	21	M.107 (19-43); M.113 (27-41); M.116 (30-44); M.123 (29-43); M.129 (30-44); M.149 (30-44); M.164 (30-44); M.174 (23-37); M.178 (41-55); M.191 (41-55)
VINLVLVIGDGAKTII	21	M.178 (41-55)
MEKWLIL29MVA4SLV	21	M.123 (48-68)
YQDTLYTHAQRCRPF	21	M.101 (36-50); M.146 (49-63); M.165 (51-65); M.183 (36-50); M.204 (49-63); M.34 (19-33); M.6 (17-31)
GTIDFTECMBQWVQI	21	M.183 (56-70)
AKTIIILKFLLPVMIY	21	M.178 (52-66)
ALAH2211VASG12RN	8	M.763 (0-14)
MKIPTRIMVLLLLVV	8	M.763 (14-28); M.765 (11-25)
HLILVWLFZCCLAK	8	M.763 (23-37); M.765 (30-34)
MDTHYTLSAW1QLSK	8	M.733 (16-30); M.759 (57-73); M.763 (109-123); M.765 (105-120)
GNTEELFFENINVYAEI	8	M.653 (28-42); M.728 (34-48); M.733 (72-86); M.759 (113-127); M.763 (165-179); M.765 (162-376)
VIAELIUVDSM8LQPP	8	M.653 (38-52); M.728 (44-58); M.733 (82-96); M.763 (175-189)
YKQHFSRSPFVWQH	8	M.653 (115-125); M.728 (121-135); M.733 (159-173); M.747 (173-87); M.758 (198-213); M.763 (254-286); M.765 (248-362); M.653 (175-189); M.728 (181-195); M.733 (219-233); M.747 (133-147); M.759 (259-273); M.763 (312-326); M.765 (308-322)
KQMDWVSKLSAPOLM	8	M.653 (244-258); M.728 (250-264); M.733 (288-302); M.747 (202-236); M.759 (228-342); M.763 (381-396); M.765 (377-394)
SPILPMQSEIMTIEED	8	M.653 (266-280); M.728 (272-286); M.733 (310-324); M.747 (224-138); M.759 (350-364); M.763 (403-417); M.765 (399-413)
TKYLAKLKQ1QSYPG	8	M.653 (300-314); M.728 (306-320); M.733 (344-368); M.747 (258-272); M.759 (288-396); M.763 (337-451); M.765 (433-447)
SYXCG21D1LAQAKV	8	M.653 (327-341); M.728 (333-347); M.733 (371-385); M.747 (285-299); M.759 (411-425); M.763 (454-478); M.765 (460-474)
PKQVEYLEEVNREGE	8	M.759 (322-336); M.763 (373-389)
IVTAP22V1SM8LQPP	8	M.759 (322-336); M.763 (373-389)
NIPATNGAMEKLYDA	18	M.8 (0-14)
IVAYE1L1Q1GK1A1	18	M.8 (5-20)
KARAIGVBSNLASKKL	18	M.8 (16-30)
VSMLASPKLG1L1AV	18	M.8 (22-36)
KKLGDL1LAVARIPPA	18	M.8 (28-42)
SVFKEKTFPHRR1V1V1	55	M.110 (3-17); M.173 (11-35); M.249 (43-27)
PKFRRV1V1DPV1SG	55	M.110 (9-23); M.173 (17-31); M.18 (4-18); M.249 (19-33); M.33 (0-14); M.50 (9-23)
KGFLFEEK1LAV1V1Z	55	M.110 (23-43); M.173 (37-51); M.18 (24-28); M.249 (39-53); M.33 (20-34); M.50 (29-43)
FADAVMVSRGSLVRV	55	M.110 (35-49); M.173 (43-57); M.18 (30-44); M.249 (45-59); M.33 (26-40); M.50 (35-49)
YSHW1S1V1V1V1V1V1	55	M.110 (44-55); M.249 (31-65); M.33 (32-46); M.50 (41-51)
VNGFELTGF1NOLVIE	55	M.249 (59-73)
Q11RQG1Y1K1K1Y1K1	31	M.39 (5-39)
FY1K1N1V1K1K1Q1V1	31	M.39 (11-25)
YEHKG2V1S1V1T1D1N	31	M.39 (17-31)

TDKACEDLIFNHHLRK	31	M.39 (29-49)
DLIZTPHAKKLYPDKK	31	M.39 (25-49)
AEFFEGVFLDFARQQA	2	M.574 (0-14)
VDKLFKLAQAAKLVZ	2	M.974 (19-33)
ENRSVLHVALRAPRD	2	M.422 (8-22), M.431 (8-22), M.473 (0-14), M.574 (48-62), M.534 (24-38), M.676 (24-38), M.387 (54-68), M.432 (78-89), M.433 (75-89), M.437 (96-100), M.473 (161-81), M.574 (115-129), M.630 (118-49), M.634 (91-105), M.635 (91-105), M.722 (32-46)
FLKQZEVVHIALQGDP	2	M.387 (77-91), M.422 (98-112), M.431 (98-112), M.437 (59-73), M.473 (90-104), M.531 (8-22), M.574 (138-152), M.610 (55-69), M.634 (114-128), M.676 (114-128), M.722 (55-69)
HQLPFLANVDPVWVA	2	M.387 (106-120), M.422 (127-141), M.431 (127-141), M.437 (88-102), M.473 (119-133), M.531 (27-31), M.574 (367-381), M.610 (64-86), M.634 (113-157), M.526 (183-197), M.722 (64-86)
WVSKTIFTAETTMHAD	2	M.634 (160-174), M.676 (160-174), M.712 (101-115)
IKENIVVSSLGPOAVS	2	M.432 (118-152), M.473 (149-163), M.533 (63-81), M.574 (197-211), M.630 (114-126), M.634 (173-187), M.676 (173-187)
YSKHMLAVSTINKEW	2	M.722 (114-138)
RY3VC3AVGV1PLSL	2	M.387 (152-166), M.473 (183-197), M.531 (101-115), M.574 (231-245), M.610 (146-162), M.634 (207-221), M.676 (207-221), M.722 (148-162)
AVCVLPLSLQXQF73	2	M.531 (107-121), M.374 (237-251), M.610 (154-168), M.634 (113-227), M.676 (213-227), M.722 (154-168)
LSLQYGFPIVQRFLE	2	M.531 (113-127), M.574 (243-257), M.610 (160-174), M.634 (219-233), M.676 (219-233), M.722 (160-174)
PRIVWPLLEGAAISTB	2	M.531 (119-133), M.374 (149-163), M.610 (166-180), M.634 (225-229), M.636 (8-16), M.676 (225-239), M.722 (166-180)
HFRTIASFEKHPVILL	2	M.531 (135-149), M.574 (265-279), M.610 (182-196), M.634 (241-255), M.636 (18-32), M.676 (241-255), M.722 (182-196)
YKLSVSLKVNVEVLS	2	M.531 (147-161), M.610 (194-208), M.634 (253-267), M.636 (30-44), M.676 (253-267), M.722 (194-208)
SVMVYSELGYPARAJ	2	M.531 (153-167), M.610 (200-214), M.634 (259-273), M.636 (36-50), M.676 (259-273), M.722 (200-214)
AKRILPLVSK2AUEXIA	2	M.531 (164-178), M.610 (213-245), M.634 (270-284), M.636 (187-211), M.676 (270-284), M.722 (211-225)
NGOHSEFQLIHQCRV	2	M.531 (215-229), M.610 (262-276), M.634 (321-335), M.636 (98-112), M.676 (321-335), M.722 (262-276)
CDFTGIVK8QGPVY73	2	M.331 (232-246), M.610 (279-293), M.636 (115-129), M.676 (338-352), M.722 (279-293)
ELMSNPFQPDALAY	2	M.610 (303-317), M.636 (139-153), M.676 (362-376)
RTENQKREEGSPILS	2	M.636 (173-187), M.722 (337-351)
PSIBFLLESLSLSAVEI	2	M.636 (180-194), M.722 (344-358)
AVE1GQLLATVHRI	2	M.636 (191-205), M.722 (358-369)
LLAIYERRIAVQDFI	2	M.636 (197-211), M.722 (361-375)
QGELIIMINEDDQHGV	2	M.636 (308-222), M.722 (372-386)
PVEGFNPSSASLLAR	2	M.636 (245-259), M.722 (409-423)
PESASILARYV1YVEP	2	M.636 (251-265), M.722 (415-429)
HELGKILRQPGPLP	56	M.25 (1-15)
DLR2PQPL2GAK773	56	M.25 (7-23)
LRGLINNIAIASFLDPD	56	M.5 (5-19)
NIASPLDEPGMOMVY	56	M.25 (20-34), M.5 (31-25)
GNKVVIVDARDFELKE	56	M.25 (29-43), M.5 (20-34)
QDPAKIVQDQDSS1Q	57	M.394 (2-35)
RLVGLAVVHPTETLLH	57	M.394 (28-42)
HE12T1LHP2LIVV72	57	M.394 (35-48)
TEVVVVAFTAINESRQ	57	M.394 (44-58)
LVVREPLISQVWRCIV	57	M.394 (90-104)
ILL1VFAETIAZPEVKV	58	M.305 (0-14)
EPPEVKVVDL31L9PD	58	M.212 (7-21), M.271 (3-17), M.351 (34-38), M.288 (3-17), M.305 (9-23)
LKDGSIXSFFP56TIV	58	M.212 (42-56), M.271 (38-52), M.282 (49-63), M.288 (38-52), M.305 (44-58)
EEPRM2T1V6K6V1VEG	58	M.212 (49-63), M.271 (45-59), M.282 (56-70), M.285 (1-15), M.288 (45-59), M.305 (51-65), M.346 (1-14)
DDGKVYLEMS1YY2E1	58	M.159 (45-59), M.285 (74-88), M.287 (51-65), M.348 (74-88), M.33 (27-41)
WKEKIVT1LNEKREYES	59	M.396 (20-34), M.650 (6-22), M.674 (35-49), M.685 (39-49), M.703 (34-48)
EDAVEVVVSEPPFVEL	59	M.585 (49-63), M.596 (35-49), M.650 (23-37), M.674 (50-64), M.681 (49-63), M.685 (50-64), M.703 (49-63)
Y3Q9P161Q3XK411	59	M.504 (1-15), M.585 (56-70), M.596 (42-56), M.650 (30-44), M.674 (57-71), M.681 (58-70), M.685 (57-71), M.703 (58-70)

FLOQAKALLRPDFAV	59.	M.504 (7-21), M.585 (62-76), M.596 (48-62), M.680 (36-50), M.674 (63-77), M.681 (62-76), M.685 (63-77), M.703 (62-76)
KLILPDPFAVQAKCN	59.	M.585 (62-62), M.596 (54-68), M.680 (42-56), M.674 (69-83), M.681 (58-82), M.685 (69-83), M.703 (69-82)
GAFIGEISAEMLVNL	59.	M.504 (32-46), M.585 (87-101), M.596 (73-87), M.680 (61-75), M.674 (88-103), M.681 (87-101), M.685 (88-102), M.703 (87-101)
IAAEMIUNIQVPMWTT	59.	M.504 (59-52), M.585 (92-107), M.596 (72-91), M.680 (87-91), M.674 (94-108), M.681 (93-107), M.685 (94-108), M.703 (93-107)
ESNDFEVADKVAYALA	59.	M.504 (64-78), M.585 (119-133), M.596 (105-119), M.680 (93-107), M.674 (120-134), M.681 (119-133), M.685 (120-134), M.703 (119-133)
ACKVAKALAGCCEVTT	59.	M.504 (70-84), M.585 (125-139), M.596 (131-139), M.680 (99-113), M.674 (126-140), M.681 (125-139), M.703 (125-139)
ITMEVVARQTKATAE	59.	M.504 (98-112), M.526 (13-27), M.585 (153-167), M.596 (139-153), M.680 (127-141), M.674 (154-168), M.681 (153-167), M.685 (154-168), M.703 (153-167)
HWVYVAYENVVAATG	59.	M.504 (117-131), M.526 (93-48), M.585 (172-186), M.596 (158-172), M.680 (146-160), M.674 (172-186), M.681 (172-186), M.685 (173-187), M.703 (173-186)
LRKWLHNVYGPAAVE	59.	M.504 (148-162), M.526 (63-77), M.585 (203-217), M.596 (189-203), M.680 (177-191), M.674 (204-218), M.681 (203-217), M.685 (204-218), M.703 (203-217)
PEPVDTIKSATVKEE	59.	M.504 (198-212), M.526 (133-137), M.585 (283-307), M.596 (289-293), M.680 (227-241), M.674 (284-268), M.681 (253-267), M.685 (254-268), M.703 (253-267)
INGEFITATVQORGAA	19.	M.235 (25-39)
QORPAAITTSRALKSS	19.	M.235 (34-48)
TIKARMLSSALSAAS	19.	M.235 (40-54)
KEZKILKAKKACDKH	19.	M.235 (46-60)
GTPEGTFVSMGVYSD	19.	M.235 (66-80)
SEIOSLPSGCLWIKST	32.	M.389 (40-54), M.390 (40-54)
IDFYSITITRAREEEL	32.	M.389 (49-63), M.390 (49-63)
APKVQOLQDQFVKH	32.	M.344 (40-54), M.303 (44-58), M.38 (18-49), M.284 (52-56), M.303 (52-66), M.389 (101-115), M.390 (101-115), M.74 (19-33), M.92 (34-38)
EAVAYGAAVAAJILS	32.	M.284 (76-90), M.303 (76-90), M.317 (7-21), M.389 (125-139), M.390 (125-139), M.74 (43-57)
YQDILLIDVTPLSLH	32.	M.380 (11-25), M.317 (38-42)
LMSESWICACVRAAA	34.	M.607 (0-14)
ICAVYKAAVAVVZAG	34.	M.607 (6-20), M.690 (4-18)
VRVKILFTALCHTDV	34.	M.598 (34-48), M.607 (38-52), M.614 (13-27), M.632 (27-41), M.672 (23-37), M.690 (36-50)
YKDLRJNQKGRQVMI	34.	M.523 (18-32), M.598 (109-123), M.607 (113-127), M.614 (88-102), M.646 (47-61), M.632 (102-116), M.633 (42-56), M.671 (143-171), M.672 (98-112), M.690 (131-135)
KPIPHFGVGCTSFSEY	34.	M.545 (44-56), M.598 (135-149), M.607 (139-153), M.614 (114-128), M.616 (73-87), M.632 (128-142), M.633 (68-82), M.671 (69-83), M.672 (124-138), M.690 (137-151)
WGTSSSEXTVQHPSG	34.	M.545 (50-64), M.598 (131-135), M.607 (145-159), M.614 (110-134), M.616 (79-91), M.632 (124-148), M.633 (74-88), M.671 (75-89), M.672 (130-144), M.690 (143-157)
VAIPIGLCAVGLAARE	34.	M.545 (104-118), M.598 (195-209), M.607 (199-213), M.614 (174-188), M.616 (133-147), M.632 (188-202), M.633 (128-142), M.671 (129-143), M.672 (184-198), M.690 (197-211)
CAVOLAAAGCARIAG	34.	M.545 (120-134), M.598 (201-215), M.607 (205-219), M.614 (180-194), M.616 (113-153), M.632 (184-208), M.633 (134-148), M.671 (125-141), M.672 (130-204), M.690 (203-217)
GNINAMIQAFECVHD	34.	M.545 (179-193), M.598 (270-284), M.607 (274-288), M.614 (249-263), M.616 (208-222), M.632 (263-277), M.633 (203-217), M.671 (204-218), M.672 (259-273), M.690 (272-286)
LNSTTFTKMFPTKIDL	34.	M.545 (223-237), M.534 (293-307), M.616 (252-268), M.632 (307-321), M.633 (247-263), M.671 (245-262), M.673 (103-317), M.690 (318-330)
KEITHSVTFSEINKA	34.	M.616 (282-296), M.633 (277-291), M.671 (278-292), M.672 (333-347), M.690 (346-360)
YSPAEINHARDIMMK	34.	M.616 (358-361), M.633 (284-297), M.671 (384-398), M.672 (329-353), M.690 (352-366)
ALRWNLONGHSVLPK	35.	M.272 (0-14)
HLDVYDWSKTPHDLA	35.	M.272 (24-38)
DDILAKFSEIKQTHL	35.	M.272 (34-48)
PSSEKQIBLIMSGPTI	35.	M.272 (40-54)
IRILMGMFIVNKDSV	35.	M.272 (46-50)
MEKIPDCEEIKRLLA	4.	M.595 (2-19), M.648 (2-18), M.715 (0-18), M.718 (2-18), M.729 (2-16), M.725 (0-14)
PEEIKKLLASPKPES	4.	M.595 (8-22), M.648 (8-22), M.662 (7-21), M.694 (11-25), M.701 (11-25), M.715 (5-20), M.718 (8-22), M.720 (8-22), M.723 (5-19), M.725 (6-20)
RFPEVDEIGRQESSTL	4.	M.595 (32-51), M.648 (37-51), M.662 (36-50), M.694 (40-51), M.701 (40-54), M.715 (35-51), M.718 (37-51), M.720 (37-51), M.723 (34-48), M.725 (39-49)
PNLITYAKELVERMGL	4.	M.595 (66-80), M.648 (66-80), M.662 (65-79), M.694 (69-83), M.701 (69-83), M.715 (64-79), M.718 (66-80), M.720 (66-80), M.723 (63-77), M.725 (64-78)
RQMLGLWRFFYTSCH	4.	M.595 (102-118), M.648 (102-118), M.662 (103-125), M.694 (105-123), M.701 (105-114), M.715 (102-118), M.720 (102-118), M.723 (102-118), M.725 (103-124)
KRPFVTFSDSVVATIA	4.	M.595 (108-122), M.648 (108-122), M.662 (107-121), M.694 (111-125), M.701 (111-125), M.715 (106-120), M.718 (108-122), M.720 (108-122), M.723 (105-119), M.725 (106-120)
SDEVVLLIISANAVQSI	4.	M.595 (125-129), M.648 (125-129), M.662 (124-128), M.694 (128-132), M.701 (128-132), M.715 (123-127), M.718 (125-129), M.720 (125-129), M.723 (125-129), M.725 (123-127)
AVQSIPIYFABGLKGV	4.	M.595 (154-168), M.648 (154-168), M.662 (163-165), M.694 (157-171), M.701 (157-171), M.715 (152-166), M.718 (154-168), M.720 (154-168), M.723 (151-165), M.725 (152-166)
XNLNLKVEVPIQDNE	4.	

GIWAVLAWLSIITAYK	4	M.576 (33-47), M.595 (199-213), M.648 (199-213), M.662 (198-211), M.694 (202-216), M.701 (202-216), M.715 (197-213)
LGEGDQHLYSVEDIVL	4	M.576 (51-65), M.595 (217-231), M.648 (217-231), M.662 (185-230), M.694 (229-234), M.701 (220-234), M.715 (235-239)
KGJXANHJWQJGEALS	4	M.576 (207-231), M.595 (207-231), M.723 (234-238), M.725 (235-239), M.726 (57-71), M.595 (223-237), M.648 (223-237), M.662 (222-236), M.694 (226-240), M.701 (226-240), M.715 (221-235)
LVVKMQBALSVDVNKLJ	4	M.718 (223-237), M.720 (223-237), M.723 (220-234), M.725 (221-235)
RGQSRTRFLQDSSHIV	4	M.595 (191-194), M.596 (256-270), M.648 (195-200), M.662 (255-265), M.694 (259-273), M.701 (259-273), M.715 (254-265)
SLVFRKLSCTG3VCA	4	288), M.718 (258-270), M.720 (258-270), M.723 (253-267), M.725 (254-268)
GRKTHIYX3EYD9EJCS	4	M.576 (96-10), M.595 (262-276), M.648 (261-276), M.652 (261-275), M.694 (265-279), M.701 (265-279), M.715 (260-274)
DALSPLVDVALKLSK	4	M.718 (262-276), M.720 (262-276), M.723 (259-273), M.725 (260-274)
PGCRRMNSSEKAYKPF	36	M.576 (139-153), M.648 (105-118), M.662 (104-118), M.694 (108-122), M.701 (109-122), M.715 (102-117), M.718 (105-118)
NEIYAKYPPSAPAP	36	M.202 (0-14), M.302 (0-14)
TRPGRAPAKTQYVA	36	M.202 (17-38), M.303 (32-38)
ARSTYQVAALPLDAP	36	M.202 (19-33), M.301 (19-33)
LCLBARDEIECCORAL	36	M.202 (28-42), M.301 (28-42)
PPPCQNIAMASSRR	20	M.675 (19-33), M.678 (24-38)
AGQILQSRRA3XKFLHS	20	M.673 (24-48), M.678 (38-52)
SREFLH8RGYIAAAA	20	M.675 (43-57), M.678 (48-62)
EGYVAAKAAAPSPAYE	20	M.675 (49-63), M.678 (54-68)
LGEPVTNSVAAEAKAB	20	M.583 (15-29), M.641 (93-67), M.649 (22-36), M.675 (108-122), M.678 (113-127)
IAHADYLVVPEEEA	20	M.583 (30-44), M.641 (66-82), M.649 (37-51), M.675 (123-137), M.678 (118-142)
VIYVPEPPFAAAAIME	20	M.583 (38-50), M.641 (74-88), M.649 (43-57), M.675 (129-143), M.678 (134-148)
PEAAXRIMKPA, EAEZA	20	M.583 (44-56), M.641 (80-94), M.649 (49-63), M.675 (125-149), M.678 (140-154)
QHDMVVKYKAALNROS	20	M.583 (66-82), M.641 (106-120), M.649 (75-89), M.675 (161-175), M.678 (166-180)
ELIYVRAWEKJYATYGL	20	M.499 (38-52), M.583 (125-137), M.641 (161-175), M.649 (130-144), M.675 (129-130), M.678 (121-125)
DKPVVYAFIAGLICAPP	20	M.499 (90-104), M.583 (195-209), M.641 (233-247), M.649 (202-216), M.675 (288-302), M.678 (293-307)
KIKALHRENGYIYVYES	20	M.498 (125-139), M.583 (230-244), M.641 (268-282), M.649 (237-251), M.675 (183-207), M.678 (238-342)
CEIMFELIKQGRMVZ	20	M.499 (144-158), M.583 (249-263), M.641 (287-301), M.649 (256-270), M.675 (342-356), M.678 (347-361)
IVSDEIYLAVAHGARR	5	M.421 (1-18), M.625 (13-29), M.631 (9-23), M.654 (2-19), M.655 (26-40), M.682 (4-18)
LDIAVRLLEPIKEQV	5	M.393 (58-72), M.421 (71-85), M.618 (64-78), M.625 (82-96), M.631 (76-90), M.654 (72-86), M.655 (93-107), M.669 (58-72), M.682 (71-85)
AKQCVTTC34XKDXQ	5	M.393 (64-82), M.421 (81-95), M.618 (74-88), M.645 (91-109), M.631 (85-100), M.654 (81-96), M.655 (103-117), M.669 (68-82), M.682 (81-95)
ILSYADPFYOLAGVVA	5	(74-88), M.628 (87-103)
PKQZAYVVA2116G	5	M.653 (80-94), M.643 (33-107), M.618 (86-108), M.623 (104-118), M.631 (68-122), M.654 (94-108), M.655 (115-129)
DNLRQVFTAGMCLSD	5	M.393 (123-137), M.421 (136-150), M.524 (30-44), M.618 (179-143), M.625 (147-161), M.631 (141-155), M.654 (137-151)
MELIETDSDSYETLTL	5	M.655 (158-172), M.669 (123-137), M.682 (136-150)
EDAFFADYEAHKL	5	M.655 (179-193)
EDKAEKPTVLELTYKCV	60	M.509 (56-59)
RAIKFYEKAFCHELL	60	M.484 (70-84), M.493 (35-49), M.497 (35-49), M.509 (121-135), M.515 (52-66), M.521 (35-49), M.533 (70-84), M.532 (85-92), M.548 (88-103), M.583 (54-68), M.697 (54-58), M.509 (140-154), M.515 (71-85), M.521 (54-68), M.533 (88-103)
NPQYKLLIAJMMYGP	60	103), M.502 (74-88), M.484 (106-120), M.493 (71-85), M.497 (71-85), M.509 (157-171), M.515 (88-102), M.521 (71-85), M.533 (106-120)
KNAVLELTZNYHVKRE	60	M.484 (172-185), M.493 (137-151), M.497 (137-151), M.509 (154-168), M.521 (137-153), M.533 (172-185)
QDQHNSPEYTMIDFLK	60	M.502 (67-71), M.484 (88-103), M.493 (54-68), M.497 (54-58), M.509 (140-154), M.515 (71-85), M.521 (54-68), M.533 (88-103)
PEAAGTLPGLS68TIL	37	M.492 (4-18)
Q1L5F8KQ1S1PFSW	6	M.639 (0-14)
VRTRKHLAAATMADEK	6	M.639 (13-27)
SKKXEGF11SV3K14	8	M.570 (7-23), M.639 (13-37)
PIBLHGRYLG3GEETH	6	M.570 (13-27)
QKXKJLXKJLXKJLXKJ	6	M.555 (4-125), M.559 (91-105)

TEVRNGFTFLDLIIVL	6:	M.546 (34-48); M.555 (42-56); M.570 (86-100); M.639 (122-136)
FLDLIIVLQIESL693	6:	M.546 (42-56); M.555 (50-64); M.570 (94-108); M.639 (130-144)
LNNKYGNSNVPL1124Y	6:	M.546 (53-67); M.555 (61-75); M.570 (105-119); M.639 (141-155)
WYPL1124N1294KHD	6:	M.546 (60-74); M.555 (68-82); M.570 (1312-1325); M.639 (148-152)
LKIVEKYANSSIDIH	6:	M.546 (76-90); M.555 (84-98); M.570 (128-142); M.639 (164-178)
S2D180FNGS3Q7PRV	6:	M.546 (86-100); M.555 (94-108); M.570 (138-152); M.639 (174-188)
GKLDLILLSDGKEYV2	6:	M.546 (135-149); M.555 (141-157); M.570 (187-201); M.639 (223-237)
GKEYV21A9GSD1124	8:	M.546 (144-158); M.555 (152-160); M.570 (139-140); M.639 (133-146)
SDNLGA1VDMKILAH	6:	M.450 (4-18); M.546 (153-167); M.555 (162-175); M.570 (205-219); M.639 (241-255)
IVDNEKJINLJIKC9	6:	M.450 (10-24); M.546 (159-173); M.555 (167-181); M.570 (211-225); M.639 (247-261)
ISYEGRVOVLEZIAQV	6:	M.450 (44-58); M.546 (193-207); M.555 (203-215); M.570 (245-259); M.639 (281-295)
VCILLL1LICYPDARY7D	6:	M.450 (60-64); M.546 (195-213); M.555 (203-221); M.570 (251-265); M.639 (287-301)
EKSJENFK1FNTNNL	6:	M.450 (66-80); M.546 (219-229); M.555 (223-237); M.639 (303-317)
PK3EMK1NNLNUVNL2A	6:	M.450 (72-86); M.546 (223-239); M.555 (229-243); M.639 (309-313)
NNLWVNLKA1KRLVE	6:	M.450 (78-92); M.546 (227-241); M.555 (235-249); M.639 (315-329)
3NRLVACAD1JNME1	6:	M.450 (87-101); M.546 (236-250); M.555 (244-258); M.639 (324-338)
VKVIQLETAAGAAIR	6:	M.341 (4-18); M.342 (4-18); M.343 (4-18); M.450 (110-124)
KA1PFDH81S1H78	8:	M.343 (15-28); M.342 (19-29); M.343 (35-59); M.450 (121-135)
GINVPRSRFLPVKAT	6:	M.341 (25-39); M.342 (25-39); M.343 (25-39); M.450 (131-145)
RE1PVKAT1D1Q1W2	6:	M.341 (31-46); M.343 (32-46); M.343 (32-46); M.450 (138-152)
TSDLQLVQ5DLYTILV	6:	M.341 (39-53); M.342 (39-53); M.343 (39-53); M.450 (145-159)
VQSM1T3LYQ2EVTR	6:	M.341 (45-59); M.342 (45-59); M.343 (45-59); M.450 (151-165)
GPEFKXVGSPFLERFB	6:	M.342 (74-88); M.343 (74-88)
CEPNK1PS1K2ZEGEL	6:	M.341 (83-99); M.342 (85-99); M.343 (85-99)
LQSKNC1L1YLCSIMI	61:	M.478 (0-14)
33YLCSIM1G1CNEK2	61:	M.478 (6-20)
3M1CNCKVSKV1N1Y	61:	M.478 (12-26)
3V3N1VNT1T1P1L1X	61:	M.478 (18-32)
GT1RNLING1T1V1REP	7:	M.658 (30-44)
3V3N3S3H0W3X1A1X	7:	M.548 (7-23); M.580 (7-23); M.595 (37-51); M.628 (25-49); M.558 (125-144); M.639 (71-85)
1OGEFAZASMA1AYEK	7:	M.548 (27-41); M.560 (27-41); M.606 (37-51); M.628 (46-60); M.658 (120-134); M.635 (91-105)
ASNAJAY1ZK1K1P1Y1L	7:	M.548 (32-47); M.560 (33-47); M.606 (34-57); M.628 (52-60); M.636 (126-140); M.635 (97-113)
ENKHWELYLSTKNT1L	7:	M.548 (40-54); M.560 (40-54); M.605 (50-64); M.628 (59-73); M.658 (133-147); M.635 (104-118)
CHFNK1E1D1Y1K1X1M	7:	M.548 (53-71); M.560 (53-73); M.606 (69-92); M.628 (79-92); M.658 (152-166); M.635 (125-137)
WYCA1R1D1D1M1VAY1L	7:	M.248 (28-42); M.548 (83-97); M.560 (83-97); M.606 (93-107); M.628 (102-116); M.639 (176-190); M.635 (147-161)
YQK1E1Z1P1C1S1C1G	7:	M.248 (49-73); M.548 (114-128); M.560 (114-128); M.606 (114-138); M.628 (133-147); M.638 (207-223); M.635 (178-191); M.269 (2-16); M.328 (2-16); M.466 (25-39); M.548 (165-180); M.560 (166-180); M.606 (176-190); M.628 (185-199); M.658 (259-273); M.695 (230-244)
NEIAS1P1F1W1T1O1A1H	7:	M.298 (23-36); M.328 (22-35); M.496 (45-59); M.548 (106-200); M.560 (188-200); M.606 (196-210); M.628 (205-215)
UNAKL1D1F1T1Q1L1Z1A	7:	M.654 (129-293); M.695 (254-364)
M1KDL111V1RGS1K1V	7:	M.264 (46-60); M.328 (46-60); M.466 (89-93); M.548 (210-224); M.560 (210-224); M.606 (220-234); M.628 (229-243)
1N1C1E1T1D1W1A1A1Q	7:	M.658 (303-317); M.695 (274-288)
N1R1V1L1R1R1S1P1SA	22:	M.615 (14-26); M.351 (75-85); M.514 (75-89); M.539 (94-109); M.569 (88-102); M.578 (87-101); M.580 (84-98); M.587 (96-110); M.588 (97-111); M.594 (104-115); M.618 (83-137); M.392 (82-96); M.514 (82-96); M.539 (102-116); M.569 (95-109); M.578 (94-108); M.580 (91-105); M.587 (103-117); M.588 (104-118); M.594 (111-125); M.615 (130-144)
QCA1I1M1D1V1S1L1T1Y	22:	M.514 (118-122); M.338 (108-122); M.569 (133-135); M.578 (150-154); M.580 (147-161); M.587 (159-173); M.588 (180-184); M.594 (117-121); M.615 (195-210)
3K1N1Q1T1Z1J1Z1K1W1M	22:	M.514 (128-132); M.615 (138-140)
SAK1N1V1F1K1P1J1Y1L	22:	M.514 (148-162); M.539 (168-182); M.569 (161-175); M.578 (160-174); M.580 (157-171); M.587 (169-183); M.588 (170-184); M.594 (117-121); M.615 (195-210)
K1F1L1N1R1K1A1Z1D1N	22:	M.514 (188-200); M.615 (205-219)

AN1HEVEAVAILKPPPE	22	M.514 (170-184), M.539 (190-194), M.569 (183-197), M.578 (182-195), M.580 (179-193), M.587 (191-205), M.588 (192-206), M.594 (199-213), M.615 (218-232)
ESPLAELAQAQPLPDD	22	M.514 (170-210), M.539 (216-230), M.569 (205-223), M.578 (208-222), M.580 (205-215), M.587 (217-231), M.588 (218-233), M.594 (224-239), M.615 (240-259)
YQPAAMRRRLBLILLA	62	M.528 (10-24), M.529 (10-24), M.535 (10-24), M.543 (10-24), M.590 (10-24), M.691 (10-24)
RRRRLILLAAARANLIL	62	M.528 (16-30), M.538 (16-30), M.535 (16-30), M.543 (16-30), M.590 (16-20), M.691 (16-30)
LLAAALLLAAAVSAB	62	M.510 (7-21), M.528 (22-36), M.529 (22-36), M.535 (22-36), M.543 (22-36), M.590 (22-36), M.691 (22-36)
CPRARARIAAEVYSPK	62	M.510 (37-51), M.528 (52-56), M.539 (52-60), M.535 (52-66), M.543 (52-66), M.590 (52-66), M.691 (52-66)
AFDAVVRSLKALIPEL	62	M.543 (118-132), M.590 (118-132), M.528 (118-132), M.529 (118-132), M.535 (118-132), M.543 (118-132), M.590 (118-132)
CABILATIASRVLVIM	62	M.573 (98-122), M.530 (124-138), M.518 (139-153), M.529 (139-153), M.535 (139-153), M.543 (139-153), M.590 (139-153)
NFTVGRIGIELPTIAGK	62	M.373 (105-117), M.528 (184-198), M.529 (184-198), M.535 (184-198), M.543 (184-198), M.590 (184-198), M.691 (184-198)
ICELFLAKAGETVQEM	62	M.372 (109-123), M.528 (190-204), M.535 (190-204), M.543 (190-204), M.590 (190-204), M.691 (190-204)
FTVQEMVALSGAKTL	62	M.373 (118-132), M.529 (199-213), M.535 (199-213), M.543 (199-213), M.590 (199-213), M.691 (199-213)
IAAEQDQJ3M3Q3S41SS	62	M.590 (263-277)
FDNIKYSVNIERGICLW	62	M.691 (275-289)
STGCFEDFARAHAINKL	62	M.691 (213-271)
TDITIVYCAGRTTFFR	9	M.547 (38-52), M.562 (55-69), M.761 (42-56)
GRIZTFFFLDADPLIA	9	M.547 (46-60), M.562 (63-77), M.761 (50-64)
KSLVRAFMWDSESTV	9	M.547 (134-148), M.562 (151-165), M.571 (151-165), M.741 (44-58), M.761 (138-152)
KVLSCEDPFPZTREPKJ	9	M.547 (137-171), M.562 (174-188), M.573 (174-188), M.734 (180-204), M.735 (189-193), M.741 (167-181), M.761 (163-174)
HITGSIYAV3MSAD3K	9	M.547 (242-256), M.562 (259-273), M.571 (259-273), M.734 (135-149), M.738 (134-148), M.741 (152-166), M.761 (246-260)
AGKSHKIN3S2Z7624R	9	M.597 (72-86), M.621 (49-59), M.631 (70-84), M.657 (81-95), M.677 (73-87), M.734 (224-238), M.738 (223-237), M.741 (241-255), M.761 (236-249)
VSSLIYFPQDSNPRIM	9	M.597 (247-261), M.761 (341-355)
STIGW139W1026WYQ	9	M.597 (96-110), M.621 (69-83), M.631 (94-108), M.657 (105-119), M.677 (87-111), M.734 (248-261), M.738 (247-261)
TQIRGZPVAEZEELIT	9	M.597 (241-259), M.761 (259-273)
QWLMK1KQDPEPALL	9	M.597 (120-134), M.621 (93-107), M.651 (118-132), M.657 (129-143), M.677 (121-135), M.734 (272-286), M.738 (271-285), M.741 (289-303), M.761 (383-397)
PEPALITITDASIVLL	9	M.597 (124-132), M.621 (146-160), M.651 (171-185), M.657 (182-196), M.677 (174-188), M.734 (325-339), M.738 (324-338)
PSAATVYLHRSINTVS	9	M.597 (187-191), M.621 (149-163), M.651 (194-208), M.657 (205-219), M.677 (197-211), M.734 (348-362), M.738 (347-357), M.741 (356-370), M.761 (323-347), M.761 (447-449)
IKVSYTITSSAVSBD	9	M.597 (173-187), M.621 (146-160), M.651 (171-185), M.657 (182-196), M.677 (174-188), M.734 (325-339), M.738 (324-338)
MLR12Y5SGD13TTE	9	M.597 (187-191), M.761 (342-356), M.761 (436-450)
1HY8PDVSMFASADA	9	M.597 (180-194), M.621 (133-187), M.651 (178-192), M.657 (185-193), M.677 (181-195), M.734 (332-349), M.738 (331-345), M.741 (349-363), M.761 (443-472)
IKLANKHUESTARING	9	M.597 (126-130), M.621 (169-183), M.651 (194-208), M.657 (205-219), M.677 (197-211), M.734 (348-362), M.738 (347-357), M.741 (356-370), M.761 (323-347), M.761 (447-449)
STKIFLESSTIMESRA	38	M.709 (2-16)
CRANVLSASAVVWIV	38	M.698 (7-21), M.702 (32-56)
VVVI.VVASCLAGSRV	38	M.668 (16-30)
LAGSPHVRVAVVYAT	38	M.668 (25-39)
GNXH1F1QYNPZEGAV	38	M.584 (28-42), M.592 (28-42), M.599 (51-65), M.635 (73-87), M.647 (82-96), M.668 (113-127), M.688 (65-79), M.709 (158-172), M.760 (24-38)
EMODINAMR1PLAFMY	38	M.584 (172-187), M.652 (53-67), M.599 (72-86), M.635 (88-112), M.647 (107-121), M.668 (138-154), M.688 (90-104), M.709 (181-197), M.760 (49-63)
LNMLYTGETINASVQV	38	M.489 (7-21), M.584 (40-104), M.592 (50-104), M.599 (113-127), M.635 (135-149), M.647 (144-158), M.668 (175-189), M.688 (127-141), M.705 (230-234), M.760 (86-100)
TAATV1KQDPEPALL	38	M.597 (34-46), M.627 (2-16), M.648 (23-47), M.649 (98-102), M.655 (132-146), M.584 (173-185), M.592 (171-185), M.599 (194-206), M.635 (216-230), M.647 (225-239), M.668 (256-270), M.686 (216-221), M.709 (301-315), M.739 (34-46), M.760 (187-191)
TKDFVSYIELLIPSLLH	38	M.417 (40-54), M.457 (8-22), M.486 (89-153), M.489 (94-108), M.495 (38-52), M.584 (377-391), M.592 (177-191), M.599 (200-214), M.635 (222-236), M.647 (231-245), M.668 (262-276), M.686 (214-228), M.709 (307-321), M.729 (40-54), M.760 (173-187)
KGWASLMS1P1R1V1DL	38	M.417 (122-136), M.457 (80-104), M.495 (121-135), M.499 (176-180), M.495 (120-134), M.594 (259-273), M.592 (259-273), M.599 (262-266), M.635 (202-206), M.647 (225-239), M.668 (244-258), M.686 (303-310), M.709 (309-313), M.729 (222-226), M.760 (259-263)
URPACFLD1D1ZAPF1W	38	M.729 (212-226), M.760 (345-359)
ERAFPLDHAVALIN	38	M.729 (221-235), M.760 (354-368)
EGTAVIYVYSP1L1D5	38	M.729 (209-283), M.760 (402-416)

UKRUVUGYIVPVVLLGE	38	M.729 (303-317); M.780 (436-450)
EFZVPRVLYQH2JVS	38	M.729 (317-331); M.780 (450-464)
EAIAAAGVYLFNNAA	38	M.729 (349-363); M.780 (482-496)
YK1EWAQ12E7W3V2	38	M.729 (357-371); M.780 (490-504)
TD1EVV/VVSPPYVFL	39	M.415 (6-20); M.464 (41-55); M.467 (24-48); M.520 (40-54)
SPYVPLF2YNDKQK	39	M.415 (14-28); M.464 (49-63); M.467 (32-46); M.520 (68-82)
GAFTGZVSAEMLANL	39	M.415 (44-58); M.464 (79-93); M.467 (62-76); M.494 (33-47); M.520 (78-92)
VSAEMANLQ1PWT3	39	M.415 (80-84); M.464 (89-99); M.520 (84-98)
GESSEFVGDKVAYAL	39	M.410 (21-35); M.415 (75-89); M.464 (110-124); M.467 (83-107); M.494 (64-78); M.520 (109-123); M.530 (9-16); M.410 (38-42); M.419 (83-95); M.458 (10-14); M.463 (117-121); M.467 (100-114); M.494 (71-85); M.520 (118-130)
CDKVKAXALM2GLKIV2	39	M.347 (23-37); M.374 (18-32); M.392 (30-44); M.410 (56-70); M.415 (110-124); M.458 (28-42); M.464 (145-159); M.467 (128-142); M.494 (99-113); M.520 (144-158)
3TM7VVAZQTKA1AD	39	M.347 (11-55); M.374 (38-50); M.392 (48-52); M.410 (74-80); M.415 (118-142); M.458 (46-60); M.464 (163-177); M.467 (145-160); M.494 (117-131); M.520 (163-176)
DMINWVIAZEPVNAI	39	M.347 (47-61); M.374 (42-56); M.392 (54-68); M.410 (80-94); M.415 (134-148); M.458 (52-66); M.464 (169-183); M.467 (152-166); M.494 (123-137); M.520 (168-182)
IAYPEPWAIGTCKVVA	39	M.374 (116-130); M.458 (126-140); M.494 (157-211)
CRPFPIRINXAKATV	39	M.374 (116-130); M.458 (126-140); M.494 (157-211)
RTSSWNG6A31R1DR	23	M.419 (0-14); M.443 (0-14)
SLKTTTSELVY3TPIY	23	M.419 (9-23); M.443 (9-23)
RFLHAAVAMRTRKSV	24	M.540 (10-24); M.640 (8-22); M.642 (8-22); M.645 (18-32)
MGKVK71RAD1XWPL	24	M.540 (33-47); M.622 (18-30); M.626 (18-30); M.827 (31-35); M.640 (91-145); M.643 (31-45); M.645 (41-55); M.649 (32-45); M.650 (32-48); M.653 (32-48)
TR1PAS1PTIKF1L2	24	M.540 (57-71); M.581 (10-24); M.622 (40-54); M.626 (40-54); M.627 (45-59); M.640 (55-69); M.642 (55-69); M.645 (65-79); M.646 (56-70); M.650 (58-72); M.652 (59-72)
21NPLLEKANV1A	24	M.540 (65-79); M.581 (18-32); M.622 (48-63); M.826 (48-62); M.827 (53-67); M.640 (63-77); M.642 (63-77); M.649 (73-87); M.646 (64-78); M.650 (66-80); M.832 (46-60)
EKCAKVIKASHLGRD	24	M.540 (71-85); M.581 (24-38); M.622 (54-68); M.626 (64-68); M.627 (59-73); M.640 (69-83); M.642 (69-83); M.645 (79-93); M.646 (70-84); M.650 (72-88); M.652 (72-86)
YERL3E1LQPVV1W4	24	M.540 (59-72); M.559 (12-31); M.565 (32-50); M.567 (24-36); M.581 (51-65); M.612 (81-95); M.626 (31-45); M.627 (36-100); M.640 (96-110); M.642 (96-110); M.648 (106-120); M.646 (197-211); M.650 (99-112); M.654 (99-112)
GGVLLLENVRPIKEE	24	M.540 (130-144); M.559 (49-63); M.565 (54-68); M.567 (54-68); M.640 (53-67); M.622 (113-127); M.626 (113-127); M.627 (118-132); M.640 (128-142); M.642 (128-142); M.645 (138-152); M.646 (129-143); M.650 (131-145); M.652 (131-145); M.640 (148-163); M.639 (68-82); M.658 (73-87); M.587 (73-87); M.931 (103-116); M.642 (132-146); M.626 (133-146); M.627 (137-151); M.640 (147-161); M.643 (147-161); M.645 (157-171); M.646 (148-162); M.650 (150-164); M.652 (150-164); M.647 (162-176); M.640 (186-200); M.642 (186-190); M.645 (196-210); M.646 (187-191); M.650 (188-197); M.652 (183-197)
KPLRPSVAGF1M0KE	24	M.540 (182-196); M.559 (101-115); M.565 (106-120); M.567 (106-120); M.581 (135-149); M.622 (165-179); M.626 (165-179); M.627 (170-184); M.640 (180-194); M.642 (180-194); M.645 (190-204); M.646 (181-195); M.650 (183-197); M.652 (183-197)
PLFPLK1RQVAVV1V	24	M.540 (138-192); M.559 (107-123); M.565 (112-126); M.587 (112-126); M.581 (641-655); M.622 (171-185); M.626 (171-185); M.627 (176-182); M.640 (186-200); M.642 (186-190); M.645 (196-210); M.646 (187-191); M.650 (188-193); M.652 (189-204)
VAG1L1K0N1D1Y1G	24	M.540 (195-209); M.559 (114-128); M.565 (119-133); M.567 (119-133); M.581 (148-162); M.622 (178-192); M.626 (178-192); M.627 (183-197); M.640 (193-207); M.642 (193-207); M.645 (203-217); M.646 (194-208); M.650 (196-210); M.652 (196-210)
KELDYLQGRVANPKK	24	M.540 (229-237); M.559 (142-156); M.565 (147-151); M.587 (147-151); M.581 (275-290); M.622 (206-220); M.626 (206-220); M.627 (213-223); M.640 (221-235); M.642 (221-235); M.645 (331-345); M.646 (232-236); M.650 (234-238); M.652 (234-238)
K1QV1E21LAKV1A1	24	M.559 (181-175); M.565 (166-180); M.567 (166-180); M.581 (195-209); M.622 (225-239); M.626 (225-239); M.627 (230-244); M.640 (240-254); M.642 (240-254); M.645 (250-264); M.646 (241-255); M.650 (243-257); M.652 (243-257)
GM1F1Y1XQGKAVG	24	M.559 (180-194); M.565 (188-198); M.582 (188-198); M.581 (214-228); M.632 (244-258); M.626 (244-258); M.627 (249-263); M.640 (252-273); M.642 (259-273); M.645 (269-283); M.646 (260-279); M.650 (262-276); M.651 (263-276)
SEK1L1L1A211E1TA	24	M.559 (198-212); M.565 (203-217); M.567 (203-217); M.581 (232-246); M.622 (262-276); M.626 (262-276); M.627 (267-281); M.640 (277-291); M.642 (277-291); M.645 (287-301); M.648 (278-292); M.650 (280-294); M.652 (280-294)
GSVLLLEPTIVVVADK	24	M.559 (181-195); M.565 (181-195); M.581 (214-228); M.587 (214-228); M.581 (275-290); M.622 (206-220); M.626 (206-220); M.627 (213-227); M.640 (212-236); M.642 (212-236); M.645 (271-285); M.646 (271-285); M.650 (271-285); M.652 (271-285)
SAPAF1T1R1R0F1P985	23	M.609 (1-15)
VE1VAUWMDPE1T1D1Y	26	M.285 (1-15); M.471 (1-15); M.496 (1-15); M.575 (1-15)
PGM1M1M1M1M1T1V1N1G	26	M.255 (14-28); M.471 (14-19); M.496 (14-28); M.575 (14-28); M.586 (8-22)
GGAKKV118APSKDA	26	M.471 (89-103); M.496 (89-103); M.575 (89-103); M.586 (83-97)
1TBD1T1V1V1X1C1T1	26	M.471 (125-139); M.586 (119-129); M.575 (115-129); M.586 (109-123)
KV1ND1F1G1E1G1M1T	26	M.471 (137-151); M.496 (137-151); M.575 (137-151); M.586 (131-145)
PG1V1E1M1T1V1W1M1T	26	M.471 (143-157); M.496 (143-157); M.575 (143-157); M.586 (137-151)
GORASF1N11P1S1T1G	26	M.367 (15-29); M.471 (173-187); M.496 (173-187); M.575 (173-187); M.586 (167-181)
1TV1L1E1K1A1Y1Q1X1M	26	M.367 (62-76); M.575 (320-334); M.586 (214-228)
ALNDNFV1L1V1S1Y1D1N	26	M.182 (43-57); M.189 (38-52); M.283 (50-64); M.297 (43-57); M.586 (271-285)
UNQ1D1R1V1L1A1Q1Q1Q	40	M.118 (1-15)
VE11A1D1Q1G1K1T1P1S	40	M.118 (7-21)
TT1P1V1W1P1F1S1E1R1J	40	M.218 (18-32)

KNOVAMNPINTVPGC	40	M.118 (37-51)
SEKXKTVFESCHLXKCT	40	M.318 (43-57)
SSTRGWCSSRRHACRG	41	M.346 (0-14)
ERKOPARECBISSWV	42	M.318 (16-30)
SSMVLIKMBRE1AEAF	42	M.318 (26-40)
SIXKAVVTVPHAKEND	42	M.318 (44-58)
CVIAGLNLVLRITINEP	42	M.318 (68-82)
VLKIZNGESTRAULXK	42	M.318 (75-89)
GRYZSKDAVQ11TRM	10	M.177 (9-23)
DAVQ11TRMNAKNSV	10	M.177 (15-29)
CVRRVWVYQDSSL1ST	10	M.177 (28-42)
SLG2TIPAWSX1RER	10	M.177 (38-52)
AVS1J1HERR1AADGS	10	M.177 (44-58)
XG8M1L311M18GAN	63	M.408 (0-18), M.432 (4-18), M.477 (4-18)
ILLLINGANAALDSE	63	M.361 (5-19), M.408 (10-24), M.432 (10-24), M.477 (10-24)
ESKLYANOFAMMBCG	63	M.361 (45-59), M.408 (50-64), M.432 (50-64), M.477 (50-64)
SGRLDHWSTLIAEVE	63	M.361 (80-94), M.408 (85-99), M.432 (85-99), M.477 (85-99)
INGKPAFDT1AAZLY	63	M.361 (108-122), M.408 (113-127), M.432 (113-127), M.477 (113-127)
IOKRPFASINVENED	27	M.469 (45-59)
ALRSLIITTRGKQH	27	M.469 (63-77)
LCHISGVILFEEITLY	27	M.469 (75-89)
YEAGARFAXXPAVLA	27	M.104 (18-42), M.469 (143-151)
CLARYAIIQOENGVLV	27	M.206 (26-40), M.469 (174-188), M.472 (10-24)
HCAYVIEVULACAYK	27	M.206 (97-131), M.472 (14-55)
NDQHVILLEGSSILXPN	27	M.472 (58-72)
WEISSEFGRALCOST	27	M.294 (66-80), M.318 (61-75), M.369 (53-75), M.472 (135-149)
SVGFTVETLNDLAOL	11	M.372 (57-71), M.446 (7-21), M.513 (56-70), M.579 (35-49), M.593 (50-64)
LGCAZPKKERSALEAV	11	M.372 (310-124), M.395 (29-39), M.446 (60-74), M.505 (30-44), M.513 (108-123), M.579 (88-102), M.593 (103-117)
RFKSALEAVKTLRAE	11	M.372 (116-130), M.395 (31-45), M.446 (66-80), M.513 (115-129), M.579 (94-108), M.593 (109-123)
QXLYPAEVIVDZGKQ	11	M.395 (0-15), M.446 (86-100), M.505 (56-70), M.513 (135-149), M.579 (114-128), M.593 (129-143)
VVTFNPERADRMVMLA	11	M.381 (2-16), M.386 (2-16), M.391 (2-16), M.395 (75-89), M.446 (110-124), M.506 (80-94), M.513 (159-173), M.579 (138-152), M.593 (153-167)
AGHNOVLAQKJLFRK	11	M.381 (42-55), M.386 (42-55), M.391 (9-23), M.395 (83-95), M.446 (113-131), M.506 (87-101), M.513 (166-180), M.579 (145-158), M.593 (180-194)
FDKFDARVVRVPKIKYA	11	M.381 (24-38), M.391 (24-38), M.395 (97-111), M.446 (132-146), M.506 (102-116), M.513 (181-195), M.579 (160-174), M.593 (175-189)
PRKHTERGMQ1Q1MEL	11	M.381 (63-47), M.388 (33-47), M.391 (33-47), M.395 (106-120), M.446 (141-155), M.506 (111-125), M.513 (190-204), M.579 (169-183), M.593 (184-198)
LK1PNKFLIVSPPLIE	11	M.379 (183-197), M.593 (198-212)
WILL1000000000000000	43	M.523 (0-14)
ETIMORLVAIRLWVFT	43	M.479 (11-25), M.519 (40-54), M.523 (43-57), M.500 (40-54), M.571 (12-36), M.380 (13-29), M.438 (41-57), M.461 (62-76), M.479 (81-95), M.480 (12-36), M.482 (12-26), M.519 (110-134), M.523 (132-122), M.536 (62-76), M.569 (110-134)
GYSKNOLVYMPWQF1K	43	M.371 (18-32), M.380 (18-32), M.438 (49-63), M.451 (68-81), M.479 (87-101), M.480 (18-32), M.482 (18-32), M.519 (116-130), M.523 (119-133), M.558 (59-82), M.600 (116-130)
IVVVPWGFYKAVMHWK	43	M.108 (6-20), M.254 (9-19), M.259 (9-19), M.281 (16-30), M.371 (62-78), M.380 (82-76), M.438 (93-107), M.461 (112-126), M.478 (132-135), M.480 (62-76), M.482 (62-76), M.519 (136-174), M.523 (166-177), M.556 (122-128), M.600 (160-174)
KERIDFQDQV1HGLX	43	M.478 (132-135), M.480 (62-76), M.261 (27-41), M.371 (83-97), M.380 (83-97), M.438 (114-128), M.461 (133-147), M.479 (152-165), M.480 (83-97), M.482 (83-97), M.519 (181-195), M.523 (184-198), M.556 (133-147), M.600 (181-187), M.601 (202)
ARVYQYFASL1DNE	43	195)
FANSLLEKTFN1HGF	43	M.523 (0-14)
EIPITIISYSDLYOLAG	64	M.568 (15-29), M.589 (16-30)
XSOLYGLADWVAVSY	64	M.568 (31-35), M.588 (23-36)
DBLHQYFGKOMCLSD	64	M.412 (5-19), M.516 (21-35), M.522 (9-19), M.558 (67-81), M.589 (68-82)

PPPLNEDQYFVYFELL	63	M.412 (87-81); M.462 (20-34); M.518 (82-77); M.522 (47-51); M.588 (159-123); M.589 (110-124)
KAFFEEDYKEANLRLS	64	M.412 (95-109); M.462 (68-82); M.516 (112-125); M.522 (95-109); M.568 (157-171); M.589 (158-172)
YHLICBSETPVYVTHAQ	12	M.435 (4-35); M.656 (4-1B)
FPVITYXHGRNGNLS	12	M.525 (11-25); M.656 (11-25)
PNGM-SALACPEIMOK	12	M.25 (B9-34); M.619 (20-34); M.656 (30-34)
IPPAFHLLKRNNEHVVD	28	M.420 (1-15); M.444 (1-15)
LRERNNDVYV2238E89	28	M.420 (7-21); M.444 (7-21)
VVDTINLESPTNDIVPE	28	M.420 (13-27); M.444 (13-27)
CAPTTGGGTRIAPIVS	28	M.420 (28-42); M.444 (28-42)
CYRIAPYSSILIKAI	28	M.420 (35-49); M.444 (35-49)
ECILAEGLLSVQGLRIV	13	M.620 (33-35); M.630 (16-30); M.698 (16-30); M.699 (16-30)
LLSVQGLKVELHMDRN	13	M.620 (21-35); M.630 (22-36); M.698 (22-36); M.699 (22-36); M.708 (0-14)
VERPNDQNGALVRLV	13	M.630 (73-89); M.630 (76-90); M.698 (76-90); M.699 (28-30); M.708 (54-89)
VRVLIRISVTKYLNF	13	M.620 (86-100); M.630 (87-101); M.698 (87-101); M.699 (87-101); M.708 (65-79)
TKYLNKAVGQGZPVTY	13	M.620 (95-109); M.630 (96-110); M.698 (96-110); M.699 (96-110); M.708 (24-89)
TOVEALKNSNLMLFE	13	M.620 (120-134); M.630 (121-135); M.698 (121-135); M.699 (121-135); M.708 (99-113)
EKRRRKKPETYVQDY	12	M.620 (134-148); M.630 (135-149); M.698 (135-149); M.699 (135-149); M.708 (113-127)
KEFIVYVQDYEE62DPK	13	M.620 (140-154); M.630 (141-155); M.698 (141-155); M.699 (141-155); M.708 (119-133)
IVVPPQHAAVAKARQDQ	13	M.439 (14-36); M.620 (179-191); M.630 (180-194); M.698 (180-194); M.699 (180-194); M.708 (158-172)
VKRMKLYAEESSLARFQ	13	M.439 (39-53); M.620 (204-218); M.630 (205-219); M.698 (205-219); M.699 (205-219); M.708 (183-197)
CEUETAEKQGQSAVKQ	13	M.439 (68-80); M.620 (231-249); M.630 (232-246); M.698 (232-246); M.699 (232-246); M.708 (210-224)
PARLSAVYGGTYMLN	13	M.439 (72-86); M.620 (237-251); M.630 (238-252); M.698 (238-252); M.699 (238-252); M.708 (216-230)
KONTIAFVSVT2R61D	13	M.698 (347-361); M.699 (347-361); M.708 (325-339)
ETTVKVLALYSKIT	13	M.708 (390-404)
LGQZVQWVNRNAGES	13	M.708 (398-422)
FKDCPYIYAFDSLKY	44	M.537 (6-20); M.553 (6-20)
AFDSLKV151EENQY	44	M.409 (72-87); M.401 (28-42); M.409 (34-39); M.435 (34-38); M.470 (37-81); M.474 (73-87); M.490 (73-87)
TEIHOVK9STLFDN1	44	M.537 (14-28); M.533 (39-50)
GTLEFDWILITDAAAL	44	M.409 (80-104); M.401 (48-59); M.409 (31-45); M.435 (31-45); M.470 (84-98); M.474 (80-104); M.490 (80-104); M.491 (90-104); M.537 (31-45); M.533 (31-45)
ILLIDDAALAK1PFAE	44	M.409 (96-110); M.401 (53-65); M.409 (37-51); M.435 (37-51); M.470 (90-104); M.474 (95-110); M.490 (96-110); M.491 (96-110); M.537 (37-51); M.533 (37-51)
AKPFDQDQDQV1PFL	45	M.402 (4-38); M.538 (4-38); M.534 (4-18)
RGLLRARGGPPHRRK	46	M.234 (2-16); M.237 (2-16); M.264 (2-16)
PRASPAKPPRPPRHRH	46	M.234 (19-32); M.237 (16-32); M.264 (38-32)
PGRRRAKLRSGAGEVE1	46	M.234 (39-53); M.237 (39-53); M.264 (39-53)
GEVET1PRAVWCKYK	46	M.234 (49-63); M.237 (49-63); M.264 (49-63)
IKVIFHVGVGCELLR	46	M.237 (68-80)
EDVAVSLLAKTFLAEL	47	M.549 (14-46); M.550 (14-28); M.551 (14-28); M.557 (14-28); M.563 (14-28); M.566 (29-39); M.573 (14-28)
CKPAAERGAFPTVVL2	47	M.463 (36-50); M.549 (29-43); M.550 (29-43); M.551 (29-43); M.557 (29-43); M.558 (35-49); M.563 (39-53); M.566 (40-54); M.573 (29-43)
AE3TVE888712371	47	M.463 (4-58); M.551 (37-53); M.557 (37-51); M.558 (43-57); M.566 (48-62); M.573 (37-51)
DSNYKLAVIDGILLSKV	47	M.463 (91-105); M.532 (40-54); M.549 (84-98); M.560 (84-98); M.551 (84-98); M.557 (84-98); M.558 (90-104); M.563 (94-108); M.566 (95-109); M.573 (84-98)
IVLAKOYVKGSGVLAEM2	47	M.403 (130-144); M.510 (125-137); M.512 (123-137); M.528 (128-143); M.563 (123-147); M.566 (134-148)
KSGVLAAMSTAGCPR	47	M.463 (137-151); M.550 (130-144); M.551 (130-144); M.558 (136-150); M.563 (140-154); M.566 (141-155); M.573 (140-154); M.549 (134-150); M.560 (144-158); M.551 (134-158); M.557 (134-158); M.558 (190-204); M.563 (134-208); M.566 (195-209); M.573 (180-196)
DEPOR1CT13PKVIKS	47	M.532 (146-160); M.549 (190-204); M.550 (190-204); M.551 (190-204); M.557 (190-204); M.558 (196-210); M.563 (200-214); M.566 (201-215); M.573 (190-204)
1PT1PPVIKS8ATVAM	47	M.532 (179-189); M.549 (123-237); M.550 (233-237); M.551 (233-237); M.567 (223-237); M.558 (229-343); M.563 (233-243); M.566 (234-248); M.573 (223-237)
WT1L1L1L1L1L1L1L1L1	47	M.566 (234-248); M.573 (223-237)
NKLIGARSFFESAKW	48	M.247 (1-35); M.517 (0-14)

RAHIMAFQNGF24795	48	M.247 (64-281), M.537 (63-77), M.684 (0-14), M.739 (0-14)
AB11NGFVFSIAAGNI	48	M.517 (122-186), M.684 (59-95), M.730 (45-59), M.732 (57-111), M.736 (45-59), M.737 (45-59), M.739 (59-73)
APPLGITYQAAZ79NAK	48	M.517 (147-161), M.684 (84-95), M.730 (70-84), M.732 (82-95), M.736 (70-84), M.737 (70-84), M.739 (84-95)
STSDHRFAATVKGQS	48	M.517 (156-170), M.684 (93-107), M.711 (2-16), M.732 (4-18), M.730 (79-93), M.732 (92-109), M.736 (79-93), M.737 (79-93), M.739 (93-107)
YLRAGCHF6H1YVAFZ	48	M.884 (170-184), M.711 (79-93), M.711 (81-95), M.732 (96-182), M.736 (156-170), M.739 (170-184)
FGM1VVAFAVPGPVI	48	M.737 (162-176), M.739 (176-190)
YAVQONTHAYEALAS	48	M.637 (28-42), M.684 (204-218), M.703 (113-127), M.732 (115-129), M.730 (180-204), M.732 (202-216), M.739 (180-204)
VPGVYDIVLQPKEVN	48	M.637 (94-108), M.712 (181-195), M.730 (256-270), M.732 (268-282), M.736 (256-270), M.737 (256-270)
CPHLLAFTKAL1XNAH	48	M.637 (121-135), M.684 (297-311), M.711 (405-220), M.711 (409-221), M.730 (284-303), M.732 (295-303), M.736 (283-303)
GLVYNTLAAEY1Y1PYL	48	M.637 (188-202), M.684 (364-378), M.711 (273-287), M.712 (275-289), M.730 (350-364), M.732 (362-376), M.736 (350-364), M.737 (350-364)
KADSVVNRERAVTIV	48	M.637 (345-260), M.711 (331-345), M.712 (333-347), M.730 (408-422), M.732 (420-424), M.736 (408-422), M.737 (408-422), M.739 (402-416)
KLIFKALEEVINNYTV	48	M.637 (285-299), M.711 (370-384), M.712 (372-386), M.730 (447-461), M.732 (459-473), M.736 (447-461), M.737 (447-461), M.739 (451-475)
SEMLNNTVIVHIAAV	48	M.637 (834-866), M.711 (377-393), M.732 (379-393), M.735 (454-458), M.732 (486-480), M.736 (454-468), M.737 (454-468), M.739 (468-482)
IEGQLKWWSSKRVIR	48	M.637 (311-325), M.711 (396-410), M.712 (398-412), M.736 (473-487), M.737 (473-487), M.739 (487-501)
WVSKHNNVPSPL11L	48	M.637 (317-331), M.711 (402-416), M.712 (303-418), M.736 (429-493), M.737 (479-493), M.739 (493-507)
SERFPLAASSIHPSST	29	M.707 (0-14), M.710 (1-15)
EPPEKXVILGZQVAA	29	M.702 (14-28), M.707 (34-38), M.710 (25-39), M.713 (19-23)
TERGIELLISIEIVK	29	M.638 (70-84), M.673 (49-63), M.683 (63-77), M.687 (70-84), M.697 (70-84), M.700 (68-82), M.702 (54-108), M.707 (104-118), M.710 (105-119), M.713 (99-113)
ASBIL11AAGCITIV	29	M.638 (68-102), M.673 (67-81), M.683 (81-95), M.687 (88-102), M.697 (88-102), M.700 (88-100), M.702 (112-126), M.707 (123-136), M.710 (123-137), M.713 (124-133)
FTYETL11ATGSSTI	29	M.638 (100-114), M.673 (79-93), M.683 (93-107), M.687 (100-114), M.697 (100-114), M.700 (98-112), M.702 (124-138), M.707 (134-148), M.710 (135-149), M.713 (129-143)
GGG11G12L3AAL13	29	M.638 (137-171), M.673 (135-150), M.683 (150-164), M.687 (157-171), M.697 (157-171), M.700 (155-169), M.703 (161-191), M.710 (191-205), M.712 (192-208), M.713 (193-200)
LELSAAKLXNNFDVT	29	M.638 (163-177), M.673 (142-156), M.683 (156-170), M.687 (163-177), M.697 (163-177), M.700 (161-175), M.702 (187-201), M.707 (197-201), M.710 (198-202), M.713 (192-206)
UNLNUFIVTMVYKEF	29	M.638 (169-183), M.673 (148-162), M.683 (162-176), M.687 (168-183), M.697 (169-183), M.700 (167-181), M.702 (153-207), M.707 (169-177), M.710 (208-218), M.713 (188-222)
MPRLETAGTIAHFYEG	29	M.638 (186-200), M.673 (165-179), M.683 (179-193), M.687 (185-200), M.697 (186-200), M.700 (184-198), M.702 (210-216), M.707 (220-234), M.710 (221-235), M.713 (215-239)
HRVE34YVASHQGIVW	29	M.638 (195-210), M.673 (175-189), M.683 (195-210), M.697 (196-210), M.700 (194-208), M.702 (220-234), M.707 (230-240), M.710 (213-245), M.711 (222-239)
SNGINIVKGTIVASGF	29	M.638 (204-218), M.673 (183-197), M.687 (204-218), M.700 (202-216), M.702 (228-242), M.707 (238-252), M.710 (139-251), M.713 (233-247)
DRNIVVXGVSQGRPLJ	29	M.638 (228-251), M.673 (214-245), M.683 (231-245), M.687 (228-251), M.697 (218-252), M.700 (226-250), M.702 (282-296), M.707 (220-234), M.710 (221-235), M.713 (215-239)
KIDIFFETSVAGVYA	29	M.638 (267-281), M.673 (246-260), M.683 (260-274), M.687 (267-281), M.697 (267-281), M.700 (265-279), M.702 (291-305), M.707 (301-311), M.710 (302-316), M.713 (296-310)
VYASIDVYASERKVKLY	29	M.638 (329-391), M.673 (278-285), M.683 (272-286), M.687 (279-293), M.700 (277-291), M.702 (303-311), M.707 (311-319), M.710 (313-322), M.711 (310-314-321), M.713 (308-322)
DYLPFTY5RSFDIAM	29	M.638 (329-343), M.673 (308-322), M.683 (322-336), M.687 (319-343), M.697 (329-343), M.700 (327-341), M.702 (353-367), M.707 (363-377), M.710 (364-378), M.713 (358-372)
DISKLUWVJXHRY	14	M.746 (0-14), M.798 (0-14), M.762 (0-14), M.784 (0-14)
WVVAJRRP2VRCEFS	14	M.746 (6-20), M.758 (6-20), M.762 (6-20), M.764 (6-20)
EDEN210KSPVYASZHN	20	M.608 (17-23), M.643 (23-33), M.667 (27-31), M.684 (17-33), M.695 (17-31), M.670 (17-31), M.711 (19-33), M.735 (19-33)
ROAHYHHL1PPAIV	30	M.740 (14-28), M.746 (19-33), M.750 (19-33), M.752 (18-32), M.754 (19-32), M.755 (18-32)
MHOLPQYTVL2LQKX1	30	M.608 (50-64), M.643 (52-66), M.663 (50-64), M.664 (50-64), M.666 (50-64), M.670 (50-64), M.731 (52-66), M.735 (52-66), M.740 (47-61), M.748 (42-56), M.750 (52-66), M.754 (51-65), M.756 (51-65)
YPLQYTY1A9DQER	30	M.608 (73-88), M.643 (78-93), M.663 (78-88), M.684 (74-88), M.686 (74-88), M.670 (74-88), M.731 (76-90), M.735 (76-90)
EDL1YK1120VSE1	30	M.740 (73-85), M.748 (76-90), M.750 (76-90), M.754 (76-90), M.756 (76-90), M.758 (76-90), M.760 (82-96), M.663 (82-96), M.664 (82-96), M.670 (82-96), M.731 (84-98), M.735 (84-98), M.608 (82-96), M.643 (82-96), M.663 (82-96), M.664 (82-96), M.670 (82-96), M.731 (84-98), M.735 (84-98)
EDL1PYYV1PVVGEA	30	M.740 (79-93), M.748 (84-98), M.750 (84-98), M.752 (83-97), M.754 (83-97), M.756 (83-97)
ED1QVYVYDQGEHIL	30	M.608 (92-111), M.643 (100-114), M.663 (98-112), M.664 (98-112), M.666 (98-112), M.670 (98-112), M.731 (100-114), M.735 (100-114), M.740 (100-114), M.748 (100-114), M.750 (100-114), M.752 (99-113), M.754 (99-113), M.756 (99-113)
ED1YK1120VSE1	30	M.608 (110-124), M.643 (114-126), M.663 (110-124), M.664 (110-124), M.666 (110-124), M.670 (110-124), M.731 (112-126), M.735 (112-126), M.740 (107-121), M.748 (112-126), M.750 (112-126), M.752 (111-125), M.754 (111-125), M.756 (111-125)
ED1LPVYV1PVVGEA	30	M.608 (158-172), M.643 (160-174), M.663 (160-172), M.664 (158-172), M.666 (159-172), M.670 (158-172), M.731 (160-174), M.735 (160-174), M.740 (165-180), M.748 (160-174), M.750 (160-174), M.752 (159-173), M.754 (158-173), M.756 (159-173)
ED1QVYVYDQGEHIL	30	M.608 (234-248), M.643 (236-250), M.663 (234-248), M.664 (234-248), M.666 (234-248), M.670 (234-248), M.731 (236-250), M.735 (236-250), M.740 (231-245), M.748 (236-250), M.750 (236-250), M.752 (235-249), M.754 (235-249)
EEYHELLQZPMNAVK	30	M.608 (252-266), M.643 (254-268), M.663 (252-266), M.664 (253-266), M.666 (253-266), M.670 (252-266), M.131 (254-266), M.735 (254-266), M.740 (249-263), M.748 (254-268), M.750 (254-268), M.752 (253-267), M.754 (253-267)
EDKXVYKQ5EDPENAN	30	M.608 (268-282), M.643 (270-284), M.663 (268-282), M.664 (268-282), M.666 (268-282), M.670 (268-282), M.731 (270-284), M.735 (270-284), M.740 (265-279), M.748 (270-284), M.750 (270-284), M.752 (269-283), M.754 (269-283), M.756 (269-283)
FDL1AKYTSKSHLVEPN	30	M.608 (280-294), M.643 (283-296), M.663 (280-293), M.664 (280-294), M.666 (280-294), M.670 (280-294), M.731 (283-296), M.735 (283-296), M.740 (277-293), M.748 (282-296), M.750 (282-296), M.752 (282-295), M.754 (281-293), M.756 (281-293)
VENOQH331AKPVA	30	(281-295)

SVVLAQLLAALKVIG	30	M.643 (292-306); M.663 (290-304); M.664 (290-304); M.666 (290-304); M.670 (290-304); M.731 (292-306); M.735 (292-306); M.740 (287-301); M.749 (292-306); M.750 (292-306); M.752 (291-305); M.754 (291-305); M.756 (291-305); M.643 (308-322); M.663 (308-320); M.664 (308-320); M.666 (308-320); M.670 (308-320); M.731 (308-322); M.735 (308-322); M.740 (308-322); M.741 (308-322); M.748 (308-322); M.750 (308-322); M.752 (307-321); M.754 (307-321); M.756 (324-338); M.663 (322-338); M.664 (322-338); M.666 (322-338); M.670 (322-338); M.731 (324-338); M.735 (324-338); M.740 (319-333); M.748 (324-338); M.750 (324-338); M.752 (323-337); M.754 (323-337); M.756 (323-337); M.731 (345-359); M.715 (345-359); M.740 (340-359); M.748 (345-359); M.750 (345-359); M.752 (344-359); M.754 (344-359); M.756 (344-359); M.731 (377-391); M.735 (377-391); M.740 (372-386); M.748 (377-391); M.750 (377-391); M.752 (376-390); M.754 (376-390); M.756 (376-390); M.731 (388-397); M.735 (388-397); M.740 (388-392); M.748 (388-397); M.750 (388-397); M.752 (388-397); M.754 (388-397); M.756 (388-397); M.731 (417-431); M.735 (417-431); M.740 (412-426); M.748 (417-431); M.750 (417-431); M.752 (416-430); M.754 (416-430); M.756 (416-430); M.731 (437-451); M.735 (437-451); M.740 (432-446); M.748 (437-451); M.750 (437-451); M.752 (436-450); M.754 (436-450); M.756 (436-450); M.735 (478-492); M.740 (478-487); M.748 (478-492); M.750 (478-492); M.752 (477-491); M.754 (477-491); M.756 (477-491); M.735 (484-496); M.740 (484-496); M.748 (484-496); M.750 (484-496); M.752 (483-497); M.754 (483-497); M.756 (483-497); M.735 (492-506); M.740 (487-501); M.748 (492-506); M.750 (492-506); M.752 (491-505); M.754 (491-505); M.756 (491-505); M.726 (5-14); M.726 (6-14); M.726 (6-20); M.763 (5-19); M.765 (2-16); M.171 (10-24); M.205 (6-20); M.256 (21-35); M.332 (2-16); M.348 (4-38); M.171 (16-30); M.259 (32-26); M.256 (27-43); M.332 (8-22); M.64 (0-14); M.148 (31-45); M.171 (43-57); M.205 (39-53); M.22 (19-33); M.256 (54-68); M.332 (35-49); M.4 (16-30); M.55 (23-37); M.56 (16-30); M.64 (27-41); M.332 (67-71); M.56 (38-92); M.332 (76-90); M.43 (0-14); M.47 (0-14); M.61 (0-14); M.32 (13-27); M.43 (17-31); M.47 (17-33); M.57 (6-20); M.51 (17-31); M.13 (5-18); M.32 (21-35); M.43 (24-39); M.47 (29-39); M.57 (14-29); M.61 (15-29); M.32 (37-51); M.47 (41-55); M.33 (29-43); M.57 (38-52); M.518 (9-23); M.518 (102-115); M.518 (122-136); M.518 (149-163); M.518 (167-171); M.518 (187-191); M.518 (173-187); M.518 (195-209); M.518 (201-239); M.267 (9-23); M.270 (14-28); M.267 (35-29); M.270 (20-38); M.267 (27-41); M.270 (32-46); M.350 (39-52); M.357 (61-71); M.270 (38-40); M.271 (23-47); M.73 (38-52); M.505 (0-24); M.667 (0-24); M.679 (0-24); M.680 (0-24); M.488 (4-18); M.505 (22-36); M.667 (22-36); M.679 (22-36); M.680 (22-36); M.488 (26-40); M.505 (44-58); M.667 (44-58); M.679 (44-58); M.680 (44-58)
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CDASILIOPLSNQSA	52	M.230 (1-15), M.445 (9-23), M.488 (41-55), M.505 (59-73), M.667 (59-73), M.679 (59-73), M.680 (59-73)
IDESEYRMYLA2K0E	52	M.530 (104-136), M.667 (229-341), M.679 (228-242), M.680 (228-242)
KPNDFMPTFAKAMEN	52	M.530 (141-155), M.667 (265-279), M.679 (265-279), M.680 (265-279)
PZFAARAKEXLSEV2V	52	M.530 (147-183), M.679 (273-289), M.680 (273-285)
GGSVIRISSANPDL	52	M.530 (184-198), M.667 (308-322), M.679 (308-322), M.680 (308-322)
DEWHYRILKJXZAAH	52	M.530 (218-332), M.667 (342-358), M.679 (342-356), M.680 (342-358)
WSEIOTL1KPNLIGP	53	M.436 (0-14), M.534 (0-14)
HENTIACI1DXYANAS	53	M.436 (30-44), M.487 (25-43), M.508 (27-41), M.534 (30-44), M.613 (25-43), M.683 (28-42)
NISGILICIEHAAYL	53	M.436 (45-59), M.487 (44-58), M.508 (42-56), M.534 (45-59), M.613 (44-58), M.683 (43-57)
AYTIAKIRHOLIVVYAV	53	M.436 (55-70), M.487 (55-69), M.508 (53-67), M.534 (55-70), M.613 (50-54), M.672 (1-15), M.613 (55-69), M.688 (54-64)
GLDVVDARENALIKS	53	M.436 (63-77), M.487 (62-76), M.508 (60-74), M.534 (63-77), M.552 (17-31), M.572 (8-22), M.613 (62-76), M.688 (61-75)
3N02XEX0GSEHGPVJ	53	M.436 (73-93), M.487 (63-97), M.508 (63-96), M.508 (80-94), M.534 (83-97), M.552 (27-51), M.572 (28-42), M.613 (61-96)
PVLSAFKKFPKCNRV	53	M.436 (94-108), M.487 (95-109), M.487 (94-108), M.508 (92-105), M.534 (95-109), M.552 (49-63), M.572 (40-54), M.613 (94-108)
RPKPHFNNSY8127D1	53	M.436 (103-116), M.487 (103-116), M.508 (99-113), M.534 (102-116), M.552 (66-70), M.572 (47-61), M.613 (101-115), M.688 (100-114)
VEIKEFANAVKLRRS	53	M.436 (121-135), M.487 (125-139), M.487 (124-138), M.508 (122-136), M.534 (125-139), M.552 (79-93), M.572 (70-84)
VKLPERSAVNGVOTY	53	M.613 (124-138), M.688 (123-137)
GFYLIGHENAVVERLR	53	M.436 (135-147), M.488 (132-146)
GWLMRHEMELAFDTM	53	M.436 (82-96), M.436 (146-160), M.487 (145-159), M.508 (143-157), M.534 (146-160), M.552 (100-114), M.572 (91-105)
GLVTEFPSTAAAYFR	53	M.613 (145-159), M.688 (144-158)
SHVWVYVHQJLGSLSA	54	M.384 (39-53)
QPLLFTIWCNGJQHRKN	54	M.384 (49-63)
IGSIVTIPPS1GSMR3	54	M.327 (32-26), M.345 (12-26), M.347 (16-30), M.213 (25-38), M.220 (25-39), M.384 (92-106)
GYGLISIVSRL1IPV	54	M.127 (29-43), M.145 (29-43), M.147 (33-47), M.213 (42-56), M.220 (42-56), M.384 (109-123)
VVSRLLIPVSEPPDPPA	54	M.147 (95-109), M.345 (35-49), M.213 (48-62), M.220 (68-82), M.384 (111-128)
VCIRLSEPFCCLYCIL	17	M.577 (1-15), M.717 (1-15), M.719 (3-15), M.724 (1-15), M.727 (1-15)
TCIL1AXXSYSHMLVYV	17	M.577 (12-26), M.717 (12-26), M.719 (12-26), M.724 (12-26), M.727 (12-26)
NIWADDIAASL3TLE	76	MN.169 (10-24)
IRAXELOVEMHOTEX3	76	MN.134 (0-14)
VSNONYEYILSDOKLVV	76	MN.124 (7-21)
KOMDWWETSCS1MHD	76	MN.169 (12-46)
TSCSI1HHTAVDVLVNE	76	MN.124 (23-37), MN.169 (39-53)
TKLQASIX1K1LAYPA	76	MN.124 (38-52), MN.169 (54-68)
JKSWLAFAAQKVVEV	76	MN.124 (44-58), MN.169 (60-74)
KVTVNVALCKALVSL	76	MN.124 (54-68), MN.169 (70-84)
LKDEAYFAAANAAACCA	76	MN.124 (68-82), MN.169 (84-98)
FRYVSAJH2K12KVV	76	MN.324 (158-172), MN.169 (174-188), MN.68 (15-47)
ISKVVKV1QSELDIDV	76	MN.124 (166-182), MN.169 (184-196), MN.82 (23-37)
SHVTEFEDQ12GEAZT	76	MN.369 (204-223), MN.82 (48-62)
LSGCPATIANGIVQSY	76	MN.369 (217-231), MN.82 (55-70)
DPNTV1WEMK1MAGCMT	76	MN.369 (249-263), MN.82 (88-102)
EGPLMLTVSKM1PAS	77	MN.206 (2-15), MN.210 (2-15)
KGREFPAFGKSYEAGSY	77	MN.206 (18-32), MN.210 (18-32)
GNTIVALVGLDQFJTK	77	MN.206 (78-92), MN.210 (78-92)
WGLDQ231K1H1L16	77	MN.206 (84-98), MN.210 (84-98)
PIRAMKFSVBFVVVRV	77	MN.206 (106-120), MN.210 (106-120)
ENSGAAT1V1PENVTS	77	MN.301 (19-63), MN.206 (179-192), MN.210 (179-193)

SPPVVSFRETVIDKS	77	MN.201 (58-71); MN.206 (187-201); MN.210 (187-201)
ONHHRGMYCNPPLCS	77	MN.201 (62-95); MN.206 (213-225); MN.210 (211-225)
PIARRVIFASQULAK	77	MN.136 (42-56); MN.140 (49-61); MN.173 (68-82); MN.183 (102-116); MN.184 (102-116); MN.185 (94-108); MN.193 (101-115); MN.201 (208-222); MN.206 (327-351); MN.210 (337-351)
AKPHLLEPFTYIUVZI	77	MN.136 (95-109); MN.140 (82-95); MN.173 (81-95); MN.183 (135-139); MN.184 (135-139); MN.185 (107-122); MN.193 (114-128); MN.201 (223-235); MN.206 (350-364); MN.210 (350-364)
CPVYLVIEQAPRIGAL	77	MN.136 (61-75); MN.140 (58-82); MN.173 (87-101); MN.183 (121-135); MN.184 (121-135); MN.185 (113-127); MN.193 (120-134); MN.201 (227-241); MN.206 (356-370); MN.210 (356-370)
PLYNJKAYLCPVIESE	77	MN.136 (95-123); MN.140 (108-123); MN.173 (125-139); MN.183 (159-174); MN.184 (155-175); MN.185 (155-169)
LPVIESFCESATLRA	77	MN.136 (107-121); MN.140 (114-128); MN.173 (133-147); MN.183 (167-181); MN.184 (167-181); MN.185 (159-173); MN.193 (165-180); MN.201 (213-237); MN.206 (402-416); MN.210 (402-416)
PEPSATRATA7QGZ	77	MN.136 (133-135); MN.140 (120-134); MN.173 (139-153); MN.183 (123-137); MN.184 (173-187); MN.185 (165-179); MN.193 (172-188); MN.201 (225-239); MN.206 (408-422); MN.210 (408-422)
SLKLHKACEAFNPYD	78	MN.12 (4-18)
CAFDPYKXGTSLSKU	78	MN.15 (32-35); MN.38 (27-41)
SKVRSFLTEAKAKHJ	78	MN.12 (24-38); MN.15 (24-38); MN.35 (39-53); MN.38 (39-53); MN.41 (40-54)
LLCARKRKHISKNOCLV	78	MN.12 (30-44); MN.15 (30-44); MN.3 (13-27); MN.35 (45-59); MN.38 (45-59); MN.41 (36-80); MN.47 (47-62)
KEKRMWAAALTSISAS	78	MN.86 (64-78)
GGATVOLGSSLLAERZ	78	MN.86 (82-85)
RHLAROFIPHLRQRF	78	MN.83 (0-14); MN.94 (0-14)
FIPHUNQHETINPPIN	78	MN.83 (6-30); MN.84 (6-29)
NTMENLSST1F5FPV1	78	MN.14 (3-15); MN.33 (10-24); MN.46 (22-36); MN.74 (0-14); MN.83 (23-37); MN.94 (23-37)
TITSPYJILLASASAEU	78	MN.14 (9-33); MN.17 (6-20); MN.20 (6-20); MN.30 (13-25); MN.33 (38-37); MN.46 (30-44); MN.67 (6-20); MN.74 (6-22); MN.8 (11-15); MN.83 (31-45); MN.94 (31-45)
ILLBASABLVVAGDP	78	MN.14 (19-29); MN.17 (12-26); MN.20 (12-26); MN.30 (18-32); MN.33 (24-38); MN.46 (36-50); MN.67 (12-26); MN.8 (7-23); MN.83 (37-51); MN.94 (37-51)
ELAENEVSAAPNLES	78	MN.51 (33-46); MN.56 (32-46); MN.59 (32-46); MN.63 (32-46); MN.66 (32-46); MN.94 (38-46)
SAAPHFLSMAVTAAR	78	MN.51 (39-53); MN.56 (39-53); MN.59 (39-53); MN.62 (39-53); MN.63 (39-53); MN.67 (66-80); MN.74 (68-82); MN.86 (39-53)
PSMAYTAARSQONQD	78	MN.51 (45-59); MN.56 (45-59); MN.59 (45-59); MN.62 (45-59); MN.63 (45-59); MN.67 (72-86); MN.74 (74-86); MN.86 (45-59)
KISLSKVRSELTBAK	78	MN.12 (20-34); MN.15 (20-34); MN.35 (35-49); MN.38 (35-49); MN.41 (36-50)
QOXTAALZPZLIPZCOL	79	MN.109 (131-144)
LSPILFECLIHPMLO	79	MN.106 (5-19); MN.90 (5-19); MN.96 (5-19)
VEDXILVETASHVENVY	79	MN.90 (27-41); MN.91 (0-14); MN.96 (27-41)
KLKNVILVYEARLIK	79	MN.106 (33-47); MN.80 (4-18); MN.81 (1-15); MN.90 (33-47); MN.91 (6-20); MN.96 (33-47)
EVXZARLTXKILDKQ	79	MN.36 (5-19); MN.76 (4-18)
TKFKYLAGDYLISLAD	79	MN.36 (12-25); MN.76 (11-25); MN.81 (14-28); MN.90 (46-60)
NGDYLISLADQNLQX	79	MN.106 (33-86); MN.36 (18-32); MN.76 (17-31); MN.80 (33-37); MN.81 (21-34); MN.90 (53-66); MN.91 (25-39); MN.95 (32-65)
VRAMMFTOLLAKPSVQ	79	MN.106 (85-99); MN.36 (51-65); MN.71 (25-39); MN.76 (50-64); MN.80 (56-70); MN.81 (53-67); MN.90 (85-99); MN.91 (58-72); MN.96 (85-99)
AKREICLSE7GSSCL	80	MN.486 (0-14)
LSSIGSSCL3V1LIE	80	MN.186 (6-20)
PRMKVLETFIRAKL	81	MN.58 (0-14)
SYLAGDFVSVADLNH	81	MN.58 (17-31)
FVSEADNEPFTKTY	81	MN.58 (23-47)
PPKTFYEMATPHASL	81	MN.58 (31-46)
EVKAQHETIRHACAV	81	MN.58 (52-65)
THARPAVKRJARAFV	81	MN.58 (60-74)
BRKUHGENEVH02SA	82	MN.107 (32-46)
FWRVHOISARMAEVK	82	MN.107 (38-52)
NAEVKUJGKJ1305W	82	MN.107 (48-62)
GDLYIFESRAJCKYA	82	MN.107 (108-122); MN.5 (17-31); MN.77 (39-53)
CANCYIALGQPTKTF	82	MN.107 (149-163); MN.77 (80-94)
ACSLPLMAYAVSENYF	83	MN.205 (4-18); MN.213 (4-18)
YAVSFHVEVNLCE	83	MN.205 (31-25); MN.213 (31-25)

ML1QERIKXKIKSEHG	83	MN.205 (21-35); MN.211 (21-35)
GPPIPMQZTISLQPS	83	MN.203 (27-41); MN.204 (27-41); MN.205 (53-67); MN.211 (53-67)
PGCLLWLLLTGRVPT	83	MN.203 (69-83); MN.204 (69-83); MN.205 (95-109); MN.211 (95-109)
IVVNAIDALSVTAKS	83	MN.203 (103-117); MN.204 (103-117); MN.205 (129-143); MN.211 (129-143)
QFTIGVMLQVESEF	83	MN.203 (120-134); MN.204 (120-134); MN.205 (146-160); MN.211 (146-160)
EDQCLQXARLPPVAV	83	MN.203 (193-197); MN.204 (193-197); MN.205 (179-193); MN.211 (179-193)
IARLPQVASYVYRRI	83	MN.203 (159-173); MN.204 (159-173); MN.205 (185-199); MN.211 (185-199)
ABNS3LOYADNNSPRA	83	MN.203 (182-196); MN.204 (182-196); MN.205 (208-222); MN.211 (208-222)
DPRMELMLRLYITIH	83	MN.203 (200-214); MN.204 (200-214); MN.205 (226-240); MN.211 (226-240)
AL3H3PT1SEAARLQF	83	MN.203 (232-247); MN.204 (232-247); MN.205 (259-273); MN.211 (259-273)
LSFAAALNGLAGPLH	83	MN.203 (239-253); MN.204 (239-253); MN.205 (265-279); MN.211 (265-279)
ESHLIAANDEYLLINR	83	MN.203 (351-265); MN.204 (251-265); MN.205 (277-291); MN.211 (277-291)
QEVLVNIKSVMEETIC	83	MN.203 (258-272); MN.204 (258-272); MN.205 (284-298); MN.211 (284-298)
TKOKEYVAKTILKSGKX	83	MN.203 (279-293); MN.204 (279-293); MN.205 (305-319); MN.211 (305-319)
PDPLFQLVSKLYKPVV	83	311 MN.203 (63-37); MN.203 (128-142); MN.204 (128-142); MN.205 (354-368); MN.211 (354-368); MN.69 (6-20); MN.68 (23-122) (7-31); MN.203 (322-335); MN.204 (322-335); MN.205 (348-362); MN.211 (348-362); MN.69 (3-14); MN.68 (17-31); MN.203 (323-335); MN.204 (323-335); MN.205 (349-362); MN.211 (349-362)
IVVSKLXKVVWQGILIT	83	MN.113 (28-42); MN.123 (52-65); MN.203 (357-371); MN.204 (357-371); MN.205 (383-397); MN.211 (383-397); MN.68 (28-42); MN.69 (35-49); MN.73 (28-42); MN.93 (28-42); MN.98 (52-65)
SGVLLNHEFGLVEARY	83	MN.123 (35-49); MN.203 (357-371); MN.204 (357-371); MN.205 (383-397); MN.211 (383-397); MN.68 (28-42); MN.69 (35-49); MN.73 (28-42); MN.93 (28-42); MN.98 (52-65)
IVLNGQHRSNGTGSQ	83	MN.123 (35-49); MN.203 (357-371); MN.204 (357-371); MN.205 (383-397); MN.211 (383-397); MN.68 (28-42); MN.69 (35-49); MN.73 (28-42); MN.93 (28-42); MN.98 (52-65)
GSOLIWDRAIGLPLE	83	MN.123 (56-70); MN.123 (80-94); MN.203 (385-399); MN.204 (385-399); MN.205 (411-425); MN.211 (411-425); MN.68 (56-70); MN.69 (63-77); MN.93 (56-70); MN.98 (80-94)
CPV71LNGQVYRQDQ	84	MN.105 (9-221); MN.166 (5-19); MN.167 (6-20); MN.172 (9-23); MN.178 (9-23); MN.182 (5-19)
PRFEICVQIALAIKK	84	MN.105 (24-38); MN.166 (20-34); MN.167 (21-35); MN.168 (10-24); MN.172 (24-38); MN.178 (24-38); MN.182 (20-34)
CIVQVICDSEAAKREG	84	MN.105 (47-61); MN.166 (83-97); MN.167 (84-98); MN.168 (33-47); MN.172 (87-91); MN.178 (47-61); MN.182 (43-57)
EHAFYI.DWAVHNSPFI	84	MN.105 (68-82); MN.166 (64-78); MN.167 (65-79); MN.168 (54-68); MN.172 (68-82); MN.178 (68-82); MN.182 (64-78)
FND111HEKXINHADN	84	MN.105 (322-327); MN.166 (198-313); MN.167 (99-113); MN.168 (189-192); MN.172 (102-116); MN.178 (102-116); MN.182 (98-112)
SDEKILLSVFRGVITY	84	MN.105 (124-138); MN.166 (120-134); MN.167 (121-135); MN.168 (110-124); MN.172 (124-138); MN.178 (124-138)
VNHLWALDTSIIHNMV	84	MN.182 (120-134)
TRHYAEVMPALTIVIV	84	MN.166 (160-174); MN.167 (163-175); MN.168 (150-164); MN.172 (164-178); MN.178 (164-178); MN.182 (160-174)
PAUTIMGKETDAGK31R3	84	MN.166 (150-164); MN.167 (191-205); MN.168 (180-194); MN.172 (194-208); MN.178 (194-208); MN.182 (190-204)
VIAAKL1RZQLASTIK	84	MN.166 (195-210); MN.167 (197-211); MN.168 (186-200); MN.172 (200-214); MN.178 (200-214); MN.182 (196-210)
GRG1KDEGUYNVANQJ	85	MN.39 (9-23)
LTVGNIIAGDREPSMA	85	MN.39 (28-42)
DRF2MAYJ0H3SEZBIL	85	MN.39 (27-51)
YDRTPPEELAIIVYGT	85	MN.39 (43-57)
EL1A3M729IGNEFASD	85	MN.39 (29-53)
GREENYVMAKLAEDOA	86	MN.102 (6-20); MN.116 (6-20); MN.117 (6-20); MN.181 (6-20); MN.194 (6-20); MN.202 (6-20)
VSXKVEFEMEAVAKTA	86	MN.102 (23-37); MN.116 (23-37); MN.117 (23-37); MN.181 (23-37); MN.194 (23-37)
EEERNLLSVAYKVNIG	86	MN.202 (45-59)
AYKMY1CARRASWRT	86	MN.102 (45-59); MN.116 (54-67); MN.117 (53-67); MN.186 (43-55); MN.181 (53-67); MN.194 (53-67)
RRASWR1ISSISQKE	86	MN.102 (61-75); MN.116 (61-75); MN.117 (61-75); MN.186 (49-63); MN.181 (61-75); MN.194 (61-75)
MEAVYAS1H2M1R3T3	86	MN.202 (61-75)
SKICDGILKL1DSH1	86	MN.103 (30-44); MN.202 (103-119); MN.116 (105-119); MN.127 (105-119); MN.156 (193-197); MN.181 (105-119); MN.194
YK1LDSH1LPSATA	86	(105-119); MN.195 (108-128); MN.204 (105-119)
AESKVEYLKHKGDYH	86,51	MN.101 (4-18); MN.102 (50-64); MN.102 (120-134); MN.116 (120-134); MN.117 (120-134); MN.156 (108-122); MN.181 (120-134); MN.194 (120-134); MN.195 (120-134); MN.202 (120-134)
CDVNRYLQAFKASAE	86	MN.102 (63-73); MN.118 (131-146); MN.136 (139-139); MN.181 (133-143); MN.184 (133-143); MN.195 (131-145)
NJLVAYKSAODIALA	86	MN.101 (82-96); MN.156 (140-154); MN.163 (9-23); MN.179 (9-23); MN.181 (152-166); MN.194 (152-166); MN.195 (152-166); MN.202 (152-166); MN.204 (168-182); MN.195 (168-182); MN.202 (168-182); MN.97 (22-36)
LEPTTIPRIBLGLALF	86	MN.101 (98-112); MN.156 (156-170); MN.163 (25-99); MN.175 (25-99); MN.181 (188-192); MN.194 (168-182); MN.195 (168-182); MN.202 (168-182); MN.97 (22-36)

IRIGLALNFGVVEYVS	88	MN.101 (104-118); MN.156 (382-376); MN.163 (31-45); MN.375 (31-45); MN.181 (174-188); MN.194 (174-188); MN.195 (174-188); MN.201 (174-188); MN.97 (28-42); MN.301 (310-324); MN.356 (368-382); MN.163 (37-53); MN.375 (37-53); MN.181 (180-194); MN.194 (180-194); MN.195 (180-194); MN.202 (180-194); MN.97 (35-48); MN.155 (207-221); MN.163 (76-90); MN.175 (76-90); MN.181 (219-233); MN.194 (223-233); MN.195 (219-233); MN.201 (219-233); MN.54 (37-51); MN.97 (73-87); MN.356 (213-323); MN.163 (82-96); MN.175 (82-96); MN.181 (233-239); MN.194 (225-239); MN.195 (225-239); MN.202 (225-239); MN.54 (33-57); MN.97 (79-93);
YKDSLTLIMOLLRDNL	86	
YKDSLTLIMOLLRDNL	96	MN.155 (213-223); MN.163 (76-90); MN.175 (76-90); MN.181 (219-233); MN.194 (223-233); MN.195 (219-233); MN.201 (219-233); MN.54 (37-51); MN.97 (73-87); MN.356 (213-323); MN.163 (82-96); MN.175 (82-96); MN.181 (233-239); MN.194 (225-239); MN.195 (225-239); MN.202 (225-239); MN.54 (33-57); MN.97 (79-93);
GSRALPEILLQLTKOF	87	MN.153 (7-21);
TKKVVVYXXBNYCHVY	87	MN.153 (50-64); MN.157 (28-40); MN.85 (3-18);
CVEVKVKWQVPEILSE	87	MN.118 (1-16); MN.122 (9-23); MN.128 (9-23); MN.153 (79-93); MN.92 (16-30); MN.95 (31-45); MN.124 (30-44); MN.128 (43-55); MN.219 (30-44); MN.122 (48-62); MN.228 (48-62); MN.153 (218-233); MN.157 (24-108); MN.93 (53-69); MN.36 (70-84); MN.99 (14-28); MN.114 (45-159); MN.118 (156-170); MN.119 (145-159); MN.122 (161-177); MN.128 (163-177); MN.157 (209-223);
ACQOLTEPSPKPTPQMM	87	MN.93 (53-69); MN.36 (70-84); MN.99 (14-28); MN.114 (45-159); MN.118 (156-170); MN.119 (145-159); MN.122 (161-177); MN.128 (163-177); MN.157 (209-223);
PHQCKYEAGIAZKLIK	87	MN.99 (129-143);
DVNTS3YEL6WCVGVL	88	MN.72 (3-19);
EPAYFATAESVRDHL	89	MN.199 (20-34); MN.207 (18-32); MN.224 (20-34);
QYV1A3QMEY2LQSHAL	89	MN.199 (52-68); MN.207 (50-64); MN.224 (54-68);
AVGNL6GIGAYAEPAV	89	MN.199 (69-83); MN.207 (67-81); MN.224 (69-83);
ABAVKCFPQ1ELRALA	89	MN.199 (80-94); MN.207 (78-92); MN.224 (80-94);
RLNACFLDOSMAYLNL	89	MN.199 (109-123); MN.207 (107-121); MN.214 (3-17); MN.218 (0-14); MN.219 (3-17); MN.220 (3-17); MN.221 (4-18); MN.222 (4-18); MN.233 (26-40); MN.224 (109-123);
LPXRYGLKPKQKARAE	89	MN.199 (130-144); MN.207 (128-132); MN.214 (14-38); MN.218 (23-38); MN.219 (26-28); MN.220 (24-38); MN.221 (25-38); MN.222 (25-39); MN.223 (37-61); MN.224 (130-144); MN.199 (157-171); MN.207 (155-169); MN.214 (51-65); MN.215 (26-40); MN.216 (25-39); MN.217 (26-40); MN.218 (48-62); MN.219 (51-65); MN.221 (52-66); MN.222 (74-88); MN.224 (157-171);
FSPWETVRHDVVYPV	89	MN.202 (266-280); MN.211 (62-161); MN.218 (136-50); MN.219 (63-76); MN.220 (62-76); MN.221 (63-71); MN.222 (63-77);
TRIPVPRFERVSEIUR	89	MN.223 (63-99);
CEVLNIALAYDVF1PG	89	MN.199 (190-204); MN.207 (188-222); MN.214 (84-98); MN.215 (59-73); MN.216 (58-72); MN.217 (59-73); MN.218 (81-95); MN.219 (84-98); MN.220 (84-98); MN.221 (85-99); MN.222 (85-99); MN.223 (107-121); MN.224 (190-204); MN.199 (102-210); MN.207 (200-234); MN.214 (56-110); MN.215 (71-95); MN.216 (70-94); MN.217 (77-105); MN.218 (91-107); MN.220 (225-239); MN.221 (87-111); MN.222 (187-213); MN.223 (189-234); MN.224 (209-236);
ISGVN1KNA1SL2LW	89	MN.199 (222-236); MN.207 (220-234); MN.214 (216-310); MN.215 (91-105); MN.216 (90-104); MN.217 (91-105); MN.218 (113-127); MN.219 (116-130); MN.220 (116-130); MN.221 (117-131); MN.222 (117-131); MN.223 (139-153); MN.224 (222-236);
AEDENL1FQFNDCQYE	89	MN.224 (260-274); MN.207 (258-272); MN.214 (154-169); MN.215 (129-143); MN.216 (128-142); MN.217 (128-143); MN.218 (151-165); MN.219 (158-168); MN.220 (154-168); MN.221 (153-169); MN.222 (175-169); MN.223 (177-191); MN.224 (160-274);
PKKLURKQKPF1AC	89	MN.199 (266-280); MN.207 (264-278); MN.214 (160-174); MN.215 (135-149); MN.216 (134-148); MN.217 (135-149); MN.218 (157-171); MN.219 (160-174); MN.220 (160-174); MN.221 (161-175); MN.222 (161-175); MN.223 (183-197); MN.224 (260-280);
1KQOPT1C5ASLQD1	89	MN.199 (312-328); MN.207 (310-324); MN.214 (206-220); MN.219 (181-191); MN.218 (180-194); MN.219 (208-217); MN.220 (208-220); MN.221 (208-225); MN.222 (207-221); MN.223 (207-223); MN.224 (229-243);
PLA1PFL19R1L2D6	89	MN.199 (314-328);
QSVMPKLLPROMEYI	89	MN.199 (359-373); MN.207 (357-371); MN.214 (253-267); MN.215 (228-242); MN.216 (227-241); MN.217 (228-242); MN.218 (250-264); MN.219 (253-267); MN.220 (253-267); MN.221 (254-268); MN.222 (254-268); MN.223 (276-290); MN.224 (359-373);
SE1CKKRENEMV1S1P	89	MN.207 (372-386); MN.214 (268-282); MN.215 (243-257); MN.216 (242-256); MN.217 (243-257); MN.218 (268-279); MN.220 (268-283); MN.221 (369-383); MN.222 (269-283); MN.223 (274-309); MN.224 (374-388);
POKPVVRMAN1CVVUS	89	MN.207 (403-417); MN.214 (299-313); MN.215 (274-288); MN.216 (273-287); MN.217 (274-288); MN.218 (296-310); MN.219 (299-313); MN.220 (299-313); MN.221 (300-314); MN.222 (300-314); MN.223 (322-336); MN.224 (405-419); MN.207 (431-445); MN.214 (327-341); MN.215 (302-316); MN.216 (302-315); MN.217 (302-316); MN.218 (324-338); MN.219 (327-341); MN.220 (327-341); MN.221 (328-342); MN.222 (328-342); MN.223 (329-350); MN.224 (433-447);
JKX2E1PADIYVNE1P	89	MN.214 (354-367); MN.215 (353-367); MN.216 (327-341); MN.217 (327-341); MN.218 (328-342); MN.219 (350-364); MN.220 (457-471); MN.214 (353-367); MN.215 (354-368); MN.216 (354-368); MN.217 (327-341); MN.218 (328-342); MN.219 (353-367); MN.220 (453-467); MN.214 (353-367); MN.215 (354-368); MN.216 (354-368); MN.217 (376-390); MN.224 (459-473);
PRWL1FRCNP1ELSE1	89	MN.219 (353-367); MN.220 (353-367); MN.221 (354-368); MN.222 (354-368); MN.223 (376-390); MN.224 (459-473);
PK1WATWAARAKLASH	89	MN.214 (394-408); MN.222 (395-408); MN.223 (395-409); MN.224 (397-412); MN.225 (398-409); MN.226 (399-410); MN.227 (400-411); MN.228 (401-412); MN.229 (402-413); MN.230 (403-414); MN.231 (404-415); MN.232 (405-416); MN.233 (406-417); MN.234 (407-418); MN.235 (408-419); MN.236 (409-420); MN.237 (409-421); MN.238 (410-422); MN.239 (411-423); MN.240 (412-424); MN.241 (413-425); MN.242 (414-426); MN.243 (415-427); MN.244 (416-428); MN.245 (417-429); MN.246 (418-430); MN.247 (419-431); MN.248 (420-432); MN.249 (421-433); MN.250 (422-434); MN.251 (423-435); MN.252 (424-436); MN.253 (425-437); MN.254 (426-438); MN.255 (427-439); MN.256 (428-440); MN.257 (429-441); MN.258 (430-442); MN.259 (431-443); MN.260 (432-444); MN.261 (433-445); MN.262 (434-446); MN.263 (435-447); MN.264 (436-448); MN.265 (437-449); MN.266 (438-450); MN.267 (439-451); MN.268 (440-452); MN.269 (441-453); MN.270 (442-454); MN.271 (443-455); MN.272 (444-456); MN.273 (445-457); MN.274 (446-458); MN.275 (447-459); 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MN.500 (672-695); MN.501 (673-696); MN.502 (674-697); MN.503 (675-698); MN.504 (676-699); MN.505 (677-700); MN.506 (678-701); MN.507 (679-702); MN.508 (680-703); MN.509 (681-704); MN.510 (682-705); MN.511 (683-706); MN.512 (684-707); MN.513 (685-708); MN.514 (686-709); MN.515 (687-710); MN.516 (688-711); MN.517 (689-712); MN.518 (690-713); MN.519 (691-714); MN.520 (692-715); MN.521 (693-716); MN.522 (694-717); MN.523 (695-718); MN.524 (696-719); MN.525 (697-720); MN.526 (698-721); MN.527 (699-722); MN.528 (700-723); MN.529 (701-724); MN.530 (702-725); MN.531 (703-726); MN.532 (704-727); MN.533 (705-728); MN.534 (706-729); MN.535 (707-730); MN.536 (708-731); MN.537 (709-732); MN.538 (710-733); MN.539 (711-734); MN.540 (712-735); MN.541 (713-736); MN.542 (714-737); MN.543 (715-738); MN.544 (716-739); MN.545 (717-740); MN.546 (718-741); MN.547 (719-742); MN.548 (720-743); MN.549 (721-744); MN.550 (722-745); MN.551 (723-746); MN.552 (724-747); MN.553 (725-748); MN.554 (726-749); MN.555 (727-750); MN.556 (728-751); MN.557 (729-752); MN.558 (730-753); MN.559 (731-754); MN.560 (732-755); MN.561 (733-756); MN.562 (734-757); MN.563 (735-758); MN.564 (736-759); MN.565 (737-760); MN.566 (738-761); MN.567 (739-762); MN.568 (740-763); MN.569 (741-764); MN.570 (742-765); MN.571 (743-766); MN.572 (744-767); MN.573 (745-768); MN.574 (746-769); MN.575 (747-770); MN.576 (748-771); MN.577 (749-772); MN.578 (750-773); MN.579 (751-774); MN.580 (752-775); MN.581 (753-776); MN.582 (754-777); MN.583 (755-778); MN.584 (756-779); MN.585 (757-780); MN.586 (758-781); MN.587 (759-782); MN.588 (760-783); MN.589 (761-784); MN.590 (762-785); MN.591 (763-786); MN.592 (764-787); MN.593 (765-788); MN.594 (766-789); MN.595 (767-790); MN.596 (768-791); MN.597 (769-792); MN.598 (770-793); MN.599 (771-794); MN.600 (772-795); MN.601 (773-796); MN.602 (774-797); MN.603 (775-798); MN.604 (776-799); MN.605 (777-800); MN.606 (778-801); MN.607 (779-802); MN.608 (780-803); MN.609 (781-804); MN.610 (782-805); MN.611 (783-806); MN.612 (784-807); MN.613 (785-808); MN.614 (786-809); MN.615 (787-810); MN.616 (788-811); MN.617 (789-812); MN.618 (790-813); MN.619 (791-814); MN.620 (792-815); MN.621 (793-816); MN.622 (794-817); MN.623 (795-818); MN.624

LA332WVTF11PMLP	90	MN.111(36-50); MN.141(0-14); MN.142(28-43); MN.158(37-53); MN.162(64-82)
PDLPYDYGATEPAIS	90	MN.111(87-61); MN.141(11-25); MN.142(40-54); MN.158(48-67); MN.162(55-69)
HATIVVANINKALOL	90	MN.111(73-82); MN.141(27-61); MN.142(66-80); MN.158(74-88); MN.162(81-95)
GDASAVVQLOGRAIKE	90	MN.111(94-108); MN.141(58-72); MN.142(87-101); MN.158(95-109); MN.162(102-116)
DPLVINGANLIELTG	90	MN.112(3-27); MN.141(153-167); MN.142(182-196); MN.158(190-204); MN.162(197-211); MN.53(24-39)
ANLIPILICIDWHERA	90	MN.112(80-94); MN.141(160-174); MN.142(189-203); MN.158(197-211); MN.162(204-218); MN.53(31-45)
EVAY1230NNWREPLV	90	MN.112(93-107); MN.141(179-187); MN.158(210-224); MN.162(211-231); MN.53(84-98)
PDYLINJNWKVYNNKRY	90	MN.112(104-118); MN.141(184-198); MN.158(221-235); MN.162(228-242); MN.53(55-69)
APSGRINMEIYADDV	91	MN.121(19-29); MN.127(15-29); MN.132(15-29); MN.139(15-29); MN.146(15-29)
VMELYADVVPKJAEN	91	MN.120(28-42); MN.123(21-35); MN.127(21-35); MN.130(40-54); MN.132(21-35); MN.139(21-35); MN.145(21-35)
EVKGSEPHWV3EGEM	91	MN.120(81-23); MN.121(54-68); MN.127(54-68); MN.130(73-87); MN.132(54-68); MN.139(54-68); MN.140(54-68)
SIYGAKEFADENFIRK	91	MN.120(91-105); MN.121(84-98); MN.127(84-98); MN.130(103-117); MN.132(84-98); MN.139(84-98); MN.146(84-98)
NG9QFZLCTAKTAMI	91	MN.120(112-126); MN.121(111-128); MN.127(115-129); MN.130(134-148); MN.132(117-139); MN.139(115-129)
SOVHTIRRPGGAGRDG	92	MN.37(0-14)
RESEARCHDGGGLRIP	92	MN.37(6-10)
RDGGOLRIPSLRHGG	92	MN.37(12-26)
CHCCAD25902ERXHJZ	92	MN.37(28-40)
RKHJENNCDVGRHGD	92	MN.37(37-51)
W71VMA5C0H8TER	93	MN.164(0-34)
RERDCV1SSLADFKL	93	MN.164(12-26)
ISSIAGCHB1FV1QH	93	MN.164(18-32)
PVLQH1IS1AVLA1F	93	MN.164(28-42)
181AV1R1E1C1G1M1	93	MN.164(34-48)
DEKILSVERZGVVIG	16	MN.66(2-16)
GPMV1D1X1M2R1E1SSR	88-16	MN.4(12-26); MN.66(20-34)
EEIADD1A1ERG1T1PP	16	MN.66(35-49)
FA1K2D1P1P1P1P1K1	16	MN.66(43-55)
1CPGFCLADVT1P1Y	16	MN.66(67-81)
SCRDRCP1S1K1P1Y	66	ME.3566(5-37)
SLRIPAWG3C5RM1P	66	ME.3566(11-25)
NGSCB1N1G1C1K1D1S	66	ME.3566(17-34)
NCRCPC1STRGARRL1	66	ME.3566(27-41)
STWKA1B1L1G1S1A1Z	66	ME.3566(33-47)
DWRPPPRRNNSCC1P1W	68	ME.3720(7-21); ME.3805(7-21)
4CCP1P1K1T1R1W1R1	68	ME.3720(15-29); ME.3805(15-29)
G1RRW1N1F1C1H1P1SS	68	ME.3720(23-37); ME.3805(23-37)
F1C1H1P1SS1A1T1A1S1	68	ME.3720(25-43); ME.3805(49-43)
P1G1S1R1S1Y1G1S1P1T1C	68	ME.3720(41-55); ME.3805(41-55)
K1L1Y1V1G1K1S1Y1T1E1	72	ME.4234(7-23)
IGWSVY1R1T1L1R1D1	72	ME.4234(13-27)
4EGVH1V1M1V1W1D1E1	72	ME.4230(0-18); ME.4224(188-22)
DDSGS1IVQD1Q1S1T1M	72	ME.3807(12-26); ME.4210(51-65); ME.4234(99-111)
1Q1S1M1T1S1A1X1W1V	72	ME.3807(21-35); ME.4210(82-74); ME.4234(108-122)
RRRR11M1F1V1G1L1D1C	72	ME.3807(48-62); ME.4115(4-18); ME.4210(87-101); ME.4234(135-149)
P1V1M1V1L1N1P1S1W1R1	72	ME.3807(114-146); ME.4088(28-42); ME.4115(70-84); ME.4210(153-167); ME.4234(201-215)
GKDL1L1Q1D1L1A1D1E1	72	ME.3807(132-146); ME.4088(46-60); ME.4115(88-102); ME.4210(171-185); ME.4234(219-233)

AMVQGEEHADGDDA	72	ME 3897 (160-174); ME 4088 (74-88); ME 4115 (116-130); ME 4234 (347-361)
DAYJCAIRRAKSFIV	72	ME 3897 (203-217); ME 4088 (117-131); ME 4115 (159-173); ME 4210 (242-256)
IRRNK2F1Y7ZHQYF	72	ME 3897 (209-213); ME 4088 (123-137); ME 4115 (165-179); ME 4210 (236-262); ME 4234 (236-240)
FIYIENQYFLGSSYC	72	ME 3897 (215-229); ME 4088 (129-143); ME 4115 (171-185); ME 4210 (254-268); ME 4234 (302-316)
RFITVQVWVNNP2G1	72	ME 3897 (263-277); ME 4088 (277-291); ME 4115 (219-233); ME 4210 (302-316); ME 4234 (350-364)
RRIMEMMYIDIAOAI	72	ME 3897 (291-305); ME 4088 (205-219); ME 4115 (247-261); ME 4210 (330-344); ME 4234 (378-392)
MYTOINQK1QANGID	72	ME 3897 (297-311); ME 4088 (211-215); ME 4115 (251-267); ME 4210 (336-350); ME 4234 (384-398)
DYLKAQONRRFM1YV	72	ME 3897 (345-359); ME 4088 (259-279); ME 4115 (301-315); ME 4210 (384-398); ME 4234 (432-446)
PMXSH2KQ61VODR	72	ME 3897 (395-399); ME 4088 (289-293); ME 4115 (311-325); ME 4210 (394-408); ME 4234 (442-456)
IVDDEYI1VGSANIN	72	ME 3897 (365-379); ME 4088 (279-293); ME 4115 (323-335); ME 4210 (404-418); ME 4234 (452-466)
NCVYHLLAASERERHQ	72	ME 4088 (310-324); ME 4115 (352-366); ME 4210 (435-449); ME 4234 (483-497)
CGVHGFRMALWYHRL	72	ME 4088 (323-337); ME 4115 (365-379); ME 4210 (442-462); ME 4234 (496-510)
RYQ1LWYHNLGMVDEA	72	ME 4088 (329-343); ME 4115 (371-385); ME 4210 (454-468); ME 4234 (502-516)
CVRKVNAAMDR2WNL	72	ME 4088 (352-366); ME 4115 (394-408); ME 4210 (477-491); ME 4234 (525-539)
LPGWEEFEDYDQAKIL	72	ME 4088 (396-410); ME 4115 (438-452); ME 4210 (512-535); ME 4234 (569-583)
IAPITSRRSPSAPSPH	67	ME 4056 (6-20); ME 4276 (8-22)
WATC1XTRRIHGRPT	67	ME 4056 (38-53); ME 4276 (40-54)
PWSTCRAARSPIPSA	67	ME 4056 (55-69); ME 4276 (57-71)
DRKJINLBEMVAVGS	67	ME 4056 (92-107); ME 4276 (95-109)
SEMVAHVGLQIAFWI	67	ME 4056 (100-114); ME 4276 (102-116)
VKVAPEALVWNUCLEAR	69	ME 3918 (0-34)
LVNVLEARSALIT79V	69	ME 3916 (7-21)
AB5AL11SVLH3SM	69	ME 3916 (13-27)
ISVLR13SMPE2VYH	69	ME 3916 (19-33)
IAAPWQKRYE7129G	69	ME 3916 (52-66)
SSPSCAPESIHAVRA	70	ME 3855 (0-14)
PERSTHAYRALKP3142	70	ME 3855 (6-29)
VRALPSHTIARIL1R	70	ME 3855 (12-26)
THTARIILLRSTTIANV	70	ME 3855 (19-32)
LLRSTTIANVUSCKDR	70	ME 3855 (24-38)
VDYVQ4QSC12K9M8	71	ME 1422 (33-39)
LPGAGEVCRRRRRR	71	ME 1412 (21-35)
SGQDQYDPRQG1V/SSH	71	ME 1412 (44-48)
GVVGSHLLEDRHSRQA	71	ME 1412 (53-67)
ASDPRHSGQAHPRPXR	71	ME 1412 (59-73)
HIFKSLFES3WPV9ST	73	ME 4280 (41-55); ME 4281 (41-55)
DCYIVLTTVHAGGKLR	73	ME 4229 (33-47); ME 4231 (54-49); ME 4280 (126-140); ME 4281 (136-140)
FYLTW1GKDSVLED	73	ME 4229 (50-64); ME 4231 (51-65); ME 4280 (143-157); ME 4281 (143-157)
DUNA1Q1AT7T1W9M	73	ME 4190 (3-37); ME 4229 (65-79); ME 4231 (66-80); ME 4280 (158-173); ME 4281 (158-172)
EPPQF1IAFQPMVIL	73	ME 4229 (93-107); ME 4231 (94-108); ME 4280 (186-200); ME 4281 (186-200)
KDETY8G15781VHJ	73	ME 4190 (63-77); ME 4229 (325-329); ME 4231 (226-340); ME 4280 (218-332); ME 4281 (218-232)
GYGIALVHNGTISIR	73	ME 4190 (69-83); ME 4229 (131-145); ME 4231 (132-146); ME 4280 (224-238); ME 4281 (224-238)
BNK1LQDARV81912	73	ME 4190 (84-88); ME 4229 (146-160); ME 4231 (147-161); ME 4280 (295-299); ME 4281 (299-303)
IDCFV1QSGCN8MF1H	73	ME 4190 (100-114); ME 4229 (162-176); ME 4231 (163-177); ME 4280 (255-269); ME 4281 (255-269)
QOQPA4LVA8F1H7G	73	ME 4190 (323-337); ME 4229 (185-199); ME 4231 (186-200); ME 4280 (278-292); ME 4281 (278-292)
DVLAEPALV1F8FERN	73	ME 4190 (170-184); ME 4229 (232-246); ME 4231 (233-247); ME 4280 (325-339); ME 4281 (325-339)

LSVTEVTPFQDQHLL	73	ME_4190 (187-201), ME_4229 (249-263), ME_4231 (250-264), ME_4280 (443-456), ME_4281 (441-456)
PNFBODLLTIEDVMI	73	ME_4190 (193-207), ME_4229 (255-269), ME_4231 (256-270), ME_4280 (348-362), ME_4281 (348-362)
DVHILDTAHDVVEVMM	73	ME_4190 (704-718), ME_4229 (366-390), ME_4231 (367-381), ME_4280 (959-973), ME_4281 (959-973)
CFERIXIFSMNDWIREV	73	ME_4190 (263-277), ME_4229 (325-339), ME_4231 (326-340), ME_4280 (418-432), ME_4281 (418-432)
NSICRCLLILFGMRS	73	ME_4190 (281-299), ME_4229 (343-357), ME_4231 (344-358), ME_4280 (436-450), ME_4281 (436-450)
RASALAAKSSAFNPS	73	ME_4190 (310-324), ME_4229 (372-385), ME_4231 (373-387), ME_4280 (465-479), ME_4281 (465-479)
CHSCLPLRLLSSSME	73	ME_4190 (344-358), ME_4229 (406-420), ME_4231 (407-421), ME_4280 (499-513), ME_4281 (499-513)
SCRAAAVAAISNVLT	73	ME_4190 (375-389), ME_4229 (437-451), ME_4231 (438-452), ME_4280 (530-544), ME_4281 (530-544)
YKALSNVLLAEGSSDL	73	ME_4190 (381-395), ME_4229 (443-457), ME_4231 (444-458), ME_4280 (536-550), ME_4281 (536-550)
ETIFPSKDRLLKSKTD	73	ME_4190 (445-459), ME_4229 (507-521), ME_4231 (508-522), ME_4280 (600-614), ME_4281 (600-614)
TKRRETYLSDSEFEEI	73	ME_4190 (466-480), ME_4229 (528-542), ME_4231 (529-543), ME_4280 (621-635), ME_4281 (621-635)
SEFETEVGVTKEZFY	73	ME_4190 (476-490), ME_4229 (539-553), ME_4280 (631-645), ME_4281 (631-645)
STAEFLKPSLLKPTED	73	ME_4229 (566-580)
HSILRTRTLAKFELVC	73	ME_4229 (572-586)
LRKPLVYKSHNIGVYK	73	ME_4229 (580-594)
SGNLVMPQMQDHQLI	73	ME_4229 (600-614)
QD13FLQSP271VYK	73	ME_4229 (612-626)
ISPSFLVYSEFFVHDL	73	ME_4229 (618-632)
ERLTYQIANSRHLCSV	74	ME_4230 (4-18)
ANSRLCSVLPKEEFLY	74	ME_4230 (11-25)
VLSKNEEFYCCORNIQ	74,73	ME_4230 (38-32)
FTYQOPRNKQSLOKRK	74,73	ME_1571 (24-38), ME_4190 (489-503), ME_4230 (24-38), ME_4231 (552-566), ME_4280 (644-658), ME_4281 (644-658)
DSKAKAMMIIITINSA	75	ME_3882 (3-35)
TTIRSTATATRERATIV	75	ME_3882 (9-23)

**Table 3: Panel of 25 MHC II molecules for which peptide binding affinities were predicted.**

LOCUS	Allele
HLA DP	DPA1*01-DPB1*0401
	DPA1*0103-DPB1*0201
	DPA1*0201-DPB1*0101
	DPA1*0201-DPB1*0501
	DPA1*0301-DPB1*0402
HLA DQ	DQA1*0101-DQB1*0501
	DQA1*0102-DQB1*0602
	DQA1*0301-DQB1*0302
	DQA1*0401-DQB1*0402
	DQA1*0501-DQB1*0201
	DQA1*0501-DQB1*0301
HLA DR	DRB1*0101
	DRB1*0301
	DRB1*0401
	DRB1*0404
	DRB1*0405
	DRB1*0701
	DRB1*0802
	DRB1*0901

	DRB1*1101
	DRB1*1302
	DRB1*1501
	DRB3*0101
	DRB4*0101
	DRB5*0101

**Table 4: Panel of 822 peptides predicted from 93 novel Timothy Grass (TG) proteins tested for T cell recognition in TG allergic patients.**

Antigen	Peptide	IgE/IgG	Sequence	Total response		Total response	
				IL-5	SFC	IFNg	SFC
1	1_17	E+G+	SDGTFARAAVPSGAS	0	-	0	-
	1_18	E+G+	RAAVPSGASTGVYEA	0	-	0	-
	1_19	E+G+	GASTGVYEAELLRDG	0	-	0	-
	1_20	E+G+	LGKGVEKGNRANVEL	0	-	0	-
	1_21	E+G+	NRANVELFHIHAVLLA	0	-	0	-
	1_22	E+G+	QTELDNEMVHQLDGT	0	-	0	-
	1_23	E+G+	CKQKVFFNISADADA	0	-	0	-
	1_24	E+G+	PAMMAATIQSIVKARCI	0	-	0	-
	1_25	E+G+	VDNVNSIIGPALIGK	0	-	0	-
	1_26	E+G+	RLGAAHAILAVSLAVC	0	-	0	-
	1_27	E+G+	KKIPLYQHIANLAGN	0	-	0	-
	1_28	E+G+	GNKQQLVLPVPAFNV	0	-	1	190
	1_29	E+G+	KLAMQEFMILPTGAS	0	-	0	-
	1_30	E+G+	KMGVEVYHNLKSVIK	0	-	0	-
	1_31	E+G+	GKVVIGMDVAASEFY	0	-	0	-
	1_32	E+G+	VYKSPVSEYPHISIE	1	40	0	-
	1_33	E+G+	IVGDDLLVTNPTRVA	0	0	1	193
	1_34	E+G+	NALLLKVNQIGSVTE	1	40	1	170
	1_35	E+G+	ETEDTFIADLAVGLS	0	-	0	-
	1_36	E+G+	ERLAKYKNULRIEEE	0	-	0	-
	1_37	E+G+	LGAAAVYAGLKFRAP	0	-	1	153
2	2_1	E+G+	AEFESVFLDFARQQA	2	58	0	-
	2_2	E+G+	VDKLFKLAEEAKLKE	2	88	2	247
	2_3	E+G+	ENRSVLEHVALRAPRD	2	63	1	27
	2_4	E+G+	FLGPLFVHTALQTDP	1	63	0	-
	2_5	E+G+	RQURPLANVDPVDVA	1	20	1	20
	2_6	E+G+	VVSKTFTTAETMLNA	0	-	1	97
	2_7	E+G+	IKEWIVSSLGPOQAVS	0	-	0	-
	2_8	E+G+	VSKHMIAVSTNLKLV	2	80	1	20
	2_9	E+G+	RYSVCSAVGVLPLSL	3	83	3	238
	2_10	E+G+	AVGVLPPLSLQYGFPI	3	71	4	121
	2_11	E+G+	LSLQYGFPIYQRFLE	1	127	1	50
	2_12	E+G+	FPIVQRFLEGASSID	2	92	1	90

2 <sub>246</sub>	E+G+	HHTTASFEKNIPVLL	1	33	0	-
2 <sub>247</sub>	E+G+	VLLGLLSVIVNVSFLG	2	50	0	-
2 <sub>248</sub>	E+G+	SYWNVNSFLGYPARAI	3	100	1	53
2 <sub>249</sub>	E+G+	ARAILPYSOALEKLA	1	120	1	27
2 <sub>250</sub>	E+G+	NGQHNSFYQHQQGRV	1	27	2	95
2 <sub>251</sub>	E+G+	CDFIGVIKSQQPVYL	2	98	2	238
2 <sub>252</sub>	E+G+	ELMSNFFAQPDALAY	2	102	3	99
2 <sub>253</sub>	E+G+	KTFKGNRPSLSFLLS	2	42	5	363
2 <sub>254</sub>	E+G+	PSLSPLLSSLSAYEI	1	62	1	53
2 <sub>255</sub>	E+G+	AYEIGQLLAIYEHRI	1	40	0	-
2 <sub>256</sub>	E+G+	LLAIYEHRIAVQGFI	1	77	2	42
2 <sub>257</sub>	E+G+	QGFIWGINNSFDQWGV	1	113	0	-
2 <sub>258</sub>	E+G+	PVEGFNPSSASLLAR	1	143	1	47
2 <sub>259</sub>	E+G+	PSSASLLARYLAVEP	1	127	0	-
3 <sub>1</sub>	E+G+	ILLVPAETAEPKV	0	-	0	-
3 <sub>2</sub>	E+G+	EPEVKVVDLTLSPD	0	-	0	-
3 <sub>3</sub>	E+G+	LKDGGSTYSFRFSFIV	1	20	0	-
3 <sub>4</sub>	E+G+	SFRFSFIVSNNIVSG	0	-	0	-
3 <sub>5</sub>	E+G+	DDGKVYLEMSYYFEI	0	-	0	-
3 <sub>6</sub>	E+G+	MKTIEDFESIKKLLA	0	-	1	43
4 <sub>1</sub>	E+G+	FESIKKLLASPKPSF	1	47	2	245
4 <sub>2</sub>	E+G+	RMFVDELGASESSL	1	47	1	30
4 <sub>3</sub>	E+G+	PNLTYAKELVERMGL	0	-	1	33
4 <sub>4</sub>	E+G+	RNMVVLGKRFFVTPSD	1	33	1	27
4 <sub>5</sub>	E+G+	KRFFVTPSDSWAIIA	0	-	0	-
4 <sub>6</sub>	E+G+	SDSVIIAANAVQSI	0	-	0	-
4 <sub>7</sub>	E+G+	AVQSIPIYFASGLKGV	0	-	1	37
4 <sub>8</sub>	E+G+	KNLNLKFFEVPTGWK	0	-	0	-
4 <sub>9</sub>	E+G+	GIWAVLAWLIIAYK	0	-	4	107
4 <sub>10</sub>	E+G+	NLGGDKLVSVEDIVL	0	-	0	-
4 <sub>11</sub>	E+G+	LVSVEDIVLCHHWATY	0	-	0	-
4 <sub>12</sub>	E+G+	KELMANLVKMQSALS	1	327	1	97
4 <sub>13</sub>	E+G+	LVKMQSALSALSDVNKL	2	35	0	-
4 <sub>14</sub>	E+G+	HQGIRYLFQDGSRLV	0	-	0	-
4 <sub>15</sub>	E+G+	SRLVFRSGTGSVGA	0	-	0	-
4 <sub>16</sub>	E+G+	GATIRIYIEQYEKDS	0	-	0	-
4 <sub>17</sub>	E+G+	DALSPFLVDVALKLSK	0	-	0	-
5 <sub>1</sub>	E+G+	TVSDEYLAAVAKARR	0	-	1	73
5 <sub>2</sub>	E+G+	LDIAVRLLEPIKECV	0	-	0	-
5 <sub>3</sub>	E+G+	IKEQVPILSYADFYQ	0	-	0	-
5 <sub>4</sub>	E+G+	ILSYADFYQLAGVVA	0	-	0	-
5 <sub>5</sub>	E+G+	FYOLAGVVVAEITGG	0	-	0	-
5 <sub>6</sub>	E+G+	DHLRCVFTAGJMLSD	0	-	0	-
5 <sub>7</sub>	E+G+	NPLIFDNNSYFTELLT	0	-	0	-
5 <sub>8</sub>	E+G+	EDAFFADYAEAHJKE	0	-	0	-
6 <sub>1</sub>	E+G+	TLLFPHTQJSLPSVR	2	32	0	-

	6 <sub>34</sub>	E+G+	VRTRKHLAATMADEK	0	-	0
	6 <sub>44</sub>	E+G+	DNEKSGFISLVSRYL	2	38	0
	6 <sub>50</sub>	E+G+	FISLVSRYLSGEEEH	0	-	0
	6 <sub>62</sub>	E+G+	EATKALLNKLAVLKL	1	33	0
	6 <sub>123</sub>	E+G+	IEVRNNGFTLQLIVL	1	27	0
	6 <sub>131</sub>	E+G+	FLDLIVLQIESLNKK	1	33	0
	6 <sub>142</sub>	E+G+	LNIKKYGSNYPILLMN	1	353	0
	6 <sub>149</sub>	E+G+	NVPLLLMSNFNTED	1	153	0
	6 <sub>166</sub>	E+G+	IKPVEKYANSIDIH	3	196	3
	6 <sub>172</sub>	E+G+	SIDIHTPNQSQYPRV	2	113	1
	6 <sub>210</sub>	E+G+	GKLDLILSQGKEYVF	1	87	2
	6 <sub>213</sub>	E+G+	GKEYVFIANSNDNLGA	2	115	0
	6 <sub>242</sub>	E+G+	SDNLGAIVDUMKILNH	2	28	1
	6 <sub>248</sub>	E+G+	IVDMKILNHHLHKQN	3	101	2
	6 <sub>262</sub>	E+G+	ISYECRVQVLLAEQV	0	-	0
	6 <sub>268</sub>	E+G+	VQLLEIAQVPAHVD	1	73	0
	6 <sub>304</sub>	E+G+	EKSIEKPKIFNTNNNL	1	30	1
	6 <sub>310</sub>	E+G+	FKIFNTNNLWVNLLKA	2	60	0
	6 <sub>316</sub>	E+G+	NNIEWVNLLKAIRKRLVE	3	517	2
	6 <sub>325</sub>	E+G+	IKRLVEADALKMEEII	2	103	1
	6 <sub>348</sub>	E+G+	VKVLQLETAAGAAIR	3	60	1
	6 <sub>349</sub>	E+G+	AAIRFFDHAIGINVP	4	105	4
	6 <sub>349</sub>	E+G+	GINVPRSRFLPVKAT	1	23	0
	6 <sub>375</sub>	E+G+	RFLPVKATSDLQLVQ	2	60	1
	6 <sub>383</sub>	E+G+	TSDLGEVOSDLYTLV	1	40	1
	6 <sub>389</sub>	E+G+	VQSDLYTLVDGFVTR	2	82	1
	6 <sub>418</sub>	E+G+	GPEFKRNVGSIELGREK	2	182	2
	6 <sub>429</sub>	E+G+	GRFKSIPSIVESDL	3	247	0
7	7 <sub>31</sub>	E+G+	GTRNNINGTVFREP	3	109	2
	7 <sub>301</sub>	E+G+	VFNFTGAGGVVALAMY	3	118	3
	7 <sub>311</sub>	E+G+	IQQFAEASMAIAYEK	2	33	1
	7 <sub>317</sub>	E+G+	ASMAIAYEKWPLYL	2	52	1
	7 <sub>324</sub>	E+G+	ERKKWPLYLSTKNTIL	1	63	1
	7 <sub>353</sub>	E+G+	GRFKDIFQAVYEADW	1	57	2
	7 <sub>377</sub>	E+G+	WYEHRLDDNMVAYAL	1	43	0
	7 <sub>388</sub>	E+G+	VQSDFLAQGFGSGLG	2	35	1
	7 <sub>390</sub>	E+G+	NSIASIFAWTRGLAH	0	-	1
	7 <sub>390</sub>	E+G+	DNARLLDFTQKLEDA	2	37	0
	7 <sub>391</sub>	E+G+	MTKDLIALLVHGSSKV	1	40	2
	7 <sub>324</sub>	E+G+	LNTTEEFIDAVAAELQ	3	60	3
8	8 <sub>1</sub>	E+G+	ALTHHTTIVASGIENM	0	-	0
	8 <sub>3</sub>	E+G+	TIVASGIENMKIFTR	0	-	1
	8 <sub>15</sub>	E+G+	MKUPTRTWVLLLLVV	0	-	0
	8 <sub>24</sub>	E+G+	LLLLVVLLFEGCLAK	0	-	0
	8 <sub>110</sub>	E+G+	KDTHYIILSAWLQLSK	0	-	0
	8 <sub>166</sub>	E+G+	GKGELFFETNVTAEL	0	-	0

8	8 <sub>176</sub>	E+G+	VTAELMIVDSMSLQPF	0	-	0
	8 <sub>253</sub>	E+G+	YEKWFTSRFTVATME	0	-	0
	8 <sub>312</sub>	E+G+	KCNDWVWVSKLSAPQCK	0	-	0
	8 <sub>382</sub>	E+G+	KPILFMNEVNTIEEP	0	-	0
	8 <sub>404</sub>	E+G+	TKYLAKLKGQIOSYPG	0	-	0
	8 <sub>448</sub>	E+G+	PYVRGSLDTLAQAKV	0	-	0
	8 <sub>465</sub>	E+G+	PKQVEYLEEVVMREGF	0	-	0
	8 <sub>172</sub>	E+G+	NVTAELVDSMSLQPF	0	-	0
9	9 <sub>46</sub>	E+G+	TDTIVYCAGRIFFFPR	0	-	1
	9 <sub>64</sub>	E+G+	GRTFFFRRLDAPLDA	0	-	1
	9 <sub>152</sub>	E+G+	KSLVRAFMWDSGCTV	0	-	0
	9 <sub>175</sub>	E+G+	RVLSCDFKPTRPFPRI	0	-	1
	9 <sub>269</sub>	E+G+	HTGSNHAWSWSAOSK	0	-	0
	9 <sub>349</sub>	E+G+	AGHLKTVSSLTYFPQ	0	-	0
	9 <sub>355</sub>	E+G+	VSSLTYFPQISNPRTM	1	-23	0
	9 <sub>373</sub>	E+G+	SYDGVIIRWIQGVGY	0	-	0
	9 <sub>399</sub>	E+G+	TQIKCPVAAEELIT	1	-20	0
	9 <sub>441</sub>	E+G+	NALNIAVQOPEFALL	1	-60	0
	9 <sub>468</sub>	E+G+	PEFLALITDOSAHL	1	-33	0
	9 <sub>457</sub>	E+G+	TDSAIVLLHKSTVTS	0	-	0
	9 <sub>473</sub>	E+G+	TKVSTITSSAVSPD	0	-	0
	9 <sub>499</sub>	E+G+	KLRIYSISGDTLTEE	0	-	1
	9 <sub>526</sub>	E+G+	IHYSPDVSMFASADA	1	-30	0
	9 <sub>554</sub>	E+G+	IHLKNNMLFHHTARINC	1	-33	1
10	10 <sub>10</sub>	E+G+	GRYFSKIDAVQHITKM	1	-43	1
	10 <sub>16</sub>	E+G+	DAVQHITKMAAANGV	1	-160	1
	10 <sub>24</sub>	E+G+	GVRRVWVVGQDSLST	0	-	2
	10 <sub>39</sub>	E+G+	SLLSTPAVSAIIRER	1	-37	2
	10 <sub>42</sub>	E+G+	AVSAIIRERIAADGQ	1	-60	1
11	11 <sub>58</sub>	E+G+	SVGFWETLENDLAQL	1	-30	1
	11 <sub>111</sub>	E+G+	LGEAPYKFKSALEAV	1	-53	2
	11 <sub>117</sub>	E+G+	KFKSALEAVKTLRAE	1	-43	1
	11 <sub>127</sub>	E+G+	QYLPAPVIVDESGKRS	1	-23	0
	11 <sub>151</sub>	E+G+	VVTHNFRADRMVMLA	2	-50	0
	11 <sub>168</sub>	E+G+	ADRMIVMLAKALEFAD	1	-40	0
	11 <sub>183</sub>	E+G+	FDKFDRVRVPKIKYA	0	-	0
	11 <sub>192</sub>	E+G+	PRKRYAGMLQYDQEL	0	-	0
	11 <sub>206</sub>	E+G+	LKLPNKFLVSPPLIE	1	-30	0
12	12 <sub>4</sub>	E+G+	YKLLCSSLFVITYHQ	2	-60	0
	12 <sub>12</sub>	E+G+	FPVITYHQGRNGNLS	1	-103	0
	12 <sub>21</sub>	E+G+	RNGNLSALACPNOK	1	-20	0
13	13 <sub>21</sub>	E+G+	ECILSGLL5VDGKLV	0	-	0
	13 <sub>47</sub>	E+G+	LLSVDGKLVLEHMDRN	0	-	0
	13 <sub>81</sub>	E+G+	VPIKFMAMGALVRVL	0	-	0
	13 <sub>92</sub>	E+G+	VRVILURTSVTKYLNP	0	-	0
	13 <sub>111</sub>	E+G+	TKYLNFKAVDGSFVY	0	-	0

13 <sub>146</sub>	E+G+	IDVEALKSNILMGLFE	0	-	0	-
13 <sub>148</sub>	E+G+	EKRRARKFFIVVQDY	0	-	0	-
13 <sub>149</sub>	E+G+	KFFIVVQDYEEEDPK	0	-	0	-
13 <sub>151</sub>	E+G+	TVDFIGHALALHRDD	0	-	0	-
13 <sub>156</sub>	E+G+	VKRMKLYAESLARFQ	0	-	0	-
13 <sub>237</sub>	E+G+	GELPQAFARLSAVYG	0	-	0	-
13 <sub>243</sub>	E+G+	FARLSAVYGGTYMLN	0	-	0	-
13 <sub>352</sub>	E+G+	KGKFTIAFVSTEAEVD	0	-	0	-
13 <sub>411</sub>	E+G+	ETTVKDVLAISYKIT	0	-	0	-
13 <sub>435</sub>	E+G+	LDLSVDLNAASAGES	0	-	0	-
14 <sub>1</sub>	E+G+	LLGYLLWVVAIRRPR	1	110	0	-
14 <sub>7</sub>	E+G+	WVVAIRRPRPRVRCFS	0	-	0	-
15 <sub>15</sub>	E+G+	PRVNFFKRVNLTCVF	0	-	0	-
15 <sub>7</sub>	E+G+	KRYNLTCVFWSKKKK	0	-	0	-
16 <sub>163</sub>	E-G-	DEKLLSVEREGVYVG	0	-	1	113
16 <sub>21</sub>	E-G-	GPGWYDIHSRIPSK	0	-	2	80
16 <sub>36</sub>	E-G-	EEIADDIFALPRGTRP	0	-	2	197
16 <sub>43</sub>	E-G-	FALFRGTRIPRRPKK	0	-	1	97
16 <sub>58</sub>	E-G-	LCPGFCCLADVTPTETY	0	-	2	45
17 <sub>172</sub>	E+G+	VCTRLSPFCCLYCL	2	52	0	-
17 <sub>12</sub>	E+G+	YCLCCWVYSMRLTV	1	63	0	-
18 <sub>184</sub>	E+G-	NIPATWGAMKELYDA	0	-	0	-
18 <sub>1</sub>	E+G-	GAMKELYDAGKARAI	0	-	0	-
18 <sub>17</sub>	E+G-	KARAIGVSNILASKKL	0	-	0	-
18 <sub>23</sub>	E+G-	YSMILASKKLGDILLAV	0	-	0	-
18 <sub>29</sub>	E+G-	KKLGDLLAVARIPPA	0	-	0	-
19 <sub>1936</sub>	E+G-	UNGPRIATVQORGAA	0	-	0	-
19 <sub>35</sub>	E+G-	QQRGAIIKARKLSS	0	-	0	-
19 <sub>31</sub>	E+G-	IIKARKLSSALSAAS	0	-	0	-
19 <sub>47</sub>	E+G-	LSSALSAASSACDH	0	-	0	-
19 <sub>49</sub>	E+G-	GTPEGTFVSMGVYSD	0	-	0	-
20 <sub>2025</sub>	E+G-	PPPGQHAIMAASSRR	0	-	0	-
20 <sub>40</sub>	E+G-	ASOLLGSAASRFLH5	0	-	0	-
20 <sub>49</sub>	E+G-	SRFLHSRGYAAAAAA	0	-	0	-
20 <sub>53</sub>	E+G-	RGYAAAAAAAPSPAVF	0	-	0	-
20 <sub>114</sub>	E+G-	LGLPVFNSVAEAKAE	0	-	0	-
20 <sub>123</sub>	E+G-	TKANASVIIYPPPEA	0	-	0	-
20 <sub>135</sub>	E+G-	VIYVPPPFAAAAIME	0	-	0	-
20 <sub>144</sub>	E+G-	PFAAAAAIMEALEAEL	0	-	0	-
20 <sub>167</sub>	E+G-	QHDMVKVKAALNRQS	0	-	0	-
20 <sub>222</sub>	E+G-	ILTYEAVFQITAVGL	0	-	0	-
20 <sub>194</sub>	E+G-	DKPVVAFIAQLTAPP	1	23	0	-
20 <sub>248</sub>	E+G-	KIKALREAGVTAVES	1	23	0	-
20 <sub>348</sub>	E+G-	GSTMFEIFKQRGGMVE	0	-	0	-
21 <sub>213</sub>	E+G-	GSCIDFKTHKALAKV	0	-	0	-
21 <sub>23</sub>	E+G-	MYVMYIKEGYKEYV	0	-	0	-

21	21 <sub>13</sub>	E+G-	YKEYIVTVRRTVTNLV	0	-	0	-
	21 <sub>13</sub>	E+G-	VTNLVMIQGDGAAKTI	0	-	0	-
	21 <sub>13</sub>	E+G-	NFKLMLNTSMIVAVSLEV	0	-	0	-
	21 <sub>109</sub>	E+G-	YQDTLYTHAQRQFRR	0	-	0	-
	21 <sub>125</sub>	E+G-	GRDPFEGNSQIVVIG	0	-	0	-
	21 <sub>111</sub>	E+G-	AKTIIILKFLLPVVMIV	0	-	0	-
22	22 <sub>16</sub>	E+G-	NTRVLLRRRTSPFSA	0	-	0	-
	22 <sub>124</sub>	E+G-	DGYIYHGQCAIIMFD	0	-	0	-
	22 <sub>131</sub>	E+G-	QCAIIMFDVTSRILTY	1	27	0	-
	22 <sub>187</sub>	E+G-	RKKNLQYYEISAKSN	0	-	0	-
	22 <sub>192</sub>	E+G-	SAKSNVYNEKPFYLY	0	-	0	-
	22 <sub>206</sub>	E+G-	KPFLYALKLAGDAN	2	88	1	603
	22 <sub>233</sub>	E+G-	ANIHFEAVALKPPE	0	-	1	53
	22 <sub>245</sub>	E+G-	EAEELAAAQOPLPDD	1	20	0	-
23	23 <sub>1</sub>	E+G-	RTSSWGSGASILKIDR	1	27	0	-
	23 <sub>10</sub>	E+G-	SLKIDRRELVTTRIY	2	35	0	-
24	24 <sub>21</sub>	E+G-	REIHAAVAMATKRSV	0	-	1	150
	24 <sub>44</sub>	E+G-	KGKKVFLRADLNVPL	1	30	3	234
	24 <sub>68</sub>	E+G-	TRIRASIPTIKFELLE	0	-	0	-
	24 <sub>76</sub>	E+G-	TIKFLLEKGAKVILA	2	47	0	-
	24 <sub>82</sub>	E+G-	EKGAKVILASHLGRP	1	63	0	-
	24 <sub>109</sub>	E+G-	VPRLELLGVVVVMA	2	70	2	118
	24 <sub>141</sub>	E+G-	CIGVLLLENIVRFYKEE	2	45	1	23
	24 <sub>160</sub>	E+G-	PEFAKKLASVADLYV	2	45	0	-
	24 <sub>193</sub>	E+G-	KFLRPSVAGFLMCKE	3	38	1	177
	24 <sub>199</sub>	E+G-	VAGFLMQKELDYLVG	1	90	0	-
	24 <sub>205</sub>	E+G-	KELDYLVGAVANPIK	1	37	1	143
	24 <sub>234</sub>	E+G-	KIGVIESLLAKVDIL	1	57	0	-
	24 <sub>263</sub>	E+G-	GMIFTTFYKAQGKAVG	0	-	2	397
	24 <sub>272</sub>	E+G-	EEDKLELATSLIETA	2	52	1	23
	24 <sub>296</sub>	E+G-	GVSLIIPTDVYVVAOK	1	90	0	-
25	25 <sub>1</sub>	E+G-	SAPALRILRSFPSHS	1	97	1	143
26	26 <sub>1</sub>	E+G-	VELVAVNDPFHITDY	0	-	0	-
	26 <sub>15</sub>	E+G-	DYMTYMFKYDTVHGQ	0	-	0	-
	26 <sub>90</sub>	E+G-	GGAKKVIISAPSKDIA	0	-	0	-
	26 <sub>116</sub>	E+G-	YTSDDITIVSNASCTT	0	-	0	-
	26 <sub>138</sub>	E+G-	KVNDPREGIVEGLM	0	-	1	37
	26 <sub>144</sub>	E+G-	FGIVEGLMVTWHAMT	0	-	0	-
	26 <sub>174</sub>	E+G-	GGRAASFNNIIPSSITG	0	-	0	-
	26 <sub>221</sub>	E+G-	LTVRLEKAATYEQIK	0	-	0	-
	26 <sub>474</sub>	E+G-	ALNDNFVKLWSWYDN	0	-	0	-
27	27 <sub>46</sub>	E+G-	IGKRFASINVENVED	0	-	0	-
	27 <sub>64</sub>	E+G-	AIKELLETTTPGALQH	0	-	0	-
	27 <sub>76</sub>	E+G-	LQHISGVILFEETLY	1	53	0	-
	27 <sub>146</sub>	E+G-	YEAGARFAIKWRAVEK	1	33	0	-
	27 <sub>151</sub>	E+G-	GLARYAIICQENGLV	2	33	1	140

	27 <sub>406</sub>	E+G-	RCAVYVTEVVLAACYK	1	27	0	-
	27 <sub>223</sub>	E+G-	NDQHVLLEGSLLKPN	1	27	0	-
	27 <sub>308</sub>	E+G-	WFLSFSFORALQOST	1	23	0	-
28	28 <sub>1</sub>	E+G-	IPPAFHLKRWNRVVD	1	127	0	-
	28 <sub>4</sub>	E+G-	LKRWNRVVDTNLESP	0	-	0	-
	28 <sub>14</sub>	E+G-	VVDTNLESNDIVPE	0	-	0	-
	28 <sub>16</sub>	E+G-	GAPFTGSGYRIAPYS	1	107	0	-
	28 <sub>36</sub>	E+G-	GYRIAPYSSILLKAT	0	-	2	477
29	29 <sub>2</sub>	E+G-	SFRFFLAHSSIHPSI	2	83	0	-
	29 <sub>16</sub>	E+G-	EKHFKYVILGGGVAA	0	-	0	-
	29 <sub>109</sub>	E+G-	TEKGIELLSTEIVK	1	50	1	247
	29 <sub>124</sub>	E+G-	ASKTLTSAAGATFTY	1	30	0	-
	29 <sub>136</sub>	E+G-	FTVETLIIATGSSTI	0	-	0	-
	29 <sub>193</sub>	E+G-	GGGYIGLELSAALKL	0	-	0	-
	29 <sub>189</sub>	E+G-	LELSAALKLNNFDVT	1	133	0	-
	29 <sub>205</sub>	E+G-	IKLNNFDVTMVYPEP	0	-	0	-
	29 <sub>222</sub>	E+G-	MPRLFTAGIAHFYEG	0	-	0	-
	29 <sub>192</sub>	E+G-	HFYEGYYASKGINIV	0	-	0	-
	29 <sub>246</sub>	E+G-	SKGINIVKGTIVASGF	0	-	0	-
	29 <sub>274</sub>	E+G-	DANIVIVGVGGRPLT	0	-	0	-
	29 <sub>303</sub>	E+G-	KTDTHFETSVAGVYA	0	-	0	-
	29 <sub>315</sub>	E+G-	VYAIQDVASFPMKLY	0	-	0	-
	29 <sub>345</sub>	E+G-	DYLPYFFYRSRSDIAW	0	-	0	-
30	30 <sub>12</sub>	E+G-	EQFVTPWSPSFVASGH	0	-	0	-
	30 <sub>59</sub>	E+G-	ROAHYERGLLPPAV	0	-	0	-
	30 <sub>19</sub>	E+G-	MHNLRQYTVPLQRYI	0	-	0	-
	30 <sub>82</sub>	E+G-	VPLQRYIAMMNDLDE	0	-	0	-
	30 <sub>103</sub>	E+G-	ERLFYKLLIDNVEEL	0	-	0	-
	30 <sub>206</sub>	E+G-	EELLPVVYVTPVVGEA	0	-	0	-
	30 <sub>195</sub>	E+G-	PSIQVIVVTDGERIL	0	-	0	-
	30 <sub>218</sub>	E+G-	EEYHLLCIEFMNAVK	0	-	0	-
	30 <sub>257</sub>	E+G-	GEKVLVQFEDFANHN	0	-	0	-
	30 <sub>219</sub>	E+G-	FDELLAKYSKSHLVLVN	0	-	0	-
	30 <sub>265</sub>	E+G-	VFNDDIQGTASVLA	1	67	0	-
	30 <sub>276</sub>	E+G-	SVVIACTLEAAALKVIG	0	-	0	-
	30 <sub>311</sub>	E+G-	GLADQTYLFLGAGEA	0	-	0	-
	30 <sub>327</sub>	E+G-	TGIAELIALEMMSKHT	0	-	0	-
	30 <sub>348</sub>	E+G-	CRKKIWLVDKGLLV	0	-	0	-
	30 <sub>368</sub>	E+G-	HEPLTITLEAVQSLK	0	-	0	-
	30 <sub>386</sub>	E+G-	LLEAVQSLKPTVLIQ	0	-	0	-
	30 <sub>409</sub>	E+G-	NEKPVVFSLSNPTSH	0	-	0	-
	30 <sub>440</sub>	E+G-	EEAYTWTKGTAVFAS	0	-	0	-
	30 <sub>481</sub>	E+G-	GFGLGIVISGAIRVH	0	-	0	-
	30 <sub>487</sub>	E+G-	VISGAIRVHDDMLLA	0	-	0	-
	30 <sub>495</sub>	E+G-	HDDMLIXAASEALAEQ	0	-	0	-
	30 <sub>524</sub>	E+G-	FPFPFTNIRKISANIA	0	-	0	-

	30 <sub>22</sub>	E-G+	IRKISANIAAKVAAK	0	-	0	-
31	31 <sub>6</sub>	E-G+	QJRKGFYLTKNVEH	0	-	0	-
	31 <sub>12</sub>	E-G+	FYLTKNVEHKGQVDL	0	-	0	-
	31 <sub>18</sub>	E-G+	VEHKGQVDLVTETDK	0	-	0	-
	31 <sub>30</sub>	E-G+	TDKACEDLIFNHLRK	0	-	0	-
	31 <sub>36</sub>	E-G+	DLIFNHLRKLYPDHK	0	-	0	-
32	32 <sub>41</sub>	E-G+	IEIDSLEGIDFYST	0	-	1	27
	32 <sub>50</sub>	E-G+	IDFYSTITRARFEEL	1	20	0	-
	32 <sub>62</sub>	E-G+	IPKVQQLQDFPFGK	0	-	0	-
	32 <sub>126</sub>	E-G+	EAVAYGAAVQAAILS	0	-	1	30
	32 <sub>142</sub>	E-G+	VDLILLLDVTPLSIG	0	-	1	47
33	33 <sub>1</sub>	E-G+	QEMAYWSLKAAIEIG	0	-	0	-
	33 <sub>10</sub>	E-G+	DAASSLYLEGENILPR	0	-	0	-
	33 <sub>60</sub>	E-G+	GYNISLASMIPDYDT	0	-	0	-
	33 <sub>73</sub>	E-G+	YDTVTITNVRRSLAVA	0	-	0	-
	33 <sub>116</sub>	E-G+	LEKIVAILSAFVDA	0	-	0	-
	33 <sub>17</sub>	E-G+	NVRRSLAVAKKHNHL	0	-	0	-
	33 <sub>14</sub>	E-G+	VAKKNHILAWNCR	0	-	0	-
	33 <sub>20</sub>	E-G+	LAWNCRKRGESRK	0	-	0	-
	33 <sub>33</sub>	E-G+	KKTVDAILSAFVDA	0	-	0	-
34	34 <sub>1</sub>	E-G+	LMSTFWICAVRAAA	0	-	0	-
	34 <sub>7</sub>	E-G+	ICACVRAAAVAWEAG	0	-	0	-
	34 <sub>39</sub>	E-G+	VRVKILEFTALCHTDV	0	-	0	-
	34 <sub>114</sub>	E-G+	MCDLLRINTDORGVMI	0	-	0	-
	34 <sub>140</sub>	E-G+	KPIIFHPVGTSTPSEY	1	40	0	-
	34 <sub>146</sub>	E-G+	VGTSFSEYTVMHVG	0	-	0	-
	34 <sub>200</sub>	E-G+	VAIKLGAVGIAAAE	0	-	0	-
	34 <sub>206</sub>	E-G+	GAVGLAAAEGARIAG	0	-	0	-
	34 <sub>226</sub>	E-G+	GNINAMIQAFECVHD	0	-	0	-
	34 <sub>319</sub>	E-G+	LKGTFGNGFKPRTDL	0	-	0	-
	34 <sub>343</sub>	E-G+	KRTHSVTFSEINKA	1	50	1	103
	34 <sub>355</sub>	E-G+	VTFSEINKAFDLMAK	0	-	1	103
35	35 <sub>1</sub>	E-G+	ALRWNLLQMGH5VLPK	1	47	0	-
	35 <sub>25</sub>	E-G+	NLDVYDWSIPDDLLA	1	90	1	67
	35 <sub>32</sub>	E-G+	DDLLAKTFSEIKQTRI	1	30	0	-
	35 <sub>41</sub>	E-G+	FSEIKQTRILMGNF	0	-	0	-
	35 <sub>42</sub>	E-G+	TRLLMGNFIVNKDSV	0	-	0	-
36	36 <sub>1</sub>	E-G+	QDFKKVNEIYAKYFP	0	-	0	-
	36 <sub>7</sub>	E-G+	NEIYAKYFPSPAPAR	0	-	0	-
	36 <sub>13</sub>	E-G+	YFPSPAPARSTYQVA	0	-	0	-
	36 <sub>20</sub>	E-G+	ARSTYQVAALPEDAR	0	-	0	-
	36 <sub>29</sub>	E-G+	LPIIDARIEIECIAAL	0	-	0	-
37	37 <sub>3</sub>	E-G+	EEAASLPGISSLTR	0	-	0	-
38	38 <sub>3</sub>	E-G+	STKIFLESSTMESRA	0	-	0	-
	38 <sub>44</sub>	E-G+	CAAVIAASAVVVEVV	0	-	0	-
	38 <sub>62</sub>	E-G+	VVVLVVASGLAGSRV	0	-	0	-

	38 <sub>73</sub>	E-G+	LAGSRVVRVAVDVAT	0	-	0	-
	38 <sub>159</sub>	E-G+	GWYHLYFYQYNPEGAV	0	-	0	-
	38 <sub>184</sub>	E-G+	SRDLHWRHLPLAMIV	0	-	0	-
	38 <sub>211</sub>	E-G+	LNMLIYTGSTNASVQV	0	-	0	-
	38 <sub>230</sub>	E-G+	IAMIVTKTKDIFVSYEL	0	-	0	-
	38 <sub>248</sub>	E-G+	TKDFVSYELIPGLLH	0	-	0	-
	38 <sub>258</sub>	E-G+	WGKFEYASKTFYDPAK	0	-	0	-
	38 <sub>425</sub>	E-G+	KGWAISLMSIPRTVDL	0	-	0	-
	38 <sub>448</sub>	E-G+	LRHATQLDIEAAAPRL	0	-	0	-
	38 <sub>469</sub>	E-G+	EAAFRLDHAAVAALN	0	-	0	-
	38 <sub>477</sub>	E-G+	EQTAVYYPYVSRGLDG	0	-	0	-
	38 <sub>571</sub>	E-G+	VKRVVGTYVPVLGDE	0	-	0	-
	38 <sub>595</sub>	E-G+	EAFSVRVLVLDHSIVE	0	-	0	-
	38 <sub>617</sub>	E-G+	EAIYAAAGVYLFNNA	0	-	0	-
	38 <sub>628</sub>	E-G+	VYLNNNATSGTVTVE	0	-	0	-
39	39 <sub>42</sub>	E-G+	TDIVEVVVSPPYVFL	0	-	0	-
	39 <sub>48</sub>	E-G+	SPPYYFLPTVKDKER	0	-	0	-
	39 <sub>80</sub>	E-G+	GAFTGEVSAEMLANL	0	-	0	-
	39 <sub>86</sub>	E-G+	VSAEMLANLGPWVI	0	-	0	-
	39 <sub>111</sub>	E-G+	GESSEFVGDKVAYAL	0	-	1	30
	39 <sub>118</sub>	E-G+	GDKVAYALAGGLKVI	1	67	1	73
	39 <sub>146</sub>	E-G+	STMTVVAEQTKAIAD	0	-	0	-
	39 <sub>164</sub>	E-G+	DWTNVVIAYPEVWAI	0	-	0	-
	39 <sub>170</sub>	E-G+	IAYPEVWAIGTGKVA	0	-	0	-
	39 <sub>184</sub>	E-G+	UKPERFDIINAATVK	0	-	0	-
40	40 <sub>2</sub>	E-G+	VWQHDRVEIANDQG	1	40	0	-
	40 <sub>9</sub>	E-G+	VERANDOOGNRTTPS	1	27	0	-
	40 <sub>19</sub>	E-G+	TTPSYVAFTDSERLI	0	-	0	-
	40 <sub>38</sub>	E-G+	KNQVAMNPINTVFGE	0	-	0	-
	40 <sub>44</sub>	E-G+	NPINTVFGHEHSLCT	0	-	0	-
41	41 <sub>1</sub>	E-G+	SSTRGWCSSRRAGRG	0	-	0	-
42	42 <sub>17</sub>	E-G+	EKQFAAEEISSMVL	0	-	0	-
	42 <sub>18</sub>	E-G+	SSMVLUKMREIAEAF	0	-	0	-
	42 <sub>45</sub>	E-G+	SIKNAVVTVPAYFND	0	-	0	-
	42 <sub>69</sub>	E-G+	GVIAGLNVLRHNEP	0	-	1	33
	42 <sub>76</sub>	E-G+	VLRIINEPTAAAIAY	0	-	0	-
43	43 <sub>1</sub>	E-G+	GHLDIVWYEPLTYN	0	-	0	-
	43 <sub>48</sub>	E-G+	ETMQRLVADRLPNFT	0	-	0	-
	43 <sub>144</sub>	E-G+	GYSKWLYVVPWGPYK	0	-	0	-
	43 <sub>120</sub>	E-G+	YVVPWGFYKAVMHVK	1	20	0	-
	43 <sub>164</sub>	E-G+	KFRIDYFDOQYTHELK	0	-	0	-
	43 <sub>185</sub>	E-G+	ARVTGYFAWSLDDNF	0	-	0	-
	43 <sub>191</sub>	E-G+	FAWSLDDNPEWRMIGF	1	27	0	-
44	44 <sub>71</sub>	E-G+	FKDDPYIYAFDSLKY	0	-	0	-
	44 <sub>73</sub>	E-G+	AFDSLKYIGIELWQV	0	-	0	-
	44 <sub>88</sub>	E-G+	IELWQVKSGTLFDNI	0	-	0	-

	44 <sub>39</sub>	E-G+	GTFDNILITDDAAL	0	-	0	-
	44 <sub>102</sub>	E-G+	LTDDAALAKTFAE	0	-	0	-
45	45 <sub>3</sub>	E-G+	KRPPRCCCGOLVPL	0	-	0	-
46	46 <sub>3</sub>	E-G+	RGLLRRARGGPHHRR	1	40	0	-
	46 <sub>19</sub>	E-G+	RGAHRRVPLRMLRHR	0	-	1	60
	46 <sub>40</sub>	E-G+	EGRRAKLRSAGEVEI	1	177	0	-
	46 <sub>50</sub>	E-G+	CEVSIQFRRVKCKYP	4	60	0	-
	46 <sub>67</sub>	E-G+	TKVTFHVVGVGPLLH	1	70	1	160
47	47 <sub>26</sub>	E-G+	EDVAVSLAKYTAELS	0	-	0	-
	47 <sub>41</sub>	E-G+	GKFAAERGAFTVVL	1	30	0	-
	47 <sub>49</sub>	E-G+	APTVVLSGGTIEITL	1	43	0	-
	47 <sub>96</sub>	E-G+	DSNYKLAVDGLLSKV	1	53	0	-
	47 <sub>122</sub>	E-G+	TVLKDLVRSGLAMS	2	22	0	-
	47 <sub>142</sub>	E-G+	KSGVLAMSTATGFP	1	40	0	-
	47 <sub>146</sub>	E-G+	PPPPQITFIFPVIKS	0	-	0	-
	47 <sub>202</sub>	E-G+	TFTFPVVIKSSAYVAM	0	-	0	-
	47 <sub>235</sub>	E-G+	KTLPILLPTEMAILQD	0	-	0	-
48	48 <sub>2</sub>	E-G+	NKLIGARSFFESAKW	0	-	0	-
	48 <sub>65</sub>	E-G+	RAHIAFYQVCEPEQKG	0	-	0	-
	48 <sub>124</sub>	E-G+	AALNGVFVSTAAGNI	0	-	0	-
	48 <sub>149</sub>	E-G+	APWLLTVGASTESDRR	0	-	0	-
	48 <sub>158</sub>	E-G+	STSDRRFAATVKLGS	0	-	0	-
	48 <sub>225</sub>	E-G+	VLRAGAFGMIVVAPA	0	-	0	-
	48 <sub>241</sub>	E-G+	FGMIVVAPAVFGPV	0	-	0	-
	48 <sub>363</sub>	E-G+	YAVGQKIKAYLEAES	0	-	1	297
	48 <sub>385</sub>	E-G+	VPGVVDIVLQPKEM	0	-	0	-
	48 <sub>392</sub>	E-G+	CPHLAGIAALLKNAH	0	-	0	-
	48 <sub>429</sub>	E-G+	GLVYNLTAAEYIPYL	0	-	0	-
	48 <sub>447</sub>	E-G+	KADSVVNASRAVTV	0	-	0	-
	48 <sub>525</sub>	E-G+	KLTKALEEVLYTV	0	-	0	-
	48 <sub>553</sub>	E-G+	EEVLYNYTVTVKTAAY	0	-	0	-
	48 <sub>552</sub>	E-G+	IEGQLKVVSSKHIVR	0	-	0	-
	48 <sub>588</sub>	E-G+	WVSSKHFVRSPIUL	0	-	0	-
49	49 <sub>1</sub>	E-G+	ELRKTYNLLDAVSRH	4	847	1	100
	49 <sub>18</sub>	E-G+	QVYPRSWAVMLTFD	2	602	0	-
	49 <sub>36</sub>	E-G+	AIVMLTFDNAGMWNVR	3	899	1	503
	49 <sub>42</sub>	E-G+	NVWERRHLAGEMITLM	1	130	0	-
	49 <sub>50</sub>	E-G+	GEQLYISVISPARSL	0	-	1	80
50	50 <sub>10</sub>	E-G+	DSSEYAFRTAVSSSM	0	-	0	-
	50 <sub>44</sub>	E-G+	IGNLRILDNTTUDKD	1	40	0	-
	50 <sub>48</sub>	E-G+	EIPMIONILSRSQIF	0	-	2	158
	50 <sub>57</sub>	E-G+	SRSQIFDGIPNLMSL	0	-	1	87
	50 <sub>103</sub>	E-G+	DGIPNLMSLDNVVKI	0	-	2	158
	50 <sub>123</sub>	E-G+	IWVNVEYDSFYREHG	0	-	0	-
	50 <sub>150</sub>	E-G+	EFPVTWVSSPEVALL	0	-	1	97
	50 <sub>158</sub>	E-G+	SPEVALLKSLAGKLR	1	27	1	87

	50 <sub>148</sub>	E-G+	AGKLRNISTKLIJFRFL	0	-	0	-
	50 <sub>174</sub>	E-G+	STKLIJFRFLREDLVE	1	30	0	-
	50 <sub>198</sub>	E-G+	GELLKDEKSHAFAS	0	-	1	43
	50 <sub>202</sub>	E-G+	LKSIAFASGILVPK	0	-	0	-
51	51 <sub>12</sub>	E-G+	CEGIEKLLETHLVLPS	0	-	0	-
	51 <sub>71</sub>	E-G+	LLETHLVLPSSTAPES	0	-	1	47
	51 <sub>135</sub>	E-G+	PESKVFYLKMKGDYH	1	27	1	53
	51 <sub>67</sub>	E-G+	MNSYKAAQDIALADL	0	-	1	43
	51 <sub>182</sub>	E-G+	APTHPIRLGLALKIS	0	-	0	-
52	52 <sub>1</sub>	E-G+	LLGLLAPLASAQLSR	0	-	1	33
	52 <sub>73</sub>	E-G+	PDAEKIVAAVIEKKL	1	20	0	-
	52 <sub>42</sub>	E-G+	AGLIRLLFHDCFANG	1	113	1	37
	52 <sub>60</sub>	E-G+	CDASILQPLSNQSA	3	91	5	151
	52 <sub>229</sub>	E-G+	IDSSYFANVLAKKMP	1	50	1	50
	52 <sub>266</sub>	E-G+	KPNDFMPTEAKAMEK	0	-	1	33
	52 <sub>274</sub>	E-G+	PTFAKAMEKLSVLKV	2	53	2	62
	52 <sub>309</sub>	E-G+	GGSVIRISSANPDL	1	70	2	72
	52 <sub>343</sub>	E-G+	DPWHVKTLKAAGAAH	0	-	0	-
53	53 <sub>1</sub>	E-G+	WSEICQTLKPNLIGPF	0	-	1	103
	53 <sub>31</sub>	E-G+	KFMTLAGFLDYAKAS	0	-	0	-
	53 <sub>46</sub>	E-G+	NISGILGIGIEHAAYL	0	-	0	-
	53 <sub>57</sub>	E-G+	AAYLATRGLDVVDAV	1	880	1	1030
	53 <sub>64</sub>	E-G+	GLDVVDAVSNALIKS	1	23	0	-
	53 <sub>84</sub>	E-G+	TKQQVFIQSEDPPVL	3	42	0	-
	53 <sub>98</sub>	E-G+	PVLSAEEKKKEPKPNRV	1	53	0	-
	53 <sub>103</sub>	E-G+	KFPKFNRVREIEPDI	1	30	3	499
	53 <sub>128</sub>	E-G+	VCHKEFANAVVAKLRRS	1	87	1	797
	53 <sub>135</sub>	E-G+	VKLRRSSAAQVQDGFY	3	104	0	-
	53 <sub>149</sub>	E-G+	GEYLITGFNAVVERER	0	-	0	-
	53 <sub>170</sub>	E-G+	GVLKNEFMSLAFDYW	1	83	0	-
	53 <sub>192</sub>	E-G+	GLVTEEPSTAAYFR	1	63	1	153
54	54 <sub>39</sub>	E-G+	NIVVNVFVNQLDQPLL	1	43	0	-
	54 <sub>80</sub>	E-G+	OPLLEFTWNGSLOHRKN	0	-	0	-
	54 <sub>93</sub>	E-G+	IGSFFYFPSIGMQRT	5	447	4	183
	54 <sub>116</sub>	E-G+	GYGJUSVVSRLIIPV	0	-	0	-
	54 <sub>116</sub>	E-G+	VVSRLIIPVVFDPAA	1	307	1	133
55	55 <sub>14</sub>	E-G-	SVPKKFPKJRRVLVI	0	-	0	-
	55 <sub>20</sub>	E-G-	PKFRRVLVIDPVISG	0	-	0	-
	55 <sub>49</sub>	E-G-	IGEIKGFADAVMVSIR	0	-	1	167
	55 <sub>46</sub>	E-G-	FADAVMVSRGSLVRV	0	-	0	-
	55 <sub>42</sub>	E-G-	VSRGSLVRVNGFFLT	0	-	0	-
	55 <sub>60</sub>	E-G-	VNGFFLTGFNDLVT	0	-	1	903
56	56 <sub>2</sub>	E-G-	KELGGKILRQPGPUP	0	-	0	-
	56 <sub>6</sub>	E-G-	ILRQPGPLPGUNTKI	0	-	0	-
	56 <sub>18</sub>	E-G-	LRGLNTKIASFLDPD	0	-	0	-
	56 <sub>31</sub>	E-G-	KIASFLDPDGWVVL	0	-	1	343

	56 <sub>39</sub>	E-G-	QWKKVVILVDHADFLKE	0	-	0	-
57	57 <sub>4</sub>	E-G-	QDNAKIVQIDSSIQA	0	-	0	-
	57 <sub>49</sub>	E-G-	RLVCLRVHPTFTLLH	0	-	0	-
	57 <sub>56</sub>	E-G-	HPTFTLLHPTEVVVA	0	-	0	-
	57 <sub>57</sub>	E-G-	TEVYVAFTAINGSRC	0	-	0	-
	57 <sub>58</sub>	E-G-	LVNRFELSQVSKCLV	0	-	0	-
58	58 <sub>43</sub>	E-G-	AOPCSEYFVEAYLNN	0	-	0	-
	58 <sub>49</sub>	E-G-	YFVEAYLNNPLVQKA	0	-	0	-
	58 <sub>50</sub>	E-G-	VGKAIHANTALNRPW	0	-	0	-
	58 <sub>62</sub>	E-G-	PSMLAHIKALVTTGI	0	-	0	-
	58 <sub>69</sub>	E-G-	LYSGDLDAMVPVTAS	0	-	0	-
	58 <sub>14</sub>	E-G-	UNYPWTGCRTRTYNL	0	-	0	-
	58 <sub>16</sub>	E-G-	YNLRRFGASPPSMLA	0	-	0	-
	58 <sub>41</sub>	E-G-	HIKALVTTASASGCT	0	-	0	-
59	59 <sub>33</sub>	E-G-	VKKIVTIVNEAEVPS	0	-	0	-
	59 <sub>62</sub>	E-G-	EDAVEVVSPPFVPL	0	-	0	-
	59 <sub>68</sub>	E-G-	VSPPPFVFLQQAKALL	0	-	0	-
	59 <sub>75</sub>	E-G-	FLQQAKALLRPDFAV	0	-	1	33
	59 <sub>81</sub>	E-G-	ALLRPDFAVAAQNCW	0	-	1	23
	59 <sub>100</sub>	E-G-	GAFTGEISAEMLVNL	0	-	0	-
	59 <sub>106</sub>	E-G-	ISAEMLEVNLQIVPWVI	0	-	1	37
	59 <sub>112</sub>	E-G-	ESNDFVADKVAYALA	0	-	0	-
	59 <sub>128</sub>	E-G-	AOKVAYALACGKVI	1	47	1	45
	59 <sub>156</sub>	E-G-	TTMEVVAQQTAKAE	0	-	1	23
	59 <sub>189</sub>	E-G-	WTNVVILAYEPVWAIG	1	20	0	-
	59 <sub>216</sub>	E-G-	LRKWLHANVGPVAE	0	-	2	138
	59 <sub>206</sub>	E-G-	PEFYDIIKSAIVKSS	0	-	1	137
60	60 <sub>26</sub>	E-G-	EDSHFVVELTYNYGV	0	-	0	-
	60 <sub>222</sub>	E-G-	RAIKFYEKAEGMELL	0	-	0	-
	60 <sub>111</sub>	E-G-	NPQKYTIAMMGYGP	0	-	0	-
	60 <sub>158</sub>	E-G-	KNAVLELTNYGYKE	0	-	0	-
	60 <sub>224</sub>	E-G-	DGWKSVFVDNLDFLK	0	-	0	-
61	61 <sub>1</sub>	E-G-	LQSKNCIYLCSIMI	0	-	0	-
	61 <sub>7</sub>	E-G-	ILYLC SIMIICNCKV S	0	-	0	-
	61 <sub>13</sub>	E-G-	IMICNCKVSKVLNTY	0	-	0	-
	61 <sub>19</sub>	E-G-	KVSKVLNTYFLYL	1	27	0	-
62	62 <sub>14</sub>	E-G-	YOPAAMRRLSLLA	1	63	0	-
	62 <sub>17</sub>	E-G-	RRLSLLAAAALLA	0	-	0	-
	62 <sub>23</sub>	E-G-	LEAAAALLAAA AVSAE	0	-	0	-
	62 <sub>43</sub>	E-G-	CPRAERIIAEVVQSK	0	-	0	-
	62 <sub>139</sub>	E-G-	AFDAVVR SKLALELE	0	-	0	-
	62 <sub>140</sub>	E-G-	CAOILAIASRVLVTM	1	43	0	-
	62 <sub>148</sub>	E-G-	NPTVGRIELFTAKG	4	200	6	223
	62 <sub>191</sub>	E-G-	IIELFTA KGFTVQEM	2	298	4	179
	62 <sub>200</sub>	E-G-	FTVQEMVALSGAHTL	0	-	1	937
	62 <sub>264</sub>	E-G-	IAAFNDIMSSSVLSS	0	-	0	-

	62 <sub>14</sub>	E-G-	FDNIYSVNIERGUGL	0	-	1	73
	62 <sub>15</sub>	E-G-	NTDFFEDFAKAIKEL	0	-	0	-
63	63 <sub>14</sub>	E-G-	YPHMLELILLUHGAN	0	-	0	-
	63 <sub>15</sub>	E-G-	ILLLHGANAALDEP	0	-	1	47
	63 <sub>16</sub>	E-G-	ESSLYAYQFAMSNGL	0	-	0	-
	63 <sub>17</sub>	E-G-	SGLRLDKSTLIAEVF	0	-	0	-
	63 <sub>18</sub>	E-G-	IHGWFADVDTAAEELV	1	120	2	227
64	64 <sub>17</sub>	E-G-	EIPTISYSOLYQLAG	0	-	0	-
	64 <sub>18</sub>	E-G-	YSDLYOLAGVVAVEY	0	-	0	-
	64 <sub>19</sub>	E-G-	DHLRQVFGKQMGMLSD	0	-	0	-
	64 <sub>20</sub>	E-G-	KNPLKFDTNTYFTELL	1	100	1	47
	64 <sub>21</sub>	E-G-	KAFFEDYKEAHLRLS	0	-	0	-
65	65 <sub>12</sub>	E-G-	FSCDSAYQVTVIVNG	1	23	1	47
	65 <sub>22</sub>	E-G-	YQVTVIVRGSGRVQV	1	87	1	367
	65 <sub>23</sub>	E-G-	IEGGSJFIVPRPHVV	1	130	1	113
	65 <sub>24</sub>	E-G-	GMEWFSIITTPNPIF	0	-	0	-
	65 <sub>25</sub>	E-G-	GKTSVWKAISPEVLE	0	-	0	-
66	66 <sub>4</sub>	n.d.	SCRGRCPCSLRTPAW	0	-	0	-
	66 <sub>12</sub>	n.d.	SERTPAWGSCSRMAP	0	-	0	-
	66 <sub>14</sub>	n.d.	WGSCSRMAPCNCRCP	0	-	0	-
	66 <sub>28</sub>	n.d.	NCRCPCTRGARRHL	0	-	0	-
	66 <sub>34</sub>	n.d.	STRGARRRLPGRTSS	0	-	0	-
67	67 <sub>9</sub>	n.d.	TAPTSRRSPSAPSPEH	0	-	0	-
	67 <sub>41</sub>	n.d.	TRTCISTRRIIPSRPT	0	-	0	-
	67 <sub>58</sub>	n.d.	PW5TCRAARSPTPSA	0	-	0	-
	67 <sub>59</sub>	n.d.	DRREIWLSEMVAVG	0	-	0	-
	67 <sub>103</sub>	n.d.	SEMVAVWVGLQIAFWI	0	-	0	-
68	68 <sub>8</sub>	n.d.	PWRPPIRRWSCCPLPW	0	-	0	-
	68 <sub>14</sub>	n.d.	SCCPLPWPWGTRRWWF	0	-	0	-
	68 <sub>24</sub>	n.d.	GTRRWVWFRCHQPPSS	0	-	0	-
	68 <sub>40</sub>	n.d.	FRCHQPPSSRTAPGGS	0	-	0	-
	68 <sub>42</sub>	n.d.	PGSSRSLYGSPSTSC	0	-	0	-
69	69 <sub>1</sub>	n.d.	VKVAFAALVNVLLEAR	0	-	0	-
	69 <sub>8</sub>	n.d.	LVNVLEARSLALTISV	0	-	0	-
	69 <sub>14</sub>	n.d.	ARSALTISVLRISSM	0	-	0	-
	69 <sub>20</sub>	n.d.	ISVLRISSSMPFSVYH	0	-	0	-
	69 <sub>23</sub>	n.d.	LAAPWKGKRYHLSAG	0	-	0	-
70	70 <sub>1</sub>	n.d.	SSPSCAPESTHAVRA	0	-	0	-
	70 <sub>2</sub>	n.d.	PESTHAVRALPSTHT	0	-	0	-
	70 <sub>13</sub>	n.d.	VRALPSTHTARILLR	0	-	0	-
	70 <sub>14</sub>	n.d.	THTARILLRSTTANV	0	-	0	-
	70 <sub>25</sub>	n.d.	LLRSTTANVSGCKDR	0	-	0	-
71	71 <sub>2</sub>	n.d.	VQVPGGHQGDLPRGE	0	-	0	-
	71 <sub>12</sub>	n.d.	LPGAAGEVCRRRRRR	0	-	0	-
	71 <sub>43</sub>	n.d.	GGGGVDRACQGVVGSH	0	-	0	-
	71 <sub>54</sub>	n.d.	GVVGSHLEDRHSRQA	0	-	0	-

	71_49	n.d.	LEDRHSRQAHRPVHR	0	-	0
72	72_50	n.d.	KHUYVTGWSVYTEI	0	-	0
	72_51	n.d.	TGWSVYTBTLRCA	0	-	0
	72_52	n.d.	SEGVRVLMLVWDDRT	0	-	0
	72_53	n.d.	DDSGSIVQDLCHSTM	0	-	0
	72_54	n.d.	LQISTMFTHHOKIVV	0	-	0
	72_55	n.d.	RRRHHMSFVGGLDIC	0	-	0
	72_56	n.d.	PVAWDVLYNFEQRWR	0	-	0
	72_57	n.d.	GKDILICERDILADEI	0	-	0
	72_58	n.d.	AWNVLQLFRSIDGGAA	0	-	0
	72_59	n.d.	DAVICAIRRAKSFIY	1	40	1
	72_60	n.d.	IRRAKSFIYIENQYF	0	-	0
	72_61	n.d.	FIYIENQYFLGSSYC	0	-	0
	72_62	n.d.	RFTVYVVVPMWPEGI	0	-	0
	72_63	n.d.	RRTMEMMMYTDIAQAI	0	-	0
	72_64	n.d.	MYTDIAQAIQAKGID	0	-	0
	72_65	n.d.	DYIKACQCNRRFMIIY	1	190	1
	72_66	n.d.	FMIYVHTKMMIVDDE	0	-	0
	72_67	n.d.	IVDDEIIVGSANIN	0	-	0
	72_68	n.d.	YQPYHLAASRPARGQ	0	-	0
	72_69	n.d.	GQVHGERMALWYEH	0	-	0
	72_70	n.d.	RMALWYEHLMGVDEA	0	-	0
	72_71	n.d.	CYRKVNAMADRYWNL	0	-	0
	72_72	n.d.	LPGVEFFPDITQARIL	0	-	0
73	73_73	n.d.	HTFKSLFESWIPVSS1	0	-	0
	73_74	n.d.	DCYIVLYTYHSGEKR	0	-	0
	73_75	n.d.	FYLTIVWIKDQSVLED	0	-	0
	73_76	n.d.	QHMAHQIATTIWNSM	0	-	0
	73_77	n.d.	EPPQPIALFQPMVIL	0	-	0
	73_78	n.d.	KDETYSGTGIALVHI	0	-	0
	73_79	n.d.	GTGIALVHHHGTSIH	0	-	0
	73_80	n.d.	NNKTLQVDAVISLIS	0	-	0
	73_81	n.d.	TDCPVLGSCGNSMETW	0	-	0
	73_82	n.d.	QQQWAAKVAEFLKPG	0	-	0
	73_83	n.d.	DVLREPHLYTTSFERN	1	77	0
	73_84	n.d.	LEVTEVFNFQSDLL	1	63	0
	73_85	n.d.	PNFSQDDLLTEDVMI	1	90	0
	73_86	n.d.	DVMILDTHAEVFVWM	0	-	0
	73_87	n.d.	CEFRTYPSWIDNTRSV	0	-	0
	73_88	n.d.	NSFQKKLSLLFGMRS	0	-	0
	73_89	n.d.	RASALAAALSSAFNPS	0	-	0
	73_90	n.d.	QRASALAAALSSSLNP	0	-	0
	73_91	n.d.	SQRAAAAYAALSIVVLT	0	-	0
	73_92	n.d.	VAALSNVLTAEGSTL	0	-	0
	73_93	n.d.	ETTFSYDRLISKSTD	0	-	0
	73_94	n.d.	YKRRETYLSDSEFET	0	-	0

	73 <sub>32</sub>	n.d.	SEFETVFGVTKEEFY	0	-	0	-
	73 <sub>60</sub>	n.d.	SRSFLKHSLLRTQRL	1	73	0	-
	73 <sub>66</sub>	n.d.	HSLERTOREHKPLVC	1	87	0	-
	73 <sub>67</sub>	n.d.	LHKFLVCSSMIGVMA	0	-	0	-
	73 <sub>69</sub>	n.d.	SGNLVVMFOMQDHQI	1	157	0	-
	73 <sub>70</sub>	n.d.	QLIYPLISPSFLVYS	1	200	0	-
	73 <sub>72</sub>	n.d.	ISPSPEVYSEFVHDL	1	77	0	-
74	74 <sub>5</sub>	n.d.	ERLIYQTANSRLCSV	0	-	0	-
	74 <sub>12</sub>	n.d.	ANSRLCSVLPKEEFY	0	-	0	-
	74 <sub>13</sub>	n.d.	VLPKEEFYQQPRWQQ	0	-	0	-
	74 <sub>28</sub>	n.d.	FYQQPRWQKQELQKRK	0	-	0	-
75	75 <sub>2</sub>	n.d.	TGAAAAMTTTIRSTA	0	-	0	-
	79 <sub>16</sub>	n.d.	TTTIRSTATAPRAIV	0	-	0	-
76	76 <sub>11</sub>	E-G-	NIWADDLAAISLSTLE	0	+	1	390
	76 <sub>13</sub>	E-G-	IAIAFLSVSNNYEYI	1	47	0	-
	76 <sub>24</sub>	E-G-	VSNNYYEYILSDKLVV	0	-	0	-
	76 <sub>43</sub>	E-G-	KDKLVVSTSCSLMIHT	0	-	0	-
	76 <sub>40</sub>	E-G-	TSCSLMHTAVDVLNE	1	160	0	-
	76 <sub>52</sub>	E-G-	TKLDSEIKSWLAFAAA	1	200	1	323
	76 <sub>61</sub>	E-G-	IKSWLAFAAAQKVVEV	0	-	0	-
	76 <sub>71</sub>	E-G-	KVVEVNALGKALVGL	0	+	0	-
	76 <sub>85</sub>	E-G-	LKDEAYFAANAAAQA	1	203	1	153
	76 <sub>125</sub>	E-G-	EAVVSAKEEISKV	0	-	0	-
	76 <sub>185</sub>	E-G-	ISKVVKICQELIDIV	0	-	0	-
	76 <sub>214</sub>	E-G-	MVEYFGEQLSGFAFT	0	-	0	-
	76 <sub>218</sub>	E-G-	LSGFAFTANGWVQSY	0	-	0	-
	76 <sub>230</sub>	E-G-	NHMIVFWSKMAGSMT	2	138	0	-
77	77 <sub>3</sub>	E-G-	EGPLMILYVSKMIPAS	0	-	0	-
	77 <sub>19</sub>	E-G-	KGRFFAFGRVFAGRV	0	-	0	-
	77 <sub>79</sub>	E-G-	GNTVALVGLDQFITK	0	-	0	-
	77 <sub>86</sub>	E-G-	VGLDQFITKNTATLG	0	+	0	-
	77 <sub>107</sub>	E-G-	PIRAMKFSVSPVVVRV	0	-	0	-
	77 <sub>129</sub>	E-G-	FMGGAEIIVSPPVAVS	0	+	0	-
	77 <sub>188</sub>	E-G-	SPPVVSFRETVDLKS	1	107	0	-
	77 <sub>212</sub>	E-G-	NKHNRILYMEARPLIE	1	107	0	-
	77 <sub>336</sub>	E-G-	PTARRVIFASQLTAK	0	-	0	-
	77 <sub>353</sub>	E-G-	AKPRLLEPVYLVIEIQ	0	-	0	-
	77 <sub>357</sub>	E-G-	EPVYLVEIQAPEGAL	0	-	0	-
	77 <sub>366</sub>	E-G-	PLVNIKAYLPVIESP	0	-	0	-
	77 <sub>403</sub>	E-G-	LPVIESPGFSATLRA	0	-	1	333
	77 <sub>409</sub>	E-G-	FGFSATLRAATSGQA	0	-	0	-
78	78 <sub>5</sub>	E-G-	SLKLHKACEAFNPYD	0	-	0	-
	78 <sub>14</sub>	E-G-	EADDPYYGKISLSKV	0	-	0	-
	78 <sub>15</sub>	E-G-	SKVRSFLTEAKAKHI	0	-	0	-
	78 <sub>31</sub>	E-G-	LTEAKAKHIEWNCDV	0	-	0	-
	78 <sub>116</sub>	E-G-	KEKRWNAALTISAS	0	-	0	-

78 <sub>133</sub>	E-G-	GSAYVDLGSELLAERT	0	-	0
78 <sub>1</sub>	E-G-	RHLARQFIPHILHQRF	0	-	0
78 <sub>3</sub>	E-G-	PIPHILHQRFIHPPIH	0	-	0
78 <sub>14</sub>	E-G-	NTMENLSSTIIFSFVI	0	-	0
78 <sub>32</sub>	E-G-	THESEVILLSASASL	0	-	0
78 <sub>38</sub>	E-G-	ILLSASASLVLVAGDP	0	-	0
78 <sub>46</sub>	E-G-	ELAEMEVSAAFHES	0	-	217
78 <sub>92</sub>	E-G-	SAAFHFLFSMAVTAAAR	0	-	0
78 <sub>98</sub>	E-G-	FSMAVTAAARSGQWND	0	-	0
78 <sub>143</sub>	E-G-	KISLSKVRSLTEAK	0	-	1 783
79	79 <sub>132</sub>	QCYTAALSPILPECL	1	183	0
	79 <sub>138</sub>	LSPILFECLIHPMLG	1	83	0
	79 <sub>145</sub>	VEDNLVKLKNVNLY	1	100	0
	79 <sub>165</sub>	KLKNVLNVYEARLTK	0	-	0
	79 <sub>31</sub>	EVYEARLTKPKYLAG	0	-	1 47
	79 <sub>18</sub>	TKPKYLAGDYLSLAD	1	37	0
	79 <sub>24</sub>	AGDYLSLADLNHVST	0	-	0
	79 <sub>57</sub>	VKAWTDLAKPSVQ	1	100	1 23
80	80 <sub>1</sub>	KLRFTCLSSTGSSCL	1	133	0
	80 <sub>2</sub>	LSSTGSSCLFVLILF	1	147	1 63
81	81 <sub>1</sub>	EKKKVKLEYYEARLS	2	100	0
	81 <sub>18</sub>	SYLAGDFVSFADLNH	1	40	0
	81 <sub>34</sub>	FVSEADLNHFPKTFY	0	-	0
	81 <sub>33</sub>	FPKTFYFMATPHASL	0	-	0
	81 <sub>59</sub>	HVKAWWERIMARPAY	0	-	0
	81 <sub>61</sub>	IMARPAVKKIAAMV	0	-	0
82	82 <sub>13</sub>	KRRVRCFWRVHQSIA	0	-	0
	82 <sub>49</sub>	FWRVHQISARMAPVK	0	-	0
	82 <sub>79</sub>	MAPVKLYGATLSVNV	0	-	0
	82 <sub>109</sub>	GDLYIFESRAICKYA	1	290	0
	82 <sub>158</sub>	EANQYTAALSPILFE	0	-	0
83	83 <sub>5</sub>	ACSLFLNYAVSPNYF	1	57	0
	83 <sub>12</sub>	YAVSENYFVCHLQE	1	70	1 37
	83 <sub>21</sub>	NLLQERLKKLKSEHG	1	83	1 47
	83 <sub>34</sub>	GMTGMLWETSLLDPE	1	107	0
	83 <sub>36</sub>	PEGLLWLLTGKVPPT	1	93	1 33
	83 <sub>136</sub>	YVYKAIDALPVTAHP	0	-	0
	83 <sub>147</sub>	QFTTGVMALQVESEF	0	-	0
	83 <sub>168</sub>	EDCLNUARLPQVAS	0	-	0
	83 <sub>186</sub>	IARLPQVASYVYRRI	1	187	1 33
	83 <sub>204</sub>	ADNSLDYAAINFHML	1	130	1 53
	83 <sub>227</sub>	DPKMLELMRLYITIH	1	63	1 40
	83 <sub>268</sub>	ALSDPYIISFAAAALNG	1	130	1 70
	83 <sub>266</sub>	LSFAAAALNGLAGPLH	1	103	0
	83 <sub>274</sub>	PLHGLANCIEVLLWIK	0	-	0
	83 <sub>285</sub>	QEVLWIKSVMEEGT	0	-	0

83 <sub>306</sub>	E-G-	GLKEYVVKTIKSGKV	1	90	1	40
83 <sub>349</sub>	E-G-	EDPLPQLVSKLYEVV	1	160	0	-
83 <sub>353</sub>	E-G-	LVSKLYEVVPGILTE	1	207	0	-
83 <sub>354</sub>	E-G-	SGVLLNNHFGLVEARY	1	140	0	-
83 <sub>406</sub>	E-G-	TVEPGVSRSMGIGSQ	1	123	0	-
83 <sub>417</sub>	E-G-	GSQLIWDRALGIPLE	1	37	1	57
84	84 <sub>10</sub>	GPVTEENWSPVRNDQ	1	47	0	-
	84 <sub>25</sub>	PRFETCYQIAIAIKK	0	-	0	-
	84 <sub>34</sub>	GIQVHQIDEAALREG	0	-	0	-
	84 <sub>63</sub>	EHAFYLDWAHVSFRI	1	53	1	303
	84 <sub>104</sub>	FNDIIHSINNMADAV	1	50	0	-
	84 <sub>125</sub>	SDEKLLSVFREGVTY	0	-	0	-
	84 <sub>165</sub>	VNIKMLAVLDTNEWV	1	47	0	-
	84 <sub>187</sub>	TRKYAEVMPALTNMV	0	-	0	-
	84 <sub>188</sub>	PAALTNNMYTAALKIRT	0	-	0	-
	84 <sub>201</sub>	VTAALKIRTQLASTK	0	-	0	-
85	85 <sub>10</sub>	GRGIKDDEGLVAPGQ	0	-	0	-
	85 <sub>29</sub>	LTVGNIIAGDRISMA	0	-	0	-
	85 <sub>38</sub>	DRESMAYDRTPEEL	0	-	0	-
	85 <sub>44</sub>	YDRTPEEILAVIVYGT	0	-	0	-
	85 <sub>56</sub>	EICAIIVYGTGTPAQA	0	-	0	-
86	86 <sub>12</sub>	TREENVYMAKLAEQA	0	-	0	-
	86 <sub>33</sub>	YEGMVVEFMKVKFTA	0	-	0	-
	86 <sub>51</sub>	EERNLLSVAYKNVIG	0	-	0	-
	86 <sub>59</sub>	AYKNVIGARRASWRI	0	-	0	-
	86 <sub>67</sub>	RRASWRISSIEQKE	0	-	0	-
	86 <sub>46</sub>	NEAYYASIKKEYRTRI	0	-	0	-
	86 <sub>105</sub>	SKICDGILKLLDSHL	0	-	0	-
	86 <sub>211</sub>	ILKLLDSHLVPSATA	0	-	0	-
	86 <sub>126</sub>	AESKVFYILKMKGDYH	0	-	0	-
	86 <sub>137</sub>	GDYHRYLAERKAGAE	0	-	0	-
	86 <sub>154</sub>	NTLVAYKSAQDIALA	0	-	0	-
	86 <sub>174</sub>	IPPTTHPIRLGLALNF	0	-	0	-
	86 <sub>190</sub>	IRLGLALNFSVFYYE	0	-	0	-
	86 <sub>194</sub>	LNFSVYYEILNSPD	0	-	0	-
	86 <sub>225</sub>	YKDSTLIMQQLRDNL	0	-	0	-
	86 <sub>233</sub>	IMQQLRDNETLWTSD	0	-	1	73
87	87 <sub>8</sub>	GSRALPFLQLTKQP	0	-	0	-
	87 <sub>94</sub>	VKVTIVVYYSMYGHVG	0	-	0	-
	87 <sub>80</sub>	GVEVKVWQVPEILSE	0	-	0	-
	87 <sub>119</sub>	ADGILFGFPTRFGMM	0	-	0	-
	87 <sub>134</sub>	FHQGKYFAGIAKKLK	0	-	0	-
88	88 <sub>2</sub>	DVYPTVCLPMCVCL	0	-	0	-
89	89 <sub>44</sub>	EPAYFATAESVRDHL	1	37	0	-
	89 <sub>53</sub>	QTYYLSTMEXLQGRAL	1	37	0	-
	89 <sub>70</sub>	AVGNLGITGAYAEAV	0	-	0	-

89	89 <sub>31</sub>	E-G-	AEAVKKFGYBLEALAL	1	33	0	-
	89 <sub>110</sub>	E-G-	RLAACFLDSMATTNLN	0	-	0	-
	89 <sub>431</sub>	E-G-	TRYRNGLEKQDRAKE	0	-	1	663
	89 <sub>158</sub>	E-G-	FSPWEIVRHDVVYPV	0	-	0	-
	89 <sub>163</sub>	E-G-	VYPVREFGHVEILPD	0	-	0	-
	89 <sub>191</sub>	E-G-	GEVLNALAYDVPIPG	2	288	1	1247
	89 <sub>201</sub>	E-G-	IPGYKTKNASLRLW	0	-	0	-
	89 <sub>223</sub>	E-G-	AEDFNLFQFNDGQYE	0	-	0	-
	89 <sub>261</sub>	E-G-	EGKLRLLKQGFFLCS	0	-	0	-
	89 <sub>267</sub>	E-G-	LKGQFFLCSASLQDI	0	-	0	-
	89 <sub>313</sub>	E-G-	PTLAPELMRLLMDE	0	-	0	-
	89 <sub>360</sub>	E-G-	QSVMRKLLPRQMEII	0	-	0	-
	89 <sub>375</sub>	E-G-	EEIDKRFREMVISTR	0	-	0	-
	89 <sub>406</sub>	E-G-	PQKPVVRMANLCVVS	0	-	0	-
	89 <sub>438</sub>	E-G-	ILKEELFADYVSIWP	0	-	0	-
	89 <sub>460</sub>	E-G-	PRRWLRFCNPELSEI	1	240	1	153
	89 <sub>501</sub>	E-G-	EKLHAEWAAAKLASK	0	-	0	-
	89 <sub>540</sub>	E-G-	IKRIHEYKRQLMNL	0	-	2	45
	89 <sub>546</sub>	E-G-	YKROLQMLNHLGAVYRY	2	78	1	43
	89 <sub>554</sub>	E-G-	LGAVYRYKKLKEMSA	3	54	1	43
	89 <sub>581</sub>	E-G-	GKAFTATYITNAKRVK	2	68	0	-
	89 <sub>583</sub>	E-G-	KRIVKLVDNGAVVN	1	77	2	195
	89 <sub>614</sub>	E-G-	VNKYLKQWIFPNYNV	0	-	1	213
	89 <sub>619</sub>	E-G-	VFIPNPNVSVAEVLJ	2	28	6	259
	89 <sub>641</sub>	E-G-	EDNFFLFGAKADQVA	2	35	2	292
	89 <sub>721</sub>	E-G-	TFGTYDTPLLDSLE	0	-	0	-
	89 <sub>748</sub>	E-G-	FLVGVCFPSYIDAQAA	0	-	0	-
	89 <sub>772</sub>	E-G-	KRWIKMSILNTAGSG	1	107	3	136
	89 <sub>796</sub>	E-G-	QYAKEIWGITANPVP	2	105	3	99
90	90 <sub>33</sub>	E-G-	KTLAVALGGARPLAT	0	-	1	30
	90 <sub>45</sub>	E-G-	LATRGVATEFTLPPDIP	0	-	2	30
	90 <sub>56</sub>	E-G-	PDLPYDYGALEPAIS	2	37	1	67
	90 <sub>82</sub>	E-G-	HATYVANYNKALEGQL	0	-	1	57
	90 <sub>103</sub>	E-G-	GDASAVVQLQGAIKF	0	-	0	-
	90 <sub>148</sub>	E-G-	DPLVTKGQANLPIIIG	0	-	0	87
	90 <sub>205</sub>	E-G-	ANLIPLLGIDVVWEHA	0	-	1	113
	90 <sub>218</sub>	E-G-	HAYVLCQYKNVRPDCYL	1	80	2	48
	90 <sub>229</sub>	E-G-	PDYLTNIWKVVNWKY	1	30	1	70
91	91 <sub>32</sub>	E-G-	APSGRIVMELYADVV	3	246	2	82
	91 <sub>41</sub>	E-G-	VMELYADVVPKTAEN	0	-	2	70
	91 <sub>74</sub>	E-G-	HYKGSSFHRRVIPGFM	3	208	1	207
	91 <sub>104</sub>	E-G-	SIYGAKFADENFIKK	0	-	1	60
	91 <sub>125</sub>	E-G-	NGSDFLCTACTAWL	1	530	2	130
92	92 <sub>1</sub>	E-G-	SQVHIRRPGGAGRDG	0	-	1	113
	92 <sub>7</sub>	E-G-	RPGGAGRGGQLRIP	0	-	1	130
	92 <sub>10</sub>	E-G-	RDGGOLRIPSLLHGG	0	-	1	97

	92 <sub>27</sub>	E-G-	GHGCAQPAMERRKHI	0	-	2	233
	92 <sub>38</sub>	E-G-	RKHIEWNCDCVCRHGD	0	-	1	83
93	93 <sub>11</sub>	E-G-	WTTVMRASCIGHHRPR	0	-	1	87
	93 <sub>14</sub>	E-G-	RFRDCVISSLADFKL	0	-	2	47
	93 <sub>39</sub>	E-G-	ISSLADFKLEPPVILQH	0	-	1	67
	93 <sub>79</sub>	E-G-	PVLQHIIISIAVLAIF	0	-	1	140
	93 <sub>96</sub>	E-G-	ISIAVEAFIGULMI	0	-	2	123

**Table 5: Antibody reactivity and IL-5 production of NTGAs and NTGA-derived peptides.**

Ig E	Ig G	Antigen s tested	Antigens positive	% positive	Peptide s tested	Peptides positive	% positive	Total SFC
-	+	24	14	58.3	173	46	26.6	6,154
+	-	13	9	69.2	118	33	28.0	1,796
+	+	16	12	75.0	187	93	49.7	7,229
-	-	30	17	56.7	256	68	26.6	7,628
n. d.	n. d.	10	2	20.0	88	10	11.4	1,053
		93	54	64.8	822	250	28.4	23,860

**Table 6- Epitopes tested positive for T Cell Recognition**

Antigen	Peptide	IgE/IgG	Sequence	Total response		Total response IL-5		IFNg	
				Events	SFC	Events	SFC	Events	SFC
1	1 <sub>161</sub>	E+G+	GNKQLVLPVPAFNVI	0	-	1	190		
	1 <sub>304</sub>	E+G+	VYKSFVSEYPPIVSIE	1	40	0	-		
	1 <sub>342</sub>	E+G+	IVGDDLLVTNPTRVA	0	0	1	193		
	1 <sub>365</sub>	E+G+	NALLLKVNQIGSVTE	1	40	1	170		
	1 <sub>444</sub>	E+G+	LGAAAVYAGLKFRAP	0	-	1	153		
2	2 <sub>1</sub>	E+G+	AEFEGVFLDFARQQA	2	58	0	-		
	2 <sub>20</sub>	E+G+	VDKLFKLAEEAKLKE	2	88	2	247		
	2 <sub>49</sub>	E+G+	ENRSVLHVALRAPRD	2	63	1	27		
	2 <sub>116</sub>	E+G+	FLGPLFVHTALQTDP	1	63	0	-		
	2 <sub>139</sub>	E+G+	RQLRFLANVDPVDVA	1	20	1	20		
	2 <sub>168</sub>	E+G+	VVSKTFTTAETMLNA	0	-	1	97		
	2 <sub>198</sub>	E+G+	VSKHMIAVSTNLKLV	2	80	1	20		

2 <sub>232</sub>	E+G+	RYSVCSAVGVLPPLSL	3	83	3	238	
2 <sub>238</sub>	E+G+	AVGVLPPLSLQYGFPI	3	71	4	121	
2 <sub>244</sub>	E+G+	LSLQYGFPIVQRFLE	1	127	1	50	
2 <sub>250</sub>	E+G+	FPIVQRFLEGASSID	2	92	1	90	
2 <sub>266</sub>	E+G+	HFRTASFKNIPVLL	1	33	0	-	
2 <sub>278</sub>	E+G+	VLLGLLSVWNVSFLG	2	50	0	-	
2 <sub>284</sub>	E+G+	SVWNVSFLGYPARAI	1	100	1	53	
2 <sub>295</sub>	E+G+	ARAILPYSQALEKLA	1	120	1	27	
2 <sub>346</sub>	E+G+	NGQHSFYQLIHQGRV	1	27	2	95	
2 <sub>363</sub>	E+G+	CDFIGVIKSQQPVYL	2	98	2	238	
2 <sub>387</sub>	E+G+	ELMSNFFAQPDALAY	2	102	3	99	
2 <sub>421</sub>	E+G+	KTFKGNRPSLSFLLS	2	42	5	363	
2 <sub>428</sub>	E+G+	PSLSFLLSSLSAYEI	1	67	1	53	
2 <sub>439</sub>	E+G+	AYEIGQLLAIYEHRI	1	40	0	-	
2 <sub>445</sub>	E+G+	LLAIYEHRIAIVQGFI	1	77	2	42	
2 <sub>456</sub>	E+G+	QGFIWGINSFDQWGV	1	113	0	-	
2 <sub>493</sub>	E+G+	PVEGFNPSSASLLAR	1	143	1	47	
2 <sub>499</sub>	E+G+	PSSASLLARYLAVEP	1	127	0	-	
3	3 <sub>50</sub>	E+G+	LKDGSTYSFRFSFIV	1	20	0	-
4	4 <sub>6</sub>	E+G+	MKTIFDFESIKKLLA	0	-	1	43
	4 <sub>12</sub>	E+G+	FESIKKLLASPKFSF	1	47	2	245
	4 <sub>41</sub>	E+G+	RMFVDELGASESSLL	1	47	1	30
	4 <sub>70</sub>	E+G+	PNLTYAKELVERMGL	0	-	1	33
	4 <sub>106</sub>	E+G+	RNMVLGKRFFVTPSD	1	33	1	27
	4 <sub>129</sub>	E+G+	AVQSIPYFASGLKGV	0	-	1	37
	4 <sub>203</sub>	E+G+	GIWAVLAWLSIIAYK	0	-	1	107
	4 <sub>260</sub>	E+G+	KELMANLVKMQSALS	1	327	1	97
	4 <sub>266</sub>	E+G+	LVKMQSALSVDNKLI	2	35	0	-
5	5 <sub>27</sub>	E+G+	TVSDEYLAVALKARR	0	-	1	73
6	6 <sub>1</sub>	E+G+	TLLFPHTQISLPSVR	2	32	0	-
	6 <sub>44</sub>	E+G+	DNEKSGFISLVSRYL	2	38	0	-
	6 <sub>92</sub>	E+G+	EATKALLNKLAVLKL	1	33	0	-
	6 <sub>123</sub>	E+G+	IEVRNGFTFLDLIVL	1	27	0	-

6	131	E+G+	FLDLIVLQIESLNKK	1	33	0	-
6	142	E+G+	LNKKYGSNVPLLMN	1	353	0	-
6	149	E+G+	NVPLLLMSFNTHED	1	153	0	-
6	165	E+G+	LKIVEKYANSSIDIH	3	196	3	654
6	175	E+G+	SIDIHTFNQSQYPRV	2	113	1	243
6	224	E+G+	GKLDLLSQGKEYVF	1	87	2	65
6	233	E+G+	GKEYVFIANSNDNLGA	2	115	0	-
6	242	E+G+	SDNLGAI VDMKILNH	2	28	1	30
6	248	E+G+	IVDMKILNHLHKQN	3	101	2	160
6	288	E+G+	VQLLEIAQVPDAHVD	1	73	0	-
6	304	E+G+	FKSIEKFKIFNTNNL	1	30	1	357
6	310	E+G+	FKIFNTNNLWVNLLKA	2	60	0	-
6	316	E+G+	NNLWVNLLKAIKRLVE	3	517	2	823
6	325	E+G+	IKRLVEADALKMEII	2	103	1	397
6	348	E+G+	VKVLQLETAAGAAIR	3	60	1	50
6	359	E+G+	AAIRFFDHAIGINV	4	105	4	344
6	369	E+G+	GINVPRSRFLPVKAT	1	23	0	-
6	376	E+G+	RFLPVKATSDLQLVQ	2	60	1	83
6	383	E+G+	TSDLQLVQSDLYTLV	1	40	1	87
6	389	E+G+	VQSDLYTLVDGFVTR	2	82	1	60
6	418	E+G+	GPEFKKVGSLGRFK	2	182	2	147
6	429	E+G+	GRFKSIPSIVELDSL	3	247	0	-
7	7	E+G+	GTIRNIINGTVFREP	3	109	2	523
7	31	E+G+	VFNFTGAGGVALAMY	3	118	3	968
7	101	E+G+	IQGFAEASMAIAYEK	2	33	1	50
7	121	E+G+	ASMAIAYEKWPLYL	2	52	1	80
7	127	E+G+	EKKWPLYLSTKNTIL	1	63	1	117
7	134	E+G+	GRFKDIFQAVYEADW	1	57	2	63
7	153	E+G+	WYEHRLIDDMVAYAL	1	43	0	-
7	177	E+G+	VQSDFLAQGFGSLGL	2	35	1	80
7	208	E+G+	NSIASIFAWTRGLAH	0	-	1	63
7	260	E+G+	DNARLLDFTQKLEDA	2	37	0	-
7	280	E+G+	MTKDLALLVHGSSKV	1	40	2	128
7	304	E+G+					

	7 <sub>324</sub>	E+G+	LNTEEFIDAVAAELQ	3	60	3	92
8	8 <sub>3</sub>	E+G+	TIVASGIENMKIFTR	0	-	1	293
9	9 <sub>56</sub>	E+G+	TDTIVYCAGRTFFF	0	-	1	180
	9 <sub>64</sub>	E+G+	GRTFFFRLDAPLDA	0	-	1	383
	9 <sub>152</sub>	E+G+	KSLVRAFMWDSGSTV	0	-	0	-
	9 <sub>175</sub>	E+G+	RVLSCDFKPTRPFRI	0	-	1	97
	9 <sub>355</sub>	E+G+	VSSLTYFPQSNPRTM	1	23	0	-
	9 <sub>397</sub>	E+G+	TQIKCFVAAEELIT	1	20	0	-
	9 <sub>441</sub>	E+G+	NALNIAVQQPEFALI	1	60	0	-
	9 <sub>450</sub>	E+G+	PEFALITTDASIVLL	1	33	0	-
	9 <sub>499</sub>	E+G+	KLRIYSISGDTLTEE	0	-	1	53
	9 <sub>526</sub>	E+G+	IHYSPDVSMFASADA	1	30	0	-
	9 <sub>554</sub>	E+G+	IKLKNMLFHTARINC	1	33	1	20
10	10 <sub>10</sub>	E+G+	GRYFSKDAVQIITKM	1	43	1	170
	10 <sub>16</sub>	E+G+	DAVQIITKMAAANGV	1	160	1	83
	10 <sub>29</sub>	E+G+	GVRRVWVGQDSLLST	0	-	2	30
	10 <sub>39</sub>	E+G+	SLLSTPAVSAILRER	1	37	2	30
	10 <sub>45</sub>	E+G+	AVSAIIRERIAADGS	1	60	1	47
11	11 <sub>58</sub>	E+G+	SVGFVETLENDLAQL	1	30	1	47
	11 <sub>111</sub>	E+G+	LGEAPYKFKSALEAV	1	53	2	488
	11 <sub>117</sub>	E+G+	KFKSALEAVKTLRAE	1	43	1	73
	11 <sub>137</sub>	E+G+	QYLPAPFVIVDESGKS	1	23	0	-
	11 <sub>161</sub>	E+G+	VVTFNFRADRMVMLA	2	50	0	-
	11 <sub>168</sub>	E+G+	ADRMVMLAKALEFAD	1	40	0	-
	11 <sub>206</sub>	E+G+	LKLPNKFLVSPPLIE	1	30	0	-
12	12 <sub>5</sub>	E+G+	YKLLCSSFPVITYHQ	2	60	0	-
	12 <sub>12</sub>	E+G+	FPVITYHQGRNGNLS	1	103	0	-
	12 <sub>21</sub>	E+G+	RNGNLSALACPLNQK	1	20	0	-
14	14 <sub>1</sub>	E+G+	LLGYLLWVVAIRRPR	1	110	0	-
16	16 <sub>3</sub>	E-G-	DEKLLSVFREGVVG	0	-	1	113
	16 <sub>21</sub>	E-G-	GPGVYDIHSPRIPSK	0	-	2	80
	16 <sub>36</sub>	E-G-	EEIADDFALFRGTRP	0	-	2	107
	16 <sub>42</sub>	E-G-	FALFRGTRPPRRPKK	0	-	1	97

	16 <sub>68</sub>	E-G-	LCPGFCLADVTPETY	0	-	2	45
17	17 <sub>2</sub>	E+G+	VCTRLSPFCCLYCIL	2	52	0	-
	17 <sub>13</sub>	E+G+	YCILCCWYSMRLVTV	1	63	0	-
20	20 <sub>294</sub>	E+G-	DKPVVAFIAGLTAPP	1	23	0	-
	20 <sub>329</sub>	E+G-	KIKALREAGVTVVES	1	23	0	-
22	22 <sub>131</sub>	E+G-	QCAIIMFDVTSRLTY	1	27	0	-
	22 <sub>206</sub>	E+G-	KPFLYLARKLAGDAN	2	88	1	603
	22 <sub>219</sub>	E+G-	ANIHFVEAVALKPPE	0	-	1	63
	22 <sub>245</sub>	E+G-	EAELAAAAAQPLPDD	1	20	0	-
23	23 <sub>1</sub>	E+G-	RTSSWGSGASLKIDR	1	27	0	-
	23 <sub>10</sub>	E+G-	SLKIDRRELVTTRIY	2	35	0	-
24	24 <sub>21</sub>	E+G-	RFLHAAVAMATKRSV	0	-	1	150
	24 <sub>44</sub>	E+G-	KGKKVFLRADLNVPL	1	30	3	234
	24 <sub>76</sub>	E+G-	TIKFLLEKGAKVILA	2	47	0	-
	24 <sub>82</sub>	E+G-	EKGAKVILASHLGRP	1	63	0	-
	24 <sub>109</sub>	E+G-	VPRLELLGVENVVMA	2	70	2	118
	24 <sub>141</sub>	E+G-	GGVLLLENVRFYKEE	2	45	1	23
	24 <sub>160</sub>	E+G-	PEFAKKLASVADLYV	2	45	0	-
	24 <sub>193</sub>	E+G-	KFLRPSVAGFLMQKE	3	38	1	177
	24 <sub>199</sub>	E+G-	VAGFLMQKELDYLVG	1	90	0	-
	24 <sub>206</sub>	E+G-	KELDYLVGAVANPKK	1	37	1	143
	24 <sub>234</sub>	E+G-	KIGVIESLLAKVDIL	1	57	0	-
	24 <sub>253</sub>	E+G-	GMIIFTFYKAQGKAVG	0	-	2	397
	24 <sub>272</sub>	E+G-	EEDKLELATSLIETA	2	52	1	23
	24 <sub>290</sub>	E+G-	GVSLLLPTDVVVADK	1	90	0	-
25	25 <sub>2</sub>	E+G-	SAPALRILRSFPSHS	1	97	1	143
26	26 <sub>138</sub>	E+G-	KVINDRFGIVEGLMT	0	-	1	37
27	27 <sub>76</sub>	E+G-	LQHISGVILFEETLY	1	53	0	-
	27 <sub>144</sub>	E+G-	YEAGARFAKWRAVLK	1	33	0	-
	27 <sub>175</sub>	E+G-	GLARYAIICQEGLV	2	33	1	140
	27 <sub>206</sub>	E+G-	RCAYVTEVVLAAACYK	1	27	0	-
	27 <sub>223</sub>	E+G-	NDQHVLLEGSSLKPN	1	27	0	-
	27 <sub>300</sub>	E+G-	WFLSFSFGRALQQST	1	23	0	-

28	28 <sub>2</sub>	E+G-	IPPAPHLKRWNRVVD	1	127	0	-
	28 <sub>29</sub>	E+G-	GAPFTGSGYRIAPYS	1	107	0	-
	28 <sub>36</sub>	E+G-	GYRIAPYSSILLKAT	0	-	2	477
29	29 <sub>2</sub>	E+G-	SFRFFLAHSSIHPST	2	83	0	-
	29 <sub>106</sub>	E+G-	TEKGIELILSTEIVK	1	50	1	247
	29 <sub>124</sub>	E+G-	ASKTLTSAAGATFTY	1	30	0	-
	29 <sub>199</sub>	E+G-	LELSAALKLNNFDVT	1	133	0	-
30	30 <sub>285</sub>	E+G-	VFNDDIQGTASVLA	1	67	0	-
32	32 <sub>41</sub>	E-G+	IEIDSLFEGIDFYST	0	-	1	27
	32 <sub>50</sub>	E-G+	IDFYSTITRARFEEL	1	20	0	-
	32 <sub>126</sub>	E-G+	EAVAYGAAVQAAILS	0	-	1	30
	32 <sub>147</sub>	E-G+	VQDLLLDVTPLSLG	0	-	1	47
34	34 <sub>140</sub>	E-G+	KPIFHFGTSTFSEY	1	40	0	-
	34 <sub>349</sub>	E-G+	KFITHSVTFSEINKA	1	50	1	103
	34 <sub>355</sub>	E-G+	VTFSEINKAFDLMAK	0	-	1	103
35	35 <sub>1</sub>	E-G+	ALRWNLQMGMHSVLPK	1	47	0	-
	35 <sub>25</sub>	E-G+	NLDVYDWSIPDDLLA	1	90	1	67
	35 <sub>35</sub>	E-G+	DDLLAKFSEIKQTRL	1	30	0	-
39	39 <sub>111</sub>	E-G+	GESSEFVGDKVAYAL	0	-	1	30
	39 <sub>118</sub>	E-G+	GDKVAYALAQGLKVI	1	67	1	73
40	40 <sub>2</sub>	E-G+	VWQHDRVEIIANDQG	1	40	0	-
	40 <sub>8</sub>	E-G+	VEIIANDQGNRTTPS	1	27	0	-
41	41 <sub>1</sub>	E-G+	SSTRGWCRRAGRG	0	-	0	-
42	42 <sub>69</sub>	E-G+	GVIAGLNLVRIINEP	0	-	1	33
43	43 <sub>120</sub>	E-G+	YVVPWGFYKAVMHVK	1	20	0	-
	43 <sub>191</sub>	E-G+	FAWSLLDNFEWRMGF	1	27	0	-
46	46 <sub>3</sub>	E-G+	RGLLRRARGGPHHRR	1	40	0	-
	46 <sub>19</sub>	E-G+	RGAHRRVPLRPLRHR	0	-	1	60
	46 <sub>40</sub>	E-G+	EGRRAKLRSAGEVEI	1	177	0	-
	46 <sub>50</sub>	E-G+	GEVEIQFRRVKCKYP	4	60	0	-
	46 <sub>67</sub>	E-G+	TKVTFHVVGVGPLLH	1	70	1	160
47	47 <sub>41</sub>	E-G+	GKFAAERGAAFTVVL	1	30	0	-
	47 <sub>49</sub>	E-G+	AFTVVLSGGTLIDTL	1	43	0	-

	47 <sub>96</sub>	E-G+	DSNYKLAVDGLLSKV	1	53	0	-
	47 <sub>135</sub>	E-G+	TVLKQLVKSGVLAMS	2	22	0	-
	47 <sub>142</sub>	E-G+	KSGVLAMSTATGFPR	1	40	0	-
48	48 <sub>269</sub>	E-G+	YAVGQKIKAYLEAES	0	-	1	297
49	49 <sub>1</sub>	E-G+	ELRKTYNLLDAVSRH	4	847	1	100
	49 <sub>18</sub>	E-G+	QVYPRSWSAVMLTFD	2	602	0	-
	49 <sub>26</sub>	E-G+	AVMLTFDNAGMWNV	3	899	1	503
	49 <sub>42</sub>	E-G+	NVWERHYLAGEMTLM	1	130	0	-
	49 <sub>50</sub>	E-G+	GEQLYISVSPARSL	0	-	1	80
50	50 <sub>44</sub>	E-G+	IGNLRLDNTTLIDKD	1	40	0	-
	50 <sub>88</sub>	E-G+	EIPMIQNILSRSQIF	0	-	2	158
	50 <sub>97</sub>	E-G+	SRSQIFDGIPNLMSL	0	-	1	87
	50 <sub>103</sub>	E-G+	DGIPNLMSLDNVVKI	0	-	2	158
	50 <sub>150</sub>	E-G+	EFPVTWVSSPEVALL	0	-	1	97
	50 <sub>158</sub>	E-G+	SPEVALLKSLAGKLR	1	27	1	87
	50 <sub>174</sub>	E-G+	STKLIFRFLREDLVE	1	30	0	-
	50 <sub>196</sub>	E-G+	GELLKDLKSIKAFAS	0	-	1	43
51	51 <sub>21</sub>	E-G+	LLETHLVPSSSTAPES	0	-	1	47
	51 <sub>33</sub>	E-G+	PESKVFYLKMKGDYH	1	27	1	53
	51 <sub>67</sub>	E-G+	MNSYKAAQDIALADL	0	-	1	43
52	52 <sub>1</sub>	E-G+	LLGLLAPLASAQLSR	0	-	1	33
	52 <sub>23</sub>	E-G+	PDAEKIVAAVIEKKL	1	20	0	-
	52 <sub>45</sub>	E-G+	AGLLRLLFHDCFANG	1	113	1	37
	52 <sub>60</sub>	E-G+	CDASILIDPLSNQSA	3	91	5	151
	52 <sub>229</sub>	E-G+	IDSSYFANVLAKKMP	1	50	1	50
	52 <sub>266</sub>	E-G+	KPNDFMPTFAKAMEK	0	-	1	33
	52 <sub>272</sub>	E-G+	PTFAKAMEKLSVLKV	2	53	2	62
	52 <sub>309</sub>	E-G+	GGSVIRISSANPEDL	1	70	2	72
53	53 <sub>1</sub>	E-G+	WSEIQTLPNLIGPF	0	-	1	103
	53 <sub>57</sub>	E-G+	AAYLATRGLDVDAV	1	880	1	1030
	53 <sub>64</sub>	E-G+	GLDVDAVSNALIKS	1	23	0	-
	53 <sub>84</sub>	E-G+	TKQQVFIQSEDPPVL	3	42	0	-
	53 <sub>96</sub>	E-G+	PVLSAFKKFPKFNVR	1	53	0	-

	53 <sub>103</sub>	E-G+	KFPKFNRVFEIEFDI	1	30	3	499
	53 <sub>126</sub>	E-G+	VEIKEFANAVKLRRS	1	87	1	797
	53 <sub>135</sub>	E-G+	VKLRRSSAAQVQDGFY	3	104	0	-
	53 <sub>170</sub>	E-G+	GVLKNEFMSLAFDYW	1	83	0	-
	53 <sub>202</sub>	E-G+	GLVTEFPSTAAYFR	1	63	1	153
54	54 <sub>39</sub>	E-G+	NIVVNVFNQLDQPLL	1	43	0	-
	54 <sub>93</sub>	E-G+	IGSFFYFPSIGMQRT	5	447	4	183
	54 <sub>116</sub>	E-G+	VVSRLLIPVPFDPPA	1	307	1	133
55	55 <sub>40</sub>	E-G-	IGEIKGFADAVMVSR	0	-	1	167
	55 <sub>60</sub>	E-G-	VNGFFLTGFNDLVTE	0	-	1	903
56	56 <sub>21</sub>	E-G-	KIASFLDPDGWKVVL	0	-	1	343
59	59 <sub>75</sub>	E-G-	FLQQAKALLRPDFAV	0	-	1	33
	59 <sub>81</sub>	E-G-	ALLRPDFAVAAQNCW	0	-	1	23
	59 <sub>106</sub>	E-G-	ISAEMLVNLQVPWVI	0	-	1	37
	59 <sub>138</sub>	E-G-	ADKVAYALAQGLKVI	1	47	2	45
	59 <sub>166</sub>	E-G-	TTMEVVAAQTKAIAE	0	-	1	23
	59 <sub>185</sub>	E-G-	WTNVVLAYEPVWAIG	1	20	0	-
	59 <sub>216</sub>	E-G-	LRKWLHANVGPAVAE	0	-	2	138
	59 <sub>266</sub>	E-G-	PEFVDIICKSATVKSS	0	-	1	137
61	61 <sub>19</sub>	E-G-	KVSKVLNTYIFLLYL	1	27	0	-
62	62 <sub>11</sub>	E-G-	YQPAAMRRRLSLILLA	1	63	0	-
	62 <sub>140</sub>	E-G-	CADILAIASRVLVTM	1	43	0	-
	62 <sub>185</sub>	E-G-	NFTVGRIIELFTAKG	4	200	6	223
	62 <sub>191</sub>	E-G-	IIELFTAKGFTVQEM	2	298	4	179
	62 <sub>200</sub>	E-G-	FTVQEMVALSGAHTL	0	-	1	537
	62 <sub>276</sub>	E-G-	FDNIYSVNIERGLGL	0	-	1	73
63	63 <sub>11</sub>	E-G-	ILLLHGANAALDEP	0	-	1	47
	63 <sub>114</sub>	E-G-	IHGWFAVDFTAAELV	1	120	2	227
64	64 <sub>111</sub>	E-G-	KNPLKFDNTYFTELL	1	100	1	47
65	65 <sub>22</sub>	E-G-	FSCDSAYQVTYIVRG	1	23	1	47
	65 <sub>28</sub>	E-G-	YQVTYIVRGSGRVQV	1	87	1	367
	65 <sub>55</sub>	E-G-	IEGGSLFIVPRFHVV	1	130	1	113
72	72 <sub>291</sub>	n.d.	DAYICAIRRAKSFIY	1	40	1	77

	72 <sub>433</sub>	n.d.	DYLKAQQNRRFMIYV	1	190	1	33
73	73 <sub>326</sub>	n.d.	DVLREPHLYTFSFRN	1	77	0	-
	73 <sub>343</sub>	n.d.	LEVTEVFNFNSQDDLL	1	63	0	-
	73 <sub>349</sub>	n.d.	FNFSQDDLLTEDVMI	1	90	0	-
	73 <sub>660</sub>	n.d.	SRSFLKHSLLRTQRL	1	73	0	-
	73 <sub>666</sub>	n.d.	HSLLRTQRLHKFLVC	1	87	0	-
	73 <sub>674</sub>	n.d.	LHKFLVCSSMIGVMA	0	-	0	-
	73 <sub>694</sub>	n.d.	SGNLVMFQMHDHQLI	1	157	0	-
	73 <sub>706</sub>	n.d.	QLIYPLISPSFLVYS	1	200	0	-
	73 <sub>712</sub>	n.d.	ISPSFLVYSFFVHDL	1	77	0	-
76	76 <sub>11</sub>	E-G-	NIWADDLAAASLSTLE	0	-	1	390
	76 <sub>17</sub>	E-G-	IAIAFLSVSNNYEYI	1	47	0	-
	76 <sub>40</sub>	E-G-	TSCSLMHTAVDLVNE	1	160	0	-
	76 <sub>55</sub>	E-G-	TKLDSEIKSWLAFAA	1	200	1	323
	76 <sub>85</sub>	E-G-	LKDEAYFAANAAAQA	1	203	1	153
	76 <sub>250</sub>	E-G-	NPMTVFWSKMAQSMT	2	138	0	-
77	77 <sub>188</sub>	E-G-	SPPVVSFRETVLDKS	1	107	0	-
	77 <sub>212</sub>	E-G-	NKHNRLYMEARPLEE	1	107	0	-
	77 <sub>403</sub>	E-G-	LPVIESFGFSATLRA	0	-	1	333
78	78 <sub>85</sub>	E-G-	E LAEMEVSAAFHLFS	0	-	2	217
	78 <sub>143</sub>	E-G-	KISLSKVRSLTEAK	0	-	1	783
79	79 <sub>132</sub>	E-G-	QQYTAALSPILFECL	1	183	0	-
	79 <sub>138</sub>	E-G-	LSPILFECLIHPMLG	1	83	0	-
	79 <sub>160</sub>	E-G-	VEDNLVKLKNVLNVY	1	100	0	-
	79 <sub>11</sub>	E-G-	EVYEARLTKFKYLAG	0	-	1	47
	79 <sub>18</sub>	E-G-	TKFKYLAGDYLDSLAD	1	37	0	-
	79 <sub>57</sub>	E-G-	VKA WWWTDLLAKPSVQ	1	100	1	23
	80 <sub>1</sub>	E-G-	KLRFTCLSSTGSSCL	1	133	0	-
80	80 <sub>7</sub>	E-G-	LSSTGSSCLFVLILF	1	147	1	63
	81 <sub>1</sub>	E-G-	EKLKKVLEVYEARLS	2	100	0	-
81	81 <sub>18</sub>	E-G-	SYLAGDFVFSADLNH	1	40	0	-
	82 <sub>109</sub>	E-G-	GDLYIFESRAICKYA	1	290	0	-
83	83 <sub>5</sub>	E-G-	ACSLFLNYAVSFNYF	1	57	0	-

83	12	E-G-	YAVSFNYFVCNLLQE	1	70	1	37
83	22	E-G-	NLLQERLKKLKSEHG	1	83	1	47
83	54	E-G-	GMTGMLWETSLLDPE	1	107	0	-
83	96	E-G-	PEGLLWLLTGKVPT	1	93	1	33
83	186	E-G-	IARLPQVASYVYRRI	1	187	1	33
83	209	E-G-	ADNSLDYAANFSHML	1	130	1	53
83	227	E-G-	DPKMLELMRLYITIH	1	63	1	40
83	260	E-G-	ALSDPYLSFAAALNG	1	130	1	70
83	266	E-G-	LSFAAALNGLAGPLH	1	103	0	-
83	306	E-G-	QLKEYVWKTLSKGKV	1	90	1	40
83	349	E-G-	EDPLFQLVSKLYEVV	1	160	0	-
83	355	E-G-	LVSKLYEVVPGILTE	1	207	0	-
83	384	E-G-	SGVLLNHFGLVEARY	1	140	0	-
83	400	E-G-	TVLFGVSRSMGIGSQ	1	123	0	-
83	412	E-G-	GSQLIWDRALGLPLE	1	37	1	57
84	84	E-G-	GPVTILNWSFVRNDQ	1	47	0	-
	10	E-G-	EHAFYLDWAVHSFRI	1	53	1	303
	84	E-G-	FNDIIHSIINMDADV	1	50	0	-
	103	E-G-	VNKMLAVLDTNILWV	1	47	0	-
84	165	E-G-	IMQLLRDNLTWTSD	0	-	1	73
86	86	E-G-	EPAYFATAESVRDHL	1	37	0	-
89	21	E-G-	AEAVKKFGYELEALA	1	33	0	-
	89	E-G-	QTYYLSMEYLQGRAL	1	37	0	-
	53	E-G-	LRYRYGLFKQRIAKE	0	-	1	663
	89	E-G-	GEVLNALAYDVPIPG	2	288	1	1247
	81	E-G-	PRRWLRFCNPELSEI	1	240	1	153
	131	E-G-	IKRIHEYKRQLMNIL	0	-	2	45
	191	E-G-	YKRQLMNLGAVYRY	2	78	1	43
	460	E-G-	LGAVYRYKKLKEMSA	3	54	1	43
	540	E-G-	GKAFATYTNKRIVK	2	68	0	-
	546	E-G-	KRIVKLVNDVGAVVN	1	77	2	195
	554	E-G-	VNKYLKVVFIPNYNV	0	-	1	213
	583	E-G-	VFIPNYNVSAEVLI	2	28	6	259
	612	E-G-					
	619	E-G-					

	89 <sub>681</sub>	E-G-	EDNFFLFGAKADQVA	2	35	2	202
	89 <sub>772</sub>	E-G-	KRWIKMSILNTAGSG	1	107	3	136
	89 <sub>796</sub>	E-G-	QYAKEIWGITANPVP	2	105	3	99
90	90 <sub>33</sub>	E-G-	KTLAVALGGARPLAT	0	-	1	30
	90 <sub>45</sub>	E-G-	LATRGVATFTLPDLP	0	-	2	30
	90 <sub>56</sub>	E-G-	PDLPYDYGALEPAIS	2	37	1	67
	90 <sub>82</sub>	E-G-	HATYVANYNKALEQL	0	-	1	57
	90 <sub>198</sub>	E-G-	DPLVTKGANLIPLLG	0	-	0	87
	90 <sub>205</sub>	E-G-	ANLIPLLGIDVWEHA	0	-	1	113
	90 <sub>218</sub>	E-G-	HAYYLQYKNVRPDYL	1	80	2	48
	90 <sub>229</sub>	E-G-	PDYLTNIWKVVNWKY	1	30	1	70
91	91 <sub>35</sub>	E-G-	APSGRIVMELYADVV	3	246	2	82
	91 <sub>41</sub>	E-G-	VMELYADVVPKTAEN	0	-	2	70
	91 <sub>74</sub>	E-G-	HYKGSSFHRVIPGFM	3	208	1	207
	91 <sub>104</sub>	E-G-	SIYGAKFADENFIKK	0	-	1	60
	91 <sub>135</sub>	E-G-	NGSQFFLCTAKTAWL	1	530	2	130
92	92 <sub>1</sub>	E-G-	SQVHIRRPGGAGRDG	0	-	1	113
	92 <sub>7</sub>	E-G-	RPGGAGRGGQLRIP	0	-	1	130
	92 <sub>13</sub>	E-G-	RDGGQLRIPSLHGG	0	-	1	97
	92 <sub>27</sub>	E-G-	GHGCAQPAMERRKHI	0	-	2	233
	92 <sub>38</sub>	E-G-	RKHIEWNCDVCRHGD	0	-	1	83
93	93 <sub>1</sub>	E-G-	WTTVMRASCGHHRFR	0	-	1	87
	93 <sub>13</sub>	E-G-	RFRDCVISSLADFKL	0	-	2	47
	93 <sub>19</sub>	E-G-	ISSLADFKLFPVLQH	0	-	1	67
	93 <sub>29</sub>	E-G-	PVLQHIIISIAVLAIF	0	-	1	140
	93 <sub>35</sub>	E-G-	ISIAVLAIFIGLLMI	0	-	2	123

## References

1. Brozek JL, *et al.* (2010) Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines: 2010 revision. *J Allergy Clin Immunol* 126(3):466-476.
2. Nathan RA (2007) The burden of allergic rhinitis. *Allergy Asthma Proc* 28(1):3-9.
3. Bauchau V & Durham SR (2004) Prevalence and rate of diagnosis of allergic rhinitis in Europe. *Eur Respir J* 24(5):758-764.
4. Rolland JM, Douglass J, & O'Hehir RE (2000) Allergen immunotherapy: current and new therapeutic strategies. *Expert Opin Investig Drugs* 9(3):515-527.
5. Laprise C & Boulet LP (1996) Airway responsiveness and atopy in families of patients with asthma. *Clin Invest Med* 19(6):461-469.
6. Romagnani S (2000) The role of lymphocytes in allergic disease. *J Allergy Clin Immunol* 105(3):399-408.
7. Andersson K & Lidholm J (2003) Characteristics and immunobiology of grass pollen allergens. *Int Arch Allergy Immunol* 130(2):87-107.
8. Baskett DA & Kimber I (2011) Assessing the potency of respiratory allergens: uncertainties and challenges. *Regul Toxicol Pharmacol* 61(3):365-372.
9. Gieras A, *et al.* (2007) Molecular determinants of allergen-induced effector cell degranulation. *J Allergy Clin Immunol* 119(2):384-390.
10. Vijayanand P, *et al.* (2012) Interleukin-4 production by follicular helper T cells requires the conserved Il4 enhancer hypersensitivity site V. *Immunity* 36(2):175-187.
11. Mehlhop PD, *et al.* (1997) Allergen-induced bronchial hyperreactivity and eosinophilic inflammation occur in the absence of IgE in a mouse model of asthma. *Proc Natl Acad Sci U S A* 94(4):1344-1349.
12. Oseroff C, *et al.* (2010) Molecular determinants of T cell epitope recognition to the common Timothy grass allergen. *J Immunol* 185(2):943-955.
13. Benitez D, *et al.* (2001) Specific immune response to Phleum pratense plant profilin in atopic patients and control subjects. *Allergol Immunopathol (Madr)* 29(1):9-15.
14. Wurtzen PA, van Neerven RJ, Arnved J, Ipsen H, & Sparholt SH (1998) Dissection of the grass allergen-specific immune response in patients with allergies and control subjects: T-cell proliferation in patients does not correlate with specific serum IgE and skin reactivity. *J Allergy Clin Immunol* 101(2 Pt 1):241-249.

15. Oseroff C, *et al.* (2012) T Cell Responses to Known Allergen Proteins Are Differently Polarized and Account for a Variable Fraction of Total Response to Allergen Extracts. *J Immunol.*
16. Oseroff C, *et al.* (2012) Analysis of T Cell Responses to the Major Allergens from German Cockroach: Epitope Specificity and Relationship to IgE Production. *J Immunol* 189(2):679-688.
17. Sette A, *et al.* (2008) Selective CD4+ T cell help for antibody responses to a large viral pathogen: deterministic linkage of specificities. *Immunity* 28(6):847-858.
18. Lanzavecchia A (1985) Antigen-specific interaction between T and B cells. *Nature* 314(6011):537-539.
19. Chen C, *et al.* (2011) Identification of CD4+ T cell epitopes in *C. burnetii* antigens targeted by antibody responses. *PLoS One* 6(3):e17712.
20. Chain BM, Mitchison NA, Mitchison TJ, Davies DH, & Marcinkiewicz J (1989) Antigen processing: current issues, exceptional cases (Thy 1 alloantigen, MHC class-II-restricted cytolytic T cells), and implications for vaccine development. *J Autoimmun* 2 Suppl:45-53.
21. Wang P, *et al.* (2008) A systematic assessment of MHC class II peptide binding predictions and evaluation of a consensus approach. *PLoS Comput Biol* 4(4):e1000048.
22. Wang P, *et al.* (2010) Peptide binding predictions for HLA DR, DP and DQ molecules. *BMC Bioinformatics* 11:568.
23. Lowenstein H (1978) Quantitative immunoelectrophoretic methods as a tool for the analysis and isolation of allergens. *Prog Allergy* 25:1-62.
24. Chapman MD (2008) Allergen nomenclature. *Clin Allergy Immunol* 21:47-58.
25. Petersen A, Schramm G, Schlaak M, & Becker WM (1998) Post-translational modifications influence IgE reactivity to the major allergen Phl p 1 of timothy grass pollen. *Clin Exp Allergy* 28(3):315-321.
26. Schuhbauer DM, Mitchison NA, & Mueller B (2000) Interaction within clusters of dendritic cells and helper T cells during initial Th1/Th2 commitment. *Eur J Immunol* 30(5):1255-1262.
27. Wachholz PA & Durham SR (2004) Mechanisms of immunotherapy: IgG revisited. *Curr Opin Allergy Clin Immunol* 4(4):313-318.
28. Skripak JM, *et al.* (2008) A randomized, double-blind, placebo-controlled study of milk oral immunotherapy for cow's milk allergy. *J Allergy Clin Immunol* 122(6):1154-1160.

29. Cady CT, *et al.* (2010) IgG antibodies produced during subcutaneous allergen immunotherapy mediate inhibition of basophil activation via a mechanism involving both FcgammaRIIA and FcgammaRIIB. *Immunol Lett* 130(1-2):57-65.
30. Terada T, Zhang K, Belperio J, Londhe V, & Saxon A (2006) A chimeric human-cat Fcgamma-Fel d1 fusion protein inhibits systemic, pulmonary, and cutaneous allergic reactivity to intratracheal challenge in mice sensitized to Fel d1, the major cat allergen. *Clin Immunol* 120(1):45-56.
31. Wallner M, *et al.* (2009) Immunologic characterization of isoforms of Car b 1 and Que a 1, the major hornbeam and oak pollen allergens. *Allergy* 64(3):452-460.
32. Zerbino DR & Birney E (2008) Velvet: algorithms for de novo short read assembly using de Bruijn graphs. *Genome Res* 18(5):821-829.
33. Hannon GJ (2010) FASTX-Toolkit [http://hannonlab.cshl.edu/fastx\\_toolkit/](http://hannonlab.cshl.edu/fastx_toolkit/) %3E.
34. Surget-Groba Y & Montoya-Burgos JI (2010) Optimization of de novo transcriptome assembly from next-generation sequencing data. *Genome Res* 20(10):1432-1440.1.

**WHAT IS CLAIMED IS:**

1. A protein or peptide comprising, consisting of or consisting essentially of a Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), or a subsequence, homologue, or variant thereof.
2. The protein or peptide of claim 1, wherein the protein or peptide does not consist of the sequence set forth in Table 1 as SEQ ID NOS:204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 282, 283, 284, 285, 286, 287, 289, 290, 291, 292, 293, 294, 295, 296, 489, 490 or 491.
3. A protein or peptide comprising, consisting of or consisting essentially of a Timothy Grass amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, homologue, or variant thereof.
4. The protein or peptide of claim 3, wherein the protein or peptide does not consist of the sequence set forth in Table 4 as SEQ ID NOS:1517, 1542, 1598, 1679, 1761, 1849, 1850, 1851, 1935, 2040, 2116, 2133 or 2134.
5. The protein or peptide of claim 1 or 3, wherein said homologue or variant has at least 65% homology or identity to a Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance).
6. The protein or peptide of claim 3, wherein said subsequence is 7 to 30 amino acids in length and wherein at least 7 contiguous amino acids are at least 75% identical or homologous to at least 7 contiguous amino acids of said corresponding Timothy Grass amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6.
7. The protein or peptide of any of claims 1 to 6, wherein the subsequence, homologue, or variant is:
  - i. a peptide of up to 30 amino acids in length which comprises said amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442, respectively, in

order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6; or

ii. a peptide of 7 to 30 amino acids in length which comprises a subsequence of at least 7 contiguous amino acids having at least 75% identity or homology to at least 7 contiguous amino acids of said amino acid sequence set forth in Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6.

8. The protein or peptide of any of claims 1 to 7, wherein the Timothy Grass amino acid sequence, subsequence, homologue, or variant comprises an allergen or an antigen.
9. The protein or peptide of any of claims 1 to 8, wherein the Timothy Grass amino acid sequence, subsequence, homologue, or variant decreases, inhibits, suppresses or reduces an anti-allergen immune response.
10. The protein or peptide of any of claims 1 to 9, wherein the Timothy Grass amino acid sequence, subsequence, homologue, or variant elicits, stimulates, induces, promotes, increases or enhances an anti-allergen immune response.
11. The protein or peptide of claim 9 or 10, wherein the anti-allergen immune response comprises an anti-Timothy Grass allergen immune response.
12. The protein or peptide of any of claims 9 to 11, wherein the anti-allergen immune response comprises a T cell response.
13. The protein or peptide of any of claims 9 to 11, wherein the anti-allergen immune response comprises stimulated, induced, increased or enhanced production of a lymphokine.
14. The protein or peptide of any one of claims 1 to 13, comprising, consisting of or consisting essentially of an amino acid sequence of a protein or peptide with an open reading frame identification of M.693, M.692, M.125, M.714, M.721, M.705, M.591, M.418, M.689, M.644, M.414, M.624, M.617, M.704, M.331, M.604, M.291, M.151, M.498, M.561, M.399, M.603, M.226, M.636, M.473, M.437, M.634, M.676, M.422,

M.431, M.387, M.722, M.610, M.574, M.531, M.305, M.282, M.271, M.159, M.83, M.348, M.285, M.288, M.287, M.212, M.715, M.725, M.694, M.701, M.595, M.718, M.720, M.723, M.648, M.662, M.576, M.618, M.631, M.682, M.421, M.654, M.393, M.669, M.625, M.655, M.524, M.570, M.341, M.342, M.450, M.343, M.639, M.555, M.546, M.606, M.628, M.248, M.466, M.328, M.695, M.658, M.560, M.548, M.269, M.728, M.653, M.759, M.765, M.747, M.763, M.733, M.651, M.677, M.597, M.547, M.761, M.571, M.562, M.657, M.738, M.734, M.621, M.741, M.177, M.579, M.513, M.446, M.388, M.391, M.593, M.506, M.395, M.381, M.372, M.619, M.656, M.525, M.698, M.699, M.439, M.630, M.708, M.620, M.758, M.764, M.746, M.762, M.716, M.726, M.66, M.717, M.727, M.719, M.724, M.577, M.8, M.235, M.678, M.675, M.641, M.499, M.583, M.649, M.6, M.29, M.34, M.183, M.101, M.149, M.164, M.129, M.45, M.116, M.165, M.146, M.69, M.123, M.107, M.3, M.113, M.204, M.174, M.178, M.191, M.580, M.587, M.594, M.539, M.569, M.588, M.615, M.578, M.352, M.514, M.419, M.443, M.540, M.640, M.642, M.646, M.627, M.626, M.645, M.652, M.650, M.559, M.622, M.565, M.567, M.581, M.609, M.182, M.134, M.283, M.297, M.367, M.84, M.189, M.586, M.496, M.255, M.471, M.575, M.163, M.314, M.194, M.294, M.472, M.369, M.104, M.206, M.24, M.469, M.420, M.444, M.697, M.687, M.713, M.638, M.673, M.700, M.702, M.707, M.710, M.683, M.670, M.643, M.663, M.664, M.666, M.748, M.731, M.735, M.750, M.752, M.756, M.754, M.608, M.740, M.39, M.303, M.389, M.390, M.284, M.201, M.28, M.364, M.344, M.74, M.180, M.317, M.298, M.192, M.77, M.92, M.144, M.9, M.296, M.187, M.172, M.72, M.38, M.239, M.289, M.240, M.214, M.365, M.614, M.598, M.632, M.633, M.616, M.690, M.607, M.672, M.545, M.671, M.272, M.301, M.202, M.492, M.647, M.457, M.686, M.495, M.486, M.729, M.760, M.668, M.599, M.417, M.635, M.584, M.592, M.709, M.489, M.392, M.347, M.458, M.464, M.415, M.520, M.410, M.467, M.494, M.374, M.118, M.346, M.318, M.519, M.600, M.254, M.438, M.479, M.523, M.380, M.480, M.371, M.482, M.261, M.108, M.260, M.556, M.461, M.400, M.474, M.490, M.491, M.401, M.470, M.409, M.435, M.553, M.537, M.402, M.481, M.483, M.554, M.538, M.234, M.237, M.264, M.563, M.566, M.532, M.557, M.573, M.549, M.550, M.551, M.558, M.463, M.684, M.739, M.637, M.517, M.712, M.732, M.711, M.730, M.736, M.737, M.247, M.13, M.57, M.61, M.47, M.43, M.32, M.518, M.267, M.73, M.270, M.150, M.366, M.679, M.680, M.230, M.530, M.667, M.505, M.488, M.445, M.436, M.508, M.688, M.613, M.487, M.552, M.572, M.336, M.534, M.213, M.384, M.220, M.147, M.127, M.145, M.33, M.110, M.173, M.50, M.249, M.18, M.5, M.25, M.394, M.329, M.330, M.345, M.323, M.316, M.130, M.131, M.203,

M.227, M.128, M.70, M.292, M.526, M.585, M.681, M.685, M.596, M.660, M.674, M.703, M.504, M.515, M.521, M.493, M.497, M.509, M.533, M.484, M.302, M.478, M.222, M.691, M.510, M.119, M.535, M.543, M.528, M.529, M.373, M.590, M.361, M.432, M.477, M.408, M.568, M.589, M.462, M.516, M.522, M.412, M.4, M.256, M.56, M.55, M.64, M.22, M.148, M.205, M.332, M.171, ME.3566, ME.4276, ME.4056, ME.3805, ME.3720, ME.3916, ME.3855, ME.1412, ME.4234, ME.4088, ME.4115, ME.4210, ME.3897, ME.4229, ME.4231, ME.4280, ME.4281, ME.1571, ME.4190, ME.4230, ME.3882, MN.82, MN.124, MN.169, MN.185, MN.140, MN.201, MN.193, MN.183, MN.184, MN.173, MN.210, MN.206, MN.136, MN.94, MN.83, MN.14, MN.3, MN.46, MN.17, MN.20, MN.12, MN.35, MN.15, MN.38, MN.74, MN.41, MN.67, MN.27, MN.75, MN.47, MN.33, MN.86, MN.59, MN.8, MN.51, MN.62, MN.56, MN.30, MN.81, MN.91, MN.36, MN.71, MN.80, MN.76, MN.96, MN.106, MN.90, MN.57, MN.25, MN.108, MN.186, MN.58, MN.6, MN.77, MN.107, MN.203, MN.204, MN.211, MN.205, MN.68, MN.98, MN.93, MN.113, MN.123, MN.69, MN.178, MN.182, MN.4, MN.166, MN.167, MN.172, MN.168, MN.105, MN.39, MN.194, MN.195, MN.101, MN.116, MN.181, MN.97, MN.54, MN.156, MN.117, MN.163, MN.175, MN.102, MN.202, MN.157, MN.119, MN.114, MN.92, MN.88, MN.153, MN.95, MN.128, MN.122, MN.118, MN.99, MN.72, MN.214, MN.219, MN.220, MN.199, MN.224, MN.218, MN.215, MN.207, MN.223, MN.221, MN.222, MN.216, MN.162, MN.142, MN.158, MN.141, MN.53, MN.111, MN.112, MN.120, MN.130, MN.132, MN.127, MN.121, MN.139, MN.146, MN.64, MN.87, MN.89, MN.37 or MN.164, or subsequence, portion, homologue, variant or derivative thereof.

15. The protein or peptide of any of claims 1 to 14, wherein the protein or peptide is an IgG or IgE reactive antigen or allergen.
16. The protein or peptide of any of claims 1 to 15, wherein the amino acid sequence, subsequence, homologue, or variant modulates a Th2 immune response.
17. The protein or peptide of any of claims 1 to 16, wherein the amino acid sequence, subsequence, homologue, or variant modulates production of a lymphokine or cytokine by a cell.

18. The protein or peptide of any of claims 1 to 17, wherein the amino acid sequence, subsequence, homologue, or variant desensitizes, or elicits, stimulates, induces, improves, increases, or enhances immunological tolerance of a subject to an allergen.
19. The protein or peptide of any of claims 1 to 18, wherein the amino acid sequence, subsequence, homologue, or variant desensitizes, or elicits, stimulates, induces, improves, increases, or enhances immunological tolerance of a subject to a Timothy Grass allergen.
20. The protein or peptide of any of claims 1 to 19, wherein the amino acid sequence, subsequence, homologue, or variant thereof modulates production of a lymphokine, cytokine, IL-5 (interleukin-5), IL-4 (interleukin-4), IL-10 (interleukin-13), IL-13 (interleukin-13), IL-17 (interleukin-17) or IFN- $\gamma$  (interferon-gamma).
21. The protein or peptide of claim 20, wherein the lymphokine, cytokine, IL-5 (interleukin-5), IL-4 (interleukin-4), IL-10 (interleukin-13), IL-13 (interleukin-13), IL-17 (interleukin-17) or IFN- $\gamma$  (interferon-gamma) production is detected by an immunoassay.
22. The protein or peptide of any of claims 1 to 20, wherein the amino acid sequence, subsequence, homologue, or variant increases, induces, elicits, or stimulates a Th2 immune response; increases, induce, elicits or stimulates production of a lymphokine by a cell; or increases, induces, elicits or stimulates production of IL-5 (interleukin-5), IL-4 (interleukin-4), IL-10 (interleukin-13), IL-13 (interleukin-13), IL-17 (interleukin-17) or IFN- $\gamma$  (interferon-gamma).
23. The protein or peptide of claim 22, wherein the Th2 immune response, or lymphokine, IL-5, IL-4, IL-10, IL-13, IL-17 or IFN- $\gamma$  production is determined by contacting peripheral blood mononuclear cells (PBMC) with the protein or peptide followed by an immunoassay.
24. The protein or peptide of any of claims 1 to 23, wherein the amino acid sequence, has a length in a range of about 5-10, 10-15, 15-20, 20-25, 25-30, 30-35, 35-40, 45-50, 50-60, 60-70, 70-80, 90-100, 100-125, 125-150, 150-175, 175-200, 200-250, 250-300, or more amino acid residues.

25. The protein or peptide of any of claims 1 to 23, wherein the amino acid sequence has a length in a range of up to 25 amino acids in length, or from about 7 to 25, 7 to 20; 8 to 30; 8 to 25; 8 to 20; 9 to 30; 9 to 25; 9 to 20; 10 to 30; 10 to 25; or 10 to 30 amino acid residues.
26. The protein or peptide of any of claims 1 to 25, wherein the amino acid sequence, subsequence, homologue, or variant is isolated.
27. The protein or peptide of any of claims 1 to 26, wherein the amino acid sequence, subsequence, homologue, or variant is immobilized on a substrate.
28. The protein or peptide of any of claims 1 to 26, wherein the amino acid sequence, subsequence, homologue, or variant is immobilized on a substrate, and wherein each immobilized amino acid sequence, subsequence, homologue, or variant has a unique or distinct position or address on the substrate.
29. The protein or peptide of claim 27 or claim 28, wherein the substrate comprises glass, silica, plastic, polyethylene, polystyrene, polypropylene, polyacetate, polycarbonate, polyamide, polyester, polyurethane, or polyvinylchloride.
30. A composition comprising the protein or peptide of any of claims 1 to 29.
31. A pharmaceutical composition comprising the protein or peptide of any one of claims 1 to 29.
32. A vaccine composition comprising the protein or peptide of any one of claims 1 to 29.
33. An isolated nucleic acid encoding the protein or peptide of any one of the above-mentioned embodiments.
34. An isolated nucleic acid encoding the protein or peptide of any one of claims 1 to 29.
35. A cell expressing the protein or peptide of any one of the above-mentioned embodiments.

36. A cell expressing the protein or peptide of any one of claims 1 to 29.
37. The cell of claim 35 or 36, wherein the cell is a eukaryotic or prokaryotic cell.
38. The cell of claim 35 or 36, wherein the cell is a mammalian, insect, fungal or bacterium cell.
39. A method of modulating immune activity of a cell against a Timothy Grass allergen or antigen, the method comprising contacting the cell with an amount of the protein or peptide of any one of the above-mentioned embodiments, sufficient to modulate the immune activity of the cell against the Timothy Grass allergen or antigen
40. A method of modulating immune activity of a cell against a Timothy Grass allergen or antigen, the method comprising contacting the cell with an amount of the protein or peptide of any one of claims 1 to 29, sufficient to modulate the immune activity of the cell against the Timothy Grass allergen or antigen.
41. A protein or peptide of any one of of claims 1 to 29, for use in modulating immune activity of a cell against a Timothy Grass allergen or antigen.
42. Use of the protein or peptide of any one of the above-mentioned embodiments, for manufacture of a medicament to modulate the immune activity of a cell against a Timothy Grass allergen or antigen.
43. Use of the protein or peptide of any one of claims 1 to 29, for manufacture of a medicament to modulate the immune activity of a cell against a Timothy Grass allergen or antigen.
44. The method of any of claims 39 to 43, wherein the method or use comprises inducing, eliciting, increasing or improving in the cell immunological tolerance to the Timothy Grass allergen or antigen.
45. A method of modulating an immune response against a Timothy Grass allergen in a subject, the method comprising administering to the subject an amount of the protein or peptide of any one of the above-mentioned embodiments, sufficient to modulate the immune response against the Timothy Grass allergen in the subject.

46. A method of modulating an immune response against a Timothy Grass allergen in a subject, the method comprising administering to the subject an amount of the protein or peptide of any one of claims 1 to 29, sufficient to modulate the immune response against the Timothy Grass allergen in the subject.
47. A protein or peptide of any one of claims 1 to 29, for use to modulate an immune response against an allergen in a subject.
48. Use of the protein or peptide of any one of claims 1 to 29, for manufacture of a medicament to modulate an immune response against an allergen in a subject.
49. A method of desensitizing or inducing, eliciting, increasing or improving immunological tolerance of a subject to a Timothy Grass protein or peptide allergen comprising administering to the subject an amount of the protein or peptide of any one of the above-mentioned embodiments sufficient to desensitize or induce, elicit, increase or improve tolerance of the Timothy Grass protein or peptide allergen by the subject.
50. A method of desensitizing or inducing, eliciting, increasing or improving immunological tolerance of a subject to a Timothy Grass protein or peptide allergen comprising administering to the subject an amount of the protein or peptide of any one of claims 1 to 29 sufficient to desensitize or induce, elicit, increase or improve tolerance of the Timothy Grass protein or peptide allergen by the subject.
51. A protein or peptide of any one of claims 1 to 29, for use to desensitize or to induce, elicit, increase or improve tolerance of a Timothy Grass allergen by a subject.
52. Use of a protein or peptide of any one of claims 1 to 29, for manufacture of a medicament to desensitize or to induce, elicit, increase or improve tolerance of a Timothy Grass allergen by a subject.
53. A method of reducing risk or providing a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease, comprising administering to the subject an amount of the protein or peptide of any one of the

above-mentioned embodiments sufficient to reduce risk or provide the subject with protection against the allergic reaction, allergic response, allergic disorder or allergic disease.

54. A method of reducing risk or providing a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease, comprising administering to the subject an amount of the protein or peptide of any one of claims 1 to 29 sufficient to reduce risk or provide the subject with protection against the allergic reaction, allergic response, allergic disorder or allergic disease.
55. A protein or peptide of any one of claims 1 to 29, for use to reduce risk or provide a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease.
56. Use of the protein or peptide of any one of claims 1 to 29, for manufacture of a medicament to reduce risk or provide a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease.
57. The protein or peptide of any one of the above-mentioned embodiments, for use in reducing risk or providing a subject with protection against an allergic reaction, allergic response, allergic disorder or allergic disease.
58. The protein or peptide of any one of claims 1 to 29, for use in reducing risk or providing a subject with protection against an allergic reaction, allergic response, allergic disorder or allergic disease.
59. A method of treating an allergic reaction, allergic response, allergic disorder or allergic disease, comprising administering to the subject an amount of the protein or peptide of any one of the above-mentioned embodiments, sufficient to treat the subject for the allergic response, allergic disorder or allergic disease.
60. A method of treating an allergic reaction, allergic response, allergic disorder or allergic disease, comprising administering to the subject an amount of the protein or peptide of any one of claims 1 to 29, sufficient to treat the subject for the allergic response, allergic disorder or allergic disease.

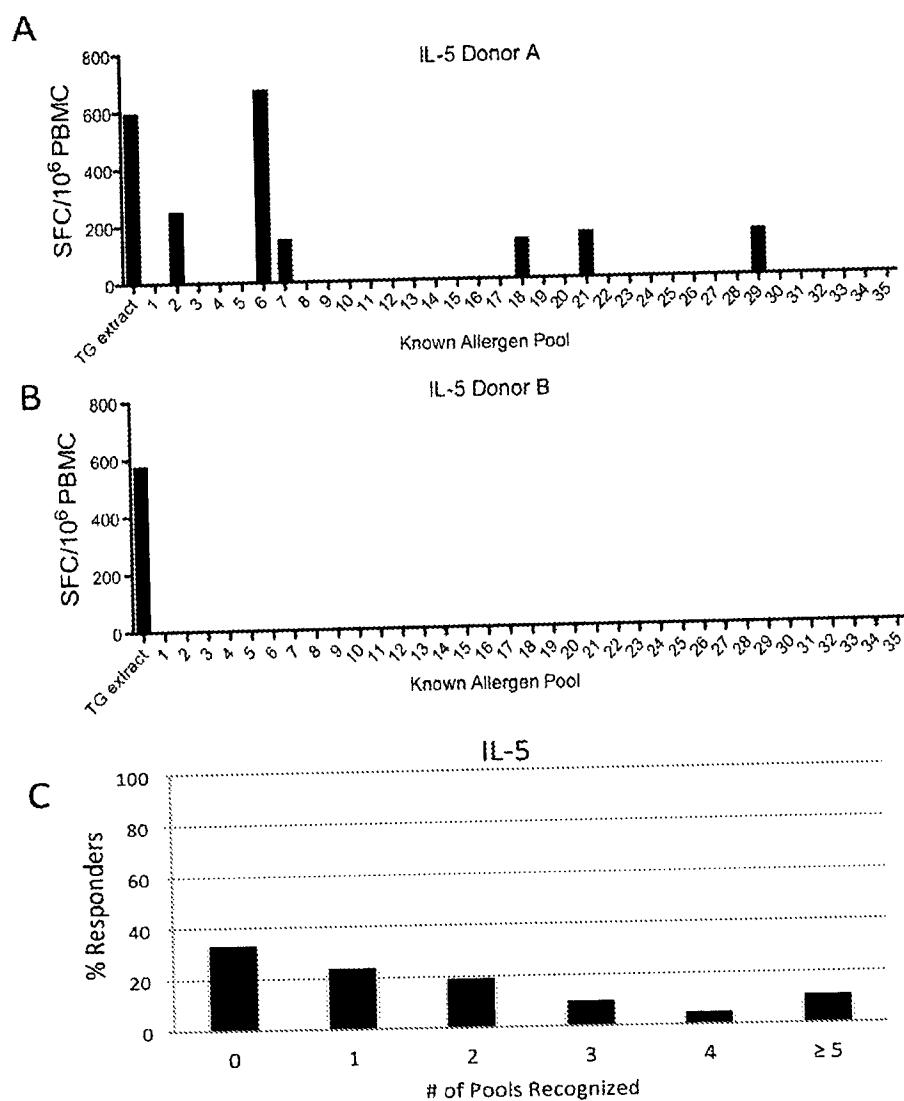
61. A protein or peptide of any one of claims 1 to 29, for use to treat an allergic reaction, allergic response, allergic disorder or allergic disease.
62. Use of the protein or peptide of any one of claims 1 to 29, for manufacture of a medicament to treat an allergic reaction, allergic response, allergic disorder or allergic disease.
63. The protein or peptide of any one of the above-mentioned embodiments, for use in treating an allergic reaction, allergic response, allergic disorder or allergic disease of a subject.
64. The protein or peptide of any one of claims 1 to 29, for use in treating an allergic reaction, allergic response, allergic disorder or allergic disease of a subject.
65. The method or use according to any one of claims 39 to 64, comprising administering to the subject or use of an amount of a Timothy Grass protein or peptide that is an IgG, IgA, IgM or IgD reactive antigen or allergen.
66. The method or use according to any one of claims 39 to 64, wherein the allergic reaction or allergic response comprises allergic rhinitis, chest pain or tightness, coughing, wheezing, irritated or itchy eyes, sinus congestion and runny nose.
67. The method or use of any one of claims 39 to 66, wherein the method or use desensitizes or induces, elicits, increases or improves immunological tolerance of a subject to an organism or product of an organism set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6.
68. The method or use of any one of claims 39 to 67, wherein the method or use comprises repeatedly contacting the cell with the protein or peptide, or repeatedly administering the protein or peptide to the subject, multiple times.

69. The method or use of any one of claims 39 to 68, wherein the protein or peptide is administered cutaneously, subcutaneously, intramuscularly, intravenously, orally, mucosally, by inhalation or nasally.
70. The method or use of any one of claims 39 to 64, wherein the allergic reaction or allergic response is caused by or associated with Timothy Grass exposure or another Grass of the order Poales, contact with a Timothy Grass allergen or contact with an allergen homologous to Timothy Grass allergen.
71. A method of detecting a Timothy Grass allergic response, or diagnosing a Timothy Grass allergy in a subject, the method comprising:
  - i. contacting a cell from the subject with a protein or peptide of any of claims 1 to 29; and
  - ii. determining if the protein or peptide modulates an immune response or activity from the contacted cell;wherein determination that the protein or peptide modulates an immune response or activity from the contacted cell detects an allergic response or indicates that the subject has a Timothy Grass allergic response or a Timothy Grass allergy.
72. The method of claim 71, wherein the allergic response or allergy comprises a Timothy Grass allergic response or allergy.
73. The method of claim 71, wherein the allergic response or allergy comprises a Timothy Grass allergic response or allergy.
74. The method of claim 71, wherein the modulation of immune response or activity is determined by assaying for a hypersensitive reaction or response.
75. The method of claim 71, wherein the modulation of immune response or activity is determined by assaying for a cutaneous immunological hypersensitive reaction.
76. The method or use of any one of claims 39 to 75, wherein the subject is a mammal.
77. The method or use of any one of claims 39 to 75, wherein the subject is a human.

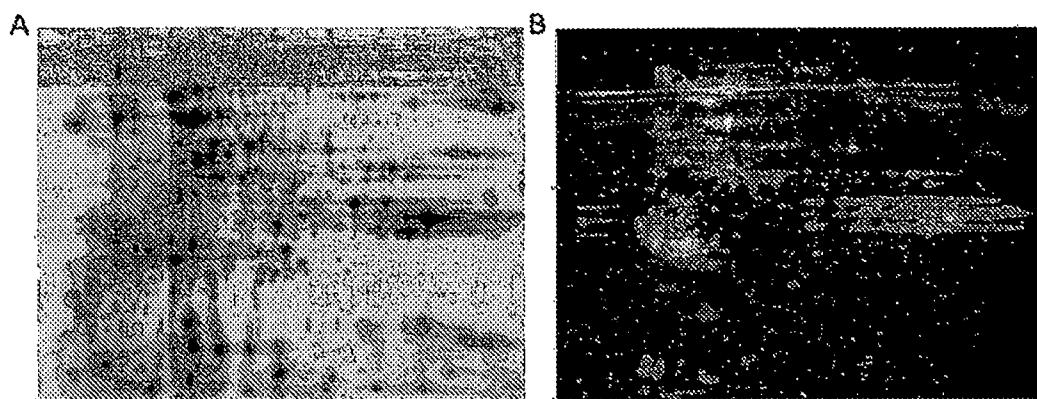
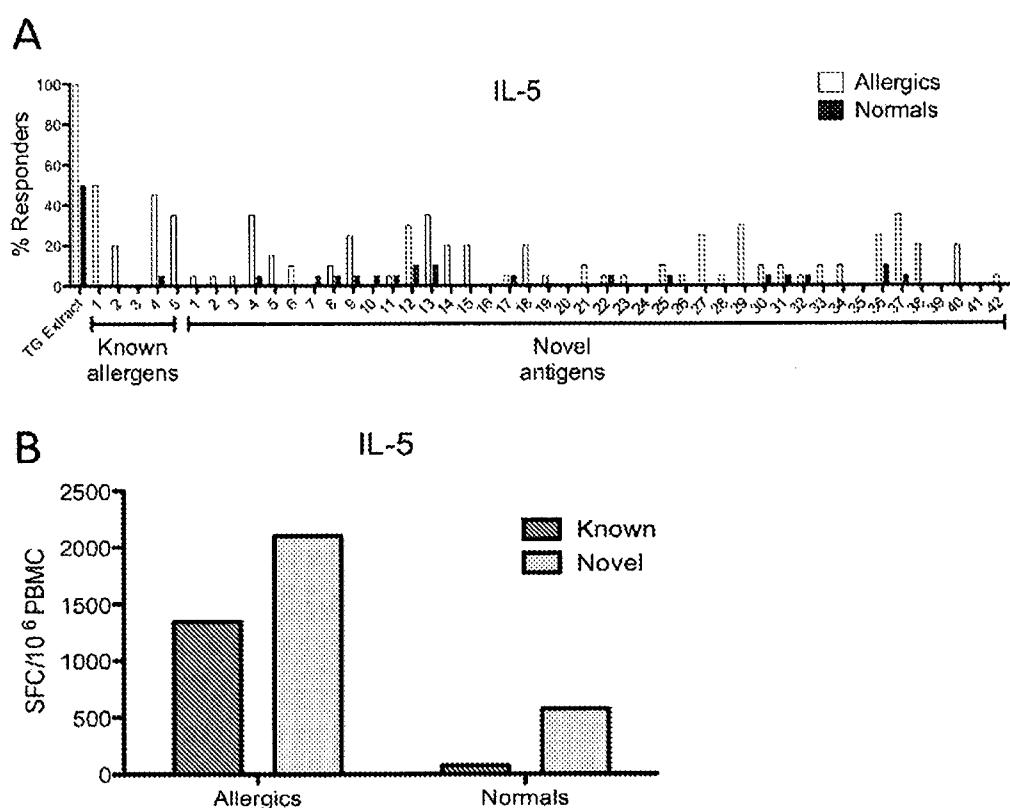
78. The method of claim 77, wherein skin of the subject is contacted.
79. The method or use of any one of claims 39 to 75, wherein the subject has exhibited a symptom of, or suffers from, an allergic reaction, allergic response, allergic disorder or allergic disease.
80. The method or use of any one of claims 39 to 75, wherein the subject has, has previously had or is at risk of having asthma or hypersensitivity to an allergen
81. The method or use of any one of claims 39 to 75, wherein the subject has had an allergic reaction or allergic response to an allergen derived from or produced by Timothy Grass or another Grass of the order Poales.
82. The method or use of any one of claims 39 to 75, wherein the subject has had an allergic reaction or allergic response to an amino acid sequence set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6.
83. The method or use of any one of claims 39 to 75, wherein the subject is allergic to an allergen derived from or produced by Timothy Grass selected from Phl p 1, Phl p 5, Phl p6 or a homologous allergen or antigen thereto.
84. A kit, comprising a compartment and instructions
  - A) wherein the compartment comprises:
    - i) one or more amino acid sequences of an organism set forth in Table 1 (SEQ ID NOS 1-620, respectively, in order of appearance), Table 2 (SEQ ID NOS 621-1442, respectively, in order of appearance), Table 4 (SEQ ID NOS 1443-2264, respectively, in order of appearance) or Table 6, or a subsequence, homologue, or variant thereof; and
  - B) wherein the instructions are for use in any of:
    - ii) modulating an immune response or activity of a cell against an allergen;
    - iii) modulating an immune response against an allergen in a subject;
    - iv) desensitizing, or inducing, eliciting, increasing or improving immunological tolerance to a protein or peptide allergen;

- v) reducing risk or providing a subject protection against an allergic reaction, allergic response, allergic disorder or allergic disease;
- vi) treating an allergic reaction, allergic response, allergic disorder or allergic disease; or
- vii) detecting an allergic response or diagnosing an allergy in a subject.

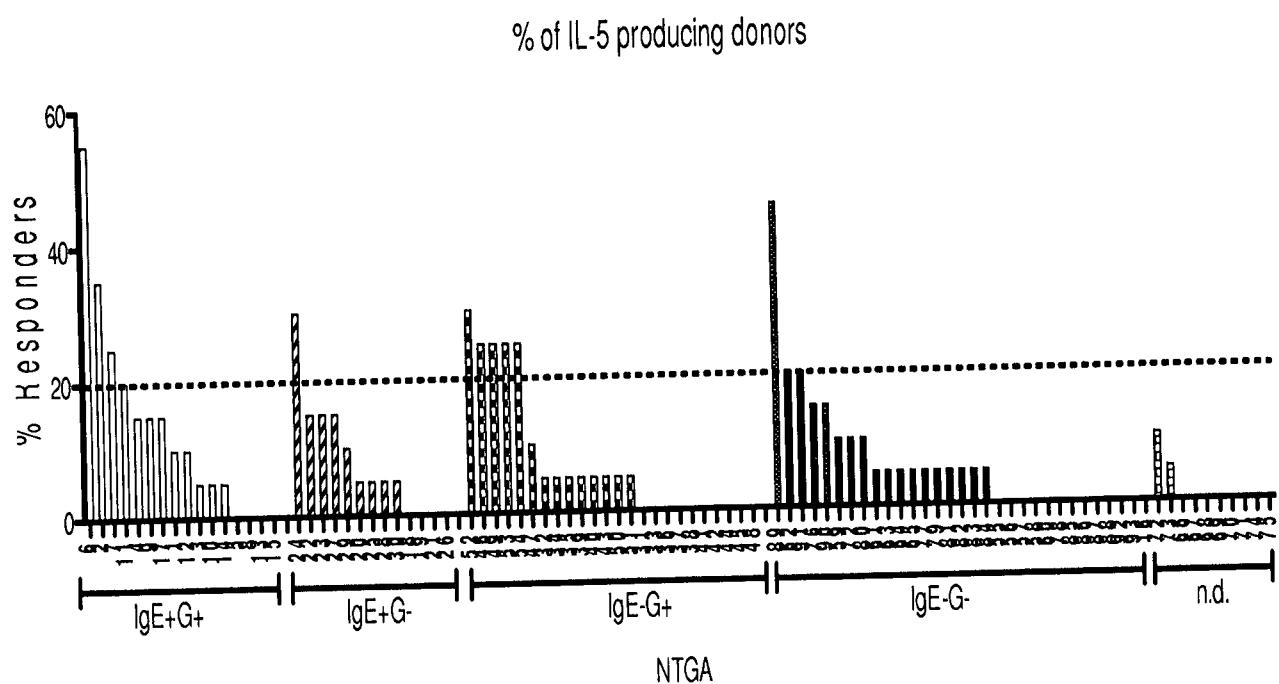
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**Figure 1.**

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**Figure 2.****Figure 3.**

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**Figure 4.**

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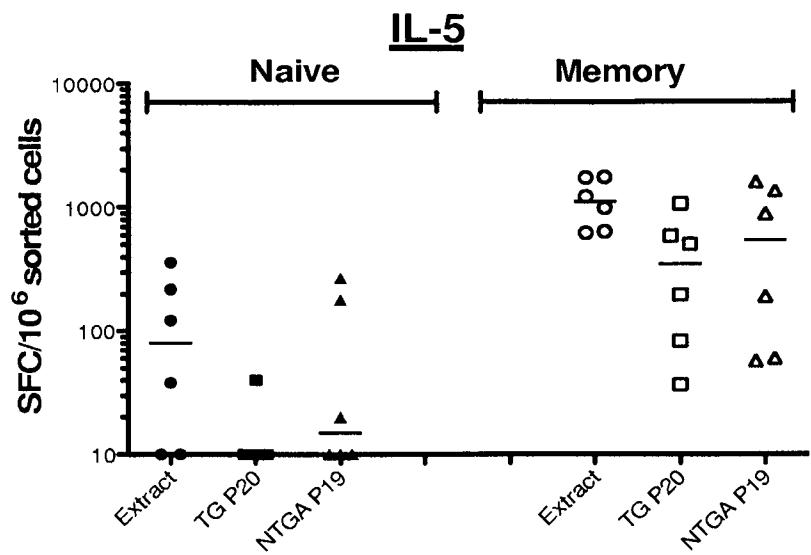


Figure 5.

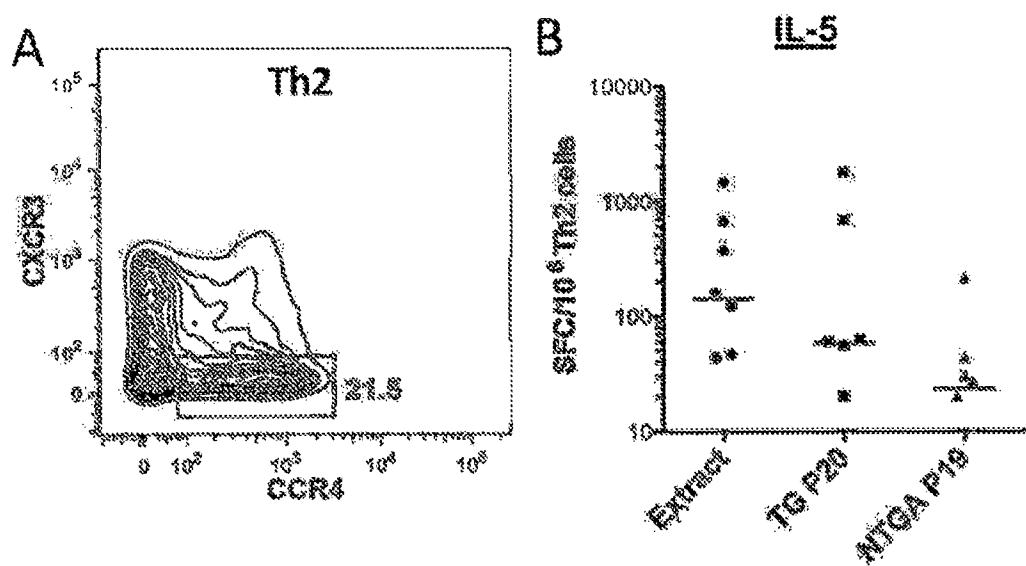


Figure 6

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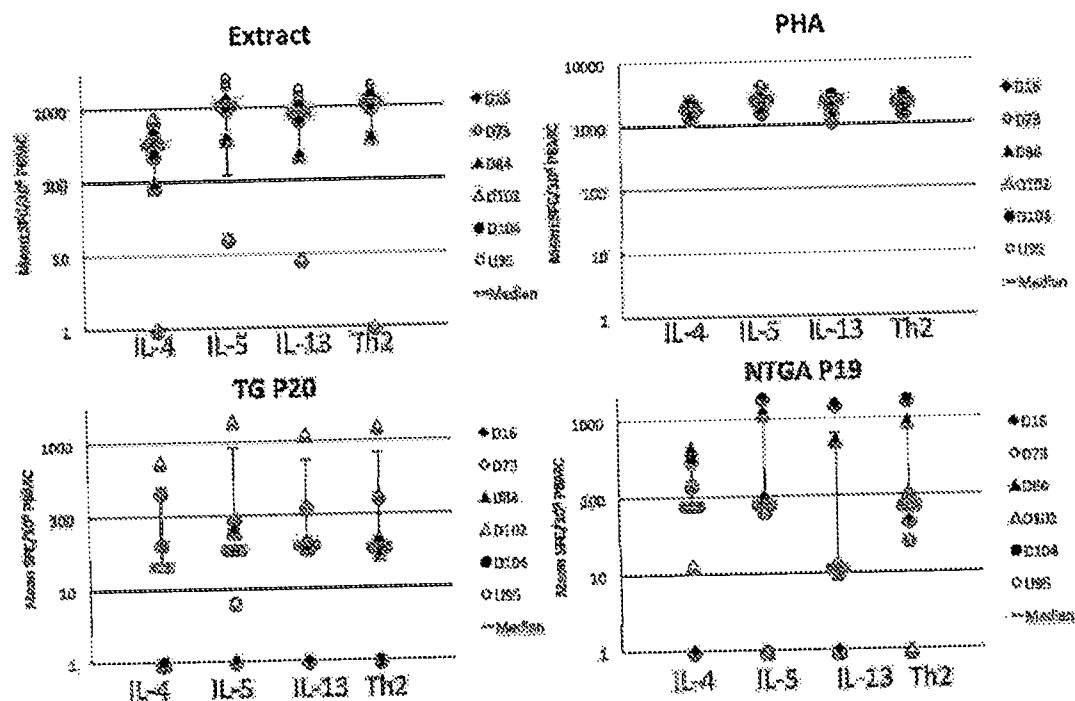


Figure 7

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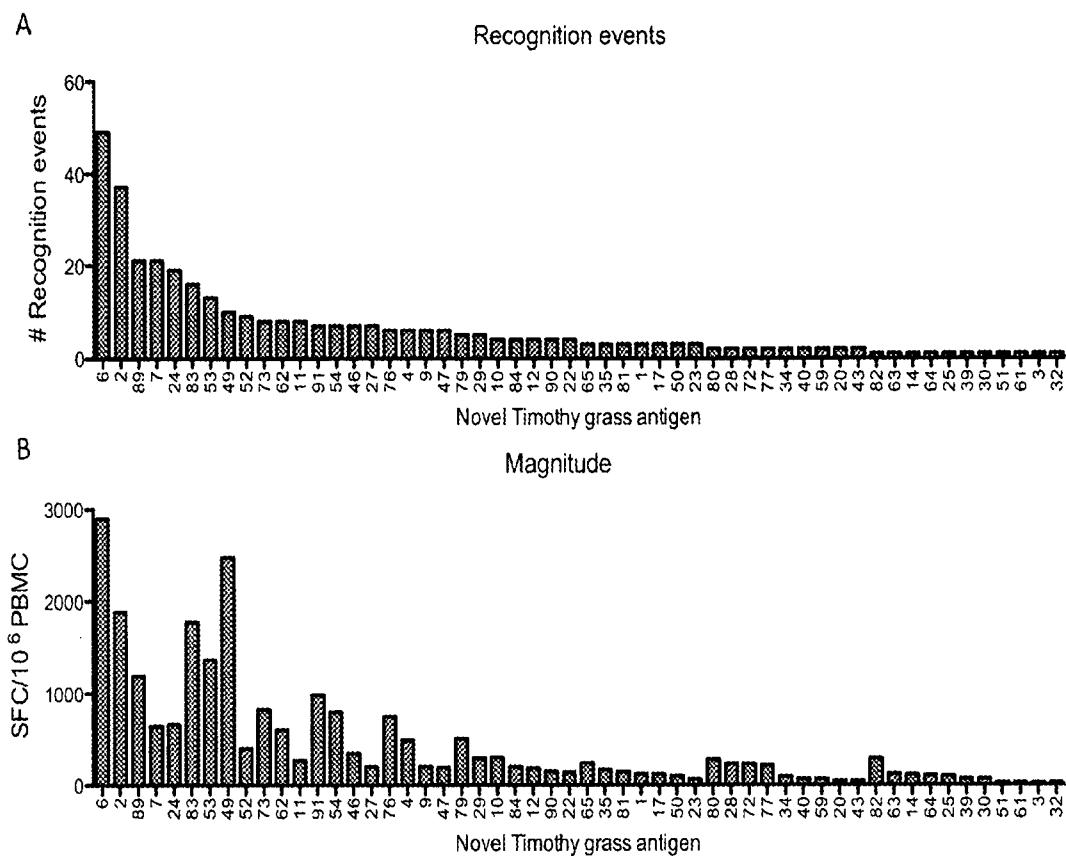


Figure 8

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/25213

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61K 39/35; A61K 38/16 (2013.01)

USPC - 424/275.1; 514/21.2

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

USPC- 424/275.1; 514/21.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
USPC- 435/69.3; 530/350; 530/868Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
PubWEST(PGPB,USPT,USOC,EPAB,JPAB); Google, Google Scholar: Timothy Grass, allergen, Phleum pratense, kit, instruction  
GenCore 6.4.1: SEQ ID NO: 1

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	UniProt Direct Submission. Q7XAS6_CYNDA. Proteomics and immunological analyses of a novel allergen, Cyn d 22, from Bermuda grass pollen. (14 December 2011) [Retrieved from the Internet 07 June 2013: <http://www.uniprot.org/uniprot/Q7XAS6.txt?version=44>]	1, 2, 5 84
Y	US 2011/0217325 A1 (O'HEHIR, et al.) 08 September 2011 (08.09.2011) Abstract, para [0005], [0014]-[0034], 30-45	84
A	US 2011/0293665 A1 (BORDAS, et al.) 01 December 2011 (01.12.2011) para [0091]	1, 2, 5, and 84
A	US 2011/0097361 A1 (Tang) 28 April 2011 (28.04.2011) para [0037], claims 28-30	1, 2, 5, and 84
A	US 2008/0193535 A1 (Jacobi, et al.) 14 August 2008 (14.08.2008) para [0109], [0282], [0298], [0303]-[0308]; claims 1, 2, 4-47	1, 2, 5, and 84
A	Vrtala, et al. cDNA cloning of a major allergen from timothy grass (Phleum pratense) pollen; characterization of the recombinant Phl pV allergen. J Immunol. 1993, 151(9):4773-81	1, 2, 5, and 84
A	Rossi, et al. Evaluation of IgE antibodies to recombinant pollen allergens (Phl p 1, Phl p 2, and Phl p 5) in a random sample of patients with specific IgE to Phleum pratense. Allergy 2000, 55(2):181-184	1, 2, 5, and 84

Further documents are listed in the continuation of Box C.

• Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  
07 June 2013 (07.06.2013)Date of mailing of the international search report  
18 JUN 2013Name and mailing address of the ISA/US  
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents  
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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US 13/25213

**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3.  Claims Nos.: 7-83 because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I+: claims 1-6 and 84, drawn to a protein or peptide comprising, consisting of or consisting essentially of a Timothy Grass amino acid sequence, or a subsequence, homologue, or variant thereof. The first invention (claims 1, 2, 5, 6, and 84) is restricted to SEQ ID NO: 1. Should an additional fee be paid, Applicant is invited to elect an additional SEQ ID NO(s) to be searched. e. g., SEQ ID NO: 2. Exact claims to be searched will depend on the election. Failure to clearly identify how any paid additional invention fees are to be applied to the "+" group(s) will result in only the first claimed invention to be searched/examined.

[NOTE: Claim 6 was excluded from the search, because it depends from claim 3 and is drawn to a non-elected subject matter.]

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

1.  As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2.  As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3.  As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
  
4.  No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1, 2, 5, and 84, restricted to SEQ ID NO: 1

**Remark on Protest**

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US 13/25213

## \*\*\*\*\* Supplemental Sheet \*\*\*\*\*

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

The inventions listed as Groups I+ do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of the inventions of Group I+ is the specific amino acid sequence recited therein. This is not a shared special technical feature because no significant structural similarities can readily be ascertained among the sequences, as evidenced by US 2011/0131684 A1 to Sanz Molinero, et al. that discloses a homologue of SEQ ID NO: 1 (SEQ ID NO 214, amino acids 57-446, 96.4% identity) and US 2006/0075522 A1 to Abad, et al. that discloses the claimed SEQ ID NO: 621 (SEQ ID NO 13971, amino acids 19-33, 100% identity).

The inventions of Group I+ share the technical feature of a Timothy Grass protein or peptide allergen. However, this shared technical feature does not represent a contribution over prior art as being anticipated by an article titled "cDNA cloning of a major allergen from timothy grass (*Phleum pratense*) pollen; characterization of the recombinant *Phl pV* allergen" by Vrtala, et al. (J Immunol. 1993, 151(9):4773-4781) (hereinafter "Vrtala") that discloses a "grass pollen allergen from a timothy grass (*Phleum pratense*) pollen ... The purified r*Phl p V* induced specific histamine release of blood basophils from grass pollen-allergic patients. This emphasizes the usefulness of the r*Phl p V* for diagnostic and therapeutic purposes and corroborates the view that specific diagnosis and therapy of type I allergy could be performed with a limited panel of relevant recombinant allergens" (Abstract). As said method would have been obvious to one of ordinary skill in the art at the time of the invention, this cannot be considered a special technical feature that would otherwise unify the groups.

Without a shared special technical feature, the inventions lack unity with one another. Therefore, Groups I+ lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.

## 说 明 书 摘 要

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本发明涉及梯牧草蛋白质和肽、其子序列、部分、同源物、变体及衍生物以及梯牧草蛋白质和肽的方法和用途。方法包括例如调节免疫反应；针对变态反应、过敏性疾病或变应性疾病保护受试者或治疗受试者；和在受试者中诱导针对变应原的免疫耐受性。