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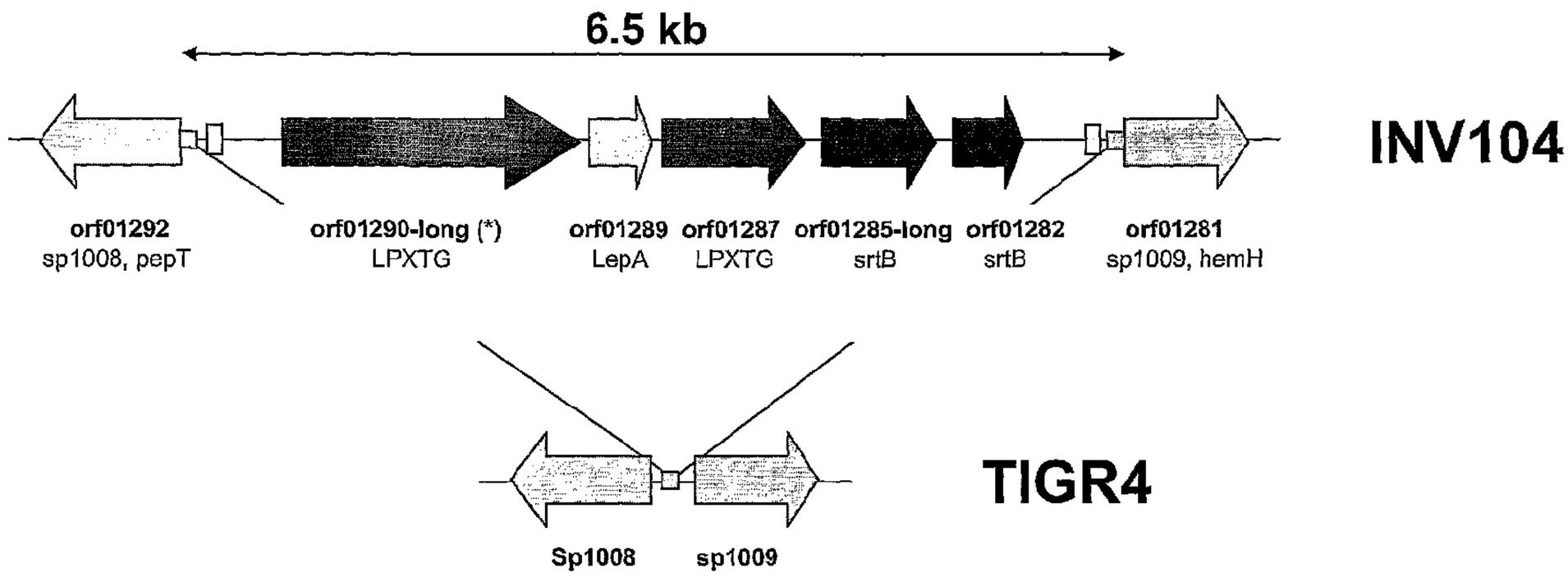
(54) Titre : ANTIGENES DE PILUS DE STREPTOCOCCUS PNEUMONIAE
(54) Title: STREPTOCOCCUS PNEUMONIAE PILUS ANTIGENS

Pilus II genomic region



- TCCT(T,C)TT
- DR: TTTACTATTTTTT

FIG 1

(57) Abrégé/Abstract:
Polypeptides from Streptococcus pneumoniae are described. In some aspects the polypeptides include pili polypeptides from a second pili island (pilus II island (INVI 04B)) identified in Streptococcus pneumoniae isolate INVI 04. In other aspects the polypeptides include pili polypeptides and non-pilus polypeptides from Streptococcus pneumoniae strains 23F, INV200, and OXC141 that are absent from Streptococcus pneumoniae isolate INV104. The polypeptides, including fragments and variants thereof, may be used in immunogenic compositions for prophylactic or therapeutic immunization against Streptococcus pneumoniae. The polypeptides are also disclosed to be used in compositions useful for the production of antibodies and immunostimulants. Also presented are methods of inhibiting Streptococcus pneumoniae, methods of treating Streptococcus pneumoniae infection, methods of identifying inhibitors of Streptococcus pneumoniae and methods for diagnosing/detecting Streptococcus pneumoniae infection.

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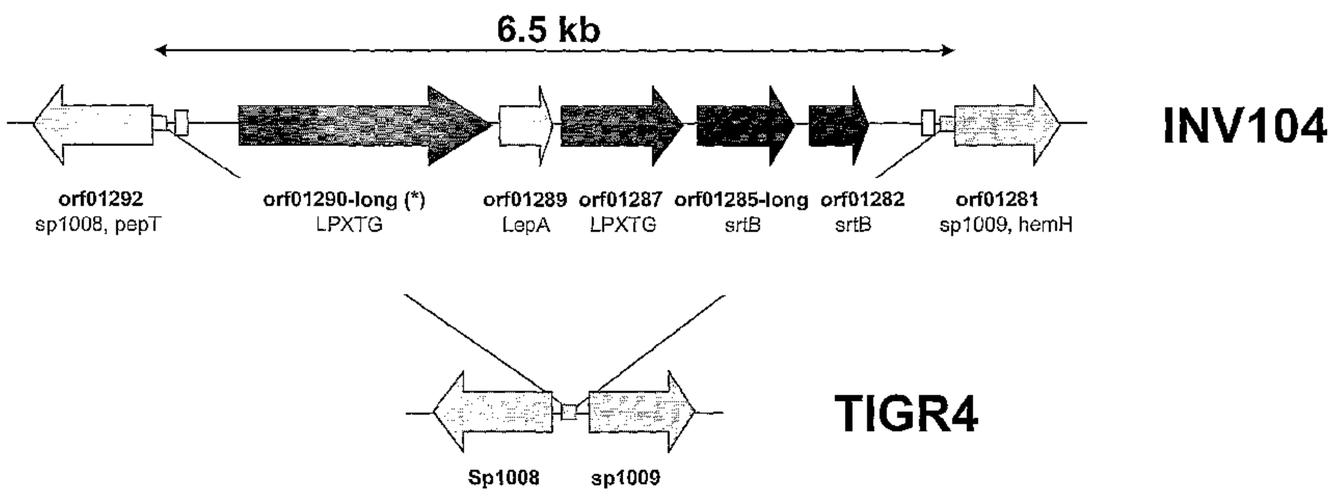

FIG 1

(57) Abstract: Polypeptides from Streptococcus pneumoniae are described. In some aspects the polypeptides include pili polypeptides from a second pili island (pilus II island (INVl 04B)) identified in Streptococcus pneumoniae isolate INVl 04. In other aspects the polypeptides include pili polypeptides and non-pilus polypeptides from Streptococcus pneumoniae strains 23F, INV200, and OXC141 that are absent from Streptococcus pneumoniae isolate INV104. The polypeptides, including fragments and variants thereof, may be used in immunogenic compositions for prophylactic or therapeutic immunization against Streptococcus pneumoniae. The polypeptides are also disclosed to be used in compositions useful for the production of antibodies and immunostimulants. Also presented are methods of inhibiting Streptococcus pneumoniae, methods of treating Streptococcus pneumoniae infection, methods of identifying inhibitors of Streptococcus pneumoniae and methods for diagnosing/detecting Streptococcus pneumoniae infection.

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STREPTOCOCCUS PNEUMONIAE PILUS ANTIGENS

FIELD

[0001] This invention relates to polypeptides, including pili proteins, from *Streptococcus pneumoniae* (*S. pneumoniae*), including fragments and variants thereof, and methods of their use in the treatment of and immunization against *S. pneumoniae* infections.

BACKGROUND

[0002] The Gram-positive bacterium *Streptococcus pneumoniae* (also known as Spn or pneumococcus) is a major cause of morbidity and mortality world-wide and represents one of the four major infectious disease killers, together with HIV, malaria, and tuberculosis (Bruyn, G. A. W. & van Furth, R. (1991) Eur. J. Clin. Microbiol. Infect. Dis. 10, 897–910; Ryan, M. W. & Antonelli, P. J. (2000) Laryngoscope 110, 961–964; Cutts, F. T., Zaman, S. M., Enwere, G., Jaffar, S., Levine, O. S., Okoko, C. Oluwalana, A., Vaughan, S., Obaro, A., Leach, A., et al. (2005) Lancet 365, 1139–1146; Swiatlo, E., Champlin, F. R., Holman, S. C., Wilson, W. W.&Watt, J. M. (2002) Infect. Immun. 70, 412–415; Sandgren, A., Albiger, B., Orihuela, C., Tuomanen, E., Normark, S. & Henriques-Normark, B. (2005) J. Infect. Dis. 192, 791–800). It is a main cause of respiratory tract infections such as otitis media, sinusitis, and community acquired pneumonia, but also an important pathogen in invasive diseases such as septicemia and meningitis. Even though pneumococcus is a devastating pathogen, it also harmlessly colonizes healthy children attending day-care centers to a high extent (Henriques Normark, B., Christensson, B., Sandgren, A., Noreen, B., Sylvan, S., Burman, L. G. & Olsson-Liljequist, B. (2003) Microb. Drug Resist. 9, 337–344; Nunes, S., Sá-Leão, R., Carriço, J., Alves, C. R., Mato, R., Avô, A. B., Saldanha, J., Almeida, J. S., Sanches, I. S. & de Lencastre, H. (2005) J. Clin. Microbiol. 43, 1285–1293). A major virulence factor in pneumococcal disease is the polysaccharide capsule, by which pneumococci are grouped into at least ninety different serotypes (Henrichsen, J. (1995) J. Clin. Microbiol. 33, 2759–2762). Other genetic factors, such as CbpA (choline-binding protein A) and pneumolysin, have been described to be of importance for virulence (Lau, G. W., Haataja, S., Lonetto, M., Kensit, S. E., Marra, A., Bryant, A. P., McDevitt, D., Morrison, D. A. & Holden, D. W. (2001) Mol. Microbiol. 40, 555–571; Rosenow, C., Ryan, P., Weiser, J. N., Johnson, S., Fontan, P., Ortqvist, A. & Masure, H. R. (1997) Mol. Microbiol. 25, 819–829; Tuomanen, E. (1999) Current Opin. Biol. 2, 35–39).

[0003] Infection by *S. pneumoniae* leads to invasive disease triggered by initial colonization of the nasopharynx, but the mechanisms of adhesion are not well understood. *In vitro* adhesion of encapsulated pneumococci is much lower than for nonencapsulated nonvirulent derivatives

(Swiatlo, E., Champlin, F. R., Holman, S. C., Wilson, W. W.&Watt, J. M. (2002) Infect. Immun. 70, 412–415), even though capsule expression is essential for successful colonization of the upper airways. These observations suggest that *in vivo*, pneumococci are adhesive despite the production of a thick capsule (Sandgren, A., Albiger, B., Orihuela, C., Tuomanen, E., Normark, S. & Henriques-Normark, B. (2005) J. Infect. Dis. 192, 791–800).

[0004] In other Gram-positive bacteria, such as *Corynebacterium diphtheriae* (Ton-That, H., Marraffini, L. A. & Schneewind, O. (2004) Mol. Microbiol. 53, 251–261; Ton-That, H. & Schneewind, O. (2003) Mol. Microbiol. 50, 1429–1438), *Actinomyces* spp. (Kelstrup, J., Theilade, J. & Fejerskov, O. (1979) Scand. J. Dent. Res. 87, 415–423), and recently group A streptococci (GAS) and group B streptococci (GBS) (Mora, M., Bensi, G., Capo, S., Falugi, F., Zingaretti, C., Manetti, A. G. O., Maggi, T., Taddei, A. R., Grandi, G. & Telford, J. L. (2005) Proc. Natl. Acad. Sci. USA 102, 15641–15646; Lauer, P., Rinaudo, C. D., Soriani, M., Margarit, I., Mainone, D., Rosini, R., Taddei, A. R., Mora, M., Rappuoli, R., Grandi, G. & Telford, J. L. (2005) Science 309, 105), pili-like surface structures have been identified by electron microscopy and characterized genetically as well as biochemically (Ton-That, H., Marraffini, L. A. & Schneewind, O. (2004) Mol. Microbiol. 53, 251–261; Ton-That, H. & Schneewind, O. (2003) Mol. Microbiol. 50, 1429–1438; Mora, M., Bensi, G., Capo, S., Falugi, F., Zingaretti, C., Manetti, A. G. O., Maggi, T., Taddei, A. R., Grandi, G. & Telford, J. L. (2005) Proc. Natl. Acad. Sci. USA 102, 15641–15646; Lauer, P., Rinaudo, C. D., Soriani, M., Margarit, I., Mainone, D., Rosini, R., Taddei, A. R., Mora, M., Rappuoli, R., Grandi, G. & Telford, J. L. (2005) Science 309, 105). In *Actinomyces* spp. type 1 fimbrial genes mediate adhesion to dental and mucosal surfaces (Li, T., Khah, M. K., Slavnic, S., Johansson, I. & Strömberg, N. (2001) Infect Immun. 69, 7224–7233). However, there is a need for functional data on the physiological role and function in infectious disease of pili and other antigens in pathogenic *Streptococcus* spp.

[0005] Gram-positive pili are extended polymers formed by a transpeptidase reaction involving covalent cross-linking of subunit proteins containing specific amino acid motifs, which are assembled by specific sortases. Sortases are also responsible for covalent attachment of the pilus to the peptidoglycan cell wall.

SUMMARY

[0006] The present disclosure describes polypeptides from *Streptococcus pneumoniae*. In some aspects the polypeptides described herein include pili peptides from *S. pneumoniae*. In other aspects, other polypeptides from *S. pneumoniae* are described. The *Streptococcus*

pneumoniae polypeptides described herein are useful in methods of treatment for and immunization against *S. pneumoniae* infections.

[0007] In some aspects, the disclosure features pili polypeptides from a second pili island identified in *Streptococcus pneumoniae* INV104B (pilus II island (INV104B)). In other aspects, the disclosure features pili polypeptides identified in *S. pneumoniae* 23F, INV200, and OXC141. The pili are thought to play a role in the pathogenesis of *S. pneumoniae*.

[0008] In some aspects, the disclosure features isolated pilus encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In some embodiments, the pilus includes a sortase. In some embodiments, the pilus includes an LPXTG cell wall anchored protein, *e.g.*, a polypeptide having the amino acid sequence of SEQ ID NO:2, 4 and/or 6, or a processed form thereof.

[0009] In some embodiments, the pili are separated from cells by enzymatic digestion (*e.g.*, with one or more enzymes such as peptidoglycan hydrolases (*e.g.*, mutanolysin, lysostaphin, and lysozyme)). In some embodiments, the pili are separated from cells by mechanical shearing (*e.g.*, by ultrasonication). In some embodiments, the pili are substantially free of bacterial cells. In some embodiments, the disclosure features methods of producing the pilus (*e.g., S. pneumoniae* pili), wherein the methods include subjecting a bacterial cell that produces the pilus to enzymatic digestion or mechanical shearing and isolating the pilus from the cell.

[0010] In other aspects, the disclosure features immunogenic compositions including more or more of the isolated pili (*e.g., S. pneumoniae* pili).

[0011] In other aspects, the disclosure features an isolated *Streptococcus pneumoniae* sortase, wherein the sortase is one of SEQ ID NO:282, SEQ ID NO:1386, SEQ ID NO:676, or SEQ ID NO:1123.

[0012] In other aspects, the disclosure features an isolated *Streptococcus pneumoniae* LPXTG cell wall anchored protein, wherein the LPXTG cell wall anchored protein is one of SEQ ID NO:2, SEQ ID NO:4, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, or SEQ ID NO:9.

[0013] In further aspects, the disclosure features methods of isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), wherein the methods include subjecting bacterial cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to enzymatic digestion (*e.g.*, mutanolysin) or mechanical shearing (*e.g.*, ultrasonication) and isolating the pili from the cells. In some embodiments, isolating includes a density gradient centrifugation. In some embodiments, isolating includes reduction of polydispersity, such as separating components by size, *e.g.*, using gel filtration chromatography.

[0014] In other aspects, the disclosure features antibodies that bind specifically to a pilus encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In some embodiments, the

antibody is a monoclonal antibody, a polyclonal antibody, a chimeric antibody, a human antibody, a humanized antibody, a single-chain antibody, or a Fab fragment.

[0015] In other aspects, the disclosure features an immunogenic composition comprising a purified *Streptococcus pneumoniae* pilus II island (INV104B) polypeptide in oligomeric form. In some embodiments, the polypeptide is a hyperoligomer. In other embodiments, the polypeptide is a fragment of a LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0016] In further aspects, the disclosure features methods of inducing an immune response against *Streptococcus pneumoniae*. In some embodiments, the methods comprise administering an effective amount of pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to a subject.

[0017] In other aspects, the disclosure features methods of detecting a *Streptococcus pneumoniae* infection in a subject. In some embodiments, the methods comprise assaying a sample from the subject for the presence of an antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0018] In other aspects, the disclosure features methods of detecting a *Streptococcus pneumoniae* infection in a subject. In some embodiments, the methods comprise contacting a sample with an antibody and detecting binding of the antibody to a component of the sample. In some embodiments, the antibody binds to a pili component. In other embodiments, the antibody binds to a pili complex.

[0019] In other aspects, the disclosure features methods of treating a subject having a *Streptococcus pneumoniae* infection. In some embodiments, the methods comprise administering to the subject an effective amount of an agent that binds specifically to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In some embodiments, the agent is an antibody. In some embodiments, the antibody blocks attachment of *Streptococcus pneumoniae* to cells. In some embodiments, the antibody specifically binds to one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0020] In other aspects, the disclosure features methods of determining the course of treatment for a subject having a *Streptococcus pneumoniae* infection. In some embodiments, the method comprises assaying a sample from the subject for the presence of an antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and administering to the subject an anti-inflammatory agent if the presence of the antibody is detected. In other embodiments, the method comprises assaying a sample from the subject for the presence of an

antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and administering to the subject an antibiotic agent if the presence of the antibody is not detected.

[0021] In other aspects, the disclosure features isolated pilus or pilus-like multimers that comprise an amino acid sequence of a pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) that has up to 30 amino acid substitutions, insertions, or deletions. In some embodiments, the amino acid sequence has up to 20 amino acid substitutions, insertions, or deletions. In other embodiments, the amino acid sequence has up to 10 amino acid substitutions, insertions, or deletions. In still other embodiments, amino acid sequence has up to 5 amino acid substitutions, insertions, or deletions.

[0022] In further aspects, the disclosure features polypeptides that have the amino acid sequence of one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In other aspects, the disclosure features immunogenic fragments of one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In other aspects, the disclosure features polynucleotides that encode polypeptides that have the amino acid sequence of one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0023] In other aspects, the disclosure features purified polypeptides with the amino acid sequence of SEQ ID NO:2, 4, 6, 7, 8, and 9. In other aspects, the disclosure features purified polypeptides having ten consecutive residues of SEQ ID NO:2, 4, 6, 7, 8, and 9. In still other aspects, the disclosure features purified polypeptides with amino acid sequences at least 85% identical to SEQ ID NO:2, 4, 6, 7, 8, and 9.

[0024] In additional aspects, the disclosure features purified polypeptides with at least 85% sequence identity to a sequence selected from the group consisting of SEQ ID NO:29 through SEQ ID NO:1742, or immunogenic fragments thereof. In other aspects, the disclosure features purified polypeptides with an amino acid sequence selected from the group consisting of SEQ ID NO:29 through SEQ ID NO:1742, or immunogenic fragments thereof.

[0025] In some embodiments, the disclosure features purified OCX141 polypeptides with at least 85% sequence identity to a sequence selected from the group SEQ ID NO: 53, SEQ ID NO: 65, SEQ ID NO: 70, SEQ ID NO: 99, SEQ ID NO: 104, SEQ ID NO: 117, SEQ ID NO: 135, SEQ ID NO: 177, SEQ ID NO: 178, SEQ ID NO: 198, SEQ ID NO: 235, SEQ ID NO: 236, SEQ ID NO: 237, SEQ ID NO: 242, SEQ ID NO: 247, SEQ ID NO: 248, SEQ ID NO: 250, SEQ ID NO: 251, SEQ ID NO: 252, SEQ ID NO: 253, SEQ ID NO: 433, SEQ ID NO: 439, SEQ ID NO: 444, SEQ ID NO: 538, SEQ ID NO: 539, SEQ ID NO: 540, SEQ ID NO: 541, SEQ ID NO: 542,

SEQ ID NO: 543, SEQ ID NO: 544, SEQ ID NO: 545, SEQ ID NO: 581, or SEQ ID NO: 593, and immunogenic fragments thereof.

[0026] In other embodiments, the disclosure features purified INV200 polypeptides with at least 85% sequence identity to a sequence selected from the group SEQ ID NO: 626, SEQ ID NO: 628, SEQ ID NO: 629, SEQ ID NO: 630, SEQ ID NO: 631, SEQ ID NO: 632, SEQ ID NO: 639, SEQ ID NO: 645, SEQ ID NO: 747, SEQ ID NO: 751, SEQ ID NO: 752, SEQ ID NO: 783, SEQ ID NO: 786, SEQ ID NO: 787, SEQ ID NO: 810, SEQ ID NO: 812, SEQ ID NO: 813, SEQ ID NO: 824, SEQ ID NO: 831, SEQ ID NO: 842, SEQ ID NO: 847, SEQ ID NO: 875, SEQ ID NO: 876, SEQ ID NO: 879, SEQ ID NO: 880, SEQ ID NO: 882, SEQ ID NO: 913, SEQ ID NO: 914, SEQ ID NO: 925, SEQ ID NO: 926, SEQ ID NO: 947, SEQ ID NO: 948, SEQ ID NO: 968, SEQ ID NO: 987, SEQ ID NO: 988, SEQ ID NO: 990, SEQ ID NO: 992, SEQ ID NO: 1003, SEQ ID NO: 1007, SEQ ID NO: 1008, SEQ ID NO: 1036, SEQ ID NO: 1082, SEQ ID NO: 1120, or SEQ ID NO: 1123, and immunogenic fragments thereof.

[0027] In further embodiments, the disclosure features purified 23F polypeptides with at least 85% sequence identity to a sequence selected from the group SEQ ID NO: 1297, SEQ ID NO: 1309, SEQ ID NO: 1311, SEQ ID NO: 1343, SEQ ID NO: 1362, SEQ ID NO: 1364, SEQ ID NO: 1434, SEQ ID NO: 1451, SEQ ID NO: 1455, SEQ ID NO: 1466, SEQ ID NO: 14678, SEQ ID NO: 1470, SEQ ID NO: 1474, SEQ ID NO: 1484, SEQ ID NO: 1485, SEQ ID NO: 1486, SEQ ID NO: 1487, or SEQ ID NO: 1491, and immunogenic fragments thereof.

[0028] In other aspects, the disclosure features immunogenic fragments of an LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0029] In further aspects, the disclosure features isolated nucleic acids with the polynucleotide sequence of SEQ ID NO:1, 3, and 5. In other aspects, the disclosure features isolated nucleic acids that hybridize under stringent conditions to a hybridization probe, wherein the probe has the polynucleotide sequence of SEQ ID NO:1, 3, and 5 or the complement of SEQ ID NO:1, 3, and 5. In still other aspects, the disclosure features an isolated nucleic acid having a sequence that encodes an amino acid sequence that is at least 85% identical to SEQ ID NO:2, 4, 6, 7, 8, and 9.

[0030] In other aspects, the disclosure features isolated nucleic acids having a sequence that encodes an amino acid sequence that is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 29 though SEQ ID NO:1742. In other aspects, the disclosure features isolated nucleic acids having a sequence that encodes an amino acid sequence that is selected from the group consisting of SEQ ID NO: 29 though SEQ ID NO:1742.

[0031] In other aspects, the disclosure features methods of inducing an immune response against *Streptococcus pneumoniae*. In some embodiments, the methods include administering an effective amount of an immunogenic fragment of a LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to a subject. In some embodiments, the subject is a human.

[0032] In other aspects, the disclosure features an antibody to a pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) in a cell. In some embodiments, the methods include expressing a nucleic acid encoding the antibody to the pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) in the cell. In some embodiments, the pilus protein is a LPXTG cell wall anchored protein.

[0033] In still other aspects, the disclosure features methods of purifying *Streptococcus pneumoniae* from a sample comprising *Streptococcus pneumoniae*. These methods include: providing an affinity matrix comprising an antibody bound to a solid support; contacting the sample with the affinity matrix to form an affinity matrix- *Streptococcus pneumoniae* complex; separating the affinity matrix-*Streptococcus pneumoniae* complex from the remainder of the sample; and releasing *Streptococcus pneumoniae* from the affinity matrix.

[0034] In further aspects, the disclosure features methods of delivering a cytotoxic agent or a diagnostic agent to *Streptococcus pneumoniae*. These methods include: providing the cytotoxic agent or the diagnostic agent conjugated to an antibody or fragment thereof; and exposing the *Streptococcus pneumoniae* to the antibody-agent or fragment-agent conjugate.

[0035] In other aspects, the disclosure features methods of identifying a binding modulator for pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). These methods include contacting an animal cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a bacterial cell having pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the bacterial cell to the animal cell is inhibited. In some embodiments, inhibition of the binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0036] In other aspects, the disclosure features methods of identifying binding modulators to the activities of pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). These methods include contacting an cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the pili to the cell is inhibited. In some embodiments, inhibition of binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0037] In further aspects, the disclosure features methods of identifying a binding modulator for pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). These methods include contacting an cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a pilus protein or cell binding fragment thereof encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the pilus protein or cell binding fragment thereof to the cell is inhibited. In some embodiments, inhibition of binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

[0038] In still other aspects, the disclosure features methods of isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). These methods include subjecting *Streptococcus pneumoniae* cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to ultrasonication or digestion with a lytic enzyme; separating non-cellular components by density gradient centrifugation; and isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B). In some embodiments, the lytic enzyme is mutanolysin. In other embodiments, the *Streptococcus pneumoniae* cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) are *Streptococcus pneumoniae* TIGR4 cells

[0039] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. In case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

[0040] The details of one or more embodiments of the invention are set forth in the accompanying figures and the description below. Other features, objects, and advantages of the invention will be apparent from the description and figures, and from the additional embodiments below.

BRIEF DESCRIPTION OF THE FIGURES

[0041] Fig 1. is a diagram showing the *S. pneumoniae* pilus II island (INV104B).

DESCRIPTION

[0042] The Applicants have identified new polypeptide sequences from *Streptococcus pneumoniae* (also known as pneumococcus), including new pili polypeptides and other

polypeptides useful as antigens. New pili polypeptide sequences were identified in the unfinished genome sequence for *S. pneumoniae* isolate INV104, as sequenced by The Institute for Genomic Research (*see worldwide web site* "tigr.org"). These pili polypeptide sequences are encoded by a pathogenicity island, referred to herein as the pilus II island (INV104B), which is present in some, but not all, clinical pneumococcal isolates. Pili are important for pneumococcal adherence to lung epithelial cells as well as for colonization. Additionally, the Sanger partial genomes for *S. pneumoniae* strains 23F, INV200, and OXC141 were analyzed (*see worldwide web site* "sanger.ac.uk/Projects/Microbes/") to identify genes encoding polypeptides absent from INV104, the results of which included additional pili polypeptides as well as a large number of other non-INV104 polypeptides. Accordingly, this disclosure features, inter alia, *S. pneumoniae* pili, pilus, and other polypeptide compositions and the use of the same in methods of treatment for, diagnosis of, and immunization against *S. pneumoniae* infections. As used herein the term *S. pneumoniae* Polypeptide(s) is meant to include *S. pneumoniae* pilus II island (INV104B) pili polypeptides, pili polypeptides from 23F, INV200, and OXC141, and other polypeptides from *S. pneumoniae*. Also as used herein the term *S. pneumoniae* Pilus Polypeptide(s) is meant to include *S. pneumoniae* pilus II island (INV104B) pili polypeptides and pili polypeptides from 23F, INV200, and OXC141.

S. pneumoniae Pili Of The Pilus II Island Of INV104B

[0043] Pneumococcal pili encoded by a 6.5kb insert between genes corresponding to sp1008 and sp1009 of *S. pneumoniae* isolate INV104B (ST227, serotype 1) of strain TIGR4 (as illustrated by Fig. 1) are described herein. This region of *S. pneumoniae* isolate INV104B is referred to herein as the "*S. pneumoniae* pilus II island (INV104B)." The *S. pneumoniae* pilus II island (INV104B) encodes three LPXTG cell wall anchored proteins (herein referred to as LPXTG-1, LPXTG-1A, and LPXTG-2), a LepA peptidase (orf01289; SEQ ID NO:673), and two predicted sortases (herein referred to as sort-1 (SEQ ID NO:676) and sort-2 (SEQ ID NO: 1123)). See Example 4 for these LepA and sortase sequences.

[0044] An exemplary nucleic acid sequence for LPXTG-1 (orf01290-long) is hereby provided:

ATGAACGTTCAATATGATTTTAAGAAGATTCAATATTTTACCAGTAGTTTAGTT
ATCTTTCTCGCTATTCTTTTTTTGTGTGCACCAATTAATTCTTTACGTGCAGAT
TCAATAACTGAACCTCAGACAACTCTGCACAAAACGATTACTCCGATATCAGGG
CAAAAAGACCAGTATGAGTTGTCACTGGATATCACATCTAAACTGGGAACGGAG
ACCCAGTCAGAACCCTTGGATGTAGTCTTGGTTGCCGATCTTTCAGGGAGTATG
GAAGAGCGAGATGTGTGGTCTTACTCTAGTAGACGATACATTAGTAGGATTGAA
GCACTAAAACATACACTGAAAGGTGTGAATGGTCGTCAGGGGCTCATTGATACA
ATTCTTTCTAATTCCCAAAACCGTCTGTCTATAGTTGGTTTTGCCGGAAAGATT
GATAATCAGTATAATGACCGTTATTATAATGAATATTATCTGAGTTATCAATAT
GGAACTTGGCCAAAT**TGA**GCTGGTTGGTATTCAAATATCTCTTCATATGATGAT

GCTAAAACTTTAGTATCTTGGAGCACGGATTCTAATAGCTCAAAAAATATTGTT
AGTTCGTTAACAATTGCTGACTCTAGTCGTTCTTATGGTATGGACGCGGGCATT
GGCACTGGGACAAATATAAATGCTGGGTTAACTGAAGCTCAAAGATTGTTGCAA
AGTGCAAGGGCTGGGGCAAAAAAAGTAGTTATTCTGCTGTCAGATGGCGAAGCT
AATATGTATTACGAGTCTAATAGTGGGAGAACAATATATAACTATTATTCTAAT
CCAAATGTGGGACGTATGATTGATACTCCATATTGGTTTACCTCTGGTTTAGAG
AGAGGAATGCTGAATATATCTAGTTTAATAGCTCCAAAAATAGATGGCTTTTAT
TCAATCAAATTCAGATATATAGGTTCAAACGATAGTATCACATCTCTTAAAGGA
TATATCAGTGGTTATAATTCTGGAATCCCCAACGAAATATTTTCTGCCAATAAT
GAAAATGACTTGCAACAAAAATTCAAAGAAATCACAGATAAAATTCTACCTCTA
GGCGTACACCATGTAACTATATCAGATGTCTTGTCCAAGTACGTGCAGCTGTTA
CCTGGTGATGCTTCACACCTTCGTGTCGTCAAAATCAAGGATGGTAACGAGCAA
GAACTGAATGACAATCAAGTTACGATTGAAACTAAGAAGAACGAACAGGGATTA
GTGGAAGTAACAGCCAAGTTTAATCCGAGTTACACTTTGGAGGATGACGCCAAG
TACGTTCTCAAGTTTACTGTCACCTCTAGCCAAGAGGCATTTGATGCGATTGCG
GGTGATAAGACACTTACTAGTGATGATGCCGAAGAAGCCGATGCTACTAAACTC
TACTCCAACAAGGGGGCAAAAGTTGCCTATTCCTATGGTATTGGGACCTCACGT
ACCAAAATAAAAGACTATTCTGAGAAGCCCACTTTCAAGCCGTCAGATCCATTG
ACGGTTCCTGTAGAGATTGAGTGGAAAGGTGTGGATGGAAAATCAAATCCATCA
GCAAATCGTCCACCTAGTGTCGAATTAAACTTAAACCAAAAGAAAGATGGAAGT
ATAAAGGATTCCTATCGAAAGGTCACTAGTCCAGTTCAAACGAATAGTTTTACT
GAAAATACTAGTTTTGCAAAGGTAGCTAAGGGATATGACTACGAACTGAAAGCA
CCAGACGCTCCGGGATACACAGTCGAAGTTCAAAAGACAGGTACGAAAGAGAAA
CCATCCTTCAAAGTTATTTACCGACAGCTTCCAAGTCTCACCGTAAAGAAAATC
CTAGAAGGTGAACAATCACCTAATAAATCTTTCACAATTAATGTTACCTTTTCA
GATAAGGATGGCAAGCCGATTAACGGCAAGTTTGGGAATACAACAGTGACTAAC
GGGAAAGCACAGATTTCTCTCAAAAATAGTCAGGAAACTGCCCTCAGTTATCTG
CCTCGTGATACCCACTATAAGGTGGAAGAAGTAGAGAACTCTAGAACGGGATAT
CATGTCACCTATGAAAAACAAGAGGGGACTTTGTCAGAGGATGTTCAAACAATC
GTCACCAACCACAGACTTCCGACACTTTCAGTCACAAAAAAAGTTACAGGTGCT
TTTGCTAATCTTCTGCAATCCTTTAAGATTACCATTAACGTAAAGGATGCGCAA
AATAAACCATTGAATGGATCGTATAGTGCAATAGTAAATAATCAAAAAACAACG
CTACAATTCACCAATGGTAAGGCGACAGTTGATCTAAAGAAAGATAAAACCATC
AAGATTCTCGACCTTCCTCTAAATGCTCGTTATAGTATCGAAGAAGAAGCAAGT
TCGTCTCGTGGGTATCAGGTGTCCTATGATAAAAAAGAAGGAACTCTTGATGCA
AATAAGTCTGCGACAGTCACGAATAATAAAAACAGCGTACCTGAAACGGGAATT
GACTTCTTGAGTAGCACTCTCGTGCTTGGAGTCGTTCTTCCTCTAGGAGGGATC
TTCTTTATCATCTTACTTGGTCACCTTGTGGTGAATAGGAGGAA (SEQ ID NO:1)

[0045] An exemplary amino acid sequence for LPXTG-1 is hereby provided:

MNVQYDFKKIQYFTSSLVIFLAILFLCAPINSLRADSITEPQTTLHKTITPISG
QKDQYELSLDITSKLGTETQSEPLDVVLVADLSGSMEERDVWSYSSRRYISRIE
ALKHTLKGVNGRQGLIDTILSNSQNRLSIVGFAGKIDNQYNDRYYNEYYLSYQY
GTWPN*AGWYSNISSYDDAKTLVSWSTDSNSSKNIVSSLTIADSSRSYGMDAGI
GTGTNINAGLTEAQRLLQSARAGAKKVVILLSDGEANMYYESNSGRTIYNYYSN
PNVGRMIDTPYWFTSGLERGMLNISSLIAPKIDGFYSIKFRYIGSNDSITSLKG
YISGYNSGIPNEIFSANNENDLQQKFKEITDKILPLGVHHVTISDVLSKYVQLL
PGDASHLRVVKIKDGNEQELNDNQVTIETKKNEQGLVEVTAKFNPSYTLEDDAK
YVLKFTVTSSQEAFDAIAGDKTLTSDDAEEADATKLYSNKGAKVAYSYGIGTSR
TKIKDYSEKPTFKPSDPLTVPVEIEWKGVDGKSNPSANRPPSVELNLNQKKDGS
IKDSYRKVTSPVQTNSFTENTSFAKVAKGYDYELKAPDAPGYTVEVQKTGTKEK
PSFKVIYRQLPSLTVKKILEGEQSPNKSFTINVTFSDKDGKPINGKFGNTTVTN

GKAQISLKNSQETALSYLPRDTHYKVEEVENSRTGYHVTYEKQEGTLSEDVQTI
VTNHRLPTLSVTKKVTGAFANLLQSFKITINVKDAQNKPLNGSYSAIVNNQKTT
LQFTNGKATVDLKKDKTIKILDLPLNARYSIEEEASSSRGYQVSYDKKEGTLDA
NKSATVTNNKNSVPETGIDFLSSTLVLGVVLPLGGIFFIILLGHLVVNRRK
(SEQ ID NOs:769 and 2)

[0046] LPXTG-1 contains a sortase substrate motif, VPXTG (SEQ ID NO:16), shown in underscore in SEQ ID NO:2, above.

[0047] The orf01290-long sequence (SEQ ID NO:1) has an intermediary stop codon that is bolded and underscored in SEQ ID NO:1. An exemplary nucleic acid sequence halted at this stop codon (orf01290-short) would have the following transcribed gene sequence (LPXTG-1A):

ATGGACGCGGGCATTGGCACTGGGACAAATATAAATGCTGGGTTAACTGAAGCT
CAAAGATTGTTGCAAAGTGCAAGGGCTGGGGCAAAAAAAGTAGTTATTCTGCTG
TCAGATGGCGAAGCTAATATGTATTACGAGTCTAATAGTGGGAGAACAATATAT
AACTATTATTCTAATCCAAATGTGGGACGTATGATTGATACTCCATATTGGTTT
ACCTCTGGTTTAGAGAGAGGAATGCTGAATATATCTAGTTTAATAGCTCCAAAA
ATAGATGGCTTTTATTCAATCAAATTCAGATATATAGGTTCAAACGATAGTATC
ACATCTCTTAAAGGATATATCAGTGGTTATAATTCTGGAATCCCCAACGAAATA
TTTTCTGCCAATAATGAAAATGACTTGCAACAAAAATTCAAAGAAATCACAGAT
AAAATTCTACCTCTAGGCGTACACCATGTAACTATATCAGATGTCTTGTCCAAG
TACGTGCAGCTGTTACCTGGTGATGCTTCACACCTTCGTGTCGTCAAAATCAAG
GATGGTAACGAGCAAGAACTGAATGACAATCAAGTTACGATTGAAACTAAGAAG
AACGAACAGGGATTAGTGGAAGTAACAGCCAAGTTTAATCCGAGTTACACTTTG
GAGGATGACGCCAAGTACGTTCTCAAGTTTACTGTCACCTCTAGCCAAGAGGCA
TTTGATGCGATTGCGGGTGATAAGACACTTACTAGTGATGATGCCGAAGAAGCC
GATGCTACTAAACTCTACTCCAACAAGGGGGCAAAAGTTGCCTATTCCTATGGT
ATTGGGACCTCACGTACCAAAATAAAAGACTATTCTGAGAAGCCCACTTTCAAG
CCGTCAGATCCATTGACGGTTCCTGTAGAGATTGAGTGGAAAGGTGTGGATGGA
AAATCAAATCCATCAGCAAATCGTCCACCTAGTGTCGAATTAAACTTAAACCAA
AAGAAAGATGGAAGTATAAAGGATTCCTATCGAAAGGTCACTAGTCCAGTTCAA
ACGAATAGTTTTACTGAAAATACTAGTTTTGCAAAGGTAGCTAAGGGATATGAC
TACGAACTGAAAGCACCAGACGCTCCGGGATACACAGTCGAAGTTCAAAAGACA
GGTACGAAAGAGAAACCATCCTTCAAAGTTATTTACCGACAGCTTCCAAGTCTC
ACCGTAAAGAAAATCCTAGAAGGTGAACAATCACCTAATAAATCTTTCACAATT
AATGTTACCTTTTCAGATAAGGATGGCAAGCCGATTAACGGCAAGTTTGGGAAT
ACAACAGTGACTAACGGGAAAGCACAGATTTCTCTCAAAAATAGTCAGGAAACT
GCCCTCAGTTATCTGCCTCGTGATACCCACTATAAGGTGGAAGAAGTAGAGAAC
TCTAGAACGGGATATCATGTCACCTATGAAAAACAAGAGGGGACTTTGTCAGAG
GATGTTCAAACAATCGTCACCAACCACAGACTTCCGACACTTTCAGTCACAAAA
AAAGTTACAGGTGCTTTTGCTAATCTTCTGCAATCCTTTAAGATTACCATTAAC
GTAAAGGATGCGCAAAATAAACCATTGAATGGATCGTATAGTGCAATAGTAAAT
AATCAAAAAACAACGCTACAATTCACCAATGGTAAGGCGACAGTTGATCTAAAG
AAAGATAAAACCATCAAGATTCTCGACCTTCCTCTAAATGCTCGTTATAGTATC
GAAGAAGAAGCAAGTTCGTCTCGTGGGTATCAGGTGTCCTATGATAAAAAAGAA
GGAACTCTTGATGCAAATAAGTCTGCGACAGTCACGAATAATAAAAACAGCGTA
CCTGAAACGGGAATTGACTTCTTGAGTAGCACTCTCGTGCTTGGAGTCGTTCTT
CCTCTAGGAGGGATCTTCTTTATCATCTTACTTGGTCACCTTGTGGTGAATAGG
AGGAA (SEQ ID NO:3)

[0048] An exemplary amino acid sequence for LPXTG-1A (from orf01290-short) is hereby provided:

MDAGIGTGTNINAGLTEAQRLLQSARAGAKKVVILLSDGEANMYYESNSGRTIY
NYYSNPNVGRMIDTPYWFTSGLERGMLNISSLIAPKIDGFYSIKFRYIGSNDSI
TSLKGYISGYNSGIPNEIFSANNENDLQQKFKEITDKILPLGVHHVTISDVLSK
YVQLLPGDASHLRVVKIKDGNEQELNDNQVTIETKKNEQGLVEVTAKFNPSYTL
EDDAKYVLKFTVTSSQEAFDAIAGDKTLTSDDAEEADATKLYSNKGAKVAYSYG
IGTSRTKIKDYSEKPTFKPSDPLTVPVEIEWKGVDGKSNPSANRPPSVELNLNQ
KKDGSIKDSYRKVTSPVQTNSFTENTSFAKVAKGYDYELKAPDAPGYTVEVQKT
GTKEKPSFKVIYRQLPSLTVKKILEGEQSPNKSFTINVTFSDKDGKPINGKFGN
TTVTNGKAQISLKNSQETALSYLPRDTHYKVEEVENSRTGYHVTYEKQEGTLSE
DVQTIVTNHRLPTLSVTKKVTGAFANLLQSFKITINVKDAQNKPLNGSYSAIVN
NQKTTLQFTNGKATVDLKKDKTIKILDLPLNARYSIEEEASSSRGYQVSYDKKE
GTLDANKSATVTNNKNSVPETGIDFLSSTLVLGVVLPLGGIFFIILLGHLVVNR
RK (SEQ ID NO:4)

[0049] LPXTG-1A contains a sortase substrate motif, VPXTG (SEQ ID NO:16), shown in underscore in SEQ ID NO:4, above.

[0050] An exemplary nucleic acid sequence for LPXTG-2 (orf01287) is hereby provided:

TTGATGATCATAATGAAAAAAGAAAATAAAAAAACAAAAGAAATAATCATGAAA
AAAACATTCTTTAAAAAGCTATTCACTGCAAGCATTGCAGCTATAACCGCTTTG
TCCGTATTCAGAGGTGTCCCGACTTTTGCGGATGATAATTCAGCAATAACCAAA
GCAAATGGTGAAAATAATGCTGTTGTGAAGATTAATAAAACGTTGAATATTGCA
GAGGGAATAACAACACCAACAGCGACATTTACATTTAAGTTTACAGAAAAAACA
GGACAATCTTCTAACGGTGCGCCATATCAAACCGGAGTTGCAATTCCAGATAGA
AATGTAGAATACAATAAAAATGATCACCCAACTGCTGATAAGATTCAAAAAGCA
ACAGAAGACATTTTTTCGGGAGTTGCTTATGGCCATGCTGGTGAATACGTTTAT
GATGTAGCGGAAGCAAAAACTGGATGGCAGGCGATTACCAAAAATGGTAAAACA
ATTGATGCCATGAGATACGACAAACGTACATATGAAATGCACGTTATTGTTAAG
AATAAAGTAAATGGTGGTGTCTATATTTCATCAGTATACTTTAAGGAAAATAAT
AAATCTAACGCCCCTAAAGTAGAACCAAGTGAACAAGGCGTTTATAATTTATTT
GATAACACATATACCAAAGACGCAAGTAAGGAGCCTAATCCTGATGATCCGAGT
CAAGTAGACCCCAATGCGAAAGCATTAACAATTACTAAAAAAGTTGATGGAGCT
TCAGGGGATAAAACAAGAGATTTCCAATTCCATATCAAGATTCAACTTCCAAGT
ACAAATAAAACAGCAGAAACCCCTGTTACGAATATTATAGTAAAACATGGATCT
AAGTCAGAGGTGTTGGCAGTAGTGACCCCAGCAGATACAGTTGAGTACAATTTT
ACTCTTAAAGATGGTGAAACATTTACAGTTGAACAACTACCAGCAGGTTCTAAA
TATACAGTAACTGAAACTGGAGTAGCAGGTTATACAGATTCATCAATTTATACT
ACAAATGGTGCAGAACAAACATCTCAAGGACAAAAAAATGTAGATTTTACATTA
ACAGATATCCTCATAGGTGAAAAGAAAAACGACAACAAAGTTACTAACAAAATC
GACGACGTTACTCCTACTGGTCTCTTGATTGATAACCTTCCATTCATTTTGATG
ATTGGTCTTGGTTTGGCTGGATTTGTTGTCTTGTCTAAAAAACGTAGAGAAGCC
TA(SEQ ID NO:5)

[0051] An exemplary amino acid sequence for LPXTG-2 is hereby provided:

MIIMKKENKKTKEIIMKKTFFKKLFTASIAAITALSVFRGVPTFADDNSAITKA
NGENNAVVKINKTLNIAEGITTPTATFTFKFTEKTGQSSNGAPYQTGVAIPDRN
VEYNKNDHPTADKIQKATEDIFSGVAYGHAGEYVYDVAEAKTGWQAITKNGKTI
DAMRYDKRTYEMHVIVKNKVNGGVYISSVYFKENNKSNAPKVEPSEQGVYNLFD
NTYTKDASKEPNPDDPSQVDPNAKALTITKKVDGASGDKTRDFQFHIKIQLPST
NKTAETPVTNIIVKHGSKSEVLAVVTPADTVEYNFTLKDGETFTVEQLPAGSKY
TVTETGVAGYTDSSIYTTNGAEQTSQGQKNVDFTLTDILIGEKKNDNKVTNKID
DVTPTGLLIDNLPFILMIGLGLAGFVVLSKKRREA (SEQ ID NO:6)

[0052] LPXTG-2 contains a sortase substrate motif, VTXTG (SEQ ID NO:21), shown in underscore in SEQ ID NO:6, above.

Polypeptide Sequences Identified In 23F, INV200, And OXC141 *S. pneumoniae* Strains

[0053] The Sanger partial genomes for *S. pneumoniae* strains 23F, INV200, and OXC141 do not contain the *S. pneumoniae* pilus II island (INV104B) region. However, 23F, INV200, and OXC141 encode sortases and LPXTG cell wall anchored proteins, which are disclosed herein. For example, 23F and OXC141 each encode at least one sortase (sort-23F (orf01917; SEQ ID NO:1386) and sort-OXC141 (orf01672; SEQ ID NO:282)) and INV200 encodes at least three cell wall anchored proteins (Anchor-1, Anchor-2, and Anchor-3) that are not encoded by *S. pneumoniae* strain INV104B.

[0054] An exemplary amino acid sequence for Anchor-1 (INV200-orf00426) is hereby provided:

MRVSSDTNIYEYRALSPQQKAALEMIRADLYKFTVPYENLEYRFYKPDWVFGLG
YQALATVRWKIEPATITVTKKWENVKEGAKKPDVWIQLLKDGKPEGERKRIESD
KGQTTFEIPNKDEINKYSVKEVDKEGRDWKHKDFTAGQPVNKGNGHFEITNTKK
EKPKIKVTFKKIAGDTNKDLAGAHLVLKKIFDDGNGLLIKQWDTIGQPVDIDLD
AGSYTLTEEKAPDGYMLAAPVSFYVEEDGQIILPKGEDLEAQNDKTITMVDEKI
KEKPTKPSGKLATTVEVDGTKADAQKELELSVATDKVTKTVKDTVVYENLLAGE
TYKLTGQLMKITADKEEEVATKETTFVADASGNGTTSLEFEDVSLEAGVKYVVY
ETAESEKEIDFKEGKEKHKVEHKDKDDKAQTVVVTKEKPTKPSGKLATTVEVDG
TKADAQKELELSVATDKVTKTVKDTVVYENLLAGETYKLTGQLMKITADKEEEV
ATKETTFVADASGNGTTSLEFEDVSLEAGVKYVVYETAESEKEIDFKEGKEKHK
VEHKDKDDKAQTVVVSKIKPEPGAQEVHFSKVNVGGEEIAGAEIHIKQGDTVVA
SWVSEAGKTHTLKLKPGHYIFHEAVAPGGYLAVTDIHFSVDETGQVTVTDVNGN
TAVAEGNKLTVTDQTKPVTPPSPEEPGAQEVHFSKVNVGGEEIAGAEIHIKQGD
TVVASWVSEAGKTHTLKLKPGHYIFHEAVAPGGYLAVTDIHFSVDETGQVTVTD
VNGNTAVAEGNKLTVTDQTKPVTPPSPEEPGAQEVHFSKVNVGGEEIAGAEIHI
KQGDTVVASWVSEAGKTHTLKLKPGHYIFHEAVAPGGYLAVTDIHFSVDETGQV
TVTDVNGNTAVAEGNKLTVTDQSADKDKQDKLPNTGETTGTYLSILGMITAVFA
SLLYRSKKK (SEQ ID NO:7)

[0055] Anchor-1 contains a sortase substrate motif, LPNTG (SEQ ID NO:10), shown in underscore in SEQ ID NO:7, above.

[0056] An exemplary amino acid sequence for Anchor-2 (INV200-orf00441) is hereby provided:

MNKGLFEKRCKYSIRKFSLGVASVMIGAAFFGTSPVLADSVQSGSTANLPADLA
TALATAKENDGRDFEAPKVGEDQGSPEVTDGPKTEEELLALEKEKPAEEKPKED
KPAAAKPETPKTVTPEWQTVEKKEQKGTVTIREEKGVRYNQLSSTAQNDNAGKP
ALFEKKGLTVVANGNATVDLTFKDDSEKGKSRFGVFLKFKDTNNNVFVGYDKDG
WFWEYKSPTTSTWYRGSRVAAPETGSTNRLSITLKSDGQLNASNNDVNLFDTVT
LPAAVNDHLKNEKKILLKAGSYGNDRTVVSVKTDNQEGVKADDTPAQKETGPVV
DDSKVTYDTIQSKVLKAVIDQAFPRVKEYSLNGHTLPGQVQQFNQVFINNHRIT
PEVTYKKINETTAEYLMKIRDDAHLINAEMTVRLQVVDNQLHFDVTKIVNHNQV
TPGQKIDDERKLLSSISFLGNALVSVSSDQTGAKFDGATMSNNTHVSGDDHIDV
TNPMKDLAKGYMYGFVSTDKLAAGVWSNSQNSYGGGSNDWTRLTAYKETVGNAN

YVGIHSSEWQWEKAYKGIVFPEYTKELPSAKVVITEDANADKKVDWQDGAIAYR
SIMNNPQGWEKVKDITAYRIAMNFGSQAQNPFLMTLDGIKKINLHTDGLGQGVL
LKGYGSEGHDSGHLNYADIGKRIGGVEDFKTLIEKAKKYGAHLGIHVNASETYP
ESKYFNEKILRKNPDGSYSYGWNWLDQGINIDAAYDLAHGRLARWEDLKKKLGD
GLDFIYVDVWGNGQSGDNGAWATHVLAKEINKQGWRFAIEWGHGGEYDSTFHHW
AADLTYGGYTNKGINSAITRFIRNHQKDAWVGDYRSYGGAANYPLLGGYSMKDF
EGWQGRSDYNGYVTNLFAHDVMTKYFQHFTVSKWENGTPVTMTDNGSTYKWTPE
MRVELVDADNNKVVVTRKSNDVNSPQYRERTVTLNGRVIQDGSAYLTPWNWDAN
GKKLSTDKEKMYYFNTQAGATTWTLPSDWAKSKVYLYKLTDQGKTEEQELTVKD
GKITLDLLANQPYVLYRSKQTNPEMSWSEGMHIYDQGFNSGTLKHWTISGDASK
AEIVKSQGANDMLRIQGNKEKVSLTQKLTGLKPNTKYAVYVGVDNRSNAKASIT
VNTGEKEVTTYTNKSLALNYVKAYAHNTRRDNATVDDTSYFQNMYAFFTTGADV
SNVTLTLSREAGDQATYFDEIRTFENNSSMYGDKHDTGKGTFKQDFENVAQGIF
PFVVGGVEGVEDNRTHLSEKHNPYTQRGWNGKKVDDVIEGNWSLKTNGLVSRRN
LVYQTIPQNFRFEAGKTYRVTFEYEAGSDNTYAFVVGKGEFQSGRRGTQASNLE
MHELPNTWTDSKKAKKATFLVTGAETGDTWVGIYSTGNASNTRGDSGGNANFRG
YNDFMMDNLQIEEITLTGKMLTENALKNYLPTVAMTNYTKESMDALKEAVFNLS
QADDDISVEEARAEIAKIEALKNALVQKKTALVADDFASLTAPAQAQEGLANAF
DGNVSSLWHTSWNGGDVGKPATMVLKEPTEITGLRYVPRGSGSNGNLRDVKLVV
TDESGKEHTFTATDWPDNNKPKDIDFGKTIKAKKIVLTGTKTYGDGGDKYQSAA
ELIFTRPQVAETPLDLSGYEAALAKAQKLTDKDNQEEVASVQASMKYATDNHLL
TERMVEYFADYLNQLKDSATKPDAPTVEKPEFKLSSLVSEQGKTPDYKQEIARP
ETPEQI<u>LPATG</u>ESQSDTSLFLASVSLALSALFVVKTKKD (SEQ ID NO:8)

[0057] Anchor-2 contains a sortase substrate motif, LPATG (SEQ ID NO:10), shown in underscore in SEQ ID NO:8, above.

[0058] An exemplary amino acid sequence for Anchor-3 (INV200-orf03448) is hereby provided:

MRVSSDTNIYEYRALSPQQKAALEMIRADLYKFTVPYENLEYRFYKPDWVFGLG
YQALATVRWKIEPATITVTKKWENVKEGAKKPDVWIQLLKDGKPEGERKRIESD
KGQTTFEIPNKDEINKYSVKEVDKEGRDWKHKDFTAGQPVNKGNGHFEITNTKK
EKPKIKVTFKKIAGDTNKDLAGAHLVLKKIFDDGNGLLIKQWDTIGQPVDIDLD
AGSYTLTEEKAPDGYMLAAPVSFYVEEDGQIILPKGEDLEAQNDKTITMVDEKI
KEKPTKPSGKLATTVEVDGTKADAQKELELSVATDKVTKTVKDTVVYENLLAGE
TYKLTGQLMKITADKEEEVATKETTFVADASGNGTTSLEFEDVSLEAGVKYVVY
ETAESEKEIDFKEGKEKHKVEHKDKDDKAQTVVVTKEKPTKPSGKLATTVEVDG
TKADAQKELELSVATDKVTKTVKDTVVYENLLAGETYKLTGQLMKITADKEEEV
ATKETTFVADASGNGTTSLEFEDVSLEAGVKYVVYETAESEKEIDFKEGKEKHK
VEHKDKDDKAQTVVVTKEKPTKPSGKLATTVEVDGTKADAQKELELSVATDKVT
KTVKDTVVYENLLAGETYKLTGQLMKITADKEEEVATKETTFVADASGNGTTSL
EFEDVSLEAGVKYVVYETAESEKEIDFKEGKEKHKVEHKDKDDKAQTVVVTKEK
PTKPSGKLATTVEVDGTKADAQKELELSVATDKVTKTVKDTVVYENLLAGETYK
LTGQLMKITADKEEEVATKETTFVADASGNGTTSLEFEDVSLEAGVKYVVYETA
ESEKEIDFKEGKEKHKVEHKDKDDKAQTVVVSKIKPEPGAQEVHFSKVNVGGEE
IAGAEIHIKQGDTVVASWVSEAGKTHTLKLKPGHYIFHEAVAPGGYLAVTDIHF
SVDETGQVTVTDVNGNTAVAEGNKLTVTDQTKPVTPPSPEEPGAQEVHFSKVNV
GGEEIAGAEIHIKQGDTVVASWVSEAGKTHTLKLKPGHYIFHEAVAPGGYLAVT
DIHFSVDETGQVTVTDVNGNTAVAEGNKLTVTDQTKPVTPPSPEEPGAQEVHFS
KVNVGGEEIAGAEIHIKQGDTVVASWVSEAGKTHTLKLKPGHYIFHEAVAPGGY
LAVTDIHFSVDETGQVTVTDVNGNTAVAEGNKLTVTDQTKPVTPPSPEEPGAQE
VHFSKVNVGGEEIAGAEIHIKQGDTVVASWVSEAGKTHTLKLKPGHYIFHEAVA

PGGYLAVTDIHFSVDETGQVTVTDVNGNTAVAEGNKLTVTDQSADKDKQDKLPN
TGETTGTYLSILGMITAVFASLLYRSKKK (SEQ ID NO:9)

[0059] Anchor-3 contains a sortase substrate motif, LPNTG (SEQ ID NO:10), shown in underscore in SEQ ID NO:9, above.

[0060] 23F, INV200, and OXC141 also encode additional polypeptide sequences that are not encoded by *S. pneumoniae* strain INV104B. These additional polypeptide sequences are disclosed herein in Example 2 as specific examples of sequences that can be used in the methods described herein and as antigens in immunogenic compositions for the production of antibodies and/or the stimulation of an immune response in a subject.

Other Bacterial Pili Polypeptides And Polypeptides From *S. pneumoniae*

[0061] The methods and compositions described herein can be used with pili polypeptides or other polypeptides from any Gram-positive bacterium including, for example, *S. pneumoniae*. Known and putative pili proteins have been identified in GAS (*e.g.*, *Streptococcus pyogenes*) (Mora et al., 2005, Proc. Natl. Acad. Sci. USA, 102:15641-6), GBS (*e.g.*, *Streptococcus agalactiae*) (Lauer et al., 2005, Science, 309:105; WO 2006/078318), *Actinomycetes naeslundii* (Yeung et al., 1998, Infect. Immun., 66:1482-91), *Corynebacterium diphtheriae* (Ton-That et al., 2003, Mol. Microbiol., 50:1429-38; Ton-That and Schneewind, 2004, Trends. Microbiol., 12:228–34), *Clostridium perfringens*, and *Enterococcus faecalis*. Examples of Gram-positive bacteria include, without limitation, firmicutes such as those of genera *Streptococcus* (*e.g.*, *S. pneumoniae, S. agalactiae, S. pyogenes, S. suis, S. zooepidemicus, S. viridans, S. mutans, S. gordonii, S. equi*), *Bacillus* (*e.g.*, *B. anthracis, B. cereus, B. subtilis), Listeria (e.g., L. innocua, L. monocytogenes*), *Staphylococcus* (*e.g.*, *S. aureus, S. epidermidis, S. caprae, S. saprophyticus, S. lugdunensis, S. schleiferi*), *Enterococcus* (*e.g.*, *E. faecalis, E. faecium*), *Lactobacillus*, *Lactococcus* (*e.g.*, *L. lactis*), *Leuconostoc* (*e.g.*, *L. mesenteroides*), *Pectinatus*, *Pediococcus*, *Acetobacterium*, *Clostridium* (*e.g.*, *C. botulinum*, *C. difficile*, *C. perfringens*, *C. tetani*), *Ruminococcus* (*e.g.*, *R. albus*), *Heliobacterium*, *Heliospirillum*, and *Sporomusa*; and actinobacteria such as those of genera *Actinomycetes* (*e.g.*, *A. naeslundii*), *Corynebacterium* (*e.g.*, *C. diphtheriae*, *C. efficiens*), *Arthrobacter*, *Bifidobacterium* (*e.g.*, *B. longum*), *Frankia*, *Micrococcus*, *Micromonospora*, *Mycobacterium* (*e.g.*, *M. tuberculosis*, *M. leprae*, *M. bovis*, *M. africanum*, *M. microti*), *Nocardia* (*e.g.*, *N. asteroides*), *Propionibacteriun*, and *Streptomyces* (*e.g.*, *S. somaliensis*, *S. avermitilis*, *S. coelicolor*).

Isolated Pili Polypeptides And Other Polypeptides From *S. pneumoniae*

[0062] Isolated *S. pneumoniae* Polypeptides, can be used in the methods described herein and as antigens in immunogenic compositions for the production of antibodies and/or the stimulation of an immune response in a subject. Examples of useful *S. pneumoniae* LPXTG cell wall anchor pili polypeptides include LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2,

and Anchor-3 (*i.e.*, SEQ ID NOs:2, 4, 6, 7, 8, and 9). Examples of useful *S. pneumoniae* sortase polypeptides include sort-1, sort-2, sort-23F, and sort-OXC141 (*i.e.*, SEQ ID NOs:676, 1123, 1386, and 282). Variants of *S. pneumoniae* Polypeptides can also be used in the methods described herein and as antigens in immunogenic compositions for the production of antibodies and/or the stimulation of an immune response in a subject. For example, *S. pneumoniae* Polypeptides containing at least 80% sequence identity, *e.g.*, at least 85%, at least 90%, at least 95%, at least 98%, or at least 99%, with a *S. pneumoniae* Polypeptide sequence are also useful in the new methods. Furthermore, a *S. pneumoniae* Polypeptide sequence with up to 50, *e.g.*, 1, 3, 5, 10, 15, 20, 25, 30, or 40 amino acid insertions, deletions, or substitutions, *e.g.*, conservative amino acid substitutions will be useful in the compositions and methods described herein.

[0063] The determination of percent identity between two amino acid sequences can be accomplished using the BLAST 2.0 program, which is available to the public at ncbi.nlm.nih.gov/BLAST. Sequence comparison is performed using an ungapped alignment and using the default parameters (BLOSUM 62 matrix, gap existence cost of 11, per residue gap cost of 1, and a lambda ratio of 0.85). The mathematical algorithm used in BLAST programs is described in Altschul et al., 1997, Nucleic Acids Research, 25:3389-3402.

[0064] As used herein, "conservative amino acid substitution" means a substitution of an amino acid in a polypeptide within an amino acid family. Families of amino acids are recognized in the art and are based on physical and chemical properties of the amino acid side chains. Families include the following: amino acids with basic side chains (*e.g.* lysine, arginine, and histidine); amino acids with acidic side chains (*e.g.*, aspartic acid and glutamic acid); amino acids with uncharged polar side chains (*e.g.* glycine, asparagine, glutamine, serine, threonine, tyrosine, and cysteine); amino acids with nonpolar side chains (*e.g.* alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, and tryptophan); amino acids with branched side chains (*e.g.*, threonine, valine, and isoleucine); and amino acids with aromatic side chains (*e.g.*, tyrosine, phenylalanine, tryptophan, and histidine). An amino acid can belong to more than one family.

[0065] Fragments of *S. pneumoniae* Polypeptides, *e.g.*, immunogenic fragments, are also useful in the methods and compositions described herein. Typically, the fragments are at least 8, 10, 15, 20, 50, 100, 200, or 500 contiguous amino acid residues of a *S. pneumoniae* Polypeptide. Examples of *S. pneumoniae* LPXTG polypeptides with useful fragments include LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2, or Anchor-3 (*e.g.*, SEQ ID NO:2, 4, 6, 7, 8, or 9). Non-limiting examples of *S. pneumoniae* sortase polypeptides with useful fragments include sort-1, sort-2, sort-23F, and sort-OXC141 (*i.e.*, SEQ ID NOs:676, 1123, 1386, and 282). In

some embodiments the fragments retain at least one biological activity of the full-length protein, such as covalent attachment to a peptidoglycan cell wall or the ability to cross-link to another fragment or protein through an LPXTG motif.

[0066] In some embodiments the immunogenic compositions described herein comprise one or more *S. pneumoniae* Pilus Polypeptides that may be formulated or purified in an oligomeric (pilus) form. In some embodiments, the oligomeric form is a hyperoligomer. In some embodiments the immunogenic compositions described herein comprise one or more *S. pneumoniae* Pilus Polypeptides that have been isolated in an oligomeric (pilus) form. The oligomer or hyperoligomer pilus structures comprising *S. pneumoniae* Pilus Polypeptides may be purified or otherwise formulated for use in immunogenic compositions.

[0067] One or more of the *S. pneumoniae* Polypeptides from *S. pneumoniae* open reading frame polynucleotide sequences may be replaced by a polynucleotide sequence coding for a fragment of the replaced ORF. In some embodiments, one or more of the *S. pneumoniae* Polypeptides from *S. pneumoniae* open reading frames may be replaced by a sequence having sequence homology to the replaced ORF.

[0068] One or more of the *S. pneumoniae* Pilus Polypeptide sequences typically include an LPXTG motif (such as LPXTG (SEQ ID NO:10)) or other sortase substrate motif. The LPXTG sortase substrate motif of a *S. pneumoniae* pilus protein may be generally represented by the formula $X_1X_2X_3X_4G$ (SEQ ID NO:1746), wherein X_1 is an L, a V, an E, a Y, an I, or a Q; wherein X_2 is a P if X_1 is an L; wherein X_2 is a V if X_1 is a E or a Q; wherein X_2 is a V or a P if X_1 is a V; wherein X_3 is any amino acid residue; wherein X_4 is a T if X_1 is a V, E, or Q; and wherein X_4 is a T, S, or A if X_1 is an L. Non-limiting examples of LPXTG motifs include YPXTG (SEQ ID NO:11), IPXTG (SEQ ID NO:12), LPXSG (SEQ ID NO:13), VVXTG (SEQ ID NO:14), EVXTG (SEQ ID NO:15), VPXTG (SEQ ID NO:16), QVXTG (SEQ ID NO:17), LPXAG (SEQ ID NO:18), QVPTG (SEQ ID NO:19), FPXTG (SEQ ID NO:20) and VTXTG (SEQ ID NO:21).

[0069] The *S. pneumoniae* Pilus Polypeptides described herein can effect the ability of the *S. pneumoniae* bacteria to adhere to and invade epithelial cells. These pilus polypeptides may also affect the ability of *S. pneumoniae* to translocate through an epithelial cell layer. In some embodiments, one or more *S. pneumoniae* Pilus Polypeptides from *S. pneumoniae* are capable of binding to or otherwise associating with an epithelial cell surface or synthetic model thereof. In some embodiments one or more *S. pneumoniae* Pilus Polypeptides bind to or associate with one or more of fibrinogen, fibronectin, or collagen.

[0070] The *S. pneumoniae* sortase proteins are predicted to be involved in the secretion and anchoring of the LPXTG containing surface proteins. The *S. pneumoniae* pilus II island (INV104B) sortase proteins disclosed herein are encoded by genes (sort-1 and sort-2) found in the same 6.5kb insert between genes corresponding to sp1008 and sp1009 of TIGR4 as the LPXTG-1 and LPXTG-2 genes discussed above. 23F and OXC141 also encode sortases: sort-23F (SEQ ID NO:1386) and sort-OXC141 (SEQ ID NO:282). Sortase proteins and variants of sortase proteins useful in the methods described herein can be obtained from Gram-positive bacteria.

[0071] The *S. pneumoniae* Pilus Polypeptides can be covalently attached to the bacterial cell wall by membrane-associated transpeptidases, such as a sortase. The sortase may function to cleave the surface protein, preferably between the threonine and glycine residues of an LPXTG motif. The sortase may then assist in the formation of an amide link between the threonine carboxyl group and a cell wall precursor such as lipid II. The precursor can then be incorporated into the peptidoglycan via the transglycoslylation and transpeptidation reactions of bacterial wall synthesis. *See* Comfort et al., Infection & Immunity (2004) 72(5): 2710 – 2722.

[0072] In some embodiments, the compositions described herein comprise oligomeric, pilus-like structures comprising *S. pneumoniae* Pilus Polypeptides such as LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2, or Anchor-3 (*e.g.*, SEQ ID NO:2, 4, 6, 7, 8, or 9). The oligomeric, pilus-like structure may comprise numerous units of pilus poplypeptides. In some embodiments, the oligomeric, pilus-like structures comprise two or more pilus proteins. In some embodiments, the oligomeric, pilus-like structure comprises a hyper-oligomeric pilus-like structure comprising at least two (*e.g.*, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 120, 140, 150, 200 or more) oligomeric subunits, wherein each subunit comprises a pilus protein or a fragment thereof. The oligomeric subunits may be covalently associated via a conserved lysine within a pilin motif. The oligomeric subunits may be covalently associated via an LPXTG motif, in some embodiments, via a threonine or serine amino acid residue.

[0073] *S. pneumoniae* Pilus Polypeptides or fragments thereof can be incorporated into the oligomeric, pilus-like structures described herein and will, in some embodiments, include a pilin motif. Oligomeric, pilus-like structures may be used alone or in combination. In some embodiments, the compositions described herein comprise a *S. pneumoniae* pilus II island (INV104B) pilus in oligomeric form. Further, in some embodiments the *S. pneumoniae* pilus II island (INV104B) pilus can be organized in a hyperoligomeric form.

Methods of Purification of Pili

[0074] Pili encoded by *Streptococcus pneumoniae* can be purified from cells, such as bacterial cells, that express *Streptococcus pneumoniae* pili or pili-like structures by separating the pili from the cells, *e.g.*, by mechanical shearing or enzymatic digestion, and isolating the separated pili.

[0075] Suitable bacterial cells for purification of pili include piliated Gram-positive bacterial strains that express *Streptococcus pneumoniae* Pili Polypeptides, non-piliated Gram-positive bacteria that have been transformed with one or more Gram-positive pilus proteins, such as *S. pneumoniae* LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2, and Anchor-3 (*e.g.*, SEQ ID NOs:2, 4, 6, 7, 8, and 9), and Gram-negative or other cells transformed with one or more Gram-positive pilus proteins, such as *S. pneumoniae* LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2, and Anchor-3 (*e.g.*, SEQ ID NOs:2, 4, 6, 7, 8, and 9). Typically, a cell used for purification of pili will produce only the type or types of pili desired, *e.g.*, endogenous or heterologous pili. For the production of heterologous pili, the cell can be altered, *e.g.*, by mutation or recombinant DNA methods, to not produce endogenous pili. Typically, a pili-producing Gram-positive bacterial cell useful for purification will express one or more compatible sortases such that the pili are expressed on the cell surface. Examples of *S. pneumoniae* pilus II island (INV104B), 23F, INV200, and OXC141 LPXTG cell wall anchor polypeptides that could be purified include LPXTG-1, LPXTG-1A, LPXTG-2, Anchor-1, Anchor-2, and Anchor-3 (*e.g.*, SEQ ID NOs:2, 4, 6, 7, 8, and 9). Examples of *S. pneumoniae* pilus II island (INV104B), 23F, INV200, and OXC141 sortases that could be purified include sort-1, sort-2, sort-23F, and sort-OXC141 (e.g., SEQ ID NOs:676, 1123, 1386, and 282).

[0076] Separation of pili from Gram-positive bacterial cells is typically accomplished by mechanical shearing, enzymatic digestion, decreasing or inhibiting sortase activity, or treatment with a compound that interferes with cell wall integrity. Mechanical shearing can physically remove the pili from the cells, whereas other methods can eliminate the point of attachment of the pili (*e.g.*, by degradation of cell wall or pilus components). Following separation of the pili from the cells, the pili and cells can be separated, *e.g.*, by centrifugation.

[0077] Non-limiting examples of mechanical shearing methods include ultrasonication, glass bead shearing, and mixing. Methods of sonication are discussed, for example, in Yamaguchi et al., 2004, Current Microbiol., 49:59-65. Methods of glass bead shearing are discussed, for example, in Levesque et al., 2001, J. Bacteriol., 183:2724-32. General methods of mechanical shearing are discussed, for example, in Wolfgang et al., 1998, Mol. Microbiol., 29:321-30; Trachtenberg et al., 2005, J. Mol. Biol., 346:665-676; Parge et al., 1990, J. Biol. Chem., 265:2278-85; Isaacson et al., 1981, J. Bacteriol., 146:784-9; Korhonen et al., 1980, Infect.

Immun., 27:569-75; Hahn et al., 2002, J. Mol. Biol., 323:845-57; St. Geme et al., 1996, Proc. Natl. Acad. Sci. USA, 93:11913-18; Weber et al., 2005, J. Bacteriol., 187:2458-68; and Mu et al., 2002, J. Bacteriol., 184:4868-74.

[0078] Non-limiting examples of enzymes suitable for enzymatic digestion include cell-wall degrading enzymes such as mutanolysin, lysostaphin, and lysozymes. Methods of enzymatic digestion are discussed, for example, in Bender et al., 2003, J. Bacteriol., 185:6057-66; Ton-That et al., 2004, Mol. Microbiol., 53:251-61; and Ton-That et al., 2003, Mol. Microbiol., 50:1429-38. For downstream administration to subjects, one can use multiple enzymes to remove cell-wall components that may cause an undesired host reaction.

[0079] Non-limiting examples of methods of inhibiting or decreasing sortase activity include decreasing, for example, SrtA activity by introduction of a loss-of-function allele of SrtA, deleting the endogenous SrtA gene, expression of a nucleic acid that decreases SrtA expression (*e.g.*, an antisense or miRNA), and treating the cells with a compound that inhibits SrtA activity (*see, e.g.*, Marrafini et al., Microbiol. Mol. Biol. Rev., 70:192-221, 2006).

[0080] Exemplary sortase A inhibitors include methane-thiosulfonates (e.g., MTSET and (2-sulfonatoethyl) methane-thiosulfonate) (Ton-That and Schneewind, J. Biol. Chem., 274:24316-24320, 1999), *p*-hydroxymercuribenzoic acid, glucosylsterol β-sitosterol-3-O-glucopyranol (Kim et al., Biosci. Biotechnol. Biochem., 67:2477-79, 2003), berberine chloride (Kim et al., Biosci. Biotechnol. Biochem., 68:421-24, 2004), peptidyl-diazomethane (LPAT-CHN2) (Scott et al., Biochem. J., 366:953-58, 2002), peptidyl-chloromethane (LPAT-CH2Cl), peptidyl-vinyl sulfone [LPAT-SO_2(Ph)] (Conolly et al., J. Biol. Chem., 278:34061-65, 2003), vinyl sulfones (e.g., di-, ethyl-, methyl-, and phenyl vinyl sulfones) (Frankel et al., J. Am. Chem. Soc., 126:3404-3405, 2004), LPXTG motif peptides with the threonine residue replaced by a phosphinate group (e.g., LPEΨ{PO_2H-CH_2}G) (Kruger et al., Bioorg. Med. Chem., 12:3723-29, 2004), substituted (Z)-diaryl-acrylonitriles (Oh et al., J. Med. Chem., 47:2418-21, 2004), and extracts of various medicinal plants (Kim et al., Biosci. Biotechnol. Biochem., 66:2751-54, 2002).

[0081] Non-limiting examples of compounds that interfere with cell wall integrity include glycine and antibiotics such as penicillins (e.g., methicillin, amoxicillin, ampicillin), cephalosporins (e.g., cefalexin, cefproxil, cefepime), glycopeptides (e.g., vancomycin, teicoplanin, ramoplanin), and cycloserine.

[0082] Separated pili can be separated from other components by density, for example by using density gradient centrifugation. For example, the pili can be separated by centrifugation on a sucrose gradient.

[0083] Typically, a sample containing Gram-positive pili will contain pili oligomers of different molecular weights due to differing numbers of pilus protein subunits present in the pili. To reduce polydispersity, a sample containing Gram-positive pili can be separated by size. For example, a gel filtration or size exclusion column can be used. An ultrafiltration membrane can also be used to reduce polydispersity.

[0084] Gram-positive pili can also be isolated using affinity methods such as affinity chromatography. For example, a protein that binds specifically to a Gram-positive pilus, *e.g.*, an antibody that binds specifically to a pilus component or an antibody that binds preferentially to pili, can be immobilized on a solid substrate (*e.g.*, a chromatography substrate), then a sample containing Gram-positive pili can be exposed to the immobilized binding protein. Such affinity isolation methods can also be used to isolate, purify, or enrich preparations of cells that express Gram-positive pili.

[0085] Gram-positive pili can also be isolated using any other protein purification method known in the art, *e.g.*, precipitations, column chromatography methods, and sample concentrations. Additional methods are described, *e.g.*, in Ruffolo et al., 1997, Infect. Immun., 65:339-43. Methods of protein purification are described in detail in, *e.g.*, Scopes, R.K., *Protein Purification: Principles and Practice*, 3rd. ed., 1994, Springer, NY.

[0086] The presence of Gram-positive pili in fractions during purification can be followed by electrophoresis (*e.g.*, polyacrylamide electrophoresis), measuring binding of an agent that specifically binds to the gram positive pili (*e.g.*, an antibody against a pilus protein or an antibody that binds preferentially to pili), and/or measuring an activity of the pili such as protein or cell binding.

Antibodies

[0087] The *S. pneumoniae* Polypeptides described herein may also be used to prepare antibodies specific to those *S. pneumoniae* Polypeptides. In some embodiments the antibodies are specific to an oligomeric or hyper-oligomeric form of a *S. pneumoniae* Pilus Polypeptide. The compositions described herein also include combinations of antibodies specific to *S. pneumoniae* pilus polypeptides and other polypeptides from *S. pneumoniae* selected to provide protection against an increased range of serotypes and strain isolates. For example, such a combination may comprise a first and second antibody, wherein the first antibody is specific to a first *S. pneumoniae* Polypeptide and the second antibody is specific to a second *S. pneumoniae* Polypeptide or non-*S. pneumoniae* Polypeptide.

[0088] The specific *S. pneumoniae* Polypeptide antibodies described herein include one or more biological moieties that, through chemical or physical means, can bind to or associate with an epitope of a *S. pneumoniae* Polypeptide. The antibodies described herein include antibodies

which specifically bind to a *S. pneumoniae* Polypeptide. The compositions described herein include antibodies obtained from both polyclonal and monoclonal preparations, as well as the following: hybrid (chimeric) antibody molecules (*see*, *e.g.*, Winter et al. (1991) Nature 349: 293-299; and U.S. Patent No. 4,816,567; F(ab')2 and F(ab) fragments; Fv molecules (non-covalent heterodimers, *see*, *e.g.*, Inbar et al. (1972) Proc Natl Acad Sci USA 69:2659-2662; and Ehrlich et al. (1980) Biochem 19:4091-4096); single-chain Fv molecules (sFv) (*see*, *e.g.*, Huston et al. (1988) Proc Natl Acad Sci USA 85:5897-5883); dimeric and trimeric antibody fragment constructs; minibodies (*see*, *e.g.*, Pack et al. (1992) Biochem 31:1579-1584; Cumber et al. (1992) J Immunology 149B: 120-126); humanized antibody molecules (*see*, *e.g.*, Riechmann et al. (1988) Nature 332:323-327; Verhoeyan et al. (1988) Science 239:1534-1536; and U.K. Patent Publication No. GB 2,276,169, published 21 September 1994); and, any functional fragments obtained from such molecules, wherein such fragments retain immunological binding properties of the parent antibody molecule. The compositions described herein further include antibodies obtained through non-conventional processes, such as phage display.

[0089] The antibodies described herein can be polyclonal, monoclonal, recombinant, *e.g.*, chimeric or humanized, fully human, non-human, *e.g.*, murine, or single chain antibodies. Methods of making such antibodies are known. In some cases, the antibodies have effector function and can fix complement. The antibodies can also be coupled to toxins, reporter groups, or imaging agents.

[0090] In some embodiments, the specific *S. pneumoniae* antibodies described herein are monoclonal antibodies. These monoclonal antibodies include an antibody composition having a homogeneous antibody population. The monoclonal antibodies described herein may be obtained from murine hybridomas, as well as human monoclonal antibodies obtained using human rather than murine hybridomas. *See*, *e.g.*, Cote, et al. Monoclonal Antibodies and Cancer Therapy, Alan R. Liss, 1985, p 77.

[0091] Chimeric, humanized, *e.g.*, completely human, antibodies are desirable for applications that include repeated administration, *e.g.*, therapeutic treatment (and some diagnostic applications) of a human subject.

[0092] The antibodies described herein can also be used in the prophylactic or therapeutic treatment of *S. pneumoniae* infection. The antibodies may block the attachment or some other activity of *S. pneumoniae* on host cells. Additionally, the antibodies can be used to deliver a toxin or therapeutic agent such as an antibiotic to *S. pneumoniae* cells.

[0093] The antibodies described herein may be used in diagnostic applications, for example, to detect the presence or absence of *S. pneumoniae* Polypeptides in a biological sample. Anti-

pili, pilus polypeptide or other polypeptide from *S. pneumoniae* antibodies can be used diagnostically to monitor protein levels in tissue as part of a clinical testing procedure, *e.g.*, to determine the efficacy of a given treatment regimen. Detection can be facilitated by coupling (*i.e.*, physically linking) the antibody to a detectable substance (*i.e.*, antibody labeling). Examples of detectable substances include various enzymes, prosthetic groups, fluorescent materials, contrast agents, luminescent materials, bioluminescent materials, and radioactive materials. Examples of suitable enzymes include horseradish peroxidase, alkaline phosphatase, β-galactosidase, or acetylcholinesterase; examples of suitable prosthetic group complexes include streptavidin/biotin and avidin/biotin; examples of suitable fluorescent materials include umbelliferone, fluorescein, fluorescein isothiocyanate, rhodamine, dichlorotriazinylamine fluorescein, dansyl chloride or phycoerythrin; examples of contrast agents include electron dense materials useful for electron microscopy, such as gold particles, or magnetically active materials useful for magnetic resonance imaging, such as supermagnetic iron particles; an example of a luminescent material includes luminol; examples of bioluminescent materials include luciferase, luciferin, and aequorin, and examples of suitable radioactive material include ^{125}I, ^{131}I, ^{35}S or ^{3}H. Such diagnostic antibodies can be used in methods to detect the presence of piliated *S. pneumoniae* containing *Streptococcus pneumoniae* pilus II island (INV104B) pili in an infected patient, *e.g.*, by testing a sample from the patient. The course of treatment can then be selected based on the presence or absence of *Streptococcus pneumoniae* Polypeptides. For example, a patient infected with non-piliated *S. pneumoniae* could be treated with an antibiotic, whereas a patient infected with piliated *S. pneumoniae* containing *S. pneumoniae* Pili Polypeptides could also be treated with a pili-binding compound, such as an antibody, and/or an anti-inflammatory agent (*e.g.*, IL-6 or an anti-TNF agent such as an anti-TNF antibody).

Screening Assays

[0094] In some aspects, the methods described herein (also referred to herein as "screening assays") can be used to identify modulators, *i.e.*, candidate compounds or agents identified from one or more test compounds (*e.g.*, antibodies, proteins, peptides, peptidomimetics, peptoids, small inorganic molecules, small non-nucleic acid organic molecules, nucleic acids (*e.g.*, antisense nucleic acids, siRNA, oligonucleotides, or synthetic oligonucleotides), or other drugs) that inhibit an activity, *e.g.*, a binding activity of *S. pneumoniae* Pili Polypeptides. Compounds thus identified can be used to modulate the binding activity of *S. pneumoniae* containing *S. pneumoniae* Pili Polypeptides or the attachment of such *S. pneumoniae* in a therapeutic protocol, to elaborate the biological function *S. pneumoniae*.

[0095] In some embodiments, assays are provided for screening test compounds to identify those that can bind to *S. pneumoniae* Pili Polypeptides or a portion thereof. Compounds that

bind to *S. pneumoniae* Pili Polypeptides can be tested for their ability to modulate an activity associated with *S. pneumoniae* pili such as attachment, infection, or an inflammatory response.

[0096] The test compounds used in the methods described herein can be obtained using any of the numerous approaches in combinatorial library methods known in the art, including: biological libraries; peptoid libraries (libraries of molecules having the functionalities of peptides, but with a novel, non-peptide backbone, which are resistant to enzymatic degradation, but which, nevertheless, remain bioactive; *see*, *e.g.*, Zuckermann et al., 1994, J. Med. Chem., 37:2678-2685); spatially addressable parallel solid phase or solution phase libraries; synthetic library methods requiring deconvolution; the "one-bead one-compound" library method; and synthetic library methods using affinity chromatography selection. The biological library and peptoid library approaches are limited to peptide libraries, while the other four approaches are applicable to peptide, non-peptide oligomer, or small molecule libraries of compounds (Lam, 1997, Anticancer Drug Des., 12:145).

[0097] Examples of methods for the synthesis of molecular libraries can be found in the art, for example in: DeWitt et al. (1993, Proc. Natl. Acad. Sci. USA, 90:6909; Erb et al., 1994, Proc. Natl. Acad. Sci. USA, 91:11422; Zuckermann et al., 1994, J. Med. Chem., 37:2678; Cho et al., 1993, Science, 261:1303; Carrell et al., 1994, Angew. Chem. Int. Ed. Engl., 33:2059; Carell et al., 1994, Angew. Chem. Int. Ed. Engl., 33:2061; and in Gallop et al., 1994, J. Med. Chem., 37:1233).

[0098] Libraries of compounds may be presented in solution (*e.g.*, Houghten, 1992, Biotechniques, 13:412-421), or on beads (Lam, 1991, Nature, 354:82-84), chips (Fodor, 1993, Nature, 364:555-556), bacteria (Ladner, U.S. Patent No. 5,223,409), spores (Ladner, U.S. Patent No. 5,223,409), plasmids (Cull et al., 1992, Proc. Natl. Acad. Sci. USA, 89:1865-1869), or on phage (Scott and Smith, 1990, Science, 249:386-390; Devlin, 1990, Science, 249:404-406; Cwirla et al., 1990, Proc. Natl. Acad. Sci. USA, 87:6378-6382; Felici, 1991, J. Mol. Biol., 222:301-310; and Ladner *supra*).

[0099] In some embodiments, the assay is a cell-based assay in which a cell, *e.g.*, a bacterial cell, that expresses a *S. pneumoniae* Polypeptides or biologically active portion thereof is contacted with a test compound, and the ability of the test compound to modulate *S. pneumoniae* activity is determined, for example, by monitoring cell binding. The cell, for example, can be of mammalian origin, *e.g.*, murine, rat, or human origin. The cell can be an epithelial cell, *e.g.*, a A549 lung epithelial cell.

[0100] The ability of the test compound to modulate *S. pneumoniae* Pili Polypeptides from binding to a ligand or substrate, *e.g.*, a cell or a protein such as fibrinogen, fibronectin, or

collagen can be evaluated, for example, by coupling the compound, *e.g.*, the substrate, with a radioisotope or enzymatic label such that binding of the compound, *e.g.*, the substrate, to *S. pneumoniae* pilus II island (INV104B) pili or pilus protein can be determined by detecting the labeled compound, *e.g.*, substrate, in a complex. Alternatively, *S. pneumoniae* Polypeptides can be coupled with a radioisotope or enzymatic label to monitor the ability of a test compound to modulate *S. pneumoniae* Polypeptide binding to a substrate in a complex. For example, compounds (*e.g.*, *S. pneumoniae* Polypeptide binding partners) can be labeled with ^{125}I, ^{35}S, ^{14}C, or ^{3}H, either directly or indirectly, and the radioisotope detected by direct counting of radioemission or by scintillation counting. Alternatively, compounds can be enzymatically labeled with, for example, horseradish peroxidase, alkaline phosphatase, or luciferase, and the enzymatic label detected by determination of conversion of an appropriate substrate to product.

[0101] The ability of a compound to interact with a *S. pneumoniae* Polypeptide with or without the labeling of any of the interactants can be evaluated. For example, a microphysiometer can be used to detect the interaction of a compound with a *S. pneumoniae* Polypeptide without labeling either the compound or the *S. pneumoniae* Polypeptide (McConnell et al., 1992, Science 257:1906-1912). As used herein, a "microphysiometer" (*e.g.*, Cytosensor®) is an analytical instrument that measures the rate at which a cell acidifies its environment using a light-addressable potentiometric sensor (LAPS). Changes in this acidification rate can be used as an indicator of the interaction between a compound and a *S. pneumoniae* Polypeptide.

[0102] In some embodiments, a cell-free assay is provided in which a *S. pneumoniae* Polypeptide or biologically active portion thereof is contacted with a test compound and the ability of the test compound to bind to the *S. pneumoniae* Polypeptide or biologically active portion thereof is evaluated. In general, biologically active portions of a *S. pneumoniae* Polypeptide to be used in the new assays include fragments that participate in interactions with other *S. pneumoniae* Polypeptide molecules.

[0103] Cell-free assays involve preparing a reaction mixture of the target gene protein and the test compound under conditions and for a time sufficient to allow the two components to interact and bind, thus forming a complex that can be removed and/or detected.

[0104] An interaction between two molecules can be detected using fluorescence energy transfer (FET) (*see*, *e.g.*, Lakowicz et al., U.S. Patent No. 5,631,169 and Stavrianopoulos et al., U.S. Patent No. 4,868,103). A fluorophore label on the first 'donor' molecule is selected such that its emitted fluorescent energy will be absorbed by a fluorescent label on a second 'acceptor' molecule, which in turn is able to fluoresce due to the absorbed energy. Alternately, the 'donor' protein molecule may simply utilize the natural fluorescent energy of tryptophan residues.

Labels are chosen that emit different wavelengths of light, such that the 'acceptor' molecule label may be differentiated from that of the 'donor.' Since the efficiency of energy transfer between the labels is related to the distance separating the molecules, the spatial relationship between the molecules can be assessed. In a situation in which binding occurs between the molecules, the fluorescent emission of the 'acceptor' molecule label in the assay should be maximal. An FET binding event can be conveniently measured through standard fluorometric detection means well known in the art (*e.g.*, using a fluorimeter).

[0105] In some embodiments, determining the ability of a *S. pneumoniae* Polypeptide to bind to a target molecule (*e.g.*, a fibrinogen, fibronectin, or collagen polypeptide or fragment thereof) can be accomplished using real-time Biomolecular Interaction Analysis (BIA) (*e.g.*, Sjolander et al., 1991, Anal. Chem., 63:2338-2345 and Szabo et al., 1995, Curr. Opin. Struct. Biol., 5:699-705). "Surface plasmon resonance" or "BIA" detects biospecific interactions in real time, without labeling any of the interactants (*e.g.*, BIAcore). Changes in the mass at the binding surface (indicative of a binding event) result in alterations of the refractive index of light near the surface (the optical phenomenon of surface plasmon resonance (SPR)), resulting in a detectable signal that can be used as an indication of real-time reactions between biological molecules.

[0106] In some embodiments, the target gene product or the test substance is anchored onto a solid phase. The target gene product/test compound complexes anchored on the solid phase can be detected at the end of the reaction. The target gene product can be anchored onto a solid surface, and the test compound, which is not anchored, can be labeled, either directly or indirectly, with a detectable labelsdiscussed herein.

[0107] Multiple target gene products can be anchored onto a solid phase using protein microarray technology, which is also known by other names including: protein chip technology and solid-phase protein array technology. Protein microarray technology is well known to those of ordinary skill in the art and is based on, but not limited to, obtaining an array of identified peptides or proteins on a fixed substrate, binding target molecules or biological constituents to the peptides, and evaluating such binding. *See, e.g.*, G. MacBeath and S. L. Schreiber, "Printing Proteins as Microarrays for High-Throughput Function Determination," Science 289(5485):1760-1763, 2000. Microarray substrates include but are not limited to glass, silica, aluminosilicates, borosilicates, metal oxides such as alumina and nickel oxide, various clays, nitrocellulose, or nylon. The microarray substrates may be coated with a compound to enhance synthesis of a probe (*e.g.*, a peptide) on the substrate. Coupling agents or groups on the substrate can be used to covalently link the first amino acid to the substrate. A variety of coupling agents or groups are known to those of skill in the art. Peptide probes can be synthesized directly on the

substrate in a predetermined grid. Alternatively, peptide probes can be spotted on the substrate, and in such cases the substrate may be coated with a compound to enhance binding of the probe to the substrate. In these embodiments, presynthesized probes are applied to the substrate in a precise, predetermined volume and grid pattern, preferably utilizing a computer-controlled robot to apply probe to the substrate in a contact-printing manner or in a non-contact manner such as ink jet or piezo-electric delivery. Probes may be covalently linked to the substrate. In some embodiments, one or more control peptide or protein molecules are attached to the substrate. Control peptide or protein molecules allow determination of factors such as peptide or protein quality and binding characteristics, reagent quality and effectiveness, hybridization success, and analysis thresholds and success.

[0108] In some embodiments it is desirable to immobilize a *S. pneumoniae* Polypeptide, an anti-pilus or pilus protein antibody, or a *S. pneumoniae* Polypeptide binding protein to facilitate separation of complexed from uncomplexed forms of one or both of the proteins, as well as to accommodate automation of the assay. Binding of a test compound to a *S. pneumoniae* Polypeptide, or interaction of a *S. pneumoniae* Polypeptide with a target molecule in the presence or absence of a candidate compound, can be accomplished in any vessel suitable for containing the reactants. Examples of such vessels include microtiter plates, test tubes, and micro-centrifuge tubes. In one embodiment, a fusion protein can be provided that adds a domain that allows one or both of the proteins to be bound to a matrix. For example, glutathione-S-transferase/ pilus II island (INV104B) pilus protein fusion proteins or glutathione-S-transferase/target fusion proteins can be adsorbed onto glutathione Sepharose™ beads (Sigma Chemical, St. Louis, MO) or glutathione derivatized microtiter plates, which are then combined with the test compound or the test compound and either the non-adsorbed target protein or *S. pneumoniae* pilus II island (INV104B) pili or pilus protein, and the mixture incubated under conditions conducive to complex formation (*e.g.*, at physiological conditions for salt and pH). Following incubation, the beads or microtiter plate wells are washed to remove unbound components, the matrix immobilized in the case of beads, complex determined either directly or indirectly, for example, as described above. Alternatively, the complexes can be dissociated from the matrix, and the level of *S. pneumoniae* Polypeptide binding or activity determined using standard techniques.

[0109] Other techniques for immobilizing either a *S. pneumoniae* Polypeptide or a binding target on matrices include using conjugation of biotin and streptavidin. Biotinylated *S. pneumoniae* Polypeptides or target molecules can be prepared from biotin-NHS (N-hydroxy-succinimide) using techniques known in the art (*e.g.*, biotinylation kits from Pierce Chemicals,

Rockford, IL), and immobilized in the wells of streptavidin-coated 96 well plates (Pierce Chemical).

[0110] To conduct the assay, the non-immobilized component is added to the coated surface containing the anchored component. After the reaction is complete, unreacted components are removed (*e.g.*, by washing) under conditions such that any complexes formed will remain immobilized on the solid surface. The detection of complexes anchored on the solid surface can be accomplished in a number of ways. Where the previously non-immobilized component is pre-labeled, the detection of label immobilized on the surface indicates that complexes were formed. Where the previously non-immobilized component is not pre-labeled, an indirect label can be used to detect complexes anchored on the surface; *e.g.*, using a labeled antibody specific for the immobilized component (the antibody, in turn, can be directly labeled or indirectly labeled with, *e.g.*, a labeled anti-Ig antibody).

[0111] In some embodiments, the assay is performed utilizing antibodies that bind specifically to *S. pneumoniae* Polypeptides or binding targets, but do not interfere with binding of the *S. pneumoniae* Polypeptide to its target. Such antibodies can be derivatized to the wells of the plate, and unbound target or *S. pneumoniae* Polypeptide trapped in the wells by antibody conjugation. Methods for detecting such complexes, in addition to those described above for the GST-immobilized complexes, include immunodetection of complexes using antibodies reactive with the *S. pneumoniae* Polypeptide or target molecule, as well as enzyme-linked assays which rely on detecting an enzymatic activity associated with the *S. pneumoniae* Polypeptide or target molecule.

[0112] In some embodiments, cell-free assays can be conducted in a liquid phase. In such an assay, the reaction products are separated from unreacted components, by any of a number of standard techniques, including but not limited to: differential centrifugation (for example, Rivas et al., 1993, Trends Biochem. Sci., 18:284-287); chromatography (gel filtration chromatography, ion-exchange chromatography); electrophoresis (*e.g.*, Ausubel et al., eds., 1999, Current Protocols in Molecular Biology, J. Wiley: New York.); and immunoprecipitation (for example, Ausubel et al., eds., 1999, Current Protocols in Molecular Biology, J. Wiley: New York). Such resins and chromatographic techniques are known to those skilled in the art (*e.g.*, Heegaard, 1998, J. Mol. Recognit., 11:141-148 and Hage et al., 1997, J. Chromatogr. B. Biomed. Sci. Appl., 699:499-525). Further, fluorescence energy transfer may also be conveniently utilized, as described herein, to detect binding without further purification of the complex from solution.

[0113] In some embodiments, the assay includes contacting a *S. pneumoniae* Pili Polypeptide, or biologically active portion thereof with a known cell or compound (*e.g.*, a

protein) that binds to *S. pneumoniae* Pili Polypeptide, to form an assay mixture, contacting the assay mixture with a test compound, and determining the ability of the test compound to affect binding of the *S. pneumoniae* Pili Polypeptide to the cell or compound.

[0114] A general assay for binding of bacterial cells that express *S. pneumoniae* pilus II island (INV104B) pili involves incubating bacterial cells that express *S. pneumoniae* pilus II island (INV104B) pili with A549 lung epithelial cells, washing to remove nonadherent bacterial cells, and detecting adherent bacterial cells. Bacterial adherence can be measured by any means in the art, *e.g.*, detecting binding of an antibody to the adherent bacterial cells or lysing the epithelial cells and counting the number of associated bacterial cells. HEP2 cells, CHO cells, or HeLa cells can also be used in assays of binding of bacterial cells that express *S. pneumoniae* pilus II island (INV104B) pili.

Immunogenic Compositions

[0115] Immunogenic compositions described herein that include *S. pneumoniae* Polypeptides may further comprise one or more antigenic agents. Exemplary antigens include those listed below. Additionally, the compositions described herein may be used to treat or prevent infections caused by any of the below-listed microbes. Antigens for use in the immunogenic compositions include, but are not limited to, one or more of the following set forth below, or antigens derived from one or more of the following set forth below:

Bacterial Antigens

[0116] *N. meningitidis:* a protein antigen from *N. meningitides* serogroup A, C, W135, Y, and/or B (Bruyn, G. A. W. & van Furth, R. (1991) Eur. J. Clin. Microbiol. Infect. Dis. 10, 897–910; Ryan, M. W. & Antonelli, P. J. (2000) Laryngoscope 110, 961–964; Cutts, F. T., Zaman, S. M., Enwere, G., Jaffar, S., Levine, O. S., Okoko, C. Oluwalana, A., Vaughan, S., Obaro, A., Leach, A., et al. (2005) Lancet 365, 1139–1146; Swiatlo, E., Champlin, F. R., Holman, S. C., Wilson, W. W.&Watt, J. M. (2002) Infect. Immun. 70, 412–415; Sandgren, A., Albiger, B., Orihuela, C., Tuomanen, E., Normark, S. & Henriques-Normark, B. (2005) J. Infect. Dis. 192, 791–800; Henriques Normark, B., Christensson, B., Sandgren, A., Noreen, B., Sylvan, S., Burman, L. G. & Olsson-Liljequist, B. (2003) Microb. Drug Resist. 9, 337–344; Nunes, S., Sá-Leão, R., Carriço, J., Alves, C. R., Mato, R., Avô, A. B., Saldanha, J., Almeida, J. S., Sanches, I. S. & de Lencastre, H. (2005) J. Clin. Microbiol. 43, 1285–1293); an outer-membrane vesicle (OMV) preparation from *N. meningitides* serogroup B. (Henrichsen, J. (1995) J. Clin. Microbiol. 33, 2759–2762; Lau, G. W., Haataja, S., Lonetto, M., Kensit, S. E., Marra, A., Bryant, A. P., McDevitt, D., Morrison, D. A. & Holden, D. W. (2001) Mol. Microbiol. 40, 555–571; Rosenow, C., Ryan, P., Weiser, J. N., Johnson, S., Fontan, P., Ortqvist, A. & Masure, H. R. (1997) Mol. Microbiol. 25, 819–829; Tuomanen, E. (1999) Current Opin. Biol. 2, 35–39); a saccharide

antigen, including LPS, from *N. meningitides* serogroup A, B, C W135 and/or Y, such as the oligosaccharide from serogroup C (*see* PCT/US99/09346; PCT IB98/01665; and PCT IB99/00103);

[0117] *Streptococcus pneumoniae*: a saccharide or protein antigen, particularly a saccharide from *Streptococcus pneumoniae* or a protein or antigenic peptide of PhtD (BVH-11-2, SP1003, spr0907) (Adamou et al., Infect. Immun., 69:949-53, 2001; Hamel et al., Infect. Immun., 72:2659-70, 2004); PhtE (BVH-3, SP1004, spr0908) (Adamou et al., Infect. Immun., 69:949-53, 2001; Hamel et al., Infect. Immun., 72:2659-70, 2004); PhtB (PhpA, BVH-11, SP1174, spr1060) (Adamou et al., Infect. Immun., 69:949-53, 2001; Zhang et al., Infect. Immun., 69:3827-36, 2001; Hamel et al., Infect. Immun., 72:2659-70, 2004); PhtA (BVH-11-3, SP1175, spr1061) (Adamou et al., Infect. Immun., 69:949-53, 2001; Wizemann et al., Infect. Immun., 69:1593-98, 2001; Zhang et al., Infect. Immun., 69:3827-36, 2001; Hamel et al., Infect. Immun., 72:2659-70, 2004); NanA (SP1693, spr1536) (Tong et al., Infect. Immun., 73:7775-78, 2005); SP1872 (spr1687) (Brown et al., Infect. Immun., 69:6702-06, 2001); PspC (CbpA, SP2190, spr1995) (Ogunniyi et al., Infect. Immun., 69:5997-6003, 2001); PspA (SP0177, spr0121, spr1274) (Briles et al., Vaccine, 19:S87-S95, 2001); SP0498 (spr0440); LytB (SP0965, spr0867) (Wizemann et al., Infect. Immun., 69:1593-98, 2001); AliB (SP1527, spr1382); PpmA (SP0981, spr0884) (Overweg et al., Infect. Immun., 68:4180-4188, 2000); LytC (SP1573, spr1431) (Wizemann et al., Infect. Immun., 69:1593-98, 2001); PsaA (Briles et al., Vaccine, 19:S87-S95, 2001); PdB (Ogunniyi et al., Infect. Immun., 69:5997-6003, 2001); RPhp (Zhang et al., Infect. Immun., 69:3827-36, 2001); PiuA (Jomaa et al., Vaccine, 24:5133-39, 2006); PiaA (Jomaa et al., Vaccine, 24:5133-39, 2006); 6PGD (Daniely et al., Clin. Exp. Immunol., 144:254-263, 2006); or PppA (Green et al., Infect. Immun., 73:981-89, 2005);

[0118] *Streptococcus agalactiae*: such as, Group B streptococcus antigens;

[0119] *Streptococcus pyogenes*: such as, Group A streptococcus antigens;

[0120] *Enterococcus faecalis or Enterococcus faecium*: such as, a trisaccharide repeat or other *Enterococcus* derived antigens provided in U.S. Patent No. 6,756,361;

[0121] *Helicobacter pylori:* including: Cag, Vac, Nap, HopX, HopY and/or urease antigen;

[0122] *Bordetella pertussis:* such as pertussis holotoxin (PT) and filamentous hemagglutinin (FHA) from *B. pertussis*, optionally also combination with pertactin and/or agglutinogens 2 and 3 antigen;

[0123] *Staphylococcus aureus:* including *S. aureus* type 5 and 8 capsular polysaccharides optionally conjugated to nontoxic recombinant *Pseudomonas aeruginosa* exotoxin A, such as StaphVAX™, or antigens derived from surface proteins, invasins (leukocidin, kinases,

hyaluronidase), surface factors that inhibit phagocytic engulfment (capsule, Protein A), carotenoids, catalase production, Protein A, coagulase, clotting factor, and/or membrane-damaging toxins (optionally detoxified) that lyse eukaryotic cell membranes (hemolysins, leukotoxin, leukocidin);

[0124] *Staphylococcus epidermis:* particularly, *S. epidermidis* slime-associated antigen (SAA);

[0125] *Staphylococcus saprophyticus:* (causing urinary tract infections) particularly the 160 kDa hemagglutinin of *S. saprophyticus* antigen;

[0126] *Pseudomonas aeruginosa:* particularly, endotoxin A, Wzz protein, *P. aeruginosa* LPS, more particularly LPS isolated from PAO1 (O5 serotype), and/or Outer Membrane Proteins, including Outer Membrane Proteins F (OprF) *(Infect Immun.* 2001 May; 69(5): 3510-3515);

[0127] *Bacillus anthracis* (anthrax)*:* such as *B. anthracis* antigens (optionally detoxified) from A-components (lethal factor (LF) and edema factor (EF)), both of which can share a common B-component known as protective antigen (PA);

[0128] *Moraxella catarrhalis:* (respiratory) including outer membrane protein antigens (HMW-OMP), C-antigen, and/or LPS;

[0129] *Yersinia pestis* (plague): such as F1 capsular antigen *(Infect Immun.* 2003 Jan; 71(1)): 374-383, LPS (*Infect Immun.* 1999 Oct; 67(10): 5395), Yersinia pestis V antigen (*Infect Immun.* 1997 Nov; 65(11): 4476-4482);

[0130] *Yersinia enterocolitica* (gastrointestinal pathogen): particularly LPS (*Infect Immun.* 2002 August; 70(8): 4414);

[0131] *Yersinia pseudotuberculosis:* gastrointestinal pathogen antigens;

[0132] *Mycobacterium tuberculosis*: such as lipoproteins, LPS, BCG antigens, a fusion protein of antigen 85B (Ag85B) and/or ESAT-6 optionally formulated in cationic lipid vesicles (*Infect Immun.* 2004 October; 72(10): 6148), Mycobacterium tuberculosis (Mtb) isocitrate dehydrogenase associated antigens *(*Proc. Natl Acad Sci U.S.A. 2004 Aug 24; 101(34)**:** 12652), and/or MPT51 antigens (*Infect Immun*. 2004 July; 72(7): 3829);

[0133] *Legionella pneumophila* (Legionnaires' Disease): L. pneumophila antigens -- optionally derived from cell lines with disrupted *asd* genes (*Infect Immun.* 1998 May; 66(5): 1898);

[0134] *Rickettsia:* including outer membrane proteins, including the outer membrane protein A and/or B (OmpB) (*Biochim Biophys Acta.* 2004 Nov 1;1702(2):145), LPS, and surface protein antigen (SPA) (*J Autoimmun.* 1989 Jun;2 Suppl:81);

[0135] *E. coli:* including antigens from enterotoxigenic *E. coli* (ETEC), enteroaggregative *E. coli* (EAggEC), diffusely adhering *E. coli* (DAEC), enteropathogenic *E. coli* (EPEC), and/or enterohemorrhagic *E. coli* (EHEC);

[0136] *Vibrio cholerae:* including proteinase antigens, LPS, particularly lipopolysaccharides of Vibrio cholerae II, O1 Inaba O-specific polysaccharides, V. cholera O139, antigens of IEM108 vaccine (*Infect Immun.* 2003 Oct;71(10):5498-504), and/or Zonula occludens toxin (Zot);

[0137] *Salmonella typhi* (typhoid fever): including capsular polysaccharides preferably conjugates (Vi, *i.e.* vax-TyVi);

[0138] *Salmonella typhimurium* (gastroenteritis): antigens derived therefrom are contemplated for microbial and cancer therapies, including angiogenesis inhibition and modulation of flk;

[0139] *Listeria monocytogenes* (systemic infections in immunocompromised or elderly people, infections of fetus): antigens derived from L. monocytogenes are preferably used as carriers/vectors for intracytoplasmic delivery of the conjugates/associated compositions described herein;

[0140] *Porphyromonas gingivalis:* such as, *P. gingivalis* outer membrane protein (OMP);

[0141] *Tetanus*: such as tetanus toxoid (TT) antigens, *e.g.*, used as a carrier protein in conjunction/conjugated with the compositions described herein;

[0142] *Diphtheria:* such as a diphtheria toxoid or a diphtheria toxoid mutant, *e.g.*, CRM_{197}, additionally antigens capable of modulating, inhibiting or associated with ADP ribosylation are contemplated for combination/co-administration/conjugation with the compositions described herein, the diphtheria toxoids can be used as carrier proteins;

[0143] *Borrelia burgdorferi* (Lyme disease): such as antigens associated with P39 and P13 (an integral membrane protein, *Infect Immun.* 2001 May; 69(5): 3323-3334), VlsE Antigenic Variation Protein (*J Clin Microbiol.* 1999 Dec; 37(12): 3997);

[0144] *Haemophilus influenzae B:* such as a saccharide antigen therefrom;

[0145] *Klebsiella:* such as an OMP, including OMP A, or a polysaccharide optionally conjugated to tetanus toxoid;

[0146] *Neiserria gonorrhoeae:* including, a Por (or porin) protein, such as PorB (*see* Zhu *et al.*, Vaccine (2004) 22:660 – 669), a transferring binding protein, such as TbpA and TbpB (*see* Price *et al.*, Infection and Immunity (2004) 71(1):277 – 283), a opacity protein (such as Opa), a reduction-modifiable protein (Rmp), and outer membrane vesicle (OMV) preparations (*see*

Plante *et al.*, J Infectious Disease (2000) 182:848 – 855), also *see, e.g.,* WO99/24578, WO99/36544, WO99/57280, WO02/079243);

[0147] *Chlamydia pneumoniae*: particularly *C. pneumoniae* protein antigens;

[0148] *Chlamydia trachomatis:* including antigens derived from serotypes A, B, Ba and C are (agents of trachoma, a cause of blindness), serotypes L_1, L_2 & L_3 (associated with Lymphogranuloma venereum), and serotypes, D-K;

[0149] *Treponema pallidum* (Syphilis): particularly a TmpA antigen; and

[0150] *Haemophilus ducreyi* (causing chancroid)*:* including outer membrane protein (DsrA).

[0151] Where not specifically referenced, further bacterial antigens as described herein may be capsular antigens, polysaccharide antigens or protein antigens of any of the above. Further bacterial antigens may also include an outer membrane vesicle (OMV) preparation. Additionally, antigens include live, attenuated, split (for enveloped viruses), and/or purified versions of any of the aforementioned bacteria. The bacterial or microbial derived antigens described herein may be gram-negative or gram-positive and aerobic or anaerobic.

[0152] Additionally, any of the above bacterial-derived saccharides (polysaccharides, LPS, LOS or oligosaccharides) can be conjugated to another agent or antigen, such as a carrier protein (for example CRM_{197}). Such conjugation may be direct conjugation effected by reductive amination of carbonyl moieties on the saccharide to amino groups on the protein, as provided in U.S. Patent No. 5,360,897 and *Can J Biochem Cell Biol.* 1984 May;62(5):270-5. Alternatively, the saccharides can be conjugated through a linker, such as, with succinamide or other linkages provided in *Bioconjugate Techniques,* 1996 and *CRC, Chemistry of Protein Conjugation and Cross-Linking*, 1993.

Viral Antigens

[0153] *Influenza:* including whole viral particles (attenuated), split, or subunit comprising hemagglutinin (HA) and/or neuraminidase (NA) surface proteins, the influenza antigens may be derived from chicken embryos or propagated on cell culture, and/or the influenza antigens are derived from influenza type A, B, and/or C, among others;

[0154] *Respiratory syncytial virus (RSV):* including the F protein of the A2 strain of RSV (*J Gen Virol.* 2004 Nov; 85(Pt 11):3229) and/or G glycoprotein;

[0155] *Parainfluenza virus (PIV):* including PIV type 1, 2, and 3, preferably containing hemagglutinin, neuraminidase and/or fusion glycoproteins;

[0156] *Poliovirus*: including antigens from a family of picornaviridae, preferably poliovirus antigens such as OPV or, preferably IPV;

[0157] *Measles:* including split measles virus (MV) antigen optionally combined with the Protollin and or antigens present in MMR vaccine;

[0158] *Mumps:* including antigens present in MMR vaccine;

[0159] *Rubella:* including antigens present in MMR vaccine as well as other antigens from Togaviridae, including dengue virus;

[0160] *Rabies*: such as lyophilized inactivated virus (RabAvert™);

[0161] *Flaviviridae viruses:* such as (and antigens derived therefrom) yellow fever virus, Japanese encephalitis virus, dengue virus (types 1, 2, 3, or 4), tick borne encephalitis virus, and West Nile virus;

[0162] *Caliciviridae;* antigens therefrom;

[0163] *HIV:* including HIV-1 or HIV-2 strain antigens, such as gag (p24gag and p55gag), env (gp160 and gp41), pol, tat, nef, rev vpu, miniproteins, (preferably p55 gag and gp140v delete) and antigens from the isolates HIV_{IIIb}, HIV_{SF2}, HIV_{LAV}, HIV_{LAI}, HIV_{MN}, $HIV\text{-}1_{CM235}$, $HIV\text{-}1_{US4}$, HIV-2; simian immunodeficiency virus (SIV) among others;

[0164] *Rotavirus:* including VP4, VP5, VP6, VP7, VP8 proteins (*Protein Expr Purif.* 2004 Dec;38(2):205) and/or NSP4;

[0165] *Pestivirus*: such as antigens from classical porcine fever virus, bovine viral diarrhea virus, and/or border disease virus;

[0166] *Parvovirus:* such as parvovirus B19;

[0167] *Coronavirus:* including SARS virus antigens, particularly spike protein or proteases therefrom, as well as antigens included in WO 04/92360;

[0168] *Hepatitis A virus*: such as inactivated virus;

[0169] *Hepatitis B virus*: such as the surface and/or core antigens (sAg), as well as the presurface sequences, pre-S1 and pre-S2 (formerly called pre-S), as well as combinations of the above, such as sAg/pre-S1, sAg/pre-S2, sAg/pre-S1/pre-S2, and pre-S1/pre-S2, (*see, e.g.*, AHBV Vaccines - *Human Vaccines and Vaccination*, pp. 159-176; and U.S. Patent Nos. 4,722,840, 5,098,704, 5,324,513; Beames et al., *J. Virol.* (1995) 69:6833-6838, Birnbaum et al., *J. Virol.* (1990) 64:3319-3330; and Zhou et al., *J. Virol.* (1991) 65:5457-5464);

[0170] *Hepatitis C virus:* such as E1, E2, E1/E2 (*see*, Houghton et al., *Hepatology* (1991) 14:381), NS345 polyprotein, NS 345-core polyprotein, core, and/or peptides from the nonstructural regions (International Publication Nos. WO 89/04669; WO 90/11089; and WO 90/14436);

[0171] *Delta hepatitis virus (HDV):* antigens derived therefrom, particularly δ-antigen from HDV (*see, e.g.*, U.S. Patent No. 5,378,814);

[0172] *Hepatitis E virus (HEV)*; antigens derived therefrom;

[0173] *Hepatitis G virus (HGV);* antigens derived therefrom;

[0174] *Varicella zoster virus:* antigens derived from varicella zoster virus (VZV) (*J. Gen. Virol.* (1986) 67:1759);

[0175] *Epstein-Barr virus:* antigens derived from EBV (Baer et al., *Nature* (1984) 310:207);

[0176] *Cytomegalovirus:* CMV antigens, including gB and gH (*Cytomegaloviruses* (J.K. McDougall, ed., Springer-Verlag 1990) pp. 125-169);

[0177] *Herpes simplex virus:* including antigens from HSV-1 or HSV-2 strains and glycoproteins gB, gD and gH (McGeoch et al., *J. Gen. Virol.* (1988) 69:1531 and U.S. Patent No. 5,171,568);

[0178] *Human Herpes Virus:* antigens derived from other human herpesviruses such as HHV6 and HHV7; and

[0179] *HPV:* including antigens associated with or derived from human papillomavirus (HPV), for example, one or more of E1 – E7, L1, L2, and fusions thereof, particularly the compositions described herein may include a virus-like particle (VLP) comprising the L1 major capsid protein, more particular still, the HPV antigens are protective against one or more of HPV serotypes 6, 11, 16 and/or 18.

[0180] Further provided are antigens, compositions, methods, and microbes included in *Vaccines*, 4th Edition (Plotkin and Orenstein ed. 2004); *Medical Microbiology* 4th Edition (Murray et al. ed. 2002); *Virology*, 3rd Edition (W.K. Joklik ed. 1988); *Fundamental Virology*, 2nd Edition (B.N. Fields and D.M. Knipe, eds. 1991), which are contemplated in conjunction with the compositions described herein.

[0181] Additionally, antigens include live, attenuated, split, and/or purified versions of any of the aforementioned viruses.

Fungal Antigens

[0182] Fungal antigens for use herein that are associated with vaccines include those described in: U.S. Pat. Nos. 4,229,434 and 4,368,191 for prophylaxis and treatment of trichopytosis caused by *Trichophyton mentagrophytes*; U.S. Pat. Nos. 5,277,904 and 5,284,652 for a broad spectrum dermatophyte vaccine for the prophylaxis of dermatophyte infection in animals, such as guinea pigs, cats, rabbits, horses and lambs, these antigens comprises a suspension of killed *T. equinum, T. mentagrophytes* (var. granulare), *M. canis* and/or *M. gypseum* in an effective amount optionally combined with an adjuvant; U.S. Pat. Nos. 5,453,273 and 6,132,733 for a ringworm vaccine comprising an effective amount of a homogenized, formaldehyde-killed fungi, *i.e.*, *Microsporum canis* culture in a carrier; and U.S. Pat. No. 5,948,413 involving extracellular and intracellular proteins for pythiosis. Additional antigens identified within antifungal vaccines include *Ringvac bovis* LTF-130 and Bioveta.

[0183] Further, fungal antigens for use herein may be derived from Dermatophytres, including: *Epidermophyton floccusum, Microsporum audouini, Microsporum canis, Microsporum distortum, Microsporum equinum, Microsporum gypsum, Microsporum nanum, Trichophyton concentricum, Trichophyton equinum, Trichophyton gallinae, Trichophyton gypseum, Trichophyton megnini, Trichophyton mentagrophytes, Trichophyton quinckeanum, Trichophyton rubrum, Trichophyton schoenleini, Trichophyton tonsurans, Trichophyton verrucosum, T. verrucosum* var. album, var. discoides, var. ochraceum, *Trichophyton violaceum,* and/or *Trichophyton faviforme.*

[0184] Fungal pathogens for use as antigens or in derivation of antigens in conjunction with the compositions described herein comprise *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Aspergillus nidulans, Aspergillus terreus, Aspergillus sydowi, Aspergillus flavatus, Aspergillus glaucus, Blastoschizomyces capitatus, Candida albicans, Candida enolase, Candida tropicalis, Candida glabrata, Candida krusei, Candida parapsilosis, Candida stellatoidea, Candida kusei, Candida parakwsei, Candida lusitaniae, Candida pseudotropicalis, Candida guilliermondi, Cladosporium carrionii, Coccidioides immitis, Blastomyces dermatidis, Cryptococcus neoformans, Geotrichum clavatum, Histoplasma capsulatum, Paracoccidioides brasiliensis, Pneumocystis carinii, Pythiumn insidiosum, Pityrosporum ovale, Sacharomyces cerevisae, Saccharomyces boulardii, Saccharomyces pombe, Scedosporium apiosperum, Sporothrix schenckii, Trichosporon beigelii, Penicillium marneffei,* Malassezia spp., Fonsecaea spp., Wangiella spp., Sporothrix spp., Basidiobolus spp., Conidiobolus spp., Rhizopus spp, Mucor spp, Absidia spp, Mortierella spp, Cunninghamella spp, and Saksenaea spp.

[0185] Other fungi from which antigens are derived include Alternaria spp, Curvularia spp, Helminthosporium spp, Fusarium spp, Aspergillus spp, Penicillium spp, Monolinia spp, Rhizoctonia spp, Paecilomyces spp, Pithomyces spp, and Cladosporium spp.

[0186] Processes for producing fungal antigens are well known in the art (*see* U.S. Patent No. 6,333,164). In some methods a solubilized fraction extracted and separated from an insoluble fraction obtainable from fungal cells of which cell wall has been substantially removed or at least partially removed, characterized in that the process comprises: obtaining living fungal cells; obtaining fungal cells of which cell wall has been substantially removed or at least partially removed; bursting the fungal cells of which cell wall has been substantially removed or at least partially removed; obtaining an insoluble fraction; and extracting and separating a solubilized fraction from the insoluble fraction.

STD Antigens

[0187] In some embodiments, microbes (bacteria, viruses and/or fungi) against which the present compositions and methods can be implement include those that cause sexually

transmitted diseases (STDs) and/or those that display on their surface an antigen that can be the target or antigen composition as described herein. In some embodiment, compositions are combined with antigens derived from a viral or bacterial STD. Antigens derived from bacteria or viruses can be administered in conjunction with the compositions described herein to provide protection against at least one of the following STDs, among others: chlamydia, genital herpes, hepatitis (particularly HCV), genital warts, gonorrhea, syphilis and/or chancroid (*see*, WO00/15255).

[0188] In some embodiments, the compositions described herein are co-administered with one or more antigens for the prevention or treatment of an STD.

[0189] Antigens derived from the following viruses associated with STDs, which are described in greater detail above, are preferred for co-administration with the compositions described herein: hepatitis (particularly HCV), HPV, HIV, or HSV.

[0190] Additionally, antigens derived from the following bacteria associated with STDs, which are described in greater detail above, are preferred for co-administration with the compositions described herein: *Neiserria gonorrhoeae, Chlamydia pneumoniae, Chlamydia trachomatis, Treponema pallidum*, or *Haemophilus ducreyi*.

Respiratory Antigens

[0191] The *S. pneumoniae* antigen may be a respiratory antigen and could further be used in an immunogenic composition for methods of preventing and/or treating infection by a respiratory pathogen, including a virus, bacteria, or fungi such as respiratory syncytial virus (RSV), PIV, SARS virus, influenza, *Bacillus anthracis,* particularly by reducing or preventing infection and/or one or more symptoms of respiratory virus infection. A composition comprising an antigen described herein, such as one derived from a respiratory virus, bacteria or fungus is administered in conjunction with the compositions described herein to an individual which is at risk of being exposed to that particular respiratory microbe, has been exposed to a respiratory microbe or is infected with a respiratory virus, bacteria or fungus. The composition(s) described herein is/are co-administered at the same time or in the same formulation with one or more antigens of the respiratory pathogen. Administration of the composition results in reduced incidence and/or severity of one or more symptoms of respiratory infection.

Pediatric/Geriatric Antigens

[0192] In some embodiments, the compositions described herein are used in conjunction with one or more antigens for treatment of a pediatric population, as in a pediatric antigen. In some embodiments, the age of the subjects in the pediatric population is less than about 3 years old, or less than about 2 years, or less than about 1 years old. In some embodiments the pediatric

antigen (in conjunction with the composition described herein) is administered multiple times over at least 1, 2, or 3 years.

[0193] In some embodiments, the compositions described herein are used in conjunction with one or more antigens for treatment of a geriatric population, as in a geriatric antigen. In some embodiments, the age of the subjects in the geriatric population is greater than about 50 years old, greater than about 55 years old, greater than about 60 years old, greater than about 65 years old, greater than about 70 years old, greater than about 75 years old, greater than about 80 years old, or greater than about 85 years old. In some embodiments the geriatric antigen (in conjunction with the composition described herein) is administered multiple times over at least 1, 2, or 3 years.

Other Antigens

[0194] Other antigens for use in conjunction with the compositions of the present include hospital acquired (nosocomial) associated antigens.

[0195] In some embodiments, parasitic antigens are contemplated in conjunction with the compositions described herein. Examples of parasitic antigens include those derived from organisms causing malaria and/or Lyme disease.

[0196] In some embodiments, the antigens in conjunction with the compositions described herein are associated with or effective against a mosquito born illness. In some embodiments, the antigens in conjunction with the compositions described herein are associated with or effective against encephalitis. In some embodiments the antigens in conjunction with the compositions described herein are associated with or effective against an infection of the nervous system.

[0197] In some embodiments, the antigens in conjunction with the compositions described herein are antigens transmissible through blood or body fluids.

Antigen Formulations

[0198] In some aspects, methods of producing microparticles having adsorbed antigens are provided. The methods comprise: (a) providing an emulsion by dispersing a mixture comprising (i) water, (ii) a detergent, (iii) an organic solvent, and (iv) a biodegradable polymer selected from the group consisting of a poly(α-hydroxy acid), a polyhydroxy butyric acid, a polycaprolactone, a polyorthoester, a polyanhydride, and a polycyanoacrylate. The polymer is typically present in the mixture at a concentration of about 1% to about 30% relative to the organic solvent, while the detergent is typically present in the mixture at a weight-to-weight detergent-to-polymer ratio of from about 0.00001:1 to about 0.1:1 (more typically about 0.0001:1 to about 0.1:1, about 0.001:1 to about 0.1:1, or about 0.005:1 to about 0.1:1); (b) removing the organic solvent from the emulsion; and (c) adsorbing an antigen on the surface of the microparticles. In some

embodiments, the biodegradable polymer is present at a concentration of about 3% to about 10% relative to the organic solvent.

[0199] In some embodiments, microparticles for use herein are formed from materials that are sterilizable, non-toxic and biodegradable. Such materials include, without limitation, poly(α-hydroxy acid), polyhydroxybutyric acid, polycaprolactone, polyorthoester, polyanhydride, PACA, and polycyanoacrylate. In some embodiments, microparticles for use with the methods described herein are derived from a poly(α-hydroxy acid), in particular, from a poly(lactide) ("PLA") or a copolymer of D,L-lactide and glycolide or glycolic acid, such as a poly(D,L-lactide-co-glycolide) ("PLG" or "PLGA"), or a copolymer of D,L-lactide and caprolactone. The microparticles may be derived from any of various polymeric starting materials which have a variety of molecular weights and, in the case of the copolymers such as PLG, a variety of lactide:glycolide ratios, the selection of which will be largely a matter of choice, depending in part on the coadministered macromolecule. These parameters are discussed more fully below.

[0200] Further antigens may also include an outer membrane vesicle (OMV) preparation.

[0201] Antigens can also be adsorbed to peptidoglycans of various gram-positive bacteria to make gram-positive enhancer matrix (GEM) particles, as described in Bosma et al., Appl. Env. Microbiol., 72:880-889, 2006, the entire contents of which are incorporated herein by reference. This method relies on the non-covalent binding of the LysM motif (Buist et al., J. Bact., 177:1554-63, 1995; Bateman and Bycroft, J. Mol. Biol., 299:1113-19, 2000) to the cell wall peptidoglycan of acid-treated cells. Briefly, a polypeptide antigen linked to one or more LysM motifs (*e.g.*, non-covalently or covalently (e.g., as a fusion protein or by conjugation) is added to acid-treated gram-positive bacteria. The antigen peptides bind with high affinity and can be used in immunogenic compositions. Exemplary acids used in these methods include trichloroacetic acid (*e.g.*, at 0.1%-10%), acetic acid (*e.g.*, at 5.6 M), HCl (*e.g.*, at 0.01 M), lactic acid (*e.g.*, at 0.72 M), and formic acid (*e.g.*, at 0.56 M).

[0202] Additional formulation methods and antigens (especially tumor antigens) are provided in U.S. Patent No. 6,884,435.

Antigen References

[0203] The following references, each of which is specifically incorporated by reference in its entirety, include antigens useful in conjunction with the compositions described herein:

[0204] International patent application WO99/24578

[0205] International patent application WO99/36544.

[0206] International patent application WO99/57280.

[0207] International patent application WO00/22430.

[0208] Tettelin et al. (2000) Science 287:1809-1815.

[0209] International patent application WO96/29412.

[0210] Pizza et al. (2000) Science 287:1816-1820.

[0211] PCT WO 01/52885.

[0212] Bjune et al. (1991) Lancet 338(8775).

[0213] Fuskasawa et al. (1999) Vaccine 17:2951-2958.

[0214] Rosenqist et al. (1998) Dev. Biol. Strand 92:323-333.

[0215] Costantino et al. (1992) Vaccine 10:691-698.

[0216] Costantino et al. (1999) Vaccine 17:1251-1263.

[0217] Watson (2000) Pediatr Infect Dis J 19:331-332.

[0218] Rubin (20000) Pediatr Clin North Am 47:269-285,v.

[0219] Jedrzejas (2001) Microbiol Mol Biol Rev 65:187-207.

[0220] International patent application filed on 3rd July 2001 claiming priority from GB0016363.4;WO 02/02606; PCT IB/01/00166.

[0221] Kalman et al. (1999) Nature Genetics 21:385-389.

[0222] Read et al. (2000) Nucleic Acids Res 28:1397-406.

[0223] Shirai et al. (2000) J. Infect. Dis 181(Suppl 3):S524-S527.

[0224] International patent application WO99/27105.

[0225] International patent application WO00/27994.

[0226] International patent application WO00/37494.

[0227] International patent application WO99/28475.

[0228] Bell (2000) Pediatr Infect Dis J 19:1187-1188.

[0229] Iwarson (1995) APMIS 103:321-326.

[0230] Gerlich et al. (1990) Vaccine 8 Suppl:S63-68 & 79-80.

[0231] Hsu et al. (1999) Clin Liver Dis 3:901-915.

[0232] Gastofsson et al. (1996) N. Engl. J. Med. 334-:349-355.

[0233] Rappuoli et al. (1991) TIBTECH 9:232-238.

[0234] Vaccines (1988) eds. Plotkin & Mortimer. ISBN 0-7216-1946-0.

[0235] Del Guidice et al. (1998) Molecular Aspects of Medicine 19:1-70.

[0236] International patent application WO93/018150.

[0237] International patent application WO99/53310.

[0238] International patent application WO98/04702.

[0239] Ross et al. (2001) Vaccine 19:135-142.

[0240] Sutter et al. (2000) Pediatr Clin North Am 47:287-308.

[0241] Zimmerman & Spann (1999) Am Fan Physician 59:113-118, 125-126.

[0242] Dreensen (1997) Vaccine 15 Suppl"S2-6.

[0243] MMWR Morb Mortal Wkly rep 1998 Jan 16:47(1):12, 9.

[0244] McMichael (2000) Vaccine19 Suppl 1:S101-107.

[0245] Schuchat (1999) Lancet 353(9146):51-6.

[0246] GB patent applications 0026333.5, 0028727.6 & 0105640.7.

[0247] Dale (1999) Infect Disclin North Am 13:227-43, viii.

[0248] Ferretti et al. (2001) PNAS USA 98: 4658-4663.

[0249] Kuroda et al. (2001) Lancet 357(9264):1225-1240; *see also* pages 1218-1219.

[0250] Ramsay et al. (2001) Lancet 357(9251):195-196.

[0251] Lindberg (1999) Vaccine 17 Suppl 2:S28-36.

[0252] Buttery & Moxon (2000) J R Coil Physicians Long 34:163-168.

[0253] Ahmad & Chapnick (1999) Infect Dis Clin North Am 13:113-133, vii.

[0254] Goldblatt (1998) J. Med. Microbiol. 47:663-567.

[0255] European patent 0 477 508.

[0256] U.S. Patent No. 5,306,492.

[0257] International patent application WO98/42721.

[0258] Conjugate Vaccines (eds. Cruse et al.) ISBN 3805549326, particularly vol. 10:48-114.

[0259] Hermanson (1996) Bioconjugate Techniques ISBN: 012323368 & 012342335X.

[0260] European patent application 0372501.

[0261] European patent application 0378881.

[0262] European patent application 0427347.

[0263] International patent application WO93/17712.

[0264] International patent application WO98/58668.

[0265] European patent application 0471177.

[0266] International patent application WO00/56360.

[0267] International patent application WO00/67161.

Fusion Proteins

[0268] The *S. pneumoniae* polypeptides used with the compositions described herein may be present in the compositions as individual separate polypeptides, but in some embodiments at least two (*i.e.* 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, or 18) of the antigens can be expressed as a single polypeptide chain (a "hybrid" or "fusion" polypeptide). Such fusion polypeptides offer two principal advantages: first, a polypeptide that may be unstable or poorly expressed on its own can be assisted by adding a suitable fusion partner that overcomes the

problem; second, commercial manufacture is simplified as only one expression and purification need be employed in order to produce two polypeptides which are both antigenically useful.

[0269] The fusion polypeptide may comprise one or more polypeptide sequences encoded by the *S. pneumoniae* Polypeptides as identified herein. Accordingly, the compositions described herein may include a fusion peptide comprising a first amino acid sequence and a second amino acid sequence, wherein said first and second amino acid sequences are selected from a protein encoded by the *S. pneumoniae* pilus II island (INV104B) or a fragment thereof. In some embodiments, the first and second amino acid sequences in the fusion polypeptide comprise different epitopes.

[0270] In some embodiments, hybrids (or fusions) consisting of amino acid sequences from two, three, four, five, six, seven, eight, nine, or ten antigens encoded by the *S. pneumoniae* Polypeptide sequences discussed herein are preferred. In some embodiments, hybrids consisting of amino acid sequences from two, three, four, or five antigens encoded by the *S. pneumoniae* Polypeptide sequences discussed herein are preferred.

[0271] Different hybrid polypeptides may be mixed together in a single formulation. Within such combinations, a sequence encoded by the *S. pneumoniae* Polypeptide sequences discussed herein may be present in more than one hybrid polypeptide and/or as a non-hybrid polypeptide. In some embodiments, however, that an antigen is present either as a hybrid or as a non-hybrid, but not as both.

[0272] Hybrid polypeptides can be represented by the formula NH_2-A-{-X-L-}$_n$-B-COOH, wherein: X is an amino acid sequence of a *S. pneumoniae* Polypeptide as described herein or a fragment thereof; L is an optional linker amino acid sequence; A is an optional N-terminal amino acid sequence; B is an optional C-terminal amino acid sequence; and *n* is 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 or 15.

[0273] If a -X- moiety has a leader peptide sequence in its wild-type form, this may be included or omitted in the hybrid protein. In some embodiments, the leader peptides will be deleted except for that of the -X- moiety located at the N-terminus of the hybrid protein *i.e.* the leader peptide of X_1 will be retained, but the leader peptides of X_2 ... X_n will be omitted. This is equivalent to deleting all leader peptides and using the leader peptide of X_1 as moiety -A-.

[0274] For each *n* instances of {-X-L-}, linker amino acid sequence -L- may be present or absent. For instance, when *n*=2 the hybrid may be NH_2-X_1-L_1-X_2-L_2-COOH; NH_2-X_1-X_2-COOH; NH_2-X_1-L_1-X_2-COOH; NH_2-X_1-X_2-L_2-COOH; *etc.* Linker amino acid sequence(s) -L- will typically be short (*e.g.* 20 or fewer amino acids *i.e.* 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1). Examples comprise short peptide sequences that facilitate cloning,

poly-glycine linkers (*i.e.* comprising Gly_n where n = 2, 3, 4, 5, 6, 7, 8, 9, 10 or more). Other suitable linker amino acid sequences will be apparent to those skilled in the art. A useful linker is GSGGGG, with the Gly-Ser dipeptide being formed from a *Bam*HI restriction site, thus aiding cloning and manipulation, and the $(Gly)_4$ tetrapeptide being a typical poly-glycine linker.

[0275] In the hybrid polypeptide formula provided above, -A- is an optional N-terminal amino acid sequence. This will typically be short (*e.g.* 40 or fewer amino acids *i.e.* 39, 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1). Examples include leader sequences to direct protein trafficking, or short peptide sequences which facilitate cloning or purification. Other suitable N-terminal amino acid sequences will be apparent to those skilled in the art. If X_1 lacks its own N-terminus methionine, -A- is preferably an oligopeptide (*e.g.* with 1, 2, 3, 4, 5, 6, 7 or 8 amino acids) which provides a N-terminus methionine.

[0276] In the hybrid polypeptide formula provided above, -B- is an optional C-terminal amino acid sequence. This will typically be short (*e.g.* 40 or fewer amino acids *i.e.* 39, 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1). Examples include sequences to direct protein trafficking, short peptide sequences which facilitate cloning or purification, or sequences which enhance protein stability. Other suitable C-terminal amino acid sequences will be apparent to those skilled in the art.

[0277] In the hybrid polypeptide formula provided above, most preferably, n is 2 or 3.

Nucleic Acids

[0278] This description provides nucleic acids encoding the *S. pneumoniae* Polypeptide sequences and/or the hybrid fusion polypeptides. This description also provides nucleic acids encoding *S. pneumoniae* Polypeptide antigen, and/or the hybrid fusion polypeptides described herein. Furthermore, the description provides nucleic acids which can hybridize to these nucleic acids, preferably under "high stringency" conditions (*e.g.* 65 °C in a 0.1x SSC, 0.5% SDS solution).

[0279] The polypeptides described herein can be prepared by various means (*e.g.* recombinant expression, purification from cell culture, chemical synthesis, *etc.*) and in various forms (*e.g.* native, fusions, non-glycosylated, lipidated, *etc.*). They are preferably prepared in substantially pure form (*i.e.* substantially free from other host cell proteins).

[0280] The nucleic acids described herein can 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.*). They are preferably prepared in substantially pure form (*i.e.* substantially free from other host cell nucleic acids).

[0281] The terms "nucleic acid" and "nucleic acids," as used herein, include DNA and RNA, and also their analogs, such as those containing modified backbones (*e.g.*, phosphorothioates, *etc.*), and also peptide nucleic acids (PNA), *etc.* The compositions described herein include nucleic acids comprising sequences complementary to those described above (*e.g.*, for antisense or probing purposes).

[0282] This description also discloses a process for producing a polypeptide, comprising the step of culturing a host cell transformed with nucleic acid as described herein under conditions which induce polypeptide expression.

[0283] This description also discloses a process for producing a polypeptide, comprising the step of synthesizing at least part of the polypeptide by chemical means.

[0284] This description also discloses a process for producing nucleic acid, comprising the step of amplifying nucleic acid using a primer-based amplification method (*e.g.* PCR).

[0285] This description also discloses a process for producing nucleic acid, comprising the step of synthesizing at least part of the nucleic acid by chemical means.

Purification and Recombinant Expression

[0286] The *S. pneumoniae* Polypeptide sequences described herein may be isolated from native *S. pneumoniae*, or they may be recombinantly produced, for instance in a heterologous host. For example, the *S. pneumoniae* pilus II island (INV104B) antigens described herein may be isolated from *S. pneumoniae* containing the *S. pneumoniae* pilus II island (INV104B), or they may be recombinantly produced, for instance, in a heterologous host.

[0287] The heterologous host may be prokaryotic (*e.g.*, a bacterium) or eukaryotic. It is preferably *E. coli*, but other suitable hosts include *Bacillus subtilis, Vibrio cholerae, Salmonella typhi, Salmonella typhimurium, Neisseria lactamica, Neisseria cinerea, Mycobacteria (e.g. M. tuberculosis), S. gordonii, L. lactis*, yeasts, etc.

[0288] Recombinant production of polypeptides may be facilitated by adding a tag protein to the *S. pneumoniae* Polypeptide sequences as described herein to be expressed as a fusion protein comprising the tag protein and the polypeptide. For example, recombinant production of polypeptides is facilitated by adding a tag protein to the *S. pneumoniae* pilus II island (INV104B) pilus antigen to be expressed as a fusion protein comprising the tag protein and the *S. pneumoniae* pilus II island (INV104B) pilus antigen. Such tag proteins can facilitate purification, detection and stability of the expressed protein. Tag proteins suitable for use with the compositions described herein include a polyarginine tag (Arg-tag), FLAG-tag, Strep-tag, c-myc-tag, S-tag, calmodulin-binding peptide, cellulose-binding domain, SBP-tag,, chitin-binding domain, glutathione S-transferase-tag (GST), maltose-binding protein, transcription termination anti-termination factor (NusA), *E. coli* thioredoxin (TrxA) and protein disulfide isomerase I

(DsbA). Preferred tag proteins include GST. A full discussion on the use of tag proteins can be found at Terpe et al., "Overview of tag protein fusions: from molecular and biochemical fundamentals to commercial systems," Appl. Microbiol. Biotechnol. (2003) 60:523-533.

[0289] After purification, the tag proteins may optionally be removed from the expressed fusion protein, *i.e.*, by specifically tailored enzymatic treatments known in the art. Commonly used proteases include enterokinase, tobacco etch virus (TEV), thrombin, and factor X_a.

Immunogenic compositions and medicaments

[0290] The compositions described herein are preferably immunogenic compositions, and are more preferably vaccine compositions. In some embodiments, the pH of the composition is between 6 and 8, preferably about 7. The pH may be maintained by the use of a buffer. The composition may be sterile and/or pyrogen-free. The composition may be isotonic with respect to humans.

[0291] Vaccines as described herein may either be prophylactic (*i.e.* to prevent infection) or therapeutic (*i.e.* to treat infection), but will typically be prophylactic. Accordingly, methods are described for the therapeutic or prophylactic treatment of a *S. pneumoniae* infection in an animal susceptible to such *S. pneumoniae* infection comprising administering to said animal a therapeutic or prophylactic amount of the immunogenic composition described herein. For example, methods are described for the therapeutic or prophylactic treatment of a *S. pneumoniae* infection in an animal susceptible to streptococcal infection comprising administering to said animal a therapeutic or prophylactic amount of the immunogenic compositions described herein.

[0292] The compositions described herein can also be used as a medicament. In some embodiments, the medicament is preferably able to raise an immune response in a mammal (*i.e.* it is an immunogenic composition) and is, in some embodiments, a vaccine. The compositions described herein can also be used in the manufacture of a medicament for raising an immune response in a mammal. In some embodiments, the medicament is a vaccine.

[0293] The compositions described herein can also be use in kits containing one or more containers of the compositions. Such compositions can be in liquid form or can be lyophilized, as can individual antigens. Suitable containers for the compositions include, for example, bottles, vials, syringes, and test tubes. Containers can be formed from a variety of materials, including glass or plastic. A container may have a sterile access port (for example, the container may be an intravenous solution bag or a vial having a stopper pierceable by a hypodermic injection needle). Such compositions may comprise a first component comprising one or more *S. pneumoniae* Pili Polypeptides. Preferably, the *S. pneumoniae* Pili Polypeptides are in an oligomeric or hyperoligomeric form.

[0294] The kit can further contain a second container comprising a pharmaceutically-acceptable buffer, such as phosphate-buffered saline, Ringer's solution, or dextrose solution. It can also contain other materials useful to the end-user, including other buffers, diluents, filters, needles, and syringes. The kit can also contain a second or third container with another active agent, for example an antibiotic.

[0295] The kit can also contain a package insert containing written instructions for methods of inducing immunity against *S. pneumoniae* or for treating *S. pneumoniae* infections. The package insert can be an unapproved draft package insert or can be a package insert approved by the Food and Drug Administration (FDA) or other regulatory body.

[0296] A delivery device pre-filled with the immunogenic compositions described herein can also be used.

[0297] A method for inducing an immune response in a mammal can include the step of administering an effective amount of a composition as described herein. In some embodiments, the immune response is protective and preferably involves antibodies and/or cell-mediated immunity. This immune response will, in some embodiments, induce long lasting (*e.g.*, neutralizing) antibodies and a cell mediated immunity that can quickly respond upon exposure to one or more *S. pneumoniae* antigens. In some embodiments, the method raise a booster response.

[0298] Methods of neutralizing *S. pneumoniae* infection in a mammal can include administering to the mammal an effective amount of the immunogenic compositions as described herein, a vaccine as described herein, or antibodies which recognize an immunogenic composition as described herein.

[0299] In some embodiments, the mammal is a human. Where the vaccine is for prophylactic use, the human can be a male or a female (either of child bearing age or a teenager). Alternatively, the human may be elderly (*e.g.*, over the age of 50, 55, 60, 65, 70, 75, 80, or 85) and may have an underlying disease such as diabetes or cancer. In some embodiments, where the vaccine is for therapeutic use, the human can be a pregnant female or an elderly adult.

[0300] In some embodiments, the uses and methods described herein are for the prevention and/or treatment of a disease caused by *S. pneumoniae*. The compositions may also be effective against other streptococcal bacteria. The compositions may also be effective against other Gram positive bacteria.

[0301] Some methods of checking efficacy of therapeutic treatment involves monitoring *S. pneumoniae* bacterial infection after administration of a composition as described herein. A non-limiting means of checking efficacy of prophylactic treatment involves monitoring immune

responses against the *S. pneumoniae* antigens in the compositions described herein after administration of the composition.

[0302] A non-limiting means of assessing the immunogenicity of the component proteins of the immunogenic compositions described herien is to express the proteins recombinantly and to screen patient sera or mucosal secretions by immunoblot. A positive reaction between the protein and the patient serum indicates that the patient has previously mounted an immune response to the protein in question—that is, the protein is an immunogen. This method may also be used to identify immunodominant proteins and/or epitopes.

[0303] Another means of checking efficacy of therapeutic treatment involves monitoring *S. pneumoniae* infection after administration of the compositions described herein. One way of checking efficacy of prophylactic treatment involves monitoring immune responses both systemically (such as monitoring the level of IgG1 and IgG2a production) and mucosally (such as monitoring the level of IgA production) against the *S. pneumoniae* antigens in the compositions described herein after administration of the composition. Typically, *S. pneumoniae* serum specific antibody responses are determined post-immunization, but pre-challenge, whereas mucosal *S. pneumoniae* specific antibody body responses are determined post-immunization and post-challenge.

[0304] The vaccine compositions described herein can, in some embodiments, be evaluated in *in vitro* and *in vivo* animal models prior to host, *e.g.,* human, administration.

[0305] The efficacy of immunogenic compositions described herein can also be determined *in vivo* by challenging animal models of *S. pneumoniae* infection, *e.g.*, guinea pigs or mice, with the immunogenic compositions. The immunogenic compositions may or may not be derived from the same serotypes as the challenge serotypes. In some embodiments, the immunogenic compositions are derivable from the same serotypes as the challenge serotypes. In some embodiments, the immunogenic composition and/or the challenge serotypes are derivable from the group of *S. pneumoniae* serotypes.

[0306] *In vivo* efficacy models include but are not limited to: (i) a murine infection model using human *S. pneumoniae* serotypes; (ii) a murine disease model which is a murine model using a mouse-adapted *S. pneumoniae* strain, such as those strains which are particularly virulent in mice and (iii) a primate model using human *S. pneumoniae* isolates.

[0307] The immune response may be one or both of a TH1 immune response and a TH2 response. The immune response may be an improved or an enhanced or an altered immune response. The immune response may be one or both of a systemic and a mucosal immune response. In some embodiments the immune response is an enhanced system and/or mucosal

response. An enhanced systemic and/or mucosal immunity is reflected in an enhanced TH1 and/or TH2 immune response. In some embodiments, the enhanced immune response includes an increase in the production of IgG1 and/or IgG2a and/or IgA. In some embodiments, the mucosal immune response is a TH2 immune response. In some embodiments, the mucosal immune response includes an increase in the production of IgA.

[0308] Activated TH2 cells enhance antibody production and are therefore of value in responding to extracellular infections. Activated TH2 cells may secrete one or more of IL-4, IL-5, IL-6, and IL-10. A TH2 immune response may result in the production of IgG1, IgE, IgA and memory B cells for future protection.

[0309] A TH2 immune response may include one or more of an increase in one or more of the cytokines associated with a TH2 immune response (such as IL-4, IL-5, IL-6 and IL-10), or an increase in the production of IgG1, IgE, IgA and memory B cells. In some embodiments, the enhanced TH2 immune response will include an increase in IgG1 production.

[0310] A TH1 immune response may include one or more of an increase in CTLs, an increase in one or more of the cytokines associated with a TH1 immune response (such as IL-2, IFNγ, and TNFβ), an increase in activated macrophages, an increase in NK activity, or an increase in the production of IgG2a. In some embodiments, the enhanced TH1 immune response will include an increase in IgG2a production.

[0311] The immunogenic compositions described herein, in particular, immunogenic compositions comprising one or more *S. pneumoniae* Polypeptide antigen, may be used either alone or in combination with other antigens optionally with an immunoregulatory agent capable of eliciting a Th1 and/or Th2 response.

[0312] The compositions described herein will generally be administered directly to a patient. Certain routes may be favored for certain compositions, as resulting in the generation of a more effective immune response, in some embodiments, a CMI response, or as being less likely to induce side effects, or as being easier for administration. Direct delivery may be accomplished by parenteral injection (*e.g.* subcutaneously, intraperitoneally, intradermally, intravenously, intramuscularly, or to the interstitial space of a tissue), or by rectal, oral (*e.g.* tablet, spray), vaginal, topical, transdermal (*see, e.g.*, WO 99/27961) or transcutaneous (*see, e.g.*, WO 02/074244 and WO 02/064162), intranasal (*see, e.g.*, WO03/028760), ocular, aural, pulmonary or other mucosal administration.

[0313] The compositions described herein may be used to elicit systemic and/or mucosal immunity.

[0314] In some embodiments, the immunogenic composition comprises one or more *S. pneumoniae* Polypeptide antigen(s) which elicits a neutralizing antibody response and one or more *S. pneumoniae* Polypeptide antigen(s) which elicits a cell mediated immune response. In this way, the neutralizing antibody response prevents or inhibits an initial *S. pneumoniae* infection while the cell-mediated immune response capable of eliciting an enhanced Th1 cellular response prevents further spreading of the *S. pneumoniae* infection. The immunogenic composition may include one or more *S. pneumoniae* Polypeptide antigens; one or more *S. pneumoniae* pilus or other *S. pneumoniae* antigens; and one or more non-pilus *S. pneumoniae* antigens, *e.g.*, cytoplasmic antigens. In some embodiments, the immunogenic composition comprises one or more *S. pneumoniae* surface antigens or the like and one or other antigens, such as a cytoplasmic antigen capable of eliciting a Th1 cellular response.

[0315] Dosage treatment can be a single dose schedule or a multiple dose schedule. Multiple doses may be used in a primary immunization schedule and/or in a booster immunization schedule. In a multiple dose schedule the various doses may be given by the same or different routes *e.g.* a parenteral prime and mucosal boost, a mucosal prime and parenteral boost, *etc.*

[0316] The compositions described herein may be prepared in various forms. For example, the compositions may be prepared as injectables, either as liquid solutions or suspensions. Solid forms suitable for solution in, or suspension in, liquid vehicles prior to injection can also be prepared (*e.g.* a lyophilized composition). The composition may be prepared for topical administration *e.g.* as an ointment, cream or powder. The composition may be prepared for oral administration *e.g.* as a tablet or capsule, as a spray, or as a syrup (optionally flavored). The composition may be prepared for pulmonary administration *e.g.* as an inhaler, using a fine powder or a spray. The composition may be prepared as a suppository or pessary. The composition may be prepared for nasal, aural or ocular administration *e.g.* as drops. The composition may be in kit form, designed such that a combined composition is reconstituted just prior to administration to a patient. Such kits may comprise one or more antigens in liquid form and one or more lyophilized antigens.

[0317] Immunogenic compositions used as vaccines comprise an immunologically effective amount of antigen(s), as well as any other components, such as antibiotics, 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, or increases a measurable immune response or prevents or reduces a clinical symptom. This amount varies depending upon the health and physical condition of the individual to be treated, age, the taxonomic group of individual to be treated (*e.g.* non-human 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.

Further Components of the Composition

[0318] The compositions described herein can, in addition to the components mentioned above, comprise one or more '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, and lipid aggregates (such as oil droplets or liposomes). Such carriers are well known to those of ordinary skill in the art. The vaccines may also contain diluents, such as water, saline, glycerol, *etc.* Additionally, auxiliary substances, such as wetting or emulsifying agents, pH buffering substances, and the like, may be present. A thorough discussion of pharmaceutically acceptable excipients is available in Gennaro (2000) *Remington: The Science and Practice of Pharmacy.* 20th ed., ISBN: 0683306472.

Adjuvants

[0319] Vaccines as described herein may be administered in conjunction with other immunoregulatory agents. In some embodiments, compositions further comprise one or more adjuvants. Adjuvants for use with the vaccines described herein include, but are not limited to, one or more of the following set forth below:

Mineral Containing Compositions

[0320] Mineral containing compositions suitable for use as adjuvants with the compositions disclosed herein include mineral salts, such as aluminum salts and calcium salts. Including mineral salts such as hydroxides (*e.g.* oxyhydroxides), phosphates (*e.g.* hydroxyphosphates, orthophosphates), sulfates, *etc.* (*see, e.g.*, chapters 8 & 9 of *Vaccine Design...* (1995) eds. Powell & Newman. ISBN: 030644867X. Plenum.), or mixtures of different mineral compounds (*e.g.* a mixture of a phosphate and a hydroxide adjuvant, optionally with an excess of the phosphate), with the compounds taking any suitable form (*e.g.* gel, crystalline, amorphous, *etc.*), and with adsorption to the salt(s) being preferred. The mineral containing compositions may also be formulated as a particle of metal salt (WO 00/23105).

[0321] Aluminum salts may be included in vaccines described herein such that the dose of Al^{3+} is between 0.2 and 1.0 mg per dose.

Oil-Emulsions

[0322] Oil-emulsion compositions suitable for use as adjuvants with the compositions described herein include squalene-water emulsions, such as MF59 (5% Squalene, 0.5% Tween

80, and 0.5% Span 85, formulated into submicron particles using a microfluidizer). *See* WO90/14837. *See also*, Podda, "The adjuvanted influenza vaccines with novel adjuvants: experience with the MF59-adjuvanted vaccine", Vaccine (2001) 19: 2673-2680; Frey et al., "Comparison of the safety, tolerability, and immunogenicity of a MF59-adjuvanted influenza vaccine and a non-adjuvanted influenza vaccine in non-elderly adults", Vaccine (2003) 21:4234-4237. MF59 is used as the adjuvant in the FLUAD™ influenza virus trivalent subunit vaccine.

[0323] In some embodiments adjuvants for use in the compositions are submicron oil-in-water emulsions. Preferred submicron oil-in-water emulsions for use herein are squalene/water emulsions optionally containing varying amounts of MTP-PE, such as a submicron oil-in-water emulsion containing 4-5% w/v squalene, 0.25-1.0% w/v Tween 80 ™ (polyoxyelthylenesorbitan monooleate), and/or 0.25-1.0% Span 85™ (sorbitan trioleate), and, optionally, N-acetylmuramyl-L-alanyl-D-isogluatminyl-L-alanine-2-(1'-2'-dipalmitoyl-*sn*-glycero-3-huydroxyphosphophoryloxy)-ethylamine (MTP-PE), for example, the submicron oil-in-water emulsion known as "MF59" (International Publication No. WO 90/14837; U.S. Patent Nos. 6,299,884 and 6,451,325, incorporated herein by reference in their entireties; and Ott et al., "MF59 -- Design and Evaluation of a Safe and Potent Adjuvant for Human Vaccines" in *Vaccine Design: The Subunit and Adjuvant Approach* (Powell, M.F. and Newman, M.J. eds.) Plenum Press, New York, 1995, pp. 277-296). MF59 contains 4-5% w/v Squalene (*e.g.* 4.3%), 0.25-0.5% w/v Tween 80™, and 0.5% w/v Span 85™ and optionally contains various amounts of MTP-PE, formulated into submicron particles using a microfluidizer such as Model 110Y microfluidizer (Microfluidics, Newton, MA). For example, MTP-PE may be present in an amount of about 0-500 μg/dose, more preferably 0-250 μg/dose and most preferably, 0-100 μg/dose. As used herein, the term "MF59-0" refers to the above submicron oil-in-water emulsion lacking MTP-PE, while the term MF59-MTP denotes a formulation that contains MTP-PE. For instance, "MF59-100" contains 100 μg MTP-PE per dose, and so on. MF69, another submicron oil-in-water emulsion for use herein, contains 4.3% w/v squalene, 0.25% w/v Tween 80™, and 0.75% w/v Span 85™ and optionally MTP-PE. Yet another submicron oil-in-water emulsion is MF75, also known as SAF, containing 10% squalene, 0.4% Tween 80™, 5% pluronic-blocked polymer L121, and thr-MDP, also microfluidized into a submicron emulsion. MF75-MTP denotes an MF75 formulation that includes MTP, such as from 100-400 μg MTP-PE per dose.

[0324] Submicron oil-in-water emulsions, methods of making the same and immunostimulating agents, such as muramyl peptides, for use in the compositions, are described

in detail in International Publication No. WO 90/14837 and U.S. Patent Nos. 6,299,884 and 6,451,325, incorporated herein by reference in their entireties.

[0325] Complete Freund's adjuvant (CFA) and incomplete Freund's adjuvant (IFA) may also be used as adjuvants with the compositions disclosed herein.

Saponin Formulations

[0326] Saponin formulations, may also be used as adjuvants with the compositions disclosed herein. Saponins are a heterologous group of sterol glycosides and triterpenoid glycosides that are found in the bark, leaves, stems, roots and even flowers of a wide range of plant species. Saponin from the bark of the *Quillaia saponaria* Molina tree have been widely studied as adjuvants. Saponin can also be commercially obtained from *Smilax ornata* (sarsaprilla), *Gypsophilla paniculata* (brides veil), and *Saponaria officianalis* (soap root). Saponin adjuvant formulations include purified formulations, such as QS21, as well as lipid formulations, such as ISCOMs.

[0327] Saponin compositions have been purified using High Performance Thin Layer Chromatography (HP-TLC) and Reversed Phase High Performance Liquid Chromatography (RP-HPLC). Specific purified fractions using these techniques have been identified, including QS7, QS17, QS18, QS21, QH-A, QH-B and QH-C. Preferably, the saponin is QS21. A method of production of QS21 is disclosed in U.S. Patent No. 5,057,540. Saponin formulations may also comprise a sterol, such as cholesterol (*see* WO96/33739).

[0328] Combinations of saponins and cholesterols can be used to form unique particles called Immunostimulating Complexs (ISCOMs). ISCOMs typically also include a phospholipid such as phosphatidylethanolamine or phosphatidylcholine. Any known saponin can be used in ISCOMs. Preferably, the ISCOM includes one or more of Quil A, QHA and QHC. ISCOMs are further described in EP0109942, WO 96/11711 and WO 96/33739. Optionally, the ISCOMS may be devoid of additional detergent. *See* WO 00/07621.

[0329] A review of the development of saponin based adjuvants can be found at Barr, et al., "ISCOMs and other saponin based adjuvants", Advanced Drug Delivery Reviews (1998) 32:247-271. *See also* Sjolander, et al., "Uptake and adjuvant activity of orally delivered saponin and ISCOM vaccines", Advanced Drug Delivery Reviews (1998) 32:321-338.

Virosomes and Virus Like Particles (VLPs)

[0330] Virosomes and Virus Like Particles (VLPs) can also be used as adjuvants with the compositions disclosed herein. These structures generally contain one or more proteins from a virus optionally combined or formulated with a phospholipid. They are generally non-pathogenic and non-replicating, and generally do not contain any of the native viral genome. The viral proteins may be recombinantly produced or isolated from whole viruses. These viral

proteins suitable for use in virosomes or VLPs include proteins derived from influenza virus (such as HA or NA), Hepatitis B virus (such as core or capsid proteins), Hepatitis E virus, measles virus, Sindbis virus, Rotavirus, Foot-and-Mouth Disease virus, Retrovirus, Norwalk virus, human Papilloma virus, HIV, RNA-phages, Qß-phage (such as coat proteins), GA-phage, fr-phage, AP205 phage, and Ty (such as retrotransposon Ty protein p1). VLPs are discussed further in WO 03/024480, WO 03/024481, and Niikura et al., "Chimeric Recombinant Hepatitis E Virus-Like Particles as an Oral Vaccine Vehicle Presenting Foreign Epitopes", Virology (2002) 293:273-280; Lenz et al., "Papillomarivurs-Like Particles Induce Acute Activation of Dendritic Cells", Journal of Immunology (2001) 5246-5355; Pinto, et al., "Cellular Immune Responses to Human Papillomavirus (HPV)-16 L1 Healthy Volunteers Immunized with Recombinant HPV-16 L1 Virus-Like Particles", Journal of Infectious Diseases (2003) 188:327-338; and Gerber et al., "Human Papillomavirus Virus-Like Particles Are Efficient Oral Immunogens when Coadministered with Escherichia coli Heat-Labile Enterotoxin Mutant R192G or CpG", Journal of Virology (2001) 75(10):4752-4760. Virosomes are discussed further in, for example, Gluck et al., "New Technology Platforms in the Development of Vaccines for the Future", Vaccine (2002) 20:B10 –B16. Immunopotentiating reconstituted influenza virosomes (IRIV) are used as the subunit antigen delivery system in the intranasal trivalent INFLEXAL™ product {Mischler & Metcalfe (2002) *Vaccine* 20 Suppl 5:B17-23} and the INFLUVAC PLUS™ product.

Bacterial or Microbial Derivatives

[0331] Adjuvants suitable for use with the compositions described herein include bacterial or microbial derivatives such as:

(a) Non-toxic derivatives of enterobacterial lipopolysaccharide (LPS)

[0332] Such derivatives include Monophosphoryl lipid A (MPL) and 3-O-deacylated MPL (3dMPL). 3dMPL is a mixture of 3 De-O-acylated monophosphoryl lipid A with 4, 5 or 6 acylated chains. A preferred "small particle" form of 3 De-O-acylated monophosphoryl lipid A is disclosed in EP 0 689 454. Such "small particles" of 3dMPL are small enough to be sterile filtered through a 0.22 micron membrane (*see* EP 0 689 454). Other non-toxic LPS derivatives include monophosphoryl lipid A mimics, such as aminoalkyl glucosaminide phosphate derivatives *e.g.* RC-529. *See* Johnson *et al.* (1999) *Bioorg Med Chem Lett* 9:2273-2278.

(b) Lipid A Derivatives

[0333] Lipid A derivatives include derivatives of lipid A from *Escherichia coli* such as OM-174. OM-174 is described for example in Meraldi et al., "OM-174, a New Adjuvant with a Potential for Human Use, Induces a Protective Response with Administered with the Synthetic C-Terminal Fragment 242-310 from the circumsporozoite protein of Plasmodium berghei",

Vaccine (2003) 21:2485-2491; and Pajak, et al., "The Adjuvant OM-174 induces both the migration and maturation of murine dendritic cells *in vivo*", Vaccine (2003) 21:836-842.

(c) Immunostimulatory oligonucleotides

[0334] Immunostimulatory oligonucleotides suitable for use as adjuvants with the compositions described herein include nucleotide sequences containing a CpG motif (a sequence containing an unmethylated cytosine followed by guanosine and linked by a phosphate bond). Bacterial double stranded RNA or oligonucleotides containing palindromic or poly(dG) sequences have also been shown to be immunostimulatory.

[0335] The CpG's can include nucleotide modifications/analogs such as phosphorothioate modifications and can be double-stranded or single-stranded. Optionally, the guanosine may be replaced with an analog such as 2'-deoxy-7-deazaguanosine. *See* Kandimalla, et al., "Divergent synthetic nucleotide motif recognition pattern: design and development of potent immunomodulatory oligodeoxyribonucleotide agents with distinct cytokine induction profiles", Nucleic Acids Research (2003) 31(9): 2393-2400; WO02/26757 and WO99/62923 for examples of possible analog substitutions. The adjuvant effect of CpG oligonucleotides is further discussed in Krieg, "CpG motifs: the active ingredient in bacterial extracts?", Nature Medicine (2003) 9(7): 831-835; McCluskie, et al., "Parenteral and mucosal prime-boost immunization strategies in mice with hepatitis B surface antigen and CpG DNA", FEMS Immunology and Medical Microbiology (2002) 32:179-185; WO98/40100; U.S. Patent No. 6,207,646; U.S. Patent No. 6,239,116 and U.S. Patent No. 6,429,199.

[0336] The CpG sequence may be directed to TLR9, such as the motif GTCGTT (SEQ ID NO:22) or TTCGTT (SEQ ID NO:23). *See* Kandimalla, et al., "Toll-like receptor 9: modulation of recognition and cytokine induction by novel synthetic CpG DNAs," Biochemical Society Transactions (2003) 31 (part 3): 654-658. The CpG sequence may be specific for inducing a Th1 immune response, such as a CpG-A ODN, or it may be more specific for inducing a B cell response, such a CpG-B ODN. CpG-A and CpG-B ODNs are discussed in Blackwell, et al., "CpG-A-Induced Monocyte IFN-gamma-Inducible Protein-10 Production is Regulated by Plasmacytoid Dendritic Cell Derived IFN-alpha", J. Immunol. (2003) 170(8):4061-4068; Krieg, "From A to Z on CpG", TRENDS in Immunology (2002) 23(2): 64-65 and WO01/95935. Preferably, the CpG is a CpG-A ODN.

[0337] In some embodiments, the CpG oligonucleotide is constructed so that the 5' end is accessible for receptor recognition. Optionally, two CpG oligonucleotide sequences may be attached at their 3' ends to form "immunomers". *See, e.g.*, Kandimalla, et al., "Secondary structures in CpG oligonucleotides affect immunostimulatory activity", BBRC (2003) 306:948-953; Kandimalla, et al., "Toll-like receptor 9: modulation of recognition and cytokine induction

by novel synthetic GpG DNAs", Biochemical Society Transactions (2003) 31(part 3):664-658; Bhagat et al., "CpG penta- and hexadeoxyribonucleotides as potent immunomodulatory agents" BBRC (2003) 300:853-861 and WO 03/035836.

(d) ADP-ribosylating toxins and detoxified derivatives thereof.

[0338] Bacterial ADP-ribosylating toxins and detoxified derivatives thereof may be used as adjuvants with the compositions described herein. In some embodiments, the protein is derived from *E. coli* (*i.e.*, E. coli heat labile enterotoxin "LT), cholera ("CT"), or pertussis ("PT"). The use of detoxified ADP-ribosylating toxins as mucosal adjuvants is described in WO95/17211 and as parenteral adjuvants in WO98/42375. In some embodiments, the adjuvant is a detoxified LT mutant such as LT-K63, LT-R72, and LTR192G. The use of ADP-ribosylating toxins and detoxified derivatives thereof, particularly LT-K63 and LT-R72, as adjuvants can be found in the following references, each of which is specifically incorporated by reference herein in their entirety: Beignon, et al., "The LTR72 Mutant of Heat-Labile Enterotoxin of *Escherichia coli* Enhances the Ability of Peptide Antigens to Elicit CD4+ T Cells and Secrete Gamma Interferon after Coapplication onto Bare Skin," Infection and Immunity (2002) 70(6):3012-3019; Pizza, et al., "Mucosal vaccines: non toxic derivatives of LT and CT as mucosal adjuvants," Vaccine (2001) 19:2534-2541; Pizza, et al., "LTK63 and LTR72, two mucosal adjuvants ready for clinical trials," Int. J. Med. Microbiol (2000) 290(4-5):455-461; Scharton-Kersten et al., "Transcutaneous Immunization with Bacterial ADP-Ribosylating Exotoxins, Subunits and Unrelated Adjuvants," Infection and Immunity (2000) 68(9):5306-5313; Ryan et al., "Mutants of Escherichia coli Heat-Labile Toxin Act as Effective Mucosal Adjuvants for Nasal Delivery of an Acellular Pertussis Vaccine: Differential Effects of the Nontoxic AB Complex and Enzyme Activity on Th1 and Th2 Cells," Infection and Immunity (1999) 67(12):6270-6280; Partidos et al., "Heat-labile enterotoxin of Escherichia coli and its site-directed mutant LTK63 enhance the proliferative and cytotoxic T-cell responses to intranasally co-immunized synthetic peptides," Immunol. Lett. (1999) 67(3):209-216; Peppoloni et al., "Mutants of the Escherichia coli heat-labile enterotoxin as safe and strong adjuvants for intranasal delivery of vaccines," Vaccines (2003) 2(2):285-293; and Pine et al., (2002) "Intranasal immunization with influenza vaccine and a detoxified mutant of heat labile enterotoxin from Escherichia coli (LTK63)," J. Control Release (2002) 85(1-3):263-270. Numerical reference for amino acid substitutions is preferably based on the alignments of the A and B subunits of ADP-ribosylating toxins set forth in Domenighini et al., Mol. Microbiol (1995) 15(6):1165-1167, specifically incorporated herein by reference in its entirety.

Bioadhesives and Mucoadhesives

[0339] Bioadhesives and mucoadhesives may also be used as adjuvants with the compositions described herein. Suitable bioadhesives include esterified hyaluronic acid microspheres (Singh *et al.* (2001) *J. Cont. Rele.* 70:267-276) or mucoadhesives such as cross-linked derivatives of poly(acrylic acid), polyvinyl alcohol, polyvinyl pyrollidone, polysaccharides and carboxymethylcellulose. Chitosan and derivatives thereof may also be used as adjuvants with the compositions described herein. *See, e.g.*, WO 99/27960.

Microparticles

[0340] Microparticles may also be used as adjuvants with the compositions described herein. Microparticles (*i.e.* a particle of ~100nm to ~150μm in diameter, more preferably ~200nm to ~30μm in diameter, and most preferably ~500nm to ~10μm in diameter) formed from materials that are biodegradable and non-toxic (*e.g.* a poly(α-hydroxy acid), a polyhydroxybutyric acid, a polyorthoester, a polyanhydride, a polycaprolactone, etc.), with poly(lactide co glycolide) are preferred, optionally treated to have a negatively-charged surface (*e.g.* with SDS) or a positively-charged surface (*e.g.* with a cationic detergent, such as CTAB).

Liposomes

[0341] Examples of liposome formulations suitable for use as adjuvants are described in U.S. Patent No. 6,090,406, U.S. Patent No. 5,916,588, and EP 0 626 169.

Polyoxyethylene ether and Polyoxyethylene Ester Formulations

[0342] Adjuvants suitable for use with the compositions described herein include polyoxyethylene ethers and polyoxyethylene esters. *See* WO99/52549. Such formulations further include polyoxyethylene sorbitan ester surfactants in combination with an octoxynol (WO01/21207) as well as polyoxyethylene alkyl ethers or ester surfactants in combination with at least one additional non-ionic surfactant such as an octoxynol (WO 01/21152).

[0343] In some embodiments polyoxyethylene ethers are selected from the following group: polyoxyethylene-9-lauryl ether (laureth 9), polyoxyethylene-9-steoryl ether, polyoxytheylene-8-steoryl ether, polyoxyethylene-4-lauryl ether, polyoxyethylene-35-lauryl ether, and polyoxyethylene-23-lauryl ether.

Polyphosphazene (PCPP)

[0344] PCPP formulations are described, for example, in Andrianov et al., "Preparation of hydrogel microspheres by coacervation of aqueous polyphophazene solutions", Biomaterials (1998) 19(1-3):109-115 and Payne et al., "Protein Release from Polyphosphazene Matrices", Adv. Drug. Delivery Review (1998) 31(3):185-196.

Muramyl peptides

[0345] Examples of muramyl peptides suitable for use as adjuvants with the compositions described herein include N-acetyl-muramyl-L-threonyl-D-isoglutamine (thr-MDP), N-acetyl-normuramyl-l-alanyl-d-isoglutamine (nor-MDP), and N-acetylmuramyl-l-alanyl-d-

isoglutaminyl-l-alanine-2-(1'-2'-dipalmitoyl-sn-glycero-3-hydroxyphosphoryloxy)-ethylamine MTP-PE).

Imidazoquinolone Compounds.

[0346] Examples of imidazoquinolone compounds suitable for use adjuvants with the compositions described herein include Imiquamod and its homologues, described further in Stanley, "Imiquimod and the imidazoquinolones: mechanism of action and therapeutic potential," Clin Exp Dermatol (2002) 27(7):571-577 and Jones, "Resiquimod 3M," Curr Opin Investig Drugs (2003) 4(2):214-218.

[0347] The compositions described herein may also include combinations of the adjuvants identified above. For example, the following adjuvant compositions may be used with the compositions described herein:

[0348] (1) a saponin and an oil-in-water emulsion (WO 99/11241);

[0349] (2) a saponin (*e.g.*., QS21) + a non-toxic LPS derivative (*e.g.* 3dMPL) (*see* WO 94/00153);

[0350] (3) a saponin (*e.g.*., QS21) + a non-toxic LPS derivative (*e.g.* 3dMPL) + a cholesterol;

[0351] (4) a saponin (*e.g.* QS21) + 3dMPL + IL-12 (optionally + a sterol) (WO 98/57659);

[0352] (5) combinations of 3dMPL with, for example, QS21 and/or oil-in-water emulsions (*See* European patent applications 0835318, 0735898 and 0761231);

[0353] (6) SAF, containing 10% Squalane, 0.4% Tween 80, 5% pluronic-block polymer L121, and thr-MDP, either microfluidized into a submicron emulsion or vortexed to generate a larger particle size emulsion;

[0354] (7) Ribi™ adjuvant system (RAS), (Ribi Immunochem) containing 2% Squalene, 0.2% Tween 80, and one or more bacterial cell wall components from the group consisting of monophosphorylipid A (MPL), trehalose dimycolate (TDM), and cell wall skeleton (CWS), preferably MPL + CWS (Detox™);

[0355] (8) one or more mineral salts (such as an aluminum salt) + a non-toxic derivative of LPS (such as 3dPML).

[0356] (9) one or more mineral salts (such as an aluminum salt) + an immunostimulatory oligonucleotide (such as a nucleotide sequence including a CpG motif). Combination No. (9) is a preferred adjuvant combination.

Human Immunomodulators

[0357] Human immunomodulators suitable for use as adjuvants with the compositions described herein include cytokines, such as interleukins (*e.g.* IL-1, IL-2, IL-4, IL-5, IL-6, IL-7,

IL-12, *etc.*), interferons (*e.g.* interferon-γ), macrophage colony stimulating factor, and tumor necrosis factor.

[0358] Aluminum salts and MF59 are preferred adjuvants for use with injectable influenza vaccines. Bacterial toxins and bioadhesives are preferred adjuvants for use with mucosally-delivered vaccines, such as nasal vaccines.

[0359] The immunogenic compositions described herein may be administered in combination with an antibiotic treatment regime. In some embodiments, the antibiotic is administered prior to administration of the antigen as described herein or the composition comprising the one or more of the antigens as described herein.

[0360] In some embodiments, the antibiotic is administered subsequent to the administration of the one or more antigens as described herein or the composition comprising the one or more antigens as described herein. Examples of antibiotics suitable for use in the treatment streptococcal infections include but are not limited to penicillin or a derivative thereof or clindamycin or the like.

[0361] Each of the patents, patent applications, accession numbers and publications described herein is hereby incorporated by reference in its entirety.

Various modifications of the invention, in addition to those described herein, will be apparent to those of skill in the art in view of the foregoing description. Such modifications are also intended to fall within the scope of the appended embodiments. The present invention is further demonstrated in the following examples that are for purposes of illustration and are not intended to limit the scope of the present invention.

EXAMPLES

Materials and Methods

S. pneumoniae Chromosomal DNA Extraction

[0362] The *S. pneumoniae* strains listed in Table 1 were grown in 200 mL liquid culture (THYE medium) until the OD600 reached between 0.25 to 0.5. Next, the samples were centrifuged at 6000 RPM for 15-20 minutes (some pellets were stored at this point at -20°C). The pellets were then resuspended with 2.7 mL (for a 3mL final volume) of 50 mM EDTA at pH 8.0 and transferred to a 15 mL Falcon™ tube (BD Biosciences; Bedford, MA). 0.55 mL of freshly prepared Lysozyme (12 mg/mL Sigma L-6876 in 50 mM EDTA pH 8.0 (Sigma-Aldrich Co.; St. Louis, MO)) and 50 µL of 5000 U/mL Mutanolysin (Sigma M-9901) in water were then sequentially added to the Falcon tube. These samples were incubated for one hour at 37°C.

[0363] After incubation, 3.6 mL of Nuclei Lysis Solution (Wizard® Genomic DNA Purification Kit (Promega Corp.; Madison, WI)) was added and the samples were mixed by inversion six-times. The samples were then incubated for 5 minutes at 80°C, then cooled to room temperature. Next 18 μL of RNase solution (Wizard® Genomic DNA Purification Kit) was added and the samples were mixed by inversion ten-times. The samples were then incubated for thirty minutes at 37°C.

[0364] Each sample was then divided into six 1.2 mL Eppendorf tubes. To each Eppendorf tube was added 0.2 mL of Protein Precipitation Solution (Wizard® Genomic DNA Purification Kit) and mixed by inversion ten-times. Immediately after the tenth inversion, the samples were centrifuged at room temperature in an Eppendorf centrifuge for three minutes at full speed. The supernatants from the Eppendorf tubes were then pooled into a 15 mL Falcon tube (about 8 mL was typically recovered). Next 0.6 vol. of isopropanol was added and the samples were mixed by inversion ten-times.

[0365] Precipitated DNA was recovered by inserting a Pasteur pipet that had been heat sealed and bent in a flame into the Falcon tube and hooking the pellet. The precipitated DNA pellet was then washed with Ethanol 70%. Finally, the precipitated DNA pellet was dissolved into 3 mL of TE (10 mM Tris HCl, 1 mM EDTA, pH 8.0).

PCR Assays

[0366] The details of PCR are well known to those of skill in the art. (*See* Mark A. Valasek, M.A., & Repa, J.J. (2005) Advan. Physiol. Educ. 29, 151-159; Ausubel, F.M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G., Smith, J.A. & Struhl, K, *Current Protocols in Molecular Biology*, Hoboken, NJ:Wiley, 2005.). The specific parameters used herein are as follows (50 μL final volume of amplification):

[0367] PCR Amplification of Genomic DNA

[0368] Reagents

5 μL Buffer (10x concentrated)

0.5 μL BSA (0.5 mg/ml)

1 μL dNTP (10 mM concentrated)

1.5 μL oligo @ 10 pmol/μL concentration (15 pmoles)

1.5 μL oligo @ 10 pmol/μL concentration (15 pmoles)

0.25 μL *Taq* polymerase (F. Hoffmann-La Roche Ltd; Basel, Switzerland)

50 ng genomic DNA

water to 50 μL

[0369] Cycle parameters:

94°C for 3 minutes (one cycle)

94°C for 30 seconds, 52°C for 30 seconds, 72°C for 1 minute and 20 seconds (6 cycles)

94°C for 30 seconds, 58°C for 30 seconds, 72°C for 1 minute and 20 seconds (30 cycles)

72°C for 8 minutes (one cycle)

PCR Amplification of Bacterial (Colony) DNA

[0370] Reagents

5 µL Buffer (10x concentrated)

0.5 µL BSA (0.5 mg/ml)

1 µL dNTP (10 mM concentrated)

1.5 µL oligo @ 10 pmol/µL concentration (15 pmoles)

1.5 µL oligo @ 10 pmol/µL concentration (15 pmoles)

0.25 µL *Taq* polymerase (F. Hoffmann-La Roche Ltd; Basel, Switzerland)

40.25 µL water

bacteria

[0371] Cycle parameters

94°C for 8 minutes (one cycle)

94°C for 30 seconds, 52°C for 30 seconds, 72°C for 1 minute and 20 seconds (6 cycles)

94°C for 30 seconds, 58°C for 30 seconds, 72°C for 1 minute and 20 seconds (30 cycles)

72°C for 8 minutes (one cycle)

DNA Probe Preparation and Hybridization

[0372] DNA samples were initially prepared (for steps 1 and 2) in parallel with separate containers for Cy3 and Cy5 labeling.

(1) Pre-anneal primer to DNA

[0373] One µg genomic DNA, 2.6 µL random nonamers (GE Healthcare; Buckinghamshire, UK (formerly Amersham Pharmacia)), and 1.5 µL spikes (control DNAs) were combined and water was added to a final volume of 29.5 µL. The mixture was heated to 70°C for five minutes, then cooled to room temperature for five minutes. Finally, the mixture was centrifuged briefly.

(2) Reaction

[0374] 4 mL NEB2 buffer, 2 mL Nucleotide Mix (2mM dATP, dGTP, dTTP and 1mM dCTP) (individually obtained from GE Healthcare; Buckinghamshire, UK), and 2 mL dCTP Cy3 (or Cy5) (GE Healthcare; Buckinghamshire, UK (formerly Amersham Pharmacia) were added to the mixture from part (1). The combination was mixed gently and 2.5 mL DNA Polymerase I, Large (Klenow) Fragment (New England Biolabs, Inc.; Ipswich, MA) was added. The

combination was gently mixed further then incubated at 37°C for 2.5 hours. Finally, the mixture was centrifuged briefly.

[0375] The two labeling reaction solutions were then combined and unincorporated nucleotides were removed by running the solution through a Qiaquick PCR clean-up spin column (Qiagen, Inc.; Valencia, CA). The samples were eluted from the column with two 30μL portions of EB buffer. Volume was reduced to 7.5 μL in a speed vacuum.

(3) Pre-hybridization

[0376] Aluminum slides were incubated for two hours at 42°C in a 5X SSC, 50% formamide, 0.2% SDS solution. Then the slides were dipped in water three-times in one dish, and two more times in a separate dish. These prepared slides were blown dry with nitrogen.

(4) Hybridization

[0377] The DNA samples from step 2 were heat denatured for two minutes at 95°C. Then the tube was spun quickly. A hybridization mix containing 1 vol. of version II buffer and 2 vol. 100% formamide (deionized) was prepared and 22.5 μL of this mix was added to each sample. Then the samples were mixed, spun briefly and incubated for one hour at 42°C. Finally, the slides prepared at step 3 were loaded with sample and incubated overnight at 42°C.

(5) Post-hybridization washes

[0378] The slides prepared at step 4 were submerged in a 1X SSC/0.2% SDS solution at 55°C (after cover slips were removed). The slides were then removed and placed in a cradle in a second tray containing the same solution. The slides were incubated in the second tray at room temperature for five minutes on an orbiting shaker. Next, the cradle and slides were transferred to a third tray containing a 0.1X SSC/0.2% SDS solution at 55°C. The cradle was dipped five times in the solution in the third tray and then incubated at room temperature for ten minutes. The slides were then transferred to a fourth tray containing the same solution as the third tray where the slides were again dipped five times and incubated at room temperature for five minutes. Next the cradle and slides were transferred to a fifth tray containing a 0.1X SSC solution at 55°C, where the cradle and slides were dipped five times. The cradle and slides were then transferred to a sixth tray containing the same solution as the fifth tray where the slides were again dipped five times. Finally, the cradle and slides were transferred to a seventh tray containing water, where the cradle and slides were dipped twice quickly and then dried in the cradle with nitrogen gas.

Microarray Data Analysis Protocols for Comparative Genomic Hybridization of Genomic DNA of S. Pneumoniae Strains

Slide Acquisition

[0379] Two color images of hybridized slides were acquired with the microarray scanner ScanArray (PerkinElmer Life and Analytical Sciences; Shelton, CT) at 10 μm of resolution. Acquisition parameters (photomultiplier gain and laser power) were adjusted to maintain a comparable fluorescence level between the two fluorophores channels (measuring the intensity level of specific control spots and the mean intensity of all the spots).

Image Analysis

[0380] Images were analyzed with the software Genepix 5.x (Molecular Devices Corp.; Sunnyvale, CA). Automatic and manually curated flagging procedures for no good quality spots were applied. From the acquired images, the Genepix software extracted the intensity levels and computed default statistical parameters for each feature spotted on the microarray slide.

Data Management and Quality Check

[0381] Data management was performed by a local installation of BASE (BioArray Software Environment, rel 1.2.10, Lund University). The data analysis consisted of two phases:

[0382] (a) Background correction and normalization—In this procedure, the local background intensity was subtracted to each spot intensity. The intensities were then normalized to the mean or median intensity of all the spots. The background correction and the normalization procedure (plug-in rel. 1.4) were applied in BASE with the following parameters:

Experimental Normalization:	Experimental Median
Experimental Background:	Background local
Threshold to correct (bkg stdev):	1
New values (bkg stdev):	1
Symmetric correction (CH1=CH2):	Yes

[0383] (b) Data merging—Intensity values of repeated spots of a single slide or of repeated slides were merged computing the mean intensities of the separated two color channels. Spots that were flagged for low quality level or for background correction were filtered out. The algorithm also evaluated the probability of having different intensity levels between the averages of the two colors intensities (applying a T-test, plug-in rel. 1.7). The resulting dataset was stored in the BASE application and could be exported for other analyses.

Clustering Analysis

[0384] The ratio of the two color intensity levels was transformed in log2 scale.

[0385] The computed ratios were organized in a table dataset containing a column for each slide or group of merged slides (experiments), and a row for each spot or group merged spots

(genes). The table was uploaded in the software TMeV (rel, 3.1, TIGR) for the clustering analysis.

[0386] Three main clustering algorithms were applied:

[0387] (a) Hierarchical clustering—This algorithm was applied to discover groups of genes showing similar presence/absence patterns among different experiments. In particular the algorithm was applied with the following settings of parameters:

Tree selection:	Gene Tree and /or Sample Tree
Distance Metric Selection:	Euclidean distance, Pearson uncentered
Linkage method selection:	Average linkage clustering

[0388] A similarity tree (based on the unweighted pair group method with arithmetic mean algorithm, UPGMA) and a similarity matrix (based on the distance metric selected) were built to represent graphically and numerically the distances between experiments and between genes.

[0389] (b) Pavlidis template matching—This algorithm was applied to discover genes showing presence/absence patterns similar to a template pattern. Pavlidis template matching was applied to discover genes showing patterns correlated or anti-correlated to a reference gene among different experiments. The algorithm was applied using the threshold parameters Absolute R (selects paterns that are either correlated or anti-correlated with the template), a threshold p-value of 0.05, Pearson default distance metrics, and hierarchical clustering of the elements in the resulting matched and unmatched groups.

[0390] (c) Significance analysis of microarrays—This algorithm was applied to discover significant genes showing presence/absence patterns that able to divide the experiments in separated groups (defined *a priori*). The algorithm was applied to discover genes that were specific of a given group of experiments. The algorithm was applied with the following parameters:

Statistical test:	Two-class unpaired
Number of permutations:	100
S0:	Tusher et al. method
Q-values:	No
Imputation engine:	K-nearest neighbour imputer

Hierarchical clustering of the elements in the resulting matched and unmatched groups

Example 1: Determination of the presence of the pilus II island (INV104B) in genomic DNA

[0391] The determination of the presence of the pilus II island (INV104B) in the *S. Pneumoniae* strains listed in Table 1 was performed on purified genomic DNA or directly on bacteria (colony PCR). The four oligos used for amplification are listed in Table 2.

Table 2: PCR Oligos

Designation	Direction	Sequence
1008for	5' → 3'	GCTGGATCGAGTTTGAAACCAGAA (SEQ ID NO:24)
1009 rev	3' → 5'	TAAGGATCACCAAAGTCCAAGGCA (SEQ ID NO:25)
Int-rev	3' → 5'	TTTCAGTGTATGTTTTAGTGCTTCA (SEQ ID NO:26)
Int-for	5' → 3'	ATGGCTTCAGGGGCTATGTTCGGTG (SEQ ID NO:27)

[0392] Three diagnostic PCRs were performed for each strain listed in Table 1 with the following PCR Oligo combinations: 1008for-1009rev; 1008for-intrev; and intfor-1009rev. Clones positive for the pilus II island (INV104B) were successfully amplified by 1008for-intrev and intfor-1009rev. Strains negative for the pilus II island (INV104B) were successfully amplified by 1008for-1009rev.

[0393] The determination of the presence of the pilus island, *i.e.*, the rlrA islet (as opposed to the pilus II island (INV104B)), in the *S. Pneumoniae* strains listed in Table 1 was performed. Similarly to the pilus II island (INV104B), specific primers were designed and used to amplify defined regions of the rlrA islet. Examples of methods for determining the presence of the rlrA islet are set forth in U.S. Application Serial No. 11/707,433, entitled "Purification of Bacterial Antigen," filed February 16, 2007; and U.S. Provisional Application Serial No. 60/774,450, entitled "Purification of Bacterial Antigen," filed on February 17, 2006, the contents of which are incorporated herein by reference in their entirety.

[0394] Table 1 indicates that a great number of *S. pneumoniae* strains contain one or both pilus and pilus II island (INV104B).

Example 2: Sequences from 23F, INV200, and OXC141

1. Sequence download and assembly

[0395] The preliminary sequences of four strains of *S.pneumoniae* were downloaded from the Sanger Web site (*see* worldwide web site "sanger.ac.uk/Projects/Microbes/"). The Sanger sequences are composed by a variable number of non-overlapping contigs. Details for the downloaded sequences are listed in Table 3:

Table 3: Downloaded Sequences

Strain	Serotype	ST	# of Contigs	Total bp
23F	23F	81	21	2225211
INV104B	1	227	68	1986609
INV200	14	9	167	2022487
OXC141	3	180	120	1962139

[0396] To identify the likely ordering of the contigs, the sequences were aligned against the TIGR4 complete sequence using MUMmer3.19, to form a single pseudo-molecule. To separate two subsequent contigs the following sequence was inserted:

NNNNNCATTCCATTCATTAATTAATTAATGAATGAATGNNNNN (SEQ ID NO:28)

SEQ ID NO:28 was designed to (*i*) generate a stop codon in all six reading frames so that no gene is predicted across junctions and (*ii*) provide a start site in all frames, pointing toward contigs to predict incomplete genes at their extremities. Contigs that did not align against the TIGR4 genome were put at the end of the pseudochromosome.

2. Gene prediction

[0397] The genes were predicted using the glimmer3.02 suite. The Hidden Markov Model was trained using the predicted genes of TIGR4 as a training set.

3. Protein set comparison

[0398] All the proteins of each genome were compared against all the proteins of the other genomes using Fasta. A protein was considered to be conserved if its aminoacidic sequence could be aligned with a percent identity of at least 90% on at least 50% of its length.

[0399] The amino acid sequences of OXC141, INV200, and 23F that did not meet this criteria are set forth below. These sequences may provide polypeptides and/or proteins that can be used in compositions or methods of treatment for, diagnosis of, and immunization against *S. pneumoniae* infections.

4. Start Codons

[0400] The N-terminal residues in the amino acid sequences listed herein are given as the amino acid encoded by the first codon in the corresponding nucleotide sequence. In those sequences in which the first codon is not ATG, it will be understood that the first codon will be translated as methionine when the codon is a start codon, but will be translated as the indicated non-Met amino acid when the sequence is at the C-terminus of a fusion partner. The listed sequences specifically disclose and encompass each of the amino acid sequences listed having a N-terminus methionine residue (*e.g.* a formyl methionine residue) in place of any indicated non-Met residue.

5. Sequences Identified from OXC141

>orf00007
MEMSFIAQDFDKLNIITVLESRTQAIIRNPMNTRLSSDTESSFNKIVRN (SEQ ID NO: 29)

>orf00009
MELAETSIVKKNHQIPCIINQKIAQKLIKKTSMTDIDHQLSISTSTVIRKINDFHFEHDFSRLPEIMS (SEQ ID NO: 30)

>orf00013
LFKIGRVYYRQLQEDLLTCCNKYPKLFFFIIISLNSTQSGGVF (SEQ ID NO: 31)

>orf00015
MKYNKTKYPNIYYYETAKGKRYYVRRSFFFRGKKREKSKSGFTTLPQARAALVELEQQIQ
EQELGINTNLTLDQYWDIYSEKRLSTGRWNDTSYYLNDNLYNNHIKAKFGSILLKNLDRN
EYELFIAEKLQNHTRYTVQTLNSSFMALLNDAVKNGNLLSNRLKGVFIGQSDIPAANKKV
TLKEFKTWIAKAEEIMPKQFYALTYLTIFGLRRGEVFGLRPMDITQNDSGRAILHLRDSR
SNQTLKGKGGLKTKDSERYVCLDDIGTDLIYYLIAEASKIKRKLGIIKEQHKDYITINEK
GGLINPNQLNRNFNLVNEATGLHVTPHMMRHFFTTQSIIAGVPLEQLSQALGHTKVYMTD
RYNQVEDELAEATTDLFLSHIR (SEQ ID NO: 32)

>orf00016
MSYSYVALDVETANDFRGSVCSIGLVKFKDGNIVDTFYTLINPEEEFDDFNIFIHGITPE
DVLDSPTFPEVRKSIVDFIGLDIVVAHFAQFDMGALKDVYQKYELDFDNIEYICSYRLAK
VALPGQLNYKLKRLAKNLNIELDHHNALSDARASGLILEYLLSTNSFSDLTAFLKEYRYN
KTGLLGQYGFKRKKGYQYKENLIYQPTEEEKAAMNPDHYFYGLYFCFTGKLERMTRKEAN
KAAALVGGIPEKGVTKHTNILVVGEQDWRVVGTDGLSSKMKKAQTLLEKGQDIEIMTEND
FIRLLEE (SEQ ID NO: 33)

>orf00017
MSLLSLHQCKVFLFYHDFISHGFKIVVGHEFEVIKLCGVIQAF (SEQ ID NO: 34)

>orf00019
MKNKKPNAERLQEIADYFNVSTDYLLGRTDNPAIAGDSKEYTWQGKTLNVEEMASNVMMF
GGRELTDEKKKIIQSIIEGYLKEAGD (SEQ ID NO: 35)

>orf00020
MSKLTKEDVLQVSQEIINDAIPVIKDMLDEVFKEYPIDMEIRKAILNSVLVAHKLSTETT
VSLLTELVNAQEN (SEQ ID NO: 36)

>orf00021
MSKELKIIKAKIKTRLIELDMTQAELAKQVSVASSVISELLKYGKGSESVKEKVADVLGI
ENPWENS (SEQ ID NO: 37)

>orf00022
MDYQILIQPAISVILAIISGLWSYIASKANNKAEIEKQAKEHSHIVEKLEKEFHYQIDTL
KQQHTLELEKVKQAHELRLQELEKVSQIDTETDKAMKMNDLIYKTFTGEVDLDKALKLAD

KANNHKQKLNKKFIQKTSKKS (SEQ ID NO: 38)

>orf00023
MNEIFNFHGQEVRTLTIDDEPWFVGKDVADILGYSKARNAITLHVDEEDALKQGIPTSGG
TQDMLIINESGLYSLILSSKLPQAKEFKRWVTSEVLPAIRKQGGFIREDLDEDAFIALFT
GQKKLREQQATMLEDIDYLKSEQPIHPSYAQSLLKKRKARVVACLGGIDSPAYADKVFAQ
SVFRQAEIDFKDHFNISRYDLLPKKHADAALAYWMTWEPSTNTKMKIMKLNSFDDV (SEQ ID NO: 39)

>orf00025
MFEPPILDQLMGVGALLLGFAGACRHIKLQEQRKEEERREEQEFASMIIQGYNHAYERGR
EAERQEIRKNIRRPFKGFTYDNEPPQGLRPEPLALPEPKQSAIRLL (SEQ ID NO: 40)

>orf00026
MEELIESLDNLIMIVKELEGRESTSRHFITIWENDYKNLLLVKEYLTDYEKLAKDYRYVT
LKNKLLKIEKMELEGRHIYEDMRMKYRANRRKWGARYV (SEQ ID NO: 41)

>orf00027
VLGMSEIKWIKITTDIFDDEKICLIDALPDPDAILVIWFKILTLAGKHNSNGLLMMTDKV
HYTDEMLATIFRRPLNTVRMAIGVFEQFGMIEIIDGIISLPNWEKHQNVDGMEKIKEQTR
NRVAKYRKKQKNLALGNVTGNVTVTDGNALEEDKDKNKNRLDKDKNKKRITTTSSGSEEN
ILELFQSEFRRLLSGFEIEEINHLLNENDVDLVKEALKTAINSGKPNIKYIGGILRNWQM
NNVTTVEQVRQSEKKNKDKKEEQEAKDEWGY (SEQ ID NO: 42)

>orf00029
MRRSASMVDNVFEEIALSYRRNTEQQEEFCEKHNIPLIKILRTESVVCRMCESERIHEEN
QERVNELANAENERERKYYLEKFSLYDEVLKNATLDNFETPTEKEAEKLAFAKRICREWS
EGARNNIVLQGEAGTGKSHLAFAMVKVLSEYTKEIAIFINVTDLLMKIKADFSQEEFLVN
KIASAKFLVLDDLGMEKDSEWSFTILYNILNKRSNTIITTNLISADIQKRYGRPFMSRLM
KGVDKDHLMVFNDLTNKRKQYF (SEQ ID NO: 43)

>orf00030
MLELYFVYNGHCKFFLGRFDNVDDLIEQMEDHQWAFSAITHPRFQKHIGQRTTRFDYGSK
DCYYLATFSGGE (SEQ ID NO: 44)

>orf00031
MVGVTYQEIHLFVEFLKEQYGQGRPDYIEALNDLDGLVEVSYREAIERFLEDEVR (SEQ ID NO: 45)

>orf00032
MMEELKKKVNAVYNWTVEDGKPQPPQQDLPQAVKDRVDYFWEMAEDGMTFMGAMECIFAD
EKPTDYELGATKGWLPKSKEFDDWIGYSPSMAQVVIAVYLIYGGN (SEQ ID NO: 46)

>orf00033
MEETKMNKQELIKKLEERRTIIGNFQGYAVSYFWIYWIVEK (SEQ ID NO: 47)

>orf00035
MEFVSPIKDNDDIQAMKDYLREWNEMYYMLFITGLNTGLRVGDILTLKVKDVQGWHIKLR
ERKTGKQITRRMTKELKKEMRRYVEGKPFHHFLFKSRQGQNKAITRERAYQIIHEAAEEL
GIDNVGTHTMRKTFGYKYYNKTKDVGTLQKMFNHSSPAITLRYIGIEQAELDDALRNFVI
(SEQ ID NO: 48)

>orf00036
MYNKPVRPSLKSKKWEKFRDRIMRKHDYLCQESLRYGISVQAEMVHHIFPVSEYPELEFV
EWNCLPLTNKKHNTFHDRVNDRVINQGLYWQKKRKKEFLNFFKNEK (SEQ ID NO: 49)

>orf00037
LAKPITAKSIKSKVVKQMKDLGTYRKEFEMIIDIFAGMLYQYQKLAQDYANLGYPVTDTY
VNKAGAENERKVPILTAMEILRKDILSYSNQLMMNPKSLGEVVEQEGDSVLTEVLKFKNE
IKKKRVSGNG (SEQ ID NO: 50)

>orf00040
MGNLDKAKEYAQHVLTHREEHCEENILAAERFFRDLENPAFEMDEDMVDFVIHFIENVIV

HQQGDDMFAVSIRNKPLLLQPWQHFVVVNLFGFYYKGTNERRFKEALIMLARKNGKTSFT
AAIALAYQILDTDSGSKCYIVANSVKQAMEAFGFLRFNVERWNDKNIRIKDNNQEHSITA
NFGDEGSFFIQALANDESRLDSLNGNVIILDEAHTMRNSKKHGLMKKTMSAYRNSMLFVI
STAGDIPTGFLANRLKYCQKVLKQLVTDDSFFIFICKANQSADGDVVNYLDENILKMANP
SWGVTVSLKALKEEAEQAMNDPQTRNEFFNKTLNIFTNSMNAYFNPDEFIASDSCYDWSL
EELARLPIRWYGGADLSRLHDLTAAALYGVYHDGEKDVDICITHAFFPRINAQKKANDDG
IPLFGWQSDGWLTMSNTPTVLYDDIVKWFIKMREKGFKIAAVGMDRKFGREFLTKMKQAR
FKMIDQPQLFYLKSEGFRRIEFKVKNKEFYYLHSDAYEYCVSNVRAIEKVDDAVQYEKLD
GDGGTARIDLFDASVFACIQALANLGKGGDVMRFFD (SEQ ID NO: 51)

>orf00043

MNEIVLSEHEINLLINKGRVKVILNGEVVTIRQRHMKNLMAETVKWEKQVIDVSQNIVRN
KHFDSLFQNTFR (SEQ ID NO: 52)

>orf00045

MGIFEKFWKRNKPSKPINMLSHSDLGLSNLMDSYVPLARNPDVVTAVNKIADLVSNMTIH
LMENTDKGDIRIRDGLARKIDINPCKHMTRKSWIFKIVRDLLLYGDGNSVLHVEYEPVTD
YISNLRPFPMREVSFQTDKDSYVISFRGEEYSPDEVVHFVINPDPDILYIGTGFRVTLTD
VVQSLNMATKTKKSFMNGKNIPSLIVKVDSSSAELDSEQGRERIAEKYLSTSRVGAPWIV
PEALLDIQQVKPLSLTDIALNESVELDKRTVAGLLGVPAFILGVGEFNKTEYNNFVNTTV
MSIATTITQTLTRDLLLSSNRYFKLNPRSLFSYNITELSAVAQQMANSAAMRRNEWRDWL
GMAPDPEMEELIVLENFLPQEKLGDQNKLKGGEEENAKAK (SEQ ID NO: 53)

>orf00047

MQKRNSYRATQFQTREEESGDLVLSGYFIKFDEETELWRGYHEVIKRAGVEKAVTDADIR
ALFNHDDSLVLGRTGNGTLTLGVDDVGLFGDIIINKDDPQAVGAYARVKRGDVIGCSFGF
IPVKIETEEREDGSYLDTVLELEIFEVSPCTFPAYPQTEIAARQKDFESQKRANREALDK
RKKEIKEKFKL (SEQ ID NO: 54)

>orf00048

MNKALIFGARMRAKATKVVELEETIEELNKRSVVELEKLDRAKNDEEVLAVEKTVDGLQR
EIEEKEAEKVQLENEIDELDKQIKEQNRKAPTPGKMEERGGKTLGQREAFNHYLRTKEAR
ADGFKSAEGEAIIPVELMTPKEAKQDKTDLTSLVNIVNVKNASGKWSVVKLTDQAMNTVE
ELEENPELAKPTFTKVNYEIKTRRGHLPVSQEFIDDADYDVMGLVAKQTKNQERITKNKE
IAKVLKTATSKSAAGLDGLKDILNVELKTYYNATIVCTQSMFAALDKIKDKDGRYMLQTD
ITSPTGYKFAGRVIVVYPDDIIGESKGDLKAFIGDVGEFATLFDRAQTTVKWQDDKIYGQ
YLATANRFDVVKVDGDAGFYVTYTDAVL (SEQ ID NO: 55)

>orf00050

LMNVEDKDMSKDDTLTTEVEKEETKVVDGKPEEGDEE (SEQ ID NO: 56)

>orf00051

MDNVQLLELLKLKLGIATKLRDKPLEKIIEAVKTELEDNLGVLLDLDSSEDQMFVVDFAA
FRYEGGVDMPRHLQWRLHNLQIASKKKVKNVES (SEQ ID NO: 57)

>orf00052

MWNHEIKLISKKITGKDKLLQPISEDVEVTLLCRKKNVTRSEFYQANQAGLKPSLVVEIR
NFEYENQEFAKFEGKQYRILKTYPIDSEILELTLTEVLK (SEQ ID NO: 58)

>orf00054

MSNDLADLIAKELAAYSDEVTEEVDKIAEQVTDETVDELKETSPKRYGKYRRSWKKKKLA
NGSFVVFNAVASLTHILENGHLSRNGGRVAGIVHIKPAEEKAIQNFEKRIKEIGK (SEQ ID NO:
59)

>orf00055

MKLSDFAAILEQANLPVTYRAFKIGNAPDLPYLVYYESSPVINSADNTVNHQIKSVTVEL
AFESKDEDLEERLEELWANHKLFFEVQEETFIETERLYVKSYTVYLY (SEQ ID NO: 60)

>orf00057

MTQENKVTFGLENVHIAPIKTLAADGVITYGDVFRFPGAMELILDTKGETTPIKADNKNY
HFMNSNEGYEGKLKIPHIIDEFATKILGEIKDPQTGVMTEKADASLTEFAIMFQFEGDKN
KTRYVMYYCFASRPSLGSKTKNGTSTNERELSFKASPRPLDTVVKRSITSADDKDAYDNW
FKKVYEPTAVAA (SEQ ID NO: 61)

>orf00058

MRKIVLVGDQEYELGTNGYTPIAYKQQFGKDYFQDLFSMLKNQSFMNELNKLETDKELTA
TNIDISMLSDFDMTFFNRLFWTFAKSANPQIKPYEQFFMEMEIFPIQEVGPVLMEMLNAS
MTTKKHQMNQNQLAKKSSQ (SEQ ID NO: 62)

>orf00060

MAGNIKGIKIEIDGDTQPLQKALKAINKESVNTTNELKQIDKALKFDTGNVILLTQKQEV
LQKQIGITRDKLETLRQAQSKVDEEFKKGNIGSEQYRAFQREVEVTQNVLKGYEGKLASL
TQALEGNGDAAKNNQAQLKELQNEQKLLASESEKVVSSFKLQESQMGANASEADKLALAE
KKIGAQSEIVTRQIENLEKQLSLTKEQYGENSAEANKMEAELNQAKTAYANLNQELGKLG
STAKSNQTQLKELQNEQSQLASEMSKVTSSFKLQESALGSNASEAERNALAQKKIGAQSE
IVSKQISNLEQQLEITKKEFGENSTQANKMESELNQAKTAFNHLNDEMKGTKSAADSTQE
SLSEISRNLRAELLQQFSEKLSAISEKLVEVGKEALEAAAQMQASNAQFTTVFGDMETQA
REALNAIGQEMDIVPERLQGSFTQMASFAKTSGLDTAEALDLTSRATRAAADGAAFYDKS
IESVTESLQSFLKGNFANDAALGISATETTRNAAANKLYGKSFKDLSEAQKQLTLLQMVE
DGNKLSGALGQAARESDGLENVMGNLKQAGTNALSAIGQPLLEMMIPVFQTLATIVKGVA
ELFSSLPAPVKDFVVILGTVVTAVGVIAPIFLSLQALAEFLKISIGEMIIAALPIIGTAI
AIAAAVAAIVAIVKYLWETNEGFRDAVTTVWNAILEVINAVVSEISNFVMSIFGTVVTWW
TENQELIRTSAETVWNAIYTVISTILDILGPLLQAGWDNIQLIITTTWEIIKIVVETAIN
VVLGVIQAVMQIITGDWSGAWETIKGVFSTVWQAIQSIVQTIFSAIQSYISNILNGISGT
VSNIWNSIKDTVSNVLNAISSTVSSVWEGIKSTISSAINGARDAVSSAIEAIKGLFNFNI
SWPHIPLPHFYVSGSANPLDWLSQGVPSIGIEWYAKGGIMTKPTIFGMNGNNIMVGGEAG
NEAVLPLNDKTLGAIGRGIAQTMGGTSPTINITITGNTVREEADISRIADEVAQRIADEL
QRKTQLRGGFT (SEQ ID NO: 63)

>orf00064

MIKHNELVIDGVRTSSFPFKVIVHDSPSIALGESKTALLEHGGISGAIVQTNKHRELVKK
TYTIYLVKPTEEQMNQFMSLFIREKFWLESERVKTTRLWCYKVNVSDLEEVQPGLYMTKA
TFTCHPTKHFKVTDTQRLTRSGTLNVQGSALAFPKITIVGQSASETSFTIAGQVIRLERL
TESLVMVNNPDNPSFKTTTGKPVKWSGDFITVDPAKVKNIGVVLGPGIQSLEIETVWGWA
(SEQ ID NO: 64)

>orf00068

LLYLLNEDVRTVRWNGESLHEATSAIVKETMNGDFTLTVKYPISDSGIYQLIQEDMLIKA
PTPVLGAQLFRIKKPVEHNDHLEITAYHISDDVMQRSITQMSVTSQSCGMALSRMVQNTK
TALGDFSFNSDIQDRRTFNTTETETLYSVLLDGKHSIVGTWEGELVRDNFAMTVKKSRGE
NRGVVITTHKNLKDYQRTKNSQNVVTRIHAKSTFKPEGAEKETTIRVTVDSPLINSYPYI
NEKEYENNNAKTVEELQKWAQSKFSNEGIDKVSDAIKIEAYELDGQVVHMGDTVNLKSWK
HNVDAFKKAIAYEFDALKEEYISLTFDDKAGIGGSRASGGLSSAADAILGVTESAQEIAL
EKALQNADLDFDHKAGLLRQEISDDIELAKARAEEVKRELSDTINQRFNSFDNGPLKETK
RKAEEALRNAGASSSLAQESKRIGLDSVARLEAFKSQTTSAQTALSGDLDALKRTIANDI
RPKQAQAEAEIAKQVEALSRTKNELAGASTLLAQEAKRIELDSVARLEAFKSQTTSAQTA
LSGDLDALKRTIANDIRPKQAQAEAEIAKQVEALSRTKNELAGASTLLAQEAKRIELDSV
ARLEAFKSQTTSAQTALSGDLDALKRTIVNDIRPKQAQAEAEIAKQVEALSRTKNELAGV
KSAQATYKETTTRRLSELTNLANGKASKSELTQTAEELSSKIASVQASGRNLFLNSLFKQ
DIPKTGIWTTSTYTATIDSESKYLGHKALKIIGLNPSGRDGGNPKVTYPALGQFGKVIPG
STTNQDVTISFYAKANKNGIMLRSRLGNIGYKTGNVTLSTEIKRYAVHIPKGWTNESKRT
TNEWLFNFNQEGTVWIWMPKFEISDVDTSYSEAPEDIEGQISTVESTFKQRANSLEAGVS
RLTEGLRTKADISSLNVTAENIRQSVKSLETDTQNKLNQKLSQAEFEVRAGSIRQEILNA
TKDKADKTLVVSEAGKLREEFSKMKVGGRNLWIKSKTVGAVIEKLPENHVTGQKECYRLE
NNSTLTFNLEPDFSSRLYQKVTFSAWIKYENVVQGRNFWNVFNCFKHYLFRKNSETGVQS
GPDYDTLGRYKGSADWKYITFTYDYSEKTNFDQLKTLLRFNLEGATSGTAWVTGIKVEIG
SVATDWSPAPEDADGLITEAKATFERTAQGLRTDLSAITEGLRTKVDISALNVTAENIRQ
SVKSLETDTQNKLNQKLSQAEFEVRAGSIRQEILNATKDKADKTLVVSEAGKLREEFSKM
KVGGRNLWIKSKTVGAVIEKLPENHVTGQKECYRLENNSTLTFNLEPDFSSRLYQKVTFS
AWIKYENVVQGRNFWNVFNCFKHYLFRKNSETGVQSGPDYDTLGRYKGSADWKYITFTYD
YSEKTNFDQLKTSLRFNLEGATSGTAWVTGIKVEIGSVATDWSPAPEDADGLITEAKATF
ERTAQGLRTDLSAIQEYVNKDGQRQEALQRYTREESTRQATAVRELVNRDFVGKATYQED
VKGINQRIEAVKTSANKDIASQIASYRQSVDGKFTDISSQITTYKQDVGGQISGLSNRLT
SSEQGTTTQISNLSNRINSNKQGTDNQISNLKTQVATNKDNAERQMGRISDQVSANKANA
DSQFANVTNQLARKVETTDFQRVKETSKLYERILGNTENGIADKVARMALTNQLFQVEVA
KNASNGQNLLKGTKDFSGGWKNKGANWKKHAEKYKGVDVLFKNNSWNGVGQEIDAKIGEV

YTFSLWMKSDWKNDTVNFYVNRNGSVEKGWGVPSETSVAITSEWKRYSFAFKITVDGFIF
PRVERLNQNTNLYIAGLKLEKGSYATPYTEAPEDTDEAIRSVQSQLTGSWAVQNINSAGD
IISGINLGANGHNRFVGKLTHITGETLIDRAVIKSAMVDKLKTANFEAGSVTTTILDAEA
VTADKVRFDAAFIRKMTANDAFIDQLTSKRIFSTKVESVISSSTFLEAYQGRIGGFTIGR
FAQGRGRWISGINQFSVGMGNGEGGSYNGENTAFWANWGHSWNSPGPNAWYVTTSGNMYC
RNGADFHGKVDFSNSSRANFYGNTTFSRSPVFSNGIELGSKDVLGDGWNPKGGRNAVVWW
NQVGSGSVKYWMEQKSDRRLKENITDTAVKALDKINRLRMVAFDFIENKKHEEIGLIAQE
AETIVPRIVSRDPENPDGYLHIDYTALVPYLIKAIQELNQKIEKMEKTIA (SEQ ID NO: 65)

>orf00069
MNTEQLNQALQMTIREMSTTSTNSMITSNILSIQLNEQREENQRLQARVDELEALLDEQT
KPADKGE (SEQ ID NO: 66)

>orf00071
MAETIQNTDNLLDLTKITEPFDLASALRYMKENGEFIRCKNVSDDFYMYRDVQKRPVIVN
GRRQFKDIETVWAFNQWGGTITTINVAVLLNHEFYIMKFDAEGNPDWTNPTVEPKE (SEQ ID NO:
67)

>orf00072
MQIEFFNFLRSVVQTEDGLVLYALALIVSMEIIDFVTGH (SEQ ID NO: 68)

>orf00073
MILIPASVLLPEKTGFVFLHSIYLGYIAFTFQSLIENYRKLKGNVTLFQPIVKVFQRLLE
KDDDTKKGE (SEQ ID NO: 69)

>orf00074
MQQITEIITNGAISILVILAGIAVKAVKEYLVKKGGEKTIKIVEILAKNAVNAVEQVAAE
TGYKGDEKLAQARAKVRAELTKYNISMTDKDLDTFVESAVKQMNDAWKGR (SEQ ID NO: 70)

>orf00075
MAFNQFNRCVTLSIPTAPNIPTSVVHRTYLHDTAVSDNM (SEQ ID NO: 71)

>orf00079
MKNREEEWQGIIAKNAILLIIAPFYFLIIVKNGVLLKIKTVTEITAF (SEQ ID NO: 72)

>orf00085
VEEVEVAEVKNARVSLTGEKTKPMKLAEVTSINVNRTKTEMEEFTRVLGGGVVPGSLVLI
GGDPGIGKSTLLLQVSTQLSQVGTVLYVSGEESAQQIKLRAERLGDIDSEFYLYAETNMQ
SVRAEVERIQPDFLIIDSIQTIMSPEISGVQGSVSQVREVTAELMQLAKTNNIAIFIVGH
VTKEGTLAGPRMLEHMVDTVLYFEGERHHTFRILRAVKNRFGSTNEIGIFEMQSGGLVEV
LNPSQVFLEERLDGATGSSIVVTMEGTRPILAEVQALVTPTMFGNAKRTTTGLDFNRASL
IMAVLEKRAGLLLQNQDAYLKSAGGVKLDEPAIDLAVAVAIASIYKDKPTNPQECFVGEL
GLTGEIRRVNRIEQRINEAAKLGFTKIYVPKNSLTGITLPKEIQVIGVTTIQEVLKKVFA
(SEQ ID NO: 73)

>orf00088
MGVSIFLALFYMIPALYFLFHIGKKWELPKKVLILSLLGAICSFTSLLLFGIYNHRRKSS
KV (SEQ ID NO: 74)

>orf00094
VFVALVSITFSLTNFFKILINLTAQVSPQVIDEKILMMDLNLNNYLSTVIQLRQDVYTGI
KILH (SEQ ID NO: 75)

>orf00095
VNIASLQNGHIFCWQVQHIANKLTSDFWIAEYFLSNQIISWADARMSENPPIPPSIVS (SEQ ID
NO: 76)

>orf00103
MKIKEQTRKLAAGCSKHCFKVVNGTDEVSSKHCFEVVDGTDEVSSKHCFEVVDRTDEVSN
HIYGKATLTWFEEIFEEYKSLHNKTHITKVV (SEQ ID NO: 77)

>orf00109
MNDDDSRCIHIERDGKTIEFGYLNISSTDRNTSHADGLVGIFNSNFSGVRVRGIAVFLNG

PDNLDTTLVGNFQTIWNFRIICIHSQNTCNKG (SEQ ID NO: 78)

>orf00110
LEFNFCRSIIKNGRDNLPNTNSTSGMATRWANHNWSDDIKDRLKTK (SEQ ID NO: 79)

>orf00114
MRYDFGKVYKEIRESKGLTQEEVCGNVISRTSLSKIESGKATPKYENMEFLLRQINMSF
(SEQ ID NO: 80)

>orf00116
MNYNLKYLLSGIFVLVFIGFLVWMRYFNQRKEEEHSDVSFEARLDSEVKTLYKQLGLGEE
PHYFLAYRYLHPWFDLAILPPTVEIFLTKIALVMVTPDELLIRNLGNGLTFTSEHHRDLR
QGLIRIPKSEMKEFEIRNWKKFFVFGDFLTIKTSQHSYYLQVRDDGLQKGSLSTKHFSDL
KSQDFLGLLTDKRTF (SEQ ID NO: 81)

>orf00124
LSLLDLRGSLCLRIYLHEPLITTVSQDFTSLSDISHF (SEQ ID NO: 82)

>orf00125
MDFKSFIIGLVVGIFGPYMDDLIRKKFLKSSEKKTEKSVKK (SEQ ID NO: 83)

>orf00175
MGRFILFENLFKPGQLHLAVDMVTDFVSSIHNLKTVF (SEQ ID NO: 84)

>orf00177
METSISMADFYGKYQNENLELIDVREAHEFQAGHAPGAKNLPLSTLEQGYKELKPDHEYY
VICQGGVRSASTCQFLSSQGLTVTNVEGGMNVWPGQVE (SEQ ID NO: 85)

>orf00179
LGGKSCLLEDRLCDIAAQTTVAADDVGLFFVQFISFLLDTLSVFDTIVQN (SEQ ID NO: 86)

>orf00183
MKIKDQTRKLAAGCSKHCFEVVDRTDEVSSKHCFEVADRTDEVSNIYTARRR (SEQ ID NO: 87)

>orf00184
MKLLSIAISSYNAAAYLHYCVESLVIGGEQVGILIINDGSQDQTQEIAECLASKYPNIVR
AIYQENKGHGGVVNRGLAEASGRYFKVVDSDDWWILVPT (SEQ ID NO: 88)

>orf00185
LKILETLQELESKGQEMDVFVTNFVYEKEGQSRKKSMSYESVLPVRQIFGWDQVGNFSKG
QYIMMHSLIYRTDLLRASQF (SEQ ID NO: 89)

>orf00186
MYYLPVDFYRYLIGREDQSVNEQVMIKCIDQQLKVNRLLVDQLDLSQVSHPKMREYLLNH
IEITTVISSTLLNRSETAEHLAKKRQLWTYIQQENPEVFQAIRKTMLSRLTKHSVLPDRK
LSNVVYQITKSVYGFN (SEQ ID NO: 90)

>orf00194
MSLQIKLKKLAKELSKLLKDSNLETVDKDVLENSQEELQKAVLFLADEKGSEHTAAELID
NLKEVIAKLKANA (SEQ ID NO: 91)

>orf00202
MKIKEQTRKLAAGCSKHCFEVVDKTDEVSYIYLRQGEADAV (SEQ ID NO: 92)

>orf00213
MSKEKVILAYSGGLDTSVAITWLKKDYDVVSVCMDVGEGKDLDFIHDKALKVGAVESYVI
DVKDEFATDYVLVALQSHAYYEQKYPLVSALSRPLISKKLVEIAHQTGATTIAHGCTGKG
NDQVEYQIAVAKKANEAKK (SEQ ID NO: 93)

>orf00215
VLDSLVFMGFSMKLIHDLDTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 94)

>orf00218
MGQLHFITKLLDIKDTNTQIIDVVNRDSHKEIIAKLDYEAPSCPECRSQMKKYYFQKPSK

IPYLETTGMPTRILLRKRRFKCYHCSKMMVAETSIVKKNHQIPRIINQKIAQKLIEKISM
TDIAHQLSISTSTVIRKLNDFHFECNFRNLPKIMSWDVETVRGVTVSIGRWR (SEQ ID NO: 95)

>orf00220

MRYDFGKVYKEIRESKGLTQEEVCGGVLSRTSLSKIESGKTTPKYENMEFLLRQINMSFE
EFEYICHLYQPSQRTEIMQTYLNMTSIIGSNSLVHFFETCQDYLKTHHDLPIEEIRDMLE
VVIYIRQHGAGELSDHAEQVVKKLWRKIEKQDTWYESDLKILNTILFSFPIEYLHLITGK
ILQRLEVYKNYQHLYDLRIAILLNLSTLYLYNQDKNMCKQICYTLLEDAKNKKSYDRLAI
CYVRIGICTDNAKLIQKGFSLLELTEETSMLSHLKKEVETHYQPKKL (SEQ ID NO: 96)

>orf00221

MNSKELSISMLKKYPCTMQHDQSDCAAAVVSTVLLSYKKELSIMKIREIIGTDMYGTTVS
GIVSGLNKLNFTVKAVRVALEDLTPKLTFPAILQVKNDLGQNHFVVLHSIKRNSKFYVAD
PASGIRKMSSDELGEIYQGITLFMVPNSDFERGKLKGKGLLDLFGRLIFNQKGLISTVIL
ASFVLSIIGILSSLFSKVIMDEVIPYALKNSLYMFLIVFGIVSFLQTLLSAFRQHVLLFL
SRKIDIPVLMGYYDHIIHLPYSFFGSRRVGDVLTRFQDAMTIKNVFTSVSISLVMDITLS
VISAVVLWTINQSLFLILVFMVIVNIILIYCFKKPYKKINHEQMEANGLLNSQLIESIRN
IDTIKSQHDEEQRLNKIEEKFVHTLEIGYKEGVLQNIQSTISSMTSTMGGLLFMGVGALF
IIDGKMTIGDLLVFQTLSQYFTEPIQNLVGLQLTFQEVQVAVSRLQELMEVDREDIALDY
SIRDFTLCDDIEFKDVTFAYGSRPPVIKDFNLRIKQGEKIAFVGESGAGKSTLVRLLLRF
INPSEGKIRIGENDLSDLDYGKLRKKISYIPQTIELFTGTIIDNLKIGNPSVTYEDMVRV
CRIVGIHDTIQRLQNRYGSFVEEGGQNFSGGEKQRLAIARALLSKADLYIFDEATSNLDS
FSEQIIQDLIFNKIMDKTTIVVAHRLSTILRCDKICFLENGTIVEYGTHEELMAKNGKYA
RMVGLQSVQVNQQIQSQAVLDTEEVTYG (SEQ ID NO: 97)

>orf00222

MAKLEVKDNKKLVLKSVICKKLHDTKVEDVDQEINKFHQHLQLLKAQIFGPLIVKSCGTT
IHDDGLITTDFEFYIQAHNAQQYSNIYDVQDSISVPYCLYVRFEDSPEYLQYAYSKLDLY
VYENDIQTDGIVYTVYVNSSPEKMVVDIFRPIVSL (SEQ ID NO: 98)

>orf00223

MKLYNKSELRYSRIFFDKRPPAFAFILIISTAIILSGALVGAAYIPKNYIVKANGNSVIT
GTEFLSAIGSGKVVTLHKSEGDMVNAGDVIISLSSGQEGLQASSLNKQLEKLRAKEAIFQ
KFEQSLNEKYNHLSNSGEEQEYYGKVEYYLSQLNSENYNNGTQYSKIQDEYTKLNKITAE
RNQLDADLQTLQNELIQLQQQGDSSSLSDTTSDDDKAKLETKISEITTKIEALKTNITSK
NSEIDSQQSNIKDMNRTYNDPTSQAYNIYAQLISELGTARSNNNKSITELEANLGVATGQ
DKAHSILASNEGTLHYLVPLKQGMSIQQGQTIAEVSGKEKGYYVEAFVLASDISRVSKGA
KVDVAITGVNSQKYGTLKGQVRQIDSGTISQETKEGNISLYKVMIELETLTLKHGSETVI
LQKDMPVEVRIVYDKETYLDWILEMLSFKQ (SEQ ID NO: 99)

>orf00224

MELVLPNNYVVIDEEEMMYLDGGAIYIPRWAITGAITGAAYAALAAAGGGGLQLVLASYG
LRSALVAGIVKGLGVLGIHIGNAFANTVIRSIASAGIGAGADWIFTNIIDGWDGRRDNQL
RIG (SEQ ID NO: 100)

>orf00226

MKDDQKYLLAGLYSLLVAIFYFPLIESKGIFVSILMAVLLLYLIYFIATVIHIVIIKFIR
KKSFKYLVLYPFTYDGSWRFQPINLLYFPEMVRDVIPINLVQEYCQGQPYGLLKKMLKRI
RLSREISLLLATIIVYFFTHRILPLSVFTFIFSYILLFAQSYLGGNTVWIGNRRLIIDDE
FEKILLSKSYIKEISSARYSEYLTCEYKNLTPIILLAIFENLLDSYLIQNQSKVDLDIFY
KVLPLLYKEKYTMGFNYFVSLNYLLYKVGFLGIIYDNEALRDLSKQYLNKNISELQDGSF
EDGIQDAVASKQIVVINEFIACLNSRCVPSQYDRFFYKDRPYIFSRKSPIKG (SEQ ID NO:
101)

>orf00227

MKNKRYFFDTILIILLLISTIFCVSPVFIKLDILGTPSHAILTFVLAIPLFYILSQCLHT
LLLLVSSIFCKLRPIYFYFIFVIIIGARKYYRILFHQLMGFSPGVAVFYKESQTTKNLFK
FYYFLYFTTLISYYFFFTFVYDKPLLLPLIPFSIIIALVQKLYRIENQQLFLLKSKVLTI
LESKKDCEFNLQDYHEIWKLQSKSELPCVALSYISLIKPYLSESVREQIDLLEVKRFKKI
NHPISLYGMLDVIKLNLYLRHYNEKNKYESMLKKILEVRPDFVLIEQNIDDSLNSSQPLS
LSLAISEIQLLLEVYMGIKHVSIRR (SEQ ID NO: 102)

>orf00228

MIRKPIIFLLMLPIWGLWIELHLLVSNLQLNLEIPFDFVVSTSLTFFVLILSKIVLDILY
ALKDLYKKEALITIFPFIFIRRKKVNVRFSPYFSFHRKSLSPDDLRSRIIWSFILEIAII
LVFILKIPFAIIMLTTIFFWTIMDINHLVFNKTEFLFNQNKWQKEDSFESDLTKTLKDKI
QKSELSYSDLMSLQLYDAMNQSTFLTDSELFEDILKKIEDSHNTLLCTGLVELLLYEMSI
SNNNNWQEKVDKIRIQLIRINQLDFFYYTSWLRQNFDFCMNREYHKMKSRKLLLSNKKIV
(SEQ ID NO: 103)

>orf00229
MELVLPNNYVVIDEEEMMYLDGGAYLSKRACQGICVALAMSPGTFIALTGAAVLTKKLIN
YIKVGGLGGWLIGAAAGVLAGAAGRIAYCIGYGALNRGCDISGNPYPWDGFISATVR (SEQ ID
NO: 104)

>orf00230
LGWIHICDSKMSNVDKIRKIHIIVCWVYIFLSFRAIINDTEYFLLIFLAFIYSIVSLPLY
SVKNKIVSICLVINSILLMSFPILINKFFPESFSTYIVLISVFITELIIFHLIGKDFDTK
LTNEYKKISQFRSKVSQSPWIKYLEISSFILTIFPSILYGTVDNHVLTLIFLIKICVDTT
IKFLFIRLFDTSTLMKRRIFFLFALDVIAYLFLGYLLVIQKAGYLFSVLLLFSNFSVPFI
KAKEYELFKNSK (SEQ ID NO: 105)

>orf00232
MNKKKMILTSLASVAILGAGFVASSPTFVRAEEAPQVVEKSSLEKKYEEAKAKYDAAKKD
YDEAKKKAAEAQKKYEEDQKKTEEKAKKEKEAAKEVDDASLAVQKAHVEYRKVLDSRNSY
RNPSDYAKKLAEADKKITEETTKLTNAQTKFQSIRTTIVVPGQSELAETKKKAEEAKAEE
KVAKRKYDYATLKVALAKKEVEAKELEIEKLQDEISTLEQEVATAQHQVDNLKKLLAGVD
PDDTEAIEAKLKKGEAELNAKQAELAKKQTELEKLLDSLDPEGKTQDELDKEAAEAELNK
KVESLQNKVADLEKEISNLEILLGGADSEDDTAALQNKLATKKAELAKKQTELEKLLDSL
DPEGKTQDELDKEAAEAELDKKVESLQNKVADLEKEISNLEILLGGADSEDDTAALQNKL
ATKKAELEKTQKELDAALNELGPDGDEEETPAPAPQPEQPAPAPKPEQPAPAPKPEQPAP
APKPEQPAKPEKPAEEPTQPEKPATPKTGWKQENGMWYFYNTDGSMATGWLQNNGSWYYL
NANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSDKWYYVNSNGAMATGWLQYNGSWYY
LNSNGAMATGWAKVNGSWYYLNANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSDKWY
YVNSNGAMATGWLQYNGSWYYLNSNGAMATGWAKVNGSWYYLNANGSMATGWVKDGDTWY
YLEASGAMKASQWFKVSDKWYYVNSNGAMATGWLQYNGSWYYLNSNGAMATGWAKVNGSW
YYLNANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSDKWYYVNGLGALAVNTTVDGYR
VNANGEWV (SEQ ID NO: 106)

>orf00233
MKIRRRYTHIIRIICILTISFKKQFLSSSLSSLTKRVIMNTAQATFNREAHTTFNRE (SEQ ID
NO: 107)

>orf00252
LKKRMNRWQFLLNQSKEMVGILLLKVKEQELIEFVVNL (SEQ ID NO: 108)

>orf00253
LIKVIKRKAFGFRNFNNFKKRILMTLNIKKESTNFVLSRL (SEQ ID NO: 109)

>orf00257
MTYNEKRLTNSLERGHMEQLKNTTDLLGLEDKNIKILSVLKYQTHLVVQAKLDSPAPPCP
HCQGKMIKYDFQKASKIPLLDCQGLPTVLHLKKRRFQCKNCLKVVVSQTSIVKKNCQISN
MVRQKIAQLLLEKQSMTEIAHRLAVSTSTVIRKLREFKFETDWTKLPKVMSWDEYSFKKS
KMSFIAQDFESKSILAILDGRTHAVIRNHFQRYQREVRELVEVITMDMYSPYYRLAKQLF
PKAKIVLDRFHIVQHLSRAMNRVRIQIMNQFDRKSLEYRALKRFWNPRFFVSRLGLNQST
GLIYYTRIASSSVRNDSISPRFECT (SEQ ID NO: 110)

>orf00258
MGYSLKKSRTYCEQDPEKVNRFLKELNHLSYLTPIYIYETGVETYFYLEYDRALSRQLVS
LEEDIII (SEQ ID NO: 111)

>orf00265
LREGCSIYDNLYPSRIVVGDETVEGRKIAELFLSISTHSTANIKNVMLVSPTEAEAIKLF
SNTFLALRVAFFNELDFFAERRSLNAEVVIKGVCLDPRIGNFYNNPSFEFGGYCLPKDTK
QLKKEFIEINAPVIEAIDISNTNRKQFIVKQILERKPKIVGIYKLGMKYNSDNYKESAIL
SIINELLIVGIKILVYEPNLNVSIDNVIFEKNFELFTKQSDLIVANRWDRGLEAYKDKVY

TRGIWIRD (SEQ ID NO: 112)

>orf00268
MLNLQFAETMELTEAELETVYGGEFGNNAVIPAGAWGGLGTSWSITNFWKKYFNHDSSTV
NRRHY (SEQ ID NO: 113)

>orf00272
MKIKEQTRKLAAGCSKHRFEVADRTDEVSSKHCFEVVDRTDEVSNHTYGKVKLTWFEESF
EEYK (SEQ ID NO: 114)

>orf00338
LNTSYSFGKKDQFALEHCFCIKLSIFARAVTLFVSCIN (SEQ ID NO: 115)

>orf00359
MLIGEGYRTFPVLIYTQFISEVGGNSAFAIMAIIIALAIFLIQKHIANRYSFSMNLLHPI
EPKKTTKGKMAAIYATVYGIIFISVLPQIYLIYTSFLKTSGMVFVKGYSPNSYKVAFNRM
GSAIFNTIRIPLIALVLVVLFTTFISYLAVRKRNLFTNLIDSLSMVPYIVPGTVLGIAFI
SSFNTGLFGSGFLMITGTAFILIMSLSVRRLPYTIRSSVASLQQIAPSIEEAAESLGSSR
LNTFAKITTPMMLSGIISGAILSWVTMISKLSTSILLYNVKTRTMTVAIYTEVLRGNYGV
AAALSTILTVLTVGSLLLFMKISKSNSITL (SEQ ID NO: 116)

>orf00360
LIIIASMSTPFVGAYSWILLLGRNEVITKFLTNALYLPAIDIYGFKGIILVFTLQLFPLV
FLYVAGTMNSIDNSLLEAAESMGSFGFKPIVTVVLPLLVPTLLAAPCLYL (SEQ ID NO: 117)

>orf00362
LLSTTEFIGLSIRILSNLHESKILVGLLNQFFFWNLLLHKTKSNVVSDSQMWENSVVLEN
QPDIAFAGFHIIDFCIIEVKFSIFDTVETCNHTKKGRFPTS (SEQ ID NO: 118)

>orf00380
VTAPTSITPLLVNTHERKSSQSLTSCLVYVVKTVLTSQHLIYSKLKLK (SEQ ID NO: 119)

>orf00382
MITIKKQEIVKLEDVLHLYQAVGWTNYTHQPEMLEQALSHSLVIYLALDGDAVVGLIRLV
GDGFSSVLVQDLIVLPIYQRQGIGSALMKEALEDYKDAYQVQLVTEQTERTLGFYRSMGF
EILSTYNCIGMTWMNRKK (SEQ ID NO: 120)

>orf00441
MGAFVLFLFQLTINRYKKKSFYWYKEVIESNGETLDN (SEQ ID NO: 121)

>orf00465
VAIDKIAGITSEKDSRAHQIFRISPTCSRCFCNDELVKWVARTIFLQFTKRCCLRSGNIT
RSNSVTLDIGSTVFRRNVAGQHFQAPFSSSISANCFTSQFAHHRTNIDNLSMPFLYHRRN
NCL (SEQ ID NO: 122)

>orf00466
LFDLLDHGLDTVLVCHVTDISMGFDANFTISFNPFIDQILIDIVKDNSSAGFSVGFGNSK
SNSIRSAGDESNFSF (SEQ ID NO: 123)

>orf00478
MKSLARLLNIHVFISIFLFFALISGAVSHTVLLLLLLFLPALNKGLEKIQSKRIPVLNAA
LFFLLISFPQLLTNPVQWKFSIFLVVTIISSLAYFYNFYQVVKEVDQKQLI (SEQ ID NO: 124)

>orf00480
LEAAGEIETEFQGWIVLVVFNHIDSLSRDTDILGEFELGNTQFLAKFFHTIHLVSFLIYV
VYI (SEQ ID NO: 125)

>orf00485
MVDRTDEVSSKHGFEVVDKEKLMWFEEVFEECKKILVS (SEQ ID NO: 126)

>orf00492
MEGVNHVDIIKVSCGSFISQVNWMMKGKIPNREGFKFSVARLDAIDLVVVHIGHTRCQFS
RTGSRSGYDNQVATDFDVVVFAHAFWGNDVIHIRRISFDWIMKIRINSVFLKLVAEGICS

GLTSVLCNDNGTNKNP (SEQ ID NO: 127)

>orf00493
MFNVASINGNHNLNLLFQFLQELDFVVRFITRKDTSSVEIF (SEQ ID NO: 128)

>orf00495
LFFHFLPLDSIIIKNWKLGNYGAKKEIKKIKQTLAQNFKKCYHIL (SEQ ID NO: 129)

>orf00498
MQLTSVTAPTGTDNENIQKLLADIKSEYRFDGRPEFVLLGCLQESDCR (SEQ ID NO: 130)

>orf00501
MIDIHSHIVFDVDDGPKSIEDSKALLREAYNQGVRMIVSTSHRRKGMFETPEEKIVTNFI
KVREIAKEVADDLVIAYGAEIYYTLDALEKLEKKKFLPLMIVVML (SEQ ID NO: 131)

>orf00502
MHTSYREIHTRLSNILMLGITPVIAHIERYDALENNEKRVRELIDMGCYTQIDSYHVSKP
KFFGEKYKFMKKRARYFLERDLVHVVASDMHNLDSRPPYMQQAYDIIAKKYRAKKAKELF
VDNPRKIIMDQLI (SEQ ID NO: 132)

>orf00503
MKEQNTLEIDVLQLFRALWKRKLVILLVAIITSSVAFAYSTFVIKPEFTSTTRIYVVNRN
QGEKSGLTNQDLQAGSYLVKDYREIILSQDVLEEVISDLKLDLTPKGLANKIKVTVPVDT
RIVSVSVNDRVPEEASRIANSLREVAAQKIISITRVSDVATLEEARPAISPSSPNIKRNT
LIGFLAGGIGTSVIVLLLELLDTHVKRPEDIEDTLQMTLLGVVPNLGKLK (SEQ ID NO: 133)

>orf00505
MAKGHHIKLKVKDKIANVLTCNTISINSITSHSNSTQFMPFGMVLTQPLNIRRHPVFSNF
NLSSFYILTERTIQ (SEQ ID NO: 134)

>orf00506
MKIAIAGSGYVGLSLAVLLAQHHEVKVIDVIKDKVESINNRKSPIKDEAIEKYLVEKELN
LEASLDPAHVYKDVEYAIIATPTNYDVDLNQFDTSSVEAAIKTCMEYNDTCTIVIKSTIP
EGYTKEVREKFNTDRIIFSPEFLRESKALYDNLYPSRIVVGTDLDDSELTKRAWQFADLL
KGGAIKEEVPILVVAFNEAEVAKLFSNTYLATRVAYFNEIDTYSEVKGLNPKTIIDIVCY
DPRIGSYYNNPSFGYGGYCLPKDTKQLKASFRDVPENLITAVVQSNKTRKDYIAGAILAK
QPSVVGIYRLIMKSDSDNFRSSAVKGVMERLDNYGKEIVIYEPTIECDTFMGYRVIKSLD
EFKNISDIVVANRMHDDLRDIQEKLYTRDLFGRE (SEQ ID NO: 135)

>orf00507
MYTFILMLLDFFQNHDFHFFMLFFVFILIRWAVIYFHAVRYKSYSCSVSDEKLFSSVIIP
VVDEPLNLFESVLNRISRHKPSEIIVVINGPKNERLVKLCHDFNEKLENNMTPIQCYYTP
VPGKRNAIRVGLEHVDSQSDITVLVDSDTVWTPRTLSELLKPFVCDKKIGGVTTRQKILD
PERNLVTMFANLLEEIRAEGTMKAMSVTGKVGCLPGRTIAFRTEILRECIHEFMNETFMG
FHKEVSDDRSLTNLTLKKGYKTVMQDTSVVYTDAPTSWKKFIRQQLRWAEGSQYNNLKMT
PWMIRNAPLMFFIYFTDMILPMLLISFGVNIFLLKILNITTIVYTASWWEIILYVLLGMI
FSFGGRNFKAMSRMKWYYVFLIPVFIIVLSIIMCPIRLLGLMRCSDDLGWGTRNLTE (SEQ ID
NO: 136)

>orf00508
LIFEKEKCFLMLRKNLKYQIMTRAGTILAILFFIILGIIVEVLF (SEQ ID NO: 137)

>orf00509
MKKVKKAVIPAAGLGTRFLPATKALAKEMLPIVDRPTIHFVIEEALRSGIEDILVVTGKS
KRSIEDYFDSTFELEYSLRKQGKMELLKSVNESTDIKVHFVRQSSPRGLGDAVLQAKSFV
GDDPFVVMLGDDLMDITDSTAVPLTRQLMDDYNATQASTIAVMPVRYEDVSSYGVISPRL
ESSNGLYSVDAFVEKPKPEEAPSNLAIIGRYLLTPEIFSILETQKPGAGNEIQLTDAIDT
LNKTQSVFAREFVGKRYDVGDKFNFMKTSIDYALQHPQIKESLKNYVIALGKQLEKLDDC
SSSGHL (SEQ ID NO: 138)

>orf00510
MNCIESYQKWLNVPDLPAYLKDELLSMDDKTKEDAFYTNLEFGTAGMRGYIGAGTNRINI
YVVRQATEGLAKLVESKGETAKKAGVAIAYDSRHFSPEFAFESAQVLAAHGIKSYVFESL

RPTPELSFAVRHLGAFAGIMVTASHNPAPFNGYKVYGSDGGQMLPADADALTDYIRAIDN
PFAVALADLEEAKSTGLIEVIGETLDSAYLEEVKSVNINQDLIDQYGRDMKIVYTPLHGT
GEMLARRALAQAGFESVQVVEAQAKPAPDFSTVASPNPESQAAFALAEELGRQVDADVLV
ATDPDADRLGVEIRQADGSYWNLSGNQIGALIAKYILEAHKQAGTLPKNAALAKSIVSTE
LVTKIAESYGATMFNVLTGFKFIAEKIQEFEEKHNHTYMFGFEEG (SEQ ID NO: 139)

>orf00520

MNKGLFEKRCKYSIRKFSLGVASVMIGAAFFGTSPVLADSVQSGSTANLPADLATALATA
KENDGRDFEAPKVGEDQGSPEVTDGPKTEEELLALEKEKPAEEKPKEDKPAAAKPETPKT
VTPEWQTVEKKEQQGTVTIREEKGVRYNQLSSTAQNDNAGKPALFEKKGLTVDANGNATV
DLTFKEDSEKGKSRFGVFLKFKDTNNNVFVGYDKDGWFWEYKSPTTSTWYRGSRVAAPET
GSTNRLSITLKSDGQLNASNNDVNLFDTVTLPAAVNDHLKNEKKILLKAGSYDDERTVVS
VKTDNQERVKTEDTPAQKETGPVVDDSKVTYDTIQSKVLKAVIDQAFPRVKEYTLNGHTL
PGQVQQFNQVFINNHRITPEVTYKKINETTAEYLMKLRDDAHLINAEMTVRLQVVDNQLH
FDVTKIVNHNQVTPGQKIDDERKLLSSISFLGNALVSVSSDQTGAKFDGATMSNNTHVSG
DDHIDVTNPMKDLAKGYMYGFVSTDKLAAGVWSNSQNSYGGGSNDWTRLTAYKETVGNAN
YVGIHSSEWQWEKAYKGIVFPEYTKELPSAKVVITEDANADKKVDWQDGAIAYRSIMNNP
QGWEKVKDITAYRIAMNFGSQAQNPFLMTLDGIKKINLHTDGLGQGVLLKGYGSEGHDSG
HLNYADIGKRIGGVEDFKTLIEKAKKYGAHLGIHVNASETYPESKYFNEKILRKNPDGSY
SYGWNWLDQGINIDAAYDLAHGRLARWEDLKKKLGDGLDFIYVDVWGNGQSGDNGAWATH
VLAKEINKQGWRFAIEWGHGGEYDSTFHHWAADLTYGGYTNKGINSAITRFIRNHQKDAW
VGDYRSYGGAANYPLLGGYSMKDFEGWQGRSDYNGYVTNLFAHDVMTKYFQHFTVSKWEN
GTPVTMTDNGSTYKWTPEMRVELVDADNNKVVVTRKSNDVNSPQYRERTVTLNGRVIQDG
SAYLTPWNWDANGKKLSTEKEKMYYFNTQAGATTWTLPSDWAKSKVYLYKLTDQGKTEEQ
ELTVKDGKITLDLLANQPYVLYRSKQTNPEMSWSEGMHIYDQGFNSGTLKHWTISGDASK
AEIVKSQGANDMLRIQGNKEKVSLTQKLTGLKPNTKYAVYVGVDNRSNAKASITVNTGEK
EVTTYTNKSLALNYVKAYAHNTRRDNATVNDTSYFQNMYAFFTTGSDVSNVTLTLSREAG
DQATYFDEIRTFENNSSMYGDKHDTGKGTFKQDFENVAQGIFPFVVGGVEGVEDNRTHLS
EKHYPYTQRGWNGKKVDDVIEGNWSLKTNGLVSRRNLVYQTIPQNFRFEAGKTYRVTFEY
EVGSDNTYAFVVGKGEFQSGRRGTQASNLEMHELPNTWTDSKKAKKATFLVTGAETGDTW
VGIYSTGNASNTRGDSGGNANFRGYNDFMMDNLQIEEITLTGKILTENALKNYLPTVAMT
NYTKESMDALKEAVFNLSQADDDISVEEARAEIAKIEALKNALVQKKTSLVADDFASLTA
PAQAQEGLANAFDGNLSSLWHTSWGGGDVGKPATMVLKEPTEITGLRYVPRGSGSNGNLR
DVKLVVTDESGKEHTFTTTDWPDNNKSKDIDFGKTIKAKKIVLTGTKTYGDGGDKYQSAA
ELIFTRPQVAETPLDLSGYEAALAKAQKLTDKDNQEEVASVQASMKYATDNHLLTERMVE
YFADYLNQLKDSATKPDAPTVEKPEFKLSSLASDQGKTPDYKQEIDRPETPEQILPATGE
SQSDTALFLAGVSLALSALFVVKTKKD (SEQ ID NO: 140)

>orf00523

LQIAQESSQDTDGINPPVVEEAMVFDRNDCLNQICGNIISLGIDAAFRTQVSNELIFIVV
DFTRSCCN (SEQ ID NO: 141)

>orf00525

MLNLMWMKIFHRNRTFLFCFLDFKVDVISIINARIVRR (SEQ ID NO: 142)

>orf00526

MYNSQALRQIVVVGSIDHLFKRHSSICEIFGLRKRCLSFLW (SEQ ID NO: 143)

>orf00537

MKLLKKTMQAGLTVIFFGLLATNTVFADNSEGWQFVQENGRTYYKKGDLKETYWRVIDGK
YYYFDSLSGEMVVGWQYIPFPSKGSTIGPYPNGMRLEGFPNSEWYYFDKNGVLQEFVGWK
TLEIKTKDSVGRKYGEKREDSEDKEEKRYYTNYYFNQNHSLETGWLYDQSNWYYLAKTEI
NGENYLGGERRAGWINDDLTWYYLDPTTGIMQTGWQYLGNKWYYLRSSGAMATGWYQEGT
TWYYLDQPNGDMKTGWQNLGNKWYYLRSSGAMATGWYQEGTTWYYLDQPNGDMKTGWQNL
GNKWYYLRSSGAMATGWYQDGSTWYYLNAGNGDMKTGWFQVNGNWYYAYSSGALAVNTTV
DGYSVNYNGEWVR (SEQ ID NO: 144)

>orf00541

MTTGWFQVNGRWYYAYSSGALAVNTTVDGYFVNYNGEWVQ (SEQ ID NO: 145)

>orf00551

MSLADLLEELEAAKDSKKARSMEAYMRHQFSFLGIAVPERNKLYKNIFQKRKKQRLSIGI
LQTLAGKRILENTNMWLLTI (SEQ ID NO: 146)

>orf00552
MEKILLHNLNQTEFFINKAIGWTLRDYSKTNPTWVTCFIEKNKERMAELSIKEASKYL (SEQ ID NO: 147)

>orf00555
VLEILKEYLLLEEGDYIFTNNGSPLMITCFNYFLKNSFRKSEIKKDDFVLTAHVFRYSHI SLLAELEVPITAIMDRVDYTNETKILSVYTHVTEKMKSNITEKLDKLVLEND (SEQ ID NO: 148)

>orf00580
LVIFKNCSHCTSNCKSRTVQGMKEFHLAICFITVTDLSTTGLEIFXXXFHSLIN (SEQ ID NO: 149)

>orf00581
MNXXARGFSFVCKDFEVAAHFASSDIGSNLIDMAPRNLDKLFDIDIWVKFQSLISDKEFP NFPSDREVGSACRTEEYCFVK (SEQ ID NO: 150)

>orf00587
LQKPLFQILQKLVKISQAFIHDSNFFLAHAINNFXXHSFIN (SEQ ID NO: 151)

>orf00590
VGFSLLLLLIFCLFCLLFNVSNQVTNCFQVIFCFDLDIKSIFDF (SEQ ID NO: 152)

>orf00614
VNIDSSEFYISHITDGIFDSFLDSNRYLRNFYSVLKVEIDICCEFFVHVFKINATAE (SEQ ID NO: 153)

>orf00615
VNTLYLCSSNSNDFFKYTWGDNDFAKLFFNSHRMTSF (SEQ ID NO: 154)

>orf00625
LFSPRPGGDNGKGTTFLNFFLNIHKFSFFDSLFFLFQ (SEQ ID NO: 155)

>orf00627
VKEEKKAIVLGADNAYMDKVETTLKSLCVHHYNLKFYVFNDDLPREWFQLMEKRLETLNS EIVNV (SEQ ID NO: 156)

>orf00643
LAQISILHFDFLSIDKHSHTVFNTLRKSLQTTLALSATSKQCFEQLAASFLVCSLIFIEY KV (SEQ ID NO: 157)

>orf00652
MSLITHRRFISSKVTRQKFVDNQIDLKYYIWRYSHALCGIDVAKNKHDVTALNVSGKTVL KPLTFSNNKAGFELLDLSLRQLNQDYLIALEDTGHYAFNLLNFLHEQGYKVYTYNPLLIK KFAKSLLLRKTKTDKKDAHGIALKLLSDPNREQFQHDNRQVELKILARHIHRLKKKQSDW KVQYTRCLDIIFPELDKIVGKHSEYTYQLLTCYPNPQKRLEAGFDKLIEIKRLTASKIQD ILSVAPRSIGTTSPAREFEIIENIKHYKRLIDKAETCVNDLMAEFNSVITTVTGIGNRLG AVILAEIQNIHAFDNPAQLQAFAGLDSSIYQSGQIDLAGRMVKRGSPHLR (SEQ ID NO: 158)

>orf00654
MDTKSSCLITTGRNDSPSTCLPRVASNNDRFSSEFRIIPDFHCSKKGIHVNMDDFS (SEQ ID NO: 159)

>orf00657
MDKMKPVFQALNKELIQENLTLTIICVGGYVLEYHGLRATQDVDAFYDQNQKINEIIARV GKQFNLNTHEELWLNNHVANMNKQPPLSLCESLYSFENLTVLVVPIEYVLGMKMMSIREQ DLKDIGAIIKYKNFHSPFDTFKYLKDMGFDTIDLSVLLEGFSYAYGMDWLEKFFKENQDK LREFY (SEQ ID NO: 160)

>orf00663
MIPLYRTDNDITKFFTKIRNGHLAKTAGGLDDKFHEANASTSKAFDRQGVGEVNDIRDSA GSQELRINDKRKTENILFLEIRVRIFRVPHPNDSFFSSHFLG (SEQ ID NO: 161)

>orf00664
VLSQGDKDITILDAGLLKNGKIGPVTKDTNDIKATDNMIENSFVLLNQQNIMLFCNQGAT
EGKTNFSPSDKDNFHNKTYFFMM (SEQ ID NO: 162)

>orf00669
MKIKEQTRKLAAGCSKQCFEIVDRTDEVSSKHGFEVVDETDEVSSKHGFEIVDETDEVSN
HTYGKAKLTWFEEIFEEYKMMGKAGQLVFFDVYRLVRQVS (SEQ ID NO: 163)

>orf00698
MEKFNFKNNIGQENKLLQIEIYKFTNFCKLQNYTSVNIFSKDIFEAIVN (SEQ ID NO: 164)

>orf00701
VRIKSIYWNFGQNKPEKSFRYIDTSSIDRKKNIINYKNLQYLSPEQAPSRARKLVSQNSV
LFSTVRPYLKNIAVVRELKEYLIASTAFIVLDTLLNETYLKYYLLSDNFINRVNNKSTGT
SYPAINDYNFNLLLIPLPPLSEQQRIVEAIESALEKVDEYAESYNRLEQLDKEFPDKLKK
SILQYAMQGKLVEQDPNDESVEVLLEKIRAEKQKLFEEGKIKKKDLDISIVSQGDDNSYY
GNIPMNWVVIKIKDIFSINTGLSYKKGDLSINKGVRIIRGGNIKPLEFSLLDNDYYIDTQ
FISSEQVYLKHNQLITPVSTSLEHIGKFARIDKDYDGVVAGGFIFQLTPFESSEIISKFL
LFNLSSPLFYKQLKAITKLSGQALYNIPKTTLSELLIPLAPFEEQELITQKVEKLFEKVN
QLWK (SEQ ID NO: 165)

>orf00720
MIRKVNHNIFKHRSVVIFTLTNSYFCKFFINDISISFHSHQHFCWIIIQIK (SEQ ID NO: 166)

>orf00724
LDNIHIVLDSLNAVSGIQDFICDGLAIFCNQITSGCSSCK (SEQ ID NO: 167)

>orf00735
MNIAWILLYALVINGLEIVIFFKVDGIGLTFDRIFKAFLLKFLLGIIFTTFQFLAVSKYL
SYFIEPLFGIGLSFLLLRGLPKKILIFYGLFPMILVELFYRGVSYFVLPFLGQGIVDGDG
NPIFLLIMIFVCFIVLVFLKWLDYDFTRLRREFLDTGFQKSLTKINWAMGAYYLVMQSLS
YLEYEQGIQSTTVRHLILVFYLLFFMGGIKKLDTYLKEKLQEELNQEQTLRYRDMERYSR
HIEELYKEIRSFRHDYTNLLTSLRLGIEEEDMEQIKEIYDSVLRDSSQKLQDNKYDLGRL
VNIRDRALKSLLAGKFIKAREKNIVFNVEVPEEIQVEGMSLLDFLTIVSILCDNAIEASA
EASQPHVSIAFLKNGAQETFIIENSIKEEGIDISEIFSFGASSKGEERGVGLYTVMKIVE
SHPNTNLNTTCQNQVFRQVLTVIHAE (SEQ ID NO: 168)

>orf00737
MISQEDILKACEVAEIRQDIERMPMGYQTQLSDGAGLSGGQKQRIALARALLTKSPVLIL
DEATSGLDVLTEKKVIDNLMSLTDKTILFVAHRLSIAERTNRVIVLDQGKIIEVGIHQEL
MQAQGFYHHLFNK (SEQ ID NO: 169)

>orf00738
MSSKISIGQLITFNTLLSYFTTPMENIINLQTKLQSAKVANNRLNEVYLVESEFQVQENP
VHSHFLMGDIEFDDLSYKYGFGRDTLTDINLTIKQGDKVSLVGVSGSGKTTLAKMIVNFF
EPYKGHISINHQDIKNIDKKSLAPSY (SEQ ID NO: 170)

>orf00740
MKSTLGIISVGLVITYILQQVMSFSRDYLLTVLSQRLSIDVILSYIRHIFELPMSFFATR
RTGEIISRFTDANSIIDALASTILSLFLDVSILILVEGVLLAQNPNLFLLSLISIPIYMF
IIFSFMKPFEKMNHDVMQSNSMVSSAIIEDINGIETIKSLTSEENRYQNIDSEFVDYLEK
SFKLSKYSILQTSLKQGNKISSEYPYPMVWRSISHVE (SEQ ID NO: 171)

>orf00742
MTSYKRTFVPQIDARDCGVAALASIAKFYGSDFSLAHLRELAKTNKEGTTALGIVKAADE
MGFETRPVQADKTLFDMSDVPYPFIVHVNKEGKLQHYYVVYQTKKDYLIIGDPDPSVKIT
KMSKERFFYEWTGVAIFLATKPSYQPHKDKKNGLLSKLPSSDFQTKISHCLHCSLKLIGH
YYQYRWFLLSPRNLG (SEQ ID NO: 172)

>orf00767
MGLIKTLAKIYGNYFLTVQGVKVMKTIKKDDHVVVGLGKLFIADKLMDTARWLIKPEDKK
(SEQ ID NO: 173)

>orf00768
MKFFWGLLAIIFIKPIIGIVKFFWMIISFAVQLLFYKIVFKILDWLFKLI (SEQ ID NO: 174)

>orf00776
MHSQTFQFLLMTDKTSLLHRKHRSFIRNIHSKFLILFDLLCGILSRNDSNHNPIS (SEQ ID NO: 175)

>orf00779
MARTELPDKIETERLVLRVRTVADAEDIFDYASLPEIAYPAGFPPVKTLEDEIYYLEHIL
PERNQKENLPAGYGIVVKGTDKIVGSVDFNHRHEDDVLEIGYTLHPDYWGRGYVPEAARA
LIDLAFKDLGLHKIELTCFGYNLQSKRVAEKLGFTLETRIRDRKDVQGNRCDSLIYGLLK
SEWEE (SEQ ID NO: 176)

>orf00781
MSDVKEEVSSLSEKQLRQIDVEYAELNDSDIIERLAYLEINNNEKRIVISDIEPTKEIMS
VSDQIFEIQKNFQKIKNMFELFISDVSDFLSIKNKLESKELEIEEADVNRFMIHLLSSGK
LFVDFNENQIKQKYSKDSEEFDCIHGFASYQYDINFTYRFCHSLRNYSQHTDLPINEVKA
VSPDDETVIIDFYIDLDYLLNSNFKWKKLKGELIKLNQETSKIDAIALVKEYFNALTELY
GNYNKLFLKLNHNTLVDIKSKLESLKLKHSRYYISKISKYDLKYNPGNYTMSPLAAFAEI
EEIYIELSKIGLVKIVNKSN (SEQ ID NO: 177)

>orf00785
MSKHPHYELLNLIGYGLAKFDKLFIKEFQCSSKSEFYRYVVSLGIAETTGVVKNRMDLFD
PYFDNNRKGWWQKAEVYRFRKDLIDMMFGNEDVHSYAEIVKMLLASEGKKTGITIVEKPI
VRTKFKRLQETGMEAENYFILHFDKEEKFQGGQLTDARLYGDGYDFQVDVQEYSYLAEVK
GIRKSKGRVRLTAKEFEKVKEFQSDFILSLVTNLDDIPKLVLIDNPLKHFEFKKNIIKNE
IIEYRSVEDLY (SEQ ID NO: 178)

>orf00787
LSTCWNGKFCHICVALFHCFRAFKLALNEILCLLTNVSFIFVSVAF (SEQ ID NO: 179)

>orf00788
LLRKQEREYLRAENAILKKLRELRLKEEKEKEERQKLFKN (SEQ ID NO: 180)

>orf00809
LKHLFCHFNPLWIDEIIRLAYKDQDTKDVKSKVKIGN (SEQ ID NO: 181)

>orf00856
MKEIAFDAFYQLYQNDQLSLVDVREVDEFAALHLEGAHNLPLSQLADSYD (SEQ ID NO: 182)

>orf00859
MVSNHKIACFQLFDKVGIFSLLDELNSLANKAHINLLNCF (SEQ ID NO: 183)

>orf00871
MDFFFMNEVKEQVLFRDNHSEHIFWIEGVSDFMIKVNTALW (SEQ ID NO: 184)

>orf00878
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSNHTHGKATLTWFEEIF (SEQ ID NO: 185)

>orf00885
MKIKEQTRKLAAGCSKHSFEVVDKTDEVSSKHGFEVVDETDEVSSKHGFEVVDETDEVSN
HIYGKATLTKFELDFRRV (SEQ ID NO: 186)

>orf00890
MEELVTLDCLFIDGTKIEANANKYSFVWKKTTEKFSAKLQEQIQVYFQEEITPLLIKYAM
FDKKQKRGYKQSAKNLANWHYNDKEDSYIHPDGWCYRFHHIKYQKTQTDFQQEIKVYYAD
EPESAPQKGLYMNERYQNLKAKECQALLSPQDRQIFAQRKIDVEPVFGQIKACLGYKRCN
LRGKRQVRIDMGLVLMANNLLKHSEMK (SEQ ID NO: 187)

>orf00892
MHIHYNTNQTTLPLEISSFLPQDHLVFTIEKVVNTLEDCHFHAFYHAFDRPSYHLKMLVS
TLLFAYSQGIFSGRKIEKWKS (SEQ ID NO: 188)

>orf00894
LRLWVIFVIMKVMKSYNTLNDYYRKLFGEKTFKVPIDAGFDCPNRDGTVAHGGSTFCTVS
GSGDAIVAPDAPIREQFYKEIDFMHRKWPDVQKYLVYFQNFTNTHEKVEVIRERYEQAIN
EPGVVGINIGTRPDCLPDETIEYLAELSECMHVTVELGLQTTYEATSDLINRVHSYEL
(SEQ ID NO: 767)

>orf00896
VETVKRLRKYPKIEIVSHLINGLPGETHEMMVENVRRCVTDNDIQGIKLHLLHLMTNTRM
QRDYHEGRLQLMSQDEYVRVICDQLEIIPKHIVIHRITGDAPRDMLIGPMWSLKKWEVLN
SIEMEMRRRGSVQGCKAVKQEFENEKTT (SEQ ID NO: 189)

>orf00908
VQVCVFTNFCFFHCFSSLANCRLFNLRGICLPCISYQ (SEQ ID NO: 190)

>orf00915
VFKKDRFSIRKIKGVVGSVFLGSLLMAPSVVDAATYHYVNKEIISQEAKDLIQTGKPDRN
EVVYGLVYQKDQLPQTGTEASVLTAFGLLTVGSLLLIYKRKKIASVFLVGAMGLVVLPSA
GAVDPVATLALASREGVVEMDGYRYVGYLSGDILKTLGLDTVLEETSAKPGEVTVVEVET
PQSTTNQEQARTENQVVETEEAPKEEAPKTEESPKEEPKSEVKPTDDTLPKVEEGKEDSA
EPSPVEEVGGEVESKPEEKVAVKPESQPSDKPAEESKVEPPVEQAKVPEQPVQPTQAEQP
STPKESSQQENPKEDRGAEETPKQEDEQPAEAPEIKVEEPVESKEETVNQPVEQPKVETP
AVEKQTEPTEEPKVEVTSIPQTTRYEEDLTKEHGTREVVKEGKNGSRTVTTPYILNATDG
TTTEGTSTTDEAEMEKEVVRVGTKPKEKLAPVLSLTSVTDNAMLRSARLTYHLENTDSVD
VKKIHAEIKNGDKVVKTIDLSKERLSDAVDGLELYKDYKIVTSMTYDRGNGEETSTLEET
PLRLDLKKVELKNIGSTNLVKVNEDGTEVASDFLTSKPVDVQNYYLKVTSRDNKVFRLTV
EKIEEVTEEGQPLYKVTAKAPNLIQHTDATKMQDEYVYYIEKTRATDGDIYYNFNDLVNA
MNKNKTGTFKLGADLNATGVPTPAKSYVTGDFRGTLTSVDGEHYTIHNTSRPLFNNIIGG
TIKDINLGNVNIHMPWANNVASLANIIKGGTTIENVKVTGNVLGKDWVSGFIDKIDSGGT
LRNVAFIGNVTSVGTGGSFLTGIVGENWKGLVEQAYVDANIRGKKAKAAGIAYWSQNGGD
NYAVGRYGAIKKSVVKGSIDVEKPIEVGGAVGSLNYLGYIEDTVAMMKVKNGEIFYGSHD
IDTDPYYTGERVNRNFIVDGVSEGKSSYKYSKQQNRIKSVSQEEADKKIKELAITADKYA
ITEPIVNKLNALTTRDNEYRTTQDYKADRELAYRNIEKLQPFYNKEWIVDQGNKVPSNSK
LLTTEVLSVTGMKDGQFVTDLSEIDKIMIHYADGTKEEMNVTAVADSKVKQVREYDVTDL
GVVYTPNMVDKNRDQLIADVKAKLSSVELISPEVRALMDKRGKAEENTEGRQNGYIRDLF
LEESFAEVKAGLGKLVKALVENEDYQLNSDEAAMRALIKKVEDNKAKIMMGLAYLNQYYS
FKYAELSIKDIMMFKPDFYGKNVNVLDFLIKIGSSERNVKGDRTLEAYRETIGGTIGINE
LNGFLHYNMKLFTNHIDINDWFKKAIEKNAYVVEQPSTNPAFANKKYRLYEGINNGQHGR
MILPLLNLKNAHLFMISTYNTISFSSFEKYGKDTDEKREKFKSEINKRAKEQVNYLDFWS
RLATDNVRDKLLKSQNVVPTPVWDNHNSPNGWASRHGHIDGKPDYAPIREFFGRINKYHG
YKYGYGAYAYIFAAPQPMDAVYFVMTDLISDFGTSAFTHETTHINDRMAYYGGHWHREGT
DLEAFAQGMLQTPSVSNPNGEYGALGLNMAYERQNDGNQWYNPNPNKLKSRAEIDHYMKN
YNEALMMLDYLEAESVLPKLKGNNDRWFKKMDKQMRKDGQPHQFDKIRDLNNEEKKIQLA
SIEDLVDNNFMTKHGAPGNGTYNPSDFSSAYVNMNMMTGVYGGNSSDGAPGAASFKHNTF
RMWGYFGYENGFIGYASNKYKAEANKAGQTLSDKYIINKVSGGTFNTLEAWKKEWFKQIK
TKAQKGFTAIEIDGKTIDSYEKLKDLFDKAVEEDLKGTGTDKTVKLKEKVYKQLLKNTDG
FSGDLFTAPQA (SEQ ID NO: 191)

>orf00933
VGDRIFIAFLQKLGLLDNLTGIREKLHPITGQGDSLGIADKDLNAHFIFQISHCIGETWL
SDKELLGCLIHGASFDDFDNIM (SEQ ID NO: 192)

>orf00941
VSRWDGHSDKGEAPAGKTSYAWIWTKWGEQVAFYCDYD (SEQ ID NO: 193)

>orf00955
MKLFKPLLTVLALAFALIFITACSSGGNAGPSSGKTTAKARTIDENKKSGELRIAVFGDK
KPFGYVDNDGSYQGYDIELGNQLAQDLGVKVKYISVDAANRAEYLISNKVDITLANFTVT
DERKKQVDFALPYMKVSLGVVSPKTGLITDVKQLEGKTLIVTKGTTAETYFEKNHPEIKL
QKYDQYSDSYQALLDGRGDAFSTDNTEVLAWALENKGFEVGITSLGDPDTIAAAVQKGNQ
ELLDFINKDIEKLGKENFFHKAYEKTLHPTYGDAAKADDLVVEGGKVD (SEQ ID NO: 194)

>orf00988

MDTPDENGYVADDYRITYLEAHIKAMRDAIYQDGVDLLGYTTWGCIDPVSAGTGEMNKRY
GFIYVDRDNVGNGALKRSKKKSFYWYKDVIDSNGASIG (SEQ ID NO: 195)

>orf01015

MTEPDFWNDNIAAQKTSQELNELKNTYNTFHKMEELQDEVEILLDFLAEDESVHDELVAQ
LAELDKIMTSYEMTLLLSEPYDHNNAILEIHPGSGGTEAQDWGDMLLRMYTRYGNAKGFK
VEVLDYQAGDEAGIKSVTLSFEGPNAYGLLKSEMGVHRLVRISPFDSAKRRHTSFTSVEV
MPELDDTIEVEIREDDIKMDTFRSGGAGGQNVNKVSTGVRLTHIPTGIVVQSTVDRTQYG
NRDRAMKMLQAKLYQMEQEKKAAEVDSLKGEKKEITWGSQIRSYVFTPYTMVKDHRTSFE
VAQVDKVMDGDLDGFIDAYLKWRIS (SEQ ID NO: 196)

>orf01045

MQVIKRNGEIAEFNPDKIYQAILKAAQTVYVLTDDLRQNLAQVTKKVVLDLQEAKVERAT
ISMIQSMVEHRLLGAGYITIAEHYISYRLQRDLERSGYGDHIAVHLHFEQIR (SEQ ID NO:
197)

>orf01068

MELFKTWKKNMVLYGLKSQIGTVYRNNDRTTSFYDVGNFLYLAGELDSRFWEDFVRKYGL
DYKIIISENTNWQDFLHRKVGLNSFTRYSFKDKANFQVEFLNNLVTHLEEGYNIVPIDNH
IYNCFSTEEWSQDLQGDFESYQDFVLKGGFGFVILKNNELIAGISSGLVYRKAVEVEVAT
RPNEQGNGFAKKLGAAMILESLNRDMFPLWDAHNEASKKVAEFLGYELSEPYEAFELEEI
LI (SEQ ID NO: 198)

>orf01090

LGSDRKALHKPVYLFWCESFDILFCTWSSQFSVLKAFI (SEQ ID NO: 199)

>orf01110

MKVINQTLLEKVIIERSRSSHKGDYGRLLLLGGTYPYGGAIIMAALAAVKSGAGLVTVGT
DRENIPALHSHLPEPMAFSLQDQQLLKEQLEKAEVILLGPGLRDDASGENLVKQVFVNLS
QNQILIVDGGALTILARTSLSFPSSQLILTPHQKEWEKLSGITIEKQKEDATASVLTSFP
QGTILVEKGPATRIWEVGQSDYYQLQVGGPYQATGGMGDTLAGMIAGFVGQFRQASLYER
VAVATHLHSAIAQELSQENYVVLPTEISRYLPKIMKIICQQDRVSKDKLV (SEQ ID NO: 200)

>orf01114

VLASNRKFIFFFFRIGILILKNIKSFNQFLALFHKIPSHDGSRKSLSWSDGKSLKXXFIH
(SEQ ID NO: 201)

>orf01121

VLDSKEELKESENDAPKLETPLREEPRLAPQTLLEASEVLENKREESKVGITEPAQDSPI
LAPVEETKEEAVTEKPTNTRSLTAEDLVKISKGELHLENDLIDESFYGEKALDLEGDDYQ
DGIKNKDGKDYLGYNSHPLLADSDGDGLADGEDDNKKEWYVTDRDSLLFMELAYRDDDYI
EKILDHKNLFPSLYLDRQEHKLMHNELAPFWKMKKAYYTDSGLDAFLFETKSDLPYLKDG
TVHMLAIRGTRVNDAKDLSADFVLLGGNKLAQADDIRKVVGELAKDISITKLYMTGHSLG
GYLAQIAAVEDYQKYPDFYNHVLRKVTTFSAPKVITSRTVWDAKNGF (SEQ ID NO: 202)

>orf01148

MGRNPKTRPEERTELERLQSENEYLRAENAILKKLRELRLKEEKEKEERQKLFKN (SEQ ID NO:
203)

>orf01150

LSTCWNGKFCHICVALFHCFRAFKLALNEILCLLTNVSFIFVSVAF (SEQ ID NO: 204)

>orf01165

VVLSTSAILVACGKTDKEADAPTTFSYVYAVDPASLGYSIATRTSRTDVIGNVIDGLMEN
DKYGNVAPSQKDYDLNSTGWAPSYQDPASYLNIMDPKSGSAMKHLGITKGKDKDVVAKPG
LDKYKKLLEDAVSETTDLEKRYEKYAKAQAWSTDSSLLMPTASSGGSPVVSNVVPFSKPY
SQVGIKGEPYIFKGMKLQKDIVTTKEYNEVFKKWQKEKLESNSKYQKELEKYIK (SEQ ID NO:
205)

>orf01169

LNFDFFIFLAHFIPLFTFSILQENPKTSKKKLYIRLL (SEQ ID NO: 206)

>orf01176

MGFSMKLIHDLDTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 207)

>orf01191
LIRIIRNIYRSGEGNTSVFQSFIDQINSNQFCYGSNFDRLRCILLIENFTSICLNSNRMF
SGNGKILSNSSRSTP (SEQ ID NO: 208)

>orf01202
MIYFDNSATTKPYPEALETYMQVASKILGNPSSLHRLGDQATRILDASRHQIADLIGKKT
DEIFLTSGGTEGDNRVLQGVAFEKAQFGKHIIVSPLPHSAVLE (SEQ ID NO: 209)

>orf01223
MKIKEQTRKLAAGCSKHCFEVVDKTDEVSSKHGFEVVDETDEVSNHTYGKATLTRIEEIF
EEYKSS (SEQ ID NO: 210)

>orf01233
LVYAPFSFNILLDYITFDFKILLFSVFLAINRFHNDFIQFLL (SEQ ID NO: 211)

>orf01236
MSGYSGLSFFEVALAEFLDIVSAVYLEDADGIIVNLWGILDK (SEQ ID NO: 212)

>orf01246
MEGVAKGRIGRKKNNGIDNRCCHKKRNGRVTWNLFFQKTIDDGDDSTFTRREKHTDEGPK
KDSPPTISREKMINLVRCDINFNQP (SEQ ID NO: 213)

>orf01249
VDKTDEVSSKHCFEVVDKTDEVSSKHCFEVVDKTDEVSSKHCFEVVDRTDEVSSKHCFEV
VDRTDEVSNRTTVRRS (SEQ ID NO: 214)

>orf01251
MDYGLYHPCPIVTPSQSSSIVANPASKLISASEELIPDAIAVDFVEVNCY (SEQ ID NO: 215)

>orf01254
MKKLFQEKFSKKPSHKEIERVQLGCAMMQATFHLMGY (SEQ ID NO: 216)

>orf01261
VVIGVASATTNIWIIFLSGFAAILAGAFSMAGGEYVSVSTPKDTEEAAVSREKLLLDQDR
GLAKKSLYAAYIQNGECKTSAQLLTNKIFLKNPLKALVEEKYGIEYEEFTNPWHAAISSF
VAFFLRSLPPMLSVTIFPSEYRIPATVLIVGVALLLTGYTSARLGKDPTRTAMIRNLAIG
LLTMGVTFLLEQLFSI (SEQ ID NO: 217)

>orf01269
MLYVGIDVAKNKHDVTALNVPGKLFLNHSLFQIIKLVLNS (SEQ ID NO: 218)

>orf01296
MDFEYFYNREAERFNFLKVPEILVDREEFRGLSAEAIILYSILLKQTGMSFKNNWIDKEG
RVFIYFTVEEIMKRRNISKPTAIKTLDELDVKKGIGLIERVRLGLGKPNIIYVKDFMSIF
QVKENDLQKSKNLTSEVKDFNLRSKENELQEVKNLDSNYIENNKSKYSKREYSFGENGLG
TFQNVFLAAEDISDLQIIMNSQLENYIRLPAKLES (SEQ ID NO: 219)

>orf01304
LLHIRVCKTFDRIPYCMLALFLSKSIGLTILLHKVKTVIFIDDQSNDKTCKICIHISFFR
IKLSQQCQLSFSVYF (SEQ ID NO: 220)

>orf01309
MTQEDALIVISHIKVLSIVPNRCLKPLDKTFSLYNWIFLSQKYILLQANFLKISRVQLQ
(SEQ ID NO: 221)

>orf01313
VTTHDEPVYEKHGVLHYAVANIPGAVARTSTIALTNVTLPYIEALAGKGFAQAISEDEGL
RQGVTTYQGYLTSLPVAQGLNRDYTDINDLV (SEQ ID NO: 222)

>orf01314
VFFIDGFIVRCHTVSCFDNATLVNSNVNDTEPGRICLTISSVTNSGAFAPGMRMAPITTS

ASLILASMLNELDIRV (SEQ ID NO: 223)

>orf01316
MLIGIPKEIKNNENRVALTPAGVHSLVSRGHRVLIETNAGLGSGFTDADYQKQGAEIVAT
AGEAWAAELVVKVKEPLSSEYGYLRDDLLLFTYLHMAAAPELADAMLAAKTTGIAYETVR
DNQGQLPLLVPMSEVAGRMAV (SEQ ID NO: 224)

>orf01334
LIRILGNSFISIDKAHEQAEEYGHSFEREMGFLAVHGLFTY (SEQ ID NO: 225)

>orf01383
VILFFIRFRVSWLTYFIMSLIFIRFTILVCLIFTNMVASVTKAIILMADVRLDVRHST
(SEQ ID NO: 226)

>orf01387
MIAMRSYITLICNLNNNLFCLNSFFLTNLVWSQIFSLLSVFITVYI (SEQ ID NO: 227)

>orf01388
MFLFLAIDFIFYSYIFCMSLIFKVNIILSIYLNNISSLNLTDDILIFRLIVGGFH (SEQ ID NO:
228)

>orf01390
VIPRGDHNHYIKVQTKGYEAALKNKIPSLQSNYQPGTFDEKAVLAKVDQLLADSRSIYKD
KPIEQRQIELALGQFTESLKKIKVS (SEQ ID NO: 229)

>orf01419
MARLEPAKIAKIVLGILLYIIDLIKSSFVLPIPKAAKKSLILISFVPSFNDKNIVIRRPR
QITKIMPRFICFLFRIFACIS (SEQ ID NO: 230)

>orf01436
MELSAIYHRPESEYAYLYKDKKLHIRIRTKKGDIESINLHYGDPFIFMEEFYQDTKEMVK
ITSGTLFDHWQVEVSVDFARIQYLFELRDTEGQNILYGDKGCVENSLENLHAIGNGFKLP
YLHEIDACKVPDWVSNTVWYQIFPERFANGNALLNPEGTLDWDSSVTPKSDDFFGGDLQG
IIDHMDYLQDLGITGLYLCPIFESTSNHKYNTTDYFEIDRHFGDKETFRELVDQAHHRGM
KVMLDAVFNHIGSQSLQWKNVVKNGEQSAYKDWFHIQQFPVTTEKLVNKRDLPYHVFGFE
DYMPKLNTANPEVKNYLLKVATYWIEEFNIDAWRLDVANEIDHQFWKDFRKAVLAKNPDL
YILGEVWHTSQPWLNGDEFHAVMNYPLSDSIKDYFLRGIKKTDQFIDEINGEFMYYKQQI
SEVMFNLLDSHDTERILWTANEDVQLVKSALAFLFLQKGTPCIYYGTELALTGGPDPDCR
RCMPWERVSSDNDMLNFMKRLIKIRKYASVIISHGKYSLQEIKSDLVALEWKYEGRILKA
IFNQSTEDYLLEKEAVALASNCQELENQLVISPDGFVIF (SEQ ID NO: 231)

>orf01442
MGQEIKLIRKQFRSTRQEEKQIKEMMREQKVDSFSEFLRQNLLKKNYQDRIFESWFSLWQ
SQKFEQISRDVYEVLVVARENHQVTQEHVSILLTCVQELIAEVNQVQPLSREFREKYMG
(SEQ ID NO: 232)

>orf01443
MVYRYRTNLKKVFLTDPELHQLNERIAKSNCQNFSVYARKVLLNPNMSFVTINTDTYDQL
VFELRRIGNNINQIARAINQSHLISQDQLQELSKGVGELIKEVDKEFQVEVKRLKEFHGS
Y (SEQ ID NO: 233)

>orf01444
MVVTKHFATHGKKYRRRLIKYILNLDKTDNLKLVSDFGMSNYLDFPSHAEMVEMYNVNFT
NNDKLYESRNDRQEKHQQTIHAHHIIQSFSPEDNLTPEEINRIGYETMMELTGGRFKFIV
ATHTDKDHVHNHILINAIDRNSDKKLIWNYALERNLRMISDRISKMTGAKIIEKRYSYRD
YKKYKESSHKFELKQRLYFLLQQSKSFDDFLEKAKQLHVQIDFSQKHSRFLMTDRTMIKP
IRGRQLSKRDLYDEEFFRTHFAKQEIESRLEFLLNRVNSLEDLITKAKELNLTIDLKQKN
VTFILEENNQKISLGHQKISDKKLYDVKFFQDYFKNKEVVASEGLENLQEQYHAFQEERD
KDKVSTEEIEEAFKTFKEK (SEQ ID NO: 234)

>orf01446
VELAENQIEKLVDKGVYIKVSFGVKQSGLIFIPNYQLDIMEEENHKKYKVYIRETSSYFV
YNKENMDNNCFIKGRTLIRQLSNDSQKLPYRRPTLKSLQEKISEINLMIELSNTNKQYQE

IKDELVLEIAEIDMKLEETQEKIATLNKMAEVLINLKSEDHETRKLARYDFSKLNLTEST
SLENVNEEIRVLQENLDYYLYEFEKRAIRLEIFVSTLNMEKDVFVIDKF (SEQ ID NO: 235)

>orf01447

MAIIKKIVVLYGGLSEEREVSENSAKEISKSLLTLGYDVISIDLSQDCSYEIGEIEKSER
GLNKQKVEIGSGIIDVCRKVDIVFLATHGGIGENGKLQAIFDVEKIDYTGNSFLSTAISM
DKKLSKIVASSVGIKCASNLMVDRIQANDFPIVIKPIRSGSSKGIKIFQNKKQFDIYYKE
HPELGSVFVEKYIKGREFSVGILGETVLPVIEIKVKNGFYDYNNKYTVGAAEEVVPAKIS
EKLTHTLQKSAYKIHKALGFNVYSRTDFIVDEKGDVYFIESNSLPGMTKTSLLPQEAKAA
GIDFPNLCERIIELSREIRSQ (SEQ ID NO: 236)

>orf01449

MKIINGICRYIFDSKGFATIEVEIFLDSGDTGIGAAPRGSTTGHYDIQYNEYYPRGNNFS
PIPDGNIEFFNENILPRIINREVEDIEDITELDKHLFDIPEIENYGNVAIACSYAVWEAF
SKNKKSPLWKLFFEPGSASKGKVKHLVNIIDGKPDSLLAGFEFLLVSEKEITFQSLLEIS
NIKNELMIKFKNQGFYTSISNQGALIINTDDFYIILDSLLETLKLYKNRYDIGLDLAMTD
RYDSSLGIYKVPWCVSQQQTVTEIMDTYCDWGVKYPLVYLEDPFSDEDLDSWRKFQLIKP
LKLQVFGDDFYATNLERISQFKDCADGIVIKPNQVGSVSKTLEVMEYAEKSGISMAFSQR
TAETENNIISHLAMSVTSSYLKAGGLDRLDRIAKYNEVLRNG (SEQ ID NO: 237)

>orf01450

MDNGKISTDGALVNNKNIEVNISSASIRYGISVFEAPKMFLLGSDIYIFRFQDYFNRLKT
SCKFLNIELPLDYNKLLYDIKKFIEFVPWQESYALRINVFCPYESELLGEVECALTLSYL
DIGIRSKSGVSSKVIKRSNLIRTSNNNLYMIKSPSHYINARKELYSDIEFDDILYVNEKE
NICELSRSNIFLIKDRTVYTPDLGSGILDGITRKLIIDLCQEHNILIEIKELNYSKLSDF
DSAFCVGTTNGITPIRNIDKNIHFDTNNLLLAEIVNYYKEVFSKKGVEKYKEWFVKL (SEQ ID
NO: 238)

>orf01451

MIKDVNYFNERAQIIRRTINDMIFGAESGHFGASLSSVDFINVIYENYVFPENAEFILSK
GHAAPALYAKLIESGVLDKDFIYGFREYRSLLTGHPNHRIPTLKFGLGSLGQGPSIGVGM
AWVNKRKKSDKKIFVMLGDGELNEGQVWEAFYTCRNLNLQNLVFIIDRNFLQLDGKCEDV
ANFPNLAQKISSFLGTNPIEVNGNSYDEILNVLDNIDYSQTNVIISNTTKGKGIEFMEGK
TEFHSYNILSSEKEVLYKRAMECLGGDKMA (SEQ ID NO: 239)

>orf01452

MRKTFIDELINKNIEEQNIVVLTGDVGRSTYASKFKEIFPENYLNLGICEANIVGISAGI
AGTLEFVPFVMLFSKHLILRALEQINDSILMNKKKVILVGGYSGYSASKEGETHQLLNDI
SILSSFPDISIYCPYDQSSIQTAINESINNDYSSYIRINKNKILNDVVSRYISQGNKSII
ISMGYLGSLLSKKYMEDSDIREFADFILVSKIKPIDWEYWENFLRKYETVYIIEENTLTG
GLGEQFKNYFFGLGINIISFGIKPHFGETGDYETLLTNEGLSPDKIFEKIRRINHVQSSE
KSIWR (SEQ ID NO: 240)

>orf01453

MYNLVKRVFGDDNFVKSDGIYLYTDDNKEIIDSCSNSMNVNLGYGVLEIEKVIHEQIRKI
NFMHTGKGTTYESLMLANRLHDIIKPYGNYKVYFATSGSDCIEAALRISVLYQQKNKRNQ
ESNTRFATFEGSYHGSTLGALSVSGHRKFQKLYNGYIGNCLTIPTRWNLEWEMDFTDITA
FVLDSMITNPIGSEMIDRDYLNYLVQICKESGVITIIDEIATSIGRLGCFFGFEDSGISP
DIVCISKGLGVGYANIGAVIVKSNIIDSINSADILGHTYNASPIDCKIAMTVLDYIEEHG
IFEHVNNLSNYIEYRLKVLKNKLPCISKVSGKGFMWSIHFRNNVNASKVFKQCYNNGLLL
LYLEYEEYNHMTFCPPLITSKNQIDSMLDILEKSITEVLHGY (SEQ ID NO: 241)

>orf01455

MDIKKLGFIIITNETFAFNLVEEVVEKLSILDVNRAIIKLLPKVDETTLIKHYREHLINW
NGKEGKSQVPSLGWPAVRNRFSSSVVLILLEGNKQSLSDEILQIKGNTYPERCRQNQIRI
KGFNPTYNLMHSSDSAEEALKEAELYFSKKELESFFCGEIGITFEEILNFILELDSIQKG
GIRSNSDLENKVNKMCYWKQRIFDLFSSKTKEESRKISEELNFIKSNRSPEDVILYLENE
SILWSKLERDLYLSHLIIEEISGE (SEQ ID NO: 242)

>orf01456

MVKIYEETLRDGIQSSELSMLNTEDKKKVIKNFDNAGIEGCCIGFINSSKKENDEINELF
QFIITNKLKIVPAVLCRLLIEDFKEIKNIVQCNLFNQLKVYTYIAVSPIRMKVENWSEEI
IIEKIIDFLNYCQMENAKITIAFEDASRADKSFLKKLIEIINNYPLVKSVVIADTVGTCN

YNSTRDLVYFFRKNLFLSKTIEWHGHNDLGLAVSNALSAIESGADIVHTCTLGIGERCGN
TSTEQLIINLIVSECGRRATYKLRYLYDVAKILENKSQFPISPKTPCFGMDSFFTCAGTH
ASSLYKSYLKNDNNFSIIFSPYDSNIFGREVTVGINSQSGRSSIEYISRKYGLELSQENI
TSILGLVKQNDLFFREEEFVDYVKQKRVERLDYK (SEQ ID NO: 243)

>orf01457

MLNKKEWKDLTISKSENDSIISCLYNWGFELPKSKDYTFSLTWYGYNNVSYKYCEKECLT
LGELSLLFPQLNDLFWENQKDNIEGRRNFYKNCKNLLGKFNIYSVRDILEISDRDLQFAL
TNRVGSKEFENSIVSLMYINKLSDDNKAENTLEKKLYFSINNEDSIIPYYENTLGMTAGN
YYFTASHRTFFSSTFPDFFKIDVPYKISNSVRNLTRNELRIRASEIIKSELANSENPILK
IFDDYAYVRIGKRNMVLRNKFFNGFIAPLFAFFQQRIFDNGKSFFTHFYDLRKNTSQNIP
DYLLLNILFPLIDCFEFFLNVSIKYKRLIFPYDFHMQNIMISIYDNQIGFIFQDFDMSKE
LTVTSFYEQLDFFFEKFVVTNILESINELKLDEKKYIMREMKKIINTKIIIKAESYFGFP
SPSEVIFPDFMKQYLRENQNVKERTIKYRSYLR (SEQ ID NO: 244)

>orf01458

LFIDILKKKKMKIIEAHDALSAYIIDQTKYSADKGDIFEYDGIWISSLCDSIIRGKPDME
VVNITDRLQTIDDILCVTEKHIIVDIDSGGTLAQTASLIEKITLRKIAGIVIEDKIGQKY
NSLFGEKNTQLQDSTESFERKIRVAIKSRKNSKTAIIARIESLVLGKSLEDLLYRGNCYI
KSGAEALVIHALNSRLDDLYQALKYFKRYFPEIPLIVIPTDFPYVCAEELFESGADLIIY
ANHLLRSIIKPMEYIAKSILIDGYSNGVENKLLPISEILNYIPLLEEIDEK (SEQ ID NO: 245)

>orf01459

MKSKDLISSLKLNGVTRFFGVPDTFLYPITSQLANDELIIVPNEGNAVSMAFGYSITTSR
MPVIFLQNSGLGNILDPVQSLVGQAVYNHPMLYIIGFRGGTDDAPQHSECGKVTKKLLEI
SQFDIYEKDYFTNALDTDIRRIIDNIKKKNKSAAILVDKEFFSDIVNIKNYQISDYNDIL
NKICAVLEKEKDSIVLTSTGYITRHMENVKDTYKKNFVHIPMPGSLGQTISFGAGICMGT
SINNKKKKIYIIDGDGSLFMHMGSLALFDYYNLDVTYILLNNYKHLSVGGENTLASSCNF
FKLAESMNFDNIYSSDNLEVVDFEEKLNQQGKNFIEIICSNEVTYSLLERMDFNFEEIKQ
FNMEN (SEQ ID NO: 246)

>orf01460

MPDRYVEYSQNDYDNIMKLDTLFISQLDSKYKVEYHKLPSLISGEVLKRCGYFSTMPNQL
SKVDIIDVSQLESLGNNRELEEIKYSSSENYFLTPAACLHFYPMLEHKEVKECIYSSLVD
VFRYENGNFTMGTRQWEFTVREFLAIGNPKFVEEFLEDLKEKFLTIALRFDSTAKIQNAC
DNFYPTNLNKVKQKFQKYNNLKFELIVHISEKEVSVASFNYHNNHFSKEFNFDSNDTIVT
GCVGLGIDRWISLIKESEKDYKL (SEQ ID NO: 247)

>orf01461

MRKQIISLFHAYLNENTQDWVEIDENFLLYQHLDMFYYYLCKKNNIEPPLMEKFEVRKKV
IESRNRQYIKVARDLNAIFEKQSIQVAFLKGIQTSEKYYEEPWIRYYSDLDILVAREMIP
GVEKLFYQLGYVFGHLKDNGEIHHATREEILYQKLFTHEIYNLVKKENDNVFINVDINFL
FSWKGLSDSEIEFNDIKNDIIYDSKIKINTLDKVMNFIHICCHLYNEARYFALNRSFLGG
DPREIQLSRVFEIALILKDLKQEEFNSVVYSSRKLNCDNKVFASIGVTKQLLELNLSILD
NYTEELKVKDEFNSYIDKDQKVKYWPISIEDRVFDLKLKVKTCDKIFIN (SEQ ID NO: 248)

>orf01462

LKYDSEIKNVIKDYIDFEFDINEIDNNVALTDYGVDSLKYISIILALEDYFKIEIPDNYL
VFSKSNTIKKLNSIIEELL (SEQ ID NO: 249)

>orf01463

MKYINSSLKPVDNYYSLEEVTCFDRLLGIFLNSINNSYCDLFYMINNFYRCYKVDDSKNE
YDFEREMHILRNFFCIESEKINFSDEYVLTEFIVKNINKYGSVFVPINLKEIYYSAYYKE
QDWPHLFLINGYDKEKELFYVIDATQIYSDILTEQNFCITFEILERAYKSYFHQTILNKE
KEYIFVVTTVVNELTETEIFHETFKYLFNQSSISSRELEIVYKILTNRDFTLLANLKNIT
KKKKLFFTIFFEKLRVYELISNKELLYLSRTVETILEEWTIFINRCIKNILKNDTKLVNY
DFFVLEEKKIFDFFSKQASRYKERLFEIISSNSNRYNEVFECIQNSGKIITITEDNSRKF
RFSFIGDKIYNSWFNDDSPKVRINQDLNYLIVKINVIHKEKDSKFVAGLYCFIDDNLYYF
GLDSNYFINLDLMGKTPEIFRKRLETSEVYLKISRQEDSCKFSYSVDGITYFYATSLDIR
SCHFSCGIGCKTYSKPTPLCIDFEDLLIG (SEQ ID NO: 250)

>orf01464

MAMIEVSCLRKDFVKIIKEPGLKGAIRSFIHPEKQIFEAVKDLSFEVPKGQILGFIGANG

AGKSTTIKMLTGILKPTSGFCRINGKIPQENRQDYVKDIGVVFGQRTQLWWDLALQETYS
VLKEIYDVPDAVFQKRMDFLNDVLDLKEFIKDPVRTLSLGQRMRADIAASLLHNPKVLFL
DEPTIGLDVSVKDNIRRAITQINQEEETTILLTTHDLSDIEQLCDRIFMIDKGQEIFDGT
VNQLKETFGKMKTLTFELRPGQNHVVSQFVGISDIHVTRKELLLNIQYDSSRYQTADIIQ
KTLSDFAIRDLKMTDVNIEDIIRRFYRKEL (SEQ ID NO: 251)

>orf01466
MVKLWKRYKLFISAGMQELITYRVNFFLYRIGDVMGAFVAFYLWRAVFSSSHQSLIRGFS
LSDMTFYIIMSFVTNLLTKSDSSFMIGEEVKDGSIIMRLLRPVHFAASYLFTEIGFRWLV
FVSVGLPFLIIIIGLKLLSGQPILQISLMTLTYLLSLILAFLINFFFNICFGFSAFVFKN
LWGSNLLKNSLVAFMSGSLIPLSFFPKIIADILYFLPFSSLIYTPVMIIVGKYNISQMIQ
AVLLQLFWLLVMIALSQIIWKRVQSHITIQGG (SEQ ID NO: 252)

>orf01467
LLVGISLLSATVTSLTWTWTKVFIFLISIPFATLIYTSLKIATASIAFWTKQSGAVIYIF
YMFNDFAKYPVVIYNSFLRWLISFIIPFAFTAYYPASYFLKDKDGLFNIGGLILISLIFF
TISLKLWNKDLDAYESSGS (SEQ ID NO: 253)

>orf01468
MDEVFKFYCTNIIRVIFIKWLFCLKSMNHTNLTLVTTTFKQFNSTSLGNHHAMV (SEQ ID NO:
254)

>orf01469
MQAFDGSTEFIHNGKGEKDSSKYQINGAGRCEVPVYVPKTDWDWIIYPQGIYD (SEQ ID NO:
255)

>orf01471
MRVKRDYPNYKIYITENGLGYKDEFVDNTVYDDGRIDYDYVKKHLEVI (SEQ ID NO: 256)

>orf01472
MEWIINIIRGIRYIGREAGVTFVEPSQTSIKSFDITIL (SEQ ID NO: 257)

>orf01473
VRHYKDYISQRSDWELAGIYADEGISGTQVGKRQDFQRLINDCVNGEIDYIVTKAIARFA
RNTLDTLKYVRMLNDMQIGVYFEEENIDILTMDGELLLTILSSVAQQEVENTSAHVKKGL
KMKMERGELVGFQGCLGYDYDVETKQISINKKESKIVRYIFERYLEGIGGKVIARELDEL
GYKSPRGLEHWNDTTVLGIIKNEKYKGDILIGKTFTVDPISKRRLSNFGEEDKYYIKDNH
EPIISK (SEQ ID NO: 258)

>orf01474
MYAFSSMLECGFCGSILSRRSCHCRSDYRKVVWHCVTSIKKGKKFCKHSKGLEKLAIEGA
FMEAYRQLYHSNENLMTDLLETIESELNDNSLNKELKRITNKLRTLLKKEENLVNLRLEG
KISDTIYDEKYNEISSEKEFLAEEKVNIETTLKSEIDVKKRLTEFKHLLSSQKMLTEFDR
AVFESIVEKIIVGGVNSNGEIDPAMLTIIFKTGETQNKDGKQFKSKRKNAKLETDKLCPQ
NSDEDKKLYSQGTDNTRGVCSVAGSILVSQ (SEQ ID NO: 259)

>orf01475
MGGNPPIKKYSIVDKIVLSTKIKRIIIFTVFRENWEPYMKKYTEVFQSQFPNLNIDYLLL
DTEQIDLDSYLDADLIIIGGGNTEKYIATYVNQEFKNYIDHMLNKGAKVIGFSAGALLLG
EKVYVSPNDNSDHQIKIKDGLGLFSQFLISVYYDSWNDKANKDRAEELVNVPIIPLNDHS
CLVLDKLGNIIEKID (SEQ ID NO: 260)

>orf01476
MDFSSKIAINTGWSDDKKYCVTDQNQQKYFLRVSDKEKLDSKKFEFDMMGKVASLGVPMC
KPISIELCDDEVHSLHEWIDGRDAIDSILTYSENQQYTYGVEAGKILRKIHTIPATEVCE
DWEIFFNLKIDDKISNEMIW (SEQ ID NO: 261)

>orf01514
LCSALKNSYDIELIKVLSNKAHLYLPIETVTPQTVSTS (SEQ ID NO: 262)

>orf01537
LVKNPFIEIERIERTWLTAHLYRKFDKYFHKTRPPIKVFEHLIGGLFIMKTFT (SEQ ID NO:
263)

>orf01538
MIKIYFTKFSENHNPFCKIFEIIFTSLIFQSILNKNKKNPLHQGETNVV (SEQ ID NO: 264)

>orf01545
MSQVKGLCVLDVDGTLILEEVIDLLGREAGHEAEISQITSRAMRGELVFESSLRKRVSLL
EGLPILVFDNVFNSIHLSLNVPEFISILQKNGILVGLVSGGFTPIVGEISKIPWYCLFHC
QPA (SEQ ID NO: 265)

>orf01546
MLKSAELGIAFCSKEMLKKEIPHHVDKRDFLEVLPLIDCLE (SEQ ID NO: 266)

>orf01551
MFGNWFFKAFVCSLERLAQDRTMNWFSCIGNKNTVAFVPILIGCFA (SEQ ID NO: 267)

>orf01565
MEKYFGEKQERFSFRKLSVGLVSATISSLFFMSVLASSSVDAQETAGVHYKYVADSELSS
EEKKQLVYDIPTYVENDDETYYLVYKLNSQNQLAELPNTGSKNERQALVAGASLAALGIL
IFAVSKKKVKNKTVLHLVLVAGIGNGVLVSVHALENHLLLNYNTDYELTSGEKLPLPKEI
SGYTYIGYIKEGKTTSDFEVSNQEKSAATPTKQQKVDYNVTPNFVDHPSTVQAIQEQTPV
SSTKPTEVQVVEKPFSTKLINPRKEEKQSSDSQEQLAEHKNLETKKEEKISPKEKTGVNT
LNPQDEVLSGQLNKPELLYREETIETKIDFQEEIQENPDLAEGTVRVKQEGKLGKKVEIV
RIFSVNKEEVSREIVSTSTTAPSPRIVEKGTKKTQVIKEQPETGVEHKDVQSGAIVEPAI
QPELPEAVVSDKGVPEVQPALSEAVVTDKGETEVQPESSDTVVSDKGEPKQVAPLPEYKG
NIEQVKPETPVEKTKEQGPEKTEEVPVKPTEETPVNPNEGTTEGTSIQGAENPVQPAEES
TTNSEKVSPDTSSENTGEVSNKPSDSKPPVEESNQPENSGNTTSENGQTEPEPSNGNSTE
NVSTKSNTSNSNGNEEIKQENELDPDKKVEDPEKTLELRNVSDLELYSLSNGTYKQHISL
EQVPSNPNSYFVKVKSSSFKDVYLPVASISEERKNDKILYKITAKVEKLQQEIESRYKDN
FTFYLAKKGTEETTNFTSFSNLVKAINQNLSGTYHLGASLNANEVELSTDDKSYIKGTFT
GQLIGEKDGKHYAIYNLKKPLFESLRGATIEKLSLKNVSISGKDDIGSLANEAQNNTKIK
QVHVDGVLAGERGIGGLLAKADQSSITESSFKGRIVNTYETTASYNIGGLVGHLTGSKAS
LTKSKATVVISSNTNSSDQTVGGIAGLVDKDAHIQNSYSEGDINNSQRFGKVAGIAGNLW
DRESNSENHAGRLTNVLSDVNVTNGNAISGYHYNGMKITDAFSNKANKVFNVTLEKDEVV
SKESFEERGTMLDASQIASKKAEINLLTPPIVKPLSTSGKKDSDFSKIAHYQANRALVYK
NIEKLLPFYNKATIVKYGNLVKENSILYQKELLSAVMMKDDQVITDIISNKQTANKLLLH
YKDHSSEKFDLRYQADFAKLAEYSLGDTGLLYTPNQFLYDQDSIINQVLPELQQVAYDSE
AIRKTLGISPEVKQTELYMEDQFTKTKQDLANSLKKLLSADAGLAGDNPVTRGYLVDKIK
NNKEALLLGLTYLERWYNFSYGQVNVKNLVMYHLDFFGKGNTSPLDTLIELGKSGFNNLL
AKNNVDTYAISLASHHGTTDLFSTLENYRKVFLPDKTNNDWFKSQTKAYIVEEKSNIEEV
KTKQGLVGTKYSIGVYDRITSDSWKYRNMVLPLLTLPERSVFVISTISSLGFGAYDRYRN
KEHQANGDLNSFVEKSAHETAERQRDHYDYWYRILDEKGREKLYRNILLYDAYKFGTDHT
EGKATEVANFDNPNPAMKHFFGPVGNKVGHNGHGAYATGDAVYYMGYRMLDKDGAITYTH
EMTHDSDQDIYLGGYGRRSGLGPEFFAKGLLQAPDQPSDATITINSILKHKTSDSTEGQR
LQVLDPTTRFNDAADLQNYVHNMFDVVYMLEYLEGQSIVKQLDAYQKMTALRKIENKYVK
DPADGNDVYATNVVKNLTEDEAKKLTSFDSLIDNNILSAREYKAGTYERNGYFTIKLFAP
IFSALSSEKGTPGDLMGRRIAYELLAAKGFKDGMVPYISNQYEEDAKQQGQTINLYGKER
GLVTDELVLKKVFDGKYKTWAEFKTAMYQERVDQFGNLKQVTFKDPTKRWPSYGTKTINN
VDELQKLMDEAVLQDATGTRWSNYNPEIDSAVHKLKRAIFKAYLAQTNDFRSSIFENKK
(SEQ ID NO: 268)

>orf01580
VLGGRANSVTSCTTNSHWNLTFTTKHVTCFSSLVDDIVHGNNREVHEGHIDDWTKSCHGC
SCCSSRDGSFRNRTVTDTFWTKFFKHSNRSTEVSSEDTDVFSHQEHIFIATHFLRHSKDN
GVTEGHCFCFHFISFSLVCVNIFKG (SEQ ID NO: 269)

>orf01581
MDMFYIGHFLDIRRDTVTVVNAIENDWQVPDRSHVHCFVENTFIGRTISKEADNDFTGIL
HLLTEGCTDSDPHTTTYDTIGTKVPSIKVSDMHRSTFPFTGSSVFTKDFSHHSVEVNPFS
NSLPVSTVV (SEQ ID NO: 270)

>orf01602
MKINKKYLVGSAAALILSVCSYELGLYQARTVKENNRVSYIDGKQATQKTENLTPDEVSK
REGINAEQIVIKITDQGYVTSHGDHYHYYNGKVPYDAIFSEELLMKDPNYKLKDEDIVNE

VKGGYVIKVDGKYYVYLKDAAHADNVRTKEEINRQKQEHSQHREGGTSTNDGAVAFARSQ
GRYTTDDGYIFNASDIIEDTGDAYIVPHGDHYHYIPKNELSASELAAAEAFLSGRENLSN
LRTYRRQNSDNTPRTNWVPSVSNPGTTNTNTSNNSNTNSQASQSNDIDSLLKQLYKLPLS
QRHVESDGLIFDPAQITSRTARGVAVPHGNHYHFIPYEQMSELEKRIARIIPLRYRSNHW
VPDSRPEQPSPQSTPEPSPSLQPAPNPQPAPSNPIDEKLVKEAVRKVGDGYVFEENGVSR
YIPAKDLSAETAAGIDSKLAKQESLSHKLGAKKTDLPSSDREFYNKAYDLLARIHQDLLD
NKGRQVDFEALDNLLERLKDVSSDKVKLVDDILAFLAPIRHPERLGKPNAQITYTDDEIQ
VAKLAGKYTTEDGYIFDPRDITSDEGDAYVTPHMTHSHWIKKDSLSEAERAAAQAYAKEK
GLTPPSTDHQDSGNTEAKGAEAIYNRVKAAKKVPLDRMPYNLQYTVEVKNGSLIIPHYDH
YHNIKFEWFDEGLYEAPKGYTLEDLLATVKYYVEHPNERPHSDNGFGNASDHVQRNKNGQ
ADTNQTEKPQTEKPEEETPREEKPQSEKPESPKPTEEPEESPEESEEPQVETEKVEEKLR
EAEDLLGKIQDPIIKSNAKETLTGLKNNLLFGTQDNNTIMAEAEKLLALLKESK (SEQ ID NO: 271)

>orf01625
MDESFDDIAHEQFTSNLTTKTDNVGVQLFFSIKGCCHITNQGRANTWNFIYSVVDTNTST
TDTYSKISLAASYSFPYFFTKDWVVSPCMVICTKVNDFISF (SEQ ID NO: 272)

>orf01629
MLDFQDRSPWLEGQKEIDLSYDLFSTDAVTLDELQSRTIALRSLKHDKGLKVHFAEFPNL
IIWSTLNKGPFITFEPWSGLSTFLEEGDHLEDKKNVCLLEANQVEELGFEIEVL (SEQ ID NO: 273)

>orf01634
MKIKEQTRKLAAGCSKHSFEVVDETDEVSNHTYGKATLTWFEEIFEEYKN (SEQ ID NO: 274)

>orf01643
LIESQVFSSLQVCCLNLCHLKFQHFDTCLVFLLVFLDFQNLLAHFPIGIKTRLIGFFQVP
KSGITKFIQHLDMQLGTH (SEQ ID NO: 275)

>orf01644
MVMLTMNIYKMLPNSSQNRQINHLTIYTADTTTILQDFPTDDNFIT (SEQ ID NO: 276)

>orf01645
MTNNICRRTSSQHHIHGINDNRLPCTRFTSQDSHPLFKIEGNSLNNGKVFYRNFK (SEQ ID NO: 277)

>orf01656
MPHTRDNWQTRFKNSSYHNFFVKGPEILNRTTSTTNNEQIQIVPLISTRNISSNFLRSPF
TLNLGRIKKDVNTWESPADGRDNISNNGSTTAGYYTNSLRKLGQSLLEAFLKQAFFCQFF
LKLFKLNRKRPNPIRLSFFNDDGVATTWFIDLYTPNHIDLHSFFQVKP (SEQ ID NO: 278)

>orf01660
LAIIRNRTCSLKLINGHLTFWTLHFLTSTRILIELATINLNCRIHRGNLGNRPSQASNRF
INKLFIQGRQNRGFCDHFPTSILSRRGIAQSNFPLIDLTLVLHKLDHACRLANRNRQNTH
HIRIQGSTMTNFLGSQNLTQFKNRIMRGHSCFFF (SEQ ID NO: 279)

>orf01667
MFALRKPGNIYTRITNPTTAALEGGVEALATASGMTAVTYTILAIAHAGDHVVAASTIYG
GTFNLLKEPLPRYGITTTFVDIDNLEEVEAAIKDNTKLVLIETLGNPLINIPDLEKLAEI
AHKHQIPLVSDNTFATPYLINVFSHGVDIAIHSATKFIGGHGTTIGGIIVDSGSFDWTAS
GKFPQFVDEGPSCHNLSYTRDVGAAAFIIAVRVQLLRDTGAALSPFNAFLLLQRLETLSL
RVERHVQNAETIVDFLVNHPKVEKVNYPKLADSPYHALAEKYLPKGVGSIFTFHVKGGEA
EARKVIDNLEIFSDLANVADAKSLVVHPATTTHGQLSDKDLEAAGVTPNQIRLSIGLENV
EDLIEDLRLALEKI (SEQ ID NO: 280)

>orf01668
MTRDFKFETLQLHAVQVVAPATKSRAVPIYQTTFFVFDDT (SEQ ID NO: 281)

>orf01672
MSQKKNNKKKNKRKNLLTNILAGFLILLSLALIFNTQIRNIFIVWNTNKYQVSQVSKEKL
EENQDTEGNFDFDSVKAISSEAVLTSQWDAQKLPVIGGIAIPELEMNLPIFKGLDNVNLF
YGAGTMKREQVMGEGNYSLASHHIFGVDNANKMLFSPLDNAKNGMKIYLTDKNKVYTYEI

REVKRVTPDRVDEVDDRDGVNEITLVTCEDLAATERIIVKGDLKETKDYSQTSNEILTAF
NQPYKQFY (SEQ ID NO: 282)

>orf01679
MRWNIGCHPNRDTSCSINQKVWKTRWQDQGFPFIGIIVINEINCIFVDITKHFQSNLAHT
CLGITLSGSTISIHGTKIPMTIYKHVTVAPPLSHTDHGFINRGIPVWVIFTHDIPCNTSR
FFMGFVWGHTQFIHSVENATVNRF (SEQ ID NO: 283)

>orf01683
LKKKWFFADYYDTTIILLALISVILVLLGFAEMIDLDNPPYSIIDLVIWGVFVIDYSWRF
FITKRKWRFILENIFDLLAILPLNAIFTVFRLGRIFRLVKLTKLLKLTRLLRIIGLTGKL
ERKISRFLRTNGLIYILYVNIFIILVGSSILSVVEEKSFSDSLWWALVTVTTVGYGDIVP
VSLLGKWLAVLLMLVGIGTIGMLTSALTNFFVKDNPDEQIKLDKLKDELSS (SEQ ID NO: 284)

>orf01693
VVDFKQTRQDPHDITIYSWLRQVKSNTGNGSCCVRSNPFQAGNSFIGIWKLATKVSHNLL
GCSLHIANSRIITQALPSFQ (SEQ ID NO: 285)

>orf01698
LINSQLIPLVQVVVNQGRKGIVGSCNSMHISSKVEVDVFHWQNLCIPTTSSTTLDPHDWT
KRRFADSNHGFLANLVQGIRKTNGKRRLSFTCRCWVDGSNQDQFTDWIALNCTNFIKAEF
SLVLSVQLQIVVRNTKFLYNINNWLQLNTLCDFNICFHSKFL (SEQ ID NO: 286)

>orf01711
MLFIIGHLNFPTAGSFIDSTLHRLGNRVCIHDDMAFTVTSSTSNSLDESTFVAKETFLVS
IENSYEAHFRNVNSFTEQVNSDQDIKDTQAQVTDNLRPFQGLDIRVHVLDLDTHFLEVVG
QILCHFLGQSCDKGTLIFFNAGIDFTQEVINLSHSRTDFHLWIQESRWTNDLLNHCLGLF
IFIVTRCR (SEQ ID NO: 287)

>orf01712
MNVTLKLLPTERTIVQSRRQTETIINQHFFTRTVSIVHALDLPYGHMTLVNHNQEIIWEE
VEKRIRRLSFAPSIHVARIIFNPIGIAHLTQHFDIILCPLFQTLGFKQFTFLFKDS (SEQ ID NO:
288)

>orf01713
MIHFSQHLTCQSLNFTNTVNFVSKKFYSKGMFISGSWENLYHIPTNAKSSALEINIIAFK
LNIDQVIQEFITRNL (SEQ ID NO: 289)

>orf01714
VAKLVNLVIDRTILLNIGIARRDIGLWLVIIIVGYEILNCIFREKFLKLPIELTSQSFIV
GNNQSWFIDFRNDLTHSIRLPCSSRPHQNLSFFSPLNVIHQLLDSLGLIS (SEQ ID NO: 290)

>orf01734
MNITQTDFLAVNLVFAISTTIDMAFHPDFLTCILDKSVMIIQSHNYRSIIERFATFGSSK
DDIRHLAPTETLDTRLPQSPTQTFCNIGLSRSIGSNNCRHTLVKNDLGLISKRLEPLNFD
FL (SEQ ID NO: 291)

>orf01736
MGFIVCNHLKLACFNLRNHDLIDKFLDLGHILIQKKGTKKGFKGITKNGVTIATTRFFFP
FTQLDKLVKLAITRKTS (SEQ ID NO: 292)

>orf01748
LFTCFSKLDNKTASTTYISHKFFTAIPVCFEFFKGFWFPRKDTTKKNIFIPMFLVECFNF
WVELR (SEQ ID NO: 293)

>orf01753
VVRELTGEIYFGDHILEERKARDINDYSYEEVERIIRKAFEIARNRRKIVTSIDKQNVLA
TSKLWRKVAEEVAQDFSDVTLEHQLVDSAAMLMITNPAKFDVIVTENLFGDILSDESSVL
SGTLGVMPSASHSENGPSLYEPIHGSAPDIAGQGIANPISMILSVVMMLRDSFGRYEDTE
RIKRAVETSLAAGILTRDIGGQASTKEMMEAIIARL (SEQ ID NO: 294)

>orf01754
MAKKIVALVGDGIGPEIMEAGLEVLEALAEKTGFDYEIDRRPFGGADIDAAGPPLPDETL

KASREADAILLVAIGSPQYDGVAVRPEQGLMALRKNSIFTLIFVL (SEQ ID NO: 295)

>orf01758
LANIESHCNFFQSSIFSSLPNTIDSLFNTSCTILDSSKAICHCHSEVIMTVRRIDDLTIR
LDILNQVFEDGTTFLWCGKSYIF (SEQ ID NO: 296)

>orf01768
MPRNRFSFTVRVTREKNFISFFSFFFQVIDKRAFSSDIDILRFIIIFNIDGHTGFLQITD
MPDTG (SEQ ID NO: 297)

>orf01772
MKIKAQTRKLATGCSKHCFEVVDKTDEVSSKYCFEVADGS (SEQ ID NO: 298)

>orf01781
VHAHTDKLCNGCNRIFNSIISHHTIFRERNKLSHKAIKSTRQEMGPCHVVFIEFFITLHR
RLIGNHDNFLTNLVGSGRVRNDGST (SEQ ID NO: 299)

>orf01782
VNHCHWKLFIQNLGITFSLIVTLIRMTDSHVVGTDKDMILLVNSLFLIFDIDKLRLS (SEQ ID
NO: 300)

>orf01784
VGNNDILWSKRTISINGFNDFLNTCIAVSTTLCNDDTFLIKRKIFIYKIFCMRNPVSMNT
NYNFFNTWLQDKFFNCMNQNRSIT (SEQ ID NO: 301)

>orf01794
LVAPVASSTRFFKNNDSLTSWNNGFIIITINTIISYQRISKGQDLSIIRLVCNGFLVAGH
PCIKDDFACYINICSEGLAFKNCAIF (SEQ ID NO: 302)

>orf01796
VVCYFYITIDWSWVHEDCCFFQTIVTFLSQAMLGMVVFF (SEQ ID NO: 303)

>orf01797
MAFVLHTEKHHDINLINDFINGYKLSIVCKLLTSPFLRSREKEFSSQAFQNLHIGFGNA
(SEQ ID NO: 304)

>orf01798
VVQVTCNSNFKTLKVAKFLINGHQIKQALARVLARTISTIDDGSRNRWTSNQFSIVVDLW
MANHTDIHS (SEQ ID NO: 305)

>orf01799
MCPCRILKEEIGNNRMVFIGNLGSIFKLNSSLDQFHYLINSEVFHGHHMVQCLLIF (SEQ ID NO:
306)

>orf01824
VQFHLIIFQNLFCSLDIVIDSLTTNTKLLSYLSKTVIISVVKLYIIHLLICQKRRIKFKE
RIHTIGFFDSKLTIXXXFHSLIN (SEQ ID NO: 307)

>orf01826
MHFHIIKLVNHFQLLIKLNRISHPNLHIKSSFLSLVLLFYQKEQDFAIMVI (SEQ ID NO: 308)

>orf01840
MTGKKGFLFLNCHICMVTTTTCFLKERVESELLIFFYISPNRCLITV (SEQ ID NO: 309)

>orf01843
LNRSILDNITLKHEVTSQKIEEVCKAVQIYDEIMAMPMKFNTIISEMGSNISGGQRQRIA
LARALINNPSIVILDEATSALDTINEERITKYIKSQGCTQIIVAHRLSTIKDADIIVVMK
GGKIVESGNHKYLMDLGGEYYSLYTKRK (SEQ ID NO: 310)

>orf01845
LFKGGVTISRTPLSSEDTVMIDATEVKINRPKKKTISE (SEQ ID NO: 311)

>orf01848

MAGKKDFLFLNCHICMVTTTTCFLKERVESELLIFFYILLNRCLITV (SEQ ID NO: 312)

>orf01850
MYQDEAGFGRISKLGSCWSPIGVGPHVHSHYIREFHYCYGAVDAHTGESFFLIAGGCNTE
WMNSFLEELSQAYPDDYLLLVMDNAIWHKSSTLKIPTNIGFTFIPPYTPEMNPLNKCGKR
FVNVDLRIRPFELWKMS (SEQ ID NO: 313)

>orf01852
LLQSPYAIDTINLKKDFLEKPIDIEKFKAFLEKEEIPLAIAWQGDSLHFYTKDRSILDNH
LDHLLEKMVNDPEKLSDFSMDKSLDDTIDEAKSQITFK (SEQ ID NO: 314)

>orf01853
MKVVNLYDLKQMGNKGGCTIQLIHHFPFGMGLGHLKKDYIEFKRVGIFDGKAVEVTLREP
YSRDILQVVKSIKQRQKLIAYRYKEGKLLFVKKEV (SEQ ID NO: 315)

>orf01876
MKPSGQEFPHPIFYSLFCFYTDTLGINSQVMQFSFERLLFQFCLNCWHLVMRSQNHNCRP
STRKVGCIGPIFFGHLLNHRKFSYQVLTIALMEEISLDCLPSGHHVSCQQGSNRYIGDRT
CSNSFLIRQFFRQDTTAVAST (SEQ ID NO: 316)

>orf01878
LQVWYNLQSDFEQEITLIMWNPFANLVFNQPLISFFADLNLKILGYSYTDRVKTWPDIGT
GCRYNNLHLILLAP (SEQ ID NO: 317)

>orf01909
LRQNRCYNCFHDHSCSWKSSRITSLHGCLVRFVGFDIHTHKRFIKSRNGFHDPTNNDGLP
ISHTTFKTT (SEQ ID NO: 318)

>orf01910
LAAFTITSLKAKTKFHPFKGIDRDNSLSQSCIQFSIPLDIGTKTNWNASDDCLHNPTDGI
TITFDLVNIVLDFLFSFLVDNRNFRLGSSLLNFSDCQIFRNIDFLATKDHDMVGNLHIQL
SQETFGYCTNCHPHGGFTS (SEQ ID NO: 319)

>orf01911
MTWARMSNFPLAFKAVFNVLRRHDVQPFLVVLIDDIHSNRRPCRLPVANARSKDNLVILN
LHTTTTTVATLTASKVLIDILSCQWKSSWNSLNNSC (SEQ ID NO: 320)

>orf01913
MHDLAITGSRFDGMANSVAKIEVKTNTIVQLIFNHHLALHLTRMFNQGLCMFQNTLNRTI
QSRQESPQFWILNQAILDNFTHPFNQLSFSEGFKNKWINQNPIWLGKGPHHIFSKWCVNT
CLSTDRRINLSCQTSRNLNKVNTPHIGRGYKSSQVPNNATTKSNDSIATSQTLLD (SEQ ID NO:
321)

>orf01915
MVICHNDYLLRLPEFSQPLTSLGHTTFFNLNIIRMMRNIDSDFHRRVSLSLLVFFC (SEQ ID NO:
322)

>orf01920
LIEGHLVFADKPAQALVLLRKVGSPKKVSFLTLHLYFLILKIDILKITGF (SEQ ID NO: 323)

>orf01951
MAVTKSQVFSRQGFDFSILGQDLTRLQDVSNLATIGTRIHKDSTANASWNTTSKLKAS
(SEQ ID NO: 324)

>orf01952
MTEGNASCFNQVSPSFCFNGIAINRNVIELVTQDDKSTNPTITNDDIACIAKNHPRDIFL
VGKFHNASQLKTISWKDQIISLSTYFCITIAMQGFLKTDINSF (SEQ ID NO: 325)

>orf01965
MRLRDLRRVDFPDPDGPIKAVISLGWKDRETLFKAFFLL (SEQ ID NO: 326)

>orf01968
LKNHSNVFTHFINVDFWTVDINSTIENLPSYFSNINGIIHAIETA (SEQ ID NO: 327)

>orf01969
LHINPLNGFIFTIVNMDILSRKGYFFFRKGKDMLLIPVIC (SEQ ID NO: 328)

>orf01981
MTIHIQVVKTNMVILADRLFQGFILRSTDKFFIKIRLVRSHNLRFNSMDFSTVAVHENKG
RHHMDELLPRFIINSKATVAKKSIVAQGFRFDGNFFRKTRQTNHLNIIFCDNPDQIIVFQ
NGLITNSQFNRLHP (SEQ ID NO: 329)

>orf01988
LGHSKAEEHETICSHPFDDHTTETIPNQVKGRDMTSSETLPFPSKNQNQGKAKQNP (SEQ ID NO:
330)

>orf01991
LLLSCRKVIVCFIFSSTWNKNFFNLAFSWNFDNCIRGFFSINSNLFGNMTSLWINIVGPC
RGYIAILSVNCNRIFTTVFCFIFFKTNSRT (SEQ ID NO: 331)

>orf01992
MVKRRIRRGTREPEKVVVPEQSSIPSYPVSVTSNQGTDVAVEPAKAVAPTTGWKQENGMW
YFYNTDGSMATGWVQVNGSWYYLNSNGSMKVNQWFQVGGKWYYVNTSGELAVNTSIDGYR
VNDNGEWVR (SEQ ID NO: 332)

>orf02006
MRFIVGRFTSFSLGIEFSPTSKLDDLLFKIAFLMILATWIKARKTKGAT (SEQ ID NO: 333)

>orf02010
MANDNKSHYLIYRVLGISFEEGENIDLYQNKGRFLYKYAGSFLEEAAVLSFNEKFGTENT
(SEQ ID NO: 334)

>orf02019
LVNCKPLEAYRQLEEAELVGCWVHVRRKFFEATPKQADKSSLGAKGLAYCDQLFALERDW
ETLSADERLQKRQEELQPLMEDFFAWCRRQSVLSGSKLGRAIEYSLKYEETFKTILKDGH
LVLSNNLAERAIKSLVMGRSKRVQWTLLA (SEQ ID NO: 335)

>orf02022
MFPVETEEITYKRKKSKGKCQALLAQFDSEEVHHQVEESICSDCQGDLKEIGATLQRQEL
VFIPAQLKRIDHIQHAYKCQACSDKNPSDKIVKAPIPKAPL (SEQ ID NO: 336)

>orf02023
LKIIQQQSATIDSLTNELALLREQVAYLTQKLYGKSSEKSVCPSGQLNLFEEESPSEEDG
DVPS (SEQ ID NO: 337)

>orf02024
LTIPVKDFKAVFTSTTKEKDLTGERIQFKVGFNQISQ (SEQ ID NO: 338)

>orf02037
LVCQTIKYWHKFHLHIGRCKLLIGLIPVLNFFIRADIDCLLVLLSLIDRQNGKQFNLCQW
IIASNGLNDSFEIIESLIHRNILSDIICPNQKKNFIYCSTI (SEQ ID NO: 339)

>orf02042
MIFSCSDSCFSIILLDGDIHENTTFSPLSILFISHRFNSLIGNEVPH (SEQ ID NO: 340)

>orf02043
MPSKDNIRSPIDHLVIKSFLFFSWFQSILNTHLRHDNGDICFLLCPFNFSLHLIFV (SEQ ID NO:
341)

>orf02045
MVSSKSPIAKSACLVHLLEPRSHILKIFMKVIGTVFFFS (SEQ ID NO: 342)

>orf02047
VVEQIPVGHNSGSFFLFLLLRLLLSPLLRNSISFLTSQGIPWKLSNNKTKPIDKPTASKS
IATNPLLLHLR (SEQ ID NO: 343)

>orf02054
MSCTKIGVPFKKLTKKACKGYKILTRLSSQWQKEAPNQSRSAAIXXHSIH (SEQ ID NO: 344)

>orf02075
MNQIQIQIIQAQFFYRFFQSLTSLLIGLLTIPKLGSYEHFFTWNSAIFDCLTNTFFILIN
RRRINMTITSLQGF (SEQ ID NO: 345)

>orf02080
MLLLISLTQLIIFLFFERFNLLLKTFLLVDLKSNKSA (SEQ ID NO: 346)

>orf02095
LIFIEYKIADKTITIIGLSRVNVGRRIALLIAYFIAK (SEQ ID NO: 347)

>orf02098
VIPRYVTKHQGWDHNPHTITNSDDDPATLVTFRTFKFNVGNCTIPKNDQNGSSQKFSGIL
QCPCEIHLLDSP (SEQ ID NO: 348)

>orf02100
VVPKTATSTETKTITRIIHYVDKVTNQNVKEDVVQPVTLSRTKTENKVTGVVTYGEWTTG
NWDEVISGKIDKYKDPDIPTVESQEVTSDSSDKEITVRYDRLSTPDKPTPEKPEIPSPQE
PGTPGEPTPEKPIPQPNPEHPSVPTPNPELPNQETPTPDKPTPEPGTPKTETPVNPDPEV
PTYETGKREELPNTGTEANATLASAGIMTLLAGLGLGFFKKKEDEK (SEQ ID NO: 349)

>orf02105
MAYSTDFKQRALDSIKEGHSHVEAAKFFGVGVRTLFTWEKKDVNKDT (SEQ ID NO: 350)

>orf02143
MPILQAKIDSFRPLFDGLTSRFKVGAGLFLKRFSFSRVKQILLALPQFSMMNPIVNG (SEQ ID
NO: 351)

>orf02158
MAVQANWSFDITHDSSFFFSNQKRGLNFSQMCFKDRRRNGFFDRKIFKFKFNNPIQIF
(SEQ ID NO: 352)

>orf02160
LFLQIKGIKPNHTIALASYIEQSFFFINKTVHFKIGKQLIRTLQTNPFVIQLNCHLFQGC
KKKCSQALSLMVRLDD (SEQ ID NO: 353)

>orf02168
MEIVLVSFSISFQHFIIAYCLDFSSAGFRNSQNFSNFC (SEQ ID NO: 354)

>orf02180
LNFNHVYFGYDENRPVLKDITCSIFKGQKIAFVGPSGSGKSTIVRLLERFYKPLSGDILM
EQSSIYDFNLKEWRSKIAWVSQNNAVLSGSIRDNLCLGLNRLVTDDELMKVLDLVSLGDE
IRSMKEGLDTEVGERGRFLSGGQSQRLQIARTYLKDAEILIFDEATANLDADSEYAIISS
LYSVLKEKTVVIIAHSLSTVKDVDCIFFLEEGKITGSGTHKELLENHERYARFVQEQMIE
(SEQ ID NO: 355)

>orf02181
LIYAEKSFFDKSQSGELTSAIVNDMSVIREFLITTFPNIILSLVMVLGSIVVLFSLDWNL
SLLLFITLPCMMFIILPLSNISEKYSRRLQKEIGFLTGQLTEKIQEHELIKTNQAEKSVQ
NVLDNCIERVQNNSLKSDRVTSFETPFALLFIFATIAVMLTYGSYRVSAGYISVGTLVSF
LIYLFQLLNPISNIANFVTVYSRSKGS (SEQ ID NO: 356)

>orf02183
MKLKLLRVDTKVIMGSFFLVLSSLLALLLPLILKGLIDGSSIENIGSKVFQSFLIFIGQA
LFSSIGYYLFSQSGEKKIAKIRKKVI (SEQ ID NO: 357)

>orf02196
LIRYLDQYEDVILREIKAQFPDVAVDKLMEEYIKAGLILRENKRYYLNFPTLESLDSLEL
DQEIFVREASPVYQALLEQSFETELRNQINAAILVEKTDFARIKMTLSNYFYKVKQQYPL
TEKQQELYDILGDVNPEYALKYMTAFLLKFLKKDHLMQKCRDIFVDSLVVLGYIVQNEDR
KYELAIDFDKERLTFYLA (SEQ ID NO: 358)

>orf02197
MIGLKEVCRFLTDNTSLSTSMINHPIQINGNMAIVTCGSLDGLSHV (SEQ ID NO: 359)

>orf02206
MLINDLTFFIFDISPIQSYKKVRLEITNLWNNTKNATSRGDSC (SEQ ID NO: 360)

>orf02208
MRERVRLSGSLFTSLKTREHIKSTMELFHKYVFFLIQEIKIKMINFLKIGDLPTL (SEQ ID NO: 361)

>orf02219
MIDHFEIKVKDLQISEGFYRSFLAPLDYKLTFKTSSLISFLSPNSPHPGGDFWLTQGTQD PVHFAFLAENKEEVQACYEAGLEAGGRDNGVPGYRSEHPIYYAAFMIDLDGNNIEVVCHK E (SEQ ID NO: 362)

>orf02221
VIVFLSRNKDGNAFCHLDLISIANPVWGWDDDFITWIDHSHKEGIERIFGSRSDCHLI (SEQ ID NO: 363)

>orf02224
LSNQFYFSLQTKPILKVKQFLLFQSQMTRVSEILQFSNKL (SEQ ID NO: 364)

>orf02227
LFRLGQLISLNVAVHKPIKKFQGWIVLSSLPFQSLDILKFFRRFLSRYLVETLQLTGRIE SQGIKHGLTFWF (SEQ ID NO: 365)

>orf02229
MEDKEMGFYLMVASMLLGLLALKIGFSQFKEKKDKFLSILTSLAGTALVLVAVWLGWPK (SEQ ID NO: 366)

>orf02250
MLDSDIGCSRKNLLGLFWIRRRRNIHIVDRAMEKGISNRAPNKISLKACFFNFF (SEQ ID NO: 367)

>orf02278
LLHPFTRNITCDRHILTLLGNLVNFIHIDNATLCTFDVKVSNLQEFEEDIFHVLTHITSL RQSCRIRNSKRYIQALSQGLGKESFP (SEQ ID NO: 368)

>orf02279
VEIDAFVVVINRHCQGTLGTILTNYIVVQDMEEFNWFWHLRQVCQDFLNQFFSNDFLSQL HAFITNKSIVASNYFLYFFLVFATK (SEQ ID NO: 369)

>orf02285
MNXXGKGEEGEDLVVGVFKWLYSERLRFDTERVGGGGKGK (SEQ ID NO: 370)

>orf02291
MHKNFVVVVTNFFTAVQFIQFNKEGTTCHNTTKFFNHLDSCLNSSTCRQKVIYNKNTLTW LNGIRVHSQGIDTVLFFIVSRNNFAWQFTWLTNRRKTNSQLKGNWTTHDKSTSFRSHDHV DFLVSSILNDFTNSVAISISISHQRTNITEGNAFLWIIFNCCNVIF (SEQ ID NO: 371)

>orf02299
MLNRQVCFCFVNHISPLNVVIWENLSLEELLYAICICFITHKIAKQTSLTIDNAGIAMNN IR (SEQ ID NO: 372)

>orf02304
LDSRFFCTDFFKGRQAKGCSFSCTSLSLTDNILAFKGQRNSLFLDRTSFYKTSFFNFC (SEQ ID NO: 373)

>orf02315
LLRKQEREYLRAENAILKKLRELRLKEEKEKEERQKLFKN (SEQ ID NO: 374)

>orf02320

MRFLADQDRIQHHRYSWALFDKVQGLLSHTDSREKTNLNSPKFHITQAI (SEQ ID NO: 375)

>orf02321
MLKNGIISWKDFKSFFCQGCQTSHCYKPMQVVQGIGSQISRQSTTTKNIISRKC (SEQ ID NO: 376)

>orf02324
VTAHRIFGTSSIHSKLIGLAMLGITAMKIICHKLNRNHINIFRRLGIQGKTEFLLIHLIR QVKMNDLSQGMNPTICPTSTVNSNDLPFI (SEQ ID NO: 377)

>orf02328
MLARSKNCFMKSLSIFLLIFYFFDSYQISKKRRSLIGL (SEQ ID NO: 378)

>orf02339
LEVCIHHHHQISCRILQACIKGCFFAKISRERNIMDCRILLPIGL (SEQ ID NO: 379)

>orf02345
LTGNVICHPKLPDKISVKCLYSSKIQFKPRQRRLAMGMVTDFVSSIHNLKAAL (SEQ ID NO: 380)

>orf02356
MGRKPKKRPEERTELERLQAENEYLRAENAILKKLRELRLKEEKEKEERQKLFKN (SEQ ID NO: 381)

>orf02360
MDEIKNFRQWGSKTPGHPEVTHTSGVDATSGPLGQGISTAVGFAQAERFLAAKYNKDGFP IFDHYTYVIAGDGDFMEGVSAEAASYAGHQALDKLIVLYDSNDICLDGETKDTFSENVRA RYDAYGWHTVLVEDGTDLAAISTAIETAKFSGKPSLIEVKTVIGYGSPNKSGTNAVHGAP LGAEETGATRKFLGWDYDPFEVPEEVYSDFKTNVADRGQEAYDAWASLVSDYKVAYPEVA SEIDAIVAGKSPVTITEKDFPVYENGFSQATRNSSQDAINTAAVLPTFLGGSADLAHSNM TYIKADGLQDKYNPLNRNIQFGVREFVMGTILNGMALHGGLRVYGGTFFVFSDYVKAAIR LSAIQELPVTYVFTHDSIAVGEDGPTHEPVEHLAGLRSMPNLTVIRPADARETQATWHHA LTSTTTPTVIVLTRQNLVVEEGTDFGKVAKGAYVVYDTPGFDTIIIATGSEVNLAIKAAK ELVLQGGKVRVVSMPSTELFDAQDATYKEDILPSKTRRRVAIEMAATQSWYKYVGLDGAV IGIDIFGASAPAQTVIDNYGFTVENIVAQVKSL (SEQ ID NO: 382)

>orf02362
LNFLNEPRRQGNIGNKMAIHNIDMIRCYFIIQKSNLLFEFVQIHGHQRW (SEQ ID NO: 383)

>orf02367
VIYSYDYPRLLHSRTLAMGNSNIIPNTGLSFCLSLIKTFDKLVSIRHITRLNQ (SEQ ID NO: 384)

>orf02371
VSRKQEQMETLLLLLRDSKDYISAKVLGEKLNCSDKTVYRLVKGINKDCPVEAFILSEKG RGFKLNPRSSLVDVDGNFTEAFDPEVRREKLLERLLLTAPKPHSIYDLGEEFYVSESVVL KDRQILQESLAIYGLDLKMRQRKLFIDGDEAQIRSAILNLLPMFNQLDLEQITQNKVQPL DGELAHFCLGLLITLERELGVNIPYPYNINIFSHLYIFISRNRRSTSIHVVAPSKPTIVD EKIYSVCQKIIQEIEQYFRMKVDAVEIDYLYQYVVSSRLQKPFSSGKLPFSQRVLDVTHY YFSRMCMDNREIETTDPDFVDLASHISPLLRRLDNRVQIKNSLLSQILLTYPNLVKELTT ISKEVSLVFGFASLSLDEIGFLVLYFARFQEKRARPLKTVVMCTSGVGTSELLRARLEKQ FSELDIIDVVAYHQLDELINLYPDLDFIVTTVALQEPASVPFVLVSAFLTEGDKQRLQAK IQEINYE (SEQ ID NO: 385)

>orf02390
MMSMVDPIDQTFIVNLKIRKSQVFSQLQFSCHIVVYPSEVHIYQALVIKLQNHILGPQVL P (SEQ ID NO: 386)

>orf02391
LANRTRIDNQLPTSPVTKQLLVNMSINSNITGRMSHQAVKLLLFASMNQLSPPVLIRQMM ANSHRQIPKLTMNLKRLIVEHFNFF (SEQ ID NO: 387)

>orf02395

MDSIEFFHDKTFLFYLTSFYSKRMGVTTKMIKIAEGRFS (SEQ ID NO: 388)

>orf02406
LTRFEEIFEEYKNPQDTFFYPLVYKENTYKKTAISIFALLMLGVCCLFLFSQQSYKKLVQ
YYANDQNLPSRITYSEYSDK (SEQ ID NO: 389)

>orf02414
MIAEFIDGLQKFHFLQNALITAIVVGIVAGAVGCFIILRGMSLMGDAISHAVLPGVALSF
ILGLDFFIGAIVFGLLAAIIITYIKGNSIIKSDTAIGITFSSFLALGIILIGVAKSSTDL
FHILFGNILAVQDTDMFITMGVGAAILLLIWIFFKQLLITSFDELLAKAMGMPVNFYHYL
LMVLLTLVSVTAMQSVGTILIVAMLITPAATAYLYANSLKSMIFLSSTFGATASVLGLFI
GYSFNVAAGSSIVLTAASFFLISFFIAPKQRYLKLKNKHLLK (SEQ ID NO: 390)

>orf02424
LNQEIIWKTRKSFTFKSRSLTDIRSRRKCLTNIQLSLIVRHLRQSRTLLAELNVNIPKRQ
IGPILTRFWPN (SEQ ID NO: 391)

>orf02437
MQGEMRFSLVQFLTTLIKFCIFPFLLPNWLFGRKACTHWEFSFPKIKGVFEFHGISFINN
NKLKTTTSKKDENRGTTFIRKKI (SEQ ID NO: 392)

>orf02438
MYEEPEVAPVHPTGPTPATETVDSIPGFEAPQESVTIL (SEQ ID NO: 393)

>orf02468
MRLSWHFMRFKKLPLLINQTILDVGSTDINCNVICHKYLLLD (SEQ ID NO: 394)

>orf02470
MGNNGQFTFGYRHDFFQNQLAIFNALVDTFTRRTIDIKTLNTFINEVLNQGTRTFWAYFS
LIIITCVEGWNDTFVFFQI (SEQ ID NO: 395)

>orf02497
LSTRNKYCKNLIIFESTFNILDIVKKDLKLNSKLEKDLKY (SEQ ID NO: 396)

>orf02499
MNRSVQERKCRYSIRKLSVGAVSMIVGAVVFGTSPVLAQEGASEQPLANETQLSGESSTL
TDTEKSQPSSETELSGNKQEQERKDKQEEKIPRDYYARDLENVETVIEKEDVETNASNGQ
RVDLSSELDKLKKLENATVHMEFKPDAKAPAFYNLFSVSSATKKDEYFTMAVYNNTATLE
GRGSDGKQFYNNYNDAPLKVKPGQWNSVTFTVEKPTAELPKGRVRLYVNGVLSRTSLRSG
NFIKDMPDVTHVQIGATKRANNTVWGSNLQIRNLTVYNRALTPEEVQKRSQLFKRSDLEK
KLPEGAALTEKTDIFESGRNGKPNKDGIKSYRIPALLKTDKGTLIAGADERRLHSSDWGD
IGMVIRRSEDNGKTWGDRVTITNLRDNPKASDPSIGSPVNIDMVLVQDPETKRIFSIYDM
FPEGKGIFGMSSQKEEAYKKIDGKTYQILYREGEKGAYTIRENGTVYTPDGKATDYRVVV
DPVKPAYSDKGDLYKGNQLLGNIYFTTNKTSPFRIAKDSYLWMSYSDDDGKTWSAPQDIT
PMVKADWMKFLGVGPGTGIVLRNGPHKGRILIPVYTTNNVSHLNGSQSSRIIYSDDHGKT
WHAGEAVNDNRQVDGQKIHSSTMNNRRAQNTESTVVQLNNGDVKLFMRGLTGDLQVATSK
DGGVTWEKDIKRYPQVKDVYVQMSAIHTMHEGKEYIILSNAGGPKRENGMVHLARVEENG
ELTWLKHNPIQKGEFAYNSLQELGNGEYGILYEHTEKGQNAYTLSFRKFNWDFLSKDLIS
PTEAKVKRTREMGKGVIGLEFDSEVLVNKAPTLQLANGKTARFMTQYDTKTLLFTVDSED
MGQKVTGLAEGAIESMHNLPVSVAGTKLSNGMNGSEAAVHEVPEYTGPLGTSGEEPAPTV
EKPEYTGPLGTSGEEPAPTVEKPEYTGPLGTAGEEAAPTVEKPEFTGGVNGTEPAVHEIA
EYKGSDSLVTLTTKEDYTYKAPLAQQALPETGNKESDLLASLGLTAFFLGLFTLGKKREQ
(SEQ ID NO: 397)

>orf02501
VDRTDEVSSKHCFEVVDRTDEVSSKHRFEVADRTDEVSNIYTARQS (SEQ ID NO: 398)

>orf02512
MSCNCAFYRSQFFDVNSVSNYHSHQKELRFPNSILFTYFVKVT (SEQ ID NO: 399)

>orf02535
VGLIKLTSYVFVCISNSFLTRHDKNDNICFFHGNFCLVLDLFHERSIDIINSSCINHAKR
TIEPLTRCINTVTCHSFDIFYNGDSLTSDPIK (SEQ ID NO: 400)

>orf02537
LSSKSCIDRTNQETFHTLGLEGVGMKSGSLFCSVQISDKEKENSRLANGFLRYQFIQGIF
LLLTSYHNHRVGLEILPR (SEQ ID NO: 401)

>orf02554
MKSKEQTRKLAVGCSKYSFEVADKTDEVSSKHCFEVVDRTDEVSNYIYGKAKLTWFEEIF
EEY (SEQ ID NO: 402)

>orf02556
LSNSFFLIKFSSSKISGKKRIVSDNIFIRNKFICHFKKE (SEQ ID NO: 403)

>orf02564
MDYSKVAAEVIEAVGKDNLVAAAHCATRLRLVLKDEAKVNQAALDNNADVKGTFSTNGQY
QIIIGPGDVNFVYAEIIKKTGLKEVSTDDLKEIANKDKKFNPLMDLIKLLSDIFVPIIPA
LVAGGLLMALRNFLTSPDLFGPQSIEDMYPAIKGFSAMIQLMSAAPFMFLPVLVGISAAK
RFGANQFLGAAIGMIMTTPDLGGKEAFWDILGFHVTQTNYAYQVIPVLVAVWLLANLEKF
FHKKLPSAVDFTFTPLLSVMITGFLTFTVIGPVMLVVSDAITNAIVWLYNTTGAFGMGLF
GGTYSLIVMTGLHQSFPAIETQLLSAYNNNGTGFGDYIFVVASMANVAQGAATLAVYFLT
KNAKTKGLSSSAAVSAFLGITEPALFGVNLKYKFPFFCALAGSAIGAFVAGLTHVIAVSL
GAAGFIGFLSIKAGSIPMYIIAEIMSFVAAFAFTYFYGKTKAASVFADEAATATAETVTE
PTVEAPVVEETDTLQNETLVTPIVGDVVALADVNDPVFSSGAMGQGIAVKPSQGVVYAPA
DAEVSIAFPTGHAFGLKTRNGAEVLIHVGIDTVSMNGDGFEAKVAQGNKVKAGDVLGTFD
SNKIAAAGLDDTTMVIVTNTADYASVAPVATGSVAKGNAVIEVKI (SEQ ID NO: 404)

>orf02570
MTESYTWVEADRATLSRYRHGQGHLTDQFFSFKVQRPAAKTLIASISTGKGMGPSFDGTP
VITSGNQNRINTIKNSFIMSSSSVRISLRKLTSQRNFLRNLSSLILLAAQVAKGDATACS
HQRIGRVVGQDSHETLSLTEFF (SEQ ID NO: 405)

>orf02571
MNINNEKVWFAFYLLDMQITRPTSTFNDRRIGLIGKLQELRFLAGNLLLR (SEQ ID NO: 406)

>orf02572
LIKGYLPNHLSLMDLCSKTTCTLDDFAGIAGRRNHRGFFCHIGNGVFLTVDKYLWNQ (SEQ ID
NO: 407)

>orf02578
LIKLTGRNFSDILIKCLVKCFTNLLSNQLMLLPSTLKL (SEQ ID NO: 408)

>orf02582
MIQSENHCSASHSNRDYQSQHDNQGRTCQCFIIVPCHKKGSCSVGEITWNQRCQNGQDKD
HSRCLIKNT (SEQ ID NO: 409)

>orf02589
MIARQLMVFFSTNQADTRITNMSIDSLIINNSKDFQSSSHASVSFILTKLVNLLIFNF
(SEQ ID NO: 410)

>orf02590
MGEPFTHFIDCIDLGINPSYTQVCHRHFTSDIPCAMTSHPIS (SEQ ID NO: 411)

>orf02597
LSSDSHFIGIKAFVILILGKSNSIVLRIVGLYQDLTCLFSTTCSTCHLSQELEGSLRRTE
IRQIQGRIRI (SEQ ID NO: 412)

>orf02598
MAVHSLGIHMQGQRNIAVGTSIHRPTLPTHDKARITTAIEHENHLLFFNQTVLDSL
(SEQ ID NO: 413)

>orf02599
MVTGIAVLLISRFMLFINNHDTQIFQRSKDSRSGTNNNLGIATLHLAPFIILFTIG
(SEQ ID NO: 414)

>orf02600
VKNGYLVPKTCYKTLGHLRSQGNLRYQQNSCLALIQGTLDNLQVNLGLPTSCNPLK
(SEQ ID NO: 415)

>orf02601
MVNLIPRLGLDLLLIDCLIFQTKQAFSSQTHHFSLLGKV (SEQ ID NO: 416)

>orf02602
LGLQTKNNPLNQAITLTKRHMNPHPNFQHSLKFLRNPVTIGLVRLHQGHIYDNLS (SEQ ID NO: 417)

>orf02605
LGNHFCTICSTTYQAFLQFIQIWWCQEDKDSIWNLFLDLKSTLNFNFKENIDSLVQGFID
IGQRSSIVVADIFCVFQHLSLTNQLFKFFTSTEEIVNTVHFSRTLCACRHRYRILKLVFR
TLKNLSSNRSFSNP (SEQ ID NO: 418)

>orf02618
VLLPNVLIKFINRFCWNVIPIKGCDSTFWNNKLIAIFKGNLDRGIHTIFCLHTT (SEQ ID NO: 419)

>orf02628
VGCSYICHELVTNHDHFLFVIVEFLHSTVNTKCEGLQGPVNVINPKFLNCSLNAFFGVI
(SEQ ID NO: 420)

>orf02629
LLHLWRSIRVVPSNEGIIQIDQNSLDSLRLQAGDCQIIDCFHSKIWYIIFNRHSGSFS
(SEQ ID NO: 421)

>orf02631
LFGSCRQINHTSLQIRQGKEVFLGSSLAQEVIDLIPTLVHLLNDRIVGIADDFQTGKEKL
INRKRVMALQITSHLFNDIGVLGITNGNQATMLDNKGHGKSLIVGXXHSIH (SEQ ID NO: 422)

>orf02633
VKGLLLATKLCRTNSHTDNLTRYSNRSICQNDLISHIQLTFKEDEKAIDDIRQKALGSHT
NRYPSNTSSSQQTRNWQT (SEQ ID NO: 423)

>orf02635
LWGILGLTLPNLSGIGLLGDLFVGGLKAVAPILVFALVANALSQHQKGQDSNMKTVVFLY
IL (SEQ ID NO: 424)

>orf02637
MIGTFAAALVAVLASFIVPIEITLNSANTEIAPPDGIGQVLSNLLLKLVDNPVNALLTAN
YIRILSWAVIFGIAMREASKNSKELLKTIADVTSKIVEWIINLAPFGILGLVFKTISDKG
VGSLANYGILLVLLVTTMLFVAPVVNPLIAFFFMRRNPYPLVWNCLRVSGVTAFFTRSST
TNIPVNMKLCHDLGLNPDTYSVSIPLGSTINMAGVAITINLLTLVTVNTLGIPVDFATAF
VLSVVAAISACGASGGASGIAGGSLLLIPVAGSLFGISNDIAIQIVGVGFVIGVIQDSCE
TALNSSTDVLFTAVAEYAATRKKASLLMSCLLRFYSNLLGNSYVY (SEQ ID NO: 425)

>orf02639
MIAHAIIILLFKNAGKLCFLVVFFFTVHTFGKNQLLLG (SEQ ID NO: 426)

>orf02645
VFEVVDKTDEVSSKHCFEVADRTDEVSNHTYGKVKLTWFEEIFEEYHTKKPCSSR (SEQ ID NO: 427)

>orf02651
MKNRIIDVFEVVNRILVITVENPDFEDLRVNQFVKIGDKKYRVRSGPMIHSTPPQSVLDR
DTFTIDYTDDELLDKEAVFTTH (SEQ ID NO: 428)

>orf02657
MAYIEYKQRGKKRLWSFSIRERSKSLLHKSGFKTKREAKIEAEKVLHKLNTGSVLSSSMT
LSELYNEWLDLKILPSNRSVVTKKKYLMRKKVIERLFGNKPVSQIKPSEYQKIMNEYGET

VSRNFLGRLNSSIQASIQMAIADKVIIEDFTAYVELFSSKSGQKVEEKYLHTESDYQKVL
VYLKNKFDYQKSIVPYVIYFLFKTGMRFSELIALTWDEVDELNEQLKTYRRYNTAIHKFT
PPKNNTSIRLVPITSDMLSLLKTLKILQLKTNKELNIDNENNLIFQHFGYVYDVPDIATV
NKAIKVMLKELQIFPLITTKGARHTYGSYLWHNNIDLGVIAKILGHKDISMLIDVYGHTL
EEKISEEFTAVKSLL (SEQ ID NO: 429)

>orf02658
MKDTISNKDLISMGYRPSTANAIIHQVRELLVSRGYTFYNRKRLMVVPKSVVKELLGMEL
(SEQ ID NO: 430)

>orf02659
MNKEVLNRAPSNSPITIHQMSNKSYSKFQEEVSLKYGFIGLKLDKLSLTAEVSEEFHSEI
LSGNFTLYDYFGVVEPNLNRNGELASYKGQFFNDEKENWYIEYTPVASIKMNKRPLKIEF
TPSKVSKKNFLIVFHRMFPYMFNIAISTFHLAYDFERDLSALRVNWPKVMYRPIYKGMKL
ETMDFGAPKGNYHLTAYNKLKERMDSGDMAEIEIYQQYDNLWRIEYKFYNEGNIKKELKN
GLPFLAKIPVYIENFKGLEFNNLGVNEKIYLFALRNKPELFAESDKRTVAKYKKLAESIS
EVNLNVFFQNALDFVEIFNQEPCLINFFEFMNSMLQGDIPKLTINQE (SEQ ID NO: 431)

>orf02660
MHFDKSKFGAVFSAPGLYEVEVINNASFGQNAQYEVIQSRKLGTFAELIEMAKIK (SEQ ID NO:
432)

>orf02661
MFKIKQTASLSEHYFLNTSKLRSIRWFTIGFLSILSLYSCILFKGWFLQMFTLSVGLIVT
LYFERKIKGCFHQIEPLLIVRENLLFMLRRNSFLFTATKDGAILRSAKFNYQLNDVSIVI
QALKSGDEFTREMDDLDVLLSSVLGISLSYKEIYATHVEYVFVYRQPERLHITSLPLEED
NSLKIKIYDDFIIDLRKNFSMLISGASGAGKSFFTYYYLTRFISQTVNGRHAKIYVIDPK
LSDIYKLSKFSGLPVENYGTTNEDAFRIVRHYINEMNRRMEIYNKSDLFDSIGIDLGLPP
LLLVIEEYSSLVASMDSKAKKDFENMVAIVAQKARSLSMGVCIVMQQPRSDSLSTNIREQ
LVNAIFLGAPTRESSQMMFGTTDVPKVKKDKGVGLYSTDREPPKEFHSPMFDRDVFEVIL
PVWEWAAKDYMKDEDEDV (SEQ ID NO: 433)

>orf02662
MKQKQPIVSRTKQHTFEELIQDQKLERLANLSPDLVGRYGFTASCASSFANLIKEAYGGK
NLNVVYASRMLALWNIACSCYHKADGYSLADALFSDKKICLDYFYYHNNTSDIITLDMIE
DVKKNYLQLVTTATSDNMSVIEFEMEKESDLYYFIKATLGSSFSRMHYSVLVKALAGALA
KNI (SEQ ID NO: 434)

>orf02664
MGWKGTPPCLHPSNQDTTILIVQQCLRRIEVLAMINFLN (SEQ ID NO: 435)

>orf02665
VFGSYYGVIASIFFKEFWITEISSNQLIWQVCSSYNWILGNLFKVNPVI (SEQ ID NO: 436)

>orf02666
VLPSHQVLTFSMSPVHRPPNTIIWIELIKEMVFSTKIDKSIWIIDPTNLS (SEQ ID NO: 437)

>orf02689
LIVSLKTKSRKAKDMAESIQGWLAQFLVNLFKSITFDCGKEFSKWKDISNHHDSESFFAN
LGCPRQRCLNEHSNRLLRCHDLPKQTDFNEVSQEF (SEQ ID NO: 438)

>orf02690
VVEIIYFLIIIIASGLGSISGMGGGIIIKPLMDSFGYHSVSDIAFYSSFSVFIMAIISTT
KRFSQSKEIKWRLIFTVSFSSVLGGFLGHLIFQVLLSQLSVRLVSIVQMILLFVMLLVSF
VLTDFKKTYQFDKIGFYMICGLLLGLISSFLGIGGGPLNVSLLMVFFSISIKEATMYSLA
IIFFSQLSHLATIVVVTGLNQYHLAPVPVIFLASICGGVLGTVVSKVLPENWVRYCFKGM
LFFVMGMTLYNLFHIL (SEQ ID NO: 439)

>orf02691
MMGTNSEEGFLDDFEGPQVAVSVKDFSIADTPVTNQEFAQFVKETGYKTLAERQEWSFVF
ILFVPEAEREGYPHPAGAPWWLQVSNACWKHPYGENSNLVGLEDHPVVHVALEDALAFCN
WSGMSLPTEAQWEYAARGGRQSEYPWGDTLLEGGYYHANTWQGRFPYENTALDGFIGTAP
VYEFLPNDFGLYQMIGNVWEWCRNPRYTLLASFNEDDYELPKYGIQDEEYAIRGGSFLCH

CSYCNRYRVAARNGCISTSTSSHLGFRCLKE (SEQ ID NO: 440)

>orf02694

MVQTKQPNIILIVVDQMRADALSLNSKDKLVSTPTLDMMASVGYNFENAYSPVPSCVPAR
AALLTGLDQDKSGRVGYQDEVPWNFTNTLPKVFKDMGYQTECIGKMHVFPSRQRLGFDHV
LLHDGYLHVDRKYDKTYGSQFDYASDYLAFLKGKVGYDVDLIDDGMDCNSWEARPWDKDE
KLHPTNWVVSESISFLQRRDPTVPFFLKMSFEKPHAPLNPPKYYFDMYMERLPQFLDLHI
GNWEVLEKQIPSIYALRGKLKEDDQRRMVAAYFGLITHIDHQISRFLTALKEFRHDKDTI
IWFVSDHGDQLGEHYLFRKGYPYQGSIHIPSFIYDPAGLIAGNRGTIKQLVKIQDIFPSL
VDLAGGTTTDELDGRSVKNLLFGQYEGWRTEFHGEHALGKDSSQYILTDQWKFIWFPVLN
HYQLFDMKKDPHEMNDLYPSEKYQPIVRQMKKKLVDFLRYREEGFVVDEELVPVELSKIT
PTLTKTGDSQS (SEQ ID NO: 441)

>orf02696

MNTMLDKMQEKLSPIAMKVGNQKFLVALRDSFVGTMPVIMTGSIALLLNAFLVDLPQQFH
LESITKTFQWLVDINNLVFKGSIPIVSLLFIYCLGVNIAKIYKVDTVSAGLVSLASFVIS
IGSTVTKSFPLANVGDVKLDQILQGIDNLAFDGKNLMVTIGNVIPGNHINARGYFTAMMI
GFLASIIFCKVMKKNWVIKLPDSVPPAIAKPFTSIIPGFMAMYIVAILTYVFHLLSNDLL
IDWVYKVLQTPLLGLSQSFFAVILMIFLNKLFWFFGLHGGNVLAPIMEGLFGVAMLANLD
AFQKGEPIPYIWTSGSFGAFVWFGGLGLVLAILIFSRNSHYRKVAKLGLAPVLFNIGEPV
NYGLPVVLNPLLFIPFVLSPVFMATVAYWATSWGLVSPVTQNVTWVMPPILYGFFSTAFD
WRAIILSVVCLIISVLTYFPFVKMADKTELS (SEQ ID NO: 442)

>orf02697

MDESNLESVMGLIMYGGEAKSNAMEAIQAAKKGDFSKANRRLADANAALLQAHKAQTEML
TREAQGEETSISLLMVHAQDHLMTSLTFVDLAKEVVEVYERFEKN (SEQ ID NO: 443)

>orf02698

MAKVTIMLACAAGMSTSLLVTKMQKAAEDKGLDAEIFAVPAPEAEEIVATKEVNVLLLGP
QVRYLLGDFQEKLKDRQIPVAVIPMTDYGMMNGSKVLDLAESLLD (SEQ ID NO: 444)

>orf02699

MKRLISANPSEILQMNAEELKQSILASEGRVVLSENVVTRETFVGDITNSEIARAFGADM
ILLNCVDVFEPKIYALDSSGDDVIHRLHQLVACPIGVNLEPIDPSAKMLEETQEIVAGRV
ASVETLKRIEELGFDFVCLTGNPGTGVSNREIIKAVQTAKENFSGLIIAGKMHGAGVNEP
VAELSVAEQLLEAGADVILVPAVGTVPAFHDQELREVVDLVHSKGGLVLSAIGTSQETSD
TDTIKEIALRNKICGVDIQHIGDAGYGGLATVDNIYALSKAIRGVRHTVSRLARSVNR
(SEQ ID NO: 445)

>orf02700

MEKLLQEKLLPVAARLGNNKALVSIRDGITLTIPLLLIGSLLMVIASFPIPGWEKYLGDI
GVADYLWKGVDSSFGLLGLVASFGIAYFMARQYKVDGIPAGIVSLSSFITVTPFITGEAG
AGMPTAFMASKGLFVAMILGLINGYIYQWFINHNIQIKMPDGVPPAVSKSFSAIIPGAVT
IVGWLIVYATLDKLSLPNLHEIAQVALGGPLGLLGNNVIGLLILIFLNSSFWFVGLHGGN
VVNAVMKPLWLANLDANKVAYQTGETLPNIFTSVFMDNFVFIGGGGATIGLVLALGYLAH
KKKASKQLKTLAPITVIPGLFNINEPAMFGVPIVLNILLLVPFILAPMFNLLVAWGAMAS
GLVPLTYTDPGWTMPPVISGLLATGSISGSLLQIVLIVLDVLLYLPFVIAIEKRFKLLED
(SEQ ID NO: 446)

>orf02701

MTLSKKQLQLRAKILETVYTLGPISRIEIATKTGITPATTSSITNDLIKENILLELGEDE
HDTSVGRKKILLDIQAKRFYYIGCELSEKHFTFALGDNLGNILKEEKEIVTKQLIQEKGN
QLINQTLKQFLNNCSDYEIEAIGIALPGRYLDDYKITTNNPLWQHIDLEMIQSHFDKPLF
FSNNVNCMAIGKRLFSRQQNDTNFAYFHFARGMHCSYIYDGNIYGKGNLMIGEIGHTVVS
SEGEECSCGRKGCLQTFAGEAWLIKKSKILYHQSPYSLLPSLVKNADDIDIQVILTAYQL
GDTGIITLIHQALLYLSQTILNISMMIDSQKIYLHSPLLTNQHIIQKLYSEMNYKPKLLY
NRLPEVIIEPYNDFTAAHSAIALCLYHTILHS (SEQ ID NO: 447)

>orf02719

MPFKENLICQHRNHHCSVFFISLGLLHNIHIEIDISQTRASFLDLSDYLQAVLMILQKFC
QAIGLAQRLDLLQLHLLHLTRLLL (SEQ ID NO: 448)

>orf02728

MYLLLLVVKDHIALIDKEMHVWRPNCILRDLTNFFIKRNHIVTNKTNGSPTKREV (SEQ ID NO: 449)

>orf02729
MVLALMNHFIKEIQGIPINRLTILIENSIFKLNLKNWIIG (SEQ ID NO: 450)

>orf02731
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHCFEVADRTDEVSSKHCFEVADRTDEVSN HTYGKATLTRFEEIFEEYKGVPR (SEQ ID NO: 451)

>orf02743
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 452)

>orf02745
VCQRMDARTCKTTIIAVHNVLTALQQTWIAVQLYQTK (SEQ ID NO: 453)

>orf02746
LHLGKSILSLPVKGKDLEFLVHLFVINHWIGFPSRTSTFCRCKVLNGME (SEQ ID NO: 454)

>orf02747
LEQTVIIANNPCELYWDNHLSFLSDSLLKQVIVHLKRICLDIHHDRGCSHVRNDTT (SEQ ID NO: 455)

>orf02749
LTDDGVLILVVDAGWRGNSCLQEQGCHHFRAILLCITWHFRSCTDKGHLTFKDIDQLRQF VQTDTSDEISNLGNTAIVSRSHQTSFFIRIRHHGTKLPNLEPTVVLGHTLLLVNHWPLAI QLDPNAQDEKDGRGQNQ (SEQ ID NO: 456)

>orf02750
MLKMRKMGEVRTSKIKAKTQSKQRLKISEPFLLETSW (SEQ ID NO: 457)

>orf02765
MDYNAVIPEFLVSNIEQSRSFYCGLLGFRIEYQRPEENFLFLLKSVN (SEQ ID NO: 458)

>orf02766
MLEEGTKDQLAELTYPFGRGVNLSFGIKDVSKLYQKVMEANYPIYRPLTKRKFRVSDPYI YPHKFAVLDPDGYFLRFSE (SEQ ID NO: 459)

>orf02771
LACDKHGKGCFTDISALLIGDIHIHHTGCTTLMDTFSFNGQYIVEFSCLKVVDRGLECHP IKSQRDNHQTTDLVT (SEQ ID NO: 460)

>orf02773
MGIAIVVERRVHYFGRHHNVTISHFFNFVIFKGRYSVKMKVFHRFLLIFQTTL (SEQ ID NO: 461)

>orf02784
MIACRHDICKSQKGLEHPFCIVRRLTRDFNQRPVCIVEANIFCLKITPQIIANMIVARTV KSSKTGITLTTSMCKRDNHKITWFHRRNGFPSFFNNPNRFVSTIFVSNFRFWITVPP (SEQ ID NO: 462)

>orf02799
MNMNKDQIAILNGADNLNLTLWMTLKEICKEGCKSFFPVRNTCRMLDIGIPYRLGLSLSN SSVLNGMDV (SEQ ID NO: 463)

>orf02814
MDGQLHHRAIFDWVHFENFINSWLGFLTINLKTTGQGAEIVLIGHTFNTRDINLVNLITR VNHLVCKVPIIGQNQDTRCIPVQTTHRVNTFFDIGQEVDNRLATLVICYTGNDTAWFVKQ IIDLFFVVDRLTFNFDLVA (SEQ ID NO: 464)

>orf02820
MHKLRIFVNQLYRRFGIILGPFLVLGFQVLTQELELAIFFDLREEVLLQVIPQVCHFCYL RKEFTTLNQHELTSHDHVLTRHFQTHGLQG (SEQ ID NO: 465)

>orf02831
MLHMNLFFQPFFTNLCKTLATGCCVKTVMEWSSIATTIDFKIIE (SEQ ID NO: 466)

>orf02832
LDNRAKEWIMSTAQNQAIHLSNQGTQGFIDHLLGNTG (SEQ ID NO: 467)

>orf02843
LSNFCFKTVTVHRYSVNTNVNQNFSTISCFQTKSVPCWKGN (SEQ ID NO: 468)

>orf02853
MKIKEQTRKLAAGCSKHCFEVVDETDEVSNHTYGKATLTWFEEIFE (SEQ ID NO: 469)

>orf02858
MSIVKSHSFSISLGIFNSFWNNIHTSECFYFLCKGKSNRSNSTISVNQMVFFINIQRFYC
FAIEDFCLLRI (SEQ ID NO: 470)

>orf02859
LNTLLPPDNLCLFTIYLTGFSCICINSYCHNFWEIFNQLFYQLS (SEQ ID NO: 471)

>orf02865
MIDKVIEQYKSHDNLDIRVELHKKYSKNKLGFNNWIFSNYQITDEVKVLELGCGTGELWK
SNSDSIDKMKQLIVTDFSKDMVKSTKSVIGNRNNVNYEIMDIQKISFENETFDIVIASML
LHHVNDIPKALSEVNRVLKTGGIFYCATFGENGVVNYLASLFKDEVNQDLENRTFTLQNG
KRYLSRYFNSVDTLLYDDELQVTSIDDLVKYIQSFKGISEIGSLEEEIIRKRLESEFNNG
MLIIPKEYGMFIARKES (SEQ ID NO: 472)

>orf02867
MDLGFDYFGSALTISPHKNSQTINSIGIDVQKIYTPHYLPNDFKKNQGYKRSVEMCEEYD
IYRQCYCGCVYAAQAQNIDLV (SEQ ID NO: 473)

>orf02868
LTKYADVTIYFANSNIHPKAEYHKRVYVTKKFVSDFNERTGNTVQYLEAPYEPN (SEQ ID NO:
474)

>orf02876
MYNKVILIGRLTSTPELHKTNNDKSVARATIAVNRRYKDQNGEREADFVNMVLWGRLAET
LASYATKGSLISVDGELRTRRFEKNGQMNYVTEVLVTGFQLLESRAQRAMRENNAGQDLA
DLVLEEEELPF (SEQ ID NO: 475)

>orf02880
MQFTRTAHHTKTLFTTKFTWENEIPFWHHSSRKRDNGFQPHTRIGSSCNDLYSLITCDCN
LADVEVVTIWMGYHLNNFTDNKLRFLIINNFFCKTFRLQLLVQTSDLLICQKDLTALCNF
K (SEQ ID NO: 476)

>orf02885
MSYSVDDVVSNAFKKRMILDSFFAFNCSGTMKVSTWVYDKGEWYYVSSSGAMIANDWVKD
NGK (SEQ ID NO: 477)

>orf02895
LTSFCFKANMFNNCLRICRIAEGHILKLDLTFEVFISQLHLNRVLDRRMQI (SEQ ID NO: 478)

>orf02897
LINPLSRDHSSGKNDEECSHEKEAHDNLHSIRHENNHVTKERQTRYRSSVVNHIGPNPVN
RHTQTT (SEQ ID NO: 479)

>orf02900
LHLRTCFVRQTNKLSPLINRTRLQFHQTILHYTLNQITSNRLGNIEFLLDIFNQDQVLVF
LAIIQKMHNLTLRPTHKFNAATFGFLLHHQVNLMTKTLKD (SEQ ID NO: 480)

>orf02916
MLEIWKYRPFVSEFWNDFKNNHDKQFVDPISLYLTLKDDDDPRIEEESEALENMILQYLG
EDDAS (SEQ ID NO: 481)

>orf02918
LTLFFFELLICLLNSEFDLSKFIFVYFDEYFHEDSLKMNLHQFSFSF (SEQ ID NO: 482)

>orf02924
MAFNQFNRCIGLSIPTAPNVPGTIINRSYLHDATVPNNVREKT (SEQ ID NO: 483)

>orf02940
LRLQIELTWFEEIFEEYKFEIMKIRQTGGCFVSHLTERDGLRVT (SEQ ID NO: 484)

>orf02944
MKKNRGIQKLAILVLLGVFMFSNTIPYQQFIQKNRQLEIRVQSQKKSNGLDVGKAD (SEQ ID NO: 485)

>orf02946
MKKLFILISNLLASLFFVWVLTIWTDTYVSHYYPNVVVRDSSPETTFQHVATRLEKLAEE
TDSFIAIQHQDPNSEGTTVFSYTTFGDGKLPDGLQEKNLEDAQSSSVETNYFVFDGHLDI
HLLREELSQLGLTNMHLTIPSKLSTLMAIFSNGFQLISLLIFILTFVALTLISQISQLRS
SGIRLISGEKRWSIFLRPVGEDLKAIAVGFSLAGVLAILMQKILSLPTQSLMTIGEGLLS
YNLILLSISLFFAQLFAVGIKKIHLMQIIKGQVPVRGIISLILIGQLLAIIIVTLGIGSS
LKYSQAWQQHRIGQEIWSQERQLITLSISREGTSPGFDEQAQRKLRTWYQLMDLAVSEQK
AFLSRHQLIDRTLQNGMASSKNLITSTEWHDYNPNGNVLIVTPQYLERQNIPVDTTIEQK
MNHLNVGEFVLLLPEHLRSEEEHYKSVFEDDLTSRISSQDERQQMTATVGYLESGQDRFV
YNTTPISYQQFLKDPIIIVITPQSTGPQSILFWIDAVQNYVLFNQLSDAQELIQRQGIEN
WVSEMQTGYHNYITLLDNIQRERWVMLAGAVLGIATSILLFNTMNRLYFEEFRRAIFIKR
IAGLRFLEIHRTYLFAQLGVFLLGFVASVFLQVEIGVAFLVLLLFTGLSLLQLHVQMQKE
NKMSILVLKGG (SEQ ID NO: 486)

>orf02955
VLKWCILRINHHISRKVDNFLEGTRAHIKGQAHTAWNPLEVPDVRYRSFQFDMSHTLTTN
FRTRYFNPTAVTNNSSVTNTFVLTTSTFPVFCRTKDHFIKESFTFWFQGTIIDCFRFFDF
SIRP (SEQ ID NO: 487)

>orf02962
LVDPLVTSHDNLLSKGSIFIQTRVSLSYSIFIFFISCQPNNFRS (SEQ ID NO: 488)

>orf02966
MPWKELCHKLAPKVFKVIRIYSRENKKSPSNWAFCSFET (SEQ ID NO: 489)

>orf02970
VSVLFFCSYFSLSLEKGWFSSLISCKFMNQFLPFCWRQDSPWILTLAQDSITYH (SEQ ID NO: 490)

>orf02978
VTDENTRKVRSLVAFFSIVIGYILSSFFISLYHLWQEALRGLL (SEQ ID NO: 491)

>orf02979
MRLLFFFANRVIRSKENSSTCPSRSYNLLINTSNVSHITIAVNGTCTGNNTTITKIWVSY
LSIDS (SEQ ID NO: 492)

>orf02983
VDSLFLSLGEEGNQEINLQESFSSTDCNPTLISPETTVAQGLCQDIIYRPFT (SEQ ID NO: 493)

>orf02985
VNPKSLGSFFLQDSKGFKELVLGHAKLSLPRIVHNVCPQFKNASRIITTRDDFWNACYSL
QMFNIFKGIQVNGRTQFTCIGVFLVWRVVGREHNLRTQKVQFMAHQKLYITRAVHTTTFF
LENFQNSWSWSSLNCKIFLKALVPRKSLVDGSCLLTNPLLIIQVKGSRELGNNRF (SEQ ID NO: 494)

>orf02989
MTTIRSLLLNFISISYSIFIQKIKKQTRKLVAGGSKHCF (SEQ ID NO: 495)

>orf03003
MDALVLQKNQETIQQIAVKIRFLDGHDYYSLIDIDNRRTNQTVFPFVNFEDIAF (SEQ ID NO: 496)

>orf03004
MAFFTEIPTRACLINLAITLHIVETCQGFNDLSLHLRVLAL (SEQ ID NO: 497)

>orf03008
MLLPLPFNTSKIKQIAMHSDLNQKEMIGHIFHDEDIF (SEQ ID NO: 498)

>orf03013
MKQTVKKLALVASIAATLGGSVAVASAAVQYPEGGVWTYGSGNGGAYSNYYHPSKYHSST
VVSRKTGSSDKGYAGAGGTSRAWIRTSWGEKVAFYYNV (SEQ ID NO: 499)

>orf03018
MLNRRFIKTNNIHLCHTHLSSQGNFFCLTTCKFFYIQVCMCIKNHLF (SEQ ID NO: 500)

>orf03029
MNTIERTRRLVKGCATHCFEVVDRTDEVSSKHCFEVADETDEVSSKHCFEVADETDEVSS
KHVFEVVDETDEVSSKHVFEVVDETDEVSSKHVFEVVDETDEVSNHTYGKATLTWFAEIF
EEY (SEQ ID NO: 501)

>orf03033
MLERLKSIHYMFWASLIFMLFPILPVVIGELPAWHLLVDILFVVTYLGVLITKNQRLSWL
FWGLMLVYVAGNTAFVAGNYIWFFFLSNLLIYHFGVRSLKSLHVWTFLLAQVLVVGRLL
IFQRIEVEFLVYMLVILTFVDLMTLGSVRIRLVEDLKEAQVEQNTQINLLLAENERNRIG
QDLHDSLGHTFAMLSVKTDLALQLFQMQAYPQVEKELREIQQISKESMCEVRTIVENLKS
RTLTSELETVKKMLEIAGIEVETDNQLDTASLTQELDSMASMILLELVTNIIKHAKASKA
YLKLERTEKELILTVSDDGCGFAFLKGDELHTVRDRVFPFSGEVSVISQKHPTEVQVRLP
YKERN (SEQ ID NO: 502)

>orf03036
MTVVKVEKLSKKIKDKEILRNISFEINDGECVALIGPNGAGKTTLLDCLLGDKLVTSGQV
SIQGLPVTSSKLDYTRAYLPQENVIVQKLKVKELIAFFQRIYPNPLSNQEIDQLLQFVKQ
QKEQLAEKLSGGQKRLFSFVLTLIGRPKIVFLDEPTASMDTSTRQRFWEIVQELKAQGVT
ILYSSHYIEEVEHTADRILLLNKGELIRDTTPLAMRSEEIEKHFILPIAYKEVVEQSNLV
ENWTLKQDSLQVVTREADAFWELLAQAGCRMQEIEVNNRSLLNTIFEETQKGDN (SEQ ID NO: 503)

>orf03039
MGEEEMRNKMIIAMSLVVTGVMTYLMFSGLDEDFCHFPWKVFAGFGIMS (SEQ ID NO: 504)

>orf03040
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 505)

>orf03063
MPSLRSLKKTDGSCDELHHFDLPVNFFKNTVLGKQTCSGVIREVCQDCFNMLWR (SEQ ID NO: 506)

>orf03091
LHTSFRSSVGHSHTWHQDIVRPILFSRFNDSIVILWQNCPTFNQGIYCYLDCFFPIVSL (SEQ ID NO: 507)

>orf03096
MWSQTLGLIHPLTSLLELPFWMACLKGFGQFCKSLSGLLSFVAECQHLLSLCSRFIRITV
LQTSKV (SEQ ID NO: 508)

>orf03112
MLEQARLKVEQQAIKNIQFLEQDLPKNPLEKEFDCLAVSRVLHHMPDLDAALSLFHQHLK
EDGKLIIADFTKTEANHHGFDLAELENKLIEHGFSSVHSQILYSAEDLFQGNHSEFFLIV
AQKSLA (SEQ ID NO: 509)

>orf03113

MKHDFNHKAETFDFPKNIFLANLVCQAAEKQIDLLSDKEILDFGGGTGLLALPLTPSQAG
(SEQ ID NO: 510)

>orf03117
MVDLQSFFTRKYLNLNSVDAYLILPRLQGHLSYPQDFFLLQDFCFLLPIFLNLSQKEGRN
AGKDS (SEQ ID NO: 511)

>orf03133
MRIRNSPFDHILQTIFEFEDRTCQVTCRFEACSSICNDNWEFSQHIISVFQSPSCHTVCD
KSDVFCSFLFDKNFASLWIYVVTITDQLCXXIPFIN (SEQ ID NO: 512)

>orf03142
MHKTCLNIWKFLFYQIESLIHQMAADKSPCRIGNRGR (SEQ ID NO: 513)

>orf03144
LNHRFNRQTTKVGRSTIWANGTVNRLIIFVIRSTCIVLINGHSFRCQTSSSTSLPNTKDK
VRLITIHLFFQYLSRFVKNCRHL (SEQ ID NO: 514)

>orf03147
MTLHQTFRFQNFEMPCQSSLINFQTLLNRHLVTRRMLQQKQ (SEQ ID NO: 515)

>orf03151
MKKRMLLASTVALSFAPVLATQAEEVLWTARSVEQIQNDLTKTDNKTSYTVQYGDTLSTI
AEALGVDVTVLANLNKITNMDLIFPETVLTTTVNEAEEVTEVEIQTPQADSSEEVTTATA
DLTTNQVTVDDQTVQVADLSQPIAEAPKEVASSSEVTKTVIASEEVAPSTGTSVPEEQTA
ETTRPVEEATPQETTPAEKQETQASPQAALAVEATTTSSEAKEVASSNGATAAVSTYQSE
ETKVISTTYEAPAAPDYAGLAVAKSENAGLQPQTAAFKEEIANLFGITSFSGYRPGDSGD
HGKGLAIDFMVPERSELGDKIAEYAIQNMASRGISYIIWKQRFYAPFDSKYGPANTWNPM
PDRGSVTENHYDHVHVSMNG (SEQ ID NO: 516)

>orf03156
MSNQITVHHSHEHLQKVFTHSWQCNIKNVFIFLKQSLLLMKRNSVGFPTEFTPSILKS
(SEQ ID NO: 517)

>orf03171
MAELNSVITTVTGIENRLGAVILAEIRNIHAFDNPAQLQAFAGLDSSIYQSGQIDLAGRM
VKRGSPHLR (SEQ ID NO: 518)

>orf03178
MEXXXDIRKGRHAVVEKVMGAQTYIPNTIQMAEDTSIQLITGPNMSGKSTYMRQLAMTAV
MAQLGSYVPAESAHLPIFDAIFTRIGAADDLVSGQSTFMVEMMEANNAISHATKNSLILF
DELGRGTATYDGMALAQSIIEYIHEHIGAKTLFATHYHELTSLESSLQHLVNVHVATLEQ
DGQVTFLHKIEPGPADKSYGIHVAKIAGLPADLLARADKILTQLENQGTESPPPMRQTSA
VTEQISLFDRAEEHPILAELAKLDVYNMTPMQVMNVLVELKQKL (SEQ ID NO: 519)

>orf03191
LTNLSSVDSEELFQFYRERGNAENFIKERKAGFFGDKTDSSTMIKNEIRMMMGCLAYNLY
LFLKQLAGDEVKALTIKRFRRLFLHIAGKYVSTARRHILKFSSLYAYSKQFQALFDTICQ
INLILPVPYRARGQGKTCLTE (SEQ ID NO: 520)

>orf03203
LFDDRQAINICPPTNGSLRLTSLQVDQNPCPPSTNLNKILARSQFLNHIQQISLSLELLQ
ANLWNLV (SEQ ID NO: 521)

>orf03207
LSVHFCSSHRCLLVRYNDTYSTKKGLKFETFLSVFRYDFLGM (SEQ ID NO: 522)

>orf03237
MDFFNYLLWMICHNHGLHTLLLSKDCVCHTARDKDGNHRIKSVFPTKGQTCYQHDSSIYQ
ERNTTDILTRFLANSQADDIRPTTGDIVSKSKTNPQTHNNTPKKGIDNGILRQGCHRDKL
DKEGTHRYRDKGKDGELMANLIPS (SEQ ID NO: 523)

>orf03245

MKIKEQTRKLAAGCSKHCFEVVDETDEVSSKHGFEVVDETDEVSSKHGFEVVDETDEVSN
HTYGKATLTWFEEIFEEH (SEQ ID NO: 524)

>orf03253
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHGFEVVDETDEVSNHTYGKVKLTWFEEIL
EEY (SEQ ID NO: 525)

>orf03254
LFFKDEKQALYTKPKTKSSSFRASKVSNQTIVATTRTDCQVIALNLCDKLENGVVVVVQT
THHIGIDDVIYSKIFQHLTHSIKMSLAFFIKKVQDRRRILYCHLVFFFLRVQDTKRIFLQ
ATLAILRQGLLERCQIVNQGLAVGCTALRISKSVEVQFDTLNTDFLQKMGCHNDCFHIGS
WIARTKTLNTNLVELAQAPCLWTLITEHRSHVVELAWLLHFWGEEFIFHIGTDNGRSSFW
TEGNMTVTLVIKIVHFLGYDIRCISDRATDNLVMLKNRRAHFCIVIALENLTGKALNVLP
LSRFSR (SEQ ID NO: 526)

>orf03260
MEQIGKVFRQLRESRNISLRQATGGQFSPSMLSRFETGQSELSVEKFLFALENISASVEE
ILFLARGFQYDTDSELRKEITDVLEPKNIAPLEDLYRREYQKHAHSHNKQKHILNAIMIK
SYMKSMDERVELTAEEGKVLHDYLFSTEIWGIYELNLFSVSSAFLSVSLFTRYVREMVRK
SDFLMEMSGNRNFFHTILLNGFLASIECEEFTNAYYFKRVIEEHFYKENETYFRIVYLWA
EGLLDSKQGRVKEGQKKMEDAVRIFEMLGCNKSAEYYRNTTEC (SEQ ID NO: 527)

>orf03261
LIPYFLHFIIFFRKFIKNLPNCQNYEKIEDIYHVEGLL (SEQ ID NO: 528)

>orf03263
MKIKGQTRKLAAGCSKHCFEVMDRTDEVSSKHCFEVVDRTDEVSNHTYGKATLT (SEQ ID NO:
529)

>orf03266
VVPFSDTFKDRNQVDIFTIKISRCNSSTIGENSWDIHISNSNHRSRHVLVTATDSDEGIH
VVTTHSRLDGVRDDVTRC (SEQ ID NO: 530)

>orf03275
MKKFSYPTRQTGEGVKYQSQMVRQWFLIRIFRLFSVA (SEQ ID NO: 531)

>orf03297
VVLDHQNQLFEARFLEHTNPLTRIQLTRVKALRILLSSPPFLVIKGIRTEVDKSC (SEQ ID NO:
532)

>orf03305
VQKLKKAIYKAHLKDSDDFRPETSTPNLFESCLKLCPCFLSS (SEQ ID NO: 533)

>orf03306
MGALGYYEGFVPYVSNQYKNQAEEEDKPLSDKYIFEKILGKTYAAFKKDQINERVEKLGK
LKPITINYNGKSEVIDSKEKLQELMNKAVKDEVAQI (SEQ ID NO: 534)

>orf03307
MMGDGMKEFQFERKQRFSLRKYAIGACSVLLGTSLFFAGMGAQPVQDTETSSALISSHYL
DEQDLSEKLKSELQWFELENKLLNLWEH (SEQ ID NO: 535)

>orf03308
MKIKEQTRKLATGCSKHRFEVVDKTDEVSSKHCFEVADRTDEVSNIYTARRR (SEQ ID NO:
536)

>orf03312
VNITKTSIIKAHTTKEDGIDHTFTRFNIMSIFYSTRKIFLDKLNSTNRQFLGYIISTRCY
QSFNSVSQSIHTSSSSQAFRFGKHEFRVINRDKSKAILVNHYHLNLAFFISNHIVNSDFC
RSSCRCIDSHNWQAFFSRLMKPFIILWFSTICSHDRNTTSCILWRTPAKTDDKVTAMFLQ
SSYPICDIFTSRVWLYIAKDDIFDSFCIQWF (SEQ ID NO: 537)

>orf03318
MSQDEKLIREQICDVCHKMWQLGWVAANDGNVSVRLDEDTILATPTGISKSFITPEKLVK

LNLKGEILEAEGDYCPSSEIKMHIRCYEEREDVRSVVHAHPPIATGFALAHIPLDTYSLI
ESAIVVGAIPITPFGVPSTMEVPEAITPYLPDHDVMLLENHGALTVGSDVITAYYRMETL
ELVAKTTFHGRMLLSTKGIEEQEIARPTLERLFSMRENYKVTGRHPGYRKYNGDGSMKET
EK (SEQ ID NO: 538)

>orf03320

MESKKIAKQILIATAVLTSFLGSNLVYADVVQSNSNNRASTETARVTGNNLEKLITKDKE
IDKEMTYLSDMDWSSATHGDIDKTKTVQKDAPFTTGNKGEHTKISLLTSDDKVKYFDKGI
GTVADSPSVISYDISGQGFEKFETYIGIDQSANSSRSDHAVVDRIEIEIDGKVVYSSSVT
NPEGFRYNTQAQFISVTIPQNAKKISLKSFAGEHTWGDEVVFADAKLIKTVSTQTITPDL
LNKGINGGVYLSDLEWVDATHGDDDKSKTVQKDKPFTPGNNGSNNKIKLLIDGKEVEFNK
GLGTVASNPSSIKYDVSGANVTRFISYVGIDRSANHLNSDYADIQKFEVVADGKVIYSSD
SKYPKGIKYDTSAFLVDVEIPKDTQTIELKSYSGKHTWADELVLGGALFMANGKFKNPND
WSEVDKRREINNEHPLLMMPLYANGEEFNQGKYTFWGGDTLTGKWENIPDDLKPYTVIQL
HPDDLPKRDGAARDFYEHMLEEAAKYVNPKTGKNEPIPVILTVYTAGNMPYYTSAHWLST
SWIDKMYQKYPNLHGIFSTENYWIWANDIENKAADYLKVSAKNGGYFIWAEQNNGSAIEK
AFGKNGKIAFQKSVDKYWKNLIFMFKNTPAAEGNDSTTESYMKGLWLSNHTYQWGGLMDT
WKWYETGKWKLFASGNIGKSQGDRQWLTEPESMLGEEALGVYLNGGVVYNFEHPAYTYGV
NNKESLLFSEVIKEFFRYVIAHPAPSKEKVLEDTKVFIHGDYSNKGNGKFFVNVNTDREQ
TPLYMTGRYNVIPAIPGVLKTDKLKESVSSSRIQIKEITSPEFSSTQARKEYLNKLYPMN
YEGDIFAQKLDNRWFVYNYKVNENVKQTGKLKFNSLEMNVEFEPHTYGIFERISNGLKVN
LNNFRTNKDSLWSNAQDANQAKKLPQLTKKGAIKWIEEHYIKDTQFGEKRVTKIVLRGID
KLPTIHSLSGTNNSYDQPSLNFDQKNHMVTITINSNGNLEFELHF (SEQ ID NO: 539)

>orf03322

MTIYINKDETVFHLAMKDSSYIFRILENGELQHLHFGKRIHVKENYNQLMAYKKRGFEVS
FSEEFEDIQQSMIQNEYSSYGKGDFRHPAFQVQGMNGSRITTLKYQGFELEKGKNRLNSL
PSTFDDIGQCAETLTIILTDSILDLTVRLNYTIFPEYNVLVRNTEFLNNSNNKLTLLKAM
SLQLDLPDSQYDFIQFSGAWLRERQLYRTSLRPGIQAIDSLRYSSSPQQNPFFMLSRRET
TEHSGEVYGFNFIYSGNFQNMIEVDHFDTARVTVGINPVEFRFLLNPAESFVTPEAIVIY
SDQGMNQMSQQLSDFYRHHLVNPNFSQASRPIILNSWETFYFDLGTEKILDLAKAAKDLG
IELFVLDDGWFGHRKDDKSSLGDWVTDRSRLPEGIGFLADEIHKIGLQFGLWFEPEMISI
DSDLYKNHADWTIHLLDREKSVGRNQYVLDLTRQEVVDYLFDSISKIIIKTNLDYIKWDM
NRHITDIYSIELDSEQQMEFGHRYILGLYQLLDRLITKFPSVLFESCSSGGGRFDLGLMY
YAPQAWTSDDTDPIERLKIQHGTSYGYSPSMMTAHVSISPNEQSGRQTSLDTRTNVAYFS
SFGYELDVTRLSVEEKEQVREQIQFYKKYRSLFQYGDFYRINSPFSCDSASWQVVSKDKC
QSILLYAQLNSKLNPGYTRVYFSGLDKDKCYSVSRFDEFFYGDELMNAGIKVSLSNLALC
VPEYLTKLFVIEEVVCKY (SEQ ID NO: 540)

>orf03323

MKIENKNVRRNFFWGEGRFYTTDIVNKRAGVMIKNVSKEEFTITLENGIKLSSTHFSAIV
REEGDTRIQVSFVCPSIRLRLIFESRDDVLSKQLVLESSTEVIKSVEVESFEFETEDNIF
YPKRQDCIKEMANFSGYYVELGQPVYANSLFLGMEFPMSENKVDGRHYVSRYYLGTVVNQ
EKSLWSCIIGGACSYKKEEIQEAFFEYVEGIAQPSYFRKQYNSWYDHMTDITEEGILKSF
SEIRDGFENHGVHLDAYVVDDGWTNYQSVWEFNHKFPNGLRNIKYLVNGFGSSLGLWIGP
RGGYNGTEIIMSDWLEAHPELNIGSKNLISNDVNVADFNYLNQMKKKMLEYQKEFDISYW
KIDGWLLQPDKPDKSGPHGMYTMTAVYEFLIQLLIDLRKERGGKDCWLNLTSYVNPSPWF
LQWVNSLWIQISQDVGFTENAGNDINRMITYRDSQYQEFLEKREIQLPMWSLYNHEPIYA
VSANTWYMDHQMFASIPDFEAYLLFISTRGNAFWEFHYSFDMFDEERWKANARAVKWIEE
NYQTLKYSKKIGGSPEKFEIYGYKCHNQKTSTEILSLRNPAQIKQKIKIENLSIENFTRV
IGDFTIQEDEIELAPYSIVILKK (SEQ ID NO: 541)

>orf03324

MKHTLETINSRIQWFREARFGMFIHWGLYSIPGKGEWIRSHQKLSIEDYEPYFRAFDPKE
YNPREWAKQAKAAGMKYMVLTAKHHDGFCLFDSKFTDYKATNTPAGRDLVKEFVDAVRAE
GLKVGLYFSLIDWHHPDFPKYADLNHPMRGNEVYRDEKINFDSYLEYLHNQVKEIVTGYG
QIDILWFDYSYEDMVGEKWGASKLIDMVRHYQPNVIVDNRLETSGEGFGSIVTDEITSYA
GDFVSPEQIVPHEGIRNFKGEPVPWELCLTMNNNWAYNPTDYLYKSSQTLIRKLVECVSK
NGNMILNVGPDALGRINDSSKKILDNFHRWMSRNGEAIYGCSGDENLPKPDWGYYTRNGN
TVYAHVFEQPIGPLALLGISKENVKRMSFLHDGSEVKISESWTTNAYKGICFAQFGEVPH
FTYPLPDLIDSVIKIELRE (SEQ ID NO: 542)

>orf03325

MNTHINGISKKGKVLIYGYMLLTILISIFPIAWIFLSSLKADPMKNPGISLPTDFTLEGY
INVFTKLHVFTYFWNSFKVVSISVIISIVMISMSSYVIARMEFRGKKLVTSMLYSTLFIP
ATAMTFPVYRLVNELGIYNTPVALILVYSCSGIAMSFFIIKNYFEIIPKELEEAAEIDGA
TYAQTFWKVMLPIARPGILTAAVLAFINNWNEYYWASMLVIDKNELTVPALLGQFTTSFN
TNYNGLFSAIVVIVLPPIILFAFTSKYFIEALGGGAVKG (SEQ ID NO: 543)

>orf03326
MAQKIMSLQNRKNQKRRFIFLFLLPTLICFFLFYFYSVVTIFLTSFAKWDYTNLNTPEFL
GFDKLFENYRYVFKEYPFFTEALINSVRWAVIGVIIQVPLAVSVAITLSKKLKGWKISRN
LYIVPSIISSAAMGLIFLQIYNPNYGVVNQIIHLFNPSFKDSVLLTPGLNIVAMTGAYIF
FAGASTIMILGQIFAIPEEVQEAAILDNITGWRKEWYITIPMIKGTIKTVSIMAATSGFL
LYNEVFFLTNGAAGTKSISFVIRELAVASSRTQYARANTIGVIQILGGMLIIVCINILFR
ERKRLKGEK (SEQ ID NO: 544)

>orf03327
MNKKSLLKCAVIGLVATFGLAACGTSKDASGGSSSGKEVLEFYHGYHHSEDEWPVAKTMR
DLYDKFAEEHKDSGVEFKPTPVNGDLKDIMNNKVASGEFPDVIDLAGNAVSLAAIEQKLV
LDLKPYIDSNKLEKNVGLNYKQNQKDGKIYTVHEQLFTMGLWYNKDIFAKAGAKTPDQWN
TWDDFTQAMASIRKQDGVYAFGAGEPSIRLFNTVLGTTENGRKLLDKPLTKEGIESKEFA
DALKMVMKEIQANGSKNAGGDANAYSKDFQEGKSAVFFNGVWASGEMSKNPSLAPGIYPA
GVAISSSGGGITISSKMSEAKQKLALEFLKYMTSDDVQKVIFEKVGANPSNENVNVKELS
EKSSEATTKILGQAITQVKNAKAVVPTVSDVWGGDVHTAIINALTESAAENVDVDQKVKS
TQDVLKSLIG (SEQ ID NO: 545)

>orf03337
MNIAIRIILNFFRVMGNHQNSLAMMMGAVVHEFVKFIFTSCIHPRCRLV (SEQ ID NO: 546)

>orf03338
MLLIMSIQTTEPAFSRIATRLDKFIDRTWKTSIKTGNLLRKIGYSQFLTLRICL (SEQ ID NO:
547)

>orf03339
LQNSKTGLDERRLSRSIFPSQGNKFPTINTIIDMFKNRLLIIIEGQILYRNISHYLISPT
KAVKNR (SEQ ID NO: 548)

>orf03344
LTSLIPRLMFQKTSQLVSIKILLEGCWIIAIFTEPLR (SEQ ID NO: 549)

>orf03352
MSNSFVKLLVSQLFANLADIFFRVTIIANIYIISKSVIATSLVPILIGISSFVASLLVPL
VTKRLALNRVLSLSQFGKTILLAILVGMFTVMQSVAPLVTYLFVVAISILDGFAAPVSYA
IVPRYATDLGKANSALSMTGEAAQLIGWGLGGLLFATIGLLPTTFIILVLYIISSFLMLF
LPNAEVEVLESETNLEILLKGWKLVARNPRLRLFVSANLLEIFSNTIWVSSIILVFVTEL
LNKTESYWGYSNTAYSIGIIISGLIAFRLSEKFLAAKWESILFPLVAMAIVTLTILYFPN
AQMFLLFSALVGMLSQLKEVPESVFLQETVEENHLVNVYSVLEVISTLAFSVFVLLMSYI
TDFGYQPFV (SEQ ID NO: 550)

>orf03353
MSKLLDKILSRENMLEAYNQVKSNKGSAGIDGMTIEEMDNYLRQNWRLTKELIKQRKYKP
QPVLRVEIPKPDGGIRQLGIPTVMDRMIQQAIVQVISPICEPHFSDTSYGFRPNRSCEKA
IMKFLEYLNDGYEWIVDIDLEKFFDTVPQDRLMSLVHNIIEDGDTESLIRKYLHSGIIIN
GQRHKTLVGTPQGGNLSPLLSNVMLNELDKELEKRGLRFVRYADDCVITVGSEAAAKRVM
YSASRFIEKRLGLKVNMTKAKITRPGELKYLGFGFWKSSDGWKSRPHQDSVRRFKLKLKK
LTQRKWSIDLTRRIEQLNLSIRGWINYFSLGNMKRIVASIDERLRTRLRVIIWKQWKKKS
RRLWGLLKLGVPKWIADKVSGWGDHYQLVAQKSVLKRAISKPVLEKRGLVSCLDYYLERH
ALKVS (SEQ ID NO: 551)

>orf03357
MFLRCATFKLADSRLNIFTCFFFGEIRFNSRNQVVKAFITDGTVISTIIVRGTVPCNQWT
KTCPAAFDIINGDVGFWKAVVDNAK (SEQ ID NO: 552)

>orf03358
MLQITCVVCISCTKVSLVFTWENKDHTTVTQTCVKVNWL (SEQ ID NO: 553)

>orf03359
LRSLIRQITYFITPRTCCINNQTGLDFKYLVCQEITSYNTCNLATFVKEEAFCLHVVGNE
GTVLVGTFDVFNHETRIVVTEVKIHSTSYQAFLLQVWLAFQDLILAQNLVRSWCVAHTC
(SEQ ID NO: 554)

>orf03360
LHFNQTSLKTASCRLQGYTSSCDSSTDNQEVQGAFLHFFN (SEQ ID NO: 555)

>orf03375
LIHSKMFVKSIRLRKKRVWDKKILILGILYYKFLKSID (SEQ ID NO: 556)

>orf03379
MFASKSERKVHYSIRKFSIGVASVAVASLVMGSVVHATENEGSTQAATFSNMANKSQTEQ
GEINIERDKAKTAVSEYKEKKVSEIYTKLERDRHKDTVDLVNKLQEIKNEYLNKIVESTS
KIEIQGLITTSRSKLDEAVSKYKKAPSSSSSSGSSTKPETPQPETSKPEVKPEPETPKPE
VKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPEP
ETPKPEVKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPEPETPKP
EVKPEPETPKPEVKPEPETPKPEVKPEPETPKPEVKPDNSKPQADDKKPSTPNNLSKDKQ
SSNQASTNENKKQGPATNKPKKSLPSTGSISNLALEIAGLLTLAGATILAKKRMK (SEQ ID NO:
557)

>orf03384
MDREILKFFQDLLSILSHNDMITLFCQKCCNSFSNHFLVICN (SEQ ID NO: 558)

>orf03386
MFITLRRICLRACVVEKEQSYLKFLFFQKRPVSFLHVKSVLAGI (SEQ ID NO: 559)

>orf03387
MVKTTDRLEAIGFSFILFENLFKPCQLYLQPQNSVLSNLQLAA (SEQ ID NO: 560)

>orf03393
MTRKLNPSYTNVASATTLTFNQVASTFRKACLDHVVNLTRNNLKGICQLTPLQLHDTRLI
(SEQ ID NO: 561)

>orf03421
VKAPIPKAPLAHSFGSASIIAHTIHQKFNLKVPNYRQEEDWTKMGLPITRKEISNWHIKT
SQYYLEPLYNLLRERLLTQPLLHADETSYRVLESDSQLTYYWTFLSGKAEKQGITLYHHV
LIDLFISYFNPL (SEQ ID NO: 562)

>orf03430
LVSVFYSLLQVDNVDSVTFSKDVLSHLRIPATSLVTKVYTSLKKLFH (SEQ ID NO: 563)

>orf03440
LIVWILKNHTDLTTYIPNIFLSQTLAINYNLSGFCFQ (SEQ ID NO: 564)

>orf03441
MPYNRKPFSTFHVKRNILHIVVVLIFFIAKRKIFYINY (SEQ ID NO: 565)

>orf03445
MFKKMSNSSRILFYISVNFCDKRIYRTKLYSDTPVNLFKFLFRQKSNCQSVGQTSSINHF
FYSWIVFFFKNNLCHSIPSIK (SEQ ID NO: 566)

>orf03458
LADGSGKLAEGGTKLTSGLEDLQTGLASLGQGLGNASDQLKSVSTESKNAEILSNPLNLS
KTDNDQVPVNGIAIAPYMISVALFFAAISTNMIFAKLPSGRHPESRWAWLKS (SEQ ID NO:
567)

>orf03464
MKNTVKLEQFVALKEKDLQKIKGGEMRLSKFFRDFILQRKK (SEQ ID NO: 568)

>orf03483
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 569)

>orf03487
LWVNIDHIRHISCENACLQYFTSIWYIDDFDLDLRVFLLKITSDFFQGFGHFFFLVEILD
GHCVIRRFTIVGASAEPKQS (SEQ ID NO: 570)

>orf03496
MKIKEQTRKLAAGCSKHCFEVVDETDEVSNHTYGKATLTWFEEIFE (SEQ ID NO: 571)

>orf03504
LIDVLFINSFIGRICFYCYRRIHATCLFLQLFSIVILNVAHTLKHSIFIVITFISRCRNF
IIVRILLENQFSRNQGIDNRVGQSRY (SEQ ID NO: 572)

>orf03505
MINVNQVSIEVKNTFKNWNFTSSIELTTFSKFSQSPTMT (SEQ ID NO: 573)

>orf03516
MGFSMKLIHDLDMHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 574)

>orf03521
MYQDLLRKIAEEKPNYNQEEIQWLLDHLGDPSPEIRDDLVFTSFARGIQEELFTQEQFHF
IAEGVSSDGGLDKEIDKIGLPTLERSFRALIYATLLSDDANQQSVFYQELNAGFRNDLSN
QGLHYLSKEKDTTGFSSQYGWVHSFAHGADLLTEVVCHPEFPKNRVHEVFDILGQLFKRI
SIRFTDDEDWRLARVIYEPILQGKLEQEQVASWIKTVDFPIEAREDFYKFSNFRSCLGKS
XXIHSLIN (SEQ ID NO: 575)

>orf03524
MGFKVSHFKIPSSHLSINVLRTIENFTEIGQGLLHISP (SEQ ID NO: 576)

>orf03525
VGFFDFGLTNSCRQVRQFTQTVQDFLVCYHQGIVKEGQGYAGICFKFHPSLGNIGKFVIA
IVRRLRHKSIVANMAHLNVDLFQFRKGLLEILKSVKIALVITAKLVDVFTSFLDCTQEIL
TVLV (SEQ ID NO: 577)

>orf03537
LKKAQWGFSNQGPDGLFLVRPTSNRDEIPPRDLAHPQNQLFLSFSQVEKLAWHAPSPLSE
FALNISLPLSSPPYLWPFIQSPVLYCASHFSIHFNSFSSHLRLVITISPHLLSSTSLLLH
TLCAQHTIHSTDLHHLRTPPPSGLFPLALYTRLAAPTLTYHTLSNIQSLKQQLVXXFIH
(SEQ ID NO: 578)

>orf03548
MANDNKSHYLIYRVLGISFEEGENIDLYQNKGRFLYKYAGSFLEEAAVLSFNEKFGTENT
(SEQ ID NO: 579)

>orf03553
MVNAMHFSFSILIEGNSRKVGICLLNRTHTRFKLSQAIYL (SEQ ID NO: 580)

>orf03562
MSQQLSDFYRHHLVNPNFSQASRPIILNSWETFYFDLGTEKILDLAKAAKDLGIELFVLD
DGWFGHRKDDKSSLGDWVTDRSRLPEGIGFLADEIHKIGLQFGLWFEPEMISIDSDLYKN
HADWTIHLLDREKSVGRNQYVLDLTRQEVVDYLFDSISKIIIKTNLDYIKWDMNRHITDI
YSIELDSEQQMEFGHRYILGLYQLLDRLITKFPSY (SEQ ID NO: 581)

>orf03572
VKEEKKAIVLGADNAYMDKVETTLKSLCVHHYNLKFYVFNDDLPREWFQLMEKRLETLNS
EIVNV (SEQ ID NO: 582)

>orf03574
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHRFEVVDRTDEVSSKHRFEVADRTDEVSS
KHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSN
IYTARRR (SEQ ID NO: 583)

>orf03576

MEXXXFKAGAKFFWAKLGLESLEAKEILRDGGWDDIVKNRCIKREQPRLIEEA (SEQ ID NO: 584)

>orf03588
MILLQNKSFCYSISQKETSLCHANVVTLNLHEALLNQISDNFSIKSSKRLSKFFLKSRHG
NPGFLAESQEHFFFHLLLLTQVIFCNTSIAFLNRTEIMTNGTMIFIAYSIDITRCPCTNT
IVFSIVPVHEIMTTFKAGFGEIRNLIMLKTRSLQLCNDVLKHLRF (SEQ ID NO: 585)

>orf03612
MDREILKFFQDLLSILSHNDMITLFCQKCCNSFSNHFLVICN (SEQ ID NO: 586)

>orf03614
MEDHLLINAVDEFRSISFFQFFKHAFFHIFLVKTNILSPKTNSLIITKGSRTTCFFFACQ
IRSSWYLKNQTNIQ (SEQ ID NO: 587)

>orf03620
LFIRKKHTWINLTPKQTIFSQMNAQFFINFTRRALKRTFITFTSPTWQFPHIGPGNACLI
IT (SEQ ID NO: 588)

>orf03637
LNIAYTDNPAHIFGKIFHDNLLALLIIFDDVTCKACLRQDKVNSGLFLDSLFNSGCKGVG
FSLVRLVISI (SEQ ID NO: 589)

>orf03641
MCELDILHDSLYQFCPELHLKRLNSLTLACHALLDCKTLTLTELGRNLPTKARTKHNIKR
IDRLLGNRHLHKERLAVYRWHASFICSGNTMPIVLVDWSDIREQKRLMVLRASVALHGRS
VTLYEKAFPLSEQCSKKAHDQFLADLASILPSNTTPLIVSDAGFKVPWYKSVEKLGWYWL
SRVRGKVQYADLGAENWKPISNLHDMSSSHSKTLGYKRLTKSNPISCQILLYKSRSKGRK
NQRSTRTHCHHPSPKIYSASAKEPWVLATNLPVEIRTPKQLVNIYSKRMQIEETFRDLKS
PAYGLGLRHSRTSSSERFDIMLLIALMLQLTCWLAGVHAQKQGWDKHFQANTVRNRNVLS
TVRLGMEVLRHSGYTITREDLLVAATLLAQNLFTHGYALGKL (SEQ ID NO: 590)

>orf03644
MXXTKSSCLITTGRNDSPSTCLPRVASNNDRFSSEFRIIPDFHCSKKGIHVNMDDFS (SEQ ID NO: 591)

>orf03650
MHFHIIKLVNHFQLLIKLNRISHPNLHIKSSFLSLVLLFYQKEQDFAIMVI (SEQ ID NO: 592)

>orf03660
MDRGESLSDCVCMAGYEPANSSRLSIEGTYENKLYKLISSKYHTTGNDIMVCVPCGYTKY
KETPGPHACTSCPGRTHAASTTNTNQDQCNRCPPGYYETNDPSYPCDVCSPNHICVGSDP
MDPALMLYSGKRIKCDKNSVTLVPFEENVHLASCLCDKGYMARTRTGIVKCEAVPKNTYK
DVVGNVGPTNCPPGSYTLKIGATDVSECVCKRGMFFDKDNKRCTVCPVGMYCLGGRLPNG
EHMLPMMCTDGNAVTKDGGATSPGECLCKPGFYLRQDGPGGCVECPENTYKSFISNENCS
PCPRIL (SEQ ID NO: 593)

>orf03667
MXXAFCLPVFAHPETLVKVKDAEDQLGARVGYIELDLNSGKILESLRPEERFPMMSTFKV
LLCGAVLSRIDAGQEQLGRRIHYSQNDLVEYSPVTEKHLTDGMTVRELCSAAITMSDNTA
ANLLLATIGGPKELTAFLHNMGDHVTRLDRWEPELNEAIPNDERDTTMPVAMATTLRKLL
TGELLTLASRQQLIDWMEADKVAGPLLRSALPAGWFIADKSGAGERGSRGIIAALGPDGK
PSRIVVIYTTGSQATMDERNRQIAEIGASLIKHW (SEQ ID NO: 594)

>orf03668
MARFIRSQTLTLLEKLNELDADEQADICESLHDHADELYRSCLARFGDDGENL (SEQ ID NO: 595)

>orf03669
MTVRELCSAAITMSDNTAANLLLTTIGGPKELTAFLHNMGDHVTRLDRWEPELNEAIPND
ERDTTMPVAMATTLRKLLTGELLTLASRQQLIDWMEADKVAGSLLRSALPAGWFIADKSG
AGERGSRGIIAALGPDGKPSRIVVIYTTGSQATMDERNRQIAEIGASLIKHW (SEQ ID NO: 596)

>orf03673
MKIHKTVNPVAYENTYYLEGDKHLIVVDPGSHWEAIRQTIEKINKPICAILLTPAHYDHI
MSLDLVRETFGNPPVYIAESETQLAPKPLPNNPLGPPXHSFIN (SEQ ID NO: 597)

[0401] In some embodiments, preferred OXC141 antigens are selected from the polypeptides orf00045 (SEQ ID NO: 53), orf00068 (SEQ ID NO: 65), orf00074 (SEQ ID NO: 70), orf00223 (SEQ ID NO: 99), orf00229 (SEQ ID NO: 104), orf00360 (SEQ ID NO: 117), orf00506 (SEQ ID NO: 135), orf00781 (SEQ ID NO: 177), orf00785 (SEQ ID NO: 178), orf01068 (SEQ ID NO: 198), orf01446 (SEQ ID NO: 235), orf01447 (SEQ ID NO: 236), orf01449 (SEQ ID NO: 237), orf01455 (SEQ ID NO: 242), orf01460 (SEQ ID NO: 247), orf01461 (SEQ ID NO: 248), orf01463 (SEQ ID NO: 250), orf01464 (SEQ ID NO: 251), orf01466 (SEQ ID NO: 252), orf01467 (SEQ ID NO: 253), orf02661 (SEQ ID NO: 433), orf02690 (SEQ ID NO: 439), orf02698 (SEQ ID NO: 444), orf03318 (SEQ ID NO: 538), orf03320 (SEQ ID NO: 539), orf03322 (SEQ ID NO: 540), orf03323 (SEQ ID NO: 541), orf03324 (SEQ ID NO: 542), orf03325 (SEQ ID NO: 543), orf03326 (SEQ ID NO: 544), orf03327 (SEQ ID NO: 545), orf03562 (SEQ ID NO: 581), orf03660 (SEQ ID NO: 593), and immunogenic fragments thereof.

6. Sequences Identified from INV200

>orf00004
LKGVDDFLFIFEEGFKQGGKARADRDYSGVSSLRNSSKVYLEFLY (SEQ ID NO: 598)

>orf00005
LCSALKNSYDIELIKVLSNKAHLYLPIETVTPQTVSTS (SEQ ID NO: 599)

>orf00006
MRVAETSIVKKNHQIPCIINQKIAQKLIKKTSMTDIDHQLSISTSTVIRKINDFHFEHDF
SRLPEIMS (SEQ ID NO: 600)

>orf00010
MFKSNLSLSQSLPHKDFFFFKRIIHLFSLFLLIDFIIIS (SEQ ID NO: 601)

>orf00015
VEEVEVAEVKNARVSLTGEKTKPMKLAEVTSINVNRTKTEMEEFNRVLGGGVVPGSLVLI
GGDPGIGKSTLLLQVSTQLSQVGTVLYISGEESAQQIKLRAERLGDIDSEFYLYAETNMQ
SVRAEVERIQPDFLIIDSIQTIMSPEISGVQGSVSQVREVTAELMQLAKTNNIAIFIVGH
VTKEGTLAGPRMLEHMVDTVLYFEGERHHTFRILRAVKNRFGSTNEIGIFEMQSGGLVEV
LNPSQVFLEERLDGATGSSIVVTMEGTRPILAEVQALVTPTMFGNAKRTTTGLDFNRASL
IMAVLEKRAGLLLQNQDAYLKSAGGVKLDEPAIDLAVAVAIASSYKDKPTNPQECFVGEL
GLTGEIRRVNRIEQRINEAAKLGFTKIYVPKNSLTGITLPKEIQVIGVTTIQEVLKKVFA
(SEQ ID NO: 602)

>orf00018
MGVSIFLALFYMIPALYFLFRIGKKWELPKKVLILSLLGGMFLSGWLSSFANTYIHDFMN
CTPKVRQKKSNFWGVLL (SEQ ID NO: 603)

>orf00019
MKLSYEDKVQIYELRKQGQSFKQLSKRFGVDVSGLKYMVKLIDRYGIEIVKKGKNRHYSS
KLKQEMMDKALLEGCSQRSISLDYALPNQGMLSFWPAQYKKNGYTIVEKTRGRPAKMGRK
RKKTWEEMTELERLQEENERLRTEVAYLKKLKELEERDEALERERQRQLEKWFQEDFD
(SEQ ID NO: 604)

>orf00020

MVSGGFRLDFLLETARLARSTYYYQLKQLDGVDKDKEIKTEIQGIDNEHKGNYGYRRIHL
ELRNRGFVVNHKKVQRLMRILGLTARIRRKRKYSSYQGEIGKKAENLIQRQFEASRPMEK
CYTDVTEFAIPNSTQKLYLSPVLDGFNSEIIAYHLSTSPNLEQVKSMLEQAFTEKYYENT
ILHSDQGWQYQHDSYHRFLESKGIQASMSRKGNSPDNSMMESFFGILKSEMFYGYEKNFR
SLENLEQAIVDYIDYYNNKRIKVKLKGLSSVQYRTKSFG (SEQ ID NO: 605)

>orf00024
VNIATLQNGHILGWQIQHIANKLTSNFWIAKDFLSYQVIGWANARMTYSHISSLFIISQF
(SEQ ID NO: 606)

>orf00026
VSITFSLTNFFKILINLTAQVSPQVIDEKILMMDLNLNNYLSTVIQLRQDVYTGIKILHR
VRHGE (SEQ ID NO: 607)

>orf00027
MSRYSYSLDSRKIVFEISCFKEKKASLTLFFHLFESSIMKLATQPSYSSFYSELK
(SEQ ID NO: 608)

>orf00033
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSS
KHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSN
IYLRQGDVDVVEEIFEEY (SEQ ID NO: 609)

>orf00034
MKPGAEGWKDERSQDIEEKDNGDGLGYFLFLSMDNRRCRCNGRTPTDRRTYSNQGSQFCI
QGKEALEEVGNNQGY (SEQ ID NO: 610)

>orf00035
LPNCEDLRDIETKTKQDNGILEQFLGTKGQSNIQLFIRREKGM (SEQ ID NO: 611)

>orf00044
LSLLDLRGSLCLRIYLHEPLITTVSQDFTSLSDISHF (SEQ ID NO: 612)

>orf00047
MDFKSFIIGLVVGIFGPYMDDLIRKKFLKSSEKKTEKSVKK (SEQ ID NO: 613)

>orf00093
MTYEYKSHIYLAETVLNVKDLASQTTFYQQVIGLEILSQTETESILGLGGKVLVQLIQAQ
ESGEVREHXXXFHSLIN (SEQ ID NO: 614)

>orf00103
MVSNLVFIGNCNFHNTVIFHLLNRLNQGPLQILSQNHDKGRRLSWIFKSRLGQLNASKNW
MGRKEQAMALAIAADLQDQLLFKKAD (SEQ ID NO: 615)

>orf00113
MKFNPNQRYTRWSIRRLSVGVASVVVASGFFVLVGQPSSVRADGLNPTPGQVLPEETSGT
KEGDLSEKPGDTVLTQAKPEGVTGNTNSLPTPTERTEVSEETSPSSLDTLFEKDEEAQKN
PELTDVLKETVDTADVDGTQASPAETTPEQVKGGVKENTKDSIDVPAAYLEKAEGKGPFT
AGVNQVIPYELFAGDGMLTRLLLKASDNAPWSDNGTAKNPALPPLEGLTKGKYFYEVDLN
GNTVGKQGQALIDQLRANGTQTYKATVKVYGNKDGKADLTNLVATKNVDININGLVAKET
VEKAVKDNVKDSIDVPAAYLEKAKGEGPFTAGVNHVIPYELFAGDGMLTRLLLKASDKAP
WSDNGEAKNPALSPLGENVKTKGQYFYQVALDGNVAGKEKQALIDQFRANGTQTYSATVN
VYGNKDGKPDLDNIVATKKVTININGLISKETVQKAVADNVKDSIDVPAAYLEKAKGEGP
FTAGVNHVIPYELFAGDGMLTRLLLKASDKAPWSDNGDAKNPALSPLGENVKTKGQYFYQ
LALDGNVAGKEKQALIDQFRANGTQTYSATVNVYGNKDGKPDLDNIVATKKVTININGLI
SKETVQKAVADNVKDSIDVPAAYLEKAKGEGPFTAGVNHVIPYELFAGDGMLTRLLLKAS
DKAPWSDNGDAKNPALSPLGENVKTKGQYFYQLALDGNVAGKEKQALIDQFRANGTQTYS
ATVNVYGNKDGKPDLDNIVATKKVTININGLISKETVQKAVADNVKDSIDVPAAYLEKAK
GEGPFTAGVNHVIPYELFAGDGMLTRLLLKASDKAPWSDNGEAKNPALSPLGENVKTKGQ
YFYQVALDGNVAGKEKQALIDQFRANGTQTYSATVNVYGNKDGKPDLDNIVATKKVTIKI
NVKETSDTANGSLSPSNSGSGVTPMNHNHATGTTDSMPADTMTSSTNTMAGENMAASANK
MSDTMMSEDKAMLPNTGETQTSMASIGFLGLALAGLLGGLGLKNKKEEN
(SEQ ID NO: 616)

>orf00118
MSLQIKLKKLAKELSKLLKDSNLETVDKDVLENSQKELQKAVLFLADEKGSEHTEAEVID
NLKEVIAKLKANA (SEQ ID NO: 617)

>orf00129
VGRFFGSSQTSDEFFFSFDSSIVKELSEIVHGFDTVSFR (SEQ ID NO: 618)

>orf00140
MKIKEQTRKLAAGCSKHCFEVADRTDEVSSKHCFKVVDGTDEVSSKHCFEVVDRTDEVSS
KHCFEVVDRTDEVSNHIRQGDVDVV (SEQ ID NO: 619)

>orf00146
MNDDDSRCIHIERDGKTIEFGYLNISSTDRNTSHADGLVGIFNSNFSGVRVRGIAVFLNG
PDNLDTTLVGNFQTIWNFRIICIHS (SEQ ID NO: 620)

>orf00147
LEFNFCRSIIKNGRDNLPNTNSTSGMATRWANHNWSDDIKDRLKTK (SEQ ID NO: 621)

>orf00152
MSCNCAFYRSQFFDVNSVSNYHSHQKELRFPNSILFTYFVKVA (SEQ ID NO: 622)

>orf00156
MSKEKVILAYSGGLDTSVAITWLKKDYDVVAVCMDVGEGKDLDFIHDKALKVGAVESYVI
DVKDEFATDYVLVALQSHAYYEQKYPLVSALSRPLISKKLVEIAHQIGATTIAHGCTGKG
NDQVEYQIAVAKKANEAKK (SEQ ID NO: 623)

>orf00157
MRYDFGKVYKEIRESKGLTQEEVCGGVLSRTSLSKIESGKTTPKYENMEFLLRQINMSFE
EFEYICQLYQPSQRTEIMQTYLNMRSIIGTSDLVNLFQKCQDYLKTHHDLPIEEIRDMLE
VVIYIRQHGAGELSDHAEQVVKKLWRKIEKQDTWYESDLKILNTILFSFPIEYLHLITGK
ILQRLEVYKNYQHLYDLRIAILLNLSTLYLYNQDKNMCKQICYTLLEDAKNKKSYDRLAI
CYVRIGICTDDSKLIQKGFSLLELTEETSMLSHLKKEVEIYYQAKER
(SEQ ID NO: 624)

>orf00158
MKIREIIGTDMYGTTVSGIVSGLNKLNFTVKAVRVALEDLTPKLTFPAILQVKNDLGQNH
FVVLHSIKEKINGTRITK (SEQ ID NO: 625)

>orf00159
MELVLPNNYVVIDEEEMMYLDGGAIYIPRWAITGAITGAAYAALAAAGGGGLQLVLASYG
LRSALVAGIVKGLGVLGIHIGNAFANTVIRSIASAGIGAGADWIFTNIIDGWDGRRDNQL
RIG (SEQ ID NO: 626)

>orf00161
MATITNALNIAATVAEVFSLGGAIAYGLDIVDGKFDGYLWA (SEQ ID NO: 627)

>orf00162
MKDDQKYLLAGLYSLLVAIFYFPLIESKGIFVSILMAVLLLYLIYFIATVIHIVIIKFIR
KKSFKYLVLYPFTYDGSWRFQPINLLYFPEMVRDVIPINLVQEYCQGQPYGLLKKMLKRI
RLSREIALLLATIIVYFFTHRILPLSVFTFMFSYILLFVQSYLGSNTAWIGNRRLIIDDE
FEKILLSKSYIKEISSARYSEYLTCEYKNPTPIILIAIFENLLDSYLLQNQSEVDLDIFY
KVLPLLYKEKYTMGFNYFVSLNYLLYKVGFLGIIYDNEALRDLSKQYLNKNISELQDGSF
EGGIQDAVASKQIVVINEFIACLNSKCMPSQYDRFFYKDRPYIFSRKSSIKG
(SEQ ID NO: 628)

>orf00163
MKNKRYFFDTILIILLLISTIFCVSPVFIKLDILGTPSHAILTFVLAIPLFYILSQCLHT
LLLLVSSIFCKLRPIYFYFIFVIIIGARKYYRILFHQLMGFSPGIAVFYKESQTTKNLFK
FYYFLYFTTLISYYFFFTFVYDKSLLLPLIPFSIIIALVQKLYRIENQQLFLLKSKVLTI
LESKRDCEFNLQDYHEIWKLQSKSELPCVALSYISLIKPYLSESVREQIDLLEVKRFKKI
NHPISLYGMLDVIKLNLYLRHYNEKNKYESMLNKILEVRPDFVLIEQNIDDSLNSSQPLS
LSLAISEIQLLLEVYIGIKHVSIRR (SEQ ID NO: 629)

>orf00164
MIRKPIIFLLMLPIWGLWIELHLLVSNLQLNLEIPFDFVVSTSLTFFVLILSKIVLDILY
ALKDLYKKEALITIFPFIFIGRKKVNVRFSPYFSFHRKSLSPDDLRSRIIWSFILEIAII
LVFILKIPFAIIMLTTIFFWTIMDINHLVFNKTEFLFNQNKWQKEDSFESDLTKTLKDKI
QKSELSYSDLMSLQLYDAMNQSTFLTDSELFEDILKKIEDSHNTLLCTGLVELLLYEISI
SNNNNWQEKVDKIRIQLIRINQLDFFYYTSWLRQNFDFCMNREYHKMKSRKLLLSNKKIV
(SEQ ID NO: 630)

>orf00165
MELVLPNNYVVIDEEEMMYFDGGAYLSKRACQGICAALAMSSGTFIALAGAAVLTKKLIN
YIKVGGLGGWLIGAAAGKIAYYIGYGVLNRGCDINGNPYPWDGFISATVR
(SEQ ID NO: 631)

>orf00166
MSNVDKIRKIHIIVCWVYIFLSFRAIINDTEYFLLIFLAFIYSIVSLPLYSVKNKIVSIC
LAINSILLMSFPILINKFFPESFLTYTVLISVFITELIIFHLIGKDFDIKLTNEYKKISQ
FRSKVSQSPWIKYLEISSFILTIFPSILYGTVDNHVLTLIFLIKICVDTTIKFLFIRLFD
TSTLMKRRIFFLFALDVIAYLFLGYLLVIQKAGYLFSVLLLFSNFSVPFIKEKEYELFKN
SK (SEQ ID NO: 632)

>orf00167
LFNEIKKTSSLIGNVFIGMKEDDAMFKKRIEKGKSSVFIFLE (SEQ ID NO: 633)

>orf00168
MNKKKMILTSLASVAILGAGFVTSQPTFVRAEEAPVASQSKAEKDYDTAKRDAENAKKAL
EEAKRAQKKYEDDQKKTEEKAKEEKQASEAEQKANLQYQLKLREYIQKTGDRSKIQKEME
EAEKKHKNAKAEFDKVRGKVIPSAEELKETRRKAEEAKAKEAELTKKVEEAEKKVTEAKQ
KLDAERAKEVALQAKIAELENQVHRLETELKEIDESDSEDYVKEGLRVPLQSELDVKQAK
LSKLEELSDKIDELDAEIAKLEKDVEDFKNSDGEYSALYLEAAEKDLVAKKAELEKTEAD
LKKAVNEPEKPAEEPENPAPAPKPAPAPQPEKPAPAPAPKPEKSADQQAEEDYARRSEEE
YNRLTQQQPPKAEKPAPAPVPKPEQPAPAPKTGWKQENGMWYFYNTDGSMATGWLQNNGS
WYYLNSNGAMATGWLQYNGSWYYLNANGAMATGWAKVNGSWYYLNANGAMATGWLQYNGS
WYYLNASGAMATGWAKVNGSWYYLNANGSMATGWLQYNGSWYYLNANGAMATGWAKVNGS
WYYLNANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSDKWYYVNGLGALAVNTTVDGY
EVNANGEWV (SEQ ID NO: 634)

>orf00190
LKKRMNRWQFLLNQSKEMVGILLLKMKEQELIEFVVNL (SEQ ID NO: 635)

>orf00191
LIKVIKRKAFGFRNFNNFKKRILMTLNIKKESTNFVLSRL (SEQ ID NO: 636)

>orf00195
MTYNEKRLTNSLERVHMEQLKNTTDLLGLEDKNIKILSVLKYQTHLVVQAKLDSPAPPCP
HCQGKMIKYDFQKASKIPLLDCQGLPTVLHLKKRRFQCKNCLKVVVSQTSIVKKNCQISN
MVRQKIAQLLLEKQSMTEIAHRLAVSTSTVIRKLREFKFETDWTKLPKVMSWDEYSFKKS
KMSFIAQDFESKSILAILDGRTHAVIRNHFQRYQREVRELVEVITMDMYSPYYRLAKQLF
PKAKIVLDRFHIV (SEQ ID NO: 637)

>orf00196
MGYSLKKSRTYCEQDPEKVNRFLKELNHLSYLTPIYIYETGVETYFYLEYDRALSRQLVS
LEEDIII (SEQ ID NO: 638)

>orf00201
MRFYCEAYEVITEEKKVYFNDIELEVKYSSVEELFIICEKLLDKKKVSFFYVDEKPLRYL
LFDYIFLLVLAKKNIPILDGVSNKQVDPTLLHHFSLEIEKNFIDFCYKNMDLILKTQSIS
LCHREELIIVDVSDDSKFGVFYKRFRTLVDKNNGKYVCVYNFSRVSDILQNWKNYCNRKF
SVTFTESQFELFKLLYNQKNFKTISLLFGKKIVAGGIIYYSDLTNIEYFCIFWWDSMFGK
DSIGKYVYVEEISRCHFLDRNYSFCYGLQDYKSKLIKYFLE
(SEQ ID NO: 639)

>orf00202

METRNLISYSLTDIFETDKIRIELLGEIYYKNIKLELHEFAGLYKIYGISLIKNITGMFL
IIIFDTKTKELKIFQDITTSYFNLYYTVYGGVFYYSTSLKKVMKLSHVPVTLNNKKIQEF
MRNGFILDSNTLVTEINKLEYFSYISVNNTLRICGIDYNDSNNFTKEQVLKNWDSMLRES
ILRVYSEAGEANITLSSGFDSNYILYTLANYTNSSINAFCIGGEKGINEIPEVTKIAKFY
GINLLVDTVMSQDLEYFPDIVWRLEGSLFECGVILQYYLGRLLFQKGNTSILCGESADEI
MTFKYHSVNYNQFCNDKQKSVYFSYSDYPFYVTNSIVLKKNSLLLHSFGIHPRYPYKMSE
IVEMSKKISDLNDKKEFHKKNCELRFQDSVLDNINSVPGTTHLFSCLNIQTLVKIILYIF
RYNSCMKIFNFRDKELIFFNKIVNGLIQNIEENLEDDIERILKYLYICLFNEIFIIKNKV
NFFDDVEFNQTLSEFLDKL (SEQ ID NO: 640)

>orf00204

MKFFCENNLNITFFDTFSEIKNNIDYYIIALPTDYDEKIGSFNTYEIEQTVSKILRVKPN
GKIILKSTVPIGFSNKLKRLFDTKNIIFVPEFLREGCSIYDNLYPSRIVVGDETVEGRKI
AELFLSISTHSTANIKNVMLVSPTEAEAIKLFSNTFLALRVAFFNELDSFAERRSLNAEV
VIKGVCLDPRIGNFYNNPSFGFGGYCLPKDTKQLKKEFIEINAPVIEAIDISNTNRKQFI
VKQILERKPKIVGIYKLGMKYNSDNYKESAILSIINELLIVGIKILVYEPNLNVSIDNVI
FEKNFELFTKQSDLIVANRWDRGLEAYKDKVYTRGIWIRD
(SEQ ID NO: 641)

>orf00206

LEEESFIMENTEFSLELDVTEVATEQDYVSSGVTSTGCCKN (SEQ ID NO: 642)

>orf00207

MFKIKDNYIYRQCVNDSILIEKLNENNLEIFFDSKIFQEMLMVANPRFFNELTKEKIYQN
STFRNYAKRSLTRATPFGLFSSVGVGSFSKVSYPQQIRENYSKKVSVSGEWISSLCMMLE
NEDSVLLQLHLQWNQKVLELSDKYQLNNINYWGVSEQSRDILIKKTALLEFIKKLTYKSE
VSVLDLVQEIQTKSPNLETQKIIDYLRNLIISEFLFTNLRKVVINHNCLDNLIYILSSIN
EQTKLTTDLLQLKSCIEKYSKSELGEGILQYAEICEKMSHIFNEEKQRYLKVDLVNSYDS
LLPKDLKKTLEDFVNFISRINLGKDYRNKELISYTEKFVEKYGEYVEVPIKQLLDSKLGL
GIPKQNLEPYSILSSVAEQTFLSYLSKEIFKAVKNNKKEIDISNIPPELLYPNLDRFAVN
QFELYCEMKNFGEQPVISIVPNTGSDMIGKSIGRFASYFLNSNIELDSRVDNVELIEFPS
DNKNLNVMSSHHGHSKKLLLSYEDDFDIDSLELDFLVVGVERVNEHYKLYFRDLRTDLIV
NFVTTSMLNHKSIGVFSHLARFLLTVSLEWQDNPFSLFRVIENLDFLPYIPRIKYKNIIL
SEEKWILSDVDKKDMSTISQWKKFFDVPSLLYFHKDDERLLIDLKNSLDVQWILKQNVDK
LHFTRFDKIDGKNCEFIFGFENPRNSVYPHSVSEKTVRRIENDFYKDYVKTFSSDWIYFK
LYGINSSTMPELRENLLIFTDELLAEKLVSDFHFVNYNDGGDGSIRLRFKIMNEDDFEKL
RYRIIHWIDFLLNHYFCKDVSFNLYEREVERYGGIGFLTVCERIFSIDSYLVLKLFSKKV
LKVDDYLSVLHSIFIYIRLLGISPKQLLKLMKDTFTQNIYRKSFKKVFPNNAKVIKEFKQ
YFEDQSKFDIFNEVFKSFSPIEKHFEYKNDMIHSLLHMHMNRIGIFSLNEKEYLYFVRYI
LEVLNNYEKYN (SEQ ID NO: 643)

>orf00208

MRNIIKKYDEIINKVDSLVLDNNIIDLLQRSCYTENRSYLSEYPSIIIYLSYRLANCDDN
EHSKLLYNRVNYYLHELLKSIKLNSRNNISMCYGFSGYVYALKLLPKRSKEYSKLLETLE
TILVSLTRDRLSEIKKSNKVKEEYIDVIQGVSSVGKYFLSKDKLTSNQELLLKGVLNYLA
GVINNKPTIYPEYMPNEKLKRKFPNGYINLGVAHGILGPLYVLALGFKKFNMPEYLISLK
KGLSYYEKTFQTNKIGKIIGWNGRVSAEVESEKFEYNLSWCYGSLGMARVLYNISKIIDI
PKLQELATDVFHSSIYYLNSSEILNNAICHGRSGIMLLFNLMYLDTGESQFKAISDNLFK
EIVNKATDSEYIFVERDIYFRGVNYDEVIEYIDFCLLNGVSGIVLALMAQRTGNASPLAE
MFFMQ (SEQ ID NO: 644)

>orf00209

MKKILNNKLYMKVLVSDLISNFGDTLYFIALMTYVTEIKSSNLAISIVNISETIPILFTI
FFGIIADRTLNKVGMIIKTLWIRTILYLLVAVVMNFKESILVVILASIVNLISDTLGQFE
NGLFYPISNRIVKKSDREETMAFRQTATSTMNIVNQSLGAFLITFLSFFHLALINSLTFA
ISLLITLAIKSQINNFYIDKTPSTKVSKVDFKATFSDIISNLKLSLKHLFSLTNMKTVLL
VIPILNGSLAIIIPLAVVNLSKSSALTIISSATTISVLGISTVSGGILGGTLILISKKFK
NLSIENLLKMNLMTILLSFIAFYYQNIYFIVLTLFLSSVFVSALNPKIGAIIFNNLDETK
LATIFGGMVTYFQLGDVVSRLLFSTLVIYLSYTYIAVIYMILVLIVAIYTFRRVQTTS
(SEQ ID NO: 645)

>orf00213

MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHCFEVVDRTDEVSNHTYGKVKLTWFEESF

EEYK (SEQ ID NO: 646)

>orf00217
LKSSILSKMGDFSVRYCNLVGTVLFGVVLIAILRLVF (SEQ ID NO: 647)

>orf00246
MGLDVGSKTVGVAISDPLGFTAQGLEIIQINEEQGQFGFDRVKELVDTYKVERFVVGLPK
NMNNTSGPRVEASQAYGAKLEEFFGLPVDYQDERLTTVAAERMLIEQADISRNKRKXXIP
FIN (SEQ ID NO: 648)

>orf00270
LNTSYSFGKKDQFALEHCFCIKLSIFARAVTLFVSCIN (SEQ ID NO: 649)

>orf00291
MLIGEGYRTFPVLIYTQFISEVGGNSAFAIMAIIIALAIFLIQKHIANRYSFSMNLLHPI
EPKKTTKGKMAAIYATVYGIIFISVLPQIYLIYTSFLKTSGMVFVKGYSPNSYKVAFNRM
GSAIFNTIRIPLIALVLVVLFATFISYLAVRKRNLFTNLIDSLSMVPYIVPGTVLGIAFI
SSFNTGLFGSGFLMITGTAFILIMSLSVRRLPYTIRSSVASLQQIAPSIEEAAESLGSSR
LNIFAKITTPMMLSGIISGAILSWVTMISKLSTSILLYNVKTRTMTVAIYTEILRGNYGV
AAALSTILTVLTVGSLLLFMKISKSNSITL (SEQ ID NO: 650)

>orf00292
LIIIASMSAPFVGAYSWVLLLGRNEVITKFLTNALYLPAIDIY
(SEQ ID NO: 651)

>orf00293
MERKKLNIWTVSSFFLFLTYPIFLVYPIVTVLKQALIHEGQFSLANFVTFFSKAY
(SEQ ID NO: 652)

>orf00295
LLSTTEFIGLSIRILSNLHEFKILVGLLNQFFFWNLLLHKTKSNVVSDSQMWENSVVLEN
HPDIAFAGFHIIDFCIIEVKFSTFDTVETCNHTKKGRFPTS
(SEQ ID NO: 653)

>orf00314
MITIKKQEIVKLEDVLHLYQAVGWTNYTHQPEMLEQALSHSLVIYLALDGDAVVGLIRLV
GDGFSSVLVQDLIVLPIYQRQGIGSALMKEALEDYKDAYQVQLVTEETERTLGFYRSMGF
EILSTYNCIGMTWMNRKK (SEQ ID NO: 654)

>orf00325
MKIKEQTRKLAAGCSKQCFEVVDRTNEVSNHTYGKATLTWFEEIFEEYNTNLEYKQPICS
QEKA (SEQ ID NO: 655)

>orf00359
MVDNIPKRVNDVIRQAGNNAKTSRPHVGIGKSHISVSFLFPYHTANRIKNQEKVIF
(SEQ ID NO: 656)

>orf00375
LFDLLDHGLDTVLVCHVTDISMGLDANFTISFNPFIDQILIDIVKDNSSAGFSVGFGNSK
SNSIRSAGDESNFSF (SEQ ID NO: 657)

>orf00387
MKSLARLLIIHVFISIFLFFALTSGAISHTVLLLLLLFLPALNKGLEKIQSKRIPVLNAA
LFFLLISFPQLLTNPVQWKFSIFLVVTIISSLAYFYNFYQVVKEVDQKQLI (SEQ ID NO: 658)

>orf00390
LEAAGEIETEFQGWIVLVVFNHIDSLSRDTDILGEFELGNTQFLAKFFHTIHLISFLIYV
VYI (SEQ ID NO: 659)

>orf00403
MEGVNHVDIIKVSCCSFISQVNWMMKGKIPNREGFKFSVARFDAIDLVVVHIGHTRCQFS
RTGSRSGYDNQVATGFDVVVFAHAFWGNDVIHIRRISFDWIMKIRINSVFLKLVAEGICS
GLASVLCNDNGTNKNP (SEQ ID NO: 660)

>orf00404
MFNVASINGNHNLNLLFQFLQELDFVVRFITRKDTSSVEIF (SEQ ID NO: 661)

>orf00409
MIDIHSHIVFDVDDGPKSREESKALLIESYRQGVRTIVSTSHRRKGMFETPEEKIAENFL
QVREIAKEVADDLVIAYGAEIYYTLDALEKLEKKEIPTLNDSRYALIEFSMHTSYRQIHT
GLSNILMLGITPVIAHIERYDALENNEKRVRELIDMGCYTQINSYHVSKPKFFGEKYKFM
KKRARYFLERDLVHVVASDMHNLDSRPPYMQQAYDIIAKKYGAKKAKELFVDNPRKIIMD
QLI(SEQ ID NO: 662)

>orf00410
MKEQNTLEIDVLQLSRALWKRKLVILLVAIITSSVAFAYSTFVIKPEFTSTTRIYVVNRD
QGEKSGLTNQDLQAGSYLVKDYREIILSQDVLEEVVSDLKLDLTPKGLANKIKVTVPVDT
RIVSVSVNDRVPEEASRIANSLREVAAQKIISITRVSDVTTLEEARPAISPSSPNIKRNT
LIGFLAGVSGTSVIVFLLEFLNTRVKRPEDIENTLQMTLLGVVPNLSKLK
(SEQ ID NO: 663)

>orf00413
MDKKGLEIFLAVLQSIIVILLVYFLSFVRETELERSSMVILYLLHFFVFYFSSYGNKFFK
RGYLVEFNSTIRYIFFFAIAISVLNFFIAERFSISRRGMVYFLTLEGISLYLLNFLVKKY
WKHVFFNPKNSKKILLLTVTENIEKVLDKLLESDELSWKLVAVSVLDKSDFQHDKIPVIE
KEKIIEFATHEVVDEVFVDLPGESYDIGEIISKFETMGIDVTVNLNAFNKNLGRNKQIHE
IVGLNVVTFSTNFYKTSHVISKRILDICGATIGLILFAIASLVLVPLIRKDGGPAIFAQT
RIGKNGRHFTFYKFRSMRIDAEAIKEQLMDQNTMRGGMFKMDNDPRVTKIGRFIRKTSLD
ELPQFWNVFIGDMSLVGTRPPTVDEYDQYTPEQKRRLSFKPGITGLWQVSGRSKITDFDD
VVKLDVAYIDNWTIWKDIEILLKTVKVVFMRNGAK (SEQ ID NO: 664)

>orf00414
VTFDKEDARSILENEIFYPCYYPTNRNLKNLIKNTILAFKILRKERPDIIVSSGAAVAVP
FFYLGKIFGAKTVYIEVFDRIDAPTMTGKLVYPVTDRFIVQWEEMKKVYPKAINLGGIF
(SEQ ID NO: 665)

>orf00415
MIFVTVGTHEQQFNRLIKEVDRLKGEGFIQDDVFIQTGYSNYVPKFCKWEKVISYEKMNQ
LIKESDIIITHGGPATFMAVIAKGKNPIIVPRLKKFGEHVNDHQMQFVKITKEIYNLIVI
DDISDLHLILHNFKDKHFETYLNNERFNVRFNVEISNLFKGNKINEN
(SEQ ID NO: 666)

>orf00416
MKIRIEPQYFLYKYLWFIILLPKQFMQLILFFLIALTLLPTYIKEKQVFKIDTPSFCMVL
WTIIYSISIIFNSLIDGLAVQVIFSDLSKAFNWLIAVFFYNYYLKMPINIDRIKRYMYYN
FTILVVFVGLFYIQRGSNVILFGRSLLDWDGFTLATSYGVRYTGFLEYATLNGQLILFLL
PLIRLFRFRFFTQTIIFAFLLEVLVLSKSRIAIVAMLIYIAFAVVNEINSNNKWLIGIFC
PIIPFMLFYNFEKIKQIFFQMFSSRSGSNATRFRVYEESLKAINGMEMLLGAGVRIPSTV
DILLGSHSMYISFIYRTGVLGSIIITVMFYYLFSKFLKCDSSERLRSIGYILALSVFWLF
EELDPHYWCLILFFSTISIFINNRKEEIVG (SEQ ID NO: 667)

>orf00417
MIEVSIIIPIYNAEKTIKNCVDSALKQNLESLEVILVNDGSNDSTSKILEQYGDNPQVMI
FHQVNMGVSAARNVGLSYASGEYVFFLDSDDILDEGMLSKMYQFAKSNKIDLLSCWHKEP
STTQYGGNDNSSASFIARTKEEIGNHFVDIFPRSACAKLFLRRRIEENNIAFSTEMSLGE
DMSFVCQYLMVSRSIAVIDGLYYTIQNVNPQSLSKRYVSNIENSLLMQNQLWDQLLEVYP
KIEENYYKQHMDFRFYLASLYVNNLFKFDSPYSSKEKWDNIAQQLKKYRPFLDEKVSKEK
KPKNMNEMVIFYLLKSKIPALIYSFYSFKEWWKKKRLKN
(SEQ ID NO: 668)

>orf00418
MEDLVSIVVPVYNVEKYLKKSIESILNQTYDNLEVLLVDDGSTDSSGEICDSFIKVDSRI
RVFHKENGGLSDARNFGIEHMKGQYVSFIDGDDYISKDYVWKLYHSLKNNNSEVSICSFS
LVDETGEKIKDELLDSGEVSLSGQQILEKALTADGYRYVVAWNKLYRSTLFEKLKFKKGM
LYEDEFLNYPLFWDCKRVSIVEEPLYLYVQRKGSIIQSNMTLEKIKMKDKMHTSRIEFYA
EKKNSFLHQRSCQQYCNWIVTITVSHYNVLNVAFLKYLQHQFRRIVKYTQNDDKKLIIQN

ILGYINIRLAAYVKSKVM (SEQ ID NO: 669)

>orf00419
MFPIYIISNQNIAFQQEIDIAYRKMKRQFSHISLTESEQKNDMNISNKVWICWFQGEERP
PELIRTCIQSMRTHFLGREIIVLTEENISDYIDIPDYITDKYKKGSISRAHYSDILRVEL
LCRYGGLWVDVTVLNTGGDFSNLELPLFVYKSLDLSRKDSQAIVASSWLISSYSNHPILL
YARKLLWEYWRRKNSLCNYFLFHIFFTIATELYPIEWSAVLTFNNHSPHMFNFELNNQFS
EKRWEQLKQISVFHKLNHHIDYSIGVNNFYKFIVFSKVEKNE
(SEQ ID NO: 670)

>orf00420
MSNKISKNLAYNIGYQLIGIAFPLITSPYLSRILGAENLGIHSFTISVALYFMMFMLLGI
ANYGNRTIATVKREGKEILSKTFWNIYYVQLLMSVLVTIAYLIYLYFWVSSYKFIAILQL
FLLLSNAVDITWLFYGLEDFKQIVFRNTLVKLLGLFLIFSFVHESSDLWKYTLINGGVTL
VGQLLLWGQLKGRLSWVKIQKKDLLSHIKPILVLFIPVLAISIFSNMDKYMLGLMVGVKQ
VGFYDNANRIIDIPKALIAALEAVMLPRTSYLLAEGQEEKSNYYIEVTILYAMMISSVLI
FGIISVSDIFSLVFWGEEFLESGRLIAAMAPVFVFSVPGNIIRTQYLIPRAKDKDYVLSL
IIGALVNILLNCFLIKPFGAMGATISTVLAEFVLYGVQFWTVRRDLDFKKYLKNGFIFYL
FGMIMYLAIIAVKAHLQYNIINLVLLIVLGGIVYTGFCCFYILISRNVHFEILREKIKRK
IGYENIL (SEQ ID NO: 671)

>orf00422
MFVADIMISDYSSAPIDFLLLNRVVFLYLPDFKEYQSDKNPFFEVFKVSKTKGIALDPFD
EIIGRFQFGVRIV (SEQ ID NO: 672)

>orf00428
MGFSMKLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 674)

>orf00431
MEQLHFITKLLDIKDTNTQIIDVVNRDSHKEIIAKLDYDAPSCPECGSQMKKYDFQKPSK
IPYLETTGMPTRILLRKRRFKCYHCSKMMVAETPLVKKNHQIPRIINQKIAQKLIEKISM
TDIAHQLSISTSTVIRKLNDFHFECNFRNLPKIMSWDVETVRGVTVSIGRWR
(SEQ ID NO: 675)

>orf00444
LQIAQESSQDTDGINPPVVEEAMVFDRNDCLNQICGNIISLGIDAAFRTQVSNELIFIVV
DFTRSCCN (SEQ ID NO: 677)

>orf00446
MLNLMWMKIFHRNRTFLFCFLDFKVDVISIINARIVRR (SEQ ID NO: 678)

>orf00447
MYNSQALRQIVVVGSIDHLFKRHSSICEIFGLRKRCLSFL (SEQ ID NO: 679)

>orf00472
MSLADLLEELEAAKDSKKARSMEAYMRHQFSFLGIAVPERNKLYKNIFQKRKKQRLSIGI
LQTLAGKRSLENTNMWLLTI (SEQ ID NO: 680)

>orf00473
MEKILLHNLNQTEFFINKAIGWTLRDYSKTNPTWVTCFIEKNKERMAELSIKEASKYL
(SEQ ID NO: 681)

>orf00477
LSTCWNGKFCHICVALFHCFRAFKLALNEILCLLTNVSFIFVSVAF
(SEQ ID NO: 682)

>orf00487
LLGSFFSWTTKELMGIIFFNNFPTVHKNNMMGYISSKTYLIKLIKNSI
(SEQ ID NO: 683)

>orf00509
LKNVFSVGCHFFQFFVRFFWFGKFDHFNLVELVQTDQATRITTGRTSLRTE
(SEQ ID NO: 684)

>orf00535
LIDIKHFFLCLPLSKKMIIDIIVNKNPDRFCMIEKVKKTMAENR
(SEQ ID NO: 685)

>orf00539
VNIDSSEFYISHITDGIFDSFLDSNRYLRNFYSVLKVEIDICCEFFVHVFKINATAE
(SEQ ID NO: 686)

>orf00540
VNTLYLCSSDSNDFFKYTWGDNDFAKLFFNSHRMTSF (SEQ ID NO: 687)

>orf00550
VKEEKKAIVLGADNAYMDKVETTIKSLCVHHYNLKFYVFNDDLPREWFQLMEKRLETLNS
EIVNV (SEQ ID NO: 688)

>orf00551
VSNEIKIIALKLSIFWGHNHFRLTGNWKIFYLCLKSGLA (SEQ ID NO: 689)

>orf00552
MKRIQLNMNETKKYLVIKAIAQGKKTKKRACVELNLSERQINRLLLAYQQKGKEAFRHGH
GNRNRKPKHAIPDEIKERVLKKYLSYETYKPNVLHFCELLAEEEGIKLSDTTVRKILYKK
NILSPKSHRKTKKRVRKQAKLNLNQPLDNPILPTAKDFLEDPKKVHPSRPRKKFAGELIQ
MDASPHAWFGPETTNLHLAIDDASGNILGAYFDKQETLNAYYHVLEQILANHGIPLQMKT
DKRTVFTYQASNSKKMEDDTYTQFGYACHQLGILLETTSIPQAKGRVERLNQTLQSRLPI
ELERNNIHTLEDANTFLLSYIQTFNEQFGNKTKLSVFEEAPNPSERNLILARLAERVVDS
GHHIRFQNRYYMPVEQGKEVYFIRKTKALVLKAFDGDIYLNIADKIYHTKELLDHELYSK
NFEQEPEQKKKDASISLHKPIRGNSHLSNNTFIKIKRIMKSLLVRSFILLNYKYNLFFAK
WEAFP (SEQ ID NO: 690)

>orf00556
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 691)

>orf00557
MGEEEMRNKMIIAVSLVVAGVMTYLMFSGLDEDFYHFP (SEQ ID NO: 692)

>orf00567
MNTIERTRRLVKGCATHCFEVVDRTDEVSSKHVFEVVDETNEVSSKHVFEVVDETDEVSN
HTYGKAT (SEQ ID NO: 693)

>orf00581
MLSNDFIQLRKDDIKTTSVLYFPIRLFSLETMNMSSQYF (SEQ ID NO: 694)

>orf00582
LTCYPNPQKRLEAGFDKLIEIKRLTASKIQDILSVAPRSIGTTSPAREFEIIENIKHYKR
LIDKAKKCVNDLMAEFNSVITTVTGIENRLGAVILAEIRNIHAFDNPAQLQAFAGLDSSI
YQSGQIDLAGRMVKRGSPHLR (SEQ ID NO: 695)

>orf00595
MKRIQLNMNETKKYLVIKAIAQGKKTKKRACVELNLSERQINRLLLAYQQKGKEAFRHGN
RNRKPKHAIPDEIKERILKKYLSYETYKPNVLHFCELLAEEEGIKLSDTTVRKILYKKNI
LSPKSHRKTKKRVRKQAKLNLNQPLDNPILPTAKDFLEDPKKVHPSRPRKKFSGELIQMD
ASPHAWFGPETTNLHLAIDDASGNILGAYFDKQETLNAYYHVLEQILANHGIPLQMKTDK
RTVFTYQASNSKKMEDDTYTQFGYACHQLGILLETTSIPQAKGRVERLNQTLQSRLPIEL
ERNNIHTLEDANTFLLSYIQTFNEQFGNKTKLSVFEEAPNPSERNLILARLAERVVDSGH
HIRFQNRYYMPVEQGKEVYFIRKTKALVLKAFDGDIYLNIADKIYHTKELLDHELYSKNF
EQEPEQKKERRKYIPPQTHPWKLTSFKQYLHKNKKDYEEFTSEEIHSPQLQV
(SEQ ID NO: 696)

>orf00601
MDTKSSCLITTGRNDSPSTCLPRVASNNDRFSSEFRIIPDFHCSKKGIHVNMDDFS
(SEQ ID NO: 697)

>orf00604
MMSIREQDLKDIGAIIKYKNFHSPFDTFKYLKDMGFDTIDLSVLLEGFSYAYGMDWLEKF
FKENQDKLREFY (SEQ ID NO: 698)

>orf00610
MIPLYRTDNDITKFFTKIRNGHLAKTAGGLDDKFHEANASTSKAFDRQGVGEVNDIRDSA
GSQELRINDKRKTENILFLEIRVRIFRVPHPNDSFFSSHFLG
(SEQ ID NO: 699)

>orf00611
VLSQGDKDITILDAGLLKNGKIGPVTKDTNDIKATDNMIENSFVLLNQQNIMLFCNQGAT
EGKTNFSPSDKDNFHNKTYFFMM (SEQ ID NO: 700)

>orf00616
MKIKEQTRKLAAGCSKQCFEIVDRTDEVSSKHGFEVVDETDEVSNHTYGKAKLTWFEEIF
EEYKMMGKAGQLVFFDVYRLVRQVS (SEQ ID NO: 701)

>orf00645
LVEIVRGGSPRPIKDYLTSEVDGINWIKIGDTEKGEKYINNVKEKIKKSGLNKTRFVKKG
TFLLTNSMSFGRPYILNVDGAIHDGWLAISNYENSLNKDYLFYILSSNVVYSQFLSLISG
AVVKNLNSDKVASILIPLPPLAEQQRIIEAIESALEKVDEYAESYNRLEQLDKEFPDKLK
KSILQYAMQGKLVEQDPNDESVEVLLEKIRAEKQKLFEEGKIKKKDLDISIVSQGDDNSY
YEEVPCEIPESWEWVRLNDITSYIQRGKSPKYSNIPIYPVIAQKCNQWSGFSIDLARFID
PETVHSYQKERLLRDGDLMWNSTGLGTLGRLAIYHENKNPYVWAVADSHVTVIRVLSGVI
NCHFIYNFLSSPIVQSVIEEKASGSTKQKELLTKTIKEYLIPLPPLPEQSRIVDKIEQFF
AHIDALI (SEQ ID NO: 702)

>orf00657
MTPEQLKASILQRAMEGKLVPQNPNDEPASELLKRIKAEKEKLISEGKIKRDKKETEIFR
GDDGKHYGKFADGSTQEIDVPYDIPDTWEWVRFSTLVEIVRGGSPRPIKDYLTSEVDGIN
WIKIGDTEKGEKYINNVKEKIKKSGLNKTRFVKKGTFLLTNSMSFGRPYILNVDGAIHDG
WLAISNYENSLNKDYLFYILSSNVVYSQFLSLISGAVVKNLNSDKVASILIPLPPLAEQQ
RIIEAIESALEKVDEYAESYNRLEQLDKEFPDKLKKSILQYAMQGKLVEQDPNDESVEVL
LEKIRAEKQKLFEEGKIKKKDLDISIVSQGDDNSYYGNIPMNWVVIKIKDIFSINTGLSY
KKGDLSINKGVRIIRGGNIKPLEFSLLDNDYYIDTQFISSEQVYLKHNQLITPVSTSIEH
IGKFARIDKDYDGVVAGGFIFQLTPFESSEIISKFLLFNLSSPLFYKQLKAITKLSGQAL
YNIPKTTLSELLIPLAPFEEQELITQKVEKLFEKVNQLWK
(SEQ ID NO: 703)

>orf00669
MCKANSRNDIFILQDSFCFEIFSRKKFKIVKEVLPNSTCKFRVVQ
(SEQ ID NO: 704)

>orf00673
VDRTDEVSSKHCFEVVDRTDEVSNHTHDKPTLTWFEEIFEEYHSPFHN
(SEQ ID NO: 705)

>orf00674
LDNIHIVLDSLNAVSGIQDFICDGLAIFCNQITSGCSSCK
(SEQ ID NO: 706)

>orf00683
MGPLLMHLCQQLVWLAKYLKRAGSDMMFLQEFLNRRFNPSLLGKIIL
(SEQ ID NO: 707)

>orf00684
LVAKGQGHKLRVSRHKDNQGIGVLFPNLSSHFQPLHLLISNLNIQKE
(SEQ ID NO: 708)

>orf00692
MTSYKRTFVPQIDARDCGVAALASIAKFYGSDFSLAHLRELAKTNKEGTTALGIVKAADE
MGFETRPVQADKTLFDMSDVPYPFIVHVNKEGKLQHYYVVYQTKKDYLIIGDPDPSVKIT
KMSKERFFSEWTGVAIFLAPKPSYQPHKDKKNGLLSFLPLIFKQKSLIAYIVLSSLLVTI

INIGGSYYLQGILDEYIPNQMKSTLGIISVGLVITYILQQVMSFSRDYLLTVLSQRLSID
VILSYIRHIFELPMSFFATRRTGEIISRFTDANSIIDALASTILSLFLDVSILILVGGVL
LAQNPNLFLLSLLSIPIYMFIIFSFMKPFEKMNHDVMQSNSMVSSAIIEDINGIETIKSL
TSEENRYQNIDSEFVDYLEKSFKLSKYSILQTSLKQGTKLVLNILILWFGAQLVMSSKIS
IGQLITFNTLFSYFTTPMENIINLQTKLQSAKVANNRLNEVYLVESEFQAPENPVHSHFL
MGDIEFDDLSYKYGFGRDTLTDINLTIKQGDKVSLVGVSGSGKTTLAKMIVNFFEPYKGH
ISINHQDIKNIDKKVLRRHINYLPQQAYIFNGSILENLTLGGNHMISQEDILKACELAEI
RQDIERMPMGYQTQLSDGAGLSGGQKQRIALARALLTKAPVLILDEATSGLDVLTEKKVI
DNLISLTDKTILFVAHRLSIAERTNRVIVLDQGKIIEVGSHQELMQAQGFYHHLFNK
(SEQ ID NO: 709)

>orf00699
LRIYLHEPLITTVSQDFSSLSDISATHFEQLHIVAIVHSDIQRNNSPLTCDNRLSLHSVK
FLFTRIIG (SEQ ID NO: 710)

>orf00723
MGLIKTLAKIYGNYFLTVQGVKVMKTIKKDDNAVVGLGKLFIADKLMDTARWLIKPEDKK
(SEQ ID NO: 711)

>orf00724
MKFFWGLLAILFIKPIIGIVKFFWMIISFAVQLLFYKILDWFFKLI
(SEQ ID NO: 712)

>orf00725
MKIKEQTRKLAADCSKQCFEVVDRTDEVSSKHRFEVVDRTDEVSNHTYSKVKLTWFEEIF
EEYKMILLLILYHMERD (SEQ ID NO: 713)

>orf00733
MHSQTFQFLLMTDKTSLLHRKHRSFIRNIHSKFLILFDLLCGILSRNDSNHNPIS
(SEQ ID NO: 714)

>orf00736
MARTELPDKIETERLVLRVRTVADAEDIFDYASLPEVAYPAGFPPVKTLEDEIYYLEYIF
PERNQKENLPAGYGIVVKGTDKIVGSVDFNHRHEDDVLEIGYTLHPDYWGRGYVPEAARA
LIDLAFKDLGLHKIELTCFGYNLQSKRVAEKLDFTLEARIRDRKDAQGNCCDDLRYALLK
SEWEVI (SEQ ID NO: 715)

>orf00741
MGKIVAIDLFNGAGGTTSGLKKSGIDVQVAVEIDSVAVKTYKLNNPEVSVIDME
(SEQ ID NO: 716)

>orf00746
LLRKQEGEYLRAENAILKKLRELRLKEEKEKEERQKLFKN
(SEQ ID NO: 717)

>orf00768
LKHLFCHFNPLWIDEIIRLAYKDQDTKDVKSKVKIGN (SEQ ID NO: 718)

>orf00792
LCCNRHIANLDLEFISYYLGQVGFDTRISTGLGIFVTKIGNVLFDTDNQFASFLNVCDTS
ISLDWFGSSKAEKANQ (SEQ ID NO: 719)

>orf00817
MKTKEQTRKLASGCSKHCFEVVDGTDVVSSKHCFEVVDRTDEVSNHTHGKATLTWFEEIF
EEY (SEQ ID NO: 720)

>orf00819
MDFFFMNEVKEQVLFRDNHSEHIFWIEGVSDFMIKVNTALW (SEQ ID NO: 721)

>orf00839
MEELVTLDCLFIDGTKIEANANKYSFVWKKTTEKFSAKLQEQIQVYFQEEITPLLIKYAM
FDKKQKRGYKQSAKNLANWHYNDKEDSYIHPDGWCYRFHHIKYQKTQTDFQQEIKVYYAD
EPESAPQKGLYMNERYQNLKAKECQALLSPQDRQIFAQRKIDVEPVFGQIKACLGYKRCN

LRGKRQVRIDMGLVLMANNLLKHSEMK (SEQ ID NO: 722)

>orf00840
MHIHYNTNQTTLPLEISSFLPQDHLVFTIEKVVNTLEERHFYAFYHAFGRPSYHPKMLVS
TLLFAYSQGIFSGRKIEKWKS (SEQ ID NO: 723)

>orf00843
LRLWVIFVIMKVIKSYNTLNDYYRKLFGEKTFKVPIDAGFDCPNRDGTVAHGGCTFCTVS
GSGDTIVAPDPPIREQFYKEIDFMHRKWPDVQKYLVYFQNFTNTHEKVEVIRERYEQAIN
EPGVVGINIGTRPDCLPDETIEYLAELSECMHVTFELGLQTTYEATSDLINRAHSYEL
(SEQ ID NO: 724)

>orf00845
VETVKRLRKYPKIEIVSHLINGLPGETHEMMVENVRRCVTDNDIQGIKLHLLHLMTNTRM
QRDYHEGRLQLMSQDEYVRVICDQLEIIPKHIVIHRITGDAPRDMLLGPMWSLKKWEVLN
SIEMEMRRRGSVQG (SEQ ID NO: 725)

>orf00853
MKIKEQTRKLAAGCSKHCFEVVDKTDEVSHIHTVRRR (SEQ ID NO: 726)

>orf00859
VQVCVFTNFCFFHCFSSLANCRLFNLRGICLPCISYQ (SEQ ID NO: 727)

>orf00868
VFKKDRFSIRKIKGVVGSVFLGSLLMAPSVVDAATYHYVNKEIISQEAKDLIQTGKPDRN
EVVYGLVYQKDQLPQTGTEASVLTAFGLLTVGSLLLIYKRKKIASVFLVGAMGLVVLPSA
EAVDPVATLALASREGVVEMDGYRYVGYLSGDILKTLGLDTVLEETSAKPGEVTVVEVET
PQSTTNQEQARTENQVVETEEAPKEEAPKTEESPKEEPKSEVKPTDDTLPKVEEGKEDSA
EPAPVEEVGGEVESKSEEKVAVKPESQPSDKPAEESKVEQAGEPVAPREDEKAPVEPEKQ
PEAPEEEKAVEETPKQEDTQPEVVETKDEAANQPVEEPKVETPAVEKQTEPTEEPKVEQV
GEPVEPREDEKAPVSPEKQPEAPEEEKTAEETPKQEDKIKGIGTKEPVDKSELNNQIDKA
SSVSPTDYSTASYNALGPVLETAKGVYASEPVKQPEVNSETKAEKVAANTDAKQSEVNSE
TASLKTAISGLNTDKVELENQLKIAQGKTETDFSMESWTVLSTAKNKAQEVKDNGTATQE
QINEAEKSLKTALADLSVDKTALGSAIDTATKKNKENYTNQTWAELETVLTAAKSVNTNE
SKQSEVNEAVEKLTATIEKLVELSEKPRLTLSIEKRDIDRKVTVTYTLENPANTQIKSIT
ATLKKGEEVVKDFVLTEENLKTNHLTALFEKLDYYKEYTLSTDMVYNRGNDDETESISEE
LIQLNLKKLELKDIQTVSLMKFENGQESQVTHLSDKPTDLSKLYLKVTSSTSKDAVLAVS
SIEEEIVENKKIFKIHADTPELVVRKKDGSLSKGFDYYMERVIPHDGDIYYDFKDLISAM
TSNPTGTFILGRDISSRNVKPDGNGKSYIKGEFKGKLLGTNDNVRHSIFDLEYPLFDTIK
SGVVKDIDFKHVNMVFPDSNQGDNVATIARVIKDKTKIENVNVEGYLEGRDHVAGLVNNL
EGNSEIENISFTGKIKSKGGNSITAGIAGRNILSRVKRAYVNANIEVLGSTNSSMLVAVN
GTTLNASGGWGAWGRLTESVAKGTLEIKRSGQAGGVTATVWPYGAIDKVVSYAKVTKGKE
LFGSDGDLNNNWFMQKINNIFGVQGISSGDSGNDSKFKRISEEEAKQKVASYNITAPNLM
SDSSLLVDRLNESWKNTDQFESIQDYQSQNQLIYQNLTKFTPYYNKEFIVHEGNALTPEQ
EILKTKKIKSIVGLKGTEFVVDGSDIDTIMLHFEDGSQKRYKVTSTGKFSITNLPEYQVE
DLNVVYTSEHIVHPLDSSLINNLVEELKKVELYTESTYQVLGIDKDNANKLNRTKRLFLD
ESLDAVKTQLPTFVKTMFENEWLHINGESSGAVAALRQKIMDNKTAILLALTYINRYYDV
KFSDYNIKKLMLFKPTFHGEKIDLLDRLIRLGSSGENRLKGSENAETFKQLFASETKQKD
LVTYLDYNRSLLTNYQTTGEWFKETTKDYIQFEERPSLVEEIKDAKYRVYDNLTAPYYQG
YILPLLTLKNTHLAILSNYSTMTFVSREKRPNWKNEDFDKWVKYVATAHRNHVDTWYKIL
PDNIKGKMVKENVTAVWEGLSIPGSEWVDQNAVDRKGRDYAPAREFFNLVGGPMGGWYAY
HGYGAHAGGRNRVNYEVFDVLSEYGISVFTHELTHVNDTWIYLGGYGRRENMGPEAYAQG
LFQSPVPGQPGWGALGLNMAFERKNDGDLIYNASPTQFENRKELDSYMKNYNDTLMMVDY
LEGDAVISKGKEAITKWFKKVEPKVVSQTAQYDTVRQLTAEEKEKLSVSSVDDLVDQGLM
SDRAVGNNTYNPADFETSYIAIDYMTGIYGGGKNSVGSPGALMFKHNTFRMWGYYGFEEG
VLGYASNKFKQASRDEGHAGLSDNFIISKISKGEFLTMEAFKKGYFKKVVEELKTKGIRP
VTINQKTYSTFEELQEGFKQAVERDLKKNQLDERETRNFKFQVFRQLLQQTDSFKTSIFR
(SEQ ID NO: 728)

>orf00883
VGNRIFIAFLQKLGLLDNLTGIREKLHPITGQGNTLGIADKDFNAHFIFQISHCIGETGL
SDKELLGCLIHRASFDDFDNIM (SEQ ID NO: 729)

>orf00892
MKTKKHRLLALALISSFTLLGAASAAVQYPDGGVWTYGEGSGGGWAFSNYYHGKKYHYSS
LVSRWNSHSDKGEASAGKTSYAWIWTKWGEQVAFYCDYD (SEQ ID NO: 730)

>orf00903
MSMIEVSHLSKSFGDKIALNDISFTVKEGQIFGFLGPSGSGKTTTINILTGQLLADKGQS
IILGQKSQNLTSGELKRIGLVSDTSGFYEKMSLYNNLLFYSKFYNISKLRVDNLLKRVGL
YDSCKMVAGKLSTGMRQRMLLARALINKPAVLFLDEPTSGLDPTTSRTIHELILELKTAG
TTIFLTTHDMNEATLLCDYVALLNKGKLVEQGAPSELIQRYNKDKKIKVTDYNGNQITFD
FTSLEQVSQADLENIFSIHSCEPTLEDIFITLTGGKLNA (SEQ ID NO: 731)

>orf00911
LISNKVDITLANFTVTDERKKQVDFALPYMKVSLGVVSPKTGLITDVKQLEGKTLIVTKG
TTAETYFEKNHPEIKLQKYDQYSDSYQALLDGRGDAFSTDNTEVLAWALENKGFEVGITS
LGDPDTIAAAVQKGNQELLDFINKDIEKLGKENFFHKAYEKTLHPTYGDAAKADDLVVEG
GH (SEQ ID NO: 732)

>orf00912
MKLFKPLLTVLALAFALIFITACSSGGNAGSSSGKTTAKARTIDEIKKSGELRIAVFGDK
KPFGYVDNDGSYQGYATILN (SEQ ID NO: 733)

>orf00946
MTGKKGFLFLNCHICMVTTTTCFLKERVESELLIFFTFC (SEQ ID NO: 734)

>orf00948
MDTPDENGYVADDYRITYLEAHIKAMRDAIYQDGVDLLGYTTWSCIDPVSAGTGEMNKRY
GFIYVDRDNVGNGTLKRSKKKSFYWYMSFIAMV (SEQ ID NO: 735)

>orf00953
LSCQIAFCLIDRLDYPIMFSKVCQENHFQVFTPFSKKLKNFLKNA (SEQ ID NO: 736)

>orf00966
MFLGMIGNISIILQFFGITIIVKIDNQARAIDFFKHDKSSF (SEQ ID NO: 737)

>orf00968
MFSLNFFDDNVFLSIKIAHKGCFQLLDMTNPNFFNKFFLAQASDQLLHFLSWNIEL
(SEQ ID NO: 738)

>orf00978
MTEPDFWNDNIAAQKMSQELNELKNTYNTFHKMEELQDEVEILLDFLAEDESVHDELVAQ
LAELDKIMTSYEMTLLLSEPYDHNNAILEIHPGSGGTEAQDWGDMLLRMYTRYGNAKGFK
VEVLDYQAGDEAGIKSVTLSFEGPNAYGLLKSEMGVHRLVRISPFDSAKRRHTSFTSVEV
MPELDDTIEVEIREDDIKMDTFRSGGAGGQNVNKVSTGVRLTYIPTGIVVQSTVDRTQYG
NRDRAMKMLQAKLYQMEQEKKAAEVDSLKGEKKEITWGSQIRSYVFTPYTMVKDHRTSFE
VAQVDKVMDGDLDGFIDAYLKWRIS (SEQ ID NO: 739)

>orf01011
MQVIKRNGEIAEFNPDKIYQAILKAAQTVYVLTDDLRQNLAQVTKKVVLDLQEAKVERAT
ISMIQSMVEHRLLGAGYITIAEHYISYRLQRDLERSGYGDHIAVHLHFEQIR
(SEQ ID NO: 740)

>orf01015
MKIKEQTRKLAAGCSKHCFEVVDETDEVSSKHCFEVVDETDEVSNHTYGKAKLMRFEEIF
EEY (SEQ ID NO: 741)

>orf01068
MKVINQTLLEKVIIERSRSSHKGDYGRLLLLGGTYPYGGAIIMAALAAVKSGAGLVTVGT
DRENIPALHSHLPEPMAFSLQDQQLLKEQLEKAEVVLLGPGLRDDASGENLVKQVFVNLS
QNQILIVDGGALTILARTSLSFPSSQLILAPHQKEWEKLSGITIEKQKEDATASVLTSFP
QGTILVEKGPATRIWEVGQSDYYQLQVGGPYQATGGMGDTLAGMIAGFVGQFRQASLYER
VAVATHLHSAIAQELSQENYVVLPTEISRYLPKIMKIICQQERGSKDKLV
(SEQ ID NO: 742)

>orf01077
VLDSKEELKESENDAPKLETPLREEPRLAPQTLPEASEVLENKREESKVEIIEPAQADDI
RKVVGELAKDISITKLYMTGHSLGCYLAQIAAVEAYQKYPDFYNHVLRKVTTFSAPKVIT
SRTVWDAKNGF (SEQ ID NO: 743)

>orf01091
LSYSILICLCNSTINESLRAFYCWQKFITFNQVTGNARGKGTTCTSIGPDN
(SEQ ID NO: 744)

>orf01094
MGRKPRTRPEERTELERLQAENEYLRAENAILKKLRELRLKEEKEKEERQKLFKN
(SEQ ID NO: 745)

>orf01096
LSTCWNGKFCHICVALFHCFRAFKLALNEILCLLTNVSFIFVSVAF
(SEQ ID NO: 746)

>orf01109
VVLSTSAILVACGKTDKEADAPTTFSYVYAVDPASLGYSIATRTSRTDVIGNVIDGLMEN
DKYGNVAPSQKDYDLNSTGWAPSYQDPASYLNIMDPKSGSAMKHLGITKGKDKDVVAKPG
LDKYKKLLEDAVSEITDLEKRYEKYAKAQAWSTDSSLLMPTASSGGFPVVSNVVPFSKPY
SQVGIKGEPYIFKGMKLQKDIVTTKEYNEVFKKWQKEKLESNSKYQKELEKYIK
(SEQ ID NO: 747)

>orf01113
LNFDFFIFLAHFIPLFTFSILQENPKTSKKKLYIRLL (SEQ ID NO: 748)

>orf01119
MGFSMKLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 749)

>orf01134
LIRIIRNIYRSGEGNTSVFQSFIDQINSNQFCYGSNFDRLRCILLIENFTSICLNSNRMF
SGNGKILSNSSRSTP (SEQ ID NO: 750)

>orf01137
MNATDIKNTYLKYIKENAVFNDVTDTHTEVITPFIDPLGEAIGFSIKSNGKHLTVTDDGY
TIWNLSINNIDVTKKGRRQDIFNSLLHFNGFDLHDGAIERTTGKEHLGQVIHDMTQLLMN
VYDFIQLTPNNIKSQFLDDVKSYFMKNEHYTVFPAFSIAGKSRLEHRFNFVFMSKGISKI
ARVHNNITKQQVDTILASWLDTSEYRRKEYGDTEQLYIIVSDEGYNNIKDDHQIALQEYG
INILNFSDKEQLEIQLGK (SEQ ID NO: 751)

>orf01138
MSKVVKVTGAEVVISHNEEYLKVNPSELNFVPKLGDEVEVHKVDGEIIVIKVKDKKDDKI
NINIVNENNAMQNQSQVVHTQEIATGVHYVNKWVYVILALFLGGLGIHHFYAGYNGKGFL
FLILSLTGIPAIIALFQGIIALFKKPDVYGRIAV (SEQ ID NO: 752)

>orf01149
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHGFEVVDETDEVSSKHGFEVVDETDEVSN
RTTVRRR (SEQ ID NO: 753)

>orf01156
LQNDKNHKLFDNYTCQKEKDVLQCKQVKRKEERSYDVGTRIYTIYYFLLF
(SEQ ID NO: 754)

>orf01158
VDRTDEVSSKHGFEVVDETDEVSNHTYGKVKLTWFEEIFEEY (SEQ ID NO: 755)

>orf01159
LFFKDEKQALYTKPKTKSSSFRASKVSNQTIVATTRTDCQVIALNLCDKLENGVVVVVQT
THHIGIDDVIYSKIFQHLTHSIKMSLAFFIKKVQDRRRILYCHLVFFFLRVQDTKRIFLQ
ATLAILRQGLLERCQIVNQGLAVGCTALRISKSVEVQFDTLNTDFLQKMGCHSDCFHIGS
WIARAKTLNTNLVELAQAPCLWTLITEHRSHIVELAWLLHFWGEEFIFHIGTDNGRSSFW
TEGNMTVTLVIKIVHFLGYDIRCISDRATDNLVMLKNRRAHFCIVIALENLTGKALNVLP

LSRFSR (SEQ ID NO: 756)

>orf01164
MEQIGKVFRQLRESRNISLRQATGGQFSPSMLSRFETGQSELSVEKFLFALENISASVEE
ILFLARGFQYDTDSELRKEITDVLEPKNIAPLEDLYRREYQKHAHSHNKQKHILNAIMIK
SYMKSIDERVELTAEEGKVLHDYLFSTEIWGIYELNLFSVSSPFLSVSLFTRYVREMVRK
SDFLMEMSGNRNLFHTILLNGFLASIECEEFTNAYYFKRVIEEHFYKENETYFRIVYLWA
EGLLDSKQGRVKEGQKKMEDAVCIFEMLGCNKSAEYYRNTTEC (SEQ ID NO: 757)

>orf01165
LIPYFLHFIIFFRKFIKNLPNCQNYEKIEDIYHVEGLL (SEQ ID NO: 758)

>orf01167
MKIKGQTRKLAAGCSKHCFEVMDRTDEVSSKYCFEVVDRTDEVSNHTYGKATLT
(SEQ ID NO: 759)

>orf01170
VVPFSDTFKDRNQVDIFTIKISRCNSSTIGENSWDIHISNSNHRSRHVLVTATDSDEGIH
VVTTHSRLDGVRDDVTRC (SEQ ID NO: 760)

>orf01190
MKKVKLGEVLSLKKGKKATVLAEQTTLSQRYIQIDDLRNNNNLKFTESLNMTEALPDDIL
IAWDGANAGTVGYGLSGAVGSTITVLKKNERYKEKIISDYLGVFLESKSQYLRDHSTGAT
IPHLNKNILLDLQLELLGIEEQENIICILNTIKRLITKRKFQLDELNLLVKSRFNEMFEE
YPDSVFLDTYIKELRAGKSLAGEENNKNKVLKTGAVSYDYFNSSEVKNLPIDYIPLDEHK
VEIGDVIISRMNTSELVGAAGYVWAINSDNIYLPDRLWKVILNDRVNPVFLWKLITNEKT
KLKIKRISSGTSGSMKNISKSQLLQIRVPFPPLALQNEFADFVALVDKSQLAIQKSLEEL
ETLKKSLMQEYFG (SEQ ID NO: 761)

>orf01199
MKIKEQTRKLAAGCSKHCFEVVDKTDEVSSKHGFEVVDETDEVSNHTYGKATLTRIEEIF
EEYKSS (SEQ ID NO: 762)

>orf01226
MRLSIQLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 763)

>orf01237
LVYAPFSFNILLDYITFDFKILLFSVFLAINRFHNDFIQFLL (SEQ ID NO: 764)

>orf01240
LGTKIGISKNTIGNYEKRVKSTKKNTIFDLAKVFSSLIDALFPPVQKDSPSDIQSIYDQR
APPRQGKVLTYA (SEQ ID NO: 765)

>orf01246
LFVFILIFLKSSIYIGIFWFIDFGKAVDFQGWKVLFEFFMVVIDQFSFGCNPGVVFILPG
IALGQQSIDTRICDTVDNAESEQKLTIGMTGVVIDKACKLDCLALKFIWIVVDSLHDFHI
VFISDLNTILG (SEQ ID NO: 766)

>orf01247
MTVGFDLLHPDIQLNNCQDKGKHHGDIGQIGIVHVDVLV (SEQ ID NO: 777)

>orf01249
MEGVAKGRIGRKKNNGIDNRCCHKKRNGRVTWNLFFQKTIDDGDDSTFTRREKYTDKGPK
KDSPPTISREKMINLVRCDINFNQP (SEQ ID NO: 778)

>orf01262
VVIGVASATTNIWIIFLSGFTAILAGAFSMAGGEYVSVSTPKDTEEAAVSREKLLLDQDR
ELAKKSLYAAYIQNGEFKTSAQLLTNKIFLKNPLKALVEEKYGIEYEEFTNPWHAAISSF
VAFFLRSLPPMLSVTIFPSDYRIPATVLIVGVALLLTGYTSARLGKAPTKTAMIRNLAIG
LLTMGVTFLLGQLFSI (SEQ ID NO: 779)

>orf01277
MILMTKNINLTNEELELIQGGADPYGKEPNGYYPWKMEPVLTLLVHGFCPRDTDDLGYIG

GGNHLCKGSAARF (SEQ ID NO: 780)

>orf01282
LQVGQANEIGDPGAHFTQWNLLDDIGFDQLIQPNQKQYNDCHYCSFFHDFLF
(SEQ ID NO: 781)

>orf01301
LLHICIGETFDCIPYCMLTFFLSKSIGLTILLHKVKTVVFIDDQSNDKTCKICIHISFFR
IKLSQQCQLSFSVYF (SEQ ID NO: 782)

>orf01309
MTTIFLTRTSCSNCGKQSTFERFDRVYAAKTPEIISAILDWDFFKFTCHNCNHKVLIDYP
TVVVDEEQKTIIQYCADGNVDVLSMQICSLISEGVNLSEYRIRVVSDIESFVEKVQIVSV
GYDDRAIELMKYMNSPLEDGDIQFNYEHMVFTKVGHENYQFMFINNQIAVASLDFSQEQY
EYYLADVEDLETNTYYIDSRWAESFFRTSLA (SEQ ID NO: 783)

>orf01310
MVRRNSKITRQQKKIRDAFVSERTVEIIPAKREFTDVKTKKLRVAAYCRVSTFDESQSGS
FELQKQTYTERINSNPDWIMAGIYADQGASGTSIKRREQFQQMLHDCRCGKIDLIIVKSV
SRFARNQLDFISIYRELKALSPPVGIYIEDINLNTLDTNSEFILGIMAIVAQGESEQKSA
SITWSVIERFKRGIPMIPTHNLLGYTKDQYGRVVIDETEAKIVRLIYDSYIEGMTASEIA
STLMTNHIPTVTGLERWTSLAVYNILRNEKYKGEIIMQKTYTVDCFSHKTRKNNGEKPKY
RLKNGIPSIIPESRWDLVQELLKQPRRKSKSTSEIFVPKLYIKKLKSGKLRDFVVLDPSW
KSEDIHEVFK (SEQ ID NO: 784)

>orf01311
MTVNKNFVTFSKGIVQALEYPAHVLVAFNKDTKVMGIQVCRAKTRGAFSFSKPVGEQKGI
VQVGHKTLKETLLTIMSEWKSDKRYRVEGIHIPEDKAFVFELKDFDELSDFRKNDNR
(SEQ ID NO: 785)

>orf01313
MEKYNNWKLKFYTIWAGQAVSLITSAILQMAIIFYLTEKTGSAMVLSMASLLGFLPYAVF
GPAIGVLVDRHDRKKIMIGADLIIAAAGSVLTIVAFYMELPVWMVMIVLFIRSIGTAFHT
PALNAVTPLLVPEEQLTKCAGYSQSLQSISYIVSPAVAALLYSVWELNAIIAIDVLGAVI
ASITVAIVRIPKLGDRVQSLDPNFIREMQEGMAVLRQNKGLFALLLVGTLYMFVYMPINA
LFPLISMDYFNGTPVHISITEISFASGMLIGGLLLGLFGNYQKRILLITASIFMMGISLT
ISGLLPQSGFFIFVVCCAIMGLSVPFYSGVQTALFQEKIKPEYLGRVFSLTGSIMSLAMP
IGLILSALFADRIGVNHWFLLSGTLIICIAIVCPMINEIRKLDLK
(SEQ ID NO: 786)

>orf01315
MELILKAKDISVEFKGHDVLDINELEVYDYDRIGLVGANGAGKSTLFKVLLGELIPPGCK
MNHLGELAYIPQLDEVTLQEEKDFALVGKLGVEQLNIQTMSGGEETRLKIAQALSAQVHG
ILADEPTSHLDREGIDFLIGQLKYFTGALLVISHDRYFLDEIVDKIWELKDGKITEYWGN
YSDYLRQKEEERKRQAAEYEQFIAERARLERAAEEKRKQARKIEQKAKGSSKKKSTEGGG
RLAHQKSIGSKEKKMHNAAKSLENRIAALGKVEAPEGIRRIRFRQSKALELHNPYPIVGA
EINKVFGDKALFENASFQIPLGAKVALTGGNGTGKTTLIQMILNHEEGISISPKAKIGYF
AQNGYKYNSNQNVMEFMQKDCDYNISEIRSVLASMGFKQNDIGKSLSVLSGGEIIKLLLA
KMLMGRYNILIMDEPSNFLDIPSLEALEILMKEYTGTIVFITHDKRLLENVADVVYEIRD
KKIKLKH (SEQ ID NO: 787)

>orf01316
MNQLEFQRNHLQMDYYSESYQDFERDFYRYSNMNIPLTFLTDDILKTMATSRKNYFVLNK
EKSRDNRDHFFIFEVRTLEENPLIYHYTYKKTTTYLAEK (SEQ ID NO: 788)

>orf01317
MQKWMGFFLSEHTSALTDDANKVTYMSDLSLEKKLLLLSQVYAGQLNTRIHVVKKNNQVS
YTGTIPSLTKDFILIKTTTGHINLKLKDIVSIELVEEVLYESA (SEQ ID NO: 789)

>orf01318
MKKSINAQKKIDPANLPKTMVGHVLELFRKKYTSGAVRQIGVSYGGFVDENFTLLSLFDD
VEQIEKENRLQTAIDVVREQFGFLAIQKGTVLTEGSRNIERSKLIGGHSAGGLEGLK
(SEQ ID NO: 790)

>orf01343
MNXXFISTKDKHTLIQVSAVRFRDGREIDAYDSYVHTSVPLKSFINEFDRGLQLRP
(SEQ ID NO: 791)

>orf01363
MIAMRSYITLTCNLNNNLFCLNSFFLTNLVWSQIFSLLSVFITVYI (SEQ ID NO: 792)

>orf01364
MVFDANRIISEDSEGFVIPHGDHNHYIKVQTKGYEAALKNKIPSLQSNYQPGTFDEKAVL
AKVDQLLADSRSIYKDRLS (SEQ ID NO: 793)

>orf01390
MARLEPAKIAKIVLGILLYIIDLIKSSFVLPIPKAAKKSLILISFVPSFNDKNIVIRRPR
QITKIMPRFICFLFRIFACIS (SEQ ID NO: 794)

>orf01396
MASKRLSIEEQIEKKEESIKQLQNQKRQLKKKLNEQERKARNKRLIEKGAVFESIFEESI
DLTKDEFYKLIKTLNDEEIRLNIMEILEERIDDNVEKSSKDEIT (SEQ ID NO: 795)

>orf01397
MADSFHFSVNIISRGKGKSAVASAAYISGEKIKNEWDGVTHDYTRKEKILVKNIILPDHI
PKEFNDRSTLWNKVEMAEKNSNAQLARQFIIGLPKELSLSENKNLVERYIKENLTSQGMI
VDYAIHDESQDKNGNIHCHIMTIMRPINEKGEFLAKSKKEYILDEKGEKVLNKNGKPKTR
KVELTTWNDTGNVEKWRENFSDLCNKYLERAGAEKRVDHRVLKDKIQIIYRQSI
(SEQ ID NO: 796)

>orf01398
MERKGIETDKGNYNREIRKYNQLVKTIKEEIKTLKGWIGNLLDNLSTAYEKFKDIERDKV
IDNPKLFNLTNYLLTYSEIQKEKSKYLKGYAKTNKEKYDFKKLTSAYSYLRKNNIETIGQ
LQTKIETLKSNSYRLNKKAKTIHKEMEDVEKKILYYEIYKAKKEVYEEYQKKNIFTKEAF
YNKHKKDIDQYKVVSGKLKKLLSDKEKLSPKKWNEEKILLMSNLEEINKEKDKIKDEYQE
INHIKYSVDFVNKELGIDLSIEIDKLIKQGEKPSVIAQIKKFQDQVNKDNEYREMMKNKK
MDQER (SEQ ID NO: 797)

>orf01407
MELSAIYHRPESEYAYLYKDKKLHIRIRTKKGDIESINLHYGDPFIFMEEFYQDTKEMVK
ITSGTLFDHWQVEVSVDFARIQYLFELRDTEGQNILYGDKGCVENSLENLHAIGNGFKLP
YLHEIDACKVPDWVSNTVWYQIFPERFANGNALLNPEGTLDWDSSVTPKSDDFFGGDLQG
IIDHMDYLQDLGITGLYLCPIFESTSNHKYNTTDYFEIDRHFGDKETFRELVDQAHHRGM
KVMLDAVFNHIGSQSLQWKNVVKNGEQSAYKDWFHIQQFPVTTEKLVNKRDLPYHVFGFE
DYMPKLNTANPEVKNYLLKVATYWIEEFNIDAWRLDVANEIDHQFWKDFRKAVLAKNPDL
YILGEVWHTSQHWLNGDEFHAVMNYPLSDSIKDYFLRGIKKTDQFIDEIN
(SEQ ID NO: 798)

>orf01408
MFNLLDSHDTERILWTANEDVQLVKSALAFFFLQKGTPCIYYGTELALTGGPDPDCRRCM
PWERVSSDNDMLNFMKRLIKIRKYASVIISHGKYSLQEIKSDLVALEWKYEGRILKVIFN
QSTEDYLLEKEAVALASNCQELENQLVISPDGFVIF (SEQ ID NO: 799)

>orf01414
MSEQYRDIRKEVNLTADELKQIEKMMEVDNYRHFSPFVRDKILMTDDKQLAAKEWFSLWQ
SQKFEQISRDVHLVLIIARENHQVTQEHVSILLTCVQELIAEVNQVQSLSRGFREKYMR
(SEQ ID NO: 800)

>orf01415
MVYRYRTNLKKVFLTDSELHQLNERIAKSNCQNFSVYARKVLLNPNMSFVTINTDTYDQL
VFELRRIGNNINQIARAINQSRLISQEQLQELSKGVGELIKEVDKEFQVEVKRLKEFHGS
H (SEQ ID NO: 801)

>orf01417
MVVTKHFATHGKKYRRRLIKYILNPDKTDNLKLVSDFGMSNYLDFPSYEEMVEMYNVNFT
NNDKLYEYRNDRQEKHQQNIHAHHLIQSFSPEDNLTPEEINRIGYETIMELTGGRFRFIV

ATHTDKDHIHNHILINAIDCNSDKKLIWNYALERNLRMISDRISKMAGAKIIEKRFSYRD
YQKYRATSHKFELKQRLYFLMQQSKSFDDFLEKAEQLHVHIDFSQKHSRFMMTDRAMTKP
IRGRQLSKRDLYDEDFFRMHFTKQEIASRLEFLLNCVNSLEGLLTKSKELNLTIDLKQKN
VIFILEENGKQFSLSHKKISDEKLYDVNFFQDYFKNKEVGVSEGIENLQAQYRAFQEERD
KEKVSTEEIEEAFETFKEKRDAVHEFEVKLTEHQIEKLVDEGIYIKVSFGINQSGLIFIP
NYQLDIMEEENQKKYKVYIRETTSYFVYNKEHSDKNQYIKGRTLIRQLTNDSRVIPYRRP
TVERLQEKISEISLLIELTETDKKYQDIKDNLVSEIAELDIKLTQTNEKIATLNKMAEVL
INSKSEGSGSQKLARHEFSKLNMTESTTLEQVNEELLKLQQEFGNVLDEYEKTIRKLGQL
FKVFDECINKEIMNEI (SEQ ID NO: 802)

>orf01419
MVCLIIDVSPYSTLCDIVVPKTHFLRQLMELCDFSFIYDELEKNYQPDFGCRSYSLLIMM
FKYLLLKDIYKLSDVDVVERSFSGMTFKYFLGLAPVIEPSSLTKFRKLRNKDERLLDLLI
AKSVQIAIELGLIKSNILIVDATHTKVHYNHKKPQEVLRERSKALRKTIYQYSEYIKAEF
PSKPQEDTLVAELRYTQEVISVLEKHDELTGIPAISQNSITLKKL (SEQ ID NO: 803)

>orf01420
LESSVKEEARIGHKSADSSFYGYKEHFAMTDERIITACVVTSGEKSDGPVLEELYHKSKD
NGVTIEAIVGDRAYSGKDNMQFTKKERVH (SEQ ID NO: 804)

>orf01421
MSVFKFRIFGFYLVAMFGLFFKIGRFLKPLLENMFIALKGYQISLRLSPFFITAHF
(SEQ ID NO: 805)

>orf01425
MQEHYTPKGKHLTIDNRRLIERWKNENKSNREIAGLLGKAPQTIHNEVKRGTTLQQVRKG
LYKKVYSADYAQTVYQFNRKRSVKKLILTKEIREKILHYHKQKFSPEMMVNKKQVKVGIS
TIYYWFHNGHLGLTKADMLYPRKRKGVKKQASPNFKPAGKSIEERPDVINLRLENGHYEI
DTVLLTKIKNYCLLVLTDRRSRHQIIRLIPNKTAESVNQALTLLLGEHRILSITADNGSE
FKRLSEVFPEEHIYYAHAYSSWERGSNENHNRLIRRWLPKGTKKTTPKEVAFIENWINNY
PKKCLDYKSPSEFLLGG (SEQ ID NO: 806)

>orf01426
MLHPIFIIRRSWDGIFHLSEWKRNEEFDFFNKMDVPYLSMSSRIEVTQAINFHKKHSISL
YAIISWCVMSAINSIPELLMDTDGKIVWQYNQRGCSFTTLTSEDKLNFSSFTMGDNLIEF
VSAFNINKQKAEEGQKPNIDKNNIAYLSCVPWIDFLHVSTPMNLSKIDTVPRITWGKVIQ
ENQRYFCTVNLQINHGMGDGLHVSNFFVLLQRFVNKINEYFQKK
(SEQ ID NO: 807)

>orf01428
MSIFIGGAWPYANGSLHIGHAAALLPGDILARYYRQKGEEVLYVSGSDCNGTPISIRAKK
ENKSVKEIADFYHKEFKETFEKLGFTYDLYSRTDSPLHHEIVQELFLQLYEKKFLYTKKI
KQLYCTFDNQFLPDRFVEGKCPNCGTHSRGDQCDNCSAILDPIDLVDKRCSICSNEPEVR
ETEHFYYVFSEFQNLLETYLNDAEETVRWRKNAINLTKRYLREGLPDRAVTRDLPNGIPV
PIDGFRDKKIYVWFEAVAGYYTASVDWAQKLQNNITDFWNNRTKSYYVHGKDNIPFHTII
WPAILSGLEIEPLPEYIISSEYLTLENKKISTSNNWAIWLNDIIKKYDADSIRYFLTINA
PEMKDANFSWREFIYSHNSELLGSYGNFINRTLKFIEKYFESEIPTKYLEGEILYNLKEL
YTTVGNLVESGHMKQALEEIFEYIRSANKFYDDMKPWALRESDIEKCKEVLATCVIIILN
LGQMLNPFIPFSGKKIEDMFKTKLNTWNYISNLPNKLSDVSMLFDRIDLKKIDEEVLELQ
QTSSR (SEQ ID NO: 808)

>orf01429
LNNLTLLKEYNFRDLGNHLTQTGQKIKPKTLFRSSKLFGISKIDVDLLQSYGITKVIDFR
SANEIKKAPDPDIKNIKNIVIPIFYNDDSELTEFPIEFFNKSDAGFQHMIKTYDQMINQK
QSKLGYKKFFKLLLSHPKDESLLFHCSMGKDRTGIASLFLLYILGVDMNDIFHDYLLSNK
YLINVRKENIEYVNNHSGNVILMHNLLSLSSAKEEYINRVLNVLDKEYGGILRYINTELG
ISSQEIEELKDRYLF (SEQ ID NO: 809)

>orf01431
MDFLNEVLDLKEFIQDPVRTLSLGQRMRADIAASLLHNPKVLFLDEPTIGLDVSVKDNIR
RAITQINQEEETTILLTTHDLGDIEQLCDRIFMIDKGREIFDGTVNQLKKTFGKMKTLSF
ELHPGQDYIVSHFEGLSDIYVTRQELSLDIQYDSSQYQTADIIQQTLSDFTIRDLKMTDA
NIEDIIRRFYRKEL (SEQ ID NO: 810)

>orf01432
MTKLWKRYKPFVSAGIQELITYRVNFFLYRIGDVMGAFVAFYLWKAVFDSSHQSLIQGFT
LSDMTLYIIMSFVTNLLTKSDSSFMIGWEVKDGSIIMRLLRPVHFAMSYLFTEIGSRWLV
FVSVGLPFVILIAGLKLLSGESFLQIVLITTVYLLSLILAFLINFFSIFALVFQLLCLKT
YGDQIF (SEQ ID NO: 811)

>orf01433
MKKYQRMHLIFIRQYLKQIMEYKADFLVGVVGVFLTQGLNMLFLNILFQHIPLLDGWSFH
QVAFIYGFSLIPKGIDHLFFDNLWALGQHLIRKGEFDKYLTRPISPLFHILVETFQIDAL
GELLVGVLLLLMTITSLTWTWAKVFLFLISIPFATLIYTSLKIVTASIAFWTKQSGAIIY
IFYMFNDFAKYPIAIYHSFLRWLISFIIPFAFTAYYPASYFLKDKDGLFNIGGLILISLI
FFTLSLKLWNKGLDAYESAGS (SEQ ID NO: 812)

>orf01434
MIELAEPLPEYEILLSIPGIAETTATSIIGELETFVAFSLPTKSMPLSVLTSDTMNLAIS
(SEQ ID NO: 813)

>orf01435
MLGWKDGHEVPILFPCRSREKVLYFWKGNLKHLVQAILSPNDVFCQILIESTEVTQILID
FFLNISWFAVKDEL (SEQ ID NO: 814)

>orf01437
MMRTVFRMDVSKASSEVAILVNGEKVHGYTMPNDAIGFSRLLEDLK
(SEQ ID NO: 815)

>orf01438
MKKNNVEIIKADSLVRRRGDNVERHLKRVAAYCRVSSDSEDQKNSYDSQVRHYKEYISQR
SDWELADIYADEGISGTQVGKRQDFQRLINDCANGEIDYIVTKAIARFARNTLDTLKYVR
MLKDMQIGVYFEEENIDTLTMDGELLLTILSSVAQQEVENTSAHVKKGLKMKMQRGELVG
FQGCLGYDYDVETKQISINKKEAKIVRYIFERYLEGIGGKVIARELDELGYKSPRGLEHW
NDTTVLGIIKNEKYKGDILMGKTFTVDPISKRRLSNFGEEDKYYIKDNHEPIISKEDFEK
AQEIRLRRAGNKKTAANVNGKRERYSKMYAFSSMLECGFCGSILSRRSWHCRSDYRKVVW
HCVTSIKKGKKFCKHSKGLEEIAIEGAFLEAYRQVYHSNENLMTDLLETIESELNDNSLN
KELKRITNKLRILLKKEENLVNLRLEGKVSDSIYNEKYNEISSEKEFLAEEKVNIETTLK
SEIDVKKRLTEFKHLLSSQKMLTEFDRAVFESIVEKIIVGGVNSNGEIDPAMLTIIFKTG
EIQNKDGKQFKSKRKNAKLETDKLCPQNSDEDKKLYSQGTDNTRGVCSVAGSILASQ
(SEQ ID NO: 816)

>orf01439
MGGNPPMKKYSIVDKIVLSTKIKRIIIFTVFRENWEPYMKKYTEVFQSQFPNLNIDYLLL
DTEQIDLDSYLDADIIIIGGGNTEKYIATYVNQEFKSYIDHMLNKEAKIIGFSAGALLLG
EKVYVSPNDNSDHQIKIKNGLGLFSQFLISVHYDSWNDKANKDRAEELVNVPIIPLNDHS
CLVLDKLGNIIEKID (SEQ ID NO: 817)

>orf01440
MDDEASKQLSDSRFKILVGVQRTTFEEMLAVLKTAYQRKRAKGGRKTKLSLDDLLMVTIQ
YMRE (SEQ ID NO: 818)

>orf01457
MGFSMKLIHDLDTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 819)

>orf01492
LILNEYEKRIFHEKTHNIECFDTCYYAFFIIFAPFLAFVIDKHCSSSLFLER
(SEQ ID NO: 820)

>orf01520
MSQVKGLCVLDVDGTLILEEVIDLLGREAGHEAEISQITSRAMRGELVFESSLRKRVSLL
EGLPILVFDNVFNSIHLSLNVPEFISILQKNGILVGLVPGGFTPIVGEISKIPWYCLFHC
QPA (SEQ ID NO: 821)

>orf01521
MLKSAELGIAFCSKEMLKKEIPHHVDKRDFLEVLPLIDCLE (SEQ ID NO: 822)

>orf01527
MGFSMKLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 823)

>orf01537
MDKLIIFIEKGKPFFEKLSRNIYLRAIKDGFISSMPAVLFSSIFILIAAVPNIFGFKWSD
EQLAFILKPYNYSMGILALLVAGTTAKSLTDSVNTRSMEKTNQINYMSTFLAAVVGLLIL
AADPIEGGFANGLLGTRGLLTAFLAAFITVNIYKVCIKNNVTIRLPEEVPPNIAQVFKDV
IPFALSVLSIYGLDLIVRNIFGTNVAESVGKILAPLFSATDGYIGLAIVFGAYAFFWFVG
IHGPSVVEPLIVAISYANIEANVQLVQAGMHADKILNPVTQTFVVTMGGTGATLVVPFMF
MWLCKSKRNRIVGRASVVPTFFGVNEPILFGAPIVLNPIFFIPFVTAPIINVWIMKFFVD
VLQMNSFSIILPWTTPAPIGIVMGTALAPLSFVLAITLIIIDTLIYYPFVKVYDHQILEE
ERKGNSSSELKEKVAANFNTVKADAILEKAGVDAAQNTITEETNVLVLCAGGGTSGLLAN
ALNKAAAEYNVPVKAAAGGYGAHREMLPEFDLVILAPQVASNFEDMKAETDKLGIKLAKT
EGAQYIKLTRDGKGALAFVQEQFD (SEQ ID NO: 824)

>orf01552
LFKTRSNSSALGSSYISNRNIFSYFTNQFNNTFCNVFGM (SEQ ID NO: 825)

>orf01557
MALTQRQFVELFQETINVITLTCLTVSVAVVACVSICSS (SEQ ID NO: 826)

>orf01558
MLTMFLFLPIDFFFCTDIIRMSCILKVNIVFSIYLNHITTLDFTDNILVL
(SEQ ID NO: 827)

>orf01560
LVCYFDDDLFGIDSFTLANLIRSQILRFLRRLFSIYIGNTIISLTVLA
(SEQ ID NO: 828)

>orf01570
MGFSMKLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 829)

>orf01585
MEKYFGEKQERFSFRKLSVGLVSATISSLFFMSVLASSSVDAQETAGVHYKYVADSELSS
EEKKQLVYDIPTYVENDDETYYLVYKLNSQNQLAELPNTGSKNERQALVAGASLAALGIL
IFAVSKKKVKNKTVLHLVLVAGIGNGVLVSVHALENHLLLNYNTDYELTSGEKLPLPKEI
SGYTYIGYIKEGKTTSDFEVSNQEKSAATPTKQQKVDYNVTPNFVDHPSTVQAIQEQTPV
SSTKPTEVQVVEKPFSTKLINPRKEEKQSSDSQEQLAEHKNLETKKEEKISPKEKTGVNT
LNPQDEVLSGQLNKPELLYREETIETKIDFQEETQENPDLAEGTVRVKQEGKLGKKVEIV
RIFSVNKEEVSREIVSTSTTAPSPRIVEKGTKKTQVIKEQPETGVEHKDVQSGAIVEPAI
QPELPEAVVSDKGVPEVQPALSEAVVTDKGEPAVQPELSEAVVTDKGEPAVQPELSEAVV
TDKGEPAVQPELPEAVVSDKGEPAVQPELPEAVVTDKGETEVQPESPDTVVSDKGEPKQV
APLPEYTGPQASAIVEPEQVAPLPEYTGVQAGSIVEPEKVEAPKEYTGKIEQPSAEDTKP
ENEASSTNGESERPKDKIKEEKQVDKKLELRNVSNVELYTVENNKYRHITAVDGALDSSL
KYFMKVKSENFKDIMLPVTKIESTTKNNKEVYKIVAHAENLIQHENNVISNDYTYYLPKT
QQSETGVYTSFKNLVDAMNSDPNGTFHLGATMDAREVELPDDQESYVKNEFYGKLIGENN
GKYYAIYNLKKPLFKTLNTATIQNLSIKEANVSSKEDAATISKEAKYNTLIDNVHSDGII
AGERGIGGLVSKVDNSRISNSSFTGRITNTYDTTAGYEIGGLVGKLSGSLASIEKSIASI
DIASNAKSGDQIVGGIAGVVEKSATIKYSYVEGNVNNVRHFGKVGGVAGNLWDRDSQDVS
KSGKLSYVLSDVNVTNGNAIAGYNFNGIKTIETYSNKNNKVVNVVQEDDEVVTKDSDVQR
GTVLDADKVKEKKVELVSKHSTKVEDFDFTSRYNTNYNEVTGYQQSREQVYKNIEKLLPF
YNRETIVKYGNLVEDNSDLFTKKLLSVVPMKNNEVITDINKNKQEINKLLLHFEGNKSRV
LNIAYKNDFSKVAEYDIANTKLMYTPNTMLHDYNNIVKTILNDLKSVQYSSADVRKVLDI
SGNIKLTELYLGEQFEKTKANIEDSLSKLLTADAAIVENNNKVIDNYVIEKIKNNKEALL
LGLTYLERWYNFNYGETNAKDLIMYHLDFFGKSNSSALDNVIELGKSGFNNLLAKNNVIT
YNVLLAKNYGTESLFKALEGYRKVFLPTISNNEWFKKQTKAYIVEEKSTIEEGREKQGKE
GTKYSIGVYDRLTNPSWKYQSMVLPLLTLPEEKTVFMIANISTIGFGAYDRYRSSEYPKG
EKLNKFVEDNAKEAAKRFRDHYDYWYKILDNDNKEKLYRSILVYDAFKFGTDKDKDKVTH
QATFETDHPAIKYFFGPAGNNVVHNGHGAYATGDAFYYMAYRMLDKDGAVTYTHEMTHNS
DREIYLGGYGRRSGLGPEFYAKGLLQAPDHPYDPTITINSVLKYEDSENSTRLQVADPTQ
RFNSAEDLHNYMHNMFDVIYMLEYLEGKAVANLETNQKYELLRKIENKFDLDQDGNNVYA
TNVVRRLTMDEVNKLNSFDSLIENDIITSRGYKDQEYKRNGYYTIDLFSPIYSALSGEKG

TPGDLMGRRIAFELLAAKGYKEGMVPYISNQYEKDAKAAGSKINSYGKEVGLVTDELVLE
KVFNGQYKTWTQFKKDMYKEREKQFSKLNRVNFINPNNPLSRQRNVSVTDIGVLERMIVE
AVRDDAQDDVAKFYPETNSRVLKLKKAIYKAYLDQTNDFRSSIFENKK
(SEQ ID NO: 830)

>orf01588
LSLLKKDKFSIRKIKGIVGSVFLGSLLFAPSVVGASTYHYLDYSSLTQTERDQLKQGRPD
ESKESYALDYEKDALPNTGSSQSIMTALGLLAIGSLIVIITKDNRNKKIATFLIVGATGL
VTLSTASALNLNANIHESGRDGVLQISGYRYVGYLELDDKTVSSVSPASTVSPVEQPKVV
TEKGEPEVQPALPEAVVTDKGEPEVQPTLPEAVVTDKGEPEVHEKPDYTQPIGANLVEPE
VHEKLAYTESVGTTGMDENGNLIEPPVSDIPEYTESVGTTGVDENGNLIEPPVSDIPEYT
ESVGTTGVDENGNLIEPPVNDIPEYTEPISTVSEVASEREELPSLHTDIRTETIPKTTIE
ESDPSKFIGDDSVKEVGEDGERQIVTSYEELHGKKISEPVETVTILKEMKPKILVKGTKE
NPKEKTVPVLTLTKVTEDAMNRSANLNYELDNKDNAEISSIIAEIKDGDTVVKKVDLSKE
KLTDAVQNLDLFKDYKIATTMIYDRGQGSETSKLDEKTLRLELKKVEIKNISSTNLVKVN
DDGTEIPSDFMSEKPSDEDVKKMYLKITSRDNKVTRLAVDKIELVTEKEKELYKITASAQ
DLIQHVDPSKTRNEYIHYIEKPVPKVNNVYYNFNELVRDMQEHPNDEFKLGADLNATNVS
AFGKSYVTKDFKGKLLSDGDNHYTIHNLSRPLFGNVIGGTIKNINLGNVDINMPWANQVA
AVANIIKGGTTIENVKVKGNIVGKDWVSGFIDKIDNQGTLRNVAFIGNVTSVGDGGQFLT
GIVGENWKGLVERAYVNANLIGKKAKAAGIAYWTQNEGNNNTVRQEGAIKKSIAKGTIQV
TEAIESGGVVGSMKHHGSVEDSVSMMKVPNGEIFYGSSDIDYDDGYWTGDNVRRNYVVIG
VSDGHSSYQRSKDKNRIRPISEEEAKSKIEATGITADKYEINEPVVNRLNRLTRREDEYK
STQDYKVDRDLAYRNIEKLQPFYNKEWIVNQGNKLAEDSNLAKKEVLSVTGMKDGQFVTD
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KDRLATVELISPEVRALMDKRDTSRDPNANSDERKNGYIRDLYFEESFSETKANLDKLVK
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FYGKSVDLLDFLIRIGSSERNIKGDRTLDAYRDMIGGTIGKSELHGFLDYNMRLFTNDTD
LNDWFIHAAKNVYIVEPKTTNPDFVNKRHRAFDGLNNGVHNRMILPLLTLKNAHMFLIST
YNTMAYSSFEKYGKYTEAEREAFKDKIKEVAHAQQTYLDFWSRLALPSVRDQLLKSQNRV
PTPVWDNQNYHNVEGVNRMGYDKNNKPIAPIRELYGPTWRYHTTNWYMGAMASIFQDPNN
NDQVYFMGTNMISPFGISAFTHETTHVNDRMLYFGGHRHRQGTDVEAYAQGMLQTPDKSG
NGEYGALGLNMAYHRENDGDQWYNYDPDKLKTREDIDRYMRNYNDALMMLDHLEADAVIP
KLHGNISRWFKKMDRQYRKNGELHQFDKVRELTEDEKKKIVINNIDDLVNNNLMTKHGAP
SDRTYNPEDFDSAYVNINMMTGIYGGNTSQGAPGAASFKHNTFRMWGYFGYENGFISYAS
SKYQGEADKTNKKLLGDDFIIKKVSKDKFNNLEEWKKQYFKDVKSKAEKGFTAIEIDGRQ
ITNYAQLKTLFAEAVQKDIDGMSDPKIKDHFKNTVDLKSKVFKALLKNTDGFFNKLFKED
I (SEQ ID NO: 831)

>orf01603
VLGGRANSVTSCTTNSHWNLTFTTKHVTCFSSLVDDIVHGNNREVHEGHIDDWTKSCHGC
SCCCSRDGSFRNRTVTDTFWTKFFKHSNRSTEVSSEDTDVFSHQEHIFIATHFLRHSKDN
GVTEGHCFCFHFISFSLVCVNIFKG (SEQ ID NO: 832)

>orf01604
MDMFYIGHFLDIRRDTVTVVNAIENDWQVPDRSHVHCFVENTFIGRTISKEADNDFTGIL
HLLTEGCTDSDPHTTTYDTIGTKVPSIKVSDMHRSTFPFTGSSVFTKDFSHHSVEVNPFS
NSLPVSTVV (SEQ ID NO: 833)

>orf01606
MNXXDFIGHCDKIKRNIFEKSHKVFSGLFGLHPKDFLNLIFSNQIPLPFSECNPLTNYNH
LFSLIISDKRDIVIHWI (SEQ ID NO: 834)

>orf01622
LIEIQVFSSLQVCCLNLCHLKFQHFDTCLVFLLVFLDFQNLLAHFPIGIKTRLIGFFQVP
KSGITKFIQHLDMQLGTH (SEQ ID NO: 835)

>orf01623
MVMLTMNIYKMLPNSSQNRQINHLTIYTADTTTILQDFPTDDNFIT
(SEQ ID NO: 836)

>orf01624
MTNNICRRTSSQHHIHGINDNRLPCTRFTSQDSHPLFKIEGNSLNNGKVFYRNFK
(SEQ ID NO: 837)

>orf01634
LFVIRNPSSQTLFQTQLQLVQALQITVIQALRLSKDNRLTAFFQSLLFLR
(SEQ ID NO: 838)

>orf01636
MPHTRDNWQTRFKNSSYHNFFVKGPEILNRTTSTTNNEQIQIVPLISTRNISSNFLRSPF
TLNLGRIKKDVNTWESPADGRDNISNNGSTTAGYYPNSLRKLGQSLLEAFLKQAFFCQFF
LKLFKLNRKRPNPIRLNFFNDDGVATTWFIDLYTPNHIDLHSFFQVKP
(SEQ ID NO: 839)

>orf01637
VTLADFVADRRAATPTAAAELATPVTKVGCISSFAKSGKTDGNGSPKCSI
(SEQ ID NO: 840)

>orf01640
LAIIRNRTCSLKLINDHLTFWTLRFLTSTRILIELATINLNCRIHRGNLSNRPSQASNRF
INKLFIQGRQNRGFCDHFPTSILSRRGIAQSDFPLIDLTLVLHKLDHACRLANRNRQNTH
HIRIQGSTMTNFLGSQNLTQFKNRIMRGHSCFLF (SEQ ID NO: 841)

>orf01642
MEDDLNYENLMDDVTEAIKKFNLVIFIGAGVSIAQGYPNWNNYIEHLIKYWQGQVLSVSG
EKRLGREHHVVFDLISKSSISNKRKVDLVNYELKKVFGEDFEKRRLDFEKGYFKNLLPYS
IVNQTVESLASLNAIFITSNYDYEIENHIKRLKNAVVTINDLNEFTKNKNGKLQFGDVLH
IHGTPDCDVKYFVSSSADYSKTYLKNRENFENLVTWFKETKPTVLFIGAGLEEDEILSLL
CKDSKNYALMKSENTGNQRVDEHYRGVVEGFFSSENHTQIIWYGDEFEKLPLFVKKLVAD
INEKLGTHDFYNQWNNLLNPSINQEEYNKNLDSISNDFKYLSSVLDKVIENDNNQLDQLM
LNALLRSETLTVIKKNFVLVFWKFIVKNIEKLSDNEWDVIYKIIYEGSQNYFIDDVFFVY
NYAIDNKISSFTNNNKLNELREIISKDGYIVNSNFNKDKTLLGYWLVSAFEQQNRDLYIK
EDSEVEVNLNYECVNKLMSILNNPEFLSYNYYSIEHQLKEYDVVKFLYELVKSKKLFIEE
EKFLESDSEDLISTILIQKLLVQLDNEINLDLEFIKRLIDKIDFSNIHFGEELNTFIKEH
RSIIREKNIEIPKKPYRNWISSLEGGFVSQFSYLTQENLVEYDESRVLEILVNAEKEQRG
SSFLEEKTINETENFFITVLKESNEISKKVSDLLKNHIDDLYPKYKRLYVKIISFPEIEE
NLRKIVREKYLKRFNKESFDSNDRKFFEYHIKQQNTDIDIFEKLLSINVNELSTPKGDNK
QLDILHFINSEMGSYFQCLISLFINHSSYRDVIIQIINSVTDTDYREFAQGILLNEYNPN
RINVTYNTFLGFAYYHSTITIEAADVFTDVVRDILNKKIEDNQILNKVYLVALERVDPTI
ESFSLSKNNYSQMINIIFTGDYEFRYSKEWLGALFKFDSSANYLVTIFYLLYNENLKKNR
FALFIEELSDYLTTYNQKLSLRGMNYKLNHEELNNFDLLKKMFLKLMETDKIENDIFYLD
GIKSILPLLSLDDRRNVLQHIQKQNNCPPPEIEELQRIIVN
(SEQ ID NO: 842)

>orf01645
MFMSNLCQFFQVWNINQGVTQGFNQDKLGIVFDSCFYFLQIINIDKGCCDTITRKEFFQK
IEGSTVNSRSSHYMVTSMGKRQNRISHCSHT (SEQ ID NO: 843)

>orf01646
LINVFSHGVDIAIHSATKFIGGHGTTIGGIIVDSGRFDWMASGKFPQFVDEGSSCHNLSY
TRDVGAVAFIIAVRVQLLRDTGAALSPFNAFLLLQRLETLSLRVERHVQNAETIVDFLVN
HPKVEKVNYPKLADSPYYALAEKYLPKSVGSIFTFHVKGGEEEARKVIDNLEIFSDLANA
ADAKSLVVHPATTTHGQLSEKDLEAAGVTPN (SEQ ID NO: 844)

>orf01647
MTCDFKFETLQLHAGQVVAPATKSRAVPIYQTTFFVFDDT (SEQ ID NO: 845)

>orf01651
MAWLLVGNVGVRQVLEHLNAELKKVMQLSGTQNIENVKPFNSVTSIKPTLPNDPPDLKFI
DKKNAPPKCGVFLCYGKKFVLKNKKNEIRIGRIVQDSQIDF
(SEQ ID NO: 846)

>orf01656
LKKKWFFADYYDTTIILLALISVILVLLGFAEMIDLDNPPYSIIDLVIWGVFVIDYSWRF
FITKRKWRFILENVFDLLAILPLNAIFTVFRLGRIFRLARLTKLLKLTRLLRIIGLTGKL
ERKISRFLRTNGLIYILYVNIFIVLVGSSILSVVEEKSFSDSLWWALVTVTTVGYGDIVP

VSLFGKTNYRAKEY (SEQ ID NO: 847)

>orf01666
VVDFKQTRQDPHDITIYSWLRQVKSNTGNGSCCVRSNPFQAGNSFIGIWKLATKVSHNLL
GCSLHIANSRIITQALPSFQ (SEQ ID NO: 848)

>orf01671
MAERTVVQVHNAFPEDTTLINSQLIPLVQVVVNQGRKGIVGSCNSMHISSKVEVDVFHWQ
NLCIPTTSSTTLDPHDWTKRRFADSNHGFLANLVQGIRKTNGKRRLSFTCRCWVDGSNQD
QFTDWIALNCTNFIKAEFSLVLSVQLQIVVRNTKFLYNINNWLQLNTLCDFNICFHSKFL
(SEQ ID NO: 849)

>orf01684
MLFIIGHLNFPTAGSFIDSTLHRLGNRVCIHDDMAFTVTSSTSNSLDESTFVAKETFLVS
IENSYEAHFRNVNSFTEQVNSDQDIKDTQAQVTDNLRPFQGLDIRVHVLDLDTHFLEVVG
QILCHFLGQSCDKGTLIFFNAGIDFTQEVINLSHSRTDFHLWIQESRWTNDLLNHCLGLF
IFIVTRCR (SEQ ID NO: 850)

>orf01685
MNVTLKLLPTERTIVQSRRQTETIINQHFFTRTVSIVHALDLPYGHMTLVNHNQEIIWEE
VEKRIRRLSFAPSIHVARIIFNPIGIAHLTQHFDIILCPLFQTLGFKQFTFLFKDS
(SEQ ID NO: 851)

>orf01686
MIHFSQHLTCQSLNFTNTVNFVSKKFYSKGMFISGSWENLYHIPTNAKSSALEINIITFK
LNIDQVIQEFITRNL (SEQ ID NO: 852)

>orf01687
VAKLVNLVIDRTILLNIGIARRDIGLWLVIIIVGYEILNCIFREKFLKLPIELTSQSFIV
GNNQSWFIDFRNDLTHSIGLPCSSRPHQNLSFFSPLNVIHQLLDSLGLIS
(SEQ ID NO: 853)

>orf01705
MNITQTDFLAVNLVFAISTTIDMAFHPDFLTCILDKSVMIIQSHNYRSIIERFATFCSSK
DDIRHLAPTETLDTRLPQSPTQTFCNIGLSRSIGSNNCRHTLVKNDLGLISKRLEPLNFD
FL (SEQ ID NO: 854)

>orf01707
MSFIVCNHLKFACFNLRNHDLIDKFLDLGHILIQKKGTKKGFKGITKNGVTIATTRFFFP
FTQLDKLVKLAITRKTS (SEQ ID NO: 855)

>orf01719
LFTCFSKLDNKTASTTYISHKFFTAIPVCFEFFKGFWFPRKDTTKKNIFIPMFLVECFNF
WVELR (SEQ ID NO: 856)

>orf01726
MTKKIVALAGDGIGPEIMEAGLEVLEALAKKTGFVYEIDRRPFGGAGIDAAGHPLPDETL
KACREADAILLAAIGSPQYDGAVVRPEQGLLALRKELNLYANIRPVKIFESLKHLSPLKS
ERIAGVDFVIVRELTGGIYFGDHILEERKARDINDYSYEEVERIIRKAFEIARNRRKIVT
SIDKQNVLATSKLWRKVAEEVAQDFPDVTLEHQLVDSAAMLMITNPAKFDVIVTENLFGD
ILSDESSVLSGTLGVMPSASHSENGPSLYEPIHGSVPDIAGQGIANPISMILSVSMMLRD
SFGGYEDAERIKRAVETSLAAGILTRDIGGQASTKEMTEAIIARL
(SEQ ID NO: 857)

>orf01727
VVRNTASHLTCILFLNKGISVYIGNSRSLKHIKIKPCCIKDGFCISVFNSDQNPILGIDS
ICYRIDSVGHQTNRLVKELIDSIKDCFNGTLPCRIKFDFLTIHIG
(SEQ ID NO: 858)

>orf01729
VEAFWIFNHGSSYQSSNICICDFLLLIGQCLELSKEWFDILFCKI
(SEQ ID NO: 859)

>orf01732
LANIESHCNFFQSSISSSLPNTIDSPFNTSCTILDSSKAICHCHSEVIMTVRRIDDLTIR
LDILNQVFEDGTIFL (SEQ ID NO: 860)

>orf01741
MQEHYTPKGKHLTIDNRRLIERWKNENKSNREIAGLLGKAPQTIHNEVKRGTTLQQVRKG
LYKKVYSADYAQTVYQFNRKRSVKKLILTKEIREKILHYHKQKFSPEMMVNKKQVKVGIS
TIYYWFHNGHLGLTKADMLYPRKRKGVKKQASPNFKPAGKSIEERPDVINLRLENGHYEI
DTVLLTKIKNYCLLVLTDRRSRHQIIRLIPNKTAESVNQALTLLLGEHRILSITADNGSE
FKRLSEVFPEEHIYYAHAYSSWERGSNENHNRLIRRWLPKGTKKTTPKEVAFIENWINNY
PKKCLDYKSPSEFLLGG (SEQ ID NO: 861)

>orf01752
VHAHTDKLCNGCNRIFNSIISHHTIFRERNKLSHKAIKSTRQEMGPCHVVFIEFFITLHR
RLIGNHDNFLTNLVGSGRVRNDGST (SEQ ID NO: 862)

>orf01753
VNHCHWKLFIQNLGITFSLIVTLIRMTDSHVVGTDKDMIFLVNSLFLIFDIDKLRLS
(SEQ ID NO: 863)

>orf01755
VGNNDILWSKRTISINGFNDFLNTCIAVSTTLCNDDTFLIKRKIFIYKIFCMRNPVSMNT
NYNFFNTWLQDKFFNCMNQNRSIT (SEQ ID NO: 864)

>orf01765
LVAPVASSTRFFKNNDSLTSWNNGFIIITINTIISYQRISKGQDLSIIRLVCNGFLVAGH
PCIKDDFACYINICSEGLAFKNCAIF (SEQ ID NO: 865)

>orf01767
VVCYFYITIDWSWVHEDCCFFQTIVTFLSQAMLGMVVFF (SEQ ID NO: 866)

>orf01768
MAFVLHTEKHHDINLINDFINGYKLSIVCKLLTSPFLRSSEKEFRSQAFQNLHIGFGNA
(SEQ ID NO: 867)

>orf01769
VVQVTCNSNFKTLKVAKFLINGHQIKQALARVLARTISTIDDGSRNRWTSNQFSIVVDLW
MANHTDIHS (SEQ ID NO: 868)

>orf01770
MCPCRILKEEIGNNRMVFIGKLGSIFKLNSSLDQFHYLIDSEVFHGHHMVQCLLIF
(SEQ ID NO: 869)

>orf01776
MSINCKGWNPKSYTHDNIGCLATNTCQTLQFFTCLRDLTIKIV
(SEQ ID NO: 870)

>orf01790
MPDCTLTNFLDKVLYNRQGNVGLEQGQANFFGCLLDIRFRDFSFFT
(SEQ ID NO: 871)

>orf01793
VQFHLIIFQNLFCSLDIVIDSLTTDTELLGNFSKAVIISVVELDIIHLLICQKRRIKFKE
RIHTIGFFDFHNFYYTKN (SEQ ID NO: 872)

>orf01796
MKFNHYFFLFLIIEKQVAIISFFMHFHIIKLVNHFQLLIKLNCISHPNLHIRPSFLSLVL
LFYQKEQDFAIMVI (SEQ ID NO: 873)

>orf01799
LANNRKTETLGVSYLSTFIDKHELLQSYFESNDKTPVWDGEIHVLKSPSEKKDEILGKVP
VQIKTTRQKKDVLKSFSLDTRDLELYKPNGGVVLFVVWLNEDNGLRDIYYKSLPPLSIKN
LLKKSKLKNKSTNRKKLSIEIFKLDEKKMYPMLVDFINNSQKQYSFINVEGISVEDIPDD

KTLKFYFYGQEKEEIFNYQEEHDLFIYYLDPITGIEIPLENTIKIVETEEETDLIIKIGD
YVFQDVKRHRFPDGSVQLHFGESFTMSFDIKKKQFKFNYTRPDLLSKAIKCTQVFQELGK
IGYFTLNGNKIELDERSIKDISSLDLEADIKGLLKISNFMKKMGIQKDVDLSCFDKQSQR
NLNILYSGLVLKKKVALNYNESKLLHLNIANIHIITLYSFLSDKNGTMIDIFTETPWCRE
GETEDEDYLDISIFEVFEPNDWLKIDNCKIDSVIASYQRLVDNKLKYEGADRTILKIVIA
ADMAEDKTKRELLLNWAQCLSDWNLKYSKNCEMAIINDLQIKSRVRKLNSKETETLTNIL
VNSNDNYELCFGSSVLLKSKPQADLFWNKLDNETKERYKDFPIYTLYMKLS
(SEQ ID NO: 874)

>orf01800
MKVSKKITLFSLSFAGFVLLTLPQAGKAFELKEDWAFKGGIRYENGKVSKINNGYEVNIK
VLDLPSTSAIEWTVRLNGEKQNTNFLAEERTVSKTEDKGRFLHFYIPYGYRGDIVVEAKS
GNEVKTWSTKVVDDVYSDSAKSGYFILDGEQILESSWDSVNESYIATLPTVTSGKTVVAW
REKGTLNLIKPGRIARQYNSSGSYVELSPIFETASWLKSNQNWYYQKQGQLVQNSWIKDQ
GSWYFMDDEGVMFNQTWLHQGGSWYAFKSSGAMISADWLYDNGSWYYLKDSGSMVTGWLK
NGGSWYYLNKSGSMATGWIKDSGTWYYLKNSGSMATGWVKDSGSWYYLKNSGSMATGWVK
DNGKWYYLASSGNMLRNTRTPDGYYVDGSGAWK (SEQ ID NO: 875)

>orf01801
MKKILLSTVALLSLVASLLANNPVSAQESSSQATYSKSSGSWIKSGNRWWYKHSDGSYTT
NGWEKINGTWYYFDSEGWMKTGWIKEYGKWYYLDDSGAMKTGWCLVSGSWYYLNSSGVMQ
TGLQTINGKQYYLAAGGAMQTGWHNIGDDTYFFANSGENQNINRRALVLGETSTRAVPIA
DVNAMEKVFNNQNFSEVVRFPDRTKSEIIAKMQELFESSSEGDVNYLYFTCHGGRDGRIY
IGSDGLAFSGWELASVLKQYKGKFVVMLDCCHAGTIISKDNTGEGNEGASTEYFDLDEFV
SGFSNMDGNEKSGEMIDSKFLVLCSSRGAEYSSGGSLSLATKYWSLGSGWNPLQNSQAYL
AADQNNNRRITLNELYTYSREQVLKQNSNQHIEVYPDNSQFVLFKK
(SEQ ID NO: 876)

>orf01802
MENFGAVLKDIRISKNFRLKDLSCNEISESTISRFENGITKLSINHFYILLNRLGISFSE
FEELVHCYYSKKECLFEELEHAVNSSDIFLLQELVDKIELKQKQEKSLCNYHIKLIAEQQ
INRLANLPYNSSKCNELIKYLLSVDTWMEYELKLFYNSVFFMNTRTISLLYRIVIKKTRY
FLKTNTGTHRIIPLYLFNLKLLLKNNLLGSAQFFIDDLENLLTRQGYYFEKNYLLFLKGI
YLIKTNQIELGKKECFKAMRIFKEYNDSDTINELNQKFKLDLTI
(SEQ ID NO: 877)

>orf01803
MSSIYSSAKKDFLYWNVLIFIMELPNDVKVQFYELRKKVQSFNQLSKRFGMDVSG
(SEQ ID NO: 878)

>orf01810
LSFLILSPAGAQESLSFFFVKITDASKTVKNGGQTETQKLVTKMASDFERVENKDSEVGK
IVKEKLALSGDITEAKLTEISSALLAFEKEQNPVDLDAEKEKLVNRLSPRFETLEQAIAS
KDLEKVREAFKKMNSTWTINESVVRDNSTAHYGRVETAISFLPSSMETEPTDESGT
(SEQ ID NO: 879)

>orf01812
MQKNIYFVVLDLHTTDRDKIIQLFKDWTDYSAKLVEGELVKKDGQNALFPPSDTGETVGL
NPHRLTLTFGVSASFLKRMNLENKRPRLFRDLPLFPKEQLREKYTGGDIVIHACADDEQI
AFHAIRNLIRKGRNAVPLRWSQSGFAAIGDRMETPWNLFGFKDGTANPTKEQDFDRVIWA
DSKDWMENGSYMAVRRIQMFLETWDRTSLEEQENTFGRYKESGAPFGKKNEFDEVDLSLL
PDDSHVCLAKEVDKPLLRRSYSYSDGIDEKTGQFDTGLLFISFQKDPDNFVKVQTNLGAT
DKMNEYITHIGSGLFTCFGGVEKGGYIGQKLLEG (SEQ ID NO: 880)

>orf01815
MTGKKGFLFLNCHICMVTTTTCFLKERVESELLIFFYISLNRCLITV
(SEQ ID NO: 881)

>orf01818
MSLRNKIEQHIKELEGGKFQKLGDAYLSRKYNFNIVSLGSQEGTDKTTKGIPDSYAVENG
KYVYIMYGTHKSVISKLEGDIQSVKKKILEENIAEDKVGRLICCHTSSNITIKQKEDLEK
MAEPYHLELIGINEIANDLTKIDFQYLAKEYLSISESTEQVWSINDFIRIHDESKTNAPI
SNDYIGDVSEIINTIKSSEKRIFLISAKPGTGKTRLAIEICSLLDRNKYNIICVKSNNQD

IYQDVKRNLNLHKENIVFIDDVNTTQNYISTLGLLNTTSNIRFILTVRDYAKKDVINNIK
VYGYNNIEPELIKDDNFKELLNQFSRNDFTNQEIEHIKTISKSNPRIAVIAAKLSSSQDL
TNFNDEIDILKDYYEEILNKNNIIYAEQKTLFILSYLKKIRLESLEENQEFNKLLKITDI
TNTDFKSAVEKLHERELCNIYNDKIVKIADQSLDDYIVIKFLINKKISILEILHELYPVN
DQRVVQILNQCSNFIRKESDLEGVSDAVKSYYYNESNFESDELKEKFLIQFGVLLPLEAI
SHVKNKIDNIESQVYTKTNFINQKDKKGSIEDSVLNIVFVTTRTKYCSQILQLLLKYFDK
NPNKISEVYSILEANYGLVTEREYIDYTLAENTISELANLDLTKSYNQELIVTILKQFLK
IEIERTEAHEEKFTFGRYKVPDSEKLKQYHRSILKLLANLYNIGSCETRFYIEKMLYDYR
RKILTYSESHRNTIFGDLRNIRKLFFNDIKNLSMIGEKIVYALHKAEVKENLPIVFDDYI
ISDRQKIYNNLTNPNHAWFYDASEIKLQQIANSYSNVWLKIFNFANQFKHSLFMNDNNIE
LVLFNMFLLSKNDKKIKFLNYMFKSNYHFVNMNPISFLENIEESSMQSVIVSSPESEKYE
WQLAYLTQLENVKNEDLQTLKSILEANSLPCYFTILNFERLILKDPSLKELLIQKAGNTN
FVISDFIREEEVPKLINLIGVKELKFWYLINLENCQNHSYNLFQKLGEKDVDFSVEVLKK
IDELRIGHSNLGYMVLHSISEFRDKKEIYKKFIRFAINRPYYYYNNMIDDIIKNDSQIIL
EILEETNNEQSAIRLVNLGVEFLENNNQKLILFNLLRAKGFGKKSFQEIHFTPYSHFYTG
SHVPVLELEKELLERIKKIFETGIDYINLLLYLNKLIDCKRKAIERELEKEF
(SEQ ID NO: 882)

>orf01822
MNESLDDITHKQFTSNLTTKADNVSVQLFFSIKGCCHITNQGRTYTWNFIYSVVDTNTSS
TDTYLKISLAASYSFPYFFTKDWVESPCMVICTKVNDFISF (SEQ ID NO: 883)

>orf01824
MAISQMKRISLLFSKSSLDDVLKTIQELESVQFRDLKVQDNWSEALEKDEVVFPTIQISH
TSNSNHGVIEGNDALIYLMNQQQYLEATVEKLQEYLPKENTFKLVRQPPITTSYKELEKL
VKLMLPRVFLKK (SEQ ID NO: 884)

>orf01826
MNRACIIQPSLVEIQIWLLNHVCKCSDFLSHRMRSLLDRKLDLISLLIKLFPKKNWKN
(SEQ ID NO: 885)

>orf01828
LNGGEFLETEFGHSVLAIQSVVWFSFFCLKSNASSLAHGI (SEQ ID NO: 886)

>orf01829
LLAGILELENWGKTTELRPTLLSGPVQNKIEALKRAKI (SEQ ID NO: 887)

>orf01834
MRSQNHNCRPSTRKVGCIGPIFFGHLLNHRKFSYQVLTITLMEEVSLDCLPSGHHVSCQQ
GSNRYIGDRTCSNSFLIRQFFRQDTTAVAST (SEQ ID NO: 888)

>orf01861
LRQNRCYNCFHDHSCSWKSSRITSLHGCLVRFVGFDIHTHKRFIKSRNGFHDPTNNDGLP
ISHTTFKTT (SEQ ID NO: 889)

>orf01862
LAAFTITSLKAKTKFHPFKGIDRDNSLSQSCIQFSIPLDIGTKTNWNASDDCLHNPTDGI
TTTFDLVNIVLDFLFSFLVDNRNFRLGSSLLNFSDCQIFRNIYFLTTKDHDMVGNLHIQL
SQEAFGYCTNCHPHGGFTS (SEQ ID NO: 890)

>orf01863
MTWARMSNFPLAFKAVFNVLRRHDVQPFLVVLIDDIHSNRRPCRLPVANARSKDNLVTLN
LHTTTTTVATLTASKVLIDILSCQWKSSWNSLNNSC (SEQ ID NO: 891)

>orf01865
MHDLAITGSRFDGMANSVAKIEVKTNTIVQLIFNHHLALHLTRMFNQGLCMFQNTLNRTI
QSRQESPQFWILNQAILDNFTHPFNQLSFSEGFKNKWINQNPIWLGKGPHHIFSKWCVNA
CLSTDRRINLSCQTSRNLNKVNTPHIGRGYKASQVPNNATTKSNDSIATSQTLLD
(SEQ ID NO: 892)

>orf01867
MVICHNDYLLRLPEFSQPLTSLGHTTFFNLNIIRMMRNIDSDFHRRVSLSLLVFFC
(SEQ ID NO: 893)

>orf01872
LIEGHLVFADKPAQALVLLRKVGSPKKVSFLTLHLYFLILKIDILKITGF
(SEQ ID NO: 894)

>orf01882
MSTTTKFNRVVTDSHDTNFLAVFLTKEGHSSHFFSSVNIRFHCLNFKSFPDFFVDLLFNR
TQFFSSYRLGSG (SEQ ID NO: 895)

>orf01887
VTWIHSHFNPAVVRIFIVWIVGHVKFFSREIKPFRACQKLISPSDSFVTEVIPDREVPQH
FKHGMVTRSLPYVFDVVGTDSLLGIGNTWIFRDNGPVKVFLKRLLPQS
(SEQ ID NO: 896)

>orf01906
MNGHFLLLFCLFNIFFHLVNIELSKQVLTVLDWETLVQXXIPFIN (SEQ ID NO: 897)

>orf01911
MRLRDLRRVDFPDPDGPIKAVISLGWKDRETLFKAFFLL (SEQ ID NO: 898)

>orf01914
LKNHSNVFTHFINVDFWTVDINSTIENLPSYFSNINSIIHAIETA (SEQ ID NO: 899)

>orf01915
LHINPLNGFIFTIVNMDILSRKGYFFFRKGKDMLLIPVIC (SEQ ID NO: 900)

>orf01920
LSPFQHCHSSGSIFFNLHFLNRNILQSFDNPFLGLIRENKIEKFCSQLIGLPQCIHMLIR
PQGPIIATYIFWT (SEQ ID NO: 901)

>orf01921
MNXXNSRCNHPTWSNFLDILEVDFLGNIVGQKIRSHDLKNPVQVFTVIDMTIHIQVVKTN
MVILADRLFQGFILRSTDKFFIKIRLVRSHNLRFNNMDFSTVAVHENKGRHHVDELLPRF
IINSKATVAKKSIVAQGFRFDGNFFRKTRQTNHLNIIFCDNPDQIIVFQNGLITNSQFNR
LHP(SEQ ID NO: 902)

>orf01930
MWYFYNTDGSMATGWVQVNGSWYYLNSNGSMKVNQWFQVGGKWYYVNTSGELAVNTSIDG
YRVNDNGEWVR (SEQ ID NO: 903)

>orf01931
LTFIKSWAIEIFCFDWNFLDKNLGLGSFFNNSCLRVFFLT (SEQ ID NO: 904)

>orf01932
LLLSCRKVIVCFIFSSKWNKNFFNLAFSWNFDNCIRGFFSINSNLFGNITSLWINIVGPC
RSYIAILSINCNRIFTTVFCFIFFITNSRT (SEQ ID NO: 905)

>orf01949
MRFIVGRFTSFSLGIEFSPTSKLDDLLFKIAFLMILATWIKARKTKGAT
(SEQ ID NO: 906)

>orf01961
LVNCEPLEAYRQLEEAELVGCWAHVRRKFFEATPKQADKSSLGAKGLAYRDQLFALERDW
EALPADERLQKRPAPNGRLLCLVPPSVSFSRFKTRKGN
(SEQ ID NO: 907)

>orf01963
LKRNKIWKKTLTYPVEREEITYKRKKAKGKRQAILAQFDSEEVHHRLENCICPDCQGELK
EIGASLQRQELVFILAQLKRVNHIQHAYKCQTCSKNNPSDKIVKAPIPKAPLAHSLGSAS
IIAHTIHQKFILKVPNYR (SEQ ID NO: 908)

>orf01964
LKIIQQQSATIDSLTNELALLREQVAYLTQKLYGKSSEKSVCPSGQLSLFEEEQNMEEDS

DLPS (SEQ ID NO: 909)

>orf01972
LICQTIKYWHKFHLHIGRCKLLIGLIPILNFFIRADIDCLLVLLSLIDRQNGKQFNLCQW
IIASNGLNDSFEIIESLIHRNILSDIICPNQKKNFIYCSTI
(SEQ ID NO: 910)

>orf01978
MSFSCSDSCFSILLLDGDIHENTTFSPLSILFISHRFNSLIGNEVPHLIDNELLISIFFH
RFRWFNNVRMPSKDNIRSPIDHLVIKSFLFFSWFQSILNTHLKHDNGDICFLLCPFNFSL
HLIFV (SEQ ID NO: 911)

>orf01981
VVEQIPVGHNSGSFFLFLLLRLLLSPLLRNSISFLTSQGIPWKLSNNKTKPIDKSTASKS
IATNPLLLHLR (SEQ ID NO: 912)

>orf01988
MLKLIIYQFQYSKRQWLGTIPLLFVSSLIVGTSLFGIASSIKTANINASQLFQMLIIFGG
TTLFFLISNNIRLLIDIFKKDYQLWTILGASRTQLSLLVSGQFYLMAVIVSSIGTILSFI
MADSYYKFLQNLLGRDELPDLVITANIQSILLSIFIVPTIVGIGAYFYSSRILKISSILK
PKKKKRKVTVTGFVNISVRLFLWLLCIGSIVSAGFIRNKEIIEKQSSIILFLLIIHILII
QSLSPSIQMFLIKFLMRIFPTENYVINTGFWNLLSNPSYLKSIQTSMSMGVTLISGFILY
TQNMYSFMNTANGVNEARASFIAYMSAPIILIITSSISLTILSSNKDIEDIKQLKTLGVS
RLQLFKIRIGEAIIHSVLILLVSVIFNLIILILVSIIGQFLGRSLVDISGFWQPSLIVIS
LLVIFYSITKGFYLFQDR (SEQ ID NO: 913)

>orf01989
MVNNVAVKVSNLSKEFLLGQDKTVSILKDISLSVNYGEFVSILGVSGSGKSTLLSCLSSL
SEPTSGEVVINGVNPYTLKEGKLAKFRRQDIAIIFQNYNLVPALPVLENVTLPLRLSGKS
VDSNKVKKMLDSLNFKAELSSLVATLSGGEQQKVAITRAIIADSKIIFADEPTGALDSVS
RKLIFETLRNLASQGKCVLMVTHDIELASKTDRALILKDGKISRQIIKPSADELYQALES
SKD (SEQ ID NO: 914)

>orf01994
LALVRKFIDYFFGVLVPFPDLYVFKSCFKFAGSFTDFDTFDWWLDWCRSCSENRFFV
(SEQ ID NO: 915)

>orf02006
MPTILLLKKFYERLITNFFRLKFLFCKEILATNIFNHPLFEPDIRVITIKII
(SEQ ID NO: 916)

>orf02009
MXXGAFGQGELLLQQSRNSSITEIVSDSWAGAGRRILPLPKSVTPLVSS
(SEQ ID NO: 917)

>orf02013
MLLLISLTQLIIFLFFERFNLLLKTFLLVDLKSNKSA (SEQ ID NO: 918)

>orf02022
MAGKKGFLFLNCHICMVTTTTCFLKERVESELLIFFYISPNRCLITVYSVLNL
(SEQ ID NO: 919)

>orf02029
VIPRYVTKHQGWDHNPHTITNSDDDPATLVTFRTFKFNVGNCTIPKNDQNGSSQKFSGIL
QCPCEIHLLDSP (SEQ ID NO: 920)

>orf02034
LLVRKFNIQTFFIQVFILNDFGYTVNGLIVYRLLLTSSILSFNDYSIGSFRTVIVI
(SEQ ID NO: 921)

>orf02040
MRLSIQLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 922)

>orf02048
MTAQLPSDALQMALWRRKRPRNVIVHTDRGGQYCSADYQAQLKRHNLRGSMSAKGCCYDN
ACVESFFHSLKVECIHGEHFISREIMRATVFNYIECDYNRWRRHSWCGGLSPEQFENKNL
A (SEQ ID NO: 923)

>orf02093
MEIVLVSFSISFQHFIIAYCLDFSSAGFRNSQNFSNFC (SEQ ID NO: 924)

>orf02105
LTEKIQEHELIKTNQAEKSVQDVLDNCIERVQNNSLKSDRVTSFETPFALLFIFATIAVM
LTYGGYRVSAGYISVGTLVSFLIYLFQLLNPISNIANFVTVYSRSKGSSVALENLLAVPK
EKFEGGKSVSGRGLNFNHVYFGYDENRPVLKDITCSIFKGQKIAFVGPSGSGKSTIVRLL
EQFYKPLSGDILMEQSSIYDFNLKEWRSKIAWVSQNNAVLSGSIRDNLCLGLNRLVTDDE
LMKVLDLVSLGDEIRSMKEGLDTEVGERGRFLSGGQSQRLQIARTYLKDAEILIFDESTA
NLDADSEYAIISILYSALKEKTVVIIAHRLSTVKDVDCIFFLEERKITGSGTHKELLENH
ERYARFVQEQMIE (SEQ ID NO: 925)

>orf02106
MKLKLLRVDTKVIMGSFLLVLSSLLALLLPLILKGLIDGSSIENIGSKVFQSFLIFIGQA
LFSSIGYYLFSQSGEKKIAKIRKKVIEGLIYAEKSFFDKSQSGELTSAIVNDTSVIREFL
ITTFPNIILSLVMVLGSIVVLFSLDWNLSLLLFITLPCMMFIILPLSNISEKYSRRLQEE
I (SEQ ID NO: 926)

>orf02115
MXXALIPRVSIGSVGLLLLTENYVKGDLKAASRLVQDSLTLLFMFLLPATVGVVMVGEPL
YTVFYGKPDSLALGLFVFAVLQSIILGLYMVLSPMLQAMFRNRKAVLYFIYGSIAKLVLQ
LPTIALFHSYGPLISTTIALIIPNVLMYRDICKVTGVKRKVILKRTILISLLTLVKVSVN
RNHPVAVRIFLPTKWTFVELPLCSSCRCHGGWTLYGYESAYLFIR
(SEQ ID NO: 927)

>orf02125
MRERVRLSGSLFTSLKTREHIKSTMELFHKYVFFLIQEIKIKMINFLKIGDLPTL
(SEQ ID NO: 928)

>orf02134
MANHLYIVPIQVNHKSSIVNRMLTSITRNPIVSPTCLYASLITSLNFFLIFC
(SEQ ID NO: 929)

>orf02137
VIVFLSRNKDGNAFCHLDLISIANPVWGWDDDFITWIDHSHKEGIERIFGSRSDCHLI
(SEQ ID NO: 930)

>orf02140
LSNQFYFSLQTKPILKVKQFLLFQSQMTRVSEILQFSNKL (SEQ ID NO: 931)

>orf02141
MSKKVLFIVGSVRQGSFNHQMALEAEKTLAGKAEVSYLDYSDLPLFSQDLEVPTHPAVAA
AREAVLVEDAIWIFSHSLQLLYPRYSEKLA (SEQ ID NO: 932)

>orf02144
MEDKEMGFYLMVASMLLGLLALKIGFSQFKEKKDKFLSILTSLAGTALVLVAVWLGWPK
(SEQ ID NO: 933)

>orf02166
MLDSDIGCSRKNLLGLFWIRRRRNIHIVDRAMEKGISNRAPNKISLKACFFNFF
(SEQ ID NO: 934)

>orf02193
LLHPFTRNITCDRHILTLLGNLVNFIHIDNATLCTFDVKVSNLQEFEEYIFHILTHITSL
RQSCRIRNSKRYIQALSQGLGKESFP (SEQ ID NO: 935)

>orf02194
VEIDAFVVVINRHCQGTLGTILTNYIVVQDMEEFNWFWHLRQVCQDFLNQFFSNDFLS

(SEQ ID NO: 936)

>orf02198
MEXXXTELAGRGFLVWHPKMDEYMEALDGHLDEISERLITLGGSPFSTLTEFLQNSEIEE
EAGEYRNVEESLERVLAIYRYLITLFQKALDVTDEEGDDVTNDIFVGAKAELEKTVWMLA
AELGQAPGL (SEQ ID NO: 937)

>orf02199
LITRLLHRVHVLVDDFNPSICITWSSLALIYIFPVLNIIIDRVRQVHIVFLYKSHGLFSV
ILSIGLIFSIGIEIDTIRNSQNG (SEQ ID NO: 938)

>orf02200
MXXTGSLSANFAGSTTASSSSEQNQSSNKTQTSAEVQTNAAAHWDGDYYVKDDGSKAQSE
WIFDNYYKAWFYINSDGRYSQNEWHGNYYLKSGGYMAQNEWIYDSNYKSWFYLKSDGAYA
HQEWQLIGNKWYYFKKWGYMAKSQWQGSYFLNGQGAMMQNEWLYDPAYSAYFYLKSDGTY
ANQEWQKVGGKWYYLKKWGYMARNEWQGNYYLTGSGAMATDEVIMDGARYIFAASGELKE
KKDLNVGWVHRDGKRYFFNNREEQVGTEHAKKIIDISEHNGRINDWKKGIDEKRVDGVIC
RLGYSGKEDKEWRIH (SEQ ID NO: 939)

>orf02202
MHKNFVVVVTNFFTAVQFIQFNKEGTTCHNTTKFFNHLDSCLNSSTCRQKVIYNKNTLTW
LNGIRVHSQGIDTVLFFIVSRNNFAWQFTWLTNRRKTNSQLKGNWTTHDKSTSFRSHDHV
DFLVSSILNDFTNSVAISISISHQRTNITEGNAFLWIIFNCCNVIF
(SEQ ID NO: 940)

>orf02209
MNRCNSRQAIWKIISTLNRENTHIMLNRQVCFCFVNHISPLNVVIWENLSLEELLYAICI
CFITHKIAKQTSLTIDNAGIAMNNIR (SEQ ID NO: 941)

>orf02214
LDSRFFCTDFFKGRQAKGCSFSCTSLSLTDNILAFKGQRNSLFLDRTSFYKTSFFNFC
(SEQ ID NO: 942)

>orf02225
MGRKPRTRPEERTELERLQAENEYLRAENAILKKLRELRLKEEKEKEERQKLFKN
(SEQ ID NO: 943)

>orf02246
MLSKEEYIEEIGLIEKQNYVEVELYPLVADIINPTLKNSLSKRYVFGRRKSNMGQIYYGL
SNFPDIVILDKNYQNKARKSIEIEEWKKLRGCVEIKSLKHDLITEEKIKSTISNSFEHIT
GEMGQLIGDLLWYKKVIYTNGIEWRFLSLDDKEEIDNTIVQVVNKRIETEEAGNSFDWWK
NIKDLSFNYTDIYLSKDCIQEWDEFVKKVKEIEW (SEQ ID NO: 944)

>orf02248
LEVCIHHHHQISCRILQACIKGCFFAKISRERNIMDCRILLPIGL
(SEQ ID NO: 945)

>orf02255
VDRTDEVSSKHCFEVVDRTDEVSNHTHGKATLTWFELDFRRV (SEQ ID NO: 946)

>orf02263
MTPIKDKVRRVKTPMMVNPDTDLTISSVQQDYFSLALIGFSLLTGDFLSFSKGDQKTGLS
AFIKICHLIKIARLDNKITKQQEYWLYDLLMMSQGEKIQKIKQLKQVTSDILLNTPDFSS
YFEKYNFKEEAENIKSYLLAKSMDKSGRLFPSNEFGEFVSPVSFQHGFGGVLFFMNKYYV
EEDENTVKEWLTKLENYEAANFLHGYSLLFGKAGFLFGILDRYEKTKERYLIDISKRLVD
HLMRVYDNISNLDFALGKSGILLSLMKYCTIFDDKKLANFIKNNINDAYSLLESEDNGDI
YSNNFAHGRSGAAYVLKAYTDIFGDSRYQNHLQKFSDGISELLEEKLSSFSKLDNLGLSW
CDGVSGLILYLCLIDKERYSEIIYKSQLEMVQQYEAMGTSFCHGLSSLLQTTIYNKNQKV
EQFIKKILLTRSYRNNDRLLQFQGEDGINSYFDFGVGNLGIYWTLLGYTFPFELSKGD
(SEQ ID NO: 947)

>orf02264
MHIFLKNRAFRQLTVNEWISSFGDTIFYLAFINYVSSYAFAPLAIFLISLSETIPQVLQL

FTGVIADFQKNRISKYISILFIKVLLYSGVTLLLTSTDFSLFSVFFICSMNLISDTIGFL
AGYMLTPIYIRLINDDMTEAMGFRQSTSSIVRLIGNLSGGVFLGLFSISTLAFVNVLTFL
FAFLGSLLIRNRLKKEEEKIEVPPYVGMSSFFQHLKESMKLLMTMEDVMVLLWILSISQA
VLMMVEPVSAILLIHHPFMGLSTGQSLAILIMISLLHVILGGLLSGFLSKKISIRLNIYW
SLLMESLIVIDFLRGSFLLILLGSAGDAFSAGVLSPRLQAMIFGIIPEELMGSVQSSINV
INLLIPAVLSLALVFLATSAGLEVVAFALIILLLIAAYLVHQMKNLPNQEEV
(SEQ ID NO: 948)

>orf02266

MTVPDRLPARMRMDGRSIFQQIKNYFDTENKEYFKHPNTYDGISMHLEPNILTSMEHFDL
TGFHCECKDFQNQGVCKHWVAMDLYFRSLPQAIQERIGKASHKPSFASQLIPTLPSEELQ
DELVEEKATAPSLALHGQVEIRNHSLAWTLKLQVEQAPRAYVIKDIAHFIFLIFQKEDYF
VSQKIGTIRLSLNQFNQASQNLLLYIKKYFIDRNEHSYFNFSYGINPRDYGRYLETPVSY
LNDLVPLFQALDVFQYVTSKAEYPLIFLDDSPFIPEEEIFKVVKSNNHYEIINTAYFGFI
IQEKLWIRHNHFHIIKEEHRYFLDKLATWIYHYQENSPLIFSKENKAELMQVCNIISNYV
PISIPDELQIHDFIPTFAFSKTRNEIALNMVWSFGEKQVHSKQDLLTLPYTYQASKARKI
YHQLLSAGFKEEFHSLSKIKIVDFFLKELPRFRTLGQVQLDESLEKLLVEDPAVIDIFDD
ESFLSVQFDFSMISEDEVEKAIQALWNQESHYQTKQGKVLVFDDESLKVAQSLQDLRAKF
SDGKIKMHKSRAFSLSETFKDNEHVNFSRDFKKMAYDLTHPEEFDIKPYEVKAKLRSYQK
EGVKWLSMLDHYHFGGILADDMGLGKTLQTITLLEANLKPDQKALILAPASLLYNWKEEF
RKFVPHKQVEVAYGSKTERIKQIEKSATITITSYPSFRSDLEHYQKQSYDYLILDEAQMI
KNSQTKTAQALREFDVKTCYALSGTPIENRLEEIWSIFQIVLPGLLPSKKEFSKLSPQLV
AKLIQPFVLRRKKDEVLTELPELSEHLYSNELSSSQKTLYLAQLRRMQEMVSGASAYEIK
RHKIEILAGLTRLRQICNTPALFLEDYKGDSGKMDSLFELLDTIREKGSRPLIFSQFTSM
LDLIEQELEKKEMSHFKITGQTPSDKRQEMVNLFNQGEKDCFLISLKAGGTGLNLTGADT
VILCDLWWNPAVEMQAIGRSHRLGQTKQVDVYRLITLGTIEEKIQELQESKKELFNTVLE
GQESRSNLSVDDIKEILGVE (SEQ ID NO: 949)

>orf02283

MMSMVDPIDQTFIVNLKIGKSQVFSQLQFSCHIVVYPSEVHIYQAFVIKLQNHILGPQVL
P (SEQ ID NO: 950)

>orf02284

LPNRTRIDNQLPTSPVTKQLLVNMSINSNITGRMSHQAVKLLLFASMNQLSPPVLIRQMM
ANSHRQIPKLTMNLKRLIVEHFNFF (SEQ ID NO: 951)

>orf02285

LIQQVQNPSTPCPWHENISQKPVFIHSYLPSICQNSLQGGGISMNI
(SEQ ID NO: 952)

>orf02308

MIDKVVRNLLLTFLFCKMTKIINFLTTILVKKKKMCYNVSKLREKKKGAMMWVLGFILFI
IFFYSNNSKKIKKLRE (SEQ ID NO: 953)

>orf02309

VDRTDEVSSKHGFEVVDETDEVSNHTYGKVKLTWFEEIFEEY (SEQ ID NO: 954)

>orf02314

MIAEFIDGLQKFHFLQNALITAIVVGIVAGAVGCFIILRGMSLMGDAISHAVLPGVALSF
ILGLDFFIGAIVFGLLAAIIITYIKGNSIIKSDTAIGITFSSFLALGIILIGVAKSSTDL
FHILFGNILAVQDTDMFITMGVGAAILLLIWIFFKQLLITSFDELLAKAMGMPVNFYHYL
LMVLLTLVSVTAMQSVGTILIVAMLITPAATAYLYANSLKSMIFLSSTFGATASVLGLFI
GYSFNVAAGSSIVLTAASFFLISFFIAPKQRYLKLKNKHLLK
(SEQ ID NO: 955)

>orf02336

MYEEPEVAPVHPTGPTPATETVDSAPGFEAPQESVTIL (SEQ ID NO: 956)

>orf02363

MGNNGQFTFGYRHDFFQNQLAIFNALVDTFTRRTIDIKTLNTFINEVLNQGTRTLWTYFS
LLIITCVEGWNDTFVFFQI (SEQ ID NO: 957)

>orf02368

LHEVVIPSIDEGKDCKGCKPWFHNREGYTPEGTNLTTTVDFS (SEQ ID NO: 958)

>orf02369
LFHEEDTEWPSNQRQDNCPESIVDSHEVDDTYQWYKDNLFWKRHSSDKDSK
(SEQ ID NO: 959)

>orf02393
MSYFRNRDIDIERISMNRSVQERKCRYSIRKLSVGAVSMIVGAVVFGTSPVLAQEGASEQ
PLANETQLSGESSTLTDTEKSQPSSETELSGNKQEQERKDKQEEKIPRDYYARDLENVET
VIEKEDVETNASNGQRVDLSSELDKLKKLENATVHMEFKPDAKAPAFYNLFSVSSATKKD
EYFTMAVYNNTATLEGRGSDGQQFYGNYNDAPLKVKPGQWNSVTFTVEKPTAELPKGRVR
LYVNGVLSRTSLKSGNFIKDMPDVTHVQIGATKRANNTVWGSNLQIRNLTVYNRALTPEE
VQKRSQLFKRSDLEKKLPEGAVLTEKTDIFESGRNGKPNKDGIKSYRIPALLKTDKGTLI
AGADERRLHSSDWGDIGMVIRRSEDNGKTWGDKVVISNLRDNPEAKDPAAPSPLNIDMVL
VQDPTTKRIFSIYDMFPEGRAVFGMPKTPEKAYEKIGDKTYQILYKQGESGHYTVRENGE
VYNAQNQKTDYRVVVNPTEPGYRDKGNLYKGQELIGNIYFAHSTKNPFRVANTSYLWMSY
SDDDGKTWSAPRDITPGLRKDWMKFLGTGPGTGIVLRNGPHKGRILIPVYTTNNVSHLNG
SQSSRVIYSDDHGKTWHAGEAVNDNRQVDGQKIHSSTMNNERAQNTESTVVQLNNGDVKL
FMRGLTGDLQVATSKDGGVTWEKDIKRYPQVKDVYVQMSAIHTMHEGKEYIILSNAGGPK
RENGMVHLARVEENGELTWLKHNPIQKGEFAYNSLQELGNGEYGILYEHTEKGQNAYTLS
FRKFNWDFLSKDLISPTEAKVKRTREMGKGEMGKGVIGLEFDSEVLVNKAPTLQLANGKT
ATFLTQYDSKTLLFAVDKEDIGQEIIGIAKGSIESMHNLPVNLAGARVPGGVNGSKAAVH
EVPEFTGGVNGTEPAVHEIAEYKGSDSLVTLTTKEDYTYKAPLAQQALPETGNKESDLLA
SLGLTAFFLGLFTLGKKREQ (SEQ ID NO: 960)

>orf02395
VADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFE
VADRTDEVSNIYTARRS (SEQ ID NO: 961)

>orf02399
MKIKEQTRKLTAGCSKHCFEVVDETDEVSSKHCFEVADRTDEVSSKHCFEVADRTDEVSN
IYTVRRR (SEQ ID NO: 962)

>orf02407
MSCNCAFYRSQFFDVNSVSNYHSHQKELRFPNSILFTYFVKVA (SEQ ID NO: 963)

>orf02428
VGLIKLTSYVFVCISNSFLTRHDKNDNICFFHGNFCLVLDLFHERSIDIINSSCINHAKR
TIEPLTRCINTVTCHSFDIFYNGDSLTSDPIK (SEQ ID NO: 964)

>orf02430
LSSKSCIDRTNQETFHTLGLEGVGMKSGSLFCSVQISDKEKENSRLANGFLRYQFIQGIF
LLLTSYHNHRVGLEILPR (SEQ ID NO: 965)

>orf02448
MKSKEQTRKLAVGCSKYSFEVADKTDEVSSKHCFEVVDRTDEVSNYIYGKAKLTWFEEIF
EEY (SEQ ID NO: 966)

>orf02450
LSNSFFLIKFSSSKTSGKKRIVSDNIFIRNKFICHFKKE (SEQ ID NO: 967)

>orf02459
MDYSKVAAEVIEAVGKDNLVAAAHCATRLRLVLKDEAKVNQAALDNNADVKGTFSTNGQY
QIIIGPGDVNFVYAEIIKKTGLKEVSTDDLKEIANKDKKFNPLMDLIKLLSDIFVPIIPA
LVAGGLLMALRNFLTSPDLFGPQSIEDMYPAIKGFSAMIQLMSAAPFMFLPVLVGISAAK
RFGANQFLGAAIGMIMTTPDLGGKEAFWDILGFHVTQTNYAYQVIPVLVAVWLLANLEKF
FHKKLPSAVDFTFTPLLSVMITGFLTFTVIGPVMLVVSDAITNAIVWLYNTTGAFGMGLF
GGTYSLIVMTGLHQSFPAIETQLLSAYNNNGTGFGDYIFVVASMANVAQGAATLAVYFLT
KNAKTKGLSSSAAVSAFLGITEPALFGVNLKYKFPFFCALAGSAIGAFVAGLTHVIAVSL
GAAGFIGFLSIKAGSIPMYIIAEIMSFVAAFAFTYFYGKTKAASVFADEAATATAETVTE
PTVEAPVVEETDTLQNETLVTPIVGDVVALADVNDPVFSSGAMGQGIAVKPSQGVVYAPA
DAEVSIAFPTGHAFGLKTRNGAEVLIHVGIDTVSMNGEGFEAKVAQGDKVKAGDVLGTFD
SNKIAAAGLDDTTMVIVTNTADYASVAPVATGSVAKGDAVIEVKI

(SEQ ID NO: 968)

>orf02466
MTESYTWVEADRATLSRYRHGQGHLTDQFFSFKVQRPAAKTLIASISTGKGMGPSFDGTP
VITSGNQNRINTIKNSFIMSSSSVRISLRKLTSQRNFLRNLSSLILLAAQVAKGDATACS
HQRISRVVGQDSHETLSLTEFF (SEQ ID NO: 969)

>orf02467
MNINNEKVWFAFYLLDMQITRPTPTFNDRRIGLIGKLQELRFLAGNLLLR
(SEQ ID NO: 970)

>orf02468
LIKGYLPNHLALMDLCSKTTCTLDDFAGIAGRRNHRGFFCHIGNGVFLTVDKYLRNQRIR
QRKSSHHILTQLVCHSHTHLFILLQTSLSLRTKERLSF (SEQ ID NO: 971)

>orf02474
LIKLTGRNFSDILIKCLVKCFTNLLSNQLMLLPSTLKL (SEQ ID NO: 972)

>orf02479
MIESENHCSASHSNRDYQSQHDNQGRTCQCFIIVPCHKKGSCSVGEITWNQRCQNGQDKD
HSRCLIKNT (SEQ ID NO: 973)

>orf02486
MIARQLMVFFSTNQADTRITNMSIDSLIINNSKDFQSSSHASVSFILTKLVNLLIFNF
(SEQ ID NO: 974)

>orf02487
MGEPFTHFIDCIDLGINPSYTQVCDRHFTSDIPCTMTSHPIS (SEQ ID NO: 975)

>orf02494
LSSDSHFIGIKAFVILILGKSNSIVLRIVGLYQDLTCFFSPTCSTCHLSQELEGSLRRTE
IRQIQGRIRI (SEQ ID NO: 976)

>orf02495
MAVHSLGIHMQGQRNIAVGTSIHRPTLPTHDKARITTAIEHENHLLFFNQTVLDSL
(SEQ ID NO: 977)

>orf02496
MVTGIAVLLISHFMLFINNHDTQIFQRSKDSRSGTNNNLGIATLHLAPFIILFTIG
(SEQ ID NO: 978)

>orf02497
VKNGYLVPKTCYKTLGHLRSQGNLRYQQNSCLALIQGTLDNLQVNLGLPTSCNPLK
(SEQ ID NO: 979)

>orf02498
MVNLIPRLGLDLLLIDCLIFQTKQAFSSQTHHFSLLGKV (SEQ ID NO: 980)

>orf02499
LGLQTKNNPLNQAIPLTKRHMNPHPNFQHSLKFLRNPVTIGLVRLHQGHIYDNLS
(SEQ ID NO: 981)

>orf02502
LGNHFCTICSTTYQAILQFIQIWWCQEDKDSIWNLFLDLKSTLNFNFKENIDSLVQGFID
IGQRSSIVVADIFCVFQHLSLTNQLFKFFTSTEEIVNTVHFSRTLCACRHRYRILKLVFR
TLKNLSSNRSFSNP (SEQ ID NO: 982)

>orf02527
VGCSYICHELVTNHDHFLFVIVEFLHSTVNTKCEGLQGPVNVINPKFLNCSLNAFFGVI
(SEQ ID NO: 983)

>orf02528
LLHLWRSIRVVPSNGGIIQIDQNSLDSLRLQAWDCQIIDCFHSKIWYIIFNRHSGSFC

(SEQ ID NO: 984)

>orf02530

MIGTFAAALVAVLASFIVPIEITLNSANTEIAPPDGIGQVLSNLLLKLVDSPVNALLTAN
YIGILSWAVIFGIAMREASKNSKELLKTIADVTSKIVEWIINLTPFGILGLVFKTISDKG
VGSLANYGILLVLLVTTMLFVAPMVNPLIAFFFMRRNPYPLVWNCLRVSGVTAFFTRSSA
ANIPVNMKLCHDLGLNPDTYSVSIPLGSTINMAGVAITINLLTLVTVNTLGIPVDFATAF
VLSVVAAISACGASGIAGGSLLLIPVACSLFGISNDIAIQIVGVGFVIGVIQDSCETALN
SSTDVLFTAVAEYAATRKK (SEQ ID NO: 985)

>orf02537

MWNKNRQLRKVKKILNQINRRKEEMALLTDEELAAKTQEFKRRLTAGETLDDILVEAFAV
VREADKRILGMFPYDVQVMGGIVIHQGNVAEMNTGEGKTLTATLPIYLNALSGQGVILVT
TNSYLAKRDAEEMGKVYEFLGLTIRLPFADDEEEKITPKEKKEIYSADIVYTTNSGLGFD
YLIDNLASSEEQKYMPEFNFVLVDEIDSVLLDSAQTPLVISGSPRVQSNFYGIIDTLMTT
LVDGEDYIFKEEKKEVWLTNKGAKIAEKFLGIDNLYAEENNVLARHLVFALRAHTLFKRD
KDYIIRKGEKDQELVLLDQGTGRLMEMTKLQGGLHQAIEAKEHVKLSPETRAMASITYQS
LFKMFNKISGMTGTGKVAEKEFIETYNMSVVRIPTNRPRQRIDYPDNLYITLPEKVYASL
EYIKQYHAKGNPLLVFVGSVEMSQLYSSLLFREGIAHNVLNANNAAREAQIISESGQMGA
VTVATSMAGRGTDIKLGKGVAELGGLIVIGTERMESQRIDLQIRGRSGRQGDPGMSKFFV
SLEDDVIKKFGPSWVHKKYKDYQVQDMTQPEVLKGRKYRKLVEKAQHASDSAGRSARRQT
LEYAESMNIQRDIVYKERNRLIDGSRDLEDVVVDIIERYTEEVAADHYASRELLFHFIVT
NISFHVKEVPDYIDVTDKTAVRSFMKQVIDKELSEKKELLNQHDLYEQFLRLSLLKAIDD
NWVEQVDYLQQLSMAIGGQSASQKNPIVEYYQEAYAGFEAMKEQIHADMVRNLLMGLVEV
TPKGEIVTHFP (SEQ ID NO: 986)

>orf02538

VSNKLHILQIGNRNWSHYYEIPENIEWHFFWPGSTTAIKKVMKMEGIRTFSGVVIENPDY
LPDLLPLINILTPYTIFYSDICASYSPLVEEFLKKTCAQVTDFSNPRELLRILSKALFKG
QYGDKLTPIDMVVNPYFAGSIRYNGYENLELVGSYGEDFRPLISWKYNIRASEWNPIELW
LEYEKDLSCDIRIVVRNIQDGSTADFIKERIFTTDDMEAAILLDDDFSSFISVSLEAKGN
GRLKIGALHQRLTRYQFGKFVLGGNIIRSKNREEINYFFYPGDFKPPLNVYFSGYRRAEG
FEGFGMMKSLGSPFLLFQDPRIDGGAFYLGDDDFENAVRRVIQHHLDLLGFSNKELILSG
ISMGTYGALYYSSDFEPKAVIVSKPLTNLGLIAERGRLEAPGLFPTAFDILRHHSQGKAD
IDSINILNARFWERFRGADFNQTIFGLSYMKEEDYDPIAYDSLVDSLYSTGARIMVKGTS
GRHNDDNDSTILWFVNFYKMVLEQEFGRKY (SEQ ID NO: 987)

>orf02539

MYYFIPFLESMNQSWQVDIVPWYQTTHRLEFDDVLHQIRIFKREGIKSKIVLLPYHPHMR
YLLHRQDLLEVEAFSVFDAIQDIENEEIYPLQLKDLAWDEDCDFIYTPFLIAVKQKGELH
AHIEFGTEGFISYITYFKDNQVDFICYFDDRGFLSSLVKYQDNQAVSRYYYNSNAEWQIK
EYLQGIHTKVEVNPRFSHRFRKSTYQSMDEVVWEFFEKFLTAEYKEGESFVLAAQTKYQN
QLLKHLPEHADKILTFFIERNQEDDLNLHHQAVKQAKILISDRQDFLERLKQHYPQFTYK
MHHLPSFDTRLKLGVSQRVKESKLYVQLDLNTPLNSEALYEVLNFVSQNPLTEIVFATFN
AEGYQIEALQKHLFTLISERLNFRDLLKESIISGAENKLEENKEENYRFQIVNLNDEIGL
IRELEYTRLIVDLNPIANIYTQIAGISAGIPQINLSESEYVTHLQNGYILSDLSEFSKAG
HYFLDTLEHWNQALIHSIDKIRQNTGNQFVQKWERWLEEAKSEQ (SEQ ID NO: 988)

>orf02540

LKKKLKSVVVKRVMWTICFIFVYILGSRLTLPFVNVNDTSFLGGNAAFLAFSTAMTGGNL
RSLSLFSVGLSPWMSAMILWQMFSMSKKLGLGNLPLEIQERRKMILTFIISFIQTLAITL
NLPIQEGVNHDLVLILNILLLISGTFFLVWLSDLNSLLGVGGSVVILMSSMIVSVPENIV
RSIIDLHVNLLFIISLLLISIAFLYIAVRVQKARYRILVNKIMIHNRFKRYSYFDIMLNP
AGGMPFMYAISLVSIPQYLLMLLHIFVPKTRWVDNWIAEFTIGRPVWVYTYIIVLFLLGI
AFAFVNMNGEQIADKMKKSGEYIYDIYPGEDTALYINRLVLRFAVIGSIYILLMAGIPML
IILYEPRYMQLSMLPGLFLMFNGMIFNVKEEINALTLNESYRPLVERK
(SEQ ID NO: 989)

>orf02541

MKINITNIYGMSGQSTALIAQNETVKIAKKLDFHELSFYFYNIYSDSEGELNSRLDGVLA
KLGYGDIVVYQSPTWNGREYDQAFIRKCKILNTRIITFIHDVPPLMFPSNYYLMSEYIEM
YNQSDLVVVPSEKMKERLIQEGLTVQKIIIQGMWDHVHNYPLKQPSFQKKLSFAGSVERF
GHLSNWSYSTPLDIFSESNYENSNPRVSFKGWKTDPELLFALSEGGFGLVWGTNENPADE

EDYYRLNISHKVSTYLAAGIPVVVPSYLSNASFIKEKGLGYVVDSLEEANRLVEETTVEV
YQQMVENVSKVSYALKEGYFTKKLLTDAIMQLLDI (SEQ ID NO: 990)

>orf02543

MKAIVLAGDKNYLTPILTTIKSILYYNQNVKIYILHQDIPSDWLQELKIQVEKLGSVVEG
IYIGDAIDSEWKTQAHISPIAYARYLISRLITEDRVVYLDSDIIVNGDLSPLFELSLGDY
SLAAVRDVDGNGFNSGMLVIDCQKWREKDVTSMLFDKTVEYMSYLDHTDTDGFNGDQTIF
NLVFQNHWLELDKRFNFQVGHDIIAFYSHWDSHFELDEEPLIIHYTTYRKPWTTLMGYCY
RDLWWSFHDVTFDQISDHYQGRFAVKRVYDFHDINLFTFTDSQDLLYIDELAQSLLDIAF
HIGAYTDMGDILLALDKYPNVYLYPSMVGAVIDEMIEKSDAYLDIHKGSSMDFIVNRYTS
AGRPVLTFDVTNKNQLEEIVVPSQSPLEMIKVIKKLKSDKMETKAIVFGANYQYADKVLT
TIKSICCHNRGLRFYLINSDFPTEWFYNLNRKLTKLDCEIVNARVNSSHISQYKTNIHYA
VFLRYFISDFVEEAKVLYLDCDLVVTRDLSPLFDLELGDYPLAAVKDLGGQIYFGEHIFN
SGVMLINNRLWKQEEVRKQLIEMTNELHDKVAQSDQSILNLLFKDRWLALDFKYNCITLH
THFSDYRPESGTYPPIIHYLTERKPWGLYECSIYRDVWWYYNAQDWSDMSQVTPSLTKDQ
VSQYTGVQYSALVYTFSSDLRNMGYLIENLPDVKFYVAAPVMVADSITDLLAYPNVSVLS
DIAGQPPLIDSLVEGCDFLLDINADIEVDGIIERFRQAGKPVFAFESVVHGEQGQFLYDQ
AHPEEMVLAIEAYCQNGELPVKKFQSYPKVLDIQQSLDYILEHHTSVIRYGDGEMDIMMG
HGIPYQDYDETLAEQLRSMIQLESSPELLVCLSDVFEGLERYNSESVNFWKKHLEHYKDA
YQQYCTASFYGSTFISRPYMDLKDKTASVAHFEKLKQLWDERDILIVEGENSRSGVGNDL
FDNAQSVERIICPSRNAYSKVQVIQEAVEKYADGKLVFLMLGPTAKVLAYHLSQKGIQAI
DLGHVDSEYEWFKMGATSKVKFSHKHTAEHNFDQEIQFVEDEIYNKQVVVRI
(SEQ ID NO: 991)

>orf02545

MTDKASKKAIVLGADSNYMDKVETTIKSVCSHNRDIRFYIFNSDFPTEWFQLMNKRLSVL
NSEIINIKITDDTISHFHLPTPHLSSATYLRYFIPNFVFEKKVLYLDSDIVVTSSLTALF
DIDLDGYPLGVVPDIPTTDEEFNSGVLLIDTNRWREEDIYRQLFELTIAHHEHVYGDQGI
FNILFKDRWKRLDITYNLQVGVDAHRYYMGDYDWYELFEGVPCIIHYTTENKPWKHFRFN
RFRDVWWFYYGLNWNDILLRTHVLKETFLELISPISKHVSIFTNTGDIESIGYLLEKLPD
VQFHIVAPTYFSPNVIELQRYSNCYIYPCADPKMKQDIIDKTDICLDINYGPAMDQMLQE
MVRRGKTIYSFDCTNHFFNGESTVFTVDEIDELIRSVKELKM
(SEQ ID NO: 992)

>orf02546

LKDLVSVVIPVYNVENYLEECIQSVLNQTYTNLDIVLVNDGSTDASAEICARFAEIDGRV
RVFHTENRGAALSKNFGVTQALGEYVLFVDSDDIAEKRMVETLYRQVEETGADIVIGNYF
LYDENDGQYKLYVLERDFCIEELSAQELIDRQAGKWHLNASAFIMPVFKLFKKDLLLQVP
LLMVGALMMKQRFIDCS (SEQ ID NO: 993)

>orf02550

MRGGVDTTQVMTETVEDKVSHSITGLDILKGIAAVGAVISGTVATQTKVFTNESAVLEKT
VEKTDALATNGTVVLGTISTSNSASSTSLSASESASTSASESASTSASTSASTSASESAS
TSASTSISASSTVVGSQTAAATEATAKKVEEDRKKPASDYVASVTNVNLQSYAKRRKRSV
DSIEQLLASIKNAAVFSGNTIVNGAPAINASLNIAKSETKVYTGTGKDSFYNIPIYYQLT
VINDGSKLTFTYTVTYVNPKTKTLGNISKKMSNGYSIYNTGTSIQTMLTLGSGLGKPSGV
KNSITDKNGKQVRPYNTSTMTMWRSGYTWANGAQMNGFFAKKGYGLTSSWTVPITGTDTS
FTFTPYAAKTDRIGTNYFNGTRKVVESSTTSQSLSQSKSLSVSASQSASASASTSASASA
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SASESASTSASASASTSASVSTSESTSTSGSTNSRPQETITNSRQELPNTGEKQSVKSGL
LGLILGLTGLGLVAKRRKRDDED (SEQ ID NO: 994)

>orf02551

LKAFVEAHPDAFLREIAARFDCALPSVWAVLKQIKVILKKTTSFKEQKPEKVSEFLDILD

NLKDLPVLYIDETGINRYLYRPYAGAPRGEKVYDKISGRRFERTNEVEQKLNGSFLIRYI
DSQIRE (SEQ ID NO: 995)

>orf02552
MAYSTDFKQGALDSIKEGHRHVEAAKVFDVGVRTLFTWEKKDVNKGT
(SEQ ID NO: 996)

>orf02559
MKIKEQTRKLAAGCSKQCFEVVDETDEVSLKHCFEVADRTDEVSNHTYDKVKLTWFEEIF
EEYHTKKPCSSR (SEQ ID NO: 997)

>orf02561
MKKSDVLDLIKYHYEGRETEFRNQSIAIARNFNKHGDTQIAQYIMGLMSQSDRFMPQIEN
PSEYLTPAKLDIGPLPLPLSIMNDLKGIINAVNHHIGINKFLFVGSPGTGKTESVKQVAR
LIGKELLVVDFSHLVDSKLGQTVKNLATLFNEINNLPFKQNYIILFDEIDSIVLDRVNQN
DLREMGRVTSAFLKELDRLSPEIVLIATTNLFENLDKAVTRRFDAIIDFDRYTDEDKVEV
ATIILNELLKQFKNVARDLKLFKKIINSANVIPNPGDLRNSIRTSLAFSDPSDPHDYQKR
LLRSLHNGRNLSISKLSKLGFTVREIEILTGISKSSVSRELSED
(SEQ ID NO: 998)

>orf02597
MRFIVGIFISFSPEIEFLSSLKFLTDFVEICLLWQVMTP (SEQ ID NO: 999)

>orf02598
VVEIIYFLIIIIASGLGSISGMGGGIIIKPLMDSFGYHSVSDIAFYSSFSVFIMAIISTT
KRFSQSKEIKWRLIFTVSFSSVLGGFLGHLIFQVLLSQLSVRLVSIVQMILLFVMLLVSF
VLTDFKKTYQFDKIGFYMICGLLLGLISSFLGIGGGPLNVSLLMVFFSISIKEATMYSLA
IIFFSQLSHLATIVVVTGLNQYHLAPVPVIFLASICGGVLGTVVSKVLPENWVRYCFKGM
LFFVMGMTLYNLFHIL (SEQ ID NO: 1000)

>orf02599
MMGTNSEEGFLDDFEGPQVAVSVKDFSIADTPVTNQEFAQFVKETGYKTLAERQEWSFVF
ILFVPEAEREGYPHPAGAPWWLQVSNACWKHPYGENSNLVGLEDHPVVYVALEDALAFCN
WSGMSLPTEAQWEYAARGGRQSEYPWGDTLLEGGYYHANTWQGRFPYENTALDGFIGTAP
VYEFLPNDFGLYQMIGNVWEWCRNPRYTLLASFNEDDYELPKYGIQDEEYAIRGGSFLCH
CSYCNRYRVAARNGCISTSTSSHLGFRCLKE (SEQ ID NO: 1001)

>orf02602
MVQTKQPNIILIVVDQMRADALSLNSKDKLVSTPTLDMMASVGYNFENAYSPVPSCVPAR
AALLTGLDQDKSGRVGYQDEVPWNFTNTLPKVFKDMGYQTECIGKMHVFPSRQRLGFDHV
LLHDGYLHVDRKYDKAYGSQFDYASDYLAFLKGKVGYDVDLIDDGMDCNSWEARPWDKDE
KLHPTNWVVSESISFLQRRDPTVPFFLKMSFEKPHAPLNPPKYYFDIYMERLPQFLDLHI
GNWEVLEKQIPSIYALRGKLKEDDQRRMVAAYFGLITHIDHQISRFLTALKEFRHDKDTI
IWFVSDHGDQLGEHYLFRKGYPYQGSIHIPSFIYDPAGLIAGNRGTIKQLVKIQDIFPSL
VDLAGGTTTDELDGRSVKNLLFGQYEGWRTEFHGEHALGKDSSQYILTDQWKFIWFPVLN
HYQLFDMKKDPHEMNDLYPSEKYQPIVRQMKKKLVDFLRYREEGFVVDEELVPVELSKIT
PTLTKTGDSQS (SEQ ID NO: 1002)

>orf02604
MNTMLDKMQEKLSPIAMKVENQKFLVALRDSFVGTMPVIMTGSIALLLNAFLVDLPQQFH
LESITKTFQWLVDINNLVFKGSIPIVSLLFIYCLGVNIAKIYKVDTVSAGLVSLASFVIS
IGSTVTKSFPLANVGDVKLDQILQGIDNLAFDGKNLMVTIGNVIPGNHINARGYFTAMMI
GFLASIIFCKVMKKNWVIKLPDSVPPAIAKPFTSIIPGFMAMYIVAILTYVFHLLSNDLL
IDWVYKVLQTPLLGLSQSFFAVILMIFLNKLFWFFGLHGGNVLAPIMEGLFGVAMLANLD
AFQKGEPIPYIWTSGSFGAFVWFGGLGLVLAILIFSRNSHYRKVAKLGLAPVLFNIGEPV
NYGLPVVLNPLLFIPFVLSPVFMATVAYWATSWGLVSPVTQNVTWVMPPILYGFFSTAFD
WRAIILSVVCLIISVLTYFPFVKMADKTELS (SEQ ID NO: 1003)

>orf02605
MNESNLESVMGLIMYGGEAKSNAMEAIQAAKKGDFSKANRRLADANAALLQAHKAQTEML
TREAQGEKTSISLLMVHAQDHLMTSLTFVDLAKEVVEVYERFEKN
(SEQ ID NO: 1004)

>orf02606
MAKVTIMLACAAGMSTSLLVTKMQKAAEDKGLDAEIFAVPAPEAEEIVATKEVNVLLLGP
QVRYLLGDFQEKLKDRQIPVAVIPMTDYGMMNGSKVLDLAESLLD
(SEQ ID NO: 1005)

>orf02607
MKRLISANPSEILQMNAEELKQSILASEGRVVLSENVVTRETFVGDITNSEIARAFGADM
ILLNCVDVFEPKIYALDSSGDDVIHRLHQLVACPIGVNLEPIDPSAKMLEETQEIVAGRV
ASVETLNRIEELGFDFVCLTGNPGTGVSNREIIKAVQTAKENFSGLIIAGKMHGAGVNEP
VAELSVAEQLLEAGADVILVPAVGTVPAFHDQELREVVDLVHSKGGLVLSAIGTSQETSD
TDTIKEIALRNKICGVDIQHIGDAGYGGLATVDNIYALSKAIRGVRHTVSRLARSVNR
(SEQ ID NO: 1006)

>orf02608
MEKLLQEKLLPVAARLGNNKALVSIRDGITLTIPLLLIGSLLMVIASFPIPGWEKYLGDI
GVADYLWKGVDSSFGLLGLVASFGIAYFMARQYKVDGIPAGIVSLSSFITVTPFIRGEAG
AGMPTAFMASKGLFVAMILGLINGYIYQWFINHNIQIKMPDGVPPAVSKSFSAIIPGAVT
IVGWLIVYATLDKLSLPNLHEIAQVALGGPLGLLGNNVIGLLILIFLNSSFWFVGLHGGN
VVNAVMKPLWLANLDANKVAYQTGETLPNIFTSVFMDNFVFIGGGGATIGLVLALGYLAH
KKKASKQLKTLAPITVIPGLFNINEPAMFGVPIVLNILLLVPFILAPMFNLLVAWGAMAS
GLVPLTYTDPGWTMPPVISGLLATGSISGSLLQIVLIVLDVLLYLPFVIAIEKRFKLLED
(SEQ ID NO: 1007)

>orf02609
MTLSKKQLQLRAKILETVYTLGPISRIEIATKTGITPATTSSITNDLIKENILLELGEDE
HDTSVGRKKILLDIQAKRFYYIGCELSEKHFTFALGDNLGNILKEEKEIVTKQLIQEKGN
QLINQTLKQFLNNCSDYEIEAIGIALPGRYLDDYKITTNNPLWQHIDLEMIQSHFDKPLF
FSNNVNCMAIGKRLFSRQQNDPNFAYFHFARGMHCSYIYDGNIYGKGNLMIGEIGHTVVS
SEGEECSCGRKGCLQTFAGESWLIKKSKILYHQSPYSLLPSLVKNADDIDIQVILTAYQL
GDTGIITLIHQALLYLSQTILNISMMIDSQKIYLHSPLLTNQHIIQKLYSEMNYKPKLLY
NRLPEVIIEPYNDFTAAHSAIALCLYHTILHS (SEQ ID NO: 1008)

>orf02628
MPFKENLICQHRNHHCSVFFISLGLLHNIHIEIDISQTRASFLDLSDYLQAVLMILQKFC
QAIGLAQRLDLLQLHLLHLTRLLL (SEQ ID NO: 1009)

>orf02636
MYLLLLVVKDHIALIDKEMHVWRPNCILRDLTNFFIKRNHIVTHKTNGSTTKR
(SEQ ID NO: 1010)

>orf02637
VLTLMNHFIKEIQGISINHLTILIKNSIFKLNLKNRIIG (SEQ ID NO: 1011)

>orf02641
MKIKEQTRKLAAGCSKPCFEVVDRTDEVSSKYCFEVVDRTDEVSSKHCFEVADRTDEVSN
HTYGKATLTRFEEIFEEYKGVPR (SEQ ID NO: 1012)

>orf02655
VCQRMDARTCKTTIIAVHNVLTALQQTWIAVQLYQTK (SEQ ID NO: 1013)

>orf02656
LHLGKSILSLPVKGKDLEFLVHLFVINHWIGSPSRTSTFCRCKVLNGME
(SEQ ID NO: 1014)

>orf02657
LEQTVIIANNPCELYWDNHLSFLSDSLLKQVIVHLKRICLDIHHDRGCSHVRNDTT
(SEQ ID NO: 1015)

>orf02673
MLEEGTKDQLAELTYPFGRGVNLSFGIKDVPKLYQKVMEANYPIYRLLTKRKFRVSDPYI
YPHKFAVLDPDGYFLRFSE (SEQ ID NO: 1016)

>orf02689

MIACRHDICKSQKGLEHPFCIIRRLTRDFNQRPVCIVEANIFCLKITPQIITNMIVARTV
KSSKTGITLTTSMCKRDNHKITWFHRRNGFPSFFNNPNRFVSTIFMSSFRFWITVPP
(SEQ ID NO: 1017)

>orf02705
MNMNKDQIAILNGADNLNLTLWITLKEICKEGCKSFFPVRNTCRMLDIGIPYRLGLSLSN
SSVLNGMDV (SEQ ID NO: 1018)

>orf02725
MHKLRIFVNQLCRRFGIILGPFLVLGFQVLTQELELAIFFDLREEVLLQVIPQVCHFCYL
RKEFTTLNQHELTSHDHVLTRHFQTHGLQG (SEQ ID NO: 1019)

>orf02732
MQVTIEADSGLFLLSPVVQLLKVEIDVKQVTMSLDNLGRTKLSHQTFWVAGVEVHVPFNN
ADALPKWRIRT (SEQ ID NO: 1020)

>orf02734
MKNGIDFAHIAITDFFHNQAIAMGIAHYNDGLLCHDGNTSKSFLTAKAR
(SEQ ID NO: 1021)

>orf02758
MSIVKSHSFSISLGIFNSFWNNIHTSECFYFLCKGKSNRSNSTISVNQMVFFINIQRFYC
FAIEDFCLLRI (SEQ ID NO: 1022)

>orf02759
LNTLLPPDNLCLFTIYLTGFSCICINSYCHNFWEIFNQLFYQLS
(SEQ ID NO: 1023)

>orf02778
MYNKVIMIGRLTSTPELHKTNNDKSVARATIAVNRRYKDQNGEREADFVNMVLWGRLAET
LASYATKGSLISVDGELRTRRFEKNGQMNYVTEVLVTGFQLLESRAQRAMRENNAGLKGQ
IWXXIHSLIN(SEQ ID NO: 1024)

>orf02782
MQFTRTTHHPKTLFTTKFAWENEIPFWHHGTRKSHNGFQPNTRIRCSCNDLHYLVTCDCN
LADVEVVTVWMSYHLDNFTNNKLRFLIINNFFCKTFRL (SEQ ID NO: 1025)

>orf02784
LTALCNFKQARNLKNVPSYCFPIFFEENTGYLAFAFHIQFGISAIFHDDHKDITDMFFVI
RKNHCFLFLLFQSC (SEQ ID NO: 1026)

>orf02788
MKIKDQTRKLAAGCSKHCFEVVDRTDEVSSKHCFEVVDEADVV (SEQ ID NO: 1027)

>orf02789
MYYSVDDVVSNAFKKRMILDSFFAFNCSGTMKVSTWVYDKGEWYYVSSSGSMIANDWVKD
NGK (SEQ ID NO: 1028)

>orf02793
LTWILTKIARKDSLQLFELEANLISFLLVMSVDLAPFCFKEENF (SEQ ID NO: 1029)

>orf02803
MEDIDEDELLIFEKVLGQLQANIKGIGGENKEISQKN (SEQ ID NO: 1030)

>orf02804
LHLRTCFVRQTNKLSPLINRTRLQFHQTILHYTLNQITSNRLGNIEFLLDIFNQDQVLVF
LAIIQKTHNLTLRPTHKFNAATFGFLLHHQVNLMTKTLKD (SEQ ID NO: 1031)

>orf02821
MLEIWKYRPFVSEFWNDFKNNHDKQFVDPISLYLTLKDDDDPRIEEESEALENMILQYLG
EDDAS (SEQ ID NO: 1032)

>orf02823

MQDLLFHFYSYRLNLTFFFFELLICLLNSEFDLSKFIFVYFDEYFHEDSLKMNLHQFSFS
F (SEQ ID NO: 1033)

>orf02829
MAFNQFNRCIGLSIPTAPNVPGTIINRSYLHDATVPNNVREKT (SEQ ID NO: 1034)

>orf02845
LTDFHDFKFIFFENLFKSRQLYLQSQNSVLSNLWLAT (SEQ ID NO: 1035)

>orf02850
MKKLFILISNLLASLFFVWVFTIWTDTYVSHYYPNVVVHDSSPETTFQHVATRLEKLAEE
TDSFIAIQHQDPNSEGTTVFSYTTFGDGKLPDGLQEKNLEDAQSSSVETNYFVFDGHLDI
HLLREELSQLGLTNMHLTIPSKLSTLMAIFSNGFQLISLLIFILTFVALTLISQISQLRS
SGIRLISGEKRWSIFLRPVGEDLKAIAVGFSLAGVLAILMQKILSLPTQSLMTIGAGLLS
YNLILLSISLFFAQLFAVGIKKIHLMQIIKGQVPVRGIISLILIGQLLAIIIVTLGIGSS
LKYSQAWQQHRIGQEIWSQERQLITLSISREGTSPGFDEQAQRKLRTWYQLMDLAVSEQK
AFLSRHQLIDRTLQNGMASSKNLITSTEWHDYNPNGNVLIVTPQYLERQNIPVDTTIEQK
MNHLNVGEFVLLLPEHLRSEEEHYKSVFEDDLTSRMSSQDERQQMTATVGYLESGQDRFV
YNTTPISYQQFLKDPIIIVITPQSTGPQSILFWIDAVQNYVLFNQLSDAQELIQRQGIEN
WVSEMQTGYHNYITLLDNIQRERWVMLAGAVLGIATSILLFNTMNRLYFEEFRRAIFIKR
IAGLRFLEIHRTYLFAQLGVFLLGFVASVFLQVEIGVAFLVLLLFTGLSLLQLHVQMQKE
NKMSMLVLKGG (SEQ ID NO: 1036)

>orf02859
VLKWCILRINHHISRKVDNFLEGTRAHIKGQAHTAWNPLEVPDVRYRSFQFDMSHTLTTN
FRTRYFNPTAVTNNSSVTNAFVLTTSTFPVFCRTKDHFIKESFTFWFQGTIINCFRFFDF
SIRP (SEQ ID NO: 1037)

>orf02869
MPWKELCHKLAPKVFKVIRIYSRENKKSPSNWAFCSFET (SEQ ID NO: 1038)

>orf02877
VDSLFLSLGEESNQEINLQESFSSTDCNPTLISPETTVAQGLCQDIIYRPFT
(SEQ ID NO: 1039)

>orf02880
VNPKSLGSFFLQDSKGFKELVLGHAKLSLPRIVHNVCPQFKNASRIITTRDDFWNACYSL
QMFNIFKGIQVNGRTQFTCIGVFLVWRVVGREHNLRTQKVQFMAHQKLYITRAVHTTTFF
LENFQNSWSWSSLNCKIFLKALVPRKSLVDGSCLLTNPLLIIQVKGSRELGNNRF
(SEQ ID NO: 1040)

>orf02884
MDNLCFHNAWTDWASILKQAVVTEDDMTKQNDFFLGIIDAEFHNCLGNFAINESDMSKKI
TSHCVLCLVWPRQLDDLS (SEQ ID NO: 1041)

>orf02885
MQHNPRIEQALIELRINFANSVCQTHHGRRMIGQARFKGMVVGLGSWIGVEFLIILGVEI
SDNPLPDRIFNFENHLRHVVTNFLDINW (SEQ ID NO: 1042)

>orf02886
LIDLRGIVINFSASFHVDNLTCGKGLNVMRLGIPELPINLATIILEGKG
(SEQ ID NO: 1043)

>orf02899
MDALVLQKNQETIQQIAVKIRFLDGHDYYSLIDIDNRRTNQTVFPFVNF (SEQ ID NO: 1044)

>orf02900
MAFFTEIPTRACLINLAITLHIVETCQGFNDLSLHLRVLAL (SEQ ID NO: 1045)

>orf02904
MLLPLPFNTSKIKQIAMHSDLNQKEMIGHIFHDEDIF (SEQ ID NO: 1046)

>orf02909

MKQTVKKLALVASIAATLGGGVSVASAAVQYPEGGVWTYGSGNGGAYSNYYHPSKYHSST
VVSRKTGSSDKGYAGAGGTSRAWIRTSWGEKVAFYYNV (SEQ ID NO: 1047)

>orf02919
MNQENLFLLQEIKDKLLIIIDTVHIAVDFWEDIEPRLGFNGRQTWNILNGIIDEISLLVD
SSTRKKQFID (SEQ ID NO: 1048)

>orf02920
LLGQNVRAKAHIGQHIEPFDIALNMSLRARQDHPTHTETCYAVGF (SEQ ID NO: 1049)

>orf02921
MSVHYHAVIDFIRKDNQIVLTGNLNNLQQEFLRIKGSSWVIWIDKDDCLGIGSDF
(SEQ ID NO: 1050)

>orf02923
VTYNRIRQTSHPLCNQKCQQQGDAYNPDSLVNKNSFDITILITNCLHDTYFLGTLHDIDV
NNDTNHNRCYHNSL (SEQ ID NO: 1051)

>orf02924
LIRQHETVAVLHVIFIIDYTYNLRLKLSNLTSFGSTFYNAG (SEQ ID NO: 1052)

>orf02954
LHTSFRSSVGHSHTWHQDIVRPILFSRFNDSIVILWQNCPTFN (SEQ ID NO: 1053)

>orf02968
LRLAKLVPSLKIALKSFSLFTRKFFFKTQLHLLNYYYYTIFFKKANHSKVLDNFIRKRSW
KNNFPNSLY (SEQ ID NO: 1054)

>orf02973
LKAEQQAIKNIQFLEQDLPKNPLEKEFDCLAVSRVLHHMPDLDADLSLFHQHLKEDGKLI
IADFTKTEANHHGFDLAELENKLIEHGFSSVHSQILYSAEDLFQGNHSEFFLTVSQKSLA
(SEQ ID NO: 1055)

>orf02974
MKHDFNHKAETFDSPKNIFLANLVCQAVEKQIDILSDKVILDFGGGTGLLALPLAKQAKS
VTLVDISEKMLE (SEQ ID NO: 1056)

>orf02978
MVDLQSFFTRKYLNLNSVDAYLILPRLQGHLSYPQDFFLLQDFCFLLPIFLNLSQKEGRN
AGKDS (SEQ ID NO: 1057)

>orf02991
VTENPAPFVFTVSINSFFTVVAFTTGTDARNQDLVTFFEVGNSFPNFFNNPNPFVAKNGT
TLASRNIPFDNMEVCSTNSGFYNTHNSICWLANNWFVYINKRSKSWFNIRXXIPFIN
(SEQ ID NO: 1058)

>orf02993
MRIRNSPFDHILQTIFEFEDRTCQVTCRFEACSSICNDNWEFSQHIISVFQSPSCHTVCD
KSDVFCSFLFDKNFASLWIYVVTITDQLCIGMWQLVHGSNHTQFTVSQPTHSIVSMHPNT
RSSIDCFFGFIKSRV (SEQ ID NO: 1059)

>orf02994
MSKSNRHTFARNCTNKVFHPITFWCKGNFIKQAICRFLPRMKLLNTRVSHISWILCPLKS
FCEIWTFIINPTNLSTCCFFIMVSKIFSDCKQLLISGC (SEQ ID NO: 1060)

>orf02996
MQCTFNVVVHHIYTCISMNMSIHKSWGNAITCIVNHLSPFRNLLYMFPKLAVHKFQVTTS
TNSVWVEKLIRFNIVRHNVNLLKRLILQFIMSITL (SEQ ID NO: 1061)

>orf03011
MTLHQTFRFQNLEMPCQSSLINFQTLLNRHLVTRRMLQQKQ (SEQ ID NO: 1062)

>orf03023

LLSSFQDAVKFFAVVFFRKVQPSQEVAPNASSFTDQFMGG (SEQ ID NO: 1063)

>orf03025
MVVTTFNDFSIFKDNNLICIENGFQAVGNDETSSTCYNHLHGMLNLAFRHRIYV
(SEQ ID NO: 1064)

>orf03031
MAEFNSVITTVTGIGDRLGAVILAEIRNIHAFDNPAQLQAFAGLDSSIYQSDQIDLAGRM
VKRSSPHLR (SEQ ID NO: 1065)

>orf03041
MQQYVDIKKQYPDAFLLFRMGDFYELFYEDAVNAAQILEISLTSRNKNADNPIPMAGVPY
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EVVQVFLDHFFERSDLTDSLKGVYDIERLASRVSFGKTNPKDLLQLATTLSSVPRIRAIL
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GTSWIAEIEAKERENSGISTLKIDYNKKDGYYFHVTNSQLGNVPAHFFRKATLKNSERFG
TEELARIEGDMLEAREKSANLEYEIFMRIREEVGKYIQRLQALAQGIATVDVLQSLAVVA
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TYMRQLAMTAVMAQLGSYVPAESAHLPIFDAIFTRIGAADDLVSGQSTFMVEMMEANNAI
SHATKNSLILFDELGRGTATYDGMALAQSIIEYIHEHIGAKTLFATHYHELTSLESSLQH
LVNVHVATLEQDGQVTFLHKIEPGPADKSYGIHVAKIAGLPADLLARADKILTQLENQGT
ESPPPMRQTSAVTEQISLFDRAEEHPILAELAKLDVYNMTPMQVMNVLVELKQKL
(SEQ ID NO: 1066)

>orf03051
LTNLSSVDSEELFQFYRERGNAENFIKERKAGFFGDKTDSSTMIKNEVRMMMGCLAYNLY
LFLKQLAGDEVKALTIKRFRRLFLHIAGKYVSTARRHILKFSSLYAYSKQFQALFDTICQ
INLILPVPYRARGQGKTCLTE (SEQ ID NO: 1067)

>orf03061
LFDDRQAINICPPTNGSLRLTSLQVDQNPCPPSTNLNKILARSQFLNHIQQISLSLELLQ
ANLWNLV (SEQ ID NO: 1068)

>orf03092
MKIKVQTRKLAAGCSKHCFEVVDRTDEVSSKHGFEVADRTDEVSSKHGFEVADRTDEVSN
IYTVRRR (SEQ ID NO: 1069)

>orf03093
MDFFNYLLWMICHNHGLHTLLLSKDCVCHTARDKDGNHRIKSVFPTKGQTCYQHDSSIYQ
ERNTTDILTRFLTNSQADDVRPTTGDIVSKSKTNPQTHNNTPKKGIDNGILCQGCHRDKL
DKEGTHRYRDKGKDGELMANLIPS (SEQ ID NO: 1070)

>orf03104
MIKQIKAHLNKSIQSIIGQKVEFVKQDEQAFTRKRRLSLETMIRTILGMGGKSLSKELLD
ARLTVSNSALVQRRYQIKPEAFYALFKEFTAPIPLNTDFPIFAADGSDICIPRNPMDTET
SIQTQTDVKSYNLIHINALYDLTTGVYRDVSIQDKHAQHERLALIQMMEASPFRESSCYH
G (SEQ ID NO: 1071)

>orf03108
MAHFQEKGWLYIIRIRDGKQSMPSSFNLPNTECFDQKVSLKLSRKQTNQLKKLYRDFPND
YHFIPHNSIFDFLPETSRKQDPVTLYELPFRMVRLKVEEGKYETLVTNTDYSVQELKNLY
ASRWGIETSFRDLKYSIGLVNFHAKKKEGILQEIFARFTNFNFCRWVTSQVAIDSSHKKQ
RYKVCFSDAAYACRLFFNGSLSSHQLKNYLKKQLSIIRPNRKYSRKIKAQSVVDFICRVT
(SEQ ID NO: 1072)

>orf03110
MCELDILHDSLYQFCPELHLKRLNSLTLACHALLDCKTLTLTELGRNLPTKARTKHNIKR
IDRLLGNRHLHKERLAVYRWHASFICSGNTMPIVLVDWSDIREQKRLMVLRASVALHGRS
VTLYEKAFPLSEQCSKKAHDQFLADLASILPSNTTPLIVSDAGFKVPWYKSVEKLGWYWV
SRVREKVQYAP (SEQ ID NO: 1073)

>orf03139
LSIQVETLELRVIFKEIKEIVKQFHQLHTMAFKRQVPLTIPVTM
(SEQ ID NO: 1074)

>orf03154
MGALGYYEGFVPYVSNQYKNQAEEEGKPLSDKYIFEKILGKTYAAFKKDQINERVEKLGK
LKPITINYNGKSEVIDSKEKLQELMNKAVKDEVAQIS (SEQ ID NO: 1075)

>orf03155
MMGDGMKEFQFERKQRFSLRKYAIGACSVLLGTSLFFAGMGAQPVQDTETSSALISSHYL
DEQDLSEKLKSELQWFELENKLLNLWEH (SEQ ID NO: 1076)

>orf03159
VNITKTSIIKAHTTKEDGIDHTFTRFNIMSIFYSTRKIFLDKLNSTNRQFLGYIISTRCY
QSFNSVSQSIHTSSSSQAFRFGKHEFRVINRDKSKAILVNHYHLNLAFFISNHIVNSDFC
RSSCRCIDSHNWQAFFSRLMKPFIILWFSTICSHDRNTTSCILWRTPAKTDDKVTAMFLQ
SSYPICDIFTSRVWLYIAKDDIFDSFCIQWF (SEQ ID NO: 1077)

>orf03175
MSMDNCIDIITSLILNQMHIPFARWQAFSLYNISINIHHYNIGFFDFKEINTRRGNCHQL
FFTIENAEIPTCSFRQICFY (SEQ ID NO: 1078)

>orf03182
MNIAIRIILNFFRVMGNHQNSLAMMMGAVVHEFVKFIFTSCIHPRCRLV
(SEQ ID NO: 1079)

>orf03183
MLLIMSIQTTEPAFSRIATRLDKFIDRTWKTSIKTGNLLRKIGYSQFLTLRICL
(SEQ ID NO: 1080)

>orf03184
LQNSKTSLDERRLSRSIFPSQGNKFPTINTIIDMFKNRLLIIIEGQILYRNISHYLISPT
KAVKNR (SEQ ID NO: 1081)

>orf03197
MSNSFVKLLVSQLFANLADIFFRVTIIANIYIISKSVIATSLVPILIGISSFVASLLVPL
VTKRLALNRVLSLSQFGKTILLAILVGMFTVMQSVAPLVTYLFVVAISILDGFAAPVSYA
IVPRYATDLGKANSALSMTGEAVQLIGWGLGGLLFATIGLLPTTFIILVLYIISSFLMLF
LPNAEVEVLESETNLEILLKGWKLVARNPRLRLFVSANLLEIFSNTIWVSSIILVFVTEL
LNKTESYWGYSNTAYSIGIIISGLIAFRLSEKFLAAKWESILFPLVAMAIVTLTILYFPN
AQMFLLFSALVGMLSQLKEVPESVFLQETVEENHLVNVYSVLEVISTLAFSVFVLLMSYI
TESFGISISFWLSAICLMIEAILIYIRRDYFK (SEQ ID NO: 1082)

>orf03198
MSKLLDKILSRENMLEAYNQVKSNKGSAGIDGMTIEEMDNYLRQNWRLTKELIKQRKYKP
QPVLKVEIPKPDGGIRQLGIPTVMDRMIQQAIVQVMSPICEPHFSDTSYDFRPNRSCEKA
IMKLLEYLNDGYEWIVDIDLEKFFDTVPQDRLMSLVHNIIEDGDTESLIRKYLHSGVIIN
GQRYKTLVGTPQGGNLSPLLSNIMLNELDKELEKRGLRFVRYADDCVITVGSEAASKRVM
YSVSRFIEKRLGLKVNMTKRVEISRFWVLEIIRWLEKPSTSR (SEQ ID NO: 1083)

>orf03202
MFLRCATFKLADSRLNIFTCFFFGEIRFNSRNQVVKAFITDGTVISTIIVRGTVPCNQWT
KTCPAAFDIINGDVGFWKAVVDNAK (SEQ ID NO: 1084)

>orf03203
MLQITCVVCISCTKVSLVFTWENKDHTTVTQTCVKVNWL (SEQ ID NO: 1085)

>orf03204
LRSLIRQITYFITPRTCCINNQTGLDFKHLVCQEITSYNTCNLATFVKEEAFCLHVVGNE
GTVLVGTFDVFNHETRIVVTEVKIHSTSYQAFLLQVWLAFQDLILAQNLVRSWCVAHTC
(SEQ ID NO: 1086)

>orf03205
LHFNQTSLKTASCRLQGYTSSCDSSTDNQEVQGAFLHFFN (SEQ ID NO: 1087)

>orf03216
LKIDHTQLSPSNLLNTFVTPFIFYLKHSINLTNAEIICFSFYFHADFLVHYPENQ
(SEQ ID NO: 1088)

>orf03224
LKKVQHTQNVDFNKKLSRIKTKYLYGLKEKSEAELTLKTKETKEELTAAFEQFKKDTLKS
GKKVAEAEKKAKAQKEEDRRNYPTNTYKTIELEIAEAEVGVAKAELELEFAQAQVQIPQD
TEKINAAKSKVEAAKSNVKKLEKIKSDIEKTYLYKLDNSTKETPKSRVRRNSPQVGDSRE
LKETIDKAKETLSTYMVTRLTKLDPSVFWFADLLMDAKKVVEEYKTKLEDASDKKSVEDL
RKEAEGKIESLIVTHQNREKENQPAPQPGGQAGGSMVVPPVTQTPPSTSQSPGQKATEAE
KKKLQDLIRQFQEALNKLDDETKTVPDGAKLTGEAGKAYNETRTYAKEVVDKSKKLLSQT
AVTMDELAMQLTKLNDAMSKLKEAKAKLVPEVKPQPENPEPKPQPEGEKPSVPDINQEKE
KAKLAIATYMSKILDDIKKHHLKKEKHHQIVALIKDLDKLKKQALSEIDNVNTKVEIENT
VHKVFADMDTVVTKFQKGLIQNTPQVPEAPKSPEVPKVSDTPKAPDTPQVPEAPKSPEVP
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SGALAVNTTVGGYRVNANGKWVN (SEQ ID NO: 1089)

>orf03230
MDREILKFFQDLLSILSHNDMITLFCQKCCNSFSNHFLVICN (SEQ ID NO: 1090)

>orf03232
MFITLRRICLRACVVEKEQSYLKFLFFQKRPVSFLHVKSVLAGI
(SEQ ID NO: 1091)

>orf03233
MVKTTNRLEAIGFSFILFENLFKPRQLYLQPQTSVLSNLRLAA
(SEQ ID NO: 1092)

>orf03239
MTRKLNPSYTNVASATTLTFNQVASTFRKACLDHVVNLTRNNLKGICQLTPLQLHDTRLI
(SEQ ID NO: 1093)

>orf03270
MRTFFLYSSAFKKHSSPSPINDGLYHLLLQSLYNILELIHDIFQSLKGFILKSTFTNLFP
HLFNGVHLWCVWRNKCKANISRNL (SEQ ID NO: 1094)

>orf03277
LVSVFYSLLQVDNVDSVTFSKDVLSHLRIPATSLVTKVYTSLKKLFH
(SEQ ID NO: 1095)

>orf03286
LIVWILKNHTDLTTYIPNIFLSQTLAINYNLSRFCFQ (SEQ ID NO: 1096)

>orf03287
MPYNRKPFSTFHVKRNILHIVVVLIFFITKRKIFYINY (SEQ ID NO: 1097)

>orf03291
MFKKMSNSSRILFYISVNFCDKRIYRTKLYSDTPVNLFKFLFRQKSNCQSIGQTSSINLF
FYSWIVFFFKNNLCHSIPSIK (SEQ ID NO: 1098)

>orf03304
LADGSGKLAEGGTKLTSGLEDLQTGLASLGQGLGNASDQLKSVSTESKNAEILSNPLNLS
KTDNDQVPVNGIAIAPYMISVALFFAAISTNMIFAKLPSGRHPESRWAWLKS
(SEQ ID NO: 1099)

>orf03310

MKNTVKLEQFVALKEKDLQKIKGGEMRLSKFFRDFILQRKK (SEQ ID NO: 1100)

>orf03330
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 1101)

>orf03344
MKIKEQTRKLAAGCSKHCFEVVDETDEVSNHTYGKVKLTWFEEIFE (SEQ ID NO: 1102)

>orf03352
LIDVLFINSFIGRICFYCYRRIHATCLFLQLFSIVILNVAHTLKHSIFIVITFISRCRNF
IIVRILLENQFSRNQGIDNRVGQSRY (SEQ ID NO: 1103)

>orf03353
MVNVNQVSIEVKNTFKNWNFTSSIELTTFSKFSQSPTMT (SEQ ID NO: 1104)

>orf03364
MGFSMKLIHDLDMHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 1105)

>orf03368
LKSVGSRVEDKRYQETIVATFSDILKRSREMQDQNIKXXFIH (SEQ ID NO: 1106)

>orf03372
MLTIEPTKAPLVNVCDTANTARIDDEPYSPGDFXXHSIH (SEQ ID NO: 1107)

>orf03373
MRWNIGCHPNRDTSCSINQKVWKTRWQDQGFPFIGIIVINEINCIFVDITKHFQSNLAHT
CLGITLSGSTISIHGTKIPMTIYKHVTVAPPLSHTDHGFINRGIPVWVIFTHDIPCNTSR
FFMGFVWGHTQFIHSVKNATVNRF (SEQ ID NO: 1108)

>orf03380
MTDFNTFLQLSEGWSLFRSDFLLCIKHFLNSFSSSKGQLKASPTRCNLDNRLVVLL
(SEQ ID NO: 1109)

>orf03390
MGGNPPMKKYSIVDKIVLSTKIKRIIIFTVFRENWEPYMKKYTEVFQSQFPNLNIDYLLL
DTEQIDLDSYLDADIIIIGGGNTEKYIATYVNQEFKNYIDHMLNKGAKVIGFSAGALLLG
EKVYVSPNDNSDHQIKIKDGLGLFSQFLISVYYDSWNDKANKDRAEELVNVPIIPLNDHS
CLVLDKLGNIIEKID (SEQ ID NO: 1110)

>orf03393
MYGGEAKSNAMEAIQAAKKGDFSKANRRLADANAALLQAHKAQTEMLTREAQGEKTSISL
LMVHAQDHLMTSLTFVDLAKEVVEVYERFEKN (SEQ ID NO: 1111)

>orf03396
MLARSKNCFMKSLSIFLLIFYFFDSYQISKKRRSLIGL (SEQ ID NO: 1112)

>orf03399
VTAHRIFGTSSIHSKLIGLAMLGITAMKIICHKLNRNHINIFRRLGIQGKTEFLLIHLIR
QVKMNHLSQGMNPTICPTSTVNSNGLPFI (SEQ ID NO: 1113)

>orf03402
MLKNGIISWKDFKSFFCQGCQTSHCYKPMQAVQGIGSQIS (SEQ ID NO: 1114)

>orf03403
MRFLADQDRIQHHRYSWALFDKVQGLLSHADSREKTNLNSPKFHITQAI
(SEQ ID NO: 1115)

>orf03405
MSYGRPYILNVDGAIHDGWLAISNYENSLNKDYLFYILSSNVVYSQFLSLISGAVVKNLN
SDKVASILIPLPPLAEQQRIIEAIESALEKVDEYAESYNRLEQLDKEFPDKLKKSILQYA
MQGKLVEQDPNDESVEVLLEKIRAEKQKLFEEGKIKKKDLDISIVSQGDDNSYYEEVPCE
IPESWEWVRLNDITSYIQRGKSPKYSNIPIYPVIAQKCNQWSGFSIDLARFIDPETVHSY
QKERLLRDGDLMWNSTGLGTLGRLAIYHENKNPYVWAVADSHVTVIRVLSGVINCHFIYN

FLSSPIVQSVIEEKASGSTKQKELLTKTIKEYLIPLPPLPEQSRIVDRIEQFFAHIDALI
(SEQ ID NO: 1116)

>orf03424
LAQISILHFDFLSIDKHSHTVFNTLRKSLQTTLALSATSKQCFEQLAASFLVCSLIFIEY
KV (SEQ ID NO: 1117)

>orf03430
MGFKVSHFKIPSSHLSINVLRTVENFTEIGQGLLHISP (SEQ ID NO: 1118)

>orf03431
VGFFDFGLTNSCRQVRQFTQTVQDFLVCCHQGIVKEGQGYAGICFKFHPSLGNIGKFVIA
IVRRLRHKSIVANMAHLNVDLFQFRKGLLEILKSVKIALVITAKLVDVFASFLDCTQEIL
TVLV (SEQ ID NO: 1119)

>orf03439
MNITYIVGNGLDLQYGLKTRYRDFYEFQNKVYISRTENEEKYSNFIYESLFSDKVNDYEN
WSDFELSIGKLTKDNDLISSSIEIKEKFIDDFSEVVDDLREYLRIQQEKNLEKGNAIDFI
STLDDMRTSLPVINQPAIDKKYNENPHQDDIVNIVTLNYTHVIDKLYNGSAKSFRNQLRA
NLYNFYIEPPIHAHGTVDVCTVLGVSDEIQISNSFDEEQKESLIKNLVLKNYRENMDVKN
SDIIKNSDIIILYGVSLGETDGYIWNQIAEQSIRSSVPVIIYHYVPHFDAGNPTRVKRLY
RNVEDKFIQNSGIDLELEKKLRDNLIVVIGKTIFNLMER
(SEQ ID NO: 1120)

>orf03440
VGAKFNDEKTKHIVTHYISRDALNKTITVLSKIIEVFEEHFDRAITCEMFSDSSTFASIN
FSEYGISKSKFQQYLRDSCFIENFGVEHTTVSDIQNSIVTFYDVHTDIFRLLNKLNIDIS
EANIMNQTTVLLDEKNIELLLSKAPYLVSMIVEDFSKLSVDDFSLDNNDLKINLPSPMNE
PVVGVIDTLFDKRVYFNEWVEYHDFVSPDISKDSQDYKHGTAVTSLIVDGANLNPNLDDG
CGNFRVRHFGVSLQSGFNSFTIIKQIKEIVSQNADIKVWNLSLGSNDEIRENFISAEGAL
LDEIQFENDVIFIIAGTNASVINGKRKRIGAPADSLNSIIVNSVDFNNQSVSYSREGIVL
SFFVKPDVSYYGGGNGDFINVCEPLGLGRVAGTSFAAPFIARKMAYLIHIMGLSREEAKA
LLIDAAIPWNDKKTFTDLSLIGNGIVPIKMDDILSTPDDEIKFIVSDISRAYDTYNYDFP
VPISSESYPYVAKATMCYFPNCSRKQGVDYTNTEMQLTFGRLKSDGIKSINKDNQHAEDT
PGYVRENAARNIFRKWDNVKHIGESFTSRKRAKAILNPSNPQWGMSIKTIERLKSGDGQG
VRFGVVVTLKELNGVNRIEDFIQQAELRGWLVNRLQVEAQVDLFNSLNEEIEFE
(SEQ ID NO: 1121)

>orf03442
MFVADIMISDYSSAPIDFLLLNRVVFLYLPDFKEYQSDKNPFFEVFKVSKTKGIALDPFD
EIIGRFQFGVRIV (SEQ ID NO: 1122)

>orf03450
MGFSMKLIHDLNTHTTHSTAKMLYNVKAIKNDFSIRE (SEQ ID NO: 1124)

>orf03453
MEQLHFITKLLDIKDTNTQIIDVVNRDSHKEIIAKLDYDAPSCPECGSQMKKYDFQKPSK
IPYLETTGMPTRILLRKRRFKCYHCSKMMVAETPLVKKNHQIPRIINQKIAQKLIEKISM
TDIAHQLSISTSTVIRKLNDFHFECNFRNLPKIMSWDVETVRGVTVSIGRWR
(SEQ ID NO: 1125)

>orf03462
LDPWDGNSQKPRFQGLWKFIQRDSRKWRERRFYGPTFGKHLTNKKVFDKVFELFTRPGNI
IIIFINFCGFTSEIRNRGKFFGLIEDNLKQVHPIFQTVFKTFLKDKEKIINALQLHYSNA
KPEATNNLIKLIKRNAFGFRNFENFKKRIFIALNIKKERTKFVLSRA
(SEQ ID NO: 1126)

>orf03466
MVLYFWKVFQRVPNKLWKNMGENFQVRSLQDKIIQNLTNKGFSYFDAKMPIDEWDSQVDE
ETTQELISRDLISNILSMPESMKDTN (SEQ ID NO: 1127)

>orf03469
MSKSHSFSISLGISNSFWNNIHTSECWYFLAEGKSNRSNSTISVNQMVFFINIQRFYCFA

IEDFCLLRI (SEQ ID NO: 1128)

>orf03470
LNTLLPPDNLCLFTIYLTGFSCICINSYCHNFWEIFNQLFYQLS
(SEQ ID NO: 1129)

>orf03475
MKLLSIAISSYNAAAYLHYCVESLVIGGEQVGILIINDGSQDQTQEIAECLASKYPNIVR
AIYQENKCHGGAVNRGLAEASGRYFKVVDSDDWVDPRAYLKILETLQELESKGQEVDVFV
TNFVYEKEGQSRKKSMSYDSVLPVRQIFGWDQVGNFSKGQYTMMHSLIYRTDLLRASQF
(SEQ ID NO: 1130)

>orf03476
MYYLPVDFYRYLIGREDQSVNEQVMIKCIDQQLKVNRLLIDQLDLSQVSHPKMREYLLNH
IEITTVISSTLLNRSGTAEHLAKKRQLWTYIQQKNPEVFQAIRKTMLSRLTKHSVLPDRK
LSNVVYQITKSVYGFN (SEQ ID NO: 1131)

>orf03484
MKRIQLNMNETKKYLVIKAIAQGKKTKKRACVELNLSERQINRLLLAYQQKGKEAFRHGH
GNRNRKPKHAIPDEIKERVLKKYLSYETYKPNVLHFCELLAEEEGIKLSDTTVRKILYKK
NILSPKSHRKTKKRVRKQAKLNLNQPLDNPILPTAKDFLEDPKKVHPSRPRKKFAGELIQ
MDASPHAWFGPETTNLHLAIDDASGNILGAYFDKQETLNAYYHVLEQILANHGIPLQMKT
DKRTVFTYQALQL (SEQ ID NO: 1132)

[0402] In some embodiments, preferred INV200 antigens are selected from the polypeptides orf00159 (SEQ ID NO: 626), orf00162 (SEQ ID NO: 628), orf00163 (SEQ ID NO: 629), orf00164 (SEQ ID NO: 630), orf00165 (SEQ ID NO: 631), orf00166 (SEQ ID NO: 632), orf00201 (SEQ ID NO: 639), orf00209 (SEQ ID NO: 645), orf01109 (SEQ ID NO: 747), orf01137 (SEQ ID NO: 751), orf01138 (SEQ ID NO: 752), orf01309 (SEQ ID NO: 783), orf01313 (SEQ ID NO: 786), orf01315 (SEQ ID NO: 787), orf01431 (SEQ ID NO: 810), orf01433 (SEQ ID NO: 812), orf01434 (SEQ ID NO: 813), orf01537 (SEQ ID NO: 824), orf01588 (SEQ ID NO: 831), orf01642 (SEQ ID NO: 842), orf01656 (SEQ ID NO: 847), orf01800 (SEQ ID NO: 875), orf01801 (SEQ ID NO: 876), orf01810 (SEQ ID NO: 879), orf01812 (SEQ ID NO: 880), orf01818 (SEQ ID NO: 882), orf01988 (SEQ ID NO: 913), orf01989 (SEQ ID NO: 914), orf02105 (SEQ ID NO: 925), orf02106 (SEQ ID NO: 926), orf02263 (SEQ ID NO: 947), orf02264 (SEQ ID NO: 948), orf02459 (SEQ ID NO: 968), orf02538 (SEQ ID NO: 987), orf02539 (SEQ ID NO: 988), orf02541 (SEQ ID NO: 990), orf02545 (SEQ ID NO: 992), orf02604 (SEQ ID NO: 1003), orf02608 (SEQ ID NO: 1007), orf02609 (SEQ ID NO: 1008), orf02850 (SEQ ID NO: 1036), orf03197 (SEQ ID NO: 1082), orf03439 (SEQ ID NO: 1120), orf03448 (SEQ ID NO: 1123), and immunogenic fragments thereof.

7. Sequences Identified from 23F

>orf00010
LPVTFDFLIEGSTKGNIDKLDTATDCHNWFILTKRFLQECQFKFVTDQIVIIAFDGLFLS
IKLRMNILASCQNEFVNHFHIITYN (SEQ ID NO: 1133)

>orf00017
MSLITHKRFISCNENIKHYKRLIDKAKKCVNDLMAEFNSVITTVTGIENRLGAVILAEIR
NIHAFDNPAQLQAFAGLDSSIYQSGQIDLAGRMVKRGSPHLR (SEQ ID NO: 1134)

>orf00027
MQQYVDIKKQYPDAFLLFRMGDFYELFYEDAVNAAQILEISLTSRNKNADNPIPMAGVPY
HSAQQYIDVLIEQGYKVAIAEQMEDPKQAVGVVKREVVQVITPGTVVDSSKPDSQNNFLV
SIDREGNQFGLAYMDLVTGDFYVTGLLDFTLVCGEIRNLKAREVVLGYDLSEEEEQILSR
QMNLVLSYEKESFEDLHLLDLRLATVEQTASSKLLQYVHRTQMRELNHLKPVIRYEIKDF
LQMDYATKASLDLVENARSGKKQGSLFWLLDETKTAMGMRLLRSWIHRPLIDKERIVQRQ
EVVQVFLDHFFERSDLTDSLKGVYDIERLASRVSFGKTNPKDLLQLATTLSSVPRIRAIL
EGMEQPTLAYLIAQLDAIPELESLISAAIAPEAPHVITDGGIIRTGFDETLDKYRCVLRE
GTSWIAEIEAKERENSGISTLKIDYNKKDGYYFHVTNSQLGNVPAHFFRKATLKNSERFG
TEELARIEGDMLEAREKSANLEYEIFMRIREEVGKYIQRLQALAQGIATVDVLQSLAVVA
ETQHLIRPEFGDDSQIDIRKGRHAVVEKVMGAQTYIPNTIQMAEDTSIQLVTGPNMSGKS
TYMRQLAMTAVMAQLGSYVPAESAHLPIFDAIFTRIGAADDLVSGQSTFMVEMMEANNAI
SHATKNSLILFDELGRGTATYDGMALAQSIIEYIHEHIGAKTLFATHYHELTSLESSLQH
LVNVHVATLEQDGQVTFLHKIEPGPADKSYGIHVAKIAGLPADLLARADKILTQLENQGT
ESPPPMRQTSAVTEQISLFDRAEEHPILAELAKLDVYNMTPMQVMNVLVELKQKL
(SEQ ID NO: 1135)

>orf00033
MRRKYKSIALKKELANDSGKKKFHAMKAQAIVTSQGRIVSIAMI
(SEQ ID NO: 1136)

>orf00042
LTNLSSVDSEELFQFYRERGNAENFIKERKAGFFGDKTDSSTMIKNEVRMMMGCLAYNLY
LFLKQLAGDEVKALTIKRFRRLFLHIAGKYVSTARRHILKFSSLYAYSKQFQALFDTICQ
INLILPVPYRARGQGKTA (SEQ ID NO: 1137)

>orf00051
LFDDRQAINICPPTNGSLRLTSLQVDQNPCPPSTNLNKILARSQFLNHIQQISLSLELLQ
ANLWNLV (SEQ ID NO: 1138)

>orf00055
LSVHFCSSHRCLLVRYNDTYSTKKGLKFETFLSVFRYDFLGM
(SEQ ID NO: 1139)

>orf00086
VDRTDEVSSKHGFEVVDETDEVSSKHGFEVADRTDEVSSKHGFEVADRTDEVSSKHGFEV
ADRTDEVSSKHGFEVADRTDEVSSKHGFEVADRTDEVSSKHGFEVADRTDEVSSKHGFEV
ADRTDEVSSKHGFEVADRTDEVSSKHGFEVADRTDEVSNIYTAR
(SEQ ID NO: 1140)

>orf00088
MDFFNYLLWMICHNHGLHTLLLSKDCVCHTARDKDGNHRIKSVFPTKGQTCYQHDSSIYQ
ERNTTDILTRFLANSQADDIRPTTGDIVSKSKTNPQTHNNTPKKGIDNGILRQGCHRDKL
DKEGTHRYRDKGKDGELMANLIPS (SEQ ID NO: 1141)

>orf00096
MKIKEQTRKLAAGCSKHCFEVVDETDKVSSKHGFEVVDETDEVSSKHGFEVVDETDEVSN
HTYGKATLTWFEEIFEEY (SEQ ID NO: 1142)

>orf00103
LQNDKNHKLFDNYTCQKEKDVLRCKQVKRKEERSYDVGTRIYTIYDFLLF
(SEQ ID NO: 1143)

>orf00105
MKIKEQTRKLAAGCSKHCFEVMDRTDEVSSKHGFEVVDETDEVSNHTYGEVKLTWFEEIF
EEY (SEQ ID NO: 1144)

>orf00106
LFFKDEKQALYTKPKTKSSSFRASKVSNQTIVATTRTDCQVIALNLCDKLENGVVVVVQT
THHIGIDDVIYSKIFQHLTHSIKMSLAFFIKKVQDRRRILYCHLVFFFLRVQDTKRIFLQ
ATLAILRQGLLERCQIVNQGLAVGCTALRISKSVEVQFDTLNTDFLQKMGCHSDCFHIGS
WIARAKTLNTNLVELAQAPCLWTLITEHRSHVVELAWLLHFWGEEFIFHIGTDNGRSSFW

TEGNMAVTLVIEIVHFLGYDIGRISDRAADNLVMLKNGRAHFCVVVALENFTGKALNVLP
FGRFSR (SEQ ID NO: 1145)

>orf00114
MEQIGKVFRQLRESRNISLRQATGGQFSPSMLSRFETGQSELSVEKFLFALENISASVEE
ILFLARGFQYDTDSELRKEITDVLEPKNVAPLEDLYRREYQKHAHSHNKQKHILNAIMIK
SYMKSMDERVELTAEEGKVLHDYLFSTEIWGIYELNLFSVSSPFLSVSLFTRYVREMVRK
SDFLMEMSGNRNLFYTILLNGFLASIECEEFTNAYYFKRVIEEHFYKENETYFRIVYLWA
EGLLDSKQGRVKEGQKKMEDAVRIFEMLGCNKSAEYYRNTTEC
(SEQ ID NO: 1146)

>orf00118
MQEHYTPKGKHLTIDNRRLIERWKNENKSNREIAGLLGKAPQTIHTEVKRGTTLQQVRKG
LYKKVYSADYAQTVYQFNRKRSVKKLILTKEIREKILHYHKQKFSPEMMVNKKQVKVGIS
TIYYWFHNGHLGLTKADMLYPRKRKGVKKQASPNFKPAGKSIEERPDVINLRLENGHYEI
DTVLLTKIKNYCLLVLTDRRSRHQIIRLIPNKTAESVNQALTLLLGEHHILSITADNGSE
FKRLSEVFPEEHIYYAHAYSSWERGSNENHNRLIRRWLPKGTKKTTPKEVAFIENWINNY
PKKCLDYKSPSEFLLGG (SEQ ID NO: 1147)

>orf00121
MKIKGQTRKLAAGCSKHCFEVVDRTDEVSNHTYGKATLT (SEQ ID NO: 1148)

>orf00124
VVPFSDTFKDRNQVDIFTIKISRCNSSTIGENSWDIHISNSNHRSRHVLVTATDSDEGIH
VVTTHSRLDGVRDDVTRC (SEQ ID NO: 1149)

>orf00139
MDLKFEGVDLEYKKAKNNLPESFWETYSAFANTNGGKIILGIDEKNIDTYQRVNRLPAKL
(SEQ ID NO: 1150)

>orf00156
LSIQVETLELRVIFKEIKEIVKQFHQLHTMAFKRQVPLTVPVTM (SEQ ID NO: 1151)

>orf00171
VQKLKKAIYKAHLKDSDDFRPETSTPNLFESCLKLCPCFLSS (SEQ ID NO: 1152)

>orf00172
MGALGYYEGFVPYVSNQYKNQAEEEGKPLSDKYIFEKILGKTYAAFKKDQINERVEKLGK
LKPITINYNGKSEVIDSKEKLQELMNKAVKDEVAQI (SEQ ID NO: 1153)

>orf00173
MMGDGMKEFQFERKQRFSLRKYAIGACSVLLGTSLFFAGMGDQPVQDTETSSALISSHYL
DEQDLSEKLKSELQWFELENKLLNLWEH (SEQ ID NO: 1154)

>orf00177
VNIAKTSIIKAHTTKEDGIDHTFTRFNIMSIFYSTRKIFLDKLNSTNRQFLGYIISTRCY
QSFNSVSQSIHTSSSSQAFRFGKHEFRVINRDKSKAILVNHYHLNLAFFISNHIVNGNFC
(SEQ ID NO: 1155)

>orf00178
MKPFIILWSSTICSHDRNTTSCILWRTPAKTDDKVTAMFLQSSYPICDIFTSRVWLYIAK
DDIFDSFCIQWF (SEQ ID NO: 1156)

>orf00194
MHIPFARWQAFSLYNISINIHHYNIGFFDFKEINTRRGNCHQLFFTIENTEIPTCSFRQI
CFY (SEQ ID NO: 1157)

>orf00205
MNIAIRIILNFFRVMGNHQNSLAMMMGAVVHEFVKFIFTSCIHPRCRLV
(SEQ ID NO: 1158)

>orf00206
MLLIMSIQTTEPAFSRIATRLDKFIDRTWKTSIKTGNLLRKIGYSQFLTLRICL

(SEQ ID NO: 1159)

>orf00207
LQNSKTSLDERRLSRSIFPSQGNKFPTINTIIDMFKNRLLIIIEGQILYRNISHYLISPT
KAVKNR (SEQ ID NO: 1160)

>orf00220
MSNSFVKLLVSQLFANLADIFFRVTIIANIYIISKSVIATSLVPILIGISSFVASLLVPL
VTKRLALNRVLSLSQFGKTILLAILVGMFTVMQSVAPLVTYLFVVAISILDGFAAPVSYA
IVPRYATDLGKANSALSMTGEAVQLIGWGLGGLLFATIGLLPTTFIILVLYIISSFLMLF
LPNAEVEVLESETNLEILLKGWKLVARNPRLRLFVSANLLEIFSNTIWVSSIILVFVTEL
LNKTESYWGYSNTAYSIGIIISGLIAFRLSEKFLAAKWESILFPLVAMAIVTLTILYFPN
AQMFLLFSALVGMLSQLKEVPESVFLQETVEENHLVNVYSVLEVISTLAFSVFVLLMSYI
TESFGISISFWLSAICLMIEAILIYIRRDYFK (SEQ ID NO: 1161)

>orf00221
MSLVHNIIEDGDTESLIRKYLHSGVIINGQRYKTLVGTPQGGNLSPLLSNIMLNELDKEL
EKRGLRFVRYADDCVITVGSEAASKRVMYSVSRFIEKRLGLKVNMTKTKITRPRELKYLG
FGFWKSSDGWKSRPHQDSVRRFKLKLKKLTHRKWSIDLTRRIEQLNLSIRGWISYFSLGN
MKV (SEQ ID NO: 1162)

>orf00222
MSKLLDKILSRENMLEAYNQVKSNKGSAGIDGMTIEEMDNYLRQNWRLTKELIKQRKYKP
QPVLKVEIPKPDGGIRQLGIPTVMDRMIQQAIVQVMSPICEPHFSDTSYGFRPNRSCEKA
IMKLLEYLNDGYEWIVD (SEQ ID NO: 1163)

>orf00229
LHFNQTSLKTASCRLQGYTSSCDSSTDNQEVQGAFLHFFN (SEQ ID NO: 1164)

>orf00247
MFCLTFICLIRRSGYLGSYLLLCRMNHTSHKKTGNSYTSYSNTKFTN
(SEQ ID NO: 1165)

>orf00248
LPSEIKAKLDAAFEQFKKDTLPTEPGKKVAEAEKKVEEAKKKAEDQKEKDLRNYPTNTYK
TLELDIAESDVEVKKAELELVKEEAKESRDEKKINQAKAKVENKKAEATRLKNIKTDREK
AEEAKRRADAKLQEANVATSEQDKSKRRAKREVLGELATPDKKENDAKSSDSSVGEETLT
SPSLKPEKKVAEAEKKVEEAKKKAEDQKEEDRRNYPTNTYKTLELEIAESDVEVKKAELE
LVKEEAKESRDEKKINQAKAKVENKKAEATRLKNIKTDREKAEEAKRRADAKLQEANVAT
SEQDKSKRRAKREVLGELATPDKKENDAKSSDSSVGEETLTSPSLKPEKKVAEAEKKVEE
AKKKAEDQKEEDRRNYPTNTYKTLELEIAESDVEVKKAELELVKEEAKESRNEEKIKQVK
AKVESKKAEATRLENIKTDRKKAEEEEAKRRAAEEDKVKEKPAEQPQPAPAPQPEKPTEE
PENPAPAPAPKPENPAEKPKAEKPADQQAEEDYARRSEEEYNRLTQQQPPKAEKPAQPST
PKTGWKQENGMWYFYNTDGSMATGWLQNNGSWYYLNSNGAMATGWLQNNGSWYYLNANGS
MATGWLQNNGSWYYLNANGSMATGWLQYNGSWYYLNANGDMATGWLQNNGSWYYLNANGD
MATGWLQNNGSWYYLNANGDMATGWLQYNGSWYYLNANGDMETGWVKDGDTWYYLEASGA
MKASQWFKVSDKWYYVNGSGALAVNTTVDGYGVNANGEWVN
(SEQ ID NO: 1166)

>orf00254
MDREILKFFQDLLSILSHNDMITLFCQKCCNSFSNHFLVICN (SEQ ID NO: 1167)

>orf00261
MTRKLNPSYTNVASATTLTFNQVASTFRKACLDHVVNLTRNNLKGICQLTPLQLHDTRLI
(SEQ ID NO: 1168)

>orf00300
LVSVFYSLLQVDNVDSVTFSKDVLSHLRIPATSLVTKVYTSLKKLFH
(SEQ ID NO: 1169)

>orf00309
LIVWILKNHTDLTTYIPNIFLSQTLAINYNLSGFCFQ (SEQ ID NO: 1170)

>orf00310
MPYNRKPFSTFHVKRNILHIVVVLIFFIAKRKIFYINY (SEQ ID NO: 1171)

>orf00314
MFKKMSNSSRILFYISVNFCDKRIYRTKLYSDTPVNLFKFLFRQKSNCQSVGQTSSINLF
FYSWIVFFFKNNLCHSIPSIK (SEQ ID NO: 1172)

>orf00327
LADGSRKLAEGGTKLTSGLEDLQTGLASLGQGLGNASDQLKSVSTESKNAEILSNPLNLS
KTDNDQVPVNGIAIAPYMISVALFLQQYQQI (SEQ ID NO: 1173)

>orf00356
MEMSFIAQDFDKLNIITVLESRTQAIIRNPMNTRLSSATGSSFNKIVRN
(SEQ ID NO: 1174)

>orf00358
MELAETSIVKKNHQIPCIINQKIAQKLIEKTSMTDIDHQLSISTSTVIRKINNFHFEHDF
SRLPEIMS (SEQ ID NO: 1175)

>orf00364
MNYIDTNEMLFVETPRKVITSDELRKKNTKYLDQKEFKLFIQNLKDEALCDYRITKYIRI
AKVLFLTGMRYGELAALNYKEDIDFSKKTIHIKHTYDFRQKERTTPKTIKSDRVITAPQK
VLDIIKEQIIENATNGFDTDFIFINTLGEPITNARVICALKRHGQKIGIEKNITTHTFRH
SHISLLAELGIPLTAIMDRVGHSDSKTTLEIYSHVTQKMVSDISSKLDKIKF
(SEQ ID NO: 1176)

>orf00365
MWMEELPNGKYKFFERYKDPYTEKLKKVSVTMEKKTPQARNQAAILLQEKIKQKLGEKQH
SVSNITFEKLYEEFEENWKHGVKNSTVYASKNVKKEILKQIEGDYLVRNLIDVYYKK
(SEQ ID NO: 1177)

>orf00367
MEIDKVKADLKQVGKRVADLSQSITNEEQTKNAFIMPFFQALGYDIFNPLEFVPEFTADV
GIKKGEKVDYAIILDGEPQILIECKSITENLTKHDSQLFRYFVTTKSKFGILTNGREYKF
FTDLDEPNKMDTTPFLTIDVTDIKENQFTEIIKFHKENFDIDNIVSSASELKYLNNLKAF
LTENITTPSDSFLRYLTSEIYEGRVTQNILTTFSPIIVKGFNQFITERVNEKLSAALNTS
VETKVTTDIPKVEAEAEEIVEVTDEIITTPAELEVYTVVKMLARDVVSPERVFYRDNRSY
FNVLVDDNIKKWVLRYRSNSKKSTIEIRDKGIFPVSTPLEVANYANEILEVIKKFS
(SEQ ID NO: 1178)

>orf00368
MTLAKLCEEYQVELCLFDGSNWHNSGFYNPDTNVLAIDHNLTPEQQIQVALHELGHKDHT
RSEHQNARLRCENEADRNMIHHLVKDALENLDDPTEFDYLKFMSYYNLKTMTNEIMVKEE
YLALVN (SEQ ID NO: 1179)

>orf00369
MYRLDIDKKALKQLKKLDTPTRKQILSWLAKNIENTTNPRQHGKALKANLAGYWRYRVEN
YRIICDIQDDKLVVLAVEIAHRRDVYK (SEQ ID NO: 1180)

>orf00370
MTITINFTEKNSYITDYLNKHGIDTTTMDFDDFMALMEDIEDARAADQAYMEYLADPATY
TMDEVLDELGLTREDIA (SEQ ID NO: 1181)

>orf00371
MFETFEKIKELAKKRGKALGQVEEDLGYGRNTLYKIKNSTPNAERIAEIANYFNVSTDYL
LGRTDNPAIAGSDEFAQVNGQIIDLRKAAANTMLFDGKPLNEDDIDFITSVLSAHFKSKG
ER (SEQ ID NO: 1182)

>orf00372
MVSILKNLEQEKDHLEKVIKVVSAGGKFLRLPYQKSHARLVRI (SEQ ID NO: 1183)

>orf00373
MPDIANGRERVIAFLKEKGIKKATLAVAYGFKRQEVTNILSGTTKGPRANSFILQVIEDY

GIE (SEQ ID NO: 1184)

>orf00374
MRPKRYPYSGQKESTFVKADPELVEKLLRNTSFLECLQKKPINFQIDSEEFKRLSYEAIH
DTSQVTQ (SEQ ID NO: 1185)

>orf00377
LKNREEEWQGIIAKNAILLIIAPFYFLIIVKNGVLSKIKTVTEITAYQL
(SEQ ID NO: 1186)

>orf00378
MREVIQELLDSSMSTSAISQGAGVPWTTVSDLRKGKTSMDKMALLTAEKLYEFATTDKQ
(SEQ ID NO: 1187)

>orf00382
VEEVEVAEVKNARVSLTGEKTKPMKLAEVTSINVNRTKTEMEEFNRVLGGGVVPGSLVLI
GGDPGIGKSTLLLQVSTQLSQVGTVLYVSGEESAQQIKLRAERLGDIDSEFYLYAETNMQ
SVRAEVERIQPDFLIIDSIQTIMSPEISGVQGSVSQVREVTAELMQLAKTNNIAIFIVGH
VTKEGTLAGPRMLEHMVDTVLYFEGERHHTFRILRAVKNRFGSTNEIGIFEMQSGGLVEV
LNPSQVFLEERLDGATGSSIVVTMEGTRPILAEVQALVTPTMFGNAKRTTTGLDFNRASL
IMAVLEKRAGLLLQNQDAYLKSAGGVKLDEPAIDLAVAVAIASSYKDKPTNPQECFVGEL
GLTGEIRRVNRIEQRINEAAKLGFTKIYVPQNSLTGITLPKEIQVIGVTTIQEVLKKVFA
(SEQ ID NO: 1188)

>orf00389
VNIATLQNGHILGWQIQHIANKLTSNFWIAKDFLSYQVIGWANARMTYSHISSLFIISQF
(SEQ ID NO: 1189)

>orf00391
VSITFSLTNFFKILINLTAQVSPQVIDEKILMMDLNLNNYLSTVIQLRQDVYTGIKILHR
VRHGE (SEQ ID NO: 1190)

>orf00392
MSRYSYSLDSRKIVFEISCFKEKKASLTLFFHLFESSIMKLATQPSFSSFYSELK
(SEQ ID NO: 1191)

>orf00396
MKIKEQTRKLAAGCSKHCFEVVDRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSN
IYLRQGDVDVV (SEQ ID NO: 1192)

>orf00408
LSLLDLRGSLCLRIYLHEPLITTVSQDFTSLSDISHF (SEQ ID NO: 1193)

>orf00411
MDFKSFIIGLVVGIFGPYMDDLIRKKFLKSSEKKTEKSVKK (SEQ ID NO: 1194)

>orf00434
MFEKIKGINIKSGIFEDETKLELFEGNFEGTNPVQNDRASLLFGRNGSGKSTIARGINQL
KNGEIGTDRVSFIDKNNNNIVLSDTERKSIFVFNEHYVDQKVKIAQEGLDTIVILGEQVD
IDEELDRLRTQLSESQIESQDYYAEYEEYLDEKNEKSPDFWKKEMTDSLKGVGNWAERDR
EIKGNRAASPVHNNTFQNFVDLQPILDKNELEVEFNNKKARYFSIRDSAVTINNELSLPD
INFDSNELSTLLSEKIEEPELNSRDKYLLTLLSDSTKGERHLREVKDFFEDEHQKKCPFC
TQSVSEDVKVELTNGITKLLSRAVEEHQSALRGKKIDEINQDFSGYEQIDPILIQSYQNS
INALNAKFNEINSIIDKKIDNPYNIVELPNISFSQELSQAEHDIEKINQAIIKHNSEISG
IQKLKVDLLQINNELAFYEIQDAYKKFQEKTNKKAICENNYNNSSKRVKDYEKQISDLED
KKLNIDIAVDEINKSLNYIFFSKNRLAIQNQNGKYYLLSRGKSVVPSRVSVGERNALALC
YFFTEIIQQRELADAYSHEYFIVIDDPISSFDMENKVGITSYLKYCLTRFFKGNSNTRVL
LMTHDKQTIYDFDIFLKEIMESCKEEEGGQKSKYKKLELVSGKLQEFKTSTHDYTELLEI
VFGYALGNSTPTSESFVGNAMRKILEAYGSFNYKKGIAELTTDPLIVEKIDKEYRTYFEN
LMYRLVLNGESHFKDPVKTLSIDFFDTISDEERKKTARDLLVLLYLLDDLHVLKHLEGVS
NAENRLEQWKCEILE (SEQ ID NO: 1195)

>orf00458

MIEGDRDCADIVTQLTAVKSSVERVIEMIITENLTECINQPLDDSEAQKERLEKALRVID
KRK (SEQ ID NO: 1196)

>orf00460
METSISMADFYGKYQNENLELIDVREAHEFQAGHAPGAKNLPLSTLEQGYKELKPDHEYY
VICQGGVRSASTCQFLSSQGLTVTNVEGGMNAWPGQVE (SEQ ID NO: 1197)

>orf00462
LGGKSCLLEDRLCDIAAQTTVAADDVGLFFVQFISFLLDTLSVFDTIVQN
(SEQ ID NO: 1198)

>orf00466
MKIKDQTRKLAAGCSKHCFEVVDRTDEVSSKHCFEVADRTDEVSNIYTARRR
(SEQ ID NO: 1199)

>orf00467
MKLLSIAISSYNAAAYLHYCVESLVIGGEQVGILIINDGSQDQTQEIAECLASKYPNIVR
AIYQENKGHGGAVNRGLAEASGRYFKVVDSDDWVDPRAYLKILETLQEFESKGQEVDVFV
TNFVYEKEGQSCKKSMSYDSVLPVRQIFGWDQVGNFSKGQYIMMHSLIYRTDLLRASQF
(SEQ ID NO: 1200)

>orf00468
MYYLPVDFYRYLIGREDQSVNEQVMIKCIDQQLKVNRLLVDQLDLSQVSHPKMREYLLNH
IEITTVISSTLLNRSGTAEHLAKKRQLWTYIQQKNPEVFQAIRKTMLSRLTKHSVLPDRK
LSNVVYQITKSVYGFN (SEQ ID NO: 1201)

>orf00476
MSLQIKLKKLAKELSKLLKDSNLETVDKDVLENSQKELQKAVLFLADEKGSEHTEAEVID
NLKEVIAKLKANA (SEQ ID NO: 1202)

>orf00483
MKIKEQTRKLAAGCSKHCFEVVDKTDEVSYIYLRQGEADAV (SEQ ID NO: 1203)

>orf00503
MKIKEQTRKLAAGSSKHCFKVVDGTDEVSSKHCFKVVDGTDEVSSKHCFEVVDRTDEVSN
HIRQGDVDVV (SEQ ID NO: 1204)

>orf00509
MNDDDSRCIHIERDGKTIEFGYLNISSTDRNTSHADGLVGIFNSNFSGVRVRGIAVFLNG
PDNLDTTLVGNFQTIWNFRIICIHS (SEQ ID NO: 1205)

>orf00510
LEFNFCRSIIKNGRDNLPNTNSTSGMATRWANHNWSDDIKDRLKTK (SEQ ID NO: 1206)

>orf00515
MSNVDKIRKIHIIVCWMYIFLSFRAIINDTEYFLLIFLAFIYSIVSLPLYSVKNKIVSIC
LVINSILLMSFPILINKFFPESFLTYIVLISVFITELIIFHLIGKDFDTKLTNEYKKISQ
FRSKVSQSPWIKYLEISSFILTIFPSILYGTVDNHVLTLIFLIKICVDTTIKFLFIRLFD
TSTLMKRRIFFLFALDVIAYLFLGYLLVIQKAGYLFSVLLLFSNFSVPFIKEKEYELFKN
SK (SEQ ID NO: 1207)

>orf00516
MNKKKMILTSLASVAILGAGFVASSPTVVRAEDAPQVVEKSSLEKKYEEAKTKADTAKKD
YETAKKKAEDAQKKYDEDQKKTEEKAKKEKEAAKKVDDASLAVQKAYVEYRKVQESRSNY
RNRSDYNKKLAEAQVKIDEANKKLTAANNEFKTVRAVVVPEPNALAETKKKAEEAKAEK
(SEQ ID NO: 1208)

>orf00518
LEQEVATAQHQVDNLKKLLAGVDPDDTEAIEAKLKKGEAELNAKQAELAKKQTGLEKLLD
SLDPEGKTQDELDKEAAEAELNKKVESLQNKVADLEKEISNLEILLGGADSEDDTAALQN
KLAAKKAELAKKQTELEKLLDSLDPEGKTQDELDKEAAEAELDKKADELQNKVADLEKEI
SNLEILLGGADPEDDTAALQNKLATTKAELEKTQKELDAALNELGPDGDEEETPAPAPQP
EQPAPAPAPKPEQPAPAPKPEKSADQQAEEDYARRSEEEYNRLTQQQPPKAEKPAPAPAP

KPEQPAPAPKTGWKQENGMWYFYNTDGSMATGWLQNNGSWYYLNSNGAMATGWAKVNGSW
YYLNANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSDKWYYVNSNGAMATGWLQYNGS
WYYLNANGAMATGWAKVNGSWYYLNANGSMATGWVKDGDTWYYLEASGAMKASQWFKVSD
KWYYVNGLGALAVNTTVDGYEVNANGEWV (SEQ ID NO: 1209)

>orf00519
LTISFKKQFLSSSLSSLTKRVIMNTAQATFNREAHTTFNRE (SEQ ID NO: 1210)

>orf00525
MKIKEQTRKLAVGCSKHCFEVVDRTDEVSSKHRFEVVDRTDEVSNIYTARRS
(SEQ ID NO: 1211)

>orf00539
LKKRMNRWQFLLNQSKEMVGILLLKMKEQELIEFVVNL (SEQ ID NO: 1212)

>orf00540
LIKVIKRKAFGFRNFNNFKKRILMTLNIKKESTNFVLSRL (SEQ ID NO: 1213)

>orf00544
MTYNEKRLTNSLERVHMEQLKNTTDLLGLKDKNIKILSVLKYQTHLVVQAKLDSPAPPCP
HCQGKMIKYDFQKASKIPLLDCQGLPTVLHLKKRRFQCKNCLKVVVSQTSIVKKNCQISN
MVRQKIAQLLLEKQSMTEIAHRLAVSTSTVIRKLREFKFETDWTKLPKVMSWDEYSFKKS
KMSFIAQDFESKSILAILDGRTHAVIRNHFQRYQREVRELVEVITMDMYSPYYRLAKQLF
PKAKIVLDRFHIVQHLSRAMNRVRIQIMNQFDRKSLEYRALKRFWNPRFFVSRLGLNQST
GLIYYTRIASSSVRNDSISPRFECT (SEQ ID NO: 1214)

>orf00545
MGYSLKKSCTYCEQDPEKVNRFLKELNHLSYLTPIYIYETGVETYFYLEYDRALSRQLVS
LEEDIII (SEQ ID NO: 1215)

>orf00552
MNIAVIGLGHVGLAYALLFASKYKVVAYDIDSVKINNLKKGILPSKNEELMKFFCENNLN
ITFFDTFSEIKNNIDYYIIALPTDYDEKIGSFNTYEIEQTVSKILRVKPNGKIILKSTVP
FGFSNKLKRLFDTKNIIFVPEFLREGCSIYDNLYPSRIVVGDETVEGRKIAELFLSISTH
STANIKNVMLVSPTEAEAIKLFSNTFLALRVAFFNELDSFAERRSLNAEVVIKGVCLDPR
IGNFYNNLSFGFGGYCLPKDTKQLKKEFIEINAPVIEAIDISNTNRKQFIVKQILERKPK
IVGIYKLGMKYNSDNYKESAILSIINELLIVGIKILVYEPNLNVSIDNVIFEKNFELFTK
QSDLIVANRWDRGLEAYKDKVYTRGIWIRD (SEQ ID NO: 1216)

>orf00554
MLNLQFAETMELTEAELEIVYGGEFGNNAVIPAGAWGGFGTPWSITNFWKKNFNDRPDFD
SDRRRY (SEQ ID NO: 1217)

>orf00599
MGLDVGSKTVGVAISDPLGFTAQGLEIIQINEEQGQFGFDRVKELVDTYKVERFVVGLPK
NMNNTSGPRVEASQAYGAKLEEFFGLPVDYQDERLTTVAAERMLIEQADISRNKRKKVID
KLAAQLILQNYLDRKF (SEQ ID NO: 1218)

>orf00635
LNPSYSFGKKDQFALEHCFCIKLSIFARAVTLFVSCIN (SEQ ID NO: 1219)

>orf00656
MITGTAFILIMSLSARKLPYTIRSSVASLQQIAPSIEEAAESLGSSRLNIFAKITTPMML
SDIISGAILSWVTLISELSTSILLYNVKTRTMTVAIYTEVLRGNYGVAAALSTILTVLTV
GSLLLFMKISKSNSITL (SEQ ID NO: 1220)

>orf00657
MLIGEGYRTFPVLIYTQFISEVGGNSAFAIMAIIIALAIFLIQKHIANRYSFSMNLLHPI
EPKKTTKGKMAAIYATVYGIIFISVLPQIYLIYTSFLKTSGMVFVKGYSPNSYKLAFNRM
GSAIFNTIRIPLIALVLVVLFTTFISYLAVRKRNLFTNLIDSLSMVPYIVPGTVLGIAFI
SLVYLEVDFL (SEQ ID NO: 1221)

>orf00658

MECKKLNIWTASSFFLFLTYLVFLVYPIVTVLKQALIHEGQFSLANFVTFFSKAYYSETL
VNSFRVSITATVTSLVVGTLLAYLFSMYDFKGKKFLQILIIIASMSAPFVGAYSWILLLG
RNEVITKFLTNALYLPAIDIYGFKGIVLVFTLQLFPLVFLYVAGTMNSIDNSLLEAAESM
GSFGFKPIVTVVLPLLVPTLLAAPCLYL (SEQ ID NO: 1222)

>orf00660
LLSTTEFIGLSIRILSNLHEFKILVGLLNQFFFWNLLLHKTKSNVVSDSQMWENSVVLEN
QPDIAFAGFHIIDFCIIEVKFSIFDTVETCNHTKKGRFPTS (SEQ ID NO: 1223)

>orf00679
MITIKKQEIVKLEDVLHLYQAVGWTNYTHQPEMLEQALSHSLVIYLALDGDAVVGLIRLV
GDGFSSVLVQDLIVLPIYQRQGIGSALMKEALEDYKDAYQVQLVTEETERTLGFYRSMGF
EILSTYNCIGMTWMNRKK (SEQ ID NO: 1224)

>orf00710
VLKIRYHKQFKKDFKLAMKRGLNAELLEEVLKIWFKKKNFLLDIVIIN
(SEQ ID NO: 1225)

>orf00714
MLGSMFVGLLVGFLAGTLTNRGEHMGCFGKMFLGWIGAFIGHLLFGTWGPIIAGTAIIPA
VLGSMIVLAIFWRRGS (SEQ ID NO: 1226)

>orf00741
MIDDIPKRVNDVIGQAGNNAKTSRPHVGIGKSHISVPFLFPYHTANRIKNQEKVIF
(SEQ ID NO: 1227)

>orf00755
VAIDKIAGITSEKDSRAHQIFRISPTCSRCFCNDELVKWVARTIFLQLTKRCCLRSGNIT
RSNSVTLDIGSTVFRRNVAGQHFQAPFSSSISANCFTSQFAHHRTNIDNLSMPFLYHRRN
NCL (SEQ ID NO: 1228)

>orf00756
LFDLLDHGLDTVLVCHVTDISMGFDANFTISFNPFIDQILIDIVKDNSSAGFSVGFGNSK
SNSIRSAGDESNFSF (SEQ ID NO: 1229)

>orf00768
MKSLARLLIIHVFISIFLFFALISGAVSHTVLLLLLLFLPALNKGLEKIQSKRIPVLNAA
LFFLLISFPQLLTNPVQWKFSIFLVVTIISSLAYFYNFYQVVKEVDQKQLI
(SEQ ID NO: 1230)

>orf00769
LEAASEIETEFQSWIVLVVFNHIDGLSRDTDILGELELGNAQFLAKFFHTIHLVSFLICV
VYI (SEQ ID NO: 1231)

>orf00774
MKWTKRVIRYATKNRKSPAENRRRVGKSLSLLSVFVFAIFLVNFAVIIGTGTRFGTDLAK
EAKKVHQTTRTVPAKRGTIYDRNGVPIAEDATSYNVYAVIDENYKSATGKILYVEKTQFN
KVAEVFHKYLDMEESYVREQLSQPNLKQVSFGSKGNGITYANMMSIKKELETAEVKGIDF
TTSPNRSYPNGQFASSFIGLAQLHENEDGSKSLLGTSGMESSLNSILAGTDGIITYEKDR
VGNIVPGTELVSQQTVDGKDVYTTLSSPLQSFMETQMDAFLEKVKGKYMTATLVSAKTGE
ILATTQRPTFNADTKEGITEDFVWRDILYQSNYEPGSAMKVMTLASSIDNNTFPSGEYFN
SSEFKIADATTRDWDVNDGLTTGGMMTFLQGFAHSSNVGMSLLEQKMGDATWLDYLKRFK
FGVPTRFGLTDEYAGQLPADNIVSIAQSSFGQGISVTQTQMLRAFTAIANDGVMLEPKFI
SAIYDTNNQSVRKSQKEIVGNPVSKEAASTTRNHMILVGTDPLYGTMYNHYTGKPIITVP
GQNVAVKSGTAQIADEKNGGYLVGSTNYIFSVVTMNPAENPDFILYVTVQQPEHYSGIQL
GEFATPILERASAMKESLNLQSPAKNLDKVTTESSYAMPSIKDISPGELAEALRRNIVQP
IVVGTGTKIKETSVEEGTNLAPNQQVLLLSDKVEEIPDMYGWKKETAETFAKWLDIELEF
EGSGSVVQKQDVRTNTAIKNIKKIKLTLGD (SEQ ID NO: 1232)

>orf00776
MVDRTDEVSSKHGFEVVDKEKLMWFEEVFEECKKILVS (SEQ ID NO: 1233)

>orf00783

MEGVNHVDIIKVSCCSFISQVNWMMKGKIPNREGFKFSVARFDAIDLVVVHIGHTRCQFS
RTGSRSGYDNQVATGFDVVVFAHAFWGNDVIHIRRISFDWIMKIRINSVFLKLVAEGICS
GLASVLCNDNGTNKNP (SEQ ID NO: 1234)

>orf00784
MFNVASINGNHNLNLLFQFLQELDFVVRFITRKDTSSVEIF (SEQ ID NO: 1235)

>orf00790
LTNQDLQAGTYLVKDYREIILSQDALEKVATNLKLDMPAKTLASKVQVAVPADTRIVSIS
VKDKQPEEASRIANSLREVAAEKIVAVTRVSDVTTLEEARPATTPSSPNVRRNSLFGFLG
GAVVTVIAVLLIELLDTRVKRPEDVEDVLKIPLLGLVPDFDKIK
(SEQ ID NO: 1236)

>orf00791
MPTLEISQAKLDSVKKAEEYYNALCTNLQLSGDGLKVFSITSVKIGEGKSTTSANIAWAF
ARAGYKTLLIDGDIRNSVMLGVFKARNKITGLTEFLSGTTDLSQGLCDTNIENLFVIQAG
SVSPNPTALLQSKNFTTMLETLRKYFDYIIVDTAPVGVVIDAAIITRNCDASILVTEAGE
INRRDIQKAKEQLEHTGKPFLGIVLNKFDTSVDKYGSYGNYGNYGKNKK
(SEQ ID NO: 1237)

>orf00792
MNEKILRSSLAIIQSFLVILLTYLLSAVRETEIVSTTAIALYILHYFVFYISDYGQDFFK
RRYLIELVQTLKYILFFALAIGISNFFLEDRFSISRRGMIYFLTLHALLVYVLNLFIKWY
WKRAYPNFKGSKKILLLTATSRVEKVLDRLIESNEVVGKLVAVSVLDKPDFQHDCLKVVA
EGEIVNFATHEVVDEVFINLPGEKYNIGELVSQFETMGIDVIVNLNAFDRSLARNKQIRE
MAGLNVVTFSTTFYKTSHVIAKRIIDIVGALVGLILCGLVSIVLVPLIRKDGGSAIFAQT
RIGKNGRQFTFYKFRSMCVDAEAKKRELMEQNTMQGGMFKVDDDPRITKIGCFIRKTSLD
ELPQFYNVLKGDMSLVGTRPPTVDEYEHYTPEQKRRLSFKPGITGLWQVSGRSEIKNFDE
VVKLDVAYIDGWTIWKDIEILLKTVKVVFMRDGAK (SEQ ID NO: 1238)

>orf00793
MKKSVYIIGSKGIPAKYGGFETFVEKLTAFQQDKAIQYYVACMRENSAKSGTTEDVFEHN
GAICYNVDVPNIGPARAIAYDIAAINRAIEIAKENKDEDPIFYILACRIGPFIHGIKKKI
QEIGGTLLVNPDGHEWLRAKWSAPVRRYWKISEGLMVKHADLLVCDSKNIEKYIQEDYKQ
YQPKTTYIAYGTDTTRSVLKSSDEKVRSWFKEKNVSENEYYLVVGRFVPENNYESMIRGF
LASNSKKDFVLITNVEQNKFYNQLLAKTGFDKDPRVKFVGTVYEQELLKYIRENAFAYFH
GHEVGGTNPSLLEALASTKLNLLLDVGFNREVAEDGAIYWKKDNLHEIIETSEQKTQKEI
DEKDILSIKQVTERFSWELIVNEYEKLFLCEK (SEQ ID NO: 1239)

>orf00794
VTIKINNLFFVCLSFFGIVLSSSQVIVNLGLSSIIQYISYFMLMLCVFLTLIKNTLNVFA
NRIIYFLIISFLFIIGINLQNLPLSRKIYLSFSMLIISSLSTLPIKLINNLSDLRRISYY
LLHSIFLSVFLGLVFKISLVTVAVEGIGFSYGFNGGLTHKNFYAITILVSYILLYVSRKY
DAKHQIDSFVLWLDLFLLLISNTRTVYIILVVFWIIINRNFINNIKKEHRLVVTATTIVI
SLLALTFFFKHIINNSESYSHRVLGVVNFFKYYESDRFHLFFGDAELAFGNTTKGYGHNI
RSVLGWDGTVEMPLLSVMIKNGYVGLVGYIIVLFKFISSIISVKNSTKKNIGLSIFIPLL
LSATVENYIVNISFVFMPVCFCILCSIKNIKLVNNRK (SEQ ID NO: 1240)

>orf00796
MEKLVSIILPVYNVEQYIKNCLESIQQQTYSNLEVIIVNDGSTDKSVEYCEQICKIDSRF
SITHKENGGLSDARNVGIDKSKGDYLIFVDSDDFVSQDMVSYLVSCMENNEADIAICDPV
HYYSDRQNNDLNIFSPASNVKVYETTEALCEMFYQKSFLVSAWAKIFKRELFDDIRFPVG
KLFEDSAIMYLLFEKCETIAYSDAELYAYVHRDNSITTKKFSDRDLDILEITNTIINHYG
DNLRVYTAAVSYKVSACFRILLNSPSGEKYKKVQKECLSYILQNWRNILFNNNVRLKNKL
ALISITIFNPFVKFIYSKVNRWE (SEQ ID NO: 1241)

>orf00797
MNKYEERYQENLSKNDFYKLINKSYLSDKELQVQQVKAGIVLPPKAFETKLSNKLGLQKS
LHGKGGVVDSNGNYIELSAQKAVGMRNRVYGPYKINYDNLPIRNEKVIYLNYFIKQWGHF
LLDVVGRLWYPLLQDNDTKLVYTCYAGTETKIEGNYLEFLKLLGIDQSRLIMINCPTQFS
EVIIPESSILPGGYYTKEYKQLFSSVVENIKLDKYDVNAKMIYCSRSKLGIAKSKEFGED
GIEGIFKQNGYTSVYMETMSLEEQIKTLLSAKTIVLTSGSLAHNLLFVNKDIDVFILNKT
YRVNLHQFLINEISDATVRFVDIYRSPLPILYGYGPFLMDLTKPLANFLDDNEFVYEKGT

VLSKKDYFKYYLKWLWSYRFFLFRLNGIKEGNSEFEKSFKIIRRYYKTGR
(SEQ ID NO: 1242)

>orf00798
MSKYKELAKNTGIFALANFSSKILIFLLVPIYTRVLTTTEYGFYDLVYTTIQLFVPILTL
NISEAVMRFLMKDGVSKKSVFSIAVLDIFIGSIAFALLLLVNNLFSLSDLISQYSIYIFV
IFVFYTLNNFLIQFSKGIDKIGVTAISGVISTAVMLAMNVILLVVFDWGLLGFFIANVCG
YVIPCIYIVSRLRLWELFEIKIDKKLQWEMVYYALPLVLNILSWWVNNTSDRYIVTAIVG
IQASAIISVAYKIPQILSTISAIFIQSWQISAIKIQEDKSDTTFVSNMLLYYNALLLIIA
SGIILFVKPISNILFGISFYSAWELVPFLIISSLFNAISGCIGAIMGAKMDTHNIAKSAL
VGMIANIILNIVLTFLMGPQGITISTLIASFLIFYMRKDSVKEINSETYRAIYLSWILLV
VEACLLIYMDFIIGALIAMVINLFLLKDVIKPLYLKIFKRN
(SEQ ID NO: 1243)

>orf00799
MIVLQYFKILARFVFMFLISAVLLPFKIKPNKIVFINFNGKGYGDNPKSICEYLRTTYPD
LDLVWLARDNEGFPDGVRVVKYGTFQAFYEQASSKVWVYNVRAFARILKKRGQIYIQTWH
GASSFKLIEKQADLPINYVLEAKYDARVTDIMISDSRKQTEEFQKYFWYSGEIFEVGMPR
NDALFHYKEDYDKLNNIRKELSIHSDDYVILYAPTFRDDGDASYLDINFERLLQCVEHGI
KKKCKFLIRLHPNHSHLCNNISFNKNIINATFYSDMQELTLLADVLVTDYSSSIFDFMLL
NKPYVRYVNDLEKYAELRGVSDTYYELPDSIIKTAEELYDLLPKKIENFDYDSIKKYRNE
ILCPIFNGTASENVGGRIIQEL (SEQ ID NO: 1244)

>orf00800
LKNNDLKIGSGAIHQISATLSQNSISGKILYCADPVVDDLYGSIVRSQIEEIGRVKEESC
NYNTIAYAMNIAERAIATDIDCIVGMGGGRVLDVCKYASFISKRPYLSIPTTAANDGIAS
PVAVLKRQDDRPKSLGAAIPSMTLIDIDVIASGPIQNIKAGIGDTISNYTALKDWELAVE
RGKDEMHGFAYLMSQNSLDALMKTKYNSITPDFIEVLVNSLVLSGIAMDFAGSSRPVSGS
EHLFSHALDYYGSTRNLHGIQVALGTVAVLKLIENSVDTVVDYLQRFEVHINPKLLGIDE
ELFIYCMQHATKMRSNRYTYLHEVDLSTDRLKQIYKELISEL
(SEQ ID NO: 1245)

>orf00801
MKALILAAGLGTRLAPITNEVPKSLVPVNGKPILMKQIENLYQNNITDITIIAGYKSSVL
TDAVTEKYPEINIIDNVDFKTTNNMYSAYLGKAAMGDSDFLMMNADVFYDASVIKSLLLH
KAPNAIVTDLGIYIEESMKVVEKNGRLVEISKQISPEETLGASIDVYKFSYEAGARFFEK
CKEFIEDKRELQMWSEVALNAILSEVEFVACPLEGRWLEIDNHEDLVAAEKLFA
(SEQ ID NO: 1246)

>orf00802
MKLTNRVDYFGADISELQNKKLFLFDMDGTIYEEDRLFEGTLELLDYIHNIGGEYIFITN
NSSKSVVDYVEKVNRLGIKAERDNFFTSAQATIVYIKENYPKSKVYCQGTKSLIKELSDA
GIDVTEQVSADIDVVLVGFDTELTSDKIRNTCEILSTKDVPFIATNPDIRCPVSFGFIPD
CGSICDMISKSVDRKPVYIGKPEPTMVDIVRKKLNYSLFETVVIGDRLYTDIMTGINAGV
TSVCVLTGEATVNDIQQDSIKPTYTFKNVKEMWKGIV (SEQ ID NO: 1247)

>orf00804
MKGIILAGGSGTRLYPLTRAASKQLMPVYDKPMIYYPLSTLMLAGIRDILIISTPQDLPR
FKELLQDGSEFGIKLSYAEQPSPDGLAQAFIIGEEFIGDDSVALILGDNIYHGPGLSTML
QKAAKKEKGATVFGYHVKDPERFGVVEFDENMNAISIEEKPEYPRSNYAVTGLYFYDNDV
VEIAKSIKPSPRGELEITDVNKAYLDRGDLSVELMGRGFAWLDTGTHESLLEASQYIETV
QRMQNVQVANLEEIAYRMGYISREDVLALAQSLKKNEYGQYLLRLIGEA
(SEQ ID NO: 1248)

>orf00806
MTDNFFGKTLAARKVEAIPCMLEFDIPVHGDNRGWFKENFQKEKMLPLGFPESFFAEGKL
QNNVSFSRKNVLRGLHAEPWDKYISVADGGKVLGSWVDLREGETFGNTYQTVIDASKGIF
VPRGVANGFQVLSDTVSYSYLVNDYWALELKPKYAFVNYADPSLGIEWENIAEAEVSEAD
KNHPLLKDVKPLKKEDL (SEQ ID NO: 1249)

>orf00810
MTEYKNIIVTGGAGFIGSNFVHYVYENFPDVHVTVLDKLTYAGNRANIEEILGNRVELVV
GDIADAELVDKLAAQADAIVHYAAESHNDNSLNDPSPFIHTNFIGTYTLLEAARKYDIRF

HHVSTDEVYGDLPLREDLPGHGEGPGEKFTAETKYNPSSPYSSTKAASDLIVKAWVRSFG
VKATISNCSNNYGPYQHIEKFIPRQITNILSGIKPKLYGEGKNVRDWIHTNDHSSGVWTI
LTKGQIGETYLIGADGEKNNKEVLELILKEMGQAADAYDHVTDRAGHDLRYAIDASKLRD
ELGWKPEFTNFEAGLKATIKWYTDNQEWWKAEKEAVEANYAKTQEIITV
(SEQ ID NO: 1250)

>orf00813
MILITGANGQLGTELRYLLDERNEEYVAVDVAEMDITNEEMVEKVFEEVKPTLVYHCAAY
TAVDAAEDEGKELDFAINVTGTKNVARASEKHGATLVYISTDYVFDGKKPVGQEWEVDDR
PDPQTEYGRTKRMGEELVEKHVSNFYIIRTAWVFGNYGKNFVFTMQNLAKTHKTLTVVND
QYGRPTWTRTLAEFMTYLAENRKEFGYYHLSNDATEDTTWYDFAVEILKDTDVEVKPVDS
SQFPAKAKRPLNSTMSLAKAKATGFVIPTWQDALQEFYKQEVR
(SEQ ID NO: 1251)

>orf00814
LVNCEPLEAYRQLEEAELVGCWAHVRRKFFEATPKQADKSSLGAKGLAYCNQLFSLERDW
EALPADERLQKRQEELQPLMEDFFAWCRRQSVLSGSKLGRAIEYSLKYKETFKTILKDGH
LVLSNNLAERAIKSLVMGRSKRVQWTLLA (SEQ ID NO: 1252)

>orf00823
MNKGLFEKRCKYSIRKFSLGVASVMIGAAFFGTSPVLADSVQSGSTANLPADLATALATA
KENDGRDFEAPKVGEDQGSPEVTDGPKTEEELLALEKEKPAEEKPKEDKHAAAKPETLKT
VTPEWQTVEKKEQQGTVTIREEKGVRYNQLSSTAQNDNAGKPALFEKKGLTVDANGNATV
DLTFKEDSEKGKSRFGVFLKFKDTNNNVFVGYDKDGWFWEYKSPTTSTWYRGSRVAAPET
GSTNRLSITLKSDGQLNASNNDVNLFDTVTLPAAVNDHLKNEKKILLKAGSYDDERTVVS
VKTDNQEGVKTEDTPAEKETGPEVDDSKVTYDTIQSKVLKAVIDQAFPRVKEYSLNGHTL
PGQVQQFNQVFINNHRITPEVTYKKINETTAEYLMKLRDDAHLINAEMTVRLQVVDNQLH
FDVTKIVNHNQVTPGQKIDDERKLLSSISFLGNALVSVSSDQTGAKFDGATMSNNTHVSG
DDHIDVTNPMKDLAKGYMYGFVSTDKLAAGVWSNSQNSYGGGSNDWTRLTAYKETVGNAN
YVGIHSSEWQWEKAYKGIVFPEYTKELPSAKVVITEDANADKNVDWQDGAIAYRSIMNNP
QGWEKVKDITAYRIAMNFGSQAQNPFLMTLDGIKKINLHTDGLGQGVLLKGYGSEGHDSG
HLNYADIGKRIGGVEDFKTLIEKAKKYGAHLGIHVNASETYPESKYFNEKILRKNPDGSY
SYGWNWLDQGINIDAAYDLAHGRLARWEDLKKKLGDGLDFIYVDVWGNGQSGDNGAWATH
VLAKEINKQGWRFAIEWGHGGEYDSTFHHWAADLTYGGYTNKGINSAITRFIRNHQKDAW
VGDYRSYGGAANYPLLGGYSMKDFEGWQGRSDYNGYVTNLFAHDVMTKYFQHFTVSKWEN
GTPVTMTDNGSTYKWTPEMRVELVDADNNKVVVTRKSNDVNSPQYRERTVTLNGRVIQDG
SAYLTPWNWDANGKKLSTDKEKMYYFNTQAGATTWTLPSDWAKSKVYLYKLTDQGKTEEQ
ELTVKDGKITLDLLANQPYVLYRSKQTNPEMSWSEGMHIYDQGFNSGTLKHWTISGDASK
AEIVKSQGANDMLRIQGNKEKVSLTQKLTGLKPNTKYAVYVGVDNRSNAKASITVNTGEK
EVTTYTNKSLALNYVKAYAHNTRRNNATVDDTSYFQNMYAFFTTGSDVSNVTLTLSREAG
DEATYFDEIRTFENNSSMYGDKHDTGKGTFKQDFENVAQGIFPFVVGGVEGVEDNRTHLS
EKHDPYTQRGWNGKKVDDVIEGNWSLKTNGLVSRRNLVYQTIPQNFRFEAGKTYRVTFEY
EAGSDNTYAFVVGKGEFQSGRRGTQASNLEMHELPNTWTDSKKAKKATFLVTGAETGDTW
VGIYSTGNASNTRGDSGGNANFRGYNDFMMDNLQIEEITLTGKMLTENALKNYLPTVAMT
NYTKESMDALKEAVFNLSQADDDISVEEARAEIAKIEALKNALVQKKTALVADDFESLDA
PAQPDEGLENAFDGNVSSLWHTSWNGGDVGKPATMVLKEATEITGLRYIPRGSGSNGNLR
DVKLVVTDESGKEHTFAATDWPDNNKPKDIDFGKTIKAKKIVLTGTKTYGDGGDKYQSAA
ELIFTRPQVAETPLDLSGYEAALAKAQKLTDKDNQEEVASVQASMKYATDNHLLTERMVE
YFADYLNQLKDSATKSDAPTVEKPEFKLSSLASEQGKTPDYKQEIDRPETPEQILPATGE
SQSDTALFLAGVSLALSALFVVKTKKD (SEQ ID NO: 1253)

>orf00824
LQIAQESSQDTDGINPPVVEEAMVFDRNDCLNQICGNIISLGIDAAFRTQVSNELIFIVV
DFTRSCCN (SEQ ID NO: 1254)

>orf00826
MLNLMWMKIFHRNRTFLFCFLGFKVDVISIINARIVRR (SEQ ID NO: 1255)

>orf00827
VYNSQALRQIVVVGSIDHLFKRHSSICEIFGLRKRWLSFL (SEQ ID NO: 1256)

>orf00830
MTSIIFSAKDIFEQEFGREVRGYSKVEVDEFLDDVIKDYETYATLVKSLRQEIADLKEEL

TRKPQVSSAPSPSHPDPIDVAASSSMTNFDILKRLNRLEKEVFGKQILDNTDL
(SEQ ID NO: 1257)

>orf00854
LISIKHFFWLPLSKKMIIDIIVNKNPDRFCMIEKVKKTMAENR (SEQ ID NO: 1258)

>orf00858
VNIDSSEFYISHITDGIFDSFLDSNRYLRNFYSVLKVEIDICCEFFVHVFKINATAE
(SEQ ID NO: 1259)

>orf00859
VNPLYLCSSDSNDFFKYTWGDNDFAKLFFNSHRMTSF (SEQ ID NO: 1260)

>orf00887
LAQISILHFDFLSIDKHSHTVFNTLRKSLQTTLALSATSKQCFEQLAASFLVCSLIFIEY
KV(SEQ ID NO: 1261)

>orf00897
MLYVGIDIAKNKHDVTALNVPGKTVLKPLTFSNNKAGFELLDLSLRQLNQDCLIALKLLS
DPNREQFQHDNRQVDLKILARHIHRLKKKQSDWKVQYTRCLDIIFPELDKIVGKHSEYTY
QLLTRYPNPQKRIEAGFDKLIEIKRLTASKIQDILSVAPRSIETTSPAREFEIIEIIKHY
KRLIDKAETCVNDLMAEFNSVITTVTGIGGRLGAVILAEIRNIHAFDNPAQLQAFAGLDS
SIYQSGQIDLAGRMIKRGSPHLRWALIQAAKACARFSPAFKAYLKTKLEQGKHYNVAIIH
LAKKLIRTLFYILKKSCHLTNKK (SEQ ID NO: 1262)

>orf00900
MDTKSSCLITTGRNDSPSTCLPRVASNNDRFSSEFRIIPDFHCSKKGIHVNMDDFS
(SEQ ID NO: 1263)

>orf00903
MMSIREQDLKDIGAIIKYKNFHSPFDTFKYLKDMGFDTIDLSVLLEGFSYAYGMDWLEKF
FKENQDKLREFY (SEQ ID NO: 1264)

>orf00909
MIPLYRTDNDITKFFTKIRNGHLAKTAGGLDDKFHEANASTSKAFDRQGVGEVNDIRDSA
GSQELRINDKRKTENILFLEIRVRIFRVPHPNDSFFSSHFLG
(SEQ ID NO: 1265)

>orf00910
VLSQGDKDITILDAGLLKNGKIGPVTKDTNDIKATDNMIENSFVLLNQQNIMLFCNQGAT
EGKTNFSPSDKDNFHNKTYFFMM (SEQ ID NO: 1266)

>orf00915
MKIKEQTRKLAAGCSKQCFEIVDRTDEVSSKHGFEVVDETDEVSNHTYGKAKLTWFEEIF
EEYKMMGKAGQLVFFDVYRLVRQVS (SEQ ID NO: 1267)

>orf00942
LVEIVRGGSPRPIKDYLTSEVDGINWIKIGDTEKGEKYINNVKEKIKKSGLNKTRFVKKG
TFLLTNSMSFGRPYILNVDGAIHDGWLAISNYENSLNKDYLFYILSSNVVYSQFLSLISG
AVVKNLNSDKVASILIPLPPLSEQQRIIEAIESALEKVDEYAESYNRLEQLDKEFPDKLK
KSILQYAMQGKLVEQDPNDESVEVLLEKIRAEKQKLFEEGKIKKKDLDISIVSQGDDNSY
YGNIPMNWVVIKIKDIFSMNTGLSYKKGDLSINNKGVRIIRGGNIKPLEFSLLDNDYYID
TQFISSEQVYLKHNQLITPVSTSLEHIGKFARIDKDYDGVVAGGFIFQLTPFESSEIISK
FLLFNLSSPLFYKQLKAITKLSGQALYNIPKTTLSELLIPLAPFEEQELITQKVEKLFEK
VNQLWK (SEQ ID NO: 1268)

>orf00963
VDRTDEVSSKHCFEVVDTTDEVSSKHCFEVVDRTDEVSNHTHDKPTLTWFEEIFEEYHSP
FHN (SEQ ID NO: 1269)

>orf00964
LDNIHIVLDSLNAVSGIQDFICDGLAIFCDQITSGCSSCK (SEQ ID NO: 1270)

>orf00979
MKSTLGIISVGLVITYILQQVMSFSRDYLLTVLSQRLSIDVILSYIRHIFELPMSFFATR
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IIFSFMKPFEKMNHDVMQSNSMVSSAIIEDINGIETIKSLTSEENRYQNIDSEFVDYLEK
SFKLSKYSILQTSLKQGTKLVLNILILWFGAQLVMSSKISIGQLITFNTLFSYFTTPMEN
IINLQTKLQSAKVANNRLNEVYLVESEFQVQENPVHSHFLMGDIEFDDLSYKYGFGRDTL
TDINLTIKQGDKVSLVGVSGSGKTTLAKMIVNFFEPYKGHISINHQDIKNIDKKVLRRHI
NYLPQQAYIFNGSILENLTLGGNHMISQEDILRACELAEIRQDIERMPMGYQTQLSDGAG
LSGGQKQRIALARALLTKAPVLILDEATSGLDVLTEKKVIDNLMSLTDKTILFVAHRLSI
AERTNRVIVLDQGKIIEVGSHQELMQAQGFYHHLFNK
(SEQ ID NO: 1271)

>orf00981
MTSYKRTFVPQIDARDCGVAALASIAKFYGSDFSLAHLRELAKTNKEGTTALGIVKAADE
MGFETRPVQADKTLFDMSDVPYPFIVHVNKEGKLQHYYVVYQTKKDYLIIGDPDPSVKIT
KMSKERFFYEWTGVAIFLATKPSYQPHKDKKNGLLSKLPSSDFQTKISHCLHCSLKLIGH
YYQYRWFLLSPRNLG (SEQ ID NO: 1272)

>orf00984
MDTKMMSQFSVMDTEMLACVEGGGCNWGDFAKAGVGGAAVVAALGCAAGGVKYGKILGPW
GAAIGGIGGAVVCGYLAYTATS (SEQ ID NO: 1273)

>orf00988
MKKKILIIFVLYLIMSIFLYPLRESIWYNLFYTIAYMIAVMIYFSLIKKKEKK
(SEQ ID NO: 1274)

>orf01008
LNCKGNDHPKEFHNPNNRFDKKNSKKTKKNFILSPLA (SEQ ID NO: 1275)

>orf01009
MKIKEQTRKLAAGCSKQCFEVVDRTDEVSSKHRFEVVDRTDEVSSKHRFEVVDRTDEVSS
KHRFEVVDRTDEVSNIYTAR (SEQ ID NO: 1276)

>orf01017
MHSQTFQFLLMTDKTSLLHRKHRSFIRNIHSKFLILFDLLCGILSRNDSNHNPIS
(SEQ ID NO: 1277)

>orf01021
MSDVKEEVSSLSEKQLRQIDVEYAELNDSDIIERLAYLEINNNEKRIVISDIEPTKEIMS
VSDQIFEIQKNFQKIKNMFELFISDVSDFLSIKNKLESKELEIEEADVNRFMIHLLSSGK
LFVDFNENQIKQKYSKDSEEFDCIHGFASYQYDTNFAYRFCHSLRNYSQHTDLPINEVKA
VSPDDETVIIDFYIDLDYLLNSNFKWKKLKGELIKLNQETSKIDAIALVKEYFNALTELY
GNYNKLFLKLNHNTLVDIKSKLESLKLKHSRYYISKISKYDLKYNPGNYTMSPLAAFAEI
EEIYIELSKIGLVKIVNKSN (SEQ ID NO: 1278)

>orf01025
MSKHPHYELLNLIGYGLAKFDKLFIKEFQCFSKSEFYRYVVSLGIAETTGVVKNRMDLFD
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VRTKFKRLQETGMEAENYFILHFDKEEKFQGGQLTDARLYGDGYDFQVDVQEYSYLAEVK
GIRKSKGRVRLTAKEFEKVKEFQSDFILSLVTNLDDIPKLVLIDNPLKHFEFKKNIIKNE
IIEYRSVEDLY (SEQ ID NO: 1279)

>orf01027
MFIAEFTAILLNEFPVALDSLVFMGFSMKLIHDLDTHTTHSTAKMLYNMKAIKNDFSIRE
(SEQ ID NO: 1280)

>orf01049
LKHLFCHFNPLWIDEIIRLAYKDQDTKDVKSKVKIGN (SEQ ID NO: 1281)

>orf01077
LCCNRHIANLDLEFISYHLGQVGFDTRISTGLGIFVTKIGNVLFDTDNQFASFLNVCDTC
ISLDWFGSSKAEKANQ (SEQ ID NO: 1282)

>orf01095
MKEIAFDAFYQLYQNDQLSLVDVREVDEFAALHLECAHNLPLSQLADSYD
(SEQ ID NO: 1283)

>orf01098
MCLICQRIELIKAGQNPYFVKELETGYVVIGDYQYFKGYTLFLAKDHVTELHHMETSVKL
RFLEEMSLVQEAVAKAFEAEKMNIELLGNGDAHAHWHLFPRRAGDMKSHGLNGRGPVWWV
PWEEMAAEDCQVQSPELEEMIKILSHELEKYLA (SEQ ID NO: 1284)

>orf01099
MKKRYVILSGLLALTLAACSQEKTKVEENTQKTEQSSQPEGTVGSKSQASSQKKAEVSNK
GSYYSIQGKYDEIILANKRYPLSKDYNPGENPTAKAELLKLIAAMQAEGYPISDQYSGFR
SYETQAKLYQDYVNQDGKEAADRYSARPGYSEHQTGLAFDLIGTDGDLVTEEKAAQWLLD
HAADYGFVVRYLKGKEKETGYMAEEWHLRYVGKEAKEIAASGLSLEEYYGFEGGDYVD
(SEQ ID NO: 1285)

>orf01104
MKTKEQTRKLAAGCSKHCFEVVDRTDEVSNHTHGKATLTWFEEIFKEY
(SEQ ID NO: 1286)

>orf01105
MDFFFMNEVKEQVLFRDNHSEHIFWIEGVSDFMIKVNTALW (SEQ ID NO: 1287)

>orf01109
VCFLGFQTILANPSKPQRQLPFLIFILDFFNYKHHKFLS (SEQ ID NO: 1288)

>orf01124
MEELVTLDCLFIDGTKIEANANKYSFVWKKTTEKFSAKLQEQIQVYFQEEITPLLIKYAM
FDKEQKRGYKESAKNLANWHYNDKEDSYTHPDGWYYRFHHTKHQKTQTDFQQEIKVYYAD
EPESAPQKGLYMNERYQNLKAKECQALLSPQGRQIFAQRKIDVEPVFGQIKASLGYKRCN
LRGK (SEQ ID NO: 1289)

>orf01126
MHIHYNTNQTTLPLEISSFLPQDHLVFTIEKVVNTLEDCHFHAFYHAFDRLSYHLKMLVS
TLLFAYSQGIFSGRKIEKWKS (SEQ ID NO: 1290)

>orf01129
LRLWVIFVIMKVIKSYDTLNDYYRKLFGEKTFKVPIDAGFDCPNRDGTVAHGGCTFCTVS
GSGDAIVAPDPPIREQFYKEIDFIHRKWPDVQKYLVYFQNFTNTHEKVEVIRERYEQAIN
EPGVVGINIGTRPDCLPDETIEYLAELSECMHVTVELGLQTTYEATSDLINRAHSYEL
(SEQ ID NO: 1291)

>orf01131
VETVKRLRKYPKIEIVSHLINGLPGETHEMMVENVRRCVTDNDIQGIKLHLLHLMTNTRM
QRDYHEGRLQLMSQDEYVRVICDQLEIIPKHIVIHRITGDAPRDMLIGPMWSLNKWEVLN
SIEMEMRRRGSVQGCKAVKQEFENEKTT (SEQ ID NO: 1292)

>orf01143
VQVCVFTNFCFFHCFSSLANCRLFNLRGICLPCISYQ (SEQ ID NO: 1293)

>orf01152
VFKKDRFSIRKIKGVVGSVFLGSLLMAPSVVDAATYHYVNKEIISQEAKDLIQTGKPDRN
EVVYGLVYQKDQLPQTGTEASVLTAFGYLSGDILKTLGLDTVLEETSAKPGEVTVVEVET
PQSTTNQEQARTENQVVETEEAPKEEAPKTEESPKEEPKSEIKPTDDTLPKVEEGKEDSA
EPAPVEEVGGEVESKPEEKVAVKPESQPSDKPTEEPKVEQVGEPVEPSEDEQAPTAPVEP
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SWQNLQTGVTEAEKVAANTDAKQSEVNSETASLKTAISRLNTDKVELENQLKIAQGKTET
DFSMESWTVLSTAKNKAQEVKDNGTATQEQINEAEKSLKTALADLSVDKTALGSAIDTAT
KKNKENYTNQTWAELETALTAAKSVNTNESKQSDVNEAAEKLTATMEKLVELSEKPRLTL
SIEKRDIDRKATVTYTLENPANTQIKSITATLKKGEEVVKDFVLTEENLKTNHLTALFEK
LDYYKEYTLSTDMVYNRGNDDETESISEELIQLNLKKLELKDIQTVSLMKFENGQESQVT
HLSDKPTDLSKLYLKVTSSTSKDAVLAVSSIEEEIIENKKIFKIHADTPELVVRKKDGSL

SKGFDYYMERVIPHDGDIYYDFKDLISAMTSNPTGTFILGRDISSRNVKPDGNGKSYIKG
EFKGKLLGTNDNVRHSIFDLEYPLFDTIKSGVVKDIDFKHVNMVFPDSNQGDNVATIARV
IKDKTKIENVNVEGYLEGRDHVAGLVNNLEGNSEIENVSFTGKIKSKGGNSITAGIAGRN
ILSRVKRAYVNADIEVHRSSNSSMLVAVNGINADASGGWGTWGRLTESVAKGTLETKQGG
QAGGASSTVWPYGAIDNVVSYAKVTKGKELFGSDGDLNYDWFMKKISNIFGVQGISSGDS
GSDSKFTRISEEEANQKVASYNITAPNLMSDSSLLVDRLNESWKNTDQFESIQDYQAQNQ
LIYQNLTKFTPYYNKEFIVHEGNALTPEQEILKTKKIKSIVGLKGTEFVVDGSDIDTIML
HFEDGSQKRYKVTSTGKFSITNLPEYQVEDLNVVYTSEHIVHPLDSSLINNLVEELKKVE
LYTESTYQVLGIDKDNANKLNRTKRLFLDESLDAVKTQLPTFVKTMFENEWLHINGESSG
AVAALRQKIMDNKTAILLALTYINRYYDVKFSDYNIKKLMLFKPTFHGEKIDLLDRLIRL
GSSGENRLKGSENAETFKQLFASETKQKDLVTYLDYNRSLLTNYQTTGEWFKETTKDYIQ
FEERPSLVEEIKDAKYRVYDNLTAPYYQGYILPLLTLKNTHLAILSNYSTMTFVSREKRP
NWKNEDFDKWVKYVATAHRNHVDTWYKILPDNIKGKMVKENVTAVWEGLSIPGSEWVDQN
AVDRKGRDYAPAREFFNLVGGPMGGWYAYHGYGAHAGGRNRVNYEVFDVLSEYGISVFTH
ELTHVNDTWIYLGGYGRRENMGPEAYAQGLFQSPVPGQPGWGALGLNMAFERKNDGDLIY
NASPTQFENRKELDSYMKNYNDTLMMVDYLEGDAVISKGKEAITKWFKKVEPKVVSQTAQ
YDTVRQLTAEEKEKLSVSSVDDLVDQGLMSDRAVGNNTYNPADFETSYIAIDYMTGIYGG
GKNSVGSPGALMFKHNTFRMWGYYGFEEGVLGYASNKFKQASRDEGHAGLSDNFIISKIS
KGEFLTMEAFKKGYFKKVVEELKTKGIRPVTINQKTYSTFEELQEGFKQAVERDLKKNQL
DERETRNFKFQVFRQLLQQTDSFKTSIFR (SEQ ID NO: 1294)

>orf01156
MKSKIVLGASLAIATLSLVSLVEIEGLSPFLIENVSANTHSANKVINHKVSIYLENADEG
KGLTVNFSTDSVSPNLFDEFEKKSGITITTMLVNAKTGEVVEKRLTPSVFLRSNDLTSGT
ISSFIFSEYPDGEYKYVVSKGDFIDPKTQFKHQYRGESPVFRIRNRKYVELGTTDKKLDE
RRDNSVYKDGVVEHKVNLSLTSYQGGNGVTAIFSTDSVNSNLLNSFGEKAKKVLIRSKLI
NVKTGEVIDETFSPKVSLTSKILKSGSTAVFYFIDLTDGEYKYVAYESQQYTDPQTTLTH
QYRGESPIFSIKDGKFSGLVSASKPDENPKPTPKPDEKPKPSAPQQEKTKPTVQSGWVGS
SYYQNGKKVTSKWIFDKKYNSYFYLDASGNYVQNAWVGNYYLKSGGYMAKSEWIYDKNYG
SYYYLTSEGSYARNTWSGNYYLKSNGKMAKSEWVYDSNYKSYYYLTSEGSYARNTWVGNY
YLKSNGKMAVNERTPDGYRVDGSGKWVK (SEQ ID NO: 1295)

>orf01157
MSACTVCAEKGRTPDLSIVDNVPIVENAKAHENNFFYSSDITYYPIF
(SEQ ID NO: 1296)

>orf01158
MAKYYIILPKDAEIYKTWRGTVNIPIIDATKTTPELSYFKEDHRNYIANENKSGANYIEW
KGTVEEFKEAIKKLTDKKSTTATPKKDEKPTPKPDEKPKPTPTVQSGWVGSSYYQDGKKV
ISKWIFDKKYNSYFYLDASGNYVQNAWVGNYYLKSGGYMAKGEWVYDATYQAWYYLTSDG
SYAYSTWQGNYYLKSDGKMAVNEWVDGGRYYVGADGVWKEGQASTASSSNDSNSEYSAAL
GKAKSYNSLFHMSKKNVCIDN (SEQ ID NO: 1297)

>orf01179
VSRWDGHSDKGEAPAGKTSYAWIWTKWGEQVAFYCDYD (SEQ ID NO: 1298)

>orf01193
MKSKKGGELRIAVFGDKKPFGYVDNDGSYQGYDIELGNQLAKDLGVKVKYISVDAANRAE
YLISNKVDITLANFTVTDERKKQVDFALPYMKVSLGVVSPKTGLITDVKQLEGKTLIVTK
GTTAETYFEKNHPEIKLQKYDQYSDSYQALLDGRGDAFSTDNTEVLAWALENKGFEVGIT
SLGDPDTIAAAVQKGNQELLDFINKDIEKLGKENFFHKAYEKTLHPTYGDAAKADDLVVE
GGH (SEQ ID NO: 1299)

>orf01194
MKLFKPLLTVLALAFALIFITACSSGGNAGSSSGKTTAKARTIDEIKKRR
(SEQ ID NO: 1300)

>orf01231
MYQDEAGFGRISKLGSCWAPIGVGPHVHSHYIREFHYCYGAVDAHTGESFFLIAGGCNTE
WMNAFLEELSQAYPDDYLLLVMDNAIWHKSSTLKIPTNIGFTFIPPYTPEMNPLNKCGKR
FVNVDLRIRPFELWKMS (SEQ ID NO: 1301)

>orf01233

MVTATTCFLKERVEFELLIFFYISPNRCLITVYSVLNL (SEQ ID NO: 1302)

>orf01234
MDTPDENGYVADDYRITYLEAHIKAMRDAIYKDGVDLLGYTTWGCIDSVSAGTGEMNKRY
GFIYVDRDNVGNGTLKCSKKKSFYWYMSFIAMV (SEQ ID NO: 1303)

>orf01255
MFLGMIGNISIILQFFGITIIVKIDNQARAIDFFKHDKSSF (SEQ ID NO: 1304)

>orf01257
MFSLNFFDDSVFLSIKIAHKGCFQLLDMTNPNFFNKFFLAQASDQLLHFLSWNIEL
(SEQ ID NO: 1305)

>orf01266
MTEPDFWNDNIAAQKTSQELNELKNTYNTFHKMEELQDEVEILLDFLAEDESVHDELVAQ
LAELDKIMTSYEMTLLLSEPYDHNNAILEIHPGSGGTEAQDWGDMLLRMYTRYGNAKGFK
VEVLDYQAGDEAGIKSVTLSFEGPNAYGLLKSEMGVHRLVRISPFDSAKRRHTSFTSVEV
MPELDDTIEVEIREDDIKMDTFRSGGAGGQNVNKVSTGVRLTHIPTGIVVQSTVDRTQYG
NRDRAMKMLQAKLYQMEQDKKAAEVDSLKGEKKEITWGSQIRSYVFTPYTMVKDHRTSFE
VAQVDKVMDGDLDGFIDAYLKWRIS (SEQ ID NO: 1306)

>orf01267
MLQSNQVQNFHHSSFDITAIFPDYFHSVSNIFIDSFLW (SEQ ID NO: 1307)

>orf01299
MQVIKRNGEIAEFNPDKIYQAILKAAQTVYVLTDDLRQNLAQVTKKVVLDLQEAKVERAT
ISMIQSMVEHRLLGAGYITIAEHYISYRLQRDLERSGYGDHIAVHLHFEQIR
(SEQ ID NO: 1308)

>orf01305
MKLKLCIIGFFFCLIATIGLVTISDTEIPIPLPIDGAFSIQGKSNLSNNEIYEMVRDLSK
TEKVTIYKPIVQSSGQLKYVNFDDVNNEQLKSAPIVGMYYTLGKMDVDSLKPLTMTGLQT
VYMAYPWYIGGILQFTGTLRILLMGSIYLTLLVVLFVVRTRQIKEGVIRRSLGLPIYDLR
REYGISLIFELIMMALLMISYSSFLGNGFFTYSSKLFFSLLLTNFILFQIIDLITFVLFW
LTIQIEKPIEIIKNKAKNKLIFVVWLAIISIIILVSGVFLQETKSSQSSINIQIQNLVPW
DTVKDWRRIEFLGIESNSTKNREVNDSDGQYLQIVAALKNLDFLYIERSSAYVPDFMKTS
HVIENFSKQLENDGITNPEINKELIYINQTGANLQNKVNGTNYHLLDNKIATIYIPEKWK
ENQKSIENTVVAEQFIGTNYTREQLAVQIIPDGEKIFYFNEDADNNLKMKDILPLANVAD
SKDNIVVVLDTDKMMENNKFSLASNILYKSLFSPEAVKKINEMTVLLNFSMNPVDVYQIV
KLKIQSLEHQILLSQILQKIIYSIVFILIYQYVQLFITLKQNEYVKKIILGLSKTYIAIS
SLKYFMMTITMVILFTFLMTGQIELLYIGAASLLVLMLSIIMSFRKLSESYTKILKGDES
(SEQ ID NO: 1309)

>orf01306
MTIDLLNVSKSFGSKKIFTDLNLIFESGKSYALIGGSGSGKSTLLNIIGRLEKIDSGNVL
VDKQDIWKIKERTFFKNTVGYVFQNYSLIDNKTVYDNLSLITKDKKTITDVLEKVGLSSD
YLHQKIYELSGGQAQRVAIARMLMKPRKIILADEPTGALDGEIGKEIIRLLLNETAEDKY
VIIATHDPAVYNEVDVIIDMKDIGYKV (SEQ ID NO: 1310)

>orf01307
MKKKIYIALIFVTGVLAIFFFGKQMITKENINKPTVELTIYTLSSSDTEKWNKVRQVETE
EAIYFITVKEVSSSEEVFSNIIANGAATGFGVREEEVKKFNNGLGDTIEDSKHNKLIEIE
FFTFSDDGAGFVVANFDYGKEELNSQKKDIKELYKKIYESFKEKNK
(SEQ ID NO: 1311)

>orf01317
MKIKEQTRKLAAGCSKHSFEVVDETDEVSSKHSFEVVDETDEVSNHT
(SEQ ID NO: 1312)

>orf01324
MELFKTWKKNMVLYGLKSQIGTVYRNNDRTTSFYDVGNFLYLAGELDSRFWEDFVRKYGL
DYKIIISENTNWQDFLHRKVGLNSFTRYSFKDKANFQVEFLNNLVTHLEEGYNIVPIDNH
IYNCFSTEEWSQDLQGDFESYQDFVLKGGFGFVILKNNELIAGISSGLVYRKAVEVEVAT

RPNEQGNGFAKKLGAAMILESLNRDMFPLWDAHNEASKKVAEFLGYELSEPYEAFELEEI
LI (SEQ ID NO: 1313)

>orf01369
MKVIDQALLEKVIIERSRTSHKGDYGRLLFLGGTYPYGGAIIMAALAAVKSGAGLVTVGT
DRENIPALHSHLPEAMAFSLQDQQLLKEQLEKAEVVLLGPGLRDDAFGEDLVKQVFAGLR
QNQILIVDGGALTILARTSLSFSSSQLILTPHQKEWEKLSGITIEKQKEDATASALTSFP
QGTILVEKGSATRIWQAGQSDYYQLQVGGPYQATGGMGDTLAGMIAGFAGQFKQASLYER
VAVATHLHSAIAQELAQEQYVVLPTEISNCLPKVMKRYV (SEQ ID NO: 1314)

>orf01376
VLDSKEELKESENDAPKLETPLREEPRLAPQTLPEASEVLENKREESKVEITEPAQADDI
RKVVGELAKDISITKLYMTGHSLGGYLAQIAAVEDYQKYPDFYNHVLRKVTTFSAPKVIT
SRTVWDAKNGF (SEQ ID NO: 1315)

>orf01404
MGRKPKKRPEERTELEHLQAENEYLRAENAILKKLRELRLKEEKEKEERQKLFKN
(SEQ ID NO: 1316)

>orf01417
VVLSTSAILVACGKTDKEADAPTTFSYVYAVDPASLGYSIATRTSRTDVIGNVIDGLMEN
DKYGNVAPSQKDYDLNSTGWAPSYQDPASYLNIMDPKSGSAMKHLGITKGKDKDVVAKPG
LDKYKKLLEDAVSETTDLEKRYEKYAKAQAWSTDSSLLMPTASSGGSPVVSNVVPFSKPY
SQVGIKGEPYIFKGMKLQKDIVTTKEYNEVFKKWQKEKLESNSKYQKELEKYIK
(SEQ ID NO: 1317)

>orf01421
LNFDFFIFLAHFIPLFTFSILQENPKTSKKKLYIRLL (SEQ ID NO: 1318)

>orf01428
MRLSMKLIHDLDMHTTHSTAKMLYNMKAIKNDFSIRE (SEQ ID NO: 1319)

>orf01442
LIRIIRNIYRSGEGNTSVFQSFIDQINSNQFCYGSNFDRLRCILLIENFTSICLNSNRMF
SGNGKILSNSSRSTP (SEQ ID NO: 1320)

>orf01453
MSNYRRTSKPKTEHIKKGFTVFQKTITTIGSILGLITAGITIMNALDNNNKNTKKEPTTS
QTTTFVKEIQKESPQENTTPNKENNTSQEKTQQEETPKSSVKEEKKEDQKTATQDSTTPA
TSKPATENEKQPNTPTSENNTQ (SEQ ID NO: 1321)

>orf01457
MNQSYFYLKMKEHKLKVPYTGKERRVRILLPKDYEKDTDRSYPVVYFHDGQNVFNSKESF
IGHSWKIIPAIKRNPDISRMIVVAIDNDGMGRMNEYAAWKFQESPIPEQQFGGKGVEYAE
FVMEVVKPFIKHKTGWFDGMMTTGCSMGAYHALNFFLQHPDVFTKVIALSGVYDARFFVG
DYYNDDAIYQNSPVDYIWNQNDGWFIDRYRQAEIVLCTGLGAWEQDGLPSFYKLKEAFDQ
KQIPAWFAEWGHDVAHDWEWWRKQMPYFLGNLYL (SEQ ID NO: 1322)

>orf01466
MSSIHTKNSSLKSKSRFNEMFGDPLNNNKKFAVKTGQQCFKFSSGKFLDKHDRVFEGYPA
YGGNGIAWKSRKYLIDNPTIIIGRVGAYCGNVRTTHGKVWISDNAIYIKEFKNSDFNLVF
LLELMKVIDFSKFADFSGQPKITQKPLENQKYILPPLALQNEFADFVALVDKSQFACEIA
IKVWRNSLKFSII (SEQ ID NO: 1323)

>orf01476
LVYAPFSFNILLDYITFDFKILLFSVFLAINRFHNDFIQFLL (SEQ ID NO: 1324)

>orf01479
MSEYSGLSFFEVALAEFLDIVSAVYLEDADGIIVNLWGILDK (SEQ ID NO: 1325)

>orf01490
MEGVAKGRIGRKKNNGIDNRCCHKKRNGRVTWNLFFQKTIDDGDDSTFTRREKYTDKGPK
KDSPPTISREKMINLVRCDINFNQP (SEQ ID NO: 1326)

>orf01493
VDKTDEVSSKHCFEVVDRTDEVSSKHCFEVVDRTDEVSSKHCFEVVDRTDEVSNRTTVRR
S (SEQ ID NO: 1327)

>orf01495
MTEFMSDNFPKNLHTQFLINLGIKIQMPIFGEKSPTCRT (SEQ ID NO: 1328)

>orf01503
VVIGVASATTNIWIIFLSGFTAILAGAFSMAGGEYVSVSTPKDTEEAAVSREKLLLDQDR
ELAKKSLYAAYIQNGEFKTSAQLLTNKIFLKNPLKALVEEKYGIEYEEFTNPWHAAISSF
VAFFLRSLPPMLSVTIFPSDYRIPATVLIVGVALLLTGYTSARLGKAPTKTAMIRNLAIG
LLTMGVTFLLEQLFSI (SEQ ID NO: 1329)

>orf01535
MSFKNNWIDKEGRVFIYFTVEEIMKRRNISKPTAIKTLDELDIKKGIGLIERVRLGLGKP
NIIYVKDFMSIFQVKENDLQKSKNLTSEVKDFNLRSKENELQEVKNLDSNYIENNKSKYS
KREYSFGENGLGTFQNVFLAAEDI (SEQ ID NO: 1330)

>orf01543
LLHIRVCKTFDRIPYCMLALFLSKSIGLTILLHKVKTVIFIDDQSNDKTCKICIHISFFR
IKLSQQCQLSFSVYF (SEQ ID NO: 1331)

>orf01547
MTQEDALIVISHIKVLSIVPNRCLKPLDKTFSLYNWIFLSQKYILLQANFLKISRVQLQ
(SEQ ID NO: 1332)

>orf01552
VTTHDEPVYEKHGVLHYAVANIPGAVARTSTIALTNVTLPYIEALAGKGFAQAISEDEGL
RQGVTTYQGYLTSLPVAQGLNRDYTDINDLV (SEQ ID NO: 1333)

>orf01553
VFFIDGFIVRCHTVSCFDNATLVNSNVNDTEPGRICLTISSVTNSGAFAPGMRMAPITTS
ASLTLASMLNELDIRV (SEQ ID NO: 1334)

>orf01555
LSTKTKGDAGSMCTDDTITDDSYFSFGTPGTPPGRTPEPPACLVRK
(SEQ ID NO: 1335)

>orf01556
MLIGIPKEIKNNENRVALTPAGVHSLVSRGHRVLIETNAGLGSGFTDADYQKQGAEIVAT
AGEAWAAELVVKVKEPLNSEYGYLRDDLLLFTYLHMAAAPELADAMLAAKTTGIAYETVR
DNQGQLPLLVPMSEVAGRMAV (SEQ ID NO: 1336)

>orf01576
MASRNVLSMEPKFLLAGHFKGQFLILKIVSSDIDDGFAIAC (SEQ ID NO: 1337)

>orf01577
LSSADKTCLNQFFTDFSDFFQSSLVEDGFYTFQIENSGFGFFNQISQVFDSFFEFLIPFK
IALGILVGSQSLIKRNHDRLVGIVVV (SEQ ID NO: 1338)

>orf01578
VSVFLKFIFNTTNQFTGLLFDAVALSLILIVGVQQIRKICKRLSHLICKRNWTEGSLSQA
WLGFLIEKISESGKFFTNQYPFQFICSIASQTLKEALKIFCC
(SEQ ID NO: 1339)

>orf01579
MVSNLVFIGNCNFHNTVIFHLLNRLNQGPLQILSQNHDKGRRLSWIFKSRLGQLNASKNW
MGRKEQAMALAIAADLQDQLLFKRLIDFLDATIH (SEQ ID NO: 1340)

>orf01599
LLYNPVEKTRVHIKKGIGKLQYLFTRLFYLIFVSTDYISYGSSSEG (SEQ ID NO: 1341)

>orf01630
MRSYITLICNLNNNLFCLNSFFLTNLVWSQIFSLLSVFITVYI (SEQ ID NO: 1342)

>orf01631
LLEITLKSPYQFAHILFQSTIVPHGGHYHFIPESDLSAGELAATYVFNPNDIVRDTGDAY
IVRHGDHYHYIPKSSLNNPPSHSNTEEVGSSSSSVLSNPSLHVHHEEEDGHGFDANRIIS
EDSEGFVIPHGDHNHYIKVQTKGYEAALKNKIPSLQSNYQPGTFDEKAVLAKVDQLLADS
RSIYKDRLS (SEQ ID NO: 1343)

>orf01664
MARLEPAKIAKIVLGILLYIIDLIKSSFVLPIPKAAKKSLILISFVPSFNDKNIVIRRPR
QITKIMPRFICFLFRIFACIS (SEQ ID NO: 1344)

>orf01680
MELSAIYHGPESEYAYLYKDKKLHIRIRTKKGDIESINLHYGDPFIFMEEFYQDTKEMVK
ITSGTLFDHWQVEVSVDFARIQYLFELRDTEGQNILYGDKGCVENSLENLHAIGNGFKLP
YLHEIDACKVPDWVSNTVWYQIFPERFANGNALLNPEGTLDWDSSVTPKSDDFFGGDLQG
IIDHMDYLQDLGITGLYLCPIFESTSNHKYNTTDYFEIDRHFGDKETFRELVDQAHHRGM
KVMLDAVFNHIASQSLQWKNVVKNGEQSAYKDWFHIQQFPVTTEKLVNKRDLPYHVFGFE
DYMPKLNTANPEVKNYLLKVATYWIEEFNIDAWRLDVANEIDHQFWKDFRKAVLAKNPDL
YILGEVWHTSQPWLNGDEFHAVMNYPLSDSIKDYFLRGIKKTDQFIDEINGESMYYKQQI
SEVMFNLLDSHDTERILWTANEDVQLVKSALAFLFLQKGTPCIYYGTELALTGGPDPDCR
RCMPWERVSSDNDMLNFMKRLIKIRKYASVIISHGKYSLQEINSDLVALEWKYEGRILKA
IFNQSTEDYLLEKEAVALASNCQELDNQLVISPDGFMIF (SEQ ID NO: 1345)

>orf01688
MGQEIKLIRKQFRITRQEEKQIKEMMREQKVDSFSEFLRQNLLKKNYQDRIFESWFSLWQ
SQKFEQISRDVYEVLVVARENHQVTQEHVSILLTCVQELIAEVNQVQPLSREFREKYMG
(SEQ ID NO: 1346)

>orf01689
MVYRYRTNLKKVFLTDPELHQLNERIAKSNCQNFSVYARKVLLNPNMSFVTINTDTYDQL
VFELRRIGNNINQIARAINQSHLISQDQLQELSKGVGELIKEVDKEFQV
(SEQ ID NO: 1347)

>orf01690
MVVTKHFATHGKKYRRRLIKYILNPDKTDNLKLVSDFGMSNYLDFPSHTEMVEMYNVNFT
NNDKLYESRNDRQEKHQQTIHAHHLIQSFSPEDNLTPEEINRIGYETMMELTGGRFKFIV
ATHTDKDHVHNHILINAIDRNSDKKLIWNYALERNLRMISDRISKMAGAKIIEKRYSYRG
YKKYRESSHKFELKQRLYFLMQQSK (SEQ ID NO: 1348)

>orf01691
MMTDRAMTKPIRGRQLSKRDLYDEEFFRTHFAKQEIESRLEFLLNRVNSLEELITKAKEL
NLTIDLKQKNVTFILKENNQKISLGHQKISDKKLYDVKFFQDYFKNKEVIASEGLENLQE
QYHAFQEERDKDKVSTEEIEEAFKTFKKPLRHLRKNEIPFVNLKWNLQRTK
(SEQ ID NO: 1359)

>orf01692
MEEENHKKYKVYIRETSSYFVYNKENMDNNCFIKGRTLIRQLSNDSQKLPYRRPTLKSLQ
EKISEINLMIELSNTNKQYQEIKDELVLEIAEIDMKLEETQEKIATLNKMAEVFINLKSE
DEIGRKLAKYDFDQMNMTESIMLDRLNTDILKLQQELGNEINKYEEIARRLDLFVKIINT
NKFTVLKFHENALLE (SEQ ID NO: 1350)

>orf01693
MKSKLGITLRKVRKGKQISLCSVADEHLSKSQISRFERGESEISCIRLINILDKLHITLD
EFLVLHNDDYTSSESFANLVQYIRKQYSSQSINNIACLLSDTSDYTLNSFEKTMVKSILH
TMDSNIIPSDEELLHLTDYLFKIEKWGYYEIILLGNCVRTINYNSYFLLTKEMLNNYIYS
SLNKTNKQIVSQLAINCFILSIDKEEFSNCSYLISKIKTLLDNELNFYEQTVFLYATGYY
EFKRQLSSGIETMKQAIQVLDILGEDKLKLHYTSHFDKLVNNK
(SEQ ID NO: 1351)

>orf01694
MSLSYYYEINPSTDILKCIEELLYKEDKCFNNILKNWKDIRRNHNDSFPNFWCYGAPGIL

LARKEIFDKTNIGNNDLSIIKNVLTNVEKIRELNLCHGSVGTISCLDAILKDEENLLIKE
SIDFYFDNVVSQVIKPELSTDLNTMNTFSFMLGVSGVVYEISRKQDDRLLNVLLLELRGH
DD (SEQ ID NO: 1352)

>orf01695
MMTRKVPNIEQMSQIECGLCCCLSILHFYKSKETLLDLRRDIEKGRDGYSIGDLKQLLNK
RNFDTGSYQVKDVNKISELPLPLIAFWDNQHYVVIYKVKKNKVYIMDPSKGYINYEFKEF
SKHFSNIVLLSFPNENYQSLKSQFPSPWIRVFSSFSKVKGRLILTLLFSIISYLIILSVP
VMTSKFINSALGNTFSFQTSFLILFSLLCLYLISILARSMGILFSNIFFSRDIESFTFKH
LLKLPYSFFELRAKGDILYRISSLSGFRELFTNQVVGGVVDIGTILSVVIYMFLSSKTLS
IIALILSLINFLFLFSTRKIMYDTVNRELQEQSLIYSVETEALNTISSIKISGLEDEIYE
NWSKYLKNVLTKYKKRSIVHILYNSATNVFQLFAPIIILIFGLDNVLNGKILLGEVVAFQ
TMASILFSSEISIFNAYTQYILAAGYLNRVNDIWLENEENVENGLKKCSLEGRIDIKDLS
FSYSKDSAPVIENLNLTIEPGQRIALVGQSGSGKSTLSKILSGLYKIDTGKILFDGVNIN
QIDKKILSQNLGVVPQDSFLLNRSILDNITLKNEVTSQKIEEVCKAVQIYDEIMAMPMKF
NTIISEMGSNISGGQRQRIALARALINNPSIVILDEATSALDTINEERITKYIQSQGCTQ
IIIAHRLSTIKDADIIFVMKGGKIVESGNHKYLMDLGGEYYSLYTKRK
(SEQ ID NO: 1353)

>orf01696
MAIVEIINLTKSFKDIEVIHNTSFYLNKGKVYGFVGPNGAGKTTIIKMILGILKPDSGKI
TIFNQTVEQNSENILSRIGLVLGPSFYGHLDAYKNLKLIANMKGLSLDTERLNEYLSMVG
LKDVKKKKVKNFSMGMKQRLSIAASLLGSPEILIWDEPINGLDPQGVIEIRSLIRFLQEK
KGITFLISSHILSELDKVISDIIIINYGKVEFFGSCHYLLQKYNCRNLEEAYLACLAGGE
YD (SEQ ID NO: 1354)

>orf01697
MIKLEFLKQKKSILWFVLIFPIILNVLLYIDLTFRYRGYLLVHQNELALSNWQLIFKEQT
IFYFSELFYLVLSLIIYEVFAVEFKNDAWLTVISLPFRNKYTINSKLLITVVYTFTFWLS
DYISLYVIGKAIDNSLEIGLIFFLKTFTIQLISSLMIMLLYFLTLVLIRKISGIIPIGII
MMILTISIYYNDYNFKIYLPFTYLSHAFRVTESQFYMILLSNIIIIVLFYILIRKLNERS
FEMKL(SEQ ID NO: 1355)

>orf01698
MKLLKNELIKSKIFLFIIVDICIQILVILAIKTYILDISALYSELDYNKYWYILHTLIYM
LMIFPIQILYQNLREALIEDNNNGWNIMVINTNNLVKIIYIKVTINIVRCFICYFVYTIF
SLIQLGGMGTDMLLTNIIFPNIMSFLLFLPIAIFMQICCIRFDSILAKALPNILLILIVL
ITFQSDWNIFIPATYYYTEIQSTTNLGIKLLVCIWIMGFEFFLLPKLIKLKEQNLV
(SEQ ID NO: 1356)

>orf01725
MRFSAFKIFSNSVCKRIITKGLGFRALLLYTISKVKLREDILVSQSIVPVEIPQYCRFDS
KKRNGILFNVRIANLKFTFFRLDFLRNKIWYSSSMNDEASKQLTDARFKRLVGVQRTTFE
EMLAVLKTAYQLKHAKGGRKPKLSLEDLLMATLQYVREYRTYEEIAAVFGIHESNLIRRS
(SEQ ID NO: 1357)

>orf01753
MHTKSRTIKSLITQFTAILLYELPLALDSLVFMGFSMKLIHDLNTHTTHSTAKMLHNVKA
IKNDFSIRE (SEQ ID NO: 1358)

>orf01776
MIKIYFTKFSENHNPFCKIFEIIFTNLIFQSILNKNKKNPLRQGEANVV
(SEQ ID NO: 1359)

>orf01783
MSQVKGLCVLDVDGTLILEEVIDLLGREAGHEAEISQITSRAMRGELVFESSLRKRVSLL
EGLPILVFDNVFNSIHLSLNVPEFISILQKNGILVGLVSGGFTPIVGEISKIPWYCLFHC
QPA (SEQ ID NO: 1360)

>orf01784
MLKSAELGIAFCSKEMLKKEIPHHVDKRDFLEVLPLIDCLE (SEQ ID NO: 1361)

>orf01789

MFGNWFFKAFVCSLERLAQDRTMNWFSCIGNKNTVAFVPILIGCFA
(SEQ ID NO: 1362)

>orf01804
MEKYFGEKQERFSFRKLSVGLVSATISSLFFMSVLASSSVDAQETAGVHYKYVADSELSS
EEKKQLVYDIPTYVENDDETYYLVYKLNSQNQLAELPNTGSKNERQALVAGASLAALGIL
IFAVSKKKVKNKTVLHLVLVAGMGNGVLVSVHALENHLLLNYNTDYELTSGEKLPIPKEI
SGYTYIGYIKEGKTTSDFEVSNQEKSAATPTKQQKVDYNVTPNFVDHPSTVQAIQEQTPV
SSTKPTEVQVVEKPFSTELINPRKEEKQSSDSQEQLAEHKNLETKKEEKISPKEKTGVNT
LNPQDEVLSGQLNKPELLYRDETIETKIDFQEEIQENPDLAEGTVRVKQEGALGKKVEIV
RIFSVNNEEVSREIISTSTTAPVSRIVEKGTKKAQVIKEQAETGAEHKEVQSGAIVEPAI
QPELPAAVLTDKGESAVQPELPEAVVSDKGVPEVQPALPEAVMTDKGDPEQVEPLPEYTG
VQAGAIVEPEKVEPEYAGVQAGAIVEPEQVAPLPEYTGVQAGAIVEPEKVEAPKEYTGVQ
AGAIVEPEKVEPSKEYTGVQAGAIVEPEQIAPLPEYTGVQ
AGAIVEPEKVEALKEYTGKIEQPSAEDTKPNNENTNTPEEMSIQKKSSALINMNFITDSS
KVTGVGSATFIAPNVLLTVAHNFINNSTDNTTGEFRGDKSKNVYEWVTPDGQKGTFTANN
IHFYNKKDYPKGFIYDLAVIKLPETTGREHVELVKNYSKVNLNDKLNVHGYPAGKYTHLK
DATVEMEQEYANNTYGVQYQGGNPGMSGGGIFNANGEVIGVHQNGAQNRSGGLILSPTQL
AWIKSIIAGNEIPPVYDELYRHKDEKKDDAKDEKEVIKKLELRNISSVELYSKDGNKYRH
VTSLASLPSNAENYFMKVKSENFKDVMLPVTSITNDTKDNRDVYKIVASANSLIQHENNN
VLENYTYYLPKTQQSETGVYTSFKNLVDAMNSNPNGTFRLGATMDAREVELPDGQESYVN
NVFHGILVGTNNEKYYAIYNLKKPLFGELNGATVEKLSLKDVNISAKDDTATLAKEANNN
THIDNVHADGAIAGERSIGGLVSQVNNSTISNSSYTGRITNTYKTVASYQIGGLVGKLSG
PRGLIDKSFASIDLSSNATQGDQSIGGIVGAVENSALISNSYAEGNLNNVQRFANVGGVV
GNLWDPVGGLEKSGRLSNVLSDVNVTNGNAIAGYNFNGIKANGTYSNKNNKVVNVVQEDD
EILTKDSTVQRGEVLEDAQIKEKKATFVSKNTIKTEDFNFSSRYVTDYKNLENADSSKEK
VYKNIEKLLPFYNRETIVKYGNLVETSSNLYNKELLSVVPMKDKEVISDINKNKSSINKL
LLYYADNTSETLNVNYQTDFSNVAEYRIGGTNLIYTPNTLLRNYQNILDEVLPALNSVEY
KSEAIRKVLDVSKDVSLTELYLEEQFNTTKTNLKDSLTKLLTADAAIAENNNKVIDNYVI
EKIKNNKEALLLGLTYLERWYDFKYRDTKAKDLVMYHLDFFGKSNSSALDNVIELGKSGY
NNLLAKNNVITYNVLLAKNYKTNNLFDALEKYRKAFVPDKTNNEWFKEQTKAYIVEEKST
IKEVSDKQSIAGSPYSIGVYDRLTSPSWKYPSMVLPLLTLPEKSVFIIANISTIGFGAYD
RYRSKEHPAGTDLNDYVEKKAKEAAVRFRDHYDYWYRILDDKNKEKLYRSVLVYDAFRFG
TDEKEDKDTYQATFETNHPAIKHFFGPAGNNVVHNSNGAYATGDAFYYMAYRMLDKDGAV
TYTHEMTHNSDREIYLGGYGRRNGLGPEFYAKGLLQAPDHPNDPTVTINSILKYDQSEES
TRLQVADPTQRFGSVDDLNKYMHNMFDVIYMLEILEGKAVAKLDTNQKYDLLRKIENEYK
PDPDGNSVYATNVVRRLKPEELTKLTTFNSLIEHDIITRRGYVDEATYKRNGYYTINLFS
PIYSALSSKIGTPGDLMGRRIAFELLAAKGYKDGMVPYISNQYEKEAKAQGKVITSYGKQ
IGLVTDEIVLSKVFNNQYNSWIDFKKDMYKEREDKFGKLNKVSFIDPNGSWARQQKVTID
NINRLEKMIEDAVKFDAEDEVAKLYPETNSRVLKLKKAIFKAYLDQTGDFRSSIFENKK
(SEQ ID NO: 1362)

>orf01807
MTALGLLAIGSLIVIITKDNRNKKIATFLIVGATGLVTLSTASALNLNANIHESGRDGVL
QISGYRYVGYLELDDKTVSSVSPASTVSPVEQPKVVTEKGEPEVHEKPDYTQPIGANLVE
PEVHEKLAYTEPVGTTGVDENGNLIEPPVNDIPEYTEPVGTTGVDENGNLIEPPVSDIPE
YTEPISTVSEVASEREELPSLHTDIRTETIPKTTIEESDPSKFIGDDSVRQVGEDGERQI
VTSYEELHGKKISDPVETVTILKEMKPKILVKGTKEKPKEKTAPVLTLDRTNTNVLNRSA
TLSYHLVNTDGVTINKITATIKDGNEIVKTVDLTSEQLDKQVEDLKFYKDYKIETTMTYD
RGKGEETATLEEKPLRLDLKKVEIKNIASTNLVKVNDDGTETPSDFMTEKPSDEDVKKMY
LKITSRDNKVTRLAVDKIEEVTEEGKKLYKITAEAQDLIQHTDPTKVRNKYVHYIEKPVP
KVDDVYYNFKELVDAMNADKNGTFKIGADLNATNVPTPNKQYVPGTFKGHLSSVDGKQYT
IHNIARPLFDRVENGSVKNINLGNVDINMPWADGIAPVANMVKNATVEDVKVTGNVVANN
NIAGIVNKIDSGGQLTNVAFIGNLTGVGDKGQYMAGIAGEIWRGNLAKAYVEADIVANRA
RIGGLVAKTDNGNDSMGIGKYGSIRKSVTKGTIKTKVLFETGGFINSNLPFGKLEDNISM
MRVENGEEFFGSSDLDYDGGYFTNGWLERNFVVKGVSSGKHSYKRSRDKIKEISQDEANK
RIANFGLTADKYEINEPVVNRLNRLTRREDEYKSTQDYKSERDLAYRNIEKLQPFYNKEW
IVNQGNKLAEDSNLAKKEVLSVTGMKDGQFVTDLSDIDKIMVHYADGTKEEMDVTKNTDS
KVQQVREYSVSGLGDVVYTPNMVVKNRDKLIADVKSQLSSVELISQEVRDLMSRRDKPAE
NTDERKNGYIKDLYLEESFAEVKQNLDKLVKSLVENEDHQLNGDEAAIKSLLKKVETNKA
KIMMALTYLNRYYDIKYGDISIKNIMMFKPDFYGKTPSVIDRLINIGSSEKNLKGDRTQD
AYREIIAGNTGKSNLRNFLEYNMRLFTEDKDINDWFIHSAKNVYVSEPKTTNTELKDKRH
RVFDGLDNGVHGRMILPLLTLKDAHMFLISTYNTMAYSSFEKYGKHTEEARNEFKTKIDE

VAHAQQTYLDFWSRLALPNVRDRLLKSQNMVPTPVWDNQTYNGSPVGRRGFDSKGNPIAP
IRELYGPTWRHHDRDWRMGAMASIFPNPNNDDKVLFMVTDMISPFGISAFTHETTHVNDR
MLYFGGHKHRQGTDVEAYAQGMLQTPDSSTTNGEYGALGINMAYHRPNDGNQWYNPDPDK
LKTRDDIDRYMRNYNEAMMLLDHVEADAVLPKIKGDNSKWFKKIDKEMRSKIQYNDLLGP
NQWDSIRDLKDEEKVMTLSSVNDLVDNNFMTKHGNPGNGRYRPEDFTPNSAYVNVNMMAG
IYGGNTSQGAPGSLSFKHNAFRMWGYYGYENGFISYVSNKYKAEADKNNHGLLSDKLIIN
KVSKGNFNTLEEWKRHWYGEVLAKAKKGFEAIDIDGVHISNYDELRPLFDKAVEEDLKKP
DDFSHTVALKSKVFKALLKNTDGFFNKLFKEDI (SEQ ID NO: 1364)

>orf01818
VFHKSLNNCKRKKVCYSSLLPSCFHDWLKNLLTKSQHFSHINFIVEGEGWRSQVRFNHAL
GNNLTHWCHWNTLDFTIWCYVIRDFFHFFNLSRRFDAIVFDIFRKQGQNILLHDFTTMTG
SLDFLPSNVMFEGNSFCKWRNANHVCVFISFHVFFVDTTVCT
(SEQ ID NO: 1365)

>orf01822
VLGGRANSVTSCTTNSHWNLTFTTKHVTCFSSLVDDIVHGNNREVHEGHIDDWTKSCHGC
SCCCSRDGSFRNRTVTDTFWTKFFKHSNRSTEVSSEDTDIFSHQEHIFIATHFLRHSKDN
GVTEGHCFCFHFISFSLVCVNIFKG (SEQ ID NO: 1366)

>orf01823
MDMFYIGHFLDIRRDTVTVVNAIENDWQVPDRSHVHCFVENTFIGRTISKEANNDFTGIL
HLLTEGCTDSDPHTTTYDTIGTKVPSIKVSDMHRSTFPFTGSSVFTKDFSHHSVEVNPFS
NSLPVSTVV (SEQ ID NO: 1367)

>orf01841
MISVWHCNTSSCSTCDLRWVENKAIRFHMALTQRQFVELFQETINVITLTCLTVSVAVVA
CVSICSSWIAYRRYPVCS (SEQ ID NO: 1368)

>orf01842
MISMRNDISITSILYDIRSIKDITIICSIASLRTCQGNSSIVSWSPSFTILTMFLFLSID
FLFCTDVIRVGSILKVNIVFSIYLDNISTLDLINNILIF (SEQ ID NO: 1369)

>orf01843
LVCYLDDDLLSIDSFTLANLIRSQILRFLRRLFSIYIGNTIIFLNRSSLIQSQLVRTNT
(SEQ ID NO: 1370)

>orf01859
MDKLIIFIEKGKPFFEKLSRNIYLRAIKDGFISSMPAVLFSSIFILIAAVPNIFGFKWSD
EQLAFILKPYNYSMGILALLVAGTTAKSLTDSVNTRSMEKTNQINYMSTFLAAVVGLLIL
AADPIEGGFANGLLGTRGLLTAFLAAFITVNIYKVCIKNNVTIRLPEEVPPNIAQVFKDV
IPFALSVLSIYGLDLIVRNIFGTNVAESVGKILAPLFSATDGYIGLAIVFGAYAFFWFVG
IHGPSVVEPLIVAISYANIEANVQLVQAGMHADKILNPVTQTFVVTMGGTGATLVVPFMF
MWLCKSKRNRIVGRASVVPTFFGVNEPILFGAPIVLNPIFFIPFVTAPIINVWIMKFFVD
VLQMNSFSIILPWTTPAPIGIVMGTALAPLSFVLAITLIIIDTLIYYPFVKVYDHQILEE
ERKGNSSSELKEKVAANFNTAKADAILEKAGVDAAQNTITEETNVLVLCAGGGTSGLLAN
ALNKAAAEYNVPVKAAAGGYGAHREMLPEFNLVILAPQVASNFEDMKAETDKLGIKLAKT
EGAQYIKLTRDGKGALAFVQEQFD (SEQ ID NO: 1371)

>orf01861
MIFSNQIPLLLSECNPLTNYNHLFSLIISDKRDIVIHWI (SEQ ID NO: 1372)

>orf01868
MDGFIVTVKIIGHLLVVVFSAIPFFKEFCKEVCVCLLSIVTFKVFNFRNQFLVFFRWFVF
SMNESFDDITHKQFTSNLTTKADNVSVQLFFSIKGCCHITNQGRTNTWNFIYSVVDTNTS
TTDTYPKISLAASYSFPYFFTKDWVVSPCMVICTKVNDFISF (SEQ ID NO: 1373)

>orf01871
MLDFQDRSPWLEGQKEIDLSYDLFSTDAVTLDELQSRTIALRSLKHDKGLKVHFAEFPNL
IIWSTLNKGPFITFEPWSGLSTFLEEGDHLEDKKNVCLLEANQVEELGFEIEVL
(SEQ ID NO: 1374)

>orf01872

MKLFKMSCRNIGQAGKILADSGYQGLMKIYPQAQTPRKSSKLKPLTAEDKACNHALSKGE
ARLRTSLPK (SEQ ID NO: 1375)

>orf01874
MRRKYKSIALKKELANDSGKKKCHAMKAQAIVTSQGRIVSLDIAVNYLL
(SEQ ID NO: 1376)

>orf01878
MKIKEQTRKLAAGYSKHNFEVVDETDEVSNHTYSKATLTWFEEIFEEYKN
(SEQ ID NO: 1377)

>orf01886
LIESQVFSSLQVCCLNLCHLKFQHFDTCLVFLLVFLDFQNLLAHFPIGIKTRLIGFFQVP
KSGITKFIQHLDMQLGTH (SEQ ID NO: 1378)

>orf01887
MVMLTMNIYKMLPNSSQNRQINHLTIYTADTTTILQDFPTDDNFIT
(SEQ ID NO: 1379)

>orf01888
MTNNICRRTSSQHHIHGINDNRLPCTRFTSQDSHPLFKIEGNSLNNGKVFYRNFK
(SEQ ID NO: 1380)

>orf01899
MPHTRDNWQTRFKNSSYHNFFVKGPEILNRTTSTTNNEQIQIVPLISTRNISSNFLRSPF
TLNLGRIKKDVNTWESPADGRDNISNNGSTTAGYYPNSLRKLG
(SEQ ID NO: 1381)

>orf01900
LLEAFLKQAFFCQFFLKLFKLNRKRPNPIRLSFFNDDGVATTWFIDLYTPNHIDLHSFFQ
VKP (SEQ ID NO: 1382)

>orf01911
MFMSNLCQFFQVWNINQGVTQGFNQDKLGIVFDSCFYFLQIINIDKGCCDTITRKGFFQK
IEGSTVNSRSSHYMVTSMGKRQNRISHCSHT (SEQ ID NO: 1383)

>orf01912
LINVFSHGVDIAIHSATKFIGGHGTTIGGIIVDSGRFDWMASGKFPQFVDEGSSCHNLSY
TRDVGAVAFIIAVRVQLLRDTGAALSPFNAFLLLQRLETLSLRVERHVQNAETIVDFLVN
HPKVEKVNYPKLADSPYYALAEKYLPKGVGSIFTFHVKGDEEEARKVIDNLEIFSDLANA
ADAKSLVVHPATITHGQLSEKDLEAAGVTPNQIHLSIGLENVEDLIEDLRLALEKI
(SEQ ID NO: 1384)

>orf01913
MTRDFKFETLQLHAGQVVTPATKSRAVPIYQTTSFVFDDT (SEQ ID NO: 1385)

>orf01917
MSQKNNKKKNKRKNLLTNILAGFLILLSLALIFNTQIRNIFIVWNTNKYQVSQVSKEKLE
ENQDTEGNFDFDSVKAISSEAVLTSQWDAQKLPVIGGIAIPELEMNLPIFKGLDNVNLFY
GAGTMKREQVMGEGNYSLASHHIFGVDNANKMLFSPLDNAKNGMKIYLTDKNKVYTYEIR
EVKRVTPDRVDEVDDRDGVNEITLVTCEDLAATERIIVKGDLKETKDYSQTSDEILTAFN
QPYKQFY (SEQ ID NO: 1386)

>orf01924
MRWNIGCHPNRDTSCSINQKVWKTRWQDQGFPFIGIIVINEINCIFVDITKHFQSNLAHT
CLGITLSGSTISIHGTKIPMTIYKHVTVAPPLSHTDHGFINRGIPVWVIFTHDIPCNTSR
FFMGFVWGHTQFIHSVENATVNRF (SEQ ID NO: 1387)

>orf01928
LKKKWFFVDYYDTTIILLALISVILVLLGFAEMIDLDNPPYSIIDLVIWGVFVIDYSWRF
FITKRKWRFILENIFDLLAILPLNAIFTVFRLGRIFRLAKLTKLLKLTRLLRIIGLTGKL
ERKISRFLRTNGLIYILYVNIFIVLVGSSILSVVEEKSFSDSLWWALVTVTTVGYGDIVP
ASIFGKWLAVLLMLVGIGTIGMLTSALTNFFVKDNPDEQIKLDKLQDELSSQRILLEKQS

KKIEELHKMIQDLIEKT (SEQ ID NO: 1388)

>orf01938
VVDFKQTRQDPHDITIYSWLRQVKSNTGNGSCCVRSNPFQAGNSFIGIWKLATKVSHNLL
GCSLHIANSRIIAQALPSFQ (SEQ ID NO: 1389)

>orf01943
MAERTVVQVHNAFPEDTTLINSQLIPLVQVVVNQGRKGIVGSCNSMHISSKVEVDVFHWQ
NLCIPTTSSTTLDPHDWTKRRFADSNHGFLANLVQGIRKTNGKRRLSFTCRCWVDGSNQD
QFTDWIALNCTNFIKAEFSLVLSVQLQIVVRNTKFLYNINNWLQLNTLCDFNICFHSKFL
(SEQ ID NO: 1390)

>orf01950
LRILDSQPCFFVDFTNDRLRKSLIIFYMTSRKGITRPAIVFRGAILHHHALSFEVFNQTN
IG (SEQ ID NO: 1391)

>orf01957
MLFIIGHLNFPTAGSFIDSTLHRLGNRVCIHDDMAFTVTSSTSNSLDESTFVAKETFLVS
IENSYEAHFRNVNSFTEQVNSDQDIKDTQAQVTDNLRPFQGLDIRVHVLDLDTHFLEVVG
QILCHFLGQSCDKGTLIFFNAGIDFTQEVINLSHSRTDFHLWIQESRWTNDLLNHCLGLF
IFIVTRCR (SEQ ID NO: 1392)

>orf01958
MNVTLKLLPTERTIVQSRRQTETIINQHFFTRTVSIVHALDLPYGHMTLVNHNQEIIWEE
VEKRIRRLSFAPSIHVARIIFNPIGIAHLTQHFDIILCPLFQTLGFKQFTFLFKDS
(SEQ ID NO: 1393)

>orf01959
MIHFSQHLTCQSLNFTNTVNFVSKKFYSKGMFISGSWENLYHIPTNAKSSALEINIITFK
LNIDQVIQEFITRNL (SEQ ID NO: 1394)

>orf01960
VAKLVNLVIDRTILLNIGIARRDIGLWLVIIIVGYEILNCIFREKFLKLPIELTSQSFIV
GNNQSWFIDFRNDLTHSIGLPCSSRPHQNLSFFSPLNVIHQLLDSLGLIS
(SEQ ID NO: 1395)

>orf01979
MNITKTNFLAVNFVFTIPTTIDMAFYSDFLTCILDKSIMIIQSHNYRSIIKRFTTFCSSK
DDIRHLAPTETLDTRLSQGPSQTFCNIRLSRSIGSNDCRHTLVKDDLGLISKRLESLNFD
FL (SEQ ID NO: 1396)

>orf01981
MGFIVCNHLKFACFNLRNHDLIDKFLDLGHILVQKKGTKKGFKGITKNGITIAPTRFFFP
LTQLDKLVKLAITRKASQTLLTDNHSTEF (SEQ ID NO: 1397)

>orf01989
MRITDNQHKIAKEDFVAEYPKLSQALLDRTLDNLSREDNIFIFPNDLTHTPDLDKDQKIF
ETVNQKIKTGNVIGFLGYGQERLTISSRFSDESNDHFLHYLLNKVLHINLTSLDVALSRE
ERLYQLLMYLFPKYLQAAIRKGLYKEYHRFSHNDSHVKGVIDVRNHLKKNLPFTGNIAYT
TREFTYDNPLMQLVRHTIECIKNQKSIGQGVLDNLSTSRENVSEIVRVTPSYKLADRAKI
IRMNKIKLIRHAYFREYRKLQELCLVILSREKHGLGPQAQRVHGILFDVAWLWEEYVYTL
LPKGFVHPRNKDKTDGISVFSVGKRKVYPDFYDRERKIVLDAKYKKLELTEKGINREDLF
QLISYSYILKAEKAGLVFPSKDKVIDNEIGNLAGYGLFESLRMPHSIVHFVK
(SEQ ID NO: 1398)

>orf01995
LDEDILLGCILPWKPEAFEKLKAYGNGREELMTDVRGTSCFVIKFGKAGEQLAAKLWEEG
KMVYASSASMTKRLKLAMSKV (SEQ ID NO: 1399)

>orf02000
MAKKIVALVGDGIGPEIMEAGLEVLEALAEKTGFDYEIDRRPFGGADIDAAGPPLPDETL
KASREADAILLAAIGSPQYDGAAVRPEQGLMALRKELNLYANIRPVKIFDSLKYLSPLKP
ERISGVDFVVVRELTGEIYFGDHILEERKARDINDYSYEEVERIIRKAFEIARNRRKIVT

SIDKQNVLATSKLWRKVAEEVAQDFPDVTLEHQLVDSAAMLMITNPAKFDVIVTENLFGD
ILSDESSVLSGTLEVMPSASHSENGPSLYEPIHGSAPDIAGQGIANPTSMILSVAMMLRD
SFGRYEDAERIKHAVETSLAAGILTRDIGGQASTKEMTEAIIARL
(SEQ ID NO: 1400)

>orf02004
LANIESHCNFFQSSIFSSLPNTIDSPFNTSCTILDSSKAICHCHSEVIMTVRRTDDLTIR
LDILNQVFEDGTIFL (SEQ ID NO: 1401)

>orf02011
MTAIWEIATSVEFTKTTKFNDHWTATHFTVKSSWFILNLDFFHFFFSLGNFF
(SEQ ID NO: 1402)

>orf02016
MPRNRFSFTVRVTREKNFISFFSFFFQVIDKRAFSSDINILRFIIIFNIDGHTGFLQITD
MPDTG (SEQ ID NO: 1403)

>orf02020
MKIKAQTRKLATGCSKHCFEVVDKTDEVSSKYCFEVADGS (SEQ ID NO: 1404)

>orf02029
VHAHTDKLCNGCNRIFNSIISHHTIFRERNKLSHKAIKSTRQEMGPCHVVFIEFFITLHR
RLIGNHDNFLTNLVGSGRVRNDGST (SEQ ID NO: 1405)

>orf02030
VNHCHWKLFIQNLGITFSLIVTLIRMTDSHVVGTDKDMILLVNSLFLIFDIDKLRLS
(SEQ ID NO: 1406)

>orf02032
VGNNDILWSKRTISINGFNDFLNTCIAVSTTLCNDDTFLIKRKIFIYKIFCMRNPVSMNT
NYNFFNTWLQDKFFNCMNQNRSIT (SEQ ID NO: 1407)

>orf02042
LVAPVASSTRFFKNNDSLTSWNNGFIIITINTIISYQRISKGQDLSIIRLVCNGFLVAGH
PCIKDDFACYINICSEGLAFKNCAIF (SEQ ID NO: 1408)

>orf02044
VVCYFYITIDWSWVHEDCCFFQTIVTFLSQAMLGMVVFF (SEQ ID NO: 1409)

>orf02045
MAFVLHTEKHHDINLINDFINGYKLSIVCKLLTSPFLRSSEKEFSSQAFQNLHIGFGNA
(SEQ ID NO: 1410)

>orf02046
VIQVTCNSNFKTLKVAKFLINGHQIKQALARVLARTISTIDDGSRNRWTSNQFSIVVDLW
MANHTDIHS (SEQ ID NO: 1411)

>orf02047
MCPCRILKEEIGNNRMVFIGKLGSIFKLNSSLDQFHYLIDSEVFHGHHMVQCLLIF
(SEQ ID NO: 1412)

>orf02059
MQEHYTPKGKHLTIDNRRLIERWKNENKSNREIAGLLGKAPQTIHTEVKRGTTLQQVRKG
LYKKVYSADYAQTVYQFNRKRSVKKLILTKEIREKILHYHKQKFSPEMMVNKKQVKVGIS
TIYYWFHNGHLGLTKADMLYPRKRKGVKKQASPNFKPAGKSIEERPDVINLRLENGHYEI
DTVLLTKIKNYCLLVLTDRRSRHQIIRLIPNKTAESVNQALTLLLGEHHILSITADNGSE
FKRLSEVFPEEHIYYAHAYSSWERGSNENHNRLIRRWLPKGTKKTTPKEVAFIENWINNY
PKKCLDYKSPSEFLLGG (SEQ ID NO: 1413)

>orf02076
VQFHLIIFQNLFCSLDIVIDSLTTDTELLGNFSKAVIISVVELDIIHLLICQKRRIKFKE
RIHTIGFFDFHNFYYTKN (SEQ ID NO: 1414)

>orf02079
MKFNHYFFLFLIIEKQVAIISFFMHFHIIKLVNHFQLLIKLNCISHPNLHIRPSFLSLVL
LFYQKEQDFAIMVI (SEQ ID NO: 1415)

>orf02085
MKKEQFYPLGIFLAAMLGGLVRYLVSTWLPASPDFPWGTLFVNYLGIFCLIYLVKGYLVY
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EEEMVIVYLAIACGLGALVRYFFSRYNQASKLPLGTLIANLLGCFLIGVFYNHVESKEVY
AILATGFCGGLTTFSTLNDELQRLLSDKKVFYSYLTLTYIGGLVAIFLGILL
(SEQ ID NO: 1416)

>orf02097
LNRSILDNITLKHEVTSQKIEEVCKAVQIYDEIMAMPMKFNTIISEMGSNISGGQRQRIA
LARALINNPSIVILDEATSALDTINEERITKYIQSQGCTQIIVAHRLSTIKDADVIFVMK
GGKIVESGNHKYLITLGGEYYSLYTKRK (SEQ ID NO: 1417)

>orf02100
MSLLETAKRHQLNSEKYLSYLLECLPNEETLVNKEVLEAYLPWTKVVQEKCK
(SEQ ID NO: 1418)

>orf02101
LKRPPKQADKSSLGAKGLAYCDQLFSLERDWEALPADERLQKRQEHLQPLMEDFFA
(SEQ ID NO: 1419)

>orf02102
VISIEMRTFFLYSSAFKKHSSPSPINDGLYHLLLQSLYNILELIHDIFQSLKGFILKSTF
TNLFPHLFNGVHLWCVWRNKCKANISRNL (SEQ ID NO: 1420)

>orf02129
METKKIKNLKGQIIVSCQALEGEPLYTPNGGVMPLLAKAAFQAGAKGIRANSVRDISEIK
EEVDLPIIGIIKRDYDGFEPFISATMKEIDELVSEGVDILALDCTNRSRPGYDNITDFIH
DIKVKYPNQLLMADISTFEEGKVAAESGVDFVGTTLSGYTPYSPKKDNPDFELVERLVKE
LDVPVIAEGRISTPEQARKMLDLGAYAVVVGGAITRPKEIAQRFINVIK
(SEQ ID NO: 1421)

>orf02134
MTKDILELESQKMSSDTFIDEIKNNYLSIVESTRKLIDGRQIELAIKLIREANQILMIGV
GSSGNAAREFESSLLRIGIISKTVIDTHFQLMHTALLKDNDLIIAFSLSGSTKEVEETLL
NAKRKNVKIISITNYSSRNIAKLSDCVLLTSKKESYLEGGSLMAKASQLFIIDVICTRLS
LINYEDTICKKEEIASLLSNKVE (SEQ ID NO: 1422)

>orf02135
MQIKFIDKVSNLIMLNLLYVASVVTVIAIGSGESALIATLIKIVRHEESYPYRDFANSFF
KDYWKNLGAALISNLPILILLFSLFFLPYIPLPIYIISILRHIGVIYIILHLIATTFLIP
LIGRYNNTLKNSLHNSIMLAYKHFFIAVLIRIIEIIPVLLFFILQNQLLVWITLMIFILP
SITKYANAFLYNFIFSKYEKLN (SEQ ID NO: 1423)

>orf02136
MVSGGFRLDFLLETARLARSTYYYQLKQLDGVDKDKEIKTEIQGIDNEHKGNYGYRRIHL
ELRNRGFVVNHKKVQRLMRILGLTARIRRKRKYSSYQGEIGKKAENLIQRQFEASRPMEK
CYTDVTEFAIPNSTQKLYLSPVLDGFNSEIIAYHLSTSPNLEQVKSMLEQAFTEKYYENT
ILHSDQGWQYQHDSYHRFLESKEIQASMSRKGNSPDNGMMESFFGILKSEMFYGYEKNFR
SLENLEQAIVDYIDYYNNKRIKVKLKGLSSVQYRTKSFG (SEQ ID NO: 1424)

>orf02137
MKLSYEDKVQIYELRKQGQSFKQLSKRFGVDVSGLKYMVKLIDRYGIEIVKKGKNRHYSS
KLKQEMMDKALLEGCSQRSISLDYALPNQGMLSFWPAQYKKNGYTIVEKTRGRPAKMGRK
RKKTWEEMTELERLQEENERLRTEVAYLKKLKELEERDEALERERQRQLEKWFQEDFD
(SEQ ID NO: 1425)

>orf02152
MVISKTKKYKGVYKDSKGKIYFQIELGVDPITGKRIQKKGRKNQQGLPFNSFKEAYEEIL
RLKHEFVNSTINNSFLTFREFMEEIYLKYYQQKVQFVTYQTALPHHQLFIKQFGSKKLSD

ISTIDCERFRLAIIDKYSSNYAKNMWSRFKACLGYAERLGYIDRVPFKGLDNPRGKHPDT
KFWTFDEFKKIINSFDISEYEGLHNYMTIWLYFMTGLRVSEGIALKWEDIDFERKWIHVH
STIEKDKNGVWYAKQQTKTVAGNRKIDLDDFTITILKKWREVQIKNDDKDYVISRFGAPL
CKSTISRIIKRHAKITGVPEITGKGLRHSHASYLINVLHKDTLYVSYRLGHADKSTTLNT
YSHWYYSGDSTISEEITNSLDNLGLSIYLPNSCQS (SEQ ID NO: 1426)

>orf02153
METVNYKDLVAIGFPEHTSRNIIRQAKKIAVKKFEEARKNDKNAVQLGCSPFDNKRLGIA
PKNIVENLIGISFSDIEGEKNGYIKDKEI (SEQ ID NO: 1427)

>orf02154
MLKRIRDLREDDDLTQEYIAKIVLNCTRSSYSKMEAGSRLISINDLIKLADFYKVSLDYL
VGRVDNKEDHYSKK (SEQ ID NO: 1428)

>orf02155
MVITKHFAIHGKNYRSKLVKYILNPSKTKNLALVSDFGMRNYLDFPSYKELVKMYNDNFL
SNDGLYEFRHDRQEVNQRRIYSHHIIQSFSPDDHLTPEQINRIGYETVKELTGGRFRFIV
ATHVDKGHIHNHIILNSIDQNSDKKFLWNYKSERNLRMVSDRLSKIAGAKIIENRYSHRQ
YEVYRKTNYKYEIKQRVYFLIENSKNFEDFRKKAKALHLIIDFRHKHVTFFMTDSNMKQV
VRDDKLNRKQPYNETYFKQKFVQREIINILEFLLPKMKNMNELIQQAEFFDLKIIPKEKH
VLFEFNGIKLSEQELGKMNQYSVSYFQDYFNNKNETFVLDNNNLIELYNKEKLIKEKELP
TEEVVWKSYQDFKRNRDAVHELEVELNLNQIEAVVDDGIYIKVQFGIRQEGLIFVPNIQI
NMEEEKVKVFLRETSSYYVYHKDSADKNRFMKGKTLIRQFTLQHEPQHMYRRIPLSKIKE
KIEQLDFLISAENSPNDFEDITNDFIAQISYLENMIEQVQNKIDDLTNLEEVLLNNTTNS
SSNLENSIQGKSSVDTIEKDLYIYKGKIETLKEQHGEAINLFEMFNKTIKKYKKKQNMKS
IEENEIHLE (SEQ ID NO: 1429)

>orf02156
MKRDIRSIRKQFRLTETEEKQILDLMREKGEDNFSDFLRKSLLLSDGQKQMEKWFNLWKK
QKLEQISRDVHEILIIAKINHQVTQEHVSILLTCIQELIKEVEKTSPLSENFRNKYMR
(SEQ ID NO: 1430)

>orf02157
MEYVEAVNQFIERHYKEKDIGHIEIDFWGNKNHPHSLYIYKRSKKIEYDYFFFDSIDYYE
EPDFLEFKYIVHLENITYIFWQED (SEQ ID NO: 1431)

>orf02162
MTTLDFKTLFKEEYDKLNKQQKKAVDTVEGPVMVIAGPGTGKTQILSRRVANILTNYHTS
SEEIVCLTYTEAGASEMLDRLEKLIGEEGRKVRVSTIHAFCSELILRNSEIFGGQPKIIS
TAAKYEILKEIMDEYVIEGNPLYKNSGKRYSAKDQLLELFYKMKRENLNKEDFEKEIDEY
FKMIDLSIPGDDLYSKFKYARNSKSKDKKVGDYKDKAINELKENTQKLLAGVEIIEKYSS
DISNHNYFDFDDMILWTIEKLEENEGFQRSVSDTIRYLFVDEFQDTSVVQNKLVDLLVKG
KDNPNIFVVGDDDQSIYRFQGVSANNIRDFDKKYKPTKIVLDENYRSSQAIIDASRQLIS
HNPREEKLLIAAGANKDYDYQLPILKSYENAKAEMFGVLTEIKELIDSGVSPNEIGVIYG
RNSYGEEFAKILRDKGIFVQMKENKDLFSEPFFKKIVAILKYLCKPSRDVRELRKIVYFD
FFEVVLSQIVMIRNLKKDEKISIPTIAEIDQKLEIIRKKVNQSSKYLSPMYVLSDVLKSL
SIDEYIMKSKEKYHLVSVLNELYKLMLMECHIHPKLTVKGFLNQLSALEEMGISLPIEDI
SGSPSNCVQLMTAHGSKGLEFDHVFIMKCNDGKKKSEAWPGGENNSGRFSYPPSLNGKDE
NESQLKEEENRRLFYVAMTRAKKVLHLSYANDSTKTHLINEFEEFIDEVDVTESFEDCQS
VDKVVMPKFSNNVINEIFDELSLSVSTLNSFLKCPLSFYFNKGLKLPSETNEAMVFGSII
HEVLEKIYISVDGSQSSELTAKTVLSLEEALKLFETVFEEKSYQLTSNKIKKDDYARGKK
IIENLYKKSGYLKDGVVAVEVPIQGIRLGDILNTTVDLSEVSNIEINGKIDKIECDGNIV
CLVDYKTGNFENAKKKLVAPSEKEPLGGDYWRQAVFYYILFKNAGIDISDKEILVKYVLV
ENSTNEDGFSETEDIRITQKEVDIVLNQIKESIMKIKQGDFNCGCGVLKKDRDNYPCDYC
LQVSANTTPKFDNTEALEVATYQQTRGNYKSLSVSKLNRYLRCPKSIYFEDVLQLSQAAG
LSAGAKEKSTKITINHAPTGPVFGTAIHETMEKIYKEDLQLEDAIEFYDSSLYSHQEEII
DTMSVEELKEYGHNLLTNLFEHFIPNSLKGEHVSLEKELRVKLGDNYSINGIIDKLEFDN
DLIRVVDYKTGSAQRGVEELEVGHDYWRQAVFYNLLLENSSEIDTTDKRIETQYIFLDDN
STESGYSIHTIQVTKEDLDLVTSQIQNFWSHMNTADFTGSCGKNDCDYCRLAEFVDFELL
KETIESGKESNLVN (SEQ ID NO: 1432)

>orf02163
MSGRLTRQNYYLLGKLIDEFHAVKAAMRVIETKRNDFNI (SEQ ID NO: 1433)

>orf02164
MKPQERLLTIFFRLQAGERLSKAQLSDEYEIDYRTVQRYMSTLKNFLQEQRISNTEIKFD
TSDNTYRLIAKTTFNKKDILVISKILLENRALNKSELYSLLEDLLSLLSSEEQKEIDAII
GSERFNYKSLTNDKDRIDTIWILSEAIRREQMLEIEYKAPLKDIKSHIIFPVSLYYDAHY
FYLVAYHLKHENYTTYRVDRMESLSESHVKKPEISYGRKYRDGEVRNQKVDAFEGRKIDV
TLIYKGNTEIVLDQFPEREILSENHDEIKVKIKTQDTPGLKRWILGQGDAVTLLSPSKLI
EEIQESLENTLRNYKK (SEQ ID NO: 1434)

>orf02165
MSVQKTKNTLNEPLKTLLDEYHDKVGKINNSSELFDIYSPWNNFNIEKMIESFNKALQSN
SNNFSWLDIEEDLPKSTDVDIKYGLPNHIKGNIDEATLFLCLVNPNIDEVKTEKKDVGIH
TYYKKAREMESGDDSLNILNDKGKLRIDPKVYIKEHILDVRETSSILYNELQIVKQTRSY
KDTYYLGHYLPHFIKEFLNKKGSFKNVIHNLTDEWDELEKMSKKIANLEAFPFRSQNPNY
TYKSNKRATNFTNLLIESDSKVNLLSARVIIWRIVKHLESSQHKPAFILRRFNTFWLPTI
SKVLEQDLNFTKEEINQIINALDEEYFFTVRKKDYNGQSGYFGRNFCKNNERISNSSFKH
LVQETLGEYVKK (SEQ ID NO: 1435)

>orf02166
MSGSFSDSPTHDDKFSIENYINGLSNFIIECETPLTVAIQGDWGTGKTSIMYQVEKRLNP
EKQDKKIQTIFFNTWQYSQFDMGNNLAVALITDLISELNVEDSKKKQFFKKAKGALSKGL
EYVNLDFGILNGEKLTEKFQDLIIGFGERTDDIKHLKENLQDIINDAIKENKSDRIVIFI
DDLDRLVPEKAIELLEVLKLFLDCEHCVFVLAIDYNVVVRGAKSKYGKDLDDEKGKAFFE
KIIQVPFTVPVANYDLQNFIESSLKKLDFCFDKNNKERNQLETITQLIRYSIGNNPRSIN
RLFNSVSLLMYINNGDKVDHDEKLMILAMVCFQLRFEEAYNYLLTAYNNSPEDSDDIESY
LIDLLENSFELLDDEVYYNSLVSLLGKFTFKDKKDRDDFTNFYRTLKELLGYNEQGLTME
QFNKLIEKMTFSNAVSIGNTDTITADKKKQNHAPNEDVQFVIRKLFNTLVGDENYFDLKK
PELFGKETREKREAPLSEEFISIPNEFDRIRLTRGKGQGLNIYSSHNKSNFIYISGDTHG
RMLNDGMAIVVNNNLVEKIKDNILASDLRSEELYHEFEMNFRDNLNKLLSKASKILNN
(SEQ ID NO: 1436)

>orf02167
MEFIRAANQFIENYYPREDLDRIESIEIGIRDSENYSRYFLEIQKQSEEFECDFFNFDNI
DYYVVDDSVHFKQIINLENSSYVFWKDY (SEQ ID NO: 1437)

>orf02168
MNKPIAAIFDIDGTIFRDSLLLKHMEKCVSYDVFPNSVNSEIKFHKNAWENRELDYDDYL
YIAATLYTKYIADKDILDIDFVAKKVIEKESKKLYRYTRDRIKWHKEQGHQIIFISGSPD
FLVSKMAEKLGADIWYASNYLQLDSKYTGEVIPMWDSTSKLQVLKKLFIDFEKSYAYGDT
TGDFTMLQSVGFPTAINPNKKLLDKITMEKLDCKIIIERKDVIYKLDEVTHGIY
(SEQ ID NO: 1438)

>orf02169
MTNAKEFALTAHKNQTRKGKITPYSFHLFLVNNILETLTEDPHIIATGWLHDTVEDTDVS
LEDIKQEFNDEIYSYMSLESEDKSIKDWQTRKELQLAKFREAAEDESLRKVLLVTFSDKL
ANLMELYQDYLIIGGLLWDRFNSKDPKKQRWYFNEFYKIFKDNQDLFSKNKDILNNYKEI
LKLLFYNN (SEQ ID NO: 1439)

>orf02170
LKAIVKNPKRLFELLRLYFVPVKGRKVVHVPAYAYKEDENEKIYLHNNELHLSKKMFEFL
VNQGLDLVECLPEE (SEQ ID NO: 1440)

>orf02172
MANSSEAHGRVYIKASNLKTIEDFLLIQEERNKYVYYPTDIIDSQSNISDIVSSRTTQEN
GYYICNMWFTAEGRWCFENNIDDFFDCTLFQDTDDVLIRQMKEYVCSQDIQIKFEYVDAE
ASQNFVKEQEATITYNSKTKDISIDVKTIKDLPYTAENLIVYGYYECDEIVSVQFLLDYY
DDYLRGNEFYLKHKDGIVPILERQQ (SEQ ID NO: 1441)

>orf02173
MAESALINLINFSKENEELTNLVSGHASKREKATISKDGLIQARSIENFIDNYALSDFDF
STIKEKCVFIKINNSFQADDTTEDIYHNVRGVWNISESRKKDLEYALALYRGVCVGVYKI
QGWKKAYEHSSEYPFPTRKEGGKIETSEETIVKYSNIEDLKKDYPELYKRSFSNSEFPQK
SLDKWRNRSFFYGNWDGSDVPQHLAQCLNKRIINIPKFTKSVKEFKSIDNQASVIYNDLK

(SEQ ID NO: 1442)

>orf02174
MDLVEDCNTFLSFVADKTLEKQKLYKANSCKNRFCPVCAWRKARKDALGLSLMMQYIKQQ
EKKEFIFLTLTTPNVMSDELENEIKRYNNSFRKLIKRKKVGSVIKGYVRKLEITYNKKRD
DYNPHFHVLIAVNKSYFTDKRYYISQQEWLDLWRDVTGISEITQVQVQKIRQNNNKELYE
MAKYSGKDSDYLINQKVFDAFYKSLKGKQVLVYSGLFKEAKKKLKNGDLDYLKEIDPTEY
IYQIFYIWKQKEYLASELYDLTEQEKREINHKMIDEIEEEQ (SEQ ID NO: 1443)

>orf02175
MNFNKIDLDNWKRKEIFNHYLNQQTTFSITTEIDISVLYRNIKQEGYKFYPAFIFLVTRV
INSNTAFRTGYNSDGELGYWDKLEPLYTIFDGVSKTFSGIWTPVKNDFKEFYDLYLSDVE
KYNGSGKLFPKTPIPENAFSLSIIPWTSFTGFNLNINNNSNYLLPIITAGKFINKGNSIY
LPLSLQVHHSVCDGYHAGLFMNSIQELSDRPNDWLL (SEQ ID NO: 1444)

>orf02176
MNYQKLNDITGATKNEKDKYYVYGLYEEGKQLPFYIGKGEGTRLISHIDEALTEINQEEN
IQISKKIQIIRKHKGKIIPVII (SEQ ID NO: 1445)

>orf02177
MTTTKNPWNQLSNVDINGEQAILATEDVELIKKYTSTKHYKNLKDDIYRLQLGFCPQQFV
GDIQNADIIVLSKNPGYTPEFKTLYDHDKNYQKTLLNNLQLKGNLYFHAFDLDTNEFGYW
AKKFKVWFDDVDNLQDLKEKLPWFSKHVALAEYFPYYSTKYDDKLNDFISKEGYFPTQKF
LFNLIRERVLDDNDPVIIIITRSYNKWYDAIPQLKEYKNCYETSNPSNPSLKPENLLKVK
RYSAKKEVEKVLEDSLKKLEHK (SEQ ID NO: 1446)

>orf02181
MFTKLFKKNQDNSDVFKKLIHRLSDMSIQDLKKIDRLLDIIFTPDQGSEQLKTEATYREE
TLDDTLKEAKNQLHMEQLEKNLERFRKNSQ (SEQ ID NO: 1447)

>orf02183
MTKDWNFNQPLESKSENQEDPDKIAALFGNHQGGNEVNYEAAFQKRKQAPVTESNSSSKP
KVTEVRTGKETDITTSYQQHLKRLIADNNSDIQSSQKKIEELHTLIDTKNKDNKKLQSIY
DAISELH (SEQ ID NO: 1448)

>orf02185
MTIIERLEEKVTRQESKVARETEKLAAYKEQLETAMFATFKRRQSISHMSFEEALDHAFG
KERQFDDSEFRKDEMSE (SEQ ID NO: 1449)

>orf02187
MEIEECKKISILDVANRLGISFKQVSSSVYEHPEHDSFRIFSTTNTFKWFSRDIQGDVID
FVRLVKGISFKEALAFLSEEPFQKEAVQEKRERPFYYPLKRIEDSNCSLARYYLTECRGI
SEEIIQKMIQQGLMSQASWKTNETVEPVIVFKSFDHRHKLQAASLQGIYKNHSLPRERLK
TILKGSHGHVGISFDIGKPNRLVFCESFIDLMSYYELHQQNLFDVRLVSMEGLKRSVVAY
QTLRLIAEENQKLEFLDTVIPSKLLPLINTIRDTTSYFDNHPDLLTLAVDCDDAGKDFSD
KLSRSGFPVFLDLPDNESGKEKRDWNDILREKKSDLQLMIENAKETLRNQPVRQTSQCLE
L (SEQ ID NO: 1450)

>orf02189
MLNKVKTKALISVGAVAATSFILMVGYTIGQHSTAKQSRKEIELAATKLVEDKQAEDKAS
ILSSDTVKEFLTQYYTKEKLGENNTRIQPYMTESAYSQELSSQNDAMNQVYKDYILDYHF
EKADIFVNQTTNQAIAMVSYNVTYVSDLKNANQSKTNQTETRTVKLSYSKLPGKLLVNQV
QVWKSGLDDLDKVTPKTLEESSSIPSLPNTTTK (SEQ ID NO: 1451)

>orf02190
LKKVKFIQQLSETSCGLACMAMILDYYGHEANLYELCCDFENSRDGLSIREIKDIASYFG
LDSKATEILNIKKFLGNKFVEPYIALTQNAHYIVVEKHNEHSVVFIDPERGRITEDISNF
ANNISGIVIFFSPNRKFTKKKKHSNFFKILKIGKIDIKRLCYISLISILVQSLTLLLPLL
TRFIIDNVISKGEMYRLGMLFSIFSLITFYALFSFIRTKLIITVEKRYIFTLKDKIVGKI
FTLPMKFFDSRSSGEIVTRINNLDSLEKIISSGISSLLIDLSTIIIAFIAMAMISLYFTL
IITCFAIFLFIVLYFLLKKLEEKNSNFISSKELTQGYLMEIFSNLLFLKVSAKGDVSYTK
WKEMFSNELKFDVERENYLNIFQTFISIYRLVPNLLILILGGLEVQQHMMSLGSLMSFLS
LVSLLLSPITLIVQNCFQFQFCFTILDRVFDIIYTPEEKNQFSISKLPPFEMMTFRNLSF

AYSSACKVIYDISLTIKKGERIAIVGRTGCGKTTLIKLLLRLYDVEKNTILYNGNDINLF
DLNSYRKSFGVVLQNDVMFNDTVISNIDLTHSHSMEDVISAASLAELDIEINNMPMGYYT
SIGDNGNNLSGGQRQRLAIARAILQNPEIIIFDEGTGQLDTITEKKIMDNLKHKGITQIF
ITHRLSNAQEYDNIIVMDNGKIIDSGKHDELCGKEGMYKRLFETSYN
(SEQ ID NO: 1452)

>orf02191
MNRKLNITDFKDASYFSERKISSHDLGDGLKSRKRKEYWDNFIGEGSNEFWKYLQEKNDF
SKHDLDIFLEEHTYDVKDIDSFSHMDEFIEFFFKRNDYTLPEFYIVDSEGKRKPIFSNFV
IPFLKFAAYKLEDNLSSQNLKVTRDVLNSLLIALFQQILNISYRTLILELQVLKEQNMLK
GETGEKRFKYFSEIYLSDHFWDILKEYPVMFRLIIENIQNWVTNNVEFLTNLKEDKALLQ
EHFSINGELTKIESGVSDFHNHGKSVYLLWFGTNKLVYKPRDLILDVKFQNLLSWYNLKF
NKNLYVTNILNRGNYGWVEYIEHLPCTYESDFIQFYTHLGYLLFLLFAMRGNDIHFENII
AKGNRPVLVDIETLFHNTTEYRKEYETADKLIFSLLEKSVKRVGILPNIVWGKDGNSGVD
ISGLSSSAGEMIPIERASIMHSMTDEMKIGYEQSALQSKDNQPFIQSGKDVDLNSYKNYV
SAGFKEAYEIISKDPSSIEEFLVEIEKFNNAYSRQIMRPTQFYSNLIQTSYHPSFLRSGL
DREMLFSKVWKIVFEDKKVQRIASSEFESLLLGDIPLFQTKISDRFLCSELTKYQNFFNI
SGMELAIQQIKDFCQKDMEFQLNLIETTLNYDPSYNLVQDSFVPLKPSVKVIRNLNQKEI
QETKSRIVPLTEKIADYLSKISYSGTSGDICWVDMNILGEKTNDWNMVPIGCDLYNGISG
IMLFYLFLYLETKKKDYLIYLKKCYRSLKYYLDSRKQFATHSQVLFGGFSGETPIIYVLL
LLKTRMPEHFNSDELDVYIYDIIDDLKKGYRYDENFDVLVGSAGAIIHLLNVFEVTRDEE
LLILAHDLFSHLEKNSTKITVEGQDGRAWKGTMASNPLAGFAHGVSGIVWALSKLSRYFP
EDKKLKTIIKQGIIFENSMFDTEKSNWSDYRETESGIKYKDIVENIPVSWCHGAPGILIS
RLELYKNNTLNVEFRRTMKSDMDVAIDTTIKYGFGKSHCLCHGDLGNLNILFYVAKKMSS
EHLYNVVYSYLNTILDDLESENWKCGLPYKNSPSLMSGIAGIGLGLLTLNNLSIPSVINL
EIW (SEQ ID NO: 1453)

>orf02192
MLMLEFTKLRRRKILYMIPFVAILLFLLEFMIGHQIYQGHSYGSVNGWYVENGFFFLNYY
FLLPFASMILVDLIRIEQVSKTISNLRLIPVDLKQLLQAKFMLALLINLLVSEFTFLAML
VLELMDGDFAFSSLAMLSWGVVYGAIAFAYTLSAGIIVLFLGKYRKELILALPLAFLLSF
AGLFALTTVVGRYYLANLLLIIMEQFTALTVSVYAIWLVTLVACLLYLLADKRMMNIIFA
YK (SEQ ID NO: 1454)

>orf02194
LLDLVKIEFLKQRHQKLNFVVYGVVSLYLALICYYVNDARGLFDSFPFVYKFSLSYLNFL
ILPLYCVSYTIQAFGLEYRYRIMNNLKLASANLMKTFWAKILYIEINALCIMLFTYISVS
LFALLSRFSSTVSLSLLLRFFYLCMSSGILIPMGVFPLVALVMIKVRGKEIVGNLVGVMY
VLVSFFLARTSPNISPVTSANSLIWEGNREGVVLQQPAILSIVVLGLSLLVLSFLSIKSW
LRKVDE (SEQ ID NO: 1455)

>orf02195
MRNPVIQTFNLSKSYDGKIVLDRIDFTLRQGEIYGLLGRNGTGKTTFIKAILGLTAMDSG
EVNILSEKLLGEFSKDLLSQIGVVLDSASFYPNLTGPENLSIFARLRGISLKQVEQALQV
VGLDGENKKLFKQYSLGMKQRLAIANAIMHQPKILILDEPTNGLDPIGILEMRRYLKELS
TNHGISILISSHIISELEKLVDRVGILHDAHLMAEKTMKELIDGADKRKIHLIVSDAPQA
KEVLCRINLQEQISILSDIELELQGESPTFDIAVVSNSLKDNGIVLKEYSYKNNESLEDY
FKRITGGEGIA (SEQ ID NO: 1456)

>orf02196
MTILSDKLKAKRKEKGFSQKTLSEGICEQSQISKIERGNYMPAADLLYKLANRLQVPLDY
FFDEQIEMTSNITPFKKLAEKLLEDRNYEDLEYLLNLEKEKSQYLSTEDEFYLLWIQSII
LFYLHSSKDEAIASLENALPKLSVSSSVYLKLLNTLSNFYFSVGRDAEYEENNSLLISLY
QEKDLNHQEYLFGYIRVKHNFAYYLHSKGKELEAVQEALETIDFCKQKETSYQLAPLLTI
VANAGKDFLKHDEILDYYLQARDICKIYEHKLMMAKIDHFLKDKDR
(SEQ ID NO: 1457)

>orf02197
MNDLLLIPVIFLAVGGILILLWRLFLIASGLFLIGFVSFLIFVEVYGIYLLFTETELYTA
DLAQNGLFGFTTFFIIFNLVLLALACWAGYKWKRGY (SEQ ID NO: 1458)

>orf02199
MEDTYYQLEEALVQGFQTPEEYQAYKELKEHYEEVTGDYSFSKRELTSQLEIALQNHRGV

DFEEYEKKDYLELVQKLEEFDSSLATHYRQLID (SEQ ID NO: 1459)

>orf02200
MVRRWVLSLQRNGRIIRQGNENKEVDIYHYITKGSFDNYLWATQENKLRYIKQIMTSKEP
IRAAEDIDEQTMTASDFKALATGNPYLKYKMELENDLTLLENQRRAFQRSKDHYRHTISY
CEENMPILEKRLSKYEGDIQQSEISKDQAFSMRVGKQSFDQRAEAGESLHRLIRHNQADS
KEFRTLASYRGFDIKMLSLPTNQPLPETFSVKIVGENQYSVSLDLYSPLGTIQRLQHTID
HIKEDQVKTQNLLDELKDKWNTAKVEIEKNFPKEEDYQTKKAEYDVLAPLIETETDLDTI
DQALRQFHEKGKEKQEQLSFELD (SEQ ID NO: 1460)

>orf02202
MRNPQNVLNNLTKHSKDKNYQFERLYRLLYNKEMYLVAYQTIYANPGHLTPGVDELTIDG
MSIARIDQLIDSLKDESYQPHPSRRTYIPKKNGKLRPLGIPSFDDKLLQQVIKMILEAIY
EGQFEPSSHGFRPNKSCHTALTQIQKTYTGTKWFIEGDIKSFFDNINHDVMIHILRERIT
DERFLRLIRKFLNAGYVEDWKFYKTYSGTPQGGIISPILANIYLDKFDKYMTDYVKNFCQ
GKYRKRTPEYRQNEIALGKARRALECVSTENQRQEVIQRIRQLEKERVLIPHSDPMDSSF
KRLTYTRYADDFICGVIGSKEDAHRIKADIKDYLEAVLKLELSVEKTLITNARDKAKFLG
YHLYIRQSNLAKRDSAGRLVRNYTGRLVLEVSIETIRDRLLSYGAMKMTYHRGYEVWKPT
ARYFMKDCDDLEILERYNAEIRGFYNYYCIANNSSILHRFKYIMEYSMYKTYATKYRTTK
SHIIRKYKKDGQFSVQYIGRKGDTMTRYLYNGGFKRQKKSFLENDNLPNTAKYFSRTNLI
DRLKASRCEYCQATDSSLEIHHVRKLKDLKGKTFWERLMISRQRKTIALCKDCHKKLHHG
KLD (SEQ ID NO: 1461)

>orf02208
MEVMKLLAMFRGTIPKDREKMDLFLRYQAQHFDEKWQDLVESFLAEEGKIEEIPHVYSFH
QDIISFLEASSENNDQDLESYTRNFGQAGLSKLSQLSNFEKNLVLEVATYNLSTRFYIQS
EKEKLEPLSELVCLQNQDVNLVNVYRVANNLSDRISRDIEEFLLMVDSKELTKEVLEIHF
EEKEGDVLAYLGSELMATLDTVTDLVHHEENYTQLPLTQKLKIITHFDDVKARSEKSNQV
EEVLSPSSDIEQETEETNSFSNVDKIVEEALREYPIGSQVSYKGQVFQLVSIENAQLNDL
IRLELFNDSNQLFEENPILYLNSLEEIEQVLSLVELEKEDSEIEIDSSSESQEIDLFSYL
EEEKENEKDKETETLIVGIEETDVPVQDFVFPDDLEDFYPKTNREKIETNIAAIELVKRL
EKEGRQANPEEQELLAKYVGWGGLANEFFDELNPKYETERLTLKSLVSKSEYSTMKQSSL
TAYYTDPMIIRQIWQKLLDDGFEGGRILDPSMGTGNFFAAMPRSIRDKSELYGVELDSVT
GAIAKKLHPNTHIEVRGFEEVPYQNNSFDLVLTNVPFGNFRIADKNYDKPYMIHDYFVKH
SLDLVRDGGQVSIISSIGTMDKRTDNVLQEIKTNTHFLGGVRLPDTAFKSIAGTRVTTDI
LFFQKDQAKNLNEEELVFSGSIPFEEDKRVWINPYFDGKYNTQVLGEYEVRNFNGGTLNV
KGVSETLSTDIMKALENVEAPKQIDNFLKAPVFIQEEVDNSLPSRIREDLALYSFGYERN
QIYYRDTHGIRKSSKVDEISYYVDEKGDFKAWDSSLSEHKIDRFVQLHLTDEEALDVYKS
EEASKRGKYKGLFKKTVFYESPLSDKDISRIKGMVDLRETYQSLIEIQRHQDYSRTDFQV
LLSKLNHNYDRFVSQFGYLNASVNRNLFDSDDKYSLLASLEDEYIDSKDQKVKYKKSLAF
EKALVRPERVIARVSTALDALNSSLSDGRGVDLDYMVSIYPEHSQAAILDELGDQILIDP
ESYLRGERKYLSKNQFLSGDILNKIEVVQLLVEENNQEYDWNHALDLLESVRPPRIHLAD
IEFKIGSRWIPQSVYGKFAFECFTNREFELSSPDVEQVIEANPVDGQVHLRTSFAYRYPS
AKDSSLGVSGSRYDTGRKIFENLLNSNQPTITMTVTEGEKKKTITDLEKTSVLRAKEQHL
QELFQDFVSRYPEVQQVIEESYNRLYNRTVSREYDGSHLVIDGLAQNISLRPHQENAIQR
IVEEKRALLAHEVGSGKTLTMLGAGFKLKELGMVHKPLYVVPSSLSAQFGQEIMKFFPTK
KVFVTTKKDFVKARRKQFVSRIITGDYDAIVIGDSQFEKIPVSKERQMNYIEDKLNELRE
IKTHSENKYTVKEAEQSISGLEKQLEELQRFNRDSFIDFENLGIDFLFVDEAHHFKNIRP
ITGLGNVAGITNTTSKKNVDMEMKVRQIQEEHDFKNIVFATGTPVSNSISELYTMMNYIQ
PDILKRYQVDYFDSWVGAFGEIQNSMELAPTGDKYQPKKRFKKFVNLPELMKIYKETADI
QTQDMLDLPVPEAHIIPIESELTENQKLYLEELVMRSDMVKCGTVDPSQDNMLKITGEAR
KLAIDMRLLDSSYSLADNHKLLQVVDNVERIYREGMENKATQMIFSDIGTPKKKDNGFDV
YSEIKALLVDRGIPSKEIAFVHDANSDEKKNSLSRKVNAGEVRILLASTEKGGTGLNVQS
KMKAVHHLDVPWRPSDIQRASVKAV (SEQ ID NO: 1462)

>orf02209
MEGIYQRDSDQDGLTDAQELALGTNPLSADSDGDGRSDLVEVEEGTNPLEKDLQDIDQTS
ITEPSSVFMEMKQKISDMMESHYKEFIQALISIETGIENEQDLEDLYTYYMRTDSISLLS
SDLETSPQKVEMEIEL (SEQ ID NO: 1463)

>orf02210
VADTRTKSDSNLGRKGQAVADTRINRLTRWLTDSVNHLFCEENMANSRDYRNPNYTEKIK
LQRFFTQLQIAASFFKEHFVGKIMYYETEIESVELHFSPTNFMHLCGVDYRKGAGSFFDD

CLNRHVIIDELKIKKDGTTMQKLQVLGSIEELLGKHVHLTGSGRYLYLEFDYALRTRKQI
LALTLKETSRKIVPQSLLDLKRKTVFPKGQKVISIYSKHLQTSELFYYLKD
(SEQ ID NO: 1464)

>orf02217
MKDKREIIRARKAFRRSLKDEKKFLKKGKKEVKKQKKDSAVLDEKAWKKEIKKKLEEMRE
ASKARVKQANEDYNHILQNSPPSLLNRKELRDRRLPHARKRLKIAKKQYREAKVEAKEER
KESRKERKTNQKFLYGQESKAKSNFFFQGKSLEELKVKKEVKTAKENLKSTKQAYKSKKV
SRKAKTFLYVLGREGGELASENEDLDGYRTLQETIRKGKRYSRLSYNLGKASVKTGQATC
RFTKKRLTNTKERYHHFKDGKGWKLAKDKPSSFKNRFRKLKKQGLTSVRNIYQKLKAAFS
FFTFAAGNPVTWIVGGIVFLLLLIMSFFLGFSSASLIQQDEFELTKAYTHLTWEDAEHTR
TNDKGITYYTKVDDVMGYMNFKFHDYELHKPVHLFSSETYKDYLSTLWHDLNDGEDLKSM
QDLYETPKYKLSKDDQEEMKELKEEGIYASMQELDNPFEGKSNEDSLTMTYRYGYYDLDG
KPTLQEYILLEAKAHQTIVAPMDGVVSLDGDNVILTNGKGENESRLTLYSIHNGRAIEGT
RVLTGDIIGETPDDTGLKVSYQKYKNKKEKLVYVNPQFYFPKVIQLQTTILPAIGQFGGD
EFERAKHIYEFLKSQGASPQAIAAILGNWSVESSINPKRAEGDYLSPPVGATDSSWDNET
WLAIGGPAIYSGAYPNILHRGLGLGQWTDTADGSTRHTALLNYAHSKNKKWYDLDLQLDF
MLHGDSPYYQSWLKDFFGNTGSAANLAQLFLTYWEGNSGDKLLERQTRATEWYYQIEKGF
SQTNGGQAKSDPQSLEGVRGDLYDHSVPGGGDGMAYAYGQCTWGVAARMNQLGLKLKGRN
GEKISIINTMGNGQDWVATASSLGGETGSTPKAGAIVSFVGGTHGTPAIYGHVAFVEKVY
DDGSFLVSETNYGGNPNYTFRKISQADSAISFAYTTK
(SEQ ID NO: 1465)

>orf02219
MTYKKEEVKGKKEEVLPSTANTISYQALYQNGLMQVKEDYFSQSYLLGDVNYQTVGLEDK
GAIIEKYSDLINSLDDQTNFQLTIFNKRLNLEKFRQSVLYEEKEDGYDTYRKELNRMMNQ
NLDSGENNFSAVKLISFGRKDSNPKQAYRSLSQIGEYFKSGFSEIDARFESLAGEERVNL
LADMLRGEHHLPFSYCDLTRSGQTTRHFIAPNLLDFKNKNYLQINDRLLQIVYVRDYGME
LGDQFIRDLMQGDLELIVSLHAQSSTKADAMKKLRTKKTLMESQKIGEQQKLARTGIYLE
KVGHVLESNIDEAEELLKTMTETGDKLFQTVFLIGVFGQDEEELKQALDTIQQVAGSNDL
MIDKLPYMQEAAFNCLLPFGCDFLEGVSRSLLTSNIAVNSPWTSVDLQDRSGKYYGINQI
SSNIITIDRSLLNTPSGLILGTSGAGKGMATKHEIITTKIKESGENTEIIIVDPEAEYSV
IGRAFGGEMIDIAPDSQTYLNVLDLSEENMDEDPVKVKSEFLLSFIGKLLDRKMDGREKS
IIDRVTRLTYQSFKEPSLEEWVFVLSQQPEEEAQNLALDMELYVEGSLDIFSHKTNIQTG
SNFLIYNVKKLGDELKQIALMVVFDQIWNRVVRNQKLGKKTWIYFDEMQLLLLDKYASDF
FFKLWSRVRKYGASPTGITQNVETLLLDPNGRRIIANSEFMILLKQAKNDREELVQLLGL
SKELEKYLVNPEKGAGLIKAGSVVVPFKNKIPKGTQLFDIMSTDPDKMASN
(SEQ ID NO: 1466)

>orf02220
MNTRVFKDISKYQHRAWLGFTTRQIIFVLPAFIVTIIVLGLNLFFWQFGDWFVYGFVFAF
TIPLMLFGVYKPNDLYFEHYLKYRLHFELTVPLRTITGKKGHEHEKKIKYIKETKSFNDL
(SEQ ID NO: 1467)

>orf02221
MNLSLVSPFVYLASEKISAENLFEGFSVDLQSTVDLIKSLSSYNPTVWTYMSSITKSVMQ
PLGVAILSVVLILEFSKMAKKIANSGGAMTFEALAPMLISYIMVAVVITNTTVIVEAIIG
IASHAIEQVASIVAHGGAKYDTISGLKGSGFIGRMIVGFFALLIWLVRIVSAAMVNLLVS
IRFIQLYLMIPFAPLTIPTFLSDEWKSIGIGYLKNIMVYAVQGVLIFLIVSLVPLFESAG
KIAVSNGAGVLQSLAIMFGSLVQAILLIIALVGSQRTARSILGM
(SEQ ID NO: 1468)

>orf02223
MITHFKGFVYGVDASAMFAQAMSLLQKGLIAVGAFLVVVGIVNLATNIKDGGPGVRNAIL
EIVGGVMVGAAGAFVTQISI (SEQ ID NO: 1469)

>orf02224
MMYSGKKFLLFSLLGILLGYLFHRLTLLYDSYTGNSLDKWTHLLMEGQDEVLQSPWNVSF
TGKSSAFFLLGFVMMLLVYLYLETGKKQYREGIEYGSAHFGTLKEKKLFYGKEFSHDTIL
AQDVRLTLLDKKPPQYDRNKNIAVIGGSGSGKTFRFVKPNLIQMNSSNIVVDPKDHLAEK
TGKLFLEHGYQVKVLDLVNMKNSDGFNPFRYIETENDLNRMLTVYFNNTKGSGSRSDPFW
DEASMTLVRALASYLVDFYNPPKTREQLIEESRLSQKEHQNLLKRQKKEVEERKKRGRYP
SFAEISKLIKHLSKGENQEKSVLEILFENYAKKYGTENFTMRNWADFQNYKDKTLDSVIA

VTTAKFALFNIQSVMDLTKRDTLDMKTWGKEKSMVYLVIPDNDSTFRFLSALFFSTVFQT
LTRQADIDFKGQLPLHVRVYLDEFANIGEIPDFAEQTSTVRSRNMSLVPILQNIAQLQGL
YKEKEAWKTILGNCDSLVYLGGNDEDTFKFMSGLLGKQTIDVRNTSRSFGQTGSGSLSHQ
KIARDLMTPDEVGNMKRHECLVRIANMPVFKSKKYNSTKHPNWKYLANQETDERWWDYQI
NPLNQSQENHLEGLRIRDLTFESSLK (SEQ ID NO: 1470)

>orf02225
MSSEQQERMAVQYAERSLLFTVKSLLKILEWSRRQALAQDSAYKIGVQKLEELLQSPYSI
DTINLKKDFLDKPIDIEKFKAFLEKEEIPLAIAWQGDSLHFYTKDRSILDNHLDQLLEKM
VNDPEKLADFTMDKSLDDAIDEAKSQITFRQEGAVKQKEMVR
(SEQ ID NO: 1471)

>orf02226
MKVVNLYDLKQMGNKGGCTIQLIHHFPFGMGLGHLKKDYIEFKRVGIVDGKAVEVTLREP
YSRDLLQVVKSIKQRQKLIAYRYKEGKLLFVKEEASDVL (SEQ ID NO: 1472)

>orf02227
MFSNANSFKAKIKNISKDKGIPAQQVQQHYLIEQVLKLISTSSYRDSFIVKGGYLIGQMI
GLDKRTTMDLDVTLKGTEMSRENLIHIFEEILCSKTDGFSFSVDKLEPIRQDDEYGGFSL
KLNATFDTLKEVVFIDITTGDKITPREITYSMTSIFTNESIKIWTYNLETVLAEKLETII
SRGLASTRPRDRYDLFTLYKLRKEEINLEVLKNALENTAEKRKSKDTIYNWEEQVRGIEI
SDYQKELWIRYQRQFKYAKDISFDNSVQVIREIMQQIF (SEQ ID NO: 1473)

>orf02228
MVDKREKLMNSFNQYGFLTFKQVIDENLHYKTLLKMVAEGKIDAEEKGLYRLPDIYLDEW
FVLQYRFPKGIFSLETALWLHGLSLTIPFNMTMSFPYGTNTKNIKEADICPIILRSHYSE
GIIEIERLPGQFIKVYEVERVLVECLRPVHQVDLQIIAPAFKKYFQQNKIHLHKLFYYAQ
LFKVTDKLQSYTEVLS (SEQ ID NO: 1474)

>orf02229
MRCLFFYPILKGSELMKTKNQESKGRSPLFKTIKHSFSQ (SEQ ID NO: 1475)

>orf02230
MELKFVIPNMEKTFGNLEFAGEDKVVQRRINGRLTVLSRSYNLYSDVQRADDIVVVLPAE
AGEKHFGFEERVKLVNPRITAEGYKIGTRGFTNYLLHADDMIKE (SEQ ID NO: 1476)

>orf02231
MRLANGIVLDKDTTFGELKFSALRREVRIQNEDGSVSDEIKERTYDLKSKGQGRMIQVSI
PASVPLKEFDYNARVELINPIADTVATATYQGADVDWYIKADDIVLTKDSSSFKAQPQAK
KEPTQDK (SEQ ID NO: 1477)

>orf02233
MKQRGKRIRPSGKDLVFHFTIASLLPVFLLVVGLFHVKTIQQINWQDFNLSQADKIDIPY
LIISFSVAILICLLVAFVFKRVRYDTVKQLYHRQKLAKMILENKWYESEQVKTEGFFKDS
AGRTKEKITYFPKMYYRLKNGLIQIRVEITLGKYQDQLLHLEKKLESGLYCELTDKELKD
SYVEYTLLYDTIASRISIDEVEAKDGKLRLMKNVWWEYDKLPHMLIAGGTGGGKTYFILT
LIEALLHTDSKLYILDPKNADLADLGSVMANVYYRKEDLLSCIETFYEEMMKRSEEMKQM
KNYKTGKNYAYLGLPAHFLIFDEYVAFMEMLGTKENTAVMNKLKQIVMLGRQAGFFLILA
CQRPDAKYLGDGIRDQFNFRVALGRMSEMGYGMMFGSDVQKDFFLKRIKGRGYVDVGTSV
ISEFYTPLVPKGYDFLEEIKKLSNSRQSTQATCEAEVAGVD (SEQ ID NO: 1478)

>orf02234
LAYGLSQNRLAVATGITRQYLSDIETGKVKPSEDLQQSLWEALERFNPDAPLEMLFDYVR
IRFPTTDVQQVVENILQLKLSYFLHEDYGFYSYSEHYALGDIFVLCSHELDKGVLVELKG
RGCRQFESYLLAQQRSWYEFFMDVLVAGGVMKRLDLAINDKTGILNIPVLTEKCQQEECI
SVFRSFKSYRSGELVRKEEKECMGNTLYIGSLQSEVYFCIYEKDYEQYKKNDIPIEDAEV
KNRFEIRLKNERAYYAVRDLLVYDNPEHTAFKIINRYIRFVDKDDSKPRSDWKLNEEWAW
FIGNNRERLKLTTKPEPYSFQRTLNWLSHQVAPTLKVAIKLDEINQTQVVKDILDHAKLT
DRHKQILKQQSVKEQDVITTKK (SEQ ID NO: 1479)

>orf02235
MNFGQNLYNWFLSNAQSLVLLAIVVIGLYLGFKREFSKLIGFLIIAIIAVGLVFNAAGVK
DILLELFNRIIGA (SEQ ID NO: 1480)

>orf02236
MNGVFLIFIIQADFLFDFLKVNGKGKPRTDQFALIVFA (SEQ ID NO: 1481)

>orf02237
MYDVARYYIEETGALGEVPASLQNYIDYQAYGRDLDLSGTFISTNHGIFEIVY
(SEQ ID NO: 1482)

>orf02239
MYLIGYAIKFTPNCCNGFLWLVSAKRYFFSCIGQLWSQCISNDRLQKSIRLFTIKSFCRH
KPCESHRNPKVFEKCSLYHGKRGQVAKYHHCKE (SEQ ID NO: 1483)

>orf02242
MAYPIKYIENNLVWNKDGECYAYYELVPYNYSFLSPEQKIQVHDSFRQLIAQNRDGKIHA
LQISTESSIRSAQERSKNEVTGKLKAVAYDKIDQQTDALISMIGENQVNYRFFIGFKLLL
NDQEFSMKSLTVEAKNALSDFVYDVNHKLMGDFVSMSNDEILRFQKMEKLLENKISRRFK
IRRLDKDDFGYLIEHLYGQTGTAYEEYEYHLSKKKLDNETLIKYYDLIKPTRCLVEEKQR
YLKIQQEDETVYVAYFTINSIVGELDFPSSEIFYYQQQQFTFPIDTSMNVEIVANRKALS
TVRNKKKELKDLDNHAWQSDNETSSNVAEALESVNELETNLDQSKESMYKLSYVVRVSAN
DLDELKRRCNEVKDFYDDLSVKLVRPFGDMLGLHEEFLPASKRYMNDYIQYVTSDFLAGL
GFGATQMLGENEGIYVGYSLDTGRNVYLKPALASQGVKGSVTNALASAFVGSLGGGKSFA
NNLIVYYAVLYGAQAVIVDPKAERGRWKETLPEISHEINIVTLTSDEKNKGLLDPYVIMK
NPKDSESLAIDILTFLTGISSRDGERFPILRKAIRAVTNSEVRGLMKVIEELRVENTPLS
TSIADHIESFTDYDFAHLLFSNGYVEQSISLEKQLNIIQVADLVLPDKETSFEEYTTMEL
LSVAMLIVISTFALDFIHTDRSIFKIVDLDEAWSFLQVAQGKTLSMKLVRAGRAMNAGVY
FVTQNTDDLLDEKLKNNLGLKFAFRSTDLNEIKKTLAFFGVDPEDENNQKRLRDLENGQC
LISDLYGRVGVIQFHPVFEELLHAFDTRPPVRKEV (SEQ ID NO: 1484)

>orf02244
VKPSIVNRIKSNWTLKRLGKVAMTVAFTLVIAIFLLAMLGTVVQAAGLVDDTVNVANEYS
RYPLENYQLDFYVDNSWGWLPWNWSDGIGKQVMYGLYAITNFIWTISLYVSNATGYLVQE
AYSLDFISATADSIGKNMQTLAGVSANGFSTEGFYVGFLLLLILVLGVYVAYTGLIKRET
TKAIHAIMNFVLVFILSASFIAYAPDYIKKINDFSSDISNASLSLGTKIVMPHSDSQGKD
SVDLIRDSLFSIQVQQPWLLLQYNSSDIESIGIDRVESLLSTSPDSNNGEDREKIVAEEI
EDRSNTNLTITKTINRLGTVFFLFVFNIGISIFVFLLTGIMIFSQVLFIIYAMFLPVSFI
LSMIPSFDGMSKRAITKLFNTILTRAGITLIITTAFSISTMLYTLSAGYPFFLIAFLQIV
TFAGIYFKLGDLMSMFSLQSNDSQSVGSRVMRKPRMLMHAHMHRLQRKLGRSMTTLGAGS
AIVTGKKGQSGSGSSARTQADHSRPDGKEKSTLGKRIGQTIGTVADTKDRMVDTASGLKE
QVKDLPTNARYAVYQGKSKVKENVRDLTSSISQTKADRASGRKEQQEQRRKTIAKRRSEM
KQVKQKKQPASSVHERPTTRQEQYHDEQTSKQSNIQTSYKESQQAKQERPAVKSDFSSPK
VERQGNTVQEKTVQKPATSTTTADRTSQRPITKERPSTVQRVPLQNTRTTNQNRHH
(SEQ ID NO: 1485)

>orf02246
MKLKTLVIGGSGLFLMVFSLLLFVAILFSDEQDSGISNIHYGGVNVSAEVLAHKPMVEKY
AKEYGVEEYVNILLAIIQVESGGTAEDVMQSSESLGLPPNSLSTEESIKQGVKYFSELLA
SSERLSVDLESVIQSYNYGGGFLGYVANRGNKYTFELAQSFSKEYSGGEKVSYPNPIAIP
INGGWRYNYGNMFYVQLVTQYLVTTEFDDDTVQAIMDEALKYEGWRYVYGGASPTTSFDC
SGLTQWTYGKAGINLPRTAQQQYDVTQHIPLSEAQAGDLVFFHSTYNAGSYITHVGIYLG
NNRMFHAGDPIGYADLTSPYWQQHLVGAGRIKQ (SEQ ID NO: 1486)

>orf02247
MMKFRKNQNKEKQIPKEKKPRVYKVNPHKKVVIALWVLLGLSFSFAIFKHFTAIDTHTIH
ETTIIEKEYVDTHHVENFVENFAKVYYSWEQSDKSIDNRMESLKGYLTDELQALNVDTVR
KDIPVSSSVRGFQIWTVEPTGDNEFNVTYSVDQLITEGENTKTVHSAYIVSVYVDGSGNM
VLVKNPTITNIPKKSSYKPKAIESEGTVDSITTNEINEFLTTFFKLYPTATASELSYYVN
DGILKPIGKEYIFQELVNPIHNRKDNQVTVSLTVEYIDQQTKATQVSQFDLVLEKNGSNW
KIIE (SEQ ID NO: 1487)

>orf02249
MKIINIGVLAHVDAGKTTLTESLLYNSGAITELGSVDKGTTRTDNTLLERQRGITIQTGI
TSFQWENTKVNIIDTPGHMDFLAEVYRSLSVLDGAILLISAKDGVQAQTRILFHALRKMG
IPTIFFINKIDQNGIDLSTVYQDIKEKLSAEIVIKQKVELYPNMCVTNFTESEQWDTVIE

GNDDLLEKYMSGKSLEALELEQEESIRFQNCSLFPLYHGSAKSNIGIDNLIEVITNKFYS
STHRGQSELCGKVFKIEYSEKRQRLAYIRLYSGVLHLRDSVRISEKEKIKITEMYTSING
ELCKIDKAYSGEIVILQNEFLKLNSVLGDTKLLPQRERIENPLPLLQTTVEPSKPQQREM
LLDALLEISDSDPLLRYYVDSATHEIILSFLGKVQMEVTCALLQEKYHVEIEIKEPTVIY
MERPLKKAEYTIHIEVPPNPFWASIGLSVAQLPLGSGVQYESSVSLGYLNQSFQNAVMEG
IRYGCEQGLYGWNVTDCKICFKYGLYYSPVSTPADFRMLAPIVLEQVLKKAGTELLEPYL
SFKIYAPQEYLSRAYNDAPKYCANIVDTQLKNNEVILSGEIPARCIQEYRSDLTFFTNGR
SVCLTELKGYHVTTGEPVCQPRRPNSRIDKVRYMFNKIT (SEQ ID NO: 1488)

>orf02250
MKPSSFQTTIENQFDYICKRAMEDERKNYMLYLSRIAKREVSFSDVGDYLVSQFATTDNY
STDFQIFTLNGLSVGVENDLLSEALRELPDKKREILLLFYFMDMSDSEIADLLKLNRSTV
YRHRTSGLALIKKFMEEFEE (SEQ ID NO: 1489)

>orf02251
LATLDCVQCIYNFFKLFSFNLNTIAIHNQPICIFIFLCQAS (SEQ ID NO: 1490)

>orf02252
MSEKRRDNKGRILKTGESQRKDGRYLYKYIDSFGEPQFVYSWKLVATDRVPAGKRDCISL
REKIAELQKDIHDGIDVVGKKMTLCQLYAKQNAQRPKVRKNTETGRKYLMDILKKDKLGV
RSIDSIKPSDAKEWAIRMSENGYAYQTINNYKRSLKASFYIAIQDDCVRKNPFDFQLKAV
LDDDTVPKTVLTEEQEEKLLAFAKADKTYSKNYDEILILLKTGLRISEFGGLTLPDLDFE
NRLVNIDHQLLRDTEIGYYIETPKTKSGERQVPMVEEAYQAFKRVLANRKNDKRVEIDGY
SDFLFLNRKNYPKVQVITTA (SEQ ID NO: 1491)

>orf02253
MGHANIAMTLNYYAHATFDSAMAEMKRLNKEKQQERLVA (SEQ ID NO: 1492)

>orf02254
MKRIIPVYIFQQVNVLLVSLYLLKLLCISELTILQILYCASLISFLWMYGQRKQVVKVNM
KTRMKWLGIGFVSLLIINLCFSLIHAQGTTNQANLIGLQHQVPWFSFLLLLINASMVEEF
LYREILWNLVRKLDIRVALTSILFVLAHHPGTILAWCLYVSLGMFLGLVRYKSDLWGSMG
LHLVWNLSVYVLFFL (SEQ ID NO: 1493)

>orf02259
MKRITANQYQTSERYYKLPKILFEDEKYMDMKLEVKVAYSILKDRLELSLSRGWIDEEGA
VYLVFSNSKLMKLLGCSKSKLLSIKKILKEYDLIDEVQQSSSEKGRLANKIYLGELSSTP
VASSNRPSVKKKIGQVENETAPVSHSAPSETEVSETKYSETDSLFSEDEEERYTQPILKR
KVEKVTKYDQDYIWGLVQDQFRREGFSETASEIAMTDFERIYQYALDNVRFVRRAEVLAE
FVFNGLYSVWNNRVRKGGG (SEQ ID NO: 1494)

>orf02260
MTKELQSSRYIVISFLVREMGIDIVEAISLMAELEKSGLVRLESSGDLILKELGGAL
(SEQ ID NO: 1495)

>orf02261
MIVILLSFFLQKIKKGEQYSTVLQNIFIKKKNPAKLIFGRVFGRKLN
(SEQ ID NO: 1496)

>orf02276
LQVWYNLQSDFEQEITLIMWNPFANLVFNQPLISFFADLNLKILGYSYTDRVKTWPDIGT
GCRYNNLHLILLAP (SEQ ID NO: 1497)

>orf02314
MVICHNDYLLWLPEFSQPLTSLSQTTFFNLNIIRMMRNIDSDFHRRISFSLLVFFC
(SEQ ID NO: 1498)

>orf02318
LIEGHLVFADKPAQALVLLRKVGSPKKVSFLTLHLYFLILKIDILKITGF
(SEQ ID NO: 1499)

>orf02324
MFLHHLLQIKGGLGIQTSQGFVQNPNIRSRQECPNDKDFLTHSVRKSFNNLIAVFSKIKN

VQ (SEQ ID NO: 1500)

>orf02326
MTNQAHNLSIFNLQIEITQGLFITIQLTNILKFNHGTTPIFICIIHRYTSTLIQKNQYFI
LSS (SEQ ID NO: 1501)

>orf02348
MAVTKSQVFSRQGFDFSILGQDLTRLQDVSNLATIGTRIHKDSTANASWNTTSKLKAS
(SEQ ID NO: 1502)

>orf02349
MTEGNASCFNQVSPSFCFNGIAINRNVIELVTQDDKSTNPTITNDDIACIAKNHPRDIFL
VGKFHNASQLKTISWKDQIISLSTYFCITIAMQGFLKTDINSF (SEQ ID NO: 1503)

>orf02361
MRLRDLRRVDFPDPDGPIKAVISLGWKDRETLFKAFFLL (SEQ ID NO: 1504)

>orf02364
LKNHSNVFTHFINVDFWTVDINSTIENLPSYFSNINGIIHAIETA (SEQ ID NO: 1505)

>orf02365
LHINPLNGFIFTIVNMDILSRKGYFFFRKGKDMLLIPVIC (SEQ ID NO: 1506)

>orf02387
MTIHIQVVKTNMVILADRFFQGLILRSTDKFFIKIRLVRSHNLRFNNMDFSTVAVHENKG
RHHVDELLLRFIINSKATVAKKSIVAQGFRFDGNFFRKTRQTNHLNIIFYDNPDQIIFFQ
NGLITNSQFNRLHP (SEQ ID NO: 1507)

>orf02404
MVKRRIRRGTREPEKVVVPEQSSIPSYPVSVTSNQGTDVAVEPAKAVAPTTGWKQENGMW
YFYNTDGSMATGWVQVNGSWYYLNSNGSMKVNQWFQVGGKWYYVNTSGELAVNTSIDGYR
VNDNGEWVR (SEQ ID NO: 1508)

>orf02420
MRFIVGRFTSFSLGIEFSPTSKLDDLLFKIAFLMILATWIKARKTKEAT
(SEQ ID NO: 1509)

>orf02424
MANDNKSHYLIYRVLGISFEEGENIDLYQNKGRFLYKYAGSFLEEAAVLSFNEKFGTENT
(SEQ ID NO: 1510)

>orf02433
LHYRTTPTLIMVVQRDCLILSFPRQKGPIVGQMAIIL (SEQ ID NO: 1511)

>orf02435
VFALLDNSTFLRKSLHLRKMEMFPVETEEITYKRKKSKGKRQAILAQFDSEEVHHQVEES
ICPDCQDDLKEIGASLQRQELVFIPAQLKRVDHIQHAYKCQTCSKNNPSDKIVKAPIPKA
PL (SEQ ID NO: 1512)

>orf02451
LVCQTIKYWHKFHLHIGRCKLLIGLIPVLNFFIRADIDCLLVLLSLIDRQNGKQFNLCQW
IIASNGLNDSFEIIESLIHRNILSDIICPNQKKNFIYCSTI (SEQ ID NO: 1513)

>orf02459
VGHNSGSFFLFLLLRLLLSPLLRNSISFLTSQGIPWKLSNNKTKPIDKPTASKSIATNPL
LLHLR (SEQ ID NO: 1514)

>orf02480
LDFLNHLWVAHAGNSSSCTNISRNSFQGHHSCRTSSFCDTSLFRILHIHNNTTLEHLCQV
FI (SEQ ID NO: 1515)

>orf02505
MLLLISLTQLIIFLFFERFNLLLKTFLLVDLKSNKSA (SEQ ID NO: 1516)

>orf02517
MGFSMKLIHDLNTHTTHSTAKMLHNVKAIKNDFSIRE (SEQ ID NO: 1517)

>orf02524
MQEHYTPKGKHLTIDNRRLIERWKNENKSNREIAGLLGKAPQTIHTEVKRGTTLQQVRKG
LYKKVYSADYAQTVYQFNRKRSVKKLILTKEIREKILHYHKQKFSPEMMVNKKQVKVGIS
TIYYWFHNGHLGLTKADMLYPRKRKGVKKQASPNFKPAGKSIEERPDVINLRLENGHYEI
DTVLLTKIKNYCLLVLTDRRSRHQIIRLIPNKTAESVNQALTLLLGEHRILSITADNGSE
FKRLSEVFPEEHIYYAHAYSSWERGSNENHNRLIRRWLPKGTKKTTPKEVAFIENWINNY
PKKCLDYKSPSEFLLGG (SEQ ID NO: 1518)

>orf02527
VVPRYVTKHQGWDHNSHTITNSDDDPATLVTFRTFKFNVGNCTIPKNDQNGSSQKFSGIL
(SEQ ID NO: 1519)

>orf02534
MAYSTDFKQRALDYIKEGHSHVEAAKFFGVGVRTLFTWEKKDVNKDT
(SEQ ID NO: 1520)

>orf02585
MAVQANWSFDITHDSSFFFSNQKRGLNFSQMCFKDRRRNGFFDRKIFKFKFNNPIQIF
(SEQ ID NO: 1521)

>orf02595
MEIVLVSFSISFQHFIIAYCLDFSSAGFRNSQNFSNFC (SEQ ID NO: 1522)

>orf02608
MKLKLLRVDTKVIMGSFLLVLSSLLALLLPLILKGLIDGSSIENIGSKVFQSFLIFIGQA
LFSSIGYYLFSQSGEKKIAKIRKKVIEGLIYAEKSFFDKSQSGELTSAIVNDMSVIREFL
ITTFPNIILSLVMVLGSIVVLFSLDWNLSLLLFITLPCMMFIILPLSNISEKYSRRLQEE
IGFLTGQLTEKIQEHELIKTNQAEKSVQDVLDNCIERVQNNSLKSDRVTSFETPFALLFI
FATIVVMLTYGGYRVSAGYISVGTLVSFLIYLFQLLNPISNIANFVTIYSSSKGSSVALE
NLLAVPKEKFEGGKSVSGQGLNFNHVYFGYDENRPVLKDITCSIFKGQKIAFVGPSGSGK
STIVRLLERFYKPLSGDILMEQSSIYDFNLKEWRSKIAWVSQNNAVLSGSIRDNLCLGLN
RLVTDDELMKVLDLVSLGDEIRSMKEGLDTEVGERGRLLSGGRSQRLQIARAYLKDAEIL
IFDEATANLDADSEYAIISSLYSVLKEKTVVIIAHRLSTVKDVDCIFFLEEGKITGSGTH
KELLENHERYARFVQEQMIE (SEQ ID NO: 1523)

>orf02621
LIRYLDQYEDVILREIKAQFPDVAVDKLMEEYIKAGLILRENKRYYLNFPTLESLDSLEL
DQEIFVREASPVYQALLEQSFETELRNQINAAILVEKTDFARIKMTLSNYFYKVKQQYPL
TEKQQELYDILGDVNPEYALKYMTAFLLKFLKKDQLMQKCRDIFVDSLVVLGYIVQNEDG
KYELAIDFDKERLTFYLA (SEQ ID NO: 1524)

>orf02622
MIGLKEVCRFLTDNTSLSTSMINHPIQINGNMAIVTCGSLDGLSHV
(SEQ ID NO: 1525)

>orf02633
MRERVRLSGSLFTSLKTREHIKSTMELFHKYVFFLIQEIKIKMINFLKIGDLPTL
(SEQ ID NO: 1526)

>orf02643
MIDHFEIKVKDLQISEGFYRSFLAPLDYKLAFKTSSLISFLSPNSPHPGGDFWLTQGTQD
PVHFAFLAENKEEVQACYEAGLEAGGRDNGAPGYRSEHPIYYAAFMIDLDGNNIEVVCHK
E (SEQ ID NO: 1527)

>orf02645
VIVFLSRNKDGNAFCHLDLISIANPVWGWDDDFITWIDHSHKEGIERIFGSRSDCHLI
(SEQ ID NO: 1528)

>orf02648

LSNQFYFSLQTKPILKVKQFLLFQSQMIRVSEILQFSNKL (SEQ ID NO: 1529)

>orf02652
MKHSHKKSFDWYSMQQRYSIRKYYFGAVSVLLGTALVLGAAASVQTVQAEENKQETTNSI
SVGRGEAATKPAEVSASNKEKTYAAPTVANPVETTPVKTGEVTKPAEKVEEAKDKKEEVT
HQDAIDKSKLLTALSRAKKLESKLYTEASAANLQTSIQAGQSLLGKADASEAELSAAESS
IQSSIIGLELRSNSNKGTVSETPVAKKANIVEAKEETKPAVTTTERSAVDSAILPISTAA
KVETTSAPASTNEILKPSLSLSDARQNPAIRKEDVDRGYSGFRTAGSGFRAAGSGFRAAG
PENKPILNPNNTIAFSDISQGLHSFRGIGHSRGGREIHYDVTTVRRGNRLNFTIKYSGPG
EFVNNNFILDKGDGFGNPSNATITSSNPRVREQSKSISQGANYVSHSGYSMTSATSTNTE
QTIRFSLPIINPNGDLSVRLKPVTFNVDQGGGGAATSNDPYSNSNYYHRANPLLLDANPY
GGTNNKTVSEDIDFQTVYLPTSKLPEGQTRLVREGEKGQRQITYKVHRFGNETLLGLPIS
NRVTKEAKPRIMQIGVAKELIDTVKPRVDQNKVGDTNNLTFYLDNDGNGVYTEGVDELVQ
KIAIKDGAKGEKGDQGERGLTGAQGTKGEKGDQGERGLTGAQGAKGEKGEQGFQGRDGEQ
GPKGEDGKTPTVKVTDGQDGTHTITINDGKGGITTTVVRDGFDGASPLVSTHRNEADKTT
TVIFYYDLNDNNQFDEGDTKLKEVVIADGKQGPKGDKGDNGKDGFTPEVTVTDNNNGTHT
ITITQPDNRPSLTTIVKNGEDGKTPKVKAERDDAKKQTTLTFYIDKDGDGSYTAGKDELV
QTTVVKDGQDGAAGASGRDGKEVLNGKADPTTEGKDGDTFVNTQTGDVFVKKGNTWEPAG
NIKGPKGDKGADGAKGEKGDRGERGLTGAQGTKGEKGDQGERGLTGAQGTKGEKGDRGER
GLTGAQGQAGRDAVTPTVTVKDNKNDGTHTITINDGRGNVASTVVRDGFDGASPLVATQR
NEADKTTTVIFYYDQNGNNELDASDKKLKEVIIADGAKGEQGLQGRDGQDGAQGQAGRDG
KDVLNGKANPEVNQGKDGDKYVNTETGDVFVKNNGNWDKEGNIKGPKGDKGERGEDGKTP
EVTVTPGKDGHSTDITFTVPGKDPVTFTVKDGKNGKDGRAPKIKVEDITSPSRIRRDTDA
AATPTRNGIRVTVYDDVNDNGVYDEGVDKVLNSKDIYNGIDGRDGSAPTITTKDNGDGTH
TITVQNPDSSESTTVVKDGKDGKTANITTTENPDGSHTITVTNPDGSTKETVVKNGKDGK
TPKVEVTDNNDGTHTVKVTDGDGNVTNAIIKDGKDGKAATATTTENPDGSHTVTITNPDG
TKNEFVVKNGRDGVDGRTPTASVRDNGDGSHTIVITNPEGVTTETTVRDGKSPKVTITDE
QNGTHKISVLNGDGTTTETIIKDGKSPVATVRDNQDGTYTIRVENGNGTVSETTVRDGKS
PTAKVVDNGDGTHTITVVNSDGTTTTTTVRDGREPKLEVIDNNDGSHTIKVTGADGKGTT
TTIFDGKSPKANIVDNGDGTHTLTIVDSDGREYKSIIKDGKDGKDSVSPTVTVKNNNDGT
HVVTITNPDGSKTEMVIKDGKDGKCGCQDKPVTPSNDKPVPPTPNVPTPEVPVKPVPAQP
TPNVPTPEVPVQPTPAVPTPEVPVKPVPAVPEQPVVPTPAQPATPVNANPVAPTTGKENR
GDKLPETGSQSDYISVLLGSGILLSLYVGRRKED (SEQ ID NO: 1530)

>orf02654
MRNLLSTKVQRQLRLMETLIQNRNWMKLHELAEKLGCTERILKSDLNELRIAFPSINIQS
SVNGIMIDLEVNTSVEDIYQYFLANSQSFQLLEYMFFNEGLPIYRTIENLYFSSANLYRL
GRNITKVLSSQFQIELSFTPSEIRGNEIDIRYFFAQYFSERYYFLDWPFPDLPEEDLTEF
ADFFYKITNYPMRFSIYRMYKLMIAISIHRVKNGHFIDLPNHFYKEYYPLLKSIPNFQET
LAYFSKHFGLEMTPDTIAQIFISFLQNDIFLDPQEFFNSLEDNSQARYSYQLLSQILERL
SKQYKITFTNHDELIWHLHNTAFFERQEIFSTPILFEQKALTIKKFEVYFPDFMGSARQE
LAQYRQAIGQHDHPEQLEHLMYTILTHAENLSTQLLENRPPIKVLIISNFDHAISLTFVD
MLSYYCNNRFTFDIWDELKTSPEILNQTDYDIIVSNFYISGITKKFICRNHLSIMNLVNH
LNTLSNEIHLSNTL (SEQ ID NO: 1531)

>orf02655
MIFKIGLFYLGQFVSLDMTVHKPIKKLQGWVVLSSLPFQSLDILTFFRSLLS
(SEQ ID NO: 1532)

>orf02657
MGFYLMVASMLLGLLALKIGFSQFKENKDKFLSILTSLAGLALVLVAVWLGWPK
(SEQ ID NO: 1533)

>orf02677
MLDSDIGCSRKNLLGLFWIRRRRNIHIVDRAMEKGISNRAPNKISLKACFFNFF
(SEQ ID NO: 1534)

>orf02696
MAFNQFNRCITLSIPTAPNIPTSVVHRTYLHDATVPNNVREKT (SEQ ID NO: 1535)

>orf02698
MQQITEIIIAFATSFLTVAVGGIVKAVKDYLLRKGGEKAVIIAEILAKNAVHAVEQVASE
TGYKGEEKLEQARAKVRAELTKYNISMTDKDLDTFVESAVKQMNDAWKGR

(SEQ ID NO: 1536)

>orf02699
MKIEFFNFLRSVIQTEDGLVLYALALIVSMEIIDFVTGTIAAIINPDIEYKSKIGINGLL
RKISGVLLLMILIPASVLLPEKTGFAFLYSICLGYIAFTFQSLIENYRKLKGNVTLFQPI
VKVFQRLLEKDDDTKKGE (SEQ ID NO: 1537)

>orf02700
MLKVTKTRQLVTEFFAQDGDQQKLVKTTVINTDNKAVSTISETLHDPDLYANNRISMRKH
EQELREMRYKIEDAILAELEADSEHKE (SEQ ID NO: 1538)

>orf02702
MTKFINSSGSLHLNIYIEQVSQDIANNSSRVSWKATVDRDGAYRTYTYGNISNLSVWLNG
SSVHSSHPNFDTSGQEFTLASGEVTIPHSGDGTKTFAVWASFDPNNGVHGNITVSANYTL
SSIPRSSSVSDNALSGNRRLGSPHTLTIDRKSSSFTHQVWYRVFGSNWIDLGKNHATGVS
FVPNIDLARYNTKAKSGTMDICVRTYNGTTQVGNDVYSNGWYFEIPESVKPTFSGITLTD
MNTVARQLLSGNNFLQIISDIQVNFNNPSGAYGSTITGYRAEIVNKNQVTTVNGGRLGMM
NFNGSATIRASVVDSRGRQSDTRDITINVIEYFAPAFSFTAFRTRETPNIIQVVRNAKIA
PITLSGSQKNVMTLSFKVARLGSTTFTADHGRASGIWTTQHTLNNSAANMAGNYVATKSF
VVIGTLSDKFTSTEFTATVATESVVMSYDKDGRVGIGKVAEQGGAGSLDVLGDIYARNKP
IQQYQLTDNNGCGKLIKQDFNTMKETGTWWINGSSQNNPFSGTWGMLEVFRPNPGSHERI
QRFTTSTGYMAVRENGYDNNWRPWRYLVQQSKSTNNSDYVALLKSESTPTPWQNAILQNG
WNHHRDYGGVQFSKTFDGVVCFKGTCKGGKIARESIILTLPEHFRPSTTLFKTALNNDYG
SAVIGIYPNGNVVVKSNVDATWLNFDNVFFKI (SEQ ID NO: 1539)

>orf02709
MLLTIHDANLQKVAFIDNEKQGTLNYYDDTWTRSLATGSSTFEFTVFKKAVKSDLPLAKA
YHHLNEHAFVSFKYKGKSFVFNIIIVEENEQTIKCYCENLNLELINELANPYKSNKAMTF
KEYCEAMDLLNYTHLSIGINEISDYKRTLEWEGQETKLARLLSLAKRFDAEIEFDTQLNA
DSTIKKFSVNVYHENDDNHQGVGRVRNDVIVKYGKNIHSITRKVDKTGIFNTIRPTGKMP
TVEEELSGDKGSKSETVKNADGSTTKTTISTASDGTKSKTIVHTKVTKLADKTRITTTTT
TRSDGSIEQTVTTSKKGGASTSETKVLKKPNPKEKTNTTEDVLTIEGLDEWEVKNEKGIV
EFYQRGQALYAPISMQLYPSTFTHSTGELDQWTRKDFHFETDEPNELRRLGYLKLKKYCY
PAITYEVDGFVDADIGDTVKVHDDGFAPLLMIQARVTDQKISFTNPVRNKTIFDNFKALE
NKLSADIQSAFERLFEAAKPYTIKLSTDNGVIFKNQIGQSLVTPTLYKGGKPVVVGVTWR
WALDGEVTTGMTYLVRGSNVTDTVTLTVAAYIGNKEVAVDEISLVNVADGKLGTPGTPGR
DGRTPYVHTAWANNATGTDGFSLDSSINKLYIGIYTDFEPNDSTDPKKYKWAKVKGEKGE
KGDKGEPGQRGLDGLQGARGEQGLPGRNGADGRTQYTHIAYSNSADGTKDFSVSASDRAY
IGMYVDFNRADSNTPSDYNWTLVKGSDGANGVAGKAGTDGRTPYLHIAYATSNNGSQGFS
TTDSTNKTYIGTYTDYTQADSTDYRVYKWTLIKGADGTGISNVTNYYLATTVSTGITRTS
AGWTTTPQPITSDKRYLWNYRVELYTNGTSKTTEPTVIGVHGEKGERGLQGLQGLQGARG
EQGIPGPRGADGRTQYTHMAYADNATGGGFSQTNTDKAFVGVYIDFNPTDSRNPADYRWT
RWKGRDGANGVAGRAGADGRTPYLHIAYATSNNGSQGFSTTDSTNKTYIGTYTDYTQADS
TDPKKYKWAKVKGDKGEKGDKGERGLQGLQGLQGARGEQGIPGPRGADGRTQYTHMAYAD
NATGGGFSQTNTDKAFVGVYIDFNPTDSRNPADYRWTRWKGRDGANGVAGRAGADGRTPY
LHIAYATSNNGSQGFSTTDSTNKTYIGTYTDYTQADSTDPKKYKWAKVKGDKGEKGDKGE
RGLQGLQGLQGARGEQGIPGPRGADGRTQYTHMAYADNATGGGFSQTNTDKAFVGVYIDF
NPTDSRNPADYRWTRWKGRDGANGVAGRAGADGRTPYVHFAYSENADGSGLTMTDNGQRY
FGHYSDYEKPDSSDKTKYKWADRWAKVDGGYVNIYALSKNRSIGKSYHVSEFNMDVLSGN
ITLKAIGSDPYIGAVSSHPGIFIKQQGMKIPVIQGRSICITITNPLFRKNYISFFNSLGK
TVKTYKHYNTNKFLISSADLVGVEFIALRYGAGSSNIQIGTVLETKVKVEYGTVHSDWSP
APEDIESNINSKADQGLTQEQLNALNEKSQILEAEMKAKASMEAFSELEKAYNAFVKSNA
DSRKKSESDLVEAGRRIDLLTTQFGGLAELKTFIDTYMKSTNEGLIIGKNDASSTIKVSS
DRISMFSAGKEVMYISQGVINIDNGIFTASIQIGRFRTEQYHLNKDVNVIRYIGG
(SEQ ID NO: 1540)

>orf02711
MTKIMTFNGVDMSKFFRITDIIRPIGNKRSVSTDNAPLLGVNIQQVKIGEKEHIIKFDIK
TTNAIEMEQLKHDLAGILNVLEPVKITYGDEPDKYYMGLPVDEITPENLTRWFQRSELKI
IIPDGVAHSTTLKNFDIDTNETSAPDRIVFNLTNTGTEPAYPIIRIKHNSENGYIGVVNN
RAAFELGNREEADTEKYRDSETLIDYRGTNILKGFQNGTKGVAVTNDNKERLVGTLSTTS
MWGRNHIELSNRGTVEKNRNNAQSLTWAIPVDSSGEVGSLNDYLLWRQVFMAAVANQYGF
IKVTVSDTDGNFLYGVETYKRYQTLDCEYSFFTTDGKGGYKFIKWWYFTGTGAQVGKLDP

FSAEKGWSELKRNDDRVQVFFDGSHYDFIIPEIKDKKSAKIHITLGALRDWPLVSHMYVD
EFMYRKDFVTKSRDIPNRYPIGSNVVINSEDDSVYIDGISKVSEVVDGSHWPAIPPGKSQ
LELYFSRFVKKKPTVTIEFEERWI (SEQ ID NO: 1541)

>orf02714
MADGKVTIVVDVDGNKVKVLNDELDKAAQKGDRGSDSLKKFAIGGAAFKLASKAVDLLTD
SLGGAIQRFDTLESYPRVMQAMGHSTEDVTRSTKKLAAGIEGLPTTLNEVVGTAQRLTSI
TGDINKSTDLTLALNNAFLASGSSSADASRGLQQFSQMLSAGKVDMQSWKTLQETMPYAL
QKTADSFGFAGQSAQNDFYSALKEGRITFNQFSKKLVELNGGVGGFAELAKSNSKGIQTS
FGNLKNAVVKGVANTIKALDDLTKAATGKTIAENFDALKVIINAAFGVIVNVIKASTPVF
QTLFSILGTGASVISSLTPVIISLVSALVAMRAANEAITATKNLINSWQTFKTTATGAIQ
IINLMTAAQATCGSVTKAQLVANLANNGALTASNLLYGVLTGSISLQTAATIAATAATTA
FKAALTALTGPIGLVVAGVGLAVGALVGLWQWLTAESEETKRLKSEQEELVKSTDQLTDS
VKQSAKERQKNLESVKGNTESYQKLADEIVQLSQKTNKTAADKKNLKKKIDALNASVSGL
NLVYDKNTDSLSHNNDQIKARISAMEAESTWETSQKNLLDIEQKRAEIGEQLKQIAEQRK
KWNEESNVSDSVRKERLQELNDKETELKNTQTELQTEYEKTSQVQQAASEAMAAAAAENGS
NRQVISYEGMSKAQQKAVDDMRSKYNELLETTTNMFDQIQMKSAISVDEMIANLQKNQEA
VNNWATNLNTLAERGVNEGILAKLQAMGPQGGLYVQELVNASDEKLATLNEVFTQGGESA
MNGLTAGMDTGALGITDKIKGIVQSQVSSLQEEIAAADFPEKGKNIPEGVGDGIKAGAEI
ASEASKNMANDIKESFTSEMDINSPSRVFNEYGGFITTGLAEGVDKGTNQPVSSVTNLAN
QIKKPFDSLQSDFTYIGEMAMSGLNAGLWSGSGSVMATANSIAERVKATIKSALDIHSPS
RAMRDEVGRFIPQGIAVGIEADAGVVEKSMLRLKESMMIDTRPEIALGLNKKLGAQVTVK
QSSKQTIAEKIKVTMDKSSELLEKALDVAETAVRRPNEMYLNDGTLVARTGDKFAKYQSE
QLRRDNRMKGVLS (SEQ ID NO: 1542)

>orf02715
MSMKLNDALITNFSIADKEYDIDLSFNKVLDVFEILKEDEMTRLEQAQLIVHLLTGQELY
DIKEVVDCWIYIKEHFLGIEKETVQYDLLGNPMPKAKGEEEQEKLIDFEQDAEYIYASFL
QAYGINLLKVQNELTWTEFKALLNALPDNTIMQQIIEIRAWKPEYGGDKNKMRKLQAKYS
LGKEGEDNG (SEQ ID NO: 1543)

>orf02717
MTDIQIELKRTGFPVKIGEVELWFDTSQESLMCFYDMEEELKRRLVQYELDVVSANINNK
IERDGVTKEVVAGAIELEKKQLEIQYDLIFGDGTFDKLYSIYPDYNALNNALEQTAIMLH
DKLEEVAEQHKTVVKERASHYLNKGKVTPIKNNKKQKKNKKK (SEQ ID NO: 1544)

>orf02718
MTRQKNALRGHFVAPYNGGTEPSTEDTWLELAKWISDVSDDTDEKTDDQAYYDGDGVEET
TVVSVKGAYTFEGTYDPDDKAQALIAGMKYKTGDDRKLWHKVVSSDRKKQWVGAATATEI
KAGSGAASDYEAFGCKLSYNSTPKETGIG (SEQ ID NO: 1545)

>orf02719
MRENDFQNVLLKHIKTLNLPVEPRFDYFEDDKDDLVINQIPGGKVDREYMDGTQEVSLPF
EIAVKAKKNSVANDTIWLVTSELAKIDLVLPSDNNSYEYMGMEVSRPAMKGKDEQGYYYY
TIEIVAKIVIERNKQ (SEQ ID NO: 1546)

>orf02720
MNIAIKVDLQKAKQKLSNESMTRGKIAVASKILLDNEQYIPLRGGELRASGRIVGQGDAV
VYGTVYARAQFYGSNGIVTFRRYTTPGTGKRWDQVATSKHAEEWARAFVKGMGL
(SEQ ID NO: 1547)

>orf02721
MTYLTQEEFDELDFDEVTDFEKLAKRAKIAIDLYTNGIYQKDIDFEKEIAYRKSAVKLAM
AFQIAYLDASGIMSADDKQLANSVSIGRTSISYSTSQSTLAGQRFNLSMDAENALRQAGF
SLVVGVAYDR (SEQ ID NO: 1548)

>orf02722
MALYKATKNLFFEQLNMDVIVDDIIELDEDYAKEVNKKLKNAFPDVKNVLELVDKNGTLE
PEDAPSVDDASQATVED (SEQ ID NO: 1549)

>orf02723
MPSNQNNAVRRYEKQYAGILETVFGVRAAFSNALAPIQILDGVQENSKAFSVKTNNTPVV
IGEYKTGENDGGFGDNSGAQSRFGGVTEVKYENTDVNYDYTLTIHEGLDRYTVNNDLNAA

VADRLKLQSEAQTRTVNKRIGKYLSDNATKTEALADFTDDKVKALFNKLSAFYTNNEVTA
PITVYLRSEFYNAIVDMASVTSAKGATISLDENGLPKYKGFTLEETPAQYFETGVIAIFS
PNGIIIPFVGISTARVIEAENFDGVKLQAAAKGGTYTLDDNKKAIYKVTGTIV
(SEQ ID NO: 1550)

>orf02724
MAFTTEELLNLGLTEEQAKSVFALRGKELNEDKSALETIKQERDSLKSQLQKAEEQVEHL
KSLENISAEQKDAIDKLQAEYDKYKNEAAAELAQTKKVSAISLALKDTNAFNPDKLMKFI
DVDAIQLDDNGKPQIDEVINGLKESDPYLFKAEESKPSPNILPQGNPAGEGTSDVDPFQA
IIDGYGK (SEQ ID NO: 1551)

>orf02727
MKKKRKQITFNDQQFPLQMQGVGDIYEKLQIDIFDRMIKRLKERGSIDLMRNPYIWQLEK
LNDMHMLNEQNLKLISERTGIAERLLRDVIENEGLKVYKDTKQQLEEDLNKIPEGEISNG
VTDSLEAYSRQAVSDLNLINTTLPKSLQVAYKSIVEETVAQVVAGTKTSDVALHDTIMKW
QKNAFTGFVDKGGRHWKADSYARAIIKSTTYKVYNEMRTRPAEELGVDTFYYSMKAMARP
ACSPLQGQIVTKGTGREIDGITIYSLLDYGYGTAAGCLGIHCGHYLTPFIVGVHELPNLP
DYLKNLTPEQAEENARIEAGQRGLERLIKTHKERLHYAHTLQDDKMIQAERLKVRGYQTK
IRNLINQHDFLTRDYRREKLYIS (SEQ ID NO: 1552)

>orf02728
MSLFQKVKDFFSRGRYYMQTSNLNSILEHPKIAVTQEEYDRIKRNLVYYQSKWDDVQYKN
TDGDIKSRPMNHLPIARTASKKIASLVYNEQATITTKNEILQKFLDDMLTNDRFNKNFER
YLESCLALGGLAMRPYIDGDKVRVAFIQAPVFFPLESNTQDVSSAAILTKTIKSEGRKNV
YYTLVEFHEWVTADGQETGSTNDKKYYRITNELYRSDVNDVLGQRVNLSELDKYKNLEPV
TVFENLSRPLFTYLKTPGMNNKDINSPLGLSIFDNAKTTIDFINRSYDEFMWEVRMGQRR
VIVPEHLTQRQYQRPDGTIDFRPRFDVEQNVYMQIGGSSMDAGGITDLTSPIRANDYILA
ISEGLKLFEMQIGVSSGMFTFDGQGMKTATEIVSENSDTYQMRSSIVALVEQSIKELCVS
MCELGKAVGVYSGEIPELDDISVNLDDGVFTDRHAELDYWAKMVAAGFSTKKRAIGKTLN
ISGVEAEKELNAINSELLPMNDAELAIYGMHDQNEEKADDKG
(SEQ ID NO: 1553)

>orf02730
MTFNVQKNINPHFKSVWISSLPYNVLKGGRNSFKSSVIVLKLAYMMIRYIIAGEAANIVV
IRKVANTIRDSVFNKVWWALNLFGIAEQFTKTVSPFKIVHKTTGSTFYFYGQDDFQKLKS
NDIGNIIAVWYEEAAEFNDQEDFDQSNVTFMRQKHPRAKFVQFFWSYNPPRNPYSWINEW
FESIKTNKNYLAHSSTYLDDELGFVTEQMLEDIERIKENDYDYYRYLYLGEAVGLGNNVY
NMSMFHAIDALPSDDKLIGISFALDGGHQQSATACCAFGITAKGKVILLDTWYYSPAGQV
VKKAPSQLSKEIYAYMRSVIEKYRVQALQYTIDSAEGALRNQMFLDFGLKWHPVAKLRKV
TMIDSFQSLLAQGRFYYLNTENNKIFIEEHKMYRWDEKTIKSDNPSVIKEDDHTCDTTQY
FVLDNAKLLGLRVGNV (SEQ ID NO: 1554)

>orf02731
LPRDGTKNLKPVTERTKDEARAISSKGGKASGIARRKKADLKKAFETLLSLDVTDSKIKK
QLEEMGMAGNNEALLAFATFQQAVKGNQKATENIIKLTNTKDKYDIQEQKERIKALKYEN
RERAEAEKGSSETIEIVDAWAEDVRGATDDL (SEQ ID NO: 1555)

>orf02732
VAQKLTKLKDIFKHVSSIDLGKEILFEDLELYNKETETSKQYQSIEEAENDLYLMEKVNK
INFTLGGGRGANFEKGKDGKYPGFRGAGGARDSGSSKALHPASLNNQGRFSSVEGAIQGF
IKKHGGSRTEYSTAVDSQGFAHNYVHGGKNSVQILPISGGFTAIHNHPNGSNFSSTDLHS
FAALKGMNTLVATNSSKAYRITKGANFDAKGFDKAVSKSRFTTKDYNKGADLWLKKNAKK
YGYTYSYE (SEQ ID NO: 1556)

>orf02735
MLQIEYVDIKSIKPYHKNARHNDGEATEKVAASIKAFGFQQPILVDDNNIIITGHTRLKA
ALSLGIDTIPIAHAVNLTDEQIKAYRLADNRVAEYSTWDSELLNIELSQFETIDMAQFGF
ELSVTGFNFGNEEEQQEETENEEEDAEDFHRDTTINQYNLFNYDDTRVEGFYNMPKIEGV
DHIPKDFQGFNYVLNKPDYSSCVHFFLDDYQFERIWQRPDFYIEKLLEFDSALAPDFSLY
LDMPIAMQVWNIYRSRLIGQIMQDYGLTVIPTVSWASEESFDFCFDGLPKNSTLAISTIG
VKQNKEQFEVWKNGVTEMIKRLTPKRIVVYGGKVEYDYKDIEVVYFENATTERMKESGTK
TN (SEQ ID NO: 1557)

>orf02736
MNVIGACQKILFYSPTQAYVLLNAWFNDYFRATYTELLENAILDK
(SEQ ID NO: 1558)

>orf02738
MNPEIIDNINKPSHYQGANGLEAIDVVHNFVGSLSGASAFFWGNAIKYMLRFQKKNGLED
LKKARKNLDWLIEEMDKEGR (SEQ ID NO: 1559)

>orf02739
MFFQDSEIEEFELNDTLRNDYITAYPDEIELMQSTGLKDKNGKEIFEGDIVRTTRFLGRA
DEIGGFYEYEKDYVGVVKVLEGSWVIDTGSVAVRLWSEIDESEVLGNIYENLEFLEVNE
(SEQ ID NO: 1560)

>orf02740
MEDEQNILETQLILGKQVLEIVLDLLKDDSKIGVVLPLNINDREFTITVEKEVTDRD
(SEQ ID NO: 1561)

>orf02741
MTQTLEEGMKNQSKCIKIPMEIRPFDVGYRIVNKHGQALALKNGASIFALPSLAEKAIKK
EFGKNDPDFDIEKHFVEEVAIVNLSKFHSYFEEVE (SEQ ID NO: 1562)

>orf02742
MNIKALIKKYEELWNEHSPFYEPVPYTSMVELFLKELKQLDEPEKVKVPRFVAEWIEEAR
KACKDVVELFEFDFTNDEVRKWFMQERPFDLVARAWLDGYEVEEEKRYLVTLKNRQPLVK
SQSGSTLYFSQDITARNYKGTQKELEDANFGWVFDCEGIEIEEVE
(SEQ ID NO: 1563)

>orf02743
MMEELKQKVNEVYNWTVEDGKPQPPKQDLPQAVKERVDYFWEMAEDGMTFMGAMECIFAD
EKPTDYDLGATKDWLPKSKEFDDWIGYAPSMAQVVIAVYLIYRGN
(SEQ ID NO: 1564)

>orf02744
VIEVNIKFDNFEAHGFYQDDTKLGKIRDAIISQMNNGHVVVLGEDRGILLNPKVIKSVQF
KVVEDNQI (SEQ ID NO: 1565)

>orf02745
LYPTVKAIIDGMTDAGIWTDDNHKVIKKLSFVYGGLSEEKGHYRLEFDIEEV
(SEQ ID NO: 1566)

>orf02746
MTTENLKSALEYAVELNEHGLEILTAADGTEYYDANKFNLKELDPKRYPKTLELSTLTSL
VDYLKTDLNNLKNQRLIVAVEKNDEVCVWSENDEIEHRTLLVDVKARIPELSFGRFLSLE
QFNIMLQSNFIDDNDRGTLLEFASALKIENGAEIEDNGVSQVATVKTGVASLAKGKAPNP
VTLRPYRTFSEVEQPASLFVFRIDKQANMALFEADGKRWVADAVGNIASYLKEQLADQKH
ITVLA (SEQ ID NO: 1567)

>orf02747
MDKKLIGLDLTHIADGGLQEKLDKELEKVFDNILDLNTDAKAKRKVTITLTMSANEERTV
VDTTMEVKSKFAPQNGVATTILIGRDFDTGQVHANELKSTVPGQMYFDENGEILTDIGQP
VAEIEQQAETKSDIIDFNKKKVGN (SEQ ID NO: 1568)

>orf02749
MESAGHECIGFCEIDKFARASYKAIHDTKGEIELHDITTVSDDTIRGIGHVDVICGGFPC
QAFSIAGNRRGFEDTRGTLFFEIARFASILKPRYLFLENVKGLLNHDRGNTFEVILSALD
ELGYDVEWQVLNSKNFGVPQNRERVFIIGHLRGGSGRKVFPLSGDGAAITCEQPKINKVG
NTRKKGKSQSGDVVSIDSLAPTLCSTTTQKDPLKVLIENEIKQFGVLQPNYNQSGVVYEI
DGISPTIRAYQGGNLEPKIRVKEATKQGYQEAEIGDSVNLSHPNSKTRRGRVGKQIANTL
LTGESQGVVEPDFRIRKLTPRECWRLQGFPDWAFDKAQEVNSNSQLYKQAGNSVTVNVIS
AIAQGLGGN (SEQ ID NO: 1569)

>orf02751
MINNVVLVGRLTRDAELRYTQSNIAVATFTLAVNRPFKNEAGEREADFINCVIWRQLAEN

LANWAKKGSLIGVTGVIQTRSYDNQQGQRVYVTEVVASNFQLLESRNSQQNNQGHQDHHG
GYQQQGYSNQGSSFQNGNSYGQQGSFVEGNTTNLVPDFTRDNNPFGRPTNPLDISDDDLP
F (SEQ ID NO: 1570)

>orf02752
MRCFYVSGKIADLDLGSEINAENSFMAAIEFVKRYTDLLKFGSNEIKVSEVEEVQNDK
(SEQ ID NO: 1571)

>orf02754
MVKDVTNSLTEIKVDFQPAVINVDREAIEAQVAAAIAQYSGREVTVDNYKEVYEERTRFN
KLIGGLDTQRKDFNRQINEPAKDFDKWVKEKVIKPIEAVTDAMSAGLNAIDEHERLMRVD
VVRATFEDKCMVAGIEKSTFADKYDEYSLKKYFKTGKYELKKTTLDEMDGLVLSEFDALE
EYKANKQAIQEQAQEYDLPADSYIRHLEDGKSLVDILKMMKTDRDAEIARKEQKEIQEKA
KAERLEEIAQSAKKNANANIKAYDAETGEILEQGTITPEPQNNAREVAKFEPSEPLVKLV
RLELHGGLEQWENTQEYFEDNFIGFETLED (SEQ ID NO: 1572)

>orf02756
MADLTFAELQRKMQIEKQTKQGVKYPFRTAEDINNKFKSLDSGWSVSFPEDDIIQKGDKL
YYKAVAVVKRESDGTIEKAIGWAREEDVPIFHTQKGDVKQMQDPQWTGAVGSYARKYALQ
GLFAIGGEDVDEYPVEESQEQGQNNQQQKPNNQQAQGQNQVRYIDNTQYQEINDLINDIA
KIKGMPFDTLANYVLSEKLKGLQDFHRVQVGDYEVLKNYLTEQLAKAKAKAKRGN
(SEQ ID NO: 1573)

>orf02757
MPNWAEGTLKLRGRRENVASALKEMLLGNKGATLEEEYDGTLLIFKNEYDYFYINGTRRA
FISSKDIEIWLDDDFVIIELEDFEQAWAALADNYTEISSKFDVDIKIFTFEMGMEFTQEI
EISKGEIIKNIVNENFTNYSWDVPFSRLGG (SEQ ID NO: 1574)

>orf02758
MKKIATAMNVSVSDLFTQDTPIKKNRHSTPVNPKIYKEFIDNVNQYQRLTGATYEKISNI
IGKSNSYIYDVIDKQRKSTLSIKSNASLTKGSMILRQEIEKIESGKNRIPSKLTYQTIDR
DSEVVFRFNGLIKSVNELSDKELQIIVSIFDALKIPAKISKIEIRETNVFGGGK
(SEQ ID NO: 1575)

>orf02760
MKKLPSQQKYLRNDGQLVTIKGFDAYLQYRGSQSWKKEMAKTVKMTR
(SEQ ID NO: 1576)

>orf02761
MPDITNGREKVNDFLKDKGIKKTSLAIAYGFKRQEVTNILSGTTKGPRANSFILQVIEDY
GIE (SEQ ID NO: 1577)

>orf02762
MFETFEKIKSLAKKQGISLNTLEDRVGLGKNYIYSLKNKKTPSAEHISKIADYFNVSTDY
LLGRTDNPTIANKKEQFFFEGKEVDVEELASTAMRFNGKPLTEEDKKAIQNIIEIYLRKQ
(SEQ ID NO: 1578)

>orf02763
MTEKEFSQNLGIDIEIFEDGLFPDEAFYIPALKTMFLSDAISDEKRVQVALHEIGHRNHA
PDTYQLFREKCELEANRNMIHHLMKAELDIAEDATTFNYLVFMEKYNLKTIADEIMVKEE
YLALLN (SEQ ID NO: 1579)

>orf02764
MNIIAIIIIVIFVGGVIGAVIDNQKKSPEQRERELETFRANQEKKKQEKKQNIITCPNCK
SKDVTFLQQDKKAFSVGKAVGGAVLTGGVGALAGFAGKKGNKQWHCQNCGNFFETK
(SEQ ID NO: 1580)

>orf02765
MWMEELSNGKYKFFERYKDPYTEKLKKVSVTMEKKTPQARNQAAILLQEKINKKLSTKQV
ESITFEEIYNLFYKSWAQTVKESTKHNCKSVDKKMKEVIPSDTILANLDRRFLQEAIEKI
IESNGYITAKKVRHRLRGIFNYAVQYSYIENNEVDYTTIPQKPKTLEELEKKRNNFLTMQ
EIKALVDVLNRREYHQKYADMVLVLTLTGMRYGELTALQLKNIDFENNKIEITGNFDSVN
KIKTLPKTTNSIRTIKVSESVIEAIQRQIVRLSERFQPLSSDDYIFCFEKWNQPTTIACF

IQILKKYGKQAKIEKNLSSHIFRHSHISFLAESGLPIKSIMDRVGHSNAKMTLEIYSHTT
EDMEDKLVNKLDTIF (SEQ ID NO: 1581)

>orf02777
LHPFTRNITCDRYILALFSNLVNFIHVDNPTFCTLNVKVSSLQEFEEDIFHILTYITSLR
QSCRIRNRKRYIQALSQGLSKESFP (SEQ ID NO: 1582)

>orf02778
MIINRHCQGTLGTILTDYIVVQDMEEFDWFWYLRQVCQDFLNQFFSNNFLS
(SEQ ID NO: 1583)

>orf02786
LKTKIGLASICLLGLATSHVAANETEVAKTSQDTTTASSSSEQNQSSNKTQTSAEVQTNA
AAHWDGDYYVKDDGSKAQSEWIFDNYYKAWFYINSDGRYSQNEWHGNYYLKSGGYMAQNE
WIYDSNYKSWFYLKSDGAYAHQEWQLIGNKWYYFKKWGYMAKSQWQGSYFLNGQGAMMQN
EWLYDPAYSAYFYLKSDGTYANQEWQKVGGKWYYFKKWGYMARNEWQGNYYLTGSGAMAT
DEVIMDGARYIFAASGELKEKKDLNVGWVHRDGKRYFFNNREEQVGTEHAKKIIDISEHN
GRINDWKKVIDENEVDGVIVRLGYSGKEDKELAHNIKELNRLGIPYGVYLYTYAENETDA
ENDAKQTIELIKKYNMNLSYPIYYDVENWEYVNKSKRAPSDTDTWVKIINKYMDTMKQAG
YQNVYVYSYRSLLQTRLKHPDILKHVNWVAAYTNALEWENPYYSGEKGWQYTSSEYMKGI
QGRVDVSVWY (SEQ ID NO: 1584)

>orf02791
MHKNFVVVVTDFFTAVQFIQFNKEGTTCHNTTKFFNHLDSCLNSSTCRQKVIYNKNTLTW
LNGIRVHSQGIDTVLFFIVSRNNFAWQFTWLTNRRKTNSQLKGNWTTHDKSTSFRSHDHV
DFLVSSILNDFTNSVAISISISHQRTNITEGNAFLWIIFNCCNVIF
(SEQ ID NO: 1585)

>orf02795
MEIKEQTRKLAVSYSKYSFEVADKTDEVSNHTYGKATLTWFEEIFEEYKEHHNIDV
(SEQ ID NO: 1586)

>orf02801
LHKTLENIGEFEEDNLYYSSMTKAETRISFPIFSLILHYI (SEQ ID NO: 1587)

>orf02803
MLNRQVCFCFVNHISPLNVVIWENLSLEELLYAICICFITHKIAKQTSLTIDNAGIAMNN
IR (SEQ ID NO: 1588)

>orf02808
LNSRFFYTDFFKGRQAKGCSFSCTSLSLTDNILAFKGQRNSLFLDRTSFYKTSFFNFC
(SEQ ID NO: 1589)

>orf02821
MRFLADQDRIQHHRYSWALFDKVQGLLSHTDSREKTNLNSPKFHIT (SEQ ID NO: 1590)

>orf02822
MLKNGIISWKDFKSFFCQGCQTSHCYKPMQAVQGIGSQIS (SEQ ID NO: 1591)

>orf02825
VTAHRIFGTSSIHNKLIGLAMFGITAMKIICHKLNRNHINIFRRLGIQGKTEFLLIHLIR
QVKMNDLSQGMNPTICPTSTVNSNGLPFI (SEQ ID NO: 1592)

>orf02829
MLARSKNCFMKSLSIFLLIFYFFDSYQISKKRRSLIGL (SEQ ID NO: 1593)

>orf02840
LEVCIHHHHQISCRILQACIKGCFFAKISRERNIMDCRILLPIGL
(SEQ ID NO: 1594)

>orf02847
VDRTDEVSSKHCFEVVDRTDEVSNHTHGKATLTWFELDFRRV (SEQ ID NO: 1595)

>orf02893
MIAEFIDGLQKFHFLQNALITAIVVGIVAGAVGCFIILRGMSLMGDAISHAVLPGVALSF
ILGLDFFIGAIVFGLLAAIIITYIKGNSIIKSDTAIGITFSSFLALGIILIGVAKSSTDL
FHILFGNILAVQDTDMFITMGVGAAILLLIWIFFKQLLITSFDELLAKAMGMPVNFYHYL
LMVLLTLVSVTAMQSVGTILIVAMLITPAATAYLYANSLKSMIFLSSTFGATASVLGLFI
GYSFNVAAGSSIVLTAASFFLISFFIAPKQRYLKLKNKHLLK (SEQ ID NO: 1596)

>orf02913
MYEEPEVAPVHPTGPTPATETVDSAPGFEAPQESVTIL (SEQ ID NO: 1597)

>orf02945
MGNNGQFTFGYRHDFFQNQLAIFNALVDTFTRRTIDIKTLNTFINEVLNQGTRTLWTYFS
LLIITCVEGWNDTFVFFQI (SEQ ID NO: 1598)

>orf02948
LTKIFGWILRIAVLAADVYGNFANNIAVAWDAHDKIPNNGRINF
(SEQ ID NO: 1599)

>orf02974
LSTRNKYCKNLIIFESTFNILDIVKKDLKLNSKLEKDLKY (SEQ ID NO: 1600)

>orf02976
MSYFRNRDIDIERISMNRSVQERKCRYSIRKLSVGAVSMIVGAVVFGTSPVLAQEGASEQ
PLANETQLSGESSTLTDTEKSQPSSETELSGNKQEQERKDKQEEKIPRDYYARDLENVET
VIEKEDVETNASNGQRVDLSSELDKLKKLENATVHMEFKPDAKAPAFYNLFSVSSATKKD
EYFTMAVYNNTATLEGRGSDGKQFYGNYNDAPLKVKPGQWNSVTFTVEKPTPELPKGRVR
LYVNGVLSRTSLKSGNFIKDMPDVTHVQIGATKRANNTVWGSNLQIRNLTVYNRALTPEE
VQKRSQLFKRSDLEKKLPEGAVLTEKTDIFESGRNGKPNKDGIKSYRIPALLKTDKGTLI
AGADERRLHSSDWGDIGMVIRRSEDNGKTWGDRVTITNLRDNPKAFDPSIGSPVNIDMVL
VQDPETKRIFSIYDMFPEGKGIFGMSSQKEEAYKKIDGKTYQILYREGEKGAYTIRENGT
VYTPDGKATDYRVVVDPVKPAYSDKGDLYKGNQLLGNIYFTTNKTSPFRIAKDSYLWMSY
SDDDGKTWSAPQDITPMVKADWMKFLGVGPGTGIVLRNGPHKGRILIPVYTTNNVSHLNG
SQSSRVIYSDDHGKTWHAGEAVNDNRQVDGQKIHSSTMNNKRAQNTESTVVQLNNGDVKL
FMRGLTGDLQVATSKDGGVTWEKDIKRYPQVKDVYVQMSAIHTMHNGKEYIILSNAGGPN
RENGMVHLARVEENGELTWLKHNPIQKGEFAYNSLQELGNGEYGILYEHTEKGQNAYTLS
FRKFNWEFLSKDLISPTEAKVKRTREMGKGEMGKGVIGLEFDSEVLVNKAPTLQLANGKT
ATFLTQYDSKTLLFAVDKEDIGQEIIGIAKGSIESMHNLPVNLAGARVPGGVNGSKAAVH
EVPEFTGGVNGTEPAVHEIAEYKGSDSLVTLTTKEDYTYKAPLAQQALPETGNKESDLLA
SLGLTAFFLGLFTLGKKREQ (SEQ ID NO: 1601)

>orf02978
VDKTDKVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSSKHRFEV
ADRTDEVSSKHRFEVADRTDEVSSKHRFEVADRTDEVSNIYTARRS
(SEQ ID NO: 1602)

>orf02989
MSCNCAFYRSQFFDVNSVSNYHSHQKELRFPNSILFTYFVKVT (SEQ ID NO: 1603)

>orf03007
MTVKHRIVNSNGEARSGESLTTCGTRSTHGNWATVGYVYAADMARQNWWDLSAAISGSWS
PN (SEQ ID NO: 1604)

>orf03009
MRWDYGQIFKEIRKSKGLTQQDVCGQVIHRTTLTNIEHGKVIPSFENMVFLLEQIDMSLA
EFKYICNEYHPSKRRDIIVESQNPSTFQDTRKMVELTEKCQKYLKTHHDVPIQNIYRHTK
IVTELRTKGFKNNHVLKDLYEEIWDYLEPMDTWYISDLKLLGTILFFFPSENLPLLIDRI
MKTIEKYKYFRETKAFLSSFLANLSTVYFQHHLFKECETITLQLLVLAEELKIYDILGFS
QVRLGILQHNSDLIDKGITLLRLTKEEALVKILEKEINDFSNL
(SEQ ID NO: 1605)

>orf03014
VGLIKLTSYVFVCISNSFLTRHDKNDNICFFHGNFCLVLDLFHERSIDIINSSCINHAKR
TIEPLTRCINTVTCHSFDIFYNGDSLTSDPIK (SEQ ID NO: 1606)

>orf03016
LSSKSCIDRTNQETFHTLGLEGVGMKSGSLFCSVQISDKEKENSRLANGFLRYQFIQGIF
LLLTSYHNHRVGLEILPR (SEQ ID NO: 1607)

>orf03049
MTESYTWVEADRATLSRYRHGQGHLTDQFFSFKVQRPAAKTLIASISTGKGMGPSFDGTP
VITSGNQNRINTIKNSFIMSSSSVRISLRKLTSQRNFLRNLSSLILLAAQVAKGDATACS
HQRISRVVGQDSHETLSLTEFF (SEQ ID NO: 1608)

>orf03050
MNINNEKVWFAFYLLDMQITRPTPTFNDRRIGLIGKLQELRFLAGNLLLR
(SEQ ID NO: 1609)

>orf03051
LIKGYLPNHLALMDLCSKTTCTLDDFAGIAGRRNHRGFFCHIGNGVFLTVDKYLRNQRIR
QRKSSHHILTQLVCHSHTHLFILLQTSLSLRTKERLSF (SEQ ID NO: 1610)

>orf03057
LIKLTDRNFSDILIKCLIKCFTNLLSNQLMLLPSTLKL (SEQ ID NO: 1611)

>orf03060
LFKGGVTISRTPLSSEDTVMIDATEVQINCPKKTISE (SEQ ID NO: 1612)

>orf03062
MIQSENHCSASHSNRDYQSQHDNQGRTCQCFIIVPCHKKGSCSVGEITWNQRCQNGQDKD
HSRCLIKNT (SEQ ID NO: 1613)

>orf03069
MIARQLMVFFSTNQADTRITNMSIDSLIINNSKDFQSSSHASVSFILTKLVNLLIFNF
(SEQ ID NO: 1614)

>orf03070
MGEPFTHFIDCIDLGINPSYTQVCDRHFTSDIPCTMTSHPIS (SEQ ID NO: 1615)

>orf03077
LSSDSHFIGIKAFVILILGKSNSIVLRIVGLYQDLTCFFSPTCSTCHLSQELEGSLRRTE
IRQIQGRIRI (SEQ ID NO: 1616)

>orf03078
MAVHSLGIHMQGQRNIAVGTSIHRPTLPTHDKARITTAIEHENHLLFFNQTVLDSL
(SEQ ID NO: 1617)

>orf03079
MVTGIAVLLISHFMLFINNHDTQIFQRSKDSRSGTNNNLGIATLHLAPFIILFTIG
(SEQ ID NO: 1618)

>orf03080
VKNGYLVPKTCYKTLGHLRSQGNLRYQQNSCLALIQGTLDNLQVNLGLPTSCNPLK
(SEQ ID NO: 1619)

>orf03081
MVNLIPRLGLDLLLIDCLIFQTKQAFSSQTHHFSLLGKV (SEQ ID NO: 1620)

>orf03082
LGLQTKNNPLNQAIPLTKRHMNPHPNFQHSLKFLRNPVTIGLVRLHQGHIYDNLS
(SEQ ID NO: 1621)

>orf03085
LGNHFCTICSTTYQAILQFIQIWWCQEDKDSIWNLFLDLKSTLNFNFKENIDSLVQGFID
IGQRSSIVVADIFCVFQHLSLTNQLFKFFTSTEEIVNTVHFSRTLCACRHRYRILKLVFR
TLKNLSSNRSFSNP (SEQ ID NO: 1622)

>orf03092
MKFKNYLFDLYPYFPKGFSLDNREDPDVCSKALYDDLCKMFFDDDSKEKLKITSVCNKCQ
NYGNRDYYTLFIDKDKYLLSSDYIGASIYWAQEAGLNDRIILDHLSISRTIGGHILFPRG
GKLETVNQARGGEKGYYDRFDLTLYAIKEWFVENKNTKIGYAIENYHEWFELFSGDDNCK
NGFENFVEFFKLEGFIYEQNKIIDLIKSDLENNQVVFLDKEDILIASTEEEYIRYMKNLN
IIILERTKKILL (SEQ ID NO: 1623)

>orf03093
MELSIQLIHDLNTHTTHSTAKMLHNVKAIKNDFSIRE (SEQ ID NO: 1624)

>orf03096
LKAKLFSQVIVRAKHIHSNNFDATSDSSIVAKKVISNDSLFSSLKNSDDIEIVKILRNEA
HLSLCKSILIPRHNLRKTRKIMFKVKIKEQTRKLAAGCT (SEQ ID NO: 1625)

>orf03113
VGCSYICHELVANHDHFLFVIVEFLHGTVNTKCEGLQGPVNVINPKFLNCSLNAFFGVI
(SEQ ID NO: 1626)

>orf03114
LLHLWRSIRVVPSNEGIIQIDQNSLDSLRLQAWDCQIIDCFHSKIWYIIFNRHSGSFS
(SEQ ID NO: 1627)

>orf03118
VKGLLLATKLCRTNSHTDNLTRYSNRSICQNDLISHIQLTFKEDEKAIDDIRQKALGSHT
NRYPSNTSSSQQTRNWQT (SEQ ID NO: 1628)

>orf03120
LWGILGLTLPNLSGIGLLGDLFVGGLKAVAPILVFALVANALSQHQKGQDSNMKTVVFLY
IL (SEQ ID NO: 1629)

>orf03121
MIGTFAAALVAVLASFIVPIEITLNSANTEIAPPDGIGQVLSNLLLKLVDSPVNALLTAN
YIGILSWAVIFGIAMREASKNSKELLKTIADVTSKIVEWIINLTPFGILGLVFKTISDKG
VGSLANYGILLVLLVTTMLFVAPVVNPLIAFFFMRRNPYPLVWNCLRVSGVTAFFTRSSA
ANIPVNMKLCHDLGLNPDTYSVSIPLGSTINMAGVAITINLLTLVTVNTLGIPVDFATAF
VLSVVAAISACGASGIAGGSLLLIPVACSLFGISNDIAIQIVGVGFVIGVIQDSCETALN
SSTDVLFTAVAEYAATRKK (SEQ ID NO: 1630)

>orf03124
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KHSFEVVDRTDEVSSKHGFEVVDRTDEVSSKHGFEVVDRTDEVSSKHGFEVVDRTDEVSS
KHSFEVVDRTDEVSNIYTAR (SEQ ID NO: 1631)

>orf03145
MKDLISVIVPVYNVEPFISSCLDSLSKQIYQNFEVLLVNDGSTDNSGAICREYADRDSRF
HYFEKENAGVADARNFGIERSKGDYITFVDSDDWVTEEYLSILIETLKEQHSEIVVSTYS
TYNESDGLFYIHVFDSDYYVKNYNSKLLMEELPLLERYDMSFLTSWGILFKRELFQEVQF
PFGRVCEYIGTNYKLFMQVEKVTYINKVLYWYRVGKEGLSNSYSPKMMRDDCDFRLERIA
VLALKGYDVSKYLDQMKFYLKYRHDIAIQRELKENVETRHLEMLDYLLNGNKYN
(SEQ ID NO: 1632)

>orf03148
LNVRGGAYITFVDSDDWLEHDALDRLYGALKKENADISIGRYNSYDETRYVYMTYVTDPD
DSLEVIEGKAIMDREGVEEVRNGNWTVAVLKLFKRELLQDLPFPIGKIAEDTYWTWKVLL
RASRIVYLNRCVYWYRVGLSDTLSNTWSEKRMYDEIGAREEKIAILASSDYDLTNHILIY
KNRLQRVIAKLEEQNMQFTEIYRRMMEKLSLLP (SEQ ID NO: 1633)

>orf03167
VLAKAEAEALVDADSDADVLADTEAEALVDAEAEALVEADAEALVLAEAEALVDAEADAL
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ADSDAEAL (SEQ ID NO: 1634)

>orf03175
VFEVVDKTDEVSSKHCFEVADRTDEVSLKHCFEVADRTDEVSLKHCFEVADRTDEVSNHT
YDKVKLTWFEEIFEEYHTKKPCSSR (SEQ ID NO: 1635)

>orf03178
MYQDLLRKIAEEKPNYNQEEIQWLLDHLGDPSPEIRDDLVFTSFARGIQEELFTQEQFHF
IAEGVSSDGGLDKEIDKIGLPTLERSFRALIYATLLSDDANQQSIFYQRLKAEIRNVLLN
QGLHYLSKEKDTTGFSSQYGWVHSFAHGADLLKEVVCHPDFPKNRVHEVFDILGQLFKRM
SIRFTDDEDWRLARVIYEPILQGKLEQEQVASWIKTVDFPIEEREDFSKFSNFRSCLVEV
YVQLDQRNSLQDELKEAIQSFQY (SEQ ID NO: 1636)

>orf03181
MGFKVSHFKIPSSHLSINVLRTIENFTEIGQGLLHISP (SEQ ID NO: 1637)

>orf03182
VGFFDFGLTNSCRQVRQFTQTVQDFLVCYHQGIVKEGQGYAGICFKFHPSLGNIGKFVIA
IVRRLRHKSIVANMAHLNVDLFQFRKGLLEILKSVKIALVITAKLVDVFTSFLDCTQEIL
TVLV (SEQ ID NO: 1638)

>orf03190
MNITYIVGNGLDLQYGLKTRYRDFYEFQNKVYISRTENEEKYSNFIYESLFSDKVNDYEN
WSDFELSIGKLTKDNDLISSSIEIKEKFIDDFSEVVDDLREYLRIQQEKNLEKGNAIDFI
STLDDMRTSLPVINQPAIDKKYNENPHQDDIVNIVTLNYTHVIDKLYNGSAKSFRNQLRA
NLYNFYIEPPIHAHGTVDVCTVLGVSDEIQISNSLEEQKESLIKSLVLKNYRENMDVKNS
DIIKNSDIIILYGVSLGETDRYIWSQIAERSISGSVPVIIYHYVPHFDPGNPIRAKRLYR
NVEDKFIQNSGIDLELEKKLRDNLIVVIGKTIFDLIER (SEQ ID NO: 1639)

>orf03191
MNTLLTLRGKSFTQKSRNNGMGPITIPKKTIITLEHLKYLHFSLEETKTYWEKNNIIDGI
LISIYYNRIVAKSNRINGYFNVGGGNPFPNDTIVGAKFNDEKTKHIVTHYISRDALNKTI
TVLSKIIEVFEEHFDRAITCEMFSDSSTFASINFSEYGISKSKFQQYLRDSCFIENFGVE
HTTVSDIQNSIVTFYDVHTDIFRLLNKLNIDISEANIMNQTTVLLDEKNIELLLSKAPYL
VSMIVEDFSKLSVDDFSLDNNDLKINLPSPMNEPVVGVIDTLFDKRVYFNEWVEYHDFVS
PDISKDSQDYKHGTAVTSLIVDGANLNPNLDDGCGNFRVRHFGVSLQSGFNSFTIIKQIK
EIVSQNADIKVWNLSLGSNDEIRENFISAEGALLDEIQFENDVIFIIAGTNASVINGKRK
RIGAPADSLNSIIVNSVDFNNQSVSYSREGIVLSFFVKPDVSYYGGGNGDFINVCEPLGL
GRVAGTSFAAPFIARKMAYLIHIMGLSREEAKALLIDAAIPWNDKKTFTDLSLIGNGIVP
IKMDDILSTPDDEIKFIVSDISRAYDTYNYDFPVPISSESYPYVAKATMCYFPNCSRKQG
VDYTNTEMQLTFGRLKSDGIKSINKDNQHAEDTPGYVRENAARNIFRKWDNVKHIGESFT
SRKRAKAILNPSNPQWGMSIKTIERLKSGDGQGVRFGVVVTLKELNGVNRIEDFIQQAEL
RGWLVNRLQVEAQVDLFNSLNEEIEFE (SEQ ID NO: 1640)

>orf03192
MKKSDVLDLIKYHYEGRETEFRNQSIAIARNFNKHGDTQIAQYIMGLMSQSDRFMPQIEN
PSEYLTPAKLDIGPLPLPLSIMNDLKGIINAVNHHIGINKFLFVGSPGTGKTESVKQVAR
LIGKELLVVDFSHLVDSKLGQTVKNLATLFNEINNLPFKQNYIILFDEIDSIVLDRVNQN
DLREMGRVTSAFLKELDRLSPEIVLIATTNLFENLDKAVTRRFDAIIDFDRYTDEDKVEV
ATIILNELLKQFKNVARDLKLFKKIINSANVIPNPGDLRNSIRTSLAFSDPSDPHDYQKR
LLRSLHNGRNLSISKLSKLGFTVREIEILTGISKSSVSRELSED
(SEQ ID NO: 1641)

>orf03200
MINSQVFEIRIFNSYYKDAIYYFKNINYSIFHIFSTHY (SEQ ID NO: 1642)

>orf03205
VGHRFDPCRGHLNTTGKALEPRFFCLNKIFFKFFRKLA (SEQ ID NO: 1643)

>orf03206
MGWKGTPPCLHPSNQDTTILIVQQCLRRIEVLAMINFLN (SEQ ID NO: 1644)

>orf03207
VFGSYYRVIASIFFKEFWITEISSNQLIWQVCSSYNWILGNLFKVNPVI

(SEQ ID NO: 1645)

>orf03208
VLPSHQVLTFSMSPVHRSPNTIIWIELIKEMVFSTKINKSIWIIDPTNLS
(SEQ ID NO: 1646)

>orf03219
LLRFAIHSNLLFLKRFIFSIKDSAWRCLFISFFETFHFCFKNKSFYLNSFYH
(SEQ ID NO: 1647)

>orf03230
LIVSLKTKSRKAKDMAESIQGWLAQFLVNLFKSITFDCGKEFSKWKDISNHHDSESFFAN
LECPRQRCLNEHSNRLLRCHDLPKQTDFNEVSQEF (SEQ ID NO: 1648)

>orf03231
VVEIIYFLIIIIASGLGSISGMGGGIIIKPLMDSFGYHSVSDIAFYSSFSVFIMAIISTT
KRFSQSKEIKWRLIFTVSFSSVLGGFLGHLIFQVLLSQLSVRLVSIVQMILLFVMLLVSF
VLTDFKKTYQFDKIGFYMICGLLLGLISSFLGIGGGPLNVSLLMVFFSISIKEATMYSLA
IIFFSQLSHLATIVVVTGLNQYHLAPVPVIFLASICGGVLGTVVSKVLPENWVRYCFKGM
LFFVMGMTLYNLFHIL (SEQ ID NO: 1649)

>orf03232
MMGTNSEEGFLDDFEGPQVAVSVKDFSIADTPVTNQEFAQFVKETGYKTLAERQEWSFVF
ILFVPEAEREGYPHPAGAPWWLQVSNACWKHPYGENSNLVGLEDHPVVHVALEDALAFCN
WSGMSLPTEAQWEYAARGGRQSEYPWGDTLLEGGYYHANTWQGRFPYENTALDGFIGTAP
VYEFLPNDFGLYQMIGNVWEWCRNPRYTLLASFNEDDYELPKYGIQDEEYAIRGGSFLCH
CSYCNRYRVAARNGCISTSTSSHLGFRCLKE (SEQ ID NO: 165)

>orf03235
MVQTKQPNIILIVVDQMRADALSLNSKDKLVSTPTLDMMASVGYNFENAYSPVPSCVPAR
AALLTGLDQDKSGRVGYQDEVPWNFTNTLPKVFKDMGYQTECIGKMHVFPSRQRLGFDHV
LLHDGYLHVDRKYDKAYGSQFDYASDYLAFLKGKVGYDVDLIDDGMDCNSWEARPWDKDE
KLHPTNWVVSESISFLQRRDPTVPFFLKMSFEKPHAPLNPPKYYFDIYMERLPQFLDLHI
GNWEVLEKQIPSIYALRGKLKEDDQRRMVAAYFGLITHIDHQISRFLTALKEFRHDKDTI
IWFVSDHGDQLGEHYLFRKGYPYQGSIHIPSFIYDPAGLIAGNRGTIKQLVKIQDIFPSL
VDLAGGTTTDELDGRSVKNLLFGQYEGWRTEFHGEHALGKDSSQYILTDQWKFIWFPVLN
HYQLFDMKKDPHEMNDLYPSEKYQPIVRQMKKKLVDFLRYREEGFVVDEELVPVELSKIT
PTLTKTGDSQS (SEQ ID NO: 1651)

>orf03237
MNTMLDKMQEKLSPIAMKVGNQKFLVALRDSFVGTMPVIMTGSIALLLNAFLVDLPQQFH
LESITKTFQWLVDINNLVFKGSIPIVSLLFIYCLGVNIAKIYKVDTVSAGLVSLASFVIS
IGSTVTKSFPLANVGDVKLDQILQGIDNLAFDGKNLMVTIGNVIPGNHINARGYFTAMMI
GFLASIIFCKVMKKNWVIKLPDSVPPAIAKPFTSIIPGFMAMYIVAILTYVFHLLSNDLL
IDWVYKVLQTPLLGLSQSFFAVILMIFLNKLFWFFGLHGGNVLAPIMEGLFGVAMLANLD
AFQKGEPIPYIWTSGSFGAFVWFGGLGLVLAILIFSRNSHYRKVAKLGLAPVLFNIGEPV
NYGLPVVLNPLLFIPFVLSPVFMATVAYWATSWGLVSPVTQNVTWVMPPILYGFFSTAFD
WRAIILSVVCLIISVLTYFPFVKMADKTELS (SEQ ID NO: 1652)

>orf03238
MNESNLESAMGLIMYGGEAKSNAMEAIQAAKKGDFSKANRRLADANAALLQAHKAQTEML
TREAQGEETSISLLMVHAQDHLMTSLTFVDLAKEVVEVYERFEKN
(SEQ ID NO: 1653)

>orf03239
MAKVTIMLACAAGMSTSLLVTKMQKAAEDKGLDAEIFAVPAPEAEEIVATKEVNVLLLGP
QVRYLLGDFQEKLKDRQIPVAVIPMTDYGMMNGSKVLDLAESLLD
(SEQ ID NO: 1654)

>orf03240
MKRLISANPSEILQMNAEELKQSILASEGRVVLSENVVTRETFVGDITNSEIARAFGADM
ILLNCVDVFEPKIYALDSSGDDVIHRLHQLVACPIGVNLEPIDPSAKMLEETQEIVAGRV
ASVETLKRIEELGFDFVCLTGNPGTGVSNREIIKAVQTAKENFSGLIIAGKMHGAGVNEP

VAELSVAEQLLEAGADVILVPAVGTVPAFHDQELREVVDLVHSKGGLVLSAIGTSQETSD
TDTIKEIALRNKICGVDIQHIGDAGYGGLATVDNIYALSKAIRGVRHTVSRLARSVNR
(SEQ ID NO: 1655)

>orf03241
MEKLLQEKLLPVAARLGNNKALVSIRDGITLTIPLLLIGSLLMVIASFPIPGWEQYLGDI
GVADYLWKGVDSSFGLLGLVASFGIAYFMARQYKVDGIPAGIVSLSSFITVTPFIRGEAG
AGMPTAFMASKGLFVAMILGLINGYIYQWFINHNIQIKMPDGVPPAVSKSFSAIIPGAVT
IVGWLIVYATLDKLSLPNLHEIAQVALGGPLGLLGNNVIGLLILIFLNSSFWFVGLHGGN
VVNAVMKPLWLANLDANKVAYQTGETLPNIFTSVFMDNFVFIGGGGATIGLVLALGYLAH
KKKASKQLKTLAPITVIPGLFNINEPAMFGVPIVLNILLLVPFILAPMFNLLVAWGAMAS
GLVPLTYTDPGWTMPPVISGLLATGSISGSLLQIVLIVLDVLLYLPFVIAIEKRFKLLED
(SEQ ID NO: 1656)

>orf03242
MTLSKKQLQLRAKILETVYTLGPISRIEIATKTGITPATTSSITNDLIKENILLELGEDE
HDTSVGRKKILLDIQAKRFYYIGCELSEKHFTFALGDNLGNILKEEKEIVTKQLIQEKGN
QLINQTLKQFLNNCSDYEIEAIGIALPGRYLDDYKITTNNPLWQHIDLEMIQSHFDKPLF
FSNNVNCMAIGKRLFSRQQNDPNFAYFHFARGMHCSYIYDGNIYGKGNLMIGEIGHTVVS
SEGEECSCGRKGCLQTFAGESWLIKKSKILYHQSPYSLLPSLVKNADDIDIQVILTAYQL
GDTGIITLIHQALLYLSQTILNISMMIDSQKIYLHSPLLTNQHIIQKLYSEMNYKPKLLY
NRLPEVIIEPYNDFTAAHSAIALCLYHTILHS (SEQ ID NO: 1657)

>orf03243
MTIRFEEKVSTENAQFVCQWSNSLGKVFQEQWIGPRIPFPLTIQVFQDLEGILSIFEGQE
FVGLIQKIRLEDSNLHIGRFFINPQKQGQGLGSQALRKFVSLAFENRDIDSISLNVFEAN
QRAQNLYQKEGFEIV (SEQ ID NO: 1658)

>orf03261
MPFKENLICQHRNHHCSVFFISLGLLHNIHIEIDISQTRASFLDLSDYLQAVLMILQKFC
QAIGLAQRLDLLQLHLLHLTRLLL (SEQ ID NO: 1659)

>orf03271
MYLLLLVVKDHIALIDKEMHVWRPNCILRDLTNFFIKRNHIVTHKTNGSTTKR
(SEQ ID NO: 1660)

>orf03272
VLTLMNHFIKEIQGIPINHLTILIENSIFKLNLKNWIIG (SEQ ID NO: 1661)

>orf03274
VDRTDEVSSKHCFEVADRTDEVSNHTYDKATLTRFEEFFEEYKGVPR
(SEQ ID NO: 1662)

>orf03293
VCQRMDARTCKTTIIAVHNVLTALQQTWIAVQLYQTK (SEQ ID NO: 1663)

>orf03294
LHLGKSILSLPVKGKDLEFLVHLFVINHWIGFPSRTSTFCRCKVLNSME
(SEQ ID NO: 1664)

>orf03295
LEQTVIIANNPCELYWDNHLSFLSDSLLKQVIVHLKRICLDIHHDRGCSHVRNDTT
(SEQ ID NO: 1665)

>orf03297
LTDDGVLILVVDAGWRGNSCLQEQGCHHFRAILLCITWHFRSCTDKGHLTFKDIDQLRQF
VQTDTSDEISNLGNTAIVSRSHQTSFFIRIRHHGTELPNLEPTVVLGHTLLLVNHWPLAI
QLDPNAQDEKDGRS (SEQ ID NO: 1666)

>orf03298
MLKMRKMGEVRTSKTKAKTQSKQRLKISEPFLLETSW (SEQ ID NO: 1667)

>orf03313

MLEEGTKDQLAELTYPFGRGVNLSFGIKDVPKLYQKVMEANYPIYRLLTKRKFRVSDPYI
YPHKFAVLDPDGYFLRFSE (SEQ ID NO: 1668)

>orf03316
MDQNLFNYNDEDIDSVIEYSHKLLNRKFSDVMEEYNRSLYKSYDDYNDRVVSEVQDKAIS
MKSKGQYGNYIEKYFYGYQPNSDSEADFEKIGVELKVTPFKINKNGTLSAKERLVLTILN
YMEENLEDFYSTHLWKKCAKILLLFYNGLIPNQTMKDYVIEKIFLYEWFEEDMAVILEDY
QKITDKIKNGKAHELSESDGNYLSTCTKGAGKGKDLRQQPFSHELAKQRAWELKSSYMTY
LINHKIFNQSDQESVLANFRGEKKSFTEVIAEKILSYKGFSEQELYDRFEVNSKAKGKNS
TLIRKILGLTGDLDKTKEFQKANMNLRVIRVDKNNLPKEDSPFKTYCFKELAATDSWESS
HVYNEIYNKRFLFVIFKEIEPKLFVLDSIKFWGFQDRQLEEIQRVWQETRQIISDGVKLT
QNGNKVSTNFPQSKINKILFTKLHATNTYYEIDKGKFVGKGSLSDTDELPDGRRITKHSF
WMPKKFIKEILDGNWD(SEQ ID NO: 1669)

>orf03317
MKVLELFAGVGGFRIGLENADKQLFKTKWANQWEPSRKSQDAFEVYDYHFPNSKNINISI
SDITDEQFSKMDADMIVGGFPCQDYSVARSKKNEKGIEGKKGVLFWEIIRATEIIKPKYL
ILENVDRLLKAPSKQRGRDFAIMLTAFNNLGYSVEWRVINAAEYGRSQRRRRVFFFVYRN
DTVFAQKIDNLYEKNEEIFEDNRYDDYIFNQGLFAKQFPIKPIAVKNRHVFYELPNDIVE
VSDTFTGTVWNTGIMRRGKYYSIDTEPNYNGNPITLGEILQDESEVPEKYFLTDQSKLEK
FQYLRGPKKIERTSSDGHQYIYSEGGMSPYDDLNLPGRTMLTSEGTVNRSTHLLFVNNKY
RLITPIEAERLQDFPDDWTAKKKLSDDSIVEVSDKMRMFFMGNALVTEIVKEIAKFIKEI
D (SEQ ID NO: 1670)

>orf03318
MDTFSFNGQYIVEFSCLKVVDRGLECHPIKSQRDNHQTTDLVT (SEQ ID NO: 1671)

>orf03320
MGIAIVVERRVHYFGRHHNVTISHFFNFVIFKGRYSVKMKVFHRFLLIFQTTL
(SEQ ID NO: 1672)

>orf03333
MIACRHDICKSQKGLEHPFCIIRRLTRDFNQRPVCIVEANIFCLKITPQIITNMIVARTV
KSSKTGITLTTSMCKRDNHKITWFHRRNGFPSFFNNPNRFVSTIFMSSFRFWITVPP
(SEQ ID NO: 1673)

>orf03341
MLRQFRLGFFDVRMTECHLKWKERENFHDFLKFYCKDS (SEQ ID NO: 1674)

>orf03350
MNMNKDQIAILNGADNLNLTLWMTLKEICKEGCKSFFPVRNTCRMLDIGIPYRLGLSLSN
SSVLNGMDV (SEQ ID NO: 1675)

>orf03370
MHKLRIFVNQLCRRFGIILGPFLVLGFQVLTQELELAIFFDLREEVLLQVIPQVCHFCYL
RKEFTTLNQHELTSHDHVLTRHFQTHGLQG (SEQ ID NO: 1676)

>orf03382
MLHMNLFFQPFFTNLCKTLATGCCVKTVMEWSSIATTIDFKIIE
(SEQ ID NO: 1677)

>orf03383
LDNRAKEWIMSTAQNQAIHLSNQGTQGFIDHLLGNTG (SEQ ID NO: 1678)

>orf03385
LSLDFFPDDRSRSVTSNDNHFDILGQEKVDQLPSIFTNLLSRTGAIGRPRRISNIDDFFM
GKLAHELAHNGQAPDTRIQKTNWSIIHTVFFLVFFLIDRSL (SEQ ID NO: 1679)

>orf03394
VSYGSHIFFASNCLKQIFGFLFKFSHLILLILVKASLI (SEQ ID NO: 1680)

>orf03397
MTSLLTLENIHKTFEAGTVNENHVLKGLDLEVEEGDFISVIGGNGAGKSTLMNILAGNLS

VDEGDLLLAGKSIKNLSVRKRAKDIARVFQDPKMGTASRLTIEENMAIALRRGQKRGLGW
GVKEKDRIQFQEALKELNIGLENRLKVDTQYLSGGQRQALTLVMTDLMKPKLLLLDEHTA
ALDPKTSQMVMDLTQKIVEHHQWTTLMITHDMNHAIEYGNRLIMLYQGKIVVDVKGEEKK
HLTVEDLMHLFQKNSGQSLVSDELVLG (SEQ ID NO: 1681)

>orf03398
MNFVLSSLSEGLLWSIVAIGDYLTFRILDIADMTAEGAFPLGAAVVVSQIQAGANPWLAT
LLALLAGMVAGLVSGMLHTKMKIPALLTGIVTLTGLYSINIKIMGSVPNLSLGDSATVFK
QLASLGLTNEGAVFSLSLVCFLLVCLVLTLLMKTEIGLVLRSTGDNIPMSEANGVNVDTM
KIVGYMISNGLIALCGSLFAQNDGFSDVTSGTGTIVVGLSSVIIAEVLIHDLTIGGRLLS
IGIGAIVYRLIILNIYEIPNLDQNLVRLFNAILLALVLFAPELQKRLKIRGLKLRNE
(SEQ ID NO: 1682)

>orf03399
MAEVDMVFVPTDNIILSTMETVKQVSIKHKVPVFGGSTEMIAVGGLYNYGTNYEELGRQT
ARMLIRVLKGEEPENIAVELPEKLELHTNQEMADALGIDISKLEGKE
(SEQ ID NO: 1683)

>orf03400
VDELAKQGYVEGENIEIDLQNAQGEQRNLKTISQQLAESSDVVLAIARPSAQSLANTTQT
TPVIFSAVTDPVSAKLVESREHPGGNVTGTSDQSSDAISTQINLIKKVLLKAKTIGILYT
QSEPNSVV (SEQ ID NO: 1684)

>orf03401
MQTDQRSQEEPHYQEGASDFRTTFIMKLLLRKDKTKNRLDTI (SEQ ID NO: 1685)

>orf03402
MLPILSPFSSPVNNISEFFKIFRKFFQEAFKVFQISPTKKVL (SEQ ID NO: 1686)

>orf03412
MINVNQVSIEVKNTFKNWNFTSSIELTTFSKFSQSPTMT (SEQ ID NO: 1687)

>orf03414
LIDVLFINSFIGRICFYCYRRIHATCLFLQLFSIVILNVAHTLKHSIFIVITFISRCRNF
IIVRILLENQFSRNQGIDNRVGQSRY (SEQ ID NO: 1688)

>orf03423
MKIKEQTRKLAAGCSKHCFEVVDETDEVSNHTYGKVKLTWFEEIFEEYKKSSWNL
(SEQ ID NO: 1689)

>orf03442
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 1690)

>orf03443
MSIVKSHSFSISLGIFNSFWNNIHTSECFNFLCKGKSNRSNSTISVNQMVFFINIQRFYC
FAIEDFCLLRI (SEQ ID NO: 1691)

>orf03444
LNTLLPPDNLCLFTIYLTGFSCICINSYCHNFWEIFNQLFYQLS
(SEQ ID NO: 1692)

>orf03451
MGFSMKLIHDLNTHTTHSTAKMLHNVKAIKNDFSIRE (SEQ ID NO: 1693)

>orf03460
MYNKVILIGRLTSTPELHKTNNDKSVARATIAVNRRYKDQNGEREVDFVNMVLWGRLAET
LASYATKGSLISVDGELRTRRFEKNGQMNYVTEVLVTGFQLLESRAQRAMRENNAGQDLA
DLVLEEEELPF (SEQ ID NO: 1694)

>orf03464
MQFTRTAHHTKTLFTTKFTWENEIPFWHHSSRKRDNGFQPHTRIGSSCNDLYSLITCDCN
LADVEVVTIWMGYHLNNFTDNKLRFLIINNFFCKTFRLQLLVQTSDLLICQKDLTALCSF
K (SEQ ID NO: 1695)

>orf03469
MILDSFFAFNCSGTMKVSTWVYDKGEWYYVSSSGSMIANDWVKDNGK
(SEQ ID NO: 1696)

>orf03476
MCTSINKKKKAVKPSFDLFFCFIFCKLTIVQVSVEATLRHQFLIVALLDDISIFHDQDQV
CISDG (SEQ ID NO: 1697)

>orf03484
LHLRTCFVRQTNKLSPLINRTRLQFHQTILHYTLNQITSNRLGNIEFLIDIFNQDQVLVF
LAIIQKMHNLTLRPTHKFNAATFGFLLHHQVNLMTKTLKD (SEQ ID NO: 1698)

>orf03499
MLEIWKYRPFVSEFWNDFKNNHDKQFVDSISLYLTLKDDDDPRIEEESEALENMILQYLG
EDDAS (SEQ ID NO: 1699)

>orf03507
MAFNQFNRCIGLSIPTAPNVPGTIINRSYLHDATVPNNVREKT (SEQ ID NO: 1700)

>orf03523
LTDFHDFKFIFFENLFKSRQLYLQSQNTVLSNLWLAT (SEQ ID NO: 1701)

>orf03533
MKIMKKKYWTLAILFFCLFNNSVTAQEIPKNLDGNITHTQTSESFSESDEKQVDYSNKNQ
EEVDQNKFRIQIDKTELFVTTDKHLEKNCCKLELEPQINNDIVNSESNNLLGEDNLDNKI
KENVSHLDNRGGNIEHDKDNLESSIVRKYEWDIDKVTGGGESYKLYSKSNSKVSIAILDS
GVDLQNTGLLKNLSNHSKNYVPNKGYLGKEEGEEGIISDIQDRLGHGTAVVAQIVGDDNI
NGVNPHVNINVYRIFGKSSASPDWIVKAIFDAVDDGNDIINLSTGQYLMIDGEYEDGTND
FETFLKYKKAIDYANQKGVIIVAALGNDSLNVSNQSDLLKLISSRKKVRKPGLVVDVPSY
FSSTISVGGIDRLGNLSDFSNKGDSDAIYAPAGSTLSLSELGLNNFINAEKYKEDWIFSA
TLGGYTYLYGNSFAAPKVSGAIAMIIDKYKLKDQPYNYMFVKKILEETLPVKNGIKVLNI
PNVLRYDLNMLQLEYKNEQSWDSFIDNVNLIELEERIQTTIGIKQINTHNIITIAREGYS
QNYLPNTSENTYNSLQVSLVGVLLLFISMVNILWAKKSK (SEQ ID NO: 1702)

>orf03543
VLKWCILRINHHISRKVDNFLEGTRAHIKGQAHTAWNPLEVPDVRYRSFQFDMSHTLTTN
FRTRYFNPTAVTNNSSVTNAFVLTTSTFPVFCRTKDHFIKESFTFWFQGTIIDCFRFFDF
SIRP (SEQ ID NO: 1703)

>orf03553
MPWKELCHKLAPKVFKVIRIYSRENKKSPSNWAFCSFET (SEQ ID NO: 1704)

>orf03559
VSVLFFCSYFSLSLEKGWFSSLISCKFMNQFLPFCWRQDSPWILTLAQDSITYH
(SEQ ID NO: 1705)

>orf03564
VTDENTRKVRLLVAFFSIVIGYILSSFFISLYHLWQEALRGLL
(SEQ ID NO: 1706)

>orf03566
LHVELIDSHKFNIGRTTCSLLSTTNICKRCQPSINHMS (SEQ ID NO: 1707)

>orf03567
MLNTNRNELIGTSFLIFCVIYFKDLANIFRTTWNLYIIRQGHYKCQESHNQGRNDV
(SEQ ID NO: 1708)

>orf03570
VNKPILSDIDCHLTNSINLFLPDTQTGNLFWKFNGLIRLAHNHNIFRKKLSLSHFFNICY
DLFLGIGRV (SEQ ID NO: 1709)

>orf03571

LKFSNFLGHLDIFSHDGLSLTVSLHQNSTGHATRYCFDR (SEQ ID NO: 1710)

>orf03584
VDSLFLSLGEESNQEINLQESFSSTDCNPTLISPETTVAQGLCQDIIYRPFT
(SEQ ID NO: 1711)

>orf03586
VNPKSLGSFFLQDSKGFKELVLGHAKLSLPRIVHNVCPQFKNASRIITTRDDFWNACYSL
QMFNIFKGIQVNGRTQFTCIGVFLVWRVVGREHNLRTQKVQFMAHQKLYITRAVHTTTFF
LENFQNSWSWSSLNCKIFLKALVPRKSLVDGSCLLTNPLLIIQVKGSRELGNNRF
(SEQ ID NO: 1712)

>orf03590
MDNLCLHNTWTDWTSIFKQAVVTEDDMTKQNDFFLGIIDAEFHNCLGNFAINESDMSKKI
TSHCVLCLVWPRQLDDLSQVMQHNPRIEQALIELRINFANSVCQTHHGRRMIGQARFKGM
VVGLGSWIGVEFLIILGVEISDNPLPDRIFNFENHLRHVVTNFLDINW
(SEQ ID NO: 768)

>orf03591
LIDLRGIVINFSASFHVDNLTCGKGLNVMRLGIPELPINLATIILEGKG
(SEQ ID NO: 1713)

>orf03604
MDALVLQKNQETIQQIAVKIRFLDGHDYYSLIDIDNRRTNQTVFPFVNFEDIAF
(SEQ ID NO: 1714)

>orf03605
MAFFTEIPTRACLINLAITLHIVETCQGFNDLSLHLRVLAL (SEQ ID NO: 1715)

>orf03609
MLLPLPFNTSKIKQIAMHSDLNQKEMIGHIFHDEDIF (SEQ ID NO: 1716)

>orf03614
MKQTVKKLALVASIAATLGGGVSVASAAVQYPEGGVWTYGSGNGGAYSNYYHPSKYHSST
VVSRKTGSSDKGYAGAGGTSRAWIRTSWGEKVAFYYNV (SEQ ID NO: 1717)

>orf03643
LVEQLTFNQWVTGSSPVRVIYAGLAELADAPDLGSGA (SEQ ID NO: 1718)

>orf03675
MKELLNKAFFNKNKASLSKEVLLELQGKRLPVNLFLSKSLFQASL
(SEQ ID NO: 1719)

>orf03690
MMTKIKLTIDIIMPCRHITNIWIYKEEGRVNLFFYSQIFFDAIDERIIHNFNSKYHLSFF
SPVTGFSQIFDKTLACLG (SEQ ID NO: 1720)

>orf03695
LHTSFRSSVGHSHTWHQDIVRPILFSRFNDSIVILWQNCPTFN (SEQ ID NO: 1721)

>orf03713
MLEQARLKVEQQAIKNIQFLEQDLPKNPLEKEFDCLAVSRVLHHMPDLDAALSLFHQHLK
EDGKLIIADFTRTEANHHGFDLAELENKLIEHGFSSVHSQILYSAEDLFQGNHSEFFLIV
AQKSLA (SEQ ID NO: 1722)

>orf03714
MKHDFNHKAETFDSPKNIFLANLVCQAAEKQIDLLSDKEILDFGGGTGLLALPLTPSQAG
(SEQ ID NO: 1723)

>orf03716
VWKKKKVKAGVLLYAVTIAAIFSLLLQFYLNRQIAHYQDYALNKEKLVAFAMAKRTKDKA
EQESGEQVFNLGQVSYQNKKTSLVTTVRTSKSQYEFLFPSVKIKEEKRDKKEEVATDSSE
KAEKKNQKRSLKRKRIPSQFNYNALNPE (SEQ ID NO: 1724)

>orf03718
MVDLQSFFTRKYLNLNSVDAYLILPRLQGHLSYPQDFFLLQDFCFLLPIFLNLSQKEGRN
AGKDS (SEQ ID NO: 1725)

>orf03733
MRIRNSPFDHILQTIFEFEDRTCQVTCRFEACSSICNDNWEFSQHIISVFQSPSCHTVCD
KSDVFCSFLFDKNFASLWIYVVTITDQLCIGMWQLVHGSNHTQFTVSQPTHSIVGMHPNT
RSSIDCFFGFIKSRV (SEQ ID NO: 1726)

>orf03734
MSKSNRHTFARNCTNKVFHPITFWCKGNFIKQAICRFLPRMKLLNTRVSHISWILCPLKS
FCEIWTFIINPTNLSTCCFFIMVSKIFSDCKQLLISGC (SEQ ID NO: 1727)

>orf03736
MQCTFNVVVHHIYTCISMNMSIHKTWGNAITCIVNHLSPFRNLLYMFPKLAVHKFQVTTS
TNSVWVEKLIRFNIVRHNVNLLKRLILQFIMSITL (SEQ ID NO: 1728)

>orf03750
MKKRMLLASTVALSFAPVLATQAEEVLWTARSVEQIQNDLTKTDNKTSYTVQYGDTLSTI
AEALGVDVTVLANLNKITNMDLIFPETVLTTTVNEAEEVTEVEIQTPQADSSEEVTTATA
DLTTNQVTVDDQTVQVADLSQPIAEVTKTVIASEEVAPSTGTSVPEEQTTETTRPVEEAT
PQETTPAEKQETQASPQAASAVEVTTTSSEAKEVASSNGATAAVSTYQPEETKIISTTYE
APAAPDYAGLAVAKSENAGLQPQTAAFKEEIANLFGITSFSGYRPGDSGDHGKGLAIDFM
VPERSELGDKIAEYAIQNMASRGISYIIWKQRFYAPFDSKYGPANTWNPMPDRGSVTENH
YDHVHVSMNG (SEQ ID NO: 1729)

>orf03763
VLAEADALVDAEAEALVDAEADALVLAEAEALVDADSDALVDAEADALVDAEAEALVDAD
SDADVLADTEAEALVDAEADALVLVDADVLALVDADVLADVLALVDADVLAEAEALVLAE
AEALVDAEAEALVDADSDAEVLAEADALVLAEADALVDAEAEALVDAEAEALVDAXXHSF
IN (SEQ ID NO: 1730)

>orf03764
VRRLQHRQVLQLQRQPVRRLQRQPVRQPQQAPVLRLQQVLAPQPQHQQVLRSQRQPVPLN
PHQPVHRLQQVLAPQLQHQRVLQLSMNQCVGIRINQCIGFSKY (SEQ ID NO: 1731)

>orf03766
VRRNPHQPVHRLQQVLVHQLQHQRVLRLQQAPVRLNPHQRLPQPQQVPVRQLQQVLVHQL
PHQQVLQLQRQPAPQPQQVPVRQLQQAQAPLSQRQPVRQLQXXXFHSLIN
(SEQ ID NO: 1732)

>orf03772
VTDENTRKVRLLVAFFSIVIGYILSSFFISLYHLWQEALRGLL (SEQ ID NO: 1733)

>orf03774
MNXXALVDAEAEADVDAEAEALVDADAEALVLAEADALVDADSDADVLAEAEALVDAEAD
ALIDADSEADVLAEAEALVDAEADALVDAEAEALVLADAEALVDAEADALVDAEADALVD
AEADALVDAEAEALVDAEADALVLAEAEALVDAEADALVDADSDAEVLVLAEAEALVDAE
ADALVDADSDAEILAEADALVDAEAEALVLADSDALVNAEADVLAEADALVDADSEALVL
AEADALVLAEAEALVDAEAEGTGMRKLIH (SEQ ID NO: 1734)

>orf03777
VLALVDADVLADVLALVDADVLAEAEALVLAEAEALVDAEAEALVDADSDAEVLAEADAL
VLAEADALVDAEAEALVDAEAEALVDAEAEALVDADSDADVLAEADALVDAEADALVLAE
ADALVLAEADALVDADSEALVDAEAEALVDAEAEALVDAEAEALVDAEAEALVDAEAEAD
VDAEAEALVDADAEALVLAEADALVDADSNADVLAEAEALVDAEXXIPFIN
(SEQ ID NO: 1735)

>orf03794
MKIKEQTRKLAVGCLKQCFEVVDRTDEVSSKYCFEVADGS (SEQ ID NO: 1736)

>orf03804

LLGSFFSWTTKELMGIIFFNNFPTVHKNNMIGYISSKTYLIKLIKNSI
(SEQ ID NO: 1737)

>orf03818
MEKILLHNLNQTEFFINKAIGWTLRDYSKTNPTWVTCFIEKNKERMAELSIKEASKYL
(SEQ ID NO: 1738)

>orf03819
MSLADLLEELEAAKDSKKARSMEAYMRHQFSFLGIAVPERNKLYKNIFQKRKKQRLSIGI
LQTLAGKRILENTNMWLLTI (SEQ ID NO: 1739)

>orf03829
MTTGWFQVNGRWYYAYSSGALAVNTTVDGYSVNYNGEWAQ (SEQ ID NO: 1740)

>orf03851
MAFTTEELLNLGLTEEQAKSVFALRGKELNEDKSALETIKQERDSLKSQLQKAEEQVEHL
KSLENISAEQKDAIDKLQAEYDKYKNEAAAELAQTKKVSAISLALKDTNAFNPDKLMKFI
DVDAIQIDDNGKPQIDEVINGIKESDPHLFQAEESKPSPNIFPLR
(SEQ ID NO: 1741)

>orf03853
MGSSGEMRTRPAEELGVDTFYYSMKAMARPACSPLQGQIVTKGTGREIDGITIYSLLDYG
YGTAAGCLGIHCGHYLTPFIVGVHELPNLPDYLKNLTPEQAEENARIEAGQRGLERLIKT
HKERLHYAHTLQDDKMIQAERLKVRGYQTKIRNLINQHDFLTRDYRREKLYIS
(SEQ ID NO: 1742)

[0403] In some embodiments, preferred 23F antigens are selected from the polypeptides orf01158 (SEQ ID NO: 1297), orf01305 (SEQ ID NO: 1309), orf01307 (SEQ ID NO: 1311), orf01631 (SEQ ID NO: 1343), orf01804 (SEQ ID NO: 1362), orf01807 (SEQ ID NO: 1364), orf02164 (SEQ ID NO: 1434), orf02189 (SEQ ID NO: 1451), orf02194 (SEQ ID NO: 1455), orf02219 (SEQ ID NO: 1466), orf02221 (SEQ ID NO: 1467), orf02224 (SEQ ID NO: 1470), orf02228 (SEQ ID NO: 1474), orf02242 (SEQ ID NO: 1484), orf02244 (SEQ ID NO: 1485), orf02246 (SEQ ID NO: 1486), orf02247 (SEQ ID NO: 1487), orf02652 (SEQ ID NO: 1491), and immunogenic fragments thereof.

Example 3: Pilus adhesion

[0404] The pilus 2 mediates adhesion to alveolar epithelial cells A459. Dual-label staining shows that a pilus 2-positive strain adheres to the surface of the A549 cells and that the pilus (visualized using labeled anti-01287 antibody) is contacting the cells.

[0405] Furthermore, isogenic knockout mutants of the pilus are significantly impaired in host cell interaction. Figure 2 shows that a pilus-negative strain (D39) fails to bind to A549 cells, in contrast to a pilus-positive strain (PN110). Knockout of the pilus in PN110 removes binding.

[0406] Incubation of A459 cells grown on glass coverslips with 01287 purified protein shows low level binding by confocal microscopy inspection. This observation was confirmed by incubating the protein with cells in suspension and quantifying the level of adherence by FACS

analysis (Figure 4). Pneumococcal pilus 1 RrgA subunit was used as positive control comparison, and green fluorescent protein (GFP) as a negative control.

[0407] Purified pilus was imaged by confocal microscopy. It was shown to adhere to A459 cells grown on glass coverslips. Furthermore, purified pilus seems to increase adherence to the respiratory cells when added to strains expressing the pilus type 2. This effect is probably due to the interaction of the purified pilus with both bacteria and A549 cells. Purified pilus does not increase adherence of isogenic knockout mutants of the pilus 2 to the respiratory cells (Figure 3).

Example 4: Other Sequences From INV104B

[0408] An exemplary nucleic acid sequence for LepA Peptidase (orf 01289) is hereby provided:

ATGCTGCTTAAAAAGAAACATAAGAAACCAGTAACACAAGTCAATCGGG
ATAAGTCTCCGCCGAGTGTCTGGGGAGATATCCTTTACTTAGTCAGTAA
ACTTCTGATGGTTGGATTTGTACTAGCCATCCTTTACTTTTTCGTCTTT
GGATTATTAAGATACAATGACGATGGCATGAAGCCCGCCTTAAAAGATG
GCGACTTGGTCGTCTATTATAGGTTGGATAAACGCTATTCGATTGGTGA
TTTGCTAGTCTATAGTTATAAAGGTAAGGAAAGAGTGGCGCGTGTCATA
GCAACCGAAGGAAGTACAATCGATATAAACGAAAATGGTCTCATCATCA
ACGGTTCTCCTCAACAAGAGCAAGATATCTACAAAGAAACGCTGCTCTA
TAAGGAAGGGGCAACCTTCCCGATGAAAGTCCCAGCAGGACAACTTTTT
GTCCTCGGGGACAATCGAACAACGGCTGTAGACAGTCGTGCTTTTGGAA
CCATCCCTATACAGGATACTCAAGGCAAAGTTGTAACAGTCATTAGAAG
ACGAGGCTTT (SEQ ID NO:1743)

[0409] An exemplary amino acid sequence for LepA Peptidase is hereby provided:

MLLKKKHKKPVTQVNRDKSPPSVWGDILYLVSKLLMVGFVLAILYFFVF
GLLRYNDDGMKPALKDGDLVVYYRLDKRYSIGDLLVYSYKGKERVARVI
ATEGSTIDINENGLIINGSPQQEQDIYKETLLYKEGATFPMKVPAGQLF
VLGDNRTTAVDSRAFGTIPIQDTQGKVVTVIRRRGF (SEQ ID
NO:673)

[0410] An exemplary nucleic acid sequence for sort-1 (orf01285) is hereby provided:

ATGATGAAAACCAAGCGTGAGAAACCAAAAAAGAGTCTGTCTAGGCGTC
TCGTTCTTGCTGTGGATGGGGTGATCAATCACTTGCTGCTCATTTTTGC
AGCTTTGATCTTTCTCTTTGGTTTCTACGCCCTTTGGGATTCCAACCAA
GTCTACTCCTTAGCTTCGTCAAGTGAGTACGAAGCTTATCGACCTGTCA
CGACGCAACAGGATGAGCTGGCCAGTTTTTCAGGCTTCAGCAAACTCCA
AGAACTCAATCCCGAAGTCCTCGGTTGGATCAATGTCTATGGCACCAAT
ATCGACTATCCCTTAGTCCAAGCCAAGGACAATGAAAAGTATCTCAACA
AGGACTCCAAAGGTGAGTTTGCAGCGACAGGCGCTATCTTTCTCGATGC
ACGAAATAATCCTAAGTTCGAAGACTTTAATACCATTATCTACGGGCAC
CACGTAGAAAATGGGGTCATGTTTGGTGATGTGGCTAAGTTTGCTGATC
AGGAATTTTTTGACCAGCATCGTTACGGTAGTATATACTACAATGGTGT
GGAAAAAGGGCTCGAGATCTTTGAGATGTTGGAGGTTGATGCCTATGAC
TTTAACATCTATGATCCAGGAATACAGGGTGAGGACCGCCAGCAGGCCT
ATCTAGACCACCTGCTCTCAGTCGCCATGCACAAGCGGGATATCTCACT

CTCACCGAGTGATCGTATCATCCTACTCAGTACCTGTTTTCTCGATGTG
ACCAATGGTCGTCATATCGTAGTCGCAAAGATTACAGACACCGTCCCTA
AAAATACTTTCCATACAAAAAAATCAAAACCATTTCCATACAGTGTCTT
TGATGACTCGTCTCTTGGACGTTTCCTCTCATCAATCCCACTATGGATT
TGGTACCTTATCTTGTTTGTATTGTTCTTGCTCTTGATTTTCTTACTCC
TTGTCCTCTACTTGATCCTACGTCGTAGAAGAGAGAGTAAAAAAAATGC
AAGAAGCAGACCCTTTTACTGACTAAGGGTGAATAGAAA (SEQ ID NO:1744)

[0411] An exemplary amino acid sequence for sort-1 is hereby provided:

MMKTKREKPKKSLSRRLVLAVDGVINHLLLIFAALIFLFGFYALWDSNQ
VYSLASSSEYEAYRPVTTQQDELASFSGFSKLQELNPEVLGWINVYGTN
IDYPLVQAKDNEKYLNKDSKGEFAATGAIFLDARNNPKFEDFNTIIYGH
HVENGVMFGDVAKFADQEFFDQHRYGSIYYNGVEKGLEIFEMLEVDAYD
FNIYDPGIQGEDRQQAYLDHLLSVAMHKRDISLSPSDRIILLSTCFLDV
TNGRHIVVAKITDTVPKNTFHTKKSKPFPYSVFDDSSLGRFLSSIPLWI
WYLILFVLFLLLIFLLLVLYLILRRRRESKKNARSRPFY (SEQ ID NO:676)

[0412] An exemplary nucleic acid sequence for sort-2 (orf01282) is hereby provided:

ATGACGGTTCAAAAAAGAGCGCGATTTAAAAACGTATTTCTGGTATTCT
TCTGTGTTTTTGTAGCTCTTTTTAGTTGGCAGAGAGTAGTAGAAGCAAG
TGACTATGATCACTATAATCCTATTGAAAAGGATGCTTCGAGCACAGGT
TTTGAAACCCTACAGCACTTGAACAAAGATGTTTGCGGTTGGATTAGCC
TTGATGGGACCAAGGTAGACTATCCGCTTCTACAAAGTCAGGATAATGT
CAAATACCTTGACCGCAATGCCTTTGGCGATTATACGATAATGGGATCA
ATTTTTCTCGACTATCGCTTTAATCCCAACTTTACTGATTTTAATACGA
TCATCTACGGACACTCTATGGCTTCAGGGGCTATGTTCGGTGAGATTAA
GAAATTTGCTGATAAGGAATTCTTCGACCAGCATCGCTACGGTTCTATC
TACTACAATGGTCGAGAACGTGGTCTTGAAATTTTTGGGATTTTAGAAG
TGGATGCCTATGACACGGAGATTTATCGAACCTTGAGTTCCAAGGATGA
GGAACACCAGGCTTACTATCAATATCTGCTAAGTAAAGCCAAGTACAAG
CGAGATGTTTCCTTAACA (SEQ ID NO:1745)

[0413] An exemplary amino acid sequence for sort-2 is hereby provided:

MTVQKRARFKNVFLVFFCVFVALFSWQRVVEASDYDHYNPIEKDASSTG
FETLQHLNKDVCGWISLDGTKVDYPLLQSQDNVKYLDRNAFGDYTIMGS
IFLDYRFNPNFTDFNTIIYGHSMASGAMFGEIKKFADKEFFDQHRYGSI
YYNGRERGLEIFGILEVDAYDTEIYRTLSSKDEEHQAYYQYLLSKAKYK
RDVSLT (SEQ ID NO:1123)

[0414] A number of embodiments of the inventive methods and compositions have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention.

Table 1: Pilus and Pilus II Screening Results

Strain Identity & Pilus Presence				Patient Information				Strain Source Information		
Strain	Serotype	Pilus	Pilus II	Year	Age (yrs)	Sex	Diagnosis	Source	Country	Reference
19FIJ	19F	No	No					Iceland		Same ST of NCTC11906
England14-9	14	No	No					PMEN	England	PN93/872/B (ATCC 700676)
PN137	14	No	No	1999	51	F	meningitis	ISS	Italy - Arezzo	Same ST of England14-9 / mefA
PN099	14	No	No	1998	9 mos.	M	meningitis	ISS	Italy - Reggio Emilia	erm
Spain14-5	14	No	No	1990				PMEN	Spain	MS22 (ATCC 700902)
CSR14-10	14	No	No	1987				PMEN	Slovakia	87-029055 (ATCC 700677)
Tennessee23F-4	23F	No	No	1991	1	F	bacteraemia	PMEN	USA	CS111 (ATCC 51916)
South Africa19A-13	19A	No	No					PMEN	South Africa	51702 (ATCC 700904)
67A	8	No	No				Meningitis	Brazil	Brazil	
G54	19F	No	No					Lab strains	Italy	Complete - Glaxo Wellcome
South Africa19A-7	19A	No	No	1989				PMEN	South Africa	17619 (ATCC 700674)
Spain23F-1	23F	No	No	1984	67		pneumonia	PMEN	Spain	SP264 (ATCC 700669) - Finishing - Sanger
Spain6B-2	6B	Yes[a]	No	1988			other	PMEN	Spain	GM17 (ATCC 700670)
1889	18C	No	No	1996			sepsis	ISS	Italy - Bergamo	(ST100 generally associated to serotypes 33F)
AP141	14	No	No	2002	38		sepsis	ISS	Italy - Bergamo	
AP173	14	No	No	2003	3		sepsis	ISS	Italy - Novara	
6BIJ	6B	Yes[a]	No					Iceland		
PT051	14	Yes[b]	No	2001	49		sepsis	ISS	Italy - Torino	Same ST of Spain9V-3 / erm

Spain9V-3	9V	Yes[c]	No	1993				PMEN	France	TL7/1993 (ATCC 700671)
Poland23F-16	23F	Yes[a]	No	1999	13	F	LRTI	PMEN	Poland	178 (ATCC BAA-343)
PB011	6B	Yes[d]	No	2001	11 mos.		meningitis	ISS	Italy - Bari	
PB001	3	No	No	2001			meningitis	ISS	Italy - Bari	erm
PT131	3	No	No	2002	34		pneumonia	ISS	Italy - Novara	
70A	3	No	no				Meningitis	Brazil	Brazil	
OXC141	3	No (by BLAST)	no					Sanger		Finishing - Sanger
South Africa6B-8	6B	No	No	1990				PMEN	South Africa	50803 (ATCC 700675)
AP/PT108	7F	No	Yes	2003	3		sepsis	ISS	Italy - Cuneo	erm
32/14	7F	No	Yes	1999	<5		carriage	ISS	Italy - Roma	
PN195	7F	No	Yes	2002	44		meningitis	ISS	Italy - Napoli	
86A	7F	No	Yes				Meningitis	Brazil	Brazil	
16117	18C	No	No		10 mos.		Carriage	Brazil	Brazil	
6054	18C	No	No		6		Carriage	Brazil	Brazil	
19135	18C	No	No		10		Carriage	Brazil	Brazil	
TIGR4	4	Yes[c]	No		30	M	meningitis	Lab strains	Norway-Kongsvinger	JNR.7/87 (ATCC BAA-334) - Complete - TIGR
INV104B	1	No (by BLAST)	Yes					Sanger		Finishing - Sanger
PNS28	14	No	No	2001			sepsis	ISS	Italy - Perugia	Same ST of Clone 32
Taiwan19F-14	19F	Yes[c]	Yes	1997			meningitis	PMEN	Taiwan	TW31 (ATCC 700905)
Taiwan23F-15 (**)	23F	Yes[e]	No	1997			bacteraemia	PMEN	Taiwan	TW17 (ATCC 700906)
Hungary19A-6	19A	Yes[a]	No	1989				PMEN	Hungary	HUN663 (ATCC 700673)
Finland6B-12	6B	Yes[a]	No	1987				PMEN	Finland	43362 Fi10 (ATCC 700903)
SP307	5	No	No	2000	3		sepsis	ISS	Italy - Bergamo	
PT075	5	No	No	2001	61		sepsis	ISS	Italy - Torino	
96A	5	No	no				Meningitis	Brazil	Brazil	

PN57	1	No	No	1997			meningitis	ISS	Italy - Roma	Same ST of INV1871
P1031	1	No	No	2002	45	F	Meningitis	Ghana	Ghana	
P1074	1	No	No	2003	70	M	Meningitis	Ghana	Ghana	
PN110	1	No	Yes	1998	5		meningitis	ISS	Italy - Lecco	
PB013	1	No	Yes	2002			sepsis	ISS	Italy - Bari	erm
SPPD	1	No	Yes	2005			bilateral pneumonia + sepsis	Padova	Italy-North	(isolated from from BE; patient's sera available)
D39	2	No	No	1916			pneumonia	Lab strains	Caucasian	NCTC 7466
R6	cps-	No	No	1930				Lab strains	USA	(ATCC BAA-255) - Complete - Eli Lilly
P1054	1	No	No	2001	32	F	Meningitis	Ghana	Ghana	
1IJ	1	No	No					Iceland		
2010	34	No	No		3		Carriage	Brazil	Brazil	
30A	3	Yes?[b]	no				Meningitis	Brazil	Brazil	
3IJ	3	No	No					Iceland		
PN95	3	No	No	1998	65		meningitis	ISS	Italy - Milano	
PNS32	14	No	No	2001	32		sepsis	ISS	Italy - Napoli	Same ST of Sweden15A-25 / erm
27/13	14	No	No	1999	<5		carriage	ISS	Italy - Roma	
6AIJ	6A	No	No					Iceland		
117	4	Yes[b]	no				Meningitis	Brazil	Brazil	
JJA	14	No	no				Meningitis	Brazil	Brazil	
279A	14	No	no				Meningitis	Brazil	Brazil	
P1040	14	No	No	2002	0	M	meningitis	Ghana	Ghana	
P1059	6A	No	No	2002	47	F	meningitis	Ghana	Ghana	
P1075	14	No	No	2003	8	M	meningitis	Ghana	Ghana	
P1076	14	No	No	2003	0	F	meningitis	Ghana	Ghana	
P1077	14	No	No	2003	54	M	meningitis	Ghana	Ghana	
P1083	38	Yes[f]	No	2003	58	M	meningitis	Ghana	Ghana	
P1086	4	No	No	2002			meningitis	Ghana	Ghana	
P1095	4	No	No	2004				Ghana	Ghana	
P1101	38	No	No	2004				Ghana	Ghana	

P1104	4	No	No	2004				Ghana	Ghana	
PJ1466	7F	no	Yes					Sweden	Sweden	
PJ176	14	no	No					Sweden	Sweden	
PJ1354	1	no	Yes					Sweden	Sweden	
I101	3	no	No					Sweden	Sweden	
P1022	3	No	No	2001	1	M	meningitis	Ghana	Ghana	
P1068	10F	No	No	2003	42	M	meningitis	Ghana	Ghana	
RP1554	9V	yes[c]	No		68			Sweden	Sweden	
RP3718	9V	yes[b]	No		4			Sweden	Sweden	
AP207	9V	Yes	No	2003	71		meningitis	ISS	Italy	
PT052	9V	Yes	No	2001	74		meningitis	ISS	Italy	
PN131	24F	Yes	No	1998	72	M	meningitis	ISS	Italy	
AP062	9V	Yes	No	2003	91			ISS	Italy	
AP233	6B	Yes	No	2003	82			ISS	Italy	
PT134	6B	Yes	No	2003	44			ISS	Italy	
PN6	6B	Yes	No	1996			meningitis	ISS	Italy	
PN20	6B	Yes	No	1997	1	M	meningitis	ISS	Italy	
PN68	6B	Yes	No	1997	65	F	meningitis	ISS	Italy	
PN126	6B	Yes	No	1998	3	M	meningitis	ISS	Italy	
SP95	6B	Yes	No	1999	4	F	meningitis	ISS	Italy	
AP174	6B	Yes	No	2003	18			ISS	Italy	
PN217	6B	No	No	2003			meningitis	ISS	Italy	
1404	6B	Yes	No	1999		F	carriage	ISS	Italy	
Pn102	6B	Yes	No	1998	2	F	meningitis	ISS	Italy	
PB018	6B	Yes	No	2001				ISS	Italy	
PN218	19F	No	No	2003	58		meningitis	ISS	Italy	
AP235	23F	No	No	2003	63			ISS	Italy	
PGX1416	19F	Yes	Yes					ISS		proviene dalla GSK
SME15	35B	Yes[f]	No					Sweden	Sweden	
PJ1423	4	Yes	No					Sweden	Sweden	

Pilus Type: [a] 6B/c; [b] T4; [c] T4/c; [d] 6B; [e] 23F/c; [f] 23F

What is claimed is:

1. An isolated pilus encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

2. The pilus of claim 1, wherein the pilus comprises a sortase.

3. The pilus of claim 1, wherein the pilus comprises a LPXTG cell wall anchored protein.

4. The pilus of claim 1, wherein the pilus has been separated from cells by enzymatic digestion or mechanical shearing.

5. The pilus of claim 1, wherein the mechanical shearing comprises ultrasonication.

6. The pilus of claim 1, wherein the pilus is substantially free of bacterial cells.

7. An immunogenic composition comprising one or more pili of claim 1.

8. A method of producing the pilus of claim 1, the method comprising subjecting a bacterial cell that produces the pilus to enzymatic digestion or mechanical shearing and isolating the pilus from the cell.

9. An isolated *Streptococcus pneumoniae* sortase, wherein the sortase is one of SEQ ID NO:282, SEQ ID NO:1386, SEQ ID NO:676, or SEQ ID NO:1123.

10. An isolated *Streptococcus pneumoniae* LPXTG cell wall anchored protein, wherein the LPXTG cell wall anchored protein is one of SEQ ID NO:2, SEQ ID NO:4, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, or SEQ ID NO:9.

11. A method of isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) comprising:

subjecting bacterial cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to enzymatic digestion or mechanical shearing; and

isolating the pili from the cells.

12. The method of claim 11, wherein the mechanical shearing involves ultrasonication.

13. The method of claim 11, wherein the enzymatic digestion is performed using mutanolysin.

14. The method of claim 11, wherein the isolating comprises one or more density gradient centrifugations.

15. The method of claim 11, wherein the isolating comprises reducing polydispersity.

16. The method of claim 15, wherein polydispersity is reduced by separating components by size.

17. An antibody that specifically binds to a pilus encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

18. The antibody of claim 17, wherein the antibody is a monoclonal antibody, a polyclonal antibody, a chimeric antibody, a human antibody, a humanized antibody, a single-chain antibody, or a Fab fragment.

19. The antibody of claim 17, wherein the antibody is labeled.

20. The antibody of claim 19, wherein the label is an enzyme, radioisotope, contrast agent, toxin, or fluorophore.

21. The antibody of claim 17, wherein the antibody specifically binds to one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

22. The antibody of claim 17, wherein the antibody specifically binds to one or more LPXTG cell wall anchored proteins selected from the group consisting of SEQ ID NO:2, SEQ ID NO:4, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, and SEQ ID NO:9.

23. The antibody of claim 17, wherein the antibody specifically binds to one or more sortase selected from the group consisting of SEQ ID NO:282, SEQ ID NO:1386, SEQ ID NO:676, or SEQ ID NO:1123.

24. An immunogenic composition comprising a purified *Streptococcus pneumoniae* pilus II island (INV104B) polypeptide in oligomeric form.

25. The immunogenic composition of claim 24, wherein the oligomeric form is a hyperoligomer.

26. The immunogenic composition of claim 24, wherein the polypeptide is a fragment of a LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

27. The immunogenic composition of claim 26, wherein the fragment is at least 100 contiguous amino acid residues in length.

28. The immunogenic composition of claim 26, wherein the fragment is at least 50 contiguous amino acid residues in length.

29. The immunogenic composition of claim 26, wherein the fragment is at least 20 contiguous amino acid residues in length.

30. The immunogenic composition of claim 26, wherein the fragment retains the ability to covalently attach to a peptidoglycan cell wall.

31. The immunogenic composition of claim 26, wherein the fragment retains the ability to cross-link to another fragment or protein through an LPXTG motif.

32. The immunogenic composition of claim 24, wherein the polypeptide comprises two or more fragments of LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

33. A method of inducing an immune response against *Streptococcus pneumoniae*, the method comprising administering an effective amount of pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to a subject.

34. The method of claim 33, wherein the pili are isolated.

35. The method of claim 33, wherein the subject is human.

36. A method of detecting a *Streptococcus pneumoniae* infection in a subject, the method comprising assaying a sample from the subject for the presence of an antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

37. The method of claim 36, wherein the antibody preferentially binds to a pili complex compared to a pili component.

38. The method of claim 36, wherein the sample is serum.

39. The method of claim 36, wherein the subject is human.

40. A method of detecting a *Streptococcus pneumoniae* infection in a subject, the method comprising contacting a sample with an antibody of claim 17 and detecting binding of the antibody to a component of the sample.

41. The method of claim 40, wherein the antibody preferentially binds to a pili complex compared to a pili component.

42. The method of claim 40, wherein the sample is serum.

43. The method of claim 40, wherein the subject is human.

44. A method of treating a subject having a *Streptococcus pneumoniae* infection, the method comprising administering to the subject an effective amount of an agent that binds specifically to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

45. The method of claim 44, wherein the agent is an antibody.

46. The method of claim 45, wherein the antibody is a monoclonal antibody, a polyclonal antibody, a chimeric antibody, a human antibody, a humanized antibody, a single-chain antibody, or a Fab fragment.

47. The method of claim 45, wherein the antibody blocks attachment of *Streptococcus pneumoniae* to cells.

48. The method of claim 47, wherein the cells are epithelial cells.

49. The method of claim 48, wherein the epithelial cells are lung or nasopharyngeal epithelial cells.

50. The method of claim 45, wherein the antibody specifically binds to one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

51. The method of claim 47, wherein the antibody blocks at least 50% of *Streptococcus pneumoniae* attachment to the cell measured in an assay measuring attachment of *Streptococcus pneumoniae* to A549 lung epithelial cells, as compared to a control.

52. The method of claim 44, wherein the subject is human.

53. A method of determining the course of treatment for a subject having a *Streptococcus pneumoniae* infection, the method comprising:

assaying a sample from the subject for the presence of an antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B); and

administering to the subject an anti-inflammatory agent if the presence of the antibody is detected.

54. The method of claim 53, wherein the subject is human.

55. A method of determining the course of treatment for a subject having a Streptococcus pneumoniae infection, the method comprising:

assaying a sample from the subject for the presence of an antibody to pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B); and

administering to the subject an antibiotic agent if the presence of the antibody is not detected.

56. The method of claim 55, wherein the subject is human.

57. An isolated pilus or pilus-like multimer comprising a polypeptide comprising the amino acid sequence of a pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) with up to 30 amino acid substitutions, insertions, or deletions.

58. The pilus or pilus-like multimer of claim 57 with up to 20 amino acid substitutions, insertions, or deletions.

59. The pilus or pilus-like multimer of claim 57 with up to 10 amino acid substitutions, insertions, or deletions.

60. The pilus or pilus-like multimer of claim 57 with up to 5 amino acid substitutions, insertions, or deletions.

61. The polypeptide of any one of the claims 57-60 wherein the amino acid substitutions, insertions, or deletions are amino acid substitutions.

62. The polypeptide of claim 61, wherein the amino acid substitutions are conservative amino acid substitutions.

63. The polypeptide of claim 57, wherein the protein is a LPXTG cell wall anchored protein.

64. A polypeptide comprising the amino acid sequence of one or more LPXTG cell wall anchored proteins encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), or immunogenic fragments thereof.

65. The polypeptide of claim 64, wherein the polypeptide comprises the amino acid sequences of two or more LPXTG cell wall anchored proteins, or immunogenic fragments thereof.

66. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:2.

67. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:2.

68. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:2.

69. The purified polypeptide of claim 68, wherein the sequence is at least 90% identical to SEQ ID NO:2.

70. The purified polypeptide of claim 68, wherein the sequence is at least 95% identical to SEQ ID NO:2.

71. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:4.

72. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:4.

73. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:4.

74. The purified polypeptide of claim 73, wherein the sequence is at least 90% identical to SEQ ID NO:4.

75. The purified polypeptide of claim 73, wherein the sequence is at least 95% identical to SEQ ID NO:4.

76. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:6.

77. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:6.

78. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:6.

79. The purified polypeptide of claim 78, wherein the sequence is at least 90% identical to SEQ ID NO:6.

80. The purified polypeptide of claim 78, wherein the sequence is at least 95% identical to SEQ ID NO:6.

81. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:7.

82. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:7.

83. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:7.

84. The purified polypeptide of claim 83, wherein the sequence is at least 90% identical to SEQ ID NO:7.

85. The purified polypeptide of claim 83, wherein the sequence is at least 95% identical to SEQ ID NO:7.

86. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:8.

87. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:8.

88. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:8.

89. The purified polypeptide of claim 88, wherein the sequence is at least 90% identical to SEQ ID NO:8.

90. The purified polypeptide of claim 88, wherein the sequence is at least 95% identical to SEQ ID NO:8.

91. A purified polypeptide, the amino acid sequence of which consists of SEQ ID NO:9.

92. A purified polypeptide comprising at least ten consecutive residues of SEQ ID NO:9.

93. A purified polypeptide, the amino acid sequence of which comprises a sequence at least 85% identical to SEQ ID NO:9.

94. The purified polypeptide of claim 93, wherein the sequence is at least 90% identical to SEQ ID NO:9.

95. The purified polypeptide of claim 93, wherein the sequence is at least 95% identical to SEQ ID NO:9.

96. A purified polypeptide, the amino acid sequence of which is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 29 through SEQ ID NO:1742, or an immunogenic fragment thereof.

97. The purified polypeptide of claim 96, wherein the sequence is at least 90% identical.

98. The purified polypeptide of claim 96, wherein the sequence is at least 95% identical.

99. The purified polypeptide of claim 96, wherein the sequence is selected from the group consisting of SEQ ID NO: 29 through SEQ ID NO:1742.

100. A purified polypeptide, the amino acid sequence of which is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 53, SEQ ID NO: 65, SEQ ID NO: 70, SEQ ID NO: 99, SEQ ID NO: 104, SEQ ID NO: 117, SEQ ID NO: 135, SEQ ID NO: 177, SEQ ID NO: 178, SEQ ID NO: 198, SEQ ID NO: 235, SEQ ID NO: 236, SEQ ID NO: 237, SEQ ID NO: 242, SEQ ID NO: 247, SEQ ID NO: 248, SEQ ID NO: 250, SEQ ID NO: 251, SEQ ID NO: 252, SEQ ID NO: 253, SEQ ID NO: 433, SEQ ID NO: 439, SEQ ID NO: 444, SEQ ID NO: 538, SEQ ID NO: 539, SEQ ID NO: 540, SEQ ID NO: 541, SEQ ID NO: 542, SEQ ID NO: 543, SEQ ID NO: 544, SEQ ID NO: 545, SEQ ID NO: 581, and SEQ ID NO: 593, or an immunogenic fragment thereof.

101. The purified polypeptide of claim 100, wherein the sequence is at least 90% identical.

102. The purified polypeptide of claim 100, wherein the sequence is at least 95% identical.

103. A purified polypeptide, the amino acid sequence of which is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 626, SEQ ID NO: 628, SEQ ID NO:

629, SEQ ID NO: 630, SEQ ID NO: 631, SEQ ID NO: 632, SEQ ID NO: 639, SEQ ID NO: 645, SEQ ID NO: 747, SEQ ID NO: 751, SEQ ID NO: 752, SEQ ID NO: 783, SEQ ID NO: 786, SEQ ID NO: 787, SEQ ID NO: 810, SEQ ID NO: 812, SEQ ID NO: 813, SEQ ID NO: 824, SEQ ID NO: 831, SEQ ID NO: 842, SEQ ID NO: 847, SEQ ID NO: 875, SEQ ID NO: 876, SEQ ID NO: 879, SEQ ID NO: 880, SEQ ID NO: 882, SEQ ID NO: 913, SEQ ID NO: 914, SEQ ID NO: 925, SEQ ID NO: 926, SEQ ID NO: 947, SEQ ID NO: 948, SEQ ID NO: 968, SEQ ID NO: 987, SEQ ID NO: 988, SEQ ID NO: 990, SEQ ID NO: 992, SEQ ID NO: 1003, SEQ ID NO: 1007, SEQ ID NO: 1008, SEQ ID NO: 1036, SEQ ID NO: 1082, SEQ ID NO: 1120, and SEQ ID NO: 1123, or an immunogenic fragment thereof.

104. The purified polypeptide of claim 103, wherein the sequence is at least 90% identical.

105. The purified polypeptide of claim 103, wherein the sequence is at least 95% identical.

106. A purified polypeptide, the amino acid sequence of which is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 1297, SEQ ID NO: 1309, SEQ ID NO: 1311, SEQ ID NO: 1343, SEQ ID NO: 1362, SEQ ID NO: 1364, SEQ ID NO: 1434, SEQ ID NO: 1451, SEQ ID NO: 1455, SEQ ID NO: 1466, SEQ ID NO: 14678, SEQ ID NO: 1470, SEQ ID NO: 1474, SEQ ID NO: 1484, SEQ ID NO: 1485, SEQ ID NO: 1486, SEQ ID NO: 1487, and SEQ ID NO: 1491, or an immunogenic fragment thereof.

107. The purified polypeptide of claim 106, wherein the sequence is at least 90% identical.

108. The purified polypeptide of claim 106, wherein the sequence is at least 95% identical.

109. A polynucleotide that encodes a polypeptide of claim 64, or immunogenic fragment thereof.

110. A purified antibody obtained by immunization of a subject with the polypeptide of claim 64.

111. A method of inducing an immune response against *Streptococcus pneumoniae*, the method comprising administering an effective amount of a polypeptide of claim 64 to a subject.

112. An immunogenic fragment of a LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

113. An isolated polynucleotide encoding the polypeptide or fragment of any of claims 57-65 or 112.

114. An isolated nucleic acid, the polynucleotide sequence of which consists of SEQ ID NO:1 or a degenerate variation of SEQ ID NO:1.

115. An isolated nucleic acid comprising a sequence that hybridizes under stringent conditions to a hybridization probe, the nucleotide sequence of the probe consisting of SEQ ID NO:1 or the complement of SEQ ID NO:1.

116. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:2.

117. The isolated nucleic acid of claim 116, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:2.

118. The isolated nucleic acid of claim 116, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:2.

119. An isolated nucleic acid, the polynucleotide sequence of which consists of SEQ ID NO:3 or a degenerate variation of SEQ ID NO:3.

120. An isolated nucleic acid comprising a sequence that hybridizes under stringent conditions to a hybridization probe, the nucleotide sequence of the probe consisting of SEQ ID NO:3 or the complement of SEQ ID NO:3.

121. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:4.

122. The isolated nucleic acid of claim 121, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:4.

123. The isolated nucleic acid of claim 121, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:4.

124. An isolated nucleic acid, the polynucleotide sequence of which consists of SEQ ID NO:5 or a degenerate variation of SEQ ID NO:5.

125. An isolated nucleic acid comprising a sequence that hybridizes under stringent conditions to a hybridization probe, the nucleotide sequence of the probe consisting of SEQ ID NO:5 or the complement of SEQ ID NO:5.

126. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:6.

127. The isolated nucleic acid of claim 121, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:6.

128. The isolated nucleic acid of claim 121, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:6.

129. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:7.

130. The isolated nucleic acid of claim 129, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:7.

131. The isolated nucleic acid of claim 129, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:7.

132. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:8.

133. The isolated nucleic acid of claim 132, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:8.

134. The isolated nucleic acid of claim 132, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:8.

135. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to SEQ ID NO:9.

136. The isolated nucleic acid of claim 135, wherein the amino acid sequence is at least 90% identical to SEQ ID NO:9.

137. The isolated nucleic acid of claim 135, wherein the amino acid sequence is at least 95% identical to SEQ ID NO:9.

138. An isolated nucleic acid comprising a sequence that encodes a polypeptide the amino acid sequence of which is at least 85% identical to a sequence selected from the group consisting of SEQ ID NO: 29 through SEQ ID NO:1742.

139. The isolated nucleic acid of claim 138, wherein the sequence is at least 90% identical.

140. The isolated nucleic acid of claim 138, wherein the sequence is at least 95% identical.

141. The isolated nucleic acid of claim 138, wherein the sequence is selected from the group consisting of SEQ ID NO: 29 through SEQ ID NO:1742.

142. A method of inducing an immune response against *Streptococcus pneumoniae*, the method comprising administering an affective amount of an immunogenic fragment of a LPXTG cell wall anchored protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to a subject.

143. The method of claim 142, wherein the subject is human.

144. A method of expressing an antibody to a pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) in a cell, the method comprising expressing a nucleic acid encoding the antibody to the pilus protein encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) in the cell.

145. The method of claim 144, wherein the pilus protein is a LPXTG cell wall anchored protein.

146. A method of inducing an immune response against *Streptococcus pneumoniae*, the method comprising administering an effective amount of a nucleic acid encoding the polypeptide of claim 64 to a subject.

147. A method of purifying *Streptococcus pneumoniae* from a sample comprising *Streptococcus pneumoniae*, the method comprising:

a) providing an affinity matrix comprising the antibody of claim 17 bound to a solid support;

b) contacting the sample with the affinity matrix to form an affinity matrix-*Streptococcus pneumoniae* complex;

c) separating the affinity matrix-*Streptococcus pneumoniae* complex from the remainder of the sample; and

d) releasing *Streptococcus pneumoniae* from the affinity matrix.

148. A method of delivering a cytotoxic agent or a diagnostic agent to *Streptococcus pneumoniae*, the method comprising:

a) providing the cytotoxic agent or the diagnostic agent conjugated to an antibody or fragment thereof of claim 17; and

b) exposing the *Streptococcus pneumoniae* to the antibody-agent or fragment-agent conjugate.

149. A method of identifying a binding modulator for pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), the method comprising contacting an animal cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a bacterial cell having pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the bacterial cell to the animal cell is inhibited, wherein inhibition of the binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

150. A method of identifying a binding modulator of an activity of pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), the method comprising contacting an cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the pili to the cell is inhibited, wherein inhibition of the binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

151. A method of identifying a binding modulator for pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), the method comprising contacting an cell susceptible to *Streptococcus pneumoniae* pili binding with a candidate compound and a pilus protein or cell binding fragment thereof encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), and determining whether binding of the pilus protein or cell binding fragment thereof to the cell is inhibited, wherein inhibition of the binding activity is indicative of an inhibitor of binding by pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

152. The method of claim 151, wherein the animal cell is isolated or cultured.

153. A method of isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B), the method comprising:

subjecting *Streptococcus pneumoniae* cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) to ultrasonication or digestion with a lytic enzyme;

separating non-cellular components by density gradient centrifugation; and

isolating pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B).

154. The method of claim 153, wherein the lytic enzyme is mutanolysin.

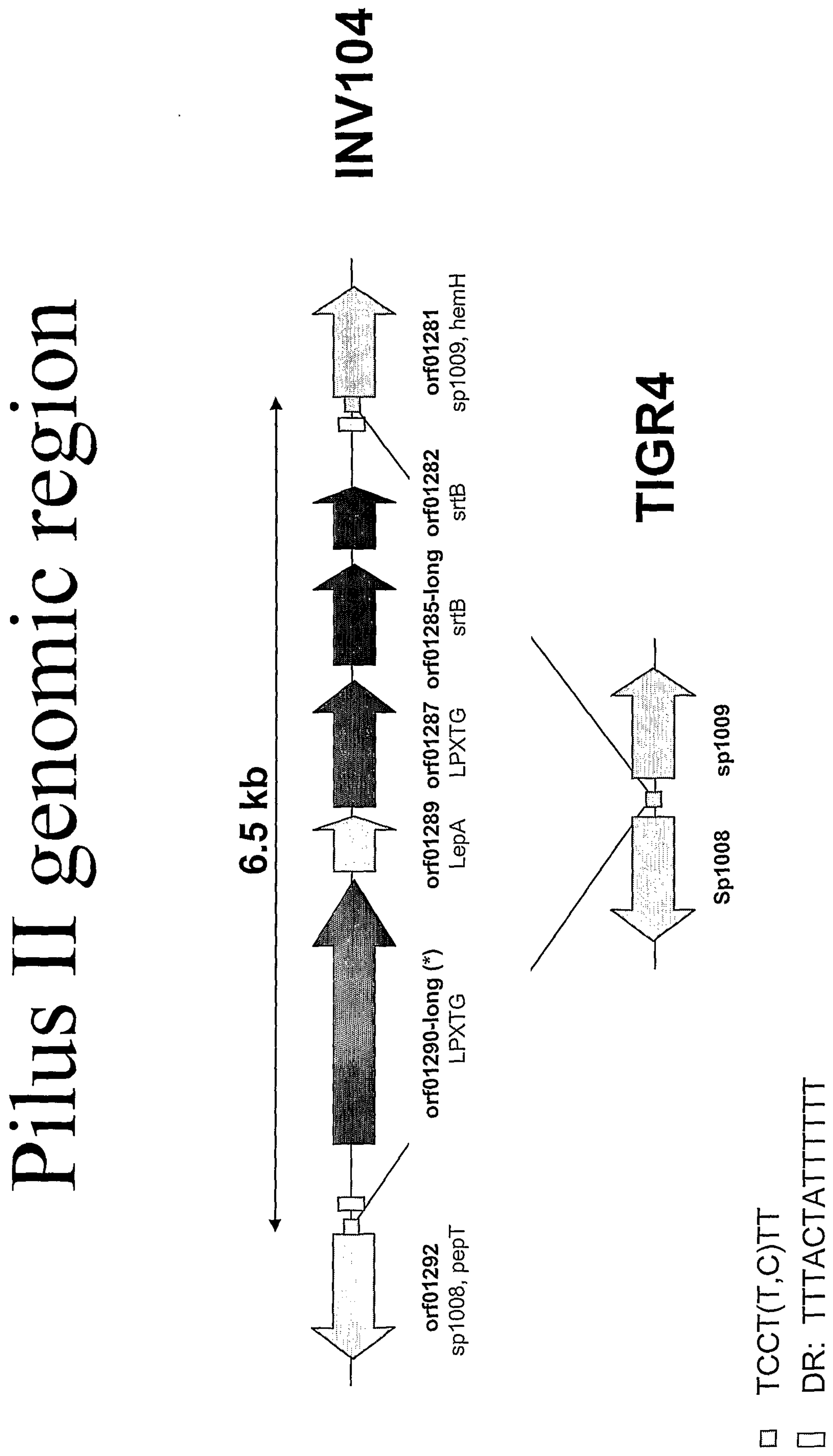
155. The method of claim 153, wherein the non-cellular components are separated using density gradient centrifugation.

156. The method of claim 153, wherein the *Streptococcus pneumoniae* cells that produce pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) are *Streptococcus pneumoniae* TIGR4 cells.

157. The method of claim 153, wherein the method further comprises degrading nucleic acids with a nuclease.

158. The method of claim 153, wherein the method further comprises reducing polydispersity by separating the pili encoded by the *Streptococcus pneumoniae* pilus II island (INV104B) by size using gel filtration chromatography.

FIGURE 1


Pilus II genomic region
INV104
6.5 kb
orf01292
sp1008, pepT
orf01290-long (*)
LPXTG
orf01289
LepA
orf01287
LPXTG
orf01285-long
srtB
orf01282
srtB
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sp1009, hemH
TIGR4
Sp1008
sp1009
TCCT(T,C)TT
DR: TTTACTATTTTTT

FIGURE 2

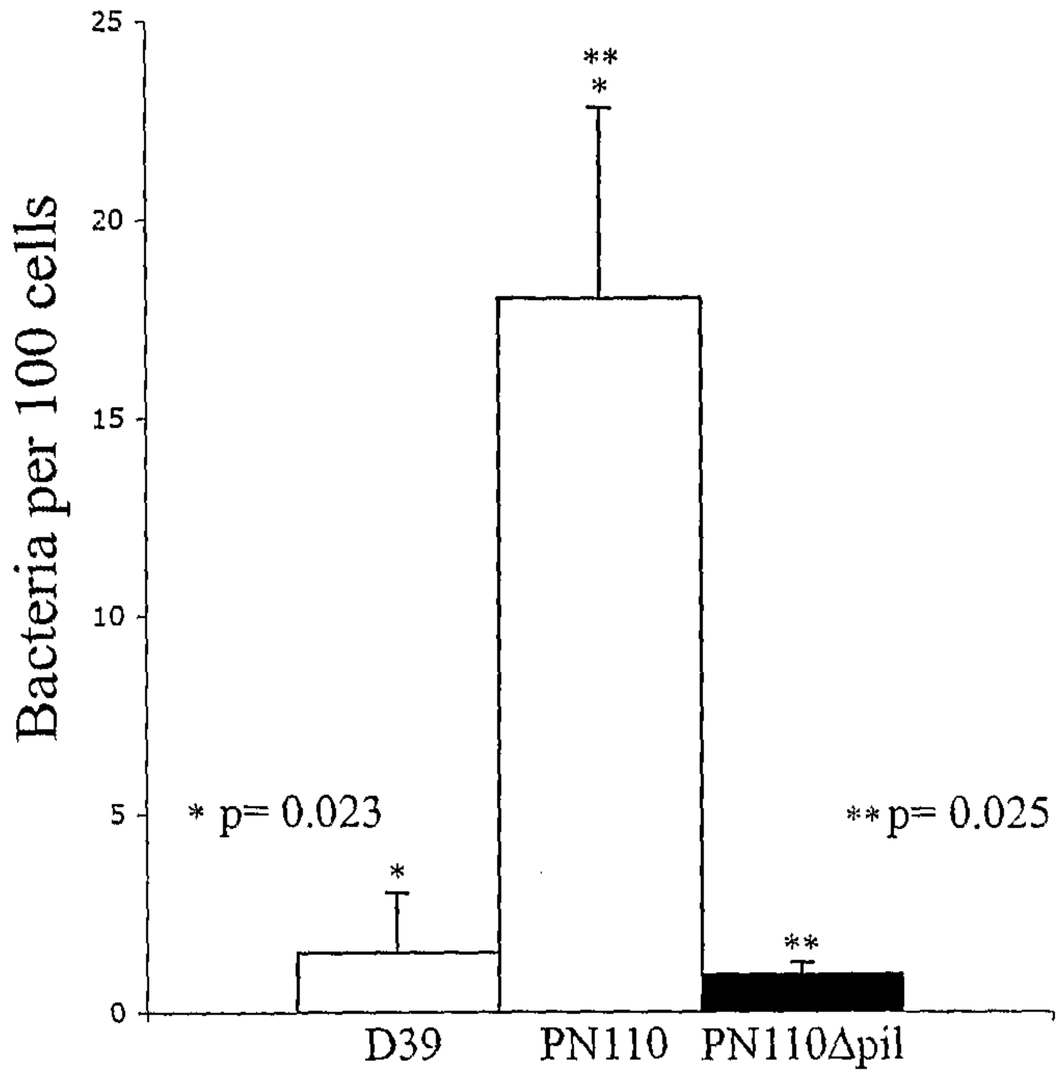


FIGURE 3

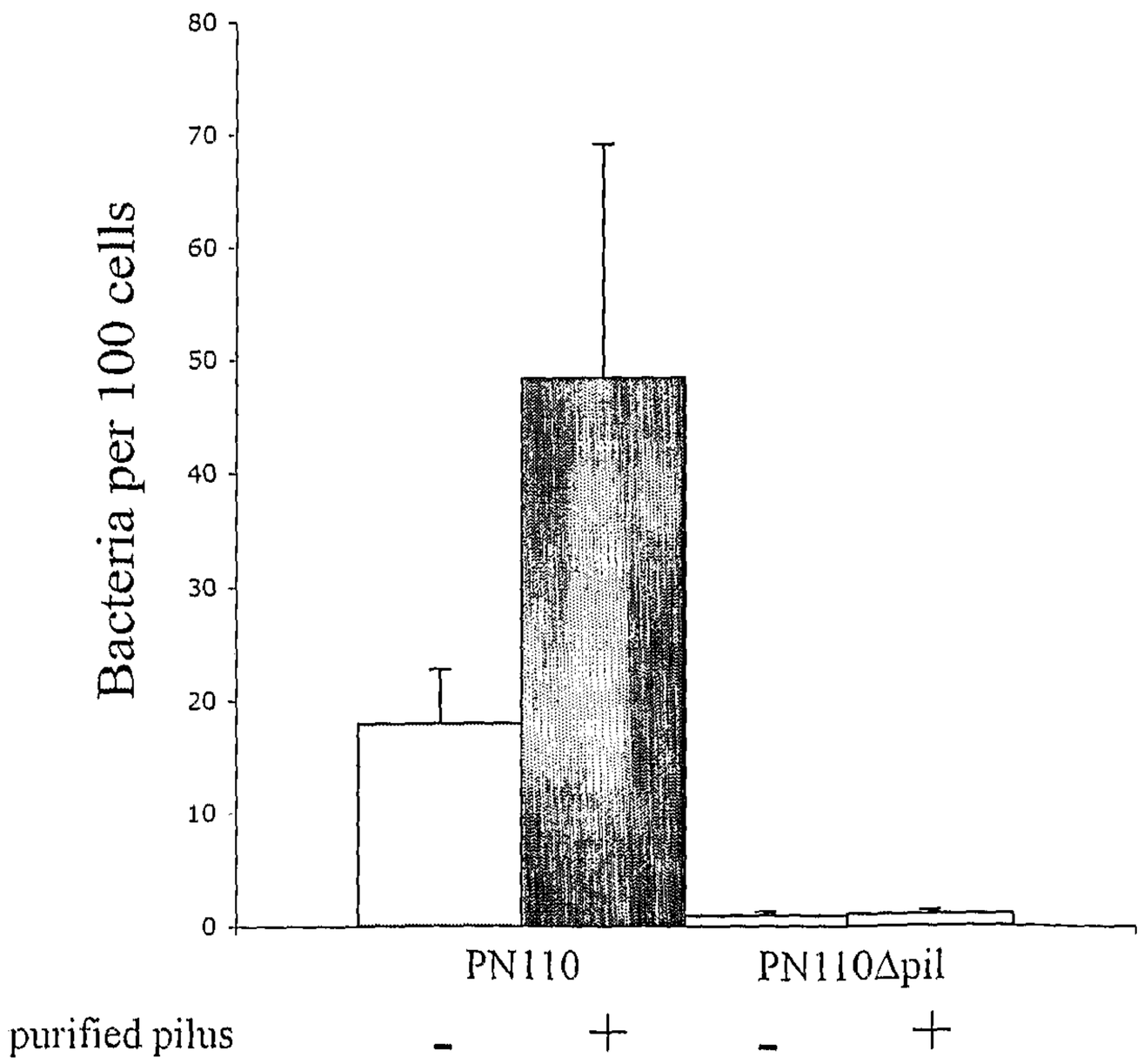
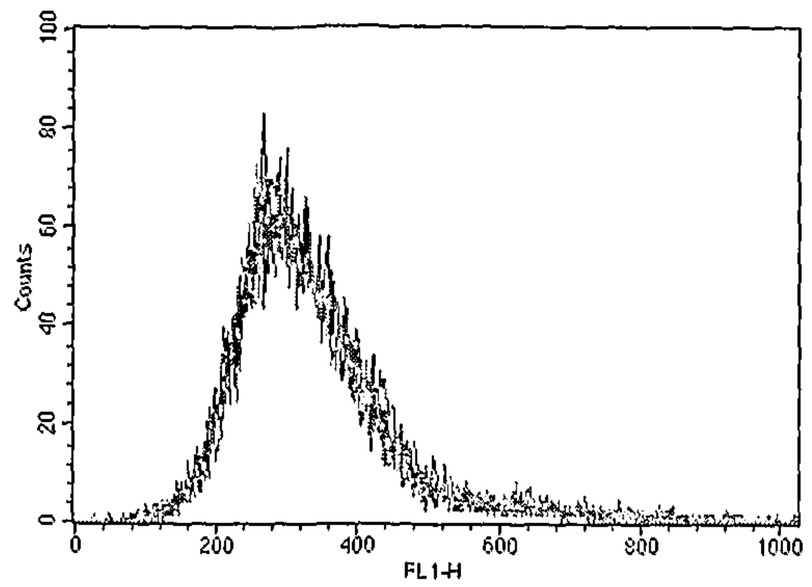
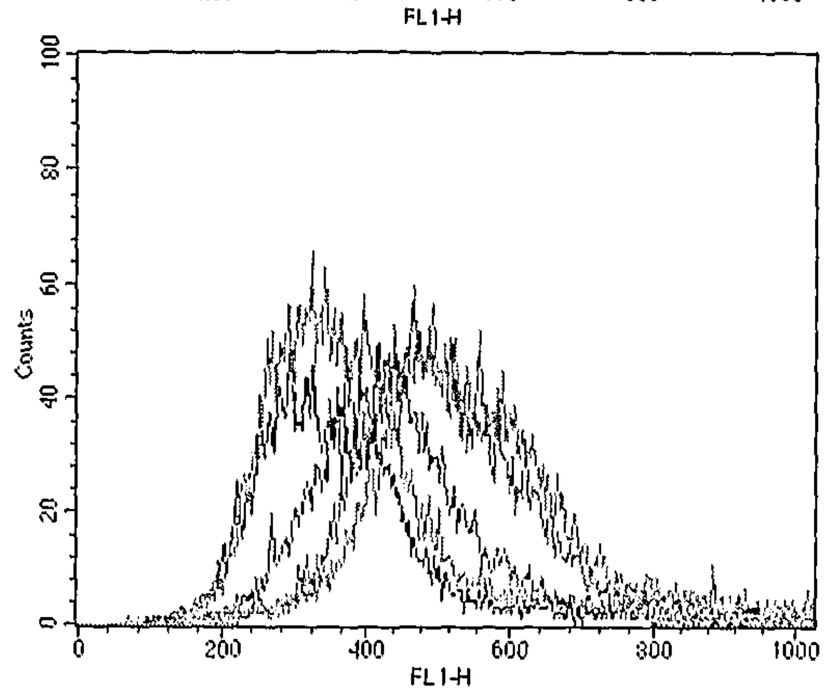


FIGURE 4

01287



RrgA



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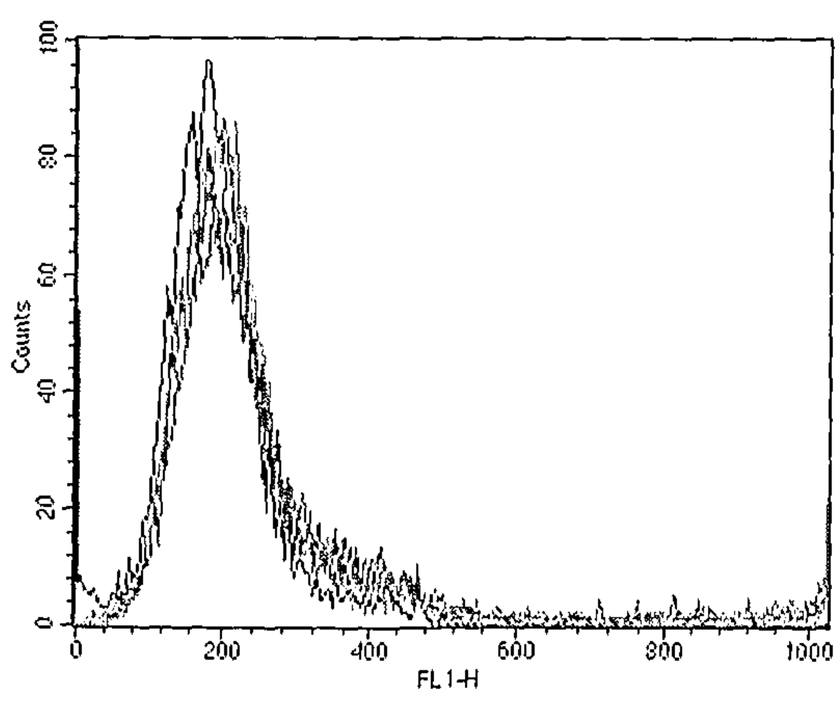
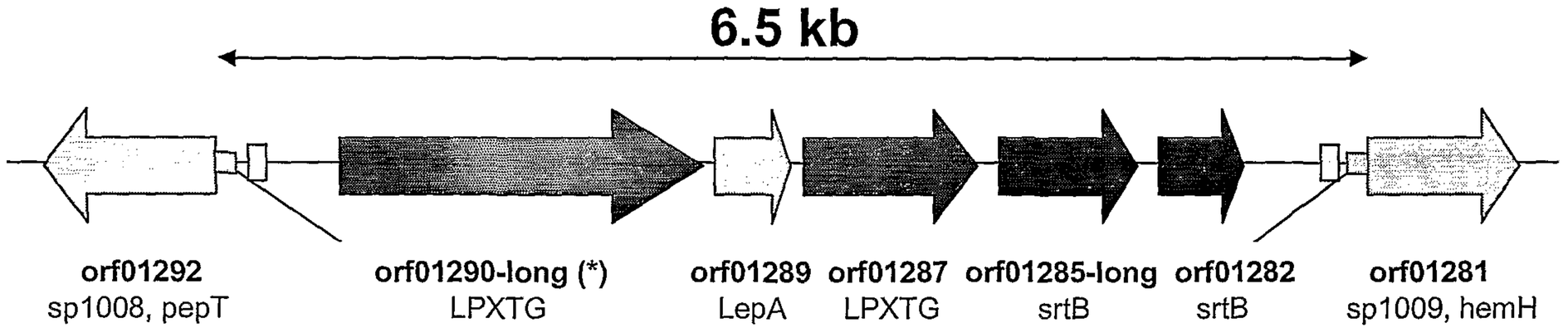


Pilus II genomic region



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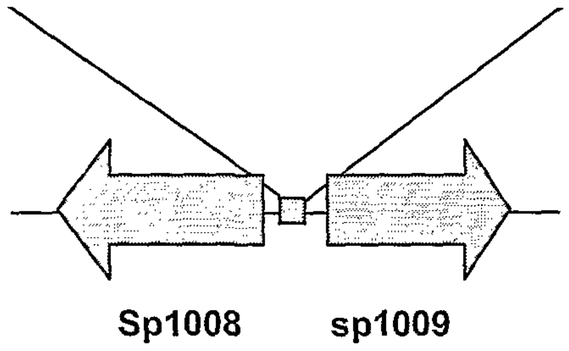

TIGR4

- TCCT(T,C)TT
- DR: TTTACTATTTTTT

FIG 1