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(54) Titre : PEPTIDES ANTIGENIQUES DE NEISSERIA  
(54) Title: NEISSERIAL ANTIGENIC PEPTIDES

(57) **Abrégé/Abstract:**

This invention provides, among other things, proteins, polypeptides, and fragments thereof, derived from the bacteria *Neisseria meningitidis* B. Also provided are nucleic acids encoding for such proteins, polypeptides, and/or fragments, as well as nucleic acids complementary thereto e.g., antisense nucleic acids). Additionally, this invention provides antibodies which bind to the proteins, polypeptides, and/or fragments. This invention further provides expression vectors useful for making the proteins, polypeptides, and/or fragments, as well as host cells transformed with such vectors. This invention also provides compositions of the proteins, polypeptides, fragments, and/or nucleic acids, for use as vaccines, diagnostic reagents, immunogenic compositions, and the like. Methods of making the compositions and methods of treatment with the compositions are also provided. This invention also provides methods of detecting the proteins, polypeptides, fragments, and/or nucleic acids.



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**Abstract**

This invention provides, among other things, proteins, polypeptides, and fragments thereof, derived from the bacteria *Neisseria meningitidis* B. Also provided are nucleic acids encoding for such proteins, polypeptides, and/or fragments, as well as nucleic acids complementary thereto *e.g.*, antisense nucleic acids). Additionally, this invention provides antibodies which bind to the proteins, polypeptides, and/or fragments. This invention further provides expression vectors useful for making the proteins, polypeptides, and/or fragments, as well as host cells transformed with such vectors. This invention also provides compositions of the proteins, polypeptides, fragments, and/or nucleic acids, for use as vaccines, diagnostic reagents, immunogenic compositions, and the like. Methods of making the compositions and methods of treatment with the compositions are also provided. This invention also provides methods of detecting the proteins, polypeptides, fragments, and/or nucleic acids.

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## **JUMBO APPLICATIONS / PATENTS**

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- 1 -

**NEISSERIAL ANTIGENIC PEPTIDES**

This application is a divisional application of Canadian Patent Application number 2,863,668 filed September 18, 2014, which is a divisional of Canadian Patent Application number 2,389,321 filed October 30, 2000.

**TECHNICAL FIELD**

This invention relates to antigenic peptide sequences from the bacteria *Neisseria meningitidis* and *Neisseria gonorrhoea*.

**BACKGROUND ART**

*N. meningitidis* is a non-motile, Gram-negative diplococcus that is pathogenic in humans.

Based on the organism's capsular polysaccharide, 12 serogroups of *N. meningitidis* have been identified. Group A is the pathogen most often implicated in epidemic disease in sub-Saharan Africa. Serogroups B and C are responsible for the vast majority of cases in the United States and in most developed countries. Serogroups W135 and Y are responsible for the rest of the cases in the United States and developed countries.

The meningococcal vaccine currently in use is a tetravalent polysaccharide vaccine composed of serogroups A, C, Y and W135. Meningococcus B remains a problem, however. The polysaccharide approach cannot be used because the menB capsular polysaccharide is a polymer of  $\alpha(2-8)$ -linked *N*-acetyl neuraminic acid that is also present in mammalian tissue. One approach to a menB vaccine uses mixtures of outer membrane proteins (OMPs). To overcome the antigenic variability, multivalent vaccines containing up to nine different porins have been constructed [e.g., Poolman JT (1992) Development of a meningococcal vaccine. *Infect. Agents Dis.* 4: 13-28]. Additional proteins to be used in outer membrane vaccines have been the opa and ope proteins, but none of these approaches have been able to overcome the antigenic variability [e.g., Ala'Aldeen & Borriello (1996)]. The meningococcal transferrin-binding proteins 1 and 2 are both surface exposed and generate bactericidal antibodies capable of killing homologous and heterologous strains. [*Vaccine* 14(1):49-53].

**DISCLOSURE OF THE INVENTION**

The invention provides fragments of the proteins disclosed in international patent applications WO99/57280 and WO00/22430 (the "International Applications"), wherein the fragments comprise at least one antigenic determinant.

Thus, if the length of any particular protein sequence disclosed in the International Applications is  $x$  amino acids, the present invention provides fragments of at most  $x-1$  amino acids of that protein. The fragment may be shorter than this (e.g.,  $x-2$ ,  $x-3$ ,  $x-4$ ), and is

preferably 100 amino acids or less (*e.g.*, 90 amino acids, 80 amino acids *etc.*). The fragment may be as short as 3 amino acids, but is preferably longer (*e.g.*, up to 5, 6, 7, 8, 9, 10, 12, 15, 20, 25, 30, 35, 40, 50, 75, or 100 amino acids).

Preferred fragments comprise the meningococcal peptide sequences disclosed in Table 1, or sub-sequences thereof. The fragments may be longer than those given in Table 1 *e.g.*, where a fragment in Table 1 runs from amino acid residue  $p$  to residue  $q$  of a protein, the invention also relates to fragments from residue  $(p-1)$ ,  $(p-2)$ , or  $(p-3)$  to residue  $(q+1)$ ,  $(q+2)$ , or  $(q+3)$ .

The invention also provides polypeptides that are homologous (*i.e.*, have sequence identity) to these fragments. Depending on the particular fragment, the degree of sequence identity is preferably greater than 50% (*e.g.*, 60%, 70%, 80%, 90%, 95%, 99% or more). These homologous polypeptides include mutants and allelic variants of the fragments. Identity between the two sequences is preferably determined by the Smith-Waterman homology search algorithm as implemented in the MPSRCH program (Oxford Molecular), using an affine gap search with parameters *gap open penalty*=12 and *gap extension penalty*=1.

The invention also provides proteins comprising one or more of the above-defined fragments.

The invention is subject to the proviso that it does not include within its scope proteins limited to any of the full length protein sequences disclosed in the International Applications (*i.e.*, the even SEQ IDs: 2-3020 of WO99/57280 and the odd SEQ IDs: 963-1045 of WO00/22430).

The proteins of the invention can, of course, be prepared by various means (*e.g.*, recombinant expression, purification from cell culture, chemical synthesis *etc.*) and in various forms (*e.g.*, native, C-terminal and/or N-terminal fusions *etc.*). They are preferably prepared in substantially pure form (*i.e.*, substantially free from other Neisserial or host cell proteins). Short proteins are preferably produced using chemical peptide synthesis.

According to a further aspect, the invention provides antibodies which recognise the fragments of the invention, with the proviso that the invention does not include within its scope antibodies which recognise any of the complete protein sequences in the International Applications. The antibodies may be polyclonal or monoclonal, and may be produced by any suitable means.

The invention also provides proteins comprising peptide sequences recognised by these antibodies. These peptide sequences will, of course, include fragments of the meningococcal

proteins in the International Applications, but will also include peptides that mimic the antigenic structure of the meningococcal peptides when bound to immunoglobulin.

According to a further aspect, the invention provides nucleic acid encoding the fragments and proteins of the invention, with the proviso that the invention does not include within its scope nucleic acid encoding any of the full length protein sequences in the International Applications. The nucleic acids may be as short as 10 nucleotides, but are preferably longer (*e.g.*, up to 10, 12, 15, , 18, 20, 25, 30, 35, 40, 50, 75, or 100 nucleotides).

In addition, the invention provides nucleic acid comprising sequences homologous (*i.e.*, having sequence identity) to these sequences. The degree of sequence identity is preferably greater than 50% (*e.g.*, 60%, 70%, 80%, 90%, 95%, 99% or more). Furthermore, the invention provides nucleic acid which can hybridise to these sequences, preferably under "high stringency" conditions (*e.g.*, 65°C in a 0.1xSSC, 0.5% SDS solution).

It should also be appreciated that the invention provides nucleic acid comprising sequences complementary to those described above (*e.g.*, for antisense or probing purposes).

Nucleic acid according to the invention can, of course, be prepared in many ways (*e.g.*, by chemical synthesis, from genomic or cDNA libraries, from the organism itself *etc.*) and can take various forms (*e.g.*, single stranded, double stranded, vectors, probes *etc.*). In addition, the term "nucleic acid" includes DNA and RNA, and also their analogues, such as those containing modified backbones, and also peptide nucleic acids (PNA), *etc.*

According to a further aspect, the invention provides vectors comprising nucleotide sequences of the invention (*e.g.*, expression vectors) and host cells transformed with such vectors.

According to a further aspect, the invention provides compositions comprising protein, antibody, and/or nucleic acid according to the invention. These compositions may be suitable as vaccines, for instance, or as diagnostic reagents, or as immunogenic compositions.

The invention also provides nucleic acid, protein, or antibody according to the invention for use as medicaments (*e.g.*, as vaccines or as immunogenic compositions) or as diagnostic reagents. It also provides the use of nucleic acid, protein, or antibody according to the invention in the manufacture of: (i) a medicament for treating or preventing infection due to Neisserial bacteria; (ii) a diagnostic reagent for detecting the presence of Neisserial bacteria or of antibodies raised against Neisserial bacteria; and/or (iii) a reagent which can raise

antibodies against Neisserial bacteria. Said Neisserial bacteria may be any species or strain (such as *N. gonorrhoeae*) but are preferably *N. meningitidis*, especially strain A or strain B.

The invention also provides a method of treating a patient, comprising administering to the patient a therapeutically effective amount of nucleic acid, protein, and/or antibody according to the invention.

According to further aspects, the invention provides various processes, for example:

A process for producing proteins of the invention is provided, comprising the step of culturing a host cell according to the invention under conditions which induce protein expression;

A process for producing protein or nucleic acid of the invention is provided, wherein the protein or nucleic acid is synthesised in part or in whole using chemical means;

A process for detecting polynucleotides of the invention is provided, comprising the steps of: (a) contacting a nucleic probe according to the invention with a biological sample under hybridizing conditions to form duplexes; and (b) detecting said duplexes; and

A process for detecting proteins of the invention is provided, comprising the steps of: (a) contacting an antibody according to the invention with a biological sample under conditions suitable for the formation of an antibody-antigen complexes; and (b) detecting said complexes.

A summary of standard techniques and procedures which may be employed in order to perform the invention (*e.g.*, to utilise the disclosed sequences for vaccination or diagnostic purposes) follows. This summary is not a limitation on the invention but, rather, gives examples which may be used, but which are not required.

#### General

The practice of the present invention will employ, unless otherwise indicated, conventional techniques of molecular biology, microbiology, recombinant DNA, and immunology, which are within the skill of the art. Such techniques are explained fully in the literature *e.g.*, Sambrook *Molecular Cloning; A Laboratory Manual, Second Edition* (1989); *DNA Cloning, Volumes I and ii* (D.N Glover ed. 1985); *Oligonucleotide Synthesis* (M.J. Gait ed, 1984); *Nucleic Acid Hybridization* (B.D. Hames & S.J. Higgins eds. 1984); *Transcription and Translation* (B.D. Hames & S.J. Higgins eds. 1984); *Animal Cell Culture* (R.I. Freshney ed. 1986); *Immobilized Cells and Enzymes* (IRL Press, 1986); B. Perbal, *A Practical Guide to Molecular Cloning* (1984); the *Methods in Enzymology* series (Academic Press, Inc.), especially volumes 154 & 155; *Gene Transfer Vectors for Mammalian Cells* (J.H. Miller and M.P. Calos eds. 1987, Cold Spring Harbor Laboratory); Mayer and Walker, eds. (1987), *Immunochemical Methods in Cell and Molecular Biology* (Academic Press, London); Scopes, (1987) *Protein Purification: Principles and Practice*, Second Edition

(Springer-Verlag, N.Y.), and *Handbook of Experimental Immunology, Volumes I-IV* (D.M. Weir and C. C. Blackwell eds 1986).

Standard abbreviations for nucleotides and amino acids are used in this specification.

### Definitions

A composition containing X is "substantially free of" Y when at least 85% by weight of the total X+Y in the composition is X. Preferably, X comprises at least about 90% by weight of the total of X+Y in the composition, more preferably at least about 95% or even 99% by weight.

The term "comprising" means "including" as well as "consisting" e.g., a composition "comprising" X may consist exclusively of X or may include something additional to X, such as X+Y.

The term "antigenic determinant" includes B-cell epitopes and T-cell epitopes.

The term "heterologous" refers to two biological components that are not found together in nature. The components may be host cells, genes, or regulatory regions, such as promoters. Although the heterologous components are not found together in nature, they can function together, as when a promoter heterologous to a gene is operably linked to the gene. Another example is where a meningococcal sequence is heterologous to a mouse host cell. A further examples would be two epitopes from the same or different proteins which have been assembled in a single protein in an arrangement not found in nature.

An "origin of replication" is a polynucleotide sequence that initiates and regulates replication of polynucleotides, such as an expression vector. The origin of replication behaves as an autonomous unit of polynucleotide replication within a cell, capable of replication under its own control. An origin of replication may be needed for a vector to replicate in a particular host cell. With certain origins of replication, an expression vector can be reproduced at a high copy number in the presence of the appropriate proteins within the cell. Examples of origins are the autonomously replicating sequences, which are effective in yeast; and the viral T-antigen, effective in COS-7 cells.

### Expression systems

The meningococcal nucleotide sequences can be expressed in a variety of different expression systems; for example those used with mammalian cells, baculoviruses, plants, bacteria, and yeast.

#### i. Mammalian Systems

Mammalian expression systems are known in the art. A mammalian promoter is any DNA sequence capable of binding mammalian RNA polymerase and initiating the downstream (3') transcription of a coding sequence (e.g., structural gene) into mRNA. A promoter will have a transcription initiating region, which is usually placed proximal to the 5' end of the coding sequence, and a TATA box, usually located 25-30 base pairs (bp) upstream of the transcription initiation site. The TATA box is thought to direct RNA polymerase II to begin RNA synthesis at the correct site. A mammalian promoter will also contain an upstream promoter element, usually located within 100 to 200 bp upstream of the TATA box. An upstream promoter element determines the rate at which transcription is initiated and can act in either orientation [Sambrook et al. (1989) "Expression of Cloned Genes in Mammalian Cells." In *Molecular Cloning: A Laboratory Manual*, 2nd ed.].

Mammalian viral genes are often highly expressed and have a broad host range; therefore sequences encoding mammalian viral genes provide particularly useful promoter sequences. Examples include the SV40 early promoter, mouse mammary tumor virus LTR promoter, adenovirus major late promoter (Ad MLP), and herpes simplex virus promoter. In addition, sequences derived from non-viral genes, such as the murine metallothionein gene, also provide useful promoter sequences. Expression may be either constitutive or regulated (inducible), depending on the promoter can be induced with glucocorticoid in hormone-responsive cells.

The presence of an enhancer element (enhancer), combined with the promoter elements described above, will usually increase expression levels. An enhancer is a regulatory DNA sequence that can stimulate transcription up to 1000-fold when linked to homologous or heterologous promoters, with synthesis beginning at the normal RNA start site. Enhancers are also active when they are placed upstream or downstream from the transcription initiation site, in either normal or flipped orientation, or at a distance of more than 1000 nucleotides from the promoter [Maniatis et al. (1987) *Science* 236:1237; Alberts et al. (1989) *Molecular Biology of the Cell*, 2nd ed.]. Enhancer elements derived from viruses may be particularly useful, because they usually have a broader host range. Examples include the SV40 early gene enhancer [Dijkema et al (1985) *EMBO J.* 4:761] and the enhancer/promoters derived from the long terminal repeat (LTR) of the Rous Sarcoma Virus [Gorman et al. (1982b) *Proc. Natl. Acad. Sci.* 79:6777] and from human cytomegalovirus [Boshart et al. (1985) *Cell* 41:521]. Additionally, some enhancers are regulatable and become active only in the presence of an inducer, such as a hormone or metal ion [Sassone-Corsi and Borelli (1986) *Trends Genet.* 2:215; Maniatis et al. (1987) *Science* 236:1237].

A DNA molecule may be expressed intracellularly in mammalian cells. A promoter sequence may be directly linked with the DNA molecule, in which case the first amino acid at the N-terminus of the recombinant protein will always be a methionine, which is encoded by the ATG start codon. If desired, the N-terminus may be cleaved from the protein by *in vitro* incubation with cyanogen bromide.

Alternatively, foreign proteins can also be secreted from the cell into the growth media by creating chimeric DNA molecules that encode a fusion protein comprised of a leader sequence fragment that provides for secretion of the foreign protein in mammalian cells. Preferably, there are processing sites encoded between the leader fragment and the foreign gene that can be cleaved either *in vivo* or *in vitro*. The leader sequence fragment usually encodes a signal peptide comprised of hydrophobic amino acids which direct the secretion of the protein from the cell. The adenovirus tripartite leader is an example of a leader sequence that provides for secretion of a foreign protein in mammalian cells.

Usually, transcription termination and polyadenylation sequences recognized by mammalian cells are regulatory regions located 3' to the translation stop codon and thus, together with the promoter elements, flank the coding sequence. The 3' terminus of the mature mRNA is formed by site-specific post-transcriptional cleavage and polyadenylation [Birnstiel et al. (1985) *Cell* 41:349; Proudfoot and Whitelaw (1988) "Termination and 3' end processing of eukaryotic RNA. In *Transcription and splicing* (ed. B.D. Hames and D.M. Glover); Proudfoot (1989) *Trends Biochem. Sci.* 14:105]. These sequences direct the transcription of an mRNA which can be translated into the polypeptide encoded by the DNA. Examples of transcription

terminator/polyadenylation signals include those derived from SV40 [Sambrook et al (1989) "Expression of cloned genes in cultured mammalian cells." In *Molecular Cloning: A Laboratory Manual*].

Usually, the above described components, comprising a promoter, polyadenylation signal, and transcription termination sequence are put together into expression constructs. Enhancers, introns with functional splice donor and acceptor sites, and leader sequences may also be included in an expression construct, if desired. Expression constructs are often maintained in a replicon, such as an extrachromosomal element (*e.g.*, plasmids) capable of stable maintenance in a host, such as mammalian cells or bacteria. Mammalian replication systems include those derived from animal viruses, which require trans-acting factors to replicate. For example, plasmids containing the replication systems of papovaviruses, such as SV40 [Gluzman (1981) *Cell* 23:175] or polyomavirus, replicate to extremely high copy number in the presence of the appropriate viral T antigen. Additional examples of mammalian replicons include those derived from bovine papillomavirus and Epstein-Barr virus. Additionally, the replicon may have two replication systems, thus allowing it to be maintained, for example, in mammalian cells for expression and in a prokaryotic host for cloning and amplification. Examples of such mammalian-bacteria shuttle vectors include pMT2 [Kaufman et al. (1989) *Mol. Cell. Biol.* 9:946] and pHEBO [Shimizu et al. (1986) *Mol. Cell. Biol.* 6:1074].

The transformation procedure used depends upon the host to be transformed. Methods for introduction of heterologous polynucleotides into mammalian cells are known in the art and include dextran-mediated transfection, calcium phosphate precipitation, polybrene mediated transfection, protoplast fusion, electroporation, encapsulation of the polynucleotide(s) in liposomes, and direct microinjection of the DNA into nuclei.

Mammalian cell lines available as hosts for expression are known in the art and include many immortalized cell lines available from the American Type Culture Collection (ATCC), including but not limited to, Chinese hamster ovary (CHO) cells, HeLa cells, baby hamster kidney (BHK) cells, monkey kidney cells (COS), human hepatocellular carcinoma cells (*e.g.*, Hep G2), and a number of other cell lines.

#### ii. Baculovirus Systems

The polynucleotide encoding the protein can also be inserted into a suitable insect expression vector, and is operably linked to the control elements within that vector. Vector construction employs techniques which are known in the art. Generally, the components of the expression system include a transfer vector, usually a bacterial plasmid, which contains both a fragment of the baculovirus genome, and a convenient restriction site for insertion of the heterologous gene or genes to be expressed; a wild type baculovirus with a sequence homologous to the baculovirus-specific fragment in the transfer vector (this allows for the homologous recombination of the heterologous gene in to the baculovirus genome); and appropriate insect host cells and growth media.

After inserting the DNA sequence encoding the protein into the transfer vector, the vector and the wild type viral genome are transfected into an insect host cell where the vector and viral genome are allowed to recombine. The packaged recombinant virus is expressed and recombinant plaques are identified and purified. Materials and methods for baculovirus/insect cell expression systems are commercially available in kit form from, *inter alia*, Invitrogen, San Diego CA ("MaxBac" kit). These techniques are generally known to those

skilled in the art and fully described in Summers and Smith, *Texas Agricultural Experiment Station Bulletin No. 1555* (1987) (hereinafter "Summers and Smith").

Prior to inserting the DNA sequence encoding the protein into the baculovirus genome, the above described components, comprising a promoter, leader (if desired), coding sequence of interest, and transcription termination sequence, are usually assembled into an intermediate transplacement construct (transfer vector). This construct may contain a single gene and operably linked regulatory elements; multiple genes, each with its own set of operably linked regulatory elements; or multiple genes, regulated by the same set of regulatory elements. Intermediate transplacement constructs are often maintained in a replicon, such as an extrachromosomal element (e.g., plasmids) capable of stable maintenance in a host, such as a bacterium. The replicon will have a replication system, thus allowing it to be maintained in a suitable host for cloning and amplification.

Currently, the most commonly used transfer vector for introducing foreign genes into AcNPV is pAc373. Many other vectors, known to those of skill in the art, have also been designed. These include, for example, pVL985 (which alters the polyhedrin start codon from ATG to ATT, and which introduces a BamHI cloning site 32 basepairs downstream from the ATT; see Luckow and Summers, *Virology* (1989) 17:31.

The plasmid usually also contains the polyhedrin polyadenylation signal (Miller et al. (1988) *Ann. Rev. Microbiol.*, 42:177) and a prokaryotic ampicillin-resistance (*amp*) gene and origin of replication for selection and propagation in *E. coli*.

Baculovirus transfer vectors usually contain a baculovirus promoter. A baculovirus promoter is any DNA sequence capable of binding a baculovirus RNA polymerase and initiating the downstream (5' to 3') transcription of a coding sequence (e.g., structural gene) into mRNA. A promoter will have a transcription initiation region which is usually placed proximal to the 5' end of the coding sequence. This transcription initiation region usually includes an RNA polymerase binding site and a transcription initiation site. A baculovirus transfer vector may also have a second domain called an enhancer, which, if present, is usually distal to the structural gene. Expression may be either regulated or constitutive.

Structural genes, abundantly transcribed at late times in a viral infection cycle, provide particularly useful promoter sequences. Examples include sequences derived from the gene encoding the viral polyhedron protein, Friesen et al., (1986) "The Regulation of Baculovirus Gene Expression," in: *The Molecular Biology of Baculoviruses* (ed. Walter Doerfler); EPO Publ. Nos. 127 839 and 155 476; and the gene encoding the p10 protein, Vlak et al., (1988), *J. Gen. Virol.* 69:765.

DNA encoding suitable signal sequences can be derived from genes for secreted insect or baculovirus proteins, such as the baculovirus polyhedrin gene (Carbonell et al. (1988) *Gene*, 73:409). Alternatively, since the signals for mammalian cell posttranslational modifications (such as signal peptide cleavage, proteolytic cleavage, and phosphorylation) appear to be recognized by insect cells, and the signals required for secretion and nuclear accumulation also appear to be conserved between the invertebrate cells and vertebrate cells, leaders of non-insect origin, such as those derived from genes encoding human  $\alpha$ -interferon, Maeda et al., (1985), *Nature* 315:592; human gastrin-releasing peptide, Lebacqz-Verheyden et al., (1988), *Molec. Cell. Biol.* 8:3129; human IL-2, Smith et al., (1985) *Proc. Nat'l Acad. Sci. USA*, 82:8404; mouse IL-3, (Miyajima et al.,

(1987) *Gene* 58:273; and human glucocerebrosidase, Martin et al. (1988) *DNA*, 7:99, can also be used to provide for secretion in insects.

A recombinant polypeptide or polyprotein may be expressed intracellularly or, if it is expressed with the proper regulatory sequences, it can be secreted. Good intracellular expression of nonfused foreign proteins usually requires heterologous genes that ideally have a short leader sequence containing suitable translation initiation signals preceding an ATG start signal. If desired, methionine at the N-terminus may be cleaved from the mature protein by *in vitro* incubation with cyanogen bromide.

Alternatively, recombinant polyproteins or proteins which are not naturally secreted can be secreted from the insect cell by creating chimeric DNA molecules that encode a fusion protein comprised of a leader sequence fragment that provides for secretion of the foreign protein in insects. The leader sequence fragment usually encodes a signal peptide comprised of hydrophobic amino acids which direct the translocation of the protein into the endoplasmic reticulum.

After insertion of the DNA sequence and/or the gene encoding the expression product precursor of the protein, an insect cell host is co-transformed with the heterologous DNA of the transfer vector and the genomic DNA of wild type baculovirus -- usually by co-transfection. The promoter and transcription termination sequence of the construct will usually comprise a 2-5kb section of the baculovirus genome. Methods for introducing heterologous DNA into the desired site in the baculovirus virus are known in the art. (See Summers and Smith *supra*; Ju et al. (1987); Smith et al., *Mol. Cell. Biol.* (1983) 3:2156; and Luckow and Summers (1989)). For example, the insertion can be into a gene such as the polyhedrin gene, by homologous double crossover recombination; insertion can also be into a restriction enzyme site engineered into the desired baculovirus gene. Miller et al., (1989), *Bioessays* 4:91. The DNA sequence, when cloned in place of the polyhedrin gene in the expression vector, is flanked both 5' and 3' by polyhedrin-specific sequences and is positioned downstream of the polyhedrin promoter.

The newly formed baculovirus expression vector is subsequently packaged into an infectious recombinant baculovirus. Homologous recombination occurs at low frequency (between about 1% and about 5%); thus, the majority of the virus produced after cotransfection is still wild-type virus. Therefore, a method is necessary to identify recombinant viruses. An advantage of the expression system is a visual screen allowing recombinant viruses to be distinguished. The polyhedrin protein, which is produced by the native virus, is produced at very high levels in the nuclei of infected cells at late times after viral infection. Accumulated polyhedrin protein forms occlusion bodies that also contain embedded particles. These occlusion bodies, up to 15  $\mu$ m in size, are highly refractile, giving them a bright shiny appearance that is readily visualized under the light microscope. Cells infected with recombinant viruses lack occlusion bodies. To distinguish recombinant virus from wild-type virus, the transfection supernatant is plaqued onto a monolayer of insect cells by techniques known to those skilled in the art. Namely, the plaques are screened under the light microscope for the presence (indicative of wild-type virus) or absence (indicative of recombinant virus) of occlusion bodies. "Current Protocols in Microbiology" Vol. 2 (Ausubel et al. eds) at 16.8 (Supp. 10, 1990); Summers and Smith, *supra*; Miller et al. (1989).

Recombinant baculovirus expression vectors have been developed for infection into several insect cells. For example, recombinant baculoviruses have been developed for, *inter alia*: *Aedes aegypti*, *Autographa californica*, *Bombyx mori*, *Drosophila melanogaster*, *Spodoptera frugiperda*, and *Trichoplusia ni* (WO 89/046699; Carbonell et al., (1985) *J. Virol.* 56:153; Wright (1986) *Nature* 321:718; Smith et al., (1983) *Mol. Cell. Biol.* 3:2156; and see generally, Fraser, et al. (1989) *In Vitro Cell. Dev. Biol.* 25:225).

Cells and cell culture media are commercially available for both direct and fusion expression of heterologous polypeptides in a baculovirus/expression system; cell culture technology is generally known to those skilled in the art. See, e.g., Summers and Smith *supra*.

The modified insect cells may then be grown in an appropriate nutrient medium, which allows for stable maintenance of the plasmid(s) present in the modified insect host. Where the expression product gene is under inducible control, the host may be grown to high density, and expression induced. Alternatively, where expression is constitutive, the product will be continuously expressed into the medium and the nutrient medium must be continuously circulated, while removing the product of interest and augmenting depleted nutrients. The product may be purified by such techniques as chromatography, e.g., HPLC, affinity chromatography, ion exchange chromatography, etc.; electrophoresis; density gradient centrifugation; solvent extraction, or the like. As appropriate, the product may be further purified, as required, so as to remove substantially any insect proteins which are also secreted in the medium or result from lysis of insect cells, so as to provide a product which is at least substantially free of host debris, e.g., proteins, lipids and polysaccharides.

In order to obtain protein expression, recombinant host cells derived from the transformants are incubated under conditions which allow expression of the recombinant protein encoding sequence. These conditions will vary, dependent upon the host cell selected. However, the conditions are readily ascertainable to those of ordinary skill in the art, based upon what is known in the art.

### iii. Plant Systems

There are many plant cell culture and whole plant genetic expression systems known in the art. Exemplary plant cellular genetic expression systems include those described in patents, such as: US 5,693,506; US 5,659,122; and US 5,608,143. Additional examples of genetic expression in plant cell culture has been described by Zenk, *Phytochemistry* 30:3861-3863 (1991). Descriptions of plant protein signal peptides may be found in addition to the references described above in Vaulcombe et al., *Mol. Gen. Genet.* 209:33-40 (1987); Chandler et al., *Plant Molecular Biology* 3:407-418 (1984); Rogers, *J. Biol. Chem.* 260:3731-3738 (1985); Rothstein et al., *Gene* 55:353-356 (1987); Whittier et al., *Nucleic Acids Research* 15:2515-2535 (1987); Wirsal et al., *Molecular Microbiology* 3:3-14 (1989); Yu et al., *Gene* 122:247-253 (1992). A description of the regulation of plant gene expression by the phytohormone, gibberellic acid and secreted enzymes induced by gibberellic acid can be found in R.L. Jones and J. MacMillin, *Gibberellins*: in: *Advanced Plant Physiology*, Malcolm B. Wilkins, ed., 1984 Pitman Publishing Limited, London, pp. 21-52. References that describe other metabolically-regulated genes: Sheen, *Plant Cell*, 2:1027-1038(1990); Maas et al., *EMBO J.* 9:3447-3452 (1990); Benkel and Hickey, *Proc. Natl. Acad. Sci.* 84:1337-1339 (1987).

Typically, using techniques known in the art, a desired polynucleotide sequence is inserted into an expression cassette comprising genetic regulatory elements designed for operation in plants. The expression cassette is inserted into a desired expression vector with companion sequences upstream and downstream from the expression cassette suitable for expression in a plant host. The companion sequences will be of plasmid or viral origin and provide necessary characteristics to the vector to permit the vectors to move DNA from an original cloning host, such as bacteria, to the desired plant host. The basic bacterial/plant vector construct will preferably provide a broad host range prokaryote replication origin; a prokaryote selectable marker; and, for *Agrobacterium* transformations, T DNA sequences for *Agrobacterium*-mediated transfer to plant chromosomes. Where the heterologous gene is not readily amenable to detection, the construct will preferably also have a selectable marker gene suitable for determining if a plant cell has been transformed. A general review of suitable markers, for example for the members of the grass family, is found in Wilmink and Dons, 1993, *Plant Mol. Biol. Rept.*, 11(2):165-185.

Sequences suitable for permitting integration of the heterologous sequence into the plant genome are also recommended. These might include transposon sequences and the like for homologous recombination as well as Ti sequences which permit random insertion of a heterologous expression cassette into a plant genome. Suitable prokaryote selectable markers include resistance toward antibiotics such as ampicillin or tetracycline. Other DNA sequences encoding additional functions may also be present in the vector, as is known in the art.

The nucleic acid molecules of the subject invention may be included into an expression cassette for expression of the protein(s) of interest. Usually, there will be only one expression cassette, although two or more are feasible. The recombinant expression cassette will contain in addition to the heterologous protein encoding sequence the following elements, a promoter region, plant 5' untranslated sequences, initiation codon depending upon whether or not the structural gene comes equipped with one, and a transcription and translation termination sequence. Unique restriction enzyme sites at the 5' and 3' ends of the cassette allow for easy insertion into a pre-existing vector.

A heterologous coding sequence may be for any protein relating to the present invention. The sequence encoding the protein of interest will encode a signal peptide which allows processing and translocation of the protein, as appropriate, and will usually lack any sequence which might result in the binding of the desired protein of the invention to a membrane. Since, for the most part, the transcriptional initiation region will be for a gene which is expressed and translocated during germination, by employing the signal peptide which provides for translocation, one may also provide for translocation of the protein of interest. In this way, the protein(s) of interest will be translocated from the cells in which they are expressed and may be efficiently harvested. Typically secretion in seeds are across the aleurone or scutellar epithelium layer into the endosperm of the seed. While it is not required that the protein be secreted from the cells in which the protein is produced, this facilitates the isolation and purification of the recombinant protein.

Since the ultimate expression of the desired gene product will be in a eucaryotic cell it is desirable to determine whether any portion of the cloned gene contains sequences which will be processed out as introns by the host's splicosome machinery. If so, site-directed mutagenesis of the "intron" region may be conducted

to prevent losing a portion of the genetic message as a false intron code, Reed and Maniatis, *Cell* 41:95-105, 1985.

The vector can be microinjected directly into plant cells by use of micropipettes to mechanically transfer the recombinant DNA. Crossway, *Mol. Gen. Genet*, 202:179-185, 1985. The genetic material may also be transferred into the plant cell by using polyethylene glycol, Krens, et al., *Nature*, 296, 72-74, 1982. Another method of introduction of nucleic acid segments is high velocity ballistic penetration by small particles with the nucleic acid either within the matrix of small beads or particles, or on the surface, Klein, et al., *Nature*, 327, 70-73, 1987 and Knudsen and Muller, 1991, *Planta*, 185:330-336 teaching particle bombardment of barley endosperm to create transgenic barley. Yet another method of introduction would be fusion of protoplasts with other entities, either minicells, cells, lysosomes or other fusible lipid-surfaced bodies, Fraley, et al., *Proc. Natl. Acad. Sci. USA*, 79, 1859-1863, 1982.

The vector may also be introduced into the plant cells by electroporation. (Fromm et al., *Proc. Natl Acad. Sci. USA* 82:5824, 1985). In this technique, plant protoplasts are electroporated in the presence of plasmids containing the gene construct. Electrical impulses of high field strength reversibly permeabilize biomembranes allowing the introduction of the plasmids. Electroporated plant protoplasts reform the cell wall, divide, and form plant callus.

All plants from which protoplasts can be isolated and cultured to give whole regenerated plants can be transformed by the present invention so that whole plants are recovered which contain the transferred gene. It is known that practically all plants can be regenerated from cultured cells or tissues, including but not limited to all major species of sugarcane, sugar beet, cotton, fruit and other trees, legumes and vegetables. Some suitable plants include, for example, species from the genera *Fragaria*, *Lotus*, *Medicago*, *Onobrychis*, *Trifolium*, *Trigonella*, *Vigna*, *Citrus*, *Linum*, *Geranium*, *Manihot*, *Daucus*, *Arabidopsis*, *Brassica*, *Raphanus*, *Sinapis*, *Atropa*, *Capsicum*, *Datura*, *Hyoscyamus*, *Lycopersion*, *Nicotiana*, *Solanum*, *Petunia*, *Digitalis*, *Majorana*, *Cichorium*, *Helianthus*, *Lactuca*, *Bromus*, *Asparagus*, *Antirrhinum*, *Hererocallis*, *Nemesia*, *Pelargonium*, *Panicum*, *Pennisetum*, *Ranunculus*, *Senecio*, *Salpiglossis*, *Cucumis*, *Browaalia*, *Glycine*, *Lolium*, *Zea*, *Triticum*, *Sorghum*, and *Datura*.

Means for regeneration vary from species to species of plants, but generally a suspension of transformed protoplasts containing copies of the heterologous gene is first provided. Callus tissue is formed and shoots may be induced from callus and subsequently rooted. Alternatively, embryo formation can be induced from the protoplast suspension. These embryos germinate as natural embryos to form plants. The culture media will generally contain various amino acids and hormones, such as auxin and cytokinins. It is also advantageous to add glutamic acid and proline to the medium, especially for such species as corn and alfalfa. Shoots and roots normally develop simultaneously. Efficient regeneration will depend on the medium, on the genotype, and on the history of the culture. If these three variables are controlled, then regeneration is fully reproducible and repeatable.

In some plant cell culture systems, the desired protein of the invention may be excreted or alternatively, the protein may be extracted from the whole plant. Where the desired protein of the invention is secreted into the medium, it may be collected. Alternatively, the embryos and embryoless-half seeds or other plant tissue may

be mechanically disrupted to release any secreted protein between cells and tissues. The mixture may be suspended in a buffer solution to retrieve soluble proteins. Conventional protein isolation and purification methods will be then used to purify the recombinant protein. Parameters of time, temperature pH, oxygen, and volumes will be adjusted through routine methods to optimize expression and recovery of heterologous protein.

#### iv. Bacterial Systems

Bacterial expression techniques are known in the art. A bacterial promoter is any DNA sequence capable of binding bacterial RNA polymerase and initiating the downstream (3') transcription of a coding sequence (*e.g.*, structural gene) into mRNA. A promoter will have a transcription initiation region which is usually placed proximal to the 5' end of the coding sequence. This transcription initiation region usually includes an RNA polymerase binding site and a transcription initiation site. A bacterial promoter may also have a second domain called an operator, that may overlap an adjacent RNA polymerase binding site at which RNA synthesis begins. The operator permits negative regulated (inducible) transcription, as a gene repressor protein may bind the operator and thereby inhibit transcription of a specific gene. Constitutive expression may occur in the absence of negative regulatory elements, such as the operator. In addition, positive regulation may be achieved by a gene activator protein binding sequence, which, if present is usually proximal (5') to the RNA polymerase binding sequence. An example of a gene activator protein is the catabolite activator protein (CAP), which helps initiate transcription of the lac operon in *Escherichia coli* (*E. coli*) [Raibaud *et al.* (1984) *Annu. Rev. Genet.* 18:173]. Regulated expression may therefore be either positive or negative, thereby either enhancing or reducing transcription.

Sequences encoding metabolic pathway enzymes provide particularly useful promoter sequences. Examples include promoter sequences derived from sugar metabolizing enzymes, such as galactose, lactose (*lac*) [Chang *et al.* (1977) *Nature* 198:1056], and maltose. Additional examples include promoter sequences derived from biosynthetic enzymes such as tryptophan (*trp*) [Goeddel *et al.* (1980) *Nuc. Acids Res.* 8:4057; Yelverton *et al.* (1981) *Nucl. Acids Res.* 9:731; US patent 4,738,921; EP-A-0036776 and EP-A-0121775]. The  $\beta$ -lactamase (*bla*) promoter system [Weissmann (1981) "The cloning of interferon and other mistakes." In *Interferon 3* (ed. I. Gresser)], bacteriophage lambda PL [Shimatake *et al.* (1981) *Nature* 292:128] and T5 [US patent 4,689,406] promoter systems also provide useful promoter sequences.

In addition, synthetic promoters which do not occur in nature also function as bacterial promoters. For example, transcription activation sequences of one bacterial or bacteriophage promoter may be joined with the operon sequences of another bacterial or bacteriophage promoter, creating a synthetic hybrid promoter [US patent 4,551,433]. For example, the *tac* promoter is a hybrid *trp-lac* promoter comprised of both *trp* promoter and *lac* operon sequences that is regulated by the *lac* repressor [Amann *et al.* (1983) *Gene* 25:167; de Boer *et al.* (1983) *Proc. Natl. Acad. Sci.* 80:21]. Furthermore, a bacterial promoter can include naturally occurring promoters of non-bacterial origin that have the ability to bind bacterial RNA polymerase and initiate transcription. A naturally occurring promoter of non-bacterial origin can also be coupled with a compatible RNA polymerase to produce high levels of expression of some genes in prokaryotes. The bacteriophage T7 RNA polymerase/promoter system is an example of a coupled promoter system [Studier *et*

*al.* (1986) *J. Mol. Biol.* 189:113; Tabor *et al.* (1985) *Proc Natl. Acad. Sci.* 82:1074]. In addition, a hybrid promoter can also be comprised of a bacteriophage promoter and an *E. coli* operator region (EPO-A-0 267 851).

In addition to a functioning promoter sequence, an efficient ribosome binding site is also useful for the expression of foreign genes in prokaryotes. In *E. coli*, the ribosome binding site is called the Shine-Dalgarno (SD) sequence and includes an initiation codon (ATG) and a sequence 3-9 nucleotides in length located 3-11 nucleotides upstream of the initiation codon [Shine *et al.* (1975) *Nature* 254:34]. The SD sequence is thought to promote binding of mRNA to the ribosome by the pairing of bases between the SD sequence and the 3' end of *E. coli* 16S rRNA [Steitz *et al.* (1979) "Genetic signals and nucleotide sequences in messenger RNA." In *Biological Regulation and Development: Gene Expression* (ed. R.F. Goldberger)]. To express eukaryotic genes and prokaryotic genes with weak ribosome-binding site [Sambrook *et al.* (1989) "Expression of cloned genes in *Escherichia coli*." In *Molecular Cloning: A Laboratory Manual*].

A DNA molecule may be expressed intracellularly. A promoter sequence may be directly linked with the DNA molecule, in which case the first amino acid at the N-terminus will always be a methionine, which is encoded by the ATG start codon. If desired, methionine at the N-terminus may be cleaved from the protein by *in vitro* incubation with cyanogen bromide or by either *in vivo* or *in vitro* incubation with a bacterial methionine N-terminal peptidase (EPO-A-0 219 237).

Fusion proteins provide an alternative to direct expression. Usually, a DNA sequence encoding the N-terminal portion of an endogenous bacterial protein, or other stable protein, is fused to the 5' end of heterologous coding sequences. Upon expression, this construct will provide a fusion of the two amino acid sequences. For example, the bacteriophage lambda cell gene can be linked at the 5' terminus of a foreign gene and expressed in bacteria. The resulting fusion protein preferably retains a site for a processing enzyme (factor Xa) to cleave the bacteriophage protein from the foreign gene [Nagai *et al.* (1984) *Nature* 309:810]. Fusion proteins can also be made with sequences from the *lacZ* [Jia *et al.* (1987) *Gene* 60:197], *irpE* [Allen *et al.* (1987) *J. Biotechnol.* 5:93; Makoff *et al.* (1989) *J. Gen. Microbiol.* 135:11], and *Chey* [EP-A-0 324 647] genes. The DNA sequence at the junction of the two amino acid sequences may or may not encode a cleavable site. Another example is a ubiquitin fusion protein. Such a fusion protein is made with the ubiquitin region that preferably retains a site for a processing enzyme (*e.g.*, ubiquitin specific processing-protease) to cleave the ubiquitin from the foreign protein. Through this method, native foreign protein can be isolated [Miller *et al.* (1989) *Bio/Technology* 7:698].

Alternatively, foreign proteins can also be secreted from the cell by creating chimeric DNA molecules that encode a fusion protein comprised of a signal peptide sequence fragment that provides for secretion of the foreign protein in bacteria [US patent 4,336,336]. The signal sequence fragment usually encodes a signal peptide comprised of hydrophobic amino acids which direct the secretion of the protein from the cell. The protein is either secreted into the growth media (gram-positive bacteria) or into the periplasmic space, located between the inner and outer membrane of the cell (gram-negative bacteria). Preferably there are processing sites, which can be cleaved either *in vivo* or *in vitro* encoded between the signal peptide fragment and the foreign gene.

DNA encoding suitable signal sequences can be derived from genes for secreted bacterial proteins, such as the *E. coli* outer membrane protein gene (*ompA*) [Masui *et al.* (1983), in: *Experimental Manipulation of Gene Expression*; Ghrayeb *et al.* (1984) *EMBO J.* 3:2437] and the *E. coli* alkaline phosphatase signal sequence (*phoA*) [Oka *et al.* (1985) *Proc. Natl. Acad. Sci.* 82:7212]. As an additional example, the signal sequence of the alpha-amylase gene from various *Bacillus* strains can be used to secrete heterologous proteins from *B. subtilis* [Palva *et al.* (1982) *Proc. Natl. Acad. Sci. USA* 79:5582; EP-A-0 244 042].

Usually, transcription termination sequences recognized by bacteria are regulatory regions located 3' to the translation stop codon, and thus together with the promoter flank the coding sequence. These sequences direct the transcription of an mRNA which can be translated into the polypeptide encoded by the DNA. Transcription termination sequences frequently include DNA sequences of about 50 nucleotides capable of forming stem loop structures that aid in terminating transcription. Examples include transcription termination sequences derived from genes with strong promoters, such as the *trp* gene in *E. coli* as well as other biosynthetic genes.

Usually, the above described components, comprising a promoter, signal sequence (if desired), coding sequence of interest, and transcription termination sequence, are put together into expression constructs. Expression constructs are often maintained in a replicon, such as an extrachromosomal element (*e.g.*, plasmids) capable of stable maintenance in a host, such as bacteria. The replicon will have a replication system, thus allowing it to be maintained in a prokaryotic host either for expression or for cloning and amplification. In addition, a replicon may be either a high or low copy number plasmid. A high copy number plasmid will generally have a copy number ranging from about 5 to about 200, and usually about 10 to about 150. A host containing a high copy number plasmid will preferably contain at least about 10, and more preferably at least about 20 plasmids. Either a high or low copy number vector may be selected, depending upon the effect of the vector and the foreign protein on the host.

Alternatively, the expression constructs can be integrated into the bacterial genome with an integrating vector. Integrating vectors usually contain at least one sequence homologous to the bacterial chromosome that allows the vector to integrate. Integrations appear to result from recombinations between homologous DNA in the vector and the bacterial chromosome. For example, integrating vectors constructed with DNA from various *Bacillus* strains integrate into the *Bacillus* chromosome (EP-A- 0 127 328). Integrating vectors may also be comprised of bacteriophage or transposon sequences.

Usually, extrachromosomal and integrating expression constructs may contain selectable markers to allow for the selection of bacterial strains that have been transformed. Selectable markers can be expressed in the bacterial host and may include genes which render bacteria resistant to drugs such as ampicillin, chloramphenicol, erythromycin, kanamycin (neomycin), and tetracycline [Davies *et al.* (1978) *Annu. Rev. Microbiol.* 32:469]. Selectable markers may also include biosynthetic genes, such as those in the histidine, tryptophan, and leucine biosynthetic pathways.

Alternatively, some of the above described components can be put together in transformation vectors. Transformation vectors are usually comprised of a selectable market that is either maintained in a replicon or developed into an integrating vector, as described above.

Expression and transformation vectors, either extra-chromosomal replicons or integrating vectors, have been developed for transformation into many bacteria. For example, expression vectors have been developed for, *inter alia*, the following bacteria: *Bacillus subtilis* [Palva *et al.* (1982) *Proc. Natl. Acad. Sci. USA* 79:5582; EP-A-0 036 259 and EP-A-0 063 953; WO 84/04541], *Escherichia coli* [Shimatake *et al.* (1981) *Nature* 292:128; Amann *et al.* (1985) *Gene* 40:183; Studier *et al.* (1986) *J. Mol. Biol.* 189:113; EP-A-0 036 776, EP-A-0 136 829 and EP-A-0 136 907], *Streptococcus cremoris* [Powell *et al.* (1988) *Appl. Environ. Microbiol.* 54:655]; *Streptococcus lividans* [Powell *et al.* (1988) *Appl. Environ. Microbiol.* 54:655], *Streptomyces lividans* [US patent 4,745,056].

Methods of introducing exogenous DNA into bacterial hosts are well-known in the art, and usually include either the transformation of bacteria treated with  $\text{CaCl}_2$  or other agents, such as divalent cations and DMSO. DNA can also be introduced into bacterial cells by electroporation. Transformation procedures usually vary with the bacterial species to be transformed. See *e.g.*, [Masson *et al.* (1989) *FEMS Microbiol. Lett.* 60:273; Palva *et al.* (1982) *Proc. Natl. Acad. Sci. USA* 79:5582; EP-A-0 036 259 and EP-A-0 063 953; WO 84/04541, *Bacillus*], [Miller *et al.* (1988) *Proc. Natl. Acad. Sci.* 85:856; Wang *et al.* (1990) *J. Bacteriol.* 172:949, *Campylobacter*], [Cohen *et al.* (1973) *Proc. Natl. Acad. Sci.* 69:2110; Dower *et al.* (1988) *Nucleic Acids Res.* 16:6127; Kushner (1978) "An improved method for transformation of *Escherichia coli* with ColEI-derived plasmids. In *Genetic Engineering: Proceedings of the International Symposium on Genetic Engineering* (eds. H.W. Boyer and S. Nicosia); Mandel *et al.* (1970) *J. Mol. Biol.* 53:159; Taketo (1988) *Biochim. Biophys. Acta* 949:318; *Escherichia*], [Chassy *et al.* (1987) *FEMS Microbiol. Lett.* 44:173 *Lactobacillus*]; [Fiedler *et al.* (1988) *Anal. Biochem.* 170:38, *Pseudomonas*]; [Augustin *et al.* (1990) *FEMS Microbiol. Lett.* 66:203, *Staphylococcus*], [Barany *et al.* (1980) *J. Bacteriol.* 144:698; Harlander (1987) "Transformation of *Streptococcus lactis* by electroporation, in: *Streptococcal Genetics* (ed. J. Ferretti and R. Curtiss III); Perry *et al.* (1981) *Infect. Immun.* 32:1295; Powell *et al.* (1988) *Appl. Environ. Microbiol.* 54:655; Somkuti *et al.* (1987) *Proc. 4th Eur. Cong. Biotechnology* 1:412, *Streptococcus*].

#### v. Yeast Expression

Yeast expression systems are also known to one of ordinary skill in the art. A yeast promoter is any DNA sequence capable of binding yeast RNA polymerase and initiating the downstream (3') transcription of a coding sequence (*e.g.*, structural gene) into mRNA. A promoter will have a transcription initiation region which is usually placed proximal to the 5' end of the coding sequence. This transcription initiation region usually includes an RNA polymerase binding site (the "TATA Box") and a transcription initiation site. A yeast promoter may also have a second domain called an upstream activator sequence (UAS), which, if present, is usually distal to the structural gene. The UAS permits regulated (inducible) expression. Constitutive expression occurs in the absence of a UAS. Regulated expression may be either positive or negative, thereby either enhancing or reducing transcription.

Yeast is a fermenting organism with an active metabolic pathway, therefore sequences encoding enzymes in the metabolic pathway provide particularly useful promoter sequences. Examples include alcohol dehydrogenase (ADH) (EP-A-0 284 044), enolase, glucokinase, glucose-6-phosphate isomerase, glyceraldehyde-3-phosphate-dehydrogenase (GAP or GAPDH), hexokinase, phosphofructokinase, 3-

phosphoglycerate mutase, and pyruvate kinase (PyK) (EPO-A-0 329 203). The yeast *PHO5* gene, encoding acid phosphatase, also provides useful promoter sequences [Myanohara *et al.* (1983) *Proc. Natl. Acad. Sci. USA* 80:1].

In addition, synthetic promoters which do not occur in nature also function as yeast promoters. For example, UAS sequences of one yeast promoter may be joined with the transcription activation region of another yeast promoter, creating a synthetic hybrid promoter. Examples of such hybrid promoters include the ADH regulatory sequence linked to the GAP transcription activation region (US Patent Nos. 4,876,197 and 4,880,734). Other examples of hybrid promoters include promoters which consist of the regulatory sequences of either the *ADH2*, *GAL4*, *GAL10*, OR *PHO5* genes, combined with the transcriptional activation region of a glycolytic enzyme gene such as GAP or PyK (EP-A-0 164 556). Furthermore, a yeast promoter can include naturally occurring promoters of non-yeast origin that have the ability to bind yeast RNA polymerase and initiate transcription. Examples of such promoters include, *inter alia*, [Cohen *et al.* (1980) *Proc. Natl. Acad. Sci. USA* 77:1078; Henikoff *et al.* (1981) *Nature* 283:835; Hollenberg *et al.* (1981) *Curr. Topics Microbiol. Immunol.* 96:119; Hollenberg *et al.* (1979) "The Expression of Bacterial Antibiotic Resistance Genes in the Yeast *Saccharomyces cerevisiae*," in: *Plasmids of Medical, Environmental and Commercial Importance* (eds. K.N. Timmis and A. Puhler); Mercerau-Puigalon *et al.* (1980) *Gene* 11:163; Panthier *et al.* (1980) *Curr. Genet.* 2:109;].

A DNA molecule may be expressed intracellularly in yeast. A promoter sequence may be directly linked with the DNA molecule, in which case the first amino acid at the N-terminus of the recombinant protein will always be a methionine, which is encoded by the ATG start codon. If desired, methionine at the N-terminus may be cleaved from the protein by *in vitro* incubation with cyanogen bromide.

Fusion proteins provide an alternative for yeast expression systems, as well as in mammalian, baculovirus, and bacterial expression systems. Usually, a DNA sequence encoding the N-terminal portion of an endogenous yeast protein, or other stable protein, is fused to the 5' end of heterologous coding sequences. Upon expression, this construct will provide a fusion of the two amino acid sequences. For example, the yeast or human superoxide dismutase (SOD) gene, can be linked at the 5' terminus of a foreign gene and expressed in yeast. The DNA sequence at the junction of the two amino acid sequences may or may not encode a cleavable site. See *e.g.*, EP-A-0 196 056. Another example is a ubiquitin fusion protein. Such a fusion protein is made with the ubiquitin region that preferably retains a site for a processing enzyme (*e.g.*, ubiquitin-specific processing protease) to cleave the ubiquitin from the foreign protein. Through this method, therefore, native foreign protein can be isolated (*e.g.*, WO88/024066).

Alternatively, foreign proteins can also be secreted from the cell into the growth media by creating chimeric DNA molecules that encode a fusion protein comprised of a leader sequence fragment that provide for secretion in yeast of the foreign protein. Preferably, there are processing sites encoded between the leader fragment and the foreign gene that can be cleaved either *in vivo* or *in vitro*. The leader sequence fragment usually encodes a signal peptide comprised of hydrophobic amino acids which direct the secretion of the protein from the cell.

DNA encoding suitable signal sequences can be derived from genes for secreted yeast proteins, such as the yeast invertase gene (EP-A-0 012 873; JPO. 62,096,086) and the A-factor gene (US patent 4,588,684). Alternatively, leaders of non-yeast origin, such as an interferon leader, exist that also provide for secretion in yeast (EP-A-0 060 057).

A preferred class of secretion leaders are those that employ a fragment of the yeast alpha-factor gene, which contains both a "pre" signal sequence, and a "pro" region. The types of alpha-factor fragments that can be employed include the full-length pre-pro alpha factor leader (about 83 amino acid residues) as well as truncated alpha-factor leaders (usually about 25 to about 50 amino acid residues) (US Patents 4,546,083 and 4,870,008; EP-A-0 324 274). Additional leaders employing an alpha-factor leader fragment that provides for secretion include hybrid alpha-factor leaders made with a presequence of a first yeast, but a pro-region from a second yeast alphafactor. (*e.g.*, see WO 89/02463.)

Usually, transcription termination sequences recognized by yeast are regulatory regions located 3' to the translation stop codon, and thus together with the promoter flank the coding sequence. These sequences direct the transcription of an mRNA which can be translated into the polypeptide encoded by the DNA. Examples of transcription terminator sequence and other yeast-recognized termination sequences, such as those coding for glycolytic enzymes.

Usually, the above described components, comprising a promoter, leader (if desired), coding sequence of interest, and transcription termination sequence, are put together into expression constructs. Expression constructs are often maintained in a replicon, such as an extrachromosomal element (*e.g.*, plasmids) capable of stable maintenance in a host, such as yeast or bacteria. The replicon may have two replication systems, thus allowing it to be maintained, for example, in yeast for expression and in a prokaryotic host for cloning and amplification. Examples of such yeast-bacteria shuttle vectors include YEp24 [Botstein *et al.* (1979) *Gene* 8:17-24], pCI/1 [Brake *et al.* (1984) *PNAS USA* 81:4642-4646], and YRp17 [Stinchcomb *et al.* (1982) *J. Mol. Biol.* 158:157]. In addition, a replicon may be either a high or low copy number plasmid. A high copy number plasmid will generally have a copy number ranging from about 5 to about 200, and usually about 10 to about 150. A host containing a high copy number plasmid will preferably have at least about 10, and more preferably at least about 20. Either a high or low copy number vector may be selected, depending upon the effect of the vector and the foreign protein on the host. See *e.g.*, Brake *et al.*, *supra*.

Alternatively, the expression constructs can be integrated into the yeast genome with an integrating vector. Integrating vectors usually contain at least one sequence homologous to a yeast chromosome that allows the vector to integrate, and preferably contain two homologous sequences flanking the expression construct. Integrations appear to result from recombinations between homologous DNA in the vector and the yeast chromosome [Orr-Weaver *et al.* (1983) *Methods in Enzymol.* 101:228-245]. An integrating vector may be directed to a specific locus in yeast by selecting the appropriate homologous sequence for inclusion in the vector. See Orr-Weaver *et al.*, *supra*. One or more expression construct may integrate, possibly affecting levels of recombinant protein produced [Rine *et al.* (1983) *Proc. Natl. Acad. Sci. USA* 80:6750]. The chromosomal sequences included in the vector can occur either as a single segment in the vector, which results in the integration of the entire vector, or two segments homologous to adjacent segments in the

chromosome and flanking the expression construct in the vector, which can result in the stable integration of only the expression construct.

Usually, extrachromosomal and integrating expression constructs may contain selectable markers to allow for the selection of yeast strains that have been transformed. Selectable markers may include biosynthetic genes that can be expressed in the yeast host, such as *ADE2*, *HIS4*, *LEU2*, *TRP1*, and *ALG7*, and the G418 resistance gene, which confer resistance in yeast cells to tunicamycin and G418, respectively. In addition, a suitable selectable marker may also provide yeast with the ability to grow in the presence of toxic compounds, such as metal. For example, the presence of *CUP1* allows yeast to grow in the presence of copper ions [Butt *et al.* (1987) *Microbiol. Rev.* 51:351].

Alternatively, some of the above described components can be put together into transformation vectors. Transformation vectors are usually comprised of a selectable marker that is either maintained in a replicon or developed into an integrating vector, as described above.

Expression and transformation vectors, either extrachromosomal replicons or integrating vectors, have been developed for transformation into many yeasts. For example, expression vectors have been developed for, *inter alia*, the following yeasts: *Candida albicans* [Kurtz, *et al.* (1986) *Mol. Cell. Biol.* 6:142], *Candida maltosa* [Kunze, *et al.* (1985) *J. Basic Microbiol.* 25:141], *Hansenula polymorpha* [Gleeson, *et al.* (1986) *J. Gen. Microbiol.* 132:3459; Roggenkamp *et al.* (1986) *Mol. Gen. Genet.* 202:302], *Kluyveromyces fragilis* [Das, *et al.* (1984) *J. Bacteriol.* 158:1165], *Kluyveromyces lactis* [De Louvencourt *et al.* (1983) *J. Bacteriol.* 154:737; Van den Berg *et al.* (1990) *Bio/Technology* 8:135], *Pichia guillermondii* [Kunze *et al.* (1985) *J. Basic Microbiol.* 25:141], *Pichia pastoris* [Cregg, *et al.* (1985) *Mol. Cell. Biol.* 5:3376; US Patent Nos. 4,837,148 and 4,929,555], *Saccharomyces cerevisiae* [Hinnen *et al.* (1978) *Proc. Natl. Acad. Sci. USA* 75:1929; Ito *et al.* (1983) *J. Bacteriol.* 153:163], *Schizosaccharomyces pombe* [Beach and Nurse (1981) *Nature* 300:706], and *Yarrowia lipolytica* [Davidow, *et al.* (1985) *Curr. Genet.* 10:380471 Gaillardin, *et al.* (1985) *Curr. Genet.* 10:49].

Methods of introducing exogenous DNA into yeast hosts are well-known in the art, and usually include either the transformation of spheroplasts or of intact yeast cells treated with alkali cations. Transformation procedures usually vary with the yeast species to be transformed. See *e.g.*, [Kurtz *et al.* (1986) *Mol. Cell. Biol.* 6:142; Kunze *et al.* (1985) *J. Basic Microbiol.* 25:141; *Candida*]; [Gleeson *et al.* (1986) *J. Gen. Microbiol.* 132:3459; Roggenkamp *et al.* (1986) *Mol. Gen. Genet.* 202:302; *Hansenula*]; [Das *et al.* (1984) *J. Bacteriol.* 158:1165; De Louvencourt *et al.* (1983) *J. Bacteriol.* 154:1165; Van den Berg *et al.* (1990) *Bio/Technology* 8:135; *Kluyveromyces*]; [Cregg *et al.* (1985) *Mol. Cell. Biol.* 5:3376; Kunze *et al.* (1985) *J. Basic Microbiol.* 25:141; US Patent Nos. 4,837,148 and 4,929,555; *Pichia*]; [Hinnen *et al.* (1978) *Proc. Natl. Acad. Sci. USA* 75:1929; Ito *et al.* (1983) *J. Bacteriol.* 153:163 *Saccharomyces*]; [Beach and Nurse (1981) *Nature* 300:706; *Schizosaccharomyces*]; [Davidow *et al.* (1985) *Curr. Genet.* 10:39; Gaillardin *et al.* (1985) *Curr. Genet.* 10:49; *Yarrowia*].

### Antibodies

As used herein, the term "antibody" refers to a polypeptide or group of polypeptides composed of at least one antibody combining site. An "antibody combining site" is the three-dimensional binding space with an

internal surface shape and charge distribution complementary to the features of an epitope of an antigen, which allows a binding of the antibody with the antigen. "Antibody" includes, for example, vertebrate antibodies, hybrid antibodies, chimeric antibodies, humanised antibodies, altered antibodies, univalent antibodies, Fab proteins, and single domain antibodies.

Antibodies against the proteins of the invention are useful for affinity chromatography, immunoassays, and distinguishing/identifying meningococcal proteins.

Antibodies to the proteins of the invention, both polyclonal and monoclonal, may be prepared by conventional methods. In general, the protein is first used to immunize a suitable animal, preferably a mouse, rat, rabbit or goat. Rabbits and goats are preferred for the preparation of polyclonal sera due to the volume of serum obtainable, and the availability of labeled anti-rabbit and anti-goat antibodies. Immunization is generally performed by mixing or emulsifying the protein in saline, preferably in an adjuvant such as Freund's complete adjuvant, and injecting the mixture or emulsion parenterally (generally subcutaneously or intramuscularly). A dose of 50-200  $\mu$ g/injection is typically sufficient. Immunization is generally boosted 2-6 weeks later with one or more injections of the protein in saline, preferably using Freund's incomplete adjuvant. One may alternatively generate antibodies by *in vitro* immunization using methods known in the art, which for the purposes of this invention is considered equivalent to *in vivo* immunization. Polyclonal antisera is obtained by bleeding the immunized animal into a glass or plastic container, incubating the blood at 25°C for one hour, followed by incubating at 4°C for 2-18 hours. The serum is recovered by centrifugation (e.g., 1,000g for 10 minutes). About 20-50 ml per bleed may be obtained from rabbits.

Monoclonal antibodies are prepared using the standard method of Kohler & Milstein [*Nature* (1975) 256:495-96], or a modification thereof. Typically, a mouse or rat is immunized as described above. However, rather than bleeding the animal to extract serum, the spleen (and optionally several large lymph nodes) is removed and dissociated into single cells. If desired, the spleen cells may be screened (after removal of nonspecifically adherent cells) by applying a cell suspension to a plate or well coated with the protein antigen. B-cells expressing membrane-bound immunoglobulin specific for the antigen bind to the plate, and are not rinsed away with the rest of the suspension. Resulting B-cells, or all dissociated spleen cells, are then induced to fuse with myeloma cells to form hybridomas, and are cultured in a selective medium (e.g., hypoxanthine, aminopterin, thymidine medium, "HAT"). The resulting hybridomas are plated by limiting dilution, and are assayed for the production of antibodies which bind specifically to the immunizing antigen (and which do not bind to unrelated antigens). The selected MAb-secreting hybridomas are then cultured either *in vitro* (e.g., in tissue culture bottles or hollow fiber reactors), or *in vivo* (as ascites in mice).

If desired, the antibodies (whether polyclonal or monoclonal) may be labeled using conventional techniques. Suitable labels include fluorophores, chromophores, radioactive atoms (particularly  $^{32}\text{P}$  and  $^{125}\text{I}$ ), electron-dense reagents, enzymes, and ligands having specific binding partners. Enzymes are typically detected by their activity. For example, horseradish peroxidase is usually detected by its ability to convert 3,3',5,5'-tetramethylbenzidine (TMB) to a blue pigment, quantifiable with a spectrophotometer. "Specific binding partner" refers to a protein capable of binding a ligand molecule with high specificity, as for example in the case of an antigen and a monoclonal antibody specific therefor. Other specific binding partners include

biotin and avidin or streptavidin, IgG and protein A, and the numerous receptor-ligand couples known in the art. It should be understood that the above description is not meant to categorize the various labels into distinct classes, as the same label may serve in several different modes. For example,  $^{125}\text{I}$  may serve as a radioactive label or as an electron-dense reagent. HRP may serve as enzyme or as antigen for a MAb. Further, one may combine various labels for desired effect. For example, MAbs and avidin also require labels in the practice of this invention: thus, one might label a MAb with biotin, and detect its presence with avidin labeled with  $^{125}\text{I}$ , or with an anti-biotin MAb labeled with HRP. Other permutations and possibilities will be readily apparent to those of ordinary skill in the art, and are considered as equivalents within the scope of the invention.

#### Pharmaceutical Compositions

Pharmaceutical compositions can comprise either polypeptides, antibodies, or nucleic acid of the invention. The pharmaceutical compositions will comprise a therapeutically effective amount of either polypeptides, antibodies, or polynucleotides of the claimed invention.

The term "therapeutically effective amount" as used herein refers to an amount of a therapeutic agent to treat, ameliorate, or prevent a desired disease or condition, or to exhibit a detectable therapeutic or preventative effect. The effect can be detected by, for example, chemical markers or antigen levels. Therapeutic effects also include reduction in physical symptoms, such as decreased body temperature. The precise effective amount for a subject will depend upon the subject's size and health, the nature and extent of the condition, and the therapeutics or combination of therapeutics selected for administration. Thus, it is not useful to specify an exact effective amount in advance. However, the effective amount for a given situation can be determined by routine experimentation and is within the judgement of the clinician.

For purposes of the present invention, an effective dose will be from about 0.01 mg/kg to 50 mg/kg or 0.05 mg/kg to about 10 mg/kg of the DNA constructs in the individual to which it is administered.

A pharmaceutical composition can also contain a pharmaceutically acceptable carrier. The term "pharmaceutically acceptable carrier" refers to a carrier for administration of a therapeutic agent, such as antibodies or a polypeptide, genes, and other therapeutic agents. The term refers to any pharmaceutical carrier that does not itself induce the production of antibodies harmful to the individual receiving the composition, and which may be administered without undue toxicity. Suitable carriers may be large, slowly metabolized macromolecules such as proteins, polysaccharides, polylactic acids, polyglycolic acids, polymeric amino acids, amino acid copolymers, and inactive virus particles. Such carriers are well known to those of ordinary skill in the art.

Pharmaceutically acceptable salts can be used therein, for example, mineral acid salts such as hydrochlorides, hydrobromides, phosphates, sulfates, and the like; and the salts of organic acids such as acetates, propionates, malonates, benzoates, and the like. A thorough discussion of pharmaceutically acceptable excipients is available in Remington's Pharmaceutical Sciences (Mack Pub. Co., N.J. 1991).

Pharmaceutically acceptable carriers in therapeutic compositions may contain liquids such as water, saline, glycerol and ethanol. Additionally, auxiliary substances, such as wetting or emulsifying agents, pH buffering

substances, and the like, may be present in such vehicles. Typically, the therapeutic compositions are prepared as injectables, either as liquid solutions or suspensions; solid forms suitable for solution in, or suspension in, liquid vehicles prior to injection may also be prepared. Liposomes are included within the definition of a pharmaceutically acceptable carrier.

#### Delivery Methods

Once formulated, the compositions of the invention can be administered directly to the subject. The subjects to be treated can be animals; in particular, human subjects can be treated.

Direct delivery of the compositions will generally be accomplished by injection, either subcutaneously, intraperitoneally, intravenously or intramuscularly or delivered to the interstitial space of a tissue. The compositions can also be administered into a lesion. Other modes of administration include oral and pulmonary administration, suppositories, and transdermal or transcutaneous applications (*e.g.*, see WO98/20734), needles, and gene guns or hyposprays. Dosage treatment may be a single dose schedule or a multiple dose schedule.

#### Vaccines

Vaccines according to the invention may either be prophylactic (*i.e.*, to prevent infection) or therapeutic (*i.e.*, to treat disease after infection).

Such vaccines comprise immunising antigen(s), immunogen(s), polypeptide(s), protein(s) or nucleic acid, usually in combination with "pharmaceutically acceptable carriers," which include any carrier that does not itself induce the production of antibodies harmful to the individual receiving the composition. Suitable carriers are typically large, slowly metabolized macromolecules such as proteins, polysaccharides, polylactic acids, polyglycolic acids, polymeric amino acids, amino acid copolymers, lipid aggregates (such as oil droplets or liposomes), and inactive virus particles. Such carriers are well known to those of ordinary skill in the art. Additionally, these carriers may function as immunostimulating agents ("adjuvants"). Furthermore, the antigen or immunogen may be conjugated to a bacterial toxoid, such as a toxoid from diphtheria, tetanus, cholera, *H. pylori*, *etc.* pathogens.

Preferred adjuvants to enhance effectiveness of the composition include, but are not limited to: (1) aluminum salts (alum), such as aluminum hydroxide, aluminum phosphate, aluminum sulfate, *etc.*; (2) oil-in-water emulsion formulations (with or without other specific immunostimulating agents such as muramyl peptides (see below) or bacterial cell wall components), such as for example (a) MF59™ (WO 90/14837; Chapter 10 in *Vaccine design: the subunit and adjuvant approach*, eds. Powell & Newman, Plenum Press 1995), containing 5% Squalene, 0.5% Tween\* 80, and 0.5% Span\* 85 (optionally containing various amounts of MTP-PE (see below), although not required) formulated into submicron particles using a microfluidizer such as Model 110Y microfluidizer (Microfluidics, Newton, MA), (b) SAF, containing 10% Squalene, 0.4% Tween 80, 5% pluronic-blocked polymer L121, and thr-MDP (see below) either microfluidized into a submicron emulsion or vortexed to generate a larger particle size emulsion, and (c) Ribi™ adjuvant system (RAS), (Ribi Immunochem, Hamilton, MT) containing 2% Squalene, 0.2% Tween 80, and one or more bacterial cell wall components from the group consisting of monophosphorylipid A (MPL), trehalose

\*Trade-mark

dimycolate (TDM), and cell wall skeleton (CWS), preferably MPL + CWS (Detox<sup>TM</sup>); (3) saponin adjuvants, such as Stimulon<sup>TM</sup> (Cambridge Bioscience, Worcester, MA) may be used or particles generated therefrom such as ISCOMs (immunostimulating complexes); (4) Complete Freund's Adjuvant (CFA) and Incomplete Freund's Adjuvant (IFA); (5) cytokines, such as interleukins (*e.g.*, IL-1, IL-2, IL-4, IL-5, IL-6, IL-7, IL-12, *etc.*), interferons (*e.g.*, gamma interferon), macrophage colony stimulating factor (M-CSF), tumor necrosis factor (TNF), *etc.*; and (6) other substances that act as immunostimulating agents to enhance the effectiveness of the composition. Alum and MF59<sup>TM</sup> are preferred.

As mentioned above, muramyl peptides include, but are not limited to, N-acetyl-muramyl-L-threonyl-D-isoglutamine (thr-MDP), N-acetyl-normuramyl-L-alanyl-D-isoglutamine (nor-MDP), N-acetylmuramyl-L-alanyl-D-isoglutaminyl-L-alanine-2-(1'-2'-dipalmitoyl-*sn*-glycero-3-hydroxyphosphoryloxy)-ethylamine (MTP-PE), *etc.*

The immunogenic compositions (*e.g.*, the immunising antigen/immunogen/polypeptide/protein/ nucleic acid, pharmaceutically acceptable carrier, and adjuvant) typically will contain diluents, such as water, saline, glycerol, ethanol, *etc.* Additionally, auxiliary substances, such as wetting or emulsifying agents, pH buffering substances, and the like, may be present in such vehicles.

Typically, the immunogenic compositions are prepared as injectables, either as liquid solutions or suspensions; solid forms suitable for solution in, or suspension in, liquid vehicles prior to injection may also be prepared. The preparation also may be emulsified or encapsulated in liposomes for enhanced adjuvant effect, as discussed above under pharmaceutically acceptable carriers.

Immunogenic compositions used as vaccines comprise an immunologically effective amount of the antigenic or immunogenic polypeptides, as well as any other of the above-mentioned components, as needed. By "immunologically effective amount", it is meant that the administration of that amount to an individual, either in a single dose or as part of a series, is effective for treatment or prevention. This amount varies depending upon the health and physical condition of the individual to be treated, the taxonomic group of individual to be treated (*e.g.*, nonhuman primate, primate, *etc.*), the capacity of the individual's immune system to synthesize antibodies, the degree of protection desired, the formulation of the vaccine, the treating doctor's assessment of the medical situation, and other relevant factors. It is expected that the amount will fall in a relatively broad range that can be determined through routine trials.

The immunogenic compositions are conventionally administered parenterally, *e.g.*, by injection, either subcutaneously, intramuscularly, or transdermally/transcutaneously (*e.g.*, WO98/20734). Additional formulations suitable for other modes of administration include oral and pulmonary formulations, suppositories, and transdermal applications. Dosage treatment may be a single dose schedule or a multiple dose schedule. The vaccine may be administered in conjunction with other immunoregulatory agents.

As an alternative to protein-based vaccines, DNA vaccination may be employed [*e.g.*, Robinson & Torres (1997) *Seminars in Immunology* 9:271-283; Donnelly *et al.* (1997) *Annu Rev Immunol* 15:617-648; see later herein].

Gene Delivery Vehicles

Gene therapy vehicles for delivery of constructs including a coding sequence of a therapeutic of the invention, to be delivered to the mammal for expression in the mammal, can be administered either locally or systemically. These constructs can utilize viral or non-viral vector approaches in *in vivo* or *ex vivo* modality. Expression of such coding sequence can be induced using endogenous mammalian or heterologous promoters. Expression of the coding sequence *in vivo* can be either constitutive or regulated.

The invention includes gene delivery vehicles capable of expressing the contemplated nucleic acid sequences. The gene delivery vehicle is preferably a viral vector and, more preferably, a retroviral, adenoviral, adeno-associated viral (AAV), herpes viral, or alphavirus vector. The viral vector can also be an astrovirus, coronavirus, orthomyxovirus, papovavirus, paramyxovirus, parvovirus, picornavirus, poxvirus, or togavirus viral vector. See generally, Jolly (1994) *Cancer Gene Therapy* 1:51-64; Kimura (1994) *Human Gene Therapy* 5:845-852; Connelly (1995) *Human Gene Therapy* 6:185-193; and Kaplitt (1994) *Nature Genetics* 6:148-153.

Retroviral vectors are well known in the art and we contemplate that any retroviral gene therapy vector is employable in the invention, including B, C and D type retroviruses, xenotropic retroviruses (for example, NZB-X1, NZB-X2 and NZB9-1 (see O'Neill (1985) *J. Virol.* 53:160) polytropic retroviruses *e.g.*, MCF and MCF-MLV (see Kelly (1983) *J. Virol.* 45:291), spumaviruses and lentiviruses. See RNA Tumor Viruses, Second Edition, Cold Spring Harbor Laboratory, 1985.

Portions of the retroviral gene therapy vector may be derived from different retroviruses. For example, retrovector LTRs may be derived from a Murine Sarcoma Virus, a tRNA binding site from a Rous Sarcoma Virus, a packaging signal from a Murine Leukemia Virus, and an origin of second strand synthesis from an Avian Leukosis Virus.

These recombinant retroviral vectors may be used to generate transduction competent retroviral vector particles by introducing them into appropriate packaging cell lines (see US patent 5,591,624). Retrovirus vectors can be constructed for site-specific integration into host cell DNA by incorporation of a chimeric integrase enzyme into the retroviral particle (see WO96/37626). It is preferable that the recombinant viral vector is a replication defective recombinant virus.

Packaging cell lines suitable for use with the above-described retrovirus vectors are well known in the art, are readily prepared (see WO95/30763 and WO92/05266), and can be used to create producer cell lines (also termed vector cell lines or "VCLs") for the production of recombinant vector particles. Preferably, the packaging cell lines are made from human parent cells (*e.g.*, HT1080 cells) or mink parent cell lines, which eliminates inactivation in human serum.

Preferred retroviruses for the construction of retroviral gene therapy vectors include Avian Leukosis Virus, Bovine Leukemia, Virus, Murine Leukemia Virus, Mink-Cell Focus-Inducing Virus, Murine Sarcoma Virus, Reticuloendotheliosis Virus and Rous Sarcoma Virus. Particularly preferred Murine Leukemia Viruses include 4070A and 1504A (Hartley and Rowe (1976) *J Virol* 19:19-25), Abelson (ATCC No. VR-999), Friend (ATCC No. VR-245), Graffi, Gross (ATCC No. VR-590), Kirsten, Harvey Sarcoma Virus and Rauscher (ATCC No. VR-998) and Moloney Murine Leukemia Virus (ATCC No. VR-190). Such

retroviruses may be obtained from depositories or collections such as the American Type Culture Collection ("ATCC") in Rockville, Maryland or isolated from known sources using commonly available techniques.

Exemplary known retroviral gene therapy vectors employable in this invention include those described in patent applications GB2200651, EP0415731, EP0345242, EP0334301, WO89/02468; WO89/05349, WO89/09271, WO90/02806, WO90/07936, WO94/03622, WO93/25698, WO93/25234, WO93/11230, WO93/10218, WO91/02805, WO91/02825, WO95/07994, US 5,219,740, US 4,405,712, US 4,861,719, US 4,980,289, US 4,777,127, US 5,591,624. See also Vile (1993) *Cancer Res* 53:3860-3864; Vile (1993) *Cancer Res* 53:962-967; Ram (1993) *Cancer Res* 53 (1993) 83-88; Takamiya (1992) *J Neurosci Res* 33:493-503; Baba (1993) *J Neurosurg* 79:729-735; Mann (1983) *Cell* 33:153; Cane (1984) *Proc Natl Acad Sci* 81:6349; and Miller (1990) *Human Gene Therapy* 1.

Human adenoviral gene therapy vectors are also known in the art and employable in this invention. See, for example, Berkner (1988) *Biotechniques* 6:616 and Rosenfeld (1991) *Science* 252:431, and WO93/07283, WO93/06223, and WO93/07282. Exemplary known adenoviral gene therapy vectors employable in this invention include those described in the above referenced documents and in WO94/12649, WO93/03769, WO93/19191, WO94/28938, WO95/11984, WO95/00655, WO95/27071, WO95/29993, WO95/34671, WO96/05320, WO94/08026, WO94/11506, WO93/06223, WO94/24299, WO95/14102, WO95/24297, WO95/02697, WO94/28152, WO94/24299, WO95/09241, WO95/25807, WO95/05835, WO94/18922 and WO95/09654. Alternatively, administration of DNA linked to killed adenovirus as described in Curiel (1992) *Hum. Gene Ther.* 3:147-154 may be employed. The gene delivery vehicles of the invention also include adenovirus associated virus (AAV) vectors. Leading and preferred examples of such vectors for use in this invention are the AAV-2 based vectors disclosed in Srivastava, WO93/09239. Most preferred AAV vectors comprise the two AAV inverted terminal repeats in which the native D-sequences are modified by substitution of nucleotides, such that at least 5 native nucleotides and up to 18 native nucleotides, preferably at least 10 native nucleotides up to 18 native nucleotides, most preferably 10 native nucleotides are retained and the remaining nucleotides of the D-sequence are deleted or replaced with non-native nucleotides. The native D-sequences of the AAV inverted terminal repeats are sequences of 20 consecutive nucleotides in each AAV inverted terminal repeat (*i.e.*, there is one sequence at each end) which are not involved in HP formation. The non-native replacement nucleotide may be any nucleotide other than the nucleotide found in the native D-sequence in the same position. Other employable exemplary AAV vectors are pWP-19, pWN-1, both of which are disclosed in Nahreini (1993) *Gene* 124:257-262. Another example of such an AAV vector is psub201 (see Samulski (1987) *J. Virol.* 61:3096). Another exemplary AAV vector is the Double-D ITR vector. Construction of the Double-D ITR vector is disclosed in US Patent 5,478,745. Still other vectors are those disclosed in Carter US Patent 4,797,368 and Muzyczka US Patent 5,139,941, Chartejee US Patent 5,474,935, and Kotin WO94/288157. Yet a further example of an AAV vector employable in this invention is SSV9AFABTKneo, which contains the AFP enhancer and albumin promoter and directs expression predominantly in the liver. Its structure and construction are disclosed in Su (1996) *Human Gene Therapy* 7:463-470. Additional AAV gene therapy vectors are described in US 5,354,678, US 5,173,414, US 5,139,941, and US 5,252,479.

The gene therapy vectors of the invention also include herpes vectors. Leading and preferred examples are herpes simplex virus vectors containing a sequence encoding a thymidine kinase polypeptide such as those disclosed in US 5,288,641 and EP0176170 (Roizman). Additional exemplary herpes simplex virus vectors include HFEM/ICP6-LacZ disclosed in WO95/04139 (Wistar Institute), pHSVlac described in Geller (1988) *Science* 241:1667-1669 and in WO90/09441 and WO92/07945, HSV Us3::pgC-lacZ described in Fink (1992) *Human Gene Therapy* 3:11-19 and HSV 7134, 2 RH 105 and GAL4 described in EP 0453242 (Breakefield), and those deposited with the ATCC as accession numbers ATCC VR-977 and ATCC VR-260.

Also contemplated are alpha virus gene therapy vectors that can be employed in this invention. Preferred alpha virus vectors are Sindbis viruses vectors. Togaviruses, Semliki Forest virus (ATCC VR-67; ATCC VR-1247), Middleberg virus (ATCC VR-370), Ross River virus (ATCC VR-373; ATCC VR-1246), Venezuelan equine encephalitis virus (ATCC VR923; ATCC VR-1250; ATCC VR-1249; ATCC VR-532), and those described in US patents 5,091,309, 5,217,879, and WO92/10578. More particularly, those alpha virus vectors described in US Serial No. 08/405,627, filed March 15, 1995, WO94/21792, WO92/10578, WO95/07994, US 5,091,309 and US 5,217,879 are employable. Such alpha viruses may be obtained from depositories or collections such as the ATCC in Rockville, Maryland or isolated from known sources using commonly available techniques. Preferably, alphavirus vectors with reduced cytotoxicity are used (see USSN 08/679640).

DNA vector systems such as eukaryotic layered expression systems are also useful for expressing the nucleic acids of the invention. See WO95/07994 for a detailed description of eukaryotic layered expression systems. Preferably, the eukaryotic layered expression systems of the invention are derived from alphavirus vectors and most preferably from Sindbis viral vectors.

Other viral vectors suitable for use in the present invention include those derived from poliovirus, for example ATCC VR-58 and those described in Evans, *Nature* 339 (1989) 385 and Sabin (1973) *J. Biol. Standardization* 1:115; rhinovirus, for example ATCC VR-1110 and those described in Arnold (1990) *J Cell Biochem* L401; pox viruses such as canary pox virus or vaccinia virus, for example ATCC VR-111 and ATCC VR-2010 and those described in Fisher-Hoch (1989) *Proc Natl Acad Sci* 86:317; Flexner (1989) *Ann NY Acad Sci* 569:86, Flexner (1990) *Vaccine* 8:17; in US 4,603,112 and US 4,769,330 and WO89/01973; SV40 virus, for example ATCC VR-305 and those described in Mulligan (1979) *Nature* 277:108 and Madzak (1992) *J Gen Virol* 73:1533; influenza virus, for example ATCC VR-797 and recombinant influenza viruses made employing reverse genetics techniques as described in US 5,166,057 and in Enami (1990) *Proc Natl Acad Sci* 87:3802-3805; Enami & Palese (1991) *J Virol* 65:2711-2713 and Luytjes (1989) *Cell* 59:110, (see also McMichael (1983) *NEJ Med* 309:13, and Yap (1978) *Nature* 273:238 and *Nature* (1979) 277:108); human immunodeficiency virus as described in EP-0386882 and in Buchschacher (1992) *J. Virol.* 66:2731; measles virus, for example ATCC VR-67 and VR-1247 and those described in EP-0440219; Aura virus, for example ATCC VR-368; Bebaru virus, for example ATCC VR-600 and ATCC VR-1240; Cabassou virus, for example ATCC VR-922; Chikungunya virus, for example ATCC VR-64 and ATCC VR-1241; Fort Morgan Virus, for example ATCC VR-924; Getah virus, for example ATCC VR-369 and ATCC VR-1243; Kyzylagach virus, for example ATCC VR-927; Mayaro virus, for example ATCC VR-66; Mucambo virus, for example ATCC

VR-580 and ATCC VR-1244; Ndumu virus, for example ATCC VR-371; Pixuna virus, for example ATCC VR-372 and ATCC VR-1245; Tonate virus, for example ATCC VR-925; Trinita virus, for example ATCC VR-469; Una virus, for example ATCC VR-374; Whataroa virus, for example ATCC VR-926; Y-62-33 virus, for example ATCC VR-375; O'Nyong virus, Eastern encephalitis virus, for example ATCC VR-65 and ATCC VR-1242; Western encephalitis virus, for example ATCC VR-70, ATCC VR-1251, ATCC VR-622 and ATCC VR-1252; and coronavirus, for example ATCC VR-740 and those described in Hamre (1966) *Proc Soc Exp Biol Med* 121:190.

Delivery of the compositions of this invention into cells is not limited to the above mentioned viral vectors. Other delivery methods and media may be employed such as, for example, nucleic acid expression vectors, polycationic condensed DNA linked or unlinked to killed adenovirus alone, for example see US Serial No. 08/366,787, filed December 30, 1994 and Curiel (1992) *Hum Gene Ther* 3:147-154 ligand linked DNA, for example see Wu (1989) *J Biol Chem* 264:16985-16987, eucaryotic cell delivery vehicles cells, for example see US Serial No. 08/240,030, filed May 9, 1994, and US Serial No. 08/404,796, deposition of photopolymerized hydrogel materials, hand-held gene transfer particle gun, as described in US Patent 5,149,655, ionizing radiation as described in US 5,206,152 and in WO92/11033, nucleic charge neutralization or fusion with cell membranes. Additional approaches are described in Philip (1994) *Mol Cell Biol* 14:2411-2418 and in Woffendin (1994) *Proc Natl Acad Sci* 91:1581-1585.

Particle mediated gene transfer may be employed, for example see US Serial No. 60/023,867. Briefly, the sequence can be inserted into conventional vectors that contain conventional control sequences for high level expression, and then incubated with synthetic gene transfer molecules such as polymeric DNA-binding cations like polylysine, protamine, and albumin, linked to cell targeting ligands such as asialoorosomucoid, as described in Wu & Wu (1987) *J. Biol. Chem.* 262:4429-4432, insulin as described in Hucked (1990) *Biochem Pharmacol* 40:253-263, galactose as described in Plank (1992) *Bioconjugate Chem* 3:533-539, lactose or transferrin.

Naked DNA may also be employed. Exemplary naked DNA introduction methods are described in WO 90/11092 and US 5,580,859. Uptake efficiency may be improved using biodegradable latex beads. DNA coated latex beads are efficiently transported into cells after endocytosis initiation by the beads. The method may be improved further by treatment of the beads to increase hydrophobicity and thereby facilitate disruption of the endosome and release of the DNA into the cytoplasm.

Liposomes that can act as gene delivery vehicles are described in US 5,422,120, WO95/13796, WO94/23697, WO91/14445 and EP-524,968. As described in USSN. 60/023,867, on non-viral delivery, the nucleic acid sequences encoding a polypeptide can be inserted into conventional vectors that contain conventional control sequences for high level expression, and then be incubated with synthetic gene transfer molecules such as polymeric DNA-binding cations like polylysine, protamine, and albumin, linked to cell targeting ligands such as asialoorosomucoid, insulin, galactose, lactose, or transferrin. Other delivery systems include the use of liposomes to encapsulate DNA comprising the gene under the control of a variety of tissue-specific or ubiquitously-active promoters. Further non-viral delivery suitable for use includes mechanical delivery systems such as the approach described in Woffendin *et al* (1994) *Proc. Natl. Acad. Sci. USA*

91(24):11581-11585. Moreover, the coding sequence and the product of expression of such can be delivered through deposition of photopolymerized hydrogel materials. Other conventional methods for gene delivery that can be used for delivery of the coding sequence include, for example, use of hand-held gene transfer particle gun, as described in US 5,149,655; use of ionizing radiation for activating transferred gene, as described in US 5,206,152 and WO92/11033

Exemplary liposome and polycationic gene delivery vehicles are those described in US 5,422,120 and 4,762,915; in WO 95/13796; WO94/23697; and WO91/14445; in EP-0524968; and in Stryer, *Biochemistry*, pages 236-240 (1975) W.H. Freeman, San Francisco; Szoka (1980) *Biochem Biophys Acta* 600:1; Bayer (1979) *Biochem Biophys Acta* 550:464; Rivnay (1987) *Meth Enzymol* 149:119; Wang (1987) *Proc Natl Acad Sci* 84:7851; Plant (1989) *Anal Biochem* 176:420.

A polynucleotide composition can comprises therapeutically effective amount of a gene therapy vehicle, as the term is defined above. For purposes of the present invention, an effective dose will be from about 0.01 mg/ kg to 50 mg/kg or 0.05 mg/kg to about 10 mg/kg of the DNA constructs in the individual to which it is administered.

#### Delivery Methods

Once formulated, the polynucleotide compositions of the invention can be administered (1) directly to the subject; (2) delivered *ex vivo*, to cells derived from the subject; or (3) *in vitro* for expression of recombinant proteins. The subjects to be treated can be mammals or birds. Also, human subjects can be treated.

Direct delivery of the compositions will generally be accomplished by injection, either subcutaneously, intraperitoneally, intravenously or intramuscularly or delivered to the interstitial space of a tissue. The compositions can also be administered into a lesion. Other modes of administration include oral and pulmonary administration, suppositories, and transdermal or transcutaneous applications (e.g., see WO98/20734), needles, and gene guns or hyposprays. Dosage treatment may be a single dose schedule or a multiple dose schedule.

Methods for the *ex vivo* delivery and reimplantation of transformed cells into a subject are known in the art and described in e.g., WO93/14778. Examples of cells useful in *ex vivo* applications include, for example, stem cells, particularly hematopoietic, lymph cells, macrophages, dendritic cells, or tumor cells.

Generally, delivery of nucleic acids for both *ex vivo* and *in vitro* applications can be accomplished by the following procedures, for example, dextran-mediated transfection, calcium phosphate precipitation, polybrene mediated transfection, protoplast fusion, electroporation, encapsulation of the polynucleotide(s) in liposomes, and direct microinjection of the DNA into nuclei, all well known in the art.

#### Polynucleotide and polypeptide pharmaceutical compositions

In addition to the pharmaceutically acceptable carriers and salts described above, the following additional agents can be used with polynucleotide and/or polypeptide compositions.

##### A. Polypeptides

One example are polypeptides which include, without limitation: asialoglycosomucoid (ASOR); transferrin; asialoglycoproteins; antibodies; antibody fragments; ferritin; interleukins; interferons, granulocyte,

macrophage colony stimulating factor (GM-CSF), granulocyte colony stimulating factor (G-CSF), macrophage colony stimulating factor (M-CSF), stem cell factor and erythropoietin. Viral antigens, such as envelope proteins, can also be used. Also, proteins from other invasive organisms, such as the 17 amino acid peptide from the circumsporozoite protein of plasmodium falciparum known as RII.

#### B.Hormones, Vitamins, etc.

Other groups that can be included are, for example: hormones, steroids, androgens, estrogens, thyroid hormone, or vitamins, folic acid.

#### C.Polyalkylenes, Polysaccharides, etc.

Also, polyalkylene glycol can be included with the desired polynucleotides/polypeptides. In a preferred embodiment, the polyalkylene glycol is polyethylene glycol. In addition, mono-, di-, or polysaccharides can be included. In a preferred embodiment of this aspect, the polysaccharide is dextran or DEAE-dextran. Also, chitosan and poly(lactide-co-glycolide)

#### D.Lipids, and Liposomes

The desired polynucleotide/polypeptide can also be encapsulated in lipids or packaged in liposomes prior to delivery to the subject or to cells derived therefrom.

Lipid encapsulation is generally accomplished using liposomes which are able to stably bind or entrap and retain nucleic acid. The ratio of condensed polynucleotide to lipid preparation can vary but will generally be around 1:1 (mg DNA:micromoles lipid), or more of lipid. For a review of the use of liposomes as carriers for delivery of nucleic acids, see, Hug and Sleight (1991) *Biochim. Biophys. Acta.* 1097:1-17; Straubinger (1983) *Meth. Enzymol.* 101:512-527.

Liposomal preparations for use in the present invention include cationic (positively charged), anionic (negatively charged) and neutral preparations. Cationic liposomes have been shown to mediate intracellular delivery of plasmid DNA (Felgner (1987) *Proc. Natl. Acad. Sci. USA* 84:7413-7416); mRNA (Malone (1989) *Proc. Natl. Acad. Sci. USA* 86:6077-6081); and purified transcription factors (Debs (1990) *J. Biol. Chem.* 265:10189-10192), in functional form.

Cationic liposomes are readily available. For example, N[1-2,3-dioleoyloxy)propyl]-N,N,N-triethylammonium (DOTMA) liposomes are available under the trademark Lipofectin, from GIBCO BRL, Grand Island, NY. (See, also, Felgner *supra*). Other commercially available liposomes include transfectace (DDAB/DOPE) and DOTAP/DOPE (Boehringer). Other cationic liposomes can be prepared from readily available materials using techniques well known in the art. See, e.g., Szoka (1978) *Proc. Natl. Acad. Sci. USA* 75:4194-4198; WO90/11092 for a description of the synthesis of DOTAP (1,2-bis(oleoyloxy)-3-(trimethylammonio)propane) liposomes.

Similarly, anionic and neutral liposomes are readily available, such as from Avanti Polar Lipids (Birmingham, AL), or can be easily prepared using readily available materials. Such materials include phosphatidyl choline, cholesterol, phosphatidyl ethanolamine, dioleoylphosphatidyl choline (DOPC), dioleoylphosphatidyl glycerol (DOPG), dioleoylphosphatidyl ethanolamine (DOPE), among others. These

materials can also be mixed with the DOTMA and DOTAP starting materials in appropriate ratios. Methods for making liposomes using these materials are well known in the art.

The liposomes can comprise multilammellar vesicles (MLVs), small unilamellar vesicles (SUVs), or large unilamellar vesicles (LUVs). The various liposome-nucleic acid complexes are prepared using methods known in the art. See *e.g.*, Straubinger (1983) *Meth. Immunol.* 101:512-527; Szoka (1978) *Proc. Natl. Acad. Sci. USA* 75:4194-4198; Papahadjopoulos (1975) *Biochim. Biophys. Acta* 394:483; Wilson (1979) *Cell* 17:77; Deamer & Bangham (1976) *Biochim. Biophys. Acta* 443:629; Ostro (1977) *Biochem. Biophys. Res. Commun.* 76:836; Fraley (1979) *Proc. Natl. Acad. Sci. USA* 76:3348; Enoch & Strittmatter (1979) *Proc. Natl. Acad. Sci. USA* 76:145; Fraley (1980) *J. Biol. Chem.* (1980) 255:10431; Szoka & Papahadjopoulos (1978) *Proc. Natl. Acad. Sci. USA* 75:145; and Schaefer-Ridder (1982) *Science* 215:166.

#### E. Lipoproteins

In addition, lipoproteins can be included with the polynucleotide/polypeptide to be delivered. Examples of lipoproteins to be utilized include: chylomicrons, HDL, IDL, LDL, and VLDL. Mutants, fragments, or fusions of these proteins can also be used. Also, modifications of naturally occurring lipoproteins can be used, such as acetylated LDL. These lipoproteins can target the delivery of polynucleotides to cells expressing lipoprotein receptors. Preferably, if lipoproteins are including with the polynucleotide to be delivered, no other targeting ligand is included in the composition.

Naturally occurring lipoproteins comprise a lipid and a protein portion. The protein portion are known as apoproteins. At the present, apoproteins A, B, C, D, and E have been isolated and identified. At least two of these contain several proteins, designated by Roman numerals, AI, AII, AIV; CI, CII, CIII.

A lipoprotein can comprise more than one apoprotein. For example, naturally occurring chylomicrons comprises of A, B, C, and E, over time these lipoproteins lose A and acquire C and E apoproteins. VLDL comprises A, B, C, and E apoproteins, LDL comprises apoprotein B; and HDL comprises apoproteins A, C, and E.

The amino acid of these apoproteins are known and are described in, for example, Breslow (1985) *Annu Rev. Biochem* 54:699; Law (1986) *Adv. Exp Med. Biol.* 151:162; Chen (1986) *J Biol Chem* 261:12918; Kane (1980) *Proc Natl Acad Sci USA* 77:2465; and Utermann (1984) *Hum Genet* 65:232.

Lipoproteins contain a variety of lipids including, triglycerides, cholesterol (free and esters), and phospholipids. The composition of the lipids varies in naturally occurring lipoproteins. For example, chylomicrons comprise mainly triglycerides. A more detailed description of the lipid content of naturally occurring lipoproteins can be found, for example, in *Meth. Enzymol.* 128 (1986). The composition of the lipids are chosen to aid in conformation of the apoprotein for receptor binding activity. The composition of lipids can also be chosen to facilitate hydrophobic interaction and association with the polynucleotide binding molecule.

Naturally occurring lipoproteins can be isolated from serum by ultracentrifugation, for instance. Such methods are described in *Meth. Enzymol.* (*supra*); Pitas (1980) *J. Biochem.* 255:5454-5460 and Mahey (1979) *J Clin. Invest* 64:743-750. Lipoproteins can also be produced by *in vitro* or recombinant methods by

expression of the apoprotein genes in a desired host cell. See, for example, Atkinson (1986) *Annu Rev Biophys Chem* 15:403 and Radding (1958) *Biochim Biophys Acta* 30: 443. Lipoproteins can also be purchased from commercial suppliers, such as Biomedical Technologies, Inc., Stoughton, Massachusetts, USA. Further description of lipoproteins can be found in Zuckermann *et al.* WO98/06437..

#### F. Polycationic Agents

Polycationic agents can be included, with or without lipoprotein, in a composition with the desired polynucleotide/polypeptide to be delivered.

Polycationic agents, typically, exhibit a net positive charge at physiological relevant pH and are capable of neutralizing the electrical charge of nucleic acids to facilitate delivery to a desired location. These agents have both in vitro, ex vivo, and in vivo applications. Polycationic agents can be used to deliver nucleic acids to a living subject either intramuscularly, subcutaneously, etc.

The following are examples of useful polypeptides as polycationic agents: polylysine, polyarginine, polyornithine, and protamine. Other examples include histones, protamines, human serum albumin, DNA binding proteins, non-histone chromosomal proteins, coat proteins from DNA viruses, such as (X174, transcriptional factors also contain domains that bind DNA and therefore may be useful as nucleic acid condensing agents. Briefly, transcriptional factors such as C/CEBP, c-jun, c-fos, AP-1, AP-2, AP-3, CPF, Prot-1, Sp-1, Oct-1, Oct-2, CREP, and TFIID contain basic domains that bind DNA sequences.

Organic polycationic agents include: spermine, spermidine, and putrescine.

The dimensions and of the physical properties of a polycationic agent can be extrapolated from the list above, to construct other polypeptide polycationic agents or to produce synthetic polycationic agents.

Synthetic polycationic agents which are useful include, for example, DEAE-dextran, polybrene. Lipofectin<sup>®</sup>, and lipofectAMINE<sup>®</sup> are monomers that form polycationic complexes when combined with polynucleotides/polypeptides.

#### Immunodiagnostic Assays

Meningococcal antigens of the invention can be used in immunoassays to detect antibody levels (or, conversely, anti-meningococcal antibodies can be used to detect antigen levels). Immunoassays based on well defined, recombinant antigens can be developed to replace invasive diagnostics methods. Antibodies to meningococcal proteins within biological samples, including for example, blood or serum samples, can be detected. Design of the immunoassays is subject to a great deal of variation, and a variety of these are known in the art. Protocols for the immunoassay may be based, for example, upon competition, or direct reaction, or sandwich type assays. Protocols may also, for example, use solid supports, or may be by immunoprecipitation. Most assays involve the use of labeled antibody or polypeptide; the labels may be, for example, fluorescent, chemiluminescent, radioactive, or dye molecules. Assays which amplify the signals from the probe are also known; examples of which are assays which utilize biotin and avidin, and enzyme-labeled and mediated immunoassays, such as ELISA assays.

Kits suitable for immunodiagnosis and containing the appropriate labeled reagents are constructed by packaging the appropriate materials, including the compositions of the invention, in suitable containers, along

with the remaining reagents and materials (for example, suitable buffers, salt solutions, etc.) required for the conduct of the assay, as well as suitable set of assay instructions.

#### Nucleic Acid Hybridisation

"Hybridization" refers to the association of two nucleic acid sequences to one another by hydrogen bonding. Typically, one sequence will be fixed to a solid support and the other will be free in solution. Then, the two sequences will be placed in contact with one another under conditions that favor hydrogen bonding. Factors that affect this bonding include: the type and volume of solvent; reaction temperature; time of hybridization; agitation; agents to block the non-specific attachment of the liquid phase sequence to the solid support (Denhardt's reagent or BLOTTO); concentration of the sequences; use of compounds to increase the rate of association of sequences (dextran sulfate or polyethylene glycol); and the stringency of the washing conditions following hybridization. See Sambrook *et al.* [*supra*] Volume 2, chapter 9, pages 9.47 to 9.57.

"Stringency" refers to conditions in a hybridization reaction that favor association of very similar sequences over sequences that differ. For example, the combination of temperature and salt concentration should be chosen that is approximately 120 to 200°C below the calculated  $T_m$  of the hybrid under study. The temperature and salt conditions can often be determined empirically in preliminary experiments in which samples of genomic DNA immobilized on filters are hybridized to the sequence of interest and then washed under conditions of different stringencies. See Sambrook *et al.* at page 9.50.

Variables to consider when performing, for example, a Southern blot are (1) the complexity of the DNA being blotted and (2) the homology between the probe and the sequences being detected. The total amount of the fragment(s) to be studied can vary a magnitude of 10, from 0.1 to 1 µg for a plasmid or phage digest to  $10^{-9}$  to  $10^{-8}$  g for a single copy gene in a highly complex eukaryotic genome. For lower complexity polynucleotides, substantially shorter blotting, hybridization, and exposure times, a smaller amount of starting polynucleotides, and lower specific activity of probes can be used. For example, a single-copy yeast gene can be detected with an exposure time of only 1 hour starting with 1 µg of yeast DNA, blotting for two hours, and hybridizing for 4-8 hours with a probe of  $10^8$  cpm/µg. For a single-copy mammalian gene a conservative approach would start with 10 µg of DNA, blot overnight, and hybridize overnight in the presence of 10% dextran sulfate using a probe of greater than  $10^8$  cpm/µg, resulting in an exposure time of ~24 hours.

Several factors can affect the melting temperature ( $T_m$ ) of a DNA-DNA hybrid between the probe and the fragment of interest, and consequently, the appropriate conditions for hybridization and washing. In many cases the probe is not 100% homologous to the fragment. Other commonly encountered variables include the length and total G+C content of the hybridizing sequences and the ionic strength and formamide content of the hybridization buffer. The effects of all of these factors can be approximated by a single equation:

$$T_m = 81 + 16.6(\log_{10} C_i) + 0.4[\%(G + C)] - 0.6(\% \text{ formamide}) - 600/n - 1.5(\% \text{ mismatch}).$$

where  $C_i$  is the salt concentration (monovalent ions) and  $n$  is the length of the hybrid in base pairs (slightly modified from Meinkoth & Wahl (1984) *Anal. Biochem.* 138: 267-284).

In designing a hybridization experiment, some factors affecting nucleic acid hybridization can be conveniently altered. The temperature of the hybridization and washes and the salt concentration during the

washes are the simplest to adjust. As the temperature of the hybridization increases (*i.e.*, stringency), it becomes less likely for hybridization to occur between strands that are nonhomologous, and as a result, background decreases. If the radiolabeled probe is not completely homologous with the immobilized fragment (as is frequently the case in gene family and interspecies hybridization experiments), the hybridization temperature must be reduced, and background will increase. The temperature of the washes affects the intensity of the hybridizing band and the degree of background in a similar manner. The stringency of the washes is also increased with decreasing salt concentrations.

In general, convenient hybridization temperatures in the presence of 50% formamide are 42°C for a probe with 95% to 100% homology to the target fragment, 37°C for 90% to 95% homology, and 32°C for 85% to 90% homology. For lower homologies, formamide content should be lowered and temperature adjusted accordingly, using the equation above. If the homology between the probe and the target fragment are not known, the simplest approach is to start with both hybridization and wash conditions which are nonstringent. If non-specific bands or high background are observed after autoradiography, the filter can be washed at high stringency and reexposed. If the time required for exposure makes this approach impractical, several hybridization and/or washing stringencies should be tested in parallel.

#### Nucleic Acid Probe Assays

Methods such as PCR, branched DNA probe assays, or blotting techniques utilizing nucleic acid probes according to the invention can determine the presence of cDNA or mRNA. A probe is said to "hybridize" with a sequence of the invention if it can form a duplex or double stranded complex, which is stable enough to be detected.

The nucleic acid probes will hybridize to the meningococcal nucleotide sequences of the invention (including both sense and antisense strands). Though many different nucleotide sequences will encode the amino acid sequence, the native meningococcal sequence is preferred because it is the actual sequence present in cells. mRNA represents a coding sequence and so a probe should be complementary to the coding sequence; single-stranded cDNA is complementary to mRNA, and so a cDNA probe should be complementary to the non-coding sequence.

The probe sequence need not be identical to the meningococcal sequence (or its complement) — some variation in the sequence and length can lead to increased assay sensitivity if the nucleic acid probe can form a duplex with target nucleotides, which can be detected. Also, the nucleic acid probe can include additional nucleotides to stabilize the formed duplex. Additional meningococcal sequence may also be helpful as a label to detect the formed duplex. For example, a non-complementary nucleotide sequence may be attached to the 5' end of the probe, with the remainder of the probe sequence being complementary to a meningococcal sequence. Alternatively, non-complementary bases or longer sequences can be interspersed into the probe, provided that the probe sequence has sufficient complementarity with the meningococcal sequence in order to hybridize therewith and thereby form a duplex which can be detected.

The exact length and sequence of the probe will depend on the hybridization conditions, such as temperature, salt condition and the like. For example, for diagnostic applications, depending on the complexity of the analyte sequence, the nucleic acid probe typically contains at least 10-20 nucleotides, preferably 15-25, and

more preferably at least 30 nucleotides, although it may be shorter than this. Short primers generally require cooler temperatures to form sufficiently stable hybrid complexes with the template.

Probes may be produced by synthetic procedures, such as the triester method of Matteucci *et al.* [*J. Am. Chem. Soc.* (1981) 103:3185], or according to Urdea *et al.* [*Proc. Natl. Acad. Sci. USA* (1983) 80: 7461], or using commercially available automated oligonucleotide synthesizers.

The chemical nature of the probe can be selected according to preference. For certain applications, DNA or RNA are appropriate. For other applications, modifications may be incorporated *e.g.*, backbone modifications, such as phosphorothioates or methylphosphonates, can be used to increase *in vivo* half-life, alter RNA affinity, increase nuclease resistance *etc.* [*e.g.*, see Agrawal & Iyer (1995) *Curr Opin Biotechnol* 6:12-19; Agrawal (1996) *TIBTECH* 14:376-387]; analogues such as peptide nucleic acids may also be used [*e.g.*, see Corey (1997) *TIBTECH* 15:224-229; Buchardt *et al.* (1993) *TIBTECH* 11:384-386].

Alternatively, the polymerase chain reaction (PCR) is another well-known means for detecting small amounts of target nucleic acids. The assay is described in: Mullis *et al.* [*Meth. Enzymol.* (1987) 155: 335-350]; US patents 4,683,195 and 4,683,202. Two "primer" nucleotides hybridize with the target nucleic acids and are used to prime the reaction. The primers can comprise sequence that does not hybridize to the sequence of the amplification target (or its complement) to aid with duplex stability or, for example, to incorporate a convenient restriction site. Typically, such sequence will flank the desired meningococcal sequence.

A thermostable polymerase creates copies of target nucleic acids from the primers using the original target nucleic acids as a template. After a threshold amount of target nucleic acids are generated by the polymerase, they can be detected by more traditional methods, such as Southern blots. When using the Southern blot method, the labelled probe will hybridize to the meningococcal sequence (or its complement).

Also, mRNA or cDNA can be detected by traditional blotting techniques described in Sambrook *et al* [*supra*]. mRNA, or cDNA generated from mRNA using a polymerase enzyme, can be purified and separated using gel electrophoresis. The nucleic acids on the gel are then blotted onto a solid support, such as nitrocellulose. The solid support is exposed to a labelled probe and then washed to remove any unhybridized probe. Next, the duplexes containing the labeled probe are detected. Typically, the probe is labelled with a radioactive moiety.

#### **MODES FOR CARRYING OUT THE INVENTION – PREFERRED FRAGMENTS**

The protein sequences disclosed in the International Applications have been, *inter alia*, subjected to computer analysis to predict antigenic peptide fragments within the full-length proteins. Three algorithms have been used in this analysis:

- **AMPHI** This program has been used to predict T-cell epitopes [Gao *et al.* (1989) *J. Immunol.* 143:3007; Roberts *et al.* (1996) *AIDS Res Hum Retrovir* 12:593; Quakyi *et al.* (1992) *Scand J Immunol* suppl.11:9] and is available in the Protean package of DNASTAR, Inc. (1228 South Park Street, Madison, Wisconsin 53715 USA).

- **ANTIGENIC INDEX** as disclosed by Jameson & Wolf (1988) The antigenic index: a novel algorithm for predicting antigenic determinants. CABIOS, 4:181:186
- **HYDROPHILICITY** as disclosed by Hopp & Woods (1981) Prediction of protein antigenic determinants from amino acid sequences. PNAS, 78:3824-3828

The three algorithms often identify the same fragments. Such multiply-identified fragments are particularly preferred. The algorithms often identify overlapping fragments (*e.g.*, for antigen "013", AMPHI identifies aa 42-46, and Antigenic Index identifies aa 39-45). The invention explicitly includes fragments resulting from a combination of these overlapping fragments (*e.g.*, the fragment from residue 39 to residue 46, in the case of "013"). Fragments separated by a single amino acid are also often identified (*e.g.*, for "018-2", antigenic index identifies aa 19-23 and 25-41). The invention also includes fragments spanning the two extremes of such "adjacent" fragments (*e.g.*, 19-41 for "081-2"). The Example provides preferred antigenic fragments of the proteins disclosed in the International Applications.

#### **Example 1 – Preferred Antigenic Protein Fragments**

The following amino acid sequences in Table 1 are identified by titles indicating the number assigned to the particular open reading frame (ORF), consistent with those designated in the International Applications. The titles are of the following form: [no prefix, g, or a] [#], where "no prefix" means a sequence from *N. meningitidis* serotype B, "a" means a sequence from *N. meningitidis* serotype A, and "g" means a sequence from *N. gonorrhoeae*; and "#" means the number assigned to that open reading frame (ORF). For example, "127" refers to an *N. meningitidis* B amino acid sequence, ORF number 127. The presence of a suffix "-1" or "-2" to these titles indicates an additional sequence found for that particular ORF. Thus, for example, "a12-2" refers to an *N. meningitidis* A amino acid sequence, ORF number 12, which is another sequence found for ORF 12 in addition to the originally designated ORF 12 and ORF 12-1. Each amino acid sequence is preceded by the beginning amino acid position number and followed by the ending amino acid position number.

**Table 1**

012-1

**AMPHI Regions - AMPHI**

19-LysLeuLeuGluGlnLeuMetArgPheLeuGlnPheLeuSerGluPheLeuPheAlaLeuPheArgIle-41

48-ArgAlaLeuLysPheAlaArgArg-55

90-AsnPheIleArgHisThr-95

133-HisAlaAlaArgThrPhe-138

-36-

160-GlnGlyPheTyrGlyVal-165

179-GlyPheLeuArgPheGlyArgPheLeuProThrLeuLeuGlnThrLeu-194

**Antigenic Index - Jameson-Wolf**

42-PheThrHisLysSerAsnArgAlaLeuLysPheAlaArgArgHisHis-57

77-HisThrHisArgThrAspAsnArgLysArgSerGlySerAsnPhe-91

93-ArgHisThrArgHis-97

101-AlaAlaArgArgHisLeuIleAspGlyAspGlyGlnArgAsn-114

120-ThrXxxLysLeuArgSerArgGlnThr-128

137-ThrPheGlnSerGluGlnAsnLeu-144

147-ArgLeuGlyAsnGlnLysHisArgArgAsnLeuMetThrGln-160

173-IleGlnHisLysLysAlaGly-179

**Hydrophilic Regions - Hopp-Woods**

45-LysSerAsnArgAlaLeuLysPheAlaArgArgHisHis-57

77-HisThrHisArgThrAspAsnArgLysArgSerGly-88

101-AlaAlaArgArgHisLeuIleAspGlyAspGlyGlnArg-113

121-XxxLysLeuArgSerArgGln-127

149-GlyAsnGlnLysHisArgArgAsnLeu-157

173-IleGlnHisLysLysAlaGly-179

013

**AMPHI Regions - AMPHI**

42-AspSerTyrThrPhe-46

**Antigenic Index - Jameson-Wolf**

17-LysSerGluArgXxxSerGlyGlyAsnMetValProArgProSerProPheLeuPro-35

39-ThrGlnLeuAspSerTyrThr-45

58-GluAlaAlaAlaGlnLysGlnProLysThrArgAlaValGly-71

91-ArgSerGlyXxxLysIle-96

**Hydrophilic Regions - Hopp-Woods**

17-LysSerGluArgXxxSerGly-23

58-GluAlaAlaAlaGlnLysGlnProLysThrArgAlaValGly-71

015-2

**AMPHI Regions - AMPHI**

33-GluLysProLeuAlaGlyPheTrpLysAlaLeuProHis-45

107-MetCysCysValAlaCysIleVal-114

**Antigenic Index - Jameson-Wolf**

29-TrpLysAsnProGluLysProLeu-36

90-MetArgAlaArgProArgSerThrLys-98

**Hydrophilic Regions - Hopp-Woods**

31-AsnProGluLysProLeu-36

90-MetArgAlaArgProArgSerThrLys-98

018-2

**AMPHI Regions - AMPHI**

6-IleGlnHisLeuArg-10

180-HisGlyCysGlnHisIlePhe-186

**Antigenic Index - Jameson-Wolf**

-37-

1-MetValGluArgHisIleGln-7  
 9-LeuArgAsnGlyHis-13  
 19-ProSerGlnGlnVal-23  
 25-GlnMetPheGlyGlyArgAlaTyrAspPheArgAlaAspLysAlaAlaGly-41  
 67-TyrPheAlaAspAspLysPhe-73  
 78-LeuArgGlyAsnLeuArg-83  
 85-PheGlnThrAspLysAlaAspLeuArgThrGlyLysHisHisAlaAspGlyAlaAlaPro-104  
 106-ThrAlaAlaAspIleArgValAlaAla-114  
 129-GlnGlnArgGlnLeuVal-134  
 137-IleAlaCysAspGluAspMetArgAsnThrGlyLeuHis-149  
 151-GlnArgValGlyAsnArgTyrAla-158

**Hydrophilic Regions - Hopp-Woods**

1-MetValGluArgHisIleGln-7  
 30-ArgAlaTyrAspPheArgAlaAspLysAlaAla-40  
 67-TyrPheAlaAspAspLysPhe-73  
 85-PheGlnThrAspLysAlaAspLeuArgThrGlyLysHisHisAlaAspGlyAlaAla-103  
 106-ThrAlaAlaAspIleArgValAlaAla-114  
 137-IleAlaCysAspGluAspMetArgAsn-145

019-2

**AMPHI Regions - AMPHI**

33-ProAlaAspAsnIleGlu-38  
 60-AspTyrGlyGlyTyrProSerAlaLeuAspAla-70  
 80-AlaAlaTyrLeuGluAsnAlaGlyAsp-88  
 90-AlaMetAlaGluAsnValArgAsnGluTrpLeuLysSer-102  
 142-AlaAlaGluLeuValLysAsnThrGlyLysLeuProSerGlyCysThrLysLeuLeuGluGlnAlaAlaAlaSer-166  
 173-AspAlaTrpArgArgValArg-179  
 193-LeuAlaAlaAlaLeuGlySerProPheAspGlyGlyThrGlnGly-207  
 215-AsnValIleGlyLysGluAlaArgLysSer-224  
 229-AlaLeuLeuSerGluMet-234  
 259-AsnValProAlaAlaLeuAspTyrTyrGly-268  
 292-ArgArgTrpAspGluLeuAlaSerValIleSerHisMetProGluLysLeuGlnLys-310  
 329-GlnGluAlaGluLysLeuTyrLysGlnAla-338  
 367-AlaGlyLysAsnSerValArgArgMetAlaGlu-377  
 451-ArgTyrIleSerPro-455  
 495-GlnGlyLeuMetGlnValMet-501  
 582-ArgAspTyrValLysLysValMet-589

**Antigenic Index - Jameson-Wolf**

22-SerSerThrAsnThr-26  
 28-ProAlaGlyLysThrProAlaAspAsnIleGluThrAlaAspLeuSerAlaSerValProThrArgProAlaGluProGluArgLysThrLeuAlaAspTyrGlyGlyTyrProSerAla-67  
 69-AspAlaValLysGlnLysAsnAspAla-77  
 85-AsnAlaGlyAspSerAlaMet-91  
 103-LeuGlyAlaArgArgGln-108  
 115-GluTyrAlaLysLeuGluProAlaGlyArgAlaGlnGluValGluCysTyrAlaAspSerSerArgAsnAspTyrThrArgAlaAlaGluLeuValLysAsnThrGlyLysLeuProSerGlyCys-156  
 167-GlyLeuLeuAspGlyAsnAspAlaTrpArgArgValArgGly-180  
 182-LeuAlaGlyArgGlnThrThrAspAlaArgAsn-192  
 199-SerProPheAspGlyGlyThrGlnGlySerArgGluTyr-211  
 217-IleGlyLysGluAlaArgLysSerProAsnAla-227  
 232-SerGluMetGluSerGlyLeuSerLeuGluGlnArgSer-244  
 254-GlnSerGlnAsnLeu-258

-38-

266-TyrTyrGlyLysValAlaAspArgArgGlnLeuThrAspAspGlnIle-281  
 287-AlaAlaLeuArgAlaArgArgTrpAspGlu-296  
 304-MetProGluLysLeuGlnLysSerProThr-313  
 320-ArgSerArgAlaAlaThrGlyAsnThrGlnGluAlaGluLysLeuTyrLys-336  
 339-AlaAlaThrGlyArgAsn-344  
 350-AlaGlyGluGluLeuGlyArgLysIleAspThrArgAsnAsnValProAspAlaGlyLysAsnSerValArg  
 ArgMetAlaGluAspGlyAlaValLysArg-383  
 389-GlnAsnSerGlnSerAlaGlyAspAlaLysMetArgArgGlnAlaGlnAla-405  
 409-PheAlaThrArgGlyPheAspGluAspLysLeuLeu-420  
 438-SerAlaGluArgThrAspArgLysLeuAsnTyr-448  
 454-SerProPheLysAspThrValIle-461  
 464-AlaGlnAsnValAsnValAspProAla-472  
 478-IleArgGlnGluSerArgPhe-484  
 488-AlaGlnSerArgValGlyAla-494  
 504-ThrAlaArgGluIleAlaGly-510  
 520-TyrThrAlaAspGlyAsnIleArgMetGly-529  
 535-AspThrLysArgArgLeuGlnAsnAsnGluVal-545  
 550-GlyTyrAsnAlaGlyProGlyArgAlaArgArgTrpGlnAlaAspThrProLeuGlu-568  
 579-SerGluThrArgAspTyrValLys-586  
 606-LeuLysGlnArgMet-610

**Hydrophilic Regions - Hopp-Woods**

30-GlyLysThrProAlaAspAsnIleGluThrAlaAspLeu-42  
 46-ValProThrArgProAlaGluProGluArgLysThrLeuAla-59  
 69-AspAlaValLysGlnLysAsnAspAla-77  
 85-AsnAlaGlyAspSerAlaMet-91  
 103-LeuGlyAlaArgArgGln-108  
 115-GluTyrAlaLysLeuGluProAlaGlyArgAlaGlnGluValGluCysTyrAlaAspSerSerArgAsnAsp  
 TyrThrArgAlaAlaGluLeuValLysAsnThrGlyLysLeuProSerGlyCys-156  
 170-AspGlyAsnAspAlaTrpArgArgValArgGly-180  
 185-ArgGlnThrThrAspAlaArgAsn-192  
 201-PheAspGlyGlyThrGlnGlySerArgGlu-210  
 217-IleGlyLysGluAlaArgLysSerProAsn-226  
 232-SerGluMetGluSer-236  
 238-LeuSerLeuGluGlnArgSer-244  
 270-ValAlaAspArgArgGlnLeuThrAspAspGlnIle-281  
 287-AlaAlaLeuArgAlaArgArgTrpAspGlu-296  
 304-MetProGluLysLeuGlnLys-310  
 320-ArgSerArgAlaAlaThr-325  
 327-AsnThrGlnGluAlaGluLysLeuTyrLys-336  
 350-AlaGlyGluGluLeuGlyArgLysIleAspThrArgAsnAsnValProAspAlaGlyLysAsnSerValArg  
 ArgMetAlaGluAspGlyAlaValLysArg-383  
 392-GlnSerAlaGlyAspAlaLysMetArgArgGlnAlaGlnAla-405  
 411-ThrArgGlyPheAspGluAspLysLeuLeu-420  
 438-SerAlaGluArgThrAspArgLysLeu-446  
 478-IleArgGlnGluSerArgPhe-484  
 504-ThrAlaArgGluIleAlaGly-510  
 535-AspThrLysArgArgLeuGlnAsn-542  
 554-GlyProGlyArgAlaArgArgTrpGlnAla-563  
 579-SerGluThrArgAspTyrValLys-586  
 606-LeuLysGlnArgMet-610

023

**AMPHI Regions - AMPHI**

-39-

42-LysGluTyrSerAlaTrpGlnAlaPhePheSerGlnThrTrpValLysValPheThrGlnValSerPheIleAlaValPheLeuHisAlaTrpValGly-74  
 77-AspLeuTrpMetAspTyrIleLys-84

**Antigenic Index - Jameson-Wolf**

1-MetValGluArgLysLeuThr-7  
 40-LeuProLysGluTyrSer-45

**Hydrophilic Regions - Hopp-Woods**

1-MetValGluArgLysLeuThr-7

025-2

**AMPHI Regions - AMPHI**

9-AlaAlaCysThrAlaValAlaAlaLeuLeuGlyGlyCysAla-22  
 36-MetGlnAspAlaProSerSerAlaValTyrAsnAsnProTyrGlyAla-51  
 126-AspPheArgAlaTrpAsnGlyMetThrAsp-135  
 140-IleGlyGlnIleValLysVal-146  
 206-AspPheArgAlaTrpAsnGlyMetThrAspAsnMet-217  
 219-SerIleGlyGlnIleValLysVal-226  
 248-AlaValGlnThrProValLysProAlaAla-257  
 261-ValGlnSerAlaProGlnPro-267  
 290-SerGlyThrArgSer-294  
 307-LysValValAlaAspPhe-312  
 343-GlyLeuArgGlyTyrGlyAsn-349

**Antigenic Index - Jameson-Wolf**

22-AlaThrGlnGlnPro-26  
 33-AsnSerGlyMetGlnAspAlaProSerSer-42  
 52-ThrProTyrSerProAlaProAlaGlyAspAlaProTyr-64  
 108-ValArgGlyAspThr-112  
 115-AsnIleSerLysArgTyrHisIleSerGlnAspAspPheArgAla-129  
 131-AsnGlyMetThrAspAsnThrLeu-138  
 144-ValLysValLysProAlaGly-150  
 157-AlaAlaValLysSerArgProAlaVal-165  
 170-GlnProProValGln-174  
 188-ValArgGlyAspThr-192  
 195-AsnIleSerLysArgTyrHisIleSerGlnAspAspPheArgAla-209  
 211-AsnGlyMetThrAspAsnMetLeu-218  
 224-ValLysValLysProAlaGly-230  
 232-AlaAlaProLysThrAlaAlaValGluSerArgProAlaValPro-246  
 252-ProValLysProAlaAlaGlnProProValGlnSerAlaProGlnPro-267  
 270-ProAlaAlaGluAsnLysAlaValPro-278  
 280-ProAlaProGlnSerProAlaAlaSerProSerGlyThrArgSerValGly-296  
 302-ArgProThrGlnGlyLysValValAlaAspPheGlyGlyAsnAsnLysGlyValAsp-320  
 333-AlaAspGlyLysVal-337  
 342-SerGlyLeuArgGlyTyrGly-348  
 363-TyrGlyHisAsnGln-367  
 370-LeuValGlyGluGlyGlnGlnValLysArgGlyGlnGln-382  
 387-GlyAsnThrAspAlaSerArgThrGlnLeu-396  
 398-PheGluValArgGlnAsnGlyLysProValAsnProAsnSer-411

**Hydrophilic Regions - Hopp-Woods**

35-GlyMetGlnAspAlaProSer-41  
 108-ValArgGlyAspThr-112  
 120-TyrHisIleSerGlnAspAspPheArg-128

-40-

144-ValLysValLysPro-148  
 157-AlaAlaValLysSerArgProAlaVal-165  
 188-ValArgGlyAspThr-192  
 200-TyrHisIleSerGlnAspAspPheArg-208  
 224-ValLysValLysPro-228  
 237-AlaAlaValGluSerArgProAlaVal-245  
 253-ValLysProAlaAla-257  
 270-ProAlaAlaGluAsnLysAlaValPro-278  
 290-SerGlyThrArgSer-294  
 313-GlyGlyAsnAsnLysGlyValAsp-320  
 333-AlaAspGlyLysVal-337  
 373-GluGlyGlnGlnValLysArgGlyGln-381  
 389-ThrAspAlaSerArgThr-394  
 400-ValArgGlnAsnGlyLysProValAsn-408

031

**AMPHI Regions - AMPHI**

11-TyrSerAlaIleArgLeuPheThrGlnAlaValIleGluPheProGlnThrAlaGluHisCysArgArgThrA  
 rgAsp-36  
 48-ArgArgProValGln-52

**Antigenic Index - Jameson-Wolf**

1-ArgLeuLysHisGlyVal-6  
 25-ProGlnThrAlaGluHisCysArgArgThrArgAspGlnHisGlnGluArgArgAsnArgGlnGlyPheArgA  
 rgProValGlnHisValGlyArgArgAsnGlnGlnGlnArgHisSerGlnThrCysGlyGlnSerGlyArgAsnHi  
 sAlaGlnLysGlnGlnCysAlaThrArgGln-84

**Hydrophilic Regions - Hopp-Woods**

28-AlaGluHisCysArgArgThrArgAspGlnHisGlnGluArgArgAsnArgGlnGlyPheArgArgProVal-  
 51  
 54-ValGlyArgArgAsnGlnGlnGlnArgHisSerGln-65  
 69-GlnSerGlyArgAsnHisAlaGlnLysGlnGlnCysAlaThrArgGln-84

032-2

**AMPHI Regions - AMPHI**

11-LeuArgArgProLeuArgGln-17  
 67-ProPheAlaAspAsnValTyrPro-74  
 94-ThrAlaAlaValHisGlnPheGluGln-102  
 114-ValHisGlyGlnIleGlnHisProValGlnProPheLeuArg-127  
 134-LeuGlyLeuLeuArgArgPheAspVal-142

**Antigenic Index - Jameson-Wolf**

1-MetArgArgAsnVal-5  
 10-ValLeuArgArgProLeuArg-16  
 28-ArgAlaValProAlaGlyLysGlnGlyPhe-37  
 41-CysArgLeuThrGlnArgGln-47  
 57-AlaAspGlnArgHis-61  
 107-HisArgGlnArgVal-111  
 138-ArgArgPheAspValGlyGlyArgVal-146  
 160-LeuProProArgArgLysLeuAlaSerGlnArgProPheProGln-174

**Hydrophilic Regions - Hopp-Woods**

1-MetArgArgAsnVal-5  
 10-ValLeuArgArgProLeuArg-16

-41-

28-ArgAlaValProAlaGlyLys-34  
 41-CysArgLeuThrGln-45  
 57-AlaAspGlnArgHis-61  
 107-HisArgGlnArgVal-111  
 138-ArgArgPheAspValGlyGly-144  
 161-ProProArgArgLysLeuAlaSer-168  
 033-2

**AMPHI Regions - AMPHI**

6-GlnTyrGlyGlyLeuAlaGlyPheProLysArgCysGluSerGlu-20  
 64-GlyGlnAlaPheGluAlaLeuAsnCys-72  
 95-ValGlyAlaLeuProLysTyrLeuAlaSerAsnValValArgAspMetHisGlyLeuLeuSerThrVal-117  
 120-GlnThrGlyLysValLeuAspLysIleProGlyAlaMetGlu-133  
 142-IleLysThrLeuAlaGlu-147  
 157-SerLeuPheGluAsnPhe-162  
 168-GlyProValAspGlyHisAsnValGluAsnLeuValAspValLeuLysAspLeuArgSerArg-188  
 207-AlaGluAsnAspPro-211  
 213-LysTyrHisAlaValAlaAsnLeuProLysGluSerAlaAla-226  
 242-TyrThrGlnValPheGlyLys-248  
 280-PheProAspArgTyrPheAspVal-287  
 307-LysProValValAlaIleTyrSer-314  
 316-PheLeuGlnArgAlaTyrAspGlnLeu-324  
 363-CysValProAsnMet-367  
 390-AlaProAlaAlaValArgTyrProArgGlyThr-400  
 406-ValSerAspGlyMetGluThrValGlu-414  
 419-IleIleArgArgGlu-423  
 432-PheGlySerMetValAla-437  
 453-MetArgPheValLysProIleAspGluGlu-462  
 469-ArgSerHisAspArgIle-474  
 489-AlaValLeuGluValLeu-494  
 510-AspThrValThrGlyHisGly-516  
 518-ProLysLysLeuLeu-522

**Antigenic Index - Jameson-Wolf**

11-AlaGlyPheProLysArgCysGluSerGluTyrAspAla-23  
 28-HisSerSerThrSerIle-33  
 41-AlaAlaAspLysLeuLeuGlySerAspArgArgSerVal-53  
 57-GlyAspGlyAlaMetThr-62  
 72-CysAlaGlyAspMetAspVal-78  
 85-AsnAspAsnGluMetSerIle-91  
 105-AsnValValArgAspMetHisGly-112  
 117-ValLysAlaGlnThrGlyLysValLeuAspLysIleProGly-130  
 134-PheAlaGlnLysValGluHisLysIleLysThrLeuAlaGluGluAlaGluHisAlaLysGln-154  
 166-TyrThrGlyProValAspGlyHisAsn-174  
 181-ValLeuLysAspLeuArgSerArgLysGlyProGln-192  
 198-ThrLysLysGlyAsnGlyTyrLysLeuAlaGluAsnAspProValLys-213  
 220-LeuProLysGluSerAlaAla-226  
 228-MetProSerGluLysGluProLysProAlaAlaLysProThrTyr-242  
 253-ArgAlaAlaAlaAspSerArgLeu-260  
 266-AlaMetArgGluGlySerGlyLeuValGluPheGluGlnArgPheProAspArgTyrPhe-285  
 345-ValGlyAlaAspGlyProThrHis-352  
 370-AlaAlaProSerAspGluAsnGluCysArg-379  
 395-ArgTyrProArgGlyThrGlyThrGlyAlaProValSerAspGlyMetGluThrValGluIleGlyLysGly  
 IleIleArgArgGluGlyGluLysThrAla-428  
 457-LysProIleAspGluGluLeuIle-464  
 467-LeuAlaArgSerHisAspArgIleValThrLeuGluGluAsnAlaGluGlnGlyGlyAlaGlyGly-488

-42-

512-ValThrGlyHisGlyAspProLysLysLeuLeuAspAspLeuGlyLeu-527  
530-GluAlaValGluArgArgValArg-537  
540-LeuSerAspArgAspAlaAlaAsn-547

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**Hydrophilic Regions - Hopp-Woods**

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13-PheProLysArgCysGluSerGluTyrAsp-22

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41-AlaAlaAspLysLeuLeuGlySerAspArgArgSerVal-53

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74-GlyAspMetAspVal-78

85-AsnAspAsnGluMetSerIle-91

106-ValValArgAspMetHis-111

123-LysValLeuAspLysIleProGly-130

134-PheAlaGlnLysValGluHisLysIleLysThrLeuAlaGluGluAlaGluHisAlaLysGln-154

181-ValLeuLysAspLeuArgSerArgLysGlyPro-191

198-ThrLysLysGlyAsnGly-203

205-LysLeuAlaGluAsnAspProValLys-213

220-LeuProLysGluSerAlaAla-226

228-MetProSerGluLysGluProLysProAlaAla-238

253-ArgAlaAlaAlaAspSerArgLeu-260

266-AlaMetArgGluGlySerGly-272

274-ValGluPheGluGlnArgPheProAspArgTyrPhe-285

372-ProSerAspGluAsnGluCys-378

"

405-ProValSerAspGlyMetGluThrValGluIleGlyLysGlyIleIleArgArgGluGlyGluLysThrAla-428

"

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457-LysProIleAspGluGluLeuIle-464

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467-LeuAlaArgSerHisAspArgIleValThrLeuGluGluAsnAlaGluGlnGlyGly-485

"

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513-ThrGlyHisGlyAspProLysLysLeuLeuAsp-523

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530-GluAlaValGluArgArgValArg-537

540-LeuSerAspArgAspAlaAlaAsn-547

034-2

**AMPHI Regions - AMPHI**

-43-

35-LeuAspHisAlaAla-39  
 52-AsnLeuGluGlnMetArgAlaIleMetGluAlaAlaAspGln-65  
 94-AlaValGluGluPheProHisIlePro-102  
 152-ThrValValAsnPheSer-157  
 168-IleGlyValLeuGlyAsnLeuGluThrGly-177  
 186-GlyAlaValGlyLysLeuSer-192  
 226-TyrLysPheThrArgProProThrGly-234  
 236-ValLeuArgIleAspArgIleLysGluIleHisGlnAlaLeu-249  
 261-SerValProGlnGluTrpLeuLysValIleAsnGluTyrGlyGlyAsnIleGlyGluThrTyrGlyValPro  
 ValGluGluIleValGluGlyIleLysHisGly-295  
 314-ArgArgTyrLeuAlaGluAsn-320  
 330-LeuSerLysThrIleGluAlaMetLys-338

**Antigenic Index - Jameson-Wolf**

20-LeuProLysGluThrGln-25  
 37-HisAlaAlaGluAsnSerTyrGly-44  
 54-GluGlnMetArgAlaIleMetGluAlaAlaAspGlnValAsp-67  
 75-SerAlaGlyAlaArgLysTyrAla-82  
 106-HisGlnAspHisGlyAlaSerProAspValCysGlnArgSerIle-120  
 129-MetAspGlySerLeuMetGluAspGlyLysThrProSerSerTyrGluTyr-145  
 164-ValGluGlyGluIle-168  
 173-AsnLeuGluThrGlyGluAlaGlyGluGluAspGlyVal-185  
 191-LeuSerHisAspGln-195  
 208-LysAspThrGlyVal-212  
 221-ThrSerHisGlyAla-225  
 227-LysPheThrArgProProThrGlyAspValLeuArgIleAspArgIleLysGluIleHis-246  
 258-GlySerSerSerValPro-263  
 271-AsnGluTyrGlyGlyAsnIleGlyGlu-279  
 287-GluIleValGluGlyIleLysHisGlyValArgLysValAsnIleAspThrAspLeuArgLeuAlaSerThr  
 GlyAlaVal-313  
 316-TyrLeuAlaGluAsnProSerAspPheAspProArgLysTyrLeuSer-331  
 333-ThrIleGluAlaMetLys-338  
 350-CysGluGlyGlnAlaGlyLysIleLysProValSerLeuGluLysMetAlaSerArgTyrAlaLysGlyGlu  
 Leu-374

**Hydrophilic Regions - Hopp-Woods**

54-GluGlnMetArgAlaIleMetGluAlaAlaAspGlnValAsp-67  
 76-AlaGlyAlaArgLysTyrAla-82  
 108-AspHisGlyAlaSerProAspValCysGln-117  
 132-SerLeuMetGluAspGlyLysThrProSer-141  
 164-ValGluGlyGluIle-168  
 175-GluThrGlyGluAlaGlyGluGluAspGlyVal-185  
 208-LysAspThrGlyVal-212  
 235-AspValLeuArgIleAspArgIleLysGluIleHis-246  
 287-GluIleValGluGlyIleLysHisGlyValArgLysValAsnIleAspThrAspLeuArgLeu-307  
 320-AsnProSerAspPheAspProArgLysTyrLeu-330  
 333-ThrIleGluAlaMetLys-338  
 352-GlyGlnAlaGlyLysIleLysProValSerLeuGluLysMetAlaSerArgTyrAlaLysGlyGluLeu-374

036-1

**AMPHI Regions - AMPHI**

6-AlaValTyrSerAlaCysAlaAla-13  
 29-GlyArgCysValAsnGlnTyr-35  
 59-SerSerGlyArgPheCysGlnThrIleLys-68

-44-

106-AlaAlaSerSerSerGlnSer-112

142-AlaAsnArgArgVal-146

**Antigenic Index - Jameson-Wolf**

16-ProAlaArgThrSerSerSerArgArgCysValSerSerGlyArgCysValAsnGlnTyrSerSerArgAlaAspAla-41

43-ProTrpArgArgHisSerGlyAla-50

55-CysSerSerAspSerSerGlyArgPhe-63

73-ProSerPheSerAlaArgLysThrCysSerAspGlyGluThrSerAlaAspSerAsnTrpArg-93

96-HisAlaAspGlyLeuGlnThrAlaSerSerAlaAlaSerSerSerGlnSerAlaGlnThrAlaArgArgMetPhe-120

133-SerGlyArgPheCysCysGlyArgArgAlaAsnArgArgValArgHisGlyArgGlnAspAsnArgPro-155

158-ProMetArgGluSerArgArgGlnSerAla-167

178-LeuProAlaArgThrArgCys-184

186-CysArgLeuLysArgArgIleProProAla-195

200-ProProAlaArgProAspAsnArgSerAsnGlyGlySerSerAlaTyrArgThrMetHisLysThrLeuArgProTyrGluArgPro-228

**Hydrophilic Regions - Hopp-Woods**

18-ArgThrSerSerSerArgArgCysValSerSer-28

35-TyrSerSerArgAlaAsp-40

45-ArgArgHisSerGly-49

55-CysSerSerAspSerSerGlyArg-62

75-PheSerAlaArgLysThrCysSerAspGlyGluThrSerAla-88

107-AlaSerSerSerGlnSer-112

114-GlnThrAlaArgArgMetPhe-120

137-CysCysGlyArgArgAlaAsnArgArgValArgHisGlyArgGlnAspAsnArgPro-155

160-ArgGluSerArgArgGlnSer-166

178-LeuProAlaArgThrArgCys-184

186-CysArgLeuLysArgArgIleProPro-194

202-AlaArgProAspAsnArgSerAsnGlyGly-211

217-ThrMetHisLysThrLeuArgProTyrGluArgPro-228

038

**AMPHI Regions - AMPHI**

100-GluAlaLysAspHis-104

134-GluSerIleLys-137

157-GluLysGlyThrGlyGluLeuSerAlaValGlnGluValGluLys-171

178-AlaProIleAlaSerLeuAsn-184

195-GluPheGlyGlnPheLeuGluProValArgAlaTyrArgArgGlnTyrGlyVal-212

**Antigenic Index - Jameson-Wolf**

2-ThrAspPheArgGlnAspPhe-8

22-GluPheThrThrLysAlaGlyArgArgSerPro-32

38-GlyLeuPheAsnAspGlyLeu-44

58-IleGluSerGlyIleArg-63

85-LeuAlaGluLysGlyVal-90

96-TyrAsnArgLysGluAlaLysAspHisGlyGluGlyGly-108

125-ValIleSerAlaGlyThrSerValArgGluSerIleLysLeuIleGluAlaGluGlyAlaThrLeuAspArgMetGluLysGlyThrGlyGlu-162

167-GlnGluValGluLysGlnTyrGlyLeu-175

191-GlnAsnAsnProGluPheGlyGln-198

203-ValArgAlaTyrArgArgGlnTyrGlyValGlu-213

**Hydrophilic Regions - Hopp-Woods**

2-ThrAspPheArgGlnAspPhe-8  
 22-GluPheThrThrLysAlaGlyArgArgSer-31  
 85-LeuAlaGluLysGlyVal-90  
 96-TyrAsnArgLysGluAlaLysAspHisGlyGlu-106  
 130-ThrSerValArgGluSerIleLysLeuIleGluAlaGluGlyAlaThr-145  
 153-LeuAspArgMetGluLysGlyThrGlyGlu-162  
 167-GlnGluValGluLysGlnTyr-173  
 204-ArgAlaTyrArgArgGlnTyrGly-211

**040-2****AMPHI Regions - AMPHI**

8-ValAlaHisPheArgGluAlaValProTyrIleArg-19  
 28-AlaGlyIleAspAsp-32  
 38-AspThrLeuAsnLysLeu-43  
 78-ProHisTyrCysArgGlyLeuArgValThrAspGlu-89  
 92-LeuGluGlnAlaGlnGlnPheAlaGly-100  
 113-SerValSerGlyPheAlaArgAlaPro-121  
 134-ArgProIleGlyValIleAspGly-141  
 146-TyrAlaGlyValIleArg-151  
 187-LeuGlnThrAlaAla-191  
 207-LeuSerAspGlyIleSerArgProAspGlyThrLeuAlaGlu-220  
 223-SerAlaGlnGluAlaGlnSerLeuAlaGluHisAla-234  
 244-SerAlaValAlaAlaLeuGluGly-251  
 277-IleGlyThrSerIle-281  
 289-IleArgGlnAlaHisSerGlyAspIleProHisIleAlaAlaLeuIleArgProLeuGlu-308  
 320-TyrLeuGluAsnHisIleSerGluPheSerIle-330  
 338-TyrGlyCysAlaAlaLeuLysThrPheAlaGluAlaAsp-350  
 371-ArgLeuLeuAlaHisIle-376  
 386-SerArgLeuPheAla-390

**Antigenic Index - Jameson-Wolf**

19-ArgGlnMetArgGlyLysThrLeu-26  
 29-GlyIleAspAspArgLeuLeuGluGlyAspThrLeuAsn-41  
 65-HisPheLeuAspArgHisAlaAlaAlaGlnGlyArgThrProHisTyrCysArgGlyLeuArgValThrAspGluThrSerLeuGluGlnAlaGln-96  
 101-ThrValArgSerArgPheGlu-107  
 119-ArgAlaProSerVal-123  
 140-AspGlyThrAspMetGluTyr-146  
 150-IleArgLysThrAspThrAlaAla-157  
 173-LeuGlyHisSerTyrSerGlyLysThrPhe-182  
 208-SerAspGlyIleSerArgProAspGlyThrLeuAla-219  
 222-LeuSerAlaGlnGluAlaGlnSerLeuAlaGluHisAlaGlyGlyGluThrArgArgLeuIle-242  
 249-LeuGluGlyGlyVal-253  
 261-GlyAlaAlaAspGlySerLeuLeu-268  
 272-PheThrArgAsnGlyIleGlyThrSerIleAlaLysGluAlaPheVal-287  
 289-IleArgGlnAlaHisSerGlyAspIle-297  
 305-ArgProLeuGluGluGlnGly-311  
 313-LeuLeuHisArgSerArgGluTyrLeu-321  
 331-LeuGluHisAspGlyAsnLeuTyr-338  
 345-ThrPheAlaGluAlaAspCysGlyGlu-353  
 361-ProGlnAlaGlnAspGlyGlyTyrGlyGluArgLeu-372

-46-

377-IleAspLysAlaArgGly-382  
 393-ThrAsnThrGlyGlu-397  
 402-ArgGlyPheGlnThrAlaSerGluAspGluLeuProGluThrArgArgLysAspTyrArgSerAsnGlyArg  
 AsnSerHisIleLeu-430

**Hydrophilic Regions - Hopp-Woods**

19-ArgGlnMetArgGlyLysThr-25  
 29-GlyIleAspAspArgLeuLeuGluGlyAspThrLeuAsn-41  
 65-HisPheLeuAspArgHisAlaAlaAlaGlnGlyArgThr-77  
 84-LeuArgValThrAspGluThrSerLeuGluGln-94  
 102-ValArgSerArgPheGlu-107  
 140-AspGlyThrAspMetGluTyr-146  
 150-IleArgLysThrAspThrAlaAla-157  
 210-GlyIleSerArgProAspGlyThrLeu-218  
 222-LeuSerAlaGlnGluAlaGlnSerLeuAlaGlu-232  
 234-AlaGlyGlyGluThrArgArgLeuIle-242  
 291-GlnAlaHisSerGlyAsp-296  
 305-ArgProLeuGluGluGlnGly-311  
 315-HisArgSerArgGluTyrLeu-321  
 345-ThrPheAlaGluAlaAspCysGlyGlu-353  
 362-GlnAlaGlnAspGlyGlyTyrGlyGlu-370  
 377-IleAspLysAlaArgGly-382  
 402-ArgGlyPheGlnThrAlaSerGluAspGluLeuProGluThrArgArgLysAspTyrArgSerAsnGlyArg  
 Asn-426

**041-1****AMPHI Regions - AMPHI**

6-AspProTyrArgHisPheGluAsnLeuAspSerAlaGluThr-19  
 45-AspGlyIleLeuAla-49  
 78-LysGlyValTyrArgValCysThrAlaAla-87  
 102-ValAlaAspPheAspGluLeuLeu-109  
 117-GlyValSerHisLeuValGluGlnProAsn-126  
 219-ValAsnAlaTrpArgTyrLeuAsp-226  
 232-IleAspLeuIleGluAlaSer-238  
 258-LeuAsnLeuProAsnAspCysAspValValGlyTyrLeu-270  
 282-TrpAsnArgAlaAsnGln-287  
 317-GlnAlaLeuGluSerValGluThr-324  
 331-AlaSerLeuLeuGluAsnValGlnGlyArg-340  
 382-AspPheThrThrProLeu-387  
 405-GlnProGlnGlnPhe-409  
 451-GlyPheGlyIleProGluLeuProHisTyrLeuGlySerIleGlyLys-466  
 493-AlaAlaGlnGlyIleSerLysHisLysSerValAspAspLeuLeuAlaValValArgAspLeuSerGluArg  
 -516  
 519-SerSerProGluHis-523  
 541-ValArgGluProGlnSer-546  
 556-LeuThrAspMetIleArgTyr-562  
 571-TrpThrAspGluTyrGlyAsnProGlnLysTyrGlu-582  
 591-LeuSerProTyrHisAsnLeuSerAspGlyIleAspTyrProPro-605  
 620-AlaHisAlaLeuLys-624  
 626-TyrAlaLysLeuArg-630  
 645-GlyHisThrGlyAsn-649  
 651-ThrGlnArgGluSer-655

**Antigenic Index - Jameson-Wolf**

-47-

1-MetLysSerTyrProAspProTyrArgHisPheGluAsnLeuAspSerAlaGluThrGln-20  
 26-AlaAsnAlaGluThrArgAlaArgPheLeuGluAsnAspLysAlaArgAlaLeuSerAspGly-46  
 51-LeuGlnAspThrArgGlnIleProPhe-59  
 61-GlnGluHisArgAlaArg-66  
 72-GlnAspAlaGluTyrProLysGlyVal-80  
 89-TyrArgSerGlyTyrProGluTrp-96  
 104-AspPheAspGluLeuLeuGlyAspAspValTyr-114  
 123-GluGlnProAsnArg-127  
 133-SerLysLeuGlySerAspThrAlaTyr-141  
 145-ValAspLeuGluAlaGlyGluLeuValGlu-154  
 161-AlaGlyLysAsnHisValSerTrpArgAspGluAsnSerVal-174  
 178-ProAlaTrpAsnGluArgGlnLeuThrGlnSerGlyTyrProArgGluValTrpLeuValGluArgGlyLys  
 SerPheGluGluSerLeu-207  
 212-IleGlyGluAspGlyMet-217  
 223-ArgTyrLeuAspProGlnGlySerProIleAspLeuIleGluAlaSerAspGlyPheTyr-242  
 249-ValSerAlaGluGlyGluAlaLysProLeuAsnLeuProAsnAspCysAspVal-266  
 277-ThrLeuArgLysAspTrpAsnArgAlaAsnGlnSerTyrProSer-291  
 298-LysLeuAsnArgGlyGluLeuGly-305  
 313-ProAspGluThrGlnAla-318  
 320-GluSerValGluThrThrLys-326  
 337-ValGlnGlyArgLeuLysAla-343  
 345-ArgPheAlaAspGlyLysTrpGlnGluValGluLeuProArgLeuProSerGly-362  
 365-GluMetThrAspGlnProTrpGlyGly-373  
 401-ValMetArgArgGlnProGlnGlnPheAspSerAspGlyIleAsn-415  
 422-ThrSerAlaAspGlyGluArgIle-429  
 435-GlyLysAsnAlaAlaProAspMet-442  
 479-AsnIleArgGlyGlyGlyGluPheGlyProArgTrpHis-491  
 496-GlyIleSerLysHisLysSerValAspAsp-505  
 511-ArgAspLeuSerGluArgGlyIleSerSerProGluHisIle-524  
 G528-lyGlySerAsnGly-532  
 540-PheValArgGluProGlnSerIleGlyAla-549  
  
 568-GlySerSerTrpThrAspGluTyrGlyAsnProGlnLysTyrGluValCysLysArgArgLeuGlyGluLeu  
 SerProTyr-594  
  
 596-AsnLeuSerAspGlyIleAspTyrPro-604  
  
 610-ThrSerLeuSerAspAspArgValHis-618  
 627-AlaLysLeuArgGluThrSerAla-634  
 639-TyrSerProAspGlyGlyGlyHisThrGlyAsnGlyThrGlnArgGluSerAlaAspGluLeu-659

**Hydrophilic Regions - Hopp-Woods**

3-SerTyrProAspProTyrArgHis-10  
 12-GluAsnLeuAspSerAlaGluThr-19  
 26-AlaAsnAlaGluThrArgAlaArgPheLeuGluAsnAspLysAlaArgAlaLeuSer-44  
 52-GlnAspThrArgGln-56  
 61-GlnGluHisArgAlaArg-66  
 72-GlnAspAlaGluTyrPro-77  
 104-AspPheAspGluLeuLeuGly-110  
 145-ValAspLeuGluAlaGlyGluLeuValGlu-154  
 166-ValSerTrpArgAspGluAsnSer-173  
 180-TrpAsnGluArgGlnLeuThr-186  
 198-GluArgGlyLysSerPheGluGluSerLeu-207  
 212-IleGlyGluAspGlyMet-217  
 233-AspLeuIleGluAlaSerAsp-239

-48-

249-ValSerAlaGluGlyGluAlaLysPro-257  
 278-LeuArgLysAspTrpAsnArg-284  
 298-LysLeuAsnArgGlyGluLeuGly-305  
 313-ProAspGluThrGlnAla-318  
 320-GluSerValGluThrThrLys-326  
 337-ValGlnGlyArgLeuLysAla-343  
 401-ValMetArgArgGlnProGlnGlnPheAspSerAspGlyIleAsn-415  
 424-AlaAspGlyGluArg-428  
 436-LysAsnAlaAlaProAsp-441  
 481-ArgGlyGlyGlyGluPheGly-487  
 496-GlyIleSerLysHisLysSerValAspAsp-505  
 511-ArgAspLeuSerGluArgGlyIleSerSer-520  
 540-PheValArgGluProGlnSer-546  
 571-TrpThrAspGluTyrGlyAsn-577  
 579-GlnLysTyrGluValCysLysArgArgLeuGlyGlu-590  
 612-LeuSerAspAspArgValHis-618  
 627-AlaLysLeuArgGluThrSer-633  
 650-GlyThrGlnArgGluSerAlaAspGluLeu-659

**042-1****AMPHI Regions - AMPHI**

17-AlaLeuSerAsnThrSerThr-23  
 33-AlaValArgSerMetMetLysIle-40  
 138-SerProLeuValArgIleLeuProLeuSer-147  
 151-SerMetValValAlaPhePheAlaAsn-159

**Antigenic Index - Jameson-Wolf**

14-ArgThrSerAlaLeuSerAsnThrSerThrAlaAlaGlyProSerCys-29  
 49-TyrSerLysGluThrGlyCysProCysProSerLeuArgLysAspSerSerThrGlyGlyArgProMetSerProCys-74  
 77-LeuAlaAsnArgAspCysValProLysAlaAspThr-88  
 93-ThrAspSerThrSerProArgProLeu-101  
 122-AlaArgAlaSerLeuProLysIleArgAlaLysVal-133  
 160-CysSerTyrAlaSerAlaProGlyPro-168

**Hydrophilic Regions - Hopp-Woods**

49-TyrSerLysGluThrGlyCys-55  
 59-SerLeuArgLysAspSerSerThrGlyGlyArgProMet-71  
 78-AlaAsnArgAspCysValProLysAlaAspThr-88  
 94-AspSerThrSerProArg-99  
 125-SerLeuProLysIleArgAlaLysVal-133

**043-2****AMPHI Regions - AMPHI**

24-ValGluProSerArg-28  
 36-HisGlyGlyLeuAspGlyAlaAlaGlyPheAspGluGlyGluArg-50  
 59-AlaSerGlyAspGlyPhe-64  
 83-AlaGlyAspPheGlyAspGlyGlnArg-91

**Antigenic Index - Jameson-Wolf**

1-MetProProAlaPro-5  
 11-IleArgArgGlnLysSerValMetProSerGluArgPheValGluProSerArg-28  
 35-ValHisGlyGlyLeuAspGlyAlaAlaGlyPheAspGluGlyGluArgValPhe-52  
 56-AlaAlaGlnAlaSerGlyAspGlyPheAla-65

-49-

79-GlnSerAspAlaAlaGlyAspPheGlyAspGlyGlnArgThrGlyGlu-94  
 96-ValLeuGlnAspValGlyGly-102  
 116-AlaGluGlyGluAlaGln-121

**Hydrophilic Regions - Hopp-Woods**

11-IleArgArgGlnLysSerValMetProSerGluArgPheValGluProSerArg-28  
 43-AlaGlyPheAspGluGlyGluArgValPhe-52  
 81-AspAlaAlaGlyAspPheGlyAspGlyGlnArgThrGly-93  
 116-AlaGluGlyGluAlaGln-121

**046-2****AMPHI Regions - AMPHI**

6-ArgProThrSerSerPro-11  
 46-ThrSerCysSerGlyLeuMetValSer-54  
 64-PheSerLeuPheSerSer-69  
 113-LysSerAlaSerSer-117  
 143-SerCysAsnAlaPheSerSer-149  
 155-ThrSerLeuLeuGlyMetAlaAlaArgPheCysAlaThrVal-168

**Antigenic Index - Jameson-Wolf**

6-ArgProThrSerSerProProArgArgAlaCys-16  
 20-IleArgThrArgSerSerAlaLysArgLysThrCysAsnAlaProGlyGlnSerIleArgProAlaSerCysSer-44  
 57-ProAsnMetGluArgLeuPro-63  
 75-SerArgTyrSerLeuGluArgThrArgAlaMetArgProGlyMetLeuAsnArgSerAlaAla-95  
 105-SerLeuArgGluSerAlaSerSerLysSerAlaSerSerAlaProAlaArgSerAsnValLysGlyAspAlaProLeuProLysThrValTrpThrSerArgArgLeuProVal-142  
 169-GluProThrCysProLeuProLys-176

**Hydrophilic Regions - Hopp-Woods**

7-ProThrSerSerProProArgArgAlaCys-16  
 20-IleArgThrArgSerSerAlaLysArgLysThrCysAsn-32  
 36-GlnSerIleArgProAlaSer-42  
 58-AsnMetGluArgLeuPro-63  
 75-SerArgTyrSerLeuGluArgThrArgAlaMetArg-86  
 105-SerLeuArgGluSerAlaSerSerLysSerAlaSer-116  
 118-AlaProAlaArgSerAsnValLysGlyAspAlaProLeu-130

**047-2****AMPHI Regions - AMPHI**

17-IleAlaAspIleAlaGlnAspLeuProAspGlyAla-28  
 62-AlaGluAsnIleGlyAlaVal-68  
 93-ArgLeuAlaLysGlnLeuGlu-99  
 141-TyrIleAspGluIleAspValPhe-148  
 161-SerAlaLeuLeuAla-165  
 185-LeuLeuGluGlyAsn-189  
 202-IleGlySerIleLeuAla-207  
 247-SerGlyIleLysTrpProGluGlyCys-255  
 257-IleAlaAlaValValArgAlaGlyThrGly-266  
 293-IleLeuAsnGluLeuGluLysLeuIle-301

**Antigenic Index - Jameson-Wolf**

5-GlnAlaArgArgGlyGlyLeuLeu-12  
 20-IleAlaGlnAspLeuProAspGlyAlaAsp-29  
 36-TyrArgAsnAsnArgLeu-41

-50-

51-IleGluGlyAspGlu-55  
 70-ProGluLeuArgProLysGluThrSerThrArgArgIleMet-83  
 86-GlyGlyGlyAsnIle-90  
 96-LysGlnLeuGluHis-100  
 106-IleIleGluCysArgProArgArgAlaGluTrpIle-117  
 119-GluAsnLeuAspAsnThrLeu-125  
 130-SerAlaThrAspGluThrLeuLeuAspAsnGluTyrIleAspGluIleAsp-146  
 152-ThrAsnAspAspGluSerAsnIle-159  
 168-LeuGlyAlaLysArgVal-173  
 178-AsnArgSerSerTyr-182  
 186-LeuGluGlyAsnLysIle-191  
 208-HisIleArgArgGlyAspIleVal-215  
 219-ProIleArgArgGlyThrAlaGluAlaIleGlu-229  
 232-AlaHisGlyAspLysLysThrSer-239  
 242-IleGlyArgArgIleSerGlyIleLysTrpProGluGlyCysHis-256  
 262-ArgAlaGlyThrGlyGluThr-268  
 277-ValIleGlnAspGlyAspHis-283  
 288-ValSerArgArgArgIleLeuAsnGluLeuGluLys-299

**Hydrophilic Regions - Hopp-Woods**

5-GlnAlaArgArgGlyGly-10  
 20-IleAlaGlnAspLeuProAspGlyAlaAsp-29  
 51-IleGluGlyAspGlu-55  
 70-ProGluLeuArgProLysGluThrSerThrArgArgIleMet-83  
 106-IleIleGluCysArgProArgArgAlaGluTrpIle-117  
 130-SerAlaThrAspGluThrLeuLeu-137  
 140-GluTyrIleAspGluIleAsp-146  
 152-ThrAsnAspAspGluSerAsnIle-159  
 168-LeuGlyAlaLysArgVal-173  
 186-LeuGluGlyAsnLysIle-191  
 209-IleArgArgGlyAspIle-214  
 219-ProIleArgArgGlyThrAlaGluAlaIleGlu-229  
 232-AlaHisGlyAspLysLysThrSer-239  
 242-IleGlyArgArgIleSer-247  
 277-ValIleGlnAspGlyAsp-282  
 289-SerArgArgArgIleLeuAsnGluLeuGluLys-299  
 049-2

**AMPHI Regions - AMPHI**

15-GlnHisLeuLeuGlu-19  
 34-AspAspAlaValAspGlyIleGlyGlnMet-43  
 50-GlnProPheGlyGln-54  
 61-GluHisPheAlaProValAspGlyPheArg-70  
 79-HisGlnArgPhePheArgIle-85  
 202-ArgGlyAlaGlyGlnArgArgValSerArgHisCys-213  
 217-AlaArgLeuThrGlnValPheGlnThrPhePhe-227

**Antigenic Index - Jameson-Wolf**

6-PheAspTyrArgProArgLeuLeu-13  
 21-IleGlyGluAsnArgHis-26  
 28-LeuLeuHisArgArgSerAspAspAlaValAspGlyIleGly-41  
 49-AspGlnProPheGly-53  
 64-AlaProValAspGlyPheArgValGlnAspIleAspLeuAspGlyHisGlnArgPhe-82  
 89-ValPheArgAsnArgArgLeuIle-96  
 111-LeuSerGlyPheLys-115  
 122-GlyIleLysProAspSerProProArgPhe-131

-51-

135-PheArgAsnArgHisLeuGlnGlySerLeuArgVal-146  
 150-PheLeuLysAspAspHisArgValGly-158  
 182-GlnHisThrGlySer-186  
 193-ArgHisArgArgValArgSerGlyPheArgGlyAlaGlyGlnArgArgValSerArgHisCys-213  
 246-LysGlnThrAsnProArgProLysArgGlyLeu-256

**Hydrophilic Regions - Hopp-Woods**

21-IleGlyGluAsnArgHis-26  
 30-HisArgArgSerAspAspAlaValAsp-38  
 67-AspGlyPheArgValGlnAspIleAspLeuAspGlyHisGlnArg-81  
 91-ArgAsnArgArgLeuIle-96  
 124-LysProAspSerProProArg-130  
 150-PheLeuLysAspAspHisArgVal-157  
 193-ArgHisArgArgValArgSerGlyPheArgGlyAlaGlyGlnArgArgValSerArg-211  
 246-LysGlnThrAsnProArgProLysArgGlyLeu-256

**050-1****AMPHI Regions - AMPHI**

10-IleGlnSerIleCysAspAlaPheGlnPheIleSerTyrTyr-23  
 25-ProLysAspTyrIleAspAlaLeuTyrLysAlaTrpGlnLys-38  
 94-ValAsnGluGlyVal-98  
 163-AsnProSerAspAsnIleValAspTrpValLeuLys-174  
 177-ProThrMetGlyAla-181  
 235-LeuGluLeuPheGluLysValAsnAla-243  
 250-GlyLeuGlyGlyLeuThrThr-256  
 275-AlaMetIleProAsn-279  
 302-ArgValGluAspTrpProAspLeuThr-310  
 315-AsnGlyLysArgValAspValAsp-322  
 353-LysArgLeuValAspMetLeuAsnLys-361  
 367-ValAspPheThrAsnArgLeu-373  
 379-ProValAspProValGlyAspGlu-386  
 396-AlaThrArgMetAspLysPheThrArgGlnMet-406  
 410-ThrAspLeuLeuGlyMet-415  
 422-GlyValAlaThrCysGluAlaIleAla-430  
 452-LysSerSerLysValLeuAlaPhe-459  
 490-AlaThrAlaProArgLysTrp-496

**Antigenic Index - Jameson-Wolf**

4-IleLysGlnGluAspPheIle-10  
 23-TyrHisProLysAspTyrIleAspAlaLeu-32  
 36-TrpGlnLysGluGluAsnProAlaAlaLysAspAlaMet-48  
 55-SerArgMetCysAlaGluAsnAsnArgProIleCysGlnAspThrGly-70  
 88-MetSerValGluGluMetValAsnGluGlyValArgArgAlaTyrThrTrpGluGlyAsnThrLeuArgAlaSerVal-113  
 116-AspProAlaGlyLysArgGlnAsnThrLysAspAsnThr-128  
 138-ProGlyGlyLysValGluVal-144  
 148-AlaLysGlyGlyGlySerGluAsnLysSerLysLeu-159  
 163-AsnProSerAspAsnIle-168  
 192-GlyIleGlyGlyThrProGluLysAlaValLeuMetAlaLysGluSerLeu-208  
 213-AspIleGlnGluLeuGlnGluLysAlaAlaSerGlyAlaGluLeuSerThr-229  
 284-ArgHisValGluPheGluLeuAspGlySerGlyProValGluLeuThrProProArgValGluAspTrpProAspLeuThrTyrSerProAspAsnGlyLysArgValAspValAspLysLeuThrLysGluGluValAlaSer-331  
 345-LeuThrGlyArgAspAlaAlaHisLysArgLeuVal-356  
 359-LeuAsnLysGlyGluGluLeuPro-366

-52-

379-ProValAspProValGlyAspGluValValGlyProAlaGlyProThrThrAlaThrArgMetAspLysPhe  
 ThrArgGlnMetLeuGluGlnThrAsp-411  
 417-GlyLysSerGluArgGlyValAlaThr-425  
 428-AlaIleAlaAspAsnLysAla-434  
 450-AlaIleLysSerSerLys-455  
 470-PheGluValLysAspMetPro-476  
 481-ValAspSerLysGlyGluSerIle-488  
 492-AlaProArgLysTrpGlnAla-498

**Hydrophilic Regions - Hopp-Woods**

4-IleLysGlnGluAspPheIle-10  
 36-TrpGlnLysGluGluAsnProAlaAlaLysAspAlaMet-48  
 57-MetCysAlaGluAsnAsnArgProIleCys-66  
 88-MetSerValGluGluMetValAsnGluGlyValArgArg-100  
 117-ProAlaGlyLysArgGlnAsnThrLysAspAsnThr-128  
 140-GlyLysValGluVal-144  
 148-AlaLysGlyGlyGlySerGluAsnLysSerLysLeu-159  
 195-GlyThrProGluLysAlaValLeuMetAlaLysGluSerLeu-208  
 213-AspIleGlnGluLeuGlnGluLysAlaAlaSer-223  
 225-AlaGluLeuSerThr-229  
 284-ArgHisValGluPheGluLeuAspGly-292  
 299-ThrProProArgValGluAspTrpPro-307  
 313-ProAspAsnGlyLysArgValAspValAspLysLeuThrLysGluGluValAlaSer-331  
 345-LeuThrGlyArgAspAlaAlaHisLysArgLeuVal-356  
 359-LeuAsnLysGlyGluGluLeuPro-366  
 382-ProValGlyAspGluValVal-388  
 397-ThrArgMetAspLysPheThrArgGlnMetLeuGluGlnThrAsp-411  
 417-GlyLysSerGluArgGlyValAla-424  
 428-AlaIleAlaAspAsnLysAla-434  
 450-AlaIleLysSerSerLys-455  
 470-PheGluValLysAspMetPro-476  
 481-ValAspSerLysGlyGluSerIle-488  
 492-AlaProArgLysTrpGlnAla-498

052

**AMPHI Regions - AMPHI**

12-AlaProCysPheLysGlyCysGluProThrGlyAsp-23  
 41-AlaLysAlaSerLysSerAlaThrSerProLysGlyLeuAspGlyValSerLys-58  
 67-ThrAlaAlaPheHisSerPheIleSer-75  
 84-MetProAsnLeuValThrMetLeu-91

**Antigenic Index - Jameson-Wolf**

4-ValAlaGluGluThrGluIle-10  
 14-CysPheLysGlyCysGluProThrGlyAspSerArgLeuLeuSerThrThrLysSerAlaPro-34  
 37-CysAlaAsnSerAlaLysAlaSerLysSerAlaThrSerProLysGlyLeuAspGlyValSerLysAsnSerSer-61  
 75-SerValGlyAspThrArgLeuThrProMet-84  
 97-ValValProAsnArgLeuArgLeuGluThrThrTrpSerProAlaCysArgLysValLysAsnAlaAla-119

**Hydrophilic Regions - Hopp-Woods**

4-ValAlaGluGluThrGluIle-10  
 16-LysGlyCysGluProThrGlyAspSerArgLeu-26  
 30-ThrLysSerAlaPro-34  
 39-AsnSerAlaLysAlaSerLysSerAlaThrSerProLysGlyLeuAspGlyValSerLysAsnSer-60  
 77-GlyAspThrArgLeu-81

-53-

100-AsnArgLeuArgLeu-104  
 111-AlaCysArgLysValLysAsnAlaAla-119  
 075

**AMPHI Regions - AMPHI**

15-LysSerAlaAlaLysMetProThrThrIleGlnProAlaSerIleProSer-31  
 65-AlaProTyrLeuArgGlnValLeu-72  
 80-PheLysLysCysLeuAla-85  
 116-AspPhePheGlnThrCysValAsnArgPhePheGluValValGluIleIleGlyIleGly-135

**Antigenic Index - Jameson-Wolf**

12-GluAsnThrLysSerAlaAlaLysMetPro-21  
 52-AlaLysAlaArgGly-56  
 91-PhePheArgArgProProAsnIleArgLysSerValPheGlnLysSerGluTyrAspLys-110

**Hydrophilic Regions - Hopp-Woods**

12-GluAsnThrLysSerAlaAlaLys-19  
 52-AlaLysAlaArgGly-56  
 91-PhePheArgArgProProAsnIleArgLysSerValPheGlnLysSerGluTyrAspLys-110  
 080

**AMPHI Regions - AMPHI**

6-GluAlaMetGluArgLeuThrArg-13  
 95-PheProAspThrValGlu-100  
 108-ProValAlaArgTrpGlyAspHis-115  
 144-SerAlaGluMetLeuArgArgTyrAspGluPheSerThrValLeu-158

195-LysArgLeuArgLeuPheThrGluAlaTrpGlnHis-206

**Antigenic Index - Jameson-Wolf**

1-MetTrpAspAsnAlaGluAlaMetGluArgLeuThr-12  
 33-AsnSerAsnHisLeuPro-38  
 42-ValSerLeuLysGly-46  
 48-LeuValTyrSerAspLysLysThrLeu-56  
 67-AsnIleLeuArgThrAspIleAsnGlyAlaGlnGluAlaTyrArg-81  
 90-MetValArgArgArgPheProAspThrValGlu-100  
 103-LeuThrGluArgLysProValAlaArgTrpGly-113  
 116-AlaLeuValAspGlyGluGlyAsnValPhe-125  
 127-AlaArgLeuAspArgProGlyMetPro-135  
 138-ArgGlyAlaGluGlyThrSer-144  
 146-GluMetLeuArgArgTyrAspGlu-153  
 163-LeuGlyIleLysGlu-167  
 187-ArgLeuGlyArgGluAsnGluMetLysArgLeuArgLeu-199  
 207-LeuLeuArgLysAsnLysAsnArgLeuSer-216  
 220-MetArgTyrLysAspGlyPheSer-227  
 230-TyrAlaSerAspGlyLeuProGluLysGluSerGluGlu-242

**Hydrophilic Regions - Hopp-Woods**

3-AspAsnAlaGluAlaMetGluArgLeuThr-12  
 50-TyrSerAspLysLysThrLeu-56  
 69-LeuArgThrAspIleAsnGlyAlaGlnGluAlaTyrArg-81  
 90-MetValArgArgArgPheProAspThrVal-99  
 103-LeuThrGluArgLysProValAlaArgTrpGly-113  
 116-AlaLeuValAspGlyGluGlyAsnValPhe-125  
 127-AlaArgLeuAspArgProGly-133

138-ArgGlyAlaGluGlyThrSer-144

146-GluMetLeuArgArgTyrAspGlu153153

163-LeuGlyIleLysGlu-167

187-ArgLeuGlyArgGluAsnGluMetLysArgLeuArgLeu-199

208-LeuArgLysAsnLysAsnArgLeuSer-216

220-MetArgTyrLysAspGlyPheSer-227

234-GlyLeuProGluLysGluSerGluGlu-242

081

#### **AMPHI Regions - AMPHI**

22-LysProValSerArgIleValThrAspSer-31

85-LeuAlaAlaLeuGlnThrLeuAlaLysAlaTrpArgGluAsn-98

116-LysGluMetLeuAlaAlaValLeuArg-124

135-ThrAlaGlyAsnPhe-139

165-MetAsnHisPheGlyGluLeuAlaValLeuThrXxxIleAlaLys-179

185-ValAsnAsnAlaMetArg-190

198-AspGlyValGlyAspIleAlaLysAla-206

303-LeuAsnAspValAlaGluGlyLeuLysGlyPheSerAsnIle-316

345-AlaAlaIleAspValLeuAlaArgMetPro-354

360-ValMetGlyAspMetGlyGluLeuGlyGluLeuGlyGlu-372

402-ValGluAlaAlaGlu-406

#### **Antigenic Index - Jameson-Wolf**

16-ProMetProSerGluSerLysProValSer-25

27-IleValThrAspSerArgAspIleArgAlaGlyAsp-38

44-AlaGlyGluArgPheAspAla-50

67-ValSerArgGluAspCysAlaAla-74

77-GlyAlaLeuLysValAspAspThrLeu-85

94-AlaTrpArgGluAsnValAsnProPhe-102

108-GlySerGlyGlyLysThrThrValLysGluMetLeu-119

123-LeuArgArgArgPheGlyAspAspAlaVal-132

138-AsnPheAsnAsnHisIle-143

151-LysLeuAsnGluLysHisArg-157

178-AlaLysProAsnAla-182

194-GlyCysGlyPheAspGlyValGlyAspIleAlaLysAlaLysSerGluIle-210

212-GlnGlyLeuCysSerAspGly-218

223-ProGlnGluAspAlaAsn-228

239-LeuAsnThrArgThrPheGlyIleAspSerGlyAspValHisAla-253

269-CysGlyAspGluArgAlaAla-275

280-ValProGlyArgHisAsnVal-286

305-AspValAlaGluGlyLeuLys-311

313-PheSerAsnIleLysGlyArgLeuAsnValLysSerGlyIleLysGly-328

330-ThrLeuIleAspAspThrTyrAsnAlaAsnProAspSerMetLysAlaAla-346

363-AspMetGlyGluLeuGlyGluLeuGlyGluAspGluAlaAla-376

384-AlaTyrAlaArgAspGlnGlyIle-391

398-GlyAspAsnSerValGluAlaAlaGluLysPheGlyAla-410

425-LeuArgHisAspLeuProGluArgAlaThrVal-435

437-ValLysGlySerArg-441

446-GluGluValValGluAlaLeuGluAspLys-455

-55-

**Hydrophilic Regions - Hopp-Woods**

17-MetProSerGluSerLysProValSer-25  
 27-IleValThrAspSerArgAspIleArgAla-36  
 44-AlaGlyGluArgPheAspAla-50  
 67-ValSerArgGluAspCysAlaAla-74  
 77-GlyAlaLeuLysValAspAspThrLeu-85  
 94-AlaTrpArgGluAsnVal-99  
 109-SerGlyGlyLysThrThrValLysGluMetLeu-119  
 123-LeuArgArgArgPheGlyAsp-129  
 151-LysLeuAsnGluLysHisArg-157  
 199-GlyValGlyAspIleAlaLysAlaLysSerGluIle-210  
 223-ProGlnGluAspAlaAsn-228  
 247-AspSerGlyAspValHisAla-253  
 269-CysGlyAspGluArgAlaAla-275  
 305-AspValAlaGluGlyLeuLys-311  
 316-IleLysGlyArgLeuAsnVal-322  
 335-ThrTyrAsnAlaAsnProAspSerMetLysAlaAla-346  
 363-AspMetGlyGluLeuGlyGluLeuGlyGluAspGluAlaAla-376  
 384-AlaTyrAlaArgAspGlnGlyIle-391  
 400-AsnSerValGluAlaAlaGluLysPheGlyAla-410  
 425-LeuArgHisAspLeuProGluArgAlaThrVal-435  
 446-GluGluValValGluAlaLeuGluAspLys-455

**084-2****AMPHI Regions - AMPHI**

6-ArgIleLysAsnMetAsnGlnThrLeuLysAsnThrLeuGly-19  
 21-CysAlaLeuLeuAla-25  
 48-AlaValGlyAlaLeuAla-53  
 65-PheProArgValSer-69  
 96-GlnIleValGlySerIleLeuGluSer-104  
 111-GluPheValGlyAsnLeuProGly-118

**Antigenic Index - Jameson-Wolf**

1-MetLysGlnSerAlaArgIleLysAsnMetAsnGlnThrLeuLysAsnThr-17  
 40-TyrGluTyrGlyTyrArgTyrSer-47  
 102-LeuGluSerAsnProAlaGluAlaArgGluPheValGly-114  
 139-ValSerGlyGlyGly-143

**Hydrophilic Regions - Hopp-Woods**

1-MetLysGlnSerAlaArgIleLysAsnMetAsnGlnThrLeu-14  
 105-AsnProAlaGluAlaArgGluPheVal-113

**085-2****AMPHI Regions - AMPHI**

41-GluArgValSerGlnIleGlyLysMetPheAspGlyLeu-53  
 60-LeuLysAspAlaLeuAspAsnGlyPheAsp-69  
 90-AsnGlyGlyArgValLeuGlyAspIleGluLeuLeuAlaAsp-103  
 125-ThrSerLeuValGlyTyr-130  
 141-IleAlaGlyAsnIleGlyThr-147  
 174-GluAsnThrGluSerLeu-179  
 193-HisLeuAspArgTyrAspAspLeuLeuAspTyr-203  
 212-ArgGlyAspGlyValGln-217  
 225-PheCysArgAlaMetLysArgAla-232  
 275-HisAsnAlaAlaAsnValMetAlaAlaValAlaLeuCysGluAla-289  
 300-HisValLysThrPheGlnGlyLeuProHisArgValGluLysIleGly-315  
 336-AlaAlaIleAlaGlyLeu-341

-56-

353-GlyLysGlyGlnAspPheThr-359  
 395-AspCysAlaThrLeuGlyGluAlaValGlnThr-405  
 424-SerPheAspMetPheLysGlyTyr-431

**Antigenic Index - Jameson-Wolf**

4-GlnAsnLysLysIleLeu-9  
 23-TyrLeuArgLysAsnGlyAlaGluValAlaAlaTyrAspAlaGluLeuLysProGluArgValSerGlnIleGlyLysMetPheAsp-51  
 58-GlyArgLeuLysAspAlaLeuAspAsnGlyPhe-68  
 74-SerProGlyIleSerGluArgGlnProAspIleGluAlaPheLysGlnAsnGlyGlyArgValLeuGly-96  
 104-IleValAsnArgArgAspAspLysValIle-113  
 116-ThrGlySerAsnGlyLysThrThr-123  
 153-GluTrpGlnArgGluGlyLysLysAlaAsp-162  
 169-SerSerPheGlnLeuGluAsnThrGluSerLeuArgProThrAla-183  
 189-IleSerGluAspHisLeuAspArgTyrAspAspLeuLeu-201  
 204-AlaHisThrLysAlaLysIlePheArgGlyAspGlyVal-216  
 220-AsnAlaAspAspAlaPheCysArgAlaMetLysArgAlaGlyArgGluValLys-237  
 247-PheTrpLeuGluArgGluThrGlyArgLeuLysGlnGlyAsnGluAspLeuIleVal-265  
 291-GlyLeuSerArgGluAlaLeu-297  
 307-LeuProHisArgValGluLysIleGlyGluLysAsnGly-319  
 322-PheIleAspAspSerLysGlyThrAsnVal-331  
 351-GlyMetGlyLysGlyGlnAspPheThrProLeuArgAspAlaLeuValGlyLysAlaLys-370  
 378-AspAlaProGlnIleArgArgAspLeuAspGlyCysGly-390  
 431-TyrAlaHisArgSer-435

**Hydrophilic Regions - Hopp-Woods**

4-GlnAsnLysLysIleLeu-9  
 25-ArgLysAsnGlyAlaGlu-30  
 32-AlaAlaTyrAspAlaGluLeuLysProGluArgValSerGln-45  
 59-ArgLeuLysAspAlaLeuAspAsnGlyPhe-68  
 76-GlyIleSerGluArgGlnProAspIleGluAlaPheLysGlnAsnGlyGly-92  
 104-IleValAsnArgArgAspAspLysVal-112  
 118-SerAsnGlyLysThrThr-123  
 153-GluTrpGlnArgGluGlyLysLysAlaAsp-162  
 174-GluAsnThrGluSerLeuArgPro-181  
 189-IleSerGluAspHisLeuAspArgTyrAspAspLeuLeu-201  
 204-AlaHisThrLysAlaLysIlePheArgGlyAspGly-215  
 220-AsnAlaAspAspAlaPheCysArgAlaMetLysArgAlaGlyArgGluValLys-237  
 247-PheTrpLeuGluArgGluThrGlyArgLeuLysGlnGlyAsnGluAspLeuIleVal-265  
 291-GlyLeuSerArgGluAlaLeu-297  
 309-HisArgValGluLysIleGlyGluLysAsnGly-319  
 324-AspAspSerLysGlyThrAsn-330  
 353-GlyLysGlyGlnAsp-357  
 359-ThrProLeuArgAspAlaLeuValGlyLysAlaLys-370  
 380-ProGlnIleArgArgAspLeuAspGly-388  
 431-TyrAlaHisArgSer-435

086-2

**AMPHI Regions - AMPHI**

55-MetArgThrTrpArgArgLeuValPro-63  
 83-IleAsnGlyAlaThrArg-88  
 99-ProThrGluLeuPheLysLeuAlaVal-107  
 120-GluValLeuArgSerMetGluSerLeuGlyTrpGlnSerIleTrpArgGlyThrAlaAsn-139  
 155-GluMetTyrGlyArgPhe-160  
 185-SerPheValValIle-189  
 228-ArgValGlnArgValValAlaPheLeuAspProTrpLysAspProGln-243

-57-

293-GlyPhePheGlyMetCys-298  
 336-TrpIleGlyIleGlnSerPhe-342

**Antigenic Index - Jameson-Wolf**

20-LeuAlaSerLysGluGlyGlyAsp-27  
 55-MetArgThrTrpArgArg-60  
 79-AlaGlyArgGluIleAsnGlyAlaThr-87  
 115-PheThrArgArgGluGluValLeuArgSerMetGlu-126  
 134-TrpArgGlyThrAla-138  
 144-AlaThrAsnProGlnAlaArgArgGluThrLeuGluMet-156  
 225-AlaProTyrArgVal-229  
 236-LeuAspProTrpLysAspProGlnGlyAla-245  
 265-GlyLeuGlyAlaSerLeuSerLysArgGlyPheLeu-276  
 313-SerIleGlyLysGlnSerArgAspLeuGly-322  
 352-LeuProThrLysGlyLeu-357  
 382-IleAspTyrGluAsnArgArgLysMetArgGlyTyrArgValGlu-396

**Hydrophilic Regions - Hopp-Woods**

21-AlaSerLysGluGlyGlyAsp-27  
 79-AlaGlyArgGluIleAsnGly-85  
 115-PheThrArgArgGluGluValLeuArgSerMetGlu-126  
 147-ProGlnAlaArgArgGluThrLeuGluMet-156  
 238-ProTrpLysAspProGlnGly-244  
 270-LeuSerLysArgGlyPheLeu-276  
 316-LysGlnSerArgAspLeu-321  
 382-IleAspTyrGluAsnArgArgLysMetArgGlyTyrArgValGlu-396

087-2

**AMPHI Regions - AMPHI**

23-ValAlaAspSerLeuArg-28  
 80-GlnThrValArgGluAlaGlnArgIleIle-89  
 99-GlyPheGlyGlyPheValThrPheProGlyGlyLeuAlaAlaLysLeuLeu-115  
 129-GlyLeuSerAsnArgHisLeuSerArgTrpAlaLysArgValLeuTyrAlaPheProLys-148  
 157-ValGlyAsnProValArg-162  
 192-GlyAlaAspValLeuAsnLysThrVal-200  
 241-ValGluPheIleThrAspMetValSerAlaTyr-251  
 313-GluLysLeuAlaGluIleLeuGly-320  
 330-TrpAlaGluAsnAla-334

**Antigenic Index - Jameson-Wolf**

25-AspSerLeuArgAlaArgGly-31  
 37-LeuGlySerLysAspSerMetGluGluArgIleValProGlnTyrGlyIle-53  
 61-LysGlyValArgGlyAsnGlyIleLysArgLysLeu-72  
 81-ThrValArgGluAlaGlnArgIleIleArgLysHisArgVal-94  
 130-LeuSerAsnArgHisLeuSerArgTrpAlaLys-140  
 150-PheSerHisGluGlyGlyLeu-156  
 159-AsnProValArgAlaAspIleSer-166  
 171-ProAlaGluArgPheGlnGlyArgGluGlyArgLeu-182  
 195-ValLeuAsnLysThrVal-200  
 207-LeuProAspAsnAlaArgProGlnMetTyrHisGlnSerGlyArgGlyLysLeuGly-225  
 229-AlaAspTyrAspAla-233  
 235-GlyValLysAlaGluCys-240  
 249-SerAlaTyrArgAspAlaAsp-255  
 284-AlaValAspAspHisGlnThrAla-291  
 309-GlnLeuThrAlaGluLysLeuAlaGlu-317  
 321-GlyLeuAsnArgGluLysCysLeuLys-329

-58-

331-AlaGluAsnAlaArgThr-336  
 341-HisSerAlaAspAspValAlaGlu-348

**Hydrophilic Regions - Hopp-Woods**

25-AspSerLeuArgAlaArgGly-31  
 39-SerLysAspSerMetGluGluArgIleVal-48  
 66-AsnGlyIleLysArgLysLeu-72  
 81-ThrValArgGluAlaGlnArgIleIleArgLysHisArgVal-94  
 134-HisLeuSerArgTrpAlaLys-140  
 161-ValArgAlaAspIle-165  
 171-ProAlaGluArgPheGlnGlyArgGluGlyArgLeu-182  
 219-SerGlyArgGlyLysLeu-224  
 235-GlyValLysAlaGluCys-240  
 249-SerAlaTyrArgAspAlaAsp-255  
 284-AlaValAspAspHisGlnThrAla-291  
 310-LeuThrAlaGluLysLeuAlaGlu-317  
 322-LeuAsnArgGluLysCysLeuLys-329  
 331-AlaGluAsnAlaArg-335  
 341-HisSerAlaAspAspValAlaGlu-348

088-2

**AMPHI Regions - AMPHI**

7-HisPheSerAsnTrpLeuThrGlyLeuAsnIlePheGlnTyrThrThr-22  
 24-ArgAlaValMetAlaAlaLeu-30  
 43-ThrIleArgArgLeuThrAlaLeuLysCysGlyGln-54  
 88-LeuTrpGlyAsnTrpAlaAsn-94  
 111-GlyPheTyrAspAspTrpArgLysValValTyr-121  
 140-AlaIleIleAlaSerLeuAlaLeu-147  
 175-GlyPheLeuValLeuSerTyrLeuThrIle-184  
 187-ThrSerAsnAlaValAsnLeuThrAspGlyLeuAspGlyLeuAlaThr-202  
 221-HisSerGlnPheAlaGlnTyrLeuGlnLeuProTyr-232  
 245-AlaMetCysGlyAlaCysLeuGlyPhe-253

**Antigenic Index - Jameson-Wolf**

48-ThrAlaLeuLysCysGlyGlnAlaValArgThrAspGlyProGln-62  
 66-ValLysAsnGlyThrProThrMet-73  
 114-AspAspTrpArgLysValValTyrLysAspProAsnGlyValSerAlaLysPhe-131  
 193-LeuThrAspGlyLeuAsp-198  
 312-LysLysThrLysLysArgIle-318  
 328-TyrGluGlnLysGlyTrpLysGluThrGlnVal-338

**Hydrophilic Regions - Hopp-Woods**

56-ValArgThrAspGlyProGln-62  
 114-AspAspTrpArgLysValValTyrLysAspProAsnGlyVal-127  
 312-LysLysThrLysLysArgIle-318  
 331-LysGlyTrpLysGlu-335

089-2

**AMPHI Regions - AMPHI**

40-PheSerThrArgCysGlyArgProTrpLysValLeu-51  
 74-LeuAlaAlaLeuCysArgProCysAsnGlyMetSerCys-86  
 118-SerArgProAlaArgPhe-123

**Antigenic Index - Jameson-Wolf**

1-MetProProLysIleThrLysSerGlyPhe-10  
 40-PheSerThrArgCysGlyArgProTrpLys-49  
 54-SerSerAsnAlaSerArgAspLysProMetAlaSerHisLysAla-68

-59-

79-ArgProCysAsnGlyMetSerCys-86

95-CysPheArgArgProValSerArgSerAsnGlnLysSerAlaSerCysSerAsnGluAsnHisPheThrSerA  
 rgProAlaArgPheIleAlaArgGlnAsnAlaSerSerAlaPheLysThrCysThrProSerProArgLysIleLe  
 u-144

**Hydrophilic Regions - Hopp-Woods**

43-ArgCysGlyArgPro-47

56-AsnAlaSerArgAspLysProMetAlaSerHisLysAla-68

95-CysPheArgArgProValSerArgSerAsnGlnLysSerAlaSerCysSerAsn-112

119-ArgProAlaArgPheIleAla-125

137-ThrProSerProArgLysIle-143

090-1

**AMPHI Regions - AMPHI**

10-SerGlnSerLeuLysArgPheAspLysHisPheArg-21

56-SerGlnSerGlyAlaValGlyHisIle-64

141-AlaAspPhePheHisAlaValArgGlnAla-150

152-GluGlyPheAspValPheGluGlnCysPheAla-162

164-GlnThrAspGlyLeuThrGln-170

177-ValSerGlyValValGlnThrLeuGlnArg-186

226-LeuHisArgAlaAlaGluArgIleValArgIleGlnAsnLeuHisAlaVal-242

387-IleGluThrValValGlnArgIlePheGlnThrAla-398

404-ProValLysHisLeuThrAspLeuArg-412

425-AsnLeuArgAlaValPheAlaGlnValGlyAsnHisGlyAsnThrArgThrAlaGluSer-444

**Antigenic Index - Jameson-Wolf**

9-AlaSerGlnSerLeuLysArgPheAspLysHisPheArg-21

29-HisIleLysAlaArgAlaGlyGlyAlaGluGlnHis-40

53-AsnGlyPheSerGlnSerGly-59

73-AlaAspLeuArgArgIleAspThrAsnGlnGlu-83

94-AlaGlnGlyArgGluVal-99

107-GlnAsnHisGluGluArgIleLeuGlnThrGlyAsnArgGlyGlySerArgAlaAspIleArg-127

149-GlnAlaLeuGluGly-153

161-PheAlaArgGlnThrAspGlyLeuThrGlnSerHisGlySerHisAspValSerGly-179

187-AsnValLeuArgAspAsnGln-193

214-PheGlnArgLysProPheTyr-220

228-ArgAlaAlaGluArgIleValArg-235

269-GlnHisArgArgArgSerArgThrGlnAla-278

285-GluAlaGlyLysLeuGln-290

304-ArgLeuGlnAsnArgArgAlaAspIleAlaArgAspAsnGlyIle-318

320-ProAlaLeuAspThrGluIleAlaAspGlnAlaArgTyrArgGly-334

339-AlaGlyAsnArgAsnTyr-344

353-ValArgGlnGlnPhe-357

379-AspAlaGlyThrGluSerGlnAsnIle-387

398-AlaArgValLysHisGlnProValLysHisLeuThrAspLeuArgHis-413

421-IleIleArgSerAsnLeuArg-427

434-GlyAsnHisGlyAsnThrArgThrAlaGluSerGlyAspGluAspPhePhe-450

**Hydrophilic Regions - Hopp-Woods**

11-GlnSerLeuLysArgPheAspLysHisPheArg-21

29-HisIleLysAlaArgAlaGlyGlyAlaGluGlnHis-40

73-AlaAspLeuArgArgIleAspThrAsnGln-82

94-AlaGlnGlyArgGluVal-99

-60-

107-GlnAsnHisGluGluArgIleLeu-114  
 117-GlyAsnArgGlyGlySerArgAlaAspIleArg-127  
 163-ArgGlnThrAspGlyLeuThr-169  
 173-GlySerHisAspVal-177  
 187-AsnValLeuArgAspAsnGln-193  
 228-ArgAlaAlaGluArgIleValArg-235  
 269-GlnHisArgArgArgSerArgThrGln-277  
 285-GluAlaGlyLysLeuGln-290  
 305-LeuGlnAsnArgArgAlaAspIleAlaArgAspAsnGlyIle-318  
 322-LeuAspThrGluIleAlaAspGlnAlaArgTyrArg-333  
 380-AlaGlyThrGluSerGlnAsnIle-387  
 398-AlaArgValLysHisGlnPro-404  
 407-HisLeuThrAspLeuArgHis-413  
 421-IleIleArgSerAsnLeu-426  
 437-GlyAsnThrArgThrAlaGluSerGlyAspGluAspPhePhe-450  
**091-2**

**AMPHI Regions - AMPHI**

11-ProLeuSerAspGlyIleAlaSerCys-19  
 21-IleThrArgLeuGlnAlaLeuVal-28  
 33-ValLeuValSerValLeuThrSerLeuAlaLys-43

**Antigenic Index - Jameson-Wolf**

1-LeuSerArgArgCysProProLeuProLysProLeuSerAspGlyIleAla-17  
 73-LeuArgCysArgLeuProLysProSerAspArgPheAsp-85  
 105-LeuAspAsnProLeuArgCysArgLeuProIleProSerAspArgPheGly-121

**Hydrophilic Regions - Hopp-Woods**

1-LeuSerArgArgCysProProLeu-8  
 75-CysArgLeuProLysProSerAspArgPheAsp-85  
 107-AsnProLeuArgCys-111  
 115-IleProSerAspArgPhe-120

**092****AMPHI Regions - AMPHI**

55-GlyMetSerGlyIleAlaGluValLeuHis-64  
 76-AlaArgAsnAlaAlaThrGluHisLeu-84  
 95-HisThrAlaGluHisValAsnGly-102  
 120-ValAlaAlaLeuGlu-124  
 137-AlaGluLeuMetArgPheArgAsp-144  
 209-LeuThrProIleMetSerValValThrAsnIleAsp-220  
 226-ThrTyrGlyHisSerValGluLysLeuHisGlnAlaPheIleAspPheIleHisArg-244  
 259-HisValArgAlaIleLeuProLysValSerLysProTyr-271  
 273-ThrTyrGlyLeuAspAspThrAla-280  
 321-AsnValLeuAsnAlaLeuAlaAlaIle-329  
 339-ValGluAlaIleGlnLysGly-345  
 353-GlyArgArgPheGlnLysTyrGlyAspIleLys-363  
 407-ArgTyrThrArgThrArgAspLeuPheGluAspPheThrLysValLeuAsnThrValAspAlaLeu-428  
 449-LeuAlaArgAlaIleArgValLeuGlyLysLeu-459  
 464-CysGluAsnValAlaAspLeuProGluMetLeuLeuAsn-476

**Antigenic Index - Jameson-Wolf**

14-LeuTrpArgAlaAsnGlyGlnProPheLys-23  
 25-ThrProLeuArgIleGluAsnProProGluArgAsnIleMetMetLysAsnArgVal-43  
 70-ValSerGlySerAspGlnAlaArgAsnAlaAla-80  
 111-AlaValLysLysGluAsnProGluVal-119  
 140-MetArgPheArgAspGlyIle-146

-61-

150-GlyThrHisGlyLysThrThrThr-157  
 184-GlyThrAsnAlaArgLeuGlyLysGlyGluTyr-194  
 198-GluAlaAspGluSerAspAla-204  
 218-AsnIleAspGluAspHisMetAspThrTyrGly-228  
 230-SerValGluLysLeuHis-235  
 255-IleAspSerGluHisVal-260  
 263-IleLeuProLysValSerLysProTyrAla-272  
 275-GlyLeuAspAspThrAlaAsp-281  
 286-AspIleGluAsnValGlyAla-292  
 302-MetLysGlyHisGluGlnGlySerPhe-310  
 351-GlyValGlyArgArgPheGlnLysTyrGlyAspIleLysLeuProAsnGlyGly-368  
 374-AspAspTyrGlyHisHisPro-380  
 393-AlaTyrLeuGluLysArgLeu-399  
 404-GlnProHisArgTyrThrArgThrArgAspLeuPheGluAspPheThrLys-420  
 435-AlaAlaGlyGluGluProIleAlaAlaAlaAspSerArgAlaLeuAlaArg-451  
 466-AsnValAlaAspLeuPro-471  
 478-LeuGlnAspGlyAspIle-483  
 488-GlyAlaGlySerIleAsn-493

**Hydrophilic Regions - Hopp-Woods**

26-ProLeuArgIleGluAsnProProGluArgAsnIleMetMetLysAsnArgVal-43  
 71-SerGlySerAspGlnAlaArgAsnAlaAla-80  
 111-AlaValLysLysGluAsnProGlu-118  
 140-MetArgPheArgAsp-144  
 152-HisGlyLysThrThr-156  
 187-AlaArgLeuGlyLysGlyGlu-193  
 198-GluAlaAspGluSerAspAla-204  
 218-AsnIleAspGluAspHisMetAsp-225  
 230-SerValGluLysLeuHis-235  
 256-AspSerGluHisVal-260  
 275-GlyLeuAspAspThrAlaAsp-281  
 303-LysGlyHisGluGlnGlySer-309  
 351-GlyValGlyArgArgPheGlnLys-358  
 360-GlyAspIleLysLeu-364  
 393-AlaTyrLeuGluLysArgLeu-399  
 407-ArgTyrThrArgThrArgAspLeuPheGluAspPheThrLys-420  
 435-AlaAlaGlyGluGluProIleAlaAlaAlaAspSerArgAlaLeuAlaArg-451  
 466-AsnValAlaAspLeuPro-471  
 479-GlnAspGlyAspIle-483  
 093-2

**AMPHI Regions - AMPHI**

26-ThrAlaIleLeuAsn-30  
 59-ThrAlaPheAsnIleLeuHisGly-66  
 159-LysSerValTyrGluGluLeuLysHisLeu-168  
 196-IleHisIleIleProAlaThrGluPhe-204  
 254-PheLeuLysAspThr-258  
 267-IleAsnThrLeuProGlyMetThrSer-275

**Antigenic Index - Jameson-Wolf**

12-GlyGlyPheSerSerGluArgGluIleSerLeuAspSerGlyThr-26  
 32-LeuLysSerLysGlyIleAsp-38  
 41-AlaPheAspProLysGluThrProLeuSerGluLeuLysAlaGlnGly-56  
 66-GlyThrTyrGlyGluAspGlyAlaVal-74  
 96-GlyMetAspLysTyrArgCys-102  
 120-HisAspAspThrAspPheAspAlaValGluGluLysLeuGly-133

-62-

140-ProAlaAlaGluGlySerSer-146  
 151-LysValLysGlyLysGlyArgLeuLysSerValTyrGluGluLeuLysHisLeuGln-169  
 176-ArgPheIleGlyGlyGlyGluTyrSer-184  
 189-AsnGlyLysGlyLeuPro-194  
 203-GluPheTyrAspTyrGluAlaLysTyrAsnArgAspAspThrIleTyrGlnCysProSerGluAspLeuThr  
 GluAlaGluGluSerLeuMetArg-234  
 245-GlyAlaGluGlyCysVal-250  
 253-AspPheLeuLysAspThrAspGly-260  
 270-LeuProGlyMetThr-274  
 279-ValProLysSerAlaAla-284

**Hydrophilic Regions - Hopp-Woods**

15-SerSerGluArgGluIleSerLeu-22  
 32-LeuLysSerLysGlyIleAsp-38  
 41-AlaPheAspProLysGluThrProLeuSerGluLeuLysAla-54  
 68-TyrGlyGluAspGlyAlaVal-74  
 96-GlyMetAspLysTyrArgCys-102  
 120-HisAspAspThrAspPheAspAlaValGluGluLysLeuGly-133  
 140-ProAlaAlaGluGlySerSer-146  
 151-LysValLysGlyLysGlyArgLeuLysSerValTyrGluGluLeuLysHisLeuGln-169  
 205-TyrAspTyrGluAlaLysTyrAsnArgAspAspThrIle-217  
 221-ProSerGluAspLeuThrGluAlaGluGluSerLeuMetArg-234  
 253-AspPheLeuLysAspThrAspGly-260

094

**AMPHI Regions - AMPHI**

17-LeuProProIleThrLysValGlySer-25  
 80-PheSerPheLeuThrAlaVal-86

**Antigenic Index - Jameson-Wolf**

3-SerProLeuProLysArgAlaLeu-10  
 24-GlySerSerProAlaAlaProArgMetGluAla-34  
 50-MetProSerArgLysArgIleAsnSerAlaAsnIleArgAlaArgGlyIleThr-67

**Hydrophilic Regions - Hopp-Woods**

5-LeuProLysArgAlaLeu-10  
 28-AlaAlaProArgMetGluAla-34  
 51-ProSerArgLysArgIleAsn-57  
 60-AsnIleArgAlaArgGly-65

095-2

**AMPHI Regions - AMPHI**

9-CysAlaSerAsnLeuPheArgGlnCysGlnGlnArgGlyGlyAspAlaValAsp-26  
 38-ValLeuGlnAsnValGlnGlnHisPheGlyGlnIleGlyAsnValPheAlaVal-55  
 86-PheGlyGlnHisGlnArgValAsnGlyIleGluAspPheGlyLysValPheLysGlnIleAlaArg-107  
 132-GlyArgArgHisPheAspGlyValValSer-141  
 174-PheLeuAspArgPheAsnArgCysAlaAspPheGlnArgHisAlaAspGlyCysGlnCysValGlnHisVal  
 -197  
 204-GlnHisAspPheLys-208  
 236-AspValGlyGlyIleValGlnThrValSerSerIle-247  
 274-ThrValAspGluIleAspLysArgLeuMetGlnPhePheAspAlaVal-289  
 313-GlyCysIleArgLeuValGly-319  
 370-AsnGlyAspAlaValThrGluAlaHisGlnLeuArgGlnHisGlnGlyAla-386  
 412-AspAspIleArgThrValAsnValPheGlyGlyMet-423  
 435-MetLeuGlySerGlyIleSerArgLeuIleArgThrGly-447  
 451-AlaGlnIleValGlnAspPheGlyAspAlaAlaHisAla-463

**Antigenic Index - Jameson-Wolf**

6-SerGlyGlyCysAlaSerAsnLeu-13  
 16-GlnCysGlnGlnArgGlyGlyAspAlaValAspAlaSerArgAlaHisIle-32  
 62-GlnHisAlaAspGlyAlaGlyLysSerAlaGlyIleGlyGlyGlyAsnArgLeuPhe-80  
 88-GlnHisGlnArgValAsnGlyIleGluAspPheGlyLys-100  
 112-ValArgLeuGluGlyGluTyr-118  
 127-AlaCysGlyGlyLysGlyArgArgHisPheAspGly-138  
 144-ValHisGlnGluArgGlyProAla-151  
 163-AlaAlaAlaAspAlaPheLysAlaGluGlnAlaPhe-174  
 176-AspArgPheAsnArgCysAlaAspPheGlnArgHisAlaAspGlyCysGln-192  
 205-HisAspPheLysArg-209  
 253-GlyGlnAsnArgAlaAspVal-259  
 263-AsnThrGlnLysGlyPheAlaVal-270  
 273-HisThrValAspGluIleAspLysArgLeu-282  
 300-IleGlyAsnAspGlyHisAsnArgCysGlnValGlnLysGlyCys-314  
 339-PheAlaAlaAspAsnGluSerArgValLysSerCysArgAlaGluAspGlyGlyGlyGlnAlaGlyGlyArg  
 GlyPheAlaValArgAlaGlyAsnGlyAspAlaValThr-375  
 378-HisGlnLeuArgGlnHisGlnGlyAlaArgAsnAsnGlyAsn-391  
 394-LeuGlnArgSerAspAsnPheGly-401  
 405-PheAspGlyGlyArgGlyAsnAspAspIleArgThr-416  
 442-ArgLeuIleArgThrGlyAsnPheLys-450  
 461-AlaHisAlaAspAlaAlaAspThrAspLysMetAspValGlyAsn-475

**Hydrophilic Regions - Hopp-Woods**

17-CysGlnGlnArgGlyGlyAspAlaValAspAlaSerArgAlaHisIle-32  
 64-AlaAspGlyAlaGlyLysSerAlaGly-72  
 93-AsnGlyIleGluAspPheGlyLys-100  
 112-ValArgLeuGluGlyGluTyr-118  
 128-CysGlyGlyLysGlyArgArgHisPhe-136  
 145-HisGlnGluArgGlyPro-150  
 163-AlaAlaAlaAspAlaPheLysAlaGluGlnAlaPhe-174  
 182-AlaAspPheGlnArgHisAlaAspGly-190  
 205-HisAspPheLysArg-209  
 273-HisThrValAspGluIleAspLysArgLeu-282  
 300-IleGlyAsnAspGlyHisAsnArgCysGlnVal-310  
 339-PheAlaAlaAspAsnGluSerArgValLysSerCysArgAlaGluAspGlyGlyGly-357  
 368-AlaGlyAsnGlyAspAlaValThr-375  
 378-HisGlnLeuArgGlnHisGlnGlyAlaArgAsnAsnGly-390  
 395-GlnArgSerAspAsn-399  
 407-GlyGlyArgGlyAsnAspAspIleArgThr-416  
 461-AlaHisAlaAspAlaAlaAspThrAspLysMetAspVal-473  
 096-2

**AMPHI Regions - AMPHI**

19-GlyIlePheGluGluIleAspAlaHis-27  
 37-AlaAlaAsnArgGln-41  
 61-GlyValValAlaVal-65  
 112-GlnPhePheValAsnAlaPheGln-119  
 129-AlaTyrAlaAlaAlaPheGlyArg-136  
 172-AsnGlnPheAlaAla-176  
 187-AspThrAlaAlaGlyIleGlyAsnAlaGln-196  
 228-GlnTrpGlyPhePhe-232

**Antigenic Index - Jameson-Wolf**

1-MetAlaArgHisThrGlyGlnGlyVal-9

-64-

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22-GluGluIleAspAla-26

"

"

30-PheArgThrAspCysLeuArgAlaAlaAsn-39

"

"

75-GlyCysGlyAsnAspValTyrAla-82

"

"

88-ValGlnAspGlyAla-92

"

"

97-AlaAlaAspLysThrPheGlyAsn-104

137-ArgPheHisLysHisArgGln-143

157-ValGlnAspGlyGluLeuGlyAsnGlyGlnSerGlnCysLeu-170

181-AlaAspGlyGlyCysGlyAspThr-188

211-ThrValLysAspValGluCysArgLeu-219

**Hydrophilic Regions - Hopp-Woods**

1-MetAlaArgHisThrGlyGln-7

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22-GluGluIleAspAla-26

33-AspCysLeuArgAlaAlaAsn-39

97-AlaAlaAspLysThrPheGly-103

137-ArgPheHisLysHisArgGln-143

158-GlnAspGlyGluLeuGlyAsn-164

183-GlyGlyCysGlyAspThr-188

211-ThrValLysAspValGluCysArgLeu-219

097-2

**AMPHI Regions - AMPHI**

28-AlaGlyLeuThrThrPheLeuThrMetCysTyrIleVal-40

72-MetGlyPheValGly-76

166-AlaThrLeuValGlyLeuGlyAspIleHisGlnProSerAlaLeuLeuAlaLeuPheGly-185

207-ThrIleThrValIleAlaSerLeuMetGlyLeuAsnGluPheHisGlyIleIleGlyGluValProSerIle-230

242-LeuPheThrValSer-246

260-PheAspSerThrGlyThrLeu-266

342-LeuAlaLysSerValProAlaPheAlaThr-351

362-MetLeuArgSerAlaArgAspIle-369

**Antigenic Index - Jameson-Wolf**

1-MetAspThrSerLysGlnThrLeu-8

13-PheLysLeuLysAlaAsnGlyThrThrValArgThrGluLeu-26

125-LysValArgGluMetLeu-130

260-PheAspSerThrGly-264

277-ValAspGlyLysLeuProArgLeuLysArg-286

317-SerAlaGlyGlyArgThrGly-323

-65-

364-ArgSerAlaArgAspIleAspTrpAspAspMetThrGlu-376  
 410-LeuCysArgArgThrLysAspValProPro-419

**Hydrophilic Regions - Hopp-Woods**

1-MetAspThrSerLys-5  
 16-LysAlaAsnGlyThrThrValArgThrGluLeu-26  
 125-LysValArgGluMetLeu-130  
 279-GlyLysLeuProArgLeuLysArg-286  
 318-AlaGlyGlyArgThr-322  
 364-ArgSerAlaArgAspIleAspTrpAspAspMetThrGlu-376  
 410-LeuCysArgArgThrLysAspValPro-418

098-2

**AMPHI Regions - AMPHI**

29-AlaGluAlaGlyAspGlnPheValGlyAsp-38  
 110-ValGlyAspPhePheLysLeuAlaPhe-118  
 120-CysGlnIleGlnAsnValValThrAlaIleAlaGlnIleValAla-134  
 163-LeuSerSerPheSerHisGly-169

**Antigenic Index - Jameson-Wolf**

24-ValGlnGluAspAlaAlaGluAlaGlyAspGlnPheVal-36  
 68-MetGlyMetCysArg-72  
 78-PheAsnHisThrAspArgGlnAlaAla-86  
 136-ThrAlaAsnGlyThrGlnSerGlyIleThrGlyArgAsnAlaArgLysArgAsnGlyPhe-155  
 158-PheGluGlyArgGlyLeuSerSerPheSerHisGlyIle-170  
 180-ValPheArgArgProMetArgIleCys-188

**Hydrophilic Regions - Hopp-Woods**

24-ValGlnGluAspAlaAlaGluAlaGlyAsp-33  
 79-AsnHisThrAspArgGlnAla-85  
 144-IleThrGlyArgAsnAlaArgLysArgAsnGly-154  
 158-PheGluGlyArgGly-162  
 180-ValPheArgArgProMetArg-186

099 (delete this one--mistaken sequence)

**AMPHI Regions - AMPHI**

6-SerMetMetArgLeuProAspIle-13  
 47-AlaPheValGluPhePheGlyGluGly-55  
 102-LysLeuValGluThrTyrAlaLysThr-110  
 114-TrpAlaAspAlaLeuLysThrAla-121  
 135-ThrArgAsnMetAlaGlyProSerAsn-143  
 154-AlaAlaLysGlyLeuAlaLysProTyrGluGluProSerAspGly-168  
 178-AlaAlaIleThrSerCysThrAsnThrSerAsnProArgAsnVal-192  
 251-ThrCysAsnGlyMetSer-256  
 341-IleAspAlaValValAlaGluTyrValLysProGlnGlnPheArgAspValTyrVal-359  
 371-ProSerProLeuTyrAspTrpArg-378  
 381-SerThrTyrIleArg-385  
 398-ArgThrLeuArgGlyMetArgProLeu-406  
 443-AspPheAsnSerTyrAlaThr-449  
 468-PheAsnGluMetValLys-473  
 494-MetArgMetTrpGluAlaIleGluThrTyrMet-504  
 532-ArgLeuAlaGlyVal-536  
 539-IleValAlaGluGlyPheGluArgIleHisArgThrAsn-551  
 575-GlyThrGluThrTyr-579

**Antigenic Index - Jameson-Wolf**

17-GluLeuAsnGlyLysArgGlnAlaGly-25

-66-

38-PheLeuArgLysGluArgValVal-45  
 53-GlyGluGlyAlaArgSer-58  
 60-SerIleGlyAspArgAlaThr-66  
 70-MetThrProGluPhe-74  
 83-IleAspGluGlnThr-87  
 94-ThrGlyArgAspAspAlaGlnValLysLeu-103  
 133-SerValThrArgAsnMetAlaGlyProSerAsnProHis-145  
 157-GlyLeuAlaLysProTyrGluGluProSerAspGlyGlnMetProAspGly-173  
 183-CysThrAsnThrSerAsnProArgAsnVal-192  
 201-AsnAlaAsnArgLeuGlyLeuLysArgLysProTrpVal-213  
 216-SerPheAlaProGlySerLysValAla-224  
 235-ProGluMetGluLysLeu-240  
 251-ThrCysAsnGlyMetSerGlyAlaLeuAspProLysIleGlnLysGluIleIleAspArgAspLeuTyr-273  
 279-SerGlyAsnArgAsnPheAspGlyArgIleHisProTyrAlaLys-293  
 312-IleArgPheAspIleGluAsnAspVal-320  
 322-GlyValAlaAspGlyLysGluIleArgLeuLysAsp-333  
 335-TrpProAlaAspGluGluIleAspAlaVal-344  
 348-TyrValLysProGlnGlnPheArgAspVal-357  
 363-AspThrGlyThrAlaGlnLysAlaProSerProLeuTyrAspTrpArgProMetSerThrTyrIleArgArgProProTyrTrp-390  
 394-LeuAlaGlyGluArgThrLeuArgGlyMetArg-404  
 409-LeuProAspAsnIleThrThrAspHisLeuSerProSerAsn-422  
 438-GlyLeuProGluGluAspPheAsnSerTyrAlaThrHisArgGlyAspHisLeuThr-456  
 463-AlaAsnProLysLeuPhe-468  
 471-MetValLysAsnGluAspGlySerValArgGlnGlySerPheAlaArgValGluProGluGlyGluThr-493  
 503-TyrMetAsnArgLysGlnPro-509  
 516-AlaAspTyrGlyGlnGlySerSerArgAspTrpAlaAlaLysGlyValArg-532  
 543-GlyPheGluArgIleHisArgThrAsnLeu-552  
 562-PheLysProAspThrAsnArgHis-569  
 571-LeuGlnLeuAspGlyThrGluThrTyrAspValValGlyGluArgThrProArgCysAspLeu-591  
 595-IleHisArgLysAsnGlyGluThrValGlu-604  
 612-AspThrAlaGluGlu-616

**Hydrophilic Regions - Hopp-Woods**

18-LeuAsnGlyLysArgGlnAlaGly-25  
 38-PheLeuArgLysGluArgValVal-45  
 53-GlyGluGlyAlaArg-57  
 60-SerIleGlyAspArgAlaThr-66  
 83-IleAspGluGlnThr-87  
 94-ThrGlyArgAspAspAlaGlnValLysLeu-103  
 157-GlyLeuAlaLysProTyrGluGluProSerAspGlyGlnMetProAsp-172  
 205-LeuGlyLeuLysArgLysProTrpVal-213  
 235-ProGluMetGluLysLeu-240  
 259-LeuAspProLysIleGlnLysGluIleIleAspArgAspLeuTyr-273  
 282-ArgAsnPheAspGlyArgIle-288  
 312-IleArgPheAspIleGluAsnAspVal-320  
 324-AlaAspGlyLysGluIleArgLeuLysAsp-333  
 335-TrpProAlaAspGluGluIleAspAlaVal-344  
 366-ThrAlaGlnLysAlaPro-371  
 394-LeuAlaGlyGluArgThrLeuArgGlyMetArg-404  
 438-GlyLeuProGluGluAspPheAsn-445  
 450-HisArgGlyAspHis-454  
 471-MetValLysAsnGluAspGlySerValArg-480

-67-

485-AlaArgValGluProGluGlyGluThr-493  
 503-TyrMetAsnArgLysGlnPro-509  
 518-TyrGlyGlnGlySerSerArgAspTrpAlaAlaLysGlyValArg-532  
 543-GlyPheGluArgIleHisArg-549  
 562-PheLysProAspThrAsnArgHis-569  
 574-AspGlyThrGluThr-578  
 580-AspValValGlyGluArgThrProArgCysAsp-590  
 596-HisArgLysAsnGlyGluThrValGlu-604  
 612-AspThrAlaGluGlu-616

099-2

**AMPHI Regions - AMPHI**

30-ProGlySerTyrAspLysLeuPro-37  
 57-ProThrLeuGlnSerTrpLeuGlyGln-65  
 91-ThrAlaLeuValAspLeuAlaGlyLeuArgAsp-101  
 106-LysGlyGlyAspProAlaLysValAsn-114  
 138-AlaPheArgLysAsn-142  
 212-AspSerLeuGlyVal-216  
 234-AlaSerMetMetArgLeuProAspIle-242  
 276-AlaPheValGluPhePheGlyGluGly-284  
 331-LysLeuValGluThrTyrAlaLysThr-339  
 343-TrpAlaAspAlaLeuLysThrAla-350  
 364-ThrArgAsnMetAlaGlyProSerAsn-372  
 383-AlaAlaLysGlyLeuAlaLysProTyrGluGluProSerAspGly-397  
 407-AlaAlaIleThrSerCysThrAsnThrSerAsnProArgAsnVal-421  
 480-ThrCysAsnGlyMetSer-485  
 570-IleAspAlaValValAlaGluTyrValLysProGlnGlnPheArgAspValTyrVal-588  
 600-ProSerProLeuTyrAspTrpArg-607  
 610-SerThrTyrIleArg-614  
 627-ArgThrLeuArgGlyMetArgProLeu-635  
 672-AspPheAsnSerTyrAlaThr-678  
 697-PheAsnGluMetValLys-702  
 723-MetArgMetTrpGluAlaIleGluThrTyrMet-733  
 761-ArgLeuAlaGlyVal-765  
 768-IleValAlaGluGlyPheGluArgIleHisArgThrAsn-780  
 804-GlyThrGluThrTyr-808

**Antigenic Index - Jameson-Wolf**

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3-AlaAsnGlnArgTyrArgLysProLeuProGlyThrAspLeuGluTyrTyrAsp-20  
 22-ArgAlaAlaCysGluAspIleLysProGlySerTyrAspLysLeuProTyr-38  
 47-LeuValAsnArgAlaAspLysValAspLeuPro-57  
 67-IleGluGlyLysGlnGluIle-73  
 97-AlaGlyLeuArgAspAlaIleAlaGluLysGlyGlyAspProAlaLys-112  
 131-CysGlyGlyTyrAspProAspAlaPheArgLysAsnArgGluIleGluAspArgArgAsnGluAspArgPhe-154  
 162-ThrAlaPheGluAsn-166  
 181-AsnLeuGluLysMetSer-186  
 200-ThrCysValGlyThrAspSerHisThrProHisValAspSer-213  
 222-GlyGlyLeuGluAlaGluThr-228  
 246-GluLeuAsnGlyLysArgGlnAlaGly-254  
 267-PheLeuArgLysGluArgValVal-274  
 282-GlyGluGlyAlaArgSer-287  
 289-SerIleGlyAspArgAlaThr-295

-68-

299-MetThrProGluPhe-303  
 312-IleAspGluGlnThr-316  
 323-ThrGlyArgAspAspAlaGlnValLysLeu-332  
 362-SerValThrArgAsnMetAlaGlyProSerAsnProHis-374  
 386-GlyLeuAlaLysProTyrGluGluProSerAspGlyGlnMetProAspGly-402  
 412-CysThrAsnThrSerAsnProArgAsnVal-421  
 430-AsnAlaAsnArgLeuGlyLeuLysArgLysProTrpVal-442  
 445-SerPheAlaProGlySerLysValAla-453  
 464-ProGluMetGluLysLeu-469  
 480-ThrCysAsnGlyMetSerGlyAlaLeuAspProLysIleGlnLysGluIleIleAspArgAspLeuTyr-502  
 508-SerGlyAsnArgAsnPheAspGlyArgIleHisProTyrAlaLys-522  
 541-IleArgPheAspIleGluAsnAspVal-549  
 551-GlyValAlaAspGlyLysGluIleArgLeuLysAsp-562  
 564-TrpProAlaAspGluGluIleAspAlaVal-573  
 577-TyrValLysProGlnGlnPheArgAspVal-586  
 592-AspThrGlyThrAlaGlnLysAlaProSerProLeuTyrAspTrpArgProMetSerThrTyrIleArgArgProProTyrTrp-619  
 623-LeuAlaGlyGluArgThrLeuArgGlyMetArg-633  
 638-LeuProAspAsnIleThrThrAspHisLeuSerProSerAsn-651  
 667-GlyLeuProGluGluAspPheAsnSerTyrAlaThrHisArgGlyAspHisLeuThr-685  
 692-AlaAsnProLysLeuPhe-697  
 700-MetValLysAsnGluAspGlySerValArgGlnGlySerPheAlaArgValGluProGluGlyGluThr-722  
 732-TyrMetAsnArgLysGlnPro-738  
 745-AlaAspTyrGlyGlnGlySerSerArgAspTrpAlaAlaLysGlyValArg-761  
 772-GlyPheGluArgIleHisArgThrAsnLeu-781  
 791-PheLysProAspThrAsnArgHis-798  
 800-LeuGlnLeuAspGlyThrGluThrTyrAspValValGlyGluArgThrProArgCysAspLeu-820  
 824-IleHisArgLysAsnGlyGluThrValGlu-833  
 841-AspThrAlaGluGlu-845

**Hydrophilic Regions - Hopp-Woods**

5-GlnArgTyrArgLysProLeuPro-12  
 22-ArgAlaAlaCysGluAspIleLysProGlySerTyrAsp-34  
 47-LeuValAsnArgAlaAspLysValAspLeu-56  
 67-IleGluGlyLysGlnGluIle-73  
 97-AlaGlyLeuArgAspAlaIleAlaGluLysGlyGlyAspProAlaLys-112  
 132-GlyGlyTyrAspProAspAlaPheArgLysAsnArgGluIleGluAspArgArgAsnGluAspArgPhe-154  
 181-AsnLeuGluLysMetSer-186  
 205-AspSerHisThrProHis-210  
 224-LeuGluAlaGluThr-228  
 247-LeuAsnGlyLysArgGlnAlaGly-254  
 267-PheLeuArgLysGluArgValVal-274  
 282-GlyGluGlyAlaArg-286  
 289-SerIleGlyAspArgAlaThr-295  
 312-IleAspGluGlnThr-316  
 323-ThrGlyArgAspAspAlaGlnValLysLeu-332  
 386-GlyLeuAlaLysProTyrGluGluProSerAspGlyGlnMetProAsp-401  
 434-LeuGlyLeuLysArgLysProTrpVal-442  
 464-ProGluMetGluLysLeu-469  
 488-LeuAspProLysIleGlnLysGluIleIleAspArgAspLeuTyr-502  
 511-ArgAsnPheAspGlyArgIle-517  
 541-IleArgPheAspIleGluAsnAspVal-549

-69-

553-AlaAspGlyLysGluIleArgLeuLysAsp-562  
 564-TrpProAlaAspGluGluIleAspAlaVal-573  
 595-ThrAlaGlnLysAlaPro-600  
 623-LeuAlaGlyGluArgThrLeuArgGlyMetArg-633  
 667-GlyLeuProGluGluAspPheAsn-674  
 679-HisArgGlyAspHisLeuThr-685  
 700-MetValLysAsnGluAspGlySerValArg-709  
 714-AlaArgValGluProGluGlyGluThr-722  
 732-TyrMetAsnArgLysGlnPro-738  
 747-TyrGlyGlnGlySerSerArgAspTrpAlaAlaLysGlyValArg-761  
 772-GlyPheGluArgIleHisArg-778  
 791-PheLysProAspThrAsnArgHis-798  
 803-AspGlyThrGluThr-807  
 809-AspValValGlyGluArgThrProArgCysAsp-819  
 824-IleHisArgLysAsnGlyGluThrValGlu-833  
 841-AspThrAlaGluGlu-845

102

**AMPHI Regions - AMPHI**

42-ValLeuLeuTyrThrTrpPheSerMetLeu-51  
 67-GlyAlaSerPheAspThrMetValLysAspLeuLeuGlyArgGlyTrpAsnIleIleAsnGlyIleAla-89  
 109-ThrAlaLysGlyLeuGlySerAlaAla-117  
 128-LeuValPhePheGlyIleLeuAlaPheCys-137  
 144-LeuValAspArgPheThrGlyValLeu-152  
 155-GlyMetValLeuThr-159  
 207-AsnValSerSerLeuLeuLysTyrPheLys-216  
 221-LysValAlaLysSerIle-226  
 265-ValLeuIleGluThrLeuSerLysPheAlaGlnThrGlyAsnMetAspLysIleLeuSerLeuPheSerTyr  
 MetAla-290  
 303-PheAspTyrIleAlaAspIlePheLysTrpAsnAsp-314  
 341-PheValThrAlaIleGlyTyr-347  
 352-AlaThrValTrpThrGlyIleIlePro-360  
 374-GlyLysThrTyrLysVal-379

**Antigenic Index - Jameson-Wolf**

1-MetProAsnLysThrProSer-7  
 64-TyrProHisGlyAla-68  
 77-LeuLeuGlyArgGly-81  
 107-AspLeuThrAlaLysGlyLeuGlySerAlaAlaGlyGly-119  
 169-AlaAspAlaLysProSerVal-175  
 179-ThrGlnAlaProAlaGlyThr-185  
 214-TyrPheLysGlyAspAlaProLysValAla-223  
 246-GlyAsnLeuProArgAsnGluPhe-253  
 274-AlaGlnThrGlyAsnMetAspLysIle-282  
 311-LysTrpAsnAspSerIleSerGlyArgThrLysThr-322  
 364-LeuTyrArgSerArgLysLysPheGlyAlaGlyLysThrTyrLysVal-379

**Hydrophilic Regions - Hopp-Woods**

1-MetProAsnLysThr-5  
 169-AlaAspAlaLysPro-173  
 215-PheLysGlyAspAlaProLysValAla-223  
 248-LeuProArgAsnGluPhe-253  
 277-GlyAsnMetAspLys-281  
 316-IleSerGlyArgThrLysThr-322  
 366-ArgSerArgLysLysPheGlyAla-373

-70-

105-2

**AMPHI Regions - AMPHI**

11-TrpIleGlyLeuGly-15  
 22-ValThrArgLeuLeuAsp-27  
 51-LysValTyrGlyAsnThrAlaGluLeu-59  
 74-AlaAlaValCysAspIleLeuAsnGlyValArgAspGlyLeu-87  
 97-ThrIleSerProThr-101  
 110-ValGluAlaAlaGlyGlyGlnPheAlaGluAlaProVal-122  
 143-AlaValLeuAsnProLeuGlnLysIlePheSer-153  
 162-PheGlyAspValGlyLysGlySer-169  
 176-AsnSerLeuLeuGlyIlePheGlyGluAlaTyr-186  
 203-IleValGluAlaIleGlyXxxSerAla-211  
 249-LeuGluGlnAlaGlyAsnThrLeuProAlaValGlu-260  
 263-AlaAlaSerTyrArgLysAlaValGluAla-272

**Antigenic Index - Jameson-Wolf**

25-LeuLeuAspGlyGlyIleGlu-31  
 34-ValTyrAsnArgSerProAspLysThrAlaProIleSerAlaLysGlyAlaLysValTyrGlyAsnThr-56  
 81-AsnGlyValArgAspGlyLeuAla-88  
 96-SerThrIleSerProThrGluAsnLeuAla-105  
 121-ProValSerGlySerValGlyProAlaThr-130  
 139-GlyGlySerGluAla-143  
 155-ValGlyLysLysThrPheHisPheGlyAspValGlyLysGlySerGly-170  
 196-PheGlyIleAspThrAspThrIleVal-204  
 211-AlaMetAspSerProMetPheGlnThrLysLysSerLeuTrpAlaAsnArgGluPheProPro-231  
 237-HisAlaSerLysAspLeuAsnLeuAlaValLysGluLeuGluGlnAlaGlyAsnThrLeuPro-257  
 264-AlaSerTyrArgLysAlaValGluAlaGlyTyrGlyGluGlnAspValSerGly-281

**Hydrophilic Regions - Hopp-Woods**

25-LeuLeuAspGlyGlyIle-30  
 37-ArgSerProAspLysThrAlaProIleSerAlaLysGlyAlaLys-51  
 81-AsnGlyValArgAspGlyLeuAla-88  
 164-AspValGlyLysGlySerGly-170  
 196-PheGlyIleAspThrAspThrIle-203  
 218-GlnThrLysLysSerLeuTrpAla-225  
 237-HisAlaSerLysAspLeuAsnLeuAlaValLysGluLeuGluGlnAlaGly-253  
 265-SerTyrArgLysAlaValGlu-271  
 273-GlyTyrGlyGluGlnAspVal-279

109-2

**AMPHI Regions - AMPHI**

6-GlyThrTyrArgAspLeuHisArgProAlaSerGlu-17  
 53-LeuIleProAlaMetAlaGlyThrIleGly-62  
 69-AlaValAlaAlaAlaPhe-74  
 145-GlyLeuLeuMetAla-149  
 156-IleMetAlaLysLeuThrSer-162  
 177-GlyThrThrGlyGlnValLysLysLeuPheSerTrpAlaGly-190  
 207-ValMetTyrAlaLeuLeuGluHisTrpLysLysArgTrpLeu-220  
 222-ValProLeuGlyCysLeuIleAla-229  
 294-HisGlnValPheGlnLysIle-300  
 326-ValGlySerIleLeuGly-331  
 336-ThrSerSerTrpGlyThr-341  
 471-AlaValGlyMetLeuProGlyIleProProPheLeuGluHisPheLysSerLeu-488

**Antigenic Index - Jameson-Wolf**

-71-

1-MetGluLysHisAsnGlyThrTyrArgAspLeuHisArgProAlaSer-16  
 18-PheAlaThrArgAspGluTyrLeuGlu-26  
 32-MetGlnProLysArgTrpArgProAsnLeuProPheArgAspTyrArgPheGluTrp-50  
 78-LeuGlyLeuProAsp-82  
 109-ProGlyAlaAsnLeuProGlyThrHis-117  
 160-LeuThrSerAsnGlyVal-165  
 179-ThrGlyGlnValLysLys-184  
 259-GluAsnSerGlyTrp-263  
 301-SerTyrProGluLysThrAspLysVal-309  
 312-AsnIleAspAspThrMetThr-318  
 348-IleAlaLysArgProIleProGlyGly-356  
 398-AlaGlyMetGluMetThrArgLysGlyLysThrThrGln-410  
 441-GlyCysLysGluArgSerAla-447

**Hydrophilic Regions - Hopp-Woods**

1-MetGluLysHisAsnGlyThrTyrArgAspLeuHisArgProAlaSer-16  
 18-PheAlaThrArgAspGluTyrLeuGlu-26  
 35-LysArgTrpArgPro-39  
 44-ArgAspTyrArgPheGluTrp-50  
 180-GlyGlnValLysLys-184  
 301-SerTyrProGluLysThrAspLysVal-309  
 313-IleAspAspThrMetThr-318  
 348-IleAlaLysArgProIlePro-354  
 398-AlaGlyMetGluMetThrArgLysGlyLysThrThrGln-410  
 441-GlyCysLysGluArgSerAla-447

111-2

**AMPHI Regions - AMPHI**

6-ArgLeuProAsnPheIleArgVal-13  
 27-SerGluGlnThrTyrThrValLys-48  
 58-ProSerProAlaGluIleGlnLysArgIleAspAspAlaLeuLysGluValAsnArgGlnMetSerPheAsnG  
 lnHisThrAlaGlyLeuArgIleSer-102  
 128-GlyProLeuValAsnLeuTrp-134  
 151-IleLysGlnAlaAlaSerTyrThrGlyAspTyrAlaSerLeu-174  
 183-LeuAspLeuSerSerIleAlaLys-190  
 198-AlaGlyGluTyrLeuValGluIleGlyGly-215  
 237-AsnIleValGlnLeuSerHisIle-276  
 314-GluThrGluAlaLeu-318

**Antigenic Index - Jameson-Wolf**

1-MetProSerGluThrArgLeuProAsnPhe-10  
 CysSerGluGlnThrAla-31  
 37-GlnGlyGluThrMetGlyTyr-45  
 49-TyrLeuSerAsnAsnArgAspLysLeuProSerProAlaGluIleGlnLysArgIleAspAspAlaLeuLysG  
 luValAsnArgGlnMetSerThrTyrGlnProAspSerGluIleSerArgPheAsnGlnHisThrAlaGlyLysPr  
 oLeuArgIleSerSerAspPhe-105  
 111-GluAlaValArgLeuAsnArg-117  
 GlyPheGlyProAspLysSerValThrArgGluProSerProGluGlnIleLysGlnThrGly-159  
 163-IleIleLeuLysGlnGlyLysAspTyrAlaSerLeuSerLysThrHisProLysAla-181  
 187-SerPheGlyValAspLysValAlaGlyGluLeuGluLysTyrGly-205  
 213-IleGlyGlyGluLeuHisGlyLysGlyLysAsnAlaArgGlyGluProTrpArgIleGlyIleGluGlnPro  
 AsnIle-238  
 240-GlnGlyGlyAsnLeuAsnAsnArgSerLeuAlaThrSerGlyAspTyrArg-262  
 264-PheHisValAspLysAsnGlyLysArgLeuSerIleAsnProAsnAsnLysArgProIleSerAlaMetThr  
 AlaAspGlyLeuSer-306  
 314-GluThrGluAlaLeuLysLeuAlaGluArgGluLysLeu-326

332-ValArgAspLysGlyGlyTyrArgMetSerSerGluPheGluLysLeuLeuArg-351

**Hydrophilic Regions - Hopp-Woods**

1-MetProSerGluThrArgLeu-7  
 26-CysSerGluGlnThrAlaThrMet-41  
 51-SerAsnAsnArgAspLysLeuProSer-59  
 61-AlaGluIleGlnLysArgIleAspAspAlaLeuLysGluValAsnArgGlnGlnProAspSerGluIleSerA  
 rg-89  
 97-LysProLeuArgIleSerSer-103  
 111-GluAlaValArgLeuAsnArg-117  
 137-GlyProAspLysSerValThrArgGluProSerProGluGlnIleLysGln-153  
 163-IleIleLeuLysGlnGlyLysAspTyrAlaSer-173  
 175-SerLysThrHisPro-179  
 196-LysValAlaGlyGluLeuGluLysTyrGly-205  
 217-LeuHisGlyLysGlyLysAsnAlaArgGlyGluProTrp-229  
 267-AspLysAsnGlyLysArgLeuSerProAsnAsnLysArgProIle-285  
 299-AlaMetThrGlyLeuGluThrGluAlaLeuLysLeuAlaGluArgGluLysLeu-326  
 332-ValArgAspLysGlyGlyTyr-338  
 344-SerGluPheGluLysLeuLeuArg-351  
 117-1

**AMPHI Regions - AMPHI**

6-ProIleGlnAspThrGlnSerAla-13  
 15-LeuGlnGluLeuArgGluTrpPheAspSerTyrCysAlaThrPro-55  
 57-GlyGluProLeuProAspHisHisGluLeuAspLeuLeu-77  
 79-AspAlaValAlaAlaThrLeuLeuAlaAspIleGlyArgTyr-92  
 94-ProAspTrpLeuValSerCysAsnSerThrValAlaGluLeuValLysGlyValAspGluValGlnLysLeuT  
 hrHisPheAlaArgValAspSerLeuGlnAlaGluThrLysMetLeuLeuAlaMet-150

170-PheLeuSerAsnAlaProAspSerProGluLysAspIlePhe-191  
 216-LysProGluLysTyrArgArgLeuGluTyrIleGluAsnPheLeuAsnIleLeuArg-246  
 260-GlyArgProLysHisIleTyrSerIleTyrLys-270  
 282-LeuPheAspIleArg-286

290-IleLeuValAspThrValProGluCysTyrThrThrLeuGlyIleValHisSerLeuTrpGlnProIlePro  
 GlyGluPheAspAspTyrIleAla-321  
 327-GlyTyrLysSerLeuHisThr-333  
 351-AspMetHisGlnPheAsnGluPheGlyValAla-361  
 385-GlnLeuLeuAspTrp-389

412-AspThrHisGlyLysValHisSerSerIleGlyAspArgLeuGluAsn-465

485-TyrGluLysAlaIleGlyLysIleArgAlaTyrGlnGlnAsnAlaAsp-508  
 510-ValArgGluGlnLeuAlaLysLeuGlnGluLeuAlaGluGlyTyrLysLysProGluAspLeuTyrThrAsn  
 ArgAlaIleGlnLysAlaCysGlyThrLeuAsnGluProPro-571  
 585-LysIleLysLysGlyGlyMetThrThrLeuAlaLysCysCysLysProAlaAspAspIleIleGly-620  
 636-ProSerPheGlnHisLeuAlaGluHisAlaProGluLysValLeuAspAlaLeuGlnGlu-659

679-ArgAspValSerAspAla-684  
 714-GlnValAsnAspLeuProArgValLeuAlaSerLeuGlyAspValLysGlyValLeuSerValThrArg-73  
 6

**Antigenic Index - Jameson-Wolf**

5-SerProIleGlnAspThrGlnSerAlaThr-14  
 16-GlnGluLeuArgGluTrpPheAspSerTyrCysAlaAlaLeuProAspAsnAspLysAsnLeuHisTyrProA  
 la-50

-73-

52-AlaAlaThrProTyrGlyGluProLeuProAspHisPhe-64

72-HisAspLeuLeuPro-78

88-AspIleGlyArgTyrValProAspTrp-96

100-ValSerGluArgCysAsnSerThrVal-108

110-GluLeuValLysGlyValAspGluValGlnLysHis-123

125-AlaArgValAspSerLeuAlaThrProGluGluArgAlaGlnGlnAlaGluThrMetArg-144

162-AlaMetArgThrArgThr-167

173-AsnAlaProAspSerProGluLysArgAlaValAlaLysGluThrLeu-188

209-AspLeuGlyPheArgHisGlnLysProGluLysTyrArgGluLeuAspGluLysArgThrGluArgLeuGlu  
Tyr-237245-LeuArgGlyGluLeuLysLysTyrAsnValAlaGlyArgProLysHisLysMetValLysLysLysLeuSer  
Phe-279

283-PheArgAlaThrValProGluCysTyr-299

311-ProIleProGlyGluPheAspAspTyrIleAlaAsnProLysGlyAsnGlyTyrLysSerIleValGlyPro  
GluAspLysGlyValGluValGlnIleArgThr-349

356-AsnGlyTrpArgTyrLysGluGlyGlyLysGlyAspSerAlaTyrGluGlnLys-379

387-LeuAspTrpArgGluAsnMetAlaGluSerGlyLysGluAspLeuAlaAla-403

418-ThrProHisGlyLysProThrGly-429

440-HisSerSerIleGlyAspArgCysArgGlyAlaLysValGluGlyThrProLeuGluAsnGlyGlnArgVal  
GluIleIleThrAlaLysGluGlyHisProSerValAsnGlyTrpValLysSerAsnLysAlaIleGlyLysAla-  
500

502-IleArgGlnGlnAsnAlaAspThrValArgGluGluGlyArgValGlnLeuAspLysGlnLeuAla-523

525-LeuThrProLysProAsnLeuGlnGluLeuAlaGlu-536

538-LeuGlyTyrLysLysProGluAspLeuGlyGlnGlyGluIleSerAsnArgAlaIleGlnLysAlaCysGly  
ThrLeuAsnGluProProProValPro-574

582-LysGlnSerLysIleLysLysGlyGlyLysAsnGlyVal-594

596-IleAspGlyGluAspGlyLeu-602

608-LysCysCysLysProAlaProProAspAspIleIleValThrArgGluArgGlyIleSerValHisArgLys  
ThrCysProSerPhe-638644-HisAlaProGluLysValLeuAspGlnIleGluIleArgAlaGlnAspArgSerGlyLeuLeuArgAspVal  
SerAspAlaLeuAlaArgHisLysLeu-690

696-GlnThrGlnSerArgAspLeuGluAlaSerMet-706

710-LeuGluValLysGlnValAsnAspLeuProArg-720

726-GlyAspValLysGly-730

**Hydrophilic Regions - Hopp-Woods**

8-GlnAspThrGlnSer-12

16-GlnGluLeuArgGluTrpPhe-22

30-ProAspAsnAspLysAsnLeu-36

48-TyrProAlaProLeuProHisAspLeuLeuPro-78

100-ValSerGluArgCysAsnSerThrGluLeuValLysGlyValAspGluValGlnLysHis-123

125-AlaArgValAspSer-129

131-AlaThrProGluGluArgAlaGlnGlnAlaGluThrMetArg-144

162-AlaMetArgThrArgThrAlaProAspSerProGluLysArgAlaValAlaLysGluThrLeu-188

209-AspLeuGlyPheArgHisGlnLysProGluLysTyrArgGluLeuAspGluLysArgThrGluArgLeuGlu  
Tyr-237

245-LeuArgGlyGluLeuLysLysTyr-252

258-ValAlaGlyArgLysHisLysMetValLysLysLysLeuSerPhe-279

283-PheArgAlaThrValPro-296

314-GlyGluPheAspAsp-318

323-ProLysGlyAsnGly-327

337-GlyProGluAspLysGlyValGluValGlnIleArgThr-349

351-AspGlnArgTyrLysGluGlyGlyLysGlyAspSerAlaTyrGluGlnLeuAspTrpArgGluAsnMetAla  
GluSerGlyLysGluAspLeuAlaAla-403

405-PheLysLeuPheIleGlyAspArgCysArgGlyAlaLysValGluGlyLeuGluAsnGlyGlnArgValGlu  
IleIleThrAlaLysGluGlyHisPro-479

489-ValLysSerAsnLysAlaIleGlyLysAla-500

502-IleGlnAsnAlaAspThrValArgGluGluGlyArgValGlnLeuAspLysGlnLeuAla-523

538-LeuGlyTyrLysLysProGluAspLeuGly-551

553-GlyGluIleSerAsn-557

582-LysGlnSerLysIleLysLysGlyGlyLysVal-594

596-IleAspGlyGluAspGlyLeu-602

608-LysCysCysLysProAlaProProAspAsp-617

623-ThrArgGluArgGlyIleSerValHisArgLysThrCysHisAlaProGluLysValLeu-650

658-GlnIleGluIleArgAlaGlnAspArgSerGlyLeuLeuArgAspValSerAspAlaLeuAlaArgHisLys  
LeuThrGlnSerArgAspLeuGluAlaSerMet-706

710-LeuGluValLysGlnValAsnAspLeuProArg-720

726-GlyAspValLysGly-730

118-2

#### **AMPHI Regions - AMPHI**

11-ArgArgAsnIleGlyLysTrpTyrAsp-31

61-ProArgTyrIleGlyThrIleIleAspPheLeuMetValProAsn-79

102-GluArgLeuLysThrMetLeuArg-109

#### **Antigenic Index - Jameson-Wolf**

8-LysAsnPheArgArgAsnIleThrCysPheGluGlyTyrAspGluAsnSerPhe-25

27-GlyLysTrpTyrAspAspGlyValTrpAspAspGluGluTyrTrpLysLeuGluAsnAspLeuIleGluValA  
rgLysLysTyrProTyrProMetAspIle-60

93-AspSerValGlyIleAsnGluArgTyrGluArgLeuLysThr-106

112-PheThrGluLysAspIleValAspTyrTyrAsnLysLys-128

#### **Hydrophilic Regions - Hopp-Woods**

8-LysAsnPheArgArgAsnIleThr-15

33-GlyValTrpAspAspGluGluTyrTrpLysLeuGluAsnAspLeuIleGluValArgLysLysTyrProTyrA  
spIle-60

95-ValGlyIleAsnGluArgTyrGluArgLeuLysThr-106

112-PheThrGluLysAspIleVal-118

120-2

#### **AMPHI Regions - AMPHI**

6-LysAsnIlePheSerAla-11

49-SerGlyAsnAlaTyrLysIleValSerThrIleLys-60

77-AsnThrLeuHisProThrTyrTyrArgAspIleArgArg-89

142-IleThrAsnGlyLysLysLeuTyrSerValGlyGlyLeuAsnLysAlaGly-158

-75-

189-ProSerLeuAsnAsnIleProAla-196

**Antigenic Index - Jameson-Wolf**

3-LysThrPheLys-6

35-SerGlySerTyrGly-39

45-ThrPheGluArgSerGlyAsnAlaTyrLys-54

68-PheGluSerGlyGlyThrValVal-75

85-ArgAspIleArgArgGlyLysLeuTyrAlaGlu-95

97-LysPheAlaAspGlySerValThrTyrGlyLysAlaGlyGluSerLysThrGluGlnSerProLysAla-119

131-AlaAsnAspAlaLysLeuProProGlyLeuLysIleThrAsnGlyLysLysLeuTyrSer-150

153-GlyLeuAsnLysAlaGlyThrGlyLysTyrSerIleGlyGlyValGluThrGluValValLysTyrArgVal

ArgArgGlyAspAspAlaVal-183

199-GlyTyrThrAspAspGlyLysThrTyr-207

218-GlyGlnAlaAlaLysPro-223

**Hydrophilic Regions - Hopp-Woods**

45-ThrPheGluArgSerGlyAsn-51

85-ArgAspIleArgArgGlyLysLeuTyrAla-94

107-LysAlaGlyGluSerLysThrGluGlnSerProLysAla-119

131-AlaAsnAspAlaLysLeu-136

143-ThrAsnGlyLysLysLeuTyr-149

155-AsnLysAlaGlyThrGly-160

167-ValGluThrGluValValLysTyrArgValArgArgGlyAspAspAla-182

200-TyrThrAspAspGlyLysThrTyr-207

219-GlnAlaAlaLysPro-223

121-1

**AMPHI Regions - AMPHI**

42-ProGlyArgLeuArgArg-47

68-GlnGluLeuSerArgLeuTyrAlaGlnThr-77

101-ThrValArgHisAlaPro-106

148-ProAlaPheHisGlu-152

165-LeuAsnIleGlyGlyIleAlaAsnIle-173

189-ProGlyAsnMetLeuMetAspAlaTrpThr-198

216-GlyAsnIleLeuProGlnLeuLeuAspArgLeuLeu-227

237-ProLysSerThrGly-241

251-GluThrTyrLeuAsp-255

262-AspValLeuArgThrLeuSerArgPheThrAlaGlnThrValCysAspAlaValSerHis-281

303-AlaAspLeuAlaGluCysPhe-309

341-IleAsnArgIleProGlySerPro-348

**Antigenic Index - Jameson-Wolf**

13-ThrSerMetAspGlyAlaAsp-19

23-IleArgMetAspGlyGlyLysTrpLeuGly-32

40-ProTyrProGlyArgLeuArgArgGlnLeuLeuAspLeuGlnAspThrGlyAlaAspGluLeuHisArgSerA  
rgIleLeuSer-67

86-AsnLeuAlaProSerAspIleThrAla-94

97-CysHisGlyGlnThrValArgHisAlaProGluHisGlyTyrSer-111

119-LeuLeuAlaGluArgThrArg-125

128-ThrValGlyAspPheArgSerArgAspLeuAlaAlaGlyGlyGlnGly-143

154-LeuPheArgAspAsnArgGluThrArgAla-163

177-ProProAspAlaPro-181

184-GlyPheAspThrGlyProGlyAsn-191

205-ProTyrAspLysAsnGlyAlaLysAlaAlaGlnGlyAsn-217

235-ProHisProLysSerThrGlyArgGlu-243

253-TyrLeuAspGlyGlyGluAsnArgTyrAspValLeuArgThrLeuSerArg-269

-76-

283-AlaAlaAspAlaArgGln-288  
 293-GlyGlyGlyIleArgAsnProValLeu-301  
 321-LeuAsnLeuAspProGlnTrp-327  
 344-IleProGlySerProHisLysAlaThrGlyAlaSerLysProCysIle-359

**Hydrophilic Regions - Hopp-Woods**

13-ThrSerMetAspGlyAlaAsp-19  
 43-GlyArgLeuArgArgGlnLeuLeuAspLeuGlnAspThrGlyAlaAspGluLeuHisArgSerArgIleLeuSer-67  
 101-ThrValArgHisAlaPro-106  
 119-LeuLeuAlaGluArgThrArg-125  
 131-AspPheArgSerArgAspLeuAlaAla-139  
 154-LeuPheArgAspAsnArgGluThrArgAla-163  
 206-TyrAspLysAsnGlyAlaLysAlaAlaGln-215  
 236-HisProLysSerThrGlyArgGlu-243  
 254-LeuAspGlyGlyGluAsnArgTyrAspVal-263  
 283-AlaAlaAspAlaArgGln-288  
 345-ProGlySerProHisLysAlaThrGlyAlaSer-355  
 122-1

**AMPHI Regions - AMPHI**

6-AsnIleHisLysThrPhe-11  
 42-ThrPheLeuArgCysLeuAsnAlaLeuGluMetProGlu-54  
 102-LeuGluAsnValMetGlu-107  
 126-LysLeuLeuGluLys-130  
 176-ProGluLeuValGlnAspValLeuAspThrMetLysGluLeuAla-190  
 227-ProGlnAspLeuPheAspHisPro-234

**Antigenic Index - Jameson-Wolf**

5-ArgAsnIleHisLysThrPheGlyGluAsnThrIle-16  
 23-AspValCysLysGlyGln-28  
 34-GlyProSerGlySerGlyLysThrThr-42  
 51-GluMetProGluAspGlyGlnIleGluPheAspAsnGluArgProLeuLysIleAspPheSerLysLysProSerLysHisAspIle-79  
 81-AlaLeuArgArgLysSerGlyMet-88  
 96-PheProHisLysThrAlaLeu-102  
 114-GlyLysProAlaAlaGlnAlaArgGluGluAlaLeuLysLeuLeuGlu-129  
 131-ValGlyLeuGlyAspLysValAspLeuTyr-140  
 142-TyrGlnLeuSerGlyGlyGlnGlnGlnArgValGlyIle-154  
 168-AspGluProThrSerAlaLeuAspProGluLeuVal-179  
 182-ValLeuAspThrMetLysGluLeuAlaGlnGluGly-193  
 216-MetAspGlyGlyVal-220  
 222-ValGluGlnGlySerProGlnAspLeuPheAspHisProLysHisGluArgThrArgArgPheLeuSer-244  
 246-IleGlnSerThrLysIle-251

**Hydrophilic Regions - Hopp-Woods**

51-GluMetProGluAspGlyGlnIleGluPheAspAsnGluArgProLeuLysIleAspPheSerLysLysProSerLysHisAsp-78  
 81-AlaLeuArgArgLysSerGly-87  
 114-GlyLysProAlaAlaGlnAlaArgGluGluAlaLeuLysLeuLeuGlu-129  
 131-ValGlyLeuGlyAspLysValAsp-138  
 168-AspGluProThrSerAlaLeuAspProGluLeuVal-179  
 182-ValLeuAspThrMetLysGluLeuAlaGln-191  
 229-AspLeuPheAspHisProLysHisGluArgThrArgArgPheLeu-243  
 126-1

**AMPHI Regions - AMPHI**

73-GlyCysGlnSerValGlnGluAla-80  
 112-PheGlnLeuValGluAla-117  
 143-LeuAspAlaGlyCysGln-148  
 150-LeuMetProTrpAlaAlaProIleGlyThrGlyLeuGlyAlaVal-164  
 213-SerGlyAspProValAsnMetAlaArgAlaPhe-223

**Antigenic Index - Jameson-Wolf**

7-GluThrPheProSerArgLeu-13  
 24-GluIleLeuLysGlnSerIle-30  
 41-SerLeuArgArgAlaGlySerGlyGlyGluAlaHisGlyGlnGlyPhe-56  
 85-GlnMetAlaArgGluValPheGlu-92  
 99-GluLeuIleGlyAspAspAspThrLeuGln-108  
 121-LeuIleLysAspGlyPheLysValLeu-129  
 141-ArgLeuLeuAspAlaGlyCys-147  
 171-ValLeuArgGluArgLeuProAspThrProLeu-181  
 209-AlaValSerArgSerGlyAspProValAsn-218  
 228-GluSerGlyArgLeuAlaPhe-234  
 237-GlyProValGluAlaArgAspLysAlaGlnAlaSerThrProThrVal-252

**Hydrophilic Regions - Hopp-Woods**

41-SerLeuArgArgAlaGlySerGlyGlyGluAlaHis-52  
 85-GlnMetAlaArgGluValPheGlu-92  
 100-LeuIleGlyAspAspAspThrLeuGln-108  
 171-ValLeuArgGluArgLeuProAsp-178  
 210-ValSerArgSerGlyAspPro-216  
 228-GluSerGlyArgLeuAlaPhe-234  
 237-GlyProValGluAlaArgAspLysAlaGlnAla-247  
 127

**AMPHI Regions - AMPHI**

6-MetLeuAspThrTrpLeuGlyAla-13  
 20-AlaValGluSerValAlaAla-26  
 119-ValGlyAspTyrIleGluIle-125  
 135-IleAsnLeuLeuAsnThrLeuMet-142  
 147-ProAsnProLeuValGlyGlnLeuAla-155  
 206-LeuGluProLeuCysAlaPro-212  
 214-IleProAlaIleGlnArgXxxLeuGluAsnValGln-225  
 250-ArgIleIleValArgPheAlaSerProVal-259  
 268-AlaValMetAspGluPheLeuArgVal-276

**Antigenic Index - Jameson-Wolf**

16-IleArgAlaGluAlaValGlu-22  
 41-HisPheLysArgHisProAspPheGlyIleGluSerLysArgArgPheLeuVal-58  
 112-SerAlaThrGlnGlnTyrSerVal-119  
 126-AsnGlyLeuArgGlyArgValValAsp-134  
 169-HisProValArgArgAspAsnIleLeu-177  
 193-LeuAspSerAspGluAlaValCysArg-201  
 234-AlaAlaArgProArgValThrArgValProTyrAspAspLysAlaTyr-249  
 257-SerProValSerLysArgLeuGluIle-265  
 282-AsnHisProAlaGlySerGluThrLeu-290

**Hydrophilic Regions - Hopp-Woods**

16-IleArgAlaGluAlaValGlu-22  
 42-PheLysArgHisProAspPheGlyIleGluSerLysArgArgPheLeuVal-58  
 126-AsnGlyLeuArgGlyArgValVal-133  
 170-ProValArgArgAspAsnIleLeu-177

-78-

193-LeuAspSerAspGluAlaValCysArg-201  
 235-AlaArgProArgValThrArgValProTyrAspAspLysAlaTyr-249  
 259-ValSerLysArgLeuGluIle-265  
 285-AlaGlySerGluThrLeu-290  
 128-1  
**AMPHI Regions - AMPHI**  
 43-AlaGlnThrHisThrGlyTrpAlaAsnThrValGluProLeuThrGlyIleThrGluArgValGlyArgIleT  
 rpGlyValValSerHisLeuAsnSerValAlaAspThrProGluLeu-82  
 85-ValTyrAsnGluLeuMetProGluIle-93  
 102-GlnAspIleGluLeuTyrAsnArgPheLysThrIleLysAsnSerProGluPhe-119  
  
 166-PheSerGlnAsnValLeuAspAlaThrAsp-175  
 189-GlyIleProGluAspAla-194  
 218-HisTyrLeuAlaVal-222  
 245-GluLeuSerAspAspGlyLysPheAspAsnThrAlaAsnIleAspArgThrLeuAlaAsnAlaLeuGlnThr  
 AlaLysLeuLeuGlyPheLysAsnTyrAlaGlu-279  
 286-MetAlaAspThrProGluGlnValLeuAsnPheLeuHisAspLeuAlaArgArgAla-304  
 313-AlaGluValLysAlaPheAlaArg-320  
 359-GlyLysValLeuAsnGlyLeuPheAlaGlnIleLysLysLeuTyrGly-374  
 472-LeuHisHisLeuLeuThrGlnValAspGluLeu-482  
 496-GluLeuProSerGlnPhe-501  
 565-GlyArgLeuLysAsnTrpGlnGlnValLeuAspSerVal-577  
 610-SerTyrAlaTrpAlaGlu-615  
 623-AlaAlaPheGluGluSerAspAsp-630  
 636-LysArgPheTrpGluIleLeuAla-644  
 651-AlaAlaGluSerPheLysAlaPheArg-659  
  
**Antigenic Index - Jameson-Wolf**  
  
 9-LeuGlyGluGluProArgPheAspGlnIleLysThrGluAspIleLysProAlaLeu-27  
 32-AlaGluAlaArgGluGlnIleAla-39  
 43-AlaGlnThrHisThrGlyTrp-49  
  
 51-AsnThrValGluProLeuThrGlyIleThrGluArgValGlyArgIleTrp-67  
 75-SerValAlaAspThrProGluLeu-82  
  
 100-IleGlyGlnAspIleGluLeuTyrAsnArgPheLysThrIleLysAsnSerProGluPheAspThrLeuSer  
 ProAlaGlnLysThrLysLeuAsnHisAspLeuArgAsp-136  
 138-ValLeuSerGlyAlaGluLeuProProGluGlnGlnAlaGluLeuAlaLysLeuGlnThrGluGlyAlaGln  
 Leu-162  
 165-LysPheSerGlnAsnVal-170  
 172-AspAlaThrAspAla-176  
 190-IleProGluAspAla-194  
 202-AlaGlnSerGluSerLysThrGlyTyrLysIle-212  
 226-AlaAspAsnArgGluLeuArgGluGlnIle-235  
 240-ValThrArgAlaSerGluLeuSerAspAspGlyLysPheAspAsnThrAlaAsnIleAspArgThrLeu-26  
 2  
 285-LysMetAlaAspThrProGluGln-292  
 300-LeuAlaArgArgAlaLysProTyrAlaGluLysAspLeuAlaGlu-314  
  
 316-LysAlaPheAlaArgGluSerLeuAsn-324  
 335-TyrAlaSerGluLysLeuArgGluAlaLysTyrAlaPheSerGluThrGluValLysLys-354  
 376-GlyPheThrGluLysThrVal-382  
 387-LysAspValArgTyrPheGluLeuGlnGlnAsnGlyGluThrIle-401  
 409-TyrAlaArgGluGlyLysArgGlyGlyAla-418

-79-

420-MetAsnAspTyrLysGlyArgArgArgPheSerAspGlyThrLeu-434  
 447-ProProValGlyGlyArgGluAlaArgLeuSerHisAspGlu-460  
 478-GlnValAspGluLeuGlyVal-484  
 496-GluLeuProSerGln-500  
 516-SerAlaHisGluGluThrGlyVal-523  
  
 560-SerGluAspAspGluGlyArgLeuLysAsn-569  
 575-AspSerValArgLysLysValAla-582  
 586-ProProGluTyrAsnArg-591  
 605-SerAlaGlyTyrTyrSerTyr-611  
 625-PheGluGluSerAspAspValAlaAlaThrGlyLysArgPheTrp-639  
 646-GlyGlySerArgSerAlaAlaGluSerPheLysAlaPheArgGlyArgGluProSerIle-665  
 669-LeuArgHisSerGlyPheAspAsnAlaVal-678

**Hydrophilic Regions - Hopp-Woods**

9-LeuGlyGluGluProArgPheAspGlnIleLysThrGluAspIleLysPro-25  
  
 32-AlaGluAlaArgGluGlnIleAla-39  
 59-IleThrGluArgValGly-64  
 77-AlaAspThrProGluLeu-82  
  
 100-IleGlyGlnAspIleGluLeu-106  
 111-LysThrIleLysAsnSerProGluPheAspThr-121  
 123-SerProAlaGlnLysThrLysLeuAsnHisAspLeuArgAsp-136  
 143-GluLeuProProGluGlnGlnAlaGluLeuAlaLysLeuGlnThrGluGlyAlaGlnLeu-162  
 190-IleProGluAspAla-194  
 202-AlaGlnSerGluSerLysThrGlyTyr-210  
 226-AlaAspAsnArgGluLeuArgGluGlnIle-235  
 242-ArgAlaSerGluLeuSerAspAspGlyLysPheAspAsn-254  
 256-AlaAsnIleAspArgThrLeu-262  
 285-LysMetAlaAspThrProGlu-291  
 300-LeuAlaArgArgAlaLysProTyrAlaGluLysAspLeuAlaGlu-314  
  
 316-LysAlaPheAlaArgGluSerLeuAsn-324  
 335-TyrAlaSerGluLysLeuArgGluAlaLysTyrAlaPheSerGluThrGluValLysLys-354  
 377-PheThrGluLysThr-381  
 387-LysAspValArgTyr-391  
 396-GlnAsnGlyGluThr-400  
 409-TyrAlaArgGluGlyLysArgGlyGly-417  
 423-TyrLysGlyArgArgArgPheSerAsp-431  
 449-ValGlyGlyArgGluAlaArgLeuSerHisAspGlu-460  
 478-GlnValAspGluLeuGly-483  
 516-SerAlaHisGluGluThrGly-522  
  
 560-SerGluAspAspGluGlyArgLeuLysAsn-569  
 575-AspSerValArgLysLysValAla-582  
 625-PheGluGluSerAspAspValAlaAlaThrGly-635

647-GlySerArgSerAlaAlaGluSerPheLysAlaPheArgGlyArgGluProSerIle-665

130-2

**AMPHI Regions - AMPHI**

16-ThrLeuValSerGlyIle-21  
 36-GlySerGlySerPheGly-41  
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-80-

"

56-GlnProValGlyGlnLeu-61  
 91-AsnValProAsnAlaPro-96  
 110-GlnGlyPheAspThrLeuPheGlnHisAlaLeuAsnGlyPheAsnAlaMet-126  
 171-ThrAlaSerAlaPro-175  
 204-PheGluAlaThrCysGln-209

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211-CysHisGlyGlySerIleProGlyIlePro-220  
 234-LysGlyLysGluThr-238

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245-GluGlyPheAsnAlaMet-250

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#### **Antigenic Index - Jameson-Wolf**

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1-MetLysGlnLeuArgAspAsnLysAlaGlnGlySer-12  
 35-AlaGlySerGlySerPheGlyAspValAspAlaThrThrGluAlaAlaThrGlnThrArgIleGlnProValGly-59  
 63-MetGlyAspGlyIleProValGlyGluArgGlnGlyGlu-75  
 87-AlaAlaAspSerAsnValProAsnAlaProLysLeuGluHisAsnGlyAspTrpAla-105  
 108-IleAlaGlnGlyPhe-112  
 126-MetProAlaLysGlyGlyAla-132

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134-AspLeuThrAspGlnGluLeuLysArg-142  
 148-AlaAsnLysSerGlyGlySerPheProAsnProAspGluAlaAlaProAlaAspAsnAlaAlaSerGlyThrAlaSerAlaProAlaAspSerAlaAlaProAlaGluAlaLysAlaGluAspLysGlyAlaAla-192  
 197-GlyValAspGlyLysLysValPheGlu-205  
 221-GlyIleGlyLysLysAspAspTrpAlaProArgIleLysLysGlyLysGluThrLeuHis-240

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251-ProAlaLysGlyGlyAsnAlaGlyLeuSerAspAspGluValLysAla-266  
 274-GlnSerGlyAlaLys-278

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#### **Hydrophilic Regions - Hopp-Woods**

1-MetLysGlnLeuArgAspAsnLysAlaGlnGly-11  
 41-GlyAspValAspAlaThrThrGluAlaAlaThr-51

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68-ProValGlyGluArgGlnGlyGlu-75

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-81-

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87-AlaAlaAspSerAsnVal-92

"

"

96-ProLysLeuGluHisAsnGly-102

"

"

127-ProAlaLysGlyGlyAla-132

134-AspLeuThrAspGlnGluLeuLysArg-142

156-ProAsnProAspGluAlaAlaProAlaAspAsnAlaAla-168

174-AlaProAlaAspSerAlaAlaProAlaGluAlaLysAlaGluAspLysGlyAlaAla-192

198-ValAspGlyLysLysValPheGlu-205

222-IleGlyLysLysAspAspTrpAlaProArgIleLysLysGlyLysGluThrLeuHis-240

251-ProAlaLysGlyGlyAsn-256

258-GlyLeuSerAspAspGluValLysAla-266

132-2

**AMPHI Regions - AMPHI**

13-IleIleSerAlaLeuAlaVal-19

70-AlaThrCysMetAlaMetVal-76

92-ValGlnGlnThrGlnGlnAlaProLysProValSerAsnThr-105

**Antigenic Index - Jameson-Wolf**

26-GlnHisGlyLysGlyAlaAspAla-33

38-GlySerGlySerGlySerAla-44

81-HisThrThrLysHisGlyLeuAspPhe-89

91-AsnValGlnGlnThrGlnGlnAlaProLysProValSerAsnThrGluProSerAlaProValProGlnGlnGlnLys-116

**Hydrophilic Regions - Hopp-Woods**

28-GlyLysGlyAlaAspAla-33

97-GlnAlaProLysProValSerAsnThrGluProSerAla-109

134

**AMPHI Regions - AMPHI**

39-IleGlnSerAlaGlyThrVal-45

47-GlyLysLysThrGly-51

58-TrpMetGluIleGluLysGlnArg-65

83-ValAsnLeuLeuAspThrProGlyHis-91

97-AspThrTyrArgValLeuThrAlaVal-105

114-AlaAlaGlyValGlu-119

123-IleLysLeuLeuAsnValCysArg-130

142-LysTyrAspArgGluVal-147

149-AspSerLeuGluLeuLeuAspGluValGluAsnIleLeuLys-162

176-LysAsnPheLysGlyValTyrHisIleLeu-185

201-HisGluPheAspIleIleLysGlyIleAspAsn-211

254-PheGlySerAlaIle-258

265-GluIleLeuAsnSerLeuIleAspTrpAlaPro-275

322-LysPheGluArgGlyMetLys-328

361-AspIleIleGlyIleProAsnHis-368

395-LeuPheArgSerValArgIleLys-402

404-ProLeuLysIleLysGln-409

411-GlnLysGlyLeuGlnGlnLeuGlyGlu-419

-82-

423-ValGlnValPheLysProMetSer-430

449-SerArgLeuAlaAsnGluTyr-455

481-AlaGluPheGluLysAlaAsn-487

515-ArgTrpProAspIle-519

**Antigenic Index - Jameson-Wolf**

4-GluIleLeuAspGlnValArgArgArgArgThrPhe-15

19-SerHisProAspAlaGlyLysThrThrLeuThr-29

43-GlyThrValLysGlyLysLysThrGlyLysPheAlaThr-55

57-AspTrpMetGluIleGluLysGlnArgGly-66

76-PheAspTyrLysAspHisThrVal-83

85-LeuLeuAspThrProGlyHisGlnAspPheSerGluAspThrTyrArg-100

113-AspAlaAlaLysGlyValGlu-119

129-CysArgLeuArgAspThrPro-135

140-MetAsnLysTyrAspArgGluValArgAspSerLeuGluLeuLeuAspGluValGluAsn-159

173-GlyMetGlyLysAsnPheLys-179

194-AlaGlyGlyGluArgLeuProHis-201

207-LysGlyIleAspAsnProGluLeuGluGlnArgPheProLeu-220

223-GlnGlnLeuArgAspGluIleGluLeu-231

235-AlaSerAsnGluPheAsnLeu-241

275-ProAlaProLysProArgAspAlaThrValArgMetValGluProAspGluProLysPhe-294

302-GlnAlaAsnMetAspProLysHisArgAspArgIleAla-314

317-ArgValCysSerGlyLysPheGluArgGlyMetLysMetLysHisLeuArgIleAsnArgGluIleAla-339

348-SerHisAspArgGluLeuValGlu-355

365-IleProAsnHisGly-369

373-IleGlyAspSerPheSerGluGlyGluGln-382

399-ValArgIleLysAsnProLeuLysIleLysGlnLeuGlnLysGlyLeuGlnGlnLeuGlyGluGluGlyAla-422

450-ArgLeuAlaAsnGluTyrGlyVal-457

459-AlaValPheAspSer-463

473-SerCysAspAspLysLysLysLeuAlaGluPheGluLysAlaAsnAla-488

503-AlaProAsnArgValAsnLeu-509

511-LeuThrGlnGluArgTrpProAspIleVal-520

523-GluThrArgGluHisSerVal-529

**Hydrophilic Regions - Hopp-Woods**

4-GluIleLeuAspGlnValArgArgArgArgThr-14

21-ProAspAlaGlyLys-25

43-GlyThrValLysGlyLysLysThrGlyLys-52

59-MetGluIleGluLysGlnArgGly-66

77-AspTyrLysAspHisThr-82

92-GlnAspPheSerGluAspThrTyr-99

113-AspAlaAlaLysGlyValGlu-119

129-CysArgLeuArgAspThrPro-135

142-LysTyrAspArgGluValArgAspSerLeuGluLeuLeuAspGluValGluAsn-159

194-AlaGlyGlyGluArgLeuProHis-201

207-LysGlyIleAspAsnProGluLeuGluGlnArgPheProLeu-220

223-GlnGlnLeuArgAspGluIleGluLeu-231

277-ProLysProArgAspAlaThrValArgMetValGluProAspGluProLysPhe-294

305-MetAspProLysHisArgAspArgIleAla-314

319-CysSerGlyLysPheGluArgGlyMetLysMetLysHisLeuArgIleAsnArgGluIleAla-339

348-SerHisAspArgGluLeuValGlu-355

376-SerPheSerGluGlyGluGln-382

399-ValArgIleLysAsnProLeuLysIleLysGlnLeuGlnLysGlyLeu-414

417-LeuGlyGluGluGlyAla-422

-83-

473-SerCysAspAspLysLysLysLeuAlaGluPheGluLysAlaAsnAla-488  
 512-ThrGlnGluArgTrpPro-517  
 523-GluThrArgGluHisSerVal-529

135

**AMPHI Regions - AMPHI**

85-GluTyrThrAlaAsnLeu-90  
 169-AspIleAspGlyLeuTyrThr-175  
 185-ValArgLeuAspLysIleGluHis-192  
 212-GlyMetLeuThrLysIle-217  
 236-LeuLysProAspAla-240  
 242-AlaGluAlaAlaGlu-246  
 284-AlaGluHisAlaLeuSer-289  
 300-IleAlaGlyIleGluGly-305  
 308-SerArgMetAspThrValThrValTyr-316  
 318-LysAlaThrLysGlnPro-323

**Antigenic Index - Jameson-Wolf**

1-MetLysTyrLysArgIleVal-7  
 11-GlyThrSerSerIleThrHisSerAspGlySerLeuSerArgGlyLysIleGlnThr-29  
 60-GlyPheLysLysArgProValLysIleAlaAspLysGlnAlaSer-74  
 90-LeuSerSerAspGlyIle-95  
 105-AlaAspPheAlaAspLysArgArgTyrGlnAsnAlaGlyGly-118  
 124-LeuGlnArgArgAlaVal-129  
 132-IleAsnGluAsnAspThrValSerValGluGluLeuLysIleGlyAspAsnAspThrLeu-151  
 176-GlyAsnProAsnSerAsnProAspAlaValArgLeuAspLysIleGluHisIleAsn-194  
 202-GlyGlySerGlySerAlaAsnGlyThrGly-211  
 215-ThrLysIleLysAla-219  
 224-AlaGluSerGlyVal-228  
 233-CysSerSerLeuLysProAspAlaLeuAlaGluAlaAlaGluHisGlnAlaAspGly-251  
 257-ArgAlaLysGlyLeuArgThrGlnLysGln-266  
 271-TyrSerGluSerArgGlySerValTyrValAspGluGlyAlaGluHisAlaLeuSerGluGlnGlyLysSer  
 LeuLeu-296  
 305-GlyHisPheSerArgMetAspThr-312  
 317-SerLysAlaThrLysGlnProLeuGlyLysGlyArgVal-329  
 335-AlaAlaGluAspLeuLeuLysSerArgLysAlaLys-346  
 350-IleHisArgAspAspTrpIleSer-357

**Hydrophilic Regions - Hopp-Woods**

1-MetLysTyrLysArgIleVal-7  
 16-ThrHisSerAspGlySerLeuSerArgGlyLysIle-27  
 60-GlyPheLysLysArgProValLysIleAlaAspLysGlnAlaSer-74  
 105-AlaAspPheAlaAspLysArgArgTyrGlnAsn-115  
 124-LeuGlnArgArgAlaVal-129  
 133-AsnGluAsnAspThrValSerValGluGluLeuLysIleGlyAspAsnAspThrLeu-151  
 178-ProAsnSerAsnProAspAlaValArgLeuAspLysIleGluHisIleAsn-194  
 215-ThrLysIleLysAla-219  
 236-LeuLysProAspAlaLeuAlaGluAlaAlaGluHisGlnAlaAsp-250  
 257-ArgAlaLysGlyLeuArgThrGlnLys-265  
 272-SerGluSerArgGly-276  
 278-ValTyrValAspGluGlyAlaGluHisAlaLeuSerGluGlnGlyLys-293  
 306-HisPheSerArgMetAspThr-312  
 318-LysAlaThrLysGlnProLeuGlyLysGlyArgVal-329  
 335-AlaAlaGluAspLeuLeuLysSerArgLysAlaLys-346  
 351-HisArgAspAspTrp-355

136

**AMPHI Regions - AMPHI**

37-LeuArgPheValAspAspCysLeuPro-45  
 50-IleArgGlnCysIleArgGln-56  
 84-GlnCysHisAspGlyIleLysGlnLeuPheLysArgPheIleIleAspGlyPheLysProIleGlyArgHis-107  
 119-CysValLysIleAla-123  
 148-ArgHisCysGlnAsn-152  
 170-GlnHisPheGlyGlnPro-175  
 177-GluArgCysGlnPheVal-182  
 194-AsnLeuValAlaThr-198  
 210-GlnPheAlaGlnPro-214  
 216-PheGlyCysPheGlyLysPheSerGlyIleHis-226 \*

**Antigenic Index - Jameson-Wolf**

1-MetGluThrAsnAla-5  
 38-ArgPheValAspAspCysLeu-44  
 48-ValAspIleArgGlnCysIle-54  
 69-LeuGlnThrAspSer-73  
 84-GlnCysHisAspGlyIleLysGlnLeuPhe-93  
 99-AspGlyPheLysProIleGlyArgHisAsnIle-109  
 139-IleArgHisArgGlyGlyCysPheHisArgHisCysGlnAsnGlnProPheAsp-156  
 159-ThrPheGlyGlyGlyLysLeuArg-166  
 171-HisPheGlyGlnProValGluArg-178  
 184-ProAlaGlnGlnArgArgHisLysThr-192  
 214-ProProPheGlyCysPheGlyLysPheSerGly-224  
 236-ProTyrTyrArgArgAsnAlaVal-243

**Hydrophilic Regions - Hopp-Woods**

48-ValAspIleArgGlnCysIle-54  
 87-AspGlyIleLysGlnLeuPhe-93  
 185-AlaGlnGlnArgArgHisLysThr-192  
 137

**AMPHI Regions - AMPHI**

24-LeuSerTyrIleLeuGlyPhe-30  
 49-ThrLysGluSerLeu-53  
 55-AspPheLeuThrTrpGly-60  
 78-PheSerAspTyrLeuAlaHisProLeuAspIlePheLysValTrpGluGlyGly-95  
 120-PheLeuLysLeuMetAspThrValAlaProLeuValPro-132  
 139-ArgIleGlyAsnPheIle-144  
 149-TrpGlyArgValThrAspIleAsnAlaPhe-158  
 178-ProLeuTrpAlaGluTrpLeuGlnGlnTyr-187  
 190-LeuProArgHisProSerGlnLeu-197  
 232-TyrGlyIlePheArgPheIleAlaGluPheAlaArgGlnProAspAspTyrLeuGly-250

**Antigenic Index - Jameson-Wolf**

36-LeuGlyArgArgArgIleAlaGln-43  
 48-PheThrLysGluSerLeuAspAsp-55  
 92-TrpGluGlyGlyMet-96  
 111-LeuPheGlyArgLysHisGly-117  
 136-AlaSerGlyArgIle-140  
 164-ProGlnAlaArgTyrGluAspAlaGluAlaAlaAla-175  
 191-ProArgHisProSerGlnLeu-197  
 214-PheSerLysLysGlnArgSerThrGlyGln-223  
 241-PheAlaArgGlnProAspAspTyrLeu-249  
 277-PheGlyMetLysLysGlnHis-283

**Hydrophilic Regions - Hopp-Woods**

37-GlyArgArgArgIleAla-42  
 48-PheThrLysGluSerLeuAsp-54  
 112-PheGlyArgLysHisGly-117  
 166-AlaArgTyrGluAspAlaGluAlaAlaAla-175  
 216-LysLysGlnArgSerThrGly-222  
 241-PheAlaArgGlnProAspAspTyr-248  
 278-GlyMetLysLysGlnHis-283  
 138

**AMPHI Regions - AMPHI**

21-ProTyrIleArgArgPheSerGlySer-29  
 74-AsnAlaMetLeuGluLysVal-80  
 85-GluPheValGlnGlyMet-90  
 109-ValAsnLysGluIleValSerMetIleAsnThrTyrGly-121  
 152-IleGlyGlnValGlyThrValGluSerIle-161  
 163-ThrGlyLeuValLysGlyLeu-169  
 199-GlyLysLeuAlaGluGluLeu-205  
 213-MetThrAsnIleAlaGlyValMetAspLysThrGlyAsnLeuLeuThrLysLeuThr-231  
 234-ArgIleAspGluLeuIle-239  
 247-GlyMetLeuProLysIleAlaSerAlaValGluAlaAlaValAsn-261  
 276-AlaLeuLeuLeuGluIlePheThrAspAla-285

**Antigenic Index - Jameson-Wolf**

1-MetGluSerGluAsnIle-6  
 9-AlaAlaAspLysAlaArgIleLeu-16  
 23-IleArgArgPheSerGlySer-29  
 35-TyrGlyGlyAsnAlaMetThr-41  
 43-ProAlaLeuLysGluGlyPheAla-50  
 68-GlyGlyGlyProGln-72  
 76-MetLeuGluLysValGlyLysLysGlyGluPhe-86  
 91-ArgValThrAspLysGluAlaMetAsp-99  
 109-ValAsnLysGluIle-113  
 128-SerGlyArgAspAspHisPheIleLysAlaLysLysLeuLeuIleAspThrProGluGlnAsnGlyValAsp  
 IleGlyGln-154  
 159-GluSerIleAspThrGlyLeu-165  
 169-LeuIleGluArgGlyCysIle-175  
 182-GlyValGlyGluLysGlyGluAla-189  
 200-LysLeuAlaGluGluLeuAsnAlaGluLys-209  
 219-ValMetAspLysThrGlyAsnLeuLeuThrLysLeuThrProLysArgIleAspGluLeuIleAla-240  
 259-AlaValAsnGlyValLys-264  
 269-IleAspGlyArgLeuProAsnAla-276  
 292-LeuGlyGlyGlyGluAspAla-298

**Hydrophilic Regions - Hopp-Woods**

1-MetGluSerGluAsn-5  
 9-AlaAlaAspLysAlaArgIleLeu-16  
 43-ProAlaLeuLysGluGlyPheAla-50  
 76-MetLeuGluLysValGlyLysLysGlyGluPhe-86  
 91-ArgValThrAspLysGluAlaMetAsp-99  
 109-ValAsnLysGluIle-113  
 128-SerGlyArgAspAspHisPheIleLysAlaLysLysLeuLeuIleAspThrProGluGlnAsnGlyValAsp  
 -151  
 183-ValGlyGluLysGlyGluAla-189  
 200-LysLeuAlaGluGluLeuAsnAlaGluLys-209

-86-

219-ValMetAspLysThrGly-224

230-LeuThrProLysArgIleAspGluLeuIleAla-240

269-IleAspGlyArgLeu-273

294-GlyGlyGluAspAla-298

140-2

**AMPHI Regions - AMPHI**

23-ThrThrLeuSerAlaCysLeuGly-30

105-AspPheProAsnProAsnAspAlaTyrLysAsnLeuIle-117

139-ThrGlyGluSerValGlySerIleSerPhePro-149

201-AspIleArgHisValLysGluIleGlyHisIleAspLeuValSer-215

253-AlaAlaIleArgAsnAlaTrpValLysLeuGly-263

266-GlyValArgIleVal-270

282-ThrAlaAspLeuPheGlnIle-288

311-GlyIleArgLeuMetGlnGlnSerAsp-319

370-AspArgSerGlyGluLysPheLysArgGluMetTyr-381

415-ThrArgThrAsnPro-419

458-ThrAlaGlnAspIle-462

476-LeuAspAlaGlyLysAlaMetAsnGlyPro-485

608-TyrThrArgLeuGlyLysLeuLeuLys-616

673-SerLeuAspSerValGluLysThrAlaGly-682

696-AsnAlaAlaArgThrAlaSer-702

736-SerAlaThrProGluThrValGluThrAlaAla-746

763-ArgAlaAlaAlaAlaValGlnHisAlaAsnAlaAlaAspGlyValArgIlePheAsnSerLeuAlaAlaThr-786

803-LeuLysAlaValSerAspGlyLeuAsp-811

817-LeuArgValIleAlaGln-822

882-SerLeuPheAlaGly-886

894-IleGlyTyrLeuLysGlyLeuPheSerTyr-903

918-GluHisAlaGluGlySer-923

931-LeuGlyAlaLeuGly-935

980-GlyThrLeuValGlyLeu-985

1019-GlyGlyPheThrGlyAlaThr-1025

1040-ArgLeuValAlaGlyLeu-1045

1053-AsnGlyTrpAsnGlyLeuAlaArg-1060

**Antigenic Index - Jameson-Wolf**

1-MetArgThrThrPro-5

7-PheProThrLysThrPheLysProThr-15

30-GlyGlyGlyGlyGlyGlyThrSerAlaProAspPheAsnAlaGlyGlyThrGlyIleGlySerAsnSerArgAlaThrThrAlaLys-58

67-IleLysAsnGluMetCysLysAspArgSerMet-77

79-CysAlaGlyArgAspAspValAlaValThrAspArgAspAlaLysIleAsnAlaProProProAsnLeuHisThrGlyAspPheProAsnProAsnAspAlaTyrLysAsn-115

127-TyrThrGlyArgGlyValGlu-133

138-AspThrGlyGluSerValGlySerIleSerPhe-148

151-LeuTyrGlyArgLysGluHisGlyTyrAsnGluAsnTyrLysAsn-165

170-MetArgLysGluAlaProGluAspGlyGlyGlyLysAspIleGluAlaSerPheAspAspGluAlaValIleGluThrGluAlaLysProThrAspIleArgHisValLysGluIleGlyHis-210

220-GlyArgSerValAspGlyArgProAlaGlyGlyIleAlaProAspAla-235

241-AsnThrAsnAspGluThrLysAsnGluMet-250

262-LeuGlyGluArgGlyValArg-268

272-AsnSerPheGlyThrThrSerArgAlaGlyThrAlaAsp-284

288-IleAlaAsnSerGluGluGlnTyrArg-296

301-AspTyrSerGlyGlyAspLysThrAspGluGlyIleArg-313

-87-

315-MetGlnGlnSerAspTyrGlyAsn-322  
 327-IleArgAsnLysAsnMet-332  
 337-SerThrGlyAsnAspAlaGlnAlaGlnProAsnThr-348  
 355-TyrGluLysAspAlaGlnLys-361  
 368-GlyValAspArgSerGlyGluLysPheLysArgGluMetTyrGlyGluProGlyThrGluProLeuGluTyr  
 GlySerAsnHis-395  
 412-ValArgPheThrArgThrAsnPro-419  
 446-MetSerAsnAspAsnLeuArgThr-453  
 467-ValAspSerLysPheGly-472  
 477-AspAlaGlyLysAlaMetAsnGlyProAla-486  
 492-AspPheThrAlaAspThrLysGlyThrSer-501  
 506-SerPheArgAsnAspIleSerGlyThr-514  
 516-GlyLeuIleLysLysGlyGlySerGln-524  
 529-GlyAsnAsnThrTyrThrGlyLysThrIleIleGluGlyGlySer-543  
 548-GlyAsnAsnLysSerAspMetArgValGluThrLysGly-560  
 568-AlaSerGlyGlySerLeuAsnSerAspGly-577  
 582-AlaAspThrAspGlnSerGlyAlaAsnGlu-591  
 593-ValHisIleLysGlySerLeuGlnLeuAspGlyLysGlyThrLeu-607  
 615-LeuLysValAspGly-619  
 629-MetSerAlaArgGlyLysGlyAlaGly-637  
 640-AsnSerThrGlyArgArgValPro-647  
 653-LysIleGlyGlnAspTyr-658  
 663-AsnIleGluThrAspGlyGlyLeu-670  
 675-AspSerValGluLysThrAlaGlySerGluGlyAspThrLeu-688  
 691-TyrValArgArgGlyAsnAlaAlaArgThrAlaSer-702  
 714-HisAlaValGluGlnGlyGlySerAsnLeuGlu-724  
 730-LeuAspAlaSerGluSerSerAlaThrProGluThrValGlu-743  
 745-AlaAlaAlaAspArgThrAspMetProGlyIleArgProTyrGly-759  
 772-AsnAlaAlaAspGly-776  
 788-TyrAlaAspSerThrAlaAla-794  
 797-AspMetGlnGlyArgArgLeuLysAlaValSerAspGlyLeuAspHisAsnGlyThrGlyLeu-817  
 823-ThrGlnGlnAspGlyGlyThrTrpGluGlnGlyGlyValGluGlyLysMetArgGlySerThrGln-844  
 849-AlaAlaLysThrGlyGluAsnThrThr-857  
 863-GlyMetGlyArgSerThrTrpSerGluAsnSerAlaAsnAlaLysThrAspSerIle-881  
 887-IleArgHisAspAlaGlyAsp-893  
 902-SerTyrGlyArgTyrLysAsnSerIleSerArgSerThrGlyAlaAspGluHisAlaGluGlySerValAsn  
 -925  
 943-AlaThrGlyAspLeuThrValGluGlyGlyLeuArg-954  
 961-AspAlaPheAlaGluLysGlySerAlaLeuGlyTrpSerGlyAsnSerLeuThrGluGlyThr-981  
 990-LeuSerGlnProLeuSerAspLys-997  
 1005-GlyValGluArgAspLeuAsnGlyArgAspTyrThrVal-1017  
 1027-AlaThrGlyLysThrGlyAlaArgAsnMetProHisThr-1039  
 1049-ValGluPheGlyAsnGlyTrp-1055  
 1062-SerTyrAlaGlySerLysGlnTyrGlyAsnHisSerGlyArgValGlyVal-1078

**Hydrophilic Regions - Hopp-Woods**

50-SerAsnSerArgAlaThrThrAlaLys-58  
 67-IleLysAsnGluMetCysLysAspArgSerMet-77  
 80-AlaGlyArgAspAspValAlaValThrAspArgAspAlaLysIleAsnAla-96  
 106-PheProAsnProAsnAspAlaTyr-113  
 138-AspThrGlyGluSerValGly-144  
 152-TyrGlyArgLysGluHisGlyTyr-159  
 170-MetArgLysGluAlaProGluAspGlyGlyGlyLysAspIleGluAlaSerPheAspAspGluAlaValIle  
 GluThrGluAlaLysProThrAspIleArgHisValLysGluIleGlyHis-210  
 221-ArgSerValAspGlyArgProAlaGly-229

-88-

242-ThrAsnAspGluThrLysAsnGluMet-250  
 262-LeuGlyGluArgGlyValArg-268  
 278-SerArgAlaGlyThr-282  
 290-AsnSerGluGluGlnTyrArg-296  
 303-SerGlyGlyAspLysThrAspGluGlyIleArg-313  
  
 327-IleArgAsnLysAsn-331  
 339-GlyAsnAspAlaGlnAla-344  
 355-TyrGluLysAspAlaGlnLys-361  
 368-GlyValAspArgSerGlyGluLysPheLysArgGluMetTyrGly-382  
 384-ProGlyThrGluProLeuGlu-390  
 412-ValArgPheThrArg-416  
 477-AspAlaGlyLysAlaMetAsn-483  
 493-PheThrAlaAspThrLysGlyThrSer-501  
 509-AsnAspIleSerGly-513  
 517-LeuIleLysLysGlyGlySer-523  
 550-AsnLysSerAspMetArgValGluThrLysGly-560  
 583-AspThrAspGlnSerGlyAlaAsnGlu-591  
 601-LeuAspGlyLysGly-605  
 615-LeuLysValAspGly-619  
 631-AlaArgGlyLysGly-635  
 642-ThrGlyArgArgValPro-647  
 664-IleGluThrAspGly-668  
 675-AspSerValGluLysThrAlaGlySerGluGlyAspThr-687  
 692-ValArgArgGlyAsnAlaAlaArgThrAlaSer-702  
 714-HisAlaValGluGlnGlyGlySerAsnLeu-723  
 730-LeuAspAlaSerGluSerSerAlaThrProGluThrValGlu-743  
 745-AlaAlaAlaAspArgThrAspMetProGly-754  
 772-AsnAlaAlaAspGly-776  
 797-AspMetGlnGlyArgArgLeuLysAlaValSerAspGlyLeuAspHisAsnGlyThr-815  
 833-GlyGlyValGluGlyLysMetArgGlySerThr-843  
 851-LysThrGlyGluAsnThrThr-857  
 872-AsnSerAlaAsnAlaLysThrAspSer-880  
 887-IleArgHisAspAlaGlyAsp-893  
 905-ArgTyrLysAsnSerIleSerArgSerThrGlyAlaAspGluHisAlaGluGlySerVal-924  
 961-AspAlaPheAlaGluLysGlySer-968  
 992-GlnProLeuSerAspLys-997  
 1005-GlyValGluArgAspLeuAsnGlyArgAspTyrThr-1016  
 1027-AlaThrGlyLysThrGlyAlaArgAsnMetPro-1037  
**141**  
**AMPHI Regions - AMPHI**  
 11-GlnSerSerThrMetArgProIleGlyGluIle-21  
 44-ProAlaGluAlaPheLysLeuPro-51  
 80-AlaAspAlaLeuArgHisIle-86  
 131-PheHisAlaIleGlyAla-136  
  
 139-AsnLeuLeuAlaAlaMetLeuAspAsn-147  
 174-GlnLeuArgAsnIleIleAspGlyMetGlyLysProValAspGlyValMetArgPro-192  
 212-AspIleSerAspLeuLysGluArgLeuGlyIleLeuVal-225  
 245-MetAlaAlaLeuLeuLysAspAlaIleLysProAsnLeu-257  
  
 259-GlnThrIleGluGlyThrPro-265  
  
 272-ProPheAlaAsnIleAlaHisGlyCysAsnSerValThrAlaThrArgLeuAlaLysHisLeuAlaAspTyr  
 Ala-296

-89-

330-AlaThrValArgAla-334

351-LeuAspAlaLeuGluLysGlyLeuProAsnLeuLeuLysHisIleSerAsnLeuLysAsnValPheGly-373

406-SerLeuThrGluValTrpGlyLys-413

420-AspLeuAlaArgLysValValAsnAlaIleGluSerGln-432

473-IleAlaSerLeuGluLys-478

525-ValAlaLeuCysGlyAsnMetMetLysMetProGlyLeuProLysValProAlaAla-543

**Antigenic Index - Jameson-Wolf**

3-PheLysThrAspAlaGluIleAlaGlnSerSerThrMetArgProIleGly-19

27-LeuAsnAlaAspAsnIleGluProTyrGly-36

38-TyrLysAlaLysIleAsnProAlaGluAlaPheLysLeuProGlnLysGlnGlyArg-56

64-AsnProThrProAlaGlyGluGlyLysThrThr-74

81-AspAlaLeuArgHisIleGlyLysAspAla-90

94-LeuArgGluProSerLeuGlyPro-101

105-ValLysGlyGlyAlaAlaGlyGlyGly-113

151-GlnGlyAsnGluLeuAsnIleAspProLysArgValLeuTrp-164

166-ArgValValAspMetAsnAspArgGlnLeuArgAsnIleIleAspGlyMetGlyLysProValAspGlyValMetArgProAspGlyPheAspIle-197

211-LysAspIleSerAspLeuLysGluArgLeuGly-221

227-TyrAlaLysAspGlySerProValTyr-235

237-LysAspLeuLysAlaAsnGly-243

251-AspAlaIleLysProAsnLeu-257

287-ArgLeuAlaLysHisLeuAla-293

306-LeuGlyAlaGluLysPheCysAspIleLysCysArgLeuAlaGlyLeuLysProAspAla-325

335-LeuLysTyrAsnGlyGlyValGluArgAlaAsnLeuGlyGluGluAsnLeuAspAlaLeuGluLysGlyLeuProAsnLeu-361

383-PheValSerAspAlaAspAlaGluLeuAlaMetIleGluLysAlaCysAla-399

411-TrpGlyLysGlyGlyAlaGlyGlyAlaAspLeuAlaArgLysValValAsn-427

429-IleGluSerGlnThrAsnAsnPheGly-437

444-LeuGlyIleLysAspLysIleArgAlaIleAla-454

458-TyrGlyAlaGluAspValAspPheSerAla-467

474-AlaSerLeuGluLysLeuGlyLeuAspLysMetPro-485

494-SerLeuSerAspAsnAlaLys-500

503-GlyCysProGluAspPheArgIle-510

534-MetProGlyLeuPro-538

541-ProAlaAlaGluLysIleAspValAspAlaGluGly-552

**Hydrophilic Regions - Hopp-Woods**

3-PheLysThrAspAlaGluIleAlaGln-11

38-TyrLysAlaLysIleAsnPro-44

46-GluAlaPheLysLeuProGlnLysGlnGlyArg-56

67-ProAlaGlyGluGlyLysThr-73

81-AspAlaLeuArgHisIleGlyLysAspAla-90

94-LeuArgGluProSer-98

155-LeuAsnIleAspProLysArgValLeuTrp-164

166-ArgValValAspMetAsnAspArgGlnLeuArgAsnIleIle-179

181-GlyMetGlyLysProValAspGlyValMetArgProAspGlyPhe-195

211-LysAspIleSerAspLeuLysGluArgLeuGly-221

228-AlaLysAspGlySer-232

-90-

237-LysAspLeuLysAla-241  
 287-ArgLeuAlaLysHisLeuAla-293  
 306-LeuGlyAlaGluLysPheCysAspIleLysCysArgLeuAlaGlyLeuLysProAspAla-325  
 339-GlyGlyValGluArgAlaAsnLeuGlyGluGluAsnLeuAspAlaLeuGluLysGlyLeu-358  
 383-PheValSerAspAlaAspAlaGluLeuAlaMetIleGluLysAlaCysAla-399  
 420-AspLeuAlaArgLysValValAsn-427  
 444-LeuGlyIleLysAspLysIleArgAlaIleAla-454  
 458-TyrGlyAlaGluAspValAspPheSerAla-467  
 474-AlaSerLeuGluLysLeuGlyLeuAspLysMetPro-485  
 503-GlyCysProGluAspPheArgIle-510  
 541-ProAlaAlaGluLysIleAspValAspAlaGluGly-552

142-2

**AMPHI Regions - AMPHI**

26-ArgPheAlaAlaMetProAspValValGlyLys-36  
 44-GlyGlnProGlyLysMetPhe-50  
 100-AlaValThrProCysArg-105  
 107-ValCysArgAspAspMet-112  
 130-PheLeuGlnIleArgHisPheSerProLeu-139  
 174-LeuArgValGlnArgIleLeuAspPheGlyLysPheCysGlnGlnVal-189  
 202-LeuAspSerValValAlaPheValHisPhePheAlaAspPheLeuIle-217  
 239-AlaAspAsnGlnThrArgPhePheLysAlaGly-249  
 259-AsnAlaArgLeuIleArgGlnIleLeuLys-268

**Antigenic Index - Jameson-Wolf**

31-ProAspValValGly-35  
 38-LeuPheGlyArgGlnAlaGlyGlnProGlyLysMet-49  
 59-GlnArgIleAspAlaGluAlaAlaValPheArgGlnAspArgAsnAspSerArgThrProValAspAlaGlnHisHisGlyArgArgLeuValGlyAsnArgArgAspArgArgHisCysAsnAla-100  
 102-ThrProCysArgThrValCysArgAspAspMetAsnAlaCysArgAlaArgCysHisArgIleThrGluArgSerLeu-127  
 147-AlaAlaHisLysAlaSerPro-153  
 155-CysSerSerPheAspSerLysSerArgArgSerAspValSerAlaArgTyr-171  
 180-LeuAspPheGlyLysPheCys-186  
 225-GlnLeuGlnLysAsnThrSer-231  
 237-PheGlnAlaAspAsnGlnThrArgPhePheLysAlaGlyGlnAspThrGlyGlnAlaGlyAlaGlnAsn-259  
 267-LeuLysValGlnArgAlaValPheArgGlnLysThrAspAsnProPro-282  
 291-IleGlnAsnArgProGluLeuGlyHisGlnGly-301  
 307-GlnThrAspIleAspArgArgMetPhe-315

**Hydrophilic Regions - Hopp-Woods**

42-GlnAlaGlyGlnPro-46  
 59-GlnArgIleAspAlaGluAlaAlaValPheArgGlnAspArgAsnAspSerArgThrProValAspAlaGlnHisHisGlyArgArgLeuValGlyAsnArgArgAspArgArgHisCys-98  
 106-ThrValCysArgAspAspMetAsnAlaCysArgAlaArgCysHisArgIleThrGluArgSerLeu-127  
 147-AlaAlaHisLysAlaSerPro-153  
 158-PheAspSerLysSerArgArgSerAspValSerAla-169  
 237-PheGlnAlaAspAsnGlnThrArgPhePheLysAlaGlyGlnAspThrGlyGln-254  
 267-LeuLysValGlnArgAlaValPheArgGlnLysThrAspAsn-280  
 291-IleGlnAsnArgProGluLeuGly-298  
 309-AspIleAspArgArgMetPhe-315

144-2

**AMPHI Regions - AMPHI**

36-LeuGlyGlyIleValGlnGluPhe-43  
 45-ValLeuAlaAspGlyValArg-51

-91-

71-IleAsnLysGlnIleGlyArgValAlaGlyArg-81  
 136-SerAlaAspGlyTyr-140  
 212-SerAspAspLeuGluValPheAspPheSerArgProLys-224 \*  
 234-ArgArgGluThrGlyArgAlaGlyPhe-242  
 244-AlaTyrArgValProSerAspIleGlyArgProAlaAla-257  
 283-ProGlnAspPheAlaArg-288  
 295-AspAlaLeuAlaThr-299  
 306-AspSerLeuAsnTrpProGluPheGlyAsn-315

**Antigenic Index - Jameson-Wolf**

1-MetSerAspThrProAlaThrArgAspPheGlyLeuIleAspGlyArgAla-17  
 23-LeuSerAsnArgArgGlyThrArg-30  
 48-AspGlyValArgGlu-52  
 58-PheAspAspAlaAlaSerTyrAlaAspAsnProPheGlnIleAsn-72  
 78-ValAlaGlyArgIleArgGlyAlaAla-86  
 88-AspIleAsnGlyArgThrTyrArgValGluAlaAsnGluGlyArgAsnAlaLeuHisGlyGlySerHis-110  
 121-AlaAlaAspGlyArgSerValValLeu-129  
 131-SerArgLeuGlnGlnSerAlaAspGlyTyrProAsnAspLeuAspLeuAspIleSerTyrArgLeuAspGlu  
 AspAspArgLeuThrVal-160  
 199-MetProAlaAspAlaGluLysLeuPro-207  
 210-ThrValSerAspAspLeuGluValPheAspPheSerArgProLysProLeuAsp-227  
 232-AlaLeuArgArgGluThrGlyArgAlaGlyPheAspAspAlaTyrArgValProSerAspIleGlyArgPro  
 -255  
 261-AlaGlyArgArgArgArgIleSerIleTyrSerAspArgAsnGly-275  
 282-AlaProGlnAspPheAlaArgHisAspAlaGlyVal-293  
 300-GluAlaGlnThrLeuProAspSerLeuAsnTrpProGlu-312  
 314-GlyAsnIleArgLeuAsnLysGlyAspThrArgGluAlaThr-327

**Hydrophilic Regions - Hopp-Woods**

1-MetSerAspThrProAlaThrArgAsp-9  
 24-SerAsnArgArgGlyThrArg-30  
 48-AspGlyValArgGlu-52  
 58-PheAspAspAlaAlaSer-63  
 78-ValAlaGlyArgIleArgGlyAlaAla-86  
 89-IleAsnGlyArgThrTyrArgValGluAlaAsnGluGlyArgAsnAlaLeu-105  
 121-AlaAlaAspGlyArgSerValValLeu-129  
 131-SerArgLeuGlnGlnSerAlaAspGlyTyrProAsnAspLeuAspLeu-146  
 150-TyrArgLeuAspGluAspAspArgLeuThrVal-160  
 199-MetProAlaAspAlaGluLysLeuPro-207  
 210-ThrValSerAspAspLeuGluVal-217  
 221-SerArgProLysProLeuAsp-227  
 232-AlaLeuArgArgGluThrGlyArgAlaGlyPheAspAspAlaTyrArgValProSerAspIleGlyArg-25  
 4  
 261-AlaGlyArgArgArgArgIleSerIleTyrSerAspArgAsnGly-275  
 285-AspPheAlaArgHisAspAlaGlyVal-293  
 317-ArgLeuAsnLysGlyAspThrArgGluAlaThr-327  
 146

**AMPHI Regions - AMPHI**

19-LysGlnTyrGlyLeuLeuAspPheMetProCys-29  
 24-ProLeuAspAsnPheProThrVal-41  
 69-ValAlaAsnLeuArgArg-74  
 95-LeuArgAlaCysAlaValIleValAlaLysTyrValGlyValPheGlnLys-111  
 140-AlaArgArgValArg-144  
 158-ArgHisGlnArgGlyPheAlaArg-165  
 191-ProIleValSerGlnTrpThrPro-198

-92-

**Antigenic Index - Jameson-Wolf**

6-LeuArgSerArgGlnValValIleAspHisAspLysValLysGln-20  
 30-LeuArgGlnProProLeuAspAsn-37  
 41-ValArgProAlaSerValGluAlaArgGlyLysTyrValGluArgArgArgGlnAspLysAspAlaAspGlyPheGlyGlnArg-68  
 70-AlaAsnLeuArgArgAlaLeu-76  
 86-AlaCysArgArgGlnArgIleHisThr-94  
 112-SerPheLeuArgAspLysArgLeuLys-120  
 138-ArgArgAlaArgArgValArgHisGlyAsnAlaGln-149  
 155-GlnGlnProArgHisGlnArgGlyPheAla-164  
 166-AlaGlySerGlyArgAsnAspLysAspValAlaPheSerIle-179

**Hydrophilic Regions - Hopp-Woods**

6-LeuArgSerArgGlnValValIleAspHisAspLysValLysGln-20  
 44-AlaSerValGluAlaArgGlyLysTyrValGluArgArgArgGlnAspLysAspAlaAspGlyPheGly-66  
 70-AlaAsnLeuArgArgAlaLeu-76  
 86-AlaCysArgArgGlnArgIleHisThr-94  
 113-PheLeuArgAspLysArgLeuLys-120  
 138-ArgArgAlaArgArgValArgHisGlyAsn-147  
 156-GlnProArgHisGlnArgGlyPheAla-164  
 167-GlySerGlyArgAsnAspLysAspValAla-176  
 148

**AMPHI Regions - AMPHI**

25-AlaAspLysIleArgLysIleGluAsnTrpPro-35  
 49-GlnSerAlaGluTyrPheArgLeuLeuValAspLeu-60  
 150-AlaGlyLeuGluLeuIleArgLysLeuGlyGlyGluIle-162  
 165-AlaAlaAlaIleLeuGluPheThrAspLeuGlnGlyGlyLysAsnIleArg-181

**Antigenic Index - Jameson-Wolf**

4-LysThrSerAsnLeu-8  
 24-LeuAlaAspLysIleArgLysIleGluAsnTrpProGlnLysGly-38  
 66-MetAspGlnLysIleAspIle-72  
 76-LeuAspAlaArgGly-80  
 97-ProIleArgLysLysGlyLysLeuPro-105  
 117-TyrGlyGluAlaAlaVal-122  
 124-IleHisThrAspAlaValLysLeuGlySer-133  
 153-GluLeuIleArgLysLeuGlyGlyGluIleValGlu-164  
 172-ThrAspLeuGlnGlyGlyLysAsnIleArgAlaSerGlyAlaPro-186  
 192-GlnAsnGluGlyCysMetLysGly-199

**Hydrophilic Regions - Hopp-Woods**

24-LeuAlaAspLysIleArgLysIleGluAsnTrpPro-35  
 66-MetAspGlnLysIleAspIle-72  
 97-ProIleArgLysLysGlyLysLeuPro-105  
 117-TyrGlyGluAlaAlaVal-122  
 124-IleHisThrAspAlaValLysLeuGlySer-133  
 153-GluLeuIleArgLysLeuGlyGlyGluIleValGlu-164  
 178-LysAsnIleArgAlaSerGly-184  
 195-GlyCysMetLysGly-199

149-2

**AMPHI Regions - AMPHI**

78-AsnLeuGlyAspAlaLeuAspGlyValProGlyIle-89  
 107-ThrGlyArgArgIleLysValLeuAsnHisHisGlyGluThrGlyAspMet-123  
 141-GlnValGluIleLeuArgGlyProValThr-150

-93-

158-ValAlaGlyLeuValAsp-163  
 170-ProGluLysMetProGluAsnGlyVal-178  
 190-AsnLeuGluLysLeu-194  
 226-TyrArgAsnLeuLysArgLeuProAspSerHis-236  
 351-PheProGlyPheGlu-355  
 372-AlaGlyAspAlaValGluAsnPhePheAsnAsn-382  
 395-ProIleGlyArgLeuLys-400  
 415-LeuSerAlaIleSerGluAlaVal-422  
 571-ArgPheGlyAsnTyrIleTyrAlaGln-579  
 582-AsnAspGlyArgGlyProLysSerIleGluAsp-592  
 633-ArgGlyArgLeuLysAsnLeuProSer-641

**Antigenic Index - Jameson-Wolf**

1-MetArgArgGluAlaLysMetAla-8  
 31-HisGluThrGluGlnSerValAspLeuGluThr-41  
 46-GlyLysSerArgProArgAlaThrSerGly-55  
 61-ThrAlaSerAspLysIleIleSerGlyAspThrLeuArgGlnLysAla-76  
 103-IleArgGlyGlnThrGlyArgArgIleLysVal-113  
 115-AsnHisHisGlyGluThrGlyAspMetAlaAspPheSerProAspHis-130  
 143-GluIleLeuArgGlyPro-148  
 163-AspValAlaAspGlyLysIleProGluLysMetProGluAsnGlyValSerGlyGluLeuGlyLeu-184  
 186-LeuSerSerGlyAsnLeuGluLysLeuThrSerGlyGly-198  
 213-GlyLeuTyrArgLysSerGlyAspTyrAlaValProArgTyrArgAsnLeuLysArgLeuProAspSerHis  
 AlaAspSerGlnThrGly-242  
 250-GlyGluLysGlyPhe-254  
 258-AlaTyrSerAspArgArgAspGlnTyrGly-267  
 269-ProAlaHisSerHisGluTyrAspAspCysHisAla-280  
 287-SerLeuIleAsnLysArgTyrLeu-294  
 301-LeuThrGluGluAspIleAspTyrAspAsnProGlyLeu-313  
 316-GlyPheHisAspAspAspAsnAlaHis-324  
 326-HisThrHisSerGlyArgProTrpIleAspLeuArgAsnLysArgTyrGluLeuArgAlaGluTrpLysGln  
 ProPheProGly-353  
 360-HisLeuAsnArgAsnAspTyrArgHisAspGluLysAlaGlyAspAlaVal-376  
 380-PheAsnAsnGlnThrGlnAsnAlaArgIleGluLeuArgHisGlnProIleGlyArgLeuLysGlySerTrp  
 -403  
 408-LeuGlnGlnLysSerSerAla-414  
 428-LeuAspAsnLysVal-432  
 443-AlaAsnTrpAspAsnPheThrLeuGluGlyGlyValArgValGluLysGlnLysAlaSerIleGlnTyrAsp  
 LysAlaLeuIleAspArgGluAsnTyrTyrAsnHisProLeuProAsp-482  
 484-GlyAlaHisArgGlnThrAla-490  
 512-SerHisGlnGluArgLeuProSerThrGlnGluLeuTyrAlaHisGly-527  
 537-ValGlyAsnLysHisLeuAsnLysGluArgSerAsnAsnIle-550  
 556-TyrGluGlyAspArgTrpGln-562  
 568-TyrArgAsnArgPheGlyAsn-574  
 580-ThrLeuAsnAspGlyArgGlyProLysSerIleGluAspAspSerGluMetLysLeu-598  
 600-ArgTyrAsnGlnSerGlyAlaAspPheTyrGlyAlaGluGly-613  
 615-IleTyrPheLysProThrProArgTyrArgIle-625  
 627-ValSerGlyAspTyrValArgGlyArgLeuLysAsnLeuProSerLeuProGlyArgGluAspAlaTyrGly  
 AsnArgPro-653  
 655-IleAlaGlnAspAspGlnAsnAlaProArgValProAla-667  
 677-SerLeuThrAspArgIleAspAla-684  
 695-AsnLysLeuAlaArgTyrGluThrArgThrProGlyHis-707  
 713-GlyAlaAsnTyrArgArgAsnThrArgTyrGlyGluTrp-725  
 731-AlaAspAsnLeuLeu-735  
 745-PheLeuSerAspThrProGlnMetGlyArgSerPheThrGlyGlyVal-760

**Hydrophilic Regions - Hopp-Woods**

1-MetArgArgGluAlaLysMetAla-8

31-HisGluThrGluGlnSerValAspLeuGluThr-41  
 46-GlyLysSerArgProArgAlaThr-53  
 61-ThrAlaSerAspLysIleIleSer-68  
 70-AspThrLeuArgGlnLysAla-76  
 106-GlnThrGlyArgArgIleLysVal-113  
 118-GlyGluThrGlyAspMetAlaAspPheSerPro-128  
 163-AspValAlaAspGlyLysIleProGluLysMetProGluAsnGlyValSer-179  
 187-SerSerGlyAsnLeuGluLysLeuThr-195  
 213-GlyLeuTyrArgLysSerGlyAsp-220  
 225-ArgTyrArgAsnLeuLysArgLeuProAspSerHisAlaAspSerGlnThr-241  
 259-TyrSerAspArgArgAspGlnTyr-266  
 273-HisGluTyrAspAspCysHisAla-280  
 301-LeuThrGluGluAspIleAspTyrAspAsn-310  
 317-PheHisAspAspAspAsnAlaHis-324  
 336-LeuArgAsnLysArgTyrGluLeuArgAlaGluTrp-347  
 360-HisLeuAsnArgAsnAspTyrArgHisAspGluLysAlaGlyAspAlaVal-376  
 384-ThrGlnAsnAlaArgIleGluLeuArgHis-393  
 397-GlyArgLeuLysGly-401  
 452-GlyGlyValArgValGluLysGlnLysAla-461  
 468-AlaLeuIleAspArgGluAsnTyr-475  
 484-GlyAlaHisArgGlnThrAla-490  
 512-SerHisGlnGluArgLeuProSer-519  
 541-HisLeuAsnLysGluArgSerAsnAsn-549  
 556-TyrGluGlyAspArgTrp-561  
 581-LeuAsnAspGlyArgGlyProLysSerIleGluAspAspSerGluMetLysLeu-598  
 609-TyrGlyAlaGluGly-613  
 619-ProThrProArgTyrArgIle-625  
 630-AspTyrValArgGlyArgLeuLysAsn-638  
 643-ProGlyArgGluAspAlaTyrGly-650  
 655-IleAlaGlnAspAspGlnAsnAlaProArgValProAla-667  
 677-SerLeuThrAspArgIleAspAla-684  
 696-LysLeuAlaArgTyrGluThrArgThrProGly-706  
 715-AsnTyrArgArgAsnThrArgTyrGly-723  
 150-2

**AMPHI Regions - AMPHI**

20-IleThrGlnLeuLeuSerGlyLeuAsp-28  
 80-ValAlaAspLysAlaAlaAspSerLeuGlu-89  
 138-AsnGlyLysLysAlaProLysLeu-145  
 159-SerTyrProAsnPheCysGlnAlaGlyLysAspPheAspArgArgPheGlu-175  
 198-AlaTrpThrAspAsnIleAla-204  
 223-ThrProProAlaGlyLeuGln-229  
 293-ArgGluIleLeuAspLeuLeu-299  
 316-ValAlaArgAlaLeuSer-321  
 333-PheValLysGlyTyrAlaAlaPheAlaHisTyrGluGluLeuAspLysIleIle-350  
 365-IleValAspValLeuHisArgPheProAlaSerLeu-376  
 379-GluGlnPheIleArgLeuLeuArgProLeuAla-389  
 468-GlyValAlaProPheArg-473  
 505-ThrGluTrpGlnGlnPheAlaLys-512  
 537-IleArgGluGlnAla-541  
 560-AlaAlaLysMetAlaLysAspValGluAlaAlaLeuLeuAspValIle-575

588-GluTyrLeuAspMetLeuArgGluGlu-596

**Antigenic Index - Jameson-Wolf**

1-MetSerGluHisAspMetGlnAsnThrAsnProPro-12  
 16-LeuProProGluIle-20  
 42-LysAlaGlyAsnGlyAlaSerAlaGlyLeu-51  
 72-SerGlnThrGlyAsnAlaLysSerValAlaAspLysAlaAlaAspSerLeuGlu-89  
 96-SerArgAlaGluLeuLysAspTyrLysAlaLysAsnIleAlaGlyGluArgArgLeu-114  
 118-ThrSerThrGlnGlyGluGlyGluProProLysGluAlaValVal-132  
 137-LeuAsnGlyLysLysAlaProLysLeuAspLys-147  
 154-GlyLeuGlyAspSerSerTyrProAsnPheCysGlnAlaGlyLysAspPheAspArgArgPheGluGluLeu  
 GlyAlaLysArgLeuLeuGluArgValAspAlaAspLeuAspPhe-192  
 207-LeuLysGluGluAlaAlaLysAsnArgAlaThrProAlaProGlnThrThrProProAlaGlyLeuGlnThr  
 AlaProAspGlyArgTyrCysLys-238  
 250-GlnLysIleThrAlaArgGlnSerAspLysAspValArgHisIleGluIleAspLeuSerGlySerAspLeu  
 -273  
 276-LeuProGlyAspAla-280  
 285-PheAspAsnAspProAlaLeuVal-292  
 302-AspProAlaThrGluIleGlnAlaGlyGlyLysMetMetPro-315  
 324-PheGluLeuThrGlnAsnThrProAlaPhe-333  
 344-GluGluLeuAspLysIleIleAla-351  
 397-SerAlaGlnAlaGluValGlyAspGluValHis-407  
 415-PheGluHisGluGlyArgAlaArgThrGlyGlyAlaSerGlyPheLeu-430  
 432-AspArgLeuGluGluAspGlyThrVal-440  
 443-PheValGluArgAsnAspGlyPheArgLeuProGluAspSerArgLysPro-459  
 464-GlySerGlyThrGly-468  
 478-GlnArgAlaAlaGluAsnAlaGluGlyLysAsn-488  
 509-GlnPheAlaLysAspGlyPheLeuHisArgTyrAspPheAlaTrpSerArgAspGlnGluGluLysIleTyr  
 Val-533  
 535-AspLysIleArgGluGlnAlaGlu-542  
 559-AspAlaAlaLysMetAlaLysAspValGlu-568  
 579-GlyHisLeuAspGluGluGlyAlaGluGluTyrLeuAspMetLeuArgGluGluLysArgTyrGlnArgAsp  
 ValTyr

**Hydrophilic Regions - Hopp-Woods**

1-MetSerGluHisAspMetGlnAsn-8  
 75-GlyAsnAlaLysSerValAlaAspLysAlaAlaAspSerLeuGlu-89  
 96-SerArgAlaGluLeuLysAspTyrLysAlaLysAsnIleAlaGlyGluArgArgLeu-114  
 120-ThrGlnGlyGluGlyGluProProLysGluAlaValVal-132  
 137-LeuAsnGlyLysLysAlaProLysLeuAspLys-147  
 166-AlaGlyLysAspPheAspArgArgPheGluGluLeuGlyAlaLysArgLeuLeuGluArgValAspAlaAsp  
 LeuAspPhe-192  
 207-LeuLysGluGluAlaAlaLysAsnArgAlaThrPro-218  
 230-ThrAlaProAspGlyArgTyrCysLys-238  
 251-LysIleThrAlaArgGlnSerAspLysAspValArgHisIleGluIleAspLeuSerGly-270  
 288-AspProAlaLeuVal-292  
 344-GluGluLeuAspLysIleIleAla-351  
 398-AlaGlnAlaGluValGlyAspGluValHis-407  
 415-PheGluHisGluGlyArgAlaArgThrGlyGly-425  
 432-AspArgLeuGluGluAspGlyThrVal-440  
 443-PheValGluArgAsnAspGlyPheArgLeuProGluAspSerArgLysPro-459  
 479-ArgAlaAlaGluAsnAlaGluGlyLys-487  
 523-TrpSerArgAspGlnGluGluLysIleTyrVal-533  
 535-AspLysIleArgGluGlnAlaGlu-542  
 559-AspAlaAlaLysMetAlaLysAspValGlu-568

-96-

580-HisLeuAspGluGluGlyAlaGluGluTyrLeuAspMetLeuArgGluGluLysArgTyrGlnArgAspVal  
Tyr-604

151

**AMPHI Regions - AMPHI**

6-AsnIleAlaIleIleAla-11  
22-AspGlnLeuLeuArg-26  
72-ValAspThrProGlyHis-77  
81-GlyGlyGluValGluArgValLeuGlyMetValAspCysVal-94  
128-LysIleAspLysPro-132  
144-PheGluLeuPheAspAsnLeuGlyAlaThr-153  
165-SerGlyLeuSerGlyPheAlaLysLeuGluGluThrAspGluSerAsn-180  
184-ProLeuPheAspThrIleLeuLysTyrThr-193  
248-GlyArgIleAsnGlnLeuLeuGlyPheLysGlyLeuGluArgVal-262  
273-ValIleIleSerGlyIleGlu-279  
330-IleArgAspArgLeuGlnLysGluLeu-338  
348-AspThrAlaAspAla-352  
396-CysGluProTyrGluAsnLeuThrValAsp-405  
457-LeuThrArgGlyValGly-462  
464-MetSerHisValPheAsp-469  
537-LysGlyLysLysLeuThrAsnIle-544  
551-GluAlaValArgLeuThrThr-557

**Antigenic Index - Jameson-Wolf**

1-MetLysGlnIleArg-5  
13-ValAspHisGlyLysThrThrLeu-20  
24-LeuLeuArgGlnSerGlyThrPheArgAlaAsnGlnGlnValAspGluArgValMetAspSerAsnAspLeuG  
luLysGluArgGlyIle-53  
59-AsnThrAlaIleAspTyrGluGlyTyr-67  
72-ValAspThrProGlyHisAlaAspPheGlyGlyGluValGluArg-86  
99-AspAlaGlnGluGlyProMetProGlnThrArgPheValThr-112  
128-LysIleAspLysProSerAlaArgProSerTrp-138  
151-GlyAlaThrAspGluGlnLeuAsp-158  
171-AlaLysLeuGluGluThrAspGluSerAsnAspMetArgProLeu-185  
193-ThrProAlaProSerGlySerAlaAspGluThrLeu-204  
211-LeuAspTyrAspAsnTyrThrGly-218  
226-LeuAsnGlyArgIleLysProGlyGln-234  
240-AsnHisAspGlnGlnIleAla-246  
257-LysGlyLeuGluArgValProLeuGluGluAlaGluAlaGlyAsp-271  
277-GlyIleGluAspIleGly-282  
  
287-IleThrAspLysAspAsnProLysGlyLeuPro-297  
300-SerValAspGluProThrLeu-306  
314-ThrSerProLeuAlaGlyThrGluGlyLysPheValThrSerArgGlnIleArgAspArgLeuGlnLysGlu  
LeuLeu-339  
344-LeuArgValGluAspThrAlaAspAlaAspValPheArgValSerGlyArgGlyGluLeu-363  
371-AsnMetArgArgGluGlyTyr-377  
381-ValGlyLysProArgValValTyrArgAspIleAspGlyGlnLysCysGluProTyrGluAsnLeuThrVal  
AspValProAspAspAsnGlnGlyAlaValMetGluGluLeuGlyArgArgArgGlyGluLeuThrAsnMetGluS  
erAspGlyAsnGlyArgThrArgLeuGluTyr-440  
467-ValPheAspAspTyrAlaProValLysProAspMetProGlyArgHisAsnGly-484  
489-GlnGluGlnGlyGlu-493  
501-AsnLeuGluAspArgGlyArgMetPheValSerProAsnAspLysIleTyr-517  
524-IleHisSerArgAspAsnAspLeu-531  
535-ProLeuLysGlyLysLysLeuThrAsnIleArgAlaSerGlyThrAspGluAlaValArg-554  
569-PheIleAspAspAspGluLeuValGlu-577

-97-

579-ThrProGlnSerIleArgLeuArgLysArgTyrLeuSerGluLeuGluArgArgArgHisPheLysLysLeu  
Asp-603

#### Hydrophilic Regions - Hopp-Woods

1-MetLysGlnIleArg-5  
29-GlyThrPheArgAla-33  
35-GlnGlnValAspGluArgValMetAspSerAsnAspLeuGluLysGluArgGlyIle-53  
80-PheGlyGlyGluValGluArg-86  
99-AspAlaGlnGluGlyProMetPro-106  
128-LysIleAspLysProSerAla-134  
151-GlyAlaThrAspGluGlnLeuAsp-158  
171-AlaLysLeuGluGluThrAspGluSerAsnAspMetArgProLeu-185  
198-GlySerAlaAspGluThrLeu-204  
226-LeuAsnGlyArgIleLysPro-232  
241-HisAspGlnGlnIleAla-246  
258-GlyLeuGluArgValProLeuGluGluAlaGluAlaGlyAsp-271  
277-GlyIleGluAspIleGly-282  
287-IleThrAspLysAspAsnProLysGly-295  
300-SerValAspGluProThrLeu-306  
318-AlaGlyThrGluGlyLysPheValThr-326  
328-ArgGlnIleArgAspArgLeuGlnLysGluLeuLeu-339  
344-LeuArgValGluAspThrAlaAspAlaAspValPheArgValSerGlyArgGlyGluLeu-363  
371-AsnMetArgArgGluGlyTyr-377  
381-ValGlyLysProArgValValTyrArgAspIleAspGlyGlnLysCysGluProTyrGlu-400  
405-AspValProAspAspAsnGlnGlyAlaValMetGluGluLeuGlyArgArgArgGlyGluLeuThrAsnMet  
GluSerAspGlyAsnGlyArgThrArgLeu-438  
472-AlaProValLysProAspMetProGlyArgHis-482  
489-GlnGluGlnGlyGlu-493  
502-LeuGluAspArgGlyArgMet-508  
512-ProAsnAspLysIleTyr-517  
525-HisSerArgAspAsnAspLeu-531  
536-LeuLysGlyLysLysLeuThrAsn-543  
545-ArgAlaSerGlyThrAspGluAlaValArg-554  
569-PheIleAspAspAspGluLeuValGlu-577  
583-IleArgLeuArgLysArgTyrLeuSerGluLeuGluArgArgArgHisPheLysLysLeuAsp-603  
152

#### AMPHI Regions - AMPHI

10-LeuProThrArgLeuPhe-15  
66-ArgPheSerArgPheValGlnGlyTrpAlaGlyIleArgGlyTyrLeuLysAsnGlyIleProGluHisIleG  
lnProGlyHisAsnProLeu-96  
103-AlaLeuLeuAlaAla-107  
130-LeuAsnHisLeuValSerGluHisThrGlySerLeu-141  
150-PheLysLeuLeuAlaValPheSerAlaIleHisIleAlaAlaValAlaAlaTyr-167

#### Antigenic Index - Jameson-Wolf

1-MetLysAsnLysThrLysVal-7  
29-SerAlaLysAlaGlyGlyAsp-35  
61-GlySerAspThrAlaArgPheSerArg-69  
79-GlyTyrLeuLysAsnGlyIleProGluHisIleGlnProGlyHisAsnProLeu-96  
118-AlaAlaAspGluAsnThrPheSerThrAsnGlyTyr-129  
137-HisThrGlySerLeuMetArg-143  
169-ValPheLysLysLysAsnLeu-175  
186-IleGluGlyLysThrSerIle-192

#### Hydrophilic Regions - Hopp-Woods

-98-

1-MetLysAsnLysThrLysVal-7

63-AspThrAlaArgPhe-67

118-AlaAlaAspGluAsnThrPhe-124

169-ValPheLysLysLysAsnLeu-175

186-IleGluGlyLysThrSerIle-192

153

**AMPHI Regions - AMPHI**

17-AlaAlaSerValLeuSerLeuProGluMetMetArgLeuMetValPhe-32

96-ThrLeuValAlaTyrIleLysLeuSerSerValAlaGlu-108

130-ValSerValProGlnHisTrp-136

222-ValAsnThrIleLeuAsnGlyIleAlaTyr-231

274-AlaLysLysLeuSerHisLeuTyrArgIleThrGluAlaValGlyArgTrpSerMetIleAspIlePheVal  
Ile-298**Antigenic Index - Jameson-Wolf**

65-IleArgLysGlnAla-69

81-ValArgLeuArgGln-85

107-AlaGluValArgPhe-111

143-ArgLeuThrGlyAspAsnAlaValGlnThrAlaSerGluGlyLysThrCysCysSer-161

165-TyrPheArgAspSerAlaGluSerProCysGly-175

180-GluLeuTyrArgArgArgProLysSerLeuSer-190

215-SerAsnProAlaAlaThr-220

234-AspGluGlyAspArgLeu-239

272-ThrGlyAlaLysLysLeu-277

339-LeuLeuTrpAspLysArgAlaSerAspGlyIleAla-350

352-AsnGluThrGluLysHisAsp-358

**Hydrophilic Regions - Hopp-Woods**

81-ValArgLeuArgGln-85

107-AlaGluValArgPhe-111

152-ThrAlaSerGluGlyLysThrCysCys-160

168-AspSerAlaGluSerPro-173

180-GluLeuTyrArgArgArgProLysSerLeuSer-190

234-AspGluGlyAspArgLeu-239

273-GlyAlaLysLysLeu-277

339-LeuLeuTrpAspLysArgAlaSerAsp-347

352-AsnGluThrGluLysHisAsp

154

**AMPHI Regions - AMPHI**

122-GlyValThrGlyLeuGlyThrLeuLeu-130

152-GlnAspIleProProValThr-158

262-ThrLysAsnSerLysAsnValLysSer-270

298-PheLysGlnSerVal-302

"

"

360-SerLysGluHisTrpLysGlnGlnPheGlnThrAlaLeuAsnLysGlyLeuThrAla-378

389-SerLysMetIleGluLeuAsnAsp-396

"

429-LysLeuAlaAspLeuLeuAspLysPheAspLysLeuPro-441

446-ValAlaGluLeuAsnGly-451

467-LeuSerSerIleAspLysLeuValGlyLysProGlnThrGlnAsnIleProAsnGluLeuAsnGlnThrLeu  
LysGluLeuArgThrThr-496

-99-

506-IleTyrGlyAspValGlnAsnThrLeuGlnSerLeuAspLysThrLeuLysAspValGlnProValIleAsn  
ThrLeuLysGluLys-534

"

**Antigenic Index - Jameson-Wolf**

1-MetThrAspAsnSerProProProAsnGlyHisAlaGlnAlaArgValArgLysAsnAsnThr-21

43-LysGluIleArgAsnArgGlyProVal-51

57-AspSerAlaGluGlyIleGluValAsnAsnThr-67

75-AspValGlyArgValThrArgIleLysLeuArgAspAspGlnLysGlyValGlu-92

100-AspValSerGlyLeuIleArgSerAspThrGln-110

114-ValLysProArgIleAspGlnSerGly-122

138-ThrProGlyLysSerAspGluAlaLysAspValPheGln-150

"

"

169-LeuIleGlyLysAsnAspArgIleLeuAsn-178

"

196-AlaHisPheAspProSerAspGlnSer-204

212-GlnSerProAsnAspLysLeuIle-219

228-GluSerGlyIleAsnIleGluThrThrGlySerGlyIleLysLeuAsnSer-244

256-SerPheAspSerProLysThrLysAsnSerLysAsnValLysSerGluAspSer-273

"

"

275-ThrLeuTyrAspSerArgSerGluValAlaAsnLeuProAspAspArgSerLeu-292

300-GlnSerValArgGlyLeu-305

311-ValGluTyrLysGlyLeuAsn-317

325-ProTyrPheAspArgAsnAspSer-332

345-IleArgIleGluProSerArgLeuGluIleAsnAlaAspGluGlnSerLysGluHisTrpLysGlnGlnPhe  
-368

"

"

371-AlaLeuAsnLysGlyLeu-376

386-LeuThrGlySerLysMetIleGluLeuAsnAspGlnProSerAlaSerProLysLeuArgPro-406

"

"

419-GlnGlyGlyGlyLeuAspAspLeuGlnValLysLeu-430

432-AspLeuLeuAspLysPheAspLysLeuProLeuAspLysThrValAla-447

450-AsnGlySerLeuAlaGluLeuLysSerThrLeuLysSerAlaAsn-464

469-SerIleAspLysLeuValGlyLysProGlnThrGlnAsnIleProAsnGluLeuAsnGlnThrLeuLysGlu  
LeuArgThrThr-496

500-ValSerProGlnSer-504

516-SerLeuAspLysThrLeuLysAspValGln-525

"

530-ThrLeuLysGluLysProAsn-536

"

541-AsnSerSerSerLysAspProIleProLysGlySerArg-553

"

-100-

**Hydrophilic Regions - Hopp-Woods**

1-MetThrAspAsnSerProProPro-8

12-AlaGlnAlaArgValArgLysAsnAsn-20

"

43-LysGluIleArgAsnArgGly-49

57-AspSerAlaGluGlyIleGlu-63

75-AspValGlyArgValThrArgIleLysLeuArgAspAspGlnLysGlyValGlu-92

105-IleArgSerAspThr-109

"

116-ProArgIleAspGln-120

"

"

140-GlyLysSerAspGluAlaLysAspValPheGln-150

"

"

171-GlyLysAsnAspArgIleLeu-177

196-AlaHisPheAspProSerAspGln-203

"

214-ProAsnAspLysLeuIle-219

258-AspSerProLysThrLysAsnSerLysAsnValLysSerGluAspSer-273

"

278-AspSerArgSerGluVal-283

285-AsnLeuProAspAspArgSer-291

311-ValGluTyrLysGly-315

328-AspArgAsnAspSer-332

"

345-IleArgIleGluProSerArgLeuGluIleAsnAlaAspGluGlnSerLysGluHisTrpLys-365

390-LysMetIleGluLeuAsnAspGlnProSerAlaSerProLysLeuArgPro-406

"

421-GlyGlyLeuAspAspLeuGlnValLysLeu-430

"

"

432-AspLeuLeuAspLysPheAspLysLeuProLeuAspLysThrValAla-447

"

454-AlaGluLeuLysSerThrLeuLysSerAlaAsn-464

"

469-SerIleAspLysLeuValGly-475

"

"

482-IleProAsnGluLeu-486

498-GlnThrLeuLysGluLeuArgThr-495

"

516-SerLeuAspLysThrLeuLysAspValGln-525

"

530-ThrLeuLysGluLysProAsn-536

"

543-SerSerLysAspProIleProLysGlySerArg-553

#### 155

##### AMPHI Regions - AMPHI

28-LysLeuGlyPheGlu-32

42-AlaAlaSerLeuAsp-46

105-LeuArgAlaLysLysVal-110

118-ValProArgIleSerArgAlaGlnAlaLeuAspAlaLeuSerSerMetAlaAsnIleSerGlyTyrArgAla  
ValIleGluAlaAlaAsnAlaPheGlyArgPhePheThrGly-155

175-ValAlaGlyLeuAlaAlaIleGlyThrAlaAsnSerLeuGlyAlaValValArgAlaPhe-194

201-AlaGluGlnIleGluSerMetGlyGly-209

225-AspGlyTyrAlaLysValMet-231

262-LysProAlaProLysLeuIleThrLysGluMetValGluSerMetLys-277

295-LeuThrArgProGlyGlu-300

308-ValLysIleIleGlyTyrThrAspMetAlaAsnArgLeuAlaGlyGln-323

330-ThrAsnLeuValAsnLeuThrLysLeuLeuSer-340

404-LysLeuAlaProAlaVal-409

428-AsnHisPheIleVal-432

451-LeuHisThrProLeuMetSerValThrAsnAlaIleSerGlyIleIle-466

469-GlyAlaLeuLeuGln-473

478-AsnGlyPheValSerLeuLeuSerPheValAla-488

494-IleAsnIlePheGlyGly-499

##### Antigenic Index - Jameson-Wolf

4-GlyIleProArgGluSerLeuSerGlyGluThrArgVal-16

44-SerLeuAspAspAlaAla-49

72-ValAsnAlaProSerGluGlnGluLeu-80

94-TrpProArgGlnAsnGluAlaLeu-101

105-LeuArgAlaLysLysValAsn-111

117-MetValProArgIleSerArg-123

159-AlaAlaGlyLysValProProAla-166

194-PheAspThrArgLeuGluValAlaGluGlnIleGluSerMetGlyGlyLys-210

215-AspPheProGlnGluSerGlyGlySerGlyAspGlyTyrAlaLysValMetSer-232

242-LeuPheAlaGluGlnAlaLysGluValAsp-251

259-IleProGlyLysProAlaProLysLeuIleThr-269

271-GluMetValGluSerMetLysSerGlySer-280

289-ThrGlyGlyAsnCysGluLeuThrArgProGlyGluLeuSerVal-303

320-LeuAlaGlyGlnSerSer-325

338-LeuLeuSerProAsnLysAspGlyGluIle-347

349-LeuAspPheGluAspValIle-355

361-ValThrHisAspGlyGluIleThrPhePro-370

378-AlaGlnProGlnGlnThrProSerGluLysAlaValProAlaAlaLysProGluProLysPro-398

##### Hydrophilic Regions - Hopp-Woods

4-GlyIleProArgGluSerLeuSerGlyGluThrArgVal-16

-102-

44-SerLeuAspAspAlaAla-49  
 74-AlaProSerGluGlnGluLeu-80  
 96-ArgGlnAsnGluAlaLeu-101  
 105-LeuArgAlaLysLysValAsn-111  
 117-MetValProArgIleSerArg-123  
 194-PheAspThrArgLeuGluValAlaGluGlnIleGluSerMetGly-208  
 215-AspPheProGlnGluSerGlyGlySerGlyAspGlyTyrAla-228  
 242-LeuPheAlaGluGlnAlaLysGluValAsp-251  
 260-ProGlyLysProAlaPro-265  
 271-GluMetValGluSerMetLysSer-278  
 291-GlyAsnCysGluLeuThrArgProGlyGlu-300  
 340-SerProAsnLysAspGlyGluIle-347  
 349-LeuAspPheGluAspValIle-355  
 363-HisAspGlyGluIle-367  
 382-GlnThrProSerGluLysAlaValProAlaAlaLysProGluProLysPro-398  
 156

**AMPHI Regions - AMPHI**

56-AsnGlyPheGluAlaPheAlaProPhe-64

**Antigenic Index - Jameson-Wolf**

21-TyrAlaLysLysAlaGlyGlyPheArgPheLysAspAsnHisAsnProArgGly-38  
 44-GlnGlyAlaAlaAla-48  
 51-HisAlaAlaGlnGlnAsnGlyPheGlu-59  
 73-AlaThrGlyAsnAlaAla-78  
 103-AspLysAlaAlaMet-107

**Hydrophilic Regions - Hopp-Woods**

21-TyrAlaLysLysAlaGlyGlyPheArgPheLysAspAsnHisAsnPro-36  
 103-AspLysAlaAlaMet-107  
 157

**AMPHI Regions - AMPHI**

21-GlyArgAspValArgAlaAla-27  
 32-IleAsnHisLeuLeuLysArg-38  
 61-PheValArgAlaAlaGln-66  
 167-GlnLeuValAspArg-171  
 176-AlaHisAspArgSerLeuAspGlyPhe-184

**Antigenic Index - Jameson-Wolf**

1-MetArgAsnGluGluLysArgAlaLeuArgArgGluLeuArgGlyArgArgSerGlnMetGlyArgAspValArgAla-26  
 38-ArgTyrIleLysLysGlyArgLysIle-46  
 51-ProMetGlyLysGluLeuArgLeuAspGlyPheVal-62  
 64-AlaAlaGlnLysArgGlyAla-70  
 77-IleGluProArgSerArgArgMetTrp-85  
 89-TyrProAlaAspGlyValLysGlnGluArgLysArgGlyArgAlaLysLeuHis-106  
 111-AlaGlyArgLysLysArgValHisAsp-119  
 129-GlyMetAspArgLeuGlyTyr-135  
 151-MetLysTyrArgLeuGlnAla-157  
 172-LeuProValGluAlaHisAspArgSerLeuAspGlyPheVal-185

**Hydrophilic Regions - Hopp-Woods**

1-MetArgAsnGluGluLysArgAlaLeuArgArgGluLeuArgGlyArgArgSerGlnMetGlyArgAspValArgAla-26  
 38-ArgTyrIleLysLysGlyArgLysIle-46  
 54-LysGluLeuArgLeu-58

-103-

64-AlaAlaGlnLysArgGlyAla-70  
 77-IleGluProArgSerArgArg-83  
 92-AspGlyValLysGlnGluArgLysArgGlyArgAlaLysLeu-105  
 111-AlaGlyArgLysLysArgValHisAsp-119  
 131-AspArgLeuGlyTyr-135  
 151-MetLysTyrArgLeuGlnAla-157  
 172-LeuProValGluAlaHisAspArgSerLeuAsp-182  
 158

**AMPHI Regions - AMPHI**

20-PheSerArgAlaAlaGluGlnLeu-27  
 33-AlaValSerArgIleValLysArgLeuGlu-42  
 46-GlyValAsnLeuLeuAsnArgThr-53  
 63-GlyAlaGlnTyrPheArgArgAlaGlnArgIleLeuGlnGlu-76  
 85-LeuAlaValHisGluIleProGln-92  
 166-ValIleAlaSerPro-170  
 178-ThrProGlnSerThrGluGluLeu-185  
 188-HisGlnCysLeuGlyPheThrGluProGlySerLeuAsnThrTrpAlaVal-204

**Antigenic Index - Jameson-Wolf**

1-MetLysThrAsnSerGluGluLeu-8  
 16-GluSerGlySerPheSerArgAlaAlaGlu-25  
 36-ArgIleValLysArgLeuGluGluLysLeuGly-46  
 49-LeuLeuAsnArgThrThrArgGlnLeuSerLeuThrGluGluGlyAlaGlnTyrPheArgArgAlaGlnArgIleLeuGln-75  
 78-AlaAlaAlaGluThrGluMet-84  
 114-LysPheAsnGluArgTyrProHisIleArg-123  
 136-IleGluArgLysValAspIle-142  
 144-LeuArgAlaGlyGluLeuAspAspSerGlyLeuArgAla-156  
 158-HisLeuPheAspSerArgPheArgVal-166  
 168-AlaSerProGluTyrLeuAlaLysHisGlyThrProGlnSerThrGluGluLeuAla-186  
 192-GlyPheThrGluProGlySerLeuAsn-200  
 207-AlaGlnGlyAsnProTyrLysIle-214  
 216-ProHisPheThrAlaSerSerGlyGluIleLeu-226  
 229-LeuCysLeuSerGlyCys-234  
 243-LeuValAspAsnAspIleAlaGluGlyLysLeu-253  
 259-GluGlnThrSerAspLysThrHisProPhe-268  
 273-TyrSerAspLysAlaValAsnLeu-280  
 292-GluLeuGlyAsnAsnLeuCysGly-299

**Hydrophilic Regions - Hopp-Woods**

1-MetLysThrAsnSerGluGluLeu-8  
 19-SerPheSerArgAlaAlaGlu-25  
 36-ArgIleValLysArgLeuGluGluLysLeuGly-46  
 58-SerLeuThrGluGluGlyAlaGlnTyrPheArgArgAlaGlnArgIleLeuGln-75  
 78-AlaAlaAlaGluThrGluMet-84  
 114-LysPheAsnGluArgTyrPro-120  
 136-IleGluArgLysValAspIle-142  
 144-LeuArgAlaGlyGluLeuAspAspSerGlyLeuArgAla-156  
 162-SerArgPheArgVal-166  
 180-GlnSerThrGluGluLeuAla-186  
 246-AsnAspIleAlaGluGlyLysLeu-253  
 260-GlnThrSerAspLysThrHis-266  
 276-LysAlaValAsnLeu-280  
 160

**AMPHI Regions - AMPHI**

-104-

6-LysLeuValAspPheAlaGlnLeuThrGly-15  
 72-GlyLeuGlyHisVal-76  
 121-AlaAspLeuMetAsnGlyLeuProGluThr-130  
 157-GlyThrValSerMetValAsnAlaLeuSerSer-167  
 186-LeuSerGlyValLeuLysGlyTrpGlnAspLysArg-197  
 200-HisLeuIleGlnLysValIleAspLysProGlu-210  
 218-MetValAlaAlaAlaAsn-223  
 229-LeuMetArgArgPhe-233  
 242-HisAlaPheValAsnHisIleArg-249  
 279-PheGlyLysAlaPheLys-284

**Antigenic Index - Jameson-Wolf**

2-AspIleLeuAspLysLeuVal-8  
 28-SerValArgHisGluThrLeuGlnArgGluGlyLeu-39  
 51-CysIleAspGlyGluThrSerProArgProValSerThrGlyAsp-65  
 77-LeuSerHisAspGlyLysCysGlyGluSerLeuGlnProAspMetArgGlnHisGly-95  
 101-GlnCysGlyAsnGlyGlnAspMet-108  
 115-PheArgTyrAspThrHisAla-121  
 123-LeuMetAsnGlyLeu-127  
 149-LeuGluSerLysLysProLeu-155  
 178-LeuGluGlnAspLysAspValGluLeu-186  
 192-GlyTrpGlnAspLysArgLeuGly-199  
 205-ValIleAspLysProGluAspGluTrpAsnValAspLysMetVal-219  
 228-GlnLeuMetArgArgPheLysSerArgValGlyLeuSerProHis-242  
 255-LeuLeuLeuLysLysAsnProAspSerVal-264  
 274-GlnSerGluThrHisPhe-279  
 281-LysAlaPheLysArg-285  
 290-SerProGlyGlnTyrArgLysGluGlyGlyGlnLys-301

**Hydrophilic Regions - Hopp-Woods**

2-AspIleLeuAspLysLeuVal-8  
 29-ValArgHisGluThrLeuGlnArgGluGlyLeu-39  
 53-AspGlyGluThrSerProArgProValSer-62  
 79-HisAspGlyLysCysGlyGluSerLeuGlnProAspMetArgGln-93  
 101-GlnCysGlyAsnGlyGlnAsp-107  
 149-LeuGluSerLysLysProLeu-155  
 178-LeuGluGlnAspLysAspValGluLeu-186  
 193-TrpGlnAspLysArgLeuGly-199  
 205-ValIleAspLysProGluAspGluTrpAsnVal-215  
 228-GlnLeuMetArgArgPheLysSerArgValGly-238  
 255-LeuLeuLeuLysLysAsnProAspSer-263  
 281-LysAlaPheLysArg-285  
 293-GlnTyrArgLysGluGlyGlyGlnLys-301  
 163

**AMPHI Regions - AMPHI**

60-SerSerLeuGlyAsnIle-65  
 67-LeuGlyArgAspGluAsp-72  
 76-PheGlyPheLeuSerTrpLeuAlaMetLeuPhe-86  
 100-AlaGluProLeuMetHisTyrPheSerAspIleThrAla-112  
 170-IleSerGlyArgPheGlyAspAlaIleAspIleMetAlaLeuLeuAlaThrPhePheGlyIleIleThrThr-193  
 227-MetSerLeuAlaValValSerAlaIleSerGlyValGlyLysGlyValLysValLeuSer-246  
 272-AlaPheGlyAspAsnIleGlyAsnTyrLeuGlyAsnLeuValArg-286  
 313-TrpCysSerTrpAlaProPheValGlyLeuPheIleAla-325  
 346-LeuPheGlyValLeuTrpPhe-352

367-AlaGlyGlyMetLeuGluLysMetThrSerSer-377  
 380-ThrLeuLeuPheLysPhePheAsnTyrLeuProLeuProGluLeuThrSerIleValSerLeuLeu-401  
 438-TrpGlyValLeuMetSerAla-444  
 454-GlyLeuGlyAsnLeuGlnSerMetThrLeu-463  
 520-GluGlnAspIleLeuLysPheLeuLysGlnThrAlaSerPro-533  
 535-MetHisGluLeuGlnArgGluLeu-542  
 574-AspPheMetTyrGlyIle-579  
 583-GlyGlnAspValSerAspGlnLeu-590  
 630-AlaAspIleLeuLysAsnTyr-636

**Antigenic Index - Jameson-Wolf**

29-AspArgAlaLysGlu-33  
 65-IleArgLeuGlyArgAspGluAspValPro-74  
 111-ThrAlaGlyThrProGluHisArgGlnGln-120  
 166-LeuLysGluLysIleSerGlyArgPheGlyAspAlaIleAsp-179  
 200-GlnLeuGlyAlaGlyLeu-205  
 237-GlyValGlyLysGlyValLysVal-244  
 293-AlaTyrGluArgGluHisLysProTrpPhe-302  
 326-ArgIleSerLysGlyArgThrIleArg-334  
 370-MetLeuGluLysMetThrSerSerProGlu-379  
 409-ThrSerAlaAspSerGlyIle-415  
 421-IleThrSerArgAspLysGlyLeuSerAlaProArgTrp-433  
 451-ArgSerGlyGlyLeuGlyAsn-457  
 484-LeuSerAlaAspLysLysTyrPheGluThrArgValAsnProThrSer-499  
 503-ThrGlyGlyLysTrpLysGluArgLeu-511  
 516-SerGlnThrGlnGluGlnAspIle-523  
 527-LeuLysGlnThrAlaSer-532  
 537-GluLeuGlnArgGluLeuSerGluGluTyrGlyLeu-548  
 550-ValArgValAspLysMetPheHisArgAspGluProAla-562  
 566-ValIleArgLysGluThrMetArg-573  
 581-SerValGlyGlnAspValSerAspGlnLeuIleAsnAspGlyLysLeuProHisIleArgHisGlnThrThr  
 TyrLysProTyr-608  
 612-PheAspGlyArgValGlyTyr-618  
 622-TyrMetAsnLysAspGluLeuIle-629  
 632-IleLeuLysAsnTyrGlu-637  
 654-GluGlnValGluLeuAlaGlu-660

**Hydrophilic Regions - Hopp-Woods**

29-AspArgAlaLysGlu-33  
 66-ArgLeuGlyArgAspGluAspValPro-74  
 114-ThrProGluHisArgGlnGln-120  
 166-LeuLysGluLysIleSerGlyArgPheGlyAsp-176  
 238-ValGlyLysGlyValLysVal-244  
 293-AlaTyrGluArgGluHisLysPro-300  
 327-IleSerLysGlyArgThrIleArg-334  
 370-MetLeuGluLysMetThrSerSerPro-378  
 422-ThrSerArgAspLysGlyLeuSer-429  
 484-LeuSerAlaAspLysLysTyrPheGlu-492  
 506-LysTrpLysGluArgLeu-511  
 517-GlnThrGlnGluGlnAspIle-523  
 537-GluLeuGlnArgGluLeuSerGluGluTyrGlyLeu-548  
 550-ValArgValAspLysMetPheHisArgAspGluProAla-562  
 566-ValIleArgLysGluThrMetArg-573  
 581-SerValGlyGlnAspValSerAsp-588  
 590-LeuIleAsnAspGlyLysLeuProHis-598

-106-

622-TyrMetAsnLysAspGluLeuIle-629

654-GluGlnValGluLeuAlaGlu-660

164

**AMPHI Regions - AMPHI**

6-AlaAsnPheTyrGluMetLeuAlaAlaAla-15

33-AlaTyrArgAlaLeuLysGlnGlu-40

75-AlaIleSerAlaIleGlyAlaVal-82

97-TyrIleLeuAsnAspCys-102

113-LeuSerLysGluLeuAlaGlyLeuLysAla-122

148-PheGluAspValArgArgPheProGlu-156

160-LeuGlyArgGlnProArgIleAsnAspLeuAlaHis-171

189-TyrAlaAsnLeuPheAlaAsnLeuAsnGlyIleGluArgIlePheLys-204

264-ValProAlaIleTyrThr-269

282-TrpPheAsnArgIle-286

311-AlaLysLeuLeuGluGlyTyrGlyLeuSer-320

362-GluValGlyGluLeuIle-367

374-MetArgGlyTyrLeuAsn-379

387-ThrIleValAsnGlyTrpLeuLys-394

424-ValTyrProArgGluIleGluGluGlu-432

459-PheValGlnLeuLysGluGlyMet-466

472-GluIleArgArgHisLeuArgThrVal-480

484-PheLysIleProLysGln-489

499-AsnAlaThrGlyLysValLeuLysArgValLeuLysGluGlnPheAspGlyAsn-516

**Antigenic Index - Jameson-Wolf**

1-MetAsnArgThrTyr-5

15-AlaCysArgLysAsnGlyAsnGly-22

26-PheAspGlyLysGluLysThrAlaTyrArgAlaLeuLysGlnGluAlaGluAla-43

63-ValSerAsnSerThrGlu-68

88-ThrPheLeuLysAsnSerGlu-94

100-AsnAspCysLysAla-104

112-GlyLeuSerLysGluLeuAlaGly-119

121-LysAlaGlnThrProValGlu-127

130-IleTrpThrAspLysSerArgProThrGlyGluThrAlaGluGlyAspAlaPhePheGluAspValArgArg

PheProGluLysProAspLeuGlyArgGlnProArgIleAsnAsp-168

176-SerGlyThrThrGlyHisProLysGlyAla-185

196-LeuAsnGlyIleGluArgIlePheLysIleSerLysArgAspArgPhe-211

253-ThrLeuLeuLysArg-257

290-IleSerGlyGlyAlaProLeuAla-297

304-PheLysAlaLysPheProArg-310

317-TyrGlyLeuSerGluAlaSer-323

330-ThrProGluArgGlnLysAlaArgSer-338

343-LeuProGlyLeuGluAlaLysAlaValAspGluGluLeuValGluValProArgGlyGluValGly-364

367-IleValArgGlyGlySerValMet-374

382-AlaAlaThrAspGluThrIle-388

393-LeuLysThrGlyAsp-397

400-ThrIleAspGluAspGly-405

410-ValAspArgLysLysAspLeuIleIleSerLysGlyGlnAsnValTyrProArgGluIleGluGluGluIle

TyrLys-435

446-GlyValLysAspArgTyrAlaAspGluGluIle-456

462-LeuLysGluGlyMetAspLeuGlyGluAsnGluIleArgArgHisLeuArg-478

490-IleHisPheLysAspGlyLeuProArgAsnAlaThrGlyLysValLeuLysArgValLeuLysGluGlnPhe

AspGlyAsnLys-517

**Hydrophilic Regions - Hopp-Woods**

-107-

15-AlaCysArgLysAsnGlyAsn-21  
 26-PheAspGlyLysGluLysThrAlaTyrArgAlaLeuLysGlnGluAlaGluAla-43  
 112-GlyLeuSerLysGluLeuAlaGly-119  
 133-AspLysSerArgProThrGlyGluThrAlaGluGlyAspAlaPhePheGluAspValArgArgPheProGlu  
 LysProAspLeuGlyArgGlnProArgIleAsnAsp-168  
 198-GlyIleGluArgIlePheLysIleSerLysArgAspArgPhe-211  
 253-ThrLeuLeuLysArg-257  
 304-PheLysAlaLysPheProArg-310  
 330-ThrProGluArgGlnLysAlaArgSer-338  
 346-LeuGluAlaLysAlaValAspGluGluLeuValGluValProArgGlyGluValGly-364  
 382-AlaAlaThrAspGluThrIle-388  
 400-ThrIleAspGluAspGly-405  
 410-ValAspArgLysLysAspLeuIleIle-418  
 425-TyrProArgGluIleGluGluGluIleTyrLys-435  
 446-GlyValLysAspArgTyrAlaAspGluGluIle-456  
 462-LeuLysGluGlyMetAspLeuGlyGluAsnGluIleArgArgHisLeuArg-478  
 494-AspGlyLeuProArgAsnAlaThr-501  
 503-LysValLeuLysArgValLeuLysGluGlnPheAspGlyAsnLys-517  
 165-1

**AMPHI Regions - AMPHI**

17-AlaThrLeuGlyValLeuLeuLysGluLeu-26  
 33-ThrLeuIleGluArgLeuGluAsp-40  
 72-IleIleAspProAlaArgAlaLeuAsnIleAla-82  
 90-GlnPheTrpAlaThr-94  
 108-AsnAlaValProHis-112  
 125-LeuGlnLysArgTyrAspAlaPheLysThrGlnLysLeuPheGluAsnMet-141  
 182-ArgLeuThrArgGlnMetValLysTyrLeuGlnGly-193  
 198-ThrGluPheAsnArgHisValGluAspIleLysArgGlu-210  
 348-GlyTrpAlaAsnMetPro-353  
 364-LysThrLysGluGlu-368  
 371-AlaSerLeuLeuGluTyrTyr-377  
 453-TrpGluAspArgLeuLysGluLeu-460

**Antigenic Index - Jameson-Wolf**

1-MetAlaGluAlaThrAsp-6  
 24-LysGluLeuGluProSerTrp-30  
 36-GluArgLeuGluAspValAlaLeuGluSerSerAsnAlaTrpAsnAsnAlaGlyThrGly-55  
 97-AlaGluGlyLysLeuGluAspAsnSer-105  
 117-MetAsnGluAspHisCysSerTyrLeuGlnLysArgTyrAspAlaPheLysThrGlnLysLeuPheGlu-13  
 9  
 141-MetGluPheSerThrAspArgAsnLysIleSerAsp-152  
 157-MetMetArgGlyArgAspGluAsnGlnPro-166  
 169-AlaAsnTyrSerAlaGluGlyThrAspValAspPheGlyArgLeuThrArgGlnMet-187  
 191-LeuGlnGlyLysGlyValLysThrGluPheAsnArgHisValGluAspIleLysArgGluSerAspGly-21  
 3  
 319-ThrAlaAspThrArgAsnProAspGlyGlnLeu-229  
 249-GlnLysSerGlyIleProGluGlyLysGlyTyrGly-260  
 269-PheArgAsnSerAsnProGluThrAlaGluGlnHisAsn-281  
 300-LeuAspThrArgAsnValAspGlyLysArgHisLeu-311  
 322-AsnPheLeuLysGlnGlySerLeuMet-330  
 361-GluLeuArgLysThrLysGluGluArgPhe-370  
 377-TyrProGluAlaAsnProAspAspTrpGlu-386  
 395-GlnIleIleLysLysAspSerGluLysGlyGly-405  
 415-AlaHisAlaAspGlySer-420  
 428-SerProGlyAlaSerThr-433

-108-

446-PheProGluArgAlaProSerTrpGluAspArgLeuLysGluLeuValProGlyTyr-464  
 467-LysLeuAsnGluAsnProGluArgAlaAspGlu-477

**Hydrophilic Regions - Hopp-Woods**

1-MetAlaGluAlaThrAsp-6  
 24-LysGluLeuGluPro-28  
 36-GluArgLeuGluAspValAlaLeuGluSer-45  
 97-AlaGluGlyLysLeuGluAspAsnSer-105  
 117-MetAsnGluAspHisCys-122  
 125-LeuGlnLysArgTyrAspAlaPheLysThr-134  
 141-MetGluPheSerThrAspArgAsnLysIleSerAsp-152  
 158-MetArgGlyArgAspGluAsnGlnPro-166  
 172-SerAlaGluGlyThrAspValAspPhe-180  
 182-ArgLeuThrArgGlnMet-187  
 194-LysGlyValLysThrGluPheAsnArgHisValGluAspIleLysArgGluSerAspGly-213  
 219-ThrAlaAspThrArgAsnProAspGly-227  
 252-GlyIleProGluGlyLysGly-258  
 272-SerAsnProGluThrAlaGluGlnHisAsn-281  
 300-LeuAspThrArgAsnValAspGlyLysArg-309  
 361-GluLeuArgLysThrLysGluGluArgPhe-370  
 380-AlaAsnProAspAspTrpGlu-386  
 395-GlnIleIleLysLysAspSerGluLysGlyGly-405  
 446-PheProGluArgAlaProSerTrpGluAspArgLeuLysGluLeuVal-461  
 467-LysLeuAsnGluAsnProGluArgAlaAspGlu-477

**Hydrophilic Regions - Hopp-Woods**

1-MetAlaGluAlaThrAsp-6  
 24-LysGluLeuGluPro-28  
 36-GluArgLeuGluAspValAlaLeuGluSer-45  
 97-AlaGluGlyLysLeuGluAspAsnSer-105  
 117-MetAsnGluAspHisCys-122  
 125-LeuGlnLysArgTyrAspAlaPheLysThr-134  
 141-MetGluPheSerThrAspArgAsnLysIleSerAsp-152  
 158-MetArgGlyArgAspGluAsnGlnPro-166  
 172-SerAlaGluGlyThrAspValAspPhe-180  
 182-ArgLeuThrArgGlnMet-187  
 194-LysGlyValLysThrGluPheAsnArgHisValGluAspIleLysArgGluSerAspGly-213  
 219-ThrAlaAspThrArgAsnProAspGly-227  
 252-GlyIleProGluGlyLysGly-258  
 272-SerAsnProGluThrAlaGluGlnHisAsn-281  
 300-LeuAspThrArgAsnValAspGlyLysArg-309  
 361-GluLeuArgLysThrLysGluGluArgPhe-370  
 380-AlaAsnProAspAspTrpGlu-386  
 395-GlnIleIleLysLysAspSerGluLysGlyGly-405  
 446-PheProGluArgAlaProSerTrpGluAspArgLeuLysGluLeuVal-461  
 467-LysLeuAsnGluAsnProGluArgAlaAspGlu-477

204-2

**AMPHI Regions - AMPHI**

43-GlnAlaPheAsnArgIleThrAspLeuPhePhe-53  
 62-AlaLeuSerGlnIle-66  
 70-AsnArgArgIleValAspIlePheAspPheGluAsn-81  
 83-PheArgArgAlaLeuTyrArgValLeuArgLeuPheArgArgIlePheGly-99

**Antigenic Index - Jameson-Wolf**

-109-

34-AspGlnSerAspAsnIleLeu-40  
 44-AlaPheAsnArgIle-48  
 66-IleGlnThrGlyAsnArgArgIleValAsp-75  
 77-PheAspPheGluAsnArgPheArgArgAlaLeu-87  
 101-AlaAlaGlyGlyLysGlnGlnAla-108  
 112-TyrGlyLysArgCysPhe-117  
 126-SerLysCysArgLeuLysArgGlyArgArgArgPheGlyArgHisArgValHisPheAsnGlyArgMetPro  
 ThrAlaSerArgThrLeuSerAsnAsnSerArgAlaSerLeu-163  
 169-ProAlaCysLysIle-173  
 177-CysGluGlySerAla-181

**Hydrophilic Regions - Hopp-Woods**

68-ThrGlyAsnArgArgIleValAsp-75  
 77-PheAspPheGluAsnArgPheArgArgAlaLeu-87  
 104-GlyLysGlnGlnAla-108  
 112-TyrGlyLysArgCysPhe-117  
 126-SerLysCysArgLeuLysArgGlyArgArgArgPheGlyArgHisArgVal-142  
 148-MetProThrAlaSerArgThrLeuSerAsnAsnSerArgAlaSerLeu-163  
 205-1 (same as orf108, so delete this one)

**AMPHI Regions - AMPHI**

21-SerGluAsnThrAlaGluGlnProGlnAsnAlaValGlnSerAlaProLys-37  
 79-GluGlnAsnValIleArgLeuIleGlyLysHisProGlyAspLeu-93  
 119-HisThrLeuPheAlaLysLeuValGlyAsnIleAlaGluAspGlyGlyLys-135

**Antigenic Index - Jameson-Wolf**

18-CysGlyLysSerGluAsnThrAlaGluGlnProGlnAsnAlaValGlnSerAlaProLysProValPhe-40  
 55-LeuGlyGlnSerSerGluGlyLysThrAsnAspGlyLysLysGlnIle-70  
 73-ProIleLysGlyLeuProGluGlnAsnVal-82  
 86-IleGlyLysHisProGlyAspLeuGluAlaValSerGlyLysCysMetGluThrAspAspLysAspSerProA  
 laGlyTrpAlaGlu-114  
 129-IleAlaGluAspGlyGlyLysLeuThr-137  
 149-TyrGlnAlaGlyLysSerGlyTyr-156  
 168-IleAspSerGluGly-172  
 175-TyrPheArgArgArgHisTyr-181

**Hydrophilic Regions - Hopp-Woods**

19-GlyLysSerGluAsnThrAlaGluGlnProGln-29  
 56-GlyGlnSerSerGluGlyLysThrAsnAspGlyLysLysGlnIle-70  
 89-HisProGlyAspLeuGluAlaValSer-97  
 99-LysCysMetGluThrAspAspLysAspSerPro-109  
 129-IleAlaGluAspGlyGlyLysLeu-136  
 150-GlnAlaGlyLysSerGly-155  
 168-IleAspSerGluGly-172  
 176-PheArgArgArgHisTyr-181  
 206-2

**AMPHI Regions - AMPHI**

32-ProLysGlnThrValArgGlnIleGlnAlaVal-42  
 44-IleSerHisIleAspArgThrGlnGly-52  
 81-CysSerGlyMetIleGln-86  
 99-ArgThrAlaArgAspMet-104  
 150-SerGlyLysThrIleLysThrGlu-157

**Antigenic Index - Jameson-Wolf**

2-PheProProAspLysThrLeu-8  
 21-GlyThrThrSerGlyLysHisArgGlnProLysProLysGlnThrValArg-37

-110-

45-SerHisIleAspArgThrGlnGlySerGln-54  
 66-ThrProTyrLysTrpGlyGlySerSerThr-75  
 96-LysLeuProArgThrAlaArgAspMetAlaAlaAlaSerArgLysIleProAspSerArgLeuLysAlaGly-119  
 126-ThrGlyGlyAlaHisArgTyrSer-133  
 148-ProSerSerGlyLysThrIleLysThrGluLysLeuSer-160

**Hydrophilic Regions - Hopp-Woods**

23-ThrSerGlyLysHisArgGlnProLysProLysGlnThrVal-36  
 45-SerHisIleAspArgThrGlnGlySerGln-54  
 96-LysLeuProArgThrAlaArgAspMetAlaAlaAlaSerArgLysIleProAspSerArgLeuLysAlaGly-119  
 149-SerSerGlyLysThrIleLysThrGluLysLeuSer-160  
 211-2

**AMPHI Regions - AMPHI**

18-ValGlyAsnGlyValAspGluPheGlyArgGlyAla-29  
 57-GlnPheGluArgAla-61  
 98-IleGluGlyPheAspLysIleAsnProAla-107

**Antigenic Index - Jameson-Wolf**

8-AsnGlnLeuGlyGlyArgAsnGlyThrAlaValGlyAsnGlyValAspGluPheGlyArgGlyAlaAspAsnGlnValGluPheLeuGlu-37  
 44-GlyAlaSerGlyArgAlaAla-50  
 73-GlyGluAspAspValVal-78  
 100-GlyPheAspLysIleAsnProAlaVal-108

**Hydrophilic Regions - Hopp-Woods**

10-LeuGlyGlyArgAsnGlyThr-16  
 21-GlyValAspGluPheGlyArgGlyAlaAspAsnGlnValGluPheLeuGlu-37  
 73-GlyGluAspAspValVal-78  
 100-GlyPheAspLysIleAsn-105  
 212-2

**AMPHI Regions - AMPHI**

6-TrpAspGlyIleProAspIleArgThr-14  
 40-PheGlnThrAlaGlnAsp-45  
 64-LeuGlnPheAspSerIleAsnLeuIleGluHisIle-75  
 91-HisLeuHisGluHis-95  
 199-ArgLeuLeuGlyHis-203  
 238-HisAsnHisLeuTyrArgSerIleThrSerAlaGluAlaGluLysIle-253  
 397-TrpAsnGluAlaGluGluAla-403  
 439-AspSerProAspHis-443  
 445-ProLeuValGlyAlaLeuGlyAspIleAlaAlaMet-456  
 487-HisGlyThrArgGlyLeu-492  
 501-AlaIleAlaAlaGlnIleLeuGlyLeuPro-510

**Antigenic Index - Jameson-Wolf**

8-GlyIleProAspIleArgThrLeuAspGlnAlaIleArgLysHisAlaProProLeuAsn-27  
 33-ProAspAsnGlnIleProAspPheGlnThrAlaGlnAspAlaSerAspAlaGluCysArgLeuLysHisArgLeuAspGln-59  
 85-ProProSerArgThr-89  
 105-AlaIleProGlnThrGluSerLysProAspLysProTrp-117  
 120-LeuProGlnThrSerGluArgGlnLysProGluHis-131  
 158-LeuGluAlaArgLysAlaAlaGln-165  
 168-SerGlyAsnArgGlnGly-173

-111-

178-LysIleSerProHisAspThrGluGlnThrGlu-188  
 193-GlyTyrGlyTyrThrLys-198  
 205-LeuProGluSerGluThrTrpGlyGlyAsnGly-215  
 220-AsnTyrSerArgThrGluGlnGlnArgAsnHisGluLeuGlyLeu-234  
 246-ThrSerAlaGluAlaGluLysIleAla-254  
 260-ValProTyrAspHisProSerCys-267  
 294-LeuHisGluAspThrProLeu-300  
 302-AspIleSerHisAspGlyGluLysTrpIle-311  
 328-ThrGlyAlaAsnSerProTyrLeuPro-336  
 346-ArgGlnIleArgGlyGlnThrGlyLeuThrProSerThrProPheSerGluGlnLeuArg-365  
 376-ProSerTrpHisGly-380  
 391-AsnSerSerHisThrGlyTrpAsnGluAlaGluGluAlaSerAsnArgGlnAla-408  
 424-AsnProAsnProGlnLysHisGlnGly-432  
 436-IleArgCysAspSerProAspHisLeuPro-445  
 464-AlaLeuAspLysAsnTyrArgIleAspThrProCys-475  
 487-HisGlyThrArgGlyLeuAla-493  
 511-HisProPheSerGlnArgLeuArgHisAlaLeuHisProAsnArgThrIle-527  
 531-IleValArgArgLysAspLeuThrPro-539

**Hydrophilic Regions - Hopp-Woods**

10-ProAspIleArgThrLeuAspGlnAlaIleArgLysHisAlaPro-24  
 44-GlnAspAlaSerAspAlaGluCysArgLeuLysHisArgLeuAspGln-59  
 105-AlaIleProGlnThrGluSerLysProAspLys-115  
 122-GlnThrSerGluArgGlnLysProGluHis-131  
 158-LeuGluAlaArgLysAlaAlaGln-165  
 180-SerProHisAspThrGluGlnThrGlu-188  
 206-ProGluSerGluThr-210  
 222-SerArgThrGluGlnGlnArgAsnHisGlu-231  
 246-ThrSerAlaGluAlaGluLysIleAla-254  
 294-LeuHisGluAspThrProLeu-300  
 303-IleSerHisAspGlyGluLysTrpIle-311  
 346-ArgGlnIleArgGly-350  
 398-AsnGluAlaGluGluAlaSerAsnArgGlnAla-408  
 426-AsnProGlnLysHisGlnGly-432  
 436-IleArgCysAspSerProAsp-442  
 467-LysAsnTyrArgIleAspThr-473  
 515-GlnArgLeuArgHis-519  
 531-IleValArgArgLysAspLeuThrPro-539  
 214-1

**AMPHI Regions - AMPHI**

6-CysLysLeuPheValLeuIle-12  
 69-ValThrArgGlyGlyLysGlyGlyGluSerVal-79  
 88-PheSerGlnThrLeuAsp-93  
 122-LysValGlnArgGlyGlyAspVal-129  
 150-ThrLysSerGlyAlaLysSerAlaSerLys-159

**Antigenic Index - Jameson-Wolf**

23-LeuGlnSerAspSerArgGlnProIle-31  
 33-IleGluAlaAspGlnGlySerLeuAspGlnAlaAsnGlnSerThrThrPheSerGlyAsn-52  
 71-ArgGlyGlyLysGlyGlyGluSerValArgAlaGluGlySerProValArgPheSerGlnThrLeuAspGlyGlyLysGlyThrValArgGlyGlnAlaAsnAsn-105  
 119-GlyAsnAlaLysValGlnArgGlyGlyAspValAlaGlu-131  
 137-TyrAsnThrLysThrGluVal-143  
 148-GlySerThrLysSerGlyAlaLysSerAlaSerLysSerGlyArgValSerVal-165  
 168-GlnProSerSerThrGlnLysSerGlu-176

-112-

**Hydrophilic Regions - Hopp-Woods**

25-SerAspSerArgGlnProIle-31  
 33-IleGluAlaAspGlnGlySerLeuAspGlnAlaAsn-44  
 71-ArgGlyGlyLysGlyGlyGluSerValArgAlaGluGlySerPro-85  
 92-LeuAspGlyGlyLysGlyThrValArgGlyGlnAla-103  
 121-AlaLysValGlnArgGlyGlyAspValAlaGlu-131  
 148-GlySerThrLysSerGlyAlaLysSerAlaSerLysSerGlyArg-162  
 171-SerThrGlnLysSerGlu-176  
 215-2

**AMPHI Regions - AMPHI**

21-SerLeuSerAlaTrpLeuGlyArgIle-29  
 67-SerAlaLysGlyAlaLysGlnPheProGlu-76

**Antigenic Index - Jameson-Wolf**

3-ValArgTrpArgTyrGly-8  
 28-ArgIleSerGluValGluIleGluGluValArgLeuAsnProAspGluProGlnTyrThrMetAspGlyLeuA  
 spGlyArgArgPheAspGluGlnGlyTyrLeuLys-63  
 65-HisLeuSerAlaLysGlyAlaLysGlnPheProGluSerSerAspIleHisPheAspSerProHisLeu-87  
 99-ValGlySerAspGluAlaValTyrHisThrGluAsnLysGlnValLeuPhe-115  
 123-LysThrAlaAspGlyLysArgGlnAlaGlyLysValGluAlaGluLysLeuHisValAspThrGluSerGln  
 TyrAlaGlnThrAspThrProVal-154  
 160-AlaSerHisGlyGlnAlaGlyGlyMetThrTyrAspHisLysThrGly-175  
 179-PheSerSerLysValLys-184  
 187-IleTyrAspThrLysAspMet-193

**Hydrophilic Regions - Hopp-Woods**

29-IleSerGluValGluIleGluGluValArgLeuAsnProAspGluProGlnTyr-46  
 49-AspGlyLeuAspGlyArgArgPheAspGlu-58  
 65-HisLeuSerAlaLysGlyAlaLysGlnPheProGluSerSerAspIleHisPhe-82  
 99-ValGlySerAspGluAlaValTyr-106  
 108-ThrGluAsnLysGlnValLeu-114  
 123-LysThrAlaAspGlyLysArgGlnAlaGlyLysValGluAlaGluLysLeuHisValAspThrGluSerGln  
 TyrAla-148  
 170-TyrAspHisLysThr-174  
 187-IleTyrAspThrLysAspMet-193  
 216-2

**AMPHI Regions - AMPHI**

6-LysTyrLeuAspTrpAlaArg-12  
 19-AlaGluGlyLeuArgGluIleAlaAlaGluLeu-29  
 60-ArgLysMetAlaAla-64  
 165-LeuGlyAspAlaLeuAlaVal-171  
 201-ValAlaAspIleMetHis-206  
 216-LeuGlyThrProLeuLysGlu-222  
 242-GlyArgLeuLysGlyVal-247  
 251-GlyAspLeuArgArgLeuPheGlnGluCysAspAsnPheThrGlyLeuSerIle-268  
 272-MetHisThrHisProLysThrIleSerAla-281  
 290-LysValMetGlnAlaAsn-295

**Antigenic Index - Jameson-Wolf**

1-MetAlaGluAsnGlyLysTyr-7  
 14-ValLeuHisAlaGluAlaGluGlyLeuArgGluIleAlaAlaGluLeuAspLysAsnPhe-33  
 43-CysLysGlyArgVal-47  
 51-GlyMetGlyLysSerGlyHisIleGlyArgLysMetAla-63  
 80-GluAlaAlaHisGlyAspLeu-86

-113-

90-ValAspAsnAspVal-94  
 99-SerAsnSerGlyGluSerAspGluIle-107  
 113-AlaLeuLysArgLysAspIle-119  
 125-ThrAlaArgProAspSerThrMetAlaArgHisAlaAsp-137  
 144-ValSerLysGluAlaCysPro-150  
 177-ArgAlaPheThrProAspAspPheAla-185  
 188-HisProAlaGlySerLeuGlyLys-195  
 203-AspIleMetHisLysGlyGlyGlyLeuProAla-213  
 216-LeuGlyThrProLeuLysGluAlaIle-224  
 227-MetSerGluLysGlyLeu-232  
 237-ValThrAspGlyGlnGlyArgLeuLysGly-246  
 248-PheThrAspGlyAspLeuArgArgLeuPheGlnGluCysAspAsnPheThr-264  
 275-HisProLysThrIleSerAlaGluArgLeuAlaThrGluAlaLeuLys-290  
 303-ThrAspAlaAspGly-307

**Hydrophilic Regions - Hopp-Woods**

1-MetAlaGluAsnGlyLys-6  
 14-ValLeuHisAlaGluAlaGluGlyLeuArgGluIleAlaAlaGluLeuAspLys-31  
 43-CysLysGlyArgVal-47  
 56-GlyHisIleGlyArgLysMetAla-63  
 100-AsnSerGlyGluSerAspGluIle-107  
 113-AlaLeuLysArgLysAspIle-119  
 126-AlaArgProAspSerThrMetAlaArgHisAlaAsp-137  
 144-ValSerLysGluAlaCys-149  
 177-ArgAlaPheThrProAspAspPheAla-185  
 218-ThrProLeuLysGluAlaIle-224  
 227-MetSerGluLysGlyLeu-232  
 239-AspGlyGlnGlyArgLeuLys-245  
 251-GlyAspLeuArgArgLeuPheGlnGluCysAspAsn-262  
 277-LysThrIleSerAlaGluArgLeuAlaThrGluAlaLeuLys-290  
 303-ThrAspAlaAspGly-307

**218-2****AMPHI Regions - AMPHI**

37-LeuLeuAlaValThr-41  
 121-AlaLysValValSerThrMet-127  
 136-ThrMetAspGluIleHisSer-142  
 190-AlaArgSerTrpTrpArgAsnLeuHisGlyThrPheGlyThrTrpValSerLeuIleLeu-209  
 223-TrpGlyGlyLysPheValGlnAlaTrpSerGlnPhePro-235  
 288-AspGluProMetThrLeuGluThrValAspArgPheAlaArgGlu-302  
 359-TyrAsnProPheGlyLysPheMet-366  
 377-LeuGlyTrpTrpSerValLeuAlaAsn-385

**Antigenic Index - Jameson-Wolf**

3-ThrGlnIleLysThrGluAlaAspAsnGlnSerAsnArgArgTyrLeu-18  
 51-IleThrGlyLysGluGlyGluArgIleHis-60  
 74-AlaGluAlaAlaArgSerAlaValAsnProGluThrSerSer-87  
 94-ProArgAlaAspAspMet-99  
 105-ValAsnAsnGluGlyLysAla-111  
 125-SerThrMetProArgAsnGlnGlyTrp-133  
 174-ValLysArgArgGlyIleLysAla-181  
 183-LeuLeuProSerLysGlyArgAlaArgSerTrpTrp-194  
 196-AsnLeuHisGlyThrPheGly-202  
 235-ProAlaGlyLysTrpGlyValGluProAsnProVal-246  
 255-ValLeuAsnAspGlyLysValLysGlu-263  
 279-ThrValGlyLysAspGlyIleAsnProAspGluProMetThr-292

294-GluThrValAspArgPheAlaArg-301  
 303-IleGlyPheLysGlyArgTyrGlnLeuAsnLeuProLysGlyGluAspGly-319  
 323-LeuSerGlnAspSerMetSerTyr-330  
 336-PheAlaAspArgThrValHis-342  
 344-AspGlnTyrSerGlyLysIleLeuAla-352  
 354-IleArgPheAspAspTyrAsnProPhe-362  
 404-TrpLysArgArgProThrGlyAla-411  
 417-ProAlaGlnLysValLysLeu-423

#### Hydrophilic Regions - Hopp-Woods

3-ThrGlnIleLysThrGluAlaAspAsnGlnSerAsnArgArgTyr-17  
 52-ThrGlyLysGluGlyGluArgIleHis-60  
 74-AlaGluAlaAlaArgSerAlaValAsnProGluThrSerSer-87  
 94-ProArgAlaAspAspMet-99  
 105-ValAsnAsnGluGlyLysAla-111  
 175-LysArgArgGlyIleLys-180  
 186-SerLysGlyArgAla-190  
 255-ValLeuAsnAspGlyLysValLysGlu-263  
 279-ThrValGlyLysAspGlyIleAsnProAspGluProMetThr-292  
 294-GluThrValAspArgPheAlaArg-301  
 314-ProLysGlyGluAspGly-319  
 325GlnAspSerMetSer-329  
 336-PheAlaAspArgThrValHis-342  
 354-IleArgPheAspAsp-358  
 405-LysArgArgProThrGly-410

219-2 (included in 218, so delete this one)

#### AMPHI Regions - AMPHI

37-LeuLeuAlaValThr-41  
 121-AlaLysValValSerThrMet-127  
 136-ThrMetAspGluIleHisSer-142  
 190-AlaArgSerTrpTrpArgAsnLeuHisGlyThrPheGlyThrTrpValSerLeuIleLeu-209  
 223-TrpGlyGlyLysPheValGlnAlaTrpSerGlnPhePro-235  
 288-AspGluProMetThrLeuGluThrValAspArgPheAlaArgGlu-302  
 359-TyrAsnProPheGlyLysPheMet-366  
 377-LeuGlyTrpTrpSerValLeuAlaAsn-385

#### Antigenic Index - Jameson-Wolf

3-ThrGlnIleLysThrGluAlaAspAsnGlnSerAsnArgArgTyrLeu-18  
 51-IleThrGlyLysGluGlyGluArgIleHis-60  
 74-AlaGluAlaAlaArgSerAlaValAsnProGluThrSerSer-87  
 94-ProArgAlaAspAspMet-99  
 105-ValAsnAsnGluGlyLysAla-111  
 125-SerThrMetProArgAsnGlnGlyTrp-133  
 174-ValLysArgArgGlyIleLysAla-181  
 183-LeuLeuProSerLysGlyArgAlaArgSerTrpTrp-194  
 196-AsnLeuHisGlyThrPheGly-202  
 235-ProAlaGlyLysTrpGlyValGluProAsnProVal-246  
 255-ValLeuAsnAspGlyLysValLysGlu-263  
 279-ThrValGlyLysAspGlyIleAsnProAspGluProMetThr-292  
 294-GluThrValAspArgPheAlaArg-301  
 303-IleGlyPheLysGlyArgTyrGlnLeuAsnLeuProLysGlyGluAspGly-319  
 323-LeuSerGlnAspSerMetSerTyr-330  
 336-PheAlaAspArgThrValHis-342  
 344-AspGlnTyrSerGlyLysIleLeuAla-352  
 354-IleArgPheAspAspTyrAsnProPhe-362

404-TrpLysArgArgProThrGlyAla-411  
 417-ProAlaGlnLysValLysLeu-423

**Hydrophilic Regions - Hopp-Woods**

3-ThrGlnIleLysThrGluAlaAspAsnGlnSerAsnArgArgTyr-17  
 52-ThrGlyLysGluGlyGluArgIleHis-60  
 74-AlaGluAlaAlaArgSerAlaValAsnProGluThrSerSer-87  
 94ProArgAlaAspAspMet-99  
 105-ValAsnAsnGluGlyLysAla-111  
 175-LysArgArgGlyIleLys-180  
 186-SerLysGlyArgAla-190  
 255-ValLeuAsnAspGlyLysValLysGlu-263  
 279-ThrValGlyLysAspGlyIleAsnProAspGluProMetThr-292  
 294-GluThrValAspArgPheAlaArg-301  
 314-ProLysGlyGluAspGly-319  
 325-GlnAspSerMetSer-329  
 336-PheAlaAspArgThrValHis-342  
 354-IleArgPheAspAsp-358  
 405-LysArgArgProThrGly-410  
 225-1

**AMPHI Regions - AMPHI**

23-LeuAlaAspGluLeuThrAsn-29  
 37-IleLeuArgGlnPhe-41  
 126-AsnAlaMetGlyLeu-130  
 151-PheMetGlnHisIlePheLys-157  
 217-ThrGlyLysAsnIle-221

**Antigenic Index - Jameson-Wolf**

22-AlaLeuAlaAspGluLeuThr-28  
 32-SerSerArgGluGlnIleLeu-38  
 41-PheAlaGluAspGluGlnProVal-48  
 52-AsnArgAlaProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-66  
 71-GlyLeuAsnGluGlnProVal-77  
 81-AsnArgValProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-95  
 100-GlyLeuAsnGluGlnProVal-106  
 108-ProValAsnArgAlaProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-124  
 144-ThrGlyPheAspCysSerGly-150  
 164-LeuProArgThrSerAlaGluGlnAlaArgMet-174  
 176-ThrProValAlaArgSerGluLeuGlnProGlyAsp-187  
 194-LeuGlyGlySerArgIle-199  
 213-HisAlaProArgThrGlyLysAsnIleGlu-222  
 225-SerLeuSerHisLysTyrTrpSerGlyLys-234  
 239-ArgArgValLysLysAsnAspProSerArgPhe-249

**Hydrophilic Regions - Hopp-Woods**

22-AlaLeuAlaAspGluLeuThr-28  
 32-SerSerArgGluGlnIleLeu-38  
 41-PheAlaGluAspGluGlnPro-47  
 53-ArgAlaProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-66  
 83-ValProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-95  
 111-ArgAlaProAlaArgArgAlaGlyAsnAlaAspGluLeuIle-124  
 166-ArgThrSerAlaGluGlnAlaArgMet-174  
 178-ValAlaArgSerGluLeuGlnPro-185  
 216-ArgThrGlyLysAsnIleGlu-222  
 239-ArgArgValLysLysAsnAspProSerArg-248

-116-

226

**AMPHI Regions - AMPHI**

44-LeuIleAlaTyrLeuLys-49  
 61-AlaAlaGlnPheIleAspPheTrpLeu-69  
 98-GlnLeuAlaGlySerValThrGlyIleValThr-108  
 141-ArgSerIleGlyGlyIleProAlaIleThr-150  
 157-AlaGlyLeuValGlyGlnIleAlaGlyTyrLys-167  
 197-GluArgSerArgArg-201

**Antigenic Index - Jameson-Wolf**

3-GluIleLeuArgGlnProSer-9  
 25-ValArgThrArgThrGlyAsnIle-32  
 81-TyrGlnAsnArgArgLysIle-87  
 117-GlyAlaGluArgGluVal-122  
 128-SerLysSerValThrAsn-133  
 139-IleThrArgSerIleGlyGly-145  
 167-LysMetLeuLysAsnThrVal-173  
 195-SerLeuGluArgSerArgArgMetAla-203

**Hydrophilic Regions - Hopp-Woods**

25-ValArgThrArgThr-29  
 82-GlnAsnArgArgLysIle-87  
 117-GlyAlaGluArgGluVal-122  
 195-SerLeuGluArgSerArgArgMetAla-203

227-2

**AMPHI Regions - AMPHI**

36-GlyValLeuPheAlaLeuLeuGlnAla-44  
 52-LeuGlnGlnLeuThrAspAlaLeu-59  
 74-ValIleSerTyrLeuAspLeuIleAlaAspAspTrpPheSer-87

228

**AMPHI Regions - AMPHI**

24-GluValLysGluAlaValGlnAlaValGlu-33  
 40-AlaAlaSerAlaAlaGluSerAlaAlaSerAlaValGluGluAlaLysAspGlnValLysAspAla-61  
 78-GluAlaValThrGluAlaAlaLysAspThrLeuAsnLysAlaAlaAspAlaThrGlnGluAlaAlaAspLysMetLysAspAlaAla-106

**Antigenic Index - Jameson-Wolf**

18-SerGlnGluAlaLysGlnGluValLysGluAlaValGln-30  
 32-ValGluSerAspValLysAspThrAlaAlaSerAlaAlaGluSerAlaAlaSerAlaValGluGluAlaLysAspGlnValLysAspAlaAlaAlaAspAlaLysAlaSerAlaGluGluAlaValThrGluAlaAlaLysAspThrLeuAsnLysAlaAlaAspAlaThrGlnGluAlaAlaAspLysMetLysAspAlaAlaLys-107

**Hydrophilic Regions - Hopp-Woods**

18-SerGlnGluAlaLysGlnGluValLysGluAlaValGln-30  
 32-ValGluSerAspValLysAspThrAlaAlaSerAlaAlaGluSerAlaAlaSerAlaValGluGluAlaLysAspGlnValLysAspAlaAlaAlaAspAlaLysAlaSerAlaGluGluAlaValThrGluAlaLysGluAlaValThrGluAlaAlaLysAspThrLeuAsnLysAlaAlaAspAlaThrGlnGluAlaAlaAspLysMetLysAspAlaAlaLys-107

230-1

**AMPHI Regions - AMPHI**

6-GluLysTyrArgThr-10  
 49-AspHisSerIleAsnAsn-54  
 56-IleGlnAsnGluGln-60  
 73-GlnSerLeuLeuGln-77

-117-

81-LeuLysGlnGlyAlaLys-86

96-GlnIleLysGlnIleIle-101

133-PheValGluGluIleArgAspGlnPhe-141

144-GlnAsnLeuValAsnLeuVal-150

161-AlaGluGlnLeuIleArgLeuThrGlnValAsnArgThrIleArg-175

184-PheIleAlaGlnVal-188

194-AspLeuGlnLysPheTyrAsn-200

234-GluValLysAsnAlaPheGluGluArgValAlaArgLeu-246

272-ValAlaAspPheAsnLys-277

284-AspAspAlaPheAsnHisProSerSerLeuAlaGluAla-296

319-SerGlyMetProGluAsnLeuIleAsnAlaVal-329

398-LeuAsnGlyGlyLys-402

426-GluAlaTyrAlaGluLeu-431

444-ValArgLeuIleGlyLeuProAlaPro-452

456-GluValGlnAlaValThrProProAspAspIleAla-467

488-LeuLeuIleArgTyrPheAsn-494

**Antigenic Index - Jameson-Wolf**

4-SerIleGluLysTyrArgThrProAla-12

32-SerHisProGlyAlaAsp-37

42-ValGlyAspGluLysIleSerAspHisSerIle-52

56-IleGlnAsnGluGlnAlaAspGlyGlyGlyProSerArgAspAlaVal-71

80-TyrLeuLysGlnGlyAla-85

92-ValSerSerGluGlnIleLys-98

101-IleValAspAspProAsnPheHisAspAlaAsnGlyLysPheAsp-115

122-TyrLeuSerGlnArgHisMetSerGluAspGlnPheValGluGluIleArgAsp-139

169-GlnValAsnArgThrIleArgSerHisThrPheAsnProAspGluPhe-184

189-LysValSerGluAlaAspLeu-195

199-TyrAsnAlaAsnLysLysAspTyrLeu-207

223-AspPheAlaAspLysGlnThrValSerGluThrGluValLysAsnAlaPheGluGluArgValAlaArg-245

247-ProAlaAsnGluAlaLysProSerPheGluGlnGluLysAlaAlaValGluAsnGluLeuLysMetLysLysAlaValAlaAspPheAsnLysAlaLysGluLysLeuGlyAspAspAlaPheAsnHisProSerSerLeuAlaGluAlaAlaLysAsnSerGlyLeuLysValGluThrGlnGluThrTrpLeuSerArgGlnAspAlaGlnMetSerGlyMetProGluAsn-324

330-PheSerAspAspValLeuLysLysLysHisAsnSerGlu-342

355-ArgAlaLysGluValArgGluGluLysThrLeuPro-366

368-AlaGluAlaLysAspAlaValArg-375

377-AlaTyrIleArgThrGluAlaAlaLysLeuAlaGluAsnLysAlaLysAspValLeu-395

399-AsnGlyGlyLysAlaValAsp-405

417-GlnGlnAlaArgGlnSerMetProProGluAlaTyr-428

432-LeuLysAlaLysProAlaAsnGlyLysProAla-442

459-AlaValThrProProAspAspIleAla-467

476-AlaLeuAlaGlnGlnGlnSerAlaAsnThrPhe-486

493-PheAsnGlyLysIleLysGlnThrLysGlyAlaGlnSerValAspAsnGlyAspGlyGln-512

**Hydrophilic Regions - Hopp-Woods**

6-GluLysTyrArgThr-10

42-ValGlyAspGluLysIleSerAsp-49

56-IleGlnAsnGluGlnAlaAspGlyGlyGlyProSerArgAspAlaVal-71

92-ValSerSerGluGlnIleLys-98

101-IleValAspAspProAsnPhe-107

110-AlaAsnGlyLysPheAsp-115

-118-

126-ArgHisMetSerGluAspGlnPheValGluGluIleArgAsp-139  
 189-LysValSerGluAlaAspLeu-195  
 200-AsnAlaAsnLysLysAspTyrLeu-207  
 223-AspPheAlaAspLysGlnThrValSerGluThrGluValLysAsnAlaPheGluGluArgValAlaArg-245  
 247-ProAlaAsnGluAlaLysProSerPheGluGlnGluLysAlaAlaValGluAsnGluLeuLysMetLysLysAlaValAlaAspPheAsnLysAlaLysGluLysLeuGlyAspAspAlaPhe-287  
 292-SerLeuAlaGluAlaAlaLysAsnSerGlyLeuLysValGluThrGlnGlu-308  
 310-TrpLeuSerArgGlnAspAlaGlnMet-318  
 333-AspValLeuLysLysLysHisAsnSer-341  
 355-ArgAlaLysGluValArgGluGluLysThrLeuPro-366  
 368-AlaGluAlaLysAspAlaValArg-375  
 377-AlaTyrIleArgThrGluAlaAlaLysLeuAlaGluAsnLysAlaLysAspValLeu-395  
 417-GlnGlnAlaArgGlnSerMetPro-424  
 432-LeuLysAlaLysProAlaAsnGly-439  
 461-ThrProProAspAspIleAla-467  
 496-LysIleLysGlnThrLysGlyAlaGlnSerValAspAsnGlyAspGlyGln-512  
 231-1

**AMPHI Regions - AMPHI**

7-IleAsnArgProTyrGlnLysProAlaGluLeu-17  
 98-ArgIlePheSerPheProGln-104  
 209-AlaValAspAsnValLysGlyValAlaVal-218  
 228-AlaValAlaGlyPheArgArgCysSerAlaAla-238  
 263-LeuAlaAlaValProArgIleThrGln-271  
 281-LysProPheHisAspPhePheAsnLeu-289

**Antigenic Index - Jameson-Wolf**

1-MetSerLysArgLysSerIleAsnArgProTyrGlnLysProAlaGlu-16  
 18-ProProLeuGlnAsnAsnProProPheTyrArgLysAsnArgArgLeuAsn-34  
 39-AlaAspGlyGlyCysAlaSerProGlnLysCysArgAlaArgGlyPheGln-55  
 90-SerAlaValArgProArgArgLeuArg-98  
 135-MetProArgArgProVal-140  
 150-PheAlaAspArgAsnLeuArg-156  
 174-AlaPheArgArgArgAlaGlnVal-181  
 183-AlaArgThrArgAla-187  
 194-ArgArgValAspIleArgHisProAspPhe-203  
 211-AspAsnValLysGly-215  
 231-GlyPheArgArgCysSerAlaAlaGlyGlyArgValGlyThr-244  
 246-ValProCysArgAlaGluTyrValGluTyrGlyAsnArgArgProHisArgLeuAlaAla-265  
 269-IleThrGlnArgThrGlnLysArgGlnGlyAspGlyLysProPhe-283  
 294-MetProMetProSerGluHis

**Hydrophilic Regions - Hopp-Woods**

1-MetSerLysArgLysSerIleAsn-8  
 10-ProTyrGlnLysProAlaGlu-16  
 26-PheTyrArgLysAsnArgArg-32  
 45-SerProGlnLysCysArgAlaArgGly-53  
 92-ValArgProArgArgLeuArg-98  
 136-ProArgArgProVal-140  
 150-PheAlaAspArgAsnLeuArg-156  
 174-AlaPheArgArgArgAlaGlnVal-181  
 183-AlaArgThrArgAla-187  
 194-ArgArgValAspIleArgHis-200  
 231-GlyPheArgArgCysSerAlaAlaGlyGlyArgValGlyThr-244  
 246-ValProCysArgAlaGluTyr-252

254-GluTyrGlyAsnArgArgProHisArg-262  
 269-IleThrGlnArgThrGlnLysArgGlnGlyAspGlyLysProPhe-283  
 232-2

**AMPHI Regions - AMPHI**

23-GlnPheLeuGlyAlaPheAsnAspAsnVal-32  
 55-GlyGlnMetLeuAsn-59  
 74-SerLeuSerGlyGlnLeuGlyAsnLysPheAspLysAlaValLeuAlaArgTrpValLysValLeuGluMetI  
 leIleMet-100  
 127-ThrLeuPheGlyProLeuLysTyr-134  
 160-AlaIleLeuPheGly-164  
 167-LeuGlyThrAlaValAlaGlyValProProTyrIleValGlyIleLeuVal-183  
 214-ValArgGlyThrLysSerLeuLeuArgGlu-223  
 251-LeuProThrPheThrGln-256  
 319-ArgPheGluGlyLeuAsn-324  
 340-AlaValMetThrLeuIleGlyPhePheGlyGlyPhePheSerValProLeuTyrThrTrpLeu-360

**Antigenic Index - Jameson-Wolf**

1-MetTyrAlaLysLysGlyGlyLeuGlyLeuValLysSerArgArgPhe-16  
 75-LeuSerGlyGlnLeuGlyAsnLysPheAspLys-85  
 139-AspTyrLeuAspAspLysGluLeuMetMet-148  
 200-ValProAlaLysAlaAlaAspThrGlnIle-209  
 215-ArgGlyThrLysSerLeuLeuArgGluThrValArgHisLysPro-229  
 258-HisLeuGlyGlyAsnAspAsnVal-265  
 286-LysPheSerArgGluArgLeu-292  
 316-HisGlyHisArgPheGluGly-322  
 363-AlaSerSerGluThrPheArgAlaArgAla-372  
 420-IleLysArgGluArgArgPheLeu-427  
 431-AlaIleArgLysLysPro-436

**Hydrophilic Regions - Hopp-Woods**

2-TyrAlaLysLysGlyGly-7  
 11-ValLysSerArgArgPhe-16  
 81-AsnLysPheAspLys-85  
 140-TyrLeuAspAspLysGluLeuMet-147  
 201-ProAlaLysAlaAlaAspThrGlnIle-209  
 215-ArgGlyThrLysSerLeuLeuArgGluThrValArgHis-227  
 286-LysPheSerArgGluArgLeu-292  
 318-HisArgPheGluGly-322  
 366-GluThrPheArgAlaArgAla-372  
 420-IleLysArgGluArgArgPheLeu-427  
 431-AlaIleArgLysLysPro-436  
 233-2

**AMPHI Regions - AMPHI**

61-PheAlaAspLysValGlnThr-67  
 71-GlnValArgValTrpLysAsn-77  
 88-AsnGlyValAlaLysLeuLeuGluThr-96  
 119-AlaLeuThrArgLeuIleGluGlnAlaGlyAsnAla-130  
 138-IleProIleAlaAspThrLeuLysCysAlaAspGlyGlyAsn-151  
 180-AlaAlaGluAsnLeuAspGlyIleThrAsp-189

**Antigenic Index - Jameson-Wolf**

1-MetLysArgLysAsnIle-6  
 16-AlaArgPheGlyAlaAspLysProLysGlnTyrValGluIleGlySerLysThrValLeu-35  
 43-GluArgHisGluAlaValAsp-49  
 56-SerProGluAspThrPheAlaAspLysValGln-66

-120-

75-TrpLysAsnGlyGlyGlnThrArgAlaGluThrValArgAsnGlyVal-90  
 100-AlaGluThrAspAsn-104  
 109-AspAlaAlaArgCys-113  
 115-LeuProSerGluAlaLeu-120  
 123-LeuIleGluGlnAlaGlyAsnAlaAlaGluGlyGly-134  
 142-AspThrLeuLysCysAlaAspGlyGlyAsnIle-152  
 155-ThrValGluArgThrSerLeu-161  
 182-GluAsnLeuAspGlyIleThrAspGluAlaSerAlaValGluLysLeuGlyVal-199  
 206-GlyAspValArgAsnLeuLysLeuThrGlnProGlnAspAlaTyr-220

**Hydrophilic Regions - Hopp-Woods**

1-MetLysArgLysAsnIle-6  
 18-PheGlyAlaAspLysProLysGlnTyrVal-27  
 43-GluArgHisGluAlaValAsp-49  
 56-SerProGluAspThrPheAlaAspLysValGln-66  
 79-GlyGlnThrArgAlaGluThrValArg-87  
 100-AlaGluThrAspAsn-104  
 127-AlaGlyAsnAlaAlaGlu-132  
 142-AspThrLeuLysCysAlaAsp-148  
 182-GluAsnLeuAspGlyIleThrAspGluAlaSerAlaValGluLysLeuGlyVal-199  
 206-GlyAspValArgAsnLeuLys-212  
 234-2

**AMPHI Regions - AMPHI**

26-ArgSerLeuGluValGluLysValAlaSer-35  
 68-AspArgLeuGlySerGln-73  
 83-GlnGlnThrAsnArgPheAsnValLeuAsnArgThrAsn-95  
 121-GlyAspValThrGluPhe-126  
 206-AlaValAsnSerLeuValGlnAlaValAsp-215

**Antigenic Index - Jameson-Wolf**

21-AlaThrGluSerSerArgSerLeuGluValGluLysValAlaSer-35  
 51-ThrPheAspAsnArgSerSerPhe-58  
 62-IlePheSerAspGlyGluAspArgLeuGlySerGlnAla-74  
 83-GlnGlnThrAsnArgPheAsnValLeuAsnArgThrAsn-95  
 99-LeuLysGlnGluSerGlyIleSerGlyLysAlaHisAsnLeuLysGlyAlaAspTyr-117  
 121-GlyAspValThrGluPheGlyArgArgAspValGlyAsp-133  
 140-LeuGlyArgGlyLysSerGlnIle-147  
 160-AsnThrSerGluIle-164  
 169-GlnGlyAlaGlyGlu-173  
 175-AlaLeuSerAsnArgGluIle-181  
 185-GlyGlyThrSerGlyTyrAspAlaThrLeuAsnGlyLysValLeu-199  
 214-ValAspAsnGlyAlaTrpGlnProAsnArg-223

**Hydrophilic Regions - Hopp-Woods**

21-AlaThrGluSerSerArgSerLeuGluValGluLysValAla-34  
 52-PheAspAsnArgSerSerPhe-58  
 62-IlePheSerAspGlyGluAspArgLeuGlySerGlnAla-74  
 99-LeuLysGlnGluSerGlyIleSerGlyLysAlaHisAsn-111  
 122-AspValThrGluPheGlyArgArgAspValGlyAsp-133  
 141-GlyArgGlyLysSer-145  
 176-LeuSerAsnArgGluIle-181  
 235

**AMPHI Regions - AMPHI**

8-LeuAlaAlaValLeuAlaLeu-14  
 18-GlnValGlnLysAlaProAsp-24

-121-

86-LeuThrAsnAlaAlaAspIle-92  
 95-ValArgProGluLysLeuHisGlnIlePhe-104  
 120-SerTyrGlnIleLeuAspSerValThrThr-129  
 165-GlyAlaLeuValSerAlaValValAsnGlnIleAlaAsnSerLeuThr-180  
 187-SerLysThrAlaAlaTyrAsnLeuLeuSerProTyr-198

**Antigenic Index - Jameson-Wolf**

20-GlnLysAlaProAspPheAspTyrThrSerPheLysGluSerLysProAla-36  
 43-ProLeuAsnGluSerProAspValAsnGlyThr-53  
 62-AlaProLeuSerGlu-66  
 79-GluThrPheLysGlnAsnGlyLeuThrAsn-88  
 93-HisAlaValArgProGluLysLeu-100  
 131-SerAlaLysAlaArgLeuValAspSerArgAsnGlyLysGluLeuTrpSerGlySerAlaSerIleArgGlu  
 GlySerAsnAsnSerAsnSer-161  
 178-SerLeuThrAspArgGlyTyrGlnValSerLysThrAla-190  
 202-GlyIleLeuLysGlyProArgPheValGluGluGlnProLys-215

**Hydrophilic Regions - Hopp-Woods**

20-GlnLysAlaProAspPheAsp-26  
 29-SerPheLysGluSerLysPro-35  
 44-LeuAsnGluSerProAspVal-50  
 93-HisAlaValArgProGluLysLeu-100  
 131-SerAlaLysAlaArgLeuValAspSerArgAsnGlyLysGluLeuTrp-146  
 150-AlaSerIleArgGluGlySerAsnAsnSer-159  
 179-LeuThrAspArgGlyTyrGln-185  
 207-ProArgPheValGluGluGlnProLys-215  
 236-2

**AMPHI Regions - AMPHI**

11-LeuCysThrAlaPheAlaAsp-17  
 107-PheAlaGlyPheAlaAspCysArgProPhe-116  
 146-AspAspValProArgPhePheAlaGlyGlu-155  
 178-AlaAlaCysMetAlaValCysPheGly-186  
 214-LysValGluGlyIleThrArgIle-221  
 245-IleArgLeuLeuHisGlyIlePheAsnArgIleLysValAla-258  
 288-PheAlaAlaValIle-292  
 311-LeuArgCysAsnAspValAlaAspGlyPheArgHisPhe-323

**Antigenic Index - Jameson-Wolf**

42-GlyPheSerGlyAsnGlyLysPhe-49  
 58-ArgHisGlnGlnSerLysAlaGln-65  
 77-PhePheArgArgGlyAsnPheGlyPheGlyLeuGlnGlyArgThrAspGlyPhe-94  
 98-GlnArgLeuAspGlyGlyGlyTyr-105  
 109-GlyPheAlaAspCysArgProPhe-116  
 126-ValAspGlyArgGluLeuValProSerMetGluGluAspAla-139  
 145-AlaAspAspValPro-149  
 155-GluAlaGlnAsnArgCysAsnGlnGluAsnGlnThrAla-167  
 195-ValGluValGluArgThrGlnValPheArgAlaGluArgAsnAsnValPhe-211  
 213-GlyLysValGluGlyIleThr-219  
 261-GlyLysGlnLysAlaGlnGly-267  
 292-IleGlyArgCysArgProGlnAlaGln-300  
 312-ArgCysAsnAspValAlaAspGly-319  
 328-ValAspAsnGluThrMet-333

**Hydrophilic Regions - Hopp-Woods**

89-GlyArgThrAspGly-93

-122-

98-GlnArgLeuAspGlyGlyGly-104  
 127-AspGlyArgGluLeuValProSerMetGluGluAspAla-139  
 145-AlaAspAspValPro-149  
 156-AlaGlnAsnArgCysAsnGlnGluAsnGlnThr-166  
 195-ValGluValGluArgThrGlnValPheArgAlaGluArgAsnAsn-209  
 215-ValGluGlyIleThr-219  
 261-GlyLysGlnLysAlaGlnGly-267  
 293-GlyArgCysArgProGlnAlaGln-300  
 312-ArgCysAsnAspValAlaAspGly-319  
 328-ValAspAsnGluThrMet-333

238

**AMPHI Regions - AMPHI**

103-ValHisSerProPhe-107  
 112-SerLysSerThrSerAspPheSerGlyGlyVal-122  
 129-TyrGlnLeuHisArgThrGlySer-136  
 141-GluAspGlyTyrAspGlyProGlnGlySer-150  
 158-AlaArgAspIleTyrSerTyrTyrVal-166  
 224-AspAspValArgGlyIleValGlnGlyAlaValAsnPro-236  
 246-IleGlyAlaIleThrAspSerAlaValSerProValThrAspThrAlaAlaGlnGlnThrLeuGlnGlyIle  
 AsnAspLeuGlyLysLeu-275

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298-IleAsnSerAlaLysGlnTrpAlaAspAla-307  
 342-AspTrpValLysAsn-346  
 351-LysProAlaAlaArgHisMetGlnThrLeu-360  
 367-GlyAsnLysProIleLysSerLeuProAsn-376  
 398-PheAspSerValHisLysThrLeuThr-406  
 465-GlyLysGlnAlaLysAspTyrLeu-472

**Antigenic Index - Jameson-Wolf**

25-HisAlaAsnGlyLeuAspAlaArgLeuArgAspAspMetGlnAlaLysHisTyrGluProGlyGlyLys-47  
 53-AsnAlaArgGlySerValLysLysArgValTyr-63  
 80-ThrHisGluArgThrGlyPheGluGly-88

96-PheSerGlyHisGlyHisGluValHisSerProPheAspHisHisAspSerLysSerThrSerAspPheSerG  
 lyGlyValAspGlyGly-125  
 131-LeuHisArgThrGlySerGluIleHisProGluAspGlyTyrAspGlyProGlnGlySerAspTyrProPro  
 ProGlyGlyAlaArgAsp-160

166-ValLysGlyThrSerThrLysThrLysThr-175

182-ProPheSerAspArgTrpLeuLysGluAsnAlaGlyAla-194  
 200-SerArgAlaAspGluAlaGly-206  
 210-TrpGluSerAspProAsnLysAsnTrp-218

221-AsnArgMetAspAspValArgGlyIle-229

268-GlyIleAsnAspLeuGlyLysLeuSerProGluAlaGln-280  
 292-PheAlaValLysAspGlyIleAsnSerAlaLysGlnTrpAla-305  
 307-AlaHisProAsnIle-311  
 329-TrpArgGlyLysLysValGluLeuAsnProThrLysTrpAspTrpValLysAsnThrGlyTyrLysLysPro  
 AlaAlaArg-355

360-LeuAspGlyGluMetAlaGlyGlyAsnLysProIleLysSerLeuProAsnSerAlaAlaGluLysArgLys  
 GlnAsnPheGluLysPheAsnSerAsnTrpSer-394

-123-

396-AlaSerPheAspSerValHisLysThrLeuThrProAsnAla-409  
 413-LeuSerProAspLysValLysThrArgTyrThrSerLeuAspGlyLysIleThrIleIleLysAspAsnGlu  
 AsnAsnTyr-439

441-ArgIleHisAspAsnSerArgLysGlnTyrLeuAspSerAsnGlyAsnAlaValLysThrGlyAsnLeuGln  
 GlyLysGlnAlaLysAspTyrLeuGln-473

476-ThrHisIleArgAsnLeuAspLys-483

#### Hydrophilic Regions - Hopp-Woods

29-LeuAspAlaArgLeuArgAspAspMetGlnAlaLysHisTyrGluProGlyGly-46

54-AlaArgGlySerValLysLysArgValTyr-63

80-ThrHisGluArgThrGlyPhe-86

108-AspHisHisAspSerLysSerThrSerAspPhe-118

133-ArgThrGlySerGluIleHisProGluAspGlyTyrAspGlyProGlnGlySerAspTyrProPro-154

156-GlyGlyAlaArgAsp-160

169-ThrSerThrLysThrLysThr-175

186-ArgTrpLeuLysGluAsnAlaGly-193

200-SerArgAlaAspGluAlaGly-206

222-ArgMetAspAspValArgGly-228

271-AspLeuGlyLysLeuSerPro-277

296-AspGlyIleAsnSer-300

329-TrpArgGlyLysLysValGluLeuAsnProThr-339

347-ThrGlyTyrLysLysProAlaAlaArg-355

360-LeuAspGlyGluMetAlaGlyGlyAsnLysProIleLys-372

377-SerAlaAlaGluLysArgLysGlnAsnPheGluLysPheAsn-390

414-SerProAspLysValLysThrArgTyrThrSerLeuAspGlyLysIleThrIleIleLysAspAsnGluAsn  
 Asn-438

443-HisAspAsnSerArgLysGlnTyrLeu-451

454-AsnGlyAsnAlaValLys-459

462-AsnLeuGlnGlyLysGlnAlaLysAspTyrLeu-472

479-ArgAsnLeuAspLys-483

239-2

#### AMPHI Regions - AMPHI

49-PheArgLeuIleGlnSerCys-55

72-AsnAlaHisArgLysGln-77

123-ProGlyPheAsnAlaLeuProThrIlePhe-132

165-SerSerAsnGluTrp-169

221-PheCysAlaThrIleCysAlaSerLeuArg-230

#### Antigenic Index - Jameson-Wolf

6-GlyIleAlaArgAsnArgArgMetGlu-14

19-CysArgArgProAspArgPheValValArgGlnThrArgLeuLeu-33

53-GlnSerCysGluIleGluPro-59

66-HisAsnGlyLysSerGlyAsnAlaHisArgLysGlnGlnLysGluIle-81

100-ProAlaValArgSerAlaThrArgLysThrAla-110

132-PheArgGlySerSerGlyLysSerAlaSer-141

144-AlaAlaGlnArgGlyArgGlyAlaCys-152

164-ArgSerSerAsnGluTrpLys-170

-124-

173-ThrAlaLysArgProProSerPheArgArgHisMetThrCysGlyAsnThrAlaProThrSerSerSerSer  
ArgLeuIleLysMet-201  
209-ValAlaGlySerCysProArgSerArgValArgThr-220  
245-ArgAlaIleArgArgLeuAsnArgSerSerPro-255

**Hydrophilic Regions - Hopp-Woods**

6-GlyIleAlaArgAsnArgArgMetGlu-14  
20-ArgArgProAspArgPheValValArgGlnThrArg-31  
67-AsnGlyLysSerGlyAsnAlaHisArgLysGlnGlnLysGluIle-81  
102-ValArgSerAlaThrArgLysThrAla-110  
135-SerSerGlyLysSerAlaSer-141  
146-GlnArgGlyArgGlyAlaCys-152  
165-SerSerAsnGluTrpLys-170  
173-ThrAlaLysArgProProSerPheArgArgHisMet-184  
193-SerSerSerSerArgLeuIleLysMet-201  
211-GlySerCysProArgSerArgValArgThr-220  
245-ArgAlaIleArgArgLeuAsnArgSerSerPro-255  
240-2

**AMPHI Regions - AMPHI**

19-AlaAspValGlyArgPheLeuHis-26  
63-IleGlnCysLeuArgAsnHis-69  
87-AlaProLeuPheAlaValCysPro-94  
107-GlnGlyGluAspPheProArgAlaGlyIleGlnAsnHis-119  
154-ValPheArgGlyPheIleAlaArgGlyValGlnAlaValHisAsn-168  
188-PheLysArgLysPheGln-193

**Antigenic Index - Jameson-Wolf**

9-GlyThrGluThrArgArgGlnPheAla-17  
39-IleAlaHisGlyArgArgSerAspPheIleArg-49  
67-ArgAsnHisLysArgPheAspCysArgThrGlyPheAsp-79  
101-ValGlyGlyArgIleGlyGlnGlyGluAspPheProArgAlaGlyIleGlnAsnHisHisArgSerGly-123  
139-GlnGlyLeuAsnProLeuIleGluGlyLysAspAspVal-151  
173-ValProGlnAsnAspPheArg-179  
187-ValPheLysArgLysPhe-192  
201-AsnIleGlyLysSerAspAspValCysLys-210

**Hydrophilic Regions - Hopp-Woods**

10-ThrGluThrArgArgGlnPheAla-17  
41-HisGlyArgArgSerAspPheIleArg-49  
67-ArgAsnHisLysArgPheAspCys-74  
105-IleGlyGlnGlyGluAspPheProArg-113  
145-IleGluGlyLysAspAspVal-151  
187-ValPheLysArgLysPhe-192  
203-GlyLysSerAspAspValCysLys-210  
241-1

**AMPHI Regions - AMPHI**

6-ThrArgAlaAlaAsnProPro-12  
35-ThrArgThrProArgGluProAlaSer-43  
109-PheLeuIleGlyCysIleAla-115  
126-PheHisAlaCysGlnArgMetValAlaVal-135  
194-ArgHisIleAspArgIleAlaGlyIleLeuThrValGln-206  
229-PheValGlnLysLeuIleValGlyIleIleHis-239

**Antigenic Index - Jameson-Wolf**

-125-

1-MetProThrArgProThrArgAlaAlaAsnProProThrProProThr-16  
 23-CysProArgProProTyrArgProProSerValGlnThrArgThrProArgGluProAlaSerSerThrCysA  
 laAlaLysSerAlaAsnArgArgGluAsnSerHisAsnAlaGlnPro-62  
 68-ProSerAsnLysMetProSerGluThrGluGlnThrLeuPheArgArgHisGlnIleProProSerCysArgG  
 lnSer-93  
 122-LeuLysAlaAspPhe-126  
 147-ThrIleAspAspAsnIleAla-153  
 166-PheAspPheAsnArgGluHisAlaArgIlePheAspThrAspGlnLeu-181  
 188-ArgIleValGlyArgGlnArgHisIleAspArgIleAla-200  
 209-PheHisGlnArgGluAsnAla-215  
 244-ArgAsnHisGlyIle-248  
 250-HisAspSerHisIleCysProPheArgAsnSerArgLeuIle-263

**Hydrophilic Regions - Hopp-Woods**

1-MetProThrArgProThrArgAlaAlaAsn-10  
 32-SerValGlnThrArgThrProArgGluProAlaSer-43  
 46-CysAlaAlaLysSerAlaAsnArgArgGluAsnSerHis-58  
 70-AsnLysMetProSerGluThrGluGlnThrLeuPheArg-82  
 122-LeuLysAlaAspPhe-126  
 166-PheAspPheAsnArgGluHisAlaArgIlePheAsp-177  
 188-ArgIleValGlyArgGlnArgHisIleAspArgIleAla-200  
 209-PheHisGlnArgGluAsnAla-215  
 242

**AMPHI Regions - AMPHI**

23-SerGluValValThrGlnPheValAspPheValGlu-34  
 42-AlaGlyPheCysHisIleLeuGlnAsn-50  
 100-AlaAspGlnAlaGln-104  
 122-AsnProPhePheAspPhePheGlnAlaValVal-132  
 137-HisGlnSerGlyPheGlyAspValPhe-145  
 156-LeuGluGlnSerVal-160  
 177-PheGluLeuPheGln-181  
 191-PheGlyHisThrArgLeuPheAspIleCys-200  
 262-HisProPheAlaAspPheGlyAsnPheGlnAsnLeuLeuAlaLeu-276

**Antigenic Index - Jameson-Wolf**

13-HisPheGluGlnArgAlaGlyGlyIleAla-22  
 33-ValGluGlnGluGln-37  
 52-ThrGlyHisArgAlaAspIle-58  
 75-SerHisAlaAspIlePheProProArgCysPheGlyAspGlyPheAlaGlnArgGlyPheAlaHisAlaArgA  
 rgAlaAspGlnAlaGlnAsnArgAla-107  
 137-HisGlnSerGlyPhe-141  
 154-ArgGlnLeuGluGlnSerVal-160  
 164-AlaTyrAspGlyGlyPheArgArgHisArgTrpHis-175  
 283-MetArgCysAspArgIleGly-289

**Hydrophilic Regions - Hopp-Woods**

13-HisPheGluGlnArgAlaGlyGlyIle-21  
 33-ValGluGlnGluGln-37  
 52-ThrGlyHisArgAlaAspIle-58  
 95-AlaHisAlaArgArgAlaAspGlnAlaGlnAsnArgAla-107  
 154-ArgGlnLeuGluGlnSerVal-160  
 167-GlyGlyPheArgArgHisArg-173  
 283-MetArgCysAspArgIleGly-289  
 243

**AMPHI Regions - AMPHI**

-126-

35-IleThrArgLeuAlaArgLysAlaValGlnArgLeuThr-47  
 50-HisIleGlnXxxPhePheThrGlu-57  
 80-AspSerSerArgIleThrSerThrIle-88

**Antigenic Index - Jameson-Wolf**

29-LeuProSerAsnAlaPro-34  
 37-ArgLeuAlaArgLysAlaValGln-44  
 58-SerHisThrGlyAlaAsnArgSerSerSerSerCysLysPro-71  
 77-SerAlaSerAspSerSerArgIle-84  
 102-SerThrThrGlyAlaValThrLysSer-110

**Hydrophilic Regions - Hopp-Woods**

37-ArgLeuAlaArgLysAlaValGln-44  
 59-HisThrGlyAlaAsnArgSerSerSerSerCysLys-70  
 78-AlaSerAspSerSerArgIle-84  
 244-2

**AMPHI Regions - AMPHI**

22-LysCysPheLeuGlnLeuValGln-29  
 31-HisLeuHisAlaHis-35  
 109-IleSerArgLeuCysGlySerLeuPhe-117  
 126-CysLeuAspGlyPheHisArgLeuHis-134  
 137-AsnArgPhePheThr-141  
 165-TyrProArgLysIleArgThrPheSerArgAsnPheLysGlnLys-179

**Antigenic Index - Jameson-Wolf**

1-MetAspIleArgIle-5  
 11-PheArgValAspPheLeuAsp-17  
 45-IleGlnLysArgHis-49  
 54-LeuAspArgGlnHisPheHisGlyLysLeuLeuSerGlyGluLeuValArg-70  
 99-GlnLeuGlyAsnProArgLeu-105  
 154-LeuLysThrAsnTrpLysSerLysSerSerTyrTyrProArgLysIleArgThrPheSerArgAsnPheLys  
 GlnLysGlnArgIleSerAsnSerPheSerAsnProLeuProLysLys-193

**Hydrophilic Regions - Hopp-Woods**

1-MetAspIleArgIle-5  
 11-PheArgValAspPheLeuAsp-17  
 156-ThrAsnTrpLysSerLysSer-162  
 167-ArgLysIleArgThrPheSerArgAsnPheLysGlnLysGlnArgIle-182  
 246-2

**AMPHI Regions - AMPHI**

39-AlaValAsnIleAlaGlnCysPheThr-47  
 67-GluGlnPheAlaAsnLeuPhePhe-74  
 83-AspMetGlyArgPhe-87  
 132-PheGlyCysAspAspValValAspAsnLeuAlaGlyPheGlyArg-146  
 156-GlnLeuSerGlnValPhePheGlnLeuLeuGln-166

**Antigenic Index - Jameson-Wolf**

1-MetHisGlyArgTyrGlyGlyThrGln-9  
 18-GlnThrGlnArgThrCysPheSerAsnGlyLysValTyr-30  
 34-ThrAspIleGlySer-38  
 59-GlnArgArgThrGluValLeu-65  
 78-AspSerArgHisHisAspMetGlyArg-86  
 92-LeuAspAspGluLeuAla-97  
 133-GlyCysAspAspValValAspAsn-140  
 143-GlyPheGlyArgGlyPhe-148

-127-

**Hydrophilic Regions - Hopp-Woods**

59-GlnArgArgThrGluValLeu-65

78-AspSerArgHisHisAspMet-84

92-LeuAspAspGluLeuAla-97

247-1

**AMPHI Regions - AMPHI**

12-SerTyrAspGlyMetLysGlyPheThrIleIle-22

25-LeuValAlaGlyLeuLeuSerMetIleValLeu-35

48-LeuAsnAspAlaAlaAsn-53

81-CysPheAsnMetSerGlu-86

123-AsnTyrGlnAsnPhePheGln-129

150-ThrValValSerSerCysAlaAlaIleSerLysProGlyLysGlnIleProThrLeu-168

256-LysTyrThrAspLysPheAspSerAla-264

**Antigenic Index - Jameson-Wolf**

1-MetArgArgLysMetLeuAsnValProLysGlySerTyrAspGlyMetLys-17

42-TyrPheThrSerArgLysLeuAsnAspAlaAlaAsnGluArgLeuAlaAla-58

60-GlnAspLeuArgAsn-64

71-ArgAspAlaArgMetAlaGlyGlyPhe-79

83-AsnMetSerGluHisProAlaThrAspValIleProAspThrThrGlnGlnAsnSerProPheSerLeuLysArgAsnGlyIleAspLys-112

117-AlaGluSerSerAsnIleAsnTyrGln-125

140-IleAspAspValAsnAlaSerThr-147

157-AlaIleSerLysProGlyLysGlnIleProThrLeuGluAspAlaLysLysGluLeuLysIleProAspGlnAspLysGluGlnAsnGlyAsnIleAlaArgGlnArgHis-193

202-ArgIleAlaAspGluGluGlyLeu-209

212-PheGlnLeuAspAspLysGlyLysTrpGlyAsn-222

228-LysLysValArgHisMetLys-234

242-GlyCysProGluAspAspAspAlaGlyLysGluGluThrPheLysTyrThrAspLysPheAspSerAlaGln-265

279-SerGlyThrAspThrLysIleAlaAlaSerSerAspAsnHis-292

300-AlaThrIleArgGlyGlyAsnValCysAlaAsnArgThrLeu-313

**Hydrophilic Regions - Hopp-Woods**

1-MetArgArgLysMetLeuAsn-7

11-GlySerTyrAspGly-15

46-ArgLysLeuAsnAspAlaAlaAsnGluArgLeuAlaAla-58

60-GlnAspLeuArgAsn-64

71-ArgAspAlaArgMet-75

104-SerLeuLysArgAsnGlyIleAspLys-112

140-IleAspAspValAsnAla-145

159-SerLysProGlyLysGln-164

166-ProThrLeuGluAspAlaLysLysGluLeuLysIleProAspGlnAspLysGluGlnAsnGlyAsnIleAlaArgGlnArgHis-193

202-ArgIleAlaAspGluGluGlyLeu-209

213-GlnLeuAspAspLysGlyLysTrpGly-221

228-LysLysValArgHisMetLys-234

243-CysProGluAspAspAspAlaGlyLysGluGluThrPheLysTyrThrAspLysPheAspSerAlaGln-265

280-GlyThrAspThrLysIleAlaAlaSerSerAsp-290

248-2

**Hydrophilic Regions - Hopp-Woods**

1-MetArgArgLysMetLeuAsn-7

11-GlySerTyrAspGly-15

46-ArgLysLeuAsnAspAlaAlaAsnGluArgLeuAlaAla-58  
 60-GlnAspLeuArgAsn-64  
 71-ArgAspAlaArgMet-75  
 104-SerLeuLysArgAsnGlyIleAspLys-112  
 140-IleAspAspValAsnAla-145  
 159-SerLysProGlyLysGln-164  
 166-ProThrLeuGluAspAlaLysLysGluLeuLysIleProAspGlnAspLysGluGlnAsnGlyAsnIleAla  
 ArgGlnArgHis-193  
 202-ArgIleAlaAspGluGluGlyLeu-209  
 213-GlnLeuAspAspLysGlyLysTrpGly-221  
 228-LysLysValArgHisMetLys-234  
 243-CysProGluAspAspAlaGlyLysGluGluThrPheLysTyrThrAspLysPheAspSerAlaGln-26  
 5  
 280-GlyThrAspThrLysIleAlaAlaSerSerAsp-290

#### Antigenic Index - Jameson-Wolf

1-MetArgLysGlnAsnThrLeuThr-8  
 11-ProThrSerAspGlyGlnArgGly-18  
 40-GlnSerTyrAsnThrGluGlnArgIleSerAlaAsnGluSerAspArgLysLeuAla-58  
 64-AlaAlaLeuArgGluGlyGluLeuGln-72  
 76-LeuGluTyrAspThrAspSerLysValThrPheSerGluAsnCysGlyLysGlyLeu-94  
 99-AsnValArgThrAsnAsnAspAsnGluGluAlaPhe-110  
 116-GlnGlyLysProThrValGluAlaValLysArgSerCysProAlaAsnSerThrAspLeuCysIleAspLys  
 LysGlyMetGluTyrLysLysGlyThrArgSerValSerLysMetProArgTyr-157  
 162-LeuGlyValLysAsnGlyGluAsnValTyr-171  
 177-AlaTrpGlyLysAsnAlaAsnThr-184  
 192-ValSerAsnAsnAspGlu-197

#### Hydrophilic Regions - Hopp-Woods

1-MetArgLysGlnAsnThr-6  
 11-ProThrSerAspGlyGlnArg-17  
 42-TyrAsnThrGluGlnArgIleSerAlaAsnGluSerAspArgLysLeuAla-58  
 64-AlaAlaLeuArgGluGlyGluLeuGln-72  
 76-LeuGluTyrAspThrAspSerLysValThrPhe-86  
 101-ArgThrAsnAsnAspAsnGluGluAlaPhe-110  
 119-ProThrValGluAlaValLysArgSerCysPro-129  
 135-LeuCysIleAspLysLysGlyMetGluTyrLysLysGlyThrArgSerValSerLysMetPro-155  
 165-LysAsnGlyGluAsnValTyr-171  
 193-SerAsnAsnAspGlu-197  
 249-1

#### AMPHI Regions - AMPHI

6-CysPheArgLeuLys-10  
 17-AlaLeuIleGluValLeuVal-23  
 42-ThrValAlaSerValArgGluAla-49  
 53-ThrIleValSerGlnIleThrGlnAsnLeuMetGluGlyMet-66

#### Antigenic Index - Jameson-Wolf

1-MetLysAsnAsnAspCysPheArgLeuLysAspSerGlnSerGlyMetAla-17  
 44-AlaSerValArgGluAlaGluThr-51  
 70-ProThrIleAspSerAspSerAsnLysLysAsnTyr-81  
 93-ValAspGlyAspPheAla-98  
 101-AlaMetLysThrLysGlyGlnLeuAla-109  
 134-ValCysLysAspSerSerGlyAsnAlaProThrLeuSer-146  
 148-AsnAlaPheSerSerAsnCysAspAsnLysAlaAsnGlyAspThrLeu-163  
 171-AspSerAlaGlyAspSerAspIleSerArgThrAsnLeuGluValSerGlyAspAsn-189

-129-

196-AlaArgValGlyGlyArgGlu-202

**Hydrophilic Regions - Hopp-Woods**

1-MetLysAsnAsnAspCysPheArgLeuLysAspSerGlnSer-14

44-AlaSerValArgGluAlaGluThr-51

72-IleAspSerAspSerAsnLysLysAsn-80

101-AlaMetLysThrLysGlyGlnLeuAla-109

134-ValCysLysAspSerSerGly-140

153-AsnCysAspAsnLysAlaAsnGly-160

172-SerAlaGlyAspSerAspIleSerArgThrAsnLeu-183

198-ValGlyGlyArgGlu-202

250-2

**AMPHI Regions - AMPHI**

34-PheAlaGlyGlySerGlu-39

41-AlaThrValAsnLeuTrpAlaGluPro-49

123-LeuThrLysThrSerThrAlaLeuPro-131

**Antigenic Index - Jameson-Wolf**

14-MetGlnGlyGlyGlnLysGlyMetSer-22

35-AlaGlyGlySerGlu-39

80-IleProLeuLysLysAlaVal-86

103-GluIleGlnLysArgLysAlaAla-110

119-PheTyrSerGlyLeuThrLysThrSerThrAlaLeuProArgLeuSerSerLysLysThrIle-139

**Hydrophilic Regions - Hopp-Woods**

80-IleProLeuLysLysAlaVal-86

103-GluIleGlnLysArgLysAlaAla-110

133-LeuSerSerLysLysThrIle-139

251

**AMPHI Regions - AMPHI**

59-AlaTyrGlyAspProIleGlyAlaGlyPhe-68

114-GlnValValAlaAspPheGlyGlyIleGluGlyPhe-125

160-ArgThrValGlyArgThrValArgLeuLeuLysMetIle-172

215-AlaArgThrValPheArgAlaHis-222

260-LeuGlyGlnGluCysArg-265

267-ArgHisIleAlaArgValGluSerLeuLeuArgValPheGluTyrAlaAlaAsp-284

**Antigenic Index - Jameson-Wolf**

10-AlaArgAlaAspIleArgProProAlaGlnThrAspIleValProAsnCys-26

34-AspAlaAlaArgArgAlaValArg-41

49-AlaAspLeuProArgAsnAspIleSerProAlaTyrGlyAspProIleGlyAlaGly-67

80-LeuArgGlyArgValArgArgIleGly-88

101-GluIleArgAlaLysAlaValLysProGluIle-111

149-ArgLeuValGlyThr-153

161-ThrValGlyArgThrValArg-167

179-ProValValArgGluAlaGlyIle-186

212-ValLysHisAlaArgThrValPhe-219

244-ValThrGlyGlnArgThrArg-250

256-IleLysAsnArgLeuGlyGlnGluCysArgAsnArgHisIleAlaArgValGluSer-274

290-LeuLysThrLysThrArgAlaGluGlnProArgProAlaPhe-303

**Hydrophilic Regions - Hopp-Woods**

10-AlaArgAlaAspIleArgProProAlaGln-19

34-AspAlaAlaArgArgAlaValArg-41

50-AspLeuProArgAsnAspIle-56

-130-

82-GlyArgValArgArgIleGly-88  
 101-GluIleArgAlaLysAlaValLysProGluIle-111  
 161-ThrValGlyArgThrValArg-167  
 179-ProValValArgGluAlaGlyIle-186  
 212-ValLysHisAlaArgThrValPhe-219  
 258-AsnArgLeuGlyGlnGluCysArgAsnArgHisIleAlaArgValGluSer-274  
 292-ThrLysThrArgAlaGluGlnProArg-300  
 254-2

**AMPHI Regions - AMPHI**

6-ArgPheAsnThrTyrSerHis-12  
 32-GlyHisGlyAspGlyTyrArg-38  
 66-LysLeuLysSerIleLeuLys-72  
 142-ValLeuAlaValMetLysSerLeuThrAlaSerLeuPro-154

**Antigenic Index - Jameson-Wolf**

2-TyrThrGlyGluArgPheAsnThrTyrSer-11  
 32-GlyHisGlyAspGlyTyrArg-38  
 65-GlyLysLeuLysSerIleLeuLysLysThrAspHis-76  
 94-SerLeuArgAsnGlyProGly-100  
 120-ThrIleGlyArgLysSerGluLysArgLeu-129  
 177-AsnAspGluLysIleArgHisGlyHisGly-186

**Hydrophilic Regions - Hopp-Woods**

65-GlyLysLeuLysSerIleLeuLysLysThrAspHis-76  
 120-ThrIleGlyArgLysSerGluLysArgLeu-129  
 177-AsnAspGluLysIleArgHis-183

255

**AMPHI Regions - AMPHI**

23-ValLysThrCysAlaAspPheHisAlaPheAspGlyValAspAlaHisHisArg-40  
 71-GlyIleGlnGlyPheAlaHis-77  
 139-AlaGlyGlyGlyPhe-143

**Antigenic Index - Jameson-Wolf**

33-AspGlyValAspAlaHisHisArgValGlyAspPheGly-45  
 48-AlaValLysAsnArgPheAlaGlnAlaAspArgAspIleGlyCys-62  
 66-GlnLeuArgAlaAspGlyIleGln-73  
 91-ValGlyGlyLysLysArgIleLeu-98  
 115-GlyAsnValGlyGlyAspPheArgAla-123  
 130-PhePheGlyAsnGlySerGlySerAsnAlaGlyGly-141  
 143-PheThrGlyGlyAla-147  
 169-GlyAlaGluAlaGlyGly-174

**Hydrophilic Regions - Hopp-Woods**

33-AspGlyValAspAlaHisHisArgValGlyAspPheGly-45  
 48-AlaValLysAsnArgPheAlaGlnAlaAspArgAspIleGly-61  
 66-GlnLeuArgAlaAspGly-71  
 92-GlyGlyLysLysArgIleLeu-98  
 119-GlyAspPheArgAla-123  
 135-SerGlySerAsnAla-139  
 169-GlyAlaGluAlaGlyGly-174

256-1

**AMPHI Regions - AMPHI**

-131-

90-GlyValValValHisPheArgSerCysGlyGlyIleAlaAsn-103  
 127-ArgTyrArgGluIleTyrAlaVal-134  
 141-AsnAlaLeuAlaLysTyrLeuGlyGluGln-150  
 173-ArgArgPheAspSerGlyIleThrArgLeuLeu-183  
 197-LysSerLeuGlnGlyPheGlnThrAla-205  
 207-AlaAlaGlyCysLysThrLeuGlyGluPheAspAspArgPheThrAlaProLeuHisGly-226  
 233-TyrTyrArgGlnThrSerCysLysProLeuLeuLysHisValAla-247  
 267-ProArgAlaAspGluValSer-273

**Antigenic Index - Jameson-Wolf**

4-ThrProProAspThrProPhe-10  
 12-LeuArgAsnGlyAsnAlaAspThrIleAla-21  
 24-PheLeuGlnArgProAlaProAlaTyrArgArgGluLeuLeuProAspSerThrGlyLysThrLysVal-46  
 49-AspPheSerAspGlyIleSerProAspAla-58  
 67-LeuGluGlySerSerArgSerHisTyr-75  
 82-AlaValArgAspArgGlyTrpHis-89  
 112-GlyAspThrAlaGlu-116  
 147-LeuGlyGluGlnGlyLysLysAlaLeu-155  
 166-ValAspAlaGluAlaAlaGlyArgArgPheAspSerGlyIleThr-180  
 192-LeuIleProLysAlaLysSerLeuGln-200  
 212-ThrLeuGlyGluPheAspAspArgPheThr-221  
 227-PheAlaAspArgHisAspTyrTyrArgGlnThrSerCysLysProLeuLeu-243  
 259-ProPheLeuProProGluAlaLeuProArgAlaAspGluValSerGlu-274  
 291-SerSerThrGlyGlyArgLeu-297  
 311-AspSerPheArgThrAsnArgArg-318

**Hydrophilic Regions - Hopp-Woods**

30-ProAlaTyrArgArgGluLeuLeuPro-38  
 40-SerThrGlyLysThrLysVal-46  
 68-GluGlySerSerArgSer-73  
 83-ValArgAspArgGlyTrp-88  
 147-LeuGlyGluGlnGlyLysLysAlaLeu-155  
 166-ValAspAlaGluAlaAlaGlyArgArgPheAspSerGlyIle-179  
 192-LeuIleProLysAlaLysSer-198  
 212-ThrLeuGlyGluPheAspAspArgPheThr-221  
 227-PheAlaAspArgHisAspTyrTyrArg-235  
 265-AlaLeuProArgAlaAspGluValSerGlu-274  
 313-PheArgThrAsnArgArg-318  
 257-2

**AMPHI Regions - AMPHI**

24-SerPheLeuProAsn-28  
 73-AspLeuValAsnLysValLeuAlaGluValAlaArgLeuGluLysIleValGlnProLeu-92

**Antigenic Index - Jameson-Wolf**

1-MetGlyArgHisPheGlyArgArgArgPhe-10  
 31-AlaAlaAspAspGluLysArgAsnGlyAspGluLysArgAsnGluAsn-46  
 56-GlySerGlyAlaGlu-60  
 65-GlyValAspAspArgArgAlaAlaAspLeuVal-75  
 83-AlaArgLeuGluLysIleVal-89

**Hydrophilic Regions - Hopp-Woods**

4-HisPheGlyArgArgArgPhe-10  
 31-AlaAlaAspAspGluLysArgAsnGlyAspGluLysArgAsnGlu-45  
 65-GlyValAspAspArgArgAlaAlaAspLeuVal-75  
 83-AlaArgLeuGluLysIleVal-89

-132-

259-1

**AMPHI Regions - AMPHI**

154-TyrGlyArgValPheAlaAspIlePheGluLeuSer-165

172-AlaPheLysGlyMetLeuLysLeuThrAlaGluTyrLysAsnIlePheGlyAspAlaCysArg-192

203-AsnGlnAlaLeuGlnGluIleSerLysThrSerGlu-214

**Antigenic Index - Jameson-Wolf**

34-LysAlaTyrThrGluGluLeuProPro-42

61-SerAlaArgSerLysAlaLysAlaGluLysPheTyrArgGluLysMetIleGln-78

93-LeuGluHisLysPro-97

105-LysAsnHisGlyLysGlyMetAlaGluGlnValArgPheLysAla-119

121-ValLeuProAspAspGluAspAlaArgThrIleAla-132

144-GlyThrAspAlaValAlaSerGlyGluThrTyrGlyArgVal-157

168-LeuGluGlyArgAlaPhe-173

189-AspAlaCysArgSerGluThrAlaLeu-197

208-GluIleSerLysThrSerGluLysSerLysArg-218

**Hydrophilic Regions - Hopp-Woods**

35-AlaTyrThrGluGluLeuPro-41

62-AlaArgSerLysAlaLysAlaGluLysPheTyrArgGluLysMetIleGln-78

93-LeuGluHisLysPro-97

106-AsnHisGlyLysGlyMetAlaGluGlnValArgPheLysAla-119

121-ValLeuProAspAspGluAspAlaArgThrIleAla-132

168-LeuGluGlyArgAlaPhe-173

189-AspAlaCysArgSerGluThrAlaLeu-197

208-GluIleSerLysThrSerGluLysSerLysArg-218

260-2

**AMPHI Regions - AMPHI**

12-ProPheSerSerLeuPheArgAlaLeuPhe-21

53-PheIleAspSerValGlyGlnValAlaAlaArgLeuPheGlnAlaPhe-68

158-GlnValGlyIleValAspLeuIlePro-166

175-LeuProArgAlaValGln-180

**Antigenic Index - Jameson-Wolf**

20-LeuPheGluAspArgValGlyIle-27

30-GlyAlaHisAspAlaAlaGlu-36

38-AspPheLeuProGluGluPheThrArg-46

80-ProAlaPheArgAlaArgGluGlnAlaArgArgGlySerGly-93

97-GlyAsnAspLeuArgMetProHisLysAspAlaValGluValAspIleAspGlyGlyAsnThrVal-118

126-ThrHisPheAspAspGlyAspAla-133

139-AlaGluAlaArgPhe-143

184-ArgAsnAlaProGlnGly-189

196-ValAlaPheArgArgValArgAla-203

**Hydrophilic Regions - Hopp-Woods**

20-LeuPheGluAspArgValGlyIle-27

30-GlyAlaHisAspAlaAlaGlu-36

82-PheArgAlaArgGluGlnAlaArgArgGlySer-92

98-AsnAspLeuArgMetProHisLysAspAlaValGluValAspIleAspGly-114

127-HisPheAspAspGlyAspAla-133

139-AlaGluAlaArgPhe-143

196-ValAlaPheArgArgValArgAla-203

261

**AMPHI Regions - AMPHI**

22-GlnIlePheArgGln-26  
 32-AspThrAlaArgAlaPheAlaAlaAla-40  
 50-GlyLeuLeuAlaAspIle-55  
 94-ArgPheAspLysHis-98  
 137-AlaValTyrLysGlyIleArgAsnAlaValPhe-147  
 158-GlnGlyIleValArgAsnLeu-164  
 203-AspValPheAlaProVal-208  
 212-CysLeuAsnGlnAlaGlyGly-218

**Antigenic Index - Jameson-Wolf**

40-AlaAlaAspAspAlaVal-45  
 62-ValArgGlnArgProArgLeuArgLeu-70  
 74-HisGlnArgArgValAspLeu-80  
 86-ArgGlnIleLysGlyAsnValHisArgPheAspLysHisVal-99  
 111-AlaHisAlaArgAspAspValProTyr-119  
 126-AsnArgGlyIleGluGlnGluLysArgVal-135  
 149-SerPheAspGlyGlyGly-154  
 181-ArgAsnProAlaGly-185  
 197-LeuGluSerAsnGlyLeuAsp-203  
 214-AsnGlnAlaGlyGlyArgIleLeuThrAlaArgLysAspAspGlnGlyLeu-230

**Hydrophilic Regions - Hopp-Woods**

40-AlaAlaAspAspAlaVal-45  
 62-ValArgGlnArgProArgLeuArgLeu-70  
 74-HisGlnArgArgValAspLeu-80  
 91-AsnValHisArgPheAspLysHisVal-99  
 112-HisAlaArgAspAspValPro-118  
 127-ArgGlyIleGluGlnGluLysArgVal-135  
 221-LeuThrAlaArgLysAspAspGlnGly-229  
 263-2

**AMPHI Regions - AMPHI**

32-AsnLeuIleGlyValLeuSerAsnAla-40  
 42-GluAlaLeuAlaPheTyrGlnGluValGlyLysLeuAsnAlaAlaAsnSerLeuThr-60  
 86-LysLeuAlaThrLeuLysLys-92  
 100-LysAlaAlaArgAlaLeuAlaAlaGlyGlu-109  
 115-LeuGlyAlaLeuAlaAlaPheThrGln-123  
 135-GluGluLeuLysAlaPhePheAspAla-143  
 157-ValAlaLeuAlaThrLeuCysAsnTyrValAsnAsnLeuGly-170

**Antigenic Index - Jameson-Wolf**

10-GluThrAlaProGluAlaAlaLysAlaArgValGluAla-22  
 37-LeuSerAsnAlaPro-41  
 72-AlaArgThrAsnGlnCysGly-78  
 97-GlnSerValLysAlaAlaArg-103  
 108-GlyGluPheAspAspAlaLysLeu-115  
 126-MetAlaLysLysGlyAlaValSerAspGluGluLeuLysAla-139  
 170-GlyGlnThrGluIleAsnProGluLeu-178

**Hydrophilic Regions - Hopp-Woods**

11-ThrAlaProGluAlaAlaLysAlaArgValGluAla-22  
 97-GlnSerValLysAlaAlaArg-103  
 108-GlyGluPheAspAspAlaLysLeu-115  
 126-MetAlaLysLysGlyAlaValSerAspGluGluLeuLysAla-139  
 264

**AMPHI Regions - AMPHI**

-134-

55-ValAlaGluPheThrGlnThrGly-62  
 96-IleProSerTyrValArgValThrAsnThrLys-106  
 124-AsnArgIleIleAspValSer-130  
 183-LeuAsnGlnAlaAla-187

**Antigenic Index - Jameson-Wolf**

27-AlaValValLysAlaGluLysLeuHisAlaSerAlaAsnArgSerTyrLysValAlaGlyLysArgTyrThrProLysAsnGlnVal-55  
 57-GluPheThrGlnThrGlyAsnAlaSerTrp-66  
 68-GlyGlyArgPheHisGlyArgLysThrSerGlyGlyGluArgTyrAsp-83  
 103-ThrAsnThrLysAsnGlyLysSerVal-111  
 114-ArgValAsnAspArgGlyProPheHisGlyAsnArgIleIleAspValSerLysAlaAlaAla-134  
 153-ValProGlyGlnSerAlaProValAlaGluAsnLysAspIlePheIle-168  
 170-LeuLysSerPheGlyThrGluHisGluAla-179  
 200-SerValGluLysArgArgTyrGluTyr-208  
 213-GlyProPheThrSerGlnGluArgAlaAlaGluAlaGluAlaGlnAla-228

**Hydrophilic Regions - Hopp-Woods**

27-AlaValValLysAlaGluLysLeuHisAlaSerAlaAsnArgSerTyrLysValAlaGlyLysArgTyrThrPro-51  
 71-PheHisGlyArgLysThrSerGlyGlyGluArgTyrAsp-83  
 103-ThrAsnThrLysAsnGlyLys-109  
 115-ValAsnAspArgGlyProPheHis-122  
 125-ArgIleIleAspValSerLysAlaAlaAla-134  
 159-ProValAlaGluAsnLysAspIlePheIle-168  
 171-LysSerPheGlyThrGluHisGluAla-179  
 200-SerValGluLysArgArgTyrGluTyr-208  
 216-ThrSerGlnGluArgAlaAlaGluAlaGluAlaGlnAla-228  
 266-2

**Antigenic Index - Jameson-Wolf**

30-AlaLeuLysArgLysHisPhe-36  
 57-LeuGluSerArgAlaGlySerValHisAspGlnGlyTrpGlu-70  
 93-TrpHisThrArgAsnArgGlu-99

**Hydrophilic Regions - Hopp-Woods**

30-AlaLeuLysArgLysHisPhe-36  
 59-SerArgAlaGlySerValHis-65  
 268-1

**AMPHI Regions - AMPHI**

6-AspGlyLeuHisLysPheLysHisIleCysSerAlaAla-18  
 22-IleLysGluProLeuAspLysVal-29  
 52-GlnGluAlaAlaArgValSerGluTrp-60  
 70-GluPheGluGlnPheTrpLysGlyLeuProGlnThrValGlnAsn-84  
 89-SerGlnLysThrTrpLysSerGlyMetAspLys-99  
 110-LysThrProAsnGlyIleLys-116

**Antigenic Index - Jameson-Wolf**

1-ValGlnSerArgTyrAspGly-7  
 21-LeuIleLysGluProLeuAspLysValLysGlnArgAsnGluGluLeuGluAlaAlaGluGluAlaAlaAla-44  
 47-AlaLeuGlyArgGluGlnGluAlaAlaArgValSerGluTrpGluGluArgTyrLysLeuSerArgSerGluPhe-71  
 82-ValGlnAsnLysLeuGlnAlaSerGlnLysThrTrpLysSerGlyMetAspLysIleCysAlaAsnAsnAlaLysAlaGluGlyLysThrProAsnGlyIleLysPhe-117  
 119-GluLeuAlaCysLysThrAlaLysThrGluAlaArgLeuGluGluLeuHisAsnArgLysLysAlaLeuIleAspGluMetAlaArgGluAlaAspLysLysGluLeuSerLysArgLeu-158

-135-

**Hydrophilic Regions - Hopp-Woods**

3-SerArgTyrAspGly-7

21-LeuIleLysGluProLeuAspLysValLysGlnArgAsnGluGluLeuGluAlaAlaGluGluAlaAlaAla-44

47-AlaLeuGlyArgGluGlnGluAlaAlaArgValSerGluTrpGluGluArgTyrLysLeuSerArgSerGluPhe-71

91-LysThrTrpLysSerGlyMetAspLysIleCys-101

104-AsnAlaLysAlaGluGlyLysThrProAsn-113

119-GluLeuAlaCysLysThrAlaLysThrGluAlaArgLeuGluGluLeuHisAsnArgLysLysAlaLeuIleAspGluMetAlaArgGluAlaAspLysLysGluLeuSerLysArgLeu-158

269-2

**AMPHI Regions - AMPHI**

39-AlaSerValProAla-43

54-TrpAspPheIleGlnAsnThr-60

73-PheLysThrArgAlaLeuGlyArgPheSerSerPro-84

**Antigenic Index - Jameson-Wolf**

30-ArgSerAlaLeuSerCysLysProCysAlaSerValProAlaSerSer-45

60-ThrAlaSerProLysValSer-66

73-PheLysThrArgAlaLeuGlyArgPheSerSer-83

90-LeuSerGluArgGlyValLysLysProLeu-99

107-GlnValAspThrSerAla-112

117-SerLeuArgSerSer-121

**Hydrophilic Regions - Hopp-Woods**

61-AlaSerProLysVal-65

73-PheLysThrArgAlaLeuGly-79

90-LeuSerGluArgGlyValLysLysProLeu-99

270-2

**AMPHI Regions - AMPHI**

41-AspLeuThrGluGlyCys-46

49-ProAspGlySerArg-53

100-GlnProSerGlyThrTrp-105

**Antigenic Index - Jameson-Wolf**

1-MetAsnLysAsnArgLysLeu-7

41-AspLeuThrGluGlyCysThrLeuProAspGlySerArgValArgAlaAlaAlaValSerThrLysLysProPhe-65

71-HisAlaProAlaGlyThrGlu-77

86-LysAsnMetAspMetGlyPhe-92

95-TyrMetPheGluArgGlnProSerGlyThr-104

116-ValGluGlyArgArgAspPheThrAla-124

128-IleGlySerArgThrPhe-133

**Hydrophilic Regions - Hopp-Woods**

1-MetAsnLysAsnArgLysLeu-7

49-ProAspGlySerArgValArgAla-56

60-SerThrLysLysProPhe-65

73-ProAlaGlyThrGlu-77

96-MetPheGluArgGlnPro-101

116-ValGluGlyArgArgAspPheThrAla-124

271-2

**AMPHI Regions - AMPHI**

6-MetAlaArgIleTrp-10

-136-

20-SerProCysProAla-24  
29-ProLysSerProAla-33

**Antigenic Index - Jameson-Wolf**

2-PheSerSerArgMetAlaArg-8  
25-LeuThrThrLysProLysSerProAlaLys-34  
41-ArgSerAsnCysLeu-45  
61-SerSerThrThrGlyAlaProThrSerArg-70  
78-SerAlaSerIleAsnLysAspThrArgMetProAlaSerVal-91  
102-CysCysAlaAsnThrSerLysProProSer-111

**Hydrophilic Regions - Hopp-Woods**

27-ThrLysProLysSerProAlaLys-34  
80-SerIleAsnLysAspThrArgMet-87  
105-AsnThrSerLysProPro-110  
272-2

**AMPHI Regions - AMPHI**

44-IleThrArgIleThrAspGlu-50  
70-AlaGluGluPheSerSerThrAsn-77  
106-PheArgThrIleThrSer-111  
165-IleIleThrIleGluAspProIleGlu-173  
194-AsnTrpMetAlaAlaLeuLysAsnThrLeuArgGlnAla-206  
244-AsnGlnAlaLeuAspArgIleIleAsn-252  
307-GlyAsnIleHisGluIleLysGluValMetLys-317  
328-AspGlnHisLeuTyrGln-333  
345-AlaLeuLysAsnAlaAspSer-351

**Antigenic Index - Jameson-Wolf**

2-PheThrAspGluAsnMetThrAlaLysGluGluLeu-13  
20-MetAsnGlnAsnLysGlySerAsp-27  
38-MetLysLeuAspGlyLysIleThrArgIleThrAspGluProLeuThrAlaGluLysCysMet-58  
68-LysGlnAlaGluGluPheSerSerThrAsnGlu-78  
85-LeuProAspThrSerArgPheArgVal-93  
109-IleThrSerLysIleProLysPheGluSerLeuAsn-120  
128-ValAlaLeuLysLysArgGly-134  
142-ThrGlySerGlyLysSerThrSerLeu-150  
154-IleAspTyrArgAsnGluAsnSerPheGly-163  
168-IleGluAspProIle-172  
176-HisGluHisLysAsnCys-181  
184-ThrGlnArgGluValGlyValAspThrGluAsn-194  
199-LeuLysAsnThrLeuArgGlnAlaProAsp-208  
214-GluIleArgAspArgGluThrMet-221  
241-AsnSerThrAsnGlnAlaLeuAspArg-249  
254-PheProGluGluArgArgGluGlnLeuLeu-263  
278-LeuValProArgAspGlyGlyLysGlyArgValAlaAla-290  
310-HisGluIleLysGluValMetLysLysSerThr-320  
334-LeuTyrGluLysGlyAspIleSerLeu-342  
344-GluAlaLeuLysAsnAlaAspSerAlaHisAspLeu-355  
361-LeuArgSerArgArgAlaGlnSerSerSerProAspLeuGluLeu-375

**Hydrophilic Regions - Hopp-Woods**

2-PheThrAspGluAsnMetThrAlaLysGluGluLeu-13  
20-MetAsnGlnAsnLysGlySerAsp-27  
38-MetLysLeuAspGlyLysIleThrArgIleThrAspGluProLeuThrAlaGluLysCysMet-58  
68-LysGlnAlaGluGluPheSerSer-75

-137-

87-AspThrSerArgPheArgVal-93  
 112-LysIleProLysPheGluSer-118  
 128-ValAlaLeuLysLysArgGly-134  
 143-GlySerGlyLysSerThrSer-149  
 155-AspTyrArgAsnGluAsnSer-161  
 168-IleGluAspProIle-172  
 176-HisGluHisLysAsn-180  
 184-ThrGlnArgGluValGlyValAspThr-192  
 201-AsnThrLeuArgGlnAlaPro-207  
 214-GluIleArgAspArgGluThrMet-221  
 245-GlnAlaLeuAspArg-249  
 255-ProGluGluArgArgGluGlnLeuLeu-263  
 278-LeuValProArgAspGlyGlyLysGlyArgValAlaAla-290  
 310-HisGluIleLysGluValMetLysLysSerThr-320  
 336-GluLysGlyAspIleSerLeu-342  
 344-GluAlaLeuLysAsnAlaAspSerAlaHisAspLeu-355  
 361-LeuArgSerArgArgAlaGlnSerSerSerProAspLeuGluLeu  
 274

**AMPHI Regions - AMPHI**

31-TyrLysAspGlyLys-35  
 111-GluAlaValPheLysThrLeuSerPro-119

**Antigenic Index - Jameson-Wolf**

25-LeuValThrAspAspTyrTyrLysAspGlyLysHisIleAsp-38  
 40-GlnLeuHisArgAspGluGluAlaValArgArgHisIle-52  
 60-ProAspMetAsnAla-64  
 71-GlyGluPheAspGlyLysGlnPro-78  
 85-HisProThrArgLysAlaAspAspGlnThrVal-95  
 99-ProValGlySerAlaGlnAsnGlyArgAlaGluTyr-110  
 117-LeuSerProThrAsnHis-122  
 126-ArgValGluAspAlaAlaGly-132  
 136-ValGluAsnLysTrpIleThrSerGlnGlyAsnAlaValAspLeuThrProMetAspLysLeuPheAsnAsn  
 ThrGluSerLys-163

**Hydrophilic Regions - Hopp-Woods**

29-AspTyrTyrLysAspGlyLysHisIleAsp-38  
 40-GlnLeuHisArgAspGluGluAlaValArgArgHisIle-52  
 72-GluPheAspGlyLysGln-77  
 86-ProThrArgLysAlaAspAspGlnThrVal-95  
 104-GlnAsnGlyArgAlaGluTyr-110  
 126-ArgValGluAspAlaAlaGly-132  
 151-ThrProMetAspLysLeuPheAsn-158  
 276

**AMPHI Regions - AMPHI**

9-MetMetArgSerAlaProSerMetValValArgArgTrpAlaThrMetMet-25  
 60-SerPheLysMetAlaArg-65  
 80-ProPheAspProMetGlyTrp-86  
 115-GlyArgLeuTyrArgThrPheSerAsn-123  
 164-ThrLysArgGlySerArgLeu-170  
 207-SerThrSerThrLeuArgLysLeuMetArgProSerThr-219

**Antigenic Index - Jameson-Wolf**

10-MetArgSerAlaProSerMetVal-17  
 29-PheSerIleArgArgSerSerAlaCysTrpThrArgArgSerAspSerLeuSer-46

-138-

52-SerSerAsnAsnAsnIle-57  
 67-MetAlaThrArgCysArgCysProProAspLysLeuLeuPro-80  
 82-AspProMetGlyTrpCysSerProSerGlyGluLeuSer-94  
 104-ArgAlaAsnArgThrSerAlaSerProAlaSerGlyArgLeuTyr-118  
 121-PheSerAsnArgValSerSerAsnArgAsnThrSerTrpGluThrArgAlaAsnTrpAlaArgArgGlnSer  
 SerLeu-146  
 158-LeuProAlaAspGlySerThrLysArgGlySerArgLeuThrThr-172  
 176-ProLeuProGluArgProThrArgAlaThrArgSerProCysLeu-190  
 194-LeuLysLeuSerArg-198  
 200-LeuMetProSerGluArgTyrSerThrSerThrLeuArgLysLeuMetArgProSerThrArgCysGlyAla  
 -223  
 229-CysSerGlyGlyValSerArgAsnAlaHisThrProSerAlaAlaArgAsn-245

**Hydrophilic Regions - Hopp-Woods**

29-PheSerIleArgArgSerSer-35  
 38-TrpThrArgArgSerAspSerLeu-45  
 67-MetAlaThrArgCysArgCysProProAspLys-77  
 90-SerGlyGluLeuSer-94  
 104-ArgAlaAsnArgThrSerAla-110  
 124-ArgValSerSerAsnArgAsnThrSerTrpGluThr-135  
 137-AlaAsnTrpAlaArgArgGlnSerSer-145  
 161-AspGlySerThrLysArgGlySerArg-169  
 176-ProLeuProGluArgProThrArgAlaThrArg-186  
 194-LeuLysLeuSerArg-198  
 200-LeuMetProSerGluArgTyrSer-207  
 210-ThrLeuArgLysLeuMetArgProSerThrArgCys-221  
 232-GlyValSerArgAsnAlaHis-238  
 277

**AMPHI Regions - AMPHI**

39-GlyIleAlaValPheGluValValGlyGlyLeuLeuAspPheValLeu-54  
 70-CysProAsnGluValValAspValPheTyrThr-80  
 87-AlaPheAspAlaValGlyAspPheAlaGluTyrGlyArgAlaValAspAlaAlaAspLeuLeuGluIleGlyL  
 ysLeuGlyTyrPheHis-116  
 180-AlaValGlyValValAlaValAla-187

**Antigenic Index - Jameson-Wolf**

2-ProArgPheGluAspLysLeuValGlyArgGlnGlyGluGlyGlyVal-17  
 60-ValGlyAspGlyValAlaVal-66  
 68-ArgPheCysProAsnGluVal-74  
 95-AlaGluTyrGlyArgAlaValAspAla-103  
 118-ValGluProAspPheProAlaGlnThrProArgAlaGluGlyGly-132  
 138-PheAspLysAlaAspValVal-144  
 156-ValGluIleGluVal-160  
 164-GlyGlySerGlyLeuGluGlyAspLeu-172  
 196-LeuAspValGlyGlyLysProArgLeuGlyAla-206  
 208-CysAlaGlnAlaGlyGlyGly-214  
 219-GlyThrAspPheHis-223  
 226-GlyLeuAspAspGlyAla-231  
 239-LeuGlnPheGluAspAspLeuLeuGluGlyLysHisGlyLeu-252

**Hydrophilic Regions - Hopp-Woods**

2-ProArgPheGluAspLysLeuValGlyArgGlnGlyGlu-14  
 95-AlaGluTyrGlyArgAlaValAspAla-103  
 118-ValGluProAspPhe-122  
 126-ThrProArgAlaGluGly-131

-139-

138-PheAspLysAlaAspValVal-144  
 156-ValGluIleGluVal-160  
 167-GlyLeuGluGlyAspLeu-172  
 198-ValGlyGlyLysProArgLeuGlyAla-206  
 226-GlyLeuAspAspGlyAla-231  
 239-LeuGlnPheGluAspAspLeuLeuGluGlyLysHisGlyLeu-252  
 278

**AMPHI Regions - AMPHI**

7-GlyAlaIlePheSerIleGly-13  
 20-IleGlyProLeuProSerIleGlyArg-28  
 42-ThrGlyThrSerLys-46  
 101-ArgThrIleProSerValThrGluIle-109  
 123-PheSerIleLeuAlaLeuIleLysSerLeuIleSer-134  
 157-LeuTyrArgGlnIleGlnAsnLeuIleThrHisPheAsnPheTyrAlaAla-173  
 189-GluThrLeuIleGlnHisLeuHisGlnLeuAlaAsp-200

**Antigenic Index - Jameson-Wolf**

25-SerIleGlyArgProAsnAlaSerThrThrArgProThrSerSerArgProThrGlyThrSerLysIleArgPro-49  
 63-SerProAsnThrThrAlaProThrGluSerArgSerArgPheIleAla-78  
 80-ProLysValLeuProGlyAsnSerSerIle-89  
 93-IleAlaSerAspLysProTrpMetArg-101  
 117-SerAlaPheThrAspArgPheSer-124  
 146-ArgHisSerArgValGlnGlyThr-153  
 178-PheAspPheAspArgAspPhe-184  
 209-ThrValAsnAspGlyArgPheAspMetValGlu-219

**Hydrophilic Regions - Hopp-Woods**

27-GlyArgProAsnAlaSerThrThrArgProThrSerSerArgProThrGlyThrSerLysIleArgPro-49  
 68-AlaProThrGluSerArgSerArgPheIleAla-78  
 93-IleAlaSerAspLysProTrp-99  
 146-ArgHisSerArgValGln-151  
 178-PheAspPheAspArgAspPhe-184  
 211-AsnAspGlyArgPheAspMetValGlu-219  
 279

**AMPHI Regions - AMPHI**

6-GlyCysLeuIleSerThr-11  
 13-PheArgAlaSerAla-17  
 47-AlaAlaAlaMetAlaArgProThrAla-55

**Antigenic Index - Jameson-Wolf**

28-GlnTrpGluGlyThrAspThrGlySerGlyArgAlaArgLeuAla-42  
 64-CysProGlyGluLeuLysLeuThr-71  
 88-CysSerSerSerLysProArgIle-95  
 101-ThrProCysGlyThrAlaAspCysIleSerSerAlaArgArgArgThrSerLeu-118

**Hydrophilic Regions - Hopp-Woods**

29-TrpGluGlyThrAspThrGlySerGlyArgAlaArgLeuAla-42  
 66-GlyGluLeuLysLeu-70  
 89-SerSerSerLysProArgIle-95  
 110-SerSerAlaArgArgArgThrSerLeu-118  
 280

**AMPHI Regions - AMPHI**

27-SerPheSerIleLeuGlyAspValAlaLys-36  
 64-AspIleLysLysIleArgSerAla-71

-140-

85-AspValGlnArgAlaValLys-91  
 97-TyrThrGluAlaThrLysGlyIleGlnProLeuLys-108  
 146-AlaTyrAlaGlnAsnValAlaLysAlaLeuIleLys-157  
 233-ValAlaAlaIleIleArgGlnIleLys-241  
 243-GluGlyIleLysAlaValPheThrGlu-251  
 254-LysAspThrArgMetValAspArgIleAlaLysGluThr-266  
 274-LeuTyrSerAspAlaLeuGlyAsnAlaProAlaAspThrTyrIle-288

**Antigenic Index - Jameson-Wolf**

38-IleGlyGlyGluArgValSer-44  
 51-AlaAsnGlnAspThrHis-56  
 61-ThrSerGlyAspIleLysLysIleArgSerAlaLys-72  
 82-GluAlaAlaAspValGlnArgAlaValLysGlnSerLysValSerTyrThrGluAlaThrLysGlyIleGln-105  
 107-LeuLysAlaGluGluGluGlyGlyHisHisHisAspHisAspHisAspHisGluGlyHisHisHisAspHisGlyGluTyrAspProHisValTrpAsnAspPro-141  
 155-LeuIleLysAlaAspProGluGlyLysValTyrTyr-166  
 176-GlnLeuLysLysLeuHisSerAspAla-184  
 192-ProAlaAlaLysArgLysValLeuThr-200  
 208-MetGlyLysArgTyrHis-213  
 218-AlaProGlnGlyValSerSerGluAlaGluProSerAlaLysGln-232  
 238-ArgGlnIleLysArgGluGlyIle-245  
 251-GluAsnIleLysAspThrArgMetValAspArgIleAlaLysGluThrGlyVal-268  
 270-ValSerGlyLysLeuTyrSer-276  
 282-AlaProAlaAspThr-286  
 291-TyrArgHisAsnIle-295

**Hydrophilic Regions - Hopp-Woods**

38-IleGlyGlyGluArgValSer-44  
 63-GlyAspIleLysLysIleArgSerAlaLys-72  
 82-GluAlaAlaAspValGlnArgAlaValLysGlnSerLys-94  
 99-GluAlaThrLysGly-103  
 107-LeuLysAlaGluGluGluGlyGlyHisHisHisAspHisAspHisAspHisGluGlyHisHisHisAspHisGlyGluTyrAsp-134  
 155-LeuIleLysAlaAspProGluGly-162  
 176-GlnLeuLysLysLeuHisSerAspAla-184  
 192-ProAlaAlaLysArgLysValLeuThr-200  
 222-ValSerSerGluAlaGluProSerAlaLysGln-232  
 238-ArgGlnIleLysArgGluGlyIle-245  
 251-GluAsnIleLysAspThrArgMetValAspArgIleAlaLysGluThrGlyVal-268  
 281-2

**AMPHI Regions - AMPHI**

62-AlaAlaGlyMetLeuMetAlaLeuLeuAlaGlyLeuValSerArgPhe-77  
 126-LeuGlnLeuIleAlaAlaValSerSerLeuThr-136  
 179-LeuValSerGlyPheGlnAlaLeuGlyThrLeuMetSerVal-192  
 205-TrpAlaLysHisMet-209  
 216-SerValLeuThrAlaLeuLeuCysGly-224

**Antigenic Index - Jameson-Wolf**

25-ArgArgMetSerLeu-29  
 78-ThrThrLeuLysGluAspAlaAsn-85  
 102-SerLysAsnGlySerSerVal-108  
 159-SerValGlyGlyLysGlyGly-165  
 236-IleProSerGlyPro-240  
 256-LeuGlyLysGluGlyGlyIle-262

-141-

270-HisArgHisHisThrThr-275

**Hydrophilic Regions - Hopp-Woods**

25-ArgArgMetSerLeu-29

78-ThrThrLeuLysGluAspAlaAsn-85

103-LysAsnGlySerSer-107

256-LeuGlyLysGluGlyGlyIle-262

270-HisArgHisHisThr-274

282

**AMPHI Regions - AMPHI**

10-LeuIleValAlaPheLeuValLeuIleAsnProPheSerAlaLeu-24

50-ValPheAlaValIleAlaValPheAlaLeuIleGlyGlyThrLeu-64

112-ArgProAlaArgAsn-116

176-ValSerArgLeuLeu-180

186-ThrIleLeuAsnArgIleMetGlyMet-194

**Antigenic Index - Jameson-Wolf**

31-ThrAsnGlyHisSerThrLysGluArgArgLysValAlaArg-44

92-AsnGlyAsnAspAsnProAlaLysGlnAsnLeuGlyAlaGlnProGluThrGlyGlnAlaArgProAlaArgAsnAlaGly-118

**Hydrophilic Regions - Hopp-Woods**

34-HisSerThrLysGluArgArgLysValAlaArg-44

92-AsnGlyAsnAspAsnProAlaLysGlnAsnLeu-102

104-AlaGlnProGluThrGlyGlnAlaArgProAlaArgAsn-116

283

**AMPHI Regions - AMPHI**

11-ThrLeuAlaSerPheLeuPro-17

32-GlyGlyAsnSerTyrSerAspValProLysGlnLeuHis-44

67-AlaAspAlaGlyLysArgThr-73

**Antigenic Index - Jameson-Wolf**

28-TrpLysAspGlyGlyGlyAsnSerTyrSerAspValProLysGlnLeuHisProAspGlnSerGln-49

53-LeuArgThrArgGlnThrLysProAlaValLysProAlaGlnAlaAspAlaGlyLysArgThrAspGlyAlaAlaGlnGluAsnAsnProAspThrAlaGluLysAsnArgGlnLeuGluGluGluLysLysArgIleAlaGluThrGluArgGlnAsnLysGluGluAsnCysArgIleSerLysMetAsnLeu-117

121-GlyAsnSerAsnAlaLysAsnLysAspAspLeuIleArgLysTyrAsnAsnAlaValAsnLysTyrCysArg-144

**Hydrophilic Regions - Hopp-Woods**

35-SerTyrSerAspValProLys-41

43-LeuHisProAspGlnSerGln-49

53-LeuArgThrArgGlnThrLysProAlaValLysProAlaGlnAlaAspAlaGlyLysArgThrAspGlyAlaAlaGlnGluAsnAsnProAspThrAlaGluLysAsnArgGlnLeuGluGluGluLysLysArgIleAlaGluThrGluArgGlnAsnLysGluGluAsnCysArgIleSerLysMetAsnLeu-117

123-SerAsnAlaLysAsnLysAspAspLeuIleArgLysTyrAsn-136

284

**AMPHI Regions - AMPHI**

43-GluAlaPheAlaGlyPhePheGluThrVal-52

61-ThrPheAlaAlaArgPhe-66

125-ValAspPheAspValPhe-130

154-ValValPheArgLeuPheArgGlnValValValAsp-165

174-AspThrAlaCysGlyAsnIleGlyGly-182

186-PheAlaAlaAlaPheThrGlnIleHisGln-195

216-PheValGlnPheIleArgAsnAspPheGlyHisGly-227

-142-

277-PheArgValPheGlyGlnPheAlaArgGlnPheAla-288  
 307-CysPheHisAspGlyPheAspValValAspLys-317  
 342-LeuHisGlnValHisGlnThrAla-349  
 352-GlyAspAsnGlnIleAspArgPheAlaGln-361  
 372-AlaAspAspAlaAspGlyAla-378  
 405-GlnSerThrArgAlaPheAlaArgPhePheAlaAlaPheGlyGlnPheLeuGlnSer-423

**Antigenic Index - Jameson-Wolf**

1-MetProSerGluThrArgAsnArgPhe-9  
 109-PheAspGlyGlnPhe-113  
 132-HisPheGlyLysArgAsnArgAsnThrArgAla-142  
 147-GlyAlaProAspAlaVal-152  
 166-AsnValGlyAsnGlyArgTyrValAspThrAlaCysGlyAsnIleGlyGlyAsnGlnAsnPhe-186  
 220-IleArgAsnAspPheGlyHisGlyPheGlyGlyArgGluAsnHisAla-235  
 273-AspPheAspAspPheArg-278  
 286-GlnPheAlaAspArgAlaValProSerGlyGlyGluGlnGlnSer-300  
 303-ValAlaArgArgCysPheHisAspGlyPheAspValValAspLysAlaHis-319  
 347-GlnThrAlaArgArgGlyAspAsnGlnIleAspArgPheAlaGlnGlyThrGlyLeuValAlaGluArgArg  
 AlaAlaAspAspAlaAspGlyAlaGlu-379  
 398-PheAlaGlyArgGlyGlnHisGlnSerThrArgAla-409

**Hydrophilic Regions - Hopp-Woods**

1-MetProSerGluThrArgAsnArgPhe-9  
 134-GlyLysArgAsnArgAsnThrArgAla-142  
 229-GlyGlyArgGluAsnHisAla-235  
 286-GlnPheAlaAspArgAlaValProSerGlyGlyGluGlnGln-299  
 313-AspValValAspLysAlaHis-319  
 347-GlnThrAlaArgArgGlyAspAsnGlnIleAspArgPheAla-360  
 366-ValAlaGluArgArgAlaAlaAspAspAlaAspGlyAlaGlu-379  
 402-GlyGlnHisGlnSer-406

285-1

**AMPHI Regions - AMPHI**

15-ValCysPheLeuGly-19  
 34-GlnIleProSerTrp-38  
 50-GlyThrLeuLeuAspGlyPheAsp-57  
 116-SerLeuProAspSerIleAspLeuPro-124  
 208-HisSerThrAlaArg-212  
 240-HisProPheAlaGluSerLeuAspLysThrLeuGluGluValLeu-254  
 266-ValProSerLeuPro-270  
 280-AlaIleProSerPheSerAsp-286  
 313-GlnValLeuGlyGly-317  
 592-IleGlyLysAlaAlaAspIle-598  
 609-ProAspThrSerArg-613  
 671-GlyIleAsnArgGluLeuThrArgTrp-679  
 747-IleAlaGluLeuHisAsnPhePheLysProProPhe-758  
 776-AlaArgGlyTyrLeu-780  
 836-PheGlyGlyAsnMetAlaAsn-842  
 848-ArgIleThrAlaSerLeu-853  
 855-AspLeuGlyAlaLeu-859  
 868-GlnAsnIleThrGlySerLeuAsnAlaAla-877  
 955-GlySerIleAlaAsp-959  
 1008-ThrAlaGluLeu-1012  
 1061-ValThrGlyMetIleLys-1066  
 1135-SerGlyGlySerValArgGlyValGlyThrValArg-1146  
 1165-ThrValSerPheValGlyProLeuAsn-1173

-143-

1190-AlaGlyValGluIleLeuGlySerLeuAsn-1199  
 1244-LeuAlaGlyGlnIle-1248  
 1305-ValLysLeuIleTyrArgLeuThrArgAlaIleGlnAlaValAlaArgIleGlySer-1323

**Antigenic Index - Jameson-Wolf**

43-IleSerSerGlnAsnLeuLysGlyThrLeuLeuAspGlyPheAspGlyAspAsnTrpSerIleGluThrGluGlyAlaAspLeuLysIleSerArg-74  
 80-LysProSerGluLeuMetArgArgSerLeuHis-90  
 104-LysProThrProProLysGluGluArgProProLeuSerLeuProAspSerIleAsp-122  
 130-AspArgPheGluThrGlyLysIleSerMetGlyLysAlaPheAspLysGlnThrValTyr-149  
 151-GluArgLeuAspAlaSerTyrArgTyrAspArgLysGlyHisArgLeuAspLeuLysAlaAlaAspThrProTrpSerSerSerSerGlyAlaAla-182  
 185-GlyLeuLysLysProPheAla-191  
 198-ThrLysGlyGlyLeuGluGlyLysThrIle-207  
 209-SerThrAlaArgLeuSerGlySerLeuLysAspValArgAla-222  
 224-LeuAlaIleAspGlyGlyAsnIleArgLeuSerGlyLysSer-237  
 244-GluSerLeuAspLysThrLeuGlu-251  
 268-SerLeuProAspAla-272  
 292-GlySerLeuAspLeuGluAsnThrLys-300  
 302-GlyPheAlaAspArgAsnGlyIleProVal-311  
 320-IleArgGlnAspGlyThrVal-326  
 337-GlyArgGlyGlyIleArgLeuSerGlyLysIleAspThrGluLysAspIleLeu-354  
 362-SerValGlyAlaGluAspValLeu-369  
 372-AlaPheLysGlyArgLeuAspGlySerIle-381  
 387-ThrAlaSerProLysIle-392  
 400-ThrAlaArgThrAspGlySerLeu-407  
 411-SerAspProAlaAsnGlyGlnArgLysLeuVal-421  
 430-GlyGlnGlySerLeuThr-435  
 442-LeuPheLysAspArgLeuLeuLysLeuAspIleArgSerArgAlaPheAspProSerArgIleAspProGlnLeu-466  
 480-GluLeuAlaLysGluLysPheThrGlyLys-489  
 508-IleValTyrGluSerArgHisLeuProArgAlaAlaVal-520  
 522-LeuArgLeuGlyArgAsnIleIleLysThrAspGlyGlyPheGlyLysLysGlyAspArgLeuAsn-543  
 548-AlaProAspLeuSerArgPheGly-555  
 563-AsnValArgGlyHisLeuSerGlyAspLeuAspGlyGlyIleArgThrPheGluThrAspLeuSerGlyAlaAla-587  
 594-LysAlaAlaAspIleArgSer-600  
 605-LeuLysGlySerProAspThrSerArgProIleArgAlaAspIleLysGlySerArgLeuSerLeuSerGlyGly-629  
 634-AspThrAlaAspLeuMetLeuAspGlyThrGlyVal-645  
 647-HisArgIleArgThr-651  
 656-ThrLeuAspGlyLysProPheLysPheAspLeuAspAlaSerGlyGlyIleAsnArgGluLeuThrArgTrpLysGlySerIle-683  
 696-LeuGlnAsnArgMetThrLeu-702  
 704-AlaGlyAlaGluArgValAla-710  
 729-SerTrpAspLysLysThrGlyIleSerAlaLysGlyGlyAla-742  
 764-LeuAsnGlyAspTrp-768  
 772-TyrGlyArgAsnAlaArgGly-778  
 782-IleSerArgGlnSerGlyAspAlaValLeu-791  
 803-SerLeuLysThrArgPheGlnAsnAspArgIleGly-814  
 817-LeuAspGlyGlyAlaArgPheGlyArgIleAsnAla-828  
 844-ProLeuGlyGlyArgIleThr-850  
 882-GlyArgValGlySerProSerVal-889  
 893-ValAsnGlySerSerAsnTyrGlyLysIleAsnGly-904  
 908-ValGlyGlnSerArgSerPheAspThrAlaProLeuGlyGlyArgLeuAsn-924

-144-

941-GlnThrValLysGlySerLeu-947  
 956-SerIleAlaAspProHisLeuGlyGly-964  
 966-IleAsnGlyAspLysLeuTyrTyrArgAsnGlnThr-977  
 982-LeuAspAsnGlySerLeuArg-988  
 991-IleAlaGlyArgLysTrpVal-997  
 1001LeuLysPheArgHisGluGlyThrAlaGluLeuSerGly-1013  
 1015-ValGlyMetGluAsnSerGlyProAspValAspIle-1026  
 1031-AspLysTyrArgIleLeuSerArgProAsnArgArgLeuThr-1044  
 1047-GlyAsnThrArgLeuArgTyrSerProGlnLysGlyIle-1059  
 1065-IleLysThrAspGlnGlyLeuPheGlySerGlnLysSerSerMetProSerValGlyAspAspVal-1086  
 1091-GluValLysLysGluAlaAla-1097  
 1109-AspLeuAsnAspGlyIleArg-1115  
 1134-GlnSerGlyGlySerValArgGlyValGly-1143  
 1146-ArgValIleLysGlyArgTyrLysAlaTyrGlyGlnAspLeuAspIle ThrLysGlyThr-1165  
 1171-ProLeuAsnAspProAsnLeuAsnIleArgAlaGluArgArgLeuSerProValGly-1189  
 1197-SerLeuAsnSerProArgIle-1203  
 1207-AlaAsnGluProMetSerGluLysAspLysLeu-1217  
 1225-AlaGlySerGlySerSerGlyAspAsnAlaAla-1235  
 1246-GlyGlnIleAsnAspArgIleGlyLeu-1254  
 1256-AspAspLeuGlyPheThrSerLysArgSerArgAsnAlaGlnThrGlyGluLeuAsnProAlaGlu-1277  
 1283-GlyLysGlnLeuThrGlyLys-1289  
 1299-SerSerAlaGluGlnSerVal-1305  
 1321-IleGlySerArgSerSerGlyGlyGluLeu-1330  
 1335-ArgPheAspArgPheSerGlySerAspLysLysAspSerAlaGlyAsnGlyLysGlyLys-1354

#### Hydrophilic Regions - Hopp-Woods

56-PheAspGlyAspAsnTrpSerIleGluThrGluGlyAlaAspLeuLysIleSerArg-74  
 83-GluLeuMetArgArgSerLeuHis-90  
 105-ProThrProProLysGluGluArgProPro-114  
 130-AspArgPheGluThrGlyLys-136  
 141-LysAlaPheAspLys-145  
 151-GluArgLeuAspAla-155  
 157-TyrArgTyrAspArgLysGlyHisArgLeuAspLeuLysAlaAlaAsp-172  
 200-GlyGlyLeuGluGlyLysThrIle-207  
 215-GlySerLeuLysAspValArgAla-222  
 244-GluSerLeuAspLysThrLeuGlu-251  
 292-GlySerLeuAspLeuGluAsnThrLys-300  
 302-GlyPheAlaAspArgAsnGlyIlePro-310  
 320-IleArgGlnAspGly-324  
 343-LeuSerGlyLysIleAspThrGluLysAspIleLeu-354  
 364-GlyAlaGluAspValLeu-369  
 373-PheLysGlyArgLeuAspGly-379  
 401-AlaArgThrAspGly-405  
 412-AspProAlaAsnGlyGlnArgLysLeuVal-421  
 442-LeuPheLysAspArgLeuLeuLysLeuAspIleArgSerArgAlaPheAspProSerArgIleAspPro-464  
 480-GluLeuAlaLysGluLysPheThrGly-488  
 508-IleValTyrGluSerArgHisLeuPro-516  
 522-LeuArgLeuGlyArgAsnIleIleLysThrAspGlyGlyPheGlyLysLysGlyAspArgLeuAsn-543  
 570-GlyAspLeuAspGlyGlyIleArgThrPheGluThrAspLeuSerGlyAlaAla-587  
 594-LysAlaAlaAspIleArgSer-600  
 607-GlySerProAspThrSerArgProIleArgAlaAspIleLysGlySerArgLeuSerLeu-626  
 634-AspThrAlaAspLeuMetLeu-640  
 647-HisArgIleArgThr-651  
 657-LeuAspGlyLysProPheLysPheAspLeuAspAla-668

-145-

670-GlyGlyIleAsnArgGluLeuThrArgTrpLysGly-681  
 704-AlaGlyAlaGluArgValAla-710  
 729-SerTrpAspLysLysThrGlyIleSerAlaLysGlyGlyAla-742  
 783-SerArgGlnSerGly-787  
 806-ThrArgPheGlnAsnAspArgIle-813  
 819-GlyGlyAlaArgPheGlyArgIleAsnAla-828  
 1001-LeuLysPheArgHisGluGlyThrAlaGluLeu-1011  
 1015-ValGlyMetGluAsnSerGlyProAspValAspIle-1026  
 1031-AspLysTyrArgIleLeuSerArgProAsnArgArgLeuThr-1044  
 1049-ThrArgLeuArgTyrSerPro-1055  
 1065-IleLysThrAspGln-1069  
 1075-GlnLysSerSerMet-1079  
 1081-SerValGlyAspAsp-1085  
 1091-GluValLysLysGluAlaAla-1097  
 1109-AspLeuAsnAspGlyIleArg-1115  
 1146-ArgValIleLysGlyArgTyrLysAlaTyrGlyGlnAspLeuAspIleThrLys-1163  
 1179-IleArgAlaGluArgArgLeuSer-1186  
 1209-GluProMetSerGluLysAspLysLeu-1217  
 1225-AlaGlySerGlySerSerGlyAspAsnAlaAla-1235  
 1248-IleAsnAspArgIleGlyLeu-1254  
 1259-GlyPheThrSerLysArgSerArgAsnAlaGlnThrGlyGluLeuAsn Pro-1275  
 1300-SerAlaGluGlnSerVal-1305  
 1321-IleGlySerArgSerSerGlyGly-1328  
 1335-ArgPheAspArgPheSerGlySerAspLysLysAspSerAlaGlyAsnGlyLysGlyLys-1354  
 286

**AMPHI Regions - AMPHI**

69-GluIleLysAspMetVal-74  
 102-ProAspAsnValLysThr-107  
 145-ValAlaIleLeuGlyAsp-150  
 157-LeuAlaGluTyrTyrArgAsnAlaLeuGluAsnTrpGlnGlnProValGlySer-174  
 198-ProLeuAlaLysLeuGlyAsnThr-205  
 238-ThrGlnArgTyrProGluGlnIleValSerGlyLeuAlaArgPhe-252  
 326-AspTyrTyrAsnLeuPheAsnLys-333  
 354-IleSerGlnProArg-358  
 375-ThrThrGlnAsnLeu-379  
 428-ThrAlaSerTrpLysArgGlnLeuLeu-436  
 455-ThrLeuGlyThrPheLeu-460  
 513-GlyAlaSerSerVal-517  
 555-LeuSerGlyAlaValPheHisAspMetGlyAspAlaAlaAlaAsn-569  
 584-ArgTrpPheSerProLeu-589

**Antigenic Index - Jameson-Wolf**

1-MetHisAspThrArgThrMetMet-8  
 30-AlaAspLeuSerGluAsnLysAla-37  
 43-PheLysAsnLysSerProAspThrGluSerValLysLeuLysProLysPheProVal-61  
 64-AspThrGlnAspSerGluIleLysAspMetValGluGluHisLeu-78  
 83-GlnGlnGlnGluGluValLeuAspLysGluGlnThr-94  
 97-LeuAlaGluGluAlaProAspAsnValLysThrMetLeuArgSerLysGlyTyrPheSerSerLysValSerLeuThrGluLysAspGlyAla-127  
 133-ThrProGlyProArgThrLysIle-140  
 151-IleLeuSerAspGlyAsnLeuAlaGluTyrTyrArgAsnAlaLeuGluAsnTrpGln-169  
 172-ValGlySerAspPheAspGlnAspSerTrpGluAsnSerLysThrSerVal-188  
 192-ValThrArgLysAlaTyrPro-198  
 208-AlaValAsnProAspThrAlaThr-215  
 223-AspSerGlyArgProIleAla-229

-146-

234-GluIleThrGlyThrGlnArgTyrProGluGlnIle-245  
 252-PheGlnProGlyMetProTyrAspLeu-260  
 270-LeuGluGlnAsnGlyHisTyrSerGly-278  
 283-AlaAspPheAspArgLeuGlnGlyAspArgValProVal-295  
 298-SerValThrGluValLysArgHisLysLeuGluThrGlyIleArgLeuAspSerGluTyrGlyLeuGlyGly-321  
 342-AspMetAspLysTyrGluThr-348  
 355-SerGlnProArgAsnTyrArgGlyAsnTyrTrp-365  
 368-AsnValSerTyrAsnArgSerThrThrGlnAsnLeuGluLysArgAlaPheSerGlyGly-387  
 390-TyrValArgAspArgAlaGlyIleAspAlaArgLeuGly-402  
 405-PheLeuAlaGluGlyArgLysIleProGlySerAla-416  
 430-SerTrpLysArgGlnLeu-435  
 441-HisProGluAsnGlyHisTyrLeuAspGlyLysIle-452  
 468-ThrSerAlaArgAlaGly-473  
 476-PheThrProGluAsnLysLysLeu-483  
 496-ValAlaArgAspAsnAlaAspValProSer-505  
 509-PheArgSerGlyGlyAlaSerSerValArgGlyTyrGluLeuAspSer-524  
 534-ValLeuProGluArgAlaLeu-540  
 562-AspMetGlyAspAla-566  
 568-AlaAsnPheLysArgMetLysLeuLysHisGlySerGlyLeu-581  
 598-TyrGlyHisSerAspLysLysIleArg-606

**Hydrophilic Regions - Hopp-Woods**

1-MetHisAspThrArgThrMetMet-8  
 30-AlaAspLeuSerGluAsnLysAla-37  
 44-LysAsnLysSerProAspThrGluSerValLysLeuLysProLysPhe-59  
 64-AspThrGlnAspSerGluIleLysAspMetValGluGluHisLeu-78  
 84-GlnGlnGluGluValLeuAspLysGluGlnThr-94  
 97-LeuAlaGluGluAlaProAspAsnValLysThrMetLeuArgSer-111  
 119-ValSerLeuThrGluLysAspGlyAla-127  
 134-ProGlyProArgThrLysIle-140  
 174-SerAspPheAspGlnAspSerTrpGluAsnSerLysThr-186  
 192-ValThrArgLysAlaTyrPro-198  
 209-ValAsnProAspThrAlaThr-215  
 239-GlnArgTyrProGlu-243  
 283-AlaAspPheAspArgLeuGlnGlyAspArgValProVal-295  
 298-SerValThrGluValLysArgHisLysLeuGluThrGlyIleArgLeuAspSerGluTyr-317  
 342-AspMetAspLysTyrGluThr-348  
 373-ArgSerThrThrGlnAsnLeuGluLysArgAlaPhe-384  
 391-ValArgAspArgAla395GlyIleAspAlaArgLeuGly-402  
 405-PheLeuAlaGluGlyArgLysIlePro-413  
 478-ProGluAsnLysLysLeu-483  
 496-ValAlaArgAspAsnAlaAspVal-503  
 518-ArgGlyTyrGluLeuAspSer-524  
 534-ValLeuProGluArgAlaLeu-540  
 562-AspMetGlyAspAla-566  
 568-AlaAsnPheLysArgMetLysLeuLysHis-577  
 600-HisSerAspLysLysIleArg-606  
 287

**AMPHI Regions - AMPHI**

29-LysSerAlaAspThrLeuSerLysProAlaAla-39  
 68-GlySerGlnAspMet-72  
 131-AlaThrAspAlaGlyGluSerSerGlnProAlaAsnGlnProAspMetAlaAsnAlaAlaAspGlyMet-153  
 164-AsnAlaGlyAsnThrAlaAlaGlnGlyAlaAsnGlnAlaGly-177

-147-

246-PheGluLysLeuSerAspAlaAspLysIleSerAsnTyrLys-259  
 291-ProThrSerPheAlaArgPheArgArgSerAlaArg-302  
 410-LysSerValAspGlyIleIleAspSer-418  
 437-GlyPheLysGlyThrTrpThr-443  
 450-ValSerGlyLysPheTyr-455

**Antigenic Index - Jameson-Wolf**

18-CysGlyGlyGlyGlyGlySerProAspValLysSerAlaAspThrLeuSerLysProAla-38  
 42-ValSerGluLysGluThrGluAlaLysGluAspAlaProGlnAlaGlySerGlnGlyGlnGlyAlaProSerAlaGlnGlySerGlnAspMet-72  
 74-AlaValSerGluGluAsnThrGlyAsnGlyGlyAlaValThrAlaAspAsnProLysAsnGluAspGluValAlaGlnAsnAspMetProGlnAsnAlaAlaGlyThrAspSerSerThrProAsnHisThrProAspProAsnMet-122  
 126-AsnMetGluAsnGlnAlaThrAspAlaGlyGluSerSerGlnProAlaAsnGlnProAspMetAlaAsnAlaAlaAspGlyMetGlnGlyAspAspProSerAlaGlyGlyGlnAsnAlaGlyAsnThrAlaAlaGlnGlyAlaAsnGlnAlaGlyAsnAsnGlnAlaAlaGlySerSerAspProIleProAlaSerAsnProAlaProAlaAsnGlyGlySerAsnPheGlyArgValAspLeuAlaAsn-209  
 214-AspGlyProSerGlnAsn-219  
 223-ThrHisCysLysGlyAspSerCysSerGlyAsnAsnPheLeuAspGluGluValGlnLeuLysSerGluPheGluLysLeuSerAspAlaAspLysIleSerAsnTyrLysLysAspGlyLysAsnAspLysPhe-267  
 287-TyrLysProLysProThrSerPheAlaArgPheArgArgSerAlaArgSerArgArgSerLeuProAla-309  
 321-ThrLeuIleValAspGlyGluAla-328  
 340-AlaProGluGlyAsnTyrArgTyrLeu-348  
 351-GlyAlaGluLysLeuProGlyGlySerTyr-360  
 364-ValGlnGlyGluProAlaLysGlyGluMet-373  
 388-HisThrGluAsnGlyArgProTyrProThrArgGlyArgPheAlaAla-403  
 405-ValAspPheGlySerLysSerValAspGlyIleIleAspSerGlyAspAspLeuHisMetGlyThrGlnLysPheLysAlaAlaIleAspGlyAsnGlyPheLysGlyThrTrpThrGluAsnGlySerGlyAspValSerGly-452  
 454-PheTyrGlyProAlaGlyGluGluValAlaGlyLysTyrSerTyrArgProThrAspAlaGluLysGlyGlyPhe-478  
 482-AlaGlyLysLysGluGlnAsp-488

**Hydrophilic Regions - Hopp-Woods**

22-GlyGlyGlySerProAspValLysSerAlaAspThrLeuSerLysProAla-38  
 42-ValSerGluLysGluThrGluAlaLysGluAspAlaProGln-55  
 57-GlySerGlnGlyGlnGly-62  
 67-GlnGlySerGlnAsp-71  
 74-AlaValSerGluGluAsnThrGly-81  
 86-ValThrAlaAspAsnProLysAsnGluAspGluValAlaGlnAsnAspMetProGln-104  
 107-AlaGlyThrAspSerSerThr-113  
 127-MetGluAsnGlnAlaThrAspAlaGlyGluSerSerGlnProAlaAsnGlnProAspMetAlaAsnAlaAlaAspGlyMetGlnGlyAspAspProSerAlaGly-161  
 182-AlaGlySerSerAspProIlePro-189  
 225-CysLysGlyAspSerCysSer-231  
 235-PheLeuAspGluGluValGlnLeuLysSerGluPheGluLysLeuSerAspAlaAspLysIleSerAsnTyrLysLysAspGlyLysAsnAspLysPhe-267  
 295-AlaArgPheArgArgSerAlaArgSerArgArgSerLeuPro-308  
 322-LeuIleValAspGlyGluAla-328  
 351-GlyAlaGluLysLeuPro-356  
 364-ValGlnGlyGluProAlaLysGlyGluMet-373  
 390-GluAsnGlyArgProTyrProThrArgGlyArgPheAlaAla-403  
 405-ValAspPheGlySerLysSerValAspGlyIleIleAspSerGlyAspAspLeuHis-423  
 427-GlnLysPheLysAlaAlaIleAsp-434  
 446-GlySerGlyAspValSerGly-452

-148-

458-AlaGlyGluGluValAlaGly-464  
 466-TyrSerTyrArgProThrAspAlaGluLysGlyGly-477  
 482-AlaGlyLysLysGluGlnAsp-488

288

**AMPHI Regions - AMPHI**

7-ValSerArgValLeu-11  
 54-IleValThrLysCysAla-59  
 61-ArgProTyrArgThrPheSerProLeuProVal-71  
 97-HisSerThrLeuArg-101  
 150-AlaLeuPheGlnAlaGlyPheAsp-157

**Antigenic Index - Jameson-Wolf**

2-HisThrGlyGlnAla-6  
 28-AsnLeuProGluArgSerAlaGlySer-36  
 58-CysAlaValArgProTyrArgThrPheSerPro-68  
 72-LeuProLysGlnProSerAla-78  
 89-LeuProArgProAlaValAsnArgHisSerThrLeuArgSerProAspPheProProArgMet-109  
 113-IleArgGlyAspCysLeuPro-119  
 126-IleIleThrArgAsnThrLysMetProSerGluThrValGlnValSerAspGlyIleGlnProLys-147  
 155-GlyPheAspGluAlaVal-160

**Hydrophilic Regions - Hopp-Woods**

28-AsnLeuProGluArgSerAla-34  
 58-CysAlaValArgPro-62  
 98-SerThrLeuArgSerProAspPheProPro-107  
 113-IleArgGlyAspCys-117  
 126-IleIleThrArgAsnThrLysMetProSerGluThrValGlnVal-140  
 155-GlyPheAspGluAlaVal-160

292

**AMPHI Regions - AMPHI**

7-LysIleLeuThrProPheThrValLeuProLeu-17  
 40-GlyLysSerValAla-44  
 62-ValLeuSerValSerGlu-67  
 69-ProValLysGlyIleTyrGlu-75  
 110-GluArgAlaAlaAspLeu-115  
 124-ProLeuAspLysAlaIleLysGluValArgGly-134  
 150-PheCysLysArgLeuGluHisGluPheGluLysMetThrAspValThr-165  
 195-LysAlaTrpThrAspTrpMetArg-202  
 212-IleCysAspAsnProVal-217

**Antigenic Index - Jameson-Wolf**

1-MetLysThrLysLeu-5  
 23-ThrProValSerAsnAlaAsnAlaGluProAlaValLysAlaGluSerAlaGlyLysSerVal-43  
 47-LeuLysAlaArgLeuGluLysThrTyrSerAlaGlnAspLeuLys-61  
 66-SerGluThrProValLysGlyIle-73  
 85-TyrThrAspAlaGluGlyGlyTyr-92  
 99-IleAsnIleAspThrArgLysAsnLeuThrGluGluArgAlaAlaAspLeuAsnLys-117  
 124-ProLeuAspLysAlaIleLysGluValArgGlyAsnGlyLysLeuLysVal-140  
 142-ValPheSerAspProAspCysProPhe-150  
 152-LysArgLeuGluHisGluPheGluLysMetThrAsp-163  
 177-HisProAspAlaAlaArgLysAla-184  
 189-CysGlnProAspArgAlaLysAla-196  
 200-TrpMetArgLysGlyLysPheProVal-208  
 210-GlySerIleCysAspAsnProValAlaGluThrThrSerLeuGlyGlu-225  
 237-PheProAsnGlyArgSerGlnSerGlyTyrSerPro-248

-149-

250-ProGlnLeuGluGluIleIleArgLysAsnGln-260

**Hydrophilic Regions - Hopp-Woods**

1-MetLysThrLysLeu-5  
 28-AlaAsnAlaGluProAlaValLysAlaGluSerAlaGlyLysSerVal-43  
 47-LeuLysAlaArgLeuGluLysThrTyrSer-56  
 99-IleAsnIleAspThrArgLysAsnLeuThrGluGluArgAlaAlaAspLeuAsnLys-117  
 124-ProLeuAspLysAlaIleLysGluValArgGlyAsnGlyLysLeuLys-139  
 144-SerAspProAspCysProPhe-150  
 152-LysArgLeuGluHisGluPheGluLysMetThrAsp-163  
 179-AspAlaAlaArgLysAla-184  
 190-GlnProAspArgAlaLysAla-196  
 200-TrpMetArgLysGlyLysPhe-206  
 240-GlyArgSerGlnSer-244  
 250-ProGlnLeuGluGluIleIleArgLysAsnGln-260  
 294

**AMPHI Regions - AMPHI**

27-ArgPheProAlaAlaPheArgArgTyrSerAla-37  
 45-LysProAlaAspThr-49  
 51-TrpHisArgValArgArgPheLysSerAsnArgArgMetArgGlyGlyLysProLeuLysLysProTyrArg-74  
 84-ArgAlaTrpThrAlaLeuSerHisAsnIleAlaGluArgAlaArgGluSerProArgArgCysGlyLysArgTyrAlaAspIleGlyGly-113  
 132-TyrAlaValAlaHisIleValHisLeu-140  
 165-ValSerArgGluAlaArgArgGluVal-173  
 176-AlaMetSerTyrArg-180  
 206-SerIleLeuGlyGluProPheAlaThrSerPheGly-217  
 227-AlaPheSerValLeuAlaHisPhe-234  
 247-ThrValGlyTrpSerLysTyrIleHisAlaVal-257

**Antigenic Index - Jameson-Wolf**

20-ValValArgThrSerSerAsnArgPhe-28  
 32-PheArgArgTyrSerAlaPhe-38  
 43-PheProLysProAlaAspThrProTrpHisArgValArgArgPheLysSerAsnArgArgMetArgGlyGlyLysProLeuLysLysProTyrArgProArgGlyGlyGlyCysArgCysArgArgAla-85  
 93-IleAlaGluArgAlaArgGluSerProArgArgCysGlyLysArgTyrAlaAspIleGlyGlyAspSerAspThrIleArgIleArgValPheArgLeuGluHisArgMet-129  
 161-HisThrGlyArgValSerArgGluAlaArgArgGluValGluLysAlaMetSer-178  
 240-LysMetAlaArgSer-244

**Hydrophilic Regions - Hopp-Woods**

20-ValValArgThrSerSerAsnArg-27  
 50-ProTrpHisArgValArgArgPheLysSerAsnArgArgMetArgGlyGlyLysProLeuLysLysProTyrArgProArgGlyGlyGlyCysArgCysArgArgAla-85  
 93-IleAlaGluArgAlaArgGluSerProArgArgCysGlyLysArgTyrAlaAspIleGlyGlyAspSerAspThrIleArg-119  
 121-ArgValPheArgLeuGluHisArgMet-129  
 164-ArgValSerArgGluAlaArgArgGluValGluLysAlaMetSer-178  
 295

**AMPHI Regions - AMPHI**

79-PheArgGlnProArgArgIle-85  
 111-ValGlnArgPhePheArgGlnPro-118  
 163-ValIleArgLysIleAlaAlaLeu-170  
 189-HisGlnGlnArgArgIleGlyLysThr-197  
 240-IleCysArgGlyThrSerGly-246

-150-

263-TyrIleIleLysProLeuGluHis-270

**Antigenic Index - Jameson-Wolf**

4-MetAlaArgHisAspAspGlnGlnArg-12

18-LeuProArgArgGlnGln-23

36-AlaAlaAlaHisGlyAsnArgProAlaSerAspAlaPhePheLysLeuProArgGlnArgPheHisLeu-58

73-HisGlyCysArgAlaGlnPheArgGlnProArgArgIleArgLeu-87

89-LeuArgGlnThrProArgGlnArgSerGlyGlyArgThrAspGlnAlaAla-105

115-PheArgGlnProArgIleArgGlnLysGlnArgHisThrArgAlaProAla-131

136-ValGlyProAspPheGly-141

144-GlnAsnAlaGluHisArgAla-150

171-ArgIleGlyLysGlnAsnLeuArgGlyPheProProArgArgGlyHisLeuArgHisGlnGlnArgArgIle  
GlyLysThrProProGlnLeuAla-202207-GlyGlyThrArgPheSerAspArgAsnGlyValTyrProAsnArgAlaGlyAsnGlyIleArgIleArgLeu  
-230

239-ProIleCysArgGlyThrSerGly-246

253-ProTyrProTyrArgArgLysGlnProGlnTyr-263

273-IleSerCysLysThrAsnAla-279

287-PheArgGlnArgAsnGlnIleSer-294

**Hydrophilic Regions - Hopp-Woods**

5-AlaArgHisAspAspGlnGlnArg-12

18-LeuProArgArgGlnGln-23

36-AlaAlaAlaHisGlyAsnArgProAlaSer-45

77-AlaGlnPheArgGlnProArgArgIleArgLeu-87

91-GlnThrProArgGlnArgSerGlyGlyArgThrAspGlnAlaAla-105

118-ProArgIleArgGlnLysGlnArgHisThrArg-128

146-AlaGluHisArgAla-150

171-ArgIleGlyLysGlnAsnLeu-177

180-PheProProArgArgGlyHisLeuArgHisGlnGlnArgArgIleGlyLysThrProPro-199

210-ArgPheSerAspArgAsnGly-216

226-IleArgIleArgLeu-230

239-ProIleCysArgGlyThr-244

255-ProTyrArgArgLysGlnPro-261

287-PheArgGlnArgAsnGlnIle-293

297

**AMPHI Regions - AMPHI**

35-ArgThrGluArgVal-39

69-GlnProGlyAspSerLeuAlaAspValLeuAla-79

86-AspGluIleAlaArgIleThrGluLysTyr-95

157-LeuProThrLeuArg-161

199-LeuLysGluGlyAspAla-204

272-LeuValTyrThrArgIleSerSer-279

333-HisAlaAsnGlyValGluThrLeuTyrAlaHisLeuSerAlaPheSer-348

**Antigenic Index - Jameson-Wolf**

8-AlaLysHisArgLysTyrAla-14

32-SerThrGluArgThrGluArgValArgProGlnArgValGluGlnAsnLeuProProLeuSerTrpGlyGlyS  
erGly-57

67-AlaValGlnProGlyAspSerLeuAla-75

78-LeuAlaArgSerGlyMetAlaArgAspGluIleAlaArgIleThrGluLysTyrGlyGlyGluAlaAspLeuA  
rgHisLeuArgAlaAspGlnSerVal-110

115-GlyGlyAspGlyGlyAlaArgGluVal-123

127-ThrAspGluAspGlyGluArgAsnLeuValAlaLeuGluLysLysGlyGlyIleTrpArgArgSerAlaSer  
GluAlaAspMetLysVal-156

-151-

167-ThrSerAlaArgGlySerLeuAlaArgAlaGluValProValGluIleArgGluSerLeuSer-187  
 194-PheSerLeuAspGlyLeuLysGluGlyAspAlaVal-205  
 228-GluValValLysGlyGlyThrArgHis-236  
 240-TyrTyrArgSerAspLysGluGlyGlyGlyGlyGlyAsnTyrTyrAspGluAspGlyLysValLeuGlnGlu  
 LysGlyGlyPheAsn-268  
 276-ArgIleSerSerProPheGlyTyr-283  
 295-HisThrGlyIleAspTyrAla-301  
 303-ProGlnGlyThrProValArgAlaSerAlaAspGly-314  
 318-PheLysGlyArgLysGlyGlyTyrGly-326  
 333-HisAlaAsnGlyValGlu-338  
 350-AlaGluGlyAsnValArgGlyGlyGlu-358  
 365-SerThrGlyArgSerThrGlyProHisLeu-374  
 376-TyrGluAlaArgIleAsnGlyGlnProValAsn-386  
 393-ProThrProGluLeuThrGlnAlaAspLysAlaAla-404  
 408-GlnLysGlnLysAlaAspAlaLeu-415  
 426-ValSerGlnSerAsp-430

**Hydrophilic Regions - Hopp-Woods**

8-AlaLysHisArgLysTyrAla-14  
 32-SerThrGluArgThrGluArgValArgProGlnArgValGluGlnAsn-47  
 68-ValGlnProGlyAspSerLeuAla-75  
 82-GlyMetAlaArgAspGluIleAlaArgIleThrGluLysTyrGlyGlyGluAlaAspLeuArgHisLeuArgA  
 laAspGln-108  
 117-AspGlyGlyAlaArgGlu-122  
 127-ThrAspGluAspGlyGluArgAsnLeuValAlaLeuGluLysLysGlyGlyIleTrpArgArgSerAlaSer  
 GluAlaAspMetLysVal-156  
 167-ThrSerAlaArgGlySerLeuAlaArgAlaGluValProValGluIleArgGluSerLeu-186  
 194-PheSerLeuAspGlyLeuLysGluGlyAspAlaVal-205  
 228-GluValValLysGlyGlyThrArg-235  
 242-ArgSerAspLysGluGlyGlyGly-249  
 253-TyrTyrAspGluAspGlyLysValLeuGlnGluLysGlyGlyPhe-267  
 306-ThrProValArgAlaSerAla-312  
 319-LysGlyArgLysGlyGlyTyr-325  
 350-AlaGluGlyAsnValArgGlyGlyGlu-358  
 366-ThrGlyArgSerThrGly-371  
 378-AlaArgIleAsnGly-382  
 396-GluLeuThrGlnAlaAspLysAlaAla-404  
 408-GlnLysGlnLysAlaAspAlaLeu-415  
 298

**AMPHI Regions - AMPHI**

6-SerLeuPheSerSerIle-11  
 13-MetSerAlaLeuIleAla-18  
 26-IleAsnAlaTyrTrpGlnGln-32  
 42-ProLeuAlaAlaTyr-46  
 62-LeuSerAspGlyIleLysAlaPhe-69  
 82-GlySerAlaAspMetProSerGlu-89  
 126-LeuMetGlnGlyValAla-131  
 134-ValGlnLysSerLeuLys-139  
 157-SerTyrProSerPhePheAspTrpProLysThrIleGluGluThrLeuGlnLysHisProGluIleSer-17  
 9  
 188-AsnAspProTrpAspPhe-193  
 208-AlaGlnGluTyrLeuLysArgValAspArgIleLeuGlu-220  
 245-GlnMetArgTyrLeuAspLysLeuLeuSerGluHisLeu-257  
 276-ArgTyrThrAspSer-280  
 308-AlaLysIleMetGluLys-313

-152-

**Antigenic Index - Jameson-Wolf**

22-SerGlnAsnProIleAsnAlaTyr-29  
 34-TyrHisArgAsnSerProLeuGluPro-42  
 47-GlyTrpTrpArgSerGlyAlaAlaLeuGlnGlu-57  
 70-LeuSerGlyGluThrProProThrAlaGlnAspGlyGlySerAlaAspMetProSerGluAlaAlaAla-92  
 94-GluAlaValProGlnThrGlyGluThrGluTrpLysGlnAspThrGluAlaAlaAlaValArgSerGlyAspLysValPhe-120  
 136-LysSerLeuLysGlnGlnTyrGlyIleGluSerValAsnLeuSerLysGlnSerThrGly-155  
 162-PheAspTrpProLysThrIleGluGluThrLeuGlnLysHisProGlu-177  
 186-GlyProAsnAspProTrpAspPheProVal-195  
 203-AlaSerAspGluTrpAla-208  
 211-TyrLeuLysArgValAspArgIleLeuGlu-220  
 236-TyrMetLysLysAlaLysLeuAspGlyGlnMetArgTyrLeuAsp-250  
 252-LeuLeuSerGluHisLeuLysGly-259  
 270-LeuSerGlyGlyLysAspArgTyrThrAspSerValAsnValAsnGlyLysProValArgTyrArgSerLysAspGlyIle-296  
 318-ProSerThrGlnProSerSerThrGlnPro-327

**Hydrophilic Regions - Hopp-Woods**

73-GluThrProProThrAlaGlnAspGlyGlySerAlaAspMetProSerGluAlaAlaAla-92  
 94-GluAlaValProGlnThrGlyGluThrGluTrpLysGlnAspThrGluAlaAlaAlaValArgSerGlyAsp-117  
 148-AsnLeuSerLysGlnSerThr-154  
 166-LysThrIleGluGluThrLeuGlnLysHisProGlu-177  
 211-TyrLeuLysArgValAspArgIleLeuGlu-220  
 236-TyrMetLysLysAlaLysLeuAspGlyGlnMetArgTyrLeuAsp-250  
 252-LeuLeuSerGluHisLeuLysGly-259  
 271-SerGlyGlyLysAspArgTyrThrAsp-279  
 281-ValAsnValAsnGlyLysProValArgTyrArgSerLysAspGlyIle-296  
 319-SerThrGlnProSerSerThrGlnPro-327  
 299

**AMPHI Regions - AMPHI**

54-AlaSerProTrpMetLysLysLeuGlnSerValAlaGlnGlySer-68  
 71-ThrPheArgIleLeuGlnIleGly-78  
 85-AspPhePheThrAspSerLeuArgLysArgLeuGlnLysThrTrpGly-100  
 238-GlnLeuThrGlnTrpSerLysTrp-245  
 247-AlaAspArgMetAsnAspLeuAlaGlnThr-256  
 281-GluGlnLysTrpLeuAspThrValArgGlnIleArgAspSerLeu-295  
 307-GluSerLeuLysAsnThrLeu-313  
 322-ArgLeuThrGluValGlnGlnMetGlnArgArgValAlaArgGln-336  
 344-TrpGlnAsnAlaMetGly-349  
 374-GlyTyrArgArgAlaAlaGluMetLeuAlaAspSerLeuGluGluLeuValArgSerAlaAlaIleArg-396

**Antigenic Index - Jameson-Wolf**

1-MetAsnProLysHis-5  
 35-ProSerAlaProTyrThrAspThrAsnGlyLeu-45  
 48-AspTyrGlyAsnAlaSerAlaSerProTrpMetLysLysLeuGln-62  
 65-AlaGlnGlySerGlyGluThr-71  
 78-GlyAspSerHisThrAlaGlyAspPhePheThrAspSerLeuArgLysArgLeuGlnLysThrTrpGlyAspGly-103  
 110-AlaAsnValLysGlyGlnArg-116  
 121-ArgHisAsnGlyAsnTrpGlnSerLeuThrSerArgAsnAsnThrGlyAspPheProLeu-140  
 157-AlaSerAspGlyIleAlaSerLysGlnArgVal-167

-153-

184-GlyAsnThrValSerAlaAsnGlyGlyGly-193  
 221-GluAsnProAlaGlyGly-226  
 241-GlnTrpSerLysTrpArgAlaAspArgMetAsnAspLeuAlaGlnThrGlyAla-258  
 266-GlyThrAsnGluAlaPheAsnAsnAsnIleAspIleAlaAspThrGluGlnLysTrp-284  
 286-AspThrValArgGlnIleArgAspSerLeuPro-296  
 305-AlaProGluSerLeuLysAsnThr-312  
 319-ArgProValArgLeuThrGluValGlnGlnMetGlnArgArgValAlaArgGlnGlyGlnThr-339  
 361-GlyTrpAlaAlaLysAspGlyVal-368  
 370-PheSerAlaLysGlyTyrArgArgAlaAlaGluMetLeuAlaAspSerLeuGluGluLeuValArg-391  
 393-AlaAlaIleArgGln-397

**Hydrophilic Regions - Hopp-Woods**

67-GlySerGlyGluThr-71  
 90-SerLeuArgLysArgLeuGlnLysThrTrpGly-100  
 112-ValLysGlyGlnArg-116  
 130-ThrSerArgAsnAsnThrGly-136  
 159-AspGlyIleAlaSerLysGlnArgVal-167  
 245-TrpArgAlaAspArgMetAsnAsp-252  
 276-AspIleAlaAspThrGluGlnLysTrp-284  
 288-ValArgGlnIleArgAspSerLeuPro-296  
 319-ArgProValArgLeuThrGlu-325  
 327-GlnGlnMetGlnArgArgValAlaArgGlnGly-337  
 363-AlaAlaLysAspGlyVal-368  
 373-LysGlyTyrArgArgAlaAlaGluMetLeuAlaAspSerLeuGluGluLeuValArg-391  
 393-AlaAlaIleArgGln-397

**302-2****AMPHI Regions - AMPHI**

20-AspGlyArgPheLeuArgThrValGluTrpLeuGlyAsnMetLeuProHisPro-37  
 85-LeuAsnAlaAspGlyPheIleLysIleLeuThrHisThrValLysAsnPheThrGlyPheAlaProLeuGlyThrValLeuValSerLeu-114  
 127-SerAlaLeuMetArg-131  
 176-GlyArgHisProLeuAlaGlyLeuAlaAlaAlaPheAlaGlyValSerGly-192  
 201-GlyThrIleAspProLeuLeuAlaGlyIleThrGlnGlnAla-214  
 239-ValIleAlaLeuIleGly-244  
 271-ArgHisSerAsnGluIle-276  
 294-LeuSerAlaLeuLeuAlaTrp-300  
 308-IleLeuArgHisProGluThrGly-315  
 341-TyrGlyArgValThrArgSerLeuArgGlyGluGlnGluValValAsnAlaMetAlaGluSerMetSer-363  
 378-PheValAlaPhePheAsnTrpThrAsnIleGlyGlnTyrIle-391  
 448-AlaProGluValIleGlnAlaAlaTyrArgIleGlyAspSerValThrAsnIleIleThrProMetMetSerTyrPheGlyLeuIleMetAla-478  
 505-IleAlaTrpIleAlaLeuPheCysIle-513

**Antigenic Index - Jameson-Wolf**

8-LysGluLysGlnMetSerGlnThrAspThrGlnArgAspGlyArgPhe-23  
 61-SerValProAspProArgProValGlyAlaLysGlyArgAlaAspAspGlyLeu-78  
 119-IleAlaGluLysSerGly-124  
 134-LeuThrLysSerProArgLysLeuThr-142  
 152-LeuSerAsnThrAlaSerGlu-158  
 175-LeuGlyArgHisProLeu-180  
 250-LysIleValGluProGlnLeuGlyProTyrGlnSerAspLeuSerGlnGluGluLysAspIleArgHisSerAsnGluIleThrProLeuGluTyrLys-282  
 304-ProAlaAspGlyIleLeuArgHisProGluThrGlyLeuValSer-318

-154-

343-ArgValThrArgSerLeuArgGlyGluGlnGluVal-354

402-ValGlyLeuGlyGly-406

482-LysTyrLysLysAspAlaGlyVal-489

**Hydrophilic Regions - Hopp-Woods**

8-LysGluLysGlnMetSerGlnThrAspThrGlnArgAspGlyArgPhe-23

63-ProAspProArgProValGlyAlaLysGlyArgAlaAspAsp-76

119-IleAlaGluLysSerGly-124

136-LysSerProArgLysLeu-141

263-LeuSerGlnGluGluLysAspIleArgHisSerAsnGlu-275

307-GlyIleLeuArgHisProGlu-313

343-ArgValThrArgSerLeuArgGlyGluGlnGluVal-354

482-LysTyrLysLysAspAlaGly-488

305-2

**AMPHI Regions - AMPHI**

10-LeuMetMetGlyLeuValGluGlyPheThrGluPheLeuPro-23

33-PheGlyAsnLeuIleGly-38

66-PheSerAsnValLeuHis-71

93-AlaAlaValMetGly-97

99-LeuPheGlyLysGlnIleLysGluTyrLeuPhe-109

141-AspValAspAlaLeuArgProIleAspAla-150

155-ValAlaGlnValPheAla-160

202-AlaTyrAspValLeuLysHisTyrArgPhePheThrLeuHis-215

222-IleGlyPheIleAlaAlaPheValSer-230

235-ValLysAlaLeuLeuArg-240

**Antigenic Index - Jameson-Wolf**

41-SerAsnHisLysValPhe-469

61-GluTyrArgGlnArgPheSerAsn-68

72-GlyLeuGlyLysAspArgLysAlaAsn-80

128-ValGluLysArgGlnSerArgAlaGluProLysIleAlaAsp-141

143-AspAlaLeuArgProIleAsp-149

163-ProGlyThrSerArgSerGlySer-170

180-IleGluArgLysThrAlaThr-186

241-PheValSerLysLysAsnTyr-247

**Hydrophilic Regions - Hopp-Woods**

62-TyrArgGlnArgPhe-66

73-LeuGlyLysAspArgLysAlaAsn-80

128-ValGluLysArgGlnSerArgAlaGluProLysIleAlaAsp-141

143-AspAlaLeuArgProIleAsp-149

165-ThrSerArgSerGlySer-170

180-IleGluArgLysThrAlaThr-186

242-ValSerLysLysAsn-246

308-1

**AMPHI Regions - AMPHI**

6-PheTyrArgIleLeuGlyValAla-13

15-AsnLeuTyrProArgLeu-20

27-ThrIleIleAlaGlyLeu-32

64-AlaLeuGluLeuLeuArgAlaGln-71

83-AlaGluMetAlaArgAlaSerGlu-90

101-LeuAlaAspPheValHisProIleGlyAsnIleGlyAlaCys-114

131-SerMetArgThrLeuAlaSerValAlaHisGlyPheGlyAsp-144

172-LeuAlaHisLeuAspAsnMetLysArgValThrGlu-183

-155-

**Antigenic Index - Jameson-Wolf**

16-LeuTyrProArgLeuSerAspPheCys-24

39-TrpGluArgArgMetMetVal-45

68-LeuArgAlaGlnAspValGluThr-75

80-SerLysGlyAlaGluMetAlaArgAlaSerGluThrAlaTyrAlaArgAspGluVal-98

118-GlyThrPheLysThrAspGlyMet-125

141-GlyPheGlyAspAsnLeuLeu-147

149-ArgAlaAlaAspValValLeuLysGluArgArgArgLeu-161

166-ArgGluThrProLeu-170

176-AspAsnMetLysArgValThrGluMetGly-185

195-MetTyrArgLysProGlnThrAlaAspAspIleVal-206

219-IleAspThrProAspSerAlaGlu-226

**Hydrophilic Regions - Hopp-Woods**

39-TrpGluArgArgMetMetVal-45

68-LeuArgAlaGlnAspValGluThr-75

81-LysGlyAlaGluMetAlaArgAlaSerGlu-90

92-AlaTyrAlaArgAspGluVal-98

120-PheLysThrAspGly-124

149-ArgAlaAlaAspValValLeuLysGluArgArgArgLeu-161

176-AspAsnMetLysArgValThrGlu-183

195-MetTyrArgLysProGlnThrAlaAspAspIleVal-206

220-AspThrProAspSerAlaGlu-226

311-1

**AMPHI Regions - AMPHI**

7-SerHisTrpArgValLeuAlaGluLeuAlaAspGlyLeuProGlnHisValSerGlnLeuAlaArgMetAlaAsp-31

37-LeuAsnGlyPheTrpGlnGlnMetProAlaHisIleArgGlyLeuLeuArg-53

55-HisAspGlyTyrTrpArgLeuValArgProLeuAlaValPheAspAlaGluGlyLeuArgGluLeuGly-77

124-ArgGlnGlyArgLysTrpSerHisArgLeu-133

165-ArgAlaLeuSerArg-169

219-ValGluAsnAlaAlaSerValGlnSerLeuPheGln-230

291-PheGluGlyThrValLysGlyValAspGlyGlnGlyVal-303

362-ThrValGlySerAlaProTyrArgAspLeuSerProLeu-374

391-CysAlaValCysGlyGluPheLysLys-399

426-TyrArgHisProGluGluHisGlySerAspArgTrpPheAsnAlaLeuGlySer-443

493-AsnLeuAsnArgHisAla-498

511-AlaValAlaSerGlyMetMetAspAlaValCys-521

550-AlaAlaLysValAlaGluAlaLeuProPro-559

576-TyrGlyLeuLeuAsnMet-581

**Antigenic Index - Jameson-Wolf**

28-ArgMetAlaAspMetLysProGlnGln-36

50-GlyLeuLeuArgGlnHisAspGlyTyr-58

71-GluGlyLeuArgGluLeuGlyGluArgSerGlyPhe-82

86-LeuLysHisGluCysAlaSerSerAsnAspGluIleLeuGlu-99

102-ArgIleAlaProAspLysAlaHisLys-110

116-HisLeuGlnSerLysGlyArgGlyArgGlnGlyArgLysTrpSerHisArgLeuGlyGlu-135

145-PheAspArgProGlnTyrGluLeuGlySer-154

162-AlaCysArgArgAlaLeuSer-168

182-LeuValValGlyArgAspLysLeuGly-190

196-ThrValArgThrGlyGlyLysThrVal-204

215-LeuProLysGluValGluAsn-221

231-ThrAlaSerArgArgGlyAsnAlaAsp-239

-156-

258-TyrAlaArgAspGlyPheAla-264  
 272-AlaAlaAsnArgAspHisGlyLys-279  
 284-LeuArgAspGlyGluThrValPhe-291  
 293-GlyThrValLysGlyValAspGlyGlnGly-302  
 307-GluThrAlaGluGlyLysGlnThrValValSerGlyGluIleSerLeuArgSerAspAspArgProValSer  
 ValProLysArgArgAspSerGluArg-339  
 344-AspGlyGlyAsnSerArgLeu-350  
 364-GlySerAlaProTyrArgAspLeuSerProLeuGly-375  
 378-TrpAlaGluLysAlaAspGlyAsnValArgIle-388  
 385-GlyGluPheLysLysAlaGlnValGln-403  
 405-GlnLeuAlaArgLysIleGlu-411  
 424-AsnHisTyrArgHisProGluGluHisGlySerAspArgTrp-437  
 440-AlaLeuGlySerArgArgPheSerArgAsnAla-450  
 464-AlaLeuThrAspAspGlyHisTyrLeuGly-473  
 483-MetLysGluSerLeuAla-488  
 492-AlaAsnLeuAsnArgHisAlaGlyLysArgTyrPro-503  
 529-GlyArgLeuLysGluLysThrGlyAlaGlyLysProVal-541  
 547-GlyGlyGlyAlaAlaLysValAlaGlu-555  
 565-AsnThrValArgValAlaAsp-571  
 584-AlaGluGlyArgGluTyrGluHis-591

**Hydrophilic Regions - Hopp-Woods**

28-ArgMetAlaAspMetLysProGlnGln-36  
 50-GlyLeuLeuArgGlnHis-55  
 71-GluGlyLeuArgGluLeuGlyGluArgSerGlyPhe-82  
 86-LeuLysHisGluCysAlaSerSerAsnAspGluIleLeuGlu-99  
 102-ArgIleAlaProAspLysAlaHisLys-110  
 118-GlnSerLysGlyArgGlyArgGlnGlyArgLysTrpSerHisArgLeuGlyGlu-135  
 162-AlaCysArgArgAlaLeuSer-168  
 183-ValValGlyArgAspLysLeuGly-190  
 196-ThrValArgThrGlyGlyLys-202  
 217-LysGluValGluAsn-221  
 232-AlaSerArgArgGlyAsnAlaAsp-239  
 259-AlaArgAspGlyPhe-263  
 272-AlaAlaAsnArgAspHisGlyLys-279  
 285-ArgAspGlyGluThrValPhe-291  
 293-GlyThrValLysGlyValAspGly-300  
 307-GluThrAlaGluGlyLysGlnThrValVal-316  
 320-IleSerLeuArgSerAspAspArgProValSerValProLysArgArgAspSerGluArg-339  
 346-GlyAsnSerArgLeu-350  
 367-ProTyrArgAspLeuSer-372  
 378-TrpAlaGluLysAlaAspGlyAsnVal-386  
 395-GlyGluPheLysLysAlaGlnVal-402  
 405-GlnLeuAlaArgLysIleGlu-411  
 424-AsnHisTyrArgHisProGluGluHisGlySer-434  
 442-GlySerArgArgPheSerArg-448  
 464-AlaLeuThrAspAspGlyHis-470  
 483-MetLysGluSerLeuAla-488  
 493-AsnLeuAsnArgHisAlaGlyLysArgTyrPro-503  
 529-GlyArgLeuLysGluLysThrGlyAlaGlyLysProVal-541  
 549-GlyAlaAlaLysValAlaGlu-555  
 565-AsnThrValArgValAlaAsp-571  
 584-AlaGluGlyArgGluTyrGluHis-591

312-2

**AMPHI Regions - AMPHI**

-157-

6-GlyGluIleLeuGluThrValLysMetValAla-16

33-AspCysIleSerSer-37

44-GlnAsnIleTyrAsnLysIleThrThrValGlyLys-55

82-IleAlaGlnIleAlaAlaAlaThr-89

95-ValSerValAlaGlnThrLeuAspLysAlaAlaLys-106

109-GlyValSerPheIleGlyGlyPheSerAlaLeuValGln-121

133-ArgSerIleProGluAlaMetLysThr-141

167-GlyGluThrValLysArgThrAla-174

182-GlyCysAlaLysIleValValPheCys-190

230-SerAspAlaThrThrLeuThrGluValAlaGluValValLysLys-244

249-IleThrArgValGlyGluLeuIleGlyArgGluAlaSerLys-262

281-ValGlyAspSerValAlaArgIleLeuGluGluMetGly-293

309-LeuAsnAspAlaVal-313-

322-SerAlaValGlyGlyLeuSerGly-329

349-LeuThrLeuAspLysLeuGluAlaMetThrAla-359

374-ThrProAlaHisThrIleSerGlyIleIle-383

409-ValGlyAspSerValGluPheGlyGlyLeuLeuGly-420

**Antigenic Index - Jameson-Wolf**

4-GlnSerGlyGluIleLeuGlu-10

13-LysMetValAlaAspGlnAsnPheAspVal-22

35-IleSerSerAspIle-39

52-ThrValGlyLysAspLeuValThr-59

89-ThrHisAlaAspSer-93

100-ThrLeuAspLysAlaAlaLys-106

121-GlnLysGlyMetSerProSerAspGluValLeu-131

134-SerIleProGluAlaMetLysThrThrAsp-143

152-GlySerThrArgAla-156

161-AspAlaValLysLeuAlaGlyGluThrValLysArgThrAlaGluIleThrProGluGlyPheGly-182

192-AlaValGluAspAsnProPhe-198

204-HisGlySerGlyGluAlaAspAla-211

225-AlaAlaLeuGluAsnSerAspAla-232

237-GluValAlaGluValValLys-243

251-ArgValGlyGluLeuIleGlyArgGluAlaSerLys-262

280-AlaValGlyAspSerValAlaArgIleLeuGlu-290

311-AspAlaValLysLysGlyGlyMet-318

334-ValSerGluAspGluGlyMet-340

352-AspLysLeuGluAla-356

370-ValProGlyAspThrProAla-376

383-IleAlaAspGluAlaAla-388

392-IleAsnSerLysThrThrAla-398

405-ThrGlyLysThrValGlyAspSerValGlu-414

426-ProValLysGluGlySerCys-432

435-PheValAsnArgGlyGlyArgIle-442

447-GlnSerMetLysAsn-451

**Hydrophilic Regions - Hopp-Woods**

18-GlnAsnPheAspVal-22

52-ThrValGlyLysAspLeuValThr-59

100-ThrLeuAspLysAlaAlaLys-106

123-GlyMetSerProSerAspGluValLeu-131

134-SerIleProGluAlaMetLysThrThrAsp-143

-158-

161-AspAlaValLysLeuAlaGlyGluThrValLysArgThrAlaGluIleThrPro-178  
 192-AlaValGluAspAsnPro-197  
 207-GlyGluAlaAspAla-211  
 225-AlaAlaLeuGluAsnSerAspAla-232

237-GluValAlaGluValValLys-243

251-ArgValGlyGluLeuIleGlyArgGluAlaSerLys-262  
 284-SerValAlaArgIleLeuGlu-290

311-AspAlaValLysLysGlyGlyMet-318  
 334-ValSerGluAspGluGlyMet-340  
 352-AspLysLeuGluAla-356  
 383-IleAlaAspGluAlaAla-388  
 408-ThrValGlyAspSerValGlu-414  
 426-ProValLysGluGlySerCys-432  
 438-ArgGlyGlyArgIle-442  
 447-GlnSerMetLysAsn-451

313-2

**AMPHI Regions - AMPHI**

27-GlyMetAspAspProArgThrTyrGlySerGly-37  
 41-AlaThrAsnValLeu-45  
 60-AspAlaAlaLysGly-64  
 66-ValAlaValLeuLeuAlaArgValLeuGlnGluPro-77  
 88-ValAlaLeuAlaAlaLeuValGlyHisMetTrpPro-99  
 143-SerLeuAlaAlaLeuThrAlaThrIleAlaAlaProVal-155

**Antigenic Index - Jameson-Wolf**

26-TyrGlyMetAspAspProArgThrTyrGlySerGlyAsnProGlyAla-41  
 46-ArgSerGlyLysLysLysAlaAla-53  
 73-ValLeuGlnGluProLeuGlyLeuSerAspSerAla-84  
 104-PheLysGlyGlyLysGlyVal-110  
 181-HisLysSerAsnIle-185  
 189-LeuGluGlyArgGluSerLysIleGlyGlySerArg-200

**Hydrophilic Regions - Hopp-Woods**

26-TyrGlyMetAspAspProArgThrTyrGly-35  
 46-ArgSerGlyLysLysLysAlaAla-53  
 105-LysGlyGlyLysGlyVal-110  
 181-HisLysSerAsnIle-185  
 189-LeuGluGlyArgGluSerLysIleGlyGlySerArg-200

401

**AMPHI Regions - AMPHI**

46-ValLysProTyrAsnAlaLeu-52  
 65-CysTyrAsnCysHisSerGlnMetIleArgProPheArg-77  
 112-ValGlyGlyArgTyrSerAspGluTrpHisArgIle-123  
 157-MetLysAlaLeuArgLysValGlyThr-165  
 172-IleAlaLysAlaProGluAlaLeu-179

**Antigenic Index - Jameson-Wolf**

5-GlnLeuAlaGluGluLysIle-11  
 38-AlaAlaThrGlnProAlaProGlyValLysProTyrAsn-50  
 55-AlaGlyArgAspIleTyrIleArgGluGlyCysTyrAsnCysHis-69

-159-

74-ArgProPheArgAlaGluThrGluArgTyrGlyHis-85  
 90-GlyGluSerValTyr-94  
 98-PheGlnTrpGlySerLysArgThrGlyProAspLeuAlaArgValGlyGlyArgTyrSerAspGluTrpHis-121  
 125-LeuLeuAsnProArgAspValValProGluSerAsnMetPro-138  
 146-AsnLysValAspValAspAla-152  
 158-LysAlaLeuArgLysValGlyThrProTyrSerAspGluGluIleAlaLysAlaProGlu-177  
 179-LeuAlaAsnLysSerGluLeuAspAla-187

**Hydrophilic Regions - Hopp-Woods**

5-GlnLeuAlaGluGluLysIle-11  
 76-PheArgAlaGluThrGluArgTyrGly-84  
 101-GlySerLysArgThrGlyProAspLeuAlaArgValGlyGlyArgTyrSerAspGluTrpHis-121  
 127-AsnProArgAspValValPro-133  
 146-AsnLysValAspValAspAla-152  
 158-LysAlaLeuArgLysValGly-164  
 167-TyrSerAspGluGluIleAlaLysAlaProGlu-177  
 179-LeuAlaAsnLysSerGluLeuAspAla-187

402-2

**AMPHI Regions - AMPHI**

18-PheLeuSerGlyLeu-22  
 85-AlaGlyIleAlaAspPhe-90  
 100-ThrGlyPheSerGlyPheValHis-107  
 117-AlaValValArgGlyLeu-122  
 136-LysSerGlyArgGln-140  
 146-PheAlaAsnValAlaGly-151  
 218-ValPheGlnAsnIleAlaAspArgProAspArgLeuIle-230  
 261-AspValPheAsnSerValAsnGlyIleGlu-270  
 279-LysSerGlyIleArg-283  
 294-SerTrpAlaArgValLeuSerAlaIleProGluMetGln-306  
 344-ArgLysTrpLeuArgArgHisPro-351  
 376-AlaGluPheLeuLysGlnValGlnSerHisLeu-386  
 398-HisSerProHisAlaPheAlaThrAlaValHisSerIlePro-411  
 437-GlnArgLeuSerArgLeu-442  
 460-AlaAlaGlnLysVal-464

**Antigenic Index - Jameson-Wolf**

4-ValAsnThrLysProAsnThrSer-11  
 66-ArgIleCysArgSerArgPheValAsp-74  
 130-ValGlyThrAspGlyAsnLysSerGlyArgGlnValSer-142  
 222-IleAlaAspArgProAspArgLeuIleGluAsnLysHisGly-235  
 240-TyrHisArgAspGlyAspLysValVal-248  
 264-AsnSerValAsnGlyIleGluArg-271  
 277-SerLeuLysSerGlyIleArgArg-284  
 321-IleAlaAspGluProGln-326  
 331-LeuGlnAspLysArgValGluIleValLeuAspAspGlyArgLysTrpLeuArgArgHisProAspGluLysPheAsp-356  
 385-HisLeuThrProAspGly-390  
 429-PheProAsnLysGluLeuLeuLysGlnArgLeuSer-440  
 444-TrpProGluSerGlyArgHisValPheAspSerSerThrVal-457  
 472-MetThrGluProSerAlaGly-478  
 481-ValIleThrAspAspAsnMet-487  
 489-ValGluTyrLysTyrGlyArgGlyIle-497

**Hydrophilic Regions - Hopp-Woods**

-160-

131-GlyThrAspGlyAsnLysSerGlyArgGlnVal-141  
 222-IleAlaAspArgProAspArgLeuIleGluAsnLysHis-234  
 241-HisArgAspGlyAspLysValVal-248  
 278-LeuLysSerGlyIleArg-283  
 321-IleAlaAspGluProGln-326  
 331-LeuGlnAspLysArgValGluIleValLeuAspAspGlyArgLysTrpLeuArgArgHisProAspGluLys  
 PheAsp-356  
 430-ProAsnLysGluLeuLeuLysGlnArgLeuSer-440  
 446-GluSerGlyArgHisValPhe-452  
 473-ThrGluProSerAlaGly-478  
 481-ValIleThrAspAspAsnMet-487

501-2

**AMPHI Regions - AMPHI**

63-ValGluValLeuGlnGluLeuPheArgGlnTyrArgValAlaArgGlnLeu-79  
 88-ValPheAlaAlaPheGlnAlaVal-95  
 97-PheGlnGlyPheAspAsnGlyPhe-104  
 126-AlaAspAlaPheGlnGly-131  
 139-ValPheGluValValGlyAspIleThrArgArgThrThrGluAla-153  
 183-AspGlyPheThrArgIleAsnArgCysGlyGlnCys-194  
 196-HisAlaPheGlyAspPheIleAsp-203

**Antigenic Index - Jameson-Wolf**

6-LeuThrAlaAspAla-10  
 17-AlaAlaGlyGlyAspGlyLysValGlnHisHisPheAspGlyArgValAlaPhe-34  
 46-ValGluThrGluGlyGln-51  
 56-ValArgAlaAspGlyGluAlaValGluVal-65  
 100-PheAspAsnGlyPhe-104  
 108-GlnSerAlaAspGluArgAsnHisAspPheAsnValGlyGln-121  
 144-GlyAspIleThrArgArgThrThrGluAlaGlnHis-155  
 179-GlyHisThrAspAspGlyPheThrArgIleAsnArgCysGlyGlnCysArgHisAlaPhe-198  
 202-IleAspValGluValAspArgGlyArgValThrGlyAspThrAlaGlyAsnPhe-219

**Hydrophilic Regions - Hopp-Woods**

6-LeuThrAlaAspAla-10  
 19-GlyGlyAspGlyLysVal-24  
 46-ValGluThrGluGlyGln-51  
 56-ValArgAlaAspGlyGluAlaValGluVal-65  
 108-GlnSerAlaAspGluArgAsnHisAsp-116  
 144-GlyAspIleThrArgArgThrThrGluAlaGlnHis-155  
 179-GlyHisThrAspAspGlyPheThrArgIleAsnArg-190  
 202-IleAspValGluValAspArgGlyArgValThrGlyAspThr-215

502-1

**AMPHI Regions - AMPHI**

6-AsnLeuPheGlnPheLeuAlaValCys-14  
 26-GlyAlaValAspAlaLeuLysGlnPheAsnAsnAspAlaAspGlyIleSerGlySerPheThrGln-47  
 98-GlnValThrLysSerSerGlnAsp-105

**Antigenic Index - Jameson-Wolf**

32-LysGlnPheAsnAsnAspAlaAspGlyIleSerGlySer-44  
 48-ThrValGlnSerLysLysLysThrGlnThrAlaHisGlyThr-61  
 73-GluTyrThrLysProTyrArg-79  
 98-GlnValThrLysSerSerGlnAspGlnAlaIleGlyGlySerPro-112  
 116-LeuSerAsnLysThrAlaLeuGluSerSerTyrThrLeuLysGluAspGlySerSerAsnGly-136  
 142-AlaThrProLysArgAsnAsnAlaGly-150

-161-

158-PheLysGlyGlyAsn-162  
 167-GlnLeuLysAspSerPheGlyAsnGlnThr-176  
 184-AsnThrAsnProGlnLeuSerArgGlyAlaPhe-194  
 196-PheThrProProLysGlyValAspVal-204

**Hydrophilic Regions - Hopp-Woods**

34-PheAsnAsnAspAlaAspGlyIle-41  
 49-ValGlnSerLysLysLysThrGlnThr-57  
 ThrLysSerSerGlnAspGlnAlaIle-108  
 126-TyrThrLeuLysGluAspGlySerSerAsn-135  
 143-ThrProLysArgAsnAsnAla-149  
 167-GlnLeuLysAspSerPheGly-173

503-1

**AMPHI Regions - AMPHI**

96-SerSerThrSerAsnPheAlaSerAlaAlaGluMetArgSerLeu-110

**Antigenic Index - Jameson-Wolf**

4-SerLeuTyrArgGluAlaAsnThrTrpCys-13  
 32-ProAlaAsnAspAlaSerGlyArgSerSerAlaValAlaGluGluArgThrAlaThrGluMetSerAlaProP  
 roAla-57  
 69-SerAlaSerSerCysSerGlyLysGlyValSer-79  
 87-LeuProThrArgAlaSerSerAlaThrSerSerThrSerAsn-100  
 105-AlaGluMetArgSerLeuArg-111  
 113-LeuCysAlaArgAsnAlaArg-119

**Hydrophilic Regions - Hopp-Woods**

4-SerLeuTyrArgGlu-8  
 32-ProAlaAsnAspAlaSerGlyArgSerSerAlaValAlaGluGluArgThrAlaThrGluMetSerAla-54  
 73-CysSerGlyLysGlyValSer-79  
 89-ThrArgAlaSerSer-93  
 105-AlaGluMetArgSerLeuArg-111

505-2

**AMPHI Regions - AMPHI**

20-LeuThrAlaLeuLeuLysCysLeuSerLeuLeuProLeuSerCysLeu-35  
 37-ThrLeuGlyAsnArg-41  
 89-ProAlaPhePheArgLysProGluAspIleGluThrMetPheLysAlaValHisGlyTrpGluHisValGlnG  
 lnAlaLeuAsp-116  
 148-AlaMetTyrLysProProLysIleLysAlaIleAspLysIleMetGlnAlaGly-165  
 178-IleGlnGlyValLysGlnIleIleLysAlaLeuArg-189  
 210-GlyValTrpValAspPhePheGlyLysPro-219

**Antigenic Index - Jameson-Wolf**

39-GlyAsnArgLeuGly-43  
 50-LeuLysGluAspArgAlaArgIle-57  
 64-AlaGlyLeuAsnProAspProLysThrValLys-74  
 79-GluThrAlaLysGlyGlyLeu-85  
 92-PheArgLysProGluAspIleGluThr-100  
 114-AlaLeuAspLysHisGlu-119  
 131-TyrAspLeuGlyGlyArgTyrIleSer-139  
 150-TyrLysProProLysIleLysAlaIleAspLysIleMetGln-163  
 165-GlyArgValArgGlyLysGlyLysThrAlaProThrSer-177  
 183-GlnIleIleLysAlaLeuArgSerGlyGluAlaThr-194  
 199-AspHisValProSerProGlnGluGlyGlyGluGlyVal-211  
 243-GluArgLeuProGlyGlyGlnGly-250  
 258-ValGlnGlyGluLeuAsnGlyAspLysAlaHisAsp-269

-162-

293-AsnArgTyrLysMetPro-298

**Hydrophilic Regions - Hopp-Woods**

50-LeuLysGluAspArgAlaArgIle-57  
 65-GlyLeuAsnProAspProLysThrVal-73  
 79-GluThrAlaLysGlyGlyLeu-85  
 92-PheArgLysProGluAspIleGluThr-100  
 114-AlaLeuAspLysHisGlu-119  
 151-LysProProLysIleLysAlaIleAspLysIleMetGln-163  
 165-GlyArgValArgGlyLysGlyLysThrAlaPro-175  
 183-GlnIleIleLysAlaLeuArgSerGlyGlu-192  
 201-ValProSerProGlnGluGlyGlyGlu-209  
 258-ValGlnGlyGluLeuAsnGlyAspLysAlaHisAsp-269

506-2

**AMPHI Regions - AMPHI**

6-GluValGlyArgValAlaHisCysGlyGlyGlyVal-17  
 25-ArgValValHisGlnValGluGlnGlyAlaArg-35  
 56-PheGlnArgArgPhe-60  
 99-AlaThrArgThrIleAspGlyAsnLeuAlaGluValTyrAlaGlnThr-114  
 138-GlyAsnGluValAlaArgCys-144  
 180-GlnValLysArgMetIleArgTyrPhePheArgVal-191

**Antigenic Index - Jameson-Wolf**

13-CysGlyGlyGlyValAla-18  
 31-GluGlnGlyAlaArgLeu-36  
 54-ValAspPheGlnArgArgPheGlyGluVal-63  
 98-ArgAlaThrArgThrIleAspGlyAsnLeu-107  
 134-GlyAlaAspThrGlyAsnGluValAlaArgCysGluGly-146  
 176-ProAsnPheGlyGlnValLysArgMetIle-185  
 195-HisAspLeuAspVal-199  
 201-ArgProPheArgLys-205

**Hydrophilic Regions - Hopp-Woods**

31-GluGlnGlyAlaArgLeu-36  
 54-ValAspPheGlnArgArgPheGlyGlu-62  
 98-ArgAlaThrArgThrIleAsp-104  
 136-AspThrGlyAsnGluValAlaArgCysGluGly-146  
 180-GlnValLysArgMetIle-185  
 195-HisAspLeuAspVal-199  
 201-ArgProPheArgLys-205

513

**AMPHI Regions - AMPHI**

6-AsnAlaAlaAlaAlaAla-11  
 19-GlnGlyMetIleGlnMetLeuGlyValPheValAsp-30  
 48-ProTyrGlyAspLeu-52  
 63-ValSerGlnValGlyGlnTrp-69  
 107-ThrAlaValPheArgMet-112  
 119-TyrPheGlyAlaValAla-124  
 139-IleMetAlaTrpIleAsnLeuValAlaIleLeuLeuLeuSer-152

**Antigenic Index - Jameson-Wolf**

2-GlySerAlaProAsnAla-7  
 11-AlaGluValLysHisProVal-17  
 47-GlnProTyrGlyAspLeuSerGly-54  
 91-AlaTyrAlaGluSerAsnVal-97

-163-

160-ArgAspTyrThrAlaLysLeuLysMetGlyLysAspProGluPheLysLeuSerGluHisProGlyLeuLys  
ArgArgIleLysSerAspValTrp-191

**Hydrophilic Regions - Hopp-Woods**

11-AlaGluValLysHis-15  
166-LeuLysMetGlyLysAspProGluPheLysLeuSerGlu-178  
180-ProGlyLeuLysArgArgIleLysSer-188  
515-1

**AMPHI Regions - AMPHI**

8-ArgAlaAlaGlyValAlaArgGlyLeuHisThrGluPheAlaArgAlaVal-24  
59-AspValArgPhePheAlaGlnValGluGluIleGlyGlnAspPhePheAlaAspAla-77  
90-AlaGlyGluCysAlaAspGluValSerAspLysThr-101  
122-GluSerAlaGlnSerAlaAlaGlyGlyGlyLeuThrAspGlyPheGly-137  
176-CysGlyLysThrValGlyVal-182  
198-GlyValPheAspAla-202  
251-PheGlyGlyValAla-255  
259-AspGlyGlyPheAspGlyValLeuGlnGlyPhePheGlyGluVal-273

**Antigenic Index - Jameson-Wolf**

24-ValThrAlaGluGluIleAlaPhe-31  
38-HisGluAlaArgCysGlyGlyAsn-45  
51-IleAlaAlaAlaGluArgAlaGlyAsp-59  
67-GluGluIleGlyGln-71  
77-AlaValAspGlnGluThr-82  
84-LeuAlaValGluArgAlaAlaGlyGluCysAlaAspGluValSerAspLysThrAlaArgAsnGlyGlyIleG  
luGluAspGlyValAlaAlaCysArgAspAlaAlaAlaAlaGluSerAlaGln-125  
128-AlaGlyGlyGlyLeuThrAspGly-135  
160-GlyGlyAsnAspAlaAlaGlyAsn-167  
192-LeuHisArgArgAla-196  
217-AlaAspGlyGlyPheArg-222  
239-HisGlnThrGlyIleGlyLysSerGly-247  
256-GlyAspValAspGlyGlyPheAspGly-264  
273-ValGlySerThrGlyAla-278  
284-AspValAsnGlyAsnValGln-290

**Hydrophilic Regions - Hopp-Woods**

24-ValThrAlaGluGluIleAlaPhe-31  
38-HisGluAlaArgCysGly-43  
51-IleAlaAlaAlaGluArgAlaGlyAsp-59  
77-AlaValAspGlnGluThr-82  
84-LeuAlaValGluArgAlaAlaGlyGluCysAlaAspGluValSerAspLysThrAlaArgAsnGlyGlyIleG  
luGluAspGlyValAlaAlaCysArgAspAlaAlaAlaAlaGluSerAlaGln-125  
162-AsnAspAlaAlaGly-166  
192-LeuHisArgArgAla-196  
242-GlyIleGlyLysSerGly-247  
256-GlyAspValAspGlyGlyPhe-262  
519-1

**AMPHI Regions - AMPHI**

15-GlyPheLysSerPhe-19  
29-ValValGluArgLeuGlyArgPheHisArgAlaLeuThrAlaGly-43  
105-MetAlaIleThrGlnLeuAlaGlnThrThrLeuArgSerVal-118  
141-AlaLeuAspGluAlaAla-146  
166-GluIleLeuArgSerMetGlnAla-173  
192-LysIleGluGlnIle-196  
221-SerAsnAlaGluLysIleAlaArgIleAsn-230

-164-

249-AlaIleArgGlnIleAlaAlaAla-256  
 273-GlnTyrValAlaAlaPheAsnAsnLeuAlaLys-283  
 292-AlaAsnValAlaAspIleGlySerLeuIleSerAlaGlyMetLysIleIleAspSerSerLysThrAla-314

**Antigenic Index - Jameson-Wolf**

31-GluArgLeuGlyArgPheHisArg-38  
 58-HisSerLeuLysGluIleProLeuAspValProSerGln-70  
 72-CysIleThrArgAspAsnThrGlnLeuThrVal-82  
 91-ThrAspProLysLeuAlaSer-97  
 122-MetGluLeuAspLysThrPheGluGluArgAspGluIleAsn-135  
 141-AlaLeuAspGluAlaAlaGly-147  
 154-LeuArgTyrGluIleLysAspLeuValPro-163  
 175-IleThrAlaGluArgGluLysArgAlaArgIleAlaGluSerGluGlyArgLysIleGluGln-195  
 197-AsnLeuAlaSerGlyGlnArgGluAlaGluIleGlnGlnSerGluGlyGluAlaGlnAla-216  
 219-AsnAlaSerAsnAlaGluLysIleAlaArgIleAsnArgAlaLysGlyGluAlaGluSerLeuArgLeu-241  
 245-AlaAsnAlaGluAlaIleArg-251  
 258-GlnThrGlnGlyGlyAlaAspAlaValAsn-267  
 281-LeuAlaLysGluSerAsnThr-287  
 303-AlaGlyMetLysIleIleAspSerSerLysThrAlaLys-315

**Hydrophilic Regions - Hopp-Woods**

31-GluArgLeuGlyArgPheHisArg-38  
 58-HisSerLeuLysGluIleProLeu-65  
 73-IleThrArgAspAsnThr-78  
 91-ThrAspProLysLeu-95  
 122-MetGluLeuAspLysThrPheGluGluArgAspGluIleAsn-135  
 141-AlaLeuAspGluAlaAla-146  
 154-LeuArgTyrGluIleLysAspLeuValPro-163  
 175-IleThrAlaGluArgGluLysArgAlaArgIleAlaGluSerGluGlyArgLysIleGluGln-195  
 200-SerGlyGlnArgGluAlaGluIleGlnGlnSerGluGlyGluAlaGlnAla-216  
 221-SerAsnAlaGluLysIleAlaArgIleAsnArgAlaLysGlyGluAlaGluSerLeuArgLeu-241  
 245-AlaAsnAlaGluAlaIleArg-251  
 281-LeuAlaLysGluSerAsn-286  
 306-LysIleIleAspSerSerLysThrAlaLys-315  
 520-1

**AMPHI Regions - AMPHI**

104-LeuThrLysAlaAlaAspGlyGlnValCysArgAlaPheSerSerLeu-119

**Antigenic Index - Jameson-Wolf**

20-LysProSerArgArgAlaLeu-26  
 47-AlaSerGlyLysIleSerLeuPro-54  
 84-ProProAsnAsnSerThrThrThrSerThrSerSerArgAlaThrSerSerAsnGlySerLeuThrLysAlaAlaAspGlyGlnVal-112  
 117-SerSerLeuLysSerHisThrAlaGluIleArgIleSerArgProLysArgArgGluIleSerSerAlaLeuSerArgAsnThrAlaAla-146  
 150-ProThrValProLysProLysArgProMet-159  
 166-SerProCysLysProThrGluMet-173

**Hydrophilic Regions - Hopp-Woods**

20-LysProSerArgArgAlaLeu-26  
 93-ThrSerSerArgAlaThrSerSer-100  
 103-SerLeuThrLysAlaAlaAsp-109  
 120-LysSerHisThrAlaGluIleArgIleSerArgProLysArgArgGluIleSer-137

-165-

140-LeuSerArgAsnThrAla-145  
 151-ThrValProLysProLysArgProMet-159  
 168-CysLysProThrGluMet-173  
 521-2

**AMPHI Regions - AMPHI**

39-ThrLysProSerLysSerCys-45  
 50-LeuProProIleGly-54  
 65-GlnThrProGluProValSerSerProSer-74  
 76-GlyGlyGlnValVal-80  
 86-ValLysThrValSerLysProAlaLys-94  
 133-GlnAlaArgLeuAlaLysGlyGlyAsn-141

**Antigenic Index - Jameson-Wolf**

36-ValTyrThrThrLysProSerLysSerCysHisSerThrAspLeuProProIleGlyAsnTyrSerSerGluA  
 rgTyrIleProProGlnThrProGluProValSerSerProSerAsnGlyGlyGlnValValLysTyrLysAlaPr  
 oValLysThrValSerLysProAlaLysSerAsnThrProProProGlnGlnAlaProSerAsnAsnSerArgArg  
 SerIleLeuGluThrGluLeuSerAsnGluArgLysAlaLeuValGluAlaGlnLysMetLeuSer-132  
 135-ArgLeuAlaLysGlyGlyAsnIleAsn-143  
 152-SerAsnValLeuAspArgGlnGlnAsn-160  
 164-LeuGlnArgGluLeuGlyArg-170

**Hydrophilic Regions - Hopp-Woods**

40-LysProSerLysSerCysHis-46  
 57-SerSerGluArgTyrIle-62  
 65-GlnThrProGluProValSer-71  
 80-ValLysTyrLysAlaProVal-86  
 88-ThrValSerLysProAlaLysSerAsnThrProPro-99  
 102-GlnAlaProSerAsnAsnSerArgArgSerIleLeuGluThrGluLeuSerAsnGluArgLysAlaLeuVal  
 GluAlaGlnLysMetLeuSer-132  
 154-ValLeuAspArgGlnGlnAsn-160  
 164-LeuGlnArgGluLeuGlyArg-170  
 522

**AMPHI Regions - AMPHI**

32-TrpValIleLeuAlaLeuLeuAlaLeuThrAlaLeuLeuSer-45  
 57-LysIleValGluSerCysValLys-64  
 96-MetTrpGluGlnProLeuAspArgLeuSerGluLysGlnIleArgSerPheGlyLysLeuGlyAlaGlnGluG  
 lnLeuAspLeuLeuGlyGlyAla-127

**Antigenic Index - Jameson-Wolf**

1-MetThrGluProLysHisGluMetLeuThrLysGluGlnValAlaAlaArgLysLysAlaLysAlaLysIleAr  
 gThr-26  
 48-AlaMetSerLysProGlnAlaLysGlnLysIleValGluSerCysValLys-64  
 71-LysTrpGlnAsnAspLeuArgAlaArgGlyLeuAspSerAsnAsnThrArgLeuAla-89  
 99-GlnProLeuAspArgLeuSerGluLysGlnIleArgSerPheGlyLysLeuGlyAla-117  
 128-AsnAlaPheGluAlaArgAspLysGlnCysValAlaAspLeuLysSerGlu-144

**Hydrophilic Regions - Hopp-Woods**

1-MetThrGluProLysHisGluMetLeuThrLysGluGlnValAlaAlaArgLysLysAlaLysAlaLysIleAr  
 gThr-26  
 48-AlaMetSerLysProGlnAlaLysGlnLysIleValGluSerCysVal-63  
 71-LysTrpGlnAsnAspLeuArgAlaArgGlyLeuAspSerAsnAsnThr-86  
 100-ProLeuAspArgLeuSerGluLysGlnIleArgSerPheGly-113  
 130-PheGluAlaArgAspLysGlnCysValAlaAspLeuLysSerGlu-144  
 525-1

**AMPHI Regions - AMPHI**

-166-

59-GluPheAlaGluPheValAsnSerHisProGln-69  
 86-LysHisTrpMetLysAsnGly-92  
 125-ArgLeuProThrIleAspGluTrpGluPhe-134  
 154-ThrIleLeuAspTrpTyr-159  
 164-ArgLysGlyLeuHisAspValGly-171  
 178-TrpGlyValTyrAsp-182  
 188-TrpGluTrpThrGlu-192

**Antigenic Index - Jameson-Wolf**

24-ValGlnIleGluGlyGlySerTyrArgProLeuTyrLeuLysLysAspThrGlyLeuIleLys-44  
 46-LysProPheLysLeuAspLysTyrProValThr-56  
 67-HisProGlnTrpGlnLysGlyArgIleGlySerLysGlnAlaGlu-81  
 88-TrpMetLysAsnGlySerArgSerTyrAlaProLysAlaGlyGluLeuLysGlnPro-106  
 122-GlnGlyLysArgLeuProThrIleAspGluTrpGlu-133  
 140-AlaThrGlnLysAsnGlySerAsnGluProGlyTyrAsnArgThr-154  
 159-TyrAlaAspGlyGlyArgLysGlyLeuHisAspValGlyLysGlyArgProAsnTyr-177  
 190-TrpThrGluAspPheAsnSerSerLeuLeuSerSerGlyAsnAla-204  
 213-AlaSerIleGlySerSerAspSerSerAsnTyr-223  
 234-SerLeuGlnSerLysTyr-239

**Hydrophilic Regions - Hopp-Woods**

35-TyrLeuLysLysAspThrGlyLeuIleLys-44  
 46-LysProPheLysLeuAspLysTyrPro-54  
 71-GlnLysGlyArgIleGlySerLysGlnAlaGlu-81  
 91-AsnGlySerArgSerTyrAlaProLysAlaGlyGluLeuLysGln-105  
 122-GlnGlyLysArgLeuProThr-128  
 140-AlaThrGlnLysAsnGlySerAsnGluProGlyTyr-151  
 162-GlyGlyArgLysGlyLeuHisAspValGlyLysGlyArgPro-175  
 216-GlySerSerAspSerSerAsn-222  
 527-2

**AMPHI Regions - AMPHI**

7-PhePheGlnProValGln-12  
 28-SerAspAlaAlaGluLeuValGluLeuPheAlaLeuPhePro-41  
 73-GlyLysGlyIleGluArgGlnValAspAsnIleAlaAspValTyrGlyPhe-89

**Antigenic Index - Jameson-Wolf**

26-GlyGlySerAspAlaAlaGlu-32  
 52-GlnLysProArgLeuGlyCys-58  
 71-PheIleGlyLysGlyIleGluArgGlnValAspAsnIleAla-84  
 107-LeuLeuArgLysGlyThrGlyLeuGluLysThrCysArgProLysProPheValGlnProHisGlyGlyArg-130

**Hydrophilic Regions - Hopp-Woods**

27-GlySerAspAlaAlaGlu-32  
 52-GlnLysProArgLeuGlyCys-58  
 75-GlyIleGluArgGlnValAspAsnIleAla-84  
 107-LeuLeuArgLysGlyThrGlyLeuGluLysThrCysArgProLysPro-122  
 528-1

**AMPHI Regions - AMPHI**

7-LysTyrThrAlaMetAlaAlaLeuLeuAlaPhe-17  
 23-ArgLeuAlaGlyTrpTyrGluCysSerSerLeuThrGlyTrpCysLysProArgLysProAlaAlaIle-45  
 69-AsnArgSerValArg-73  
 86-TyrArgLysIleGlyLysPhe-92  
 106-ProLeuIleGluThrPheLys-112

**Antigenic Index - Jameson-Wolf**

1-MetGluIleArgAla-5  
 29-GluCysSerSerLeuThrGlyTrpCysLysProArgLysProAlaAla-44  
 49-AspIleGlyGlyGluSerProProSerLeuGlyAspTyrGluIleProLeuSerAspGlyAsnArgSerValA  
 rgAlaAsnGluTyrGluSerAlaGlnGlnSer-83  
 88-LysIleGlyLysPheGluAlaCysGlyLeuAspTrpArgThrArgAspGlyLysProLeu-107  
 110-ThrPheLysGlnGlyGlyPheAspCysLeuGluLysGlnGlyLeuArgArgAsnGlyLeuSerGluArgVal  
 ArgTrp-135

**Hydrophilic Regions - Hopp-Woods**

1-MetGluIleArgAla-5  
 37-CysLysProArgLysProAlaAla-44  
 51-GlyGlyGluSerProProSer-57  
 59-GlyAspTyrGluIleProLeu-65  
 67-AspGlyAsnArgSerValArgAlaAsnGluTyrGluSerAlaGln-81  
 88-LysIleGlyLysPheGluAlaCys-95  
 99-TrpArgThrArgAspGlyLysProLeu-107  
 117-AspCysLeuGluLysGlnGlyLeuArgArgAsnGlyLeuSerGluArgValArgTrp-135  
 529

**AMPHI Regions - AMPHI**

11-LeuAlaLeuIleGlyLeuAlaAlaCysSer-20  
 35-SerHisArgLeuIle-39  
 49-AsnProAspGlnGlyAsnLeuTyrArgLeuProAla-60  
 79-GlnGlnProAlaAspAlaGluValLeuLysSerValLysGlyValArg-94  
 152-GlnAspSerLeuArgArgLeuPheAsp-160  
 196-AlaMetLysGluVal-200  
 223-AlaPheLeuThrArgPheMetGlnTyrLeu-232  
 252-AlaAsnGluMetAla-256  
 270-GlyArgAsnTrpArgArgThrVal-277

**Antigenic Index - Jameson-Wolf**

19-CysSerGlySerLysThrGluGlnProLysLeuAspTyrGlnSerArgSerHisArgLeuIleLys-40  
 42-GluValProProAspLeuAsnAsnProAspGlnGlyAsnLeuTyr-56  
 60-AlaGlySerGlyAlaValArgAlaSerAspLeuGluLysArgArgThrProAlaVal-78  
 80-GlnProAlaAspAlaGluValLeuLysSerValLysGlyValArgLeuGluArgAspGlySerGln-101  
 105-ValValAspGlyLysSerProAlaGlu-113  
 123-GlnGluAsnGlyPheAspIleLysSerGluGluProAla-135  
 139-MetGluThrGluTrpAlaGluAsnArgAlaLysIleProGlnAspSerLeuArgArgLeuPheAsp-160  
 169-SerThrGlyGluArgAspLysPheIleValArgIleGluGlnGlyLysAsnGlyValSer-188  
 195-LysAlaMetLysGluValTyrGlyGlyLysAspLysAspThrThr-209  
 212-GlnProSerProSerAspProAsnLeu-220  
 233-GlyValAspGlyGlnGlnAlaGluAsnAlaSerAlaLysLysProThrLeu-249  
 253-AsnGluMetAlaArgIleGluGlyLysSer-262  
 268-AspTyrGlyArgAsnTrpArgArgThrVal-277  
 289-GlyGlnAsnThrGluArgHisAla-296  
 300-GlnLysAlaProAsnGluSerAsnAlaValThrGluGlnLysProGlyLeu-316  
 320-LeuLeuGlyLysGlyLysAlaGluLysProAlaGluGlnProGlu-334  
 342-ValAlaAsnGlySerArg-347  
 350-LeuLeuAsnLysAspGlySerAlaTyrAlaGlyLysAspAlaSer-364  
 370-LeuHisSerGluLeuArg-375

**Hydrophilic Regions - Hopp-Woods**

20-SerGlySerLysThrGluGlnProLysLeuAspTyrGlnSerArgSerHisArgLeuIleLys-40  
 42-GluValProProAspLeuAsnAsnProAspGln-52  
 63-GlyAlaValArgAlaSerAspLeuGluLysArgArgThrProAla-77

-168-

80-GlnProAlaAspAlaGluValLeuLysSerValLysGlyValArgLeuGluArgAspGlySerGln-101  
 107-AspGlyLysSerProAla-112  
 125-AsnGlyPheAspIleLysSerGluGluProAla-135  
 139-MetGluThrGluTrpAlaGluAsnArgAlaLysIleProGlnAspSerLeuArgArgLeuPheAsp-160  
 170-ThrGlyGluArgAspLysPheIleVal-178  
 180-IleGluGlnGlyLysAsnGlyVal-187  
 195-LysAlaMetLysGluValTyrGlyGlyLysAspLysAspThrThr-209  
 214-SerProSerAspProAsnLeu-220  
 235-AspGlyGlnGlnAlaGluAsnAlaSerAlaLysLysProThr-248  
 253-AsnGluMetAlaArgIleGluGlyLysSer-262  
 269-TyrGlyArgAsnTrpArg-274  
 291-AsnThrGluArgHis-295  
 302-AlaProAsnGluSerAsnAlaValThrGluGlnLysProGlyLeu-316  
 320-LeuLeuGlyLysGlyLysAlaGluLysProAlaGluGlnProGlu-334  
 352-AsnLysAspGlySer-356  
 359-AlaGlyLysAspAlaSer-364  
 370-LeuHisSerGluLeuArg-375  
 531

**AMPHI Regions - AMPHI**

59-SerLeuAlaGlyIleLeuAlaAspTyrValAlaGlyIleTrpGlyThr-74  
 90-GlySerIleIleGlyIlePhePheSerLeuProGlyLeuIleLeuGly-105  
 108-IleGlyAlaAlaAlaGly-113  
 132-LeuLeuGlyLeuValVal-137

**Antigenic Index - Jameson-Wolf**

74-ThrLysTyrThrGlyAlaGlyLysLeuAlaVal-84  
 114-GluLeuIleGluArgArgAsnMet-121

**Hydrophilic Regions - Hopp-Woods**

114-GluLeuIleGluArgArgAsnMet-121  
 532

**AMPHI Regions - AMPHI**

6-GlyLysGlyAlaAsp-10  
 27-AlaLeuLeuSerAlaValThrHisLeuLeuAlaIlePheValProMetIleThr-44  
 76-TyrLeuGlnValAsnArgPheGlyPro-84  
 122-SerThrLeuLeuGly-126  
 147-LysValIleThrProThrVal-153  
 184-ThrPheGlySerMetGluAsnLeuGly-192  
 206-CysMetLysAsnPro-210  
 224-GlyTyrIleValAlaLeu-229  
 236-PheSerAlaLeuGlnAsnLeuPro-243  
 271-LeuSerValPheGluAlaValGlyAspLeuThrAla-282  
 297-ThrLysArgLeuArgGlyGlyVal-304  
 307-AspGlyLeuValSerValIleAlaThrAlaLeuGly-318  
 338-AlaSerArgHisValGlyLysTyr-345  
 361-ArgAlaPheThrThrIleProSerProVal-370

**Antigenic Index - Jameson-Wolf**

1-MetSerGlyGlnLeuGlyLysGlyAlaAspAlaPro-12  
 18-LeuGluAspArgProProPheGlyAsn-26  
 80-AsnArgPheGlyPro-84  
 108-AlaGlyMetLysGluGlyGlyLeuThrLysAspAlaMet-120  
 177-PheGlyAlaLysAlaAspGlyThrPheGlySer-187  
 207-MetLysAsnProLeuLeuArg-213  
 286-ValSerAspGlnProIleGluGlyGluGluTyrThrLysArgLeuArgGlyGlyValLeu-305

-169-

391-ValSerHisGlyIleArgArgArgGluAlaVal-401

445-LeuProGluAspLysThrGluAlaAlaValLysPheAspThrAspHisLeuGluHis-463

**Hydrophilic Regions - Hopp-Woods**

4-GlnLeuGlyLysGlyAlaAspAlaPro-12

18-LeuGluAspArgProProPhe-24

109-GlyMetLysGluGlyGlyLeuThrLysAspAlaMet-120

179-AlaLysAlaAspGly-183

289-GlnProIleGluGlyGluGluTyrThrLysArgLeuArgGly-302

394-GlyIleArgArgArgGluAlaVal-401

445-LeuProGluAspLysThrGluAlaAlaValLysPheAspThrAspHisLeuGluHis-463

537-2

**AMPHI Regions - AMPHI**

38-GlnIleArgAspGlyGlyAspAlaLeuHisTyrLeuAsnArgIle-52

86-HisGlyGluHisHis-90

109-GlyTyrLeuTyrAsnGlyValHisGlu-117

138-ArgGlnValAspGlyLeuMetSerAlaIleTyr-148

182-ArgPheGluArgHisCys-187

194ProGluAlaGlyArgLysTyrTyrArgAsnAla-204

281-ArgProValArgValLeuThrAlaGly-289

315-TyrThrAlaValPheAspTyrValArgAsnGlyArgArgAla-328

**Antigenic Index - Jameson-Wolf**

21-ThrGlnAsnGlnSerLeuProAlaGly-29

32-ValTyrProSerAlaProGlnIleArgAspGlyGlyAspAla-45

69-AsnSerAlaArgArgHisAlaSer-76

80-LeuAsnProGluAspGlyHisGlyGluHisHisProAspAsnProHis-95

99-GlnLysLeuThrGluArgThrArgLeu-107

115-ValHisGluAsnIleSerThrGluGluGluAlaAlaGluSerSerAspSerAspIleArgThrGlnGlnArg  
GlnValAspGlyLeu-143

152-SerLeuLeuAspArgHisThrAspGluAlaGly-162

165-PheValArgGluAsnGlyLysThr-172

178-GlnGlyAsnGlyArgPheGluArgHisCysAlaGlnGlyArgAsnGlnProGluAlaGlyArgLysTyrTyr  
ArgAsnAlaCysHisAsnGly-208

212-TyrThrAspGluAlaMetPro-218

237-PheHisGlyGluArgProAspProValProGluTyrGluIleThrGlyAsnProAlaSer-256

258-AspPheSerGluAlaAlaGly-264

266-IleThrMetLysSer-270

274-TyrGlnGlyLysAsnGluIleArgPro-282

287-ThrAlaGlyAsnAspProAsnGlyArgLeuThr-297

320-AspTyrValArgAsnGlyArgArgAlaGlnAla-330

334-PheArgThrArgLysProAspTyrProTyr-343

345-GluValAsnGlyGlyGluThrLeuAlaValArgLysGlyGluLys-359

364-TrpArgGlyArgTrpCysLeu-370

376-TyrThrTyrArgGlnArgProGlySerArgLeuSerIleGlyArgHisGluAlaGlyGly-395

401-AspGlyMetAlaGlySer-406

408-IleThrLeuAlaProGluGlyGluThrGluArgGly-419

**Hydrophilic Regions - Hopp-Woods**

37-ProGlnIleArgAspGlyGlyAsp-44

69-AsnSerAlaArgArgHisAla-75

81-AsnProGluAspGlyHisGlyGluHisHisProAsp-92

100-LysLeuThrGluArgThrArgLeu-107

119-IleSerThrGluGluGluAlaAlaGluSerSerAspSerAspIleArgThrGlnGlnArgGlnValAsp-14

1

-170-

152-SerLeuLeuAspArgHisThrAspGluAlaGly-162  
 165-PheValArgGluAsnGlyLys-171  
 179-GlyAsnGlyArgPheGluArgHisCysAlaGlnGlyArgAsnGlnProGluAlaGlyArgLysTyrTyrArg  
 -202  
 238-HisGlyGluArgProAspProValProGlu-247  
 258-AspPheSerGluAlaAlaGly-264  
 266-IleThrMetLysSer-270  
 275-GlnGlyLysAsnGluIleArgPro-282  
 289-GlyAsnAspProAsnGlyArg-295  
 323-ArgAsnGlyArgArgAlaGlnAla-330  
 334PheArgThrArgLysProAsp-340  
 352-LeuAlaValArgLysGlyGluLys-359  
 377-ThrTyrArgGlnArgProGlySer-384  
 387-SerIleGlyArgHisGluAla-393  
 412-ProGluGlyGluThrGluArgGly-419  
 538-2

**AMPHI Regions - AMPHI**

42-ThrAlaLeuAlaGluAlaValGluLeuValLysAlaAlaGly-55  
 79-LysAlaAlaGluLeuSerGluAlaValAla-88  
 145-GlnLeuSerHisLeuAlaGlyArgLeuIleArgGlyTyrGlyHisLeuGln-161  
 188-IleAsnAlaLeuLysLysGlnLeuAla-196  
 211-SerGlyThrIleLysThrPheAlaLeuValGlyTyrThrAsn-224  
 231-PheAsnArgLeuThrLys-236  
 271-GlyPheValSerAspLeuProHisLysLeuIleSerAlaPheSerAlaThrLeuGlu-289  
 307-AsnSerGlyGlnGlnIleGluAspValGluAsnValLeuGlnGluIleHis-323  
 365-GluAsnThrGlyIleAspAlaLeuArgGluAlaIleAlaGluSerCysAla-381

**Antigenic Index - Jameson-Wolf**

1-MetThrGlyArgThrGlyGlyAsnGlySerThrGlnAlaGlnProGluArg-17  
 24-MetLeuAspLysAspGlyThrGlySerSerAlaAlaArg-36  
 48-ValGluLeuValLys-52  
 54-AlaGlyGlyAspSerValArgValGluThrAlaLysArgAspArgProHisThr-71  
 77-ThrGlyLysAlaAlaGluLeuSerGlu-85  
 100-GluLeuThrProThrGlnGluArgAsnLeuGluLysGluLeuLysCysArgValLeuAsp-119  
 129-AlaArgArgAlaArgThrGlnGluGlyArgLeuGlnVal-141  
 161-GlnSerGlnArgGlyGlyIleGlyMetLysGlyProGlyGluThrLysLeuGluThrAspArgArgLeuIle  
 -184  
 189-AsnAlaLeuLysLysGlnLeuAlaAsnLeuLysLysGlnArgAlaLeuArgArgLysSerArgGluSerGly  
 ThrIleLysThr-216  
 224-AsnValGlyLysSerSerLeu-230  
 233-ArgLeuThrLysSerGlyIleTyrAla-241  
 257-TyrIleSerProGluCys-262  
 287-ThrLeuGluGluThrAlaGln-293  
 304-AlaAlaProAsnSerGlyGlnGlnIleGluAspValGluAsnValLeu-319  
 323-HisAlaGlyAspIlePro-328  
 333-TyrAsnLysThrAspLeuLeuProSerGluGluGlnAsnThrGlyIle-348  
 365-GluAsnThrGlyIleAspAlaLeuArgGluAlaIleAla-377  
 380-CysAlaAlaAlaProAsnThrAspGluThrGluMetPro-392

**Hydrophilic Regions - Hopp-Woods**

1-MetThrGlyArgThrGlyGly-7  
 13-AlaGlnProGluArg-17  
 25-LeuAspLysAspGlyThrGly-31  
 48-ValGluLeuValLys-52  
 54-AlaGlyGlyAspSerValArgValGluThrAlaLysArgAspArgProHis-70

-171-

78-GlyLysAlaAlaGluLeuSerGlu-85  
 101-LeuThrProThrGlnGluArgAsnLeuGluLysGluLeuLysCysArgValLeuAsp-119  
 129-AlaArgArgAlaArgThrGlnGluGlyArgLeuGlnVal-141  
 161-GlnSerGlnArgGlyGlyIle-167  
 171-GlyProGlyGluThrLysLeuGluThrAspArgArgLeuIle-184  
 189-AsnAlaLeuLysLysGlnLeuAlaAsnLeuLysLysGlnArgAlaLeuArgArgLysSerArgGluSerGly  
 Thr-213  
 287-ThrLeuGluGluThrAlaGln-293  
 310-GlnGlnIleGluAspValGluAsnValLeu-319  
 337-AspLeuLeuProSerGluGluGlnAsn-345  
 370-AspAlaLeuArgGluAlaIleAla-377  
 384-ProAsnThrAspGluThrGluMetPro-392  
 539-2

**AMPHI Regions - AMPHI**

18-ArgGlnArgGluHisHisArgLeu-25  
 44-LeuValGlyGlyPheAspPheLeuArgValIleGlyCysGlyGlyValAlaTyrLeuProAspPheGlnGln-  
 67

**Antigenic Index - Jameson-Wolf**

1-MetGluAspLeuGlnGluIleGly-8  
 15-LysValGlyArgGlnArgGluHisHisArgLeuHisHisProGlnProGlyAsnGlyGluAlaAspAsp-37  
 63-ProAspPheGlnGlnAsnValGlyLysAlaAsp-73  
 77-ValProAspAspAlaAlaAla-83  
 88-IleGluValAspAlaAspAspAlaValCys-97  
 102-LeuPheAspGlnProAspAlaGlyGlyAlaGlyAspAlaAlaGluHis-117

**Hydrophilic Regions - Hopp-Woods**

1-MetGluAspLeuGlnGluIleGly-8  
 15-LysValGlyArgGlnArgGluHisHisArg-24  
 31-GlyAsnGlyGluAlaAspAsp-37  
 69-ValGlyLysAlaAsp-73  
 78-ProAspAspAlaAlaAla-83  
 88-IleGluValAspAlaAspAspAlaValCys-97  
 102-LeuPheAspGlnProAspAlaGlyGlyAlaGlyAspAlaAlaGluHis-117  
 542-2

**AMPHI Regions - AMPHI**

6-ArgIleArgArgCysSerVal-12

**Antigenic Index - Jameson-Wolf**

1-MetProLysTrpSerArgIleArgArgCysSerVal-12  
 37-ValArgLeuLysSerSerAspGlyIleAlaSer-47  
 56-GlyProMetProSerGluThrValSerHisLysSerAspSerSerArgAsnThrSerAlaSerArgArgAsnV  
 alSerProLysCysProPhe-86  
 90-PheArgGlnAspAlaAlaLysProArgArgPheGlyGlyLys-103  
 107-LeuThrGlySerArg-111

**Hydrophilic Regions - Hopp-Woods**

5-SerArgIleArgArgCysSer-11  
 37-ValArgLeuLysSerSerAspGlyIleAla-46  
 58-MetProSerGluThrValSerHisLysSerAspSerSerArgAsnThrSerAlaSerArgArgAsnValSerP  
 ro-82  
 90-PheArgGlnAspAlaAlaLysProArgArgPheGlyGly-102  
 544-2

**AMPHI Regions - AMPHI**

11-AlaLeuIleGlyIleLeu-16

-172-

55-PheTrpPheProSerCysProGlyCysValSerGluMetProLysIleIleLysThrAla-74  
 85-LeuAlaValAlaGlnProIleAspProIleGluSerValArgGlnTyrVal-101  
 116-LysAlaValGlyGlnAlaPhe-122

**Antigenic Index - Jameson-Wolf**

1-MetLysLysIleLeu-5  
 22-IleProAspSerLysThrAlaPro-29  
 35-AspLeuHisGlyLysThrValSerAsnAlaAspLeuGlnGly-48  
 59-SerCysProGlyCys-63  
 66-GluMetProLysIleIleLysThrAlaAsnAspTyrLysAsnLysAsnPhe-82  
 90-ProIleAspProIleGluSerValArgGlnTyrValLysAspTyrGly-105  
 113-AspAlaAspLysAlaVal-118  
 133-IleGlyLysLysGlyGluIleLeu-140  
 144-ValGlyGluProAspPheGlyLysLeuTyrGlnGluIleAspThrAlaTrpArgAsnSerAspAlaVal-166  
 6

**Hydrophilic Regions - Hopp-Woods**

1-MetLysLysIleLeu-5  
 23-ProAspSerLysThr-27  
 66-GluMetProLysIleIleLysThrAlaAsnAspTyrLysAsnLysAsn-81  
 92-AspProIleGluSerValArgGlnTyrValLys-102  
 113-AspAlaAspLysAlaVal-118  
 133-IleGlyLysLysGlyGluIle-139  
 156-IleAspThrAlaTrpArgAsnSerAspAlaVal-166  
 547-2

**AMPHI Regions - AMPHI**

7-PheAsnLysThrValAlaSerPheAlaGlnIleValGluThrPheAspVal-23  
 62-AsnArgSerPheLys-66  
 105-LeuHisIlePheThrAsnIle-111  
 121-GluLeuLeuThrIleLeuValLys-128

**Antigenic Index - Jameson-Wolf**

3-ValAspAsnGlyPheAsnLysThrVal-11  
 35-GlnMetLysGlnArgCysGly-41  
 53-PheProArgCysGlyPheGluIleProAsnArgSerPheLysGlu-67  
 76-LeuSerGluArgPheArgThrAsnAlaGluValGluMet-88  
 129-AsnLeuSerProAsnGlyLysLysArgPhe-138

**Hydrophilic Regions - Hopp-Woods**

36-MetLysGlnArgCys-40  
 60-IleProAsnArgSerPheLysGlu-67  
 76-LeuSerGluArgPheArgThrAsnAlaGluValGluMet-88  
 130-LeuSerProAsnGlyLysLysArgPhe-138  
 548-2 (from 23)

**AMPHI Regions - AMPHI**

14-ValLeuAlaAlaLeuAlaAlaCysLys-22  
 39-SerAlaAlaGluAsnAlaAlaLysPro-47  
 89-PheThrHisCysProAspValCysProThr-98  
 103-TyrSerAspThrLeuLysGlnLeuGlyGlyGln-113  
 132-GluIleIleGlyLysTyrAlaLys-139

**Antigenic Index - Jameson-Wolf**

21-CysLysProGlnAspAsnSerAlaAla-29  
 39-SerAlaAlaGluAsnAlaAlaLysProGlnThrArgGlyThrAspMetArgLysGluAspIleGlyGlyAspPheThrLeuThrAspGlyGlyGlyLysProPheAsn-74  
 76-SerAspLeuLysGly-80

-173-

91-HisCysProAspValCysPro-97  
 104-SerAspThrLeuLysGlnLeuGlyGlyGlnAlaLysAspValLys-118  
 124-IleAspProGluArgAspThrProGluIleIleGlyLysTyrAlaLysGlnPheAsnProAspPhe-145  
 150-AlaThrGlyGlyGln-154  
 169-LysValAsnGlnLysAspAspSerGluAsnTyrLeu-180  
 189-LeuIleAspLysAsnGlyGlu-195  
 200-SerProTyrGlySerGluProGluThrIleAlaAlaAspVal-213

**Hydrophilic Regions - Hopp-Woods**

22-LysProGlnAspAsnSerAla-28  
 39-SerAlaAlaGluAsnAlaAlaLysProGlnThrArgGlyThrAspMetArgLysGluAspIleGlyGly-61  
 64-ThrLeuThrAspGlyGluGlyLysPro-72  
 76-SerAspLeuLysGly-80  
 111-GlyGlyGlnAlaLysAspValLys-118  
 124-IleAspProGluArgAspThrProGluIleIle-134  
 169-LysValAsnGlnLysAspAspSerGluAsnTyrLeu-180  
 191-AspLysAsnGlyGlu-195  
 203-GlySerGluProGluThrIleAlaAlaAspVal-213  
 548-2 (from earlier--to be deleted)

**AMPHI Regions - AMPHI**

14-ValLeuAlaAlaLeuAlaAlaCysLys-22  
 39-SerAlaAlaGluAsnAlaAlaLysPro-47  
 89-PheThrHisCysProAspValCysProThr-98  
 103-TyrSerAspThrLeuLysGlnLeuGlyGlyGln-113  
 132-GluIleIleGlyLysTyrAlaLys-139

**Antigenic Index - Jameson-Wolf**

21-CysLysProGlnAspAsnSerAlaAla-29  
 39-SerAlaAlaGluAsnAlaAlaLysProGlnThrArgGlyThrAspMetArgLysGluAspIleGlyGlyAspPheThrLeuThrAspGlyGluGlyLysProPheAsn-74  
 76-SerAspLeuLysGly-80  
 91-HisCysProAspValCysPro-97  
 104-SerAspThrLeuLysGlnLeuGlyGlyGlnAlaLysAspValLys-118  
 124-IleAspProGluArgAspThrProGluIleIleGlyLysTyrAlaLysGlnPheAsnProAspPhe-145  
 150-AlaThrGlyGlyGln-154  
 169-LysValAsnGlnLysAspAspSerGluAsnTyrLeu-180  
 189-LeuIleAspLysAsnGlyGlu-195  
 200-SerProTyrGlySerGluProGluThrIleAlaAlaAspVal-213

**Hydrophilic Regions - Hopp-Woods**

22-LysProGlnAspAsnSerAla-28  
 39-SerAlaAlaGluAsnAlaAlaLysProGlnThrArgGlyThrAspMetArgLysGluAspIleGlyGly-61  
 64-ThrLeuThrAspGlyGluGlyLysPro-72  
 76-SerAspLeuLysGly-80  
 111-GlyGlyGlnAlaLysAspValLys-118  
 124-IleAspProGluArgAspThrProGluIleIle-134  
 169-LysValAsnGlnLysAspAspSerGluAsnTyrLeu-180  
 191-AspLysAsnGlyGlu-195  
 203-GlySerGluProGluThrIleAlaAlaAspVal-213  
 552-1

**AMPHI Regions - AMPHI**

18-CysThrAsnAlaPheAlaAlaPro-25  
 29-AlaSerLeuAlaArgTrpLeuAspThr-37  
 41-AspArgAspIleGluLysAsnMetIleGluGlyPheAsnAlaGlyPheLysProTyrAlaAspLysAlaLeuAlaGluMet-67

-174-

75-AlaAlaGluAlaPheAsnArgTyrArgGluAsnVal-86  
 89-AspLeuIleThrProGluValLys-96  
 116-IleAspGlyMetIleAla-121  
 139-IleLysLysSerMetSerGluIle-146  
 154-SerGlyLysIleAlaGlnHisHisLeuProGluPheThrGluGluLeuArgArg-171

**Antigenic Index - Jameson-Wolf**

25-ProProSerAspAlaSerLeu-31  
 35-LeuAspThrGlnAsnPheAspArgAspIleGluLysAsnMetIle-49  
 58-ProTyrAlaAspLysAlaLeuAlaGluMetProGluAlaLysLysAspGlnAlaAla-76  
 78-AlaPheAsnArgTyrArgGluAsnValLeu-87  
 90-LeuIleThrProGluValLysGlnAlaVal-99  
 105-LysAsnAlaArgGluIleTyrThrGlnGluGluIleAspGly-118  
 131-ValValAlaLysAsnProArgLeuIleLysLysSerMetSer-144  
 153-LeuSerGlyLysIle-157  
 164-GluPheThrGluGluLeuArgArg-171  
 173-IleCysGlyGlyLysAsnProAspAlaGlyCysLysGlnAlaGlyGlnValGlyLysArgHisGlnLys-195  
 5

**Hydrophilic Regions - Hopp-Woods**

26-ProSerAspAlaSerLeu-31  
 38-GlnAsnPheAspArgAspIleGluLysAsnMetIle-49  
 58-ProTyrAlaAspLysAlaLeuAlaGluMetProGluAlaLysLysAspGlnAlaAla-76  
 78-AlaPheAsnArgTyrArgGluAsnValLeu-87  
 90-LeuIleThrProGluValLysGlnAlaVal-99  
 105-LysAsnAlaArgGluIleTyrThr-112  
 114-GluGluIleAspGly-118  
 131-ValValAlaLysAsnProArgLeuIleLysLysSerMetSer-144  
 164-GluPheThrGluGluLeuArgArg-171  
 176-GlyLysAsnProAspAlaGlyCysLysGlnAlaGlyGlnValGlyLysArgHisGlnLys-195  
 553-2

**AMPHI Regions - AMPHI**

31-LeuThrSerIleLeuSerTyrTyrGly-39  
 59-AsnLeuAlaAspIleMetArgPheGlyAsn-68  
 83-GluLeuSerAsnLeu-87

**Antigenic Index - Jameson-Wolf**

10-GlyPheAsnLysLysLeuPro-16  
 42-ThrAspLeuArgThrLeuArgGlnLysTyr-51  
 56-LysGlyAlaAsnLeu-60  
 65-ArgPheGlyAsnGluMetAsnLeuThrProArgAlaLeuArgLeuGluLeuAspGluLeuSerAsn-86  
 105-SerIleSerLysAspSerIle-111  
 116-ProAlaValGlyMetArgLysIleLysMetAspGluValSerGlnLys-131  
 143-ThrHisPheGluGluLysLysGluThrLysLysIleLys-155  
 160-LeuArgGlyGlyGlnAla-165

**Hydrophilic Regions - Hopp-Woods**

42-ThrAspLeuArgThrLeuArgGln-49  
 75-ArgAlaLeuArgLeuGluLeuAspGluLeuSer-85  
 106-IleSerLysAspSer-110  
 118-ValGlyMetArgLysIleLysMetAspGluValSerGln-130  
 144-HisPheGluGluLysLysGluThrLysLysIleLys-155

554

**AMPHI Regions - AMPHI**

35-AlaProThrPheGlnThrProGluThrLeu-44

-175-

71-AlaAlaLeuThrGlnLeuMet-77  
 110-ArgMetPheValArgProGlyAspThrVal-119  
 124-LeuLeuLysGlyMet-128  
 148-SerIleGluAsnPheValGlnGlnMetAsnLysGlu-159  
 193-GluAlaLeuMetArgAspPheProGluTyrTyrProLeuPheSer-207  
 296-ThrValAlaGlnIle-300  
 331-GluGlnIleLeuGluThrIleGlnProIleProAla-342

**Antigenic Index - Jameson-Wolf**

24-SerProAlaProAsnArgProThrVal-32  
 37-ThrPheGlnThrProGluThr-43  
 53-LeuGlnSerLysGln-57  
 61-AlaLysAsnIleAsnThrProValGlu-69  
 84-LysAsnMetLysSerGlyAsnIleGlnSerGluGluAsnLeuLysIleProGlu-101  
 104-TrpAlaSerGluGlySerArgMetPheValArgProGlyAspThrValSerThrAspLysLeuLeu-125  
 143-ArgLeuGlyAsnGlySerIleGluAsnPhe-152  
 156-MetAsnLysGluAlaArgArgLeuGlyMetLysAsnThrValPheLysAsnProThrGlyLeuSerArgGlu  
 GlyGlnValSerThrAlaLysAsp-187  
 194-AlaLeuMetArgAspPheProGluTyrTyr-203  
 214-LysAsnIleGluGlnAsnAsnArgAsnIleLeu-224  
 226-TyrArgAspAsnAsnValAsnGlyLeuLysAlaGlyHisThrGluSerGlyGlyTyrAsn-245  
 250-TyrSerGlyAsnGlyArgHis-256  
 262-LeuGlySerGluSerAlaGluThrArgAlaSerAspAsnSerLys-276  
 285-PheAspThrProLysIleTyrProLysGlyLysThr-296  
 302-IleSerGlyGlySerLysLysThrValArg-311  
 323-ProHisLysGluAlaLysMetAlaGluGlnIleLeu-334  
 342-AlaProValLysLysGlyGlnIleLeuGlyLysIleLysIleArgGlnAsnGlyTyr-360  
 362-IleAlaGluLysGluIleValAla-369  
 371-GluAsnValLysLysArgSerArgTrpGlnArg-381

**Hydrophilic Regions - Hopp-Woods**

26-AlaProAsnArgProThr-31  
 85-AsnMetLysSerGlyAsnIleGlnSerGluGluAsnLeuLysIleProGlu-101  
 107-GluGlySerArgMetPheValArgProGlyAspThrValSerThrAspLysLeuLeu-125  
 156-MetAsnLysGluAlaArgArgLeuGlyMet-165  
 174-ThrGlyLeuSerArgGluGlyGlnValSerThrAlaLysAsp-187  
 214-LysAsnIleGluGlnAsnAsnArg-221  
 227-ArgAspAsnAsnValAsn-232  
 237-GlyHisThrGluSerGly-242  
 264-SerGluSerAlaGluThrArgAlaSerAspAsnSerLys-276  
 289-LysIleTyrProLysGlyLysThr-296  
 304-GlyGlySerLysLysThrValArg-311  
 323-ProHisLysGluAlaLysMetAlaGluGlnIleLeu-334  
 343-ProValLysLysGlyGlnIle-349  
 353-IleLysIleArgGln-357  
 362-IleAlaGluLysGluIleValAla-369  
 371-GluAsnValLysLysArgSerArgTrp-379

556

**AMPHI Regions - AMPHI**

61-IleGluArgLeuLys-65

**Antigenic Index - Jameson-Wolf**

1-MetAspAsnLysThrLysLeuArgLeu-9  
 52-ThrSerArgArgGlnGlnArgGlnPheIleGluArgLeuLysLysPheAspIleAspProGluLysGlyArgI  
 leAsnGluAlaAsnLeuArgArgMetTyrHisSerGlyGlyGlnHisGlnLysAspAla-95

-176-

102-SerGlnLysCysSerValAspGluAlaHisAlaMetPheLysLysArgProThrArgGlnGluIleAsn-124

127-AlaAlaLysGlnSerArgGlyGlnLysArgProHisArg-139

#### Hydrophilic Regions - Hopp-Woods

1-MetAspAsnLysThrLysLeuArgLeu-9

53-SerArgArgGlnGlnArgGlnPheIleGluArgLeuLysLysPheAspIleAspProGluLysGlyArgIleAsnGluAlaAsnLeuArgArgMetTyr-85

90-GlnHisGlnLysAspAla-95

105-CysSerValAspGluAlaHisAlaMetPheLysLysArgProThrArgGlnGluIleAsn-124

127-AlaAlaLysGlnSerArgGlyGlnLysArgProHisArg-139

557

#### AMPHI Regions - AMPHI

22-GlyAlaAspGlyIle-26

55-SerGlyArgValAspAspAlaAla-62

#### Antigenic Index - Jameson-Wolf

20-LeuLysGlyAlaAspGlyIleSerProProLeuThrTyrArgSerTrpHisIleGluGlyGlyGlnAlaLeuArg-44

54-AlaSerGlyArgValAspAspAlaAlaGly-63

68-LeuArgIleAspSerValSerGlnAsnLysGluThrTyrThr-81

100-GlnValLeuLysArgGlyGluProValGlyLysProMet-112

123-AlaAspAsnGluIleLeuGlyLysGlnGluGluGluAla-135

141-MetArgGlnAspAlaAlaGluGlnIleValArg-151

#### Hydrophilic Regions - Hopp-Woods

21-LysGlyAlaAspGlyIle-26

56-GlyArgValAspAspAlaAlaGly-63

68-LeuArgIleAspSerValSerGlnAsnLysGluThrTyrThr-81

100-GlnValLeuLysArgGlyGluProValGly-109

126-GluIleLeuGlyLysGlnGluGluGluAla-135

141-MetArgGlnAspAlaAlaGluGlnIleValArg-151

560

#### AMPHI Regions - AMPHI

30-PheArgAspGlyAlaHisLysMetAlaArgValTrpValGly-43

167-ArgMetAlaLysMetPhe-172

192-PheLeuLysTyrProGlyGlu-198

216-GluLeuMetGluLysCysGluHisLeuIleGlu-226

#### Antigenic Index - Jameson-Wolf

29-ProPheArgAspGlyAlaHisLysMet-37

61-GlyAlaGluAsnIleProAspArgProAla-70

76-HisGlnSerGlyTrpGlu-81

95-ValAlaLysArgGluLeuPhe-101

116-IleGlyIleAspArgAsnAsnArgArgGluAlaAsnGluGlnLeuIle-131

134-GlyLeuValArgLysAsnGluGlyTyr-142

148-ProGluGlyThrArgLeuAlaProGlyLysArgGlyLysTyrLysLeuGlyGly-165

182-AsnSerGlyGluPheTrpProLysAsnSerPheLeuLysTyrProGlyGluIle-199

209-HisAlaSerGlySerGluAlaGluLeuMetGluLysCysGluHisLeuIle-225

242-MetProSerGluThrAla-247

#### Hydrophilic Regions - Hopp-Woods

29-ProPheArgAspGlyAlaHisLysMet-37

64-AsnIleProAspArgProAla-70

95-ValAlaLysArgGluLeuPhe-101

-177-

116-IleGlyIleAspArgAsnAsnArgArgGluAlaAsnGluGlnLeuIle-131  
 134-GlyLeuValArgLysAsnGlu-140  
 149-GluGlyThrArgLeuAlaProGlyLysArgGlyLysTyrLysLeuGlyGly-165  
 211-SerGlySerGluAlaGluLeuMetGluLysCysGluHisLeuIle-225  
 242-MetProSerGluThrAla-247

561

**AMPHI Regions - AMPHI**

22-GlyLeuTrpValGlyLeuAlaAla-29  
 46-AlaSerValIleGluGluAlaGlyAsn-54  
 79-ValAlaGluPheGluLysSerLeuLysArgIleAlaGln-91  
 128-SerTyrArgArgProThrGlnVal-135  
 172-MetThrLeuValSerSer-177  
 188-ValIleArgProLeuGlnAlaLeuArgGluGlyAlaGluArgIleGlyArgArgCysPheAspIle-209  
 219-PheLysGlnValGlyArgCysPheAsnGlnMet-229  
 238-AspAspLeuGluGlyGlnValAlaGluGlnThrArgSerLeuGluLysGln-254  
 265-ThrArgAspLeuHisGlnSer-271  
 275-GlnGlnAlaAlaGluHisPhe-281

283-AsnArgIleLeuPro-287  
 317-AlaSerAspLeuGlyLysTyrHisGlu-325  
 339-ArgLeuLeuLeuSerPheProAsnGly-347  
 358-LeuGlnThrLeuGlyArgGlnLeuGly-366  
 392-GlnGlyLeuHisAspSerIleAlaGlnAlaLeuThr-403  
 434-GlyValGlnGluCysTyrGluAspValArgGluLeu-445  
 456-LysGluPheProGluAlaValAlaAspLeuPheAlaArgPhe-469  
 504-LeuSerAsnIleArgLysHisAlaArg-512  
 540-ThrGluLysIleGlyGluProThr-547

**Antigenic Index - Jameson-Wolf**

6-ArgPheSerAspGlyIleSer-12  
 48-ValIleGluGluAlaGlyAsn-54  
 66-AlaGlyGluGlySerProArgAlaGlnIleAspAsnGlnValAlaGluPheGluLysSerLeuLysArgIleAlaGlnSerAspAlaIleHisPro-97

99-IleProSerAspThrProLeu-105  
 124-ProProLeuGlnSerTyrArgArgProThrGlnValAspLeu-137  
 152-GluAsnAlaAsnGluLysAsnThr-159  
 193-GlnAlaLeuArgGluGlyAlaGluArgIleGlyArgArgCysPheAsp-208

210-ProValProGluGlyGlyThrProGluPheLysGlnValGlyArgCysPheAsnGlnMetGlyGlyArgLeuLysIleLeuTyrAspAspLeuGluGlyGlnValAlaGluGlnThrArgSerLeuGluLysGlnAsnGlnAsnLeu-258  
 263-GlnThrThrArgAspLeuHisGlnSerTyrIle-273  
 289-ValGlyAlaAspSerGlyArgValCysLeuAspGlyGlySerAsp-303  
 310-HisAlaAspCysGlyThrAlaAlaSerAspLeuGlyLysTyrHisGlu-325  
 332-TyrGlnAsnGluThrLeuGly-338  
 344-PheProAsnGlyIleSerLeuAspGluAspAspArgIleLeu-357  
 360-ThrLeuGlyArgGlnLeu-365  
 371-GlyAlaLysGlnGluGluGluLysArgLeu-380  
 384-LeuGlnGluArgAsnLeu-389  
 394-LeuHisAspSerIle-398  
 415-AlaPheAlaGluAsnLysArgGluGluAlaAlaGlu-426  
 434-GlyValGlnGluCysTyrGluAspValArgGlu-444  
 450-ArgThrLysIleSerAsnLysGluPheProGluAlaVal-462  
 480-AlaTrpGluAsnGlySer-485

-178-

488-ProProGlnGluAla-492  
 503-SerLeuSerAsnIleArgLysHisAlaArg-512  
 519-ThrLeuSerGluHisGlyGlyArgPhe-527  
 531-IleGlnAspAsnGlyGlnGlyPheAspThrGluLysIleGlyGluProThrGlySerHis-550  
 556-MetGlnGluArgAlaLysArgIle-563  
 568-GluIleArgSerGlnAlaGlnGlnGlyThrThr-578  
 584-AlaSerGluGluSerLeuLys-590

**Hydrophilic Regions - Hopp-Woods**

48-ValIleGluGluAlaGlyAsn-54  
 68-GluGlySerProArgAlaGlnIle-75  
 78-GlnValAlaGluPheGluLysSerLeuLysArgIleAlaGln-91  
 128-SerTyrArgArgProThrGln-134  
 152-GluAsnAlaAsnGluLys-157  
 193-GlnAlaLeuArgGluGlyAlaGluArgIleGlyArgArgCysPhe-207  
 213-GluGlyGlyThrProGluPheLysGlnValGly-223  
 235-IleLeuTyrAspAspLeuGluGlyGlnValAlaGluGlnThrArgSerLeuGluLysGlnAsnGln-256  
 264-ThrThrArgAspLeuHis-269  
 290-GlyAlaAspSerGlyArgValCysLeu-298

312-AspCysGlyThrAlaAlaSerAspLeuGlyLysTyrHisGlu-325  
 349-SerLeuAspGluAspAspArgIleLeu-357  
 371-GlyAlaLysGlnGluGluGluLysArgLeu-380  
 384-LeuGlnGluArgAsnLeu-389  
 415-AlaPheAlaGluAsnLysArgGluGluAlaAlaGlu-426  
 437-GluCysTyrGluAspValArgGlu-444  
 451-ThrLysIleSerAsnLysGluPheProGluAlaVal-462  
 503-SerLeuSerAsnIleArgLysHisAlaArg-512

533-AspAsnGlyGlnGlyPheAspThrGluLysIleGlyGluProThrGly-548  
 556-MetGlnGluArgAlaLysArgIle-563  
 568-GluIleArgSerGlnAlaGln-574  
 584-AlaSerGluGluSerLeuLys-590

562

**AMPHI Regions - AMPHI**

48-TrpSerLeuValSerAlaTrpMetValValIle-58  
 84-LeuGluThrThrValMetSerAlaValArgThrLeu-95  
 97-PheThrProTyrThrThrValAlaSerThrSer-107  
 116-ThrPhePheAlaProLeuSerArgTrp-124  
 133-AsnAlaProValHisSerMetThrLysSerThrProSerSerPheHis-148  
 184-ValSerAsnLeuValArgTrpAlaLeu-192

**Antigenic Index - Jameson-Wolf**

9-PheAsnSerGlySerThrLysProThr-17  
 32-ProLeuArgAlaArgArgArgSerLeuTrpArg-42  
 72-AlaThrGlyGluArgGlnLeuVal-79  
 105-SerThrSerSerProProGlyAlaGluMet-114  
 139-MetThrLysSerThrProSerSerPheHisGlySerSerAla-152  
 154-LeuArgValGluLysLysGlyIleLeuSerProLeuThr-166  
 168-ArgLeuProProSerTrpAspThrSerAlaSerLysArgProCysThr-183

**Hydrophilic Regions - Hopp-Woods**

33-LeuArgAlaArgArgArgSerLeuTrp-41

-179-

72-AlaThrGlyGluArgGlnLeuVal-79  
110-ProGlyAlaGluMet-114  
140-ThrLysSerThrPro-144  
154-LeuArgValGluLysLysGlyIle-161  
176-SerAlaSerLysArgProCysThr-183

563

**AMPHI Regions - AMPHI**

24-ThrLysArgGluGlyLys-29  
120-AsnGlnTyrAlaGlnPhe-125  
164-ValAsnGlnIleAsnSerSerHisSerSer-173  
246-AspPheThrArgIleLeuSerTyrHisSer-255  
290-AlaAlaAsnThrSerAsnAsnThrAla-298  
313-LysLeuGlyGlyMetTyr-318  
366-LysAspThrAspAsn-370  
443-AsnAsnGlnGlyLysLeu-448  
483-SerSerAsnGlnThrGlyAsn-489  
516-SerAsnIleThrAlaProThr-522  
529-ArgThrHisGlyAlaLeuAsp-535  
551-GlnGlnGlyLeuAsnAsnAlaGlyGlnIle-560  
611-LeuAspAsnAlaHisGlyLysLeuLeuSerAla-621  
736-LeuAspAsnAlaAlaGlnGly-742  
775-GlnMetAsnAsnIleGlyThr-781  
848-ThrGlyLysAlaGlnArgIleHisAsnAlaGlyAlaThrIleGlu-862  
874-LeuHisAsnThrAsnGlu-879  
896-TyrGluAlaPheGlyArg-901  
922-SerAspHisLeuArgThrProAspGlyAlaAlaHisGluAsnTrp-936  
953-ThrAlaProAlaLys-957  
1011-LeuHisSerTyrTrpArg-1016  
1036-GluGluIleThrArg-1040  
1131-LeuHisLysArgLeuGlyAspGlyTyr-1139  
1147-GluGlnIleAlaGluLeuThrGlyHisArgArgLeuAspGlyTyrGlnAsn-1163  
1169-LysAlaLeuMetAsp-1173  
1194-GlnValAlaGlnLeu-1198  
1272-ThrLeuAspAsnIleGlyGly-1278  
1289-AlaThrGlnAspIleAsnAsnIleGlyGlyMetLeu-1300  
1376-GlnAlaGlyArgAspIle-1381  
1403-IleArgGlySerThrAsnGluValGlySerSer-1413  
1461-ValAspAspAlaSerLysHisThrGlyArg-1470  
1485-SerHisHisGluThr-1489  
1524-GlnAlaGlyAsnHisVal-1529  
1539-GlnSerGluThrTyrHisGln-1545  
1594-LysHisTyrGluGlnIleGlySerThrVal-1603  
1646-ProValThrAspLeuAla-1651  
1685-TyrGlnThrGlyLysSerAlaGlnAsnLeuAlaAsnGlyThrThrAsn-1700  
1777-GluGlnSerAsnThrGluArgGlyGln-1785  
1811-GlyGlyAsnValGlyLysGlyTyrGly-1819  
1964-LysAsnHisSerGlnTyr-1969  
1987-LeuGlyGlnGlyAlaGlnAsnLysProGln-1996  
2064-ThrAspThrAlaGluArgHisSerGlySerLeuLysAsnThrPheAsn-2079  
2093-ValSerGlnAspPheSerLysAsnValGln-2102  
2161-IleLeuAsnMetLeuAlaSerGlyLeuAla-2170  
2193-GlyGlnHisPheLysAspLeuAlaGly-2201  
2223-LeuGlyAlaAlaValAla-2228  
2275-AlaIleThrAsnValLeuGlyThrAlaThrGly-2285  
2289-GlyAsnSerAlaThrAspAlaAla-2296

-180-

2332-HisLysAspProGly-2336  
 2379-IleThrArgGluPheGlyLysAspIleAla-2388  
 2393-AsnSerHisGluSer-2397  
 2414-AlaAspGluMetIleAspGlnLeuAsnAsnGluIle-2425

**Antigenic Index** - Jameson-Wolf

1-MetAsnLysThrLeu-5  
 9-IlePheAsnArgLysArgGlyAlaVal-17  
 22-GluThrThrLysArgGluGlyLysSerCysAlaAspSerAspSerGlySerAlaHis-40  
 83-IleIleAlaAspLysAlaAlaProLysThrGlnGln-94  
 127-ValGlyAsnArgGlyAlaIleLeuAsnAsnSerArgSerAsnThrGlnThr-143  
 152-AsnProTrpLeuAla-156  
 158-GlyGluAlaArgVal-162  
 167-IleAsnSerSerHisSerSerGlnMetAsnGly-177  
 179-IleGluValGlyGlyArgArgAlaGluVal-188  
 205-AsnAlaSerArgAlaThrLeu-211  
 213-ThrGlyGlnProGlnTyrGlnAlaGlyAspLeuSerGlyPheLysIleArgGlnGlyAsn-232  
 239-GlyLeuAspAlaArgAspThrAspPhe-247  
 252-SerTyrHisSerLysIleAspAla-259  
 264-GlnAspValArgVal-268  
 292-AsnThrSerAsnAsnThrAlaAsnAsnGlyThr-302  
 310-AspThrGlyLysLeuGlyGly-316  
 331-AlaGlyIleArgAsnGlnGlyGlnLeu-339  
 349-AspAlaAsnGlyArgLeuValAsn-356  
 364-AsnAlaLysAspThrAspAsnThrAlaGluHisLysValAsnIleArgSerGlnGlyValGluAsnSerGly  
 ThrAlaValSerGlnGlnGlyThrGlnIleHis-398  
 400-GlnSerIleGlnAsnThr-405  
 418-AsnSerGlySerLeuLysAsnGluThrSerGlyThrIleGluAlaAlaArgLeuAlaIleAspThrAspThr  
 LeuAsnAsnGlnGlyLysLeuSerGlnThrGlySerGlnLysLeuHisIle-458  
 460-AlaGlnGlyLysMetAspAsnArgGlyArgMetGlyLeuGlnAspThrAlaProThrAlaSerAsnGlySer  
 SerAsnGlnThrGlyAsnSerTyr-491  
 497-SerSerThrThrThrProThrThr-504  
 522-ThrPheAlaAspGlyThrIleArgThrHisGlyAlaLeuAspAsnSerGlySer-539  
 542-AlaAsnGlyGlnThrAspValSerAla-550  
 552-GlnGlyLeuAsnAsnAlaGlyGln-559  
 566-AsnAlaLysGlySerAla-571  
 573-AspAsnHisAsnGly-577  
 589-GlySerLeuAsnAsnGlnAsnGlyAsnIleThrThrArgGlnGlnLeuGluIleGluThrAspGlnLeuAsp  
 AsnAlaHisGly-616  
 631-SerLeuAsnAsnGlnAsnGlyGluIleAlaThrAsn-642  
 646-IleIleHisAspGlyGlnGlnSer-653  
 659-AsnThrAsnGlyThrIleGlnSerGlyArgAspValAlaIle-672  
 675-LysSerLeuSerAsnAsnGly-681  
 685-AlaAspAsnLysLeuAspIleAlaLeu-693  
 695-AspAspPheTyrValGlu-700  
 702-AsnIleValAlaGlyAsnGluLeu-709  
 711-LeuSerThrArgGlySerLeuLysAsnSerHisThr-722  
 725-AlaGlyLysArgIleArgIleLysAlaAsnAsnLeuAspAsnAlaAlaGlnGlyAsnIleGlnSerGlyGly  
 ThrThrAspIleGlyThrGlnHisAsnLeuThrAsnArgGlyLeuIleAspGlyGlnGlnThrLysIleGln-772  
 793-AlaThrArgLeuAspAsnGlnAspGluAsnGlyThrGly-805  
 809-AlaAlaArgGluAsnLeuAsn-815  
 821-LeuAsnAsnArgGluAsnSerLeu-828  
 839-GlyAlaLeuAspThrAsnGlyGlnAlaThrGlyLysAlaGlnArgIleHisAsnAlaGlyAla-859  
 863-AlaAlaGlyLysMetArgLeuGlyValGluLysLeuHisAsnThrAsnGluHisLeuLys-882  
 887-GluThrGlyArgGluHisIleVal-894

-181-

903-GluLeuLeuArgGluGlyThrGlnHis-911  
917-ValTyrAsnAspGluSerAspHisLeuArgThrProAspGlyAlaAlaHis-933  
937-HisLysTyrAspTyrGluLysValThrGlnLysThrGlnVal-950  
960-SerGlyAsnAspLeuThrIleAspGlyLysGluValPheAsnThrAspSer-976  
987-GlnThrGluLysAspGlyLeuHisAsnGluGlnThrPheGlyGluLysLysValPheSerGluAsnGlyLys  
LeuHisSerTyrTrpArgGluLysHisLysGlyArgAspSerThrGlyHisSerGluGlnAsnTyrThrLeuProG  
luGluIleThrArgAsn-1041  
1050-GluSerHisArgLysAlaLeu-1056  
1059-HisAlaProSerGlnGlyThrGluLeuProGlnSerAsnGlyIle-1073  
1100-TyrLeuValGluThrAspProArgPheAlaAsn-1110  
1124-LeuLysLeuAspProAsnAsnLeuHisLysArgLeuGlyAspGlyTyrTyrGluGlnArgLeuIleAsn-1  
146  
1153-ThrGlyHisArgArgLeuAspGlyTyrGlnAsnAspGluGluGlnPheLysAlaLeuMetAspAsnGlyAl  
aThrAlaAlaArgSerMetAsn-1183  
1208-LysGluValLysLeuProAspGlyGlyThr-1217  
1228-ArgValLysAsnGlyAspIleAspGlyLysGly-1238  
1252-GlySerLeuLysAsSerGlyThrIleAlaGlyArgAsnAla-1265  
1269-AsnThrAspThrLeuAspAsnIleGlyGly-1278  
1280-IleHisAlaGlnLysSerAla-1286  
1310-AlaGlyAsnAsnIleAsnSerGlnSerThrThrAlaSerSerGlnAsnThrGlnGlySerSerThrTyrLe  
u-1333  
1342-ThrGlyLysGluLysGlyVal-1348  
1353-AlaGlyLysAspIleAsnIle-1359  
1364-IleSerAsnGlnSerGluGlnGlyGlnThrArgLeuGlnAlaGlyArgAspIleAsnLeuAspThrValGl  
nThrSerLysHisGln-1392  
1396-PheAspAlaAspAsnHisValIleArgGlySerThrAsnGluValGlySerSerIleGlnThrLysGlyAs  
pVal-1420  
1425-GlyAsnAsnLeuAsnAlaLysAlaAlaGluValSerSerAlaAsnGly-1440  
1446-AlaLysAsnAspIle-1450  
1459-ThrHisValAspAspAlaSerLysHisThrGlyArgSerGlyGlyGlyAsnLysLeuValIle-1479  
1481-AspLysAlaGlnSerHisHisGluThrAlaGlnSerSerThrPheGluGlyLysGln-1499  
1503-GlnAlaGlyAsnAspAlaAsn-1509  
1515-ValIleSerAspAsnGlyThrGlnIleGlnAla-1525  
1532-GlyThrThrGlnThrGlnSerGlnSerGluThrTyrHisGlnThrGlnLysSerGlyLeu-1551  
1561-GlySerLysThrAsnThrGlnGluAsnGlnSerGlnSerAsnGluHisThrGlySerThrValGlySerLe  
uLysGlyAspThrThrIle-1590  
1592-AlaGlyLysHisTyrGluGlnIle-1599  
1603-ValSerSerProGluGlyAsnAsn-1610  
1621-AlaAlaHisAsnLysLeuAsnSerAsnThrThrGlnThrTyrGluGlnLysGlyLeu-1639  
1659-GlnSerSerLysGlnValGlyGlnSerLysAsnAspArgValAsn-1673  
1684-AlaTyrGlnThrGlyLysSerAlaGln-1692  
1694LeuAlaAsnGlyThrThrAsnAlaLys-1702  
1710-TyrGlyGluGlnGlnAsnArgGlnThrThrGln-1720  
1729-SerGlnIleGlnAlaGlyGlyLysThrThr-1738  
1744-AlaAlaGluGlnSerAsn-1749  
1754-GlySerAspValAlaGlyLys-1760  
1767-AlaAspAsnAspIleThr-1772  
1774-GlnSerAlaGluGlnSerAsnThrGluArgGlyGlnAsnLysSerAlaGlyTrpAsn-1792  
1812-GlyAsnValGlyLysGlyTyrGlyAsnGlyAspSerIleThrHisArgHisSerHisIleGlyAspLysGl  
ySer-1836  
1841-GlnSerGlyGlyAspThrThrIleLys-1849  
1851-AlaGlnValArgGlyLysGlyValGlnValAsnAlaLysAsn-1864  
1869-SerValGlnAspArgGlu1874ThrTyrGlnSerLysGlnGlnAsnAla-1883  
1895-AlaGlyGlyAspTyrSerGlnSerLysIleArgAlaAspHis-1908  
1912-ThrGluGlnSerGlyIleTyrAlaGlyGluAspGlyTyrGln-1925

-182-

1929-GlyAsnHisThrAspLeuLysGlyGlyIle-1938  
 1942-ThrGlnSerAlaGluAspLysGlyLyAsnArgPheGln-1954  
 1959-ThrHisSerAspIleLysAsnHisSerGlnTyrLysGlyGluSerPhe Gly-1975  
 1982-IleSerGlyLysThrLeuGlyGlnGlyAlaGlnAsnLysProGlnAsnLysHis-1999  
 2003-ValAlaAspLysAsnSerAlaSer Ser-2011  
 2014-GlyTyrGlySerAspSerAspSerGlnSerSerIleThrLysSerGlyIleAsnThrArgAsn-2034  
 2036-GlnIleThrAspGluAlaAlaGln-2043  
 2045-ArgLeuThrGlyLysThrAlaAlaGlnThrLyAlaAspIleAspThrAsnValThrThrAspThrAlaGlu  
 ArgHisSerGlySerLeuLysAsnThrPheAsnLysGluAlaValGlnSerGluLeuAspLeuGlnArgThrValS  
 erGlnAspPheSerLysAsnValGlnGlnAlaAsnThrGluIle-2108  
 2110-GlnHisLeuAspLysLeuLysAlaAspLysGluAlaAlaGluThrAlaAla-2126  
 2131-AlaAsnGlyAspMetGluThrAlaLysArgLysAlaHisGluAlaGlnAspAlaAlaAlaLysAlaAspAs  
 nTrpGlnGln-2157  
 2172-ProThrGlnSerGly-2176  
 2195-HisPheLysAspLeuAlaGlyGlnAsnAlaAsnGlyLysLeuThrAlaSerGlnGluThr-2214  
 2231-GlyAspAsnAsnAla-2235  
 2241-SerAlaGlyGlySerGluAla-2247  
 2256-LeuTyrGlyLysGluLysGlySerAspLeuThrAlaGluGluLysGluThrVal-2273  
 2288-ValGlyAsnSerAlaThrAspAlaAlaGlnGlySerLeuAsnAla-2302  
 2304-SerAlaValGluAsnAsnAspThrValGluGlnVal-2315  
 2319-LeuArgHisProArg-2323  
 2331-ValHisLysAspProGlySerThrLeuGluProAsnIle-2343  
 2355-PheProAsnSerGluPheGlyGlyGluGlyGlyVal-2366  
 2379-IleThrArgGluPheGlyLysAspIleAlaVal-2389  
 2391-ValGlyAsnSerHisGluSerGlyGluLysIleAsnTyrSerIleArgArgAsnLeuSerLeuAspLysAl  
 aAspGluMetIleAsp-2419  
 2421-LeuAsnAsnGluIleGlyArgGluIleAla-2430  
 2432-AsnThrAsnArgLeuAsnThrLysGluLeu-2441  
 2447-GluThrTyrLysAsnAsnGlyPhe-2454  
 2456-GlnAlaGluArgAsnSerAsnGlyAsnTyrAspValValArgLysArgLeuSerGluLysAspTyrGlnAs  
 nThrSerAsn-2482  
 2496-IleGlnGlnArgArgLysGlnIleArg-2504  
 2510-ArgGlnTrpArgArg-2514

**Hydrophilic Regions - Hopp-Woods**

10-PheAsnArgLysArgGlyAla-16  
 22-GluThrThrLysArgGluGlyLysSerCysAlaAspSerAspSerGlySerAlaHis-40  
 83-IleIleAlaAspLysAlaAlaProLysThrGlnGln-94  
 136-AsnSerArgSerAsnThr-141  
 158-GlyGluAlaArgVal-162  
 181-ValGlyGlyArgArgAlaGluVal-188  
 224-SerGlyPheLysIleArgGln-230  
 240-LeuAspAlaArgAspThrAspPhe-247  
 331-AlaGlyIleArgAsn-335  
 364-AsnAlaLysAspThrAspAsnThrAlaGluHisLysValAsnIleArgSerGlnGlyValGluAsnSerGly  
 -387  
 420-GlySerLeuLysAsnGluThrSerGlyThrIleGluAlaAlaArgLeuAlaIleAspThrAspThrLeuAsn  
 Asn-444  
 446-GlyLysLeuSerGln-450  
 460-AlaGlnGlyLysMetAspAsnArgGlyArgMetGlyLeu-472  
 481-AsnGlySerSerAsnGlnThr-487  
 534-LeuAspAsnSerGly-538  
 544-GlyGlnThrAspValSerAla-550  
 602-GlnGlnLeuGluIleGluThrAspGlnLeuAspAsnAlaHis-615  
 635-GlnAsnGlyGluIleAlaThr-641

-183-

665-GlnSerGlyArgAspValAlaIle-672  
685-AlaAspAsnLysLeuAspIleAlaLeu-693  
715-GlySerLeuLysAsn-719  
725-AlaGlyLysArgIleArgIleLysAlaAsnAsnLeuAspAsnAlaAla-740  
767-GlnGlnThrLysIleGln-772  
794-ThrArgLeuAspAsnGlnAspGluAsnGlyThr-804  
809-AlaAlaArgGluAsnLeu-814  
822-AsnAsnArgGluAsnSer-827  
841-LeuAspThrAsnGly-845  
847-AlaThrGlyLysAlaGlnArgIleHis-855  
863-AlaAlaGlyLysMetArgLeuGlyValGluLysLeuHisAsnThrAsnGluHisLeuLys-882  
887-GluThrGlyArgGluHisIleVal-894  
903-GluLeuLeuArgGluGlyThrGlnHis-911  
919-AsnAspGluSerAspHisLeuArgThrProAspGlyAlaAla-932  
939-TyrAspTyrGluLysValThrGln-946  
964-LeuThrIleAspGlyLysGluValPheAsn-973  
987-GlnThrGluLysAspGlyLeuHisAsn-995  
998-ThrPheGlyGluLysLysValPheSerGluAsnGlyLys-1010  
1015-TrpArgGluLysHisLysGlyArgAspSerThrGlyHisSerGluGln-1030  
1036-GluGluIleThrArg-1040  
1050-GluSerHisArgLysAlaLeu-1056  
1063-GlnGlyThrGluLeuProGln-1069  
1104-ThrAspProArgPheAlaAsn-1110  
1124-LeuLysLeuAspPro-1128  
1130-AsnLeuHisLysArgLeuGly-1136  
1153-ThrGlyHisArgArgLeuAspGlyTyrGlnAsnAspGluGluGlnPheLysAlaLeuMet-1172  
1175-GlyAlaThrAlaAlaArg-1180  
1208-LysGluValLysLeuProAspGlyGlyThr-1217  
1229-ValLysAsnGlyAspIleAspGlyLysGly-1238  
1252-GlySerLeuLysAsn-1256  
1280-IleHisAlaGlnLysSerAla-1286  
1324-GlnAsnThrGlnGly-1328  
1343-GlyLysGluLysGlyVal-1348  
1353-AlaGlyLysAspIleAsn-1358  
1366-AsnGlnSerGluGlnGlyGlnThrArgLeuGlnAlaGlyArgAspIleAsnLeu-1383  
1387-GlnThrSerLysHisGln-1392  
1396-PheAspAlaAspAsnHisVal-1402  
1406-SerThrAsnGluValGlySer-1412  
1414-IleGlnThrLysGlyAspVal-1420  
1428-LeuAsnAlaLysAlaAlaGluValSerSer-1437  
1446-AlaLysAsnAspIle-1450  
1460-HisValAspAspAlaSerLysHisThrGlyArgSerGlyGlyGly-1474  
1481-AspLysAlaGlnSerHisHisGluThrAlaGln-1491  
1493-SerThrPheGluGlyLysGln-1499  
1537-GlnSerGlnSerGluThr-1542  
1562-SerLysThrAsnThrGlnGluAsnGlnSerGlnSerAsnGluHisThrGly-1578  
1584-LeuLysGlyAspThr-1588  
1604-SerSerProGluGlyAsn-1609  
1621AlaAlaHisAsnLysLeuAsnSer-1628  
1634-TyrGluGlnLysGly-1638  
1659-GlnSerSerLysGlnValGlyGlnSerLysAsnAspArgValAsn-1673  
1686-GlnThrGlyLysSerAlaGln-1692  
1712-GluGlnGlnAsnArgGlnThrThr-1719  
1744-AlaAlaGluGlnSerAsn-1749  
1756-AspValAlaGlyLys-1760

-184-

1767-AlaAspAsnAspIle-1771  
 1775-SerAlaGluGlnSerAsnThrGluArgGlyGlnAsnLys-1787  
 1822-AspSerIleThrHis-1826  
 1830-HisIleGlyAspLysGlySer-1836  
 1843-GlyGlyAspThrThrIleLys-1849  
 1851-AlaGlnValArgGlyLysGlyVal-1858  
 1869-SerValGlnAspArgGluThrTyrGlnSerLysGlnGlnAsnAla-1883  
 1897-GlyAspTyrSerGlnSerLysIleArgAlaAspHis-1908  
 1919-AlaGlyGluAspGlyTyrGln-1925  
 1932-ThrAspLeuLysGly-1936  
 1943-GlnSerAlaGluAspLysGlyLysAsnArgPhe-1953  
 1961-SerAspIleLysAsn-1965  
 1967-SerGlnTyrLysGlyGluSer-1973  
 1991-AlaGlnAsnLysProGlnAsnLysHis-1999  
 2003-ValAlaAspLysAsnSerAla-2009  
 2017-SerAspSerAspSerGlnSerSerIleThr-2026  
 2036-GlnIleThrAspGluAlaAlaGln-2043  
 2050-ThrAlaAlaGlnThrLysAlaAspIleAspThr-2060  
 2065-AspThrAlaGluArgHisSerGlySerLeu-2074  
 2077-ThrPheAsnLysGluAlaValGlnSerGluLeuAspLeuGlnArg-2091  
 2104-AlaAsnThrGluIle-2108  
 2110-GlnHisLeuAspLysLeuLysAlaAspLysGluAlaAlaGluThrAlaAla-2126  
 2133-GlyAspMetGluThrAlaLysArgLysAlaHisGluAlaGlnAspAlaAlaLysAlaAspAsn-2154  
 2195-HisPheLysAspLeuAlaGly-2201  
 2208-LeuThrAlaSerGlnGluThr-2214  
 2243-GlyGlySerGluAla-2247  
 2257-TyrGlyLysGluLysGlySerAspLeuThrAlaGluGluLysGluThrVal-2273  
 2291-SerAlaThrAspAlaAlaGln-2297  
 2304-SerAlaValGluAsnAsnAspThrValGluGlnVal-2315  
 2319-LeuArgHisProArg-2323  
 2331-ValHisLysAspProGlySerThrLeu-2339  
 2379-IleThrArgGluPheGlyLys-2385  
 2393-AsnSerHisGluSerGlyGluLysIleAsnTyrSerIleArgArgAsnLeuSerLeuAspLysAlaAspGluMetIleAsp-2419  
 2424-GluIleGlyArgGluIleAla-2430  
 2435-ArgLeuAsnThrLysGluLeu-2441  
 2456-GlnAlaGluArgAsnSerAsnGly-2463  
 2466-AspValValArgLysArgLeuSerGluLysAspTyrGlnAsn-2479  
 2496-IleGlnGlnArgArgLysGlnIleArg-2504  
 2510-ArgGlnTrpArgArg-2514  
 564-2  
**AMPHI Regions - AMPHI**  
 6-TyrLysValValPhe-10  
 25-LysArgGluGlyLysAsnThr-31  
 40-LeuProAsnAspIleAlaGlyPheAlaGlyPheIleHisSerIleSer-55  
 118-AsnGlnTyrAlaGlnPhe-123  
 162-ValAsnGlnIleAsnSerSerHisSerSerGlnLeuAsn-174  
 244-AspTyrThrArgIleLeuSerTyrHisSer-253  
 288-AlaAlaAsnThrSerAsnAsnThrAla-296  
 311-LysLeuGlyGlyMetTyr-316  
 322-LeuIleSerThrValGluGln-328  
 390-SerGlnThrLeuAsp-394  
 407-ValArgAsnLeuGlyArgLeuLysAsnGlnAsn-417  
 433-LeuAspAsnThrGlyAsnIleThrGlnThrGly-443  
 449-LeuValSerAlaGlyLysPheAspAsnSer-458

-185-

478-IleProGlnIleProSerThr-484  
 518-IleGlnThrThrGlyAlaPheAspAsnAlaGlySerIleAsnAla-532  
 561-SerPheAsnAsnThrValLys-567  
 600-LeuHisAsnAlaGly-604  
 638-GlyLeuHisAsnAlaGly-643  
 658-LeuArgAsnThrGlyLysVal-664  
 736-LeuTyrAsnGlnHisGly-741  
 765-AspGlyThrIleGlnSerAla-771  
 841-AspAsnGlnValThrGlyLys-847  
 871-AspGlyLeuThrHisIleGlyAlaGly-879  
 882-LeuThrAsnThrGlyThrGlyLysIleTyr-891  
 958-AlaGlyMetAlaAspThrPheVal-965  
 980-SerValArgAsnMetGlnAsnIleAsnAsnHis-990  
 1000-AlaGluLysGlnVal-1004  
 1125-ThrGlnTrpAspSerValThrLys-1132  
 1185-IleLysLeuIleAspGlyValSerThr-1193  
 1263-HisLysArgLeuGlyAspGlyTyr-1270  
 1278-GluGlnIleHisGlnLeuThrGlyTyrArgArgLeuAspGlyTyr-1292  
 1299-PheLysAlaLeuMetAspAsn-1305  
 1325-GlnValAlaArgLeu-1329  
 1461-ThrAlaIleAspArgMetAlaGlyIleAsnValValGlySerHisThrGluGlnValAspAsnArg-1482  
 1504-SerAsnGlnValLysAspGlyThrThr-1512  
 1515-ThrAlaGlyAsnAsn-1519  
 1542-ArgHisValArgGlnSerThrGluVal-1550  
 1596-ArgGlnIleThrGluLeu-1601  
 1720-IleIleGlySerLeuAsn-1725  
 1791-AlaGlnAsnPheIleGlnAlaAlaGlnAsnValGlyLysSer-1804  
 1822-TyrGlnAlaThrGlnGlnMet-1828  
 1870-GluAlaAlaAlaSerGln-1875  
 1925-GlySerGluGlnSer-1929  
 1955-GlyGlyAsnIleGlyLysGlyLys-1962  
 2106-AspIleGlnAsnHisSer-2111  
 2138-GlnGlyArgProThrAspArgIleSerProAla-2148  
 2177-AlaGlyGlnLeuAlaArgThrGlyArgThrAlaLys-2188  
 2204-AspGlnHisSerGlyHisLeuLysAsnSerPhe-2214  
 2228-GluValThrLysGluPheGlyArgAsnAlaAla-2238  
 2243-AlaValAlaAspLysLeuGlyAsnThrGlnSerTyrGluArgTyrGln-2258  
 2297-ArgTyrAspThrTrpLysGlu-2303  
 2308-ArgSerIleLeuHisGlyAlaAlaGly-2316  
 2320-ThrGlySerLeuGlyGlyIleLeuAla-2328  
 2336-AlaProTyrLeuAspLysAlaAlaGluAsnLeuGlyPro-2348  
 2352-AlaAlaValAsnAlaLeuGly-2358  
 2395-LysTyrAlaGluAlaLeuLysArg-2402  
 2404-ValGluLysArgGluGly-2409  
 2424-GlnIleLeuArgTrpValAspLysGlySerGlnAspGly-2436  
 2470-GlnThrTyrAsnAspProLysLeuPheGluGluTyr-2481  
 2520-GluGlyLeuThrSerLeuVal-2526  
 2537-LeuAlaGlyIleArgAsnLeuLysAsnIle-2546  
 2571-ValAlaLysGlyAspArg-2576  
 2620-LysProGlnArgGln-2624  
 2647-AspValCysThrGluCys-2652  
 2669-ProGluIleGluArg-2673

**Antigenic Index** - Jameson-Wolf

10-PheAsnLysHisArgAsnCysMet-17

-186-

22-GluAsnAlaLysArgGluGlyLysAsnThrAlaAsp-33  
82-ValAlaAspLysSerAlaProAlaGlnGlnGln-92  
125-ValGlyAsnArgGlyAlaIleLeuAsnAsnSerArgSerAsnThrGlnThr-141  
150-AsnProTrpLeuAla-154  
156-GlyGluAlaArgVal-160  
165-IleAsnSerSerHisSerSerGlnLeuAsnGly-175  
177-IleGluValGlyGlyArgArgAlaGluVal-186  
203-AsnAlaSerArgAlaThrLeu-209  
214-ProGlnTyrGlnAlaGlyAspLeuSerGlyPheLysIleArgGlnGlyAsn-230  
237-GlyLeuAspAlaArgAspThrAspTyrThrArg-247  
250-SerTyrHisSerLysIleAspAla-257  
262-GlnAspValArgVal-266  
269-GlyGlnAsnAspValAlaAlaThrGlyAspAlaHisSerPro-282  
290-AsnThrSerAsnAsnThrAlaAsnAsnGlyThr-300  
308-AspThrGlyLysLeuGlyGly-314  
327-GluGlnAlaGlyIleArgAsnGlnGlyGln-336  
347-AsnAlaGluGlyLysLeuValAsn-354  
361-ThrGlyGluAsnHis-365  
373-AsnValHisAsnSerGlyThrValAlaSerGlnAspAspAlaAsnIleHis-389  
391-GlnThrLeuAspAsnSerGlyThrVal-399  
401-SerSerGlyArgLeuThrVal-407  
409-AsnLeuGlyArgLeuLysAsnGlnAsnAsnGly-419  
424-AlaArgLeuAspMetSerThrGlyGlyLeuAspAsnThrGlyAsnIleThrGlnThrGlySerGln-445  
453-GlyLysPheAspAsnSerGlyLysIleGlyValSerAspValProGlnThrGlyLeuAsnProAsnProSerVal-477  
486-ThrGlySerGlySer-490  
493-ValSerValSerLysProGlySerAsnAsnProValSerProThrAlaProAlaLysAsnTyrAla-514  
525-AspAsnAlaGlySerIleAsnAlaGlyGlyGlnIleAsp-537  
542-AsnGlyLeuGlyAsnSerGlySer-549  
553-AlaLysLeuArgValSerGlyAspSerPheAsnAsnThrValLysGlyLysLeuGlnAla-572  
580-GlnThrAlaLysAsnSerGlyHis-587  
591-GlnThrGlyLysIleAspAsnArgGluLeuHisAsnAlaGlyGlu-605  
615-HisSerGlyArgLeuSerAsnAspLysLysGlyAsnIle-627  
647-AlaAspSerGlyThrValThrThrLysAsnAsnLeuArgAsnThrGlyLysValSerValAlaArgLeuAsnThrGluGlyGlnThrLeuAspAsnThrArgGlyArgIleGluAlaGluThrValAsn-689  
694-GlnLeuThrAsnGlnSerGlyHis-701  
710-IleAsnSerArgAsnValAspAsnGlnAsnGlyLysLeuLeuSer-724  
732-ValSerAspGlyLeuTyrAsnGlnHisGly-741  
750-SerIleHisAspLysAsnGlnAsnThr-758  
761-LeuAsnAsnAlaAspGlyThrIle-768  
780-SerLeuAlaAsnAsnGlyThr-786  
789-AlaGlyAsnLysLeuAsp-794  
797-LeuThrAspAspPheValValGluArgAspLeuThrAlaGlyLys-811  
817-IleLysGlyArgLeuLysAsnThrHisThr-826  
836-AsnAlaGlyAsnIleAspAsnGlnVal-844  
849-IleGlyGlyGluGlnThrAspIleThrSerGluGlnHisValAspAsnArgGlyLeuIleAsnSerAspGly-872  
881-ThrLeuThrAsnThrGlyThrGlyLysIleTyr-891  
903-LeuAsnArgGluGluThrThrGluGlySerThrLysAla-915  
919-AlaAlaArgLysArgLeuAspIleGlyAlaLysGluIleHisAsnGlnGluGly-936  
939-LeuSerSerGluGly-943  
948-GlyAsnArgLeuAspGluGlnHisHis-956  
985-GlnAsnIleAsnAsnHisPheLysThrGluThrTyrLeuAlaLysAlaGluLysGlnValArgAsp-1006  
1017-GlnAlaGlyLysAspGlyLeuPheAspAsnSerGlnGlyGlnLysAspGlnThrThr-1035  
1039-HisLeuLysAsnGlySerArgIleGluAla-1048

-187-

1060-ThrTyrLysGluArgIleIleGluAsnArgProAlaHis-1072  
1076-GlyGlyAspLeuThrAlaSerGlyGlnAsnTrpLeuAsnLysAspSerArgIle-1093  
1098-ArgIleIleThrAspAspLeuAsnGlnLysGluIleThrAsnGlnSerThrThrGlyLysGlyArgThrAspAlaVal-1123  
1126-GlnTrpAspSerValThrLysLysGlyTrpTyrSerGlyArgLysArgGlnArgArgThrGluArgAsnHisThrProTyrHisAsp-1154  
1160-HisAspPheAspThrProVal-1166  
1172-AsnAlaAlaSerProSerPhe-1178  
1196-ValAsnGlyGlnArgIleHisThr-1203  
1223-ThrThrHisProAspAsnLysGlyTrp-1231  
1234-GluThrAspProGlnPheAlaAspTyrArgArgTrpLeuGlySerAspTyr-1250  
1258-AspThrAsnHisLeuHisLysArgLeuGlyAspGlyTyrTyrGluGlnLysLeuValAsn-1277  
1285-GlyTyrArgArgLeuAspGlyTyrArgSerAspGluGluGlnPheLysAlaLeuMetAspAsnGly-1306  
1343-LeuSerAspGlySerThrGln-1349  
1359-LeuAlaArgLysGlyAspLeuAsnThrSerGlyGly-1370  
1382-GlnAsnGlyAsnLeuThrAsn-1388  
1403-ArgAsnIleAsnSerAsnGlyAsnIleGln-1412  
1416-IleGlyLeuLysAlaGluLysSerIleAsnIleAspGlyGlyGlnValGln-1432  
1445-AsnLeuAsnGlyThrThrGlnThrSerGlyAsnGluArgAsnGlyAsnThrAlaIleAspArgMetAla-1467  
1473-GlySerHisThrGluGlnValAspAsnArgThrSerAspGly-1486  
1491-HisAlaSerAsnAspIle-1496  
1503-ValSerAsnGlnValLysAspGlyThrThr-1512  
1525-IleArgThrGluHisArgGluAlaTyrGlyThrLeuAspAspGluAsnHisArgHisValArgGlnSerThrGluValGlySerSerIleArgThrGlnAsnGly-1559  
1564-AlaGlyAsnAspLeuLysIleArgGlnGlyGluLeuGluAlaGluGlyLysThr-1582  
1586-AlaGlyArgAspValThrIleSerGluGlyArgGlnIleThrGluLeuAspThrSerValSerGlyLysSerLysGlyIleLeuSerSerThrLysThrHisAspArgTyrArgPheSerHisAspGluAlaVal-1630  
1633-AsnIleGlyGlyGlyLysMet-1639  
1644-GlyGlnAspIleAsnValArgGlySerAsnLeuIleSerAspLysGlyIleVal-1661  
1664-AlaGlyHisAspIleAspIleSerThrAlaHisAsnArgTyrThrGlyAsnGluTyrHisGluSerLysLysSerGlyVal-1690  
1699-ThrIleGlyAsnArgLysThrThrAspAspThrAspArgThrAsnIle-1714  
1723-SerLeuAsnGlyAspThr-1728  
1732-AlaGlyAsnArgTyrArgGlnThrGlySerThrValSerSerProGluGlyArgAsnThrValThr-1753  
1761-PheAlaAsnAsnArgTyrAlaThrAspTyrAlaHisThrGlnGluGlnLysGly-1778  
1799-GlnAsnValGlyLysSerLysAsnLysArgValAsn-1810  
1832-AlaProSerSerSerAlaGlyGlnGlyGlnAsnAsnAsnGlnSerProSerIle-1849  
1854-ThrTyrGlyGluGlnLysSerArgAsnGluGlnLysArgHisTyrThr-1869  
1878-GlyLysGlyGlnThr-1882  
1886-AlaThrGlySerGlyGluGlnSerAsnIleAsn-1896  
1898-ThrGlySerAspVal-1902  
1919-GlnSerAlaLysGlnAspGlySerGluGlnSerLysAsnLysSerSerGlyTrpAsnAla-1938  
1954-AlaGlyGlyAsnIleGlyLysGlyLysGluGlnGlyGlySerThrThrHisArgHisThrHisValGlySerThrThrGlyLysThrThrIleArgSerGlyGlyAspThrThrLeu-1992  
1999-GlyLysGlyIleGlnAlaAspThrArgAsnLeuHis-2010  
2013-SerValGlnAspThrGluThrTyrGlnSerLysGlnGlnAsnGlyAsn-2028  
2038-SerAlaSerGlySerTyrArgGlnSerLysValLysAlaAspHis-2052  
2062-TyrAlaGlyGluAspGlyTyrGlnIleLysValArgAspAsnThrAspLeuLysGly-2080  
2086-SerGlnSerAlaGluAspLysGlyLysAsnLeuPhe-2097  
2105-SerAspIleGlnAsnHisSerArgTyrGluGlyArgSerPheGly-2119  
2126-LeuAsnGlyGlyTrpAspGlyThrValThrAspLysGlnGlyArgProThrAspArgIleSerPro-2147  
2151-TyrGlySerAspGlyAspSerLysAsnSerThrThrArgSerGlyValAsnThrHis-2169  
2173-IleThrAspGluAlaGlyGlnLeuAlaArgThrGlyArgThrAlaLysGluThrGluAlaArgIle-2194

-188-

2197-GlyIleAspThrGluThrAlaAspGlnHisSerGlyHisLeuLysAsnSerPheAspLysAspAlaValAlaLysGluIleAsnLeuGlnArgGluValThrLysGluPheGlyArgAsnAlaAla-2238  
 2244-ValAlaAspLysLeuGlyAsnThrGlnSerTyrGluArgTyrGlnGluAlaArgThrLeuLeu-2264  
 2266-AlaGluLeuGlnAsnThrAspSerGluAlaGluLysAlaAlaPhe-2280  
 2292-AlaGluAsnGlnSerArgTyrAspThrTrpLysGluGlyGlyIleGlyArgSerIle-2310  
 2338-TyrLeuAspLysAlaAlaGluAsnLeuGlyProAlaGly-2350  
 2378-ValAspTrpAsnAsnArgGlnLeuHisProLysGluMetAlaLeu-2392  
 2394-AspLysTyrAlaGluAlaLeuLysArgGluValGluLysArgGluGlyArgLysIleSerSerGlnGluAlaAlaMetArgIleArgArgGlnIle-2425  
 2428-TrpValAspLysGlySerGlnAspGlyTyrThrAspGlnSerVal-2442  
 2448-MetLysGlyGluAspLysAlaLeu-2455  
 2460-AspTyrArgAspTyrGlyAlaArgAsnProGlnThrTyrAsnAspProLysLeuPheGluGluTyrArgArgGlnAspLysProGluTyrArgAsn-2491  
 2496-HisSerGlyThrLysAspThrLysIleArgGlnGlyGluArgLysAsnGluGluPhe-2514  
 2527-AsnProAsnProArgIleLysVal-2534  
 2541-ArgAsnLeuLysAsnIleLysProThrValThrGlySerAspPro-2555  
 2569-GlyAsnValAlaLysGlyAspArgIleProAspThrAlaLeuAlaSerLysGlyIleLysHisLysAsnArgLysAspGlnLeuGluLysAsnLysLysSerGlyGluAspPheGluMet-2608  
 2610-IleTyrGlnLysLysValLysGlnGlyPheLysProGlnArgGlnIleThrValLysThrLysSerGlyValLysThrArgLeuAspIleIleSerLysGluGlyGlyLeuAspValCysThrGluCysLysAla-2654  
 2659-ProLeuThrLysAsnGlnLysLysAlaPheProGluIleGluArgThrGlyAla-2676  
 2680-GlyLysGlyLysProGlyTyrProLysGlyThrLysIleGluProThrLysValIleIleGluArgLysArg-2703

**Hydrophilic Regions - Hopp-Woods**

10-PheAsnLysHisArgAsn-15  
 22-GluAsnAlaLysArgGluGlyLysAsnThrAlaAsp-33  
 82-ValAlaAspLysSerAlaPro-88  
 134-AsnSerArgSerAsnThr-139  
 156-GlyGluAlaArgVal-160  
 179-ValGlyGlyArgArgAlaGluVal-186  
 222-SerGlyPheLysIleArgGln-228  
 238-LeuAspAlaArgAspThrAspTyr-245  
 271-AsnAspValAlaAla-275  
 329-AlaGlyIleArgAsn-333  
 348-AlaGluGlyLysLeu-352  
 361-ThrGlyGluAsnHis-365  
 381-AlaSerGlnAspAspAlaAsnIle-388  
 409-AsnLeuGlyArgLeuLysAsnGlnAsn-417  
 424-AlaArgLeuAspMet-428  
 453-GlyLysPheAspAsnSerGlyLysIleGlyVal-463  
 494-SerValSerLysProGlySer-500  
 553-AlaLysLeuArgValSerGly-559  
 566-ValLysGlyLysLeuGlnAla-572  
 580-GlnThrAlaLysAsnSer-585  
 593-GlyLysIleAspAsnArgGluLeuHisAsn-602  
 618-ArgLeuSerAsnAspLysLysGlyAsnIle-627  
 650-GlyThrValThrThr-654  
 656-AsnAsnLeuArgAsnThrGlyLys-663  
 669-LeuAsnThrGluGlyGlnThrLeuAspAsnThrArgGlyArgIleGluAlaGluThr-687  
 713-ArgAsnValAspAsnGlnAsn-719  
 750-SerIleHisAspLysAsnGlnAsn-757  
 763-AsnAlaAspGlyThrIle-768  
 801-PheValValGluArgAspLeuThrAla-809  
 817-IleLysGlyArgLeuLysAsn-823

-189-

852-GluGlnThrAspIleThrSer-858  
860-GlnHisValAspAsnArgGlyLeuIle-868  
903-LeuAsnArgGluGluThrThrGluGlySerThrLysAla-915  
919-AlaAlaArgLysArgLeuAspIleGlyAlaLysGluIleHisAsnGlnGlu-935  
949-AsnArgLeuAspGluGlnHisHis-956  
995-ThrTyrLeuAlaLysAlaGluLysGlnValArgAsp-1006  
1018-AlaGlyLysAspGlyLeuPhe-1024  
1027-SerGlnGlyGlnLysAspGlnThr-1034  
1042-AsnGlySerArgIleGluAla-1048  
1060-ThrTyrLysGluArgIleIleGluAsnArgPro-1070  
1087-LeuAsnLysAspSerArgIle-1093  
1099-IleIleThrAspAspLeuAsnGlnLysGluIleThrAsn-1111  
1114-ThrThrGlyLysGlyArgThrAspAlaVal-1123  
1134-GlyTrpTyrSerGlyArgLysArgGlnArgArgThrGluArgAsnHis-1149  
1235-ThrAspProGlnPheAlaAspTyrArgArg-1244  
1261-HisLeuHisLysArgLeuGly-1267  
1287-ArgArgLeuAspGlyTyrArgSerAspGluGluGlnPheLysAlaLeuMet-1303  
1360-AlaArgLysGlyAspLeuAsnThr-1367  
1416-IleGlyLeuLysAlaGluLysSerIleAsn-1425  
1453-SerGlyAsnGluArgAsnGlyAsnThrAlaIleAspArgMetAla-1467  
1475-HisThrGluGlnValAspAsnArgThrSerAsp-1485  
1505-AsnGlnValLysAspGlyThrThr-1512  
1525-IleArgThrGluHisArgGluAlaTyrGlyThrLeuAspAspGluAsnHisArgHisValArgGlnSerTh  
rGluVal-1550  
1554-IleArgThrGlnAsn-1558  
1564-AlaGlyAsnAspLeuLysIleArgGlnGlyGluLeuGluAlaGluGluGlyLysThr-1582  
1586-AlaGlyArgAspValThrIleSerGluGlyArgGlnIleThrGluLeuAspThr-1603  
1605-ValSerGlyLysSerLysGlyIle-1612  
1616-ThrLysThrHisAspArgTyrArgPheSerHisAspGluAlaVal-1630  
1647-IleAsnValArgGly-1651  
1653-AsnLeuIleSerAspLysGlyIleVal-1661  
1664-AlaGlyHisAspIleAspIle-1670  
1681-GluTyrHisGluSerLysLysSerGlyVal-1690  
1701-GlyAsnArgLysThrThrAspAspThrAspArgThrAsn-1713  
1734-AsnArgTyrArgGlnThrGly-1740  
1744-SerSerProGluGlyArgAsnThrValThr-1753  
1774-GlnGluGlnLysGly-1778  
1800-AsnValGlyLysSerLysAsnLysArgValAsn-1810  
1836-SerAlaGlyGlnGlyGlnAsnAsnAsnGln-1845  
1856-GlyGluGlnLysSerArgAsnGluGlnLysArgHisTyrThr-1869  
1888-GlySerGlyGluGlnSerAsn-1894  
1919-GlnSerAlaLysGlnAspGlySerGluGlnSerLysAsnLysSerSer-1934  
1957-AsnIleGlyLysGlyLysGluGlnGlyGly-1966  
1982-ThrThrIleArgSerGlyGlyAspThrThrLeu-1992  
2002-IleGlnAlaAspThrArgAsnLeuHis-2010  
2013-SerValGlnAspThrGluThrTyrGlnSerLysGlnGlnAsn-2026  
2041-GlySerTyrArgGlnSerLysValLysAlaAspHis-2052  
2063-AlaGlyGluAspGlyTyrGlnIleLysValArgAspAsnThrAspLeuLysGly-2080  
2087-GlnSerAlaGluAspLysGlyLysAsn-2095  
2111-SerArgTyrGluGlyArgSer-2117  
2133-ThrValThrAspLysGlnGlyArgProThrAspArgIleSerPro-2147  
2152-GlySerAspGlyAspSerLysAsnSerThrThrArgSerGlyVal-2166  
2173-IleThrAspGluAlaGlyGln-2179  
2181-AlaArgThrGlyArgThrAlaLysGluThrGluAlaArgIle-2194  
2198-IleAspThrGluThrAlaAspGlnHisSerGlyHisLeu-2210

-190-

2212-AsnSerPheAspLysAspAlaValAlaLysGluIleAsnLeuGlnArgGluValThrLysGluPheGlyArg-2235  
 2244-ValAlaAspLysLeuGlyAsn-2250  
 2252-GlnSerTyrGluArgTyrGlnGluAlaArgThrLeuLeu-2264  
 2266-AlaGluLeuGlnAsnThrAspSerGluAlaGluLysAlaAlaPhe-2280  
 2294-AsnGlnSerArgTyrAspThrTrpLysGluGlyGlyIle-2306  
 2338-TyrLeuAspLysAlaAlaGluAsnLeuGlyProAlaGly-2350  
 2384-GlnLeuHisProLysGluMetAlaLeu-2392  
 2394-AspLysTyrAlaGluAlaLeuLysArgGluValGluLysArgGluGlyArgLysIleSerSerGlnGluAlaAlaMetArgIleArgArgGlnIle-2425  
 2428-TrpValAspLysGlySerGlnAspGlyTyrThr-2438  
 2448-MetLysGlyGluAspLysAlaLeu-2455  
 2460-AspTyrArgAspTyrGlyAlaArgAsnProGlnThrTyrAsnAsp-2474  
 2476-LysLeuPheGluGluTyrArgArgGlnAspLysProGluTyrArg-2490  
 2498-GlyThrLysAspThrLysIleArgGlnGlyGluArgLysAsnGluGluPhe-2514  
 2528-ProAsnProArgIleLys-2533  
 2541-ArgAsnLeuLysAsnIleLys-2547  
 2570-AsnValAlaLysGlyAspArgIleProAsp-2579  
 2585-LysGlyIleLysHisLysAsnArgLysAspGlnLeuGluLysAsnLysLysSerGlyGluAspPheGluMet-2608  
 2610-IleTyrGlnLysLysValLysGlnGlyPheLysProGlnArg-2623  
 2625-IleThrValLysThrLysSerGlyValLysThrArgLeuAspIleIleSerLysGluGlyGlyLeu-2646  
 2648-ValCysThrGluCysLysAla-2654  
 2660-LeuThrLysAsnGlnLysLysAlaPheProGluIleGluArgThrGly-2675  
 2680-GlyLysGlyLysProGlyTyrProLysGlyThrLysIleGluProThrLysValIleIleGluArgLysArg-2703

**565****AMPHI Regions - AMPHI**

50-AlaThrCysThrArgAlaMetSerLysSer-59  
 66-SerSerTrpAlaArg-70  
 84-IleSerThrTrpSerAspLeu-90  
 103-AspPheMetSerGlnLeuAspLeuThr-111  
 140-SerHisSerGlyGluThrIleSerSerCysProAlaMetAlaSerIleThrLysProAsn-159  
 184-AlaAsnThrThrSerAlaPhe-190

**Antigenic Index - Jameson-Wolf**

1-MetAspSerThrLeuSerLysThrCys-9  
 23-PheAlaArgProArgProAlaAlaSerAsnThrSerLeu-35  
 37-PheAlaSerProAsnAspThrGlySer-45  
 55-AlaMetSerLysSerSerAlaLysTyrGly-64  
 67-SerTrpAlaArgThrArgProThrValCysProProLeuProLysProThrIle-84  
 99-CysArgSerSerAspPheMetSer-106  
 109-AspLeuThrLysArgProThrSerAlaSerLeuProProLysArgLysGlyAlaIle-127  
 129-IleAspSerArgThrAlaAla-135  
 140-SerHisSerGlyGluThrIleSerSer-148  
 154-SerIleThrLysProAsnSerProProCysAlaArgTyr-166  
 170-LeuArgLeuSerProThrGlu-176  
 194-SerIleAlaAsnSerIleAsnThrCysArgGlnProPro-206

**Hydrophilic Regions - Hopp-Woods**

24-AlaArgProArgProAlaAla-30  
 39-SerProAsnAspThrGlySer-45  
 55-AlaMetSerLysSerSerAla-61  
 69-AlaArgThrArgPro-73  
 100-ArgSerSerAspPhe-104

-191-

109-AspLeuThrLysArgProThrSer-116  
 119-LeuProProLysArgLysGlyAlaIle-127  
 129-IleAspSerArgThr-133  
 141-HisSerGlyGluThrIleSer-147  
 156-ThrLysProAsnSer-160

566

**Hydrophilic Regions - Hopp-Woods**

29-ProPheArgAspGlyAlaHisLysMet-37  
 64-AsnIleProAspArgProAla-70  
 95-ValAlaLysArgGluLeuPhe-101  
 116-IleGlyIleAspArgAsnAsnArgArgGluAlaAsnGluGlnLeuIle-131  
 134-GlyLeuValArgLysAsnGlu-140  
 149-GluGlyThrArgLeuAlaProGlyLysArgGlyLysTyrLysLeuGlyGly-165  
 211-SerGlySerGluAlaGluLeuMetGluLysCysGluHisLeuIle-225  
 242-MetProSerGluThrAla-247

**Antigenic Index - Jameson-Wolf**

32-PheAlaValAspProAsnCysGlyAlaAspGlyThrGlyGlyLysGlyHisAla-49  
 61-AlaValGlyGlyGluGluGlyGlyValValAlaAspAspValAlaCysAlaAspGlyGlyLysAlaAspGlyA  
 rgArgIleAlaArg-89  
 105-SerAlaGluArgAlaGlyAspAspPheAla-114

**Hydrophilic Regions - Hopp-Woods**

36-ProAsnCysGlyAlaAspGlyThrGlyGlyLysGlyHisAla-49  
 63-GlyGlyGluGluGlyGlyValValAlaAspAspValAlaCys-76  
 78-AspGlyGlyLysAlaAspGlyArgArgIleAlaArg-89  
 105-SerAlaGluArgAlaGlyAspAspPheAla-114

567

**AMPHI Regions - AMPHI**

60-GlyValTyrGlnVal-64  
 98-GluLeuValGlnGluIleAlaArgGluVal-107  
 112-AlaLeuLysAlaVal-116  
 154-TyrAlaLeuGluGlyIleSerAspLeuIleAlaThrValArgLysIleArgGln-171  
 180-ThrGlyIleValArg-184  
 195-AlaGluValSerGluGlnLeuArgSerHisPheGlyAspLeuLeu-209

**Antigenic Index - Jameson-Wolf**

10-AsnGlnLysGlyGlyValGlyLysThrThrThr-20  
 28-LeuAlaSerArgGlyLysArg-34

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38-ValAspLeuAspProGlnGlyAsnAlaThrThrGlySerGlyIleAspLysAlaGlyLeuGlnSerGly-60  
 67-GlyAspAlaAspValGln-72  
 75-AlaValArgSerLysGluGlyGly-82  
 95-AlaGluIleGluLeu-99  
 101-GlnGluIleAlaArgGluValArgLeuLysAsnAlaLeuLysAlaValGluGluAspTyrAsp-121  
 127-CysProProSerLeu-131  
 164-AlaThrValArgLysIleArgGlnAlaValAsnProAspLeuAspIle-179

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185-ThrMetTyrAspSerArgSerArgLeuValAlaGluValSerGluGlnLeuArgSerHisPheGlyAspLeu  
 -208  
 214-IleProArgAsnIleArgLeuAlaGluAlaProSerHisGly-227

-192-

235-AlaGlnAlaLysGlyThrLys-241  
 248-AspGluLeuAlaAlaArgValSerGlyLys-257

**Hydrophilic Regions - Hopp-Woods**

10-AsnGlnLysGlyGlyValGlyLys-17  
 28-LeuAlaSerArgGlyLysArg-34

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40-LeuAspProGlnGly-44  
 50-SerGlyIleAspLysAlaGlyLeu-57  
 67-GlyAspAlaAspValGln-72  
 75-AlaValArgSerLysGluGlyGly-82  
 95-AlaGluIleGluLeu-99

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101-GlnGluIleAlaArgGluValArgLeuLysAsnAlaLeuLysAlaValGluGluAspTyrAsp-121  
 164-AlaThrValArgLysIleArgGln-171

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175-ProAspLeuAspIle-179

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186-MetTyrAspSerArgSerArgLeuValAlaGluValSerGluGlnLeuArg-202  
 216-ArgAsnIleArgLeuAlaGluAlaProSer-225  
 235-AlaGlnAlaLysGlyThrLys-241  
 248-AspGluLeuAlaAla-252

568

**AMPHI Regions - AMPHI**

32-AsnIlePheArgArgIle-37  
 49-LysAlaCysLysAsn-53  
 71-GluLysAlaAsnThrValArgTyr-78  
 82-SerLeuAlaGlnCysPheThr-88  
 112-ArgProLeuProSerIleIleThrAla-120  
 169-GluPheValGlyPheGlyAsnValPheValGlyGlnPheLeuAsnArgPhePhe-186  
 200-GluGluPhePheAspValValVal-207  
 228-PheAsnGlnValPheAlaAlaPheLeu-236  
 241-HisArgHisAlaAspGlnValAlaAspSerCysArgValGlnSerGln-256

**Antigenic Index - Jameson-Wolf**

14-SerAlaSerSerMetProCysArgIleCysArgLeuLysArgSerArgLeuProAsnIlePhe-34  
 39-PheSerCysArgArgArgThrCysPheCysLysAlaCysLysAsnSerProIleArgAsnGluThrSerSerS  
 erGlyArgArgGlnPheSerValGluLysAlaAsnThr-75  
 91-SerAsnAlaSerLysProArgLeu-98  
 100-ProIleMetArgGlyArgLysArgPhePheAla-110  
 141-PheArgGlySerAlaPheLysCysArgLeuAsnAlaGluProCysArg-156  
 213-ValAlaAspArgAspAlaAla-219  
 237-GlyGlnHisGlyHisArgHisAlaAspGlnValAlaAspSerCysArgValGlnSerGln-256

**Hydrophilic Regions - Hopp-Woods**

21-ArgIleCysArgLeuLysArgSerArgLeu-30

-193-

41-CysArgArgArgThrCysPhe-47  
 49-LysAlaCysLysAsnSerProIleArgAsnGluThrSerSerSerGlyArgArgGlnPheSerValGluLysAlaAsnThr-75  
 93-AlaSerLysProArgLeu-98  
 102-MetArgGlyArgLysArgPhePheAla-110  
 144-SerAlaPheLysCysArgLeuAsnAlaGluProCysArg-156  
 213-ValAlaAspArgAspAlaAla-219  
 239HisGlyHisArgHisAlaAspGlnValAlaAspSerCysArgVal-253  
 569

**AMPHI Regions - AMPHI**

29-AlaAlaPheCysGlyLeuIleAlaLeuIleAlaLeuTrpGluTyrAlaArgMetGlyGlyLeuCysLys-51  
 86-PheTrpLeuAlaValMetPro-92  
 166-SerProGlyLysSerTrpGluGlyAlaIle-175  
 203-ThrValLeuIleGlyLeu-208  
 210-LeuThrValValSerValCysGlyAspLeuLeuGluSerTrpLeuLys-225  
 229-GlyIleLysAspSerSer-234

**Antigenic Index - Jameson-Wolf**

50-CysLysIleLysThrAsnHis-56  
 98-LysTrpArgLeuAsnGlyGlyTrp-105  
 124-SerLeuArgProHisProAspAspAlaLeu-133  
 154-LysAlaPheGlyLysHisLysIle-161  
 165-IleSerProGlyLysSerTrpGlu-172  
 227-AlaAlaGlyIleLysAspSerSerLysLeuLeuProGlyHis-240  
 242-GlyValPheAspArgThrAspSer-249

**Hydrophilic Regions - Hopp-Woods**

50-CysLysIleLysThr-54  
 127-ProHisProAspAspAlaLeu-133  
 155-AlaPheGlyLysHisLysIle-161  
 227-AlaAlaGlyIleLysAspSerSerLys-235  
 243-ValPheAspArgThrAspSer-249  
 570

**AMPHI Regions - AMPHI**

6-ArgAlaPheAlaAlaAlaLeuIleGlyLeu-15  
 22-HisAlaAspThrPheGlnLysIleGlyPheIleAsn-33  
 43-GlnAlaArgLysIleGlnLysThrLeuAspSer-53  
 60-AspGluLeuGlnLysLeuGln-66  
 81-LeuArgAsnAlaLysLys-86  
 91-GluLysTrpArgGlyLeuValAla-98  
 122-LeuGlnGlnAsnAlaAsnArgValIleValLysIle-133

**Antigenic Index - Jameson-Wolf**

33-AsnThrGluArgIleTyrLeuGluSerLysGlnAlaArgLysIleGlnLysThrLeuAspSerGluPheSerAlaArgGlnAspGluLeuGlnLysLeuGlnArgGluGlyLeuAspLeuGluArgGlnLeuAlaGluGlyLysLeuArgAsnAlaLysLysAlaGlnAlaGluGluLysTrpArg-94  
 100-PheArgLysLysGlnAlaGlnPheGluGluAspTyrAsnLeuArgArgAsnGluGluPheAla-120  
 123-GlnGlnAsnAlaAsnArgVal-129  
 133-IleAlaLysGlnGluGlyTyrAspVal-141  
 152-GlnTyrAspValThrAspSerValIleLysGluMetAsnAlaArg-166

**Hydrophilic Regions - Hopp-Woods**

37-IleTyrLeuGluSerLysGlnAlaArgLysIleGlnLysThrLeuAspSerGluPheSerAlaArgGlnAspGluLeuGlnLysLeuGlnArgGluGlyLeuAspLeuGluArgGlnLeuAlaGluGlyLysLeuArgAsnAlaLysLysAlaGlnAlaGluGluLysTrpArg-94

-194-

100-PheArgLysLysGlnAlaGlnPheGluGluAspTyrAsnLeuArgArgAsnGluGluPheAla-120  
 133-IleAlaLysGlnGluGlyTyr-139  
 154-AspValThrAspSerValIleLysGluMetAsnAlaArg-166  
 571

**AMPHI Regions - AMPHI**

6-AlaValAsnValLeu-10  
 40-AspGlyAlaArgValPheArgAlaGly-48  
 63-AlaAlaValAlaAspPhePheAlaVal-71  
 94-ValGluValPheLysGlu-99

**Antigenic Index - Jameson-Wolf**

13-AlaAlaGlyArgGlyThr-18  
 35-LysGlnAlaGlnAlaAspGlyAlaArgValPheArgAlaGlyHisArgGluGluGlnLeuGlyGlyAspVal-58  
 76-PheArgThrGluArgAlaAla-82  
 96-ValPheLysGluGlyAspPhe-102  
 110-ArgAsnAlaAspPheAlaAlaGluHisGlnArgGluGlyPheAlaGlnGlyGluGluProGlyLeu-131  
 142-AlaAlaArgGlnGlyAspPheGlyVal-150  
 155-ValAlaAlaArgArgPro-160

**Hydrophilic Regions - Hopp-Woods**

13-AlaAlaGlyArgGly-17  
 35-LysGlnAlaGlnAlaAspGlyAlaArgValPheArgAlaGlyHisArgGluGluGlnLeuGly-55  
 76-PheArgThrGluArgAlaAla-82  
 96-ValPheLysGluGlyAspPhe-102  
 110-ArgAsnAlaAspPheAlaAlaGluHisGlnArgGluGlyPheAlaGlnGlyGluGluProGly-130  
 155-ValAlaAlaArgArgPro-160

572-2

**AMPHI Regions - AMPHI**

20-LeuAspValValSerArgHisProGluLysPheArgVal-32  
 39-LysGlnValGluLysLeuAlaAlaGlnCys-48  
 85-GlnAlaLeuValAspValAlaSerAlaAspGlu-95  
 101-CysAlaIleValGlyAlaValGlyLeuProSerAlaLeuAla-114  
 160-GlnValLeuProArgAspTyrAlaGlyArg-169  
 192-LeuAsnThrPheAspArgIleThrProAlaGlnAlaValLys-205  
 225-LysGlyLeuGluLeu-229  
 253-IleHisSerMetValArg-258  
 282-GlyLeuProGluArgIleAspSerGly-290  
 299-LeuSerAlaLeuThr-303  
 340-ValAlaAlaPheLeu-344  
 350-PheThrAspIleAlaLysThrValAlaHisCysLeuAlaGlnAspPheSerAspGlyIleGlyAspIleGlyGly-374

**Antigenic Index - Jameson-Wolf**

11-SerThrGlySerIleGlyGluSerThrLeu-20  
 22-ValValSerArgHisProGluLysPheArg-31  
 39-LysGlnValGluLysLeuAla-45  
 59-AlaAspAlaGluHisAlaAlaArgLeu-67  
 69-AlaLeuLeuLysArgAspGlyThrAla-77  
 91-AlaSerAlaAspGluValSer-97  
 117-GlnLysGlyLysThr-121  
 125-AlaAsnLysGluThrLeu-130  
 140-ThrAlaArgAlaAsnGly-145  
 150-ProValAspSerGluHis-155  
 162-LeuProArgAspTyrAlaGlyArgLeuAsnGluHisGly-174

-195-

193-AsnThrPheAspArgIleThrProAlaGlnAlaValLysHisProAsnTrpArgMetGlyArgLysIleSer  
ValAspSer-219  
224-AsnLysGlyLeuGluLeu-229  
237-AsnCysProProAspLysLeuGluVal-245  
257-ValArgTyrArgAspGlySerVal-264  
269-GlyAsnProAspMetArgThr-275  
283-LeuProGluArgIleAspSerGlyValGlyAspLeuAspPhe-296  
303-ThrPheGlnLysProAspPheAspArg-311  
363-GlnAspPheSerAspGlyIleGlyAspIleGly-373  
378-GlnAspAlaArgThrArgAlaGlnAla-386

**Hydrophilic Regions - Hopp-Woods**

22-ValValSerArgHisProGluLysPheArg-31  
39-LysGlnValGluLysLeuAla-45  
59-AlaAspAlaGluHisAlaAlaArgLeu-67  
69-AlaLeuLeuLysArgAspGlyThrAla-77  
91-AlaSerAlaAspGluValSer-97  
126-AsnLysGluThrLeu-130  
140-ThrAlaArgAlaAsnGly-145  
151-ValAspSerGluHis-155  
165-AspTyrAlaGlyArgLeuAsnGlu-172  
196-AspArgIleThrPro-200  
210-ArgMetGlyArgLysIleSerVal-217  
225-LysGlyLeuGluLeu-229  
239-ProProAspLysLeuGlu-244  
257-ValArgTyrArgAspGlySer-263  
269-GlyAsnProAspMetArgThr-275  
283-LeuProGluArgIleAspSerGlyValGlyAspLeuAspPhe-296  
305-GlnLysProAspPheAspArg-311  
364-AspPheSerAspGlyIleGly-370  
378-GlnAspAlaArgThrArgAlaGlnAla-386

**574****AMPHI Regions - AMPHI**

6-ProAsnSerLeuLysLys-11  
47-LeuLysGlnAlaLysSerIleProSerGlyPheTyrLysSerLeuAspAlaLeuValAspArgAsnSerGlyA  
rgAlaAlaArgGluLeuAlaGluValValAsp-81  
94-GlyLysLeuTyrArgGln-99  
113-MetLeuAspSerProAspThr-119  
175-GluLysAlaValGluThrAlaArgLeu-183  
218-AsnValGlyLysAlaLeuGluAlaAsnLysLysCys-229  
246-PheProAlaAlaValGluAlaTyrAlaAlaIleGlu-257  
266-MetValGlyGluLysLeuTyrGluAlaTyrAla-276  
281-ProGluGluGlyLeuAsnArgLeuThrGlyTyrMetGlnThrPheProGluLeuAspLeu-300  
332-AsnGlyValTyrArg-336  
357-ArgSerValIleGlyArgGlnLeuGlnArgSer-367

**Antigenic Index - Jameson-Wolf**

1-MetArgProAsnLeuProAsnSerLeuLysLysAlaAspMetAspAsn-16  
45-ThrValLeuLysGlnAlaLysSerIleProSerGlyPheTyrLysSerLeuAspAlaLeuValAspArgAsnS  
erGlyArgAlaAlaArgGluLeuAlaGluValValAspGlyArgProGlnSerTyrAsp-88  
96-LeuTyrArgGlnArgGlyGluAsnAspLysAlaIleAsnIleHisArgThrMetLeuAspSerProAspThrV  
alGlyGluLysArgAlaArgVal-127  
135-TyrGlnSerAlaGlyLeuValAspArgAlaGlu-145  
151-LeuGlnAspGlyLysMetAlaArgGluAlaArgGln-162  
168-TyrGlnGlnAspArgAspTrpGluLysAlaValGluThr-180

-196-

182-ArgLeuLeuSerHisAspAspGlnThrTyr-191  
 221-LysAlaLeuGluAlaAsnLysLysCysThrArg-231  
 238-AspIleGluHisArgGlnGlyAsn-245  
 277-AlaGlnGlyLysProGluGluGlyLeuAsnArgLeuThrGlyTyr-291  
 312-LysCysGluLysGluAlaAla-318  
 323-GluLeuValArgArgLysProAspLeuAsnGly-333  
 341-LysLeuSerAspMetAsnProAlaTrpLysAlaAspAlaAspMetMetArg-357  
 368-ValMetTyrArgCysArgAsnCysHisPheLys-378  
 386-CysProAlaCysAsnLysTrpGlnThrPheThrProAsnLysIleGluVal-402

**Hydrophilic Regions - Hopp-Woods**

1-MetArgProAsnLeu-5  
 7-AsnSerLeuLysLysAlaAspMetAspAsn-16  
 45-ThrValLeuLysGlnAlaLysSerIle-53  
 62-AspAlaLeuValAspArgAsnSerGlyArgAlaAlaArgGluLeuAlaGluValValAspGlyArgProGlnSer-86  
 96-LeuTyrArgGlnArgGlyGluAsnAspLysAlaIleAsn-108  
 112-ThrMetLeuAspSerProAspThrValGlyGluLysArgAlaArgVal-127  
 140-LeuValAspArgAlaGlu-145  
 152-GlnAspGlyLysMetAlaArgGluAlaArgGln-162  
 169-GlnGlnAspArgAspTrpGluLysAlaValGluThr-180  
 184-LeuSerHisAspAspGlnThrTyr-191  
 221-LysAlaLeuGluAlaAsnLysLysCysThrArg-231  
 238-AspIleGluHisArgGlnGlyAsn-245  
 279-GlyLysProGluGluGlyLeuAsn-286  
 312-LysCysGluLysGluAlaAla-318  
 323-GluLeuValArgArgLysProAspLeu-331  
 349-TrpLysAlaAspAlaAspMetMetArg-357  
 368-ValMetTyrArgCysArgAsnCysHis-376  
 398-AsnLysIleGluVal-402  
 575

**AMPHI Regions - AMPHI**

8-PheArgLysProAlaSer-13  
 20-PheAlaGluAlaVal-24  
 42-SerThrValSerGlyLeuPheSerAla-50  
 114-LeuSerLysSerLysSer-119  
 139-SerSerAspSerPro-143  
 150-PheThrSerPhePheGly-155  
 163-ValSerThrSerAlaLysValIleSerMetPro-173  
 217-SerLysValTyrGluProProAsnArgProSerAsn-228  
 237-AlaGluThrCysSerThr-242  
 287-AlaGlyPheSerAlaPheAlaSerGlyAla-296

298-ThrPheAlaSerGlyPheSerThrGly-306

308-SerThrValAlaCys-312  
 315-GlySerAspGlyMetAspAlaValSerAlaLeu-325

**Antigenic Index - Jameson-Wolf**

2-ValSerGlyGluGluAlaPheArgLysProAlaSerProGluGlyGluAlaGlyPhe-20  
 34-GlyArgLeuSerGluLysSerValSer-42  
 54-ThrAspSerGlySerGlyVal-60  
 96-SerSerSerCysValSerAlaProAspLysMetProPhe-108

-197-

113-ArgLeuSerLysSerLysSerMetArgLeuGluGly-124

134-PheAlaAspAsnSerSerSerAspSerProSerLysAlaSerVal-148

155-GlyAlaGlySerGly-159

173-ProSerSerAlaAlaSerSerArgSerGlySerSerSerGlyThrAspSerSerValArgArgAlaArgLeu  
AspTrpAlaArgArgLysSerSerSerArgAlaIle-208

211-AlaProProProAlaSer-216

218-LysValTyrGluProProAsnArgProSerAsnSer-229

232-SerValSerSerSerAlaGluThrCysSerThrGlySerGluThr-246

265-GlyAlaAspSerAlaAlaVal-271

280-GlyThrGlySerGlyArgThrAla-287

303-PheSerThrGlyPhe-307

313-LeuAspGlySerAspGlyMetAsp-320

**Hydrophilic Regions - Hopp-Woods**

2-ValSerGlyGluGluAlaPheArgLysProAlaSerProGluGlyGluAlaGlyPhe-20

34-GlyArgLeuSerGluLysSerValSer-42

101-SerAlaProAspLysMetPro-107

113-ArgLeuSerLysSerLysSerMetArgLeuGluGly-124

137-AsnSerSerSerAspSerProSerLysAla-146

176-AlaAlaSerSerArgSerGlySerSerSerGlyThrAspSerSerValArgArgAlaArgLeuAspTrpAla  
ArgArgLysSerSerSerArgAlaIle-208

218-LysValTyrGluProProAsnArgProSerAsn-228

235-SerSerAlaGluThrCysSerThrGlySerGluThr-246

314-AspGlySerAspGlyMetAsp-320

**576-1****AMPHI Regions - AMPHI**

31-AlaSerGluProAlaAlaAla-37

46-SerIleGlySerThr-50

63-GlyArgSerLeuLysGlnMetLys-70

82-ThrGluAlaMetGln-86

102-GlnGluValMetMetLysPheLeuGlnGluGlnGlnAlaLysAlaValGluLysHis-120

140-AlaLysAspGlyValLysThrThr-147

199-SerGlnValIleProGlyTrpThrGluGlyVal-209

**Antigenic Index - Jameson-Wolf**

20-AlaCysGlyLysLysGluAlaAlaPro-28

30-SerAlaSerGluProAlaAla-36

38-SerSerAlaGlnGlyAspThrSerSerIleGly-48

61-AspIleGlyArgSerLeuLysGlnMetLysGluGlnGlyAlaGluIleAspLeu-78

89-TyrAspGlyLysGluIleLysMetThrGluGluGlnAlaGln-102

109-LeuGlnGluGlnGlnAlaLysAlaValGluLysHisLysAlaAspAlaLysAlaAsnLysGluLysGlyGlu  
AlaPheLeuLysGluAsnAlaAlaLysAspGlyValLysThrThrAlaSerGlyLeu-151

154-LysIleThrLysGlnGlyGluGlyLysGlnProThrLysAspAspIleVal-170

173-GluTyrGluGlyArgLeuIleAsp-180

183-ValPheAspSerSerLysAlaAsnGlyGly-192

210-GlnLeuLeuLysGluGlyGlyGlu-217

224-SerAsnLeuAlaTyrArgGluGlnGlyAlaGlyAspLysIleGlyProAsnAla-241

253-GlyAlaProGluAsnAlaProAlaLysGlnProAla-264

266-ValAspIleLysLysValAsn-272

-198-

**Hydrophilic Regions - Hopp-Woods**

21-CysGlyLysLysGluAlaAlaPro-28  
 30-SerAlaSerGluProAlaAla-36  
 40-AlaGlnGlyAspThrSerSer-46  
 61-AspIleGlyArgSerLeuLysGlnMetLysGluGlnGlyAlaGluIleAspLeu-78  
 89-TyrAspGlyLysGluIleLysMetThrGluGluGlnAlaGln-102  
 112-GlnGlnAlaLysAlaValGluLysHisLysAlaAspAlaLysAlaAsnLysGluLysGlyGluAlaPheLeu  
 LysGluAsnAlaAlaLysAspGlyValLysThrThrAla-148  
 155-IleThrLysGlnGlyGluGlyLysGlnProThrLysAspAspIleVal-170  
 173-GluTyrGluGlyArgLeuIleAsp-180  
 185-AspSerSerLysAlaAsnGly-191  
 210-GlnLeuLeuLysGluGlyGlyGlu-217  
 227-AlaTyrArgGluGlnGlyAlaGlyAspLysIleGlyPro-239  
 253-GlyAlaProGluAsnAlaProAlaLysGlnProAla-264  
 266-ValAspIleLysLysValAsn-272  
 577

**AMPHI Regions - AMPHI**

8-GlyLysIleValGlyAsn-13  
 24-AlaAlaSerTyrProLysProCysLysSerPheLysLeuAla-37  
 62-ThrValIleLysIleIle-67  
 104-AlaPheValValGlyIleIlePheGlyMetPheAlaLeuPheGlyArg-119  
 144-GluLeuThrAlaProProAlaGln-151

**Antigenic Index - Jameson-Wolf**

1-MetGluArgAsnGlyVal-6  
 14-ArgIleLeuArgMetSerSerGluHisAla-23  
 26-SerTyrProLysProCysLysSerPheLys-35  
 88-LeuProGlyGlnLysPheAspLeu-95  
 121-LeuSerLeuArgGlyGluAsnGlyArgLeuArgAlaGluValLysLysAsnAlaArgLeuThrGlyLysGlu  
 LeuThrAlaProProAlaGlnAsnAlaProGluSerThrLysGlnPro-160

**Hydrophilic Regions - Hopp-Woods**

1-MetGluArgAsnGlyVal-6  
 14-ArgIleLeuArgMetSerSerGluHisAla-23  
 29-LysProCysLysSerPheLys-35  
 121-LeuSerLeuArgGlyGluAsnGlyArgLeuArgAlaGluValLysLysAsnAlaArgLeuThrGlyLysGlu  
 LeuThr-146  
 152-AsnAlaProGluSerThrLysGlnPro-160  
 578

**AMPHI Regions - AMPHI**

10-PheAlaAspPhePheLysAspPheAlaProGlnPheGlyGlyPheGlnAsn-26  
 34-AspPhePheAlaAlaPheLeuGlyGlyLeuGluGlyAsnMetGlyAsnThrAla-51  
 71-AsnAlaAspAlaAlaArgPhe-77

**Antigenic Index - Jameson-Wolf**

2-GlyLysLeuAspIle-6  
 13-PhePheLysAspPheAlaProGlnPheGlyGly-23  
 43-LeuGluGlyAsnMetGlyAsnThrAla-51  
 73-AspAlaAlaArgPheAlaGlu-79  
 90-GlnAsnIleGlnThrGlyAsnAspPheArgLeuGlnArgGlyGlyValGly-106

**Hydrophilic Regions - Hopp-Woods**

2-GlyLysLeuAspIle-6  
 73-AspAlaAlaArgPheAlaGlu-79  
 96-AsnAspPheArgLeuGlnArg-102

-199-

579-1

**AMPHI Regions - AMPHI**

6-PheAspPheLeuHisLeuIleSerValSerGlyTrpGluHisLeuAlaGlu-22  
 49-ValAlaValMetArg-53  
 66-IleSerPheLeuCysAsn-71  
 115-LeuSerAsnPheAla-119  
 129-ProPheLysValGlyAspPheIleArgValGlyGlyPheGluGlyTyrValArgGluIleLys-149  
 258-GlnValValGluAsnLeuArg-264

**Antigenic Index - Jameson-Wolf**

110-SerLeuLysAspGlnLeuSer-116  
 128-ArgProPheLysVal-132  
 136-IleArgValGlyGlyPheGluGlyTyrValArgGluIleLysMet-150  
 154-SerLeuArgThrThrAspAsnGluGluValValLeu-165  
 175-IleValAsnArgSerThrLeu-181  
 198-LeuLysValAlaLysGluAlaValLeu-206  
 216-ValGlnAsnGluGluArgGlnAla-223  
 231-GlyAspAsnAlaIle-235  
 244-AsnGluAlaAspArgTrpThrLeu-251  
 253-CysAspLeuAsnGluGlnValValGluAsnLeuArgLysValAsn-267  
 271-ProPheProGlnArgAspIleHis-278

**Hydrophilic Regions - Hopp-Woods**

110-SerLeuLysAspGlnLeu-115  
 144-TyrValArgGluIleLysMet-150  
 155-LeuArgThrThrAspAsnGluGluValVal-164  
 198-LeuLysValAlaLysGluAlaValLeu-206  
 216-ValGlnAsnGluGluArgGlnAla-223  
 244-AsnGluAlaAspArgTrp-249  
 254-AspLeuAsnGluGlnValValGluAsnLeuArgLysValAsn-267  
 273-ProGlnArgAspIleHis-278

580

**AMPHI Regions - AMPHI**

47-ProValSerAlaSerLys-52  
 54-SerLeuValLysProLeuSerGlnProLeuAla-64

**Antigenic Index - Jameson-Wolf**

1-MetAspSerProLysValGlyCysGly-9  
 35-ProPheGlyProThrMetPro-41  
 48-ValSerAlaSerLys-52  
 66-AlaArgProGluAlaAlaHis-72  
 81-ArgProGluAlaLeuAlaAspSerSerValSerProThrHisAlaThrSerGlyGluVal-100

**Hydrophilic Regions - Hopp-Woods**

1-MetAspSerProLysVal-6  
 66-AlaArgProGluAlaAlaHis-72  
 81-ArgProGluAlaLeuAla-86  
 96-ThrSerGlyGluVal-100

581

**AMPHI Regions - AMPHI**

43-SerHisPheIleSerLeu-48  
 56-ArgGluCysPheValGlyPhe-62  
 76-AlaThrAlaPheGlyArgIleAsnGln-84  
 91-ValHisGlyPheLeuThrThrPheAlaGlyArgIleAlaAsnProAlaHisCysGlnSerGlnThr-112

-200-

**Antigenic Index - Jameson-Wolf**

8-GlyGlnThrGlyIleGluGlnAsnThrPheCysArgArgGlyPheThrArgValAsnMetGlyGlyAsnThrAspVal-33  
 35-ValGlnAlaAspArgGlyLeuThrSer-43  
 49-SerLysLeuGluThrGluValArgGluCysPhe-59  
 100-GlyArgIleAlaAsnProAlaHisCysGlnSerGlnThrAla-113

**Hydrophilic Regions - Hopp-Woods**

35-ValGlnAlaAspArgGlyLeu-41  
 49-SerLysLeuGluThrGluValArgGlu-57

582

**AMPHI Regions - AMPHI**

27-ThrAspAsnValThrArgLeuAla-34  
 65-ValArgSerSerLeu-69  
 91-GlyGluThrAlaAspIleTyrThrProLeuSer-101  
 139-GlySerProThrArg-143  
 169-IleAlaGluAspLeuPhe-174  
 246-SerArgSerTrpAsnArgIleTyrAlaMet-255  
 263-LeuThrValIleProArgValTrpValArgAlaPheAspGlnSer-277  
 286-IleAlaAspTyrMetGlyTyr-292  
 334-LeuLysGlyValValArgGlyPheHisGlyTyrGlyGlu-346

**Antigenic Index - Jameson-Wolf**

26-LeuThrAspAsnValThr-31  
 34-AlaCysTyrAspArg-38  
 44-LeuProSerSerAlaGlyGlnGluGlyGlnGluSerLysAla-57  
 63-GluThrValArgSerSerLeuAspLysGlyGluAla-74  
 77-ValValGluLysGlyGlyAspAlaLeuProAlaAspSerAlaGlyGluThrAlaAsp-95  
 105-AspLeuAspLysAsnAspLeuArgGly-113  
 115-LeuGlyValArgGluHisAsnProMetTyr-124  
 131-AsnAsnSerProAsnTyrAlaProGlySerProThrArgGlyThrThrValGlnGluLysPheGlyGlnGlnLysArgAlaGluThrLysLeu-161  
 165-PheLysSerLysIleAlaGluAspLeuPheLysThrArgAla-178  
 183-GlyTyrThrGlnArgSerAspTrpGlnIleTyrAsnGlnGlyArgLysSerAlaProPheArgAsnThrAspTyrLysPro-209  
 216-ProValLysAlaAspLeuProPheGlyGlyArgLeuArgMet-229  
 237-GlnSerAsnGlyGlnSerArgProGluSerArgSerTrpAsn-250  
 273-AlaPheAspGlnSerGlyAspLysAsnAspAsnProAspIleAlaAsp-288  
 291-GlyTyrGlyAspValLysLeuGlnTyrArgLeuAsnAspArgGlnAsnVal-307  
 312-ArgTyrAsnProLysThrGlyTyr-319  
 330-IleLysGlyLysLeuLysGlyValVal-338  
 342-HisGlyTyrGlyGluSerLeuIleAspTyrAsnHisLysGlnAsnGly-357  
 365-AsnAspLeuAspGlyIle-370

**Hydrophilic Regions - Hopp-Woods**

48-AlaGlyGlnGluGlyGlnGluSerLysAla-57  
 63-GluThrValArgSerSerLeuAspLysGlyGluAla-74  
 79-GluLysGlyGlyAspAlaLeuProAlaAspSerAlaGlyGluThrAlaAsp-95  
 105-AspLeuAspLysAsnAspLeuArgGly-113  
 115-LeuGlyValArgGluHisAsn-121  
 140-SerProThrArgGlyThrThrValGlnGluLysPheGlyGlnGlnLysArgAlaGluThrLysLeu-161  
 165-PheLysSerLysIleAlaGluAspLeuPheLysThrArgAla-178  
 195-GlnGlyArgLysSerAlaProPheArgAsnThrAspTyrLysPro-209  
 225-GlyArgLeuArgMet-229  
 239-AsnGlyGlnSerArgProGluSerArgSerTrp-249

-201-

274-PheAspGlnSerGlyAspLysAsnAspAsnProAspIleAlaAsp-288  
 293-GlyAspValLysLeu-297  
 299-TyrArgLeuAsnAspArgGlnAsn-306  
 332-GlyLysLeuLysGlyValVal-338  
 352-AsnHisLysGlnAsn-356  
 583

**AMPHI Regions - AMPHI**

11-HisLeuAlaPheCysAlaPheCysGlyIle-20  
 28-ArgLeuHisAsnArgMetTyrAsnAlaAlaAlaAlaArg-40  
 58-ValThrAspAlaGln-62  
 66-SerLysAsnGlyAspLysGlnIle-73  
 75-AspThrHisProGlnPro-80  
 117-GlyTyrAlaGlyTyrCysAspGln-124  
 140-AspAsnGlyGlyAsnHisThrAsp-147  
 162-GlyTyrGlyGlnCysGlnAsnGlnGlyAla-171

**Antigenic Index - Jameson-Wolf**

24-ThrAlaGlyAsnArgLeuHisAsnArgMetTyr-34  
 41-GlyIleGlyArgGlyAsnGlySerGlnGlnGlnPheGlyLysSerGluThrValThrAspAlaGlnArgPheSerSerLysAsnGlyAspLysGlnIleSerAspThrHisProGlnProCysPheGluGlnThrAlaArgAsnHisAsnCysAspGlyAsnGlnProAsnGlnArgIleGlyGluArgThrGlnArgIleAlaHisArgArgAlaArgPhe-114  
 117-GlyTyrAlaGlyTyCysAspGlnProAspGlyAsnAsnArgGlnArgAlaGlnArgHisGlyLeuAlaAspAsnGlyGlyAsnHisThrAspLysHisGlyGlnGlnArgProSerLeuArgLeuAspProValGlyTyrGlyGlnCysGlnAsnGlnGlyAlaGlnTyrCysGlyAsnGlyGluGlyTyrArgPhe-182  
 190-AspLeuArgLysLysAspArgProGluLysSerGluLys-202

**Hydrophilic Regions - Hopp-Woods**

27-AsnArgLeuHisAsn-31  
 41-GlyIleGlyArgGlyAsnGlySer-48  
 51-GlnPheGlyLysSerGluThrValThrAspAlaGlnArgPheSerSerLysAsnGlyAspLysGlnIleSerAspThrHisPro-78  
 84-GlnThrAlaArgAsnHisAsnCysAspGlyAsnGlnProAsnGlnArgIleGlyGluArgThrGlnArgIleAlaHisArgArgAlaArgPhe-114  
 123-AspGlnProAspGlyAsnAsnArgGlnArgAlaGlnArg-135  
 137-GlyLeuAlaAspAsnGlyGlyAsnHisThrAspLysHisGlyGlnGlnArgProSerLeuArgLeuAspPro-160  
 178-GluGlyTyrArgPhe-182  
 190-AspLeuArgLysLysAspArgProGluLysSerGluLys-202  
 584-2

**AMPHI Regions - AMPHI**

28-GluPheSerGluSerAlaGly-34  
 60-AlaGluPheValLysLysPheAsnLysPheIleArgLys-72  
 115-AspPheAspGluLeuAsnArgPheIleAlaAspIle-126  
 148-IleAspGlnValSerLysAsp-154  
 166-LeuAlaGlyValLeuGly-171  
 186-GlySerHisIleAla-190  
 196-GlnAlaLysMetLeuArgAlaMet-203

**Antigenic Index - Jameson-Wolf**

37-ValAlaGlnAspThrMetSer-43  
 50-AlaGluGlyArgAspLysAsnAlaVal-58  
 61-GluPheValLysLysPheAsnLysPheIleArgLysSerLysAsnGlySerPheLysThrGluLeuValSerArgSerAlaMetProArgTyrGlnTyrThrAsnGlyArgArgIleGlnThrGlyTrpGluGluArgAlaGluPheLysValGluGlyArgAspPheAspGluLeuAsn-120

-202-

138-HisValSerArgGluArgArgAsnGluValIleAspGlnValSerLysAspAlaValLeu-157  
 159-PheLysAlaArgAlaGluLysLeuAla-167  
 189-IleAlaGlyGlyGly-193  
 210-AsnMetGluGlyAlaAspSerAlaAlaProGlyValGluGluIleSer-225

**Hydrophilic Regions - Hopp-Woods**

50-AlaGluGlyArgAspLysAsnAlaVal-58  
 61-GluPheValLysLysPheAsnLysPheIleArgLysSerLysAsnGlySerPheLysThrGluLeuValSer-84  
 95-AsnGlyArgArgIleGlnThrGlyTrpGluGluArgAlaGluPheLysValGluGlyArgAspPheAspGluLeuAsn-120  
 138-HisValSerArgGluArgArgAsnGluValIleAspGlnValSerLysAspAlaValLeu-157  
 159-PheLysAlaArgAlaGluLysLeuAla-167  
 210-AsnMetGluGlyAlaAspSerAlaAlaProGlyValGluGluIleSer-225

585

**AMPHI Regions - AMPHI**

6-ArgIlePheAlaThrPheCysAlaValIleValCys-17  
 46-ThrThrLeuMetGlySerIleIleSer-54  
 65-ArgGluIleLeuThrGluTrpLysAsp-73  
 93-AsnArgTyrIleAsp-97  
 133-LysAspTrpAspLysLeuGlnAlaArgArg-142  
 153-ProLeuAlaProIleTrp-158  
 178-LeuAlaGlyAsnIleAlaLysProIleArgIleLeuGlyAsnGlyMetAspArgValAla-197  
 223-PheAspLysMetValGluLysLeuGluLysLeuVal-234  
 247-GluMetArgSerPro-251  
 255-MetGlnAlaIleValGlyLeuIle-262  
 273-LeuLysArgLeuGluGly-278  
 353-LeuTyrArgAlaPheAspAsnValIleArgAsnAlaValAsn-366  
 430-IleIleGluGlnHisCysGlyLysIleIleAlaGlu-441

**Antigenic Index - Jameson-Wolf**

36-AsnGlnPheAsnGlnArgArgThrIleGlu-45  
 56-PheArgAlaArgGlyAspAlaGlyAlaArgGluIleLeuThrGluTrpLysAspSerProValSer-77  
 84-GlnGlyAspGluLysLysAspIleLeu-92  
 99-TyrThrIleGluArgAlaArgLeu-106  
 120-GluTyrAspArgPheGlyGlu-126  
 133-LysAspTrpAspLysLeuGlnAlaArgArgLeuProSerPro-146  
 189-LeuGlyAsnGlyMetAspArgValAlaAsnGlyGluLeuGluThrArgIle-205

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207-GlnGlnValAspAspArgAspAspGluLeuSer-217  
 225-LysMetValGluLysLeuGluLysLeuValAlaLysGluArgHisLeu-240  
 246-HisGluMetArgSerProLeuAla-253  
 264-AlaGlnProGlnLysGlnGluGlnTyrLeuLysArgLeuGluGlyGluLeuThrArgMetAspThrLeuAla-287  
 294-SerArgLeuGluThrSerAsnMetAlaLeuGluLysGluSerLeuLys-309  
 317-LeuValGluAspAsnGlnSerIleAlaGlnLysAsnGlyGln-330  
 335-SerAlaAspGlyLysIleProGluAsnThr-344  
 367-TyrSerProGluGlySerThr-373  
 377-AsnIleGlyGlnAspHisLysHis-384  
 388-AspValThrAspAsnGlyProGlyValAspGluMetGln-400  
 409-TyrArgAlaAspSerSerAlaAsnLysProGlyThrGly-421  
 432-GluGlnHisCysGlyLysIleIleAlaGluAsnIleLysProAsnGlyLeuArg-449  
 453-IleLeuProLysLysLysThrGlySerLysThrGluLysSerAlaAsn-468

-203-

**Hydrophilic Regions - Hopp-Woods**

37-GlnPheAsnGlnArgArgThrIleGlu-45  
 56-PheArgAlaArgGlyAspAlaGlyAlaArgGluIleLeuThrGluTrpLysAspSerProVal-76  
 84-GlnGlyAspGluLysLysAspIleLeu-92  
 100-ThrIleGluArgAlaArgLeu-106  
 120-GluTyrAspArgPheGlyGlu-126  
 133-LysAspTrpAspLysLeuGlnAlaArgArgLeuPro-144  
 192-GlyMetAspArgValAlaAsnGlyGluLeuGluThrArgIle-205  
  
 207-GlnGlnValAspAspArgAspAspGluLeuSer-217  
 225-LysMetValGluLysLeuGluLysLeuValAlaLysGluArgHisLeu-240  
 246-HisGluMetArgSerProLeu-252  
 265-GlnProGlnLysGlnGluGlnTyrLeuLysArgLeuGluGlyGluLeuThrArgMetAspThrLeuAla-287  
 294-SerArgLeuGluThr-298  
 302-AlaLeuGluLysGluSerLeuLys-309  
 317-LeuValGluAspAsnGlnSerIleAlaGlnLysAsnGlyGln-330  
 336-AlaAspGlyLysIleProGlu-342  
 389-ValThrAspAsnGlyProGlyValAspGluMetGln-400  
 410-ArgAlaAspSerSerAlaAsnLysProGlyThr-420  
  
 438-IleIleAlaGluAsnIleLys-444  
  
 454-LeuProLysLysLysThrGlySerLysThrGluLysSerAlaAsn-468

586

**AMPHI Regions - AMPHI**

12-AspAsnPheLysTyrPheTrpLysThr-20  
 30-IleLeuAlaAlaLeuGly-35  
 56-ValLeuAlaAsnIleValGluLysAlaGlnSerLys-67  
 80-LeuGlnGlnSerTyrProHisSerIleSer-89  
 177-SerGlnGluAlaLeuLysAsnTyrGlyGlnAlaLeuGluLysMetProGlnAspSerValGlyArg-198

**Antigenic Index - Jameson-Wolf**

4-HisLeuGluGluGlnGlnGluLeuAspAsn-13  
 42-TyrGlnAsnArgLysValSerGlnAsnGlnGluAla-53  
 60-IleValGluLysAlaGlnSerLysAlaProGlnSerGluIleAsnAlaGluLeuThrLysLeuGlnGln-82  
 100-ThrGluPheAspAlaGlnArgTyrAspValAlaGluGly-112  
 118-LeuSerAsnGlnLysAspSerLeu-125  
 140-GlnGlnLysLysTyrAspAla-146  
 153-ThrProValGluAlaAspPhe-159  
 164-MetGluThrLysGlyAspVal-170  
 173-AlaGlnGlyLysSerGlnGluAlaLeuLysAsnTyrGlyGlnAlaLeuGluLysMetProGlnAspSerValGlyArgGluLeuVal-201  
 204-LysLeuAspSerLeuLys-209

**Hydrophilic Regions - Hopp-Woods**

4-HisLeuGluGluGlnGlnGluLeuAspAsn-13  
 43-GlnAsnArgLysValSerGlnAsnGlnGluAla-53  
 60-IleValGluLysAlaGlnSerLysAlaProGlnSerGluIleAsnAlaGluLeuThrLys-79  
 100-ThrGluPheAspAlaGlnArgTyrAspValAlaGluGly-112  
 120-AsnGlnLysAspSerLeu-125  
 140-GlnGlnLysLysTyrAspAla-146  
 153-ThrProValGluAlaAspPhe-159

-204-

164-MetGluThrLysGlyAspVal-170  
 174-GlnGlyLysSerGlnGluAlaLeuLys-182  
 187-AlaLeuGluLysMetProGlnAspSerValGlyArgGluLeuVal-201  
 204-LysLeuAspSerLeuLys-209  
 587

**AMPHI Regions - AMPHI**

6-LeuProAlaLeuProAlaIleLeuProLeuSerThr-17  
 190-AsnGlySerLysThrLeuSer-196

**Antigenic Index - Jameson-Wolf**

27-AspIleMetThrAspLysGlyLysTrpLysLeuGluThr-39  
 44-LeuAsnSerGluAsnAsnArgAlaGluLeu-53  
 72-GluIleGlnGluAsnGlySerAsnThrAsp-81  
 95-GlyAsnThrAspIleTyrGlySerGlySer-104  
 108-HisGluGluArgLysLeuAspGlyAsnSerLysThrArgAsnLysArgMetSerAsp-126  
 135-PheLeuLysAspAspLysAsnProAla-143  
 151-ThrValTyrGluLysSerArgAsnLysAlaSerSerGlyLysSer-165  
 187-TyrArgIleAsnGlySerLysThrLeuSerAspGlyIleArgTyrLysSerGlyAsnTyr-206  
 217-AlaAsnAspArgIleSerLeuThrGlyGly-226  
 231-GlyArgGlnProAspArgThrAspGlyLysArgGluSerSerArgAsnThrSerThr-249  
 273-ValSerGlyGlnSerSerSerGluLeuLysPhe-283

**Hydrophilic Regions - Hopp-Woods**

27-AspIleMetThrAspLysGlyLysTrpLysLeu-37  
 47-GluAsnAsnArgAlaGluLeu-53  
 72-GluIleGlnGluAsnGlySerAsnThr-80  
 108-HisGluGluArgLysLeuAspGlyAsnSerLysThrArgAsnLysArgMetSerAsp-126  
 135-PheLeuLysAspAspLysAsnPro-142  
 151-ThrValTyrGluLysSerArgAsnLysAlaSerSerGly-163  
 193-LysThrLeuSerAspGlyIleArgTyrLysSer-203  
 217-AlaAsnAspArgIleSer-222  
 232-ArgGlnProAspArgThrAspGlyLysArgGluSerSerArgAsnThr-247  
 277-SerSerSerGluLeuLysPhe-283

588

**AMPHI Regions - AMPHI**

52-GlnAspGlyArgAsnTyrThrGlySerPhe-61  
 99-GlyThrPheLysLys-103

**Antigenic Index - Jameson-Wolf**

25-SerTyrGlnGluProGlyCysThrTyrAspGlyAsnValGlyLysAspGlyLysProAlaGlyLysGlyThrTrpArgCysGlnAspGlyArgAsnTyrThrGlySerPheLysAsnGlyLysPheAspGlyGlnGly-70  
 80-IlePheIleGluProPheAsnSerAspSerThrLysPheArg-93  
 100-ThrPheLysLysGlyLeuAlaHisGlyArgPheThrValSerGlnAsnGlyGluThr-118  
 124-CysGluAsnGlyMetIleLysGluValLysLeuProLysAsnLys-138

**Hydrophilic Regions - Hopp-Woods**

36-AsnValGlyLysAspGlyLysProAlaGly-45  
 47-GlyThrTrpArgCysGlnAspGlyArgAsnTyr-57  
 61-PheLysAsnGlyLysPheAspGly-68  
 85-PheAsnSerAspSerThrLysPheArg-93  
 100-ThrPheLysLysGlyLeuAla-106  
 124-CysGluAsnGlyMetIleLysGluValLysLeuProLysAsnLys-138

589

**AMPHI Regions - AMPHI**

18-AlaSerArgIleGluLysValLeu-25

-205-

54-ValAlaAspIleAlaLysIleIleGluLys-63  
 125-SerValValGlnLeuTrpLeuAla-132  
 150-MetAspValLeuValThrIle-156  
 193-PheValSerLeuGlyLysPheLeuGluHisArg-203  
 225-ValGlnArgAsnGlyGlu-230  
 240-GlnIleGlyAspLeuIleArg-246  
 307-GlnThrGlnLeuGlyAspMetMetAsnAlaLeuSerGluAlaGln-321  
 325-AlaProIleAlaArgValAlaAspLys-333  
 391-MetGlyLysAlaVal-395  
 466-IleValSerAlaAlaGln-471  
 477-IleProAlaAlaGln-481  
 497-GlyValGlyLeuValLys-502  
 511-LeuAlaLeuProLysPheLeuAspGlyValTrpAspIleAlaSerIle-526  
 539-PheAlaLeuAlaAspAlaLeuLys-546  
 548-AspThrAlaGluAlaIleGlyArgLeu-556  
 598-GluValGlnLysLeuLysAlaAla-605  
 612-ValGlyAspGlyIleAsnAspAlaPro-620  
 635-AlaAspValAlaGluHisThr-641  
 648-GlnHisSerValAsnGlnLeuAlaAsp-656  
 675-AlaPhePheTyrAsnIleLeu-681

**Antigenic Index - Jameson-Wolf**

1-MetGlnGlnLysIleArgPheGlnIle-9  
 17-CysAlaSerArgIleGluLysValLeuAsnLysLysAspPheValGluSer-33  
 39-AlaSerGluGluAlaGlnValValPheAspAspSerLysThrSerVal-54  
 59-LysIleIleGluLysThrGlyTyrGlyAlaLysGluLysThrGluAspThrLeuProGlnProGluAlaGluHis-83  
 109-GlyArgHisAspTrp-113  
 143-IleLysGlyGlyLeu-147  
 200-LeuGluHisArgThrLysLysSerSerLeuAsn-210  
 223-ValAsnValGlnArgAsnGlyGluTrpLysGlnLeuProIleAspGln-238  
 248-AsnHisGlyGluArgIleAlaAla-255  
 257-GlyIleIleGluSerGlySerGlyTrpAlaAspGluSerHisLeuThrGlyGluSerAsnProGluGluLysLysAlaGlyGly-284  
 293-ThrGluGlySerVal-297  
 318-SerGluAlaGlnGlySerLysAlaProIle-327  
 329-ArgValAlaAspLysAlaAla-335  
 356-IleLysGlyAspTrp-360  
 391-MetGlyLysAlaValLys-396  
 404-AlaAlaAlaMetGluGluAlaAlaHis-412  
 417-ValLeuAspLysThrGlyThrLeuThrGluGlySerProGln-430  
 438-ProAspSerGlyPheAspGluAspAlaLeu-447  
 454-ValGluGlnAsnAla-458  
 493-AlaGluValGluGly-497  
 502-LysAlaGlyLysAlaGluPheAla-509  
 530-SerValAspAsnLysProIleGly-537  
 543-AspAlaLeuLysAlaAspThrAlaGluAlaIleGlyArgLeuLysLysHisAsnIle-561  
 567-SerGlyAspAsnGlnGlyThrValGluTyrValAla-578  
 588-GlyAsnMetSerProArgAspLysAlaAlaGluValGlnLysLeuLysAlaAlaGly-606  
 612-ValGlyAspGlyIleAsnAspAla-619  
 631-MetLysGlyGlyAlaAspValAlaGlu-639  
 710-AsnAlaLeuArgLeuLysArgValLysIleAsp-720

**Hydrophilic Regions - Hopp-Woods**

1-MetGlnGlnLysIleArgPheGlnIle-9

19-SerArgIleGluLysValLeuAsnLysLysAspPheValGlu-32  
 39-AlaSerGluGluAlaGlnValValPheAspAspSerLysThrSerVal-54  
 64-ThrGlyTyrGlyAlaLysGluLysThrGluAspThrLeuProGlnProGluAlaGluHis-83  
 200-LeuGluHisArgThrLysLysSerSerLeu-209  
 224-AsnValGlnArgAsnGlyGluTrpLys-232  
 248-AsnHisGlyGluArgIleAlaAla-255  
 257-GlyIleIleGluSer-261  
 265-TrpAlaAspGluSerHisLeuThrGlyGluSerAsnProGluGluLysLysAlaGlyGly-284  
 318-SerGluAlaGlnGlySerLysAlaProIle-327  
 329-ArgValAlaAspLysAlaAla-335  
 404-AlaAlaAlaMetGluGluAlaAlaHis-412  
 417-ValLeuAspLysThrGlyThrLeuThrGluGlySerPro-429  
 440-SerGlyPheAspGluAspAlaLeu-447  
 454-ValGluGlnAsnAla-458  
 493-AlaGluValGluGly-497  
 502-LysAlaGlyLysAlaGluPheAla-509  
 531-ValAspAsnLysPro-535  
 543-AspAlaLeuLysAlaAspThrAlaGluAlaIleGlyArgLeuLysLysHisAsnIle-561  
 568-GlyAspAsnGlnGly-572  
 591-SerProArgAspLysAlaAlaGluValGlnLysLeuLysAlaAlaGly-606  
 633-GlyGlyAlaAspValAlaGlu-639  
 712-LeuArgLeuLysArgValLysIleAsp-720  
 590-1

**AMPHI Regions - AMPHI**

77-TyrLeuProAspAsnLeuLysThrValLeuGluGlnProValThrLeuValAsnHisIleThrHis-98  
 100-PropheAlaGlyGlyPhe-105  
 123-LysValLeuGluArgPhePheGly-130  
 132-GlnValProAlaSerLeu-137  
 177-TyrGlnLysGlyPheLysSerTyrArgAsnGly-187  
 214-ThrSerAspGlyIleAsnProLeu-221  
 248-AsnGluLeuValAsnLeuVal-254  
 331-LysArgLysPheAla-335  
 420-LysMetLeuGluAsp-424  
 450-AspIleAsnGluThrLeuArgLeuMet-458  
 460-AspSerThrValGln-464

**Antigenic Index - Jameson-Wolf**

1-MetLysLysProLeu-5  
 26-LysAlaGluGluSerLeuThrGlnGlnGlnLysIleLeuGln-39  
 47-GluSerHisGlnTyrGluArgGlyTrp-55  
 62-ThrValIleArgLeuLysProGluLeu-70  
 72-AsnAsnAlaArgLysTyrLeuProAspAsnLeuLysThrValLeu-86  
 113-ThrGluPheLysTyrAlaProGluThrGluLysValLeuGlu-126  
 128-PhePheGlyLysGlnValPro-134  
 144-AsnGlySerGlyLysMetGluVal-151  
 157-AspTyrGluGluLeuSerGly-163  
 175-ThrValTyrGlnLysGlyPheLysSerTyrArgAsnGlyTyrAspAlaPro-191  
 196-LysLeuAlaAspLysGlyAspAlaAlaPheGlu-206  
 208-ValHisPheAspSerGluThrSerAspGlyIleAsn-219  
 233-PheSerLeuGluTrpLysGluGlyValAspTyr-243  
 264-AsnProAsnGlySerIleAlaProSerLysIleGluValGly-277  
 281-PheSerThrLysThrGlyGluSerGlyAla-290  
 292-IleAsnSerGluGlyGlnPheArgPheAspThr-302  
 304-ValTyrGlyAspGluLysTyrGlyPro-312  
 330-LeuLysArgLysPheAla-335

-207-

338-SerAlaLysLysMetThrGluGluGlnIleArgAsnAspLeu-351  
 355-ValLysGlyGluAlaSerGlyLeuPheThrAsnAsnProValLeuAsp-370  
 378-LeuProSerGlyLysIleAspValGlyGly-387  
 389-IleMetPheLysAspMetLysLysGluAspLeuAsnGln-401  
 406-LeuLysLysThrGluAlaAspIleArgMet-415  
 437-AsnAlaGluAspGluAlaGluGlyArgAlaSerLeuAspAspIleAsnGluThrLeu-455  
 466-MetAlaArgGluLysTyr-471  
 475-AsnGlyAspGlnIleAsp-480  
 485-LeuLysAsnAsnGlnLeuLysLeuAsnGlyLysThrLeuGlnAsnGluProGluProAspPheAspGluGly  
 GlyMetValSerGluProGlnGln-516

**Hydrophilic Regions - Hopp-Woods**

1-MetLysLysProLeu-5  
 26-LysAlaGluGluSerLeuThrGln-33  
 62-ThrValIleArgLeuLysProGluLeu-70  
 72-AsnAsnAlaArgLysTyrLeuProAspAsnLeuLysThrValLeu-86  
 113-ThrGluPheLysTyrAlaProGluThrGluLysValLeuGlu-126  
 147-GlyLysMetGluVal-151  
 157-AspTyrGluGluLeuSerGly-163  
 180-GlyPheLysSerTyrArgAsnGlyTyr-188  
 196-LysLeuAlaAspLysGlyAspAlaAlaPheGlu-206  
 208-ValHisPheAspSerGluThrSerAspGly-217  
 233-PheSerLeuGluTrpLysGluGlyValAspTyr-243  
 272-SerLysIleGluValGly-277  
 306-GlyAspGluLysTyrGlyPro-312  
 330-LeuLysArgLysPheAla-335  
 338-SerAlaLysLysMetThrGluGluGlnIleArgAsnAspLeu-351  
 355-ValLysGlyGluAla-359  
 381-GlyLysIleAspValGlyGly-387  
 389-IleMetPheLysAspMetLysLysGluAspLeuAsn-400  
 406-LeuLysLysThrGluAlaAspIleArgMet-415  
 437-AsnAlaGluAspGluAlaGluGlyArgAlaSerLeuAspAspIleAsnGluThrLeu-455  
 466-MetAlaArgGluLysTyr-471  
 486-LysAsnAsnGlnLeuLysLeuAsnGly-494  
 496-ThrLeuGlnAsnGluProGluProAspPheAspGluGlyGlyMetValSerGluProGlnGln-516  
 591

**AMPHI Regions - AMPHI**

6-AlaPheIlePheAla-10  
 17-LeuHisGluPheGlyHisTyrIleValAla-26  
 61-LeuGlyGlyTyrValLysMetValAsp-69  
 143-GlyAspLysIleGlnSerValAsnGlyThrProValAlaAspTrp-157  
 181-SerGlyAlaGlnThrValArgThrIleAspAlaAlaGlyThrProGluAlaGlyLysIleAlaLys-202  
 218-AlaGlyGlyValGluLys-223  
 234-ProGlyAspArgLeu-238  
 245-ProIleAlaSerTrpGlnGluTrpAlaAsnLeuThrArg-257  
 270-ArgAlaGlyGlnThr-274  
 304-AlaTrpAspAlaGlnIleArg-310  
 313-TyrArgProSerValValArgAlaPheGly-322  
 324-GlyTrpGluLysThrValSerHis-331  
 335-ThrLeuLysPhePheGlyLysLeuIle-343  
 351-HisIleSerGlyProLeuThrIleAla-359  
 373-TyrLeuGluPheLeuAlaLeu-379

-208-

**Antigenic Index - Jameson-Wolf**

44-PhePheThrArgLysArgGlyAspThrGlu-53  
 68-ValAspThrArgGluGlyGluValSerGluAlaAspLeu-80  
 84-PheAspLysGlnHisProAlaLysArg-92  
 129-ValGluProAspThrIleAla-135  
 139-GlyPheGlnSerGlyAspLysIleGlnSer-148  
 157-TrpGlySerAlaGln-161  
 187-ArgThrIleAspAlaAlaGlyThrProGluAlaGlyLysIleLysAsnGlnGly-205  
 219-GlyGlyValGluLysGlySerProAlaGluLysAlaGlyLeuLysProGlyAspArgLeuThrAlaAlaAsp  
 GlyLysProIle-246  
 254-AsnLeuThrArgGlnSerProGlyLysLysIle-264  
 267-AsnTyrGluArgAlaGlyGlnThrHis-275  
 277-AlaAspIleArgProAspThrValGluGlnSerAspHis-289  
 295-ValGlyLeuArgProGlnProAspArgAlaTrp-305  
 307-AlaGlnIleArgArgSerTyrArgProSerVal-317  
 327-LysThrValSerHisSer-332  
 343-IleSerGlyAsnAla-347  
 362-AlaGlyGlnSerAla-366  
 408-IleArgGlyLysProLeuGlyGluArgValGln-418

**Hydrophilic Regions - Hopp-Woods**

44-PhePheThrArgLysArgGlyAspThr-52  
 68-ValAspThrArgGluGlyGluValSerGluAlaAspLeu-80  
 84-PheAspLysGlnHisProAlaLysArg-92  
 129-ValGluProAspThrIleAla-135  
 139-GlyPheGlnSerGlyAspLysIleGlnSer-148  
 193-GlyThrProGluAlaGlyLysIleAlaLys-202  
 220-GlyValGluLysGlySerProAlaGluLysAlaGlyLeuLysProGlyAspArgLeuThrAlaAlaAspGly  
 LysPro-245  
 256-ThrArgGlnSerProGlyLysLysIle-264  
 268-TyrGluArgAlaGlyGln-273

277-AlaAspIleArgProAspThrValGluGlnSerAsp-288  
 299-ProGlnProAspArgAlaTrp-305  
 308-GlnIleArgArgSerTyrArg-314  
 362-AlaGlyGlnSerAla-366  
 411-LysProLeuGlyGluArgValGln-418

592

**AMPHI Regions - AMPHI**

6-PheGlyGlnIlePheSer-11  
 21-GlyGlyLeuLeuGlyGlyLeuIle-28  
 50-AlaProAsnAlaAlaAlaAlaAla-57  
 65-GlnGlyMetIleGlnMetLeuGlyValPheValAsp-76  
 94-ProTyrGlyAspLeu-98  
 109-ValSerGlnValGlyGlnTrp-115  
 153-ThrAlaValPheArgMet-158  
 165-TyrPheGlyAlaValAla-170  
 185-IleMetAlaTrpIleAsnLeuValAlaIleLeuLeuLeuSer-198

**Antigenic Index - Jameson-Wolf**

35-GlyIleLysArgGlyLeuTyrSerAsnGluAlaGlyMetGlySerAlaProAsnAla-53  
 57-AlaGluValLysHisProVal-63  
 93-GlnProTyrGlyAspLeuSerGly-100  
 137-AlaTyrAlaGluSerAsnVal-143

-209-

206-ArgAspTyrThrAlaLysLeuLysMetGlyLysAspProGluPheLysLeuSerGluHisProGlyLeuLys  
ArgArgIleLysSerAspValTrp-237

**Hydrophilic Regions - Hopp-Woods**

35-GlyIleLysArgGlyLeuTyr-41  
57-AlaGluValLysHis-61  
212-LeuLysMetGlyLysAspProGluPheLysLeuSerGlu-224  
226-ProGlyLeuLysArgArgIleLysSer-234

593

**AMPHI Regions - AMPHI**

6-GlyLeuCysLysArgPheGlyAsnLysThr-15  
41-SerThrLeuLeuAsnIleIleAlaGlyIle-50  
87-HisMetSerAlaLeuGlu-92  
125-AlaHisArgLysProGluLysLeuSerGlyGlyGlu-136  
159-PheSerSerLeuAsp-163  
165-HisLeuArgGlyThrLeuArg-171  
216-ProGluThrLeuValLysThrProSerCysValGlnValAlaArgLeuMetGlyLeu-234

**Antigenic Index - Jameson-Wolf**

6-GlyLeuCysLysArgPheGlyAsnLysThrValAla-17  
24-ValGlyArgGlyLysIle-29  
33-LeuGlyArgSerGlyCysGlyLysSerThr-42  
50-IleValArgProAspGlyGlyGlu-57  
61-AsnGlyGluAsnIleThrArgMetProProGluLysArgArgIle-75  
99-LysMetGlnLysMetProLysAlaGluAlaGluArgLeuAla-112  
119-ValGlyLeuGluAsnGluAlaHisArgLysProGluLysLeuSerGlyGlyGluLysGlnArgLeuAlaLeu  
-142  
157-GluSerPheSerSerLeu-162  
168-GlyThrLeuArgArgMetThrAlaGluArgIleArgAsnGlyGlyIle-183  
190-HisSerProGluGluAlaCysThrThrAlaAspGluIleAlaVal-204  
206-HisLysGlyArgIle-210  
214-GlyThrProGluThrLeuValLysThrProSer-224  
233-GlyLeuProAsnThrAspAspAsnArgHisIle-243  
248-ValArgPheAspGlnAspGlyMetGluCysArgValLeuSer-261  
263-ThrCysLeuProGluSer-268  
291-GlyAlaValSerGlyLysAspThrVal-299  
302-HisIleGluGluArgGluIleValArgPheArg-312

**Hydrophilic Regions - Hopp-Woods**

6-GlyLeuCysLysArgPheGlyAsn-13  
25-GlyArgGlyLysIle-29  
36-SerGlyCysGlyLys-40  
51-ValArgProAspGlyGly-56  
68-MetProProGluLysArgArgIle-75  
99-LysMetGlnLysMetProLysAlaGluAlaGluArgLeuAla-112  
119-ValGlyLeuGluAsnGluAlaHisArgLysProGluLysLeuSerGlyGlyGluLysGlnArgLeuAlaLeu  
-142  
168-GlyThrLeuArgArgMetThrAlaGluArgIleArgAsn-180  
191-SerProGluGluAlaCysThrThrAlaAspGluIleAlaVal-204  
206-HisLysGlyArgIle-210  
236-AsnThrAspAspAsnArgHisIle-243  
248-ValArgPheAspGlnAspGlyMetGluCysArgValLeuSer-261  
293-ValSerGlyLysAspThrVal-299  
302-HisIleGluGluArgGluIleValArgPheArg-312

594

-210-

**AMPHI Regions - AMPHI**

21-SerIleLeuArgLeu-25  
 108-AlaGlyArgGluCysGlnGluThrAlaAlaAla-118  
 138-AlaIleLysArgCysAsn-143

**Antigenic Index - Jameson-Wolf**

1-MetGlyAlaAspThrAspGlyAspLysAspValArgLeuAsnArgThr-16  
 51-ValGluHisProAsnArgPhe-57  
 75-HisLeuAspGlySerThrGlyGly-82  
 86-PheArgArgGluLysThrGlyHisLysArgArgCysHisThrGlnCys-101  
 103-HisSerAlaArgAlaAlaGlyArgGluCysGlnGluThr-115  
 137-ArgAlaIleLysArgCysAsn-143

**Hydrophilic Regions - Hopp-Woods**

1-MetGlyAlaAspThrAspGlyAspLysAspValArgLeuAsnArg-15  
 86-PheArgArgGluLysThrGlyHisLysArgArgCysHis-98  
 105-AlaArgAlaAlaGlyArgGluCysGlnGluThr-115  
 137-ArgAlaIleLysArgCysAsn-143

595

**AMPHI Regions - AMPHI**

20-CysGlnProProGluAla-25  
 140-AlaAspLeuGluLysLeuSerGlnProLeuAla-150  
 157-GlnGlyGluValLysGluLeuVal-164  
 169-ThrPheThrGluAlaValLysAlaGlyAspIleGluLysAla-182  
 196-IleGluProIleAlaGluLeuPheSerGluLeuAspPro-208  
 224-AlaGlyPheThrGlyPheHisArg-231  
 243-SerGlyValLysGluIleAlaAlaLysLeuMetThrAspValGluAlaLeuGlnLysGluIleAsp-264  
 274-ValGlyGlyAlaSerGluLeuIleGluGluValAlaGly-286  
 309-AspGlySerLysLysIleValAspLeuPheArgProLeu-321  
 337-PheLysGlnValAsnGluIleLeuAlaLys-346  
 351-AspGlyPheGluThrTyrAspLysLeuGlyGlu-361  
 366-AlaLeuGlnAlaSerIleAsnAlaLeuAlaGluAspLeuAlaGlnLeuArgGlyIleLeuGlyLeu-387

**Antigenic Index - Jameson-Wolf**

1-MetArgLysPheAsn-5  
 21-GlnProProGluAlaGluLysAlaAlaPro-30

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32-AlaSerGlyGluAlaGlnThrAlaAsnGluGlyGlySer-44  
 50-AsnAspAsnAlaCysGluProMetGlu-58  
 70-IleLysAsnAsnSerGlyArgLysLeuGluTrpGluIle-82  
 87-MetValValAspGluArgGluAsnIleAla-96

"

"

98-GlyLeuSerAspLysMetThr-104  
 108-LeuProGlyGluTyrGluMet-114  
 120-ThrAsnProArgGlyLysLeuValValThrAspSerGlyPheLysAspThrAlaAsnGluAlaAspLeuGlu  
 LysLeuSer-146

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-211-

158-GlyGluValLysGluLeuValAlaLysThrLysThrPheThrGluAlaValLysAlaGlyAspIleGluLys  
AlaLysSerLeuPheAla-187  
189-ThrArgValHisTyrGluArgIleGluProIle-199  
204-SerGluLeuAspProValIleAspAlaArgGluAspAspPheLysAspGlyAlaLysAspAlaGly-225  
238-ValGluLysAspValSerGlyValLysGluIleAlaAla-250  
252-LeuMetThrAspValGluAlaLeuGlnLysGluIleAsp-264  
269-ProProGlyLysValValGlyGlyAla-277  
"

"  
279-GluLeuIleGluGluValAlaGlySerLysIleSerGlyGluGluAspArgTyrSerHisThrAspLeuSer  
AspPheGlnAlaAsnValAspGlySerLysLysIleValAsp-316  
322-IleGluAlaLysAsnLysAlaLeuLeuGluLysThrAspThrAsnPheLysGlnValAsn-341  
345-AlaLysTyrArgThrLysAspGlyPheGluThrTyrAspLysLeuGlyGluAlaAspArgLysAlaLeu-36  
7  
374-LeuAlaGluAspLeuAlaGln-380

#### Hydrophilic Regions - Hopp-Woods

"  
1-MetArgLysPheAsn-5  
21-GlnProProGluAlaGluLysAlaAlaPro-30  
"

"  
32-AlaSerGlyGluAlaGlnThrAlaAsnGluGlyGlySer-44  
52-AsnAlaCysGluProMetGlu-58  
72-AsnAsnSerGlyArgLysLeuGluTrpGluIle-82  
87-MetValValAspGluArgGluAsnIle-95  
99-LeuSerAspLysMetThr-104  
110-GlyGluTyrGluMet-114  
122-ProArgGlyLysLeuValVal-128  
"

"  
131-SerGlyPheLysAspThrAlaAsnGluAlaAspLeuGluLysLeuSer-146  
158-GlyGluValLysGluLeuValAlaLysThrLysThrPheThrGluAlaValLysAlaGlyAspIleGluLys  
AlaLysSerLeuPheAla-187  
"

"  
189-ThrArgValHisTyrGluArgIleGluProIle-199  
204-SerGluLeuAspProValIleAspAlaArgGluAspAspPheLysAspGlyAlaLysAspAlaGly-225  
"

"  
238-ValGluLysAspValSerGlyValLysGluIleAlaAla-250  
252-LeuMetThrAspValGluAlaLeuGlnLysGluIleAsp-264  
279-GluLeuIleGluGluValAlaGly-286  
"

"  
288-LysIleSerGlyGluGluAspArgTyrSerHis-298  
"

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308-ValAspGlySerLysLysIleValAsp-316  
 322-IleGluAlaLysAsnLysAlaLeuLeuGluLysThrAspThrAsnPhe-337  
 347-TyrArgThrLysAspGlyPheGluThrTyrAspLysLeuGlyGluAlaAspArgLysAlaLeu-367  
 374-LeuAlaGluAspLeuAlaGln-380  
 596

**AMPHI Regions - AMPHI**

9-MetLeuArgValSerLysValVal-16  
 50-LeuArgIleMetAlaGlyValAspLys-58  
 87-ValArgGluGluValGluSerGlyLeuGlyGluValAlaAlaAlaGlnLysArgLeuGluGluValTyrAlaGluTyr-112  
 192-ProThrAsnHisLeuAsp-197  
 202-GluTrpLeuGluGlnPheLeuValArgPheProGly-213  
 295-AlaArgPheGluGluMetSerAsnTyr-303  
 322-LeuGlyAsnGluValIleGluPheValAsnValSerLysSerPhe-336  
 366-SerThrLeuPheLysMet-371  
 409-AspAsnIleAlaGlu-413  
 440-AspGlnSerLysIleAlaGlyGlnLeuSerGlyGlyGlu-452  
 483-LeuArgAlaLeuGluAspAlaLeuLeuGluPheAla-494

**Antigenic Index - Jameson-Wolf**

16-ValProProGlnLysThrIleIleLysAspIleSer-27  
 41-LeuAsnGlyAlaGlyLysSerThrVal-49  
 54-AlaGlyValAspLysGluPheGluGlyGluAla-64  
 75-LeuProGlnGluProGluLeuAspProGluLysThrValArgGluGluValGluSerGlyLeu-95  
 99-AlaAlaAlaGlnLysArgLeuGluGluValTyr-109  
 112-TyrAlaAsnProAspAlaAspPheAspAlaLeuAlaGluGluGlnGlyArgLeuGlu-130  
 136-GlySerSerThrGlyGlyGlyAlaGluHisGluLeuGluIleAlaAlaAspAlaLeuArg-155  
 157-ProGluTrpAspAlaLysIleAspAsnLeuSerGlyGlyGluLysArgArgValAla-175  
 181-LeuSerLysProAspMet-186  
 190-AspGluProThrAsnHisLeuAspAlaGluSer-200  
 219-ThrHisAspArgTyrPhe-224  
 233-LeuGluLeuAspArgGlyHisGlyIle-241  
 243-TrpLysGlyAsnTyrSerSer-249  
 251-LeuGluGlnLysGluLysArgLeuGluAsnGluAlaLysSerGluAlaAlaArgValLysAlaMetLysGlnGluLeuGluTrp-278  
 280-ArgGlnAsnAlaLysGlyArgGlnAlaLysSerLysAlaArgLeuAlaArgPheGluGluMetSerAsnTyrGluTyrGlnLysArgAsnGluThrGlnGlu-313  
 319-AlaGluArgLeuGlyAsnGluVal-326  
 333-SerLysSerPheGlyAsp-338  
 360-ProAsnGlyAlaGlyLysSerThrLeu-368  
 372-IleSerGlyLysGluGlnProAspSerGlyGluValLysIle-385  
 395-AspGlnSerArgGluGlyLeuGlnAsnAspLysThrVal-407  
 411-IleAlaGluGlyArgAspIleLeu-418  
 425-IleProAlaArgGlnTyrLeuGlyArgPheAsnPheLysGlySerAspGlnSerLysIleAla-445  
 447-GlnLeuSerGlyGlyGluArgGlyArgLeuHisLeu-458  
 471-LeuAspGluProSerAsnAspLeuAspValGluThr-482  
 501-SerHisAspArgTrpPhe-506  
 516-AlaCysGluGlyAspSerLysTrp-523  
 527-AspGlyAsnTyrGlnGluTyrGluAlaAspLysLysArgArgLeuGlyGluGluGlyAlaLysProLysArgIleLysTyrLysProValThrArg-558

**Hydrophilic Regions - Hopp-Woods**

54-AlaGlyValAspLysGluPheGluGlyGluAla-64

-213-

77-GlnGluProGluLeuAspProGluLysThrValArgGluGluValGluSerGlyLeu-95  
 99-AlaAlaAlaGlnLysArgLeuGluGluValTyr-109  
 113-AlaAsnProAspAlaAspPheAspAlaLeuAlaGluGluGlnGlyArgLeuGlu-130  
 141-GlyGlyAlaGluHisGluLeuGluIleAlaAlaAspAlaLeuArg-155  
 157-ProGluTrpAspAlaLysIleAspAsn-165  
 167-SerGlyGlyGluLysArgArgValAla-175  
 181-LeuSerLysProAsp-185  
 190-AspGluProThrAsn-194  
 196-LeuAspAlaGluSer-200  
 233-LeuGluLeuAspArgGlyHis-239  
 251-LeuGluGlnLysGluLysArgLeuGluAsnGluAlaLysSerGluAlaAlaArgValLysAlaMetLysGln  
 GluLeuGluTrp-278  
 280-ArgGlnAsnAlaLysGlyArgGlnAlaLysSerLysAlaArgLeuAlaArgPheGluGluMetSerAsn-30  
 2  
 304-GluTyrGlnLysArgAsnGluThrGln-312  
 319-AlaGluArgLeuGlyAsnGluVal-326  
 372-IleSerGlyLysGluGlnProAspSerGlyGluValLysIle-385  
 395-AspGlnSerArgGluGlyLeuGlnAsnAspLysThrVal-407  
 411-IleAlaGluGlyArgAspIleLeu-418  
 435-AsnPheLysGlySerAspGlnSerLysIle-444  
 449-SerGlyGlyGluArgGlyArgLeuHisLeu-458  
 472-AspGluProSerAsnAspLeuAspValGluThr-482  
 517-CysGluGlyAspSer-521  
 529-AsnTyrGlnGluTyrGluAlaAspLysLysArgArgLeuGlyGluGluGlyAlaLysProLysArgIleLys  
 Tyr-553

597-2

**AMPHI Regions - AMPHI**

30-AlaGluValLysLys-34  
 66-LysGluAlaAlaLysGluGlyLysGluSerLysLysThrAlaLys-80  
 93-GlnSerAlaArgLysGlyArgGluGly-101  
 112-AlaHisGlyLysPro-116  
 141-GlnGlyAsnProArgLysGlyGlyLys-149  
 163-SerAspLysAsnGlyLysAlaValLysGlnAspLysLysTyrArgGluGluLysAsn-181  
 217-ValSerAsnSerLeuLysGlnLeuGlnGlu-226  
 252-TrpAspLysPheGlnLysLeu-258  
 275-GlnIleSerArgPheValSerGly-282  
 308-LeuArgTyrThrArgTyrValAsnAla-316  
 318-AsnArgGluValValLysAspLeuGluLysGlnGln-329  
 339-IleAsnAsnGluLeuAlaArgLeuLysLys-348  
 351-AlaAsnValGlnSerLeu-356  
 364-AspAlaAlaGluGlnThrGlu-370  
 376-AlaLysIleAlaLysAspAlaArg-383  
 396-AsnLysLeuLeuSer-400  
 460-ProSerValMetGlyIleGlySerAlaAspGlyPheSerArgMetGlnGlyArgLeuLysLysProValAsp  
 GlyValProThrGly-488  
 509-ProAlaThrValGluSerIleAla-516  
 521-SerTyrAlaAspGluLeuAspGlyTyrGlyLys-531  
 543-SerIleTyrAlaGlyLeu-548

**Antigenic Index - Jameson-Wolf**

23-AspAlaAlaHisAsnArgSerAlaGluValLysLysGlnThrLysAsnLysLysGluGlnProGluAlaAlaG  
 luGlyLysLysGluLysGlyLysAsnGlyAlaValLysAspLysLysThrGlyGlyLysGluAlaAlaLysGluG  
 yLysGluSerLysLysThrAlaLysAsnArgLysGluAlaGluLysGluAlaThrSerArgGlnSerAlaArgLys  
 GlyArgGluGlyAspLysLysSerLysAlaGluHisLysLysAlaHisGlyLysProValSerGlySerLysGluL  
 ysAsnAlaLysThrGlnProGluAsnLysGlnGlyLysLysGluAlaLysGlyGlnGlyAsnProArgLysGlyG

-214-

yLysAlaGluLysAspThrValSerAlaAsnLysLysValArgSerAspLysAsnGlyLysAlaValLysGlnAsp  
 LysLysTyrArgGluGluLysAsnAlaLysThrAspSerAspGluLeuLysAla-191  
 196-AlaThrAsnAspValGluAsnLysLysAlaLeuLeuLysGlnSerGluGly-212  
 219-AsnSerLeuLysGlnLeuGlnGluGluArgIleArgGlnGluArgIleArgGlnAlaArgGlyAsnLeu-24  
 1  
 243-SerValAsnArgLysGlnArgGluAlaTrpAspLysPheGlnLysLeuAsnThrGluLeuAsnArgLeuLys  
 ThrGluValAlaAla-271  
 281-SerGlyAsnTyrLysAsnSerGlnProAsn-290  
 298-AsnAlaGluProGlyGlnLysAsnArgPhe-307  
 314-ValAsnAlaSerAsnArgGluValValLysAspLeuGluLysGlnGlnLys-330  
 335-GlnGluGlnLysIleAsnAsnGluLeuAlaArgLeuLysLysIleGln-350  
 356-LeuLeuLysLysGlnGlyValThrAspAlaAlaGluGlnThrGluSerArgArgGlnAsnAlaLysIleAla  
 LysAspAlaArgLysLeuLeuGluGlnLysGlyAsnGluGlnGlnLeu-395  
 398-LeuLeuSerAsnLeuGluLysLysLysAlaGluHisArgIleGlnAspAlaGluAlaLysArgLysLeuAla  
 GluAlaArgLeuAlaAlaAlaGluLysAlaArgLysGluAlaAlaGlnGlnLysAlaGluAlaArgArgAlaGluM  
 etSerAsnLeuThrAlaGluAspArgAsnIleGlnAlaProSer-461  
 466-GlySerAlaAspGlyPheSerArgMetGlnGlyArgLeuLysLysProValAspGlyValProThr-487  
 491-GlyGlnAsnArgSerGlyGlyAspIle-499  
 521-SerTyrAlaAspGluLeuAspGlyTyrGly-530  
 536-AspHisGlyGluAsnTyr-541  
 561-AlaGlySerLysIleGlySerSerGlySerLeuProAspGlyGluGluGlyLeu-578  
 588-ValLeuAsnProSerSerTrp-594

#### Hydrophilic Regions - Hopp-Woods

23-AspAlaAlaHisAsnArgSerAlaGluValLysLysGlnThrLysAsnLysLysGluGlnProGluAlaAlaG  
 luGlyLysLysGluLysGlyLysAsnGlyAlaValLysAspLysLysThrGlyGlyLysGluAlaAlaLysGluGly  
 LysGluSerLysLysThrAlaLysAsnArgLysGluAlaGluLysGluAlaThrSerArgGlnSerAlaArgLys  
 GlyArgGluGlyAspLysLysSerLysAlaGluHisLysLysAlaHisGlyLysProValSerGlySerLysGluL  
 ysAsnAlaLysThrGlnProGluAsnLysGlnGlyLysLysGluAlaLysGlyGlnGlyAsnProArgLysGlyGly  
 LysAlaGluLysAspThrValSerAlaAsnLysLysValArgSerAspLysAsnGlyLysAlaValLysGlnAsp  
 LysLysTyrArgGluGluLysAsnAlaLysThrAspSerAspGluLeuLysAla-191  
 198-AsnAspValGluAsnLysLysAlaLeuLeuLysGlnSerGlu-211  
 220-SerLeuLysGlnLeuGlnGluGluArgIleArgGlnGluArgIleArgGlnAlaArgGlyAsn-240  
 244-ValAsnArgLysGlnArgGluAlaTrpAspLysPheGlnLysLeuAsnThrGluLeuAsnArgLeuLysThr  
 GluValAlaAla-271  
 284-TyrLysAsnSerGln-288  
 298-AsnAlaGluProGlyGlnLysAsnArgPhe-307  
 317-SerAsnArgGluValValLysAspLeuGluLysGlnGlnLys-330  
 335-GlnGluGlnLysIleAsnAsnGluLeuAlaArgLeuLysLysIleGln-350  
 356-LeuLeuLysLysGlnGlyValThrAspAlaAlaGluGlnThrGluSerArgArgGlnAsnAlaLysIleAla  
 LysAspAlaArgLysLeuLeuGluGlnLysGlyAsnGluGlnGlnLeu-395  
 400-SerAsnLeuGluLysLysLysAlaGluHisArgIleGlnAspAlaGluAlaLysArgLysLeuAlaGluAla  
 ArgLeuAlaAlaAlaGluLysAlaArgLysGluAlaAlaGlnGlnLysAlaGluAlaArgArgAlaGluMet-447  
 451-ThrAlaGluAspArgAsnIleGln-458  
 474-MetGlnGlyArgLeuLysLysProValAsp-483  
 493-AsnArgSerGlyGlyAspIle-499  
 522-TyrAlaAspGluLeuAspGlyTyrGly-530  
 563-SerLysIleGlySer-567  
 570-SerLeuProAspGlyGluGluGlyLeu-578

601-2

#### AMPHI Regions - AMPHI

29-AlaAlaArgGluAla-33  
 43-ArgValLeuGlySerPro-48  
 50-ProTyrGlyLysGlnIleAspGlyLeuGlyAsnAlaSerSerSer-64

-215-

94-PheValAspTrpSerGly-99  
 101-CysGlyAsnLeuThrAlaAla-107  
 134-TrpGlnLysAsnIleGlyLysThrIle-142  
 191-LeuValAspGluIleAspValProAsnIleGlyArg-202  
 210-AlaGlyIleProThrValPhe-216  
 226-GlyLysGluLeuGlnAspAspIleAsnAsnAspAlaAlaAlaLeuGluLysPheGluLysIleArgAlaTyr  
 GlyAlaLeu-252  
 254-MetGlyLeuIleSerAspValSerGluAlaAla-264  
 284-SerSerGlyLysThrValAsn-290  
 321-AlaAlaAlaValProGlyThrLeuValAsnLeuAlaAla-333  
 353-GlyAlaAlaAlaGlu-357

**Antigenic Index - Jameson-Wolf**

11-TyrArgGlyGlyThrSerLysGlyValPhePheLysArgSerAspLeuProGluAlaAlaArgGluAlaGlyS  
 erAlaArgAspLysIleLeu-41  
 46-GlySerProAspProTyrGlyLysGlnIleAspGlyLeuGlyAsnAlaSerSerSerThrSerLys-67  
 69-ValIleLeuAspLysSerGluArgAlaAspHisAspValAspTyr-83  
 89-SerIleAspLysProPhe-94  
 96-AspTrpSerGlyAsnCysGly-102  
 116-GlyLeuValAspLysGlyLysIleProSerAspGly-127  
 134-TrpGlnLysAsnIleGlyLysThrIle-142  
 155-GluThrGlyAspPheGluLeu-161  
 177-AspProAlaAspGlyGluGlySerMet-185  
 187-ProThrGlyAsnLeuValAspGluIleAspValProAsnIleGlyArgLeuLys-204  
 223-GlyTyrThrGlyLysGluLeuGlnAspAspIleAsnAsnAspAlaAlaAlaLeuGluLysPheGluLysIle  
 ArgAla-248  
 259-AspValSerGluAlaAlaAlaArgAlaHisThrPro-270  
 281-TyrThrAlaSerSerGlyLysThrValAsn-290  
 333-AlaGlyGlyGlyThrArgLysGluValArgPheGlyHisProSerGlyThrLeuArg-351  
 356-AlaGluCysGlnAspGlyGln-362  
 369-ValMetSerArgSerAlaArgValMet-377  
 382-ValArgValProGluAspCysPhe-389

**Hydrophilic Regions - Hopp-Woods**

22-LysArgSerAspLeuProGluAlaAlaArgGluAlaGlySerAlaArgAspLysIleLeu-41  
 49-AspProTyrGlyLysGlnIleAsp-56  
 62-SerSerSerThrSer-66  
 69-ValIleLeuAspLysSerGluArgAlaAspHisAspVal-81  
 89-SerIleAspLysProPhe-94  
 116-GlyLeuValAspLysGlyLysIleProSer-125  
 157-GlyAspPheGluLeu-161  
 177-AspProAlaAspGlyGluGly-183  
 191-LeuValAspGluIleAspVal-197  
 224-TyrThrGlyLysGluLeuGlnAspAspIleAsnAsnAspAlaAlaAlaLeuGluLysPheGluLysIleArg  
 Ala-248  
 259-AspValSerGluAlaAlaAlaArgAlaHisThr-269  
 283-AlaSerSerGlyLysThrValAsn-290  
 335-GlyGlyThrArgLysGluValArgPhe-343  
 356-AlaGluCysGlnAsp-360  
 372-ArgSerAlaArgValMet-377  
 384-ValProGluAspCysPhe-389  
 602-2

**AMPHI Regions - AMPHI**

21-ValAsnArgHisGlyGln-26  
 30-GlyGlyLeuAspAlaPheCys-36

-216-

54-ArgGlnIleAlaGlnIle-59  
 61-AlaGlyLeuHisValCysAsnSerVal-69  
 78-HisValIleValGluMetCysAlaTrpTyrGly-88

**Antigenic Index - Jameson-Wolf**

5-GlnCysAspLysThrArgHisMetArgPro-14  
 19-ArgGlnValAsnArgHisGlyGlnThrGlyAsnGlyGlyLeuAspAla-34  
 36-CysSerLeuGlnGlyAsnArgLysAlaGlnValPheAspThrAspLeuIleAspArgGlnIle-56  
 90-SerAlaGlyGluTyr-94  
 99-GlnMetArgAspTyrIle-104

**Hydrophilic Regions - Hopp-Woods**

5-GlnCysAspLysThrArgHisMetArg-13  
 20-GlnValAsnArgHisGlyGln-26  
 39-GlnGlyAsnArgLysAlaGlnValPhe-47  
 50-AspLeuIleAspArgGlnIle-56

603-2

**AMPHI Regions - AMPHI**

69-MetLeuLeuAsnGluLeuGluLys-76  
 107-ValMetAspGluLeuAsnAlaCysIlePro-116  
 121-HisAsnProAlaAsnIleSerGlyIleLeuAla-131  
 135-HisPheProGlyLeuProAsnValGly-143  
 148-SerPheHisGlnThrMetPro-154  
 161-AlaValProArgGluLeu-166  
 188-GluAlaAlaArgIleLeuGlyLysProLeuGluAspIleArgMetIleIleAlaHis-206  
 209-AsnGlyAlaSerIleThrAlaIleLysAsnGlyLysSerVal-222  
 229-ThrProIleGluGly-233  
 248-TyrSerTyrLeuThrSer-253  
 273-LeuGlyIleSerGlu-277  
 279-SerAsnAspCysArg-283  
 306-ArgLeuAlaLysTyrIleAlaSerMet-314  
 342-ValSerTyrLeuAsp-346

**Antigenic Index - Jameson-Wolf**

12-GlySerSerSerLeuLysGlyAlaValIleAspArgLysSerGlySer-27  
 33-LeuGlyGluArgLeuThrThrProGluAla-42  
 45-ThrPheAsnLysAspGlyAsnLysArgGlnValProLeuSerGlyArgAsnCysHis-63  
 73-GluLeuGluLysHisGlyLeuHisAspArgIleLysAlaIleGly-87  
 91-AlaHisGlyGlyGluLysTyrSerGlu-99  
 106-AlaValMetAspGluLeuAsn-112  
 152-ThrMetProGluArgAlaTyr-158  
 164-ArgGluLeuArgLysLysTyrAlaPheArgArgTyrGlyPheHisGlyThrSerMetArg-183  
 188-GluAlaAlaArgIleLeuGlyLysProLeuGluAspIleArg-201  
 207-LeuGlyAsnGlyAla-211  
 214-ThrAlaIleLysAsnGlyLysSerValAspThrSerMetGly-227  
 238-ThrArgCysGlyAspIleAspProGlyVal-247  
 260-AlaGlnValAspGluMetLeuAsnLysLysSerGly-271  
 276-SerGluLeuSerAsnAspCysArgThrLeuGluIleAlaAlaAspGluGlyHisGluGlyAlaArgLeu-298  
 329-GlyIleGlyGluAsnSerArgAsnIleArgAlaLysThr-341  
 352-IleAspThrLysAlaAsnMetGluLysArgTyrGlyAsnSerGlyIle-367  
 369-SerProThrAspSerSerPro-375  
 381-ProThrAsnGluGluLeu-386

**Hydrophilic Regions - Hopp-Woods**

-217-

19-AlaValIleAspArgLysSerGly-26  
 33-LeuGlyGluArgLeuThrThr-39  
 46-PheAsnLysAspGlyAsnLysArgGlnValProLeuSerGlyArgAsnCysHis-63  
 73-GluLeuGluLysHisGlyLeuHisAspArgIleLysAlaIleGly-87  
 92-HisGlyGlyGluLysTyrSerGlu-99  
 106-AlaValMetAspGluLeuAsn-112  
 153-MetProGluArgAlaTyr-158  
 164-ArgGluLeuArgLysLysTyrAlaPhe-172  
 188-GluAlaAlaArgIleLeuGlyLysProLeuGluAspIleArg-201  
 217-LysAsnGlyLysSerValAspThr-224  
 239-ArgCysGlyAspIleAspPro-245  
 260-AlaGlnValAspGluMetLeuAsnLysLysSerGly-271  
 277-GluLeuSerAsnAspCysArgThrLeuGluIleAlaAlaAspGluGlyHisGluGlyAlaArgLeu-298  
 330-IleGlyGluAsnSerArgAsnIleArgAlaLysThr-341  
 352-IleAspThrLysAlaAsnMetGluLysArgTyrGly-363  
 382-ThrAsnGluGluLeu-386

604-2

**AMPHI Regions - AMPHI**

36-HisArgValValGlnPheAla-42  
 53-ValGlyGlyValHisGlyPheAlaThr-61  
 95-ArgThrValSerAlaAspPheLeuGluPhePhe-105  
 113-AspValValLeuGlnLeuPheAlaCysValAlaGlnValGlyGlyIleGlnGluAsn-131  
 148-ArgHisIleAsnPheIleAspGlnIleAlaGlyTrpGlu-160  
 166-ValGlyTrpIleLysLysPheAsp-173  
 191-PheGlnAsnCysAlaValLeuHisArg-199

**Antigenic Index - Jameson-Wolf**

11-AlaAlaCysGlyLysValAspGlnArgThrGlyTyrGlyGlyGlyGlyArgAsnGlyAsnArgGlyGlyThrHis-35  
 67-GlyGlyGlyArgAspGluGlyAspPheArgArgValArgAlaSerGlySerPhe-84  
 106-GlnSerArgGlyIle-110  
 127-GlyIleGlnGluAsnGlyArgAsnAlaArgValAspGluArgGlyPheGln-143  
 175-TyrPheGlyCysArgGluArgTyrAlaVal-184  
 201-MetGlyAsnAsnGly-205  
 211-LeuProAspPheAspArgAlaAspAlaVal-220

**Hydrophilic Regions - Hopp-Woods**

14-GlyLysValAspGlnArgThrGlyTyr-22  
 24-GlyGlyGlyArgAsnGlyAsnArgGlyGlyThrHis-35  
 68-GlyGlyArgAspGluGlyAspPheArgArgValArgAla-80  
 127-GlyIleGlnGluAsnGlyArgAsnAlaArgValAspGluArgGlyPhe-142  
 178-CysArgGluArgTyrAlaVal-184  
 213-AspPheAspArgAlaAspAlaVal-220

605

**AMPHI Regions - AMPHI**

13-ArgGlnIleTrpLysIleAlaAsp-20  
 38-ThrLeuPheTyrArgPheIleSerGluAsnPheThrAspTyrMetGln-53  
 107-LysLeuLysGluIlePheThrAlaIle-115  
 128-IleLysGlyLeuPheAspAspPheAsp-136  
 141-ArgLeuGlySerThr-145  
 155-AlaValLeuLysGlyValAlaGluLeu-163  
 173-IleAspLeuPheGlyAspAlaTyrGluTyrLeuIleSerAsn-186  
 188-AlaAlaAsnAlaGlyLys-193  
 204-ValSerLysLeuIleAlaArg-210  
 217-GluLysValAsnLysIleTyrAspPro-225

-218-

240-PheAspGluHisIle-244  
 291-AspSerLysProPheAspAlaIleValSerAsn-301  
 341-HisAlaLeuAsnTyr-345  
 355-ValSerPheProGly-359  
 433-GluHisIleAlaGluIleValLysLeuPheAla-443  
 452-AlaGlnAsnAlaAlaGlnGlnThr-459  
 478-ThrArgGluIleIleAspIle-484  
 489-AlaGluIleGlyGluThrValAlaLysIleGluArgLeuArgArgGluIleAspGluValIleAlaGluIle  
 Glu-513

**Antigenic Index - Jameson-Wolf**

5-MetGlnGlnArgAlaGlnLeu-11  
 18-IleAlaAspGluValArgGlyAlaValAspGlyTrpAsp-30  
 44-IleSerGluAsnPheThrAspTyrMetGlnAlaGlyAspSerSerIleAsp-60  
 63-AlaMetProAspSer-67  
 71-ProGluIleLysAspAspAlaValLysVal-80  
 98-AlaHisGlnAsnGluGluLeuAsnThrLysLeuLysGlu-110  
 116-GluSerSerAlaSerGlyTyrProSerGluGlnAspIleLysGlyLeuPheAspAspPheAspThrThrSer  
 SerArgLeu-142  
 146-ValAlaAspLysAsnLysArgLeu-153  
 190-AsnAlaGlyLysSerGlyGlyGluPhePheThr-200  
 215-GlyGlnGluLysValAsnLysIleTyrAspProAlaCysGlySerGlySer-231  
 235-GlnAlaLysLysGlnPheAsp-241  
 253-GluIleAsnHisThrThrTyrAsn-260  
 280-LeuGlyAspThrLeuThrAsnProLysLeuLysAspSerLysProPheAsp-296  
 309-IleGlySerAspAspProThrLeuIleAsnAspAspArgPheAlaPro-324  
 330-ProLysSerLysAlaAsp-335  
 345-TyrLeuSerGlyArgGlyArgAlaAla-353  
 362-TyrArgGlyGlyAlaGluGlnLysIleArg-371  
 403-LeuSerLysHisLysAspAsnThrAsp-411  
 419-GlyPhePheLysLysGluThrAsnAsnAsnValLeuIle-431  
 442-PheAlaAspLysAlaAspVal-448  
 458-GlnThrValLysAspAsnGlyTyr-465  
 473-ValGluAlaGluAspThrArgGluIleIleAsp-483  
 490-GluIleGlyGluThrValAlaLysIleGluArgLeuArgArgGluIleAspGluValIleAla-510

**Hydrophilic Regions - Hopp-Woods**

5-MetGlnGlnArgAlaGlnLeu-11  
 18-IleAlaAspGluValArgGlyAlaValAsp-27  
 55-GlyAspSerSerIle-59  
 71-ProGluIleLysAspAspAlaValLysVal-80  
 98-AlaHisGlnAsnGluGluLeuAsnThrLysLeuLysGlu-110  
 122-TyrProSerGluGlnAspIleLysGlyLeuPheAspAspPheAspThrThrSerSerArgLeu-142  
 146-ValAlaAspLysAsnLysArgLeu-153  
 191-AlaGlyLysSerGlyGly-196  
 215-GlyGlnGluLysValAsnLysIleTyrAsp-224  
 235-GlnAlaLysLysGlnPheAsp-241  
 287-ProLysLeuLysAspSerLysProPhe-295  
 310-GlySerAspAspProThrLeuIleAsnAspAspArgPheAla-323  
 330-ProLysSerLysAlaAsp-335  
 348-GlyArgGlyArgAla-352  
 364-GlyGlyAlaGluGlnLysIleArg-371  
 404-SerLysHisLysAspAsnThrAsp-411  
 419-GlyPhePheLysLysGluThrAsn-426  
 442-PheAlaAspLysAlaAspVal-448

-219-

458-GlnThrValLysAspAsnGly-464  
 473-ValGluAlaGluAspThrArgGluIleIleAsp-483  
 490-GluIleGlyGluThrValAlaLysIleGluArgLeuArgArgGluIleAspGluValIleAla-510  
 606

**AMPHI Regions - AMPHI**

72-LeuLeuAspHisMetThrArgAspGlu-80  
 90-AlaHisValGlyAsnGlyAsp-96  
 100-LeuThrLeuIleGlnGlyValValAsnThrPhe-110  
 116-ArgIleIleAlaAsn-120  
 139-SerMetValPheGlnIleLeuPheGlyPheLeuAlaSerLeuIleVal-154  
 171-LysLeuValGlyAlaProLysMetIleSerAlaLeuGlnArg-184  
 191-AspLeuProGluGluMetAsnAla-198

**Antigenic Index - Jameson-Wolf**

13-GluValIleAspThrProArgThrGluGluGluAla-24  
 31-GluAlaGlnAlaArgGlnTrpAsnLeuLysThrProGlu-43  
 48-HisSerProGluProAsnAla-54  
 57-ThrGlyAlaSerArgAsnSerSer-64  
 75-HisMetThrArgAspGluValGluAla-83  
 92-ValGlyAsnGlyAsp-96  
 122-IleAlaArgAsnAsnAspGlySerGlnSerGlnGlyThr-134  
 159-ArgGlnArgGluTyrArgAlaAspAlaGlyAla-169  
 182-LeuGlnArgLeuLysGlyAsnProValAspLeuProGluGluMetAsn-197  
 203-GlyAspThrArgAspSerLeuLeuSerThrHisProSerLeuAspAsnArgIleAlaArgLeuLysSer-225

**Hydrophilic Regions - Hopp-Woods**

13-GluValIleAspThrProArgThrGluGluGluAla-24  
 59-AlaSerArgAsnSer-63  
 75-HisMetThrArgAspGluValGluAla-83  
 124-ArgAsnAsnAspGlySerGlnSer-131  
 159-ArgGlnArgGluTyrArgAlaAspAlaGlyAla-169  
 183-GlnArgLeuLysGlyAsnPro-189  
 191-AspLeuProGluGluMetAsn-197  
 203-GlyAspThrArgAspSerLeu-209  
 214-ProSerLeuAspAsnArgIleAlaArgLeuLysSer-225  
 607

**AMPHI Regions - AMPHI**

18-ArgLeuLeuThrThrLeuAlaLeu-25  
 70-PheMetGlyIleMetAlaAlaLeuAsnProMetIleAlaGln-83  
 90-ThrAspGluValGlyGluThr-96  
 104-GlyLeuPheLeuGlyValPheGlyMetValLeuMetTrpAlaAlaIleThrProPheArgAsnTrpLeuThr  
 LeuSerAspTyrValGluGlyThrMet-136  
 151-MetValHisArgAlaLeuHisAlaTyrThrSerSer-162  
 226-PhePheArgProPheGly-231  
 244-PheLysGlnIleTrpLysIleGlyAla-252  
 320-AlaArgTyrIleSerGlyVal-326  
 337-IleThrValLeuSerLeuVal-343  
 373-PheGlnProAlaAspPheThrGlnCysIleAlaSerTyrAla-386  
 424-TyrGlyPheTrpThrAlaLeuIleAla-432

**Antigenic Index - Jameson-Wolf**

15-LysGluValArgLeu-19  
 47-GlyAlaGlyLysGluAspLeuAla-54  
 86-GlyAlaGlyLysThrAspGluValGlyGluThrGlyArgGlnGlyIle-101

-220-

121-PropheArgAsnTrp-125  
 128-LeuSerAspTyrValGluGlyThr-135  
 160-ThrSerSerLeuAsnArgProArgLeu-168  
 234-AlaLysPheGlyLysProAspTrp-241  
 311-SerLeuGlyArgArgGluPheSerArgAlaArgTyrIleSer-324  
 353-TyrAsnAsnAspPro-357  
 388-ArgGlyTyrLysValThrLys-394  
 447-LeuCysSerArgGluMetValArgSerHisLysAlaVal-459

**Hydrophilic Regions - Hopp-Woods**

15-LysGluValArgLeu-19  
 47-GlyAlaGlyLysGluAspLeuAla-54  
 88-GlyLysThrAspGluValGlyGluThrGlyArg-98  
 163-LeuAsnArgProArg-167  
 312-LeuGlyArgArgGluPheSerArg-319

390-TyrLysValThrLys-394  
 447-LeuCysSerArgGluMetValArgSerHisLysAlaVal-459

608

**AMPHI Regions - AMPHI**

66-AlaValGlnLysIleLeuGln-72  
 93-ValLeuSerLeuLeu-97  
 103-ArgAlaSerAspGluLeuAlaArgIlePheGlyThrGln-115  
 124-AspIleGlyHisGlyIleLysGlnIleGlyArgAsnIleAlaGluGlnIleGlyGlyPheSerArgGluSer  
 GluSer-149  
 154-AsnGluAlaLeuAlaAspCysLeuAspGluIleSerArgLeuArgAspGlyValGluArgLeuAsnGluArg  
 LeuAspArgLeu-181

**Antigenic Index - Jameson-Wolf**

13-LeuGlnSerProAspSerArgSerGluLeu-22  
 39-LeuAlaGlyArgIleThrGluAspGlyLeuLeuSerAlaGlyAsnGlyPheAlaAspThrGluIleThrPheA  
 rgAsnSerAla-66  
 71-LeuGlnGlyGlyGluProGlyAlaGlyAspIleGlyLeuGluGly-85  
 98-GlySerLeuArgSerArgAlaSerAspGluLeuAla-109  
 114-ThrGlnAlaAspIleGlySerArgAlaAlaAsp-124  
 131-GlnIleGlyArgAsnIleAla-137  
 140-IleGlyGlyPheSerArgGluSerGluSerAlaAsnIleGlyAsnGluAlaLeuAlaAspCysLeuAspGlu  
 IleSerArgLeuArgAspGlyValGluArgLeuAsnGluArgLeuAspArgLeuGluArgAspIleTrp-186

**Hydrophilic Regions - Hopp-Woods**

15-SerProAspSerArgSerGluLeu-22  
 39-LeuAlaGlyArgIleThrGluAspGlyLeu-48  
 56-AlaAspThrGluIleThrPhe-62  
 74-GlyGluProGlyAlaGly-79  
 81-IleGlyLeuGluGly-85  
 100-LeuArgSerArgAlaSerAspGluLeuAla-109  
 116-AlaAspIleGlySerArgAlaAlaAsp-124  
 143-PheSerArgGluSerGluSerAlaAsnIleGly-153  
 156-AlaLeuAlaAspCysLeuAspGluIleSerArgLeuArgAspGlyValGluArgLeuAsnGluArgLeuAsp  
 ArgLeuGluArgAspIleTrp-186

609

**AMPHI Regions - AMPHI**

15-ThrLeuAspAlaPheVal-20  
 30-HisHisIlePheHisGluPheArgValPheValGlyPhePhe-43

-221-

52-PheGluGlnAlaValGlu-57  
 67-IleAspAspPheLeu-71  
 114-ValAlaValCysProVal-119

**Antigenic Index - Jameson-Wolf**

10-AlaLeuAspAspGluThrLeu-16  
 20-ValGlyAsnGlnArgSerSerAspIleAla-29  
 69-AspPheLeuAspThrAspPheGlyIle-77  
 79-SerGlnAlaAspGlyAsnValArg-86  
 99-GlyThrArgAlaLysArgGlyTyrGlyAsnHisAspLeu-111  
 122-PheAlaArgGluThrAspIle-128

**Hydrophilic Regions - Hopp-Woods**

10-AlaLeuAspAspGluThrLeu-16  
 23-GlnArgSerSerAspIle-28  
 79-SerGlnAlaAspGlyAsnVal-85  
 100-ThrArgAlaLysArgGlyTyrGly-107  
 122-PheAlaArgGluThrAspIle-128  
 610

**AMPHI Regions - AMPHI**

6-MetGlnPheProTyrArg-11  
 18-MetArgArgMetArgArg-23  
 98-GluArgAlaGlnGluAlaTyr-104  
 111-ProSerThrValArgAlaLeuArgGluArg-120  
 187-IleArgGluAlaLeuGlu-192  
 208-TyrAlaSerAlaPheTyrGlyProPheArgAsp-218  
 223-SerGlyAsnLeuGlyLysAlaAsp-230  
 268-LeuAspValValArgArgValLysAspGlu-277  
 296-AlaAlaIleAlaAsn-300

**Antigenic Index - Jameson-Wolf**

11-ArgAsnValProAlaSerArgMetArgArgMetArgArgAspAspPheSerArgArgLeuMetArgGluHisThrLeuThrAlaAspAsp-40  
 50-GlySerAlaArgGluGluAspValProSerMetProGlyValLysArgGlnSerLeuAsp-69  
 75-AlaGluGluAlaValLys-80  
 94-AlaAsnLysThrGluArgAlaGlnGluAlaTyrAsnProGluGlyLeuVal-110  
 115-ArgAlaLeuArgGluArgPhePro-122  
 139-GlyGlnAspGlyLeuThrAspGluAsnGlyTyrValMetAsnAspGluThrVal-156  
 175-AlaProSerAspMetMetAspGlyArgIleGlyAlaIleArgGluAlaLeuGluAspAlaGlyHis-196  
 215-ProPheArgAspAlaValGlySerSerGlyAsnLeuGlyLysAlaAspLysLysThrTyrGlnMetAspProAlaAsnThrAspGluAlaLeuHis-246  
 250-LeuAspIleGlnGluGlyAlaAsp-257  
 270-ValValArgArgValLysAspGluPheGlyVal-280  
 301-GlyTrpLeuAspGlyGlyLysValVal-309  
 317-LysArgAlaGlyAlaAspGly-323  
 331-GluAlaAlaLysMetLeuLysArg-338

**Hydrophilic Regions - Hopp-Woods**

14-ProAlaSerArgMetArgArgMetArgArgAspAspPheSerArgArgLeuMetArgGluHisThrLeuThrAla-38  
 50-GlySerAlaArgGluGluAspValProSer-59  
 61-ProGlyValLysArgGlnSerLeuAsp-69  
 75-AlaGluGluAlaValLys-80  
 95-AsnLysThrGluArgAlaGlnGluAlaTyrAsn-105  
 115-ArgAlaLeuArgGluArgPhePro-122

-222-

141-AspGlyLeuThrAspGluAsnGly-148  
 151-MetAsnAspGluThrVal-156  
 178-AspMetMetAspGlyArgIleGlyAlaIleArgGluAlaLeuGluAspAlaGly-195  
 216-PheArgAspAlaValGly-221  
 225-AsnLeuGlyLysAlaAspLysLysThrTyrGln-235  
 238-ProAlaAsnThrAspGluAlaLeuHis-246  
 250-LeuAspIleGlnGluGlyAlaAsp-257  
 270-ValValArgArgValLysAspGluPheGly-279  
 317-LysArgAlaGlyAla-321  
 331-GluAlaAlaLysMetLeuLysArg-338

611

**AMPHI Regions - AMPHI**

15-CysArgLeuPheGlyLysLeuSerLeu-23  
 26-ArgLeuLeuLeuGlyLeu-31  
 48-ArgSerValArgArgValIle-54  
 63-GlnValValAlaVal-67  
 104-ValPheIleGluAspPheVal-110  
 130-GlyPheLeuGlyAsnValLeuArgThr-138

**Antigenic Index - Jameson-Wolf**

1-MetProSerGluAsnGlyMetGlyLysArgGlnLeuAla-13  
 32-CysArgSerGlyValCysArgGlyArgCys-41  
 45-PheProSerArgSerValArgArgValIlePheArgArgValArgIle-60  
 119-AsnProAlaAspPheArgVal-125  
 142-AlaSerGlnGluAsp-146

**Hydrophilic Regions - Hopp-Woods**

1-MetProSerGluAsnGlyMetGlyLysArgGlnLeuAla-13  
 35-GlyValCysArgGlyArgCys-41  
 53-ValIlePheArgArgValArgIle-60  
 121-AlaAspPheArgVal-125  
 142-AlaSerGlnGluAsp-146

612-2

**AMPHI Regions - AMPHI**

6-AsnIleAlaLysLysLeuAlaGlyValAsp-15  
 57-LysAlaValGluLysCysAlaGluAsnValLeu-67  
 81-GlyAsnPheProAsn-85

**Antigenic Index - Jameson-Wolf**

7-IleAlaLysLysLeuAlaGlyValAsp-15  
 27-AspPheGlyArgAspAspAlaValArgHisSerGlyVal-39  
 57-LysAlaValGluLysCysAlaGlu-64  
 97-GlyHisHisArgAsnProTyrLysSer-105

**Hydrophilic Regions - Hopp-Woods**

7-IleAlaLysLysLeuAlaGlyValAsp-15  
 28-PheGlyArgAspAspAlaValArg-35  
 57-LysAlaValGluLysCysAlaGlu-64  
 101-AsnProTyrLysSer-105

613-2

**AMPHI Regions - AMPHI**

7-SerArgArgSerLeu-11  
 95-MetProArgMetArgSer-100  
 103-SerProMetSerProAla-108  
 115-ArgIlePheCysThrAlaLeuLeuArgLys-124  
 140-SerSerValMetArgProAla-146  
 168-LeuSerGlyLeuCysArgIle-174

-223-

**Antigenic Index - Jameson-Wolf**

1-MetSerArgSerSerArgSerArgArgSerLeuArgArgSerThrProSerArg-18  
 23-SerSerArgGlnSerAlaArgAla-30  
 35-PheAlaAspSerAspSerArgGluAsnProProIleCysSer-48  
 73-ProLysIleArgAlaAsnSerSerAspAlaArgGluArgArgLeuProSerArgAspSerThrAla-94  
 96-ProArgMetArgSerProSerSerProMetSerProAlaProGlySerProProTrp-114  
 130-AlaLysProPheProAlaGluSerLysProSerSerValMetArgProAlaSer-147  
 162-AlaAlaSerSerGluArgLeuSerGlyLeuCysArgIleArgArg-176  
 178-MetMetGlyArgArgAlaAspIlePheSerAspArgGlyGlyGlu-192  
 205-LeuSerArgTyrArgLysArgTyrGly-213

**Hydrophilic Regions - Hopp-Woods**

1-MetSerArgSerSerArgSerArgArgSerLeuArgArgSerThrProSer-17  
 24-SerArgGlnSerAlaArgAla-30  
 36-AlaAspSerAspSerArgGluAsnProPro-45  
 73-ProLysIleArgAlaAsnSerSerAspAlaArgGluArgArgLeuProSerArgAspSerThrAla-94  
 96-ProArgMetArgSerProSer-102  
 133-PheProAlaGluSerLysProSerSerValMetArg-144  
 162-AlaAlaSerSerGluArgLeuSerGly-170  
 172-CysArgIleArgArg-176  
 178-MetMetGlyArgArgAlaAspIlePheSerAspArgGlyGlyGlu-192  
 206-SerArgTyrArgLysArgTyrGly-213

614-2

**AMPHI Regions - AMPHI**

20-SerGlnPheIleGlnGlnVal-26  
 65-AsnLeuIleLysThrLeuLeuAsp-72  
 90-AlaLeuPheTyrSerLeuLeuProValLeu-99  
 144-ValAlaGlyCysAspGluAlaLysGluGluValGlnGluIleValAspTyrLeuLysAlaProAsnArgTyr  
 GlnSerLeu-170  
 210-AspPheValGluMetPheVal-216  
 222-ArgValArgAspMetPheGluGln-229  
 242-GluIleAspAlaValGlyArg-248  
 295-ProAlaLeuGlnArgProGlyArgPheAsp-304  
 333-SerValAspLeuLeuSerLeuAla-340  
 349-AlaAspLeuAlaAsnLeuValAsn-356  
 478-SerAsnAspPheGluArgAlaThrGlnMet-487  
 526-SerGluLysThrGln-530  
 536-GluIleArgArgIleLeuAsp-542  
 561-ThrMetCysLysAlaLeuMetGluTrpGluThr-571  
 591-AspTyrSerHisAsn-595  
 619-ProAlaProAlaAspThr-624

**Antigenic Index - Jameson-Wolf**

7-LeuAspGlyLysLysGluAspAsnGlyGlnIleGlu-18  
 26-ValAsnAsnGlyGluValSerGly-33  
 45-LeuIleLysGlyGluArgThrAspLysSerThrPhe-56  
 60-AlaProLeuAspAspAsnLeuIle-67  
 70-LeuLeuAspLysAsnValArgValLysValThrProGluGluLysProSerAla-87  
 111-MetGlnThrGlyGlyGlyGlyLysGlyGly-120  
 123-SerPheGlyLysSerArgAlaArgLeuLeuAspLysAspAlaAsnLys-138  
 145-AlaGlyCysAspGluAlaLysGluGluValGlnGlu-156  
 161-LeuLysAlaProAsnArgTyrGlnSerLeuGlyGlyArgValProArgGly-177  
 182-GlySerProGlyThrGlyLysThrLeuLeu-191  
 207-SerGlySerAspPhe-211

-224-

219-GlyAlaSerArgValArgAspMetPheGluGlnAlaLysLysAsnAla-234  
 241-AspGluIleAspAlaValGlyArgGlnArgGlyAlaGlyLeuGlyGlyGlyAsnAspGluArgGluGlnThr  
 Leu-265  
 272-MetAspGlyPheGluSerAsnGln-279  
 287-ThrAsnArgProAspValLeuAspProAlaLeuGlnArgProGlyArgPheAspArg-305  
 311-LeuProAspIleArgGlyArgGluGlnIle-320  
 323-ValHisSerLysLysValProLeuAspGluSerValAsp-335  
 341-ArgGlyThrProGlyPheSerGly-348  
 362-AlaGlyArgArgAsnLysValLysValAspGlnSerAspPheGluAspAlaLysAspLysIleTyrMetGly  
 ProGluArgArgSerMetValMetHisGluAspGluLysArgAlaThrAla-402  
 425-ThrIleMetProArgGlyArgAla-432  
 438-GlnLeuProGluArgAspArgIleSerMetTyrLysAspGlnMet-452  
 460-PheGlyGlyArgIleAlaGlu-466  
 474-SerThrGlyAlaSerAsnAspPheGluArgAlaThrGlnMetAlaArgGluMetValThr-493  
 495-TyrGlyMetSerAspLysMetGly-502  
 507-AlaGluAsnGluGlyGluValPheLeu-515  
 518-SerValThrArgSerGlnAsnIleSerGluLysThrGlnGlnAspIleAspAlaGluIleArgArgIleLeu  
 AspGluGlnTyr-545  
 551-IleLeuAspGluAsnArgAspLysMetGluThrMetCys-563  
 570-GluThrIleAspArgAspGlnVal-577  
 581-MetAlaGlyLysGlnProSerProProLysAspTyrSerHisAsnLeuArgGluAsnAlaAspAlaAlaGlu  
 AspAsnAlaProHisAlaProThrArgGluGluThrGluAlaProAlaProAlaAspThrAlaSerThrGluSerG  
 luGlnGlnProGluAsnLysAla-637

**Hydrophilic Regions - Hopp-Woods**

7-LeuAspGlyLysLysGluAspAsnGlyGln-16  
 27-AsnAsnGlyGluValSer-32  
 46-IleLysGlyGluArgThrAspLysSerThr-55  
 61-ProLeuAspAspAsnLeuIle-67  
 70-LeuLeuAspLysAsnValArgValLysValThrProGluGluLysProSerAla-87  
 115-GlyGlyGlyLysGlyGly-120  
 125-GlyLysSerArgAlaArgLeuLeuAspLysAspAlaAsnLys-138  
 145-AlaGlyCysAspGluAlaLysGluGluValGlnGlu-156  
 162-LysAlaProAsnArg-166  
 171-GlyGlyArgValProArg-176  
 221-SerArgValArgAspMetPheGluGlnAlaLysLysAsnAla-234  
 241-AspGluIleAspAlaValGlyArgGlnArgGlyAlaGly-253  
 256-GlyGlyAsnAspGluArgGluGlnThr-264  
 273-AspGlyPheGluSer-277  
 287-ThrAsnArgProAspValLeuAsp-294  
 296-AlaLeuGlnArgProGlyArgPheAspArg-305  
 312-ProAspIleArgGlyArgGluGlnIle-320  
 324-HisSerLysLysValProLeuAspGluSerValAsp-335  
 362-AlaGlyArgArgAsnLysValLysValAspGlnSerAspPheGluAspAlaLysAspLysIleTyrMetGly  
 ProGluArgArgSerMetValMetHisGluAspGluLysArgAlaThrAla-402  
 428-ProArgGlyArgAla-432  
 439-LeuProGluArgAspArgIleSerMetTyrLys-449  
 477-AlaSerAsnAspPheGluArgAlaThrGlnMetAlaArgGluMetValThr-493  
 496-GlyMetSerAspLysMetGly-502  
 507-AlaGluAsnGluGlyGluValPheLeu-515  
 518-SerValThrArgSerGlnAsnIleSerGluLysThrGlnGlnAspIleAspAlaGluIleArgArgIleLeu  
 AspGluGlnTyr-545  
 551-IleLeuAspGluAsnArgAspLysMetGluThrMetCys-563  
 570-GluThrIleAspArgAspGlnVal-577

-225-

584-LysGlnProSerProProLysAspTyrSerHisAsnLeuArgGluAsnAlaAspAlaAlaGluAspAsnAla  
Pro-608

610-AlaProThrArgGluGluThrGluAlaProAlaProAlaAspThrAlaSerThrGluSerGluGlnGlnPro  
GluAsnLysAla-637

616-2

**AMPHI Regions - AMPHI**

6-LysMetValValGlyLeu-11

13-AsnProGlyLysGluTyrGlu-19

48-PheGlyGluValAlaArgAla-54

77-ValAlaAlaLeuAlaGlnPheTyrLys-85

115-GlyHisAsnGlyLeuLysAspIle-122

159-HisArgArgGlnIleAspAspAlaValAlaLysSerLeuGlnAlaIleProAspIleLeuAlaGlyLysTrp  
GluGluAlaThrArgPheLeuHisSer-191

**Antigenic Index - Jameson-Wolf**

11-LeuGlyAsnProGlyLysGluTyrGluGlnThrArgHisAsnAlaGlyPhe-27

39-AlaSerPheLysGluGluLysLysPhePhe-48

55-AlaLeuProAspGly-59

70-MetAsnArgSerGlyGlnAla-76

86-IleLysProGluGlu

96-AspGluLeuAspIleProCysGlyArgIleLysPhe-107

109-LeuGlyGlyGlyAsnGlyGlyHisAsnGlyLeuLysAspIleGlnAla-124

127-GlyThrAlaAspTyrTyrArg-133

138-IleGlyHisProGlyAspArgAsnLeu-146

152-LeuAsnLysProSerThrGluHisArgArgGlnIleAspAspAlaValAla-168

181-LysTrpGluGluAlaThrArg-187

**Hydrophilic Regions - Hopp-Woods**

13-AsnProGlyLysGluTyrGluGlnThrArgHis-23

39-AlaSerPheLysGluGluLysLysPhePhe-48

86-IleLysProGluGlu-90

96-AspGluLeuAspIleProCysGlyArgIleLysPhe-107

117-AsnGlyLeuLysAspIleGlnAla-124

140-HisProGlyAspArgAsnLeu-146

155-ProSerThrGluHisArgArgGlnIleAspAspAlaValAla-168

181-LysTrpGluGluAlaThrArg-187

619

**AMPHI Regions - AMPHI**

50-LysLeuAlaAlaLeuLeu-55

66-GlnLeuPheGlnThrLeuThrAsn-73

134-GlnGlyGlyArgAspLeu-139

146-GlyValIlePheGlyIleLeuPheArgSerLeuSerSerLeuLeuSerArg-162

165-AspProGluGluPhe-169

175-AsnMetPheAlaGlyPheAsnThrValHisSer-185

246-AlaValValGlyProValSerPhePheGlyLeuLeuAlaAlaSerLeuAlaAsnHisPheSer-266

294-GluHisLeuLeuGly-298

303-LeuSerValValValGluPhe-309

**Antigenic Index - Jameson-Wolf**

1-MetProSerGluLysAsnIle-7

11-AlaGlySerSerArgPro-16

35-AsnValLysGlyAspTrpAsp-41

132-IleLysGlnGlyGlyArgAspLeuSer-140

163-MetIleAspProGluGluPheThr-170

203-TrpArgGluArgTyrArgLeuAsp-210

-226-

215-GlyArgAspGlnAlaVal-220  
 265-PheSerProSerValLysHisSerVal-273

**Hydrophilic Regions - Hopp-Woods**

1-MetProSerGluLysAsnIle-7  
 134-GlnGlyGlyArgAspLeuSer-140  
 163-MetIleAspProGluGluPheThr-170  
 203-TrpArgGluArgTyrArgLeu-209  
 215-GlyArgAspGlnAla-219  
 269-ValLysHisSerVal-273

620

**AMPHI Regions - AMPHI**

9-ValAlaValSerAlaLeuSerAlaCysArgGlnAla-20  
 31-IleSerAspArgSerVal-36  
 67-SerThrIleLysGlnMetPheGlyTyrThrLysLeuProGluGluProLysGlyIleArgValIleTyrValThrAspMetGlyAsnValThrAspTrpThr-100  
 139-GlnAlaGluLysPhe-143

**Antigenic Index - Jameson-Wolf**

15-SerAlaCysArgGlnAlaGluGluGlyProProProLeuProArgGlnIleSerAspArgSerValGlyHis-38  
 43-AsnLeuThrGluHisAsnGlyProLysAla-52  
 57-AsnGlyLysProAspGlnProVal-64  
 75-TyrThrLysLeuProGluGluProLysGlyIle-85  
 97-ThrAspTrpThrAsnProAsnAlaAspThrGluTrpMetAspAlaLysLys-113  
 125-GlyMetGlyAlaGluAspAlaLeuProPheGlyAsnLysGluGlnAlaGluLysPheAlaLysAspLysGlyGlyLysValValGlyPheAspAspMetProAspThrTyr-161

**Hydrophilic Regions - Hopp-Woods**

18-ArgGlnAlaGluGluGlyProProProLeu-27  
 30-GlnIleSerAspArgSerVal-36  
 46-GluHisAsnGlyProLys-51  
 58-GlyLysProAspGln-62  
 77-LysLeuProGluGluProLysGlyIle-85  
 103-AsnAlaAspThrGluTrpMetAspAlaLysLys-113  
 127-GlyAlaGluAspAlaLeu-132  
 135-GlyAsnLysGluGlnAlaGluLysPheAlaLysAspLysGlyGlyLys-150  
 155-AspAspMetProAsp-159

622

**AMPHI Regions - AMPHI**

28-LeuProLysAlaValArgAsnLeuAlaArg-37  
 62-GluGluIleIleArgTrpLeuAlaAsp-70  
 112-IleLeuGlyGlnIleLysAspAlaValArgValAlaGln-124  
 131-LysLysLeuAsnAlaLeuPheGlnLys-139  
 142-SerValAlaLysGluVal-147  
 169-GluGlnIlePheProAspIleGlyAsp-177  
 187-GluMetIleGluLeuValAla-193  
 214-AlaGlnGluLeuCysAspLys-220  
 232-AspLeuProAlaIleLeuHis-238  
 288-AspLeuAsnAspAla-292  
 297-ValAspAspMetValAsnIleValGlnSerGly-307  
 324-GluLysValAlaGluPheValArgGlnGln-333  
 345-LeuArgAspGluGlyGluLys-351  
 354-LysGlnValLeuGluAsnAlaMetLysGlnLeuAlaLys-366  
 372-GluValLeuGluArgLeuSerValGlnLeuThr-382

-227-

384-LysLeuLeuHisSerProThrGlnThrLeuAsnLysAlaGlyGlu-398

**Antigenic Index - Jameson-Wolf**

16-SerIleArgGluLysLeuAla-22  
 30-LysAlaValArgAsnLeuAlaArgSerAsnAlaAla-41  
 49-ThrCysAsnArgThrGlu-54  
 57-CysValGlyAspSerGluGluIleIle-65  
 75-ProIleGluGluIleArgPro-81  
 87-AspMetGlnGluThrValArgHis-94  
 115-GlnIleLysAspAlaValArgValAlaGlnGluGlnGluSerMetGlyLysLysLeu-133  
 142-SerValAlaLysGluValArgThrAspThrAlaValGlyGluAsnSerVal-158  
 174-AspIleGlyAspLeuAsn-179  
 199-LysSerProArgLeu-203  
 210-ThrLeuAlaArgAlaGlnGluLeuCysAspLysLeuGlyValAsnAlaGlu-226  
 257-GlyMetValGluArgAlaLeuLysGlnArgGlnSer-268  
 277-AlaValProArgAspIleGluAlaGluValGlyAspLeuAsnAsp-291  
 305-GlnSerGlyLysGluAlaArgGlnLysAlaAlaAlaAla-317  
 321-LeuValSerGluLysValAlaGluPheValArgGlnGlnGlnGlyArgGlnSerVal-339  
 343-LysAlaLeuArgAspGluGlyGluLysAlaArgLysGlnValLeu-357  
 368-AlaThrAlaGluGluValLeuGlu-375  
 381-LeuThrAsnLysLeuLeuHisSerProThrGlnThrLeuAsnLysAlaGlyGluGluAspLysAspLeuVal-404

**Hydrophilic Regions - Hopp-Woods**

16-SerIleArgGluLysLeuAla-22  
 30-LysAlaValArgAsnLeuAlaArgSerAsnAlaAla-41  
 59-GlyAspSerGluGluIleIle-65  
 75-ProIleGluGluIleArg-80  
 87-AspMetGlnGluThrValArgHis-94  
 115-GlnIleLysAspAlaValArgValAlaGlnGluGlnGluSerMetGlyLysLysLeu-133  
 142-SerValAlaLysGluValArgThrAspThrAlaValGlyGluAsnSerVal-158  
 210-ThrLeuAlaArgAlaGlnGluLeuCysAsp-219  
 257-GlyMetValGluArgAlaLeuLysGlnArgGlnSer-268  
 277-AlaValProArgAspIleGluAlaGluValGlyAspLeuAsn-290  
 305-GlnSerGlyLysGluAlaArgGlnLysAlaAlaAlaAla-317  
 321-LeuValSerGluLysValAlaGluPheValArg-331  
 333-GlnGlnGlyArgGlnSer-338  
 343-LysAlaLeuArgAspGluGlyGluLysAlaArgLysGlnValLeu-357  
 368-AlaThrAlaGluGluValLeuGlu-375  
 392-ThrLeuAsnLysAlaGlyGluGluAspLysAspLeuVal-404  
 624

**AMPHI Regions - AMPHI**

14-LeuLeuLeuGlyIleIleGlyIlePheLeuPro-24  
 45-ArgPheTyrArgTrpLeuHisArg-52  
 58-ProMetValHisAsn-62  
 92-PheProGlnArgTrpTrpValGlyAla-100  
 102-SerSerValPheCysSerLeuValAlaIle-111

**Antigenic Index - Jameson-Wolf**

41-LysAlaSerProArgPheTyr-47  
 50-LeuHisArgHisArgTyrPheGlyPro-58  
 63-TrpGluGlnAsnGlyAlaValProArgLysAlaLys-74  
 115-ArgArgProGluSer-119

**Hydrophilic Regions - Hopp-Woods**

-228-

67-GlyAlaValProArgLysAlaLys-74

115-ArgArgProGluSer-119

625

**AMPHI Regions - AMPHI**

25-SerGlyArgIleIleSerIleAlaAla-33

64-LysMetProProGluMetValTyrArgAla-73

**Antigenic Index - Jameson-Wolf**

5-ArgLysMetLysLysMetThrMetCysThrArgArgVal-17

57-ProPheLysSerProGlnThrLysMetProPro-67

73-AlaSerSerSerArgMetLysGly-80

96-AspAlaProLysThrLysLeuAsnGlyMetArgLysSerAsnValGln-111

**Hydrophilic Regions - Hopp-Woods**

5-ArgLysMetLysLysMetThrMetCysThrArgArgVal-17

60-SerProGlnThrLysMetProPro-67

74-SerSerSerArgMetLysGly-80

96-AspAlaProLysThrLysLeuAsnGlyMetArgLysSerAsnValGln-111

627-2

**AMPHI Regions - AMPHI**

52-TrpHisHisHisTyrGlyLysIleThrAlaPheTrpThrLeuLeuPheLeu-68

83-ThrValAlaHisAlaLeu-88

128-ValGlyThrAlaLeuAlaSerIleMetGly-137

173-IleGlyGlyGlyLeuThrPro-179

189-PheLeuLysGlyValAsp-194

245-AlaIlePheGlyLysTrp-250

258-ValValGlyAlaVal-262

284-LeuGlnAsnLeuVal-288

319-IleAlaGluValGlyLysLeuPheLeuGlyIlePheIleThrIlePheProValLeuSerIleLeuLysAla

GlyGluAlaGlyAlaLeuGlyGlyValValSerLeuValHisAspThrAlaGlyHisProIle-363

372-GlyIleLeuSerAlaPheLeuAspAsnAla-381

404-PheHisSerLeuLeuAlaValSer-411

416-PheMetGlyAlaLeuThrTyrIleGlyAsnAlaProAsnPheMetValLys-432

444-ThrPhePheGlyTyr-448

**Antigenic Index - Jameson-Wolf**

20-AspLeuAspGlyAlaAsn-25

114-AspLeuAsnGlyThrProLysLeu-121

149-LeuLeuLysAlaAsnGlnAsnArgThrArgArgVal-160

172-AsnIleGlyGlyGly-176

178-ThrProLeuGlyAspProPro-184

223-ArgPhePheLysGlnGluSerIleAlaGlnAspThrProAlaGlnGlnGluLysProGluLys-243

266-GlyLeuTrpLysProGluHisProGlyPhe-275

304-ThrProLysGlnValArgAlaGlyAsnGluPheAsnPhe-316

357-AspThrAlaGlyHis-361

391-AlaGlyGlyAspAla-395

433-AlaIleAlaGluGlnArgGlyValPro-441

**Hydrophilic Regions - Hopp-Woods**

153-AsnGlnAsnArgThrArgArgVal-160

228-GluSerIleAlaGln-232

234-ThrProAlaGlnGlnGluLysProGluLys-243

268-TrpLysProGluHisProGly-274

306-LysGlnValArgAlaGlyAsn-312

433-AlaIleAlaGluGlnArgGlyVal-440

-229-

628

**AMPHI Regions - AMPHI**

10-CysGlyProProAsnSerCysValSerMetLeuAlaAlaPheSerAspGlyThrSerAlaProAlaAla-32  
 34-GlnThrTrpIleLeuArgSer-40

**Antigenic Index - Jameson-Wolf**

6-LysProAlaGlyCysGlyProProAsnSer-15  
 23-PheSerAspGlyThrSerAla-29  
 40-SerValLysArgLeuAsnThrAsnArgProArgLeuLysSerSerAla-55  
 77-MetAlaAsnGlySerAlaSerThr-84  
 91-GlyArgValArgSerAlaValHisLysProAspTrpIleArgLeuArgArgThrSerSerProLeuLys-113

**Hydrophilic Regions - Hopp-Woods**

40-SerValLysArgLeuAsnThrAsnArgProArgLeuLysSerSerAla-55  
 91-GlyArgValArgSerAlaValHisLys-99  
 101-AspTrpIleArgLeuArgArgThrSerSer-110

629

**AMPHI Regions - AMPHI**

32-ArgTrpSerAspValPheSer-38  
 48-IleSerArgLeuProArgThrPhe-55  
 116-ValAlaAlaLeuIleGlyMetLeu-123  
 146-IlePheGlyGlyValIleGluAlaValAlaThr-156  
 167-MetLeuGlyValTrpGlnGlnGlyAsp-175  
 206-IleLeuGlyLeuGlyGlu-211  
 252-ValValProAsnIleIleSerArgLeuMetGlyAspArgLeuArgGlnSer-268  
 285-IleIleGlyArgVal-289  
 300-ThrValPheGlyValLeu-305

**Antigenic Index - Jameson-Wolf**

38-SerLeuSerAspSerGln-43  
 50-ArgLeuProArgThr-54  
 77-AsnArgPheValGluProSerMetValGlyAlaSerGln-89  
 130-ArgArgLeuProProThrAla-136  
 260-LeuMetGlyAspArgLeuArgGlnSer-268

**Hydrophilic Regions - Hopp-Woods**

260-LeuMetGlyAspArgLeuArgGln-267

630-2

**AMPHI Regions - AMPHI**

6-PheLeuGluLysIleGluPro-12  
 23-TrpTyrAlaLeuTyrGlu-28  
 64-LeuPheProAlaMetPheTyrGlyMetTyrAsn-74  
 87-LeuLeuGlnGlnAsnIleAlaAsnAspTrpHisTyrAlaPhe-100  
 137-GlyPheTrpGluValLeuPheAla-144  
 190-PheGlyGlyThrGlyLysAsnPhe-197  
 224-AlaValAspGlyTyrSerGlyAlaThrAlaLeuAlaGlnTrp-237  
 242-AlaAspGlyLeuLysAsnAlaVal-249  
 258-AspAlaPheIleGlyLysLeuProGlySerIleGlyGluValSer-272  
 285-PheAlaArgIleAlaSerTrpArgIleIleAlaGlyValMet-298  
 302-IleAlaMetSerSerLeuPheAsnPhe-310  
 344-ValSerAlaSerPheThrAsnValGlyLysTrpTrpTyrGlyAlaLeuIleGlyValMetCysValLeuIle  
 ArgVal-369  
 382-IleLeuPheAlaAsnLeuPheAlaProIlePheAspTyrPhe-395

**Antigenic Index - Jameson-Wolf**

6-PheLeuGluLysIleGlu-11  
 16-ProGlyGlyLysHisGluLys-22  
 37-SerGlyAlaValThrArgLysAlaAlaHisValArgAspAlaLeuAspSerLysArgMet-56  
 107-AsnMetSerSerGluAlaGlyValSerAspLysMet-118  
 146-ValArgLysHisGluIleAsnGlu-153  
 189-ValPheGlyGlyThrGlyLysAsnPheMet-198  
 212-TyrProAlaAsnLeuSerGlyAspAla-220  
 241-GlyAlaAspGlyLeuLys-246  
 264-LeuProGlySerIleGly-269  
 312-GlySerAspThrAsnAla-317  
 400-AsnIleLysArgArgLysAlaArgSerAsnGly-410

#### Hydrophilic Regions - Hopp-Woods

6-PheLeuGluLysIleGlu-11  
 18-GlyLysHisGluLys-22  
 39-AlaValThrArgLysAlaAlaHisValArgAspAlaLeuAspSerLysArgMet-56  
 108-MetSerSerGluAlaGlyValSerAsp-116  
 146-ValArgLysHisGluIleAsn-152  
 400-AsnIleLysArgArgLysAlaArgSerAsnGly-410  
 638

#### AMPHI Regions - AMPHI

30-IleValAspIleValGluHis-36  
 46-AspIleValGluTyrPheGluProLeuGlyLys-56  
 108-ProPheGlyAsnValValAlaAspAspLeuArgThrGly-120  
 148-ArgIleGlyArgThrMet-153  
 198-GluArgTyrValArgArgValTyrGlyTyrGlyThrPro-210  
 212-ProValAlaPheAspGlyCysGlyThrValGlyArg-223  
 242-SerGlnPheGluArgIleAlaArgProGly-251

#### Antigenic Index - Jameson-Wolf

43-AlaAspGlyAspIle-47  
 53-ProLeuGlyLysHisGln-58  
 81-ValAspGlyGluThrGlnIle-87  
 99-AlaGlyIleGlyLysAsnAlaVal-106  
 113-ValAlaAspAspLeuArgThrGlyCysValProAsnGly-125  
 135-GlnSerArgValAlaAsp-140  
 156-TyrAlaAspArgIleIle-161  
 168-AsnGlnGlyAlaArgGlySerPhe-175  
 178-IleAsnThrGlyIleHis-183  
 188-HisThrGlyThrGlyAsnGlyGlnValAlaGluArgTyrValArg-202  
 205-TyrGlyTyrGlyThr-209  
 216-AspGlyCysGlyThrValGlyArgProPheAsnArgAsnArgPheVal-231  
 240-AlaGlySerGlnPheGluArgIleAlaArgProGlyAlaGlyLysCysGly-256

#### Hydrophilic Regions - Hopp-Woods

43-AlaAspGlyAspIle-47  
 81-ValAspGlyGluThrGlnIle-87  
 113-ValAlaAspAspLeuArgThr-119  
 136-SerArgValAlaAsp-140  
 195-GlnValAlaGluArgTyrValArg-202  
 243-GlnPheGluArgIleAlaArgProGlyAlaGly-253  
 639-1

#### AMPHI Regions - AMPHI

95-TyrLysAsnAsnArg-99  
 137-LeuLysValPheAspAsnIle-143

-231-

157-ValAsnTyrSerAspIleHisAspAsnIleIleAsnLysAla-170  
 181-TyrAspLysLeuPheAlaAsnHisPheGlu-190  
 269-AlaProValSerArg-273  
 290-GlnPheProAlaValLeuProGly-297  
 322-AspGluLeuLeuLysGluValGlu-329

**Antigenic Index - Jameson-Wolf**

13-GluGluThrAlaPro-17  
 23-HisAsnAsnIleLeuAspAsnSer30  
 41-AlaMetValArgGluAsnLysIleValGly-50  
 52-AlaThrLeuArgValAsnGluArgGlyAsnGly-62  
 75-GlyAsnAspIleSerLysGlyArgAspGlyIlePheSerAsnThrSerThrHisAsnThrTyrLysAsnAsnArgPheSerAsp-102  
 111-TyrThrAsnAspSerGluIleSerGly-119  
 121-IleSerValGlyAsnAsn-126  
 135-GluArgLeuLysVal-139  
 145-ValGlySerArgAspGlnGlyIle-152  
 160-SerAspIleHisAspAsnIleIleAsnLysAlaGlyLys-172  
 203-GluGlyThrSerLeuHisAspAsnSerPheIleAsnAsnGluSerGlnValLysTyrVal-222  
 228-AspTrpSerGluGlyGlyHisGlyAsnTyrTrpSerAspAsnSerAla-243  
 246-LeuAsnGlyAspGlyPheGlyAspSerAlaTyrArgProAsnGlyIleIle-262  
 297-GlyGlyValValAspSerLysProLeuMetLysProTyrAlaProLysIleGlnThr-315  
 318-GlnAlaMetLysAspGluLeuLeuLysGluValGluThrArgGlnSerGluTrpGlyArgAlaGluAsnGlySerLeuAsn-344

**Hydrophilic Regions - Hopp-Woods**

41-AlaMetValArgGluAsnLysIleValGly-50  
 52-AlaThrLeuArgValAsnGluArgGlyAsn-61  
 77-AspIleSerLysGlyArgAspGlyIle-85  
 95-TyrLysAsnAsnArgPheSerAsp-102  
 113-AsnAspSerGluIleSerGly-119  
 135-GluArgLeuLysVal-139  
 146-GlySerArgAspGlnGly-151  
 299-ValValAspSerLysProLeuMet-306  
 318-GlnAlaMetLysAspGluLeuLeuLysGluValGluThrArgGlnSerGluTrpGlyArgAlaGluAsnGlySer-342

640-2

**AMPHI Regions - AMPHI**

6-SerIleLeuLysSerIleGlyIle-13  
 22-SerIleLysArgMetSer-27  
 47-LeuProAlaTyrAlaGluArgLeuProAspPheLeuAlaLysIleGlnPro-63  
 72-ArgTyrGlyLysPro-76  
 127-AlaLysLeuValAspHisHis-133  
 141-IleProHisLeuProAlaProGlyArgAlaIle-151  
 153-SerAsnTrpLeuProAla-158

**Antigenic Index - Jameson-Wolf**

24-LysArgMetSerAlaPheArgAlaArgIle-33  
 50-TyrAlaGluArgLeuProAspPhe-57  
 59-AlaLysIleGlnProSerGluIlePheProGlyAlaAspArgTyrGlyLysProGluGlyLysProMetVal-82  
 84-ArgValTyrLysGlyAspGluGlnLeu-92  
 101-AlaValAsnThrArgGlyTyrSerSerLysProIleAsp-113  
 128-LysLeuValAspHisHisGlu-134  
 144-LeuProAlaProGlyArgAlaIleArg-152

-232-

168-AsnArgLeuArgLeuLysGlyLeuPro-176  
 178-ValProGlnProSerLysAlaThrGly-186

**Hydrophilic Regions - Hopp-Woods**

24-LysArgMetSerAlaPheArgAlaArgIle-33  
 50-TyrAlaGluArgLeuPro-55  
 68-ProGlyAlaAspArgTyrGlyLysProGluGlyLysProMetVal-82  
 85-ValTyrLysGlyAspGluGlnLeu-92  
 128-LysLeuValAspHisHisGlu-134  
 146-AlaProGlyArgAlaIleArg-152  
 168-AsnArgLeuArgLeuLysGly-174  
 180-GlnProSerLysAlaThrGly-186

642-2

**AMPHI Regions - AMPHI**

157-IleLysHisIleValArgAlaPhe-164  
 179-GlyValSerAlaPheLysThrLeuArgThrGlnGluPheLeuGlnHisLeuArgGlyGlyVal-199  
 202-PheArgGlyGluGly-206  
 208-AspAspValArgLeu-212  
 228-AspValAlaValLysAsnLeuGlyAsnLeuMetAlaAlaProAsp-242  
 259-PheGlnIlePheLysAspValPheHisAsnAlaValArgHisAlaAspGlnLeuGln-277  
 311-ValAspGlyValThrAspGlyAla-318  
 337-GlnValAspAspPheGlyGluPheAlaValPhe-347  
 366-PheArgGlyValAsp-370  
 409-HisLeuGlnThrLeuArgAspLeuArgPheIleAlaGluLeuLeuGlnTrpLeuGlnHisGlnArgAlaPhe  
 AspAlaGlyThr-436  
 445-ProArgAsnProGlnAsp-450

**Antigenic Index - Jameson-Wolf**

1-MetArgHisProProGlnSerAlaAlaLeu-10  
 17-LeuLeuHisArgProLysSerValCysArgArgArgLysCysArgLeuLysAla-34  
 36-ProLeuSerAspGlyIleAlaCys-43  
 63-ValGlnGlnGluGlyCysGly-69  
 75-LeuTyrGluAspLysGluSerGlyAspAspPheAlaAspLysAspPheLeuGln-92  
 104-GluAlaAlaAspValPheArg-110  
 115-AlaGlyAspGlyGlyLysAlaGly-122  
 144-PheGlyGlyGlyAlaAspLysLeu-151  
 164-PheLysAsnArgGluGlyAlaAspValAspSerAspIleAlaGly-178  
 184-LysThrLeuArgThrGlnGlu-190  
 202-PheArgGlyGluGlyPheAspAspValArgLeu-212  
 217-GlyAspGlyGlyAsnArgArgAsnGlyMetAla-227  
 249-AspGluPheAspVal-253  
 271-ArgHisAlaAspGlnLeuGlnAlaAlaAlaAspLysAspValLeuGluArgAlaGlnThrGly-291  
 300-HisGlyGlyCysArg-304  
 306-PheGlyIleAspAlaValAspGlyValThrAspGly-317  
 331-CysPheGlyAspGluGlnGlnValAspAspPheGly-342  
 350-PheGlyGlyAsnGluGluGluValAlaLeu-359  
 369-ValAspValAsnGly-373  
 387-CysAsnArgArgAlaGlyGlyPhe-394  
 396-PheGlyAsnThrGln-400  
 411-GlnThrLeuArgAspLeuArgPhe-418  
 430-ArgAlaPheAspAlaGlyThrGlnArgAsnGly-440  
 443-ValMetProArgAsnProGlnAspPheLeuAsp-453  
 468-GluGlyGlnGlnGlnThrArg-474

**Hydrophilic Regions - Hopp-Woods**

-233-

1-MetArgHisProPro-5  
 17-LeuLeuHisArgProLysSerValCysArgArgArgLysCysArgLeuLysAla-34  
 75-LeuTyrGluAspLysGluSerGlyAspAspPheAlaAspLysAspPheLeu-91  
 104-GluAlaAlaAspValPheArg-110  
 117-AspGlyGlyLysAla-121  
 147-GlyAlaAspLysLeu-151  
 164-PheLysAsnArgGluGlyAlaAspValAspSerAspIle-176  
 184-LysThrLeuArgThr-188  
 205-GluGlyPheAspAspValArgLeu-212  
 217-GlyAspGlyGlyAsnArgArgAsnGlyMet-226  
 249-AspGluPheAspVal-253  
 271-ArgHisAlaAspGlnLeuGlnAlaAlaAlaAspLysAspValLeuGluArgAlaGlnThr-290  
 310-AlaValAspGlyValThrAspGly-317  
 331-CysPheGlyAspGluGlnGlnValAspAspPheGly-342  
 352-GlyAsnGluGluGluValAlaLeu-359  
 387-CysAsnArgArgAlaGly-392  
 412-ThrLeuArgAspLeuArgPhe-418  
 435-GlyThrGlnArgAsnGly-440  
 446-ArgAsnProGlnAsp-450  
 468-GluGlyGlnGlnGln-472  
 644-2

**AMPHI Regions - AMPHI**

13-MetAspThrAlaAlaPheLeuLysHisIleGluSerAlaPheArgArgIlePheSerAspGlyIleAspLeuMetArgTyrLeu-40  
 69-GlnPheGluIleGlnGluValLeuArgIleAlaGly-80  
 99-GlnProLeuGlnGluPheGlyAsp-106  
 139-ArgGluMetGlnSerTyrTyrGluTyrIleAspGly-150  
 160-TyrTrpGlnGlyAsn-164  
 182-LeuAlaLysValIleAspLeuLeu-189  
 234-AlaGlyLeuArgAlaPheGlnAsn-241  
 253-MetThrHisGlyIleMetGluTyrIleLeuGluAsnLeuGluArgTyrValArgAsn-271  
 291-GluIleLeuTyrArgTyrValCysHis-299  
  
 301-ValSerProValAlaProValAlaHis-309  
 314-AlaAsnIleValLysThrLeuAla-321  
 330-GlnMetLeuGlnLys-334  
 357-PheThrIlePheGluGlyProAsn-364  
  
 366-MetLeuTyrAlaGluIleTyrAspGlnPheValArgAla-378  
 397-AspArgLeuGlnThr-401  
 414-LeuProGluAspIleArgSerPhe-421  
 439-GlyLysIleIleAlaArgLeu-445

**Antigenic Index - Jameson-Wolf**

3-HisThrGluProSerAlaGlnProSerThrMetAsp-14  
 22-IleGluSerAlaPhe-26  
 29-IlePheSerAspGlyIleAsp-35  
 40-LeuProGluAspLysTrpLeu-46  
 57-PheLeuAspLysLysTyrGlyGlyArgLysGlySerGlnPheGluIle-72  
  
 103-GluPheGlyAspGluAlaGlnVal-110  
 118-PheLysGlyGluGlyGlyGlyLeuGly-126  
  
 128-ThrGluProGluThrSerGly-134  
 136-AlaIleAlaArgGluMetGlnSer-143

-234-

145-TyrGluTyrIleAspGlyGlnThr-152  
 160-TyrTrpGlnGlyAsnSerGlnSerAspPhe-169  
 174-AlaLysGluArgLysAsnGlyLysLeuAlaLys-184  
 193-LysThrTyrIleArg-197

199-GluThrLeuAlaSerGluGlyLeuArg-207  
 212-AlaValAsnArgIleAspAlaGluMet-220  
 228-LeuSerGlnSerAspAlaAlaGly-235  
 264-AsnLeuGluArgTyrValArgAsnAspIleLysPheValAspTyrGluArgArgGluIleArgArgArgHis  
 GlnVal-289  
 339-LysGlyPheGluArgGlyHisThrAlaGlyAsn-349  
 361-GluGlyProAsnAspMetLeu-367  
 378-AlaThrAlaGluGluLysGluAlaGlyMetLysLeuAspLysAsnGlnThrLeuLeuAspArgLeuGlnThr  
 AspAlaArgPhe-405  
 407-AlaValAlaArgAspTyrThrLeuProGluAspIleArgSerPheLeu-422  
 451-AlaLysHisGluAspThrAla-457  
 463-AspIleArgLysAspIleLeuAspCysArgTyrCysGly-475

**Hydrophilic Regions - Hopp-Woods**

22-IleGluSerAlaPhe-26  
 29-IlePheSerAspGlyIleAsp-35  
 40-LeuProGluAspLysTrpLeu-46  
 58-LeuAspLysLysTyrGlyGlyArgLysGlySerGln-69

103-GluPheGlyAspGluAlaGlnVal-110  
 118-PheLysGlyGluGlyGly-123  
 128-ThrGluProGluThrSerGly-134

136-AlaIleAlaArgGluMetGlnSer-143  
 174-AlaLysGluArgLysAsnGlyLysLeuAlaLys-184  
 212-AlaValAsnArgIleAspAlaGluMet-220  
 229-SerGlnSerAspAlaAlaGly-235  
 264-AsnLeuGluArgTyrValArgAsnAspIleLysPheValAspTyrGluArgArgGluIleArgArgArgHis  
 GlnVal-289  
 339-LysGlyPheGluArgGlyHisThr-346  
 378-AlaThrAlaGluGluLysGluAlaGlyMetLysLeuAspLysAsnGlnThrLeuLeuAspArgLeuGlnThr  
 AspAlaArgPhe-405  
 416-GluAspIleArgSerPheLeu-422  
 451-AlaLysHisGluAspThrAla-457  
 463-AspIleArgLysAspIleLeuAsp-470  
 645-2

**AMPHI Regions - AMPHI**

21-AsnThrLeuAsnArgCysCysLys-28  
 87-ArgThrLeuProSerLeuLysGlyLeuThrLys-97

**Antigenic Index - Jameson-Wolf**

17-ValGluGlnSerAsnThrLeuAsnArgCysCysLysLysSerArgMetThrCysSerSerSerArgSerArgS  
 erCysProCys-44  
 47-ProMetArgAlaSerGlySerArgValSerSerArgSerArgIle-61  
 68-SerLeuCysArgLysAsnThrCysProProArgLeuSerSerArgAsnThrAlaSerArgThrLeuProSerL  
 eu-92  
 99-LeuThrAlaArgArgArgLeuGly-106  
 110-IleSerGluLysSerArgSerProSerAsn-119  
 137-ThrLeuAlaArgArgArgLeuSerCysSer-146

-235-

**Hydrophilic Regions - Hopp-Woods**

19-GlnSerAsnThrLeu-23  
 25-ArgCysCysLysLysSerArgMetThrCysSerSerSerArgSerArgSerCysPro-43  
 48-MetArgAlaSerGlySerArgValSerSerArgSerArgIle-61  
 69-LeuCysArgLysAsnThrCys-75  
 77-ProArgLeuSerSerArgAsnThrAlaSerArgThr-88  
 99-LeuThrAlaArgArgArgLeuGly-106  
 110-IleSerGluLysSerArgSerProSer-118  
 137-ThrLeuAlaArgArgArgLeuSer-144  
 647

**AMPHI Regions - AMPHI**

38-GlyLysValCysArgCysPheGluGlnVal-47  
 69-ThrValPheArgGlnIleIleSerIleVal-78

**Antigenic Index - Jameson-Wolf**

26-GlyLeuValLysGluArgAlaArg-33  
 39-LysValCysArgCysPhe-44  
 54-GlyThrValGlyGlnThrGluArgGlyThr-63  
 81-AlaAspAlaGluArgThrAlaAlaHisSerArgGlyThrArgGly-95

**Hydrophilic Regions - Hopp-Woods**

26-GlyLeuValLysGluArgAlaArg-33  
 56-ValGlyGlnThrGluArgGlyThr-63  
 81-AlaAspAlaGluArgThrAlaAlaHisSerArgGlyThrArgGly-95  
 648

**AMPHI Regions - AMPHI**

7-ArgIleGluArgAlaValArg-13  
 15-AlaValIleAspValLeuAsnValAsp-23  
 44-AlaLeuAlaAspIleArgValLeu-51  
 94-AlaValAspLeuHisAlaValIleLysLeuThrAspThr-106  
 127-GlnGlyValGluGlnGly-132  
 147-ArgArgLeuLysHisPheLysGluGlyAsnAlaAlaGlyMetProArgPhe-163  
 182-AlaArgThrLeuGlyAsnValPheHis-190  
 194-GlySerGlyIleAspGlyIleGlnThrIleValAlaPheAsnGlnHisThr-210

**Antigenic Index - Jameson-Wolf**

1-MetAsnArgArgAspAlaArgIleGluArgAlaValArg-13  
 23-AspAlaProGlySerGlyThrLeuLeuHisGlnArgGlyLysGlnValGlySerArgAsnAspAlaLeuAla-46  
 65-GlyLysLysArgPheValGlnSerArgAsnLeuValGlyArgLysGlnArgAsn-82  
 125-MetProGlnGlyValGluGlnGlyCysArgAla-135  
 143-ThrGlyPheAspArgArgLeuLysHisPheLysGluGlyAsnAla-157  
 172-ThrAlaAspThrSerGlyIleAspAlaAspAlaArgThr-184  
 191-AsnArgAlaGlySerGlyIleAspGly-199

**Hydrophilic Regions - Hopp-Woods**

1-MetAsnArgArgAspAlaArgIleGluArgAlaValArg-13  
 33-GlnArgGlyLysGlnValGlySerArgAsnAspAlaLeuAla-46  
 65-GlyLysLysArgPheValGln-71  
 74-AsnLeuValGlyArgLysGlnArgAsn-82  
 127-GlnGlyValGluGlnGlyCysArgAla-135  
 143-ThrGlyPheAspArgArgLeuLysHisPheLysGluGlyAsnAla-157  
 173-AlaAspThrSerGlyIleAspAlaAspAlaArgThr-184  
 649-2

-236-

**AMPHI Regions - AMPHI**

8-AlaIleLeuLeuSerAlaIleLeuGlyLeuVal-18  
 32-ArgAspThrLysHisIleArgLysAlaAsn-41  
 62-SerGlnGlyAsnVal-66  
 68-GluLeuArgGluAsnLys-73  
 76-ArgLysAlaPheArgSerLeuPro-83

**Antigenic Index - Jameson-Wolf**

1-MetSerValLysLys-5  
 25-GlyThrSerGluProAlaHisArgAspThrLysHisIleArgLysAlaAsnLys-42  
 45-LeuHisProGluCysArgLysTyrLeuGluArgArgAlaAla-58  
 61-ArgSerGlnGlyAsnValGlnGluLeuArgGluAsnLysLysAlaArgLysAlaPheArg-80  
 85-AlaGluGlnLysIleGlnCys-91  
 97-AlaPheAspAspPheAspGlyGlySerPheArgArg-108

**Hydrophilic Regions - Hopp-Woods**

1-MetSerValLysLys-5  
 25-GlyThrSerGluProAlaHisArgAspThrLysHisIleArgLysAlaAsnLys-42  
 47-ProGluCysArgLysTyrLeuGluArgArgAlaAla-58  
 64-GlyAsnValGlnGluLeuArgGluAsnLysLysAlaArgLysAlaPheArg-80  
 85-AlaGluGlnLysIleGlnCys-91  
 97-AlaPheAspAspPheAspGlyGlySerPheArgArg-108  
 650-2

**AMPHI Regions - AMPHI**

15-SerValCysProGly-19  
 57-LeuTrpGlyGluLeuArgGln-63  
 72-ProGluLeuValArgArgHisGlu-79  
 89-PheAsnArgValIleAsn-94  
 137-SerGlyLeuTrpGln-141  
 173-AsnTyrLeuGlnTyrLeuTyrGlyLeuPheGlyAspTrpPro-186  
 198-AsnValGlyArgAlaIleAsnArgAlaArg-207  
 218-LeuArgMetProAsnGluThr-224  
 269-GluAlaIleAlaArgLeuAlaGlyIleThrGlnSer-280  
 314-SerAsnTyrLeuAsnAlaAlaProAsp-322  
 341-IleSerThrAlaThrGlyMet-347  
 349-IleAlaAspIleLysArgLeuAsnAsnLeu-358  
 376-LysThrLeuGlnThrAlaSerGlu-383  
 484-AlaAspGluLeuMetGln-489  
 496-LeuArgArgGlnAlaGlu-501  
 503-ThrIleSerAlaValIleGlyThrProAspThrValAlaGlu-516  
 556-AlaSerIleHisArgValVal-562  
 621-AspThrPheLysSerIle-626  
 636-AspIleArgArgLeu-640

**Antigenic Index - Jameson-Wolf**

1-MetSerLysLeuLys-5  
 24-GlnAsnThrSerSerHis-29  
 38-LeuAsnSerSerIleLeuAspLeuProProThrLysGlnTyrPhe-52  
 59-GlyGluLeuArgGlnGlyPheArgMetGlyGluValAsnProGluLeuValArgArgHisGluSerLysPhe-82  
 92-ValIleAsnArgSerArgProTyr-99  
 105-AsnGluValLysLysArgAsnMetProAla-114  
 128-ThrLysAlaLysSerHisValGlyAlaSerGly-138  
 145-AlaThrGlyArgHisTyrGlyLeuGluLysThrProValTyrAspGlyArgHisAspVal-164

-237-

192-TyrAsnTrpGlyGluGlyAsnValGlyArgAlaIleAsnArgAlaArgAlaGlnGlyLeuGluProThrTyr  
 GluAsnLeuArgMetProAsnGluThrArgAsnTyrVal-228  
 247-AsnIleSerAspIleAspAsnLysProTyr-256  
 259-AlaValGluProAspArgProLeuAspAsnGluAlaIleAla-272  
 296-ProLysSerLysArgLysLeu-302  
 318-AsnAlaAlaProAspSer-323  
 332-ProAlaAlaLysThrSerLeuSerAspIleSerThr-343  
 350-AlaAspIleLysArgLeuAsnAsnLeuAsnGly-360  
 370-LeuValAlaLysAsnGlyLysThrLeuGlnThrAlaSer-382  
 388-IleAspIleAspAsnThrProAspThrTyrArgSerAsnMetProAla-403  
 411-AlaArgIleArgPro-415  
 428-LeuProGlnLysThrValArgThrGluProAspProLeuValArgIleAlaGlu-445  
 454-GlnProGlnThrGluLysGlnThrAlaMetProSerGluThrGln-468  
 477-ProGlnAsnAspMetGlnAlaAlaAspGluLeu-487  
 491-ValAlaArgAsnAsnLeuArgArgGlnAlaGluGluThrIle-504  
 509-GlyThrProAspThrValAlaGluHisLysIleSerAlaSerProGln-524  
 527-AlaAlaAlaAspGlyLysArgArgValArgLeuGluThrArgValAlaLysAlaAlaAspGlyGluAlaGlu  
 Ile-551  
 560-ArgValValGluGlyAspThr-566  
 583-ValAlaAsnAsnIleLysGlyAsnThrIleGlnLysGlyGlnValLeuArg-599  
 606-AlaGlnThrArgIleGluLysValSerTyrThrAlaArgLysGlyAspThrPheLys-624  
 634-IleAspAspIleArgArgLeuAsnProAsnLeu-644  
 647-IleAsnProGlyGlnArgValLysLeu-655

**Hydrophilic Regions - Hopp-Woods**

1-MetSerLysLeuLys-5  
 61-LeuArgGlnGlyPheArgMetGlyGluValAsnProGluLeuValArgArgHisGluSerLysPhe-82  
 92-ValIleAsnArgSerArgPro-98  
 105-AsnGluValLysLysArgAsnMetProAla-114  
 128-ThrLysAlaLysSerHisVal-134  
 150-TyrGlyLeuGluLys-154  
 156-ProValTyrAspGlyArgHisAspVal-164  
 202-AlaIleAsnArgAlaArgAlaGlnGlyLeu-211  
 213-ProThrTyrGluAsnLeuArgMetProAsnGluThrArgAsnTyrVal-228  
 249-SerAspIleAspAsn-253  
 260-ValGluProAspArgProLeuAspAsnGluAlaIleAla-272  
 296-ProLysSerLysArgLysLeu-302  
 334-AlaLysThrSerLeu-338  
 350-AlaAspIleLysArgLeuAsn-356  
 373-LysAsnGlyLysThrLeuGlnThrAlaSer-382  
 389-AspIleAspAsnThrProAspThrTyrArg-398  
 411-AlaArgIleArgPro-415  
 431-LysThrValArgThrGluProAspProLeuValArgIleAlaGlu-445  
 455-ProGlnThrGluLysGlnThrAlaMetProSerGluThrGln-468  
 479-AsnAspMetGlnAlaAlaAspGluLeu-487  
 494-AsnAsnLeuArgArgGlnAlaGluGluThrIle-504  
 512-AspThrValAlaGluHisLysIleSerAla-521  
 527-AlaAlaAlaAspGlyLysArgArgValArgLeuGluThrArgValAlaLysAlaAlaAspGlyGluAlaGlu  
 Ile-551  
 560-ArgValValGluGly-564  
 608-ThrArgIleGluLysValSerTyrThrAlaArgLysGlyAspThrPheLys-624  
 634-IleAspAspIleArgArgLeuAsn-641  
 649-ProGlyGlnArgValLysLeu-655  
 652-1

**AMPHI Regions - AMPHI**

-238-

6-AspIlePheAlaArg-10  
 52-ArgAspGlyAspLys-56  
 62-LysGlyValLeuLysAlaValGluHisValAsnAsnGlnIleAlaGlnAla-78  
 130-LeuTyrArgTyrLeuGlyGlyAlaGlyPro-139  
 149-ValIleAsnGlyGly-153  
 173-LysSerPheArgGluAlaLeuArgCys-181  
 184-GluIlePheHisAlaLeuLysLys-191  
 266-AlaGluPheAlaGluTyrLeuGluGlyLeuValAsn-277  
 323-AlaGluGlyIleGluLysGlyVal-330  
 338-ValAsnGlnIleGlyThrLeuSerGluThrLeuLysAlaValAspLeuAlaLys-355  
 377-AspLeuAlaValAla-381  
 391-SerLeuSerArgSerAspArgMetAlaLysTyrAsnGlnLeuLeuArgIleGluGlu-409  
 411-LeuAlaGluAlaAlaAspTyr-417

**Antigenic Index - Jameson-Wolf**

11-GluIleLeuAspSerArgGlyAsnProThrValGlu-22  
 36-AlaValProSerGlyAlaSerThrGlyGlnLysGluAlaLeuGluLeuArgAspGlyAspLysSerArgTyrSerGlyLysGlyValLeuLysAlaValGluHisValAsn-72  
 83-AspAlaAsnGluGlnSerTyr-89  
 97-LeuAspGlyThrGluAsnLysGlyAsnLeuGly-107  
 121-AlaAlaAlaGluAspSerGlyLeuPro-129  
 135-GlyGlyAlaGlyProMet-140  
 151-AsnGlyGlyGluHisAlaAsnAsnSer-159  
 173-LysSerPheArgGluAlaLeuArgCysGlyAla-183  
 190-LysLysLeuCysAspSerLysGlyPheProThrThrValGlyAspGluGlyGlyPhe-208  
 211-AsnLeuAsnSerHisLysGluAlaLeu-219  
 243-CysAlaSerSerGluPheTyrLysAspGlyLysTyrHisLeuGluAlaGluGlyArgSerTyrThrAsn-265  
 283-SerIleGluAspGlyMetAspGluAsnAspTrpGluGly-295  
 299-LeuThrGluLysLeuGlyGlyArgValGlnLeuValGlyAspAspLeu-314  
 318-AsnProLysIleLeuAlaGluGlyIleGluLysGlyVal-330  
 352-AspLeuAlaLysArgAsnArgTyrAla-360  
 363-MetSerHisArgSerGlyGluThrGluAspSerThrIle-375  
 388-LysThrGlySerLeuSerArgSerAspArgMetAlaLys-400  
 405-LeuArgIleGluGluGluLeuAlaGluAlaAlaAspTyrProSerLys-420

**Hydrophilic Regions - Hopp-Woods**

11-GluIleLeuAspSerArgGlyAsnProThrValGlu-22  
 43-ThrGlyGlnLysGluAlaLeuGluLeuArgAspGlyAspLysSerArgTyrSerGly-61  
 63-GlyValLeuLysAlaValGlu-69  
 97-LeuAspGlyThrGluAsnLysGlyAsnLeu-106  
 121-AlaAlaAlaGluAspSerGly-127  
 153-GlyGluHisAlaAsn-157  
 173-LysSerPheArgGluAlaLeuArgCysGlyAla-183  
 190-LysLysLeuCysAspSerLysGly-197  
 202-ValGlyAspGluGlyGlyPhe-208  
 213-AsnSerHisLysGluAlaLeu-219  
 247-GluPheTyrLysAspGlyLysTyrHisLeuGluAlaGluGlyArgSerTyrThr-264  
 283-SerIleGluAspGlyMetAspGluAsnAspTrpGluGly-295  
 299-LeuThrGluLysLeuGlyGly-305  
 321-IleLeuAlaGluGlyIleGluLysGlyVal-330  
 352-AspLeuAlaLysArgAsnArgTyr-359  
 364-SerHisArgSerGlyGluThrGluAspSerThrIle-375  
 391-SerLeuSerArgSerAspArgMetAlaLys-400  
 405-LeuArgIleGluGluGluLeuAlaGluAlaAlaAspTyrProSer-419

-239-

653

**AMPHI Regions - AMPHI**

6-MetArgMetProGluValThrLysGlyPheSerGlySer-18  
 60-ThrMetArgLysProArgLeuThr-67  
 75-AlaLeuIlePheThrCysPheAla-82  
 96-ThrAlaLeuAlaAlaIleThrCysIle-104  
 111-LeuGlyLysMetGluGluPheAsn-118

**Antigenic Index - Jameson-Wolf**

4-GluProMetArgMetProGluValThrLysGlyPheSerGlySer-18  
 45-GlyCysArgSerThrArgLysThr-52  
 56-ValArgProGluThrMetArgLysProArgLeuThrAsnSerSerAla-71  
 86-AsnSerGlyCysAsnAla-91  
 103-CysIleSerGlyProProCysArgLeuGlyLysMetGluGlu-116  
 125-SerArgHisLysIleThrProProArgGlyProArgArgVal-138  
 145-ThrLysSerGlnAsnGlyThrGly-152  
 154-GlyTyrSerProProAlaThrArgProAla-163

**Hydrophilic Regions - Hopp-Woods**

4-GluProMetArgMetProGluValThrLys-13  
 47-ArgSerThrArgLysThr-52  
 57-ArgProGluThrMetArgLysProArgLeuThrAsn-68  
 107-ProProCysArgLeuGlyLysMetGluGlu-116  
 126-ArgHisLysIleThrProProArgGlyProArg-136  
 158-ProAlaThrArgProAla-163

656

**AMPHI Regions - AMPHI**

14-MetAlaArgThrLeuGlyAlaProGlu-22  
 42-ArgArgProSerThr-46  
 92-LeuAlaSerLeuAsnLysSerCys-99  
 117-MetGlyArgThrIleThr-122

**Antigenic Index - Jameson-Wolf**

6-GlySerThrSerSer-10  
 19-GlyAlaProGluSerValProAlaGlyLysValAlaAla-31  
 40-SerPheArgArgProSerThrLeuGlu-48  
 74-ArgProThrSerLeuArgProLysSerIleAsn-84  
 94-SerLeuAsnLysSerCysSerLeuAlaArgSerSerAlaGlyValLeuProArgArgArgValProAla-116  
 122-ThrSerLeuArgSerArgArgThrArgIleSerGlyGluGluProThrMetTrpLysSerProLysSer-14  
 4

**Hydrophilic Regions - Hopp-Woods**

40-SerPheArgArgProSerThr-46  
 76-ThrSerLeuArgProLysSerIle-83  
 99-CysSerLeuAlaArgSerSer-105  
 109-LeuProArgArgArgValProAla-116  
 124-LeuArgSerArgArgThrArgIleSerGlyGluGluProThrMet-138  
 140-LysSerProLysSer-144

657

**AMPHI Regions - AMPHI**

9-ProAlaMetLeuGly-13  
 20-LeuGlyArgMetPheThr-25  
 62-AlaAlaLeuAspGluLeuAlaLysCysAlaAla-72  
 85-MetArgPheLeuAlaLys-90

-240-

132-AspIleThrGluAlaSer-137

139-GlnPheLeuProGlyIleLeuLysThr-147

161-LysThrLeuAspGluLeuLysAlaAla-169

178-CysValLeuGluLysMetValAspLeu-186

203-GlnThrPheAspProAlaGluAsnIle-211

232-GlnGlnAlaArgGlnMetAlaGlnArgLeuAlaAspGluLeuAspTyrValGlyValLeu-251

314-AsnIleLeuGlyAsp-318

**Antigenic Index - Jameson-Wolf**

16-GlyGlyGlyGlnLeuGly-21

37-ValLeuAspProAspProAspAlaProAla-46

62-AlaAlaLeuAspGluLeuAlaLys-69

75-ThrGluPheGluAsnValAsnAlaAspAla-84

91-HisThrAsnValSerProSerGlyAsp-99

106-AsnArgIleGlnGluLysAlaTrpIle-114

128-CysLysAlaGluAspIleThrGluAla-136

150-LeuGlyTyrAspGlyLysGlyGlnIleArgValLysThrLeuAspGluLeuLysAlaAlaPhe-170

182-LysMetValAspLeuArgSerGluIle-190

197-LeuAsnAsnAspAsnValGlnThrPheAspProAlaGluAsnIleHisGluAsnGly-215

230-ValGlnGlnGlnAlaArgGlnMetAla-238

240-ArgLeuAlaAspGluLeuAsp-246

269-IleAlaProArgProHisAsnSerGlyHisHis-279

288-GlnPheGlnGlnGln-292

300-ProProAlaAspThrLysLeuLeuSer-308

319-ValTrpGlnGluAspGlyGlyGluProAspTrp-329

333-GlnSerHisProAsnAla-338

344-GlyLysLysThrAlaHisLysGlyArgLysMetGly-355

361-ThrThrAspSerAspThrAlaPheGlnGluAlaLysLysLeuHis-375

**Hydrophilic Regions - Hopp-Woods**

37-ValLeuAspProAspProAspAlaProAla-46

62-AlaAlaLeuAspGluLeuAlaLys-69

75-ThrGluPheGluAsnValAsn-81

128-CysLysAlaGluAspIleThrGluAla-136

152-TyrAspGlyLysGlyGlnIleArgValLysThrLeuAspGluLeuLysAlaAlaPhe-170

182-LysMetValAspLeuArgSerGluIle-190

197-LeuAsnAsnAspAsn-201

206-AspProAlaGluAsnIleHis-212

230-ValGlnGlnGlnAlaArgGlnMetAla-238

240-ArgLeuAlaAspGluLeuAsp-246

269-IleAlaProArgProHisAsn-275

301-ProAlaAspThrLysLeu-306

320-TrpGlnGluAspGlyGlyGluProAsp-328

344-GlyLysLysThrAlaHisLysGlyArgLysMetGly-355

362-ThrAspSerAspThrAlaPheGlnGluAlaLysLysLeuHis-375

658

**AMPHI Regions - AMPHI**

28-ArgGlnTyrAlaAspIleIleGlnPheValArgGlnAlaLeuArgHisLeuProArgLeuLeuLeu-49

68-ValAspValPheGlyArgValGluSer-76

92-ThrAlaGlnIleHisHisPhePheGlnAsnAlaIleHisAla-105

139-GlnLysLeuArgAlaCysPheSerAspValPheSer-150

**Antigenic Index - Jameson-Wolf**

6-ValArgAlaArgGlyAspPheValAspAspGlnPheMetArgValThrAspAsnLysHisPhe-26

-241-

40-AlaLeuArgHisLeuPro-45  
 53-ThrGlnSerArgGlyAspAspGlyIleSerGlnAspAlaVal-66  
 72-GlyArgValGluSer-76  
 107-ValPheGlyLysArgGlyPheGlu-114  
 130-GlnArgSerArgPheGlnAspAlaGlyGlnLysLeuArgAlaCysPhe-145  
 155-LeuIleArgArgGlyLeuGlnSerArgPhe-164  
 177-AsnArgHisThrIleAlaAlaArgGlyAsnIle-187  
 193-LysAlaHisArgIleGly-198  
 202-PheLysPheSerGlyHisArgArgAla-210  
 219-LeuValValLysArgArgAlaGln-226  
 230-GlyLysPheCysCysArgArgValArgIleGlyValGluAsn-243  
 250-GlyPheGlyGlyAsnGlyLysHisSerAla-259

**Hydrophilic Regions - Hopp-Woods**

6-ValArgAlaArgGlyAspPheValAsp-14  
 16-GlnPheMetArgValThrAspAsnLysHisPhe-26  
 53-ThrGlnSerArgGlyAspAspGlyIleSer-62  
 72-GlyArgValGluSer-76  
 130-GlnArgSerArgPheGlnAspAlaGlyGlnLysLeuArgAlaCysPhe-145  
 155-LeuIleArgArgGlyLeuGln-161  
 193-LysAlaHisArgIleGly-198  
 205-SerGlyHisArgArgAla-210  
 220-ValValLysArgArgAlaGln-226  
 233-CysCysArgArgValArgIleGlyVal-241  
 253-GlyAsnGlyLysHisSerAla-259

**661-2****AMPHI Regions - AMPHI**

19-GlyIleThrAspLysProPheArgArgLeuCysArgAspPheGlyAlaGly-35  
 37-AlaValCysGluMetLeu-42  
 75-AspProGlnGlnMetAlaAspAlaAla-83  
 122-AlaAlaIleLeuGluAlaValValArg-130  
 152-ProValIleAlaLysIleAlaGlu-159  
 256-AlaAlaAlaIleLeuAsnHisIleArgAlaIleHisAlaPheTyrGly-271  
 297-ArgArgGluIleAsnArgLeuAspSer-305  
 310-TyrAspMetLeuAlaGlyTyrLeuGluArgLeuAlaGluLys-323

**Antigenic Index - Jameson-Wolf**

20-IleThrAspLysProPheArgArgLeuCysArgAspPheGlyAlaGly-35  
 42-LeuThrSerAspProThrLeuArgAsnThrArgLysThrLeuHisArgSerAspPheAlaAspGluGlyGly-65  
 72-AlaGlySerAspProGlnGlnMetAlaAspAlaAlaArg-84  
 97-AsnMetGlyCysProAlaLysLysValCys-106  
 143-GlyTrpHisAspAspHisGlnAsnLeu-151  
 157-IleAlaGluAspCysGly-162  
 169-HisGlyArgThrArgThrGlnMetTyrLysGlyGluAlaArgTyr-183  
 187-AlaGluThrLysCysArgLeu-193  
 200-AsnGlyAspIleThrSerProGlnLysAla-209  
 222-MetIleGlyArgGlyAlaGlnGlyArgProTrpPhe-233  
 236-AspLeuLysHisTyrAla-241  
 270-TyrGlyAspThrAlaGly-275  
 277-ArgIleAlaArgLysHis-282  
 288-AspGluMetProAspGlyGluGlnThrArgArgGluIleAsnArgLeuAspSerAla-306  
 319-ArgLeuAlaGluLysThrAspSerTrp-327  
 330-AlaTyrArgProAsnAla-335

-242-

**Hydrophilic Regions - Hopp-Woods**

20-IleThrAspLysProPheArgArgLeuCysArgAspPhe-32  
 46-ProThrLeuArgAsnThrArgLysThrLeuHisArgSerAspPheAlaAspGluGlyGly-65  
 73-GlySerAspProGlnGlnMetAlaAspAlaAlaArg-84  
 100-CysProAlaLysLysValCys-106  
 157-IleAlaGluAspCysGly-162  
 170-GlyArgThrArgThrGlnMetTyrLysGlyGluAlaArgTyr-183  
 187-AlaGluThrLysCysArgLeu-193  
 203-IleThrSerProGlnLysAla-209  
 236-AspLeuLysHisTyrAla-241  
 277-ArgIleAlaArgLys-281  
 289-GluMetProAspGlyGluGlnThrArgArgGluIleAsnArgLeuAspSerAla-306  
 319-ArgLeuAlaGluLysThrAspSer-326  
 663

**AMPHI Regions - AMPHI**

19-ProPheAlaLeuLeuHisLysIleAlaAspLeuThrGlyLeuLeuAlaTyr-35  
 47-IleAsnLeuAlaLysCysPheSerGluTrp-56  
 66-LysGlnHisPheLysHisMetAlaLysLeu-75  
 87-AlaGlyArgLeuLysSerLeuValArg-95  
 168-GluGlyLeuArgAlaLeuValLysGlnPheArgLys-179  
 209-ThrIleThrGlyLeuSerArgIleAlaAlaLeuAlaAsn-221  
 243-ProAlaTrpLysSer-247  
 258-GlnArgMetAsnArgPheIleGluAspArgValArgGluHis-271

**Antigenic Index - Jameson-Wolf**

38-ValLysProArgArgArgIleGlyGlu-46  
 56-TrpSerGluGluLysArgLysThrValLeu-65  
 87-AlaGlyArgLeuLysSer-92  
 94-ValArgTyrArgAsnLysHisTyrLeuAsp-103  
 105-AlaLeuAlaAlaGlyGluLys-111  
 139-TyrSerHisGlnLysAsnLysIleLeuAsp-148  
 150-GlnIleLeuLysGlyArgAsnArgTyr-158  
 166-ArgThrGluGlyLeuArgAlaLeu-173  
 175-LysGlnPheArgLysSerSerAla-182  
 188-ProAspGlnAspPheGlyArgAsnAspSerVal-198  
 229-ProValArgGluAlaAspAsnThr-236  
 243-ProAlaTrpLysSerPheProGlyGluAspAlaLysAlaAspAlaGlnArgMetAsnArgPheIleGluAsp  
 ArgValArgGluHisProGlu-273  
 280-LysArgPheLysThrArgProGluGlySerProAspPheTyr-293

**Hydrophilic Regions - Hopp-Woods**

39-LysProArgArgArgIleGlyGlu-46  
 56-TrpSerGluGluLysArgLysThrValLeu-65  
 88-GlyArgLeuLysSer-92  
 94-ValArgTyrArgAsn-98  
 105-AlaLeuAlaAlaGlyGluLys-111  
 142-GlnLysAsnLysIleLeuAsp-148  
 150-GlnIleLeuLysGlyArgAsnArgTyr-158  
 166-ArgThrGluGlyLeuArgAlaLeu-173  
 176-GlnPheArgLysSerSer-181  
 190-GlnAspPheGlyArgAsnAspSerVal-198  
 229-ProValArgGluAlaAspAsn-235  
 248-PheProGlyGluAspAlaLysAlaAspAlaGlnArgMetAsnArgPheIleGluAspArgValArgGluHis  
 ProGlu-273  
 280-LysArgPheLysThrArgProGluGlySerPro-290

-243-

664-2

**AMPHI Regions - AMPHI**

47-AlaAspValPheAspAlaAlaHisGlyAlaAlaGly-58  
 90-ProValValGluIle-94  
 158-PheHisArgValPheGlnArgPhe-165  
 201-AlaArgAspGlnSerLysGlnIleAlaArgPheGlyLysArg-214

**Antigenic Index - Jameson-Wolf**

27-GlyAlaHisArgMetGlyGlyArgAlaCysVal-37  
 73-PheLeuGlnArgLysLeuGluPro-80  
 108-IleGlyGlyGlyAlaAlaValGlyLysAspGluLeuGlyValLysAspValGln-125  
 137-AlaHisGlyAspAspHisGluAsn-144  
 165-PheHisGlyLysAlaAspLeuGly-172  
 177-GlyGlyValLysLeuAspPhe-183  
 199-GlnIleAlaArgAspGlnSerLysGlnIleAlaArgPheGlyLysArgValPhe-216

**Hydrophilic Regions - Hopp-Woods**

28-AlaHisArgMetGlyGly-33  
 74-LeuGlnArgLysLeuGluPro-80  
 113-AlaValGlyLysAspGluLeuGlyValLysAspValGln-125  
 137-AlaHisGlyAspAspHisGluAsn-144  
 165-PheHisGlyLysAlaAspLeuGly-172  
 177-GlyGlyValLysLeuAspPhe-183  
 199-GlnIleAlaArgAspGlnSerLysGlnIleAlaArgPheGlyLys-213

665-1

**Hydrophilic Regions - Hopp-Woods**

39-LysProArgArgArgIleGlyGlu-46  
 56-TrpSerGluGluLysArgLysThrValLeu-65  
 88-GlyArgLeuLysSer-92  
 94-ValArgTyrArgAsn-98  
 105-AlaLeuAlaAlaGlyGluLys-111  
 142-GlnLysAsnLysIleLeuAsp-148  
 150-GlnIleLeuLysGlyArgAsnArgTyr-158  
 166-ArgThrGluGlyLeuArgAlaLeu-173  
  
 176-GlnPheArgLysSerSer-181  
 190-GlnAspPheGlyArgAsnAspSerVal-198  
 229-ProValArgGluAlaAspAsn-235  
 248-PheProGlyGluAspAlaLysAlaAspAlaGlnArgMetAsnArgPheIleGluAspArgValArgGluHis  
 ProGlu-273  
 280-LysArgPheLysThrArgProGluGlySerPro-290

**Antigenic Index - Jameson-Wolf**

8-LeuLysAspTyrGlnThrProAlaTyr-16  
 26-AspIleAsnGluPro-30  
 32-ThrValValLysSerArgLeuThrValGluProGlnArgValGlyGlu-47  
 49-LeuValLeuAspGlySerAla-55  
 80-GlyValProSerGluArgPheThrVal-88  
 90-ValGluThrGluIleLeuProAlaGluAsnLysSerLeu-102  
 115-GlnCysGluProGluGlyPheArgLys-123  
 128-IleAspArgProAspValMetSer-135  
 142-ValAlaAspLysLysArgTyrPro-149  
 153-SerAsnGlyAsnLysIleAspGlyGlyGluPheSerAspGlyArgHisTrpValLysTrpGluAspProPhe  
 SerLysProSer-180  
 191-AlaValThrGluAspTyr-196

-244-

200-MetSerGlyArgAsnValLysIle-207  
 211-ThrThrGluAlaAspLysProLysVal-219  
 230-MetLysTrpAspGluThrArgPhe-237  
 255-AsnMetGlyAlaMetGluAsnLysGlyLeu-264  
 275-AspSerArgThrAlaThrAspThrAspPheGluGlyIleGlu-288  
 295-TyrPheHisAsnTrpThrGlyAsnArgValThrCysArgAspTrp-309  
 313-SerLeuLysGluGly-317  
 322-ArgAspGlnGluPheSerGlyAspArgAlaSerArgAlaValArgArgIleGluAsn-340  
 347-HisGlnPheProGluAspAlaGlyProThrAlaHisProValArgProAlaSerTyrGluGluMetAsn-369  
 376-ValTyrGluLysGlyAlaGluVal-383  
 394-GluGlyPheGlnLysGlyMet-400  
 404-PheGlnArgHisAspGlyGlnAlaValThrCysAspAspPheArgAlaAlaMet-421  
 437-SerGlnAlaGlyThrPro-442  
 444-LeuGluAlaGluGlyArgLeuLysAsnAsnIle-454  
 459-ValLysGlnThrValProProThrProAspMetThrAspLysGlnPro-474  
 483-LeuLeuAsnArgAsnGlyGluAlaVal-491  
 494-AspTyrGlnGlyLysArgAlaThrGlu-502  
 537-LeuAsnTyrProTyrSerAspAspAspLeu-546  
 552-HisAspSerAspAla-556  
 578-LeuSerAspGlyValGluLeuProLysHisGluLysLeu-590  
 594-ValGluLysValIleSerAspAspLeuLeu-603  
 614-ValProSerGluAlaGluLeuTrpAspGlyAlaGluAsnIleAspProLeuArg-631  
 633-HisGlnAlaArgGluAlaLeu-639  
 652-HisGluLeuAsnArgGlnAlaAlaLysGlnGluAsnGlnSerTyrGluTyrSerProGluAlaAlaGly-674  
 677-ThrLeuArgAsnValCys-682  
 689-AlaAspProAlaHis-693  
 696-ThrValAlaGluLysTyrGlyGlu-703  
 719-AsnGlyAsnGluSerAspThrArgAsnArgLeu-729  
 733-PheAlaAspLysPheSerAspAspAlaLeuVal-743  
 752-GlySerSerArgArgSerAspThrLeuGlnGlnVal-763  
  
 768-GlnHisProLysPheSerLeuGluAsnProAsnLysAlaArgSer-782  
 785-GlySerPheSerArgAsnValPro-792  
 795-HisAlaGluAspGlySerGlyTyrArgPheIleAla-806  
 808-LysValIleGluIleAspArgPheAsnProGlnVal-819  
 831-AsnLysLeuGluProHisArgLysAsnLeuVal-841  
 844-AlaLeuGlnArgIleArgAlaGlnGluGlyLeuSerLysAspValGlyGluIleVal-862

**Hydrophilic Regions - Hopp-Woods**

32-ThrValValLysSerArgLeuThrValGluProGlnArgValGlyGlu-47  
 82-ProSerGluArgPheThrVal-88  
 90-ValGluThrGluIleLeuProAlaGluAsnLysSer-101  
 116-CysGluProGluGlyPheArg-122  
 129-AspArgProAspValMetSer-135  
 142-ValAlaAspLysLysArgTyr-148  
 154-AsnGlyAsnLysIleAspGlyGlyGluPheSerAsp-165  
 170-ValLysTrpGluAspProPheSer-177  
 201-SerGlyArgAsnValLys-206  
 213-GluAlaAspLysProLysVal-219  
 230-MetLysTrpAspGluThrArgPhe-237  
 258-AlaMetGluAsnLysGly-263  
 275-AspSerArgThrAlaThrAspThrAspPheGluGlyIleGlu-288  
 313-SerLeuLysGluGly-317

-245-

322-ArgAspGlnGluPheSerGlyAspArgAlaSerArgAlaValArgArgIleGluAsn-340  
 348-GlnPheProGluAspAlaGlyPro-355  
 363-AlaSerTyrGluGluMetAsn-369  
 376-ValTyrGluLysGlyAlaGluVal-383  
 394-GluGlyPheGlnLysGlyMet-400  
 406-ArgHisAspGlyGln-410  
 413-ThrCysAspAspPheArgAlaAlaMet-421  
 444-LeuGluAlaGluGlyArgLeuLysAsnAsnIle-454  
 467-ProAspMetThrAspLysGlnPro-474  
 495-TyrGlnGlyLysArgAlaThrGlu-502  
 541-TyrSerAspAspAspLeu-546  
 552-HisAspSerAspAla-556  
 580-AspGlyValGluLeuProLysHisGluLysLeu-590  
 594-ValGluLysValIleSer-599  
 616-SerGluAlaGluLeu-620  
 622-AspGlyAlaGluAsnIleAspPro-629  
 633-HisGlnAlaArgGluAlaLeu-639  
 652-HisGluLeuAsnArgGlnAlaAlaLysGlnGluAsnGlnSer-665  
 689-AlaAspProAlaHis-693  
 696-ThrValAlaGluLysTyrGlyGlu-703  
 719-AsnGlyAsnGluSerAspThrArgAsnArgLeu-729  
 733-PheAlaAspLysPheSerAsp-739  
 753-SerSerArgArgSerAspThr-759  
 776-AsnProAsnLysAlaArgSer-782  
 795-HisAlaGluAspGlySerGly-801  
 808-LysValIleGluIleAspArgPheAsn-816  
 831-AsnLysLeuGluProHisArgLysAsnLeuVal-841  
 844-AlaLeuGlnArgIleArgAlaGlnGluGlyLeuSerLysAspValGlyGluIleVal-862  
 666-2

**AMPHI Regions - AMPHI**

89-GlyTyrAspIleLeuLysGlnGlyGlySer-98  
 162-LeuLysPheMetGluAla-167  
 177-ProAlaIleProLysLeuMetGluThrIleHisGln-188  
 193-LeuProTrpGlyLysLeuPheAspThrProIleArg-204  
 227-LeuAlaArgTyrProLys-232  
 249-LeuLeuLysAsnLeuGluPheAlaAspSerValGlnAlaLeu-262  
 265-GlnGlyAlaLysAlaLeuHisThr-272  
 274-LysTyrAlaGlnAsnIleValSerValVal-283  
 295-LeuGlnAspLeuSerAspTyrGln-302  
 313-TyrArgIleTyrGluValCysGlyMetGly-322  
 332-GlyGlnIleLeuGlyIleLeuAsnGluPheSer-342  
 353-LeuArgLeuLeuGlyAsp-358  
 411-AspPheIleHisGluTrp-416  
 424-LeuProSerThrSerHis-429  
 433-ValAspLysAlaGlyAsn-438  
 441-SerMetThrThrSerIleGluAsnAlaPheGlySer-452  
 511-ProGlyGlySerArgIleIleGlyTyrValAlaLys-522  
 537-AlaIleSerAlaProAsnLeuLeuAsnArgPheGly-548  
 562-GlnGlnAlaLeuAsnAsp-567  
 590-ArgLeuValGlyGly-594

**Antigenic Index - Jameson-Wolf**

5-AsnHisGlnSerAsnSerGlyGluGlyValLeu-15  
 40-AsnGlnGlyLysValAsnThr-46  
 54-AlaAspAlaHisThrProGluHisAlaThr-63

-246-

65-LeuThrGluGlnLysGln-70  
 92-IleLeuLysGlnGlyGlySerAlaAla-100  
 114-GluProGlnSerSerGlyLeuGlyGly-122  
 130-AspAsnThrAlaLysThr-135  
 137-ThrThrPheAspGlyArgGluThrAlaPro-146  
 154-PheLeuAspLysAspGlyGlnPro-161  
 169-ValGlyGlyArgSerValGly-175  
 197-LysLeuPheAspThrProIleArgLeuAlaLysGlnGlyPhe-210  
 212-ValSerProArgLeu-216  
 221-GluGlnAsnGlnGlnHis-226  
 228-AlaArgTyrProLysThrAlaAla-235  
 271-HisThrGlyLysTyr-275  
 284-GlnAsnAlaLysAspAsnProGlyGln-292  
 296-GlnAspLeuSerAspTyrGlnValValGluArgProProValCys-310  
 320-GlyMetGlyAlaProSerSerGlyGly-328  
 340-GluPheSerProAsnGlnValGlyTyrAspAlaGluGlyLeuArgLeuLeuGlyAspAlaSerArg-361  
 363-AlaPheAlaAspArgAspValTyrLeuGlyAspProAspPheVal-377  
 384-LeuIleSerLysAspTyrLeuLysHisArgSerGlnLeuLeuGluGlnSerAspLysAlaLeu-404  
 431-SerIleValAspLysAlaGly-437  
 445-SerIleGluAsnAlaPhe-450  
 472-ProIleLysGlnGlyLysGlnValAlaAsnArgValGluProGlyLysArgProArgSerSerMet-493  
 500-LysAlaGlyLysProTyrMet-506  
 510-SerProGlyGlySerArgIle-516  
 548-GlySerTyrGluLeuGluThrGlyThr-556  
 566-AsnAspLeuGlyTyrLysThrAspValArgGluLeuAsnSerGlyVal-581  
 587-GluProSerArgLeuValGlyGlyAlaAspProArgArgGluGlyArgValMetGlyAsp-606

**Hydrophilic Regions - Hopp-Woods**

8-SerAsnSerGlyGlu-12  
 40-AsnGlnGlyLysValAsnThr-46  
 55-AspAlaHisThrProGluHis-61  
 65-LeuThrGluGlnLysGln-70  
 96-GlyGlySerAlaAla-100  
 139-PheAspGlyArgGluThrAlaPro-146  
 154-PheLeuAspLysAspGlyGlnPro-161  
 203-IleArgLeuAlaLysGlnGlyPhe-210  
 284-GlnAsnAlaLysAspAsnProGly-291  
 302-GlnValValGluArgProPro-308  
 348-TyrAspAlaGluGlyLeuArgLeuLeuGlyAspAlaSerArg-361  
 363-AlaPheAlaAspArgAspValTyrLeuGly-372  
 388-AspTyrLeuLysHisArgSerGlnLeuLeuGluGlnSerAspLysAlaLeu-404  
 432-IleValAspLysAlaGly-437  
 472-ProIleLysGlnGlyLysGlnValAlaAsnArgValGluProGlyLysArgProArgSerSerMet-493  
 572-ThrAspValArgGluLeuAsnSer-579  
 595-AlaAspProArgArgGluGlyArgValMetGlyAsp-606  
 667-2

**AMPHI Regions - AMPHI**

6-GlyLeuCysGlyGlnValIlePro-13  
 48-IleIleAlaAspPheLeuGlnProAlaArg-57  
 59-GluCysLeuProAsnLeuAlaAla-66  
 74-LysThrAlaGlnPhe-78  
 115-IleAlaAlaValAlaGluIle-121  
 153-ThrAspGlnLeuArgArgMetPhePheAsnGlnPheGluLysPheSerAsnAspHis-171  
 202-LysMetMetLeuHisLys-207  
 234-ValGlnCysSerAspThr-239

**Antigenic Index - Jameson-Wolf**

27-ProAlaAlaAspGlnThrGluThrGln-35  
 56-AlaArgMetGluCysLeuPro-62  
 71-LeuAlaArgLysThrAlaGln-77  
 89-ArgLeuValLysArgGluGlnIle-96  
 152-ProThrAspGlnLeuArg-157  
 165-GluLysPheSerAsn-169  
 190-ProThrHisAlaAlaArgAsnArgHisAsnLeu-200  
 226-ValGlyGlnArgGlyArgGlnLeu-233  
 248-IleGluSerGlnAsnArgGlyHisAspSer-257

**Hydrophilic Regions - Hopp-Woods**

27-ProAlaAlaAspGlnThrGluThrGln-35  
 56-AlaArgMetGluCys-60  
 71-LeuAlaArgLysThrAlaGln-77  
 89-ArgLeuValLysArgGluGlnIle-96  
 165-GluLysPheSerAsn-169  
 192-HisAlaAlaArgOAsnArgHisAsnLeu-200  
 228-GlnArgGlyArgGln-232  
 250-SerGlnAsnArgGlyHisAsp-256  
 669-2

**AMPHI Regions - AMPHI**

24-PheLeuGlyIleLysArgPhePheArgGlnPro-34  
 60-LysLeuHisArgAlaPhe-65  
 95-GlnIlePheArgHisValGlnSer-102  
 119-ThrArgGlnAlaPhe-123

**Antigenic Index - Jameson-Wolf**

5-ArgLeuGlnAsnGlyArgThrGlyArgAsnProProPheValGlnLysArgLeuAsp-23  
 29-ArgPhePheArgGlnProLeuGluMetArgArgIleIleLysLysHisGlnProIleAsnAla-49  
 69-GlyArgLysArgProHisHisHisAspSerSerLeuArgArgGlnHisGlyIleGluGlyMetGlyPhe-91  
 99-HisValGlnSerSerAsnArgGlnAsnGlyArgGlnProVal-112  
 114-AlaProAsnArgGlnThrArgGlnAlaPhe-123  
 137-ProThrSerAsnGlyTyrCys-143  
 149-SerThrHisArgThrThrHisLysAlaProProTyr-160

**Hydrophilic Regions - Hopp-Woods**

7-GlnAsnGlyArgThrGlyArgAsn-14  
 18-ValGlnLysArgLeuAsp-23  
 34-ProLeuGluMetArgArgIleIleLysLysHisGlnPro-46  
 69-GlyArgLysArgProHisHisHisAspSerSerLeuArgArgGlnHisGly-85  
 101-GlnSerSerAsnArgGlnAsnGlyArg-109  
 116-AsnArgGlnThrArgGlnAlaPhe-123  
 151-HisArgThrThrHisLys-156  
 670-2

**AMPHI Regions - AMPHI**

10-ArgSerCysPheGly-14  
 16-ValLysAsnAlaSerGlyValSer-23  
 34-IleThrArgSerAla-38  
 77-ValGlySerSerAsnAsnIle-83

**Antigenic Index - Jameson-Wolf**

4-CysArgAsnCysLeuAlaArgSerCys-12  
 18-AsnAlaSerGlyValSerSerSerArgIleCysProLeuSer-31

-248-

33-LysIleThrArgSerAlaThrSerArgAlaAsnProIle-45  
 65-AsnThrSerProThrIleSerGlySerSerAlaGluValGlySerSerAsnAsnIleThrArgGlySerIleA  
 laLysProArgAlaIleAla-95  
 98-CysCysTrpProProGluSerTrpGluGlyLysAla-109  
 114-AlaSerProThrArgSerLysSerSer-122  
 128-AlaCysSerAlaPhe-132

**Hydrophilic Regions - Hopp-Woods**

33-LysIleThrArgSerAlaThrSerArgAlaAsn-43  
 73-SerSerAlaGluValGlySer-79  
 87-SerIleAlaLysProArgAlaIleAla-95  
 116-ProThrArgSerLysSer-121

671

**AMPHI Regions - AMPHI**

11-PheAsnAlaProAsn-15  
 72-LysGluAlaAlaLysSerLeu-78  
 96-ThrProArgIleAla-100  
 119-ArgLeuPheIleArgTyr-124

**Antigenic Index - Jameson-Wolf**

9-ThrProPheAsnAlaProAsnThrProProLysMetArgLeuAlaLysProLysProThrAlaGlu-30  
 45-GlnAlaMetThrAsnArgGluMetAsnAspArgAlaAsnAlaAsnArgArgGlyTrpAsnGluAlaLysAlaA  
 rgSerAlaLysGluAlaAlaLysSerLeuAlaLysLysLysGluThrThr-85  
 98-ArgIleAlaAspSerThrMet-104  
 110-AlaGluThrArgArgSerAlaMet-117  
 125-LeuThrGlyAspThr-129

**Hydrophilic Regions - Hopp-Woods**

16-ThrProProLysMetArgLeuAlaLysProLysProThrAla-29  
 47-MetThrAsnArgGluMetAsnAspArgAlaAsnAlaAsnArgArgGlyTrpAsnGluAlaLysAlaArgSerA  
 laLysGluAlaAlaLysSerLeuAlaLysLysLysGluThrThr-85  
 110-AlaGluThrArgArgSerAlaMet-117

672

**AMPHI Regions - AMPHI**

38-ArgAlaValAspIleAlaArgAlaLysLys-47  
 50-AlaAlaLeuProProPheValSerValVal-59  
 67-AlaGlnAsnIleArgArgIleLeuAlaGluValPro-78  
 91-AlaPheCysArgGlnPheHisArgProTyr-100  
 105-ArgValGlnThrAlaSerAspIle-112  
 115-AlaAlaThrArgPheProAsp-121  
 131-HisProSerGluTyrGlyGlyThr-138  
 163-ProGluAsnValGlyGluAlaValArgIleThrGlyAlaGluSer-177

**Antigenic Index - Jameson-Wolf**

1-MetArgLysIleArgThrLysIle-8  
 13-ThrProGluAspAlaAlaAla-19  
 35-GlySerSerArgAlaValAspIleAlaArgAlaLysLysIleThr-49  
 65-GluSerAlaGlnAsnIleArgArgIleLeuAla-75  
 84-PheHisGlyAspGluAspAlaPhe-92  
 110-SerAspIleArgAsnAlaAlaThrArgPheProAspAla-122  
 130-TyrHisProSerGluTyrGlyGlyThrGlyAsnArgPheAsp-143  
 148-AlaGluTyrSerGlyLysPro-154  
 160-GlyLeuThrProGluAsnValGlyGluAlaValArg-171  
 176-GluSerValAspValSerGlyGlyValGluAlaSerLysGlyLysLysAspAlaAlaLys-195  
 202-ThrAlaAsnArgLeuSerArg-208

## **DEMANDES OU BREVETS VOLUMINEUX**

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

**CECI EST LE TOME \_\_1\_\_ DE \_4\_**

NOTE: Pour les tomes additionels, veuillez contacter le Bureau Canadien des Brevets.

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## **JUMBO APPLICATIONS / PATENTS**

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

**THIS IS VOLUME \_\_1\_\_ OF \_4\_**

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

**CLAIMS:**

1. A vaccine comprising an antigenic polypeptide comprising the amino acid sequence of SEQ ID NO: 11076.
2. The vaccine according to claim 1, further comprising a pharmaceutically acceptable carrier.
3. The vaccine of according to 1 or 2, further comprising an adjuvant.
4. The vaccine according to claim 3, wherein the adjuvant is an aluminum salt; an oil-in-water emulsion; a saponin adjuvant; Complete Freund's Adjuvant (CFA) or Incomplete Freund's Adjuvant (IFA); a cytokine; or an immunostimulating agent.
5. The vaccine according to claim 4, wherein the aluminum salt is aluminum phosphate.
6. The vaccine according to claim 4, wherein the aluminum salt is aluminum hydroxide.
7. The vaccine according to claim 4, wherein the oil-in-water emulsion comprises squalene.
8. The vaccine according to any one of claims 1 to 7, wherein the vaccine comprises saline.
9. The vaccine according to any one of claims 1 to 8, wherein the vaccine comprises a pH buffering substance.
10. The vaccine according to any one of claims 1 to 9, wherein the vaccine comprises a lipoprotein with the antigenic polypeptide.

11. A use of an antigenic polypeptide comprising the amino acid sequence of SEQ ID NO: 11076 for preparation of a medicament for raising an immune response in a subject.
12. The use according to claim 11, wherein the medicament further comprises a pharmaceutically acceptable carrier.
13. The use according to 11 or 12, wherein the medicament further comprises an adjuvant.
14. The use according to claim 13, wherein the adjuvant is an aluminum salt; an oil-in-water emulsion; a saponin adjuvant; Complete Freund's Adjuvant (CFA) or Incomplete Freund's Adjuvant (IFA); a cytokine; or an immunostimulating agent.
15. The use according to claim 14, wherein the aluminum salt is aluminum phosphate.
16. The use according to claim 14, wherein the aluminum salt is aluminum hydroxide.
17. The use according to claim 14, wherein the oil-in-water emulsion comprises squalene.
18. The use according to any one of claims 11 to 17, wherein the medicament comprises saline.
19. The use according to any one of claims 11 to 18, wherein the medicament comprises a pH buffering substance.
20. The use according to any one of claims 11 to 19, wherein the medicament comprises a lipoprotein with the antigenic polypeptide.

21. The use according to any one of claims 11 to 20, wherein the medicament is formulated for parenteral, oral, pulmonary, suppository, transdermal, or transcutaneous administration.
22. The use according to claim 21, wherein the medicament is formulated for parenteral administration.
23. The use according to claim 22, wherein the medicament is prepared as an injectable.
24. The use according to any one of claims 11 to 23, wherein the medicament is for prophylactic use.
25. A use of an antigenic polypeptide comprising the amino acid sequence of SEQ ID NO: 11076 for raising immunity in a subject.
26. The use according to claim 25, wherein the antigenic polypeptide is formulated for parenteral, oral, pulmonary, suppository, transdermal, or transcutaneous administration.
27. The use according to claim 26, wherein the antigenic polypeptide is formulated for parenteral administration.
28. The use according to claim 26, wherein the antigenic polypeptide is formulated as an injectable
29. The use according to any one of claims 25 to 28, wherein the antigenic polypeptide is for prophylactic use.
30. A commercial package comprising:  
a composition comprising an antigenic polypeptide comprising the amino acid sequence of SEQ ID NO: 11076 together with a pharmaceutically acceptable carrier, and

instructions for raising an immune response in a subject.

31. The commercial package according to claim 30, wherein the composition further comprising an adjuvant.

32. The commercial package according to claim 31, wherein the adjuvant is an aluminum salt; an oil-in-water emulsion; a saponin adjuvant; Complete Freund's Adjuvant (CFA) or Incomplete Freund's Adjuvant (IFA); a cytokine; or an immunostimulating agent.

33. The commercial package according to claim 32, wherein the aluminum salt is aluminum phosphate.

34. The commercial package according to claim 32, wherein the aluminum salt is aluminum hydroxide.

35. The commercial package according to claim 32, wherein the oil-in-water emulsion comprises squalene.

36. The commercial package according to any one of claims 30 to 35, wherein the composition comprises saline.

37. The commercial package according to any one of claims 30 to 36, wherein the composition comprises a pH buffering substance.

38. The commercial package according to any one of claims 30 to 37, wherein the composition comprises a lipoprotein with the antigenic polypeptide.

39. The commercial package according to any one of claims 30 to 38, wherein the composition is formulated for parenteral, oral, pulmonary, suppository, transdermal, or transcutaneous administration.

40. The commercial package according to claim 39, wherein the composition is formulated for parenteral administration.

41. The commercial package according to claim 39, wherein the composition is formulated as an injectable.

42. The commercial package according to any one of claims 30 to 41, comprising a vial or a syringe.

43. The commercial package according to any one of claims 30 to 42, wherein the instructions are for raising a prophylactic immune response.