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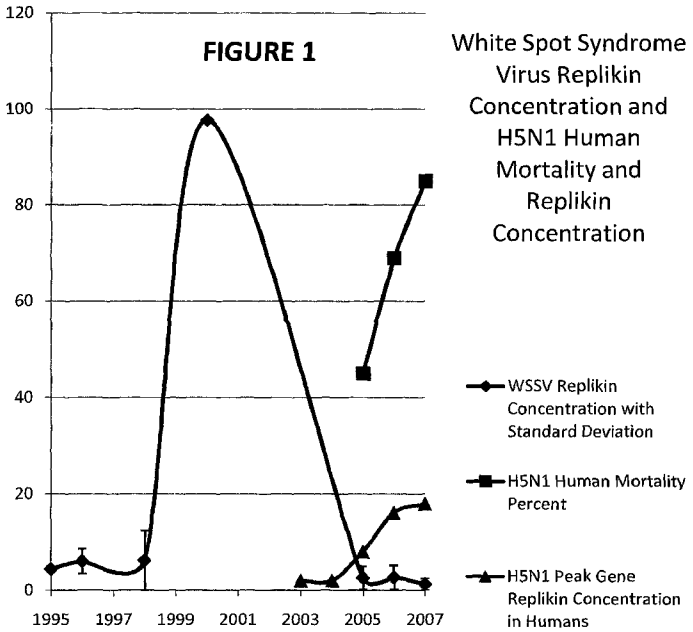
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(54) **Title:** A METHOD OF PREDICTING INFLUENZA OUTBREAKS BY CORRELATING AN INCREASE IN REPLIKIN COUNT IN SHRIMP WHITE SPOT SYNDROME VIRUS AND/OR TAURA SYNDROME VIRUS




(57) **Abstract:** The present invention provides a method of predicting outbreaks in influenza virus comprising monitoring concentrations of small peptides having defined structure in influenza viruses, and in particular viral pathogens of shrimp.

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# A METHOD OF PREDICTING INFLUENZA OUTBREAKS BY CORRELATING AN INCREASE IN REPLIKIN COUNT IN SHRIMP WHITE SPOT SYNDROME VIRUS AND/OR TAURA SYNDROME VIRUS

**[0001]** This application claims priority to U.S. Provisional Appln. Ser. No. 60/935,816, filed August 31, 2007, U.S. Provisional Appln. Ser. No. 60/935,499 filed August 16, 2007, U.S. Provisional Appln. Ser. No. 60/954,743, filed August 8, 2007, U.S. Provisional Appln. Ser. No. 60/898,097, filed January 30, 2007, U.S. Provisional Appln. Ser. No. 60/880,966, filed January 18, 2007, and U.S. Provisional Appln. Ser. No. 60/853,744, filed October 24, 2006, each of which is incorporated herein by reference in its entirety. This application additionally incorporates herein by reference: U.S. Appln. Ser. No. 11/355,120, filed February 16, 2006, U.S. Appln. Ser. No. 11/755,597, filed May 30, 2007, U.S. Appln. Ser. No. 11/116,203, filed April 28, 2005, U.S. Appln. Ser. No. 10/860,050, filed June 4, 2004, U.S. Appln. Ser. No. 10/189,437, filed July 8, 2002, U.S. Appln. Ser. No. 10/105,232, filed March 26, 2002, now U.S. Patent No. 7,189,800, U.S. Appln. Ser. No. 09/984,057, filed October 26, 2001, and U.S. Appln. Ser. No. 09/984,056, filed October 26, 2001, now U.S. Patent No. 7,176,275, each in its entirety.

## TECHNICAL FIELD OF THE INVENTION

**[0002]** This invention relates generally to predicting influenza outbreaks through monitoring quantitative changes in the concentration of a class of peptide sequences known as Replikins in virus proteins, protein fragments, or genomes.

## BACKGROUND OF THE INVENTION

**[0003]** Rapid replication is characteristic of virulence in, among other things, certain bacteria, viruses and malignancies. The inventors have described a quantitative chemistry common to rapid replication in different viruses and organisms. The chemistry of rapid replication described by the inventors is present in a family of conserved small protein sequences related to rapid replication, Replikins. An increase in the concentration of these Replikin sequences encoded in the genome of different strains of influenza virus has been correlated with an increase in the virulence of influenza. A correlation between increased concentrations of Replikin sequences and increased replication and virulence has likewise been observed in a range of viruses and organisms. Replikin sequences offer new targets for developing effective methods of predicting and treating influenza outbreaks. There continues to exist a particular need in the art for methods of predicting viral outbreaks.

**[0004]** Influenza is an acute respiratory illness of global importance. Despite international attempts to control influenza virus outbreaks through vaccination, influenza infections remain an important cause of morbidity and mortality. Worldwide influenza pandemics have occurred at irregular and previously unpredictable intervals throughout history and it is expected that influenza pandemics will continue to occur in the future. The impact of pandemic influenza is substantial in terms of morbidity, mortality and economic cost.

**[0005]** Influenza vaccines remain the most effective defense against influenza virus, but because of the ability of the virus to mutate, and the availability of non-human host reservoirs, it is expected that influenza will remain an emergent or re-emergent infection. Global influenza surveillance indicates that influenza viruses may vary within a country and between countries and continents during an influenza season. Virologic surveillance is of importance in monitoring antigenic shift and drift. Disease surveillance is also important in assessing the impact of epidemics. Both types of information have provided the basis of vaccine composition and use of antivirals. However, there has traditionally been only annual post hoc hematological classification of the increasing number of emerging influenza virus strains, and no specific chemical structure of the viruses was traditionally identified as an indicator of approaching influenza epidemic or pandemic. Until recently, the only basis for annual classification of influenza virus as active, inactive or prevalent in a given year was the activities of the virus hemagglutinin and neuraminidase proteins.

**[0006]** The small peptide structure called Replikins has now been identified within influenza virus proteins and correlated with an increase in virulence. A Replikin sequence is an amino acid sequence of 7 to about 50 amino acids comprising a Replikin motif. A Replikin motif comprises (1) at least one lysine residue located at a first terminus of the motif and at least one lysine residue or at least one histidine residue located at a second terminus of the motif; (2) a first lysine residue located six to ten residues from a second lysine residue; (3) at least one histidine residue; and (4) at least 6% lysine residues. A Replikin sequence may comprise a terminal lysine and may further comprise a terminal lysine or a terminal histidine. A Replikin peptide or Replikin protein is a peptide or protein consisting of a Replikin sequence.

**[0007]** Higher concentrations of Replikin sequences in the genomic code are associated with a variety of infectious agents including HIV, plant viruses, and a range of pathogenic animal and human viruses including flu viruses. Further, the correlation between the concentration of Replikin sequences in viral or organismal proteins and major outbreaks of disease is significant. Replikin sequences generally have been found to be conserved in both intrastrain and interstrain influenza viruses for as long as 89 years based on data going back to the 1917-18 flu pandemic.

Concentration of Replikin sequences in viral genomes has been shown to increase prior to strain-specific flu outbreaks.

**[0008]** Within the last century there have been three influenza pandemics, each strain specific: H1N1 in 1918; H2N2 in 1957; and H3N2 in 1968. The inventors have established that prior to each pandemic there was a strain-specific increase in the concentration of Replikin sequences within the strain. The strain-specific increase in Replikin concentration was followed by a decrease in Replikin concentration and several years later a rebound increase in Replikin concentration associated with a strain-specific rebound epidemic. The Replikin algorithm provided the first chemistry that correlated with influenza epidemics and pandemics.

**[0009]** A similar correlation between the outbreaks of H5NI (Bird Flu) between 1997 and 2007 and the concentration of Replikin sequences in the viral proteins during each of those years has been demonstrated. Likewise, a correlation has been established between the global outbreak of SARS coronavirus in 2003 and an increase in the concentration of Replikin sequences in the proteins of coronavirus. In another study, Replikins in two strains of human HIV-1 virus demonstrated that the Replikin concentration in the rapidly replicating strain was six fold greater than that of a slowly replicating strain. No instances of rapid replication have been observed in all the viruses and organisms examined wherein the Replikin concentration did not significantly increase as compared to the Replikin concentration in the dormant state.

**[00010]** The highest concentration of Replikin sequences in an organism or virus that has to date been analyzed and reported is 111 Replikin sequences per 100 amino acids in the extraordinarily-rapidly-replicating parasitic protozoa *Plasmodium falciparum* (reportedly responsible for 90% of malarial deaths in humans) (herein sometimes referred to as malaria). *P. falciparum* has been observed to replicate 11,000 times in 48 hours during passage of the parasite from liver to blood in the host.

**[00011]** It has been believed that changes in the activity of different influenza strains are related to random sequence changes in influenza hemagglutinins, which in turn are the products of substitutions effected by one of two poorly understood processes: i) antigenic drift, thought to be due to the accumulation of a series of point mutations in the hemagglutinin molecule, or ii) antigenic shift, in which the changes are so great that genetic reassortment is postulated to occur between the viruses of human and non-human hosts. The data provided by the inventors suggests that change in activity in different influenza strains, rather than being related to non-specific random sequence changes, is based upon, or related to, an increase in concentration of strain-specific Replikins. Data were also examined for insight into which sequence changes were due to "drift" or "shift" and which were due to conservation, storage in "reservoirs," and

reappearance. The data has shown that the epidemic-related increase in Replikin concentration is not due to the duplication of existing Replikins in the hemagglutinin of the emerging strain, but, instead is due to the reappearance of at least one Replikin composition from 1 to up to 59 years after its disappearance, plus (in the A strains only) the emergence of new strain-specific Replikin compositions. *See* U.S. Patent 7,189,800 issued March 13, 2007 (Tables 3-6).

**[00012]** In monitoring Replikin sequences in influenza virus, the inventors have additionally identified a sub-family of conserved Replikin sequences known as Replikin Scaffolds or Replikin Scaffold sequences. Replikin Scaffolds were initially identified in conserved structures in particularly virulent influenza viruses. Included among these strains were the viruses causing the pandemics of 1918, 1957, 1968 and virulent strains of the H5N1 "bird flu" strain of influenza virus. Analogues of Replikin Scaffold sequences have since been identified in the virulent and rapidly replicating SARS coronavirus. See U.S. Published Application No. 2007/0026009.

**[00013]** Scaffolding of Replikin sequences homologous but not identical to the algorithm of the identified Replikin Scaffold has also been identified in *P. falciparum*. Replikin scaffolding in general has been related to an increase in Replikin concentrations in pathogenic genomes where it has been identified. In *P. falciparum*, scaffolding contributes significantly to the very high Replikin concentration noted in the proteins of the protozoa.

**[00014]** There is a need in the art for methods of predicting increases in virulence of influenza prior to outbreaks. There is likewise a need in the art for methods of preventing and treating outbreaks caused by virulent strains of influenza. Because of the annual administration of influenza vaccines and the short period of time when a vaccine can be administered, strategies directed at improving vaccine coverage are of critical importance.

## SUMMARY OF THE INVENTION

**[00015]** The present invention provides a method of determining an increased probability of an outbreak of influenza virus within about one to about three years following an increase in Replikin concentration in an isolate of White Spot Syndrome Virus or an isolate of Taura Syndrome Virus comprising identifying said increase in the concentration of Replikin sequences in at least one first isolate of White Spot Syndrome Virus or Taura Syndrome Virus as compared to at least one other isolate of White Spot Syndrome Virus or Taura Syndrome Virus wherein said at least one first isolate is isolated at least six months later than said at least one other isolate is isolated and wherein when said at least one first isolate is a White Spot Syndrome Virus isolate said at least one other isolate is a White Spot Syndrome Virus isolate and when said at least one first isolate is a Taura Syndrome Virus isolate said at least one other isolate is a Taura Syndrome

Virus isolate, and wherein said increase in the concentration of Replikin sequences signifies the increased probability of the outbreak of influenza virus within about one to about three years following said increase in the concentration of Replikin sequences.

**[00016]** In an embodiment of the method of determining an increased probability of an outbreak of influenza virus, said identification of an increase in Replikin concentration in said at least one first isolate comprises (1) determining the concentration of Replikin sequences in (i) a plurality of isolates of White Spot Syndrome Virus wherein said at least one first isolate has been isolated about six months to about three years later than said at least one other of said isolates of White Spot Syndrome Virus, or (ii) a plurality of isolates of Taura Syndrome Virus wherein said at least one first isolate of Taura Syndrome Virus is isolated about six months to about three years later than at least one other isolate of Taura Syndrome Virus.

**[00017]** An embodiment of the present invention provides a method of determining an increased probability of an outbreak of influenza virus comprising:

(1) obtaining a plurality of isolates of White Spot Syndrome Virus or a plurality of isolates of Taura Syndrome Virus wherein at least one of said isolates of White Spot Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of White Spot Syndrome Virus or wherein at least one of said isolates of Taura Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of Taura Syndrome Virus;

(2) analyzing the amino acid sequence of at least one encoded protein or protein fragment or a combination of encoded proteins and/or protein fragments in each isolate of the plurality of isolates of White Spot Syndrome Virus or the plurality of isolates of Taura Syndrome Virus for the presence and concentration of encoded Replikin sequences;

(3) comparing the concentrations of encoded Replikin sequences in the at least one protein or protein fragment or in the combination of proteins or protein fragments in each isolate of the plurality of isolates of White Spot Syndrome Virus or in each isolate of the plurality of isolates of Taura Syndrome Virus;

(4) identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or greater; and

(5) predicting an outbreak of influenza within about one to about three years following said identified increase in the concentration of Replikin sequences in said isolates of White Spot Syndrome Virus or in the concentration of Replikin sequences in said isolates of Taura Syndrome Virus.

**[00018]** In a further embodiment of the invention, the increase in concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or greater is an increase in the mean concentration of at least two isolates as compared to at least two other isolates isolated at a later time point of about six months or greater. In a further embodiment, the increase in concentration is an increase in the mean concentration of at least 10 isolates as compared to at least 10 other isolates. In a further embodiment, the increase in concentration is an increase in the mean concentration of all isolates available at a given time point as compared to all isolates available at another given time point, wherein said time points are separated by about six months or greater. In a further embodiment, the mean concentration of said plurality of isolates is increased over the at least one time period when the mean concentration of the isolates at a later time point is greater than the mean concentration plus one standard deviation of the earlier isolates. In a further embodiment, the mean concentration of said plurality of isolates is increased over the at least one time period when the mean concentration of the isolates at a later time point is greater than the mean concentration plus two standard deviations of the earlier isolates. In a further embodiment of the invention, analyzing the combination of encoded proteins and/or protein fragments preferably comprises all amino acid sequences available for White Spot Syndrome Virus or all amino acid sequences available for Taura Syndrome Virus at a given time point, such as, for example, all amino acid sequences available in a first year and all amino acid sequences available in some other year. In another embodiment, the combination comprises at least 100 amino acid sequences. In another embodiment, the combination comprsises at least 50 amino acid sequences. In another embodiment, the combination comprises at least 10 amino acid sequences. In another embodiment, the combination comprises at least 2 amino acid sequences.

**[00019]** In further embodiment of the invention, the method of predicting the outbreak of influenza virus may further comprise:

(1) identifying at least one Replikin Scaffold sequence present in at least one isolate of the plurality of isolates of White Spot Syndrome Virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of White Spot Syndrome Virus over a time period of about six months or greater or identifying at least one Replikin Scaffold sequence present in at least one isolate in the plurality of isolates of Taura Syndrome Virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of Taura Syndrome Virus over a time period of about six months or greater;

(2) identifying at least one Replikin Scaffold sequence present in at least one isolate of a strain of influenza virus, wherein said strain of influenza is isolated within the time period in which the increase in concentration of Replikin sequences is identified or wherein said strain of influenza is isolated within said time period of about one to about three years after said increase in concentration of Replikin sequences is identified; and

(3) predicting the strain of influenza virus in which the at least one Replikin Scaffold sequence is identified as the strain of virus that will likely cause the predicted outbreak of influenza virus, wherein a Replikin Scaffold is a peptide having about 16 to about 34 amino acids comprising (a) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (b) a terminal histidine and optionally a histidine immediately adjacent to the terminal histidine, (c) a lysine within about 6 to about 10 amino acids of another lysine; and (d) at least 6% lysines. In an embodiment, the likelihood of an outbreak of influenza is preferably greater than 50%, more preferably greater than 60%, and even more preferably greater than 75%.

**[00020]** In a further embodiment of the invention, the Replikin Scaffold is a peptide having about 27 to about 33 amino acids. In an influenza virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a preferred embodiment about 28 to about 30 amino acid residues. In a White Spot Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a preferred embodiment about 29 to about 31 amino acid residues. In a Taura Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a preferred embodiment about 29 to about 33 amino acid residues.

**[00021]** In an embodiment of the invention, the method of predicting an outbreak of influenza virus may comprise the prediction of an outbreak of any strain of influenza virus. In a further embodiment, the method of predicting an outbreak of influenza virus may comprise the prediction of an outbreak of influenza A. In a preferred embodiment, the outbreak of influenza A may be an outbreak of H5N1 ("bird flu") virus.

**[00022]** In a further embodiment of the invention, a plurality of isolates of White Spot Syndrome Virus may be obtained and analyzed for Replikin concentration or a plurality of isolates of Taura Syndrome Virus may be obtained and analyzed for Replikin concentration, or both in order to predict an outbreak of influenza virus.

**[00023]** In a further embodiment of the invention, the concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or greater may

increase by one or more Replikin sequences per 100 amino acids, may increase by five or more Replikin sequences per 100 amino acids, may increase by ten or more Replikin sequences per 100 amino acids, may increase by fifty or more Replikin sequences per 100 amino acids, may increase by 90 or more Replikin sequences per 100 amino acids, or may increase by 100 or more Replikin sequences per 100 amino acids.

**[00024]** The identified increase in concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or said plurality of isolates of Taura Syndrome Virus may occur over any time period including over one month or more, over six months or more, over one year or more, or over three years or more. In an embodiment of the invention, the identified increase in concentration of encoded Replikin sequences occurs over at least six months to about five years. In a further embodiment of the invention, the identified increase in concentration of encoded Replikin sequences preferably occurs over at least six months to about three years.

**[00025]** In a further embodiment of the invention, the method of predicting an outbreak of influenza may predict an outbreak within about one month to about five years or more following the identification of an increase in Replikin concentration in a plurality of isolates of White Spot Syndrome Virus or in a plurality of isolates of Taura Syndrome Virus. In a further embodiment of the invention, the method may predict an outbreak within several months to about three years. In another embodiment, the method may predict an outbreak within about one year to about five years. In a further embodiment of the invention, the method may predict an outbreak within several months to about one year. In another embodiment, the method may predict an outbreak within about one year to about three years.

**[00026]** Another aspect of the invention provides a method of predicting an outbreak of influenza virus comprising analyzing Replikin concentration in reservoirs for influenza virus. A non-limiting embodiment of the invention provides a method of predicting an outbreak of influenza virus comprising:

(1) obtaining a plurality of isolates of a first virus from at least one reservoir of Replikin sequences shared by influenza virus wherein the reservoir of Replikin sequences shared by influenza is any source of Replikin sequences that may be shared with an influenza virus including any host of influenza virus, any food source of a host of the influenza virus, any vector of influenza virus, or any substance wherein the genetic information of the influenza virus may be shared, mingled, mixed, exchanged or come into the proximity of the Replikin sequences of the reservoir;

(2) analyzing the amino acid sequence of at least one encoded protein or protein fragment or a combination of encoded proteins and/or protein fragments in each isolate of the plurality of isolates of said first virus for the presence and concentration of encoded Replikin sequences;

(3) comparing the concentrations of encoded Replikin sequences in the at least one protein or protein fragment or in the combination of proteins or protein fragments in each isolate of the plurality of isolates of said first virus;

(4) identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of said virus over at least one time period of about six months or greater; and

(5) predicting an outbreak of influenza within about one to about three or more years following said identified increase in the concentration of Replikin sequences in said isolates of said first virus.

**[00027]** In a further non-limiting embodiment, the reservoir is shrimp. In another non-limiting embodiment, the reservoir is a bird. In another non-limiting embodiment, the reservoir is a migratory bird. In another non-limiting embodiment, the reservoir is a chicken, duck, goose, or other domestic bird.

**[00028]** In a further non-limiting embodiment, the method of predicting an outbreak of influenza virus further comprises:

(1) identifying at least one Replikin Scaffold sequence present in at least one isolate of the plurality of isolates of said first virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of said first virus over a time period of about six months;

(2) identifying at least one Replikin Scaffold sequence present in at least one isolate of a strain of influenza virus, wherein said strain of influenza is isolated within a time period in which the increase in concentration of Replikin sequences is identified or wherein said strain of influenza is isolated within a time period of about one year to about three years after said increase in concentration of Replikin sequences is identified; and

(3) predicting the strain of influenza virus in which the at least one Replikin Scaffold sequence is identified as the strain of virus that will cause the predicted outbreak of influenza virus, wherein a Replikin Scaffold is a peptide consisting of about 16 to about 34 amino acids comprising (1) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (2) a terminal histidine and optionally a histidine immediately adjacent to the terminal histidine, (3) a lysine within about 6 to about 10 amino acids of another lysine; and (4) at least 6% lysines.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[00029]** Figure 1 illustrates a correlation between (1) the mean concentration and standard deviation of Replikin sequences observed in amino acid sequences of White Spot Syndrome Virus (WSSV) isolated between 1995 and 2007 that have publicly available accession numbers at www.pubmed.com, (2) the mean concentration of Replikin sequences in the pB1 gene area of H5N1 strains of influenza virus isolated in 2003, 2004, 2005, 2006, and 2007 that have publicly available accession numbers at www.pubmed.com, and (3) the mean mortality rate for humans infected with H5N1 influenza virus isolated in 2005, 2006 and 2007. The data demonstrate an exceptionally high Replikin sequence concentration in WSSV in 2000 followed within three years by an increase in Replikin sequence concentration in H5N1 isolates (from 2003 through 2007) and a concomitant outbreak of H5N1 influenza in humans with rising mortality.

**[00030]** Figure 2 illustrates a correlation between (1) the mean concentration and standard deviation of Replikin sequences observed in Taura Syndrome Virus (TSV) isolated between 2000 and 2005 that have publicly available accession numbers at www.pubmed.com, (2) the mean concentration of Replikin sequences in the pB1 gene area of H5N1 strains of influenza virus isolated in 2003, 2004, 2005, 2006, and 2007 that have publicly available accession numbers at www.pubmed.com, and (3) the mean mortality rate for humans infected with H5N1 influenza virus isolated in 2005, 2006, and 2007. The data demonstrate a higher Replikin sequence concentration in TSV in 2000 followed by a marked decrease in Replikin concentration in TSV in 2001 followed within three years by an increase in Replikin sequence concentration in H5N1 isolates (from 2003 through 2007) and a concomitant outbreak of H5N1 influenza in humans with increasing mortality.

**[00031]** Figure 3 illustrates a correlation between Replikin concentration in the H5N1 strain of influenza virus and human mortality from 2005 through the first quarter of 2007. Figure 3 contains a graph comparing percent human mortality from H5N1 infections in years 2005 through the first quarter of 2007, mean concentration of Replikin sequences in the genome of H5N1 influenza strains isolated in 2003 through the first quarter of 2007 and mean concentration of Replikin sequences in the pB1 gene area of H5N1 influenza strains isolated in 2003 through the first quarter of 2007. Mean human mortality in deaths per 10 infections in a given year is represented by the black columns, mean Replikin concentration in the whole virus genome in a given year is represented by the light gray columns, mean Replikin concentration in the pB1 gene area in a given year is represented by the dark gray columns, and standard deviations are represented by the white columns.

**[00032]** Figure 4 illustrates that an increasing Replikin concentration of hemagglutinin protein in the H5N1 strain of influenza virus preceded three "Bird Flu" Epidemics. In H5N1 influenza, the increasing strain-specific Replikin concentration (Replikin Count, Means+/-SD) 1995 to 1997 preceded the Hong Kong H5N1 epidemic of 1997 (E1); the increase from 1999 to 2001 preceded the epidemic of 2001 (E2); and the increase from 2002 to 2004 preceded the epidemic in 2004 (E3). The decline in 1999 occurred with the massive culling of poultry in response to the E1 epidemic in Hong Kong.

**[00033]** Figure 5 illustrates a direct sequential correlation between Replikin concentration in isolates of Taura Syndrome Virus (TSV) collected from Belize, Thailand, Hawaii and Venezuela, respectively, and mean number of days until 50% mortality in *Litopenaeus vannamei* shrimp challenged with the respective TSV isolates on day zero. Statistical differences between the Replikin concentration for each isolate are significant at a level of $p<0.001$.

**[00034]** Figure 6 illustrates a direct sequential correlation between Replikin concentration in isolates of Taura Syndrome Virus (TSV) collected from Belize, Thailand, Hawaii and Venezuela, respectively, and mean cumulative survival of *Litopenaeus vannamei* shrimp at 15 days after challenge with the respective TSV isolate. Statistical differences between the Replikin concentration for each isolate are significant at a level of $p<0.001$.

**[00035]** Figure 7 illustrates that cumulative survival of *Litopenaeus vannamei* shrimp challenged with four different Taura Syndrome Virus isolates over 15 days (unless 100% mortality occurred prior to 15 days) correlates sequentially with the Replikin concentration of Open Reading Frame 1 (ORF1) of each isolate. Translated amino acid sequences of ORF1 of the genome of individual isolates of TSV from Belize, Thailand, Hawaii and Venezuela were analyzed for Replikin concentration. Replikin concentration was determined to be 3.5 for the Belize isolate, 3.4 for the Thailand isolate, 3.3 for the Hawaii isolate and 3.0 for the Venezuela isolate. Graph A illustrates observed percent survival in three trials of shrimp challenged with the Belize isolate of TSV. In one trial, total mortality was observed on day 6. In the other two trials, total mortality was observed on day 11. Graphs B, C and D illustrate observed percent survival of shrimp challenged with the Thailand isolate, the Hawaii isolate and the Venezuela isolate, respectively, each in three trials over 15 days. In the Thailand isolate, a mean of 80% percent mortality was observed on day 15. In the Hawaii isolate, a mean of 78.3% mortality was observed on day 15. In the Venezuela isolate, a mean of 58.3% mortality was observed on day 15.

**[00036]** Figure 8 illustrates the localization of the pB1 gene area as the Replikin Peak Gene in the genome of the H5N1 strain of influenza virus. Figure 8 discloses a bar graph depicting the

number (with standard deviation) of Replikins per 100 amino acids in the eight genes of H5N1 influenza virus identified annually in humans between 2003 and 2006. A significant increase is observed in the pB1 gene area as compared to the other seven genes of the H5N1 influenza virus strain.

**[00037]** Figure 9 illustrates a correlation between an increase in Replikin concentration in the pB1 gene area (Replikin Peak Gene) of the H5N1 strain of influenza virus in various bird species and humans over time with an increase in virulence of the H5N1 strain of influenza. Figure 9 discloses a graph depicting the number (with standard deviation) of Replikins per 100 amino acids in the pB1 gene area (Replikin Peak Gene) of H5N1 influenza virus strains identified annually in duck and chicken in years 2001 through 2006, in goose in years 2001 and 2003 through 2006, and in human in years 2003 through 2006. The increase in Replikin concentration in these species over time correlates with an increase in virulence of the H5N1 virus strain over the same time period and correlates with an increase in mortality rate in humans during that time period. Changes in Replikin concentration in the Replikin Peak Gene of the H5N1 isolates in Figure 9 allows for identification of those hosts in which the influenza virus strain is more virulent than other hosts.

**[00038]** Figure 10 is a bar graph depicting the number (with standard deviation) of Replikins per 100 amino acids in the pB1 gene area (Replikin Peak Gene) of H5N1 influenza virus strains identified annually in humans in Japan, Russia, Egypt, China, Vietnam, Thailand and Indonesia between 2003 and 2006. Incidence of human morbidity and mortality in the Indonesian outbreak were exceptionally high and evidence of possible human to human transmission was observed. Changes in Replikin concentration in the Replikin Peak Gene of the H5N1 isolates in Figure 10 allows for identification of those geographic areas in which the influenza virus strain is more virulent than other geographic areas.

**[00039]** Figure 11 is a graph correlating Replikin Count in each of three strains of influenza virus responsible for one of three pandemics during the $20^{th}$ century with virulence. Within the last century there have been three influenza pandemics, each pandemic being strain specific: H1N1 in 1918; H2N2 in 1957; and H3N2 in 1968. In the reported amino acid sequences of the strains responsible for each pandemic, there is a strain-specific increase in Replikin concentration correlated with the major pandemic within the strain, followed by a decrease in Replikin concentration and several years later a rebound increase associated in each case with a strain-specific rebound epidemic. The x-axis of Figure 11 shows the year and the y-axis shows the Replikin concentration in Replikin sequences per 100 amino acids. Note that within Figure 11 there is a separate graph for each strain responsible for each pandemic.

**[00040]** Figure 12 is a graph illustrating an increase in Replikin concentration in spike and nucleocapsid coronavirus proteins preceding the SARS coronavirus epidemic of 2003. The x-axis indicates the year and the y-axis indicates the Replikin concentration. The appearance of the SARS outbreak and the eight countries involved in the outbreak is shown by the conical shaded area. The solid black symbols represent the mean Replikin concentration for spike coronavirus proteins and the vertical black bars represent the standard deviation of the mean. Figure 12 illustrates a remarkable constancy of low coronavirus Replikin concentration between 1995 and 2001 in the spike proteins, followed by a dramatic increase in 2002, one year before the SARS epidemic appeared in 2003.

**[00041]** Figure 13 is a graph comparing (1) the concentration of Replikin sequences observed in isolates of West Nile Virus having publicly available accession numbers on a year by year basis between 1999 and 2006 (with standard deviation bars for each Replikin concentration data point except 2000), (2) total morbidity reported in the United States on a year by year basis by the Center for Disease Control (total U.S. morbidity is the value denoted on the y-axis times 1000), and (3) total mortality resulting from WNV infection reported in the United States on a year by year basis by the Center for Disease Control (total U.S. mortality is the value denoted on the y-axis times 100). A correlation between Replikin concentration, morbidity and mortality is demonstrated.

**[00042]** Figure 14 is a graph illustrating the mean concentration of Replikins observed in the VP1 protein of isolates of Foot and Mouth Disease Virus having publicly available accession numbers on a year by year basis between 1998 and 2006. Observed outbreaks of Foot and Mouth Disease in the United Kingdom (UK) are noted in 2001 and 2007.

**[00043]** Figure 15 illustrates an increase in Replikin concentration in a Replikin Peak Gene in the pB1 genomic area of Equine Influenza one to two years in advance of epidemics of Equine Influenza. The graph illustrates that no increase in Replikin concentration in pA or pB2 genes of the equine influenza virus correlates with the increase in the Replikin concentration of the Replikin Peak Gene or with outbreaks of the virus.

**[00044]** Figure 16 illustrates a magnification of the effect of increases in Replikin concentration on human mortality from H5N1 infections when Replikin concentration is observed in the Replikin Peak Gene (pB1 gene area) as compared to the polymerase gene or compared to the entire genome of the H5N1 virus. Figure 16 is a graph of the data disclosed in Table 10. The graph demonstrates that an increase in Replikin concentration is magnified in its

correlation with human mortality when restricted from changes in Replikin concentration in the entire genome to changes in Replikin concentration in the polymerase gene and magnified even more when restricted solely to the Replikin Peak Gene identified using the methods described herein. In Figure 16, a correlation was established between human mortality and (1) mean concentration of Replikin sequences in the whole genome, (2) mean concentration of Replikin sequences in the polymerase gene, and (3) mean concentration of Replikin sequences in the Replikin Peak Gene (pB1 gene area) of H5N1 influenza strains. As Replikin concentration increased by these three measures, human mortality was observed to increase. However, while all three measures provided a correlation with human mortality, changes in the Replikin concentration in the polymerase gene correlated more significantly with human mortality, and changes in the Replikin concentration in the Replikin Peak Gene (pB1 gene area) of the H5N1 genome correlated still more significantly with human mortality. Figure 16 suggests, therefore, that identification of Replikin Peak Genes within viral genomes improves identification and prediction of virulence and mechansisms of virulence using Replikin concentration data.

**[00045]** Figure 17 illustrates a significant eight-fold increase in Replikin concentration in the pB1 gene area (Replikin Peak Gene) of isolates of H5N1 from 2003 through the first quarter of 2007 (that correlates with an increase in host mortality in humans), while no significant increase is observed in neighboring gene areas of the pB1 gene area, namely, the pA gene area and the pB2 gene area. Figure 17 graphically compares percent human mortality from H5N1 infections in years 2005 through the first quarter of 2007 to mean concentration of Replikin sequences in (1) the pB1 gene area, (2) the pB2 gene area, and (3) the pA gene area, respectively, of H5N1 influenza strains isolated in 2003 through the first quarter of 2007. Figure 17 illustrates a significant correlation between human mortality and the Replikin Peak Gene (pB1 gene area) of isolates of H5N1 influenza virus. No correlation is observed in neighboring gene areas of the pB1 gene area. In addition to the correlative aspect of the increase in Replikin concentration being related to percent mortality, Figure 17 (graphically representing part of the data in Table

10) provides strong confirmation of the power and validity of the methodology of predicting changes in virulence and outbreaks of virus by monitoring changes in Replikin concentration.

## DETAILED DESCRIPTION OF THE INVENTION

### Definitions

**[00046]** As used herein, "animal" includes mammals, such as humans.

**[00047]** As used herein, the term "peptide" or "protein" refers to a compound of two or more amino acids in which the carboxyl group of one amino acid is attached to an amino group of another amino acid via a peptide bond. As used herein, "isolated" or "synthesized" peptide or biologically active portion thereof refers to a peptide that is, after purification, substantially free of cellular material or other contaminating proteins or peptides from the cell or tissue source from which the peptide is derived, or substantially free from chemical precursors or other chemicals when chemically synthesized by any method, or substantially free from contaminating peptides when synthesized by recombinant gene techniques. An "encoded" protein, protein sequence, protein fragment sequence, or peptide sequence is a sequence encoded by a nucleic acid sequence that encodes the amino acids of the protein or peptide sequence with any codon known to one of ordinary skill in the art now or hereafter. It should be noted that it is well-known in the art that, due to redundancy in the genetic code, individual nucleotides can be readily exchanged in a codon and still result in an identical amino acid sequence. As will be understood by one of skill in the art, a method of identifying a Replikin amino acid sequence also encompasses a method of identifying a nucleic acid sequence that encodes a Replikin amino acid sequence wherein the Replikin amino acid sequence is encoded by the identified nucleic acid sequence.

**[00048]** As used herein, a Replikin sequence is an amino acid sequence having about 7 to about 50 amino acids comprising:

(1) at least one lysine residue located six to ten amino acid residues from a second lysine residue;

(2) at least one histidine residue; and

(3) at least 6% lysine residues.

**[00049]** A Replikin sequence may comprise a terminal lysine and may further comprise a terminal lysine or a terminal histidine. A Replikin peptide or Replikin protein is a peptide or protein consisting of a Replikin sequence. A Replikin sequence may also be described as a

Replikin sequence of about 7 to about 50 amino acids comprising or consisting of a Replikin motif wherein the Replikin motif comprises:

(1) at least one lysine residue located at a first terminus of said isolated influenza virus peptide and at least one lysine residue or at least one histidine residue located at a second terminus of said isolated influenza virus peptide;

(2) a first lysine residue located six to ten residues from a second lysine residue;

(3) at least one histidine residue; and

(4) at least 6% lysine residues.

For the purpose of determining Replikin concentration, a Replikin sequence must have a lysine residue at one terminus and a lysine or a histidine residue at the other terminus.

**[00050]** The term "Replikin sequence" can also refer to a nucleic acid sequence encoding an amino acid sequence having about 7 to about 50 amino acids comprising:

(1) at least one lysine residue located six to ten amino acid residues from a second lysine residue;

(2) at least one histidine residue; and

(3) at least 6% lysine residues,

wherein the amino acid sequence may comprise a terminal lysine and may further comprise a terminal lysine or a terminal histidine.

**[00051]** As used herein, a Replikin Peak Gene (RPG) or a Replikin Peak Gene Area (RPGA) are used interchangeably to mean a segment of a genome, protein, segment of protein, or protein fragment in which an expressed gene or gene segment has a highest concentration of continuous, non-interrupted and overlapping Replikin sequences (number of Replikin sequences per 100 amino acids) when compared to other segments or named genes of the genome. Generally, the gene or gene segment associated with a whole protein or protein-expressing gene is known as the Replikin Peak Gene and the gene or gene segment associated with a protein fragment is known as a Replikin Peak Gene Area. More than one RPG or RPGA may be identified within a gene, gene segment, protein, or protein fragment. An RPG or RPGA may have a terminal lysine or a terminal histidine, two terminal lysines, or a terminal lysine and a terminal histidine. An RPG or RPGA may likewise have neither a terminal lysine or a terminal histidine as long as it contains a Replikin sequence or Replikin sequences defined by the definition of a Replikin sequence, namely, an amino acid sequence having about 7 to about 50 amino acids comprising:

(1) at least one lysine residue located six to ten amino acid residues from a second lysine residue;

(2) at least one histidine residue; and

(3) at least 6% lysine residues.

**[00052]** As used herein, "reservoir" is any source of Replikin sequences that may be shared with an influenza virus including any host of influenza virus, any food source of a host of the influenza virus, any vector of influenza virus, or any substance wherein the genetic information of the influenza virus may be shared, mingled, mixed, exchanged, or come into the proximity of the Replikin sequences of the reservoir.

**[00053]** As used herein, "different time periods" or "different time points" is any two time periods or points that may be differentiated one from another. For example, an isolate of virus isolated during the year 2004 is isolated in a different time period than an isolate of the same virus isolated during the year 2005. Likewise, an isolate of virus isolated in May 2004 is isolated in a different time period than an isolate of the same virus isolated in June 2004. When comparing Replikin concentrations of different isolates, it is preferred to use comparable time periods for comparison. For example, an isolate from 2004 is preferably compared to at least one other isolate from some other year such as 2002 or 2005. Likewise, an isolate from May 2004 is preferably compared to at least one isolate from some other month of some year, for example, an isolate from December 2003 or from June 2004. An isolate is any virus isolated from a natural source wherein a natural source includes, but is not limited to, a reservoir of a virus, a vector of a virus or a host of a virus. "Obtaining" an isolate is any action by which an amino acid or nucleic acid sequence within an isolate is obtained including, but not limited to, isolating an isolate and sequencing any portion of the genome or protein sequences of the isolate, obtaining any nucleic acid sequence or amino acid sequence of an isolate from any medium, including from a database such as PubMed, wherein the nucleic acid sequence or amino acid sequence may be analyzed for Replikin concentration, or any other means of obtaining the Replikin concentration of a virus isolated from a natural source at a time point.

**[00054]** As used herein, an "earlier-arising" virus or organism is a specimen of a virus or organism collected from a natural source of the virus or organism on a date prior to the date on which another specimen of the virus or organism was collected from a natural source. For viruses, a natural source includes, but is not limited to, a reservoir of a virus, a vector of a virus, or a host of the virus. A "later-arising" virus or organism is a specimen of a virus or organism collected from a natural source of the virus (including, but not limited to, a reservoir, a vector, or a host) or a natural source of the organism on a date subsequent to the date on which another specimen of the virus or organism was collected from a natural source.

**[00055]** As used herein, "emerging strain" refers to a strain of a virus identified as having an increased or increasing concentration of Replikin sequences in one or more of its protein

sequences relative to the concentration of Replikins in other strains of such organism. The increased or increasing concentration of Replikins occurs over a period of preferably at least about six months, at least about one year or at least about three years, but may be a much shorter period of time for highly mutable viruses. An emerging strain of virus indicates an increase in virulence or replication.

**[00056]** As used herein, "bird" is any avian species including migratory and domestic birds, wherein said migratory and domestic birds includes, for example, chickens, ducks of all kinds, geese, pigeons, gulls, seabirds *etc*.

**[00057]** As used herein, "outbreak" is an increase in virulence, morbidity or mortality in a viral disease as compared to a baseline of an earlier occurring epidemiological pattern of infection in the same viral disease. One of ordinary skill in the art will know how to determine an epidemiological baseline. As used herein, "morbidity," is the number of cases of a disease caused by the virus, either in excess of zero cases in the past or in excess of a baseline of endemic cases in the past. Therefore the baseline of endemic cases, in epidemiological terms, may, for example, relate to whether no or some cases were present in a geographic region in the immediate past. The past, in epidemiological terms, may mean more than one year and can mean several years or more as understood by one of ordinary skill in the art. The past may also mean less than one year as determined by one of ordinary skill in the art. In the case of annually-recurrent common influenza, for example, the baseline reflects an annual recurrence of common influenza.

**[00058]** As used herein, "mutation" refers to a change in the structure and properties of a virus or organism caused by substitution of amino acids. In contrast, the term "conservation" as used herein, refers to conservation of particular amino acids due to lack of substitution. A "point mutation" may refer to a change in a single amino acid residue or may refer to a change in a small number of amino acid residues.

**[00059]** As used herein, "replikin count" or "replikin concentration" refers to the number of Replikins per 100 amino acids in a protein, protein fragment, virus, or organism. A higher Replikin concentration in a first strain of a virus or organism has been found to correlate with more rapid replication of the first virus or organism as compared to a second, earlier-arising or later-arising strain of the virus or organism having a lower Replikin concentration.

**[00060]** As used herein a "Replikin Scaffold" refers to a series of conserved Replikin peptides wherein each of said Replikin peptide sequences comprises about 16 to about 34 amino acids, and preferably about 27 to about 33 amino acids and further comprises: (1) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (2) a terminal histidine and

optionally a histidine immediately adjacent to the terminal histidine; (3) a lysine within 6 to 10 amino acid residues from another lysine; and (4) about 6% lysine. "Replikin Scaffold" also refers to an individual member or a plurality of members of a series of Replikin Scaffolds.

**[00061]** In an influenza virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a preferred embodiment about 28 to about 30 amino acid residues. In a White Spot Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a more preferred embodiment about 29 to about 31 amino acid residues. In a Taura Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a more preferred embodiment about 29 to about 33 amino acid residues.

**Predicting Virulence by Determining Replikin Concentration in Viral Reservoirs, Vectors and Hosts**

**[00062]** The inventors provide herein methods of predicting outbreaks of influenza by monitoring the presence and/or concentration of Replikin sequences both throughout the virus and in specific highest concentrations of Replikins in areas designated as Replikin Peak Genes, Replikin Peak Gene Areas and/or Replikin Scaffold sequences in WSSV and TSV in shrimp and influenza viruses.

**[00063]** Before identification of the Replikin structure in virus proteins there existed no quantitative measure of virus structure that correlated quantitatively with rapid replication or that gave advance warning of virus outbreaks or emerging virus disorders.

**[00064]** Since the identification of the Replikin structure, correlation between increased concentrations of Replikin sequences and increased replication and virulence has been observed in a range of viruses and organisms. These observations are made more accurate by the present isolation *in silico* of Replikin Peak Genes. A Replikin Peak Gene includes the area in a genome, protein, or protein fragment that has the highest concentration of Replikin sequences. While increased concentration of Replikin sequences in the genome of a virus offers both advance warning and new targets for developing effective methods of predicting and treating viral outbreaks, identification of an increase in concentration of Replikin sequences in a Replikin Peak Gene of a genome or protein heightens the predictive capacity of the change in Replikin concentration and the efficacy of new targets.

**[00065]** For example, more precise predictions of increased virulence are now available through identification of a Replikin Peak Gene in, among other viruses, the H5N1 strain of influenza (Figures 3 and 8-10), the H3N8 strain of influenza that causes equine influenza (Figure

15), West Nile Virus (Figure 13), Foot and Mouth Disease Virus (Figure 14) and White Spot Syndrome Virus (Example 1). In these and other viruses, increased concentration of Replikin sequences in the whole genome, in a protein of the genome, or in a Replikin Peak Gene of the genome offer both advance warning and new targets for developing effective methods of predicting and treating viral outbreaks.

**[00066]** By monitoring changes in concentrations of Replikin sequences in viral genomes generally, emerging viral diseases can be identified in virus reservoirs and vectors in advance of their appearance in animal or human hosts. Identification of the emerging viruses and the Replikin sequences within the virus genome allows for appropriate, advance control efforts, including isolation and quarantine, and provides sufficient time for the synthesis and testing of vaccines specific to the sequences of the emerging virus.

**[00067]** Replikin sequences that had previously been shown to pass between several strains of the same virus, as in the H1N1, H2N2, H2N3 and H5N1 strains of influenza A virus, have now been found to pass between different viruses as well as different hosts, as though the Replikin structure is the key infectious and lethal unit of the disease and the virus is the carrier or vector of this infectious and lethal unit. Viewing the Replikin structure as an infectious unit of disease then allows the host organism or the virus itself to be viewed (at any given point in the infectious cycle) as a host, a reservoir, or a vector for Replikin units shared by viruses, host organisms, and vector organisms in the infectious pathway of the disease.

**[00068]** Identification of Replikin sequences as infectious units (and providing particular areas in the genome, *i.e.* Replikin Peak Genes, where those infectious units are correlated most significantly with virulence) has allowed the inventors to focus attention on the geographic area (see Figure 10), the host (see Figure 9), and the particular area of the genome of a virus (see Figure 8) wherein virulence mechanisms are located and thereby increased virulence may be identified and predicted. Because the inventors have provided a method of focusing on particular units of a viral genome, the skilled artisan will understand the importance of looking for Replikin sequences in any portion of the life cycle or infectious pathway of a virus. For example, as described herein, the skilled artisan will understand that predictive and virulence-related Replikin sequences (or concentrations of Replikin sequences in Replikin Peak Genes) may be identified in reservoirs of influenza virus such as in WSSV and TSV. The skilled artisan will further understand that predictive and virulence-related Replikin sequences or Replikin Peak Genes may be identified in vectors of the influenza virus. The skilled artisan will additionally understand that predictive and virulence-related Replikin sequences or Replikin Peak Genes may be identified in hosts of the influenza virus or in any other place where viral genes may be located or

wherein viral genetic information may encounter genetic information of other strains of virus, of other virus species, of vectors of the virus, of hosts of the virus, or of food sources of hosts of the virus. This method of locating relevant Replikin sequences finds support in the inventors' disclosure of data providing insight into what sequence changes in influenza since 1917 were due to "drift" or "shift" or, on the other hand, what sequence changes in influenza since 1917 were due to conservation, storage in "reservoirs," and reappearance in both intermediate vectors and eventual animal and human hosts. The data has shown that the epidemic-related increase in Replikin concentration is not due to the duplication of existing Replikins in the hemagglutinin of the emerging strain, but instead is due to the reappearance of at least one Replikin composition from 1 to up to 59 years after its disappearance, plus (in the A strains only) the emergence of new strain-specific Replikin compositions. *See* U.S. Patent 7,189,800 issued March 13, 2007 (Tables 3-6).

**[00069]** In another embodiment of the invention, an automated prediction of an outbreak of influenza virus is made by (1) measuring the Replikin concentration in a WSSV or TSV isolate structure, or other reservoir virus structure (2) comparing the measured concentration to the Replikin concentration determined at a previous time point in the same virus structure, and (3) observing an increase in Replikin concentration in that virus structure. If an increase has occurred, an outbreak within about one to about three years following the latest time point is predicted. In a further embodiment, the increase from one time point to another time point is statistically significant.

**[00070]** The magnitude of a Replikin increase in a virus may be a quantitative component of predicting an outbreak. For example, in H5N1 influenza virus, a two-fold (200%) increase in Replikin concentration predicted an outbreak of the virus in humans. See Figure 16 and Example 9. Further, an eight-fold (800%) increase in the Replikin Peak Gene of the virus predicted the same outbreak, which included new morbidity and increased mortality in infections from the virus. See Figure 17 and Example 9.

**Replikin Concentration in WSSV and TSV Predicts Human Influenza Outbreaks**

**[00071]** The present inventors have discovered that two viruses, White Spot Syndrome Virus (WSSV) (also known as white spot baculoform virus) and Taura Syndrome Virus (TSV), both global lethal pathogens for shrimp, are reservoirs for the peptide building blocks of influenza virus, including the H5N1 strain of influenza virus. The concentration of Replikins in WSSV, TSV, and in influenza has been shown to be related to rapid replication and epidemics in each of these viruses. An increase in the concentration of Replikin sequences has been correlated with the last three influenza pandemics of 1918, 1957 and 1968. *See* Figure 11. Quantitative

determination of the concentration of virus Replikins has made it possible to predict in advance recent influenza outbreaks including outbreaks of the H5N1 strain of influenza. Quantitative determination of the concentration of Replikins in viruses for which nucleic acid or protein sequences are available may now be automated using the proprietary FluForecast®, which is available from Replikins, LLC, Boston Massachusetts.

**[00072]** The H5N1 virus recently has been responsible for huge poultry losses in many countries and for several hundred human cases with approximately 50% mortality. While migratory waterfowl are known to transport H5N1 influenza virus globally, no reservoirs for the virus had yet been identified. The inventors, however, have now identified shrimp as a reservoir for homologous Replikin sequences identified in White Spot Syndrome Virus (WSSV) and Taura Syndrome Virus (TSV). The homologous Replikin sequences have been identified in both shrimp and influenza virus and in particular in the H5N1 "bird flu" strain of influenza virus in both birds and humans.

**[00073]** Beginning with evidence of a sharing of homologous Replikin sequences among the three viruses, namely, WSSV, TSV, and strains of influenza virus including H5N1, the inventors identified a correlation between an increase in Replikin concentration in WSSV and/or TSV and an increase in virulence (and a concomitant increase in Replikin concentration) in the H5N1 strain of influenza virus. The inventors further identified homologous Replikin sequences shared within and between the virus strains including Replikin Scaffold sequences, the presence of which have been associated with high virulence, epidemics and pandemics.

**[00074]** Using these correlations and observations, the inventors have now devised a method of predicting an outbreak of influenza virus comprising:

(1) obtaining a plurality of isolates of White Spot Syndrome Virus or a plurality of isolates of Taura Syndrome Virus wherein at least one of said isolates of White Spot Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of White Spot Syndrome Virus, or wherein at least one of said isolates of Taura Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of Taura Syndrome Virus;

(2) analyzing the amino acid sequence of at least one encoded protein or protein fragment or a combination of encoded proteins and/or protein fragments in each isolate of the plurality of isolates of White Spot Syndrome Virus or the plurality of isolates of Taura Syndrome Virus for the presence and concentration of encoded Replikin sequences;

(3) comparing the concentrations of encoded Replikin sequences in the at least one protein or protein fragment or in the combination of proteins or protein fragments in each isolate of the

plurality of isolates of White Spot Syndrome Virus or in each isolate of the plurality of isolates of Taura Syndrome Virus;

(4) identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or greater, at least about one year or greater, or at least about three year to five years; and

(5) predicting an outbreak of influenza within about one to about three years following said identified increase in the concentration of Replikin sequences in said isolates of White Spot Syndrome Virus or in the concentration of Replikin sequences in said isolates of Taura Syndrome Virus.

**[00075]** Prediction of an outbreak of influenza may further comprise:

(1) identifying at least one Replikin Scaffold sequence present in at least one isolate of the plurality of isolates of White Spot Syndrome Virus identified as having an increase in the concentration of Replikin sequence as compared to at least one other isolate of the plurality of isolates of White Spot Syndrome Virus over a time period of about six months or greater, or identifying at least one Replikin Scaffold sequence present in at least one isolate in the plurality of isolates of Taura Syndrome Virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of Taura Syndrome Virus over a time period of about six months or greater;

(2) identifying at least one Replikin Scaffold sequence present in at least one isolate of a strain of influenza virus; and

(3) predicting the strain of influenza virus in which the at least one Replikin Scaffold sequence is identified as the strain of virus that will likely cause the predicted outbreak of influenza virus wherein a Replikin Scaffold is a peptide having about 16 to about 34 amino acids comprising (a) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (b) a terminal histidine and optionally a histidine immediately adjacent to the terminal histidine, (c) a lysine within about 6 to about 10 amino acids of another lysine; and (d) at least 6% lysines.

**[00076]** In an influenza virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues and in a preferred embodiment about 28 to about 30 amino acid residues. In a White Spot Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34 amino acid residues, and in a more preferred embodiment about 29 to about 31 amino acid residues. In a Taura Syndrome Virus, a Replikin Scaffold may refer to a Replikin peptide sequence comprising about 16 to about 34

amino acid residues, and in a more preferred embodiment about 29 to about 33 amino acid residues.

**[00077]** The shrimp industry understands that a first clue that virus infection from WSSV or TSV has occurred in shrimp ponds is observation of the death of migratory birds on the periphery of the pond. This observation suggested to the inventors that shrimp and birds shared some pathogenic mechanism related to shrimp infection with WSSV and/or TSV. By analyzing Replikin concentrations in publicly available amino acid sequences of WSSV, TSV and H5N1 isolates of virus using FluForecast® software available through Replikins, LLC, Boston, MA, USA, the following findings were obtained, which demonstrated that the shrimp viruses WSSV and TSV serve as a reservoir of Replikin peptide building blocks for H5N1 and other influenza strains:

1) The shrimp viruses WSSV and TSV were found to contain Replikin peptide sequences and an increase in concentration in these sequences was correlated with specific outbreaks of the virus.

2) These shrimp virus sequences were found to be related in structure to Replikin peptide sequences in H5N1 and other strains of influenza virus that had been specifically associated with virulence, epidemics, pandemics and human mortality in influenza.

3) Shrimp WSSV Replikins increased markedly in concentration in the year 2000, just before an increase in Replikin concentration in H5N1 that directly preceded H5N1 outbreaks in chickens, other birds, and humans between 2001-2006. The increase in shrimp virus Replikin concentration was not trivial. In shrimp WSSV, which in dormant states was found to have well less than 10 Replikin sequences within 100 amino acids, Replikin concentration reached the remarkable height of 103.8 in an isolate in 2000 and a mean of 97.6 among all isolates with publicly available protein sequences. *See* Example 4. The remarkable Replikin concentration of 103.8 is comparable only to the highest Replikin concentration so far observed in any organism in nature, namely, *P. falciparum*, which has the highest Replikin concentration to date—111 Replikin sequences observed per 100 amino acid residues. *P. falciparum* is a cause of malaria and has been observed to replicate 11,000 times in 48 hours when passing in its life cycle from the liver to blood in its host.

4) Of the new shrimp Replikins that appeared in 2000, the percent that were short peptides was increased compared to dormant years. Short Replikins previously have been found to be related to high virulence and high mortality in the host, whether animal or man. *See. e.g.,* U.S. Appln. Ser. No. 10/860,050, filed June 4, 2004.

5) These short shrimp virus Replikins share structures with short Replikins in both H5N1 and other influenza strains going back 89 years to the great pandemic of 1918.

6) Replikin Scaffold sequences were identified in proteins of WSSV and TSV that were highly homologous with Replikin Scaffold sequences in highly virulent strains of influenza virus including the H5N1 strain.

**[00078]** The occurrence of the major WSSV outbreak in the year 2000 places WSSV temporally in line with the influenza outbreaks that occurred successively in other hosts: (1) in ducks in 2004-2005; (2) in chickens in 2005-2006; and (3) in humans in 2006-2007. *See* Figure 9. Each outbreak was preceded by major increases in the respective Replikin concentrations of the virus and in the Replikin concentrations of their Replikin Peak Genes. *See, e.g.*, U.S. Appln. Ser. No. 60/898,097, filed January 30, 2007, Figures 1-4. An outbreak of TSV in 2000 likewise was temporally in line with the influenza outbreaks of 2001-2007.

**[00079]** The mortality rate of shrimp for the WSSV shrimp virus is 80-100% and, as shown above, the Replikin concentration during outbreaks has exceeded 100 Replikin sequences per 100 amino acid residues. The Replikin concentrations and the mortality rates in H5N1 have not been as high in ducks and chickens. Replikin concentrations of twenty in the Replikin Peak Gene of H5N1 have been observed in humans in Indonesia along with mortality rates of approximately 80% in a small number of humans in 2006-2007. *See* U.S. Appln. Ser. No. 11/ 755,597, filed May 30, 2007, pages 36-39.

**[00080]** While Applicants do not wish to be constrained by theory, this evidence may reflect migration or vectoring of Replikin sequences between species, or may reflect successive independent stimulation of influenza strains in different hosts, or both, or even some other yet-to-be-determined mechanism. Data that supports migration of Replikin sequences between different strains of influenza virus rather than independent synthesis has been reported in previous patent applications by the Applicants (*see, e.g.,* U.S. Pat. No. 7,189,800 and U.S. Appln. Ser. No. 11/355,120, filed February 16, 2006), but the present evidence of relation of shrimp viruses to influenza viruses is the first evidence of inter-virus species migration of Replikins. In effect, the "infectious unit" of a virus may not be the whole virus but, instead, a relatively small constituent of the virus structure, namely Replikin sequences.

**Replikin Scaffold Sequences in WSSV, TSV, and Influenza**

**[00081]** Replikin Scaffold sequences so far identified in WSSV begin with KK and end with H. The length of the Scaffold Sequence is about 27 to 31, which is similar to the about 28 to about 29 amino acid Replikin Scaffolds generally observed in the H5N1, H1N1, H2N2, H2N3,

and H7N7 strains of influenza virus. The following Replikin Scaffold repeats were identified in Accession No. AAL89390, which discloses a 2000 isolate of WSSV.

$K^{66}$KNVKSAKQLPHLKV<u>H</u>LDV<u>K</u>SAKQLPHLKVH$^{96}$

$K^{160}$KNVKSAKQLPHLKV<u>H</u>LDV<u>K</u>GVKQLLH$^{186}$

$K^{239}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPH$^{265}$

$K^{303}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPH$^{329}$

$K^{397}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPHLKVH$^{427}$.

**[00082]** In the above-listed Replikin Scaffolds, the orderly substitution of H for L in positions 81 and 175 and K for R in positions 85 and 179 both result in an increase in the number of Replikins per 100 amino acids, *i.e.* in an increase in the Replikin concentration. The phenomenon of Replikin scaffolding also has been observed in *P. falciparum* (malaria). The substitution of lysines and histidines resulting in increased Replikin concentration and increased virulence also has been observed by the applicants in H5N1 in a Replikin Scaffold in China (See U.S. Appln. Ser. No. 11/755,597, filed May 30, 2007, Table 1). The homologous structural properties in shrimp WSSV and TSV and influenza provide continuing support for the structural relationship between Replikin sequences in WSSV and TSV and influenza viruses.

**[00083]** Accordingly one aspect of the invention provides a method of predicting an influenza outbreak by correlating an increase in Replikin concentration in shrimp WSSV and/or TSV over Replikin concentration in previous isolates of WSSV and/or TSV with an increase in virulence and/or replication of influenza viruses.

**Presence of Replikin Scaffold is Predictive of Epidemics**

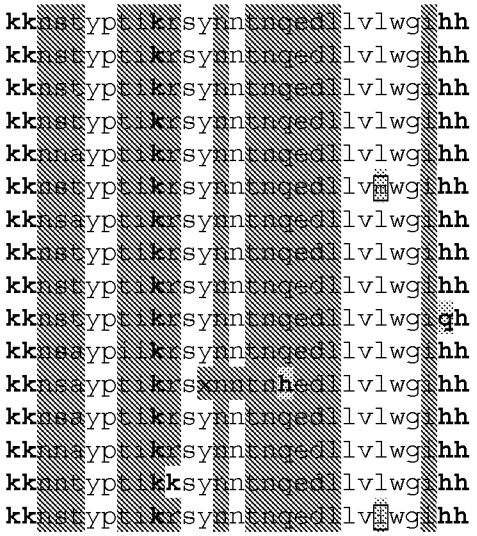
**[00084]** The inventors have established that the presence of Replikin Scaffolds in influenza strains is predictive of epidemics. As such, in addition to the total number of Replikins in a virus, the structure of each Replikin through time is informative. Table 1 shows a Replikin Scaffold first observed in a goose infected with influenza in 1917 (Goose Replikin). Constant length, constant lysines at the amino terminal and histidine residues at the carboxy terminal were conserved in different strains in a fixed scaffold for decades. Homologues of the Goose Replikin appeared from 1917 through 2006 in strains including each strain responsible for the three pandemics of 1918, 1957, and 19681, H1N1, H2N2 and H3N2, and with further substitutions between H1N2, H7N7, H5N2 and H5N1.

**TABLE 1:**

**Replikin Scaffold showing ordered substitution in the 89 year conservation of influenza virus Replikin peptides related to rapid replication, from a 1917 goose influenza Replikin and the 1918 human pandemic Replikin to 2006 H5N1 "Bird Flu" homologues.**

**(SEQ ID NOS: 368-429, respectively, in order of appearance)**

| [<----------29 Amino Acids----------→] | Year | Strain |
|---|---|---|
| kkgtsypklsksytnnkgkevlvlwgvhh | **1917** | **H1N_ Influenza Goose Replikin** |
| kkgtsypklsksytnnkgkevlvlwgvhh | **1918** | **H1N1 Human Influenza Pandemic** |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1930 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1933 | H0N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1976 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1977 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1979 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1980 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1980 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1981 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1981 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1985 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1991 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1992 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1996 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1996 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1997 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 1998 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | **1999** | **H1N1** |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2000 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2001 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2002 | H1N1 |
| kkgtsypklsksytnnkgkevlvlwgvhh | **1999** | **H1N2 Influenza** |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2000 | H1N2 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2001 | H1N2 |
| kkgtsypklsksytnnkgkevlvlwgvhh | 2001 | H1N2 |
| -kngtypklsksyannkgkevlvlwgvhh | 2002 | H1N2 |
| -kngtypklsksyannkgkevlvlwgvhh | 2002 | H1N2 |
| kkgtsypvakssyntsgeqmlvlwgvhh | **1957** | **H2N2 Human Influenza Pandemic** |
| kkgtsypvakssyntsgeqmlvlwgvhh | **1957** | **H2N2 Human Influenza Pandemic** |
| kkgtsypklksslinkkevklvlwgvhh | **1968** | **H3N2 Human Influenza Pandemic** |
| ----------ksyktrkdpallvlwgvhh | **1979-2003** | **H7N7 Influenza** |
| kknnayptikrtyntnrvedllilwgvhh | **2002** | **H5N2 Influenza** |
| kknnayptikrsyntngedilvlwgvhh | **1959** | **H5N1 Influenza (Scotland)** |
| kknnayptikrtyntnriedilvlwgvhh | 1975 | H5N1 (Wisconsin) |
| kknnayptikrtyntnmedilvlwgvhh | 1981 | H5N1 (Minnesota) |
| kkgnayptikrtyntnrvedilvlwgvhh | 1983 | H5N1 (Pennsylvania) |
| kkntayptikrsyntngedilvlwgvhh | 1988 | H5N1 (Scotland) |
| kknnayptikrsyntngedilvlwgvhh | 1996 | H5N1 (China) |
| kknnayptikrsyntngedilvlwgvhh | 1997 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 1998 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 1999 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 2000 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 2001 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 2001 | H5N1 (China) |
| kknnaypeikrsyntngedilvlwgvhh | 2002 | H5N1 (China) |
| kknatypeikrsyntngedilvlwgvhh | 2002 | H5N1 (Thailand) |



| | | |
|---|---|---|
| 2002 | H5N1 (Vietnam) | |
| 2003 | H5N1 (Vietnam) | |
| 2003 | H5N1 (Thailand) | |
| 2003 | H5N1 (Sindong, China) | |
| 2003 | H5N1 (China) | |
| 2004 | H5N1 (Vietnam, highly pathogenic) | |
| 2004 | H5N1 (Vietnam, highly pathogenic, gull) | |
| 2004 | H5N1 (Vietnam highly pathogenic) | |
| 2004 | H5N1(Thailand, highly pathogenic) | |
| 2004 | H5N1 (Thailand, highly pathogenic) | |
| 2004 | H5N1 (China, highly pathogenic) | |
| 2004 | H5N1 (China, highly pathogenic, goose) | |
| 2004 | H5N1 (Japan) | |
| **2005** | **H5N1 (Turkey)** | |
| **2006** | **H5N1 (China, Anhui)** | |
| **2006** | **H5N1 (Indonesia, highly pathogenic)** | |

* Residues identical to Goose Replikin amino acids are unshaded; amino acid substitutions are shaded lightly and darkly to show scaffold pattern across years and strains. Substitution at position 24 in 2004 and 2006 H5N1, 1957 H2N2, 1968 H3N2 and H7N7 are boxed.

**[00085]** Table 1 illustrates the history, by year or smaller time period, of the existence in the protein structure of the Goose Replikin and its homologues in other influenza Replikins. Table 1 further illustrates the history of amino acid substitutions in those homologues and the conservation of certain amino acids of the Replikin structure that are essential to the definition of a Replikin and the function of rapid replication supplied by Replikins.

**[00086]** A review of Table 1 illustrates that if random substitution of amino acids were to occur in virulent strains of influenza from 1917 through the present, certain framework amino acids of the Goose Replikin would not be conserved from year to year in strains in which epidemics occurred. However, contrary to what would result from random substitution, virulent strains of influenza from year to year consistently contain conserved amino acids at those positions that define a Replikin. That is, if a substitution were to occur in one of the amino acids that define a Replikin, e.g. lysine or a histidine, the definition of the Replikin would be lost. Nevertheless, the Replikin sequence is conserved over more than 89 years. Thus, since there is conservation of certain amino acids over decades, substitution cannot be said to be completely at random. The fact that substitutions do occur in amino acids that are not essential to the definition of a Replikin (i.e., amino acids other than lysines or histidines) demonstrates the importance of the Replikin and the Replikin Scaffold in the pathogenicity of the strain.

**[00087]** It may be further noted from Table 1 that when substitutions do occur, they are seen to occur at certain apparently preferred positions of the Replikin Scaffold. Table 1 illustrates recurring substitutions at positions 1, 3-24 and 26-27. Further, while substitutions occur

throughout these positions, a lysine continues to exist at a position 6 to 10 amino acids from a second lysine (which has not been substituted in these virulent strains).

**[00088]** Even when there is a substitution of a lysine position within the 29 amino acid stretch, as is seen in 1957, when K at position 11 shifts to position 10, that new position is maintained until 2005. Additionally, YP (at positions 6-7), SY (at positions 12-13), N (at position 15), and LVLWG (at positions 22-26) conserve the homologous structure of the Replikin Scaffold with few exceptions.

**[00089]** In the 1997 H5N1 Hong Kong epidemic, the human mortality rate was approximately 27%. In 2004, of the fifty-two people reported to have been infected by H5N1 in Asia, approximately 70% died. Nine of the eleven people infected in Vietnam from December 28, 2004 to January 27, 2005 died. Although the virulence of the virus appears to have increased, any changes thought to be required for further spread from human to human, had been thought not yet to have occurred. However, the inventors observed substitutions in three H5N1 Replikin amino acid residues at position numbers 18, 24 and 28 of the Goose Replikin scaffold from isolates in Vietnam, Thailand and China in 2004 (see Table 1). Substitution at position number 24 has not occurred since the appearance of H5N1 in 1959 but was present in the last two influenza pandemics caused by other strains, H2N2 in 1957 and H3N2 in 1968, together responsible for over two million human deaths, and in a recent virulent epidemic caused by H7N7 (see Table 1). These data on substitution, combined with the rising Replikin concentration shown in Figure 4, and the past correlation of such Replikin data with pandemics, predicted the small outbreak of H5N1 in humans in 2006 and 2007.

**[00090]** It is important to note that an extra K has also appeared in the Replikin Scaffold of a 2006 strain of H5N1 in China (Anhui). This presence of an extra K both produces and signals an increase in the Replikin count within the Replikin Scaffold. The 2006 China (Anhui) strain has a Replikin count of 6.6 (as discussed below). A Replikin count of 6.6 is the highest ever observed for an H5N1 strain and is comparable in the entire A strain of influenza only to the Replikin count of the influenza strain that caused the 1918 Pandemic.

**Homologous Replikin Scaffold Sequences in Influenza, WSSV, and TSV**

**[00091]** The inventors have further established a relationship between virulent influenza virus and WSSV and TSV in the Replikin Scaffold portions of the viruses as may be seen in Table 2 below. Although there is extensive substitution, several short Replikins of the Shrimp White Spot Syndrome Virus demonstrates significant homologies to the influenza virus Replikin sequences, especially with regard to length and key lysine (k) and histidine (h) residues. Similar, but less extensive, homologies are seen in Taura Syndrome Virus. These homologies suggest

that the sequences are derived from a shared reservoir and/or that similar mechanisms of Replikin production are used in both virus groups.

**Table 2 – Shrimp White Spot and Taura Syndrome Scaffolding**

| | | |
|---|---|---|
| kkgtsypklsksytnnkgkevlvlwgvhh | **1917** | **H1N_ Influenza goose peptide** |
| kkgnsypklskeytnnkgkevlvlwgvhh | 2002 | H1N1 Swine Influenza |
| kknvksakqlphlkvlkkldvrgakqlph | 2000 | Shrimp White Spot Syndrome Virus |
| -kvhldvkgvkqllhlkvrldvrgakqlh | 2000 | Shrimp White Spot Syndrome Virus |
| kkensypklrksiiinkkevklvlwqihh | **1968** | **H3N2 Human Influenza Pandemic** |
| ----------ksykntrkdpalilwgihh | **1979-2003** | **H7N7 Influenza** |
| kkgpnypvakrsynntsgeqmliiwgvhh | **1957** | **H2N2 Human Influenza Pandemic** |
| kkgpnypvakrsynntsgeqmliiwgihh | 1957 | **H2N2 Human Influenza Pandemic** |
| kknnayptikrtynntnvedlliiwgihh | **2002** | **H5N2 Influenza** |
| kknnayptikrsysntnqedllvlwgihh | **1959** | **H5N1 Influenza** |
| kkvqankvrvfaasnqglalatrryylsfldh | **2000** | Taura Syndrome Virus |
| kkacrnagykeaclheldcksflliaqqgragah | **2005** | Taura Syndrome Virus |

Residues identical to original 1917 Goose Replikin residues are shown in medium grey.
Amino acid substitutions in light grey *and* dark grey.

**[00092]** In addition, since many species, including but not limited to swine and birds, are known to provide animal "reservoirs" for human influenza infection, marine forms such as the shrimp virus can now be examined, with early warning diagnostic benefits for outbreaks such as swine flu and bird flu. While similarities of some influenza viruses were noted between species, and the transfer of these viruses interspecies was known, there was no previous quantitative method to gauge virus activity. The activity of Replikins in shrimp can now be monitored constantly for evidence of increased viral replication rate and thus emergence of epidemics that are likely to transfer to other species.

**[00093]** A related example of virus reservoir activity in which the Replikin concentration was increased prior to an outbreak was observed in corona viruses as a group. The Replikin concentration of the corona virus group increased markedly in 2002 before the outbreak of one of its members, SARS, in 2003. *See* Figure 12.

**[00094]** With high mortality for its shrimp host, White Spot Syndrome Virus can now have its Replikins examined as earlier forms of virus Replikins, or as parallel morphological branches, that in either case may act as reservoirs for bird and animal Replikins such as those in influenza viruses. The diagnostic and preventive uses of these Replikin findings in shrimp follow as they do in influenza and for other organisms containing Replikins.

**[00095]** Advanced forecasts of influenza virus outbreaks are now conveniently achievable with Replikin concentration analysis using the proprietary software FluForecast® from Replikins, LLC, Boston, MA. Such forecasts now may permit time for preventive public health measures to be mobilized and safer strain-specific vaccines to be synthesized, tested, and mass produced.

**Replikin Repeats as a Mechanism for High Replikin Concentrations**

**[00096]** The presence of repeat sequences of the Replikins of the nucleocapsid protein of shrimp White Spot Syndrome Virus (WSSV) accounts for the unusually high Replikin concentration of 103.8. This Replikin concentration is much higher than the Replikin concentration of, for example, influenza viruses, which usually range from less than 1 up to 5 or 7 and comparable, as discussed above, with *P. falciparum*. Interestingly, while the shrimp White Spot Syndrome pathogen is a virus, and the *P. falciparum* is a trypanosome, both spend an essential part of their reproductive cycles in red blood cells, an unusual host cell whether in shrimp (White Spot Syndrome Virus) or man (malaria), both are fulminating, rapidly-replicating diseases with high mortality rates of their hosts, and both appear to use the same methods of increasing their high Replikin concentrations to such record highs, namely, Replikin repeats and Replikin overlap.

**[00097]** As illustrated in Table 3, examples of Replikin repeats and Replikin overlaps were found by the applicants in the above nucleocapsid protein of the shrimp White Spot Syndrome Virus. 497 Replikins were observed in the White Spot Syndrome Virus. Of those 497, the Replikins illustrated below in Table 3 were selected for their short sequences and high concentration of lysines which, as demonstrated throughout this application, is associated with high mortality. The chosen sequences are easier and less expensive to synthesize than the longer sequences that are not included in Table 3.

**[00098]** Table 3 illustrates intramolecular Replikin repeats and Replikin overlap in shrimp White Spot Syndrome Virus (WSSV) nucleocapsid protein (VP35) gene with a Replikin concentration (number of Replikins per 100 amino acids) of 103.8 (497 total Replikins per 479 amino acids). The nucleocapsid protein reportedly possesses thymidine kinase and thymidylate kinase activity.

**TABLE 3** – Intramolecular Replikin repeats and Replikin overlap in shrimp White Spot Syndrome Virus (WSSV) nucleocapsid protein (VP35) gene with Replikin concentration of 103.8

Individual Replikins at Different Positions in the same Molecule, in order of appearance in the sequence

10) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}$

23) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

25) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}$

37) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

61) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

72) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

193) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

307) $K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

370) $K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

462) $K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

*Note in the shrimp virus the repeated use of identical whole Replikin sequences (underlined) and partial Replikin sequences (shaded) in different positions in the one molecule (each amino acid is numbered according to its order in the sequence).

**[00099]** Replikin concentration was determined for the ribonucleotide reductase gene in WSSV from Accession No. AAL89390. Accession No. AAL89390 discloses the amino acid sequence of ribonucleotide reductase translated from the total genome of a year 2000 isolate of White Spot Syndrome Virus made publicly available at Accession No. NC 003225.1. The Replikin concentration, as discussed above, was an unusually high at 103.8. Additionally, the Replikin concentration of the Replikin Peak Gene of the protein was even higher at 110.7. The Replikin concentration of the Replikin Peak Gene was determined by dividing the number of Replikin sequences identified in the segment of the protein containing the highest concentration of Replikin sequences, 497 Replikin sequences, by the total amino acid length of the Replikin Peak Gene, 449 amino acids, to arrive at 110.7 Replikin sequences per 100 amino acids. *See* Example 1.

**[000100]** The amino acid sequence of the protein publicly available at Accession No. AAL89390 is of particular interest because it demonstrates an overlapping of Replikin sequences that result in very high Replikin concentrations. The very large number of Replikin sequences present in the genome of the WSSV serves as a reservoir or vector for individual Replikins that are transferred or, via some other mechanism, otherwise appear in virulent strains of the influenza virus. This transfer or appearance of homologous Replikin sequences is seen in the Replikin Scaffold of the influenza virus and the Replikin Scaffold of the Shrimp White Spot Virus.

**[000101]** The amino acid sequence disclosed at Accession No. AAL89390 was further observed to contain significant Replikin Scaffold sequences. The presence of Replikin Scaffold sequences in Accession No. AAL89390 was not unexpected since Replikin Scaffolds are frequently present in viral genomes when the Replikin concentration is observed to move above 3 to 4 Replikin sequences per 100 amino acids. The presence of a Replikin Scaffold and a Replikin concentration above 3 or 4 correlates with viral outbreaks or epidemics and is another clear association with the rapid replication states of the isolated virus.

**Replikin Concentration Correlates with 20$^{th}$ Century Influenza Pandemics**

**[000102]** As discussed above, Replikin concentration has been correlated with virulence in each influenza pandemic of the 20$^{th}$ century. *See* Figure 11. This shared correlation between Replikin concentration and outbreaks and mortality in WSSV and TSV and influenza provides evidence that the Replikin structure is transferable or repeatable between these viruses.

**[000103]** The correlation between Replikin concentration and influenza outbreaks is well established and unmistakable. Within the last century there have been three influenza pandemics, each strain specific: H1N1 in 1918; H2N2 in 1957; and H3N2 in 1968. In the reported amino acid sequences of the strains responsible for each pandemic, there is a strain-specific increase in the Replikin concentration correlated with the major pandemic within the strain, followed by a decrease in Replikin concentration and several years later a rebound increase associated in each case with a strain-specific rebound epidemic. The x-axis of Figure 11 shows the year and the y-axis shows the Replikin concentration in Replikin sequences per 100 amino acids for each strain responsible for each pandemic. Note that within Figure 11 there is a separate graph for each of the three strains.

**[000104]** Figure 11 demonstrates that frequently a one to three year stepwise increase is observed before Replikin concentration reaches a peak. This stepwise increase precedes the occurrence of an epidemic, which occurs concurrently with the Replikin peak. Thus, the stepwise increase in concentration of a particular strain is a signal that a particular strain is the most likely candidate to cause an epidemic or pandemic.

**H5N1 Influenza Replikin Concentration Correlates with Epidemics**

**[000105]** Replikin concentration has also been correlated with virulence in each outbreak of H5N1 influenza ("Bird Flu") virus between the initial outbreak of 1997 and the present. Figure 4, for example, illustrates a correlation between each outbreak of H5N1 between 1997 and 2004. The x-axis in Figure 4 indicates the year and the y-axis indicates the Replikin concentration (number of Replikins per 100 amino acids). The time periods for each epidemic of H5N1 are denoted in Figure 4 by E1, E2 and E3. In H5N1 influenza, an increasing strain-specific Replikin concentration (+/-SD) from 1995 to 1997 preceded the Hong Kong H5N1 epidemic of 1997 (E1); an increase from 1999 to 2001 preceded the epidemic of 2001 (E2); and an increase from 2002 to 2004 preceded the epidemic in 2004 (E3). A decline in 1999 occurred with the massive culling of poultry in response to the E1 epidemic in Hong Kong.

**H5N1 Influenza Conservation of Replikin Scaffold in Highly Virulent Isolates**

**[000106]** There is concern that current high mortality H5N1 "bird flu" in several countries may represent an early phase of an overdue influenza pandemic. Analysis of Replikin concentration changes in H5N1 have suggested that H5N1 virulence is continuing to increase. A 2006 report nevertheless suggested that in the first probable person-to-person transmission of H5N1, "sequencing of the viral genes identified no change in the receptor-binding site of hemagglutinin or other key features of the virus. The sequences of all eight viral gene segments clustered closely with other H5N1 sequences from recent avian isolates in Thailand."

Phylogenetic analysis suggested that from the absence of evidence of "reassortment with human influenza viruses" that H5N1 is not a new variant. However, the inventors disclosed in 2006, three changes in a specific H5N1 protein sequence at sites which had not been changed in the last two H5N1 epidemics and in fact had been conserved since 1959. *See* U.S. Prov. Appln. Ser. No. 60/808,944, filed May 30, 2006.

**[000107]** The results set forth by the inventors in 2006 showed that 2005-2006 virus data indicated clearly that 1) the mortality rate of human H5N1 was increasing markedly, and that 2) the first country in which this would be clinically realized would be Indonesia. Bayu Krisnamurthi, the head of Indonesia's avian flu control commission, reported in June 2007 the clinical realization of both of these two predictions (Canadian Press, June 6, 2007). In his comments to reporters, Dr. Krisnamurthi stated that recent changes in the H5N1 virus seem to be increasing its rate and ease of transmission from birds to humans. The World Health Organization (WHO), which has not yet implemented Replikin concentration analysis and tracking that had predicted the increase in rate and transmission in 2006, reported that they had no evidence of these changes.

**[000108]** Recent discovery of the Replikin Peak Gene have allowed prediction of the geographic location, as well as the gene location and the host animal species of each outbreak. *See* Figures 8, 9 and 10. The announcement by Dr. Krisnamurthi represents the first independent government confirmation of the success of these technological improvements. *See, e.g.,* U.S. Appln. Ser. No. 11/355,120, filed February 16, 2006 and U.S. Appln. Ser. No. 11/755,597, filed May 30, 2007.

**Identification of Replikin Peak Gene for Targets and Prediction**

**[000109]** The inventors have identified a Replikin Peak Gene in an isolate of the White Spot Syndrome Virus (WSSV). A Replikin Peak Gene may be identified, isolated or synthesized for diagnosis, prevention or treatment of, for example, an outbreak of WSSV or an outbreak of a virus for which WSSV is a reservoir, such as influenza virus, by the method comprising: (1) obtaining a plurality of isolates of WSSV; (2) analyzing the protein sequences or protein sequence fragments of each isolate of the plurality of isolates for the presence and concentration of Replikin sequences; (3) identifying the protein sequence or the protein sequence fragment having the highest concentration of Replikin sequences in each isolate; (4) comparing the protein or protein fragment having the highest concentration of Replikin sequences in each isolate to the protein or protein fragment having the highest concentration of Replikin sequences in each of the other isolates of the plurality of isolates; (5) selecting the protein or protein fragment having the highest concentration of Replikin sequences; (6) identifying the amino acid sequence of the

selected protein or protein fragment as the Replikin Peak Gene of the plurality of isolates of WSSV; and (7) identifying, isolating or synthesizing the identified Replikin Peak Gene of at least one of the isolates of the plurality of isolates for diagnosis, prevention or treatment. The inventors have identified a Replikin Peak Gene in a ribonucleotide reductase gene of an isolate of WSSV. *See* Example 1.

**[000110]** A Replikin Peak Gene is a segment of the genome or a protein or segment of a protein in which the expressed gene or expressed gene segment has the highest or a higher concentration of Replikins (number of Replikins per 100 amino acids) when compared to other segments or named genes of the genome. The gene or gene segment is known as the Replikin Peak Gene or Replikin Peak Gene Area. A Replikin Peak Gene has been identified in H5N1 influenza virus and an increase in concentration of Replikins in the Replikin Peak Gene of H5N1 has been correlated with epidemics, increased virulence, morbidity and human mortality. *See* Figures 11-13 and U.S. Provisional Appln. Ser. No. 60/898,097. Likewise, a Replikin Peak Gene has been identified in the VP1 protein of Foot and Mouth Disease Virus and has been correlated with outbreaks of the virus. *See* U.S. Provisional Appln. Ser. No. 60/954,743 (*see* Figure 3 and Examples 1-4 therein). Further, a second Replikin Peak Gene has been identified in a fragment of the VP1 protein of Foot and Mouth Disease Virus and two particular Replikin sequences within the Replikin Peak Gene Area of the virus have been correlated with virulence of Foot and Mouth Disease Virus. *See id.* A Replikin Peak Gene has likewise been identified in West Nile Virus, Porcine Reproductive and Respiratory Syndrome Virus, Porcine Circovirus and Equine Influenza virus. *See* U.S. Provisional Appln. Ser. No. 60/853744, filed August 8, 2007 (Figure 2 and Example 2 therein), and U.S. Provisional Appln. Ser. No. 60/935,816, filed August 31, 2007 (Figures 1, 2 and 4).

**[000111]** Identification of Replikin sequences as infectious units has allowed the inventors to identify isolates having higher virulence relative to other isolates and to focus attention on the geographic area of an outbreak of virulent virus (see Figure 10), the particular host of hosts of an outbreak of virulent virus (see Figure 9) and the part of the genome of a virus (see Figure 8) wherein virulence mechanisms are located and wherein increased virulence may be identified and predicted. Identification of Replikin Peak Genes within viral genomes has improved the focus that is available to make these identifications and predictions of both virulence and mechanisms of virulence.

**[000112]** Because the inventors have provided a method of focusing on particular units of a viral or organismal genome, the skilled artisan will understand the importance of looking for Replikin sequences in any portion of the life cycle or infectious pathway of a virus. For example,

as described herein, the skilled artisan will understand that predictive and virulence-related Replikin sequences (or concentrations of Replikin sequence in Replikin Peak Genes) may be identified in reservoirs of influenza virus such as in WSSV and TSV. The skilled artisan will further understand that predictive and virulence-related Replikin sequences or Replikin Peak Genes may be identified in vectors of the influenza virus. The skilled artisan will additionally understand that predictive and virulence-related Replikin sequences or Replikin Peak Genes may be identified in hosts of the influenza virus or any other place where viral genes may be located or wherein viral genes may encounter genes of other strains of virus, other virus species, vectors or hosts.

**SARS Replikin Count Correlates with Epidemics**

**[000113]** An increase in Replikin concentration in coronaviruses also correlated with the SARS coronavirus epidemic of 2003. In particular, as may be seen in Figure 12, Replikin concentration in Spike and Nucleocapsid Coronavirus Proteins preceded the SARS Coronavirus epidemic of 2003. In Figure 12, the x-axis indicates the year and the y-axis indicates the Replikin concentration. The appearance of the SARS outbreak is shown by the shaded area in the graph between 2003 and 2004. The peak of the shaded area represents a total number of eight countries in which the SARS outbreak occurred in 2003. The solid black symbols represent the mean Replikin concentration for spike coronavirus proteins and the vertical black bars represent the standard deviation of the mean.

**[000114]** Figure 12 shows a remarkable constancy of low coronavirus Replikin concentration between 1995 and 2001 in the spike proteins, followed by a dramatic increase in 2002, one year before the SARS epidemic appeared in 2003. Replikin concentration of the spike proteins in SARS then returned to their normal pre-2003 levels (correlated with the disappearance of SARS). The return to normal pre-2003 levels of Replikin concentration is thus a quantitative virus structural signal of the decline of the outbreak.

**Replikin Concentration Correlates with Outbreaks in West Nile Virus, Foot and Mouth Disease and Equine Influenza**

**[000115]** In all viruses observed by the inventors, significant increases in Replikin concentration have been predictive of increases in viral virulence. For example, an increase in Replikin concentration has been correlated with outbreaks in West Nile Virus, Foot and Mouth Disease, and Equine Influenza, and is predictive of outbreaks in each of these diseases.

**[000116]** Figure 13 is a graph illustrating a correlation between Replikin concentration and morbidity and mortality in U.S. populations for West Nile Virus. Figure 14 is a graph illustrating a correlation between the concentration of Replikins observed in the VP1 protein of isolates of

Foot and Mouth Disease Virus between 1998 and 2006 and epidemics in the United Kingdom in 2001 and 2007.

**[000117]** Figure 15 is a graph illustrating a correlation between Replikin concentration in the Replikin Peak Gene of Equine Influenza virus and epidemics between 1977 and 2000. The Replikin Peak Gene in Equine Influenza is identified as the pB1 gene area. In years where the Replikin concentration increases in the pB1 gene area of the virus, no concomitant increase in the pA or pB2 virus is observed. These data demonstrate a significant effect on virulence by an observed increase in Replikin concentration particularly in a Replikin Peak Gene.

**Vaccines, Treatments and Therapeutics**

**[000118]** The observations of specific Replikins and their concentration in WSSV and TSV proteins and their correlation with outbreaks in influenza provides for early production and timely administration of vaccines tailored specifically to treat the prevalent emerging or re-emerging strain of influenza virus in a particular region of the world. By analyzing the protein sequences of isolates of a virus for the presence, concentration and/or conservation of Replikins, virus outbreaks and epidemics can be predicted and treatments developed. Furthermore, the severity of such outbreaks can be significantly lessened by administering a peptide vaccine based on the Replikin sequences identified using the methods provided herein or Replikin sequences found to be most abundant or shown to be on the rise in virus isolates over a given time period, such as about one to about three years. Vaccine products against SARS Replikin sequences and H5N1 influenza virus Replikin Scaffolds have been demonstrated by the inventors. *See, e.g.,* U.S. Appln. Ser. No. 11/355,120, filed February 16, 2006 (Examples 6 and 7). Replikin sequences added to the feed source of shrimp have likewise imparted measurable resistance to challenges with Taura Syndrome Virus. *See* Example 7 below.

**[000119]** A peptide vaccine may include a single Replikin peptide sequence or may include a plurality of Replikin sequences observed in particular virus strains. Preferably, the peptide vaccine is based on Replikin sequence(s) shown to be increasing in concentration over a given time period and conserved for at least that period of time. However, a vaccine may include a conserved Replikin peptide(s) in combination with a new Replikin peptide(s) or may be based on new Replikin peptide sequences. Replikin peptides can be synthesized by any method, including chemical synthesis or recombinant gene technology, and may include non-Replikin sequences, although vaccines based on peptides containing only Replikin sequences are preferred. Preferably, vaccine compositions of the invention also contain a pharmaceutically acceptable carrier and/or adjuvant.

**[000120]** Vaccines can be administered alone or in combination with antiviral drugs, such as gancyclovir; interferon; interleukin; M2 inhibitors, such as, amantadine, rimantadine; neuraminidase inhibitors, such as zanamivir and oseltamivir; and the like, as well as with combinations of antiviral drugs.

**[000121]** Vaccines may be administered to any animal capable of producing antibodies in an immune response. For example, a vaccine may be administered to a rabbit, a chicken, a pig, or a human. Because of the universal nature of Replikin sequences, a vaccine of the invention may be directed at a variety of strains of virus or a particular strain of virus.

**Passive Immunity**

**[000122]** In another aspect of the invention, isolated Replikin peptides may be used to generate antibodies, which may be used, for example to provide passive immunity in an individual. Various procedures known in the art may be used for the production of antibodies to Replikin sequences. Such antibodies include but are not limited to polyclonal, monoclonal, chimeric, humanized, single chain, Fab fragments and fragments produced by a Fab expression library. Antibodies that are linked to a cytotoxic agent may also be generated. Antibodies may also be administered in combination with an antiviral agent. Furthermore, combinations of antibodies to different Replikins may be administered as an antibody cocktail.

**[000123]** Monoclonal antibodies to Replikins may be prepared by using any technique that provides for the production of antibody molecules. These include but are not limited to the hybridoma technique originally described by Kohler and Milstein, (Nature, 1975, 256:495-497), the human B-cell hybridoma technique (Kosbor et al., 1983, Immunology Today, 4:72), and the EBV hybridoma technique (Cole et al., Monoclonal Antibodies and Cancer Therapy, Alan R. Liss, Inc., pp. 77-96). In addition, techniques developed for the production of chimeric antibodies (Morrison et al., 1984, Proc. Nat. Acad. Sci USA, 81:6851-6855) or other techniques may be used. Alternatively, techniques described for the production of single chain antibodies (US 4,946,778) can be adapted to produce Replikin-specific single chain antibodies.

**[000124]** Antibodies to any peptides observed to be present in an emerging or re-emerging strain of virus and combinations of such antibodies are useful in the treatment and/or prevention of viral infection.

**[000125]** Antibody fragments that contain binding sites for a Replikin may be generated by known techniques. For example, such fragments include but are not limited to F(ab')2 fragments which can be produced by pepsin digestion of the antibody molecules and the Fab fragments that can be generated by reducing the disulfide bridges of the F(ab')2 fragments. Alternatively, Fab

expression libraries can be generated (Huse et al., 1989, Science, 246:1275-1281) to allow rapid and easy identification of monoclonal Fab fragments with the desired specificity.

**[000126]** In another aspect of the invention, immune serum containing antibodies to one or more Replikins obtained from an individual exposed to one or more Replikins may be used to induce passive immunity in another individual or animal. Immune serum may be administered via i.v. to a subject in need of treatment. Passive immunity also can be achieved by injecting a recipient with preformed antibodies to one or more Replikins. Passive immunization may be used to provide immediate protection to individuals who have been exposed to an infectious organism. Administration of immune serum or preformed antibodies is routine and the skilled practitioner can readily ascertain the amount of serum or antibodies needed to achieve the desired effect.

**[000127]** Replikin peptides, alone or in various combinations, may be administered to a subject, preferably by i.v. or intramuscular injection, in order to stimulate the immune system of the subject to produce antibodies to the peptide. Generally the dosage of peptides is in the range of from about 0.1 μg to about 10 mg. In another embodiment, the dosage of pepetides is about 10 μg to about 1 mg. In a preferred embodiment, the dosage of pepetides is about 50 μg to about 500 μg. The skilled practitioner can readily determine the dosage and number of dosages needed to produce an effective immune response.

**EXAMPLES**

**Example 1 – Determination of Very High Replikin Concentration in Ribonucleotide Reductase from Accession No. AAL89390**

**[000128]** Replikin concentration was determined for ribonucleotide reductase publicly available at Accession No. AAL89390. The amino acid sequence was translated from the total genome of a year 2000 isolate of White Spot Syndrome Virus made publicly available at Accession No. NC 003225.1. The Replikin concentration in the protein was an unusually high 103.8 and the Replikin concentration of the Replikin Peak Gene of the protein was a yet higher 110.7. The Replikin concentration of the protein was determined by dividing the number of Replikin sequences identified in the amino acid sequence of the protein, 497 Replikin sequences, by the total amino acid length of the protein, 479 amino acids, to arrive at 103.8 Replikin sequences per 100 amino acids. The Replikin concentration of the Replikin Peak Gene was determined by dividing the number of Replikin sequences identified in the segment of the protein containing the highest concentration of Replikin sequences, 497 Replikin sequences, by the total amino acid length of the Replikin Peak Gene, 449 amino acids, to arrive at 110.7 Replikin sequences per 100 amino acids.

**[000129]** The amino acid sequence of the protein publicly available at Accession No. AAL89390 is of particular interest because it demonstrates an overlapping of Replikin sequences that results in very high Replikin concentrations, comparable to *P. falciparum*. The high concentrations of Replikin sequences provide a reservoir for transfer to influenza viruses.

**[000130]** In Accession No. AAL89390, the inventors identified a Replikin Peak Gene. A Replikin Peak Gene is the segment of a protein having the highest concentration of continuous, uninterrupted, overlapping, Replikin sequences. In the sequence disclosed below, the Replikin Peak Gene is underlined. The Replikin Peak Gene is observed to occupy most of the disclosed protein. The expansiveness of the Replikin Peak Gene across most of the amino acid sequence of the protein is highly unusual and creates the remarkably high Replikin concentration. The amino acid sequence further contains significant Replikin Scaffold sequences. The following Replikin Scaffold repeats were identified in Accession No. AAL89390.

$K^{66}$KNVKSAKQLPHLKV<u>H</u>LDV<u>K</u>SAKQLPHLKVH$^{96}$

$K^{160}$KNVKSAKQLPHLKV<u>H</u>LDV<u>K</u>GVKQLLH$^{186}$

$K^{239}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPH$^{265}$

$K^{303}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPH$^{329}$

$K^{397}$ KNVKSAKQLPHLKV<u>L</u>LDV<u>R</u>GAKQLPHLKVH$^{427}$

**Replikin Analysis for AAL89390**

PubMed Code: AAL89390

Description: Ribonucleotide reductase of shrimp white spot syndrome virus (WSSV):

Isolated Year: 2000

Source: Shrimp White Spot Syndrome Virus

$M^{1}K^{2}I^{3}C^{4}Q^{5}I^{6}S^{7}S^{8}P^{9}T^{10}L^{11}T^{12}L^{13}S^{14}I^{15}P^{16}L^{17}E^{18}G^{19}V^{20}Y^{21}$<u>$H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}$</u>

$G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}$
$T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}Q^{465}N^{466}L^{467}Q^{468}V^{469}K^{470}M^{471}W^{472}L^{473}N^{474}I^{475}T^{476}Y^{477}T^{478}S^{479}$

## Replikin Sequences in Amino-Terminal Portion of Peptide

(1) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}$

(2) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(3) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(4) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(5) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(6) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(7) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(8) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(9) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(10) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}$

(11) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}$

(12) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}$

(13) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(14) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(15) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(16) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(17) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(18) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(19) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(20) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(21) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(22) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(23) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(24) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(25) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}$

(26) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(27) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(28) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(29) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(30) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(31) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(32) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(33) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(34) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(35) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(36) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(37) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(38) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(39) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(40) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(41) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(42) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(43) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(44) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(45) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(46) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(47) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(48) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(49) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(50) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(51) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}$

$L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(52) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(53) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(54) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(55) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(56) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(57) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(58) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(59) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(60) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(61) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(62) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(63) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(64) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(65) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(66) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(67) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(68) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(69) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(70) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(71) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(72) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(73) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(74) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(75) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(76) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(77) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(78) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(79) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(80) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(81) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(82) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(83) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(84) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(85) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(86) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(87) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(88) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(89) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(90) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(91) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(92) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(93) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(94) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(95) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(96) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(97) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(98) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(99) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(100) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(101) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(102) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(103) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(104) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(105) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(106) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(107) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(108) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(109) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(110) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(111) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(112) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(113) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(114) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(115) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(116) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(117) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(118) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(119) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(120) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(121) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(122) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(123) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(124) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(125) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(126) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(127) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(128) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(129) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(130) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(131) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(132) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(133) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(134) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(135) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(136) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(137) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(138) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(139) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(140) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(141) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(142) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(143) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(144) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(145) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(146) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(147) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(148) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(149) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(150) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(151) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(152) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(153) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(154) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(155) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(156) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(157) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(158) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}$

(159) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(160) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(161) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(162) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(163) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(164) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(165) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(166) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(167) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(168) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}$

(169) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(170) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(171) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(172) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(173) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(174) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(175) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(176) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(177) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(178) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}$

(179) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(180) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(181) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(182) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(183) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(184) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(185) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(186) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(187) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(188) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(189) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(190) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(191) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(192) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(193) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(194) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(195) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(196) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(197) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

## Replikin Sequences in Mid-molecule Portion of Peptide

(198) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(199) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(200) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(201) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(202) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(203) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(204) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(205) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(206) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(207) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(208) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(209) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(210) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(211) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(212) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(213) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(214) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(215) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(216) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(217) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}$

(218) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(219) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(220) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(221) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(222) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(223) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(224) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(225) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(226) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(227) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(228) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(229) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(230) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(231) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}$

(232) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(233) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(234) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(235) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(236) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(237) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(238) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(239) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(240) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(241) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(242) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(243) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}$

(244) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(245) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(246) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(247) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}$

(248) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}$

(249) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}$

(250) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(251) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(252) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(253) $K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}$

(254) $K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(255) $K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(256) $K^{197}Q^{198}L^{199}L^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(257) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(258) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(259) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}$

(260) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}$

(261) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}$

(262) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}$

(263) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}$

(264) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}$

(265) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(266) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}$

(267) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(268) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(269) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(270) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}$

(271) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}$

(272) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}$

(273) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}$

(274) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}$

(275) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}$

(276) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(277) $K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}$

(278) $K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}$

(279) $K^{212}Q^{213}L^{214}P^{215}H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(280) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}$

(281) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}$

(282) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}$

(283) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}$

(284) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}$

(285) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}$

(286) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(287) $H^{216}L^{217}K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}$

(288) $K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(289) $K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(290) $K^{218}V^{219}H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}$

(291) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}$

(292) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}$

(293) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}$

(294) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}$

(295) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}$

$S^{244}A^{245}K^{246}$

(296) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(297) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}$

(298) $H^{220}L^{221}D^{222}V^{223}R^{224}G^{225}A^{226}K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(299) $K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(300) $K^{227}Q^{228}N^{229}P^{230}W^{231}R^{232}K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(301) $K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(302) $K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(303) $K^{233}N^{234}L^{235}C^{236}L^{237}L^{238}K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(304) $K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(305) $K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(306) $K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(307) $K^{239}K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(308) $K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(309) $K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(310) $K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(311) $K^{240}N^{241}V^{242}K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(312) $K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(313) $K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(314) $K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(315) $K^{243}S^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(316) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(317) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(318) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(319) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(320) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}$

(321) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(322) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}$

(323) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}$

(324) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}$

(325) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}$

(326) $K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(327) $K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(328) $K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(329) $K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(330) $K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(331) $K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(332) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}$

(333) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}$

(334) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}$

(335) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}$

(336) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}$

(337) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}$

(338) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}$

(339) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}$

(340) $K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}$

(341) $K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(342) $K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(343) $K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}$

(344) $K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}$

(345) $K^{276}Q^{277}L^{278}P^{279}H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(346) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}$

(347) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}$

(348) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}$

(349) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}$

(350) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}$

(351) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}$

(352) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(353) $H^{280}L^{281}K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(354) $K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(355) $K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(356) $K^{282}V^{283}H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}$

(357) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}$

(358) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}$

(359) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}$

(360) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}$

(361) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}$

(362) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(363) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(364) $H^{284}L^{285}D^{286}V^{287}R^{288}G^{289}A^{290}K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}$

(365) $K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(366) $K^{291}Q^{292}N^{293}P^{294}W^{295}R^{296}K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(367) $K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(368) $K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(369) $K^{297}N^{298}L^{299}C^{300}L^{301}L^{302}K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(370) $K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(371) $K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(372) $K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(373) $K^{303}K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(374) $K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(375) $K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(376) $K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(377) $K^{304}N^{305}V^{306}K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(378) $K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(379) $K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(380) $K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(381) $K^{307}S^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(382) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(383) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(384) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(385) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(386) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(387) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(388) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}$

(389) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}$

(390) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}$

(391) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}$

(392) $H^{314}L^{315}K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}$

(393) $K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(394) $K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}$

(395) $K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(396) $K^{316}V^{317}L^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

## Replikin Sequences in Carboxy-Terminal Portion of Peptide

(397) $K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(398) $K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(399) $K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(400) $K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(401) $K^{325}Q^{326}L^{327}P^{328}H^{329}L^{330}K^{331}$

(402) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}$

(403) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}$

(404) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}$

(405) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}$

(406) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}$

(407) $H^{329}L^{330}K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}$

(408) $K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}$

(409) $K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(410) $K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(411) $K^{331}V^{332}L^{333}L^{334}D^{335}V^{336}R^{337}G^{338}A^{339}K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(412) $K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}$

(413) $K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}$

(414) $K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(415) $K^{340}Q^{341}L^{342}P^{343}H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(416) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}$

(417) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}$

(418) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}$

(419) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}$

(420) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}$

(421) $H^{344}L^{345}K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}$

(422) $K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}$

(423) $K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}$

(424) $K^{346}V^{347}H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(425) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}$

(426) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}$

(427) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}$

(428) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}$

(429) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}$

(430) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}$

(431) $H^{348}L^{349}D^{350}V^{351}R^{352}G^{353}A^{354}K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}$

(432) $K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}$

(433) $K^{355}Q^{356}L^{357}P^{358}H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(434) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}$

(435) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}$

(436) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}$

(437) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}$

(438) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}$

(439) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}$

(440) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}$

(441) $H^{359}L^{360}K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}$

(442) $K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}$

(443) $K^{361}V^{362}L^{363}L^{364}D^{365}V^{366}R^{367}G^{368}A^{369}K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(444) $K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}$

(445) $K^{370}Q^{371}L^{372}P^{373}H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(446) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}$

(447) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}$

(448) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}$

(449) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}$

(450) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}$

(451) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}$

(452) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}$

(453) $H^{374}L^{375}K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}$

(454) $K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(455) $K^{376}V^{377}L^{378}L^{379}D^{380}V^{381}R^{382}G^{383}A^{384}K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(456) $K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(457) $K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(458) $K^{385}Q^{386}N^{387}P^{388}W^{389}R^{390}K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(459) $K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(460) $K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(461) $K^{391}N^{392}L^{393}C^{394}L^{395}L^{396}K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(462) $K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(463) $K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(464) $K^{397}K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(465) $K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}$

(466) $K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(467) $K^{398}N^{399}V^{400}K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(468) $K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}$

(469) $K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(470) $K^{401}S^{402}A^{403}K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(471) $K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}$

(472) $K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(473) $K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(474) $K^{404}Q^{405}L^{406}P^{407}H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}$

(475) $H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}$

(476) $H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}$

(477) $H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}$

(478) $H^{408}L^{409}K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}$

(479) $K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}$

(480) $K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(481) $K^{410}V^{411}L^{412}L^{413}D^{414}V^{415}R^{416}G^{417}A^{418}K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}$

(482) $K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}$

(483) $K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}$

(484) $K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}$

(485) $K^{419}Q^{420}L^{421}P^{422}H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}$

(486) $H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}$

(487) $H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}Q^{465}N^{466}L^{467}Q^{468}V^{469}K^{470}$

(488) $H^{423}L^{424}K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}$

(489) $K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}$

(490) $K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}$

(491) $K^{425}V^{426}H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}$

(492) $H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}$

(493) $H^{427}L^{428}D^{429}V^{430}R^{431}G^{432}A^{433}K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}Q^{465}N^{466}L^{467}Q^{468}V^{469}K^{470}$

(494) $K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}$

(495) $K^{434}Q^{435}Q^{436}Q^{437}Q^{438}L^{439}C^{440}L^{441}P^{442}L^{443}K^{444}T^{445}I^{446}S^{447}T^{448}S^{449}F^{450}T^{451}H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}$

(496) $H^{452}L^{453}L^{454}L^{455}C^{456}L^{457}Y^{458}M^{459}E^{460}Y^{461}G^{462}K^{463}H^{464}Q^{465}N^{466}L^{467}Q^{468}V^{469}K^{470}$

(497) $K^{463}H^{464}Q^{465}N^{466}L^{467}Q^{468}V^{469}K^{470}$

## Example 2 – Determination of Very High Replikin Concentration at Accession No. NP 478030.

**[000131]** Replikin concentration was determined for a functionally undefined protein in the genome of an isolate of White Spot Syndrome Virus from 2000 made publicly available at NP 478030. The Replikin Concentration in the protein was again an unusually high 97.6 Replikin sequences per 100 amino acids. The Replikin concentration was determined by dividing the

number of Replikin sequences identified in the amino acid sequence of the protein, 361 Replikin sequences, by the total amino acid length of the protein, 370 amino acids.

**[000132]** The amino acid sequence of NP 478030 is of interest because, like the protein in Example 1, it demonstrates an overlapping of Replikin sequences that results in very high Replikin concentrations comparable to the highly-replicating *P. falciparum* of malaria. These high concentrations of Replikin sequences again provide a reservoir of Replikins for transfer to influenza viruses.

**PubMed Accession Number NP 478030**

Description: Protein of unknown function translated from complete genome sequence of the shrimp white spot baculoform virus (WSSV) publicly available at PubMed Accession No. NC 003225.1.

Isolated Year: 2000

Source: Shrimp White Spot Syndrome Virus (Shrimp White Spot Baculoform Virus)

$M^{1}K^{2}I^{3}C^{4}Q^{5}I^{6}S^{7}S^{8}P^{9}T^{10}L^{11}T^{12}L^{13}S^{14}I^{15}P^{16}L^{17}E^{18}G^{19}V^{20}Y^{21}H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}$
$K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$
$S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}$
$K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}$
$G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}$
$L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$
$L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}$
$P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}$
$R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}$
$D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}$
$H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}$
$Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}$
$Q^{356}N^{357}L^{358}Q^{359}V^{360}K^{361}M^{362}W^{363}L^{364}N^{365}I^{366}T^{367}Y^{368}T^{369}S^{370}$

**Replikin Sequences Identified in Accession No. ABS00973**

**Replikin Sequences Located in Amino-Terminal of Peptide**

(1) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}$

(2) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(3) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(4) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(5) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}$
$K^{54}$

(6) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}$
$K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(7) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}$

$K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(8) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}$
$K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(9) $H^{22}V^{23}K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}$
$K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(10) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}$

(11) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}$

(12) $K^{24}Q^{25}L^{26}L^{27}H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}$

(13) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(14) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(15) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(16) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(17) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}$
$W^{58}R^{59}K^{60}$

(18) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}$
$W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(19) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}$
$W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(20) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}$
$W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(21) $H^{28}L^{29}K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}$
$W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(22) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}$
$K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(23) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}$

(24) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}$

(25) $K^{30}V^{31}H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}$

(26) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(27) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(28) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(29) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}$
$L^{62}C^{63}L^{64}L^{65}K^{66}$

(30) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}$
$L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(31) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}$
$L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(32) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}$
$L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(33) $H^{32}L^{33}D^{34}V^{35}K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}$
$L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(34) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(35) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(36) $K^{36}G^{37}V^{38}K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(37) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}$

(38) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(39) $K^{39}Q^{40}L^{41}L^{42}H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(40) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}$

(41) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}$

(42) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}$

(43) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}$

(44) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}$

(45) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}$

(46) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(47) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(48) $H^{43}L^{44}K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(49) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(50) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(51) $K^{45}V^{46}R^{47}L^{48}D^{49}V^{50}R^{51}G^{52}A^{53}K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(52) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(53) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(54) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(55) $K^{54}Q^{55}N^{56}P^{57}W^{58}R^{59}K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(56) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(57) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(58) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(59) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(60) $K^{60}N^{61}L^{62}C^{63}L^{64}L^{65}K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(61) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(62) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(63) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(64) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(65) $K^{66}K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(66) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}$

(67) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(68) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(69) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(70) $K^{67}N^{68}V^{69}K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(71) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(72) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(73) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(74) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(75) $K^{70}S^{71}A^{72}K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(76) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}$

(77) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}$

(78) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(79) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(80) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(81) $K^{73}Q^{74}L^{75}P^{76}H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(82) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(83) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(84) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(85) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(86) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(87) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(88) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(89) $H^{77}L^{78}K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(90) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(91) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(92) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(93) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}$

(94) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}$

(95) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}$

(96) $K^{79}V^{80}H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(97) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(98) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(99) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(100) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(101) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(102) $H^{81}L^{82}D^{83}V^{84}K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(103) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(104) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(105) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(106) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(107) $K^{85}S^{86}A^{87}K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(108) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(109) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(110) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(111) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}$

(112) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}$

(113) $K^{88}Q^{89}L^{90}P^{91}H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(114) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(115) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(116) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(117) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(118) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(119) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(120) $H^{92}L^{93}K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(121) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}$

(122) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}$

(123) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(124) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(125) $K^{94}V^{95}H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(126) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(127) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(128) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(129) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(130) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(131) $H^{96}L^{97}D^{98}V^{99}R^{100}G^{101}A^{102}K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(132) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}$

(133) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(134) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(135) $K^{103}Q^{104}L^{105}P^{106}H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(136) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}$

(137) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}$

(138) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(139) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(140) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(141) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(142) $H^{107}L^{108}K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(143) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}$

(144) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(145) $K^{109}V^{110}R^{111}L^{112}D^{113}V^{114}K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(146) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(147) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(148) $K^{115}S^{116}A^{117}K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(149) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}$

(150) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}$

(151) $K^{118}Q^{119}L^{120}P^{121}H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(152) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(153) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(154) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(155) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(156) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(157) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(158) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}$

(159) $H^{122}L^{123}K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(160) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}$

(161) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}$

(162) $K^{124}V^{125}H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

## Replikin Sequences Located in Mid-Molecule Portion of Peptide

(163) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(164) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(165) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(166) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(167) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(168) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}$

(169) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(170) $H^{126}L^{127}D^{128}V^{129}R^{130}G^{131}A^{132}K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(171) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(172) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}$

(173) $K^{133}Q^{134}L^{135}P^{136}H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(174) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}$

(175) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}$

(176) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$

(177) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}$

(178) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$
$K^{161}N^{162}V^{163}K^{164}$

(179) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$
$K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}$

(180) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$
$K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(181) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$
$K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(182) $H^{137}L^{138}K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}$
$K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(183) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}$
$V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(184) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}$
$V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(185) $K^{139}V^{140}R^{141}L^{142}D^{143}V^{144}R^{145}G^{146}A^{147}K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}$
$V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(186) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(187) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$
$V^{174}H^{175}$

(188) $K^{148}Q^{149}N^{150}P^{151}W^{152}R^{153}K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$
$V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(189) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$
$G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(190) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(191) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(192) $K^{154}N^{155}L^{156}C^{157}L^{158}L^{159}K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$
$G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(193) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(194) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(195) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}$
$L^{184}L^{185}H^{186}$

(196) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}$
$L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(197) $K^{160}K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}$
$L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(198) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}$

(199) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(200) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(201) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(202) $K^{161}N^{162}V^{163}K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(203) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(204) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(205) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(206) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(207) $K^{164}S^{165}A^{166}K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(208) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}$

(209) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}$

(210) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(211) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(212) $K^{167}Q^{168}L^{169}P^{170}H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(213) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(214) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(215) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(216) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}$

(217) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(218) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(219) $H^{171}L^{172}K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}$

(220) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}$

(221) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}$

(222) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}$

(223) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(224) $K^{173}V^{174}H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(225) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(226) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}$

(227) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}$

$L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}$

(228) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}$ $L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}$ $K^{225}$

(229) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(230) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}$ $L^{199}P^{200}H^{201}L^{202}K^{203}$

(231) $H^{175}L^{176}D^{177}V^{178}K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(232) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(233) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(234) $K^{179}G^{180}V^{181}K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}$ $H^{205}$

(235) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}$

(236) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(237) $K^{182}Q^{183}L^{184}L^{185}H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(238) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}$

(239) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}$

(240) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}$

(241) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}$

(242) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}$

(243) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}$

(244) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}$

(245) $H^{186}L^{187}K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}$

(246) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}$

(247) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(248) $K^{188}V^{189}R^{190}L^{191}D^{192}V^{193}R^{194}G^{195}A^{196}K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}$ $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(249) $K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}$

(250) $K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}$

(251) $K^{197}Q^{198}L^{199}P^{200}H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}$ $C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(252) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(253) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}$

(254) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}$

(255) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}$

(256) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}$

(257) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}$

(258) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}$

(259) $H^{201}L^{202}K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}$

(260) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}$

(261) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(262) $K^{203}V^{204}H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(263) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}$

(264) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}$

(265) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}$

(266) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}$

(267) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}$

(268) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}$

(269) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}$

(270) $H^{205}L^{206}D^{207}V^{208}R^{209}G^{210}A^{211}K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(271) $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(272) $K^{212}Q^{213}N^{214}P^{215}W^{216}R^{217}K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(273) $K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(274) $K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(275) $K^{218}N^{219}L^{220}C^{221}L^{222}L^{223}K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(276) $K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(277) $K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(278) $K^{224}K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(279) $K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}$

(280) $K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(281) $K^{225}N^{226}V^{227}K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

$L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(282) $K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}$

(283) $K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(284) $K^{228}S^{229}A^{230}K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}$
$L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(285) $K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}$

(286) $K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(287) $K^{231}Q^{232}L^{233}P^{234}H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}$
$V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(288) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}$

(289) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(290) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}$
$K^{261}$

(291) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}$
$K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(292) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}$
$K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}$

(293) $H^{235}L^{236}K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}$
$K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}$

(294) $K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}$

(295) $K^{237}V^{238}L^{239}L^{240}D^{241}V^{242}R^{243}G^{244}A^{245}K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}$
$L^{263}P^{264}H^{265}$

(296) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}$

(297) $K^{246}Q^{247}L^{248}P^{249}H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

## Replikin Sequences Located in Carboxy-Terminal Portion of Peptide

(298) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}$

(299) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(300) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}$

(301) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}$

(302) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}$

(303) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}$

(304) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}$

(305) $H^{250}L^{251}K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}$
$K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}$

(306) $K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}$

$N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(307) $K^{252}V^{253}L^{254}L^{255}D^{256}V^{257}R^{258}G^{259}A^{260}K^{261}Q^{262}L^{263}P^{264}H^{265}$

(308) $K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(309) $K^{261}Q^{262}L^{263}P^{264}H^{265}L^{266}K^{267}$

(310) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}$

(311) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}$

(312) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}$

(313) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}$

(314) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}$

(315) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}$

(316) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}$

(317) $H^{265}L^{266}K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}$

(318) $K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(319) $K^{267}V^{268}L^{269}L^{270}D^{271}V^{272}R^{273}G^{274}A^{275}K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(320) $K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(321) $K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(322) $K^{276}Q^{277}N^{278}P^{279}W^{280}R^{281}K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(323) $K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(324) $K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(325) $K^{282}N^{283}L^{284}C^{285}L^{286}L^{287}K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(326) $K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(327) $K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(328) $K^{288}K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(329) $K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}$

(330) $K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(331) $K^{289}N^{290}V^{291}K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(332) $K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}$

(333) $K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(334) $K^{292}S^{293}A^{294}K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(335) $K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}$

(336) $K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(337) $K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(338) $K^{295}Q^{296}L^{297}P^{298}H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}$

(339) $H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}$

(340) $H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(341) $H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(342) $H^{299}L^{300}K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}$

(343) $K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}$

(344) $K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(345) $K^{301}V^{302}L^{303}L^{304}D^{305}V^{306}R^{307}G^{308}A^{309}K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}$

(346) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}$

(347) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}$

(348) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}$

(349) $K^{310}Q^{311}L^{312}P^{313}H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}$

(350) $H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(351) $H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}$

(352) $H^{314}L^{315}K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}Q^{356}N^{357}L^{358}Q^{359}V^{360}K^{361}$

(353) $K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}$

(354) $K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}$

(355) $K^{316}V^{317}H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}$

(356) $H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}$

(357) $H^{318}L^{319}D^{320}V^{321}R^{322}G^{323}A^{324}K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}Q^{356}N^{357}L^{358}Q^{359}V^{360}K^{361}$

(358) $K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}$

(359) $K^{325}Q^{326}Q^{327}Q^{328}Q^{329}L^{330}C^{331}L^{332}P^{333}L^{334}K^{335}T^{336}I^{337}S^{338}T^{339}S^{340}F^{341}T^{342}H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}$

(360) $H^{343}L^{344}L^{345}L^{346}C^{347}L^{348}Y^{349}M^{350}E^{351}Y^{352}G^{353}K^{354}H^{355}Q^{356}N^{357}L^{358}Q^{359}V^{360}K^{361}$

(361) $K^{354}H^{355}Q^{356}N^{357}L^{358}Q^{359}V^{360}K^{361}$

**Example 3 – Determination of Low Replikin Concentrations in 2005 and 2007 Isolates of WSSV from Accession Nos. AAW88445 and ABS00973**

**[000133]** In 2006 and 2007 White Spot Syndrome Virus (WSSV) has been observed to be dormant in shrimp. This continued decline of WSSV into "quiescent" or "dormant" levels in 2006-2007 is demonstrated in mean Replikin concentrations for viruses isolated during 2005-2007 that are very low as compared to years wherein the virus demonstrated greater virulence, such as 2001. *See* Table 4 in Example 4 below. The continued quiescence in WSSV in 2007 may be contrasted with an observed rising of Replikin concentration in Taura Syndrome Virus Replikin during this period.

**[000134]** As may be seen from the analysis below, Accession Nos. AAW88445 and ABS00973 have low observed Replikin concentrations. ABS00973 contains a single Replikin sequence in the entire disclosed amino acid sequence of 240 residues. The single Replikin sequence is underlined. The Replikin concentration of Accession No. ABS00973 is an inordinately low 0.5.

**Replikin Analysis**

PubMed Code: AAW88445

Description:

Isolated Year: 2005

Source: Shrimp White Spot Syndrome Virus

$M^{1}S^{2}N^{3}G^{4}A^{5}T^{6}I^{7}S^{8}D^{9}E^{10}R^{11}L^{12}I^{13}L^{14}I^{15}L^{16}D^{17}K^{18}I^{19}V^{20}E^{21}R^{22}R^{23}G^{24}V^{25}S^{26}N^{27}L^{28}S^{29}E^{30}L^{31}L^{32}I^{33}H^{34}P^{35}I^{36}T^{37}K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}Q^{82}G^{83}I^{84}D^{85}V^{86}R^{87}Q^{88}I^{89}I^{90}T^{91}D^{92}Y^{93}L^{94}A^{95}K^{96}R^{97}K^{98}L^{99}T^{100}Q^{101}N^{102}L^{103}V^{104}H^{105}W^{106}Y^{107}R^{108}P^{109}P^{110}I^{111}S^{112}C^{113}T^{114}D^{115}I^{116}D^{117}E^{118}K^{119}I^{120}Q^{121}Q^{122}E^{123}T^{124}G^{125}Q^{126}V^{127}G^{128}R^{129}C^{130}S^{131}V^{132}$

$A^{133}T^{134}Y^{135}N^{136}L^{137}R^{138}I^{139}G^{140}G^{141}D^{142}D^{143}G^{144}E^{145}F^{146}T^{147}R^{148}Y^{149}D^{150}F^{151}S^{152}I^{153}P^{154}L^{155}G^{156}D^{157}F^{158}K^{159}I^{160}T^{161}A^{162}K^{163}L^{164}F^{165}R^{166}S^{167}I^{168}N^{169}D^{170}E^{171}D^{172}V^{173}D^{174}A^{175}V^{176}I^{177}L^{178}V^{179}S^{180}R^{181}S^{182}D^{183}V^{184}V^{185}N^{186}D^{187}V^{188}L^{189}S^{190}F^{191}E^{192}A^{193}F^{194}N^{195}R^{196}T^{197}G^{198}E^{199}R^{200}V^{201}V^{202}I^{203}F^{204}F^{205}N^{206}V^{207}I^{208}V^{209}E^{210}G^{211}K^{212}S^{213}K^{214}D^{215}I^{216}D^{217}I^{218}V^{219}C^{220}K^{221}S^{222}R^{223}Y^{224}K^{225}H^{226}T^{227}H^{228}I^{229}L^{230}N^{231}G^{232}E^{233}S^{234}A^{235}T^{236}Y^{237}A^{238}V^{239}K^{240}R^{241}I^{242}K^{243}R^{244}G^{245}D^{246}T^{247}R^{248}D^{249}D^{250}I^{251}L^{252}F^{253}A^{254}I^{255}T^{256}A^{257}F^{258}K^{259}E^{260}E^{261}$

**Replikin Sequences in Amino-terminal Portion of Peptide**

(1) $H^{34}P^{35}I^{36}T^{37}K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}$

(2) $H^{34}P^{35}I^{36}T^{37}K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}$

(3) $H^{34}P^{35}I^{36}T^{37}K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}$

(4) $K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}$

(5) $K^{38}H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}$

(6) $H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}$

(7) $H^{39}I^{40}N^{41}E^{42}L^{43}L^{44}K^{45}N^{46}T^{47}V^{48}R^{49}H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}$

(8) $H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}$

(9) $H^{50}G^{51}D^{52}R^{53}V^{54}Y^{55}M^{56}K^{57}D^{58}A^{59}E^{60}L^{61}D^{62}V^{63}R^{64}S^{65}R^{66}L^{67}E^{68}D^{69}I^{70}K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}$

(10) $K^{71}K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}Q^{82}G^{83}I^{84}D^{85}V^{86}R^{87}Q^{88}I^{89}I^{90}T^{91}D^{92}Y^{93}L^{94}A^{95}K^{96}R^{97}K^{98}L^{99}T^{100}Q^{101}N^{102}L^{103}V^{104}H^{105}$

(11) $K^{72}D^{73}C^{74}V^{75}L^{76}K^{77}A^{78}I^{79}E^{80}K^{81}Q^{82}G^{83}I^{84}D^{85}V^{86}R^{87}Q^{88}I^{89}I^{90}T^{91}D^{92}Y^{93}L^{94}A^{95}K^{96}R^{97}K^{98}L^{99}T^{100}Q^{101}N^{102}L^{103}V^{104}H^{105}$

**Replikin Sequences in Mid-Molecule Portion of Peptide**

Zero Replikins.

**Replikin Sequences in Carboxy-Terminal Portion of Peptide**

(12) $K^{212}S^{213}K^{214}D^{215}I^{216}D^{217}I^{218}V^{219}C^{220}K^{221}S^{222}R^{223}Y^{224}K^{225}H^{226}$

(13) $K^{212}S^{213}K^{214}D^{215}I^{216}D^{217}I^{218}V^{219}C^{220}K^{221}S^{222}R^{223}Y^{224}K^{225}H^{226}T^{227}H^{228}$

(14) $K^{214}D^{215}I^{216}D^{217}I^{218}V^{219}C^{220}K^{221}S^{222}R^{223}Y^{224}K^{225}H^{226}$

(15) $K^{214}D^{215}I^{216}D^{217}I^{218}V^{219}C^{220}K^{221}S^{222}R^{223}Y^{224}K^{225}H^{226}T^{227}H^{228}$

Replikin Count = Number of Replikins per 100 amino acids = 15/261 = 5.7

**PubMed Code: ABS00973**

Description:

Isolated: 2007

Source: Shrimp white spot syndrome virus

$M^{1}D^{2}L^{3}S^{4}F^{5}T^{6}L^{7}S^{8}V^{9}V^{10}S^{11}A^{12}I^{13}L^{14}A^{15}I^{16}T^{17}A^{18}V^{19}I^{20}A^{21}V^{22}F^{23}I^{24}V^{25}I^{26}F^{27}R^{28}Y^{29}H^{30}N^{31}T^{32}V^{33}T^{34}K^{35}T^{36}I^{37}E^{38}T^{39}$
$H^{40}T^{41}G^{42}N^{43}I^{44}E^{45}T^{46}N^{47}M^{48}D^{49}E^{50}N^{51}L^{52}R^{53}I^{54}P^{55}V^{56}T^{57}A^{58}E^{59}V^{60}G^{61}S^{62}G^{63}Y^{64}F^{65}K^{66}M^{67}T^{68}D^{69}V^{70}S^{71}F^{72}$
$D^{73}S^{74}D^{75}T^{76}L^{77}G^{78}K^{79}I^{80}K^{81}I^{82}R^{83}N^{84}G^{85}K^{86}S^{87}D^{88}A^{89}Q^{90}M^{91}K^{92}E^{93}E^{94}D^{95}A^{96}D^{97}L^{98}V^{99}I^{100}T^{101}P^{102}V^{103}E^{104}G^{105}$
$R^{106}A^{107}L^{108}E^{109}V^{110}T^{111}V^{112}G^{113}Q^{114}N^{115}L^{116}T^{117}F^{118}E^{119}G^{120}T^{121}F^{122}K^{123}M^{124}W^{125}N^{126}N^{127}T^{128}S^{129}R^{130}K^{131}I^{132}$
$N^{133}I^{134}T^{135}G^{136}M^{137}Q^{138}M^{139}V^{140}P^{141}K^{142}I^{143}N^{144}P^{145}S^{146}K^{147}A^{148}F^{149}V^{150}G^{151}S^{152}S^{153}N^{154}T^{155}S^{156}S^{157}F^{158}T^{159}P^{160}$
$V^{161}S^{162}I^{163}D^{164}E^{165}D^{166}E^{167}V^{168}G^{169}T^{170}F^{171}V^{172}C^{173}G^{174}T^{175}T^{176}F^{177}G^{178}A^{179}P^{180}I^{181}A^{182}A^{183}T^{184}A^{185}G^{186}G^{187}$
$N^{188}L^{189}F^{190}D^{191}M^{192}Y^{193}V^{194}H^{195}V^{196}T^{197}Y^{198}S^{199}G^{200}T^{201}E^{202}T^{203}E^{204}$

**Replikin Sequences in Amino-Terminal Portion of Peptide**

(1) $H^{40}T^{41}G^{42}N^{43}I^{44}E^{45}T^{46}N^{47}M^{48}D^{49}E^{50}N^{51}L^{52}R^{53}I^{54}P^{55}V^{56}T^{57}A^{58}E^{59}V^{60}G^{61}S^{62}G^{63}Y^{64}F^{65}K^{66}M^{67}T^{68}D^{69}V^{70}S^{71}F^{72}D^{73}S^{74}D^{75}T^{76}L^{77}G^{78}K^{79}I^{80}K^{81}I^{82}R^{83}N^{84}G^{85}K^{86}$

Mid-molecule: Zero Replikins.

Carboxy-terminal: Zero Replikins.

Replikin Count = Number of Replikins per 100 amino acids = 1/204 = 0.5

**Example 4 – Determination of Replikin Concentration in Publicly Available Accession Numbers for Isolates of WSSV from 1995 through 2007**

**[000135]** Mean Replikin concentrations were determined for all amino acid sequences for WSSV with accession numbers publicly available at www.pubmed.com. The amino acid sequences were scanned for Replikin sequences of 7 to 50 amino acids comprising (1) at least one lysine residue located at a first terminus of the sequence and at least one lysine residue or at least one histidine residue located at a second terminus of the sequence; (2) a first lysine residue located six to ten residues from a second lysine residue; (3) at least one histidine residue; and (4) at least 6% lysine residues. The total number of Replikin sequences was determined for each available accession number. The total number of Replikin sequences in each accession number was then divided by the total number of amino acid residues disclosed in the accession number. The result was the Replikin concentration. The mean Replikin concentration was then determined for all viruses isolated and reported in a particular year. Table 4 provides the results of the Replikin concentration analysis.

**Table 4 - WSSV Replikin Concentration by Year**

| Year | PubMed Accession Number-Replikin Count |
|---|---|
| 1995 | CAA88950 18 CAA91970 59 |
| | No. of isolates: 2 Mean Replikin Count: 4.4 Standard Deviation: 0.6 Significance: low p<0.10 |
| 1996 | CAE17687 160 CAB03144 29 CAB03173 31 |
| | No. of isolates: 3 Mean Replikin Count: 6.0 Standard Deviation: 2.6 Significance: low p>0.50, prev p<0.30 |
| 1997 | |
| 1998 | ABA54417 48 |
| | No. of isolates: 1 Mean Replikin Count: 6.2 Standard Deviation: 0.0 Significance: prev p>0.50 |
| 1999 | |
| 2000 | NP_478030 361 NP_478019 361 NP_478001 361 NP_477774 361 NP_477756 361 NP_477753 361 NP_477809 361 NP_477768 361 NP_477523 361 NP_477959 361 NP_478053 361 NP_478052 361 NP_478051 361 NP_478050 361 NP_478049 361 NP_478048 361 NP_478047 361 NP_478046 361 NP_478045 361 NP_478044 361 NP_478043 361 NP_478042 361 NP_478041 361 NP_478039 361 NP_478038 361 NP_478037 361 NP_478036 361 NP_478035 361 NP_478034 361 NP_478033 361 NP_478032 361 NP_478031 361 NP_478029 361 NP_478028 361 NP_478027 361 NP_478026 361 NP_478025 361 NP_478024 361 NP_478023 361 NP_478022 361 NP_478021 361 NP_478020 361 NP_478018 361 NP_478017 361 NP_478016 361 NP_478015 361 NP_478014 361 NP_478013 361 NP_478012 361 NP_478011 361 NP_478010 361 NP_478009 361 NP_478008 361 NP_478007 361 NP_478006 361 NP_478005 361 NP_478004 361 NP_478003 361 NP_478002 361 NP_478000 361 NP_477999 361 NP_477998 361 NP_477997 361 NP_477996 361 NP_477995 361 NP_477994 361 NP_477993 361 NP_477992 361 NP_477991 361 NP_477990 361 NP_477989 361 NP_477988 361 NP_477987 361 NP_477986 361 NP_477985 361 NP_477984 361 NP_477983 361 NP_477982 361 NP_477981 361 NP_477980 361 NP_477979 361 NP_477978 361 NP_477977 361 NP_477976 361 NP_477975 361 NP_477974 361 NP_477973 361 NP_477972 361 NP_477971 361 NP_477970 361 NP_477969 361 NP_477968 361 NP_477967 361 NP_477966 361 NP_477965 361 NP_477964 361 NP_477963 361 NP_477962 361 NP_477961 361 NP_477960 361 NP_477958 361 NP_477957 361 NP_477956 361 NP_477955 361 NP_477954 361 NP_477953 361 NP_477952 361 NP_477951 361 NP_477950 361 NP_477949 361 NP_477948 361 NP_477947 361 NP_477946 361 NP_477945 361 NP_477944 361 NP_477943 361 NP_477942 361 NP_477941 361 NP_477940 361 NP_477939 361 NP_477938 361 |

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|---|---|
| | NP_477937 361 NP_477936 361 NP_477935 361 NP_477934 361 NP_477933 361 NP_477932 361 NP_477931 361 NP_477930 361 NP_477929 361 NP_477928 361 NP_477927 361 NP_477926 361 NP_477925 361 NP_477924 361 NP_477923 361 NP_477922 361 NP_477921 361 NP_477920 361 NP_477919 361 NP_477918 361 NP_477917 361 NP_477916 361 NP_477915 361 NP_477914 361 NP_477913 361 NP_477912 361 NP_477911 361 NP_477910 361 NP_477909 361 NP_477908 361 NP_477907 361 NP_477906 361 NP_477905 361 NP_477904 361 NP_477903 361 NP_477902 361 NP_477901 361 NP_477900 361 NP_477899 361 NP_477898 361 NP_477897 361 NP_477896 361 NP_477895 361 NP_477894 361 NP_477893 361 NP_477892 361 NP_477891 361 NP_477890 361 NP_477889 361 NP_477888 361 NP_477887 361 NP_477886 361 NP_477885 361 NP_477884 361 NP_477883 361 NP_477882 361 NP_477881 361 NP_477880 361 NP_477879 361 NP_477878 361 NP_477877 361 NP_477876 361 NP_477875 361 NP_477874 361 NP_477873 361 NP_477872 361 NP_477871 361 NP_477870 361 NP_477869 361 NP_477868 361 NP_477867 361 NP_477866 361 NP_477865 361 NP_477864 361 NP_477863 361 NP_477862 361 NP_477861 361 NP_477860 361 NP_477859 361 NP_477858 361 NP_477857 361 NP_477856 361 NP_477855 361 NP_477854 361 NP_477853 361 NP_477852 361 NP_477851 361 NP_477850 361 NP_477849 361 NP_477848 361 NP_477847 361 NP_477846 361 NP_477845 361 NP_477844 361 NP_477843 361 NP_477842 361 NP_477841 361 NP_477840 361 NP_477839 361 NP_477838 361 NP_477837 361 NP_477836 361 NP_477835 361 NP_477834 361 NP_477833 361 NP_477832 361 NP_477831 361 NP_477830 361 NP_477829 361 NP_477828 361 NP_477827 361 NP_477826 361 NP_477825 361 NP_477824 361 NP_477823 361 NP_477822 361 NP_477821 361 NP_477820 361 NP_477819 361 NP_477818 361 NP_477817 361 NP_477816 361 NP_477815 361 NP_477814 361 NP_477813 361 NP_477812 361 NP_477811 361 NP_477810 361 NP_477808 361 NP_477807 361 NP_477806 361 NP_477805 361 NP_477804 361 NP_477803 361 NP_477802 361 NP_477801 361 NP_477800 361 NP_477799 361 NP_477798 361 NP_477797 361 NP_477796 361 NP_477795 361 NP_477794 361 NP_477793 361 NP_477792 361 NP_477791 361 NP_477790 361 NP_477789 361 NP_477788 361 NP_477787 361 NP_477786 361 NP_477785 361 NP_477784 361 NP_477783 361 NP_477782 361 NP_477781 361 NP_477780 361 NP_477779 361 NP_477778 361 NP_477777 361 NP_477776 361 NP_477775 361 NP_477773 361 NP_477772 361 NP_477771 361 NP_477770 361 NP_477769 361 NP_477767 361 NP_477766 361 NP_477765 361 NP_477764 361 NP_477763 361 NP_477762 361 NP_477761 361 NP_477760 361 NP_477759 361 NP_477758 361 NP_477757 361 NP_477755 361 NP_477754 361 NP_477752 361 NP_477751 361 NP_477750 361 NP_477749 361 NP_477748 361 NP_477747 361 NP_477746 361 NP_477745 361 NP_477744 361 NP_477743 361 NP_477742 361 NP_477741 361 NP_477740 361 NP_477739 361 NP_477738 361 NP_477737 361 NP_477736 361 NP_477735 361 NP_477734 361 NP_477733 361 NP_477732 361 NP_477731 361 NP_477730 361 NP_477729 361 NP_477728 361 NP_477727 361 NP_477726 361 NP_477725 361 NP_477724 361 NP_477723 361 NP_477722 361 NP_477721 361 NP_477720 361 NP_477719 361 NP_477718 361 NP_477717 361 NP_477716 361 NP_477715 361 NP_477714 361 NP_477713 361 NP_477712 361 NP_477711 361 NP_477710 361 NP_477709 361 NP_477708 361 NP_477707 361 NP_477706 361 NP_477705 361 NP_477704 361 NP_477703 361 NP_477702 361 NP_477701 361 NP_477700 361 NP_477699 361 NP_477698 361 NP_477697 361 NP_477696 361 NP_477695 361 NP_477694 361 NP_477693 361 NP_477692 361 NP_477691 361 NP_477690 361 NP_477689 361 NP_477688 361 NP_477687 361 NP_477686 361 NP_477685 361 NP_477684 361 NP_477683 361 NP_477682 361 NP_477681 361 NP_477680 361 NP_477679 361 NP_477678 361 NP_477677 361 NP_477676 361 NP_477675 361 NP_477674 361 NP_477673 361 NP_477672 361 NP_477671 361 NP_477670 361 NP_477669 361 NP_477668 361 NP_477667 361 NP_477666 361 NP_477665 361 NP_477664 361 NP_477663 361 NP_477662 361 NP_477661 361 NP_477660 361 NP_477659 361 NP_477658 361 NP_477657 361 NP_477656 361 NP_477655 361 NP_477654 361 NP_477653 361 NP_477652 361 NP_477651 361 NP_477650 361 NP_477649 361 NP_477648 361 NP_477647 361 NP_477646 361 NP_477645 361 NP_477644 361 NP_477643 361 NP_477642 361 NP_477641 361 NP_477640 361 NP_477639 361 NP_477638 361 NP_477637 361 NP_477636 361 NP_477635 361 NP_477634 361 NP_477633 361 NP_477632 361 NP_477631 361 NP_477630 361 NP_477629 361 NP_477628 361 NP_477627 361 NP_477626 361 NP_477625 361 NP_477624 361 NP_477623 361 NP_477622 361 NP_477621 361 NP_477620 361 NP_477619 361 NP_477618 361 NP_477617 361 NP_477616 361 NP_477615 361 NP_477614 361 NP_477613 361 NP_477612 361 NP_477611 361 NP_477610 361 NP_477609 361 NP_477608 361 NP_477607 361 NP_477606 361 NP_477605 361 NP_477604 361 NP_477603 361 NP_477602 361 NP_477601 361 NP_477600 361 NP_477599 361 NP_477598 361 NP_477597 |

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|---|---|
| | 361 NP_477596 361 NP_477595 361 NP_477594 361 NP_477593 361 NP_477592 361 NP_477591 361 NP_477590 361 NP_477589 361 NP_477588 361 NP_477587 361 NP_477586 361 NP_477585 361 NP_477584 361 NP_477583 361 NP_477582 361 NP_477581 361 NP_477580 361 NP_477579 361 NP_477578 361 NP_477577 361 NP_477576 361 NP_477575 361 NP_477574 361 NP_477573 361 NP_477572 361 NP_477571 361 NP_477570 361 NP_477569 361 NP_477568 361 NP_477567 361 NP_477566 361 NP_477565 361 NP_477564 361 NP_477563 361 NP_477562 361 NP_477561 361 NP_477560 361 NP_477559 361 NP_477558 361 NP_477557 361 NP_477556 361 NP_477555 361 NP_477554 361 NP_477553 361 NP_477552 361 NP_477551 361 NP_477550 361 NP_477549 361 NP_477548 361 NP_477547 361 NP_477546 361 NP_477545 361 NP_477544 361 NP_477543 361 NP_477542 361 NP_477541 361 NP_477540 361 NP_477539 361 NP_477538 361 NP_477537 361 NP_477536 361 NP_477535 361 NP_477534 361 NP_477533 361 NP_477532 361 NP_477531 361 NP_477530 361 NP_477529 361 NP_477527 361 NP_477526 361 NP_477525 361 NP_477524 361 |
| | No. of isolates: 529 Mean Replikin Count: 97.6 Std. Deviation: 0.0 Significance: low p<0.001 |
| 2002 | |
| 2003 | |
| 2004 | |
| 2005 | AAZ29239 9 XP_001681561 6 |
| | No. of isolates: 2 Mean Replikin Count: 2.6 Std. Deviation: 2.4 Significance: low p>0.20, prev p<0.001 |
| 2006 | ABM92267 14 ABP01348 1 ABM64218 6 ABI34434 6 ABI93178 4 ABI93177 3 ABI93176 6 ABI93174 12 ABQ12866 3 ABD65308 2 ABD65303 1 ABD65302 4 ABD65300 3 ABD65298 1 |
| | No. of isolates: 14 Mean Replikin Count: 2.7 Std. Deviation: 2.5 Significance: low p<0.001, prev p>0.50 |
| 2007 | 2ED6_L 1 2ED6_K 1 2ED6_J 1 2ED6_I 1 2ED6_H 1 2ED6_G 1 2ED6_F 1 2ED6_E 1 2ED6_D 1 2ED6_C 1 2ED6_B 1 2ED6_A 1 ABQ12772 15 ABQ12773 3 ABQ12771 6 ABQ12770 9 ABO69369 2 ABO69368 2 ABS00974 5 ABS00973 1 ABQ44211 3 ABQ44210 4 ABP52058 4 ABP52057 1 ABP52054 5 |
| | No. of isolates: 25 Mean Replikin Count: 1.3 Std. Deviation: 1.2 Significance: low p<0.001, prev p<0.05 |

**Example 5 – Determination of Replikin Concentrations in 2001 and 2005 Isolates of TSV Publicly Available at Accession Nos. AAM73766 and AAY89096**

**[000136]** The Taura Syndrome Shrimp Virus is less virulent than WSSV and the structure of the TSV Replikin Scaffold is less closely related to influenza virus than are the structures of WSSV Replikin Scaffolds. In year 2000, TSV had a Replikin concentration of 3.3. Between 2001 and 2004, TSV had a lower mean Replikin concentration, as low as 0.7, and its Replikin Scaffold disappeared. In 2005 the Replikin Scaffold reappeared, with an increase in lysines and histidines, and a commensurate increase in Replikin concentration to 3.9, followed by an increase in TSV outbreaks in 2006-2007.

**[000137]** Below is a comparison of the Replikin Scaffold identified in AAK72220 in an isolate of TSV from 2000 and the Replikin Scaffold identified in AAY89096 in an isolate of TSV from 2005. The TSV Replikin Scaffolds are also compared to two Replikin Scaffolds in H1N1 influenza virus in the 1918 pandemic and shrimp WSSV in 2000.

| | | |
|---|---|---|
| **kk**gssypk**h**sksyvnnkgkevlvlwgv**hh** | 1918 | H1N1 Human Influenza Pandemic |
| -kgssypk**h**sksyvnnkgkevlvlwgv**hh** | 1918 | H1N1 Human Influenza Pandemic |
| -kv**h**ldvkgvkqll**h**lkvrldvrgakql**h** | 2000 | Shrimp White Spot Syndrome Virus |
| **kk**nvksakqlp**h**lkvl**kk**ldvrgakqlp**h** | 2000 | Shrimp White Spot Syndrome Virus |

| | | |
|---|---|---|
| **kk**vqan**k**trvfaasnqglalalrryylsfld**h** | 2000 | Taura Syndrome Virus AAK72220 |
| kk**acrnagy**k**eacl**h**eldcksfllaqqgraga**h | 2005 | Taura Syndrome Virus AAY89096 |

**[000138]** The following analysis of Accession Nos. AAM73766 and AAY89096 demonstrate Replikin concentration analysis of amino acid sequences of isolates of Taura Syndrome Virus having publicly available accession numbers at www.pubmed.com.

**PubMed Code: AAM73766**

Description:

Isolated: 2001

Source: Taura syndrome virus

$M^{1}P^{2}A^{3}N^{4}P^{5}V^{6}E^{7}I^{8}D^{9}N^{10}F^{11}D^{12}T^{13}T^{14}T^{15}S^{16}G^{17}G^{18}L^{19}I^{20}P^{21}G^{22}G^{23}S^{24}V^{25}T^{26}N^{27}S^{28}E^{29}G^{30}S^{31}T^{32}I^{33}L^{34}M^{35}N^{36}D^{37}$
$I^{38}P^{39}I^{40}T^{41}N^{42}Q^{43}N^{44}V^{45}V^{46}L^{47}S^{48}K^{49}N^{50}V^{51}T^{52}D^{53}N^{54}L^{55}F^{56}E^{57}V^{58}Q^{59}D^{60}Q^{61}A^{62}L^{63}I^{64}E^{65}S^{66}L^{67}S^{68}R^{69}D^{70}V^{71}L^{72}L^{73}$
$H^{74}N^{75}D^{76}S^{77}W^{78}T^{79}S^{80}S^{81}D^{82}D^{83}E^{84}I^{85}G^{86}T^{87}T^{88}M^{89}T^{90}Q^{91}E^{92}Q^{93}L^{94}A^{95}T^{96}E^{97}F^{98}N^{99}Q^{100}P^{101}H^{102}L^{103}Y^{104}E^{105}I^{106}S^{107}$
$L^{108}P^{109}D^{110}D^{111}I^{112}V^{113}R^{114}K^{115}S^{116}L^{117}F^{118}M^{119}S^{120}N^{121}K^{122}L^{123}A^{124}N^{125}I^{126}A^{127}Y^{128}M^{129}R^{130}C^{131}D^{132}$
$Y^{133}E^{134}V^{135}T^{136}V^{137}R^{138}V^{139}Q^{140}A^{141}T^{142}P^{143}F^{144}L^{145}Q^{146}G^{147}A^{148}L^{149}W^{150}L^{151}W^{152}N^{153}K^{154}M^{155}N^{156}A^{157}K^{158}$
$Q^{159}T^{160}S^{161}I^{162}I^{163}R^{164}R^{165}T^{166}L^{167}T^{168}E^{169}H^{170}L^{171}R^{172}S^{173}I^{174}T^{175}S^{176}F^{177}P^{178}G^{179}I^{180}E^{181}M^{182}N^{183}L^{184}Q^{185}S^{186}$
$E^{187}A^{188}R^{189}A^{190}I^{191}T^{192}L^{193}S^{194}I^{195}P^{196}Y^{197}T^{198}S^{199}E^{200}F^{201}Q^{202}V^{203}F^{204}N^{205}P^{206}R^{207}N^{208}V^{209}N^{210}N^{211}L^{212}N^{213}S^{214}I^{215}R$
$^{216}L^{217}S^{218}V^{219}L^{220}S^{221}Q^{222}L^{223}Q^{224}G^{225}P^{226}E^{227}D^{228}V^{229}E^{230}S^{231}A^{232}S^{233}Y^{234}S^{235}I^{236}Y^{237}G^{238}R^{239}L^{240}K^{241}N^{242}I^{243}K^{244}L^{2}$
$^{45}Y^{246}G^{247}H^{248}A^{249}P^{250}S^{251}V^{252}T^{253}S^{254}S^{255}V^{256}Y^{257}P^{258}S^{259}T^{260}Q^{261}S^{262}G^{263}Y^{264}D^{265}D^{266}D^{267}C^{268}P^{269}I^{270}V^{271}H^{272}A^{273}G$
$^{274}T^{275}D^{276}E^{277}D^{278}S^{279}S^{280}K^{281}Q^{282}G^{283}I^{284}V^{285}S^{286}R^{287}V^{288}A^{289}D^{290}T^{291}V^{292}G^{293}A^{294}V^{295}A^{296}N^{297}V^{298}V^{299}D^{300}G^{301}V^{30}$
$^{2}G^{303}V^{304}P^{305}I^{306}L^{307}S^{308}T^{309}I^{310}A^{311}K^{312}P^{313}V^{314}S^{315}W^{316}V^{317}S^{318}G^{319}V^{320}V^{321}S^{322}N^{323}V^{324}$
$A^{325}S^{326}M^{327}F^{328}G^{329}F^{330}S^{331}K^{332}D^{333}R^{334}D^{335}M^{336}T^{337}K^{338}V^{339}N^{340}A^{341}Y^{342}E^{343}N^{344}L^{345}P^{346}G^{347}K^{348}G^{349}F^{350}T^{351}H^{352}$
$G^{353}V^{354}G^{355}F^{356}D^{357}Y^{358}G^{359}V^{360}P^{361}L^{362}S^{363}L^{364}F^{365}P^{366}N^{367}N^{368}A^{369}I^{370}D^{371}P^{372}T^{373}I^{374}A^{375}V^{376}P^{377}E^{378}G^{379}L^{380}D^{381}$
$E^{382}M^{383}S^{384}I^{385}E^{386}Y^{387}L^{388}A^{389}Q^{390}R^{391}P^{392}Y^{393}M^{394}L^{395}N^{396}R^{397}Y^{398}T^{399}I^{400}R^{401}G^{402}G^{403}D^{404}T^{405}P^{406}$
$D^{407}V^{408}H^{409}G^{410}T^{411}I^{412}V^{413}A^{414}D^{415}I^{416}P^{417}V^{418}S^{419}P^{420}V^{421}N^{422}F^{423}S^{424}L^{425}Y^{426}G^{427}K^{428}V^{429}I^{430}A^{431}K^{432}Y^{433}$
$R^{434}T^{435}L^{436}F^{437}A^{438}A^{439}P^{440}V^{441}S^{442}L^{443}A^{444}V^{445}A^{446}M^{447}A^{448}N^{449}W^{450}W^{451}R^{452}G^{453}N^{454}I^{455}N^{456}L^{457}N^{458}L^{459}R^{460}F^{461}$
$A^{462}K^{463}T^{464}Q^{465}Y^{466}H^{467}Q^{468}C^{469}R^{470}L^{471}L^{472}V^{473}Q^{474}Y^{475}L^{476}P^{477}Y^{478}G^{479}S^{480}G^{481}V^{482}Q^{483}P^{484}I^{485}E^{486}S^{487}$
$I^{488}L^{489}S^{490}Q^{491}I^{492}I^{493}D^{494}I^{495}S^{496}Q^{497}V^{498}D^{499}D^{500}K^{501}G^{502}I^{503}D^{504}I^{505}A^{506}F^{507}P^{508}S^{509}V^{510}Y^{511}P^{512}N^{513}K^{514}W^{515}M^{516}R$
$^{517}V^{518}Y^{519}D^{520}P^{521}A^{522}K^{523}V^{524}G^{525}Y^{526}T^{527}A^{528}D^{529}C^{530}A^{531}P^{532}G^{533}R^{534}I^{535}V^{536}I^{537}S^{538}V^{539}L^{540}N^{541}P^{542}$
$L^{543}I^{544}S^{545}A^{546}S^{547}T^{548}V^{549}S^{550}P^{551}N^{552}I^{553}V^{554}M^{555}Y^{556}P^{557}W^{558}V^{559}H^{560}W^{561}S^{562}N^{563}L^{564}E^{565}V^{566}A^{567}E^{568}P^{569}$
$G^{570}T^{571}L^{572}A^{573}K^{574}A^{575}A^{576}I^{577}G^{578}F^{579}N^{580}Y^{581}P^{582}A^{583}D^{584}V^{585}P^{586}E^{587}E^{588}P^{589}T^{590}F^{591}S^{592}V^{593}T^{594}R^{595}A^{596}$
$P^{597}V^{598}S^{599}G^{600}T^{601}L^{602}F^{603}T^{604}L^{605}L^{606}Q^{607}D^{608}T^{609}K^{610}V^{611}S^{612}L^{613}G^{614}E^{615}A^{616}D^{617}G^{618}V^{619}F^{620}S^{621}L^{622}Y^{623}$
$F^{624}T^{625}N^{626}T^{627}T^{628}T^{629}G^{630}R^{631}R^{632}H^{633}R^{634}L^{635}T^{636}Y^{637}A^{638}G^{639}L^{640}P^{641}G^{642}E^{643}L^{644}G^{645}S^{646}C^{647}E^{648}I^{649}V^{650}$
$K^{651}L^{652}P^{653}Q^{654}G^{655}Q^{656}Y^{657}S^{658}I^{659}E^{660}Y^{661}A^{662}A^{663}T^{664}S^{665}A^{666}P^{667}T^{668}L^{669}V^{670}L^{671}D^{672}R^{673}P^{674}I^{675}F^{676}S^{677}E^{678}P^{679}I^{6}$
$^{80}G^{681}P^{682}K^{683}Y^{684}V^{685}V^{686}T^{687}K^{688}V^{689}K^{690}N^{691}G^{692}D^{693}V^{694}V^{695}S^{696}I^{697}S^{698}E^{699}E^{700}T^{701}L^{702}V^{703}T^{704}C^{705}$
$G^{706}S^{707}M^{708}A^{709}A^{710}L^{711}G^{712}G^{713}A^{714}T^{715}V^{716}A^{717}L^{718}Q^{719}S^{720}V^{721}D^{722}E^{723}T^{724}I^{725}E^{726}I^{727}L^{728}K^{729}L^{730}E^{731}S^{732}$
$D^{733}F^{734}E^{735}S^{736}K^{737}A^{738}P^{739}V^{740}K^{741}F^{742}T^{743}P^{744}G^{745}N^{746}Y^{747}T^{748}V^{749}V^{750}T^{751}E^{752}A^{753}S^{754}D^{755}V^{756}E^{757}L^{758}V^{759}$
$T^{760}N^{761}Q^{762}D^{763}I^{764}T^{765}V^{766}N^{767}E^{768}H^{769}N^{770}P^{771}R^{772}T^{773}H^{774}A^{775}G^{776}I^{777}D^{778}E^{779}E^{780}P^{781}P^{782}V^{783}K^{784}R^{785}S^{786}$
$V^{787}I^{788}G^{789}R^{790}I^{791}V^{792}R^{793}R^{794}V^{795}A^{796}R^{797}Y^{798}V^{799}P^{800}N^{801}K^{802}L^{803}I^{804}R^{805}R^{806}I^{807}L^{808}R^{809}D^{810}L^{811}S^{812}Q^{813}S^{814}P^{815}C$
$^{816}I^{817}Y^{818}P^{819}S^{820}T^{821}H^{822}A^{823}G^{824}L^{825}D^{826}Y^{827}S^{828}S^{829}S^{830}D^{831}T^{832}S^{833}T^{834}M^{835}L^{836}T^{837}T^{838}M^{839}G^{840}E^{841}$
$Q^{842}F^{843}V^{844}S^{845}L^{846}R^{847}M^{848}L^{849}T^{850}R^{851}R^{852}S^{853}S^{854}P^{855}V^{856}D^{857}I^{858}L^{859}R^{860}G^{861}D^{862}L^{863}V^{864}T^{865}L^{866}P^{867}G^{868}I^{869}S^{870}$

$F^{871}G^{872}T^{873}D^{874}N^{875}S^{876}L^{877}R^{878}Q^{879}S^{880}L^{881}V^{882}N^{883}I^{884}I^{885}S^{886}Y^{887}M^{888}Y^{889}R^{890}F^{891}T^{892}H^{893}G^{894}S^{895}I^{896}S^{897}Y^{898}K^{899}I^{900}I^{901}P^{902}K^{903}N^{904}K^{905}G^{906}D^{907}L^{908}Y^{909}I^{910}T^{911}T^{912}T^{913}S^{914}P^{915}D^{916}S^{917}I^{918}E^{919}T^{920}S^{921}T^{922}S^{923}A^{924}Y^{925}Q^{926}F^{927}D^{928}T^{929}N^{930}R^{931}A^{932}M^{933}H^{934}Y^{935}I^{936}N^{937}T^{938}S^{939}L^{940}N^{941}P^{942}M^{943}A^{944}Q^{945}I^{946}S^{947}L^{948}P^{949}Y^{950}Y^{951}S^{952}P^{953}A^{954}E^{955}N^{956}L^{957}V^{958}I^{959}D^{960}S^{961}K^{962}S^{963}F^{964}P^{965}Q^{966}L^{967}S^{968}D^{969}L^{970}S^{971}I^{972}S^{973}N^{974}L^{975}E^{976}R^{977}T^{978}E^{979}N^{980}E^{981}Y^{982}F^{983}V^{984}L^{985}A^{986}S^{987}A^{988}G^{989}D^{990}D^{991}H^{992}T^{993}F^{994}S^{995}Q^{996}L^{997}A^{998}G^{999}C^{1000}P^{1001}A^{1002}F^{1003}T^{1004}F^{1005}G^{1006}P^{1007}A^{1008}E^{1009}L^{1010}A^{1011}$

**Replikin Sequences in Amino-Terminal Portion of Peptide**

(1) $H^{102}L^{103}Y^{104}E^{105}I^{106}S^{107}L^{108}P^{109}D^{110}D^{111}I^{112}V^{113}R^{114}K^{115}S^{116}L^{117}F^{118}M^{119}S^{120}N^{121}K^{122}$

(2) $K^{332}D^{333}R^{334}D^{335}M^{336}T^{337}K^{338}V^{339}N^{340}A^{341}Y^{342}E^{343}N^{344}L^{345}P^{346}G^{347}K^{348}G^{349}F^{350}T^{351}H^{352}$

(3) $K^{338}V^{339}N^{340}A^{341}Y^{342}E^{343}N^{344}L^{345}P^{346}G^{347}K^{348}G^{349}F^{350}T^{351}H^{352}$

**Replikin Sequences in Mid-Molecule Portion of Peptide**

Zero Replikins.

**Replikin Sequences in Carboxy-Terminal Portion of Peptide**

(4) $K^{729}L^{730}E^{731}S^{732}D^{733}F^{734}E^{735}S^{736}K^{737}A^{738}P^{739}V^{740}K^{741}F^{742}T^{743}P^{744}G^{745}N^{746}Y^{747}T^{748}V^{749}V^{750}T^{751}E^{752}A^{753}S^{754}D^{755}V^{756}E^{757}L^{758}V^{759}T^{760}N^{761}Q^{762}D^{763}I^{764}T^{765}V^{766}N^{767}E^{768}H^{769}N^{770}P^{771}R^{772}T^{773}H^{774}$

(5) $K^{729}L^{730}E^{731}S^{732}D^{733}F^{734}E^{735}S^{736}K^{737}A^{738}P^{739}V^{740}K^{741}F^{742}T^{743}P^{744}G^{745}N^{746}Y^{747}T^{748}V^{749}V^{750}T^{751}E^{752}A^{753}S^{754}D^{755}V^{756}E^{757}L^{758}V^{759}T^{760}N^{761}Q^{762}D^{763}I^{764}T^{765}V^{766}N^{767}E^{768}H^{769}$

(6) $H^{893}G^{894}S^{895}I^{896}S^{897}Y^{898}K^{899}I^{900}I^{901}P^{902}K^{903}N^{904}K^{905}$

(7) $K^{899}I^{900}I^{901}P^{902}K^{903}N^{904}K^{905}G^{906}D^{907}L^{908}Y^{909}I^{910}T^{911}T^{912}T^{913}S^{914}P^{915}D^{916}S^{917}I^{918}E^{919}T^{920}S^{921}T^{922}S^{923}A^{924}Y^{925}Q^{926}F^{927}D^{928}T^{929}N^{930}R^{931}A^{932}M^{933}H^{934}$

Replikin Count = Number of Replikins per 100 amino acids = 7/1011 = 0.7

**PubMed Code: AAY89096**

Description:

Isolated: 2005

Source: Taura syndrome virus

$M^{1}A^{2}S^{3}Y^{4}Y^{5}L^{6}N^{7}I^{8}K^{9}T^{10}H^{11}N^{12}L^{13}R^{14}R^{15}T^{16}P^{17}G^{18}A^{19}H^{20}R^{21}A^{22}F^{23}Y^{24}V^{25}M^{26}N^{27}D^{28}D^{29}G^{30}E^{31}N^{32}R^{33}I^{34}Y^{35}S^{36}L^{37}I^{38}G^{39}T^{40}L^{41}R^{42}R^{43}A^{44}P^{45}A^{46}F^{47}K^{48}V^{49}G^{50}S^{51}R^{52}R^{53}Y^{54}K^{55}S^{56}H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}A^{64}T^{65}V^{66}A^{67}E^{68}L^{69}C^{70}N^{71}Q^{72}L^{73}H^{74}D^{75}R^{76}V^{77}L^{78}P^{79}F^{80}A^{81}N^{82}P^{83}Q^{84}V^{85}W^{86}K^{87}E^{88}V^{89}I^{90}S^{91}E^{92}N^{93}K^{94}V^{95}Q^{96}P^{97}D^{98}S^{99}M^{100}L^{101}K^{102}A^{103}A^{104}F^{105}G^{106}N^{107}W^{108}E^{109}E^{110}W^{111}P^{112}K^{113}D^{114}K^{115}V^{116}C^{117}E^{118}E^{119}L^{120}Y^{121}S^{122}E^{123}C^{124}E^{125}C^{126}G^{127}Y^{128}V^{129}G^{130}T^{131}C^{132}Y^{133}V^{134}S^{135}V^{136}D^{137}W^{138}L^{139}R^{140}P^{141}Q^{142}A^{143}T^{144}K^{145}C^{146}N^{147}D^{148}C^{149}I^{150}L^{151}K^{152}M^{153}N^{154}R^{155}N^{156}V^{157}E^{158}Y^{159}P^{160}Y^{161}H^{162}T^{163}I^{164}G^{165}V^{166}S^{167}G^{168}N^{169}V^{170}V^{171}T^{172}N^{173}T^{174}D^{175}I^{176}V^{177}Y^{178}T^{179}G^{180}Y^{181}A^{182}D^{183}V^{184}F^{185}K^{186}C^{187}E^{188}K^{189}C^{190}D^{191}L^{192}L^{193}M^{194}G^{195}A^{196}W^{197}A^{198}P^{199}N^{200}D^{201}I^{202}P^{203}A^{204}L^{205}T^{206}H^{207}N^{208}I^{209}R^{210}S^{211}S^{212}Q^{213}C^{214}V^{215}Q^{216}F^{217}K^{218}L^{219}P^{220}T^{221}E^{222}N^{223}L^{224}A^{225}A^{226}R^{227}N^{228}Y^{229}V^{230}L^{231}L^{232}C^{233}E^{234}E^{235}I^{236}E^{237}R^{238}E^{239}N^{240}I^{241}P^{242}V^{243}I^{244}F^{245}Q^{246}D^{247}Y^{248}S^{249}E^{250}G^{251}N^{252}V^{253}F^{254}T^{255}C^{256}R^{257}I^{258}V^{259}S^{260}G^{261}D^{262}L^{263}T^{264}A^{265}V^{266}G^{267}T^{268}A^{269}S^{270}N^{271}M^{272}Y^{273}T^{274}A^{275}R^{276}D^{277}V^{278}A^{279}S^{280}K^{281}S^{282}L^{283}L^{284}D^{285}Q^{286}L^{287}H^{288}N^{289}T^{290}P^{291}N^{292}V^{293}H^{294}M^{295}H^{296}S^{297}L^{298}H^{299}S^{300}L^{301}P^{302}Y^{303}E^{304}N^{305}F^{306}P^{307}C^{308}E^{309}A^{310}L^{311}E^{312}F^{313}A^{314}V^{315}E^{316}Q^{317}G^{318}I^{319}I^{320}P^{321}P^{322}V^{323}T^{324}F^{325}D^{326}E^{327}V^{328}F^{329}A^{330}N^{331}D^{332}E^{333}Y^{334}V^{335}I^{336}T^{337}I^{338}S^{339}C^{340}S^{341}L^{342}L^{343}V^{344}V^{345}S^{346}D^{347}V^{348}G^{349}P^{350}T^{351}Q^{352}A^{353}V^{354}A^{355}R^{356}E^{357}R^{358}A^{359}A^{360}K^{361}R^{362}F^{363}L^{364}K^{365}M^{366}Y^{367}D^{368}Y^{369}S^{370}A^{371}S^{372}Y^{373}P^{374}S^{375}T^{376}H^{377}M^{378}F^{379}T^{380}L^{381}S^{382}T^{383}$

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A1273V1274V1275E1276S1277H1278Q1279D1280F1281K1282P1283K1284D1285A1286I1287V1288E1289S1290T1291I1292D1293T1294V1295F1296
T1297E1298S1299H1300Q1301D1302V1303R1304V1305K1306L1307H1308P1309Q1310I1311E1312S1313H1314Q1315D1316F1317R1318A1319K1320
N1321P1322I1323V1324E1325S1326R1327K1328P1329D1330Y1331Q1332V1333E1334W1335T1336D1337L1338R1339T1340E1341S1342S1343N1344
D1345R1346N1347A1348Q1349D1350I1351S1352N1353R1354I1355L1356S1357R1358N1359F1360V1361R1362L1363Y1364V1365P1366G1367S1368
S1369L1370Y1371T1372H1373G1374L1375F1376A1377Y1378G1379R1380M1381L1382L1383M1384P1385K1386
H1387M1388F1389D1390M1391L1392N1393G1394S1395V1396E1397I1398V1399S1400I1401A1402D1403K1404G1405N1406T1407R1408

$V^{1409}H^{1410}V^{1411}K^{1412}I^{1413}Q^{1414}S^{1415}H^{1416}K^{1417}T^{1418}V^{1419}T^{1420}R^{1421}G^{1422}G^{1423}Y^{1424}E^{1425}V^{1426}D^{1427}I^{1428}V^{1429}I^{1430}C^{1431}E^{1432}$
$M^{1433}G^{1434}N^{1435}S^{1436}I^{1437}S^{1438}A^{1439}R^{1440}K^{1441}D^{1442}I^{1443}T^{1444}S^{1445}Y^{1446}F^{1447}P^{1448}T^{1449}V^{1450}K^{1451}E^{1452}L^{1453}P^{1454}$
$G^{1455}L^{1456}T^{1457}G^{1458}M^{1459}M^{1460}S^{1461}S^{1462}G^{1463}R^{1464}M^{1465}R^{1466}V^{1467}F^{1468}S^{1469}T^{1470}A^{1471}K^{1472}F^{1473}K^{1474}A^{1475}S^{1476}$
$D^{1477}S^{1478}C^{1479}S^{1480}Y^{1481}L^{1482}M^{1483}P^{1484}Q^{1485}D^{1486}F^{1487}V^{1488}A^{1489}K^{1490}Y^{1491}I^{1492}A^{1493}A^{1494}V^{1495}D^{1496}H^{1497}I^{1498}T^{1499}S^{1500}$
$K^{1501}S^{1502}P^{1503}E^{1504}K^{1505}K^{1506}S^{1507}Y^{1508}F^{1509}I^{1510}R^{1511}Q^{1512}G^{1513}F^{1514}E^{1515}A^{1516}E^{1517}S^{1518}D^{1519}S^{1520}M^{1521}Q^{1522}G^{1523}D^{1524}$
$C^{1525}C^{1526}S^{1527}P^{1528}Y^{1529}V^{1530}L^{1531}F^{1532}N^{1533}S^{1534}A^{1535}S^{1536}R^{1537}A^{1538}K^{1539}I^{1540}V^{1541}G^{1542}L^{1543}H^{1544}C^{1545}A^{1546}G^{1547}F^{1548}$
$D^{1549}G^{1550}T^{1551}A^{1552}R^{1553}V^{1554}F^{1555}A^{1556}Q^{1557}I^{1558}I^{1559}T^{1560}Q^{1561}E^{1562}D^{1563}I^{1564}M^{1565}A^{1566}A^{1567}T^{1568}P^{1569}T^{1570}T^{1571}H^{1572}$
$A^{1573}G^{1574}R^{1575}V^{1576}T^{1577}T^{1578}E^{1579}F^{1580}P^{1581}H^{1582}T^{1583}S^{1584}L^{1585}R^{1586}D^{1587}S^{1588}P^{1589}L^{1590}P^{1591}$
$N^{1592}S^{1593}M^{1594}A^{1595}I^{1596}G^{1597}S^{1598}V^{1599}K^{1600}T^{1601}A^{1602}P^{1603}N^{1604}P^{1605}T^{1606}K^{1607}S^{1608}E^{1609}I^{1610}T^{1611}R^{1612}S^{1613}P^{1614}$
$I^{1615}H^{1616}G^{1617}C^{1618}F^{1619}P^{1620}V^{1621}R^{1622}T^{1623}A^{1624}P^{1625}A^{1626}T^{1627}L^{1628}Y^{1629}S^{1630}P^{1631}T^{1632}E^{1633}N^{1634}L^{1635}L^{1636}I^{1637}$
$K^{1638}N^{1639}A^{1640}M^{1641}K^{1642}V^{1643}T^{1644}K^{1645}N^{1646}V^{1647}E^{1648}L^{1649}L^{1650}E^{1651}E^{1652}D^{1653}L^{1654}I^{1655}D^{1656}A^{1657}C^{1658}V^{1659}$
$H^{1660}D^{1661}V^{1662}K^{1663}R^{1664}I^{1665}L^{1666}N^{1667}A^{1668}P^{1669}G^{1670}V^{1671}S^{1672}D^{1673}V^{1674}E^{1675}K^{1676}R^{1677}V^{1678}L^{1679}T^{1680}H^{1681}E^{1682}E^{168}$
$^{3}S^{1684}I^{1685}T^{1686}G^{1687}I^{1688}E^{1689}N^{1690}R^{1691}Q^{1692}Y^{1693}M^{1694}N^{1695}A^{1696}L^{1697}N^{1698}R^{1699}S^{1700}T^{1701}S^{1702}A^{1703}G^{1704}F^{1705}$
$P^{1706}Y^{1707}S^{1708}S^{1709}R^{1710}K^{1711}A^{1712}K^{1713}G^{1714}K^{1715}S^{1716}G^{1717}K^{1718}Q^{1719}T^{1720}W^{1721}L^{1722}G^{1723}S^{1724}E^{1725}E^{1726}F^{1727}I^{1728}V^{1729}$
$D^{1730}N^{1731}P^{1732}D^{1733}L^{1734}K^{1735}E^{1736}H^{1737}V^{1738}E^{1739}K^{1740}I^{1741}V^{1742}D^{1743}K^{1744}A^{1745}K^{1746}D^{1747}G^{1748}I^{1749}V^{1750}$
$D^{1751}V^{1752}S^{1753}L^{1754}G^{1755}I^{1756}F^{1757}A^{1758}A^{1759}T^{1760}L^{1761}K^{1762}D^{1763}E^{1764}R^{1765}R^{1766}P^{1767}L^{1768}E^{1769}K^{1770}V^{1771}Q^{1772}A^{1773}N^{1774}$
$K^{1775}T^{1776}R^{1777}V^{1778}F^{1779}A^{1780}A^{1781}S^{1782}N^{1783}Q^{1784}G^{1785}L^{1786}A^{1787}L^{1788}A^{1789}L^{1790}R^{1791}R^{1792}Y^{1793}Y^{1794}L^{1795}$
$S^{1796}F^{1797}L^{1798}D^{1799}H^{1800}V^{1801}M^{1802}T^{1803}N^{1804}R^{1805}I^{1806}D^{1807}N^{1808}E^{1809}I^{1810}G^{1811}L^{1812}G^{1813}V^{1814}N^{1815}V^{1816}Y^{1817}S^{1818}Y^{1819}$
$D^{1820}W^{1821}T^{1822}R^{1823}I^{1824}V^{1825}N^{1826}K^{1827}L^{1828}K^{1829}R^{1830}V^{1831}G^{1832}D^{1833}K^{1834}V^{1835}I^{1836}A^{1837}G^{1838}D^{1839}F^{1840}$
$S^{1841}N^{1842}F^{1843}D^{1844}G^{1845}S^{1846}L^{1847}N^{1848}S^{1849}Q^{1850}I^{1851}L^{1852}S^{1853}R^{1854}V^{1855}S^{1856}E^{1857}I^{1858}V^{1859}T^{1860}D^{1861}W^{1862}Y^{1863}G^{1864}$
$D^{1865}D^{1866}A^{1867}E^{1868}N^{1869}G^{1870}L^{1871}I^{1872}R^{1873}H^{1874}T^{1875}L^{1876}L^{1877}E^{1878}Y^{1879}L^{1880}F^{1881}N^{1882}A^{1883}T^{1884}W^{1885}L^{1886}M^{1887}N^{18}$
$^{88}G^{1889}K^{1890}V^{1891}F^{1892}Q^{1893}L^{1894}N^{1895}H^{1896}S^{1897}Q^{1898}P^{1899}S^{1900}G^{1901}N^{1902}P^{1903}L^{1904}T^{1905}T^{1906}L^{1907}I^{1908}N^{1909}C^{1910}V^{1911}Y^{19}$
$^{12}N^{1913}M^{1914}I^{1915}I^{1916}F^{1917}R^{1918}Y^{1919}V^{1920}Y^{1921}L^{1922}L^{1923}A^{1924}Q^{1925}R^{1926}E^{1927}N^{1928}G^{1929}F^{1930}P^{1931}M^{1932}T^{1933}L^{1934}S^{1935}G^{19}$
$^{36}F^{1937}T^{1938}T^{1939}N^{1940}V^{1941}A^{1942}C^{1943}I^{1944}F^{1945}Y^{1946}G^{1947}D^{1948}D^{1949}S^{1950}L^{1951}C^{1952}S^{1953}V^{1954}S^{1955}D^{1956}K^{1957}V^{1958}S^{1959}E^{196}$
$^{0}W^{1961}F^{1962}N^{1963}Q^{1964}H^{1965}V^{1966}I^{1967}T^{1968}R^{1969}L^{1970}M^{1971}A^{1972}A^{1973}T^{1974}G^{1975}H^{1976}E^{1977}$
$Y^{1978}T^{1979}D^{1980}E^{1981}T^{1982}K^{1983}S^{1984}G^{1985}S^{1986}P^{1987}P^{1988}P^{1989}Y^{1990}R^{1991}S^{1992}L^{1993}N^{1994}E^{1995}V^{1996}T^{1997}F^{1998}L^{1999}K^{2000}R^{2001}$
$E^{2002}F^{2003}V^{2004}L^{2005}R^{2006}D^{2007}H^{2008}F^{2009}W^{2010}I^{2011}A^{2012}P^{2013}L^{2014}S^{2015}R^{2016}N^{2017}T^{2018}I^{2019}E^{2020}D^{2021}M^{2022}C^{2023}M^{2024}W^{202}$
$^{5}S^{2026}R^{2027}K^{2028}N^{2029}I^{2030}D^{2031}A^{2032}Q^{2033}D^{2034}A^{2035}L^{2036}L^{2037}Q^{2038}T^{2039}T^{2040}R^{2041}I^{2042}A^{2043}S^{2044}F^{2045}E^{2046}A^{2047}S^{2048}L^{2049}$
$H^{2050}E^{2051}K^{2052}N^{2053}Y^{2054}F^{2055}L^{2056}M^{2057}F^{2058}C^{2059}D^{2060}V^{2061}I^{2062}K^{2063}K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}$
$A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}S^{2083}F^{2084}L^{2085}L^{2086}A^{2087}Q^{2088}Q^{2089}G^{2090}$
$R^{2091}A^{2092}G^{2093}A^{2094}H^{2095}D^{2096}S^{2097}E^{2098}F^{2099}L^{2100}S^{2101}Q^{2102}L^{2103}L^{2104}D^{2105}L^{2106}N^{2107}$

## Replikin Sequences in Amino-Terminal Portion of Peptide

(1) $H^{20}R^{21}A^{22}F^{23}Y^{24}V^{25}M^{26}N^{27}D^{28}D^{29}G^{30}E^{31}N^{32}R^{33}I^{34}Y^{35}S^{36}L^{37}I^{38}G^{39}T^{40}L^{41}R^{42}R^{43}A^{44}P^{45}A^{46}F^{47}K^{48}V^{49}G^{50}$
$S^{51}R^{52}R^{53}Y^{54}K^{55}S^{56}H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}$

(2) $K^{48}V^{49}G^{50}S^{51}R^{52}R^{53}Y^{54}K^{55}S^{56}H^{57}$

(3) $K^{48}V^{49}G^{50}S^{51}R^{52}R^{53}Y^{54}K^{55}S^{56}H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}A^{64}T^{65}V^{66}A^{67}E^{68}L^{69}C^{70}N^{71}Q^{72}L^{73}H^{74}$

(4) $K^{55}S^{56}H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}$

(5) $K^{55}S^{56}H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}A^{64}T^{65}V^{66}A^{67}E^{68}L^{69}C^{70}N^{71}Q^{72}L^{73}H^{74}$

(6) $H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}A^{64}T^{65}V^{66}A^{67}E^{68}L^{69}C^{70}N^{71}Q^{72}L^{73}H^{74}D^{75}R^{76}V^{77}L^{78}P^{79}F^{80}A^{81}N^{82}P^{83}Q^{84}V^{85}W^{86}K^{87}$
$E^{88}V^{89}I^{90}S^{91}E^{92}N^{93}K^{94}$

(7) $H^{57}I^{58}P^{59}Y^{60}R^{61}R^{62}K^{63}A^{64}T^{65}V^{66}A^{67}E^{68}L^{69}C^{70}N^{71}Q^{72}L^{73}H^{74}D^{75}R^{76}V^{77}L^{78}P^{79}F^{80}A^{81}N^{82}P^{83}Q^{84}V^{85}W^{86}K^{87}$

$E^{88}V^{89}I^{90}S^{91}E^{92}N^{93}K^{94}V^{95}Q^{96}P^{97}D^{98}S^{99}M^{100}L^{101}K^{102}$

(8) $H^{74}D^{75}R^{76}V^{77}L^{78}P^{79}F^{80}A^{81}N^{82}P^{83}Q^{84}V^{85}W^{86}K^{87}E^{88}V^{89}I^{90}S^{91}E^{92}N^{93}K^{94}V^{95}Q^{96}P^{97}D^{98}S^{99}M^{100}L^{101}K^{102}$

(9) $H^{74}D^{75}R^{76}V^{77}L^{78}P^{79}F^{80}A^{81}N^{82}P^{83}Q^{84}V^{85}W^{86}K^{87}E^{88}V^{89}I^{90}S^{91}E^{92}N^{93}K^{94}$

(10) $K^{145}C^{146}N^{147}D^{148}C^{149}I^{150}L^{151}K^{152}M^{153}N^{154}R^{155}N^{156}V^{157}E^{158}Y^{159}P^{160}Y^{161}H^{162}$

(11) $K^{469}I^{470}I^{471}D^{472}L^{473}I^{474}K^{475}E^{476}T^{477}F^{478}V^{479}S^{480}L^{481}F^{482}F^{483}A^{484}I^{485}L^{486}T^{487}K^{488}S^{489}L^{490}Y^{491}P^{492}I^{493}I^{494}$ $Q^{495}G^{496}I^{497}S^{498}S^{499}Y^{500}A^{501}L^{502}R^{503}N^{504}N^{505}L^{506}M^{507}A^{508}N^{509}H^{510}$

(12) $K^{634}S^{635}R^{636}K^{637}N^{638}L^{639}D^{640}L^{641}L^{642}K^{643}E^{644}Y^{645}P^{646}S^{647}L^{648}D^{649}S^{650}L^{651}L^{652}S^{653}I^{654}F^{655}N^{656}Y^{657}F^{658}H^{659}$

(13) $K^{637}N^{638}L^{639}D^{640}L^{641}L^{642}K^{643}E^{644}Y^{645}P^{646}S^{647}L^{648}D^{649}S^{650}L^{651}L^{652}S^{653}I^{654}F^{655}N^{656}Y^{657}F^{658}H^{659}$

(14) $H^{697}R^{698}E^{699}I^{700}S^{701}S^{702}R^{703}L^{704}K^{705}E^{706}A^{707}R^{708}N^{709}S^{710}V^{711}K^{712}$

## Replikin Sequences in Mid-Molecule Portion of Peptide

(15) $K^{705}E^{706}A^{707}R^{708}N^{709}S^{710}V^{711}K^{712}D^{713}L^{714}I^{715}A^{716}K^{717}A^{718}Q^{719}V^{720}Y^{721}L^{722}T^{723}C^{724}G^{725}D^{726}G^{727}S^{728}R^{729}V^{730}$ $P^{731}P^{732}V^{733}V^{734}V^{735}Y^{736}M^{737}Y^{738}G^{739}D^{740}A^{741}G^{742}C^{743}G^{744}K^{745}T^{746}E^{747}L^{748}S^{749}M^{750}A^{751}L^{752}Q^{753}D^{754}H^{755}$

(16) $H^{755}F^{756}A^{757}T^{758}K^{759}Y^{760}F^{761}G^{762}E^{763}V^{764}P^{765}K^{766}$

(17) $H^{755}F^{756}A^{757}T^{758}K^{759}Y^{760}F^{761}G^{762}E^{763}V^{764}P^{765}K^{766}K^{767}$

(18) $H^{755}F^{756}A^{757}T^{758}K^{759}Y^{760}F^{761}G^{762}E^{763}V^{764}P^{765}K^{766}K^{767}D^{768}V^{769}I^{770}Y^{771}S^{772}R^{773}K^{774}$

(19) $H^{755}F^{756}A^{757}T^{758}K^{759}Y^{760}F^{761}G^{762}E^{763}V^{764}P^{765}K^{766}K^{767}D^{768}V^{769}I^{770}Y^{771}S^{772}R^{773}K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}$ $D^{781}G^{782}V^{783}K^{784}$

(20) $K^{759}Y^{760}F^{761}G^{762}E^{763}V^{764}P^{765}K^{766}K^{767}D^{768}V^{769}I^{770}Y^{771}S^{772}R^{773}K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}D^{781}G^{782}V^{783}K^{784}$ $Q^{785}S^{786}H^{787}$

(21) $K^{766}K^{767}D^{768}V^{769}I^{770}Y^{771}S^{772}R^{773}K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}D^{781}G^{782}V^{783}K^{784}Q^{785}S^{786}H^{787}$

(22) $K^{767}D^{768}V^{769}I^{770}Y^{771}S^{772}R^{773}K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}D^{781}G^{782}V^{783}K^{784}Q^{785}S^{786}H^{787}$

(23) $K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}D^{781}G^{782}V^{783}K^{784}Q^{785}S^{786}H^{787}$

(24) $K^{774}A^{775}E^{776}N^{777}E^{778}F^{779}W^{780}D^{781}G^{782}V^{783}K^{784}Q^{785}S^{786}H^{787}K^{788}I^{789}I^{790}A^{791}Y^{792}D^{793}D^{794}V^{795}L^{796}Q^{797}I^{798}$ $V^{799}D^{800}S^{801}A^{802}Q^{803}K^{804}P^{805}N^{806}P^{807}E^{808}L^{809}F^{810}E^{811}F^{812}I^{813}R^{814}L^{815}N^{816}N^{817}S^{818}D^{819}P^{820}Y^{821}Q^{822}V^{823}H^{824}$

(25) $H^{858}S^{859}A^{860}D^{861}A^{862}F^{863}R^{864}R^{865}R^{866}L^{867}D^{868}L^{869}C^{870}V^{871}Y^{872}V^{873}D^{874}V^{875}K^{876}D^{877}E^{878}F^{879}A^{880}R^{881}I^{882}V^{883}$ $A^{884}G^{885}S^{886}K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}$

(26) $H^{858}S^{859}A^{860}D^{861}A^{862}F^{863}R^{864}R^{865}R^{866}L^{867}D^{868}L^{869}C^{870}V^{871}Y^{872}V^{873}D^{874}V^{875}K^{876}D^{877}E^{878}F^{879}A^{880}R^{881}I^{882}V^{883}$ $A^{884}G^{885}S^{886}K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}$

(27) $K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}$ $M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}I^{922}T^{923}P^{924}E^{925}T^{926}A^{927}V^{928}Y^{929}E^{930}L^{931}H^{932}$

(28) $K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}$

(29) $K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}$

(30) $K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}$

(31) $K^{887}G^{888}H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}$ $M^{911}K^{912}H^{913}$

(32) $H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}$ $H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}$

(33) $H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}$

(34) $H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}$

(35) $H^{889}R^{890}K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}$

(36) $K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}$

(37) $K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}$

(38) $K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}$

(39) $K^{891}V^{892}P^{893}C^{894}E^{895}Q^{896}K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}I^{922}T^{923}P^{924}E^{925}T^{926}A^{927}V^{928}Y^{929}E^{930}L^{931}H^{932}$

(40) $K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}$

(41) $K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}$

(42) $K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}$

(43) $K^{897}I^{898}W^{899}L^{900}H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}I^{922}T^{923}P^{924}E^{925}T^{926}A^{927}V^{928}Y^{929}E^{930}L^{931}H^{932}$

(44) $H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}$

(45) $H^{901}Q^{902}N^{903}P^{904}G^{905}K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}$

(46) $K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}$

(47) $K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}$

(48) $K^{906}T^{907}Q^{908}H^{909}D^{910}M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}I^{922}T^{923}P^{924}E^{925}T^{926}A^{927}V^{928}Y^{929}E^{930}L^{931}H^{932}$

(49) $H^{909}D^{910}M^{911}K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}$

(50) $K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}$

(51) $K^{912}H^{913}E^{914}I^{915}V^{916}A^{917}G^{918}T^{919}Y^{920}K^{921}I^{922}T^{923}P^{924}E^{925}T^{926}A^{927}V^{928}Y^{929}E^{930}L^{931}H^{932}$

(52) $H^{1119}W^{1120}I^{1121}S^{1122}I^{1123}S^{1124}A^{1125}V^{1126}I^{1127}G^{1128}S^{1129}A^{1130}L^{1131}L^{1132}I^{1133}G^{1134}G^{1135}V^{1136}S^{1137}S^{1138}A^{1139}V^{1140}K^{1141}C^{1142}A^{1143}T^{1144}K^{1145}C^{1146}R^{1147}V^{1148}R^{1149}K^{1150}$

(53) $H^{1278}Q^{1279}D^{1280}F^{1281}K^{1282}P^{1283}K^{1284}D^{1285}A^{1286}I^{1287}V^{1288}E^{1289}S^{1290}T^{1291}I^{1292}D^{1293}T^{1294}V^{1295}F^{1296}T^{1297}E^{1298}S^{1299}H^{1300}Q^{1301}D^{1302}V^{1303}R^{1304}V^{1305}K^{1306}L^{1307}H^{1308}P^{1309}Q^{1310}I^{1311}E^{1312}S^{1313}H^{1314}Q^{1315}D^{1316}F^{1317}R^{1318}A^{1319}K^{1320}N^{1321}P^{1322}I^{1323}V^{1324}E^{1325}S^{1326}R^{1327}K^{1328}$

(54) $H^{1300}Q^{1301}D^{1302}V^{1303}R^{1304}V^{1305}K^{1306}L^{1307}H^{1308}P^{1309}Q^{1310}I^{1311}E^{1312}S^{1313}H^{1314}Q^{1315}D^{1316}F^{1317}R^{1318}A^{1319}K^{1320}N^{1321}P^{1322}I^{1323}V^{1324}E^{1325}S^{1326}R^{1327}K^{1328}$

(55) $H^{1308}P^{1309}Q^{1310}I^{1311}E^{1312}S^{1313}H^{1314}Q^{1315}D^{1316}F^{1317}R^{1318}A^{1319}K^{1320}N^{1321}P^{1322}I^{1323}V^{1324}E^{1325}S^{1326}R^{1327}K^{1328}$

(56) $H^{1314}Q^{1315}D^{1316}F^{1317}R^{1318}A^{1319}K^{1320}N^{1321}P^{1322}I^{1323}V^{1324}E^{1325}S^{1326}R^{1327}K^{1328}$

(57) $H^{1373}G^{1374}L^{1375}F^{1376}A^{1377}Y^{1378}G^{1379}R^{1380}M^{1381}L^{1382}L^{1383}M^{1384}P^{1385}K^{1386}H^{1387}M^{1388}F^{1389}D^{1390}M^{1391}L^{1392}N^{1393}G^{1394}S^{1395}V^{1396}E^{1397}I^{1398}V^{1399}S^{1400}I^{1401}A^{1402}D^{1403}K^{1404}G^{1405}N^{1406}T^{1407}R^{1408}V^{1409}H^{1410}V^{1411}K^{1412}$

(58) $H^{1387}M^{1388}F^{1389}D^{1390}M^{1391}L^{1392}N^{1393}G^{1394}S^{1395}V^{1396}E^{1397}I^{1398}V^{1399}S^{1400}I^{1401}A^{1402}D^{1403}K^{1404}G^{1405}N^{1406}T^{1407}R^{1408}V^{1409}H^{1410}V^{1411}K^{1412}$

(59) $K^{1404}G^{1405}N^{1406}T^{1407}R^{1408}V^{1409}H^{1410}V^{1411}K^{1412}$

(60) $K^{1404}G^{1405}N^{1406}T^{1407}R^{1408}V^{1409}H^{1410}V^{1411}K^{1412}I^{1413}Q^{1414}S^{1415}H^{1416}$

## Replikin Sequences in Carboxy-Terminal Portion of Peptide

(61) $H^{1410}V^{1411}K^{1412}I^{1413}Q^{1414}S^{1415}H^{1416}K^{1417}T^{1418}V^{1419}T^{1420}R^{1421}G^{1422}G^{1423}Y^{1424}E^{1425}V^{1426}D^{1427}I^{1428}V^{1429}I^{1430}C^{1431}E^{1432}M^{1433}G^{1434}N^{1435}S^{1436}I^{1437}S^{1438}A^{1439}R^{1440}K^{1441}D^{1442}I^{1443}T^{1444}S^{1445}Y^{1446}F^{1447}P^{1448}T^{1449}V^{1450}K^{1451}$

(62) $H^{1416}K^{1417}T^{1418}V^{1419}T^{1420}R^{1421}G^{1422}G^{1423}Y^{1424}E^{1425}V^{1426}D^{1427}I^{1428}V^{1429}I^{1430}C^{1431}E^{1432}M^{1433}G^{1434}N^{1435}S^{1436}I^{1437}S^{1438}A^{1439}R^{1440}K^{1441}D^{1442}I^{1443}T^{1444}S^{1445}Y^{1446}F^{1447}P^{1448}T^{1449}V^{1450}K^{1451}$

(63) $H^{1582}T^{1583}S^{1584}L^{1585}R^{1586}D^{1587}S^{1588}P^{1589}L^{1590}P^{1591}N^{1592}S^{1593}M^{1594}A^{1595}I^{1596}G^{1597}S^{1598}V^{1599}K^{1600}T^{1601}A^{1602}P^{1603}N^{1604}P^{1605}T^{1606}K^{1607}$

(64) $K^{1600}T^{1601}A^{1602}P^{1603}N^{1604}P^{1605}T^{1606}K^{1607}S^{1608}E^{1609}I^{1610}T^{1611}R^{1612}S^{1613}P^{1614}I^{1615}H^{1616}$

(65) $H^{1616}G^{1617}C^{1618}F^{1619}P^{1620}V^{1621}R^{1622}T^{1623}A^{1624}P^{1625}A^{1626}T^{1627}L^{1628}Y^{1629}S^{1630}P^{1631}T^{1632}E^{1633}N^{1634}L^{1635}L^{1636}I^{1637}K^{1638}N^{1639}A^{1640}M^{1641}K^{1642}V^{1643}T^{1644}K^{1645}$

(66) $K^{1638}N^{1639}A^{1640}M^{1641}K^{1642}V^{1643}T^{1644}K^{1645}N^{1646}V^{1647}E^{1648}L^{1649}L^{1650}E^{1651}E^{1652}D^{1653}L^{1654}I^{1655}D^{1656}A^{1657}C^{1658}V^{1659}H^{1660}$

(67) $K^{1638}N^{1639}A^{1640}M^{1641}K^{1642}V^{1643}T^{1644}K^{1645}N^{1646}V^{1647}E^{1648}L^{1649}L^{1650}E^{1651}E^{1652}D^{1653}L^{1654}I^{1655}D^{1656}A^{1657}C^{1658}V^{1659}H^{1660}D^{1661}V^{1662}K^{1663}R^{1664}I^{1665}L^{1666}N^{1667}A^{1668}P^{1669}G^{1670}V^{1671}S^{1672}D^{1673}V^{1674}E^{1675}K^{1676}R^{1677}V^{1678}L^{1679}T^{1680}H^{1681}$

(68) $H^{1681}E^{1682}E^{1683}S^{1684}I^{1685}T^{1686}G^{1687}I^{1688}E^{1689}N^{1690}R^{1691}Q^{1692}Y^{1693}M^{1694}N^{1695}A^{1696}L^{1697}N^{1698}R^{1699}S^{1700}T^{1701}S^{1702}A^{1703}G^{1704}F^{1705}P^{1706}Y^{1707}S^{1708}S^{1709}R^{1710}K^{1711}A^{1712}K^{1713}G^{1714}K^{1715}S^{1716}G^{1717}K^{1718}$

(69) $K^{1711}A^{1712}K^{1713}G^{1714}K^{1715}S^{1716}G^{1717}K^{1718}Q^{1719}T^{1720}W^{1721}L^{1722}G^{1723}S^{1724}E^{1725}E^{1726}F^{1727}I^{1728}V^{1729}D^{1730}N^{1731}P^{1732}D^{1733}L^{1734}K^{1735}E^{1736}H^{1737}$

(70) $K^{1735}E^{1736}H^{1737}V^{1738}E^{1739}K^{1740}I^{1741}V^{1742}D^{1743}K^{1744}$

(71) $H^{1737}V^{1738}E^{1739}K^{1740}I^{1741}V^{1742}D^{1743}K^{1744}A^{1745}K^{1746}D^{1747}G^{1748}I^{1749}V^{1750}D^{1751}V^{1752}S^{1753}L^{1754}G^{1755}I^{1756}F^{1757}A^{1758}A^{1759}T^{1760}L^{1761}K^{1762}D^{1763}E^{1764}R^{1765}R^{1766}P^{1767}L^{1768}E^{1769}K^{1770}$

(72) $H^{1737}V^{1738}E^{1739}K^{1740}I^{1741}V^{1742}D^{1743}K^{1744}A^{1745}K^{1746}$

(73) $K^{1762}D^{1763}E^{1764}R^{1765}R^{1766}P^{1767}L^{1768}E^{1769}K^{1770}V^{1771}Q^{1772}A^{1773}N^{1774}K^{1775}T^{1776}R^{1777}V^{1778}F^{1779}A^{1780}A^{1781}S^{1782}N^{1783}Q^{1784}G^{1785}L^{1786}A^{1787}L^{1788}A^{1789}L^{1790}R^{1791}R^{1792}Y^{1793}Y^{1794}L^{1795}S^{1796}F^{1797}L^{1798}D^{1799}H^{1800}$

(74) $H^{1800}V^{1801}M^{1802}T^{1803}N^{1804}R^{1805}I^{1806}D^{1807}N^{1808}E^{1809}I^{1810}G^{1811}L^{1812}G^{1813}V^{1814}N^{1815}V^{1816}Y^{1817}S^{1818}Y^{1819}D^{1820}W^{1821}T^{1822}R^{1823}I^{1824}V^{1825}N^{1826}K^{1827}L^{1828}K^{1829}R^{1830}V^{1831}G^{1832}D^{1833}K^{1834}$

(75) $K^{1827}L^{1828}K^{1829}R^{1830}V^{1831}G^{1832}D^{1833}K^{1834}V^{1835}I^{1836}A^{1837}G^{1838}D^{1839}F^{1840}S^{1841}N^{1842}F^{1843}D^{1844}G^{1845}S^{1846}L^{1847}N^{1848}S^{1849}Q^{1850}I^{1851}L^{1852}S^{1853}R^{1854}V^{1855}S^{1856}E^{1857}I^{1858}V^{1859}T^{1860}D^{1861}W^{1862}Y^{1863}G^{1864}D^{1865}D^{1866}A^{1867}E^{1868}N^{1869}G^{1870}L^{1871}I^{1872}R^{1873}H^{1874}$

(76) $H^{2050}E^{2051}K^{2052}N^{2053}Y^{2054}F^{2055}L^{2056}M^{2057}F^{2058}C^{2059}D^{2060}V^{2061}I^{2062}K^{2063}K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}$

(77) $H^{2050}E^{2051}K^{2052}N^{2053}Y^{2054}F^{2055}L^{2056}M^{2057}F^{2058}C^{2059}D^{2060}V^{2061}I^{2062}K^{2063}K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}$

(78) $K^{2063}K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}$

(79) $K^{2063}K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}S^{2083}F^{2084}L^{2085}L^{2086}A^{2087}Q^{2088}Q^{2089}G^{2090}R^{2091}A^{2092}G^{2093}A^{2094}H^{2095}$

(80) $K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}S^{2083}F^{2084}L^{2085}L^{2086}A^{2087}Q^{2088}Q^{2089}G^{2090}R^{2091}A^{2092}G^{2093}A^{2094}H^{2095}$

(81) $K^{2064}A^{2065}C^{2066}R^{2067}N^{2068}A^{2069}G^{2070}Y^{2071}K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}$

(82) $K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}$

(83) $K^{2072}E^{2073}A^{2074}C^{2075}L^{2076}H^{2077}E^{2078}L^{2079}D^{2080}C^{2081}K^{2082}S^{2083}F^{2084}L^{2085}L^{2086}A^{2087}Q^{2088}Q^{2089}G^{2090}R^{2091}A^{2092}G^{2093}A^{2094}H^{2095}$

Replikin Count = Number of Replikins per 100 amino acids = 83/2107 = 3.9

## Example 6 – Determination of Replikin Concentration in Publicly Available Accession Numbers for Isolates of TSV from 2000 through 2005

**[000139]** Mean Replikin concentrations were determined for all amino acid sequences for Taura Syndrome Virus with accession numbers publicly available at www.pubmed.com. The amino acid sequences were scanned for Replikin sequences of 7 to 50 amino acids comprising (1) at least one lysine residue located at a first terminus of the sequence and at least one lysine residue or at least one histidine residue located at a second terminus of the sequence; (2) a first lysine residue located six to ten residues from a second lysine residue; (3) at least one histidine residue; and (4) at least 6% lysine residues. The total number of Replikin sequences was determined for each available accession number. The total number of Replikin sequences in each accession number was then divided by the total number of amino acid residues disclosed in the accession number. The result was the Replikin concentration. The mean Replikin concentration was then determined for all viruses isolated and reported in a particular year. Table 5 provides the results.

**Table 5 - TSV Replikin Concentration by Year**

| Year | PubMed Accession Number-Replikin Count | No. of Isolates per year | Mean Replikin Concentration per year | S.D. | Significance |
|---|---|---|---|---|---|
| 2000 | NP_149058 70 NP_149057 70 AAK72221 70 AAK72220 70 AAG44834 4 | 5 | 2.7 | 1.3 | low p<0.02 |
| 2001 | AAM73766 7 | 1 | 0.7 | 0.0 | prev p<0.02 |
| 2002 | AAN77089 2 AAN77088 2 AAN77087 2 AAN77086 2 AAW32934 2 AAW32932 2 AAW32930 2 AAW32929 1 | 8 | 0.7 | 0.4 | low p>0.50 |
| 2003 | AAR11292 6 AAR11291 6 AAR11290 6 | 3 | 0.6 | 0.0 | prev p<0.20 |
| 2004 | AAX07125 2 AAX07117 2 AAT81157 75 AAT81158 75 AAX07127 2 AAX07126 2 AAX07124 2 AAX07123 2 AAX07122 2 AAX07121 2 AAX07120 2 AAX07119 2 AAX07118 2 AAX07116 2 AAX07115 2 AAX07114 2 AAX07113 2 AAX07112 2 AAX35819 2 AAX35818 1 AAX35817 2 AAX35816 1 AAX35815 2 | 23 | 0.8 | 0.9 | low p<0.40, prev p<0.20 |
| 2005 | AAY56364 71 AAY56363 71 AAY44822 1 AAY44821 1 AAY44820 1 AAY44819 1 AAY44818 1 AAY44817 1 AAY89097 83 AAY89096 83 ABB17263 63 ABB17264 63 | 12 | 1.8 | 1.7 | low p<0.02, prev p<0.05 |

## Example 7 – Comparison of the Replikin Concentration of Four Strains of Taura Syndrome Virus by an Independent Laboratory

**[000140]** The Replikin concentrations of the protein sequences of four Taura Syndrome Virus (TSV) isolates from Hawaii, Belize, Thailand and Venezuela, respectively, were examined without any knowledge of the virulence of the four isolates, and the virulence was ranked quantitatively in the order of the Replikin concentrations. The virulence of the four TSV isolates

was compared in an independent laboratory, without any knowledge of the Replikin concentrations. The virulence was compared through a per os laboratory infection in juvenile *Litopenaeus vannamei* (Kona stock, Oceanic Institute, Hawaii). The results showed that the Belize isolate is the most virulent, the Thailand isolate is the second most virulent, followed by the Hawaii isolate, and the Venezuela isolate, which is the least virulent. This is based on the analyses of cumulative survivals at the end of a bioassay and based on the time of 50% mortality. TSV infection as the cause of death was confirmed by positive reactions in RT-PCR detection and by the appearance of characteristic lesions observed in histological analysis. The correlation of Replikin concentrations with virulence as indicated by the Mortality Rate was quantitative and linear.

**CHALLENGE METHODS:**

**[000141]** Small juveniles of specific-pathogen-free *Litopenaeus vannamei* (20 shrimp per tank, mean weight: 1.8 g) were fed minced TSV-infected tissues (infected separately with each of the 4 isolates originating from Belize, Thailand, Venezuela and Hawaii) for 3 days at 5% of their body weight. These shrimp were maintained with pelleted ration (Rangen 35%) for the following 12 days. Each challenge bioassay of a specific isolate was triplicated. During the bioassay period, all tanks were checked daily for dead or moribund shrimp. All mortalities were removed from the tank and frozen. One to three moribund shrimp from each isolate were preserved in Davidson's AFA fixative and processed for routine histology to confirm viral infection. For each isolate, six moribund shrimp were collected during the acute phase infection and total RNA was extracted from their gill tissues with a High Pure RNA tissue kit (Roche). The extracted RNA was analyzed for the presence of TSV by real-time RT-PCR.

**[000142]** All tanks were outfitted with an acclimated biological filter and aeration, and were covered with plastic to contain aerosols. The average salinity of the water was 23 ppt and the water temperature was 28°C. The challenge study was terminated after 15 days with live animals counted as survivors.

**RESULTS**

**Comparison of Virulence: Mortality in Shrimp**

**[000143]** First mortality was seen on day 2 after exposure to TSV in all 4 isolates. For Belize isolate, most (83%) of shrimp died by day 4 and had a 0% survival at day 11 (Figure 7, Table 6). For Thailand isolate, 63% mortalities occurred by day 4 and had a 20% survival at the end of 15-day bioassay (Figure 7, Table 6). For Hawaii isolate, mortalities increased starting at day 2 and reached to a peak at day 5; the cumulative survival was 22% at the end (Figure 7, Table 6). For Venezuela isolate, mortalities occurred slowly at days 2 and 3 with 22% of shrimp showed

mortalities on day 4 and then mortalities slowed down; with 42% of shrimp surviving at the end (Figure 7, Table 6). The time period for reaching 50% mortality caused by TSV infection for the isolate of Belize, Thailand, Hawaii and Venezuela were 2.8, 3.5, 4.5 and 7 days, respectively (Table 6).

**Table 6. Results from *per os* TSV challenge in SPF *Litopenaeus vannamei* (Kona stock)**

| TSV isolate | GenBank No. (ORF1) | Survival (%)(Mean) | Day of 50% mortality |
|---|---|---|---|
| Belize | AAT81157 | 0 | 2.8 |
| Thailand | AAY56363 | 20 | 3.5 |
| US-Hawaii | AAK72220 | 22 | 4.5 |
| Venezuela | ABB17263 | 42 | 7.0* |

*High variation was observed in Venezuela's triplicate tanks, thus the Day of 50% mortality was determined by Kaplan-Meier survival analysis with the Statistix 8 program.

**Pathology**

**[000144]** Histological analysis of the samples of *L. vannamei* juveniles is summarized in Table 7.

**Table 7. Summary of histological findings**

| UAZ ID# | TSV Isolate | Days after exposure | TSV lesions[1] | LOS[2] |
|---|---|---|---|---|
| O6-407J/1 | Belize | 3 | G4 | G4 |
| 06-407F/1 | Thailand | 3 | G4 | G2 |
| 06-407D/1 | Thailand | 4 | G4 | G3 |
| 06-407E/1 | Thailand | 4 | G3 | G2 |
| 06-407A/1 | Hawaii | 4 | G2 | G3 |
| 06-407C/1 | Hawaii | 4 | G2 | G4 |
| 06-407H/1 | Venezuela | 4 | G4 | G2 |

Severity grade: G1: sign of infection; G2: moderate signs of infection; G3: moderate to high signs of infection; G4: severe infection.

1. TSV lesions = Presence of TSV pathognomonic lesions in the gills, mouth, stomach, intecumental cuticular epithelium, and appendages.

2. LOS = presence of lymphoid organ spheroids within the lymphoid organ.

**[000145]** **Belize TSV**. Acute lesions of diagnostic TSV infection were found in one representative shrimp sample at a severity grade of G4. Nuclear pyknosis and karyorrhexis were observed in the cuticular epithelium of the general body surface, appendages, gills, stomach and esophagus. Lymphoid organ spheroids were also found at severity grade G4.

**[000146]** **Thailand TSV**. Severe (G4) TSV infection was detected in 2 out of 3 shrimp, and another shrimp showed a moderate to high grade (G3) of infection. Lymphoid organ spheroids were found at severities of G2 and G3.

**[000147]** **Hawaii TSV**. Moderate level (G2) of TSV infection was detected in 2 shrimp collected at day 4. Lymphoid organ spheroids were found at severities of G3 and G4.

**[000148]** **Venezuela TSV**. Severe (G4) TSV infection was detected in one representative shrimp sampled at day 4. Lymphoid organ spheroids were found at severity of G2.

**Real-time TSV RT-PCR**

**[000149]** All 24 samples (6 from each isolates) were all positive for TSV infection. This confirms that the mortalities observed from bioassays are from TSV infection.

**Table 8. Mean and range of TSV RNA in gills from shrimp challenge with TSV**

| TSV isolate | Mean (Range) TSV copies/:l RNA |
|---|---|
| Belize | $2.7 \times 10^6$ ($4.8 \times 10^5$ - $4.4 \times 10^6$) |
| Thailand | $2.7 \times 10^6$ ($4.3 \times 10^5$ - $7.5 \times 10^6$) |
| Hawaii | $5.2 \times 10^7$ ($2.3 \times 10^7$ - $7.5 \times 10^7$) |
| Venezuela | $6.5 \times 10^5$ ($6.5 \times 10^2$ - $2.0 \times 10^5$) |

**Table 9. Percent Mortality and Blind Replikin Concentration**

The results of 4 TSV virulence (percent mortality) comparisons with blind Replikin Count are:

| Isolate | Percent Mortality | Blind Replikin Concentration |
|---|---|---|
| Belize | 100 | 3.5 |
| Thailand | 80 | 3.4 |
| Hawaii | 78.3 | 3.3 |
| Venezuela | 58.3 | 3.0 |

**[000150]** The order of virulence: Belize > Thailand > (or =) Hawaii > Venezuela, is in agreement with the Replikin concentration. The differences in the Replikin concentrations appear to be small but they are statistically significant at a level of $p<0.001$. See Figures 5 and 6.

**Example 8 – Increased Host Resistance to Taura Syndrome Virus by Administration of Synthetic Replikins**

**[000151]** Shrimp cultured using the Challenge Methods described in Example 7 above were exposed in a first experiment for two weeks to synthetic Replikins per os mixed in their feed. The Replikins were peptides specific to Replikin sequences present in the TSV Hawaii strain isolate with which the shrimp were challenged/

**[000152]** In the experiment, mortality was reduced by 50% compared to a control group. The control group was given feed not containing synthetic Replikin sequences. A second control group was fed Replikin sequences synthesized with the covalent binding of additional amino acids to the same synthetic Replikins fed to the shrimp. The covalently "blocked" Replikins did not increase shrimp resistance to the virus in the same experiment demonstrating that the increase in host resistance was specific to the Replikin peptide structure.

**[000153]** Because little is known about the details of the immune system of the shrimp (shrimp appear not to produce antibodies), the phenomenon of "resistance" to infection appears

to be based in a "primitive immune system" perhaps similar to the "toll receptor" and related systems. Thus the term "increased resistance" is used for the observed phenomenon and Replikin feed is used rather than "vaccine" for the administered substance which increases resistance.

**[000154]** The surviving shrimp of the first challenge were then set up in a fresh culture, fed for an additional two weeks with feed containing Replikin sequences, then again challenged with the Hawaii strain of Taura syndrome virus. The Replikin sequence supplemented feed was maintained while the survivors were again challenged repeatedly by the same virus, in repeated cycles, until 100% of the shrimp survived the TSV challenge.

**Example 9 – H5N1 Replikin Concentration and Mortality Determinations**

**[000155]** The inventors analyzed and compared percent human mortality from H5N1 infections in years 2005 through the first quarter of 2007 to mean concentration of Replikin sequences in (1) the whole genome (2) the polymerase gene, (3) the pB1 gene area, (4) the pB2 gene area, and (5) the pA gene area, respectively, of H5N1 influenza strains isolated in 2003 through the first quarter of 2007. The following data were observed:

**Table 10 – H5N1 Replikin Concentration and Human Mortality**

| | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|
| **H5N1 (Whole Virus) Replikin Concentration in Humans** | 2.2+/-1.2 | 2.4+/-1.4 | 2.3+/-2.6 | 3.8+/-4.6 | 3.7+/-4.5 |
| **H5N1 (Polymerase) Replikin Concentration In Humans** | 2.6+/-0.8 | 2.9+/-0.9 | 4.8+/-5.0 | 7.4+/-7.0 | 7.3+/-6.7 |
| **H5N1 Replikin Peak Gene (pB1 gene area) Replikin Concentration in Humans** | 2.0+/-0 | 2.0+/-0.1 | 8.0+/7.7 | 16.1+/-5.7 | 15.4+/-5.9 |
| **H5N1 pB2 gene area Replikin Concentration In Humans** | 2.4+/-0 | 2.8+/-0.3 | 2.4+/0.4 | 2.4+/-0.1 | 2.4+/-0.3 |
| **H5N1 pA gene area Replikin Concentration In Humans** | 3.8+/-0 | 4.0+/-0.6 | 3.8+/-0.4 | 3.8+/-0.3 | 4.2+/-0.3 |
| **H5N1 Human Mortality percent** | | | 45 | 69 | 85 |

**[000156]** Table 10 provides mortality data for H5N1 infections from 2005 through 2007 and does not include earlier mortality data. Mortality data prior to 2005 has not been included in Table 10 (or in the data in Figures 1-3) because data prior to 2005 is inconsistent and understood

by those of skill in the art to contain errors, including errors caused by under-reporting. The first generally agreed occasion when there were human deaths caused by proven H5N1 infection was in Hong Kong in 1997-1998. (This is probably incorrect, however, since there probably was mortality between 1959, when H5N1 was first reported, and 1997). The usual figures cited for 1997 are: 30 human cases, 8 deaths with mortality rate of about 27%. The number of cases (morbidity) and the number who died (mortality) that were not reported is unknown, but suspected to be significant. These errors are usually high in geographic areas where the medical care is less structured and scientific, and the reporting is incomplete. Press reports between 1998 and 2002 were few, scattered, and not in agreement. Mortality data between 2005 and 2007 appear to be more consistent and have a higher level of reliability. Table 10, therefore, contains data from these years.

**[000157]** In Table 10, a correlation was established between mean human mortality and (1) mean concentration of Replikin sequences in the whole genome (two-fold increase from 2003 to 2007), (2) mean concentration of Replikin sequences in the polymerase gene (four-fold increase from 2003 to 2007) and (3) mean concentration of Replikin sequences in the Replikin Peak Gene (pB1 gene area) (eight-fold increase from 2003 to 2007) of H5N1 influenza strains. As Replikin concentration increased by these three measures, human mortality was observed to increase. See Figure 16.

**[000158]** Over the same period (2003-2007), however, no significant increase was observed in the pB2 and pA gene areas. See Figure 17. The pB2 and pA gene areas are neighbors to the Replikin Peak Gene found in the pB1 gene area. The observation that no significant increase occurred in the pB2 and pA gene areas during a remarkable increase in Replikin concentration in the neighboring pB1 area and a correlated significant increase in human mortality, provides support both for the significant capacity of Replikin concentration in the Replikin Peak Gene to predict virulence and for the precision of the method of predicting virulence using Replikin concentration in the Replikin Peak Gene Area.

**[000159]** As may be seen from Table 10, while the three measures (whole genome Replikin concentration, polymerase gene Replikin concentration, and pB1 gene area Peak Gene Replikin concentration) provided a correlation with human mortality, changes in the Replikin concentration in the polymerase gene correlated more significantly with human mortality, and changes in the Replikin concentration in the Replikin Peak Gene (pB1 gene area) of the H5N1 genome correlated still more significantly with human mortality. Table 10 demonstrates, therefore, that identification of Replikin Peak Genes within viral genomes improves identifications and predictions of virulence and mechansisms of virulence using Replikin

concentration data. As seen in Table 10, the increase in Replikin concentration is magnified in its correlation with human mortality when restricted to changes in Replikin concentration in the polymerase genes and magnified still when restricted solely to the Replikin Peak Gene identified using the methods described herein.

**Test of Reliability of Method of Predicting Outbreaks with Replikin Concentration**

**[000160]** In addition to the correlative aspect of the increase in Replikin concentration being related to percent mortality, the data in Table 10 provides strong confirmation of the power and validity of the methodology of predicting changes in virulence and outbreaks of virus with changes in Replikin concentration. These data represent an objective test of the method of independently selecting and examining several thousand individual accession numbers within approximately 12 million total accession numbers in PubMed wherein each selection is independently submitted to the PubMed data base under a separate request using objective software. If there were not a reliable principle and a reliable method underlying each request, the potential for obtaining random results, or no results, or results which do not track each other at $p<0.001$ would markedly increase. Table 10 provides results wherein p was less than 0.001 between each group as compared one to another.

**[000161]** In Table 10 the structures that are correlated have, to the knowledge of the inventors, not been correlated before, that is, the inventors have examined the relationship of one internal virus structure to another internal virus structure or structures (*e.g.,* three-way relationship between whole virus gene area, polymerase, and Replikin Peak Gene area) and have examined the external relation of these two or more internal structures to a host result of the virus infection, that is, percent mortality.

**[000162]** Table 10 represents consistent reproducible data, on repeated trials, which is the essence of the reliability of any method. For example, Table 10 provides independent data on (1) whole virus concentration of Replikins, (2) only the polymerase concentration of Replikins, and (3) only the Replikin Peak Gene concentration of Replikins. The data is then correlated with H5N1 mortality three times, namely in 2005, 2006 and 2007. The absence of significant changes in the pA and pB2 gene areas provides a control. In each case, the method measures Replikin concentration three ways, each of which correctly predict mortality, independently, thereby confirming the method, and further illustrating in the process, the magnifying function of the Replikin Peak Gene.

What is claimed is:

1. A method of determining an increased probability of an outbreak of influenza virus within about one to about three years following an increase in Replikin concentration in an isolate of White Spot Syndrome Virus or an isolate of Taura Syndrome Virus comprising identifying said increase in the concentration of Replikin sequences in at least one first isolate of White Spot Syndrome Virus or Taura Syndrome Virus as compared to at least one other isolate of White Spot Syndrome Virus or Taura Syndrome Virus, wherein said at least one first isolate is isolated at least six months later than said at least one other isolate is isolated, and wherein when said at least one first isolate is a White Spot Syndrome Virus isolate said at least one other isolate is a White Spot Syndrome Virus isolate, and when said at least one first isolate is a Taura Syndrome Virus isolate said at least one other isolate is a Taura Syndrome Virus isolate, and wherein said increase in the concentration of Replikin sequences signifies the increased probability of the outbreak of influenza virus within about one to about three years following said increase in the concentration of Replikin sequences.

2. The method of claim 1 wherein said identification of an increase in Replikin concentration in said at least one first isolate comprises: determining the concentration of Replikin sequences in (i) a plurality of isolates of White Spot Syndrome Virus, wherein said at least one first isolate has been isolated about six months to about three years later than said at least one other of said isolates of White Spot Syndrome Virus, or (ii) a plurality of isolates of Taura Syndrome Virus, wherein said at least one first isolate of Taura Syndrome Virus is isolated about six months to about three years later than at least one other isolate of Taura Syndrome Virus.

3. A computer readable medium having stored thereon instructions which, when executed, cause the processor to perform a method for predicting an outbreak of influenza virus comprising:

(1) determining the Replikin concentration of amino acid or nucleic acid sequences of a plurality of isolates of a virus wherein said virus is present in a reservoir of influenza virus and wherein at least one first isolate has been isolated about six months to about three years later than at least one other of isolate; and

(2) predicting an outbreak of influenza virus by identifying an increase in Replikin concentration in said at least one first isolate as compared to said at least one other of said plurality of isolates by comparing the Replikin concentrations of said at least one first isolate with said at least one other of said isolates wherein said outbreak of influenza virus is predicted to occur within about one to about three years from the time point at which said at least one first isolate was isolated.

4. The method of claim 1, wherein said increase in the concentration of Replikin sequences in said at least one first isolate as compared to said at least one other isolate is statistically significant.

5. The method of claim 1, wherein said increase in said concentration of Replikin sequences of said plurality of isolates is an increase in the mean concentration of at least two first isolates as compared to the mean concentration of at least two other isolates wherein said at least two first isolates are isolated about six months to about three years later than said at least two other isolates.

6. The method of claim 5, wherein said increase in said mean concentration of said at least two first isolates as compared to the mean concentration of said at least two other isolates is statistically significant.

7. The method of claim 1, wherein said increase in Replikin concentration is in an isolate of White Spot Syndrome Virus.

8. The method of claim 1, wherein said increase in Replikin concentration is in an isolate of Taura Syndrome Virus.

9. A method of predicting an outbreak of influenza virus comprising:

(1) obtaining a plurality of isolates of White Spot Syndrome Virus or a plurality of isolates of Taura Syndrome Virus wherein at least one of said isolates of White Spot Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of White Spot Syndrome Virus or wherein at least one of said

isolates of Taura Syndrome Virus is isolated about six months to about 3 years later than at least one other of said isolates of Taura Syndrome Virus;

(2) analyzing the amino acid sequence of at least one encoded protein or protein fragment or a combination of encoded proteins and/or protein fragments in each isolate of the plurality of isolates of White Spot Syndrome Virus or the plurality of isolates of Taura Syndrome Virus for the presence and concentration of encoded Replikin sequences;

(3) comparing the concentrations of encoded Replikin sequences in the at least one protein or protein fragment or in the combination of proteins or protein fragments in each isolate of the plurality of isolates of White Spot Syndrome Virus or in each isolate of the plurality of isolates of Taura Syndrome Virus;

(4) identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or greater; and

(5) predicting an outbreak of influenza within about one to about three years following said identified increase in the concentration of Replikin sequences in said isolates of White Spot Syndrome Virus or in the concentration of Replikin sequences in said isolates of Taura Syndrome Virus.

10. The method of claim 9, further comprising:

(1) identifying at least one Replikin Scaffold sequence present in at least one isolate of the plurality of isolates of White Spot Syndrome Virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of White Spot Syndrome Virus over a time period of about six months or greater or identifying at least one Replikin Scaffold sequence present in at least one isolate in the plurality of isolates of Taura Syndrome Virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of Taura Syndrome Virus over a time period of about six months or greater;

(2) identifying at least one Replikin Scaffold sequence present in at least one isolate of a strain of influenza virus; and

(3) predicting the strain of influenza virus in which the at least one Replikin Scaffold sequence is identified as the strain of virus that will cause the predicted outbreak of

influenza virus wherein a Replikin Scaffold is a peptide consisting of about 16 to about 34 amino acids comprising (1) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (2) a terminal histidine and optionally a histidine immediately adjacent to the terminal histidine, (3) a lysine within about 6 to about 10 amino acids of another lysine; and (4) at least 6% lysines.

11. The method of claim 10, wherein the Replikin Scaffold is a peptide having about 27 to about 33 amino acids.

12. The method of claim 9, wherein the increase in concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus over at least one time period of about six months or more is ten or more Replikin sequences per 100 amino acids.

13. The method of claim 12, wherein the increase in concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus over at least one time period of about six months or more is 90 or more Replikin sequences per 100 amino acids.

14. The method of claim 9, wherein the increase in concentration of encoded Replikin sequences in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or more is one or more Replikin sequences per 100 amino acids.

15. The method of claim 14, wherein the increase in concentration of encoded Replikin sequences in said plurality of isolates of Taura Syndrome Virus over at least one time period of about six months or more is 2 or more Replikin sequences per 100 amino acids.

16. The method of claim 9, further comprising identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of White Spot Syndrome Virus or said plurality of isolates of Taura Syndrome Virus over at least one to about three years.

17. The method of claim 1, wherein said outbreak of influenza is an outbreak of influenza A virus.

18. The method of claim 17 wherein said outbreak of influenza A virus is an outbreak of an H5N1 strain of influenza virus.

19. A method of predicting an outbreak of influenza virus comprising:

(1) obtaining a plurality of isolates of a first virus from at least one reservoir of Replikin sequences shared by influenza virus wherein the reservoir of Replikin sequences shared by influenza virus is any source of Replikin sequences that may be shared with an influenza virus including any host of influenza virus, any food source of a host of the influenza virus, any vector of influenza virus, or any substance wherein the genetic information of the influenza virus may be shared, mingled, mixed, exchanged or come into the proximity of the Replikin sequences of the reservoir;

(2) analyzing the amino acid sequence of at least one encoded protein or protein fragment or a combination of encoded proteins and/or protein fragments in each isolate of the plurality of isolates of said first virus for the presence and concentration of encoded Replikin sequences;

(3) comparing the concentrations of encoded Replikin sequences in the at least one protein or protein fragment or in the combination of proteins or protein fragments in each isolate of the plurality of isolates of said first virus;

(4) identifying an increase in the concentration of encoded Replikin sequences in said plurality of isolates of said virus over at least one time period of about six months or greater; and

(5) predicting an outbreak of influenza within about one to about three years following said identified increase in the concentration of Replikin sequences in said isolates of said first virus.

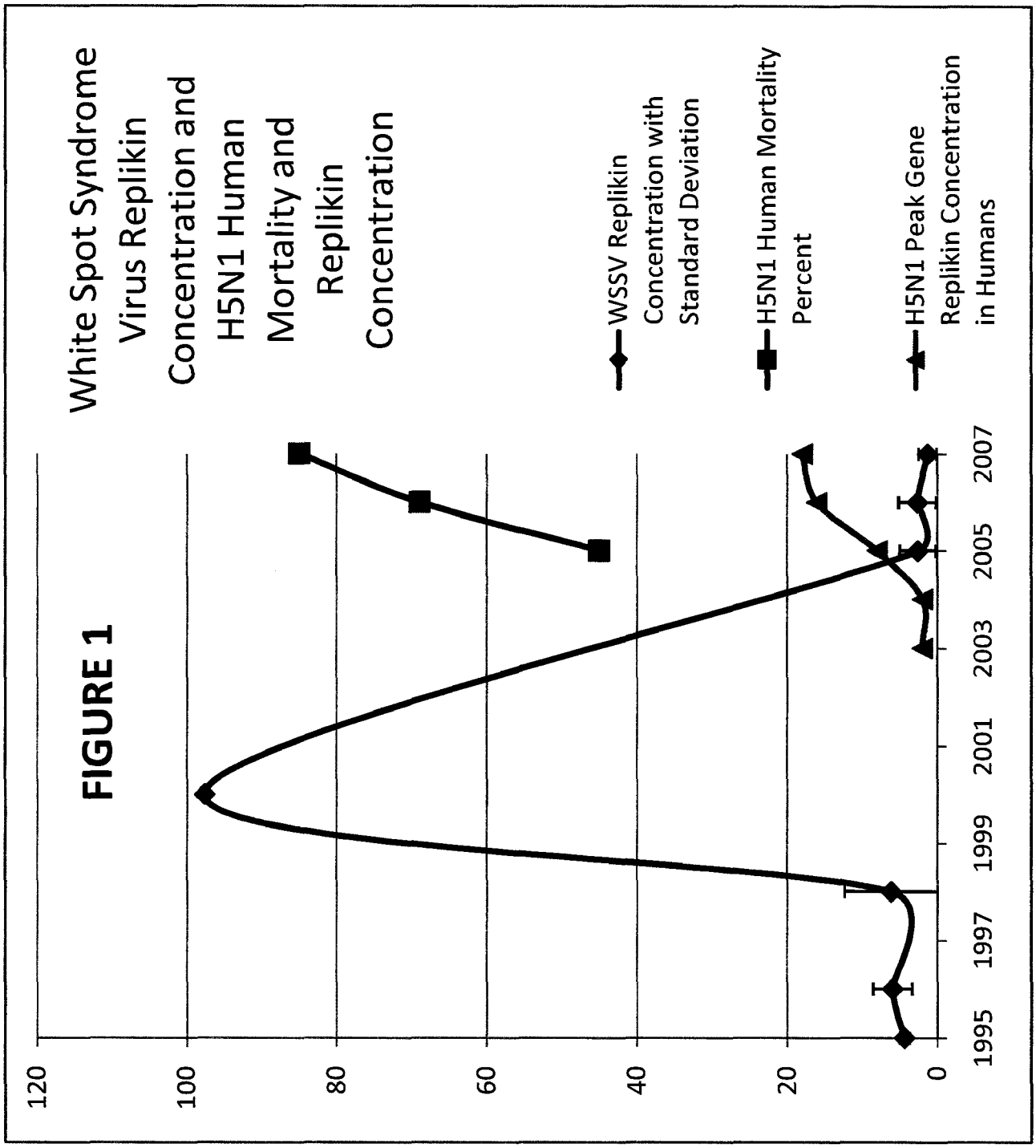
20. The method of claim 19, further comprising:

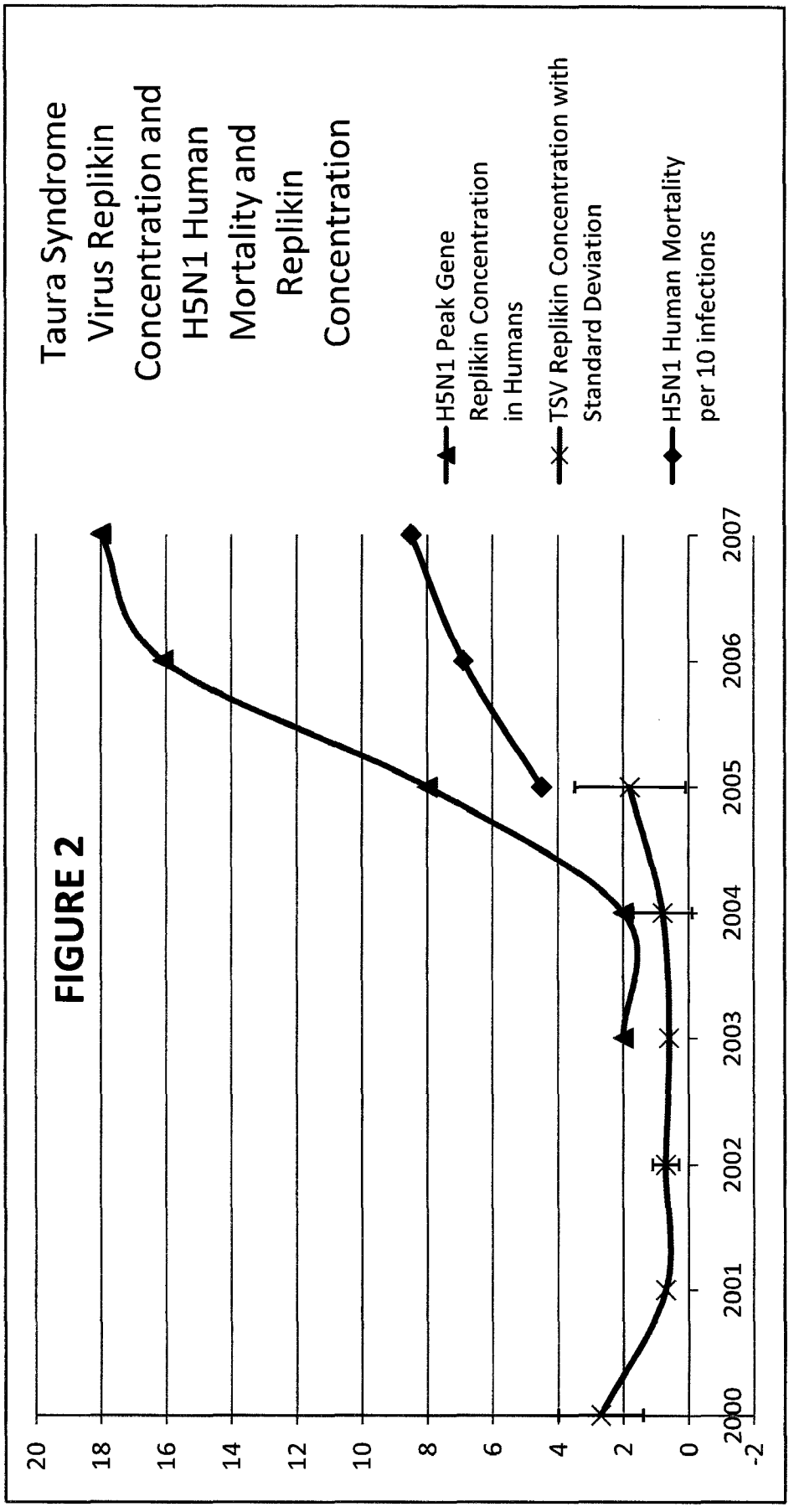
(1) identifying at least one Replikin Scaffold sequence present in at least one isolate of the plurality of isolates of said first virus identified as having an increase in the concentration of Replikin sequences as compared to at least one other isolate of the plurality of isolates of said virus over a time period of about six month;

(2) identifying at least one Replikin Scaffold sequence present in at least one isolate of a strain of influenza virus; and

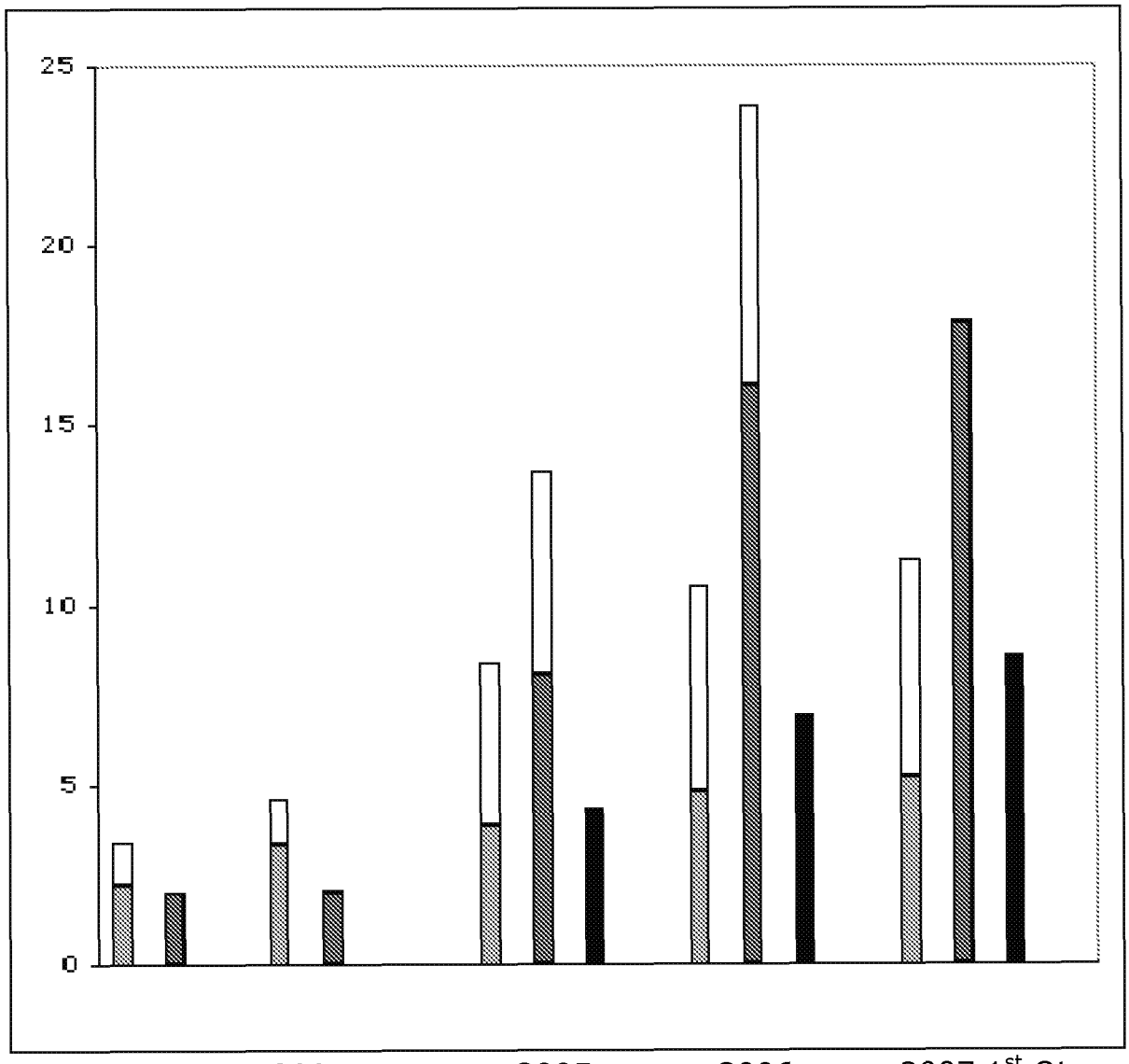
(3) predicting the strain of influenza virus in which the at least one Replikin Scaffold sequence is identified as the strain of virus that will cause the predicted outbreak of influenza virus wherein a Replikin Scaffold is a peptide consisting of about 16 to about 34 amino acids comprising (1) a terminal lysine and optionally a lysine immediately adjacent to the terminal lysine; (2) a terminal histidine and optionally a histidine immediately adjacent to the terminal histidine, (3) a lysine within about 6 to about 10 amino acids of another lysine; and (4) at least 6% lysines.

21. The method of claim 19 or claim 20, wherein the reservoir is selected from the group consisting of shrimp, bird, migratory bird, chicken, duck, goose, and domestic bird.


FIGURE 1
White Spot Syndrome Virus Replikin Concentration and H5N1 Human Mortality and Replikin Concentration
WSSV Replikin Concentration with Standard Deviation
H5N1 Human Mortality Percent
H5N1 Peak Gene Replikin Concentration in Humans
120
100
80
60
40
20
0
1995
1997
1999
2001
2003
2005
2007


FIGURE 2
Taura Syndrome Virus Replikin Concentration and H5N1 Human Mortality and Replikin Concentration
H5N1 Peak Gene Replikin Concentration in Humans
TSV Replikin Concentration with Standard Deviation
H5N1 Human Mortality per 10 infections
20
18
16
14
12
10
8
6
4
2
0
-2
2000
2001
2002
2003
2004
2005
2006
2007

# FIGURE 3




HUMAN H5N1
Light Gray = Whole virus Replikin Concentration (Number of Replikins per 100 amino acids)
Dark Gray = Replikin Peak Gene Replikin Count
Uncolored Bar = Standard Deviation
Black = % Human Mortality Rate (x 10)

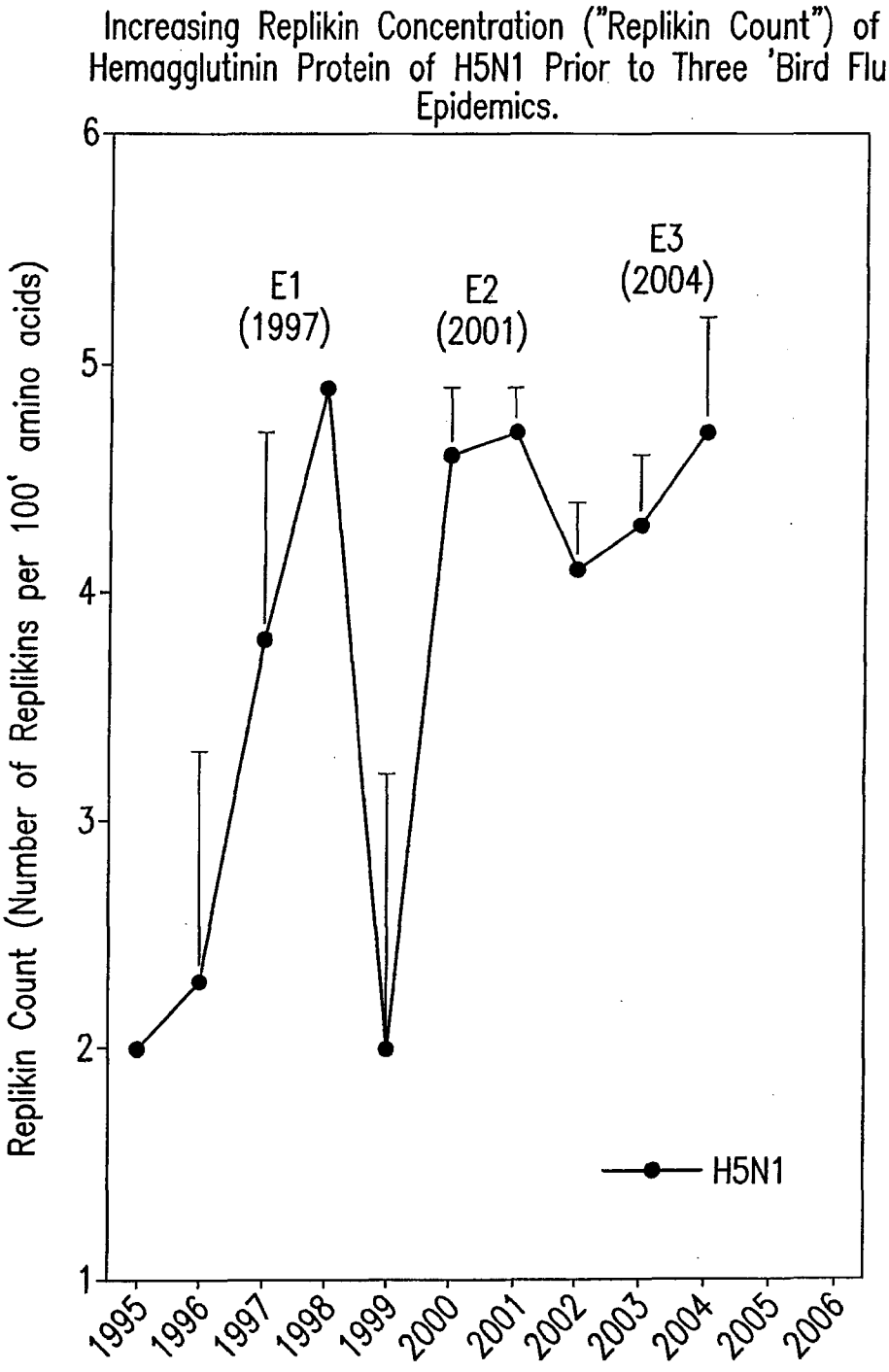
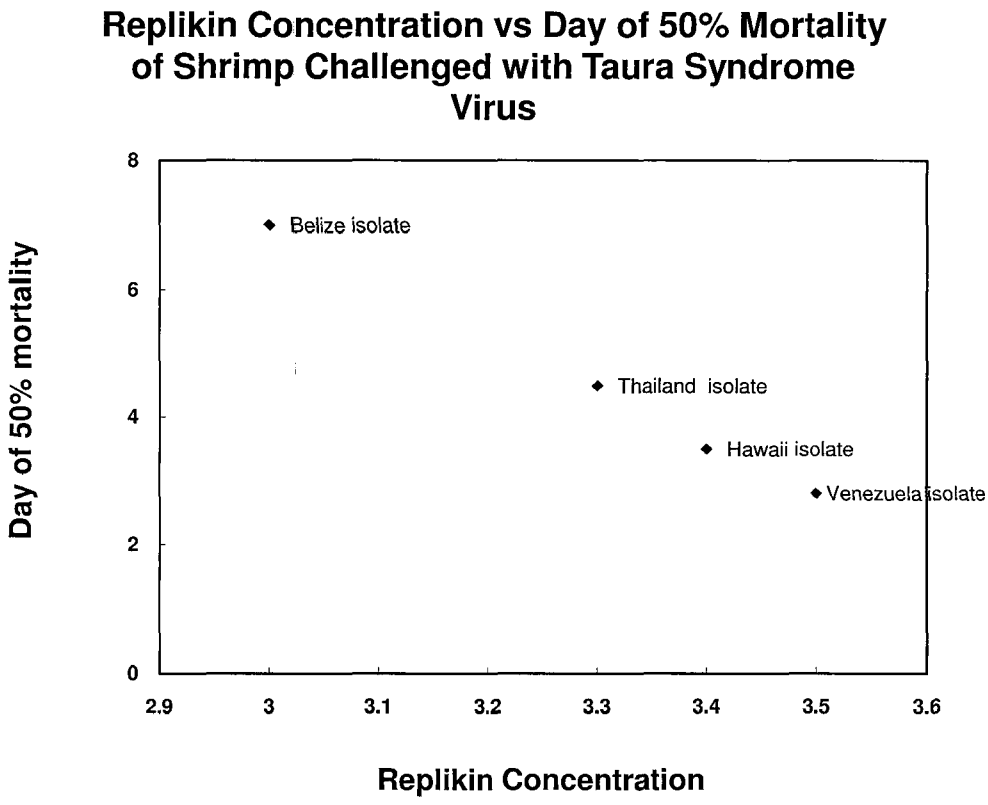
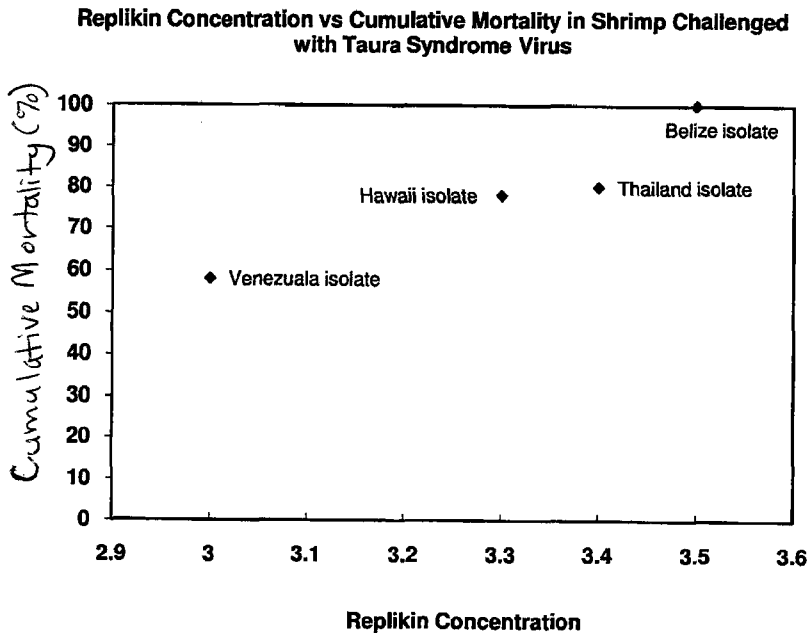

Increasing Replikin Concentration ("Replikin Count") of Hemagglutinin Protein of H5N1 Prior to Three 'Bird Flu' Epidemics.
Replikin Count (Number of Replikins per 100' amino acids)
6
5
4
3
2
1
E1 (1997)
E2 (2001)
E3 (2004)
H5N1
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006

FIG.4

# FIGURE 5

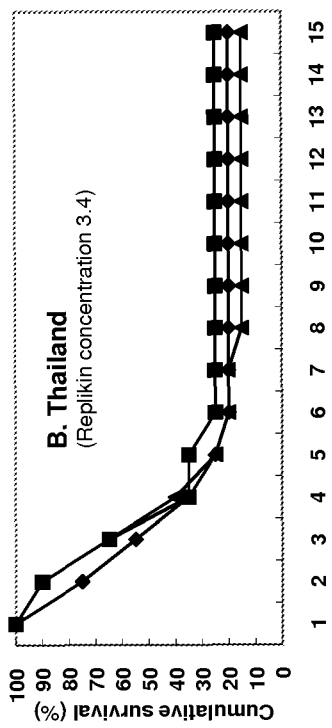

Replikin Concentration vs Day of 50% Mortality of Shrimp Challenged with Taura Syndrome Virus
Day of 50% mortality
8
6
4
2
0
Belize isolate
Thailand isolate
Hawaii isolate
Venezuela isolate
2.9
3
3.1
3.2
3.3
3.4
3.5
3.6
Replikin Concentration

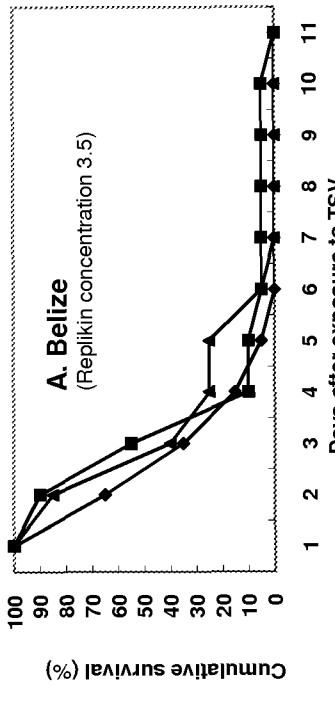
# FIGURE 6

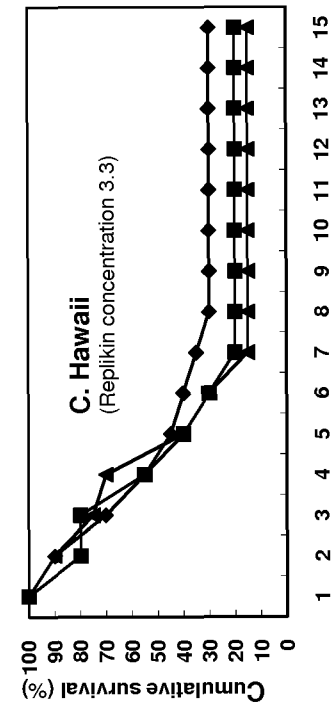

Replikin Concentration vs Cumulative Mortality in Shrimp Challenged with Taura Syndrome Virus
Cumulative Mortality (%)
100
90
80
70
60
50
40
30
20
10
0
Belize isolate
Hawaii isolate
Thailand isolate
Venezuala isolate
2.9
3
3.1
3.2
3.3
3.4
3.5
3.6
Replikin Concentration

# FIGURE 7

**Cumulative survival of *Litopenaeus vannamei per os* challenged with TSV isolates: A: Belize; B: Thailand; C: Hawaii; D: Venezuela.**



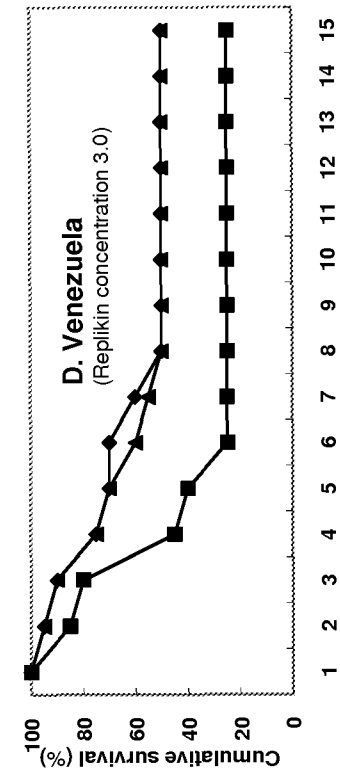
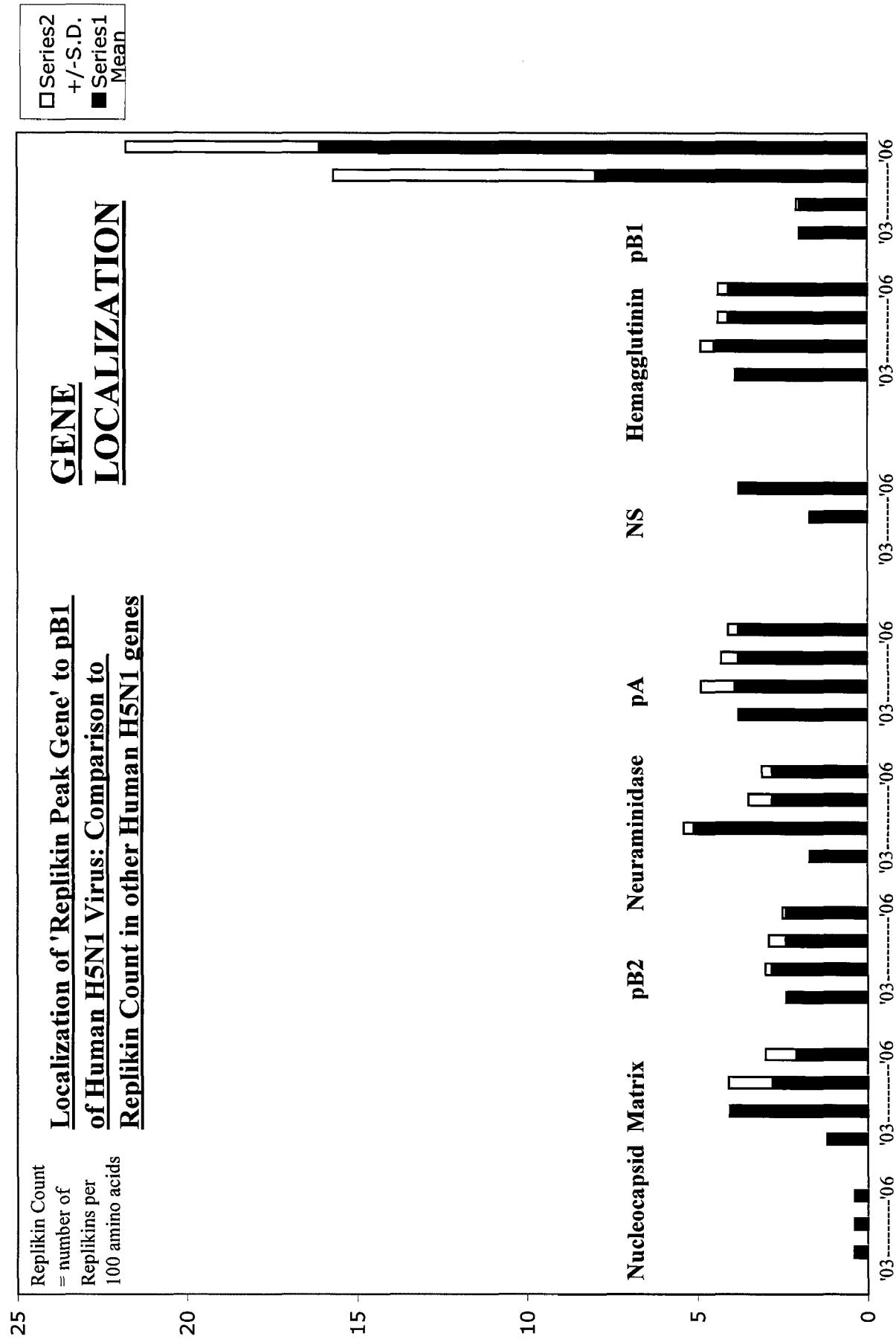



FIGURE 8


Series2
+/-S.D.
Series1
Mean
Localization of 'Replikin Peak Gene' to pB1
of Human H5N1 Virus: Comparison to
Replikin Count in other Human H5N1 genes
GENE
LOCALIZATION
Replikin Count
= number of
Replikins per
100 amino acids
25
20
15
10
5
0
Nucleocapsid
Matrix
pB2
Neuraminidase
pA
NS
Hemagglutinin
pB1
'03--------'06

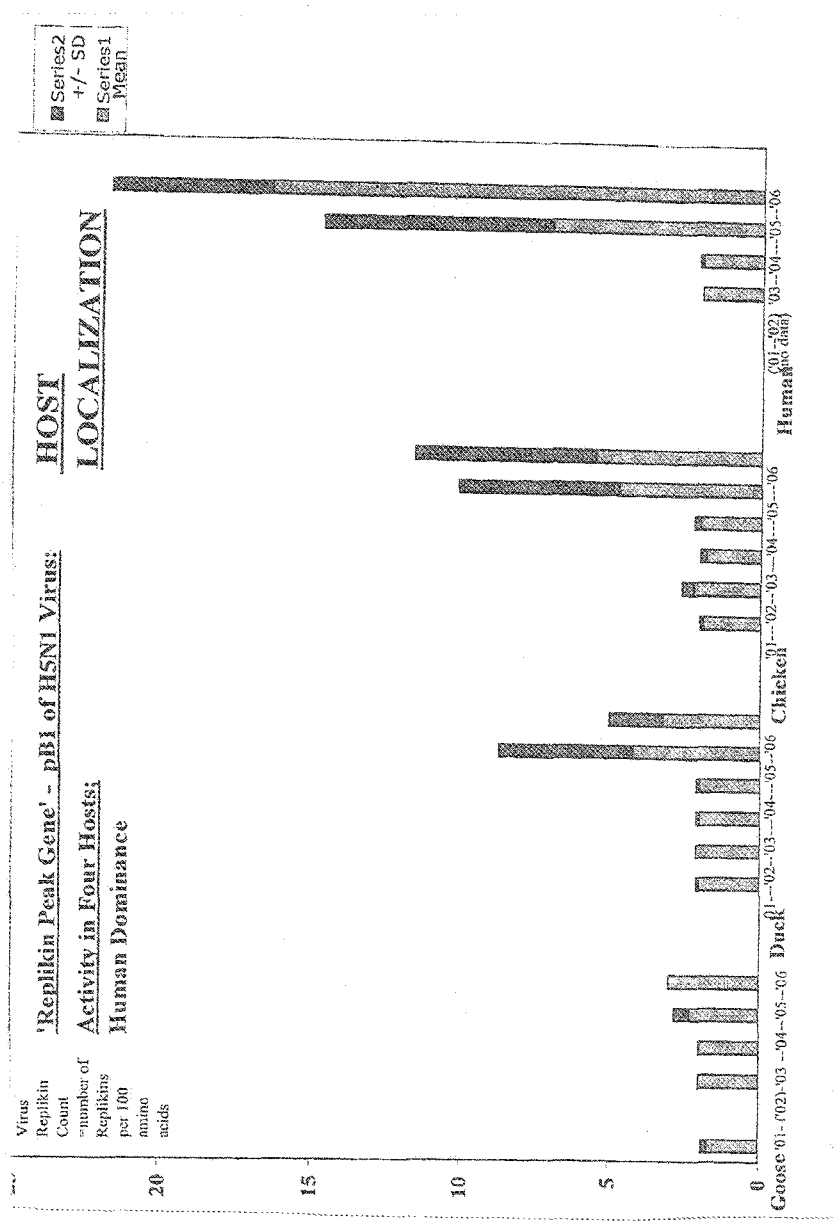
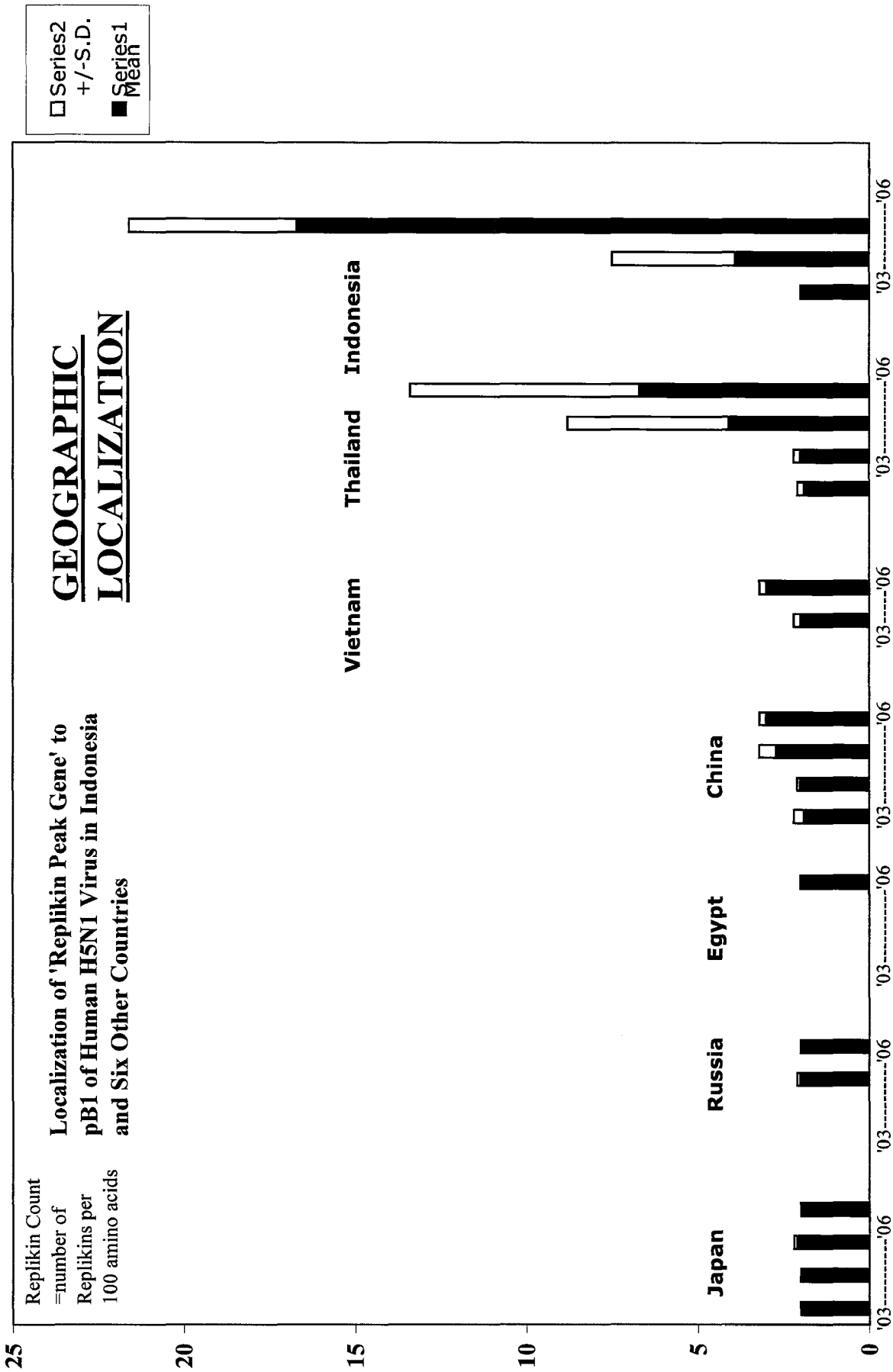

'Replikin Peak Gene' - pB1 of H5N1 Virus:
Activity in Four Hosts:
Human Dominance
HOST
LOCALIZATION
Virus Replikin Count
number of Replikins per 100 amino acids
Series2 +/- SD
Series1 Mean
0
5
10
15
20
Goose '01-'02 '03--'04--'05--'06
Duck '01--'02--'03--'04--'05--'06
Chicken '01--'02--'03--'04--'05--'06
Human (no data) '01-'02 '03--'04--'05--'06

Figure 9

FIGURE 10


Series2
+/-S.D.
Series1
Mean
GEOGRAPHIC
LOCALIZATION
Localization of 'Replikin Peak Gene' to
pB1 of Human H5N1 Virus in Indonesia
and Six Other Countries
Replikin Count
=number of
Replikins per
100 amino acids
Japan
Russia
Egypt
China
Vietnam
Thailand
Indonesia
25
20
15
10
5
0
'03
'06

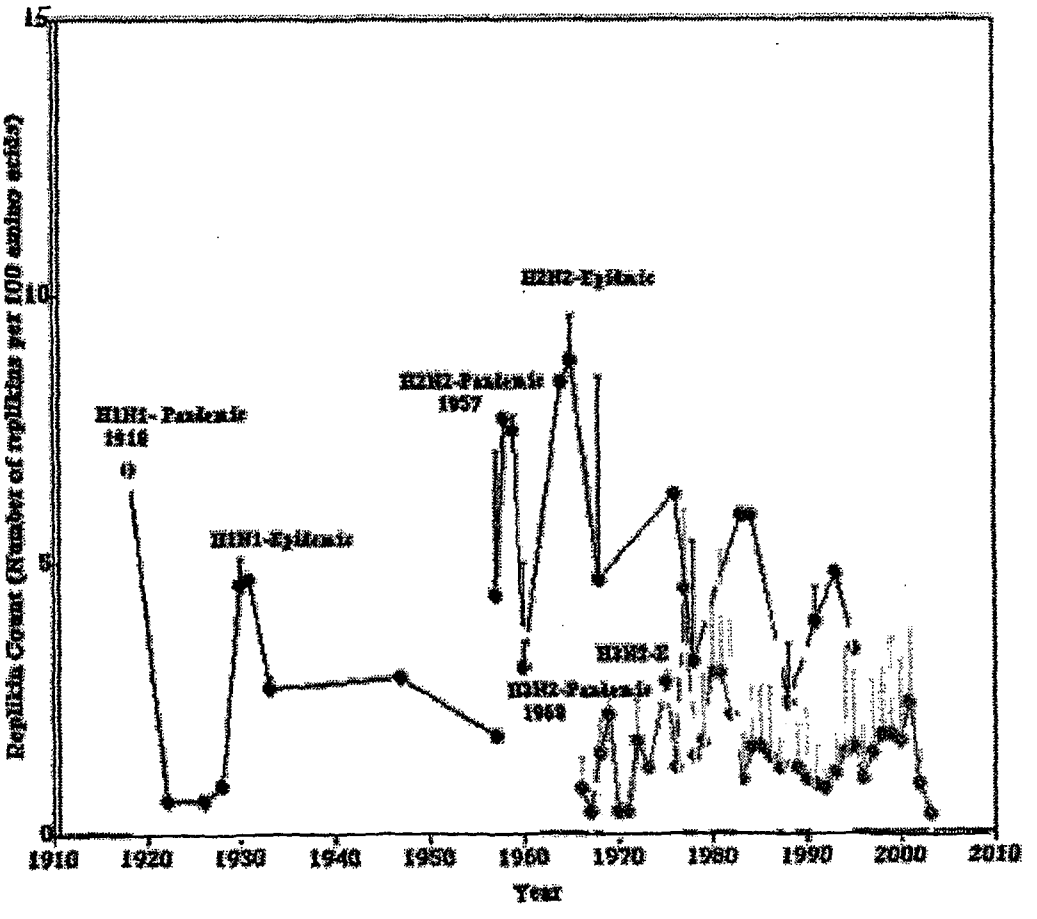

15
10
5
0
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
H1N1- Pandemic
1918
H1N1-Epidemic
H2N2-Epidemic
H2N2-Pandemic
1957
H3N2-E
H2N2-Pandemic
1968

Figure 11

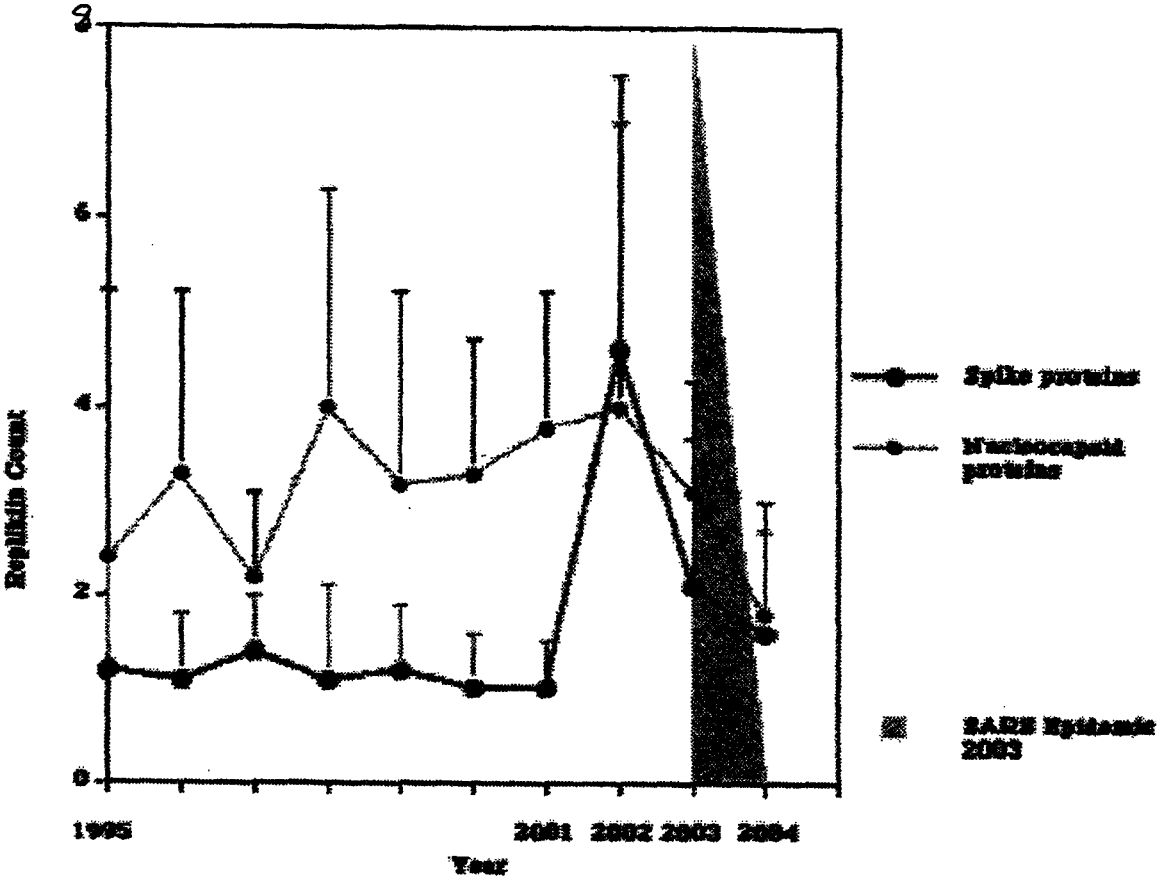
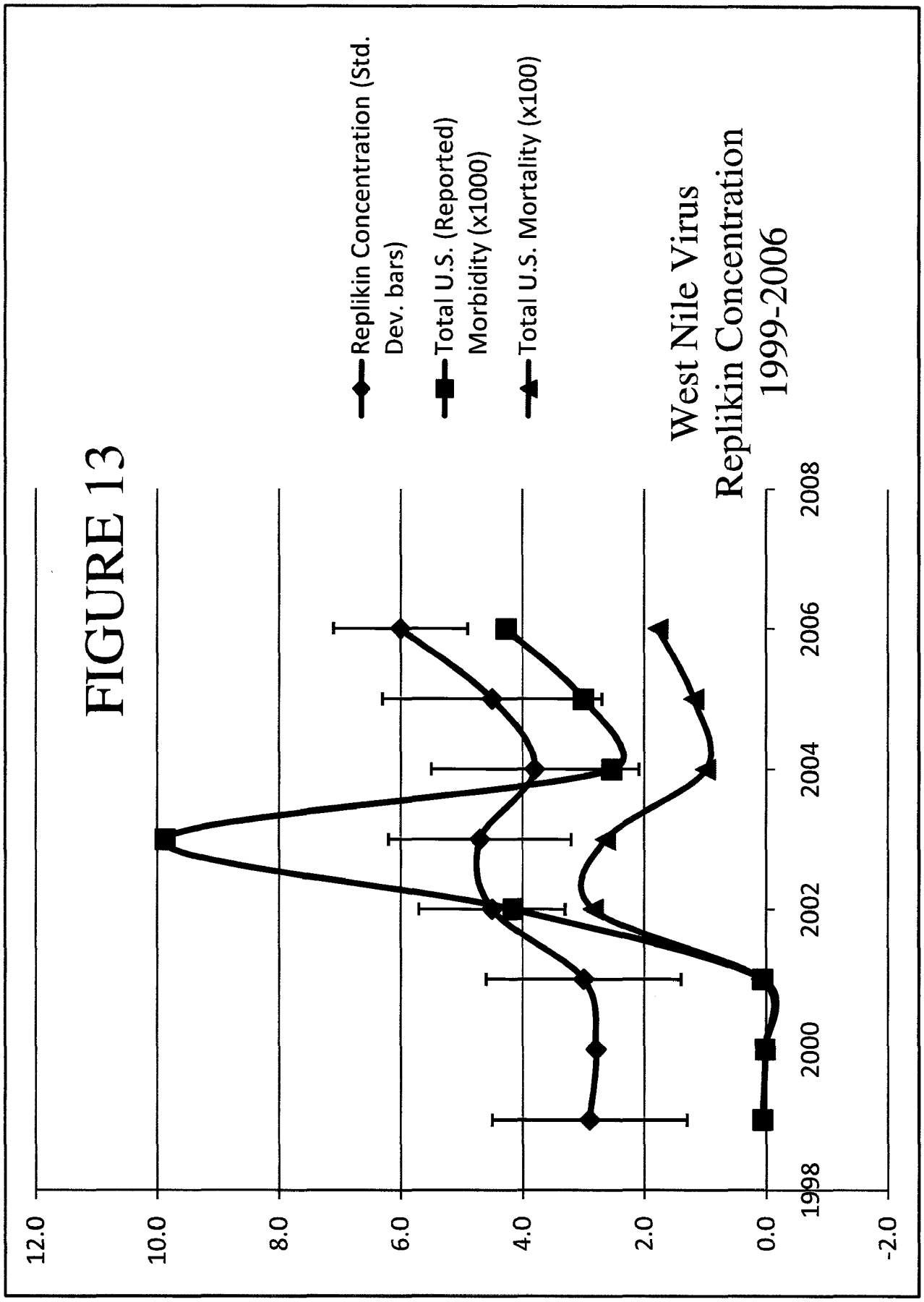
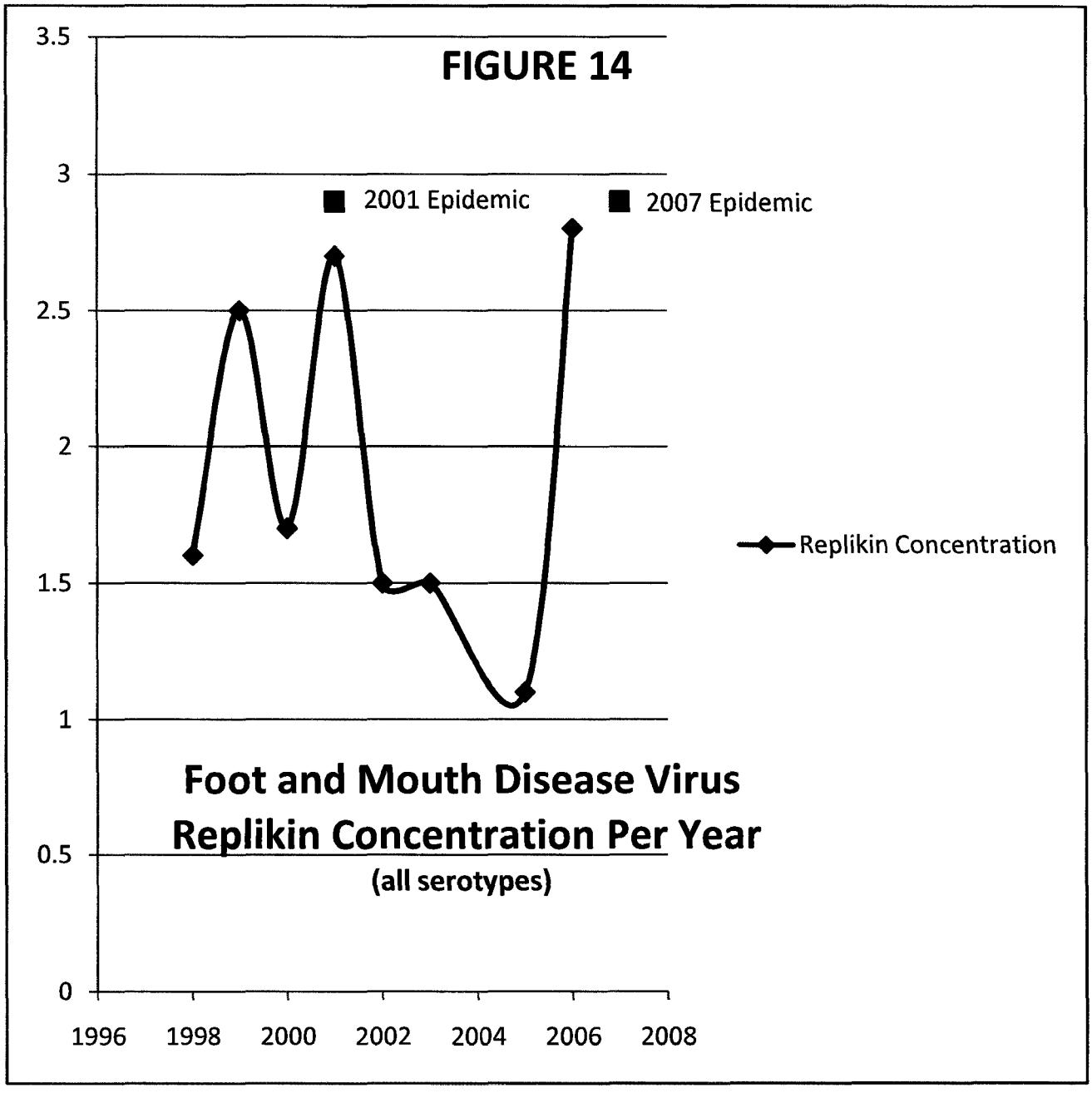
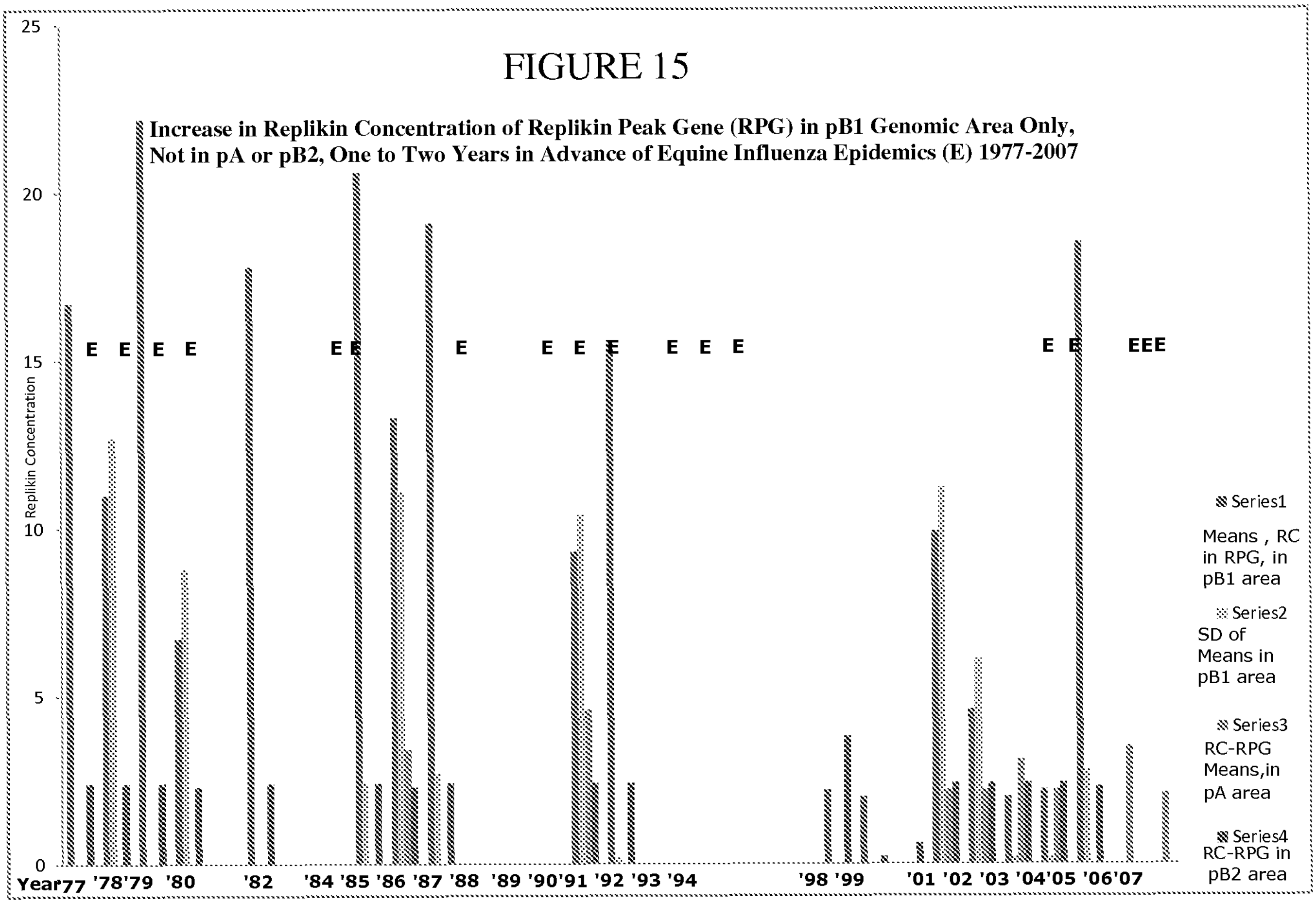

8
6
4
2
0
Replikin Count
1995
2001
2002
2003
2004
Year
Spike protein
Nucleocapsid protein
SARS Epidemic 2003

Figure 12

FIGURE 13


West Nile Virus
Replikin Concentration
1999-2006
Replikin Concentration (Std. Dev. bars)
Total U.S. (Reported) Morbidity (x1000)
Total U.S. Mortality (x100)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
1998
2000
2002
2004
2006
2008


FIGURE 14
3.5
3
2.5
2
1.5
1
0.5
0
1996
1998
2000
2002
2004
2006
2008
2001 Epidemic
2007 Epidemic
Replikin Concentration
Foot and Mouth Disease Virus
Replikin Concentration Per Year
(all serotypes)


FIGURE 15
Increase in Replikin Concentration of Replikin Peak Gene (RPG) in pB1 Genomic Area Only, Not in pA or pB2, One to Two Years in Advance of Equine Influenza Epidemics (E) 1977-2007
Replikin Concentration
25
20
15
10
5
0
E E E E
E E
E
E E E
E E E
E E
EEE
Year77 '78'79 '80 '82 '84 '85 '86 '87 '88 '89 '90'91 '92 '93 '94 '98 '99 '01 '02 '03 '04'05 '06'07
Series1
Means , RC in RPG, in pB1 area
Series2
SD of Means in pB1 area
Series3
RC-RPG Means,in pA area
Series4
RC-RPG in pB2 area

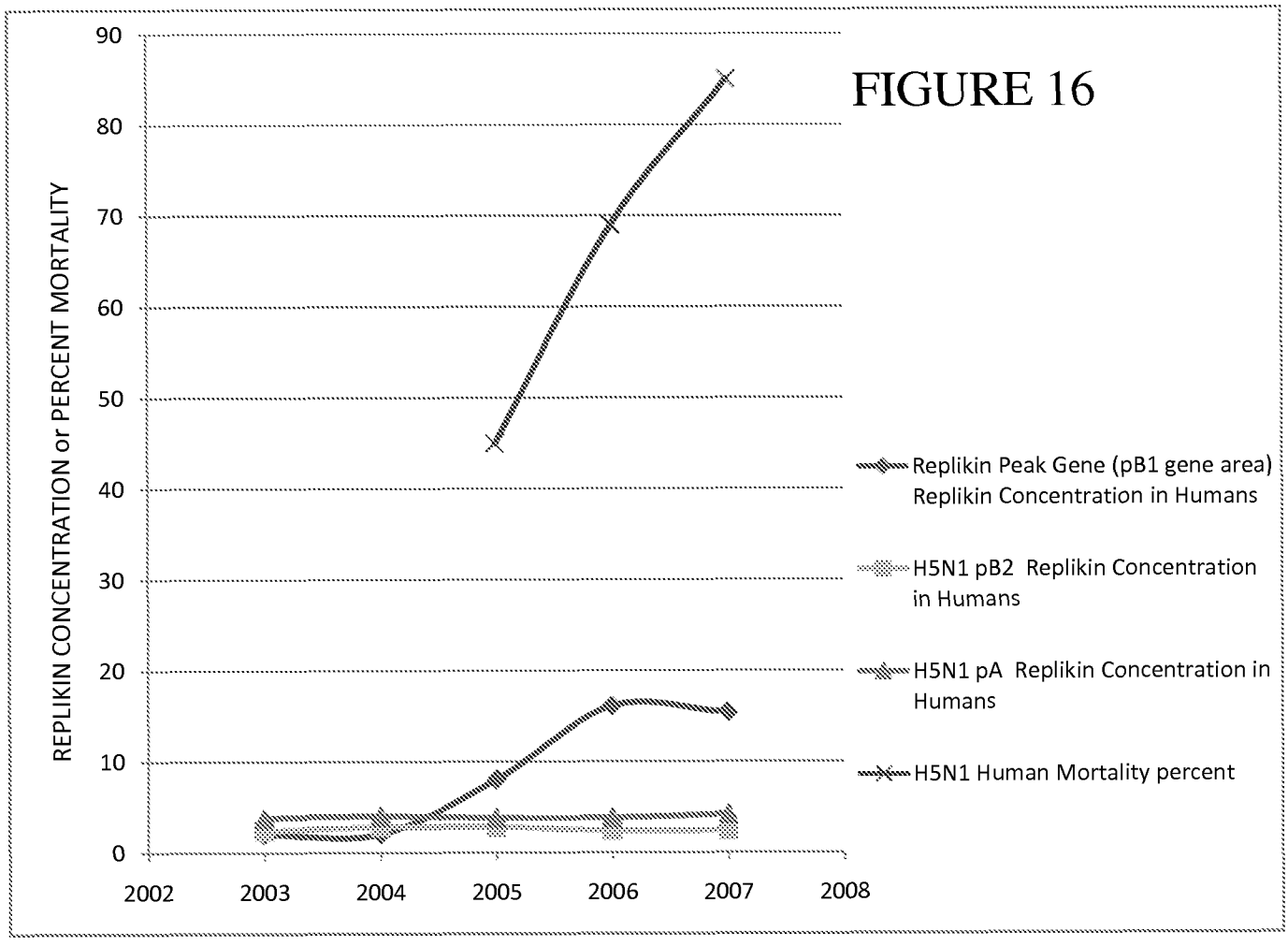

90
80
70
60
50
40
30
20
10
0
REPLIKIN CONCENTRATION or PERCENT MORTALITY
2002
2003
2004
2005
2006
2007
2008
Replikin Peak Gene (pB1 gene area) Replikin Concentration in Humans
H5N1 pB2 Replikin Concentration in Humans
H5N1 pA Replikin Concentration in Humans
H5N1 Human Mortality percent

FIGURE 16

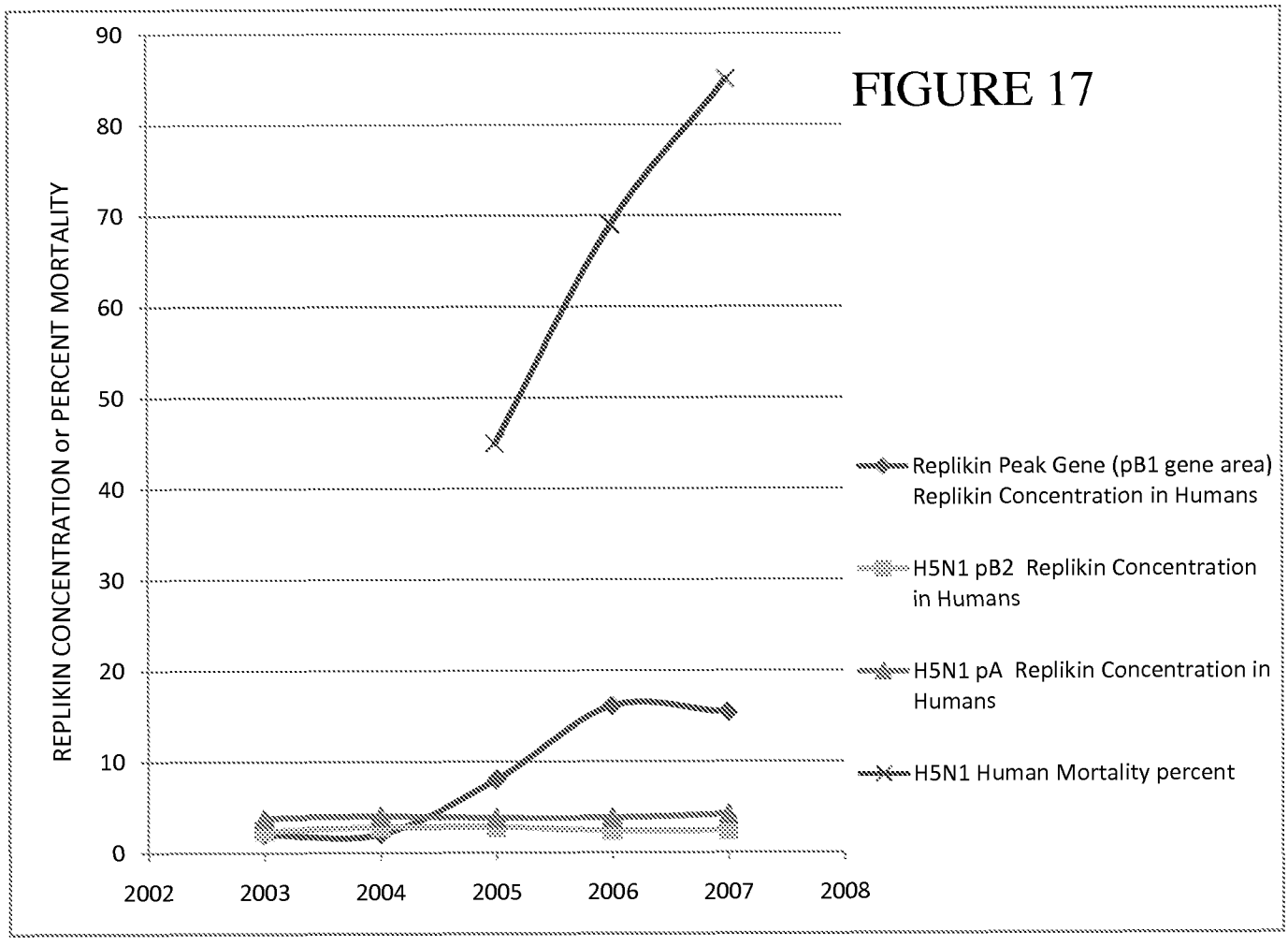

90
80
70
60
50
40
30
20
10
0
REPLIKIN CONCENTRATION or PERCENT MORTALITY
2002
2003
2004
2005
2006
2007
2008
Replikin Peak Gene (pB1 gene area) Replikin Concentration in Humans
H5N1 pB2 Replikin Concentration in Humans
H5N1 pA Replikin Concentration in Humans
H5N1 Human Mortality percent

FIGURE 17