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(54) **GRAM POSITIVE BACTERIAL MUTANTS AND METHODS OF GENERATING AND USING SUCH MUTANTS**

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(57) **ABSTRACT**

The present invention concerns gram positive bacterial mutants, particularly staphylococcus mutants of the Newman strain. It also involves transposable elements that can be used to generate these mutants, as well as methods of creating such mutants with these elements. The inventions also includes methods of using the bacterial mutants to screen for different types of genes, including virulence genes, which can lead to assays for drug compounds useful in the treatment of bacterial infection.

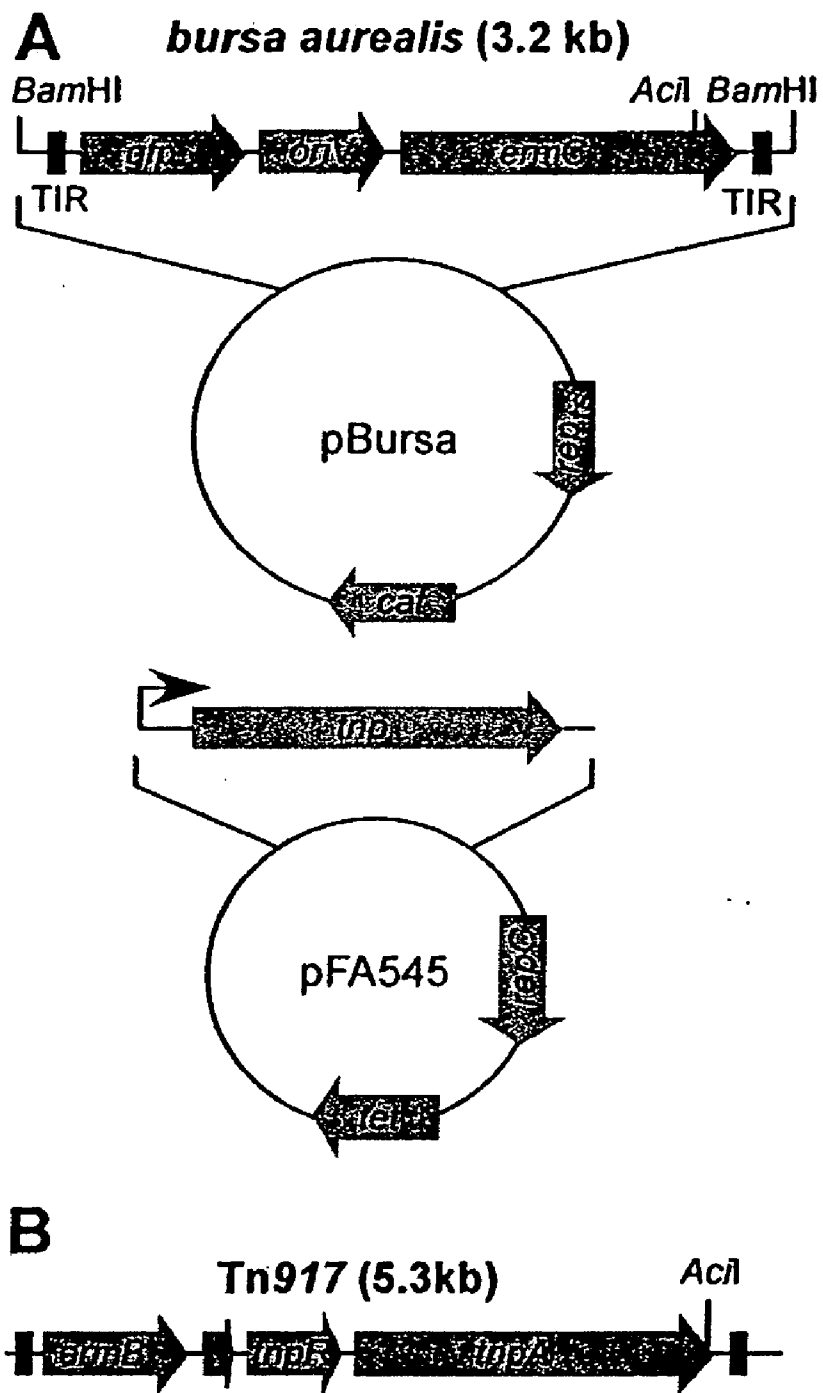


FIG. 1

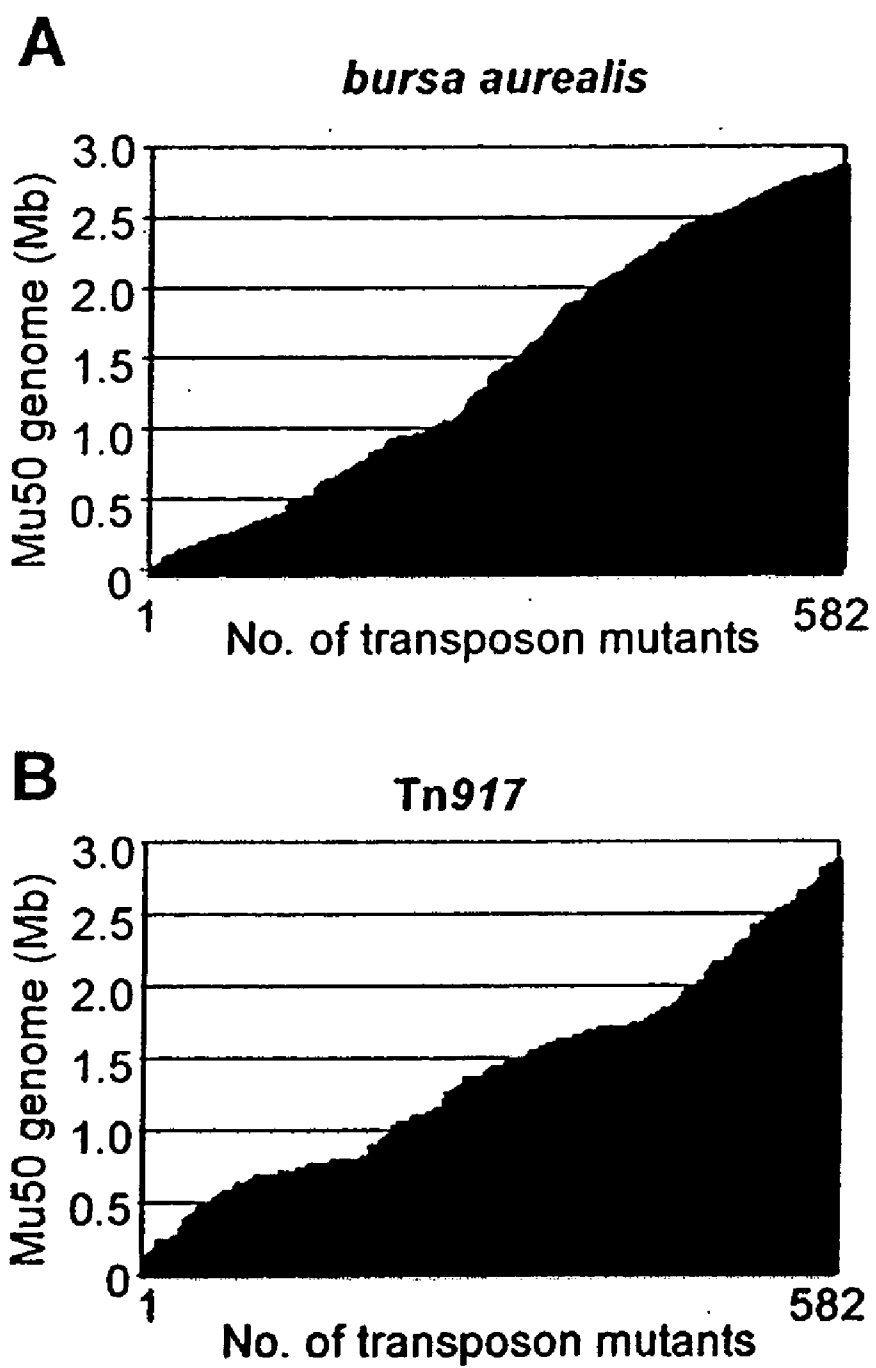


FIG. 2

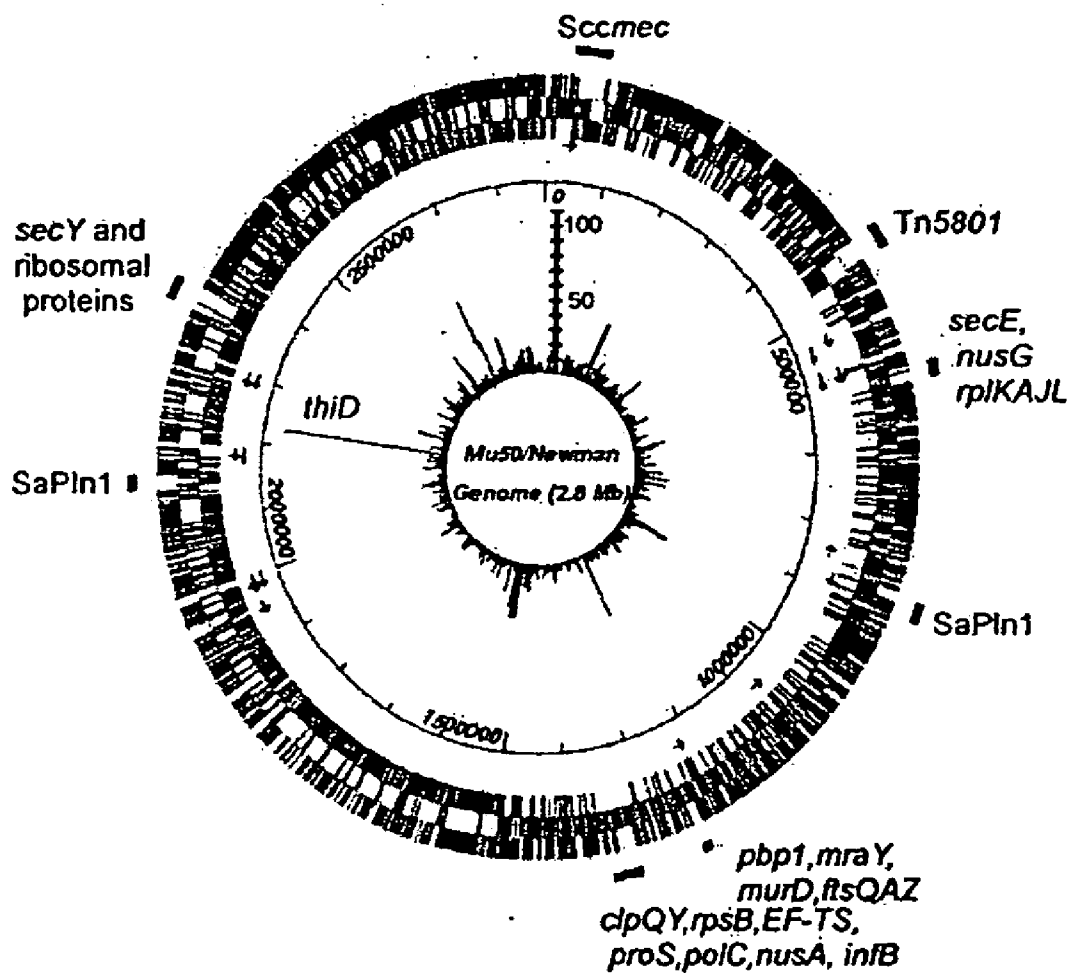


FIG. 3

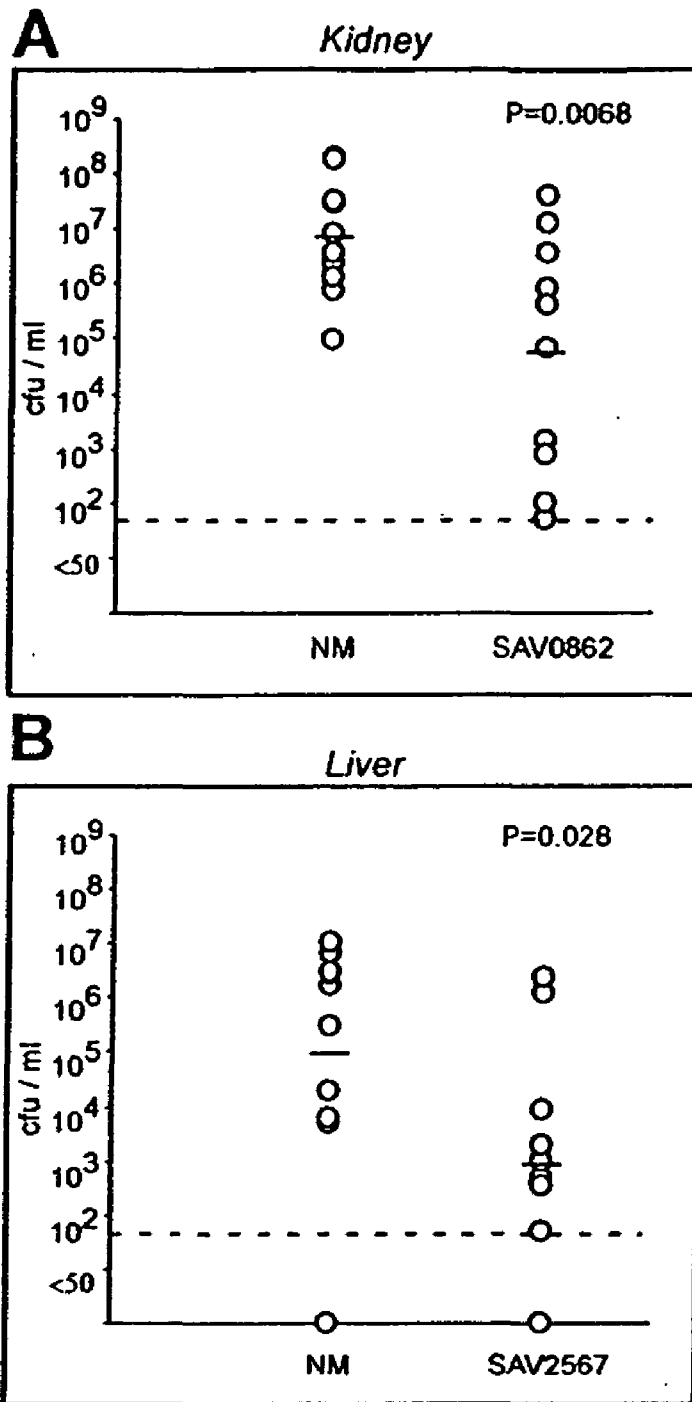


FIG. 4

**GRAM POSITIVE BACTERIAL MUTANTS AND METHODS OF GENERATING AND USING SUCH MUTANTS**

**BACKGROUND OF THE INVENTION**

[0001] This application claims priority to U.S. Provisional Patent Application serial number 60/591,007 filed on Jul. 26, 2004, which is hereby incorporated by reference in its entirety.

[0002] 1. Field of the Invention

[0003] The present invention relates generally to the fields of microbiology and pathology. More particularly, it concerns methods and compositions involving *Staphylococcus aureus* mutants.

[0004] 2. Description of Related Art

[0005] Previous work has been done on *Staphylococcus aureus* to identify staphylococcal virulence factors using Tn917 and signature tagged mutagenesis (Hartley et al., 1986; Mei et al., 1997). Libraries of 1248 or 1520 randomly chosen (non-sequenced) transposon insertion mutants of *S. aureus* were analyzed in animal infections with mixed populations to reveal a competitive disadvantage of individual variants. Based on the distribution of Tn917 knockout mutations that were analyzed here, it is estimated that these studies examined approximately 400-500 *S. aureus* genes. Only about 20% of all *S. aureus* genes were analyzed; such studies provide important forays into defining the roles of specific *S. aureus* genes during the pathogenesis of specific infectious diseases (Mei et al., 1997).

[0006] Gene function in *S. aureus* has been previously examined using antisense technology (Ji et al., 2001; Forsyth et al., 2002). By cloning gene fragments in reversed orientation under control of an inducible promoter, the ability of antisense nucleotide sequences to interfere with *S. aureus* growth on agar plates was used to identify essential genes. In two independent studies, only 30% of all gene sequences (350 genes) in each study identified the same gene (75 genes total) (Ji et al., 2001; Forsyth et al., 2002).

[0007] However, a mutagenesis scheme that generates mutations throughout the *S. aureus* genome and a more thorough analysis of such mutants are needed to gain a further understanding of *S. aureus* virulence and to identify new therapeutic and preventative agents.

**SUMMARY OF THE INVENTION**

[0008] The present invention concerns gram positive bacterial mutants, as well as their production and use. It is based on the creation of a transposable nucleic acid element that can be used in gram positive bacteria, particularly *Staphylococcus* bacteria, to generate mutations, including mutations in virulence genes. These mutants can be screened for virulence genes, as well as other classes of genes, to engage in further study and experimentation. Thus, the present invention encompasses nucleic acid elements, bacterial mutants, production methods, screening methods, and therapeutic methods.

[0009] In some embodiments, the invention covers a transposable nucleic acid element, which can be incorporated into the genome of a heterologous organism, such as a gram positive bacterium. Particularly contemplated is an element

comprising a pair of inverted repeat sequences recognized by a Himar 1 transposase, wherein an inverted repeat sequence is at each end of the element (referred to as "Himar 1 element"). The element may contain other nucleic acid sequences. In further embodiments, the element has, but is not limited to, at least one screenable marker gene. The element may have, have at least, or have at most 1, 2, 3, 4, 5, 6 or more screenable marker genes, as well as promoters or other control elements for expression of polypeptides that may be encoded by the sequences. Such screenable markers may encode for polypeptides that are calorimetric, fluorescent, or enzymatic. In certain cases, the screenable marker could be a selectable marker gene. Furthermore, an element may contain one or more selectable marker genes and/or one or more non-selectable (but screenable) marker genes. In some cases, the element has a selectable marker gene that encodes a polypeptide conferring antibiotic resistance. The resistance can be, but is not limited to, an antibiotic selected from the group consisting of erythromycin, tetracycline, spectinomycin, and chloramphenicol. In specific embodiments, the antibiotic is erythromycin or tetracycline.

[0010] The screenable marker can be used to identify an organism in which the element has been incorporated intrachromosomally or episomally. In particular cases, it can be used to identify organisms that have the element inserted into a chromosome. Alternatively, a screenable element can be used to identify or characterize nucleic acid control sequences near or at the site of integration. In some instances a screenable marker lacks a promoter so as to identify or characterize a nucleic acid sequence at the site of integration that provides a promoter sequence. The identification of enhancers can similarly be implemented. In some embodiments, the screenable marker is a gene encoding a colorimetric polypeptide, such as a green fluorescent protein.

[0011] The present invention specifically includes the transposable element termed *Bursa aurealis*, which refers to a transposable element having 1) an inverted repeat sequence in which there is the sequence



[0012] toward the 5' end of the element ("toward the end" means that a portion of the element is within 50 nucleotides of the end) and the sequence



is downstream toward the 3' end of the element; and 2) the ermC resistance marker. In certain embodiments, it also has 3) a green fluorescent protein gene without a promoter. It is contemplated that SEQ ID NO:4 and/or SEQ ID NO:5 may be placed into other elements with one or more functional genes, such as a selectable or screenable marker. Moreover, in some embodiments, the sequence of *Bursa aurealis* is SEQ ID NO:3, which contains both SEQ ID NO:4 and SEQ ID NO:5. One of the sequences in the pair of inverted repeat sequences (SEQ ID NO:4) is toward or at the end of the element while the other sequence in the pair of inverted repeat sequences (SEQ ID NO:5) is toward or at the other end of the element. It is contemplated that concomitant

changes (changes in both sequences) may be made and still enable the pair to be used as a transposable element recognized by the Himar 1 transposase.

[0013] Nucleic acids of the invention can have, have at most or have at least the following number of contiguous nucleotides from SEQ ID NO: 1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, and SEQ ID NO:1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 441, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 31, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 6000, 7000, 8000, 9000, 10000 or more, or any range derivable therein. Nucleic acids of the invention also include the full-lengths of SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, and SEQ ID NO:5. Bacteria of the invention may have all or part of these SEQ ID NOs as well.

[0014] In certain embodiments, the transposable element is contained within a plasmid or other vector. In certain embodiments, the plasmid of vector also includes an origin of replication, which comprises a temperature-sensitive replicon. The term “temperature-sensitive replicon” connotes a region that controls the replication of the plasmid or vector in a temperature-sensitive manner. There will be a temperature range at which replication can occur (permissive temperature) and a higher temperature at which replication no longer occurs (non-permissive temperature).

[0015] In certain embodiments of the invention, there is a nucleic acid encoding a transposase that recognizes and transposes the transposable element of the invention. The transposase is a hornfly transposase, meaning it is a transposase derived from the hornfly. In certain embodiments, the transposase is hornfly-based, meaning it is derived from the hornfly yet has been recombinantly altered thereafter (but has the same or better activity).

[0016] In some examples of the invention, there is a plasmid or vector containing a transposable element of the invention and/or a nucleic acid encoding a transposase that recognizes the element. Such vectors can be in a bacterium either to propagate the vector or as the target of transposon-induced mutagenesis. In certain cases, the bacterial host is, but is not limited to, gram-positive bacteria, such as staphylococcus bacteria. Moreover, both the vector containing the transposable element and a vector containing the cognate transposase may be in the same bacterial cells together. The term “cognate” transposase in the context of a transposable element refers to the transposase that mediates transposition of the transposable element. Accordingly, in some embodi-

ments of the invention, there is a bacterium with a Himar 1 element and/or a nucleic acid encoding a Himar 1 transposase.

[0017] In some embodiments, the invention concerns host cells that contain the Himar 1 element, a nucleic acid encoding a Himar 1 transposase, or both. It is contemplated that the Himar 1 element may be on a separate nucleic acid molecule than the one encoding the transposase, though in some cases they are contained in the same nucleic acid molecule, such as a plasmid. In certain embodiments, the Himar 1 element is on a plasmid in the host cell. Moreover, the nucleic acid may also be contained in a plasmid in the host cell. A host cell with an exogenous nucleic acid is typically considered a recombinant host cell. As discussed throughout the application, the host cell may be a bacterium. In certain cases, the bacterium is a gram-positive bacterium.

[0018] The invention further encompasses bacteria, particularly gram-positive bacterium having a transposon insertion, which means the bacterium has at least one element that was transposed into its genome. The insertion could be random or pre-determined or engineered. It is specifically contemplated that in some embodiments the element is a Himar 1 element. Moreover, embodiments of the invention concern, but are not limited to, the gram-positive bacteria *Staphylococcus aureus*. Particularly contemplated is the Newman strain of *S. aureus* bacteria. Bacteria containing any of the transposable elements and embodiments discussed above and those identified in Tables 1, 2, and 3 are contemplated as part of the invention. In certain embodiments, a *bursa aurealis* isolate is the invention, which refers to a bacterium with a *bursa aurealis* insertion in its genome.

[0019] Bacteria with different mutations can be created using the transposable elements of the invention. The transposon may insert itself in any site throughout the genome and is not limited to any particular place. Each individual bacterium has a mutation in a specific location. In some embodiments, the insertion is in a gene selected from the group consisting of: metabolic gene, regulatory gene, extracellular factor gene, cellular or secreted gene, and any putative gene based on the presence of an ORF and/or conservation of sequence with other organisms (“hypothetical gene” or “conserved hypothetical gene”). Alternatively, the insertion may be in a gene encoding an enzyme, a structural protein, a membrane protein, transporter, symporter, or a functional RNA molecule (such as an rRNA, tRNA, tmRNA, or small RNA), and any other gene in the bacterial genome, including any of those identified in Tables 2 or 3.

[0020] In some cases, a transposon will be inserted into the genome so as to negatively or to positively affect virulence. The term “negatively affects virulence” means that the bacterial host with a transposon insertion is less virulent compared to the same bacterial host lacking the insertion, according to any virulence assay used by those of skill in the art, including those discussed in the Examples. An insertion that “negatively affects virulence” can be one that, for example, eliminates virulence, reduces infectivity, increases an immune response to the bacterial host, reduces the number of nematodes killed, or reduces the amount or extent of abscess formation in organs of animal models of infection. Similarly, the term “positively affect virulence” means that the bacterial host with a transposon insertion is more

virulent compared to the same bacterial host lacking the insertion, according to any virulence assay used by those of skill in the art, including those discussed in the Examples. An insertion that “positively affects virulence” can be one that, for example, increases or enhances virulence, increases infectivity, decreases an immune response to the bacterial host, increases the number of nematodes killed, or increases the amount or extent of abscess formation in organs of animal models of infection.

[0021] Any embodiment concerning transposable elements can be used in any method of the invention, and vice versa. Methods of the invention involve using transposable elements and bacteria having an element transposed in their genome.

[0022] Methods of the invention also concern methods for generating one or more gram positive bacterial mutants using transposable elements of the invention. While bacteria other than gram-positive bacteria can be the subject of aspects of the invention, the use of gram positive bacteria is specifically contemplated. In certain embodiments, a method comprises: a) introducing into a gram positive bacterium i) a nucleic acid comprising a transposable element comprising a screenable marker gene and a pair of inverted repeats recognized by a Himar 1 transposase at each end of the element and ii) a gene encoding a Himar 1 transposase, wherein the gene is under the control of a promoter that expresses the transposase in the bacterium; and b) screening the bacterium using the phenotype conferred by the screenable marker gene, wherein integration of the transposable element creates a genetic mutation. In specific embodiments nucleic acids are introduced in a bacterium by transformation or transduction. Furthermore, in certain other embodiments, the screenable marker gene is a selectable marker gene and the screening involves selecting the bacterium using the phenotype conferred by the selectable marker gene. This method can involve a situation in which the nucleic acid comprising the transposable element is a plasmid that also includes a temperature-sensitive gram positive replicon. In these embodiments, the method can further include a step of raising the temperature to a non-permissive temperature of the replicon between steps a) and b).

[0023] In further embodiments, a mutation can be characterized by functional phenotype. Therefore, aspects of the invention concern identifying a transposon insertion mutation in a virulence gene. A “virulence gene” is a gene needed at least specifically for the bacteria to be virulent but is distinguishable from a gene required simply for the viability of the bacteria. For example, certain structural proteins are needed for the bacteria to survive, so in some respect they are needed for virulence, but they would not qualify as virulence genes unless a bacterium could live without them but its ability to be virulent was affected. Typically, the gene product, as opposed to the gene itself, is involved in the virulence of the bacteria. Any embodiment concerning transposable elements can be used in any method of the invention, and vice versa. Virulence can be measured or characterized by a number of different assays, which are well known to those of skill in the art. In certain cases, a virulence gene is identified or characterized using a nematode killing assay, which is described in the Examples. Alternatively or in addition to, a virulence gene can be identified or characterized by infecting a mouse or other mammal with a mutant

having a mutation identified using the nematode killing assay and analyzing the animal for an organ abscess or organ abscesses.

[0024] Methods of the invention include a method of identifying a gram positive bacterium having a mutation in a putative virulence gene. Methods can include one or more of the following: a) obtaining a gram positive bacteria with a transposon insertion, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase; b) incubating the bacteria with nematodes on an agar plate; and, c) assaying for nematode killing, wherein reduced nematode killing compared to nematode killing by gram positive bacteria without a transposon insertion identifies a bacterium with a mutation in a putative virulence gene. With this method as well as any other method of the invention, it is contemplated that a comparison can be made using a control either assayed at the same time or at a previous time. A control value may be configured based on one or more previous experiments, in which case the value may be a standardized or normalized value with or without a standard deviation. Moreover, the term “nematode killing” refers to the number of nematodes killed when incubated with the bacteria.

[0025] Other methods of the invention concern identifying or characterizing a virulence gene in a gram positive bacterium comprising: a) incubating with nematodes on an agar plate a gram positive bacterium with a transposon insertion in a putative virulence gene, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase; and, b) assaying for nematode killing, wherein reduced nematode killing compared to nematode killing by gram positive bacteria without a transposon insertion is indicative of an insertion in a putative virulence gene. The term “transposon insertion” means that there is a transposon inserted in the genome of the bacterium.

[0026] Methods of the invention also concern a method of screening for a virulence gene in a gram positive bacteria comprising: a) obtaining a gram positive bacteria with a transposon insertion, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase; b) infecting a mouse or other host mammal with the bacteria having a transposon insertion and assaying the animal for organ abscesses, wherein a reduced amount of organ abscesses compared to a mouse incubated with the gram positive bacteria without a transposon insertion is indicative of an insertion in a putative virulence gene.

[0027] Methods of the invention involve, in some embodiments, identifying the location of an insertion that creates a genetic mutation. This can be done by a number of methods, including sequencing a region on one or both sides of the integrated transposable element.

[0028] In some embodiments, methods involve identifying the putative virulence gene. Additional assays or experiments may be conducted to characterize further or confirm the identification of a virulence gene. Moreover, it can also include screening for an inhibitor of the identified putative virulence gene.

[0029] Embodiments of the invention also concern a population of different bacterial mutants, referred to as a “pool.” A “pool” is understood to refer to 2 or more different mutants of the same strain and type of bacteria, such as in

the same gram positive bacteria. Embodiments of the invention include a pool of *S. aureus* Newman strain mutants. The term "different bacterial mutants" refers to bacteria each having a different mutation(s). In certain cases the pool includes, includes at least, or includes at most 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 6000, 7000, 8000, 9000, 10,000, 10,325, 11,000, 12,000, 13,000, 14,000, 15,000 or more different bacterial mutants, or any range derivable therein. In certain embodiments, a pool contains between 2 and 500, between 5 and 400, between 10 and 200, or between 50 and 100 bacteria, each with a different transposon insertion. It is understood that a pool of different mutants can be referred to as a collection of mutants. Table 3 identifies such a pool or collection of mutants. It is contemplated that any pool or collection of the invention may contain all or part of the list of mutants in any of Tables 1, 2, and/or 3. In certain embodiments, the pool or collection contains any of the numbers of different bacterial mutants described above, including any range derivable therein.

**[0030]** In some methods, there is a step of lysing a bacteria with a transposon insertion in a putative virulence gene; transducing the insertion into a gram positive bacterium lacking a transposon insertion; and, evaluating the transduced bacteria with a nematode killing assay, wherein reduced killing compared to gram positive bacteria without a transposon insertion is further indicative of an insertion in a putative virulence gene. Furthermore, methods may also include infecting a mouse or other mammal with the bacteria having a transposon insertion in a putative virulence gene and assaying the mouse for organ abscesses, wherein a reduced amount of organ abscesses compared to an animal incubated with gram positive bacteria without a transposon insertion is further indicative of an insertion in a putative virulence gene.

**[0031]** It is also contemplated that screening assays may be conducted with a pool or population of bacterial mutants to expedite screening methods. If a pool or population of mutants yields reduced nematode killing, individual mutants or a subset of mutants in the pool can be assayed in methods of the invention to identify mutants giving rise to the reduced nematode killing. Putative virulence genes can be identified in this manner.

**[0032]** Moreover, methods and compositions of the invention can be readily applied to screening for, identifying, and characterizing other types of bacterial genes. Such screening methods are implemented like the screening methods for

virulence genes, except the screen involves assaying for the activity, function, or other phenotype caused, attributed to or related to that particular gene or type of gene.

**[0033]** It is contemplated that any method or composition described herein can be implemented with respect to any other method or composition described herein.

**[0034]** The use of the term "or" in the claims is used to mean "and/or" unless explicitly indicated to refer to alternatives only or the alternatives are mutually exclusive, although the disclosure supports a definition that refers to only alternatives and "and/or."

**[0035]** Throughout this application, the term "about" is used to indicate that a value includes the standard deviation of error for the device or method being employed to determine the value.

**[0036]** It is specifically contemplated that any embodiments described in the Examples section are included as an embodiment of the invention.

**[0037]** Following long-standing patent law, the words "a" and "an," when used in conjunction with the word "comprising" in the claims or specification, denotes one or more, unless specifically noted.

**[0038]** Other objects, features and advantages of the present invention will become apparent from the following detailed description. It should be understood, however, that the detailed description and the specific examples, while indicating specific embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0039]** The following drawings form part of the present specification and are included to further demonstrate certain aspects of the present invention. The invention may be better understood by reference to one or more of these drawings in combination with the detailed description of specific embodiments presented herein.

**[0040]** **FIG. 1.** Plasmids used for transposon mutagenesis in *S. aureus*. *Bursa aurealis*, a mini-mariner transposable element, was cloned into pTS2, with a temperature-sensitive plasmid replicon ( $rep_{ts}$ ) and chloramphenicol resistance gene (*cat*) to generate pBursa; the 3.2 kb *bursa aurealis* encompasses the mariner terminal inverted repeats (TIR), the green fluorescent protein gene (*gfp*), the R6K replication origin (*oriV*) and erythromycin resistance determinant *ermB*. The position of restriction enzyme recognition sites (*AciI* and *BamHI*) is indicated. Plasmid pFA545 encodes the mariner transposase (*tnp*), tetracycline (*tetB tetD*), ampicillin (*bla*) resistance markers, and origin of replication (*repC*). Shown at the bottom of the figure is the structure of the 5.3 kb transposon Tn917 with *ermB* erythromycin resistance determinant, *tnpR* resolvase and *tnpA* transposase.

**[0041]** **FIG. 2.** Comparison of the transposon insertion sites of *bursa aurealis* and Tn917. *S. aureus* strain Newman was subjected to mutagenesis and 582 insertion mutants of each transposon were mapped by DNA sequencing and aligned according to their insertion site on the genome of *S. aureus* strain Mu50, which is available in the art.

[0042] **FIG. 3.** *Bursa aurealis* transposon insertions in the genome of *S. aureus* strain Newman. Four regions of the genome, in which very few transposon mutants were isolated, are indicated by blue bars with the names of the genes residing in each of the four regions. The first circle represents open reading frames that were disrupted (black) or not disrupted (white) by *bursa aurealis*. The second and third circles represent open reading frames in the genome of *S. aureus* strains Mu50, in which different colors were assigned according to their functions. Green and red arrows indicate tRNAs and rRNA, respectively. The fourth circle shows the scale of the map (bp). The fifth circle is a circular bar graph showing the number of transposon mutants per open reading frame (scale bar with each ladder step representing 10 mutants). *Scmec*, staphylococcal cassette chromosome *mec* and *SaPI*n1, staphylococcal pathogenicity island 1, are indicated. *Bursa aurealis* insertions (116) were isolated at the same position within *thiD*, but these insertions are likely to represent siblings as the isolated mutants arose from the same batch of transposon insertion mutants.

[0043] **FIGS. 4A-B.** Identification of *S. aureus* virulence genes in a mouse model of infection. *S. aureus* Newman or *bursa aurealis* insertion mutants  $\Phi$ NE12478 (**FIG. 4A**) or  $\Phi$ NE02863 (**FIG. 4B**) were used to infect ten mice each via retro-orbital injection ( $\sim 1.3 \times 10^7$  CFU). After four days, mice were euthanized and organs (kidney, liver and spleen) removed. Homogenized tissues were incubated on agar medium for *S. aureus* colony formation and enumeration. Each circle indicates an animal experiment. The dashed line represents the limit of detection, P designates the p value and horizontal bars indicate the mean.

#### DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0044] The present invention concerns transposable elements, their use in generating genomic mutations, the mutant bacteria, and methods of using and screening the mutant bacteria. In particular embodiments, the invention concerns gram positive bacteria, such as *Staphylococcus aureus*.

##### I. *Staphylococcus Aureus*

[0045] The gram-positive bacterium *S. aureus* is a physiological commensal of the human skin, nares and mucosal surfaces (Lowy 1998; Archer 1998). Staphylococci are also opportunistic and adaptable pathogens equipped with the ability to infect, invade, persist and replicate in any human tissue including skin, bone, visceral organs or vasculature (Lowy 1998; Gillet et al., 2002). As a result of adaptation to specific tissues, staphylococci cause many diverse pathological syndromes such as abscess, bacteremia, osteomyelitis, toxic shock syndrome, food poisoning and endocarditis (Lowy 1998; Archer et al. 2001). Because they colonize the human skin continuously, *S. aureus* strains are exposed to all antibiotic therapies (Neu 1992). Whenever drug-resistant microbes emerge, these strains can spread by direct contact very rapidly among human populations, as is exemplified by the threat of methicillin-resistant *S. aureus* (MRSA) and vancomycin-resistant *S. aureus* (VRSA) in communities and hospitals world-wide (Brumfitt et al., 1989; Hiramatsu et al., 1997; Chang et al., 2003; Weigel et al., 2003; Oliveira et al., 2002).

[0046] Antibiotic therapy has focused on targets that are required by all bacteria, for example cell wall synthesis,

protein synthesis and DNA replication (Walsh 2000). This therapeutic strategy cannot distinguish between resident non-pathogenic flora and invading pathogens and, in principle, does not require identification of etiologic disease agents or specific diagnosis to commence therapy (Alksne et al., 2000). As bacteria distribute genetic information beyond species boundaries, the emergence of drug-resistant microbes, even those that are unable to cause human disease, profoundly impacts the selection of pathogenic microbes with resistance mechanisms against all currently known antibiotic therapies (Alksne et al., 2000).

[0047] The 2.7-2.9 Mb genomes of several different *S. aureus* strains have been sequenced and encompass between 2,550 and 2,870 different genes (Kuroda et al., 2001; Baba et al., 2002; Fitzgerald et al., 2001). Over the past several decades, *S. aureus* secreted toxins, surface proteins and regulatory factors were identified as virulence factors and characterized, often using reverse genetic approaches (Archer 1998). *S. aureus* strain Newman is a human clinical isolate that stably maintains an *agr*<sup>+</sup> phenotype, i.e. quorum controlled toxin secretion and the ability to cause animal disease (Duthie et al., 1952), whereas most other human clinical isolates rapidly lose the *agr* phenotype and with it the property of causing purulent infections in animals (Novick 2003).

##### [0048] A. Mutagenesis

[0049] Transposable elements are an important source of spontaneous mutations, and have influenced the ways in which genes and genomes have evolved. They can inactivate genes by inserting within them, and can cause gross chromosomal rearrangements either directly, through the activity of their transposases, or indirectly, as a result of recombination between copies of an element scattered around the genome. Transposable elements that excise often do so imprecisely and may produce alleles coding for altered gene products if the number of bases added or deleted is a multiple of three. Transposable elements can also be used to “knock in” heterologous sequences.

[0050] Transposable elements themselves may evolve in unusual ways. If they were inherited like other DNA sequences, then copies of an element in one species would be more like copies in closely related species than copies in more distant species. This is not always the case, suggesting that transposable elements are occasionally transmitted horizontally from one species to another. In accordance with the present invention, mutations will be introduced into gram-positive bacteria such as *S. aureus* using a Himar 1 transposase.

[0051] Himar 1 is a “mariner,” one of a widespread and diverse family of animal transposons. Himar 1 is derived from *Haematobia irritans*. This transposase can reproduce transposition faithfully in an in vitro inter-plasmid transposition reaction. It binds to the inverted terminal repeat sequences of its cognate transposon and mediates 5' and 3' cleavage of the element termini. It functions independent of species-specific host factors, which explains the broad distribution of mariners and why they are capable of horizontal transfer between species (Lampe et al., 1996).

##### [0052] B. Other Gram-Positive Bacteria

[0053] The present invention can be applied to other gram-positive bacteria as well. Gram-positive bacteria have

a cell wall structure that contains peptidoglycan, in addition to polysaccharides and/or teichoic acids. There are three general classes of gram-positive bacilli: *Bacillaceae*, *Micrococcaceae* and *Peptococcaceae*. There are two major types of gram-positive cocci: *Staphylococcous* and *Streptococcus*.

[0054] 1. Bacillaceae

[0055] The *Bacillaceae* are non-acid fast straight rod-shaped bacteria that are capable of forming spores. Some are motile, by virtue of peritrichous flagellae. They include aerobes, facultative anaerobes, and strict anaerobes and are generally non-halophilic with a wide growth range depending on the group. The biochemical actions seen in this family include fermentation and proteolytic activity. Some species can fix nitrogen, and a number of them also produce specific toxins. *Bacillus* is the type genus. The two main genera are *Bacillus* and *Clostridium*.

[0056] *Bacillus*: These are peritrichously flagellated, form ellipsoidal or spherical, endospores, which may or may not swell the sporangium. They are aerobic to facultatively anaerobic and generally catalase-positive. There are currently very many species in this genus, including, *B. anthracis*, *B. azotoformans*, *B. cereus*, *B. coagulans*, *B. israelensis*, *B. larvae*, *B. mycoides*, *B. polymyxa*, *B. pumilis*, *B. stearothermophilus*, *B. subtilis*, *B. thuringiensis* and *B. validus*. Other genera include *Sporolactobacilli*, *Sporocarcina*, *Filibacter* and *Caryophanum*.

[0057] *Clostridium*: An inability to grow in air is the characteristic of this group, although some may tolerate it. *Clostridium* has many species, including psychrophilic, mesophilic or thermophilic members. They are generally Gram-positive with peritrichous flagellation, and can degrade organic materials. Acids, such as butyric acid, are a frequent product of fermentation by these organisms. They can form ellipsoidal or spherical, endospores. They tend to be grouped into saccharolytic or proteolytic species, but some are both.

[0058] Saccharolytic species include *Cl. aerotolerans*, *Cl. aurantibutyricum*, *Cl. beijerinckii*, *Cl. botulinum B,E,F\**, *Cl. butyricum*, *Cl. chauvoei*, *Cl. difficile*, *Cl. intestinale*, *Cl. novyi A*, *Cl. pateurianum*, *Cl. saccharolyticum*, *Cl. septicum*, *Cl. thermoaceticum*, and *Cl. thermosaccharolyticum*. The proteolytic species include: *Cl. argentinense*, *Cl. ghoni*, *Cl. limosum*, *Cl. putrefaciens*, *Cl. subterminale* and *Cl. tetani*. The proteolytic and saccharolytic species include *Cl. acetobutylicum*, *Cl. bifermenans*, *Cl. botulinum A, B, F (prot)\**, *Cl. botulinum C,D\**, *Cl. cadaveris*, *Cl. haemolyticum*, *Cl. novyi B, C\**, *Cl. perfringens*, *Cl. putrefaciens*, *Cl. sordelli* and *Cl. sporogenes*. The specialist species include *Cl. acidurici*, *Cl. irregularis*, *Cl. kluveri*, *Cl. oxalicum*, *Cl. propionicum*, *Cl. sticklandii* and *Cl. villosum*. *Cl. botulinum* is subdivided into a number of types according to the serological specificities of the toxins produced. These specificities are based on neutralisation studies (\*other *Clostridium* species that produce botulinum toxins).

[0059] 2. Micrococcaceae

[0060] These are gram-positive, non-spore-forming non-acid fast cocci. They generally occur in tetrads (groups of four) or clusters and are not motile. They are generally aerobes and produce catalase. Carotenoid pigments are produced by most species. Most will grow on bacteriological media such as nutrient agar at 37° C. except some psychrotropic and

halophilic species which require cooler temperatures or 5% NaCl. There are only two genera in this family: *Arthrobacter* and *Micrococcus*. The genera *Staphylococcus* and *Planococcus* which were once considered part of this family are now excluded, due to marked differences in DNA base composition, cell wall, fatty acids and other compositions.

[0061] *Arthrobacter*: This group includes two species—the *A. globiformis/A. citreus* group and the *A. nicotianae* group—based on differences in cell wall structure. They are important soil organisms and the numerically largest number of isolates on aerobic primary isolation media.

[0062] *Micrococcus*: This genus has nine species, of which *M. luteus*, *M. lylae*, *M. roseus* are most studied. *M. agilis* differs from other species in being motile, psychrophilic and producing beta-galactosidase. *M. kristinae* can ferment glucose anaerobically and *M. halobius* requires at least 5% NaCl for growth.

[0063] 3. Peptococcaceae

[0064] These are gram-positive, non-acid fast cocci that do not form spores. They are strict anaerobes and are generally non-halophilic with a wide growth range. Many metabolize peptones and amino acids, and some require fermentable carbohydrates. The family includes fermenters, indole producers, nitrate reducers, urease producers, and those that express coagulase or catalase activity. *Peptococcus* is the type genus, and other genera include *Peptostreptococcus*, *Sarcina* and *Coprococcus*.

[0065] *Peptococcus*: Including only one species, *P. niger*, the cocci are arranged as diplococci, irregular clumps or regular clusters. They are anaerobic and n-caproic acid and butyric acid are the main metabolic products.

[0066] *Peptostreptococcus*: This genus has three groups. *Ps. anaerobius* is the only representative of one group. It is similar to *P. niger*, but grows confluent on commercial media and forms short chains. The other two groups form clumps and clusters, while some species form diplococci. Each group includes about five-six species, which are differentiated on their morphology and biochemical reactions including fermentation, reduction of nitrate, production of indole, urease, coagulase or catalase, etc.

[0067] Other genera include *Ruminococcus*, *Sarcina*, and *Coprococcus*.

[0068] 4. Streptococci

[0069] Streptococci are spheroidal bacteria in the family *Streptococcaceae*. The term streptococcus (“twisted berry”) refers to the bacteria’s characteristic grouping in chains resembling a string of beads. Streptococci can also be classified by the type of carbohydrate contained in the cell wall, a system called the Lancefield classification.

[0070] *Streptococcus pyogenes*: Group A *S. pyogenes* species of streptococci cause rheumatic fever, scarlet fever, erysipelas, strep throat, tonsillitis, and other upper respiratory infections. In common practice *Streptococcus* group A is usually found in samples from the throat, nasopharynx, or in sputum in which a plethora of unimportant nonnal flora are also present. Its characteristic type of hemolysis is key for detection. If there is an area of clear or “beta,” hemolysis, the possibility of the presence of group A organisms exists, although the same type of hemolysis pattern

may also be exhibited by some other organisms such as some gram negative rods which may also be present. Immunofluorescence can be used to confirm the group A diagnosis.

[0071] *Streptococcus agalactiae*: Group B is the most common cause of sepsis (blood infection) and meningitis (infection of the fluid and lining surrounding the brain) in newborns. Group B Streptococcus (GBS) is a frequent cause of newborn pneumonia and is more common than other, better known, newborn problems such as rubella, congenital syphilis, and spina bifida. One of every 20 babies with GBS disease dies from infection. Babies that survive, particularly those who have meningitis, may have long-term problems, such as hearing or vision loss or learning disabilities. In pregnant women, GBS can cause bladder infections, womb infections (amnionitis, endometritis), and stillbirth. Among men and among women who are not pregnant, the most common diseases caused by GBS are blood infections, skin or soft tissue infections, and pneumonia. Approximately 20% of men and nonpregnant women with GBS disease die of the disease. Adults can carry GBS in the bowel, vagina, bladder, or throat. People who carry GBS typically do so transiently.

[0072] GBS disease is diagnosed when the bacterium is grown from cultures of sterile body fluids, such as blood or spinal fluid. Cultures take a few days to complete. GBS infections in both newborns and adults are usually treated with i.v. antibiotics.

[0073] *Streptococcus mutans* is part of the normal mouth flora and is responsible for cavities. A vaccine is thought possible for *Streptococcus mutans* for the prevention of cavities.

#### [0074] 5. Staphylococcus

[0075] *Staphylococcus epidermidis* (coagulase-negative) appears as white colonies on sheep blood agar plates. Like *S. aureus*, *S. epidermidis* is a normal inhabitant of the skin, but it is considered the lesser of the two in terms of virulence. Infections by *S. epidermidis*, *S. haemolyticus*, and *S. hominis*, the latter two also being coagulase negative, are associated with infections of intravascular devices (prosthetic heart valves and intra-arterial or intravenous lines), shunts and prosthetic joints, wound infections, osteomyelitis associated with foreign bodies, and endocarditis. Another clinically significant species is *S. saprophyticus*.

## II. Nucleic Acids and Transformation

[0076] In accordance with the present invention, it may be desirable to manipulate transposon sequences to carry additional elements, which are described below. Further, transposon sequences will be transferred into bacterial host cells using the techniques described. Any nucleic acid sequence provided herein can be implemented with respect to any other embodiment. For example, a nucleic acid element may be contained in a plasmid, vector, host cell, or bacteria.

### [0077] A. Vectors

[0078] The term "vector" is used to refer to a nucleic acid molecule into which a nucleic acid sequence can be inserted for introduction into a cell where it can be replicated and/or expressed. A nucleic acid sequence can be "exogenous," which means that it is foreign to the cell into which the vector is being introduced or that the sequence is homolo-

gous to a sequence in the cell but in a position within the host cell nucleic acid in which the sequence is ordinarily not found. One of skill in the art would be well equipped to construct a vector through standard recombinant techniques, which are described in Sambrook et al. (1989) and Ausubel et al. (1994), both incorporated herein by reference.

[0079] The term "expression vector" refers to a vector containing a nucleic acid sequence coding for at least part of a gene product capable of being transcribed. In some cases, RNA molecules may then be translated into a protein, polypeptide, or peptide. In other cases, these sequences are not translated, for example, in the production of antisense molecules or ribozymes. Expression vectors can contain a variety of "control sequences," which refer to nucleic acid sequences necessary for the transcription and possibly translation of an operably linked coding sequence in a particular host organism. In addition to control sequences that govern transcription and translation, vectors and expression vectors may contain nucleic acid sequences that serve other functions as well and are described infra.

[0080] The plasmids pFA545 (SEQ ID NO:1) and pBursa (SEQ ID NO:2) are described herein. Any of the functional genes and nucleic acid regions of these plasmids may be subcloned into other plasmids or vectors.

### [0081] 1. Promoters and Enhancers

[0082] A "promoter" is a control sequence that is a region of a nucleic acid sequence at which initiation and rate of transcription are controlled. It may contain genetic elements at which regulatory proteins and molecules may bind such as RNA polymerase and other transcription factors. The phrases "operatively positioned," "operatively linked," "under control," and "under transcriptional control" mean that a promoter is in a correct functional location and/or orientation in relation to a nucleic acid sequence to control transcriptional initiation and/or expression of that sequence. A promoter may or may not be used in conjunction with an "enhancer," which refers to a cis-acting regulatory sequence involved in the transcriptional activation of a nucleic acid sequence.

[0083] A promoter may be one naturally associated with a gene or sequence, as may be obtained by isolating the 5' non-coding sequences located upstream of the coding segment. Similarly, an enhancer may be one naturally associated with a nucleic acid sequence, located either downstream or upstream of that sequence. Alternatively, certain advantages will be gained by positioning the coding nucleic acid segment under the control of a recombinant or heterologous promoter, which refers to a promoter that is not normally associated with a nucleic acid sequence in its natural environment. A recombinant or heterologous enhancer refers also to an enhancer not normally associated with a nucleic acid sequence in its natural environment.

[0084] In addition to producing nucleic acid sequences of promoters and enhancers synthetically, sequences may be produced using recombinant cloning and/or nucleic acid amplification technology, including PCR/TM, in connection with the compositions disclosed herein (see U.S. Pat. No. 4,683,202, U.S. Pat. No. 5,928,906, each incorporated herein by reference). Furthermore, it is contemplated the control sequences that direct transcription and/or expression of sequences within non-nuclear organelles such as mitochondria, chloroplasts, and the like, can be employed as well.

[0085] Naturally, it will be important to employ a promoter and/or enhancer that effectively directs the expression of the DNA segment in the cell type chosen for expression. Those of skill in the art of molecular biology generally know the use of promoters, enhancers, and cell type combinations for protein expression, for example, see Sambrook et al. (1989), incorporated herein by reference. The promoters employed may be constitutive, tissue-specific, inducible, and/or useful under the appropriate conditions to direct high level expression of the introduced DNA segment, such as is advantageous in the large-scale production of recombinant proteins and/or peptides. The promoter may be heterologous or endogenous, and will be selected for activity in gram-positive bacteria.

#### [0086] 2. Initiation Signals

[0087] A specific initiation signal also may be required for efficient translation of coding sequences. These signals include the ATG initiation codon or adjacent sequences. Exogenous translational control signals, including the ATG initiation codon, may need to be provided. One of ordinary skill in the art would readily be capable of determining this and providing the necessary signals. It is well known that the initiation codon must be "in-frame" with the reading frame of the desired coding sequence to ensure translation of the entire insert. The exogenous translational control signals and initiation codons can be either natural or synthetic. The efficiency of expression may be enhanced by the inclusion of appropriate transcription enhancer elements.

#### [0088] 3. Multiple Cloning Sites

[0089] Vectors can include a multiple cloning site (MCS), which is a nucleic acid region that contains multiple restriction enzyme sites, any of which can be used in conjunction with standard recombinant technology to digest the vector. (See Carbonelli et al., 1999, Levenson et al., 1998, and Cocea 1997, incorporated herein by reference.) "Restriction enzyme digestion" refers to catalytic cleavage of a nucleic acid molecule with an enzyme that functions only at specific locations in a nucleic acid molecule. Many of these restriction enzymes are commercially available. Use of such enzymes is widely understood by those of skill in the art. Frequently, a vector is linearized or fragmented using a restriction enzyme that cuts within the MCS to enable exogenous sequences to be ligated to the vector. "Ligation" refers to the process of forming phosphodiester bonds between two nucleic acid fragments, which may or may not be contiguous with each other. Techniques involving restriction enzymes and ligation reactions are well known to those of skill in the art of recombinant technology.

#### [0090] 4. Origins of Replication

[0091] In order to propagate a vector in a host cell, it may contain one or more origins of replication sites (often termed "ori"), which is a specific nucleic acid sequence at which replication is initiated. The origin of replication may optionally be active or non-active at specific temperatures, i.e., temperature sensitive.

#### [0092] 5. Selectable and Screenable Markers

[0093] In certain embodiments of the invention, the cells contain nucleic acid construct of the present invention, a cell may be identified *in vitro* or *in vivo* by including a marker in the expression vector. Such markers would confer an

identifiable change to the cell permitting easy identification of cells containing the expression vector. Generally, a selectable marker is one that confers a property that allows for selection. A positive selectable marker is one in which the presence of the marker allows for its selection, while a negative selectable marker is one in which its presence prevents its selection. An example of a positive selectable marker is a drug resistance marker.

[0094] Usually the inclusion of a drug selection marker aids in the cloning and identification of transformants, for example, genes that confer resistance to neomycin, puromycin, hygromycin, DHFR, GPT, zeocin and histidinol are useful selectable markers. In addition to markers conferring a phenotype that allows for the discrimination of transformants based on the implementation of conditions, other types of markers including screenable markers such as GFP, whose basis is colorimetric analysis, are also contemplated. Alternatively, screenable enzymes such as herpes simplex virus thymidine kinase (tk) or chloramphenicol acetyltransferase (CAT) may be utilized. One of skill in the art would also know how to employ fluorescent or chemiluminescent markers, possibly in conjunction with FACS analysis. The marker used is not believed to be important, so long as it is capable of being expressed simultaneously with the nucleic acid encoding a gene product. Further examples of selectable and screenable markers are well known to one of skill in the art.

#### [0095] B. Host Cell

[0096] As used herein, the terms "cell," "cell line," and "cell culture" may be used interchangeably. All of these terms also include their progeny, which is any and all subsequent generations. It is understood that all progeny may not be identical due to deliberate or inadvertent mutations. In the context of expressing a heterologous nucleic acid sequence, "host cell" refers to a prokaryotic or eukaryotic cell, and it includes any transformable organisms that is capable of replicating a vector and/or expressing a heterologous gene encoded by a vector. A host cell can, and has been, used as a recipient for vectors or viruses (which does not qualify as a vector if it expresses no exogenous polypeptides). A host cell may be "transfected" or "transformed," which refers to a process by which exogenous nucleic acid, such as a modified protein-encoding sequence, is transferred or introduced into the host cell. A transformed cell includes the primary subject cell and its progeny.

[0097] Host cells may be derived from prokaryotes or eukaryotes, including bacteria cells, yeast cells, insect cells, and mammalian cells, depending upon whether the desired result is replication of the vector or expression of part or all of the vector-encoded nucleic acid sequences. Numerous cell lines and cultures are available for use as a host cell, and they can be obtained through the American Type Culture Collection (ATCC), which is an organization that serves as an archive for living cultures and genetic materials ([www.atcc.org](http://www.atcc.org)). An appropriate host can be determined by one of skill in the art based on the vector backbone and the desired result. A plasmid or cosmid, for example, can be introduced into a prokaryote host cell for replication of many vectors.

[0098] Many host cells from various cell types and organisms are available and would be known to one of skill in the art. Similarly, a viral vector may be used in conjunction with

either a eukaryotic or prokaryotic host cell, particularly one that is permissive for replication or expression of the vector.

[0099] C. Transformation

[0100] In accordance with the present invention, nucleic acid sequences are transferred into bacterial cells using standard methodologies known to those of ordinary skill in the art. In some instances, cells can be rendered competent for transformation by chemical treatment with CaCl (Sambrook et al. 1989). Some other methods are described below.

[0101] 1. Electroporation

[0102] In certain embodiments of the present invention, the expression construct is introduced into the cell via electroporation. Electroporation involves the exposure of a suspension of cells and DNA to a high-voltage electric discharge. Electroporation works well with bacteria.

[0103] 2. Calcium Phosphate or DEAE-Dextran

[0104] In other embodiments of the present invention, the expression construct is introduced to the cells using calcium phosphate precipitation. In another embodiment, the expression construct is delivered into the cell using DEAE-dextran followed by polyethylene glycol.

[0105] 3. Particle Bombardment

[0106] Another embodiment of the invention for transferring a naked DNA expression construct into cells involves particle bombardment. This method depends on the ability to accelerate DNA-coated microprojectiles to a high velocity allowing them to pierce cell membranes and enter cells without killing them (Klein et al., 1987). Several devices for accelerating small particles have been developed. One such device relies on a high voltage discharge to generate an electrical current, which in turn provides the motive force (Yang et al., 1990). The microprojectiles used have consisted of biologically inert substances such as tungsten or gold beads.

[0107] 4. Direct Microinjection or Sonication Loading

[0108] Further embodiments of the present invention include the introduction of the expression construct by direct microinjection or sonication loading. Direct microinjection has been used to introduce nucleic acid constructs into *Xenopus* oocytes (Harland and Weintraub, 1985), and LTK<sup>-</sup> fibroblasts have been transfected with the thymidine kinase gene by sonication loading (Fechheimer et al., 1987).

[0109] C. Markers

[0110] In certain aspects of the present invention, cells containing transposon are identified with specific markers. Such markers confer on their recombinant hosts a readily detectable phenotype that emerges only under conditions where the transposon has integrated into the genome of the host. Generally reporter genes encode a polypeptide not otherwise produced by the host cell which is detectable by analysis of the cell culture, e.g., by drug-resistance, or fluorometric or spectrophotometric analysis of the cell culture.

[0111] 1. Screening Markers

[0112] Exemplary enzymes include esterases, phosphatases, proteases (tissue plasminogen activator or urokinase) and other enzymes capable of being detected by their

activity, as will be known to those skilled in the art. Contemplated for use in the present invention is green fluorescent protein (GFP) as a marker for transgene expression (Chalfie et al., 1994). The use of GFP does not need exogenously added substrates, only irradiation by near UV or blue light, and thus has significant potential for use in monitoring gene expression in living cells.

[0113] Other particular examples are the enzymes firefly and bacterial luciferase, and the bacterial enzymes  $\beta$ -galactosidase and  $\beta$ -glucuronidase. Other marker genes within this class are well known to those of skill in the art, and are suitable for use in the present invention.

[0114] 2. Selection

[0115] Another class of reporter genes which confer detectable characteristics on a host cell are those which encode polypeptides, generally enzymes, which render their transformants resistant against toxins. Examples of this class of reporter genes are the neo gene (Colberre-Garapin et al., 1981) which protects host cells against toxic levels of the antibiotic G418, the gene conferring streptomycin resistance (U.S. Pat. No. 4,430,434), the gene conferring hygromycin B resistance (Santerre et al., 1984; U.S. Pat. Nos. 4,727,028, 4,960,704 and 4,559,302), a gene encoding dihydrofolate reductase, which confers resistance to methotrexate (Alt et al., 1978), the enzyme HPRT, along with many others well known in the art (Kaufman, 1990). Chloramphenicol acetyltransferase (CAT) confer resistance to chloramphenicol, and the beta-lactamase gene confers ampicillin resistance.

### III. Screening Methods

[0116] In accordance with the present invention, following transposon mutagenesis, one will select appropriate transformed strains using a variety of criteria. At a first level of selection, one will simply wish to identify those bacterial host cells that have taken up the transposon. At a second level, one will look for particular functional attributes of the transformants, presumably based on the site of integration of the transposon and the effect caused thereby. And at a third level, it may be desirable to identify the precise nature and location of the integration, optionally for the purpose of identifying bacterial genes or assigning function thereof. Various methods for achieving each of these selections are described below.

[0117] A. Selection Based on Antibiotic Resistance

[0118] In one embodiment, the transposon will contain a selectable marker. A selectable marker is an element, usually a polypeptide, that permits ready identification and selection of a transformant. A classic and often used selectable marker is a gene encoding a protein that confers resistance to an antibiotic. Antibiotics useful in selection procedures are well known to those of skill in the art and include chloramphenicol, ampicillin, hygromycin B, puromycin, zeocin, G418 and others.

[0119] Methods for antibiotic selection are well known to those of skill in the art. Appropriate concentrations of antibiotics are well known based on the desired purpose. Bacterial cells are cultured with antibiotics under other conditions otherwise suitable for growth of host cells. Selection may also involve using increasing concentrations of antibiotic with successive rounds of more rigorous selection.

Selection may be in broth culture or plated on agar, or successive combinations of both.

#### [0120] B. Selection Based on Fluorescence

[0121] In another embodiment, transformants may be selected on the basis of expression of a fluorescent or a luminescent marker. The marker may be red fluorescent protein, green fluorescent protein, cyan fluorescent protein, or variants thereof. Luminescent markers include luciferase.

[0122] In this aspect, the present invention may take advantage of fluorescence-activated cell sorting (FACS). This technique utilizes a machine that can rapidly separate cells in a suspension on the basis of size and the color of their fluorescence. Generally, a cell suspension containing cells labeled with a fluorescent protein is directed into a thin stream so that all the cells pass in single file. This stream emerges from a nozzle vibrating at some 40,000 cycles per second which breaks the stream into 40,000 discrete droplets each second. Some of these may contain a cell. A laser beam is directed at the stream just before it breaks up into droplets. As each labeled cell passes through the beam, its resulting fluorescence is detected by a photocell. If the signals from the two detectors meet either of the criteria set for fluorescence and size, an electrical charge (+ or -) is given to the stream. The droplets retain this charge as they pass between a pair of charged metal plates. Positively-charged drops are attracted to the negatively-charged plate and vice versa. Uncharged droplets (those that contain no cell or a cell that fails to meet the desired criteria of fluorescence and size) pass straight into a third container and are later discarded. This apparatus can sort as many as 300,000 cells per minute.

#### [0123] C. Selection Based on Pathogenicity

[0124] In another aspect, the present invention will attempt to identify functional differences between bacterial mutants and their parental strains. The functional differences may be any of a variety of different traits including growth, doubling time, nutrient dependence, drug susceptibility or pathogenicity.

[0125] A particular pathogenicity assay involves the testing of bacterial strains against *C. elegans*. When incubated on agar plates with either L4 larvae or adult worms, staphylococci enter the worm oral cavity, pass the food grinder and multiply in the worm's digestive tract. Colonization with *S. aureus* causes distension of the digestive tract and ultimately killing of infected worms over a period of 2-7 days (Sifri et al., 2003). Using this assay, Sifri and colleagues demonstrated that several known *S. aureus* virulence factors are also required for the killing of *C. elegans* (Sifri et al., 2003).

[0126] Another pathogenicity assay involves a murine model. *S. aureus* strains are inoculated intravenously into mice, which are euthanized four days after infection and assessed for gross pathology in the organs (Mazmanian et al., 2002).

#### [0127] D. Promoter Identification Assays

[0128] In another embodiment, the present invention will rely on the use of transposons that contain segments encoding marker genes, but lacking the regulatory sequences needed to effect transcription. However, if the transposon integrates near a promoter sequence, the adjacent promoter may drive expression of the otherwise promoter-less marker gene, thereby permitting identification/selection as

described elsewhere in the document. It will generally be desired that the promoter-less marker be located near one terminus of the transposon, and that the 5' end of the marker be closest to the nearest transposon terminus.

#### [0129] E. Identifying Insertion Sites

[0130] Finally, in some embodiments, it may be desirable to identify where a particular transposon has inserted. This can be performed at the level of rough genetic mapping using RFLP-type procedures (restriction followed by size separation of genomic fragments), or by sequencing. The latter will permit the precise identification of sequences that have been interrupted, and in some cases, attribute previously undescribed functions to a gene of interest. Sequencing may be effected in a variety of fashions using transposon sequences to prime synthesis into adjacent genomic sequences.

### IV. Examples

[0131] The following examples are included to demonstrate preferred embodiments of the invention. It should be appreciated by those of skill in the art that the techniques disclosed in the examples which follow represent techniques discovered by the inventor to function well in the practice of the invention, and thus can be considered to constitute preferred modes for its practice. However, those of skill in the art should, in light of the present disclosure, appreciate that many changes can be made in the specific embodiments which are disclosed and still obtain a like or similar result without departing from the spirit and scope of the invention.

#### EXAMPLE 1: Materials and Methods

[0132] Transposon mutagenesis. *S. aureus* strain Newman was sequentially transformed with pFA545 and pBursa (FIG. 1) (Genbank accession nos. AY672108 and AY672109, respectively, which are hereby incorporated by reference). The resulting transformants were spread on tryptic soy agar containing 10  $\mu\text{g ml}^{-1}$  erythromycin ( $\text{TSA}_{\text{erm}}$ ) and incubated at 30° C. overnight. Isolated single colonies were suspended in 200  $\mu\text{l}$  sterile water, spread on  $\text{TSA}_{\text{erm}}$  and then incubated at 43° C. for two days to select against the plasmids. Isolated single colonies were inoculated in tryptic soy broth containing 10  $\mu\text{g/ml}$  erythromycin ( $\text{TSB}_{\text{erm}}$ ) and incubated at 43° C. overnight. Cells were collected by centrifugation, suspended in 100  $\mu\text{l}$  TSM buffer (50 mM Tris-HCl, pH 7.5, 0.5 M sucrose, 10 mM  $\text{MgCl}_2$ ) and then treated with lysostaphin (0.1 mg/ml final concentration) (Schindler et al., 1964) at 37° C. for 15 minutes. After collecting protoplasts by centrifugation, chromosomal DNA was purified with the Wizard Genomic DNA purification kit (Promega) according to the manufacturer's recommendation. Acil (NEB) was used to digest chromosomal DNA in 10  $\mu\text{l}$  reaction volumes for 1-3 hours at 37° C. The digested DNA was ligated with T4 ligase in 100  $\mu\text{l}$  reaction volume for 5-16 hours at room temperature and the resulting DNA was purified with QIAquick PCR purification kit (QIAGEN). DNA fragments carrying transposon/chromosome junction sequences were amplified by PCR with the primers: Martn-F (TTT ATG GTA CCA TTT CAT TTT CCT GCT TTT TC) and Martn-ermR (AAA CTG AIT TTT AGT AAA CAG TTG ACG ATA TTC). The annealing temperature was 63° C. and the DNA was amplified for 3 minutes with 40 cycles. After 0.8% agarose gel electrophoresis, PCR

products were directly sequenced with the Martn-F primer at the sequencing facility of the University of Chicago Cancer Research Center.

[0133] Nematode killing assay. The *C. elegans* infection assay was carried out as previously reported (Sifri et al., 2003) with the following modifications. To synchronize the growth of worms, eggs were collected via the hypochlorite method (Lewis et al., 1995). The collected eggs were incubated in M9 buffer for 16-22 hours at room temperature and worms that had been arrested at the L1 larvae stage were plated on nutrient growth medium (NGM) agar that had been inoculated with *E. coli* OP50. Agar plates were incubated at 15° C. for 72 hours to generate L4 larvae or for 84-88 hours to generate adult worms. For initial screening procedures (screens 1-3, Table 1), 30-50 adult worms were used, while 50-100 L4 larvae or adult worms were infected for the final screening assay (screen 4, Table 1—located after Examples) after transduction of transposon insertions into the wild-type strain background. Worms were transferred with a platinum wire and autoclaved Elmer's Glue™ to TSA plates that had been inoculated with staphylococci, incubated at 25° C. for 48 hours, and live worms counted under a stereomicroscope (Nikon SMZ645). The nematode strain N2 and *E. coli* OP50 used in this work were provided by the Caenorhabditis Genetics Center, which is funded by the NIH National Center for Research Resources (NCRR).

[0134] Murine intra-venous infection and abscess formation. *S. aureus* transposon mutants were grown at 37° C. overnight in TSB<sub>erm</sub>, diluted 100 fold in fresh media and incubated at 37° C. for 2.5 hours until the cultures reached OD<sub>600</sub> 1.0. Bacteria were collected by centrifugation, washed and suspended in phosphate buffered saline (PBS). Viable staphylococci were enumerated by colony formation on TSA plates to quantify the infectious dose. One hundred microliter of bacterial suspension (—1.3×10<sup>7</sup> colony forming units) was administered intra-venously via retro-orbital injection into each of ten six- to eight-week old BALB/c mice. Four days after the injection, the mice were euthanized by CO<sub>2</sub> asphyxiation and the kidneys, spleen and liver were removed. The organs were homogenized in 1 ml of PBS and dilutions of the homogenates were plated on TSA.

[0135] Statistical analysis. Chi-square analysis was used to examine the statistical significance of worm killing data. Student's t-test was performed. for statistical analysis of murine infection data, using the statistical software Analyse-*it*™.

TABLE 1-continued

Mutant Number	ORF	Screen			
		1	Screen 2	Screen 3	Screen 4
ΦNE 06084	SAV0071	119			
ΦNE 02921	SAV0082	113			
ΦNE 01632	SAV0082	89			
ΦNE 02710	SAV0084	125			
ΦNE 03605	SAV0084	65			
ΦNE 11469	SAV0085	104			
ΦNE 07569	SAV0086	100			
ΦNE 02897	SAV0087	100	90	80	
ΦNE 01747	SAV0088	100			
ΦNE 04416	SAV0089	65	100		
ΦNE 04522	SAV0093	118			
ΦNE 08742	SAV0094	86	104		
ΦNE 01578	SAV0094	104			
ΦNE 04331	SAV0096	84			
ΦNE 04701	SAV0100	100			
ΦNE 03975	SAV0100	90			
ΦNE 01752	SAV0101	42	100		
ΦNE 01586	SAV0101	79			
ΦNE 12459	SAV0102	90			
ΦNE 04675	SAV0103	100			
ΦNE 03889	SAV0104	95			
ΦNE 09435	SAV0105	91			
ΦNE 01885	SAV0106	95			
ΦNE 05474	SAV0107	105			
ΦNE 05622	SAV0107	105			
ΦNE 04993	SAV0108	85	75	56	100
ΦNE 02760	SAV0109	119			
ΦNE 02284	SAV0110	79	100		
ΦNE 03637	SAV0111	100			
ΦNE 11086	SAV0112	82	50.9		
ΦNE 00251	SAV0113	75			
ΦNE 05329	SAV0113	100			
ΦNE 12605	SAV0114	73	93		
ΦNE 04101	SAV0115	65	75	92	100
ΦNE 05598	SAV0116	105			
ΦNE 09972	SAV0117	105			
ΦNE 00750	SAV0118	80			
ΦNE 04431	SAV0119	100			
ΦNE 04528	SAV0120	118			
ΦNE 03981	SAV0121	95			
ΦNE 00568	SAV0121	85			
ΦNE 06601	SAV0122	166			
ΦNE 00693	SAV0123	85			
ΦNE 02682	SAV0124	125			
ΦNE 00114	SAV0125	95			
ΦNE 02811	SAV0126	119			
ΦNE 00797	SAV0128	100			
ΦNE 02789	SAV0129	125			
ΦNE 11103	SAV0130	86	49.1		
ΦNE 01699	SAV0130	105			
ΦNE 00235	SAV0131	95			
ΦNE 00540	SAV0132	95			
ΦNE 02728	SAV0133	113			
ΦNE 01938	SAV0134	105			
ΦNE 00707	SAV0134	70			
ΦNE 00256	SAV0135	95			
ΦNE 04115	SAV0136	89			
ΦNE 04163	SAV0137	105			
ΦNE 04768	SAV0139	100			
ΦNE 04556	SAV0140	118			
ΦNE 04840	SAV0141	100			
ΦNE 03501	SAV0142	105			
ΦNE 04512	SAV0143	118			
ΦNE 00009	SAV0144	106			
ΦNE 06375	SAV0145	153			
ΦNE 06399	SAV0147*	169			
ΦNE 01814	SAV0148	100			
ΦNE 10032	SAV0149	105			
ΦNE 05254	SAV0150	100			
ΦNE 05138	SAV0151	100			
ΦNE 02051	SAV0152	105			
ΦNE 11309	SAV0153	118			
ΦNE 05448	SAV0154	53	10	49	52

TABLE 1

Mutant Number	ORF	Screen			
		1	Screen 2	Screen 3	Screen 4
ΦNE 09697	SAV0006	105			
ΦNE 01964	SAV0007	100			
ΦNE 02761	SAV0008	119			
ΦNE 04440	SAV0008	94			
ΦNE 06169	SAV0010	169			
ΦNE 13102	SAV0013	86	100		
ΦNE 04509	SAV0013	118			
ΦNE 03581	SAV0017	105			
ΦNE 02689	SAV0017	125			
ΦNE 11611	SAV0022	67	79		96
ΦNE 04297	SAV0023	84			100
ΦNE 00158	SAV0024	90			
ΦNE 00007	SAV0031	100			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 05573	SAV0155	100			
ΦNE 11624	SAV0156	63	62		
ΦNE 04851	SAV0157	40	55	71	43
ΦNE 03492	SAV0158	68	55	62	87
ΦNE 04856	SAV0159	75	95		
ΦNE 00618	SAV0160	70			
ΦNE 01957	SAV0161	26	75	25	
ΦNE 01866	SAV0162	89			
ΦNE 05283	SAV0163	10	35	67	75
ΦNE 04700	SAV0164	100			
ΦNE 11092	SAV0165	132			
ΦNE 04350	SAV0166	94			
ΦNE 02715	SAV0167	125			
ΦNE 03273	SAV0168	63	95		
ΦNE 05237	SAV0171	95			
ΦNE 02635	SAV0172	105			
ΦNE 03639	SAV0173	112			
ΦNE 05563	SAV0174	105			
ΦNE 00698	SAV0175	100			
ΦNE 02233	SAV0176	74	100		
ΦNE 07526	SAV0177	70	93		
ΦNE 00016	SAV0179	75			
ΦNE 03096	SAV0180	56	75	92	100
ΦNE 02265	SAV0182	89			
ΦNE 12640	SAV0183	67	96		
ΦNE 02803	SAV0184	125			
ΦNE 05074	SAV0185	70	65	36	97
ΦNE 10656	SAV0186	93			
ΦNE 08784	SAV0187	63	100		
ΦNE 03140	SAV0188	75	70	88	93
ΦNE 01753	SAV0189	105			
ΦNE 04337	SAV0190	47	95		
ΦNE 00006	SAV0192	94			
ΦNE 02135	SAV0193	105			
ΦNE 02429	SAV0195	105			
ΦNE 00710	SAV0195	65			
ΦNE 05126	SAV0195	100			
ΦNE 11739	SAV0205	105			
ΦNE 10862	SAV0206	100			
ΦNE 04004	SAV0207	85			
ΦNE 12525	SAV0208	83	104		
ΦNE 03761	SAV0209	76			
ΦNE 13516	SAV0210	96			
ΦNE 10277	SAV0211*	105			
ΦNE 04162	SAV0212	63			
ΦNE 06383	SAV0213	131			
ΦNE 03834	SAV0214	85			
ΦNE 13547	SAV0215	76	107		
ΦNE 02950	SAV0216	81	95		
ΦNE 00051	SAV0216	88			
ΦNE 12364	SAV0217	63	100		
ΦNE 04534	SAV0218	118			
ΦNE 03836	SAV0219	75	95		
ΦNE 01499	SAV0219	85			
ΦNE 04364	SAV0220	47	95		
ΦNE 00616	SAV0222	75			
ΦNE 00716	SAV0222	85			
ΦNE 00452	SAV0223	45	100		
ΦNE 02933	SAV0224	88	90		
ΦNE 00232	SAV0225	100			
ΦNE 05431	SAV0226	105			
ΦNE 04690	SAV0228	100			
ΦNE 14033	SAV0229	93			
ΦNE 00492	SAV0230	95			
ΦNE 04061	SAV0231	112			
ΦNE 02733	SAV0231	119			
ΦNE 00054	SAV0232	119			
ΦNE 03997	SAV0233	100			
ΦNE 04666	SAV0234	100			
ΦNE 00796	SAV0235	85			
ΦNE 03764	SAV0235	94			
ΦNE 00015	SAV0236	106			
ΦNE 01810	SAV0237	100			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 11473	SAV0238	46	83		
ΦNE 04861	SAV0240	100			
ΦNE 02831	SAV0241	125			
ΦNE 10824	SAV0242	64	86		100
ΦNE 02365	SAV0243	95			
ΦNE 12294	SAV0244	87			
ΦNE 03950	SAV0245	90			
ΦNE 05635	SAV0246	105			
ΦNE 05298	SAV0248	55	50	25	95
ΦNE 05235	SAV0250	95			
ΦNE 01934	SAV0251	95			
ΦNE 05236	SAV0252	100			
ΦNE 03224	SAV0258	63	50	85	85
ΦNE 04126	SAV0258	42	60	75	97
ΦNE 00118	SAV0259	95			
ΦNE 02846	SAV0260	113			
ΦNE 00645	SAV0260	60			
ΦNE 05796	SAV0261	105			
ΦNE 00684	SAV0262	75			
ΦNE 05502	SAV0264	105			
ΦNE 11126	SAV0265	27	83		98
ΦNE 10852	SAV0266	86			
ΦNE 09554	SAV0267	55	86		94
ΦNE 09840	SAV0268	100	95		
ΦNE 05444	SAV0270	105			
ΦNE 03097	SAV0271	106			
ΦNE 07234	SAV0272	97			
ΦNE 12766	SAV0273	47	86		
ΦNE 00275	SAV0274	100			
ΦNE 01870	SAV0275	89			
ΦNE 02987	SAV0276	100			
ΦNE 04665	SAV0277	118			
ΦNE 05550	SAV0278	105			
ΦNE 04368	SAV0279	47	95		
ΦNE 03794	SAV0280	106			
ΦNE 02936	SAV0281	100			
ΦNE 09349	SAV0283	123			
ΦNE 03742	SAV0284	106			
ΦNE 11241	SAV0285	132			
ΦNE 02411	SAV0286	100			
ΦNE 03683	SAV0287	24	85	93	
ΦNE 04464	SAV0287	106			63
ΦNE 02755	SAV0288	125			
ΦNE 02832	SAV0288	125			
ΦNE 03493	SAV0293	100			
ΦNE 10978	SAV0294	114			
ΦNE 04048	SAV0295	106			
ΦNE 05120	SAV0296	95			
ΦNE 04317	SAV0297	105			
ΦNE 05433	SAV0298	105			
ΦNE 06103	SAV0299	134			
ΦNE 11844	SAV0300	46	103		
ΦNE 10920	SAV0302	32	100		
ΦNE 03864	SAV0304	85			
ΦNE 00605	SAV0305	55	100		
ΦNE 03413	SAV0306	79			
ΦNE 03089	SAV0307	119			
ΦNE 00460	SAV0308	70			
ΦNE 13888	SAV0309	90			
ΦNE 04052	SAV0310	102,88			
ΦNE 04086	SAV0311	76	75	78	98
ΦNE 06575	SAV0312	175			
ΦNE 05564	SAV0313	105			
ΦNE 03729	SAV0314	71			
ΦNE 09108	SAV0315	72	105		
ΦNE 02871	SAV0316	125			
ΦNE 14683	SAV0317	100			
ΦNE 03752	SAV0318	88			
ΦNE 06115	SAV0319	172			
ΦNE 08795	SAV0321	93			
ΦNE 10723	SAV0323	79			
ΦNE 11496	SAV0324	29	97		
ΦNE 05241	SAV0325	100			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 04742	SAV0326	100			
ΦNE 02961	SAV0327	94			
ΦNE 04339	SAV0327	37	85	58	100
ΦNE 06073	SAV0328	166			
ΦNE 05517	SAV0329	105			
ΦNE 02277	SAV0330	95			
ΦNE 05320	SAV0332	95			
ΦNE 04148	SAV0334	74			
ΦNE 03498	SAV0335	105			
ΦNE 08713	SAV0337	93			
ΦNE 03817	SAV0337	70			
ΦNE 00413	SAV0339	75			
ΦNE 04056	SAV0339	112			
ΦNE 05037	SAV0340	100			
ΦNE 00424	SAV0341	70			
ΦNE 12477	SAV0342	93			
ΦNE 13656	SAV0343	94			
ΦNE 05333	SAV0344	90			
ΦNE 05694	SAV0345	105			
ΦNE 03851	SAV0346	50	90		
ΦNE 10814	SAV0348	90			
ΦNE 11890	SAV0350	50	93		
ΦNE 04881	SAV0351	100			
ΦNE 03635	SAV0352	112			
ΦNE 02127	SAV0353	105			
ΦNE 03134	SAV0355	113			
ΦNE 00735	SAV0356	70			
ΦNE 00204	SAV0357	100			
ΦNE 02989	SAV0357	75	90		
ΦNE 08730	SAV0358	100			
ΦNE 04976	SAV0359	100			
ΦNE 03281	SAV0360	79			
ΦNE 11678	SAV0361	92			
ΦNE 06441	SAV0363	184			
ΦNE 01611	SAV0368	43	85	98	
ΦNE 13296	SAV0370	102			
ΦNE 02822	SAV0372	106			
ΦNE 07268	SAV0375	70	100		
ΦNE 03854	SAV0376	90			
ΦNE 04161	SAV0377	95			
ΦNE 01991	SAV0377	74	95		
ΦNE 11517	SAV0378	71	100		
ΦNE 01746	SAV0379	95			
ΦNE 12691	SAV0381	50	82		96
ΦNE 04519	SAV0382	118			
ΦNE 05489	SAV0383	105			
ΦNE 12236	SAV0385	79	93		
ΦNE 09826	SAV0386	105			
ΦNE 09238	SAV0388	94			
ΦNE 04691	SAV0389	100			
ΦNE 02868	SAV0390	125			
ΦNE 02197	SAV0391	105			
ΦNE 10224	SAV0416	105			
ΦNE 11908	SAV0417	100			
ΦNE 00572	SAV0420	60	100		
ΦNE 06130	SAV0421	109	100		
ΦNE 04681	SAV0424	100			102
ΦNE 09645	SAV0425	100	100		
ΦNE 03859	SAV0426	75	95		
ΦNE 02183	SAV0427	105			
ΦNE 01645	SAV0428	95			
ΦNE 11723	SAV0429	95			
ΦNE 06340	SAV0430	169			
ΦNE 00606	SAV0432	70			
ΦNE 13910	SAV0433	97			
ΦNE 01618	SAV0434	95			
ΦNE 01996	SAV0436	105			
ΦNE 00586	SAV0438	85			
ΦNE 12927	SAV0441	87			
ΦNE 12268	SAV0442	63	90		
ΦNE 04371	SAV0444	100			
ΦNE 00383	SAV0445	100			
ΦNE 05045	SAV0446	80			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 05251	SAV0449	100			
ΦNE 04173	SAV0450	47	90		
ΦNE 00537	SAV0455	85			
ΦNE 03741	SAV0456	106			
ΦNE 05316	SAV0457	100			
ΦNE 04955	SAV0459	95			
ΦNE 03554	SAV0461	100			
ΦNE 00099	SAV0461	90			
ΦNE 01861	SAV0461	105			
ΦNE 00841	SAV0462	62			
ΦNE 02295	SAV0463	105			
ΦNE 01857	SAV0464	89			
ΦNE 00339	SAV0464	80			
ΦNE 04405	SAV0465	112			
ΦNE 06582	SAV0466*	94			
ΦNE 02115	SAV0467	105			
ΦNE 00464	SAV0468	50	100		
ΦNE 04062	SAV0469	112			
ΦNE 03883	SAV0470	80			
ΦNE 12685	SAV0471	67	96		
ΦNE 04151	SAV0472	105			
ΦNE 02133	SAV0473	105			
ΦNE 00072	SAV0474	90			
ΦNE 03871	SAV0475	10	0		10
ΦNE 03557	SAV0476	95			
ΦNE 11167	SAV0481	105			
ΦNE 14049	SAV0485	10	64		96
ΦNE 03926	SAV0487	100			
ΦNE 01612	SAV0488	73	100		
ΦNE 04831	SAV0489	90			
ΦNE 13072	SAV0489*	102			
ΦNE 05397	SAV0490	105			
ΦNE 03488	SAV0492	105			
ΦNE 05534	SAV0493	105			
ΦNE 08899	SAV0495	33	107		98
ΦNE 09720	SAV0499	105			
ΦNE 09944	SAV0501	105			
ΦNE 02410	SAV0501	105			
ΦNE 09430	SAV0503	32	71		98
ΦNE 04818	SAV0511	60	65	33	75
ΦNE 04925	SAV0512	100			
ΦNE 09310	SAV0516	88	107		
ΦNE 04532	SAV0518	118			
ΦNE 03216	SAV0518	89			
ΦNE 10259	SAV0520	105			
ΦNE 04483	SAV0521	100			
ΦNE 00696	SAV0522	60			
ΦNE 02037	SAV0523	105			
ΦNE 03019	SAV0525	113			
ΦNE 00446	SAV0525	60	100		
ΦNE 03634	SAV0526	71			
ΦNE 05910	SAV0527	105			
ΦNE 11689	SAV0528	83			
ΦNE 02860	SAV0530	31	20		97
ΦNE 00708	SAV0531	50	100		
ΦNE 11988	SAV0532	58	93		
ΦNE 03612	SAV0541	59	50	86	100
ΦNE 03459	SAV0549	105			
ΦNE 03858	SAV0550	100			
ΦNE 01604	SAV0551	110			
ΦNE 04399	SAV0552	71			
ΦNE 02892	SAV0552	119			
ΦNE 00610	SAV0553	70			
ΦNE 08699	SAV0555	90			
ΦNE 03850	SAV0556	75	100		
ΦNE 02743	SAV0559	125			
ΦNE 13068	SAV0560	96			
ΦNE 03932	SAV0561	90			
ΦNE 03506	SAV0562	100			
ΦNE 00583	SAV0563	100			97
ΦNE 03187	SAV0564	100			
ΦNE 09690	SAV0567	105			
ΦNE 04823	SAV0568	95			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 11650	SAV0569	83			
ΦNE 12246	SAV0570	88	90		
ΦNE 03062	SAV0571	44	75	83	98
ΦNE 03520	SAV0572	84			
ΦNE 03856	SAV0573	80			
ΦNE 04380	SAV0573	65			
ΦNE 09443	SAV0574	95			
ΦNE 04497	SAV0575	118			
ΦNE 05028	SAV0576	95			
ΦNE 06188	SAV0577	131			
ΦNE 03482	SAV0580	89			
ΦNE 10785	SAV0581	86			
ΦNE 06170	SAV0583	159			
ΦNE 05277	SAV0584	75	95		
ΦNE 02439	SAV0586	105			
ΦNE 01545	SAV0588	30	35		5
ΦNE 01995	SAV0594	105			
ΦNE 10439	SAV0595	93			
ΦNE 09988	SAV0596	105			
ΦNE 04142	SAV0596	79			
ΦNE 05200	SAV0597	75	80	69	93
ΦNE 02981	SAV0598	125			
ΦNE 06547	SAV0598	88	100		
ΦNE 02070	SAV0600	84			
ΦNE 05263	SAV0601	100			
ΦNE 12002	SAV0602	121			
ΦNE 01599	SAV0603	85			
ΦNE 05238	SAV0604	85			
ΦNE 04470	SAV0605	53	85	45	97
ΦNE 00139	SAV0609	95			
ΦNE 04481	SAV0610	53	80	51	98
ΦNE 01637	SAV0611	95			
ΦNE 03143	SAV0612	75	60	70	98
ΦNE 03663	SAV0615	59	100		
ΦNE 10017	SAV0616	105			
ΦNE 03709	SAV0617	76			
ΦNE 04096	SAV0620	82	85	97	
ΦNE 04837	SAV0621	100			
ΦNE 11326	SAV0622	109			
ΦNE 00286	SAV0625	90			
ΦNE 14384	SAV0626	90			
ΦNE 01786	SAV0629	105			
ΦNE 01485	SAV0631	79			
ΦNE 02717	SAV0632	125			
ΦNE 09193	SAV0633	102			
ΦNE 04913	SAV0635	95			
ΦNE 05382	SAV0640	105			
ΦNE 11552	SAV0642	42	28		100
ΦNE 02038	SAV0643	63	60	13	23
ΦNE 12855	SAV0644	93			
ΦNE 03704	SAV0645	59	85	97	
ΦNE 03100	SAV0646*	69	75	83	98
ΦNE 11205	SAV0647	109			
ΦNE 03749	SAV0648	94			
ΦNE 02667	SAV0649	100			
ΦNE 09237	SAV0650	90			
ΦNE 02257	SAV0652	84			
ΦNE 02489	SAV0653	53	20	25	
ΦNE 02849	SAV0654	75			
ΦNE 02091	SAV0655	32	65	25	
ΦNE 00623	SAV0656	90			
ΦNE 03803	SAV0657	100			
ΦNE 03813	SAV0658	50	70	65	97
ΦNE 04324	SAV0659	89			
ΦNE 03902	SAV0660	50	75	63	98
ΦNE 00587	SAV0661	70			
ΦNE 04764	SAV0662	100			
ΦNE 04345	SAV0662	95			
ΦNE 05491	SAV0663	105			
ΦNE 03029	SAV0664	63	90		
ΦNE 09455	SAV0665	59	107		100
ΦNE 05202	SAV0667	95			
ΦNE 12771	SAV0668	90			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 04018	SAV0669	80			
ΦNE 03602	SAV0672	118			
ΦNE 02263	SAV0672	105			
ΦNE 01948	SAV0673	89			
ΦNE 01974	SAV0674	100			
ΦNE 10215	SAV0675	105			
ΦNE 05583	SAV0675	95	95		
ΦNE 00507	SAV0676	80			
ΦNE 09638	SAV0679	105			
ΦNE 00785	SAV0679	65			
ΦNE 05086	SAV0680	100			
ΦNE 00836	SAV0681	51	95		
ΦNE 00316	SAV0684	100			
ΦNE 00617	SAV0685	75			
ΦNE 03040	SAV0686	88			
ΦNE 04065	SAV0687	112			
ΦNE 10986	SAV0690	109			
ΦNE 12280	SAV0691	58	100		
ΦNE 11360	SAV0692	109			
ΦNE 04797	SAV0693	100			
ΦNE 09710	SAV0694	105			
ΦNE 05267	SAV0695	100			
ΦNE 02147	SAV0696	95			
ΦNE 09918	SAV0698	105			
ΦNE 09835	SAV0699	105			
ΦNE 04930	SAV0700	100			
ΦNE 00659	SAV0701	85			
ΦNE 05064	SAV0702	100			
ΦNE 09837	SAV0703	105			
ΦNE 09725	SAV0705	100	65	36	93
ΦNE 01594	SAV0706	98			
ΦNE 02705	SAV0707	125			
ΦNE 09654	SAV0708	105			
ΦNE 01776	SAV0709	16	90	53	78
ΦNE 03711	SAV0711	41	85	73	90
ΦNE 11117	SAV0713	91			
ΦNE 02930	SAV0714	119			
ΦNE 00549	SAV0715	85			
ΦNE 05377	SAV0717	100			
ΦNE 04130	SAV0718	95			
ΦNE 04908	SAV0720	100			
ΦNE 09483	SAV0721	27	100		68
ΦNE 09880	SAV0722	105			
ΦNE 05542	SAV0723	105			
ΦNE 02266	SAV0724	100			
ΦNE 05002	SAV0725	90			
ΦNE 00328	SAV0726	95			
ΦNE 04880	SAV0727	85	85	71	97
ΦNE 10547	SAV0728	73			
ΦNE 02913	SAV0729	119			
ΦNE 02988	SAV0733	75	90		
ΦNE 02275	SAV0733	63			
ΦNE 02772	SAV0734	125			
ΦNE 08880	SAV0735	92			
ΦNE 00012	SAV0736	100			
ΦNE 01999	SAV0737	74	100		
ΦNE 02004	SAV0740	89			
ΦNE 09297	SAV0742	103			
ΦNE 05140	SAV0743	100			
ΦNE 09363	SAV0744	23	89		100
ΦNE 05370	SAV0745	100			
ΦNE 01804	SAV0746	42	100		
ΦNE 13309	SAV0748	96			
ΦNE 12261	SAV0749	83	103		
ΦNE 01492	SAV0750	98			
ΦNE 13522	SAV0751	100			
ΦNE 03632	SAV0755	29	90		
ΦNE 00872	SAV0755	92			
ΦNE 11672	SAV0758	54	90		
ΦNE 05522	SAV0759	105			
ΦNE 04223	SAV0760	105			
ΦNE 03114	SAV0761	125			
ΦNE 00106	SAV0761	90			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 02399	SAV0762	105			
ΦNE 05151	SAV0763	100			
ΦNE 13116	SAV0768	22			
ΦNE 00102	SAV0769	95			
ΦNE 03043	SAV0769	88			
ΦNE 15277	SAV0770	57	93		
ΦNE 03118	SAV0775	125			
ΦNE 14436	SAV0779	97			
ΦNE 04111	SAV0800	79			
ΦNE 03793	SAV0803	112			
ΦNE 02513	SAV0804	100			
ΦNE 02360	SAV0805	100			
ΦNE 12858	SAV0808	43	82		98
ΦNE 09646	SAV0809	105			
ΦNE 06882	SAV0810	100			
ΦNE 05280	SAV0811	100			
ΦNE 06933	SAV0812	87			
ΦNE 09823	SAV0815	95	65	56	93
ΦNE 03877	SAV0815	97			
ΦNE 15315	SAV0819	73	104		
ΦNE 07534	SAV0822	63	82		98
ΦNE 11279	SAV0825	95			
ΦNE 06610	SAV0826	73	107		
ΦNE 12871	SAV0830	57	100		
ΦNE 06050	SAV0830	138			
ΦNE 02894	SAV0835	100	80	85	98
ΦNE 05142	SAV0837	95			
ΦNE 02404	SAV0838	105			
ΦNE 00555	SAV0838	80			
ΦNE 12909	SAV0839	90			
ΦNE 04279	SAV0841	21	30	13	10
ΦNE 03788	SAV0845	118			
ΦNE 09814	SAV0848	105			
ΦNE 00225	SAV0849	100			
ΦNE 07262	SAV0855	27	36		70
ΦNE 03416	SAV0855	84			
ΦNE 12671	SAV0858	57	29		
ΦNE 04000	SAV0861*	95			
ΦNE 12478	SAV0862	7	21		96
ΦNE 06544	SAV0863	82	104		
ΦNE 08772	SAV0866	28	22.7		
ΦNE 12985	SAV0868*	98			
ΦNE 04743	SAV0875	100			
ΦNE 03004	SAV0876	38	15	27	17
ΦNE 01478	SAV0877	85			
ΦNE 04372	SAV0881	118			
ΦNE 03060	SAV0882	75	60	65	100
ΦNE 00024	SAV0883	50	100		
ΦNE 05312	SAV0885	95			
ΦNE 00046	SAV0886	81			
ΦNE 08764	SAV0886	79			
ΦNE 10805	SAV0887	90			
ΦNE 03820	SAV0887	90			
ΦNE 00084	SAV0888	85			
ΦNE 03685	SAV0889	76			
ΦNE 00294	SAV0890	95			
ΦNE 09919	SAV0891	105			
ΦNE 00667	SAV0892	80			
ΦNE 11287	SAV0893	55	35.1		
ΦNE 02185	SAV0894	100			
ΦNE 03655	SAV0895	100			
ΦNE 02232	SAV0896	89			
ΦNE 03687	SAV0897	47	100		
ΦNE 10971	SAV0898	82			
ΦNE 04734	SAV0898	100			
ΦNE 06680	SAV0898	163			
ΦNE 09552	SAV0900	55	100		
ΦNE 03708	SAV0901	82			
ΦNE 00064	SAV0901	81			
ΦNE 00226	SAV0902	100			
ΦNE 02017	SAV0903	53	95		
ΦNE 01552	SAV0904	104			
ΦNE 03093	SAV0904	94			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 00637	SAV0905	90			
ΦNE 07080	SAV0906	67	89		
ΦNE 06695	SAV0908	96			
ΦNE 03088	SAV0909	113			
ΦNE 01519	SAV0909	104			
ΦNE 03217	SAV0910	100			
ΦNE 00672	SAV0910	70			
ΦNE 01580	SAV0911	85			
ΦNE 06605	SAV0912	166			
ΦNE 00479	SAV0913	75			
ΦNE 12527	SAV0920	47	93		
ΦNE 04333	SAV0921	100			
ΦNE 06690	SAV0922	175			
ΦNE 03068	SAV0922	106			
ΦNE 01629	SAV0922	105			
ΦNE 01811	SAV0923	89			
ΦNE 00703	SAV0924	15	100		
ΦNE 00769	SAV0927	35	100		
ΦNE 05344	SAV0928	100			
ΦNE 01968	SAV0929	95			
ΦNE 00653	SAV0930	85			
ΦNE 12076	SAV0933	54	100		
ΦNE 09346	SAV0935	100			
ΦNE 04728	SAV0937	100			
ΦNE 00231	SAV0938	100			
ΦNE 13891	SAV0939	100			
ΦNE 10876	SAV0940	72	45.5	29.8	
ΦNE 01739	SAV0941	105			
ΦNE 05012	SAV0942	85			
ΦNE 11584	SAV0943	63	93		
ΦNE 05437	SAV0944	95	65	47	25
ΦNE 04008	SAV0945	75			
ΦNE 09242	SAV0956	93			
ΦNE 03954	SAV0957	100			
ΦNE 02830	SAV0958	106			
ΦNE 00806	SAV0959	31	100		
ΦNE 04599	SAV0960	76			
ΦNE 08885	SAV0962	98			
ΦNE 00327	SAV0963	80			
ΦNE 02078	SAV0968	63	100		
ΦNE 02923	SAV0969	94			
ΦNE 11697	SAV0970	33	103		
ΦNE 05620	SAV0974	105			
ΦNE 03545	SAV0976	100			
ΦNE 00694	SAV0977	35	100		
ΦNE 05299	SAV0978	100			
ΦNE 05409	SAV0979	100			
ΦNE 01532	SAV0981	110			
ΦNE 04047	SAV0985	100			
ΦNE 02880	SAV0986	113			
ΦNE 02280	SAV0987	100			
ΦNE 14304	SAV0988	100			
ΦNE 04084	SAV0989	94			
ΦNE 02040	SAV0990	105			
ΦNE 00303	SAV0991	90			
ΦNE 01951	SAV0992	100			
ΦNE 05621	SAV0993	105			
ΦNE 03876	SAV0994	100			
ΦNE 10629	SAV0995	90			
ΦNE 05436	SAV0998	105			
ΦNE 04804	SAV1000	100			
ΦNE 00315	SAV1000	100			
ΦNE 05368	SAV1000	100			
ΦNE 06682	SAV1002	188			
ΦNE 02696	SAV1004	125			
ΦNE 04841	SAV1008	100			
ΦNE 04961	SAV1009	100			
ΦNE 00142	SAV1010	70	95		
ΦNE 00126	SAV1012	65	90	37	25
ΦNE 10663	SAV1013	97			
ΦNE 08774	SAV1014	94			
ΦNE 06998	SAV1019	70	96		
ΦNE 04400	SAV1023	71			93

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 02935	SAV1024	125			
ΦNE 05509	SAV1025	105			
ΦNE 03801	SAV1028	100			
ΦNE 00658	SAV1028*	90			
ΦNE 04348	SAV1030	112			
ΦNE 05080	SAV1031	95			
ΦNE 02673	SAV1032	95			
ΦNE 02898	SAV1033	119			
ΦNE 03633	SAV1035	88			
ΦNE 13696	SAV1037	57	100		
ΦNE 00261	SAV1039	60			
ΦNE 03175	SAV1039	106			
ΦNE 05328	SAV1040	100			
ΦNE 09687	SAV1044	105			
ΦNE 04732	SAV1046	100			
ΦNE 01572	SAV1047	91			
ΦNE 13070	SAV1048	98			
ΦNE 09873	SAV1049	105			
ΦNE 02744	SAV1050	125			
ΦNE 06238	SAV1052	22	89.7		
ΦNE 04970	SAV1053	100			
ΦNE 06233	SAV1054	144			
ΦNE 10201	SAV1054	105	59	75	100
ΦNE 05261	SAV1057	90			
ΦNE 02302	SAV1060	105			
ΦNE 05543	SAV1062	105			
ΦNE 02380	SAV1064	100			
ΦNE 05091	SAV1065	100			
ΦNE 04806	SAV1065	100			
ΦNE 02924	SAV1066	125			
ΦNE 01626	SAV1066	105			
ΦNE 12894	SAV1067	100			
ΦNE 05399	SAV1068	105			
ΦNE 03038	SAV1070	125			
ΦNE 03863	SAV1071	100			
ΦNE 04103	SAV1073	118			
ΦNE 03896	SAV1074	100			
ΦNE 03789	SAV1075	118			
ΦNE 05649	SAV1076	105			
ΦNE 13746	SAV1077	102			
ΦNE 00570	SAV1081	85			
ΦNE 00870	SAV1084	56	100		
ΦNE 06439	SAV1086	153			
ΦNE 09917	SAV1088	105			
ΦNE 01837	SAV1089	89			
ΦNE 04761	SAV1092	95			
ΦNE 10868	SAV1094	0	26		22
ΦNE 04312	SAV1098	68			
ΦNE 11872	SAV1100	75	97		
ΦNE 12133	SAV1101	46	100		
ΦNE 02669	SAV1102	100			
ΦNE 06164	SAV1104	134			
ΦNE 03662	SAV1105	76			
ΦNE 12645	SAV1108	100			
ΦNE 02729	SAV1109	125			
ΦNE 04029	SAV1109	95			
ΦNE 06499	SAV1110	141			
ΦNE 04166	SAV1111	105			
ΦNE 01941	SAV1111	105			
ΦNE 09768	SAV1112	100	100		
ΦNE 04475	SAV1114	47	95		
ΦNE 03778	SAV1114	59	100		
ΦNE 14423	SAV1115	100			
ΦNE 02477	SAV1117	79	100		
ΦNE 00441	SAV1118	25	95		
ΦNE 04298	SAV1121	105			
ΦNE 03807	SAV1121	90			
ΦNE 04820	SAV1122	75	90		
ΦNE 12232	SAV1123	96			
ΦNE 11795	SAV1126	118			
ΦNE 06230	SAV1127	166			
ΦNE 04990	SAV1129	95			
ΦNE 01954	SAV1130	105			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 09284	SAV1131	103			
ΦNE 03054	SAV1132	69			
ΦNE 04382	SAV1132	112			
ΦNE 13865	SAV1133	100			
ΦNE 12849	SAV1134	93			
ΦNE 03811	SAV1135	75			
ΦNE 01454	SAV1135	104			
ΦNE 06585	SAV1136	90	100		
ΦNE 05067	SAV1136	85			
ΦNE 04124	SAV1137	100			
ΦNE 04007	SAV1142	70			
ΦNE 00668	SAV1143	75			
ΦNE 05614	SAV1144	105			
ΦNE 05356	SAV1146	100			
ΦNE 04650	SAV1146	112			
ΦNE 01442	SAV1148	104			
ΦNE 04085	SAV1150	118			
ΦNE 02844	SAV1152	100			
ΦNE 11877	SAV1153	13	97		
ΦNE 13803	SAV1157	100			
ΦNE 03597	SAV1158	100			
ΦNE 11961	SAV1159	92			
ΦNE 02140	SAV1163	89			
ΦNE 01440	SAV1166	122			101
ΦNE 10229	SAV1168	105			
ΦNE 05014	SAV1169	100			
ΦNE 12598	SAV1170	97			
ΦNE 04829	SAV1171	95			
ΦNE 04507	SAV1172	118			
ΦNE 00372	SAV1173	75			
ΦNE 11641	SAV1174	121			
ΦNE 09093	SAV1175	97			
ΦNE 04044	SAV1177	76	30	50	100
ΦNE 10949	SAV1190	86	64.9		
ΦNE 12315	SAV1191	97			
ΦNE 00715	SAV1194	65			
ΦNE 00656	SAV1201	30	5		
ΦNE 00678	SAV1202	35	20		
ΦNE 02887	SAV1203	88	5		88
ΦNE 04659	SAV1203	12	80		
ΦNE 12249	SAV1204*	42	103		
ΦNE 02904	SAV1205	56	5		94
ΦNE 03984	SAV1206	90			
ΦNE 04888	SAV1207	100			
ΦNE 09798	SAV1208	105			
ΦNE 09735	SAV1213	105			
ΦNE 00197	SAV1217	100			
ΦNE 00032	SAV1218	81			
ΦNE 14673	SAV1219	43	100		
ΦNE 03940	SAV1220	95			
ΦNE 12600	SAV1221	30	14		
ΦNE 11428	SAV1224	117			
ΦNE 00020	SAV1226	25	100		
ΦNE 11173	SAV1227	27	24		84
ΦNE 10529	SAV1234	64	79		96
ΦNE 11999	SAV1240	104			
ΦNE 09294	SAV1241	103			
ΦNE 05179	SAV1242	90			
ΦNE 01541	SAV1244	91			
ΦNE 00594	SAV1247	60	100		
ΦNE 02920	SAV1248	88	80	78	98
ΦNE 06190	SAV1249	159			
ΦNE 03407	SAV1251	89			
ΦNE 09425	SAV1270	132			
ΦNE 02315	SAV1271	100			
ΦNE 05451	SAV1274	105			
ΦNE 10926	SAV1278	27	97		
ΦNE 14030	SAV1279	100			
ΦNE 04737	SAV1280	100			
ΦNE 01812	SAV1281	100			
ΦNE 09773	SAV1284	100	100		
ΦNE 00206	SAV1292	20	100		
ΦNE 09545	SAV1294	32	107		

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 04775	SAV1296	100			
ΦNE 00866	SAV1296	72			
ΦNE 01512	SAV1297	79			
ΦNE 00722	SAV1298	70			
ΦNE 11481	SAV1300	42	48		98
ΦNE 05496	SAV1301	105			
ΦNE 02025	SAV1302	100			
ΦNE 09695	SAV1303	105			
ΦNE 06616	SAV1305	178			
ΦNE 04164	SAV1306	100			
ΦNE 00270	SAV1307	90			
ΦNE 02357	SAV1308	105			
ΦNE 01862	SAV1314	100			
ΦNE 03808	SAV1315	85			
ΦNE 00201	SAV1317	95			
ΦNE 04854	SAV1318	100			
ΦNE 09053	SAV1319	90	100		
ΦNE 12683	SAV1320	63	104		
ΦNE 01824	SAV1321	105			
ΦNE 11466	SAV1322	46	103		
ΦNE 00021	SAV1323	94			
ΦNE 03258	SAV1324	95			
ΦNE 04891	SAV1326	100			
ΦNE 03196	SAV1327	106			
ΦNE 11942	SAV1328	104			
ΦNE 12625	SAV1329	53	71		100
ΦNE 09336	SAV1330	82			
ΦNE 10079	SAV1331	105			
ΦNE 00210	SAV1332	45	100		
ΦNE 03920	SAV1333	100			
ΦNE 12739	SAV1335	80	75		100
ΦNE 06121	SAV1336	169			
ΦNE 03569	SAV1337	89			
ΦNE 05032	SAV1338	100			
ΦNE 04545	SAV1340	106			
ΦNE 10517	SAV1341	50	86		100
ΦNE 09392	SAV1344	105			
ΦNE 05227	SAV1345	100			
ΦNE 00220	SAV1346	30	85	98	
ΦNE 06464	SAV1349	90	104		
ΦNE 00263	SAV1350	25	50		58
ΦNE 06317	SAV1351	147			
ΦNE 11868	SAV1355	21	34		100
ΦNE 09110	SAV1356	72	86.4	63.2	
ΦNE 11405	SAV1357	132			
ΦNE 08767	SAV1361	103			
ΦNE 11797	SAV1362*	50	21.1		
ΦNE 04469	SAV1364	53	95		
ΦNE 09750	SAV1365	100	100		
ΦNE 03998	SAV1366	90			
ΦNE 00553	SAV1367	100			
ΦNE 06482	SAV1368	134			
ΦNE 03894	SAV1369	100			
ΦNE 10240	SAV1370	84	65		72
ΦNE 01453	SAV1371	104			
ΦNE 11372	SAV1372	82	71.9		
ΦNE 03755	SAV1373	118			
ΦNE 00727	SAV1373	85			
ΦNE 09532	SAV1377	27	100		
ΦNE 00134	SAV1379	85			
ΦNE 04936	SAV1379	95			
ΦNE 12518	SAV1380	90			
ΦNE 05051	SAV1381	100			
ΦNE 04189	SAV1382	58	45	75	100
ΦNE 00562	SAV1383	80			
ΦNE 03893	SAV1384	85			
ΦNE 00589	SAV1385	80			
ΦNE 05321	SAV1386	100			
ΦNE 05589	SAV1387	105			
ΦNE 06387	SAV1388	153			
ΦNE 01667	SAV1389	84			
ΦNE 02833	SAV1389	125			
ΦNE 04987	SAV1391	100			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 04444	SAV1392	100			
ΦNE 09077	SAV1393	90			
ΦNE 04943	SAV1394	95			
ΦNE 02057	SAV1395	100			
ΦNE 00844	SAV1396	41	90	97	
ΦNE 12571	SAV1397	97			
ΦNE 11121	SAV1399	132			
ΦNE 10233	SAV1400	105			
ΦNE 05537	SAV1401	105			
ΦNE 08971	SAV1404	80	100		
ΦNE 09592	SAV1405	86			
ΦNE 00420	SAV1407	80			
ΦNE 03005	SAV1408	100			
ΦNE 03580	SAV1408	32	15	27	98
ΦNE 03792	SAV1411	112			
ΦNE 04792	SAV1412	90	100		
ΦNE 04120	SAV1416	53	95		
ΦNE 09941	SAV1420	105			
ΦNE 02406	SAV1423	105			
ΦNE 05309	SAV1425	95			
ΦNE 05515	SAV1429	95	100		
ΦNE 02155	SAV1432	68	100		
ΦNE 11448	SAV1433	58	66		100
ΦNE 04384	SAV1434	118			
ΦNE 00288	SAV1435	85			
ΦNE 02417	SAV1435	105			
ΦNE 03648	SAV1435	94			
ΦNE 13073	SAV1436	92			
ΦNE 03505	SAV1436	89			
ΦNE 02311	SAV1437	105			
ΦNE 09822	SAV1437	100	95		
ΦNE 03573	SAV1438	74			
ΦNE 01628	SAV1439	105			
ΦNE 10883	SAV1440	97			
ΦNE 04669	SAV1441	100			
ΦNE 10919	SAV1442	62	50	49.1	
ΦNE 05628	SAV1443	105			
ΦNE 10463	SAV1444	100			
ΦNE 02660	SAV1448	100			
ΦNE 00061	SAV1451	63	100		
ΦNE 11116	SAV1454	123			
ΦNE 01561	SAV1455	67	100	97	
ΦNE 09834	SAV1455	100	85		97
ΦNE 10521	SAV1458	41	93		
ΦNE 14032	SAV1459	100			
ΦNE 04132	SAV1461	105			
ΦNE 01471	SAV1463	98			
ΦNE 00200	SAV1469	60	95		
ΦNE 09236	SAV1476	96			
ΦNE 00664	SAV1480	75			
ΦNE 02088	SAV1480	105			
ΦNE 01733	SAV1482	95			
ΦNE 04755	SAV1483	100			
ΦNE 09828	SAV1484	105			
ΦNE 00334	SAV1485	100			
ΦNE 09669	SAV1488	105			
ΦNE 06275	SAV1489	134	100		
ΦNE 08794	SAV1489*	86			
ΦNE 12844	SAV1491	97			
ΦNE 00634	SAV1493	85			
ΦNE 08902	SAV1494	92			
ΦNE 02742	SAV1495	119			
ΦNE 10457	SAV1496	93			
ΦNE 03765	SAV1499	71			
ΦNE 08669	SAV1500	86			
ΦNE 04692	SAV1501	100			
ΦNE 03207	SAV1502	105			
ΦNE 09842	SAV1503	105			
ΦNE 03915	SAV1506	95			
ΦNE 10195	SAV1507	105			
ΦNE 04920	SAV1508	100			
ΦNE 01616	SAV1509	53	100		
ΦNE 00153	SAV1512	90			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 05030	SAV1513	95			
ΦNE 09950	SAV1514	105			
ΦNE 10858	SAV1515	64	10		
ΦNE 13468	SAV1517	100			
ΦNE 10390	SAV1518	9			
ΦNE 09439	SAV1519	45	64		
ΦNE 00598	SAV1520	50	95		
ΦNE 00218	SAV1521	65	95		
ΦNE 01978	SAV1523	26	95		
ΦNE 13764	SAV1524	98			
ΦNE 09368	SAV1529	105			
ΦNE 02082	SAV1535	95			
ΦNE 01569	SAV1536	104			
ΦNE 04366	SAV1539	112			
ΦNE 09937	SAV1540	105			
ΦNE 09268	SAV1541	100			
ΦNE 03679	SAV1543	106			
ΦNE 04447	SAV1544	82			
ΦNE 05124	SAV1545	95			
ΦNE 10927	SAV1546	68			
ΦNE 01495	SAV1547	49	100		
ΦNE 09080	SAV1549	55	96		
ΦNE 00130	SAV1550	85			
ΦNE 11029	SAV1555	127			
ΦNE 00845	SAV1556	82			
ΦNE 05095	SAV1557	100			
ΦNE 10627	SAV1558	79			
ΦNE 03909	SAV1563	100			
ΦNE 10839	SAV1571	86			
ΦNE 06393	SAV1572	153			
ΦNE 10437	SAV1574	103			
ΦNE 09721	SAV1574	105			
ΦNE 05130	SAV1576	100			
ΦNE 00034	SAV1577	69			
ΦNE 00481	SAV1583	85			
ΦNE 15237	SAV1585	70	100		
ΦNE 03153	SAV1588	19	35	43	98
ΦNE 15341	SAV1589	90			
ΦNE 04436	SAV1590	76			
ΦNE 03417	SAV1591	79			
ΦNE 13165	SAV1593	67	104		
ΦNE 01788	SAV1596	74	100		
ΦNE 09942	SAV1596	105			
ΦNE 14659	SAV1600	87			
ΦNE 10658	SAV1601	90			
ΦNE 05136	SAV1603	100			
ΦNE 03405	SAV1604	105			
ΦNE 00048	SAV1606	81			
ΦNE 02005	SAV1606	84			
ΦNE 00810	SAV1607	87			
ΦNE 05512	SAV1609	105			
ΦNE 13426	SAV1610	96			
ΦNE 02786	SAV1611	125			
ΦNE 10251	SAV1612	105			
ΦNE 05586	SAV1613	105			
ΦNE 02797	SAV1614	125			
ΦNE 09933	SAV1614	105			
ΦNE 13374	SAV1616	92			
ΦNE 13118	SAV1617	51			
ΦNE 01851	SAV1619	16	70	22	63
ΦNE 03924	SAV1619	75	30	53	78
ΦNE 12141	SAV1620	38	76		84
ΦNE 00281	SAV1623	95			
ΦNE 10418	SAV1624	103			
ΦNE 09949	SAV1625	95	90		
ΦNE 03264	SAV1627	37	70	88	98
ΦNE 11865	SAV1628	88			
ΦNE 02307	SAV1632	105			
ΦNE 12680	SAV1635	97			
ΦNE 00874	SAV1636	67			
ΦNE 02425	SAV1638	95			
ΦNE 03502	SAV1638	105			
ΦNE 03576	SAV1639	89			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 02724	SAV1640	119			
ΦNE 08942	SAV1645	51	79		98
ΦNE 04763	SAV1651	100			
ΦNE 13114	SAV1660	102			
ΦNE 04873	SAV1661	100			
ΦNE 09611	SAV1664	105			
ΦNE 00482	SAV1665	85			
ΦNE 00691	SAV1667	40	100		
ΦNE 09787	SAV1674	105			
ΦNE 11361	SAV1675	123			
ΦNE 00815	SAV1676	26	95		
ΦNE 01639	SAV1677	21	35	18	48
ΦNE 01982	SAV1687	16	50	22	
ΦNE 11111	SAV1689	123			
ΦNE 05527	SAV1690	100			
ΦNE 06260	SAV1691	169			
ΦNE 03695	SAV1692	47	90		
ΦNE 14551	SAV1693	100			
ΦNE 05271	SAV1694	70	90		
ΦNE 06106	SAV1695	188			
ΦNE 13092	SAV1697	100			
ΦNE 01819	SAV1706	16	85	73	100
ΦNE 14013	SAV1707	80	96		
ΦNE 10478	SAV1708	91			
ΦNE 02179	SAV1709	105			
ΦNE 10024	SAV1710	105			
ΦNE 09686	SAV1712	105			
ΦNE 09756	SAV1713	105			
ΦNE 12153	SAV1714	54	97		
ΦNE 00831	SAV1716	46	100		
ΦNE 13546	SAV1718	102			
ΦNE 09295	SAV1721	103			
ΦNE 06110	SAV1722	144			
ΦNE 02692	SAV1723	119			
ΦNE 05575	SAV1724	105			
ΦNE 09771	SAV1725	100	70	84	75
ΦNE 01769	SAV1726	100			
ΦNE 05535	SAV1728	100			
ΦNE 05285	SAV1730	75	80	109	
ΦNE 06315	SAV1731	163			
ΦNE 00742	SAV1731	100			94
ΦNE 04341	SAV1732	32	90		
ΦNE 00456	SAV1733	100	100		
ΦNE 09642	SAV1734	105			
ΦNE 03717	SAV1735	65			
ΦNE 11822	SAV1736	88			
ΦNE 12369	SAV1744	57	93		
ΦNE 09978	SAV1745	105			
ΦNE 13099	SAV1746	100			
ΦNE 05495	SAV1747	100			
ΦNE 00370	SAV1750	70			
ΦNE 06678	SAV1751	92			
ΦNE 06780	SAV1752	60	96		
ΦNE 03027	SAV1753	50	80	78	100
ΦNE 01581	SAV1755	91			
ΦNE 01809	SAV1756	105			
ΦNE 04980	SAV1758	100			
ΦNE 00208	SAV1758	92			104
ΦNE 05106	SAV1758	95			
ΦNE 04981	SAV1761	100			
ΦNE 00074	SAV1762	90			
ΦNE 05156	SAV1763	95			
ΦNE 11740	SAV1765	77			
ΦNE 13818	SAV1766	96			
ΦNE 00862	SAV1768	103			
ΦNE 14759	SAV1769	100			
ΦNE 04855	SAV1770	100			
ΦNE 03534	SAV1771	100			
ΦNE 02541	SAV1772	100			
ΦNE 02899	SAV1772	125			
ΦNE 11851	SAV1773	96			
ΦNE 03743	SAV1774	100			
ΦNE 06358	SAV1775	172			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 09741	SAV1777	105			
ΦNE 11323	SAV1778	105			
ΦNE 09124	SAV1779	90	93		
ΦNE 00247	SAV1780	85			
ΦNE 04924	SAV1784	100			
ΦNE 02929	SAV1785	63	95		
ΦNE 05157	SAV1787	100			
ΦNE 13264	SAV1788	90	107		
ΦNE 01969	SAV1791	16	5		90
ΦNE 05533	SAV1793	105			
ΦNE 13076	SAV1794	100			
ΦNE 13249	SAV1796	100			
ΦNE 11082	SAV1798	64	86		
ΦNE 04503	SAV1801	118			
ΦNE 04108	SAV1803	106			
ΦNE 05478	SAV1805	105			
ΦNE 04948	SAV1807	100			
ΦNE 03260	SAV1808	42	85	78	100
ΦNE 05473	SAV1808	100			
ΦNE 06104	SAV1809	169			
ΦNE 02814	SAV1810	125			
ΦNE 11075	SAV1811	100			
ΦNE 12789	SAV1813	97			
ΦNE 01785	SAV1814	105			
ΦNE 03169	SAV1815	69	90		
ΦNE 13601	SAV1819	100			
ΦNE 08984	SAV1820	92			
ΦNE 03521	SAV1821	95			
ΦNE 09153	SAV1835	88	104		
ΦNE 01973	SAV1838	105			
ΦNE 11581	SAV1839	54	76		96
ΦNE 09667	SAV1840	105			
ΦNE 09920	SAV1842	105			
ΦNE 00631	SAV1843	70			
ΦNE 03798	SAV1844	118			
ΦNE 04904	SAV1846	95			
ΦNE 06189	SAV1848	84	100		
ΦNE 03790	SAV1849	106			
ΦNE 13245	SAV1850	88	100		
ΦNE 01596	SAV1851	12			
ΦNE 03937	SAV1851	25	30		63
ΦNE 00748	SAV1852	85			
ΦNE 11183	SAV1854	82	64.9		
ΦNE 04023	SAV1856	60	65	75	100
ΦNE 09706	SAV1857	105			
ΦNE 09524	SAV1858	32	96		
ΦNE 05062	SAV1859	100			
ΦNE 01520	SAV1862	61	100		
ΦNE 05104	SAV1863	90			
ΦNE 15185	SAV1864	97			
ΦNE 01784	SAV1865	105			
ΦNE 04859	SAV1866	95			
ΦNE 00194	SAV1868	95			
ΦNE 03703	SAV1870	35	70	97	
ΦNE 12992	SAV1871	100			98
ΦNE 12899	SAV1873	53	75		96
ΦNE 06284	SAV1874	150			
ΦNE 03774	SAV1875	41	90		
ΦNE 09071	SAV1877	76	114		
ΦNE 03400	SAV1879	100			
ΦNE 03575	SAV1880	89			
ΦNE 15208	SAV1881	83	104		
ΦNE 06353	SAV1883	91	72.4		
ΦNE 02993	SAV1884	69	45	67	95
ΦNE 03821	SAV1885	70	70	68	98
ΦNE 02960	SAV1886	88	95		
ΦNE 08685	SAV1887	100			
ΦNE 11839	SAV1889	113			
ΦNE 13487	SAV1890	102			
ΦNE 06497	SAV1893	144			
ΦNE 03231	SAV1894	105			
ΦNE 04966	SAV1896	95			
ΦNE 00136	SAV1897	100			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 00137	SAV1897	100			
ΦNE 10870	SAV1897	93	55	97	
ΦNE 11673	SAV1902	79			
ΦNE 11997	SAV1903	38	72		100
ΦNE 01622	SAV1906	95			
ΦNE 01592	SAV1907	55	100		
ΦNE 05144	SAV1908	100			
ΦNE 06249	SAV1909	98			
ΦNE 04478	SAV1911	65	90		
ΦNE 04134	SAV1914	95			
ΦNE 09372	SAV1915	68			
ΦNE 00718	SAV1916	65			
ΦNE 02291	SAV1917	89			
ΦNE 04769	SAV1918	35	40	73	82
ΦNE 04846	SAV1922	100			
ΦNE 01723	SAV1924	95			
ΦNE 05468	SAV1925	105			
ΦNE 04883	SAV1926	0	10	38	30
ΦNE 11080	SAV1927	41	45		20
ΦNE 01449	SAV1928	67	35	23	15
ΦNE 11264	SAV1929	55	38.6		
ΦNE 01508	SAV1932	49	90	55	97
ΦNE 12158	SAV1933	42	62		98
ΦNE 09620	SAV1934	105			
ΦNE 13110	SAV1935	98			
ΦNE 02967	SAV1936	88			
ΦNE 04149	SAV1938	79			
ΦNE 09659	SAV1938	105			
ΦNE 03698	SAV1939	94			
ΦNE 09316	SAV1941	123			
ΦNE 02996	SAV1945	88			
ΦNE 03552	SAV1948	89			
ΦNE 04335	SAV1951	100			
ΦNE 12961	SAV1952	100			
ΦNE 04092	SAV1953	118			
ΦNE 02902	SAV1953	125			
ΦNE 01647	SAV1954	89			
ΦNE 00355	SAV1955	85			
ΦNE 04496	SAV1957	118			
ΦNE 00548	SAV1958	70			
ΦNE 05637	SAV1959	105			
ΦNE 11198	SAV1960	109			
ΦNE 12540	SAV1962	57	96		
ΦNE 11765	SAV1964	118			
ΦNE 06327	SAV1965	50	41.4		
ΦNE 04147	SAV1966	58	100		
ΦNE 03672	SAV1967	65			
ΦNE 03058	SAV1968	44	80	87	98
ΦNE 00613	SAV1969	85			
ΦNE 00311	SAV1970	100			
ΦNE 03622	SAV1974	94			
ΦNE 06446	SAV1976	169			
ΦNE 05162	SAV1977	95			
ΦNE 02679	SAV1978	25	45	23	15
ΦNE 11089	SAV1980	109			
ΦNE 04158	SAV1980	37	80	88	97
ΦNE 04765	SAV1980	100			
ΦNE 00050	SAV1981	81			
ΦNE 02109	SAV1982	105			
ΦNE 05258	SAV1983	95			
ΦNE 12674	SAV1984	73	96		
ΦNE 03200	SAV1986	38	60	83	28
ΦNE 06697	SAV1991	163			
ΦNE 02683	SAV1992	125		48	
ΦNE 01459	SAV1992	98			
ΦNE 03814	SAV1994	75			
ΦNE 09825	SAV2001	105			
ΦNE 09742	SAV2002	105			
ΦNE 04193	SAV2003	53	100		
ΦNE 03288	SAV2004	74			
ΦNE 11331	SAV2005	114			
ΦNE 09440	SAV2006	91			
ΦNE 03441	SAV2007	95			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 12603	SAV2031	23	104		
ΦNE 01971	SAV2034	105			
ΦNE 04484	SAV2034	65			
ΦNE 04055	SAV2036	65	30		
ΦNE 05384	SAV2038	89	95		
ΦNE 03938	SAV2039	100			63
ΦNE 03962	SAV2040	100			
ΦNE 03868	SAV2041	30	35		100
ΦNE 05101	SAV2042	100			
ΦNE 04946	SAV2043	85	55	62	95
ΦNE 04413	SAV2045	118			
ΦNE 04397	SAV2046	118			
ΦNE 05103	SAV2048	95			
ΦNE 00752	SAV2053	50	100		
ΦNE 10056	SAV2055	105			
ΦNE 03592	SAV2058	68			
ΦNE 11921	SAV2059	63	100		
ΦNE 06357	SAV2060	92			
ΦNE 04802	SAV2060*	95			
ΦNE 00820	SAV2061	56	95		
ΦNE 00789	SAV2063	75			
ΦNE 03805	SAV2063	85			
ΦNE 04540	SAV2064	94			
ΦNE 06056	SAV2066	75	69		
ΦNE 00527	SAV2067	60	95		
ΦNE 00556	SAV2068	40	70	88	87
ΦNE 09718	SAV2069	105			
ΦNE 13708	SAV2070	22			
ΦNE 04461	SAV2073	112			
ΦNE 03192	SAV2074	113			
ΦNE 09662	SAV2075	105			
ΦNE 03183	SAV2077	94			
ΦNE 02877	SAV2078	125			
ΦNE 00593	SAV2078	100			
ΦNE 04094	SAV2079	100			
ΦNE 12590	SAV2081	37	46		
ΦNE 02828	SAV2087	113			
ΦNE 03083	SAV2088	75			
ΦNE 00196	SAV2088	90			
ΦNE 10618	SAV2091	86			
ΦNE 12882	SAV2093	93			
ΦNE 05639	SAV2093	105			
ΦNE 00426	SAV2094	60	100		
ΦNE 05459	SAV2096	105			
ΦNE 02126	SAV2101	105			
ΦNE 02208	SAV2104	74	100		
ΦNE 00209	SAV2111	45	100		
ΦNE 03277	SAV2112	89			
ΦNE 09033	SAV2113	24	96		
ΦNE 11642	SAV2114	67	66		98
ΦNE 03191	SAV2115	100			
ΦNE 03531	SAV2117	16	35	55	92
ΦNE 01625	SAV2121	63	100		
ΦNE 03903	SAV2122	75	95		
ΦNE 13125	SAV2123	4	75		
ΦNE 04714	SAV2124	100			
ΦNE 00608	SAV2129	80			
ΦNE 09408	SAV2131	50	82		98
ΦNE 11140	SAV2132	123			
ΦNE 01579	SAV2133	73			
ΦNE 03816	SAV2133	90			
ΦNE 15294	SAV2134	73	104		
ΦNE 11538	SAV2135	54	69		98
ΦNE 04729	SAV2136	100			
ΦNE 04697	SAV2137	100			
ΦNE 00644	SAV2138	80			
ΦNE 13004	SAV2142	100			
ΦNE 00297	SAV2143	85			
ΦNE 01875	SAV2144	100			
ΦNE 13492	SAV2145	102			
ΦNE 00173	SAV2146	85			
ΦNE 04069	SAV2147	106			
ΦNE 12714	SAV2152	90			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 09777	SAV2153	95	100		
ΦNE 01551	SAV2156	85			
ΦNE 04123	SAV2157	89			
ΦNE 12774	SAV2158	50	96		
ΦNE 05401	SAV2159	105			
ΦNE 04909	SAV2160	95			
ΦNE 09330	SAV2161	27	18		
ΦNE 13821	SAV2162	102			
ΦNE 09246	SAV2164	76	63.6	57.9	
ΦNE 01617	SAV2166	105			
ΦNE 03603	SAV2167	12	65	72	67
ΦNE 01945	SAV2168	84			
ΦNE 03806	SAV2169	75	90		
ΦNE 04933	SAV2170	95			105
ΦNE 03929	SAV2171	85			
ΦNE 04558	SAV2172	118			
ΦNE 00414	SAV2174	85			
ΦNE 03244	SAV2174	100			
ΦNE 04180	SAV2175	53	75	95	98
ΦNE 05526	SAV2176	105			
ΦNE 06699	SAV2177	150			
ΦNE 00049	SAV2178	75			
ΦNE 12559	SAV2179	90			
ΦNE 02896	SAV2180	88	85		100
ΦNE 11381	SAV2181	127			
ΦNE 11306	SAV2184	100			
ΦNE 09843	SAV2185	105			
ΦNE 00615	SAV2187	85			
ΦNE 04401	SAV2188	112			
ΦNE 04314	SAV2189	32	75	64	98
ΦNE 05243	SAV2189	90			
ΦNE 06472	SAV2190	175			
ΦNE 06631	SAV2191*	163			
ΦNE 03563	SAV2192	74			
ΦNE 02796	SAV2193	119			
ΦNE 00103	SAV2194	90			
ΦNE 03251	SAV2194	89			
ΦNE 00445	SAV2197	55	100		
ΦNE 09119	SAV2200	31	89		100
ΦNE 15274	SAV2201	87			
ΦNE 03517	SAV2202	74			
ΦNE 12117	SAV2203	79			
ΦNE 04489	SAV2204	76			
ΦNE 02906	SAV2204	119			
ΦNE 08826	SAV2206	94			
ΦNE 03959	SAV2207	100			
ΦNE 06362	SAV2219	150			
ΦNE 05576	SAV2252	105			
ΦNE 05438	SAV2253	105			
ΦNE 04663	SAV2254	118			
ΦNE 04767	SAV2254	100			
ΦNE 03598	SAV2255	63	95		
ΦNE 01500	SAV2256	91			
ΦNE 01901	SAV2258	89			
ΦNE 00436	SAV2261	100			
ΦNE 03285	SAV2261	95			
ΦNE 10966	SAV2265	109			100
ΦNE 03874	SAV2266	85			
ΦNE 05250	SAV2268	100			
ΦNE 04699	SAV2269	100			
ΦNE 03509	SAV2270	105			
ΦNE 01567	SAV2271	116			
ΦNE 03209	SAV2271	89			
ΦNE 11375	SAV2273	109			
ΦNE 00662	SAV2273	65			
ΦNE 03257	SAV2274	95			
ΦNE 12467	SAV2276	93			
ΦNE 04648	SAV2277	118			
ΦNE 02985	SAV2279	100			
ΦNE 04839	SAV2280	95			
ΦNE 03843	SAV2281	80			
ΦNE 04375	SAV2283	76			
ΦNE 03239	SAV2283	105			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 13637	SAV2284	88	100		
ΦNE 03275	SAV2285	79			
ΦNE 03011	SAV2287	63	90		
ΦNE 05068	SAV2290	95			
ΦNE 09184	SAV2292	82	96		
ΦNE 01475	SAV2293	110			
ΦNE 12725	SAV2294	93			
ΦNE 03045	SAV2297	63	80	55	100
ΦNE 03230	SAV2298	89			
ΦNE 09996	SAV2300	105			
ΦNE 02916	SAV2301	75	90		
ΦNE 11716	SAV2302	118			
ΦNE 05455	SAV2304	105			
ΦNE 11098	SAV2305	127			
ΦNE 03759	SAV2306	94			
ΦNE 11146	SAV2306	123			
ΦNE 09134	SAV2307	86	86		98
ΦNE 04836	SAV2309	100			
ΦNE 03707	SAV2310	112	20	43	97
ΦNE 03164	SAV2311	69	100		
ΦNE 04299	SAV2313	105			
ΦNE 03658	SAV2313	100			
ΦNE 02969	SAV2314	119			
ΦNE 05372	SAV2315	100			
ΦNE 02289	SAV2315	74	100		
ΦNE 01488	SAV2316	116			
ΦNE 10856	SAV2317	91			
ΦNE 04077	SAV2318	94			
ΦNE 12860	SAV2320	53	104		
ΦNE 03233	SAV2321	105			
ΦNE 12342	SAV2322	57	93		
ΦNE 09671	SAV2323	100	100		
ΦNE 12551	SAV2324	83	100		
ΦNE 00733	SAV2326	50	100		
ΦNE 04482	SAV2327	59	85	55	100
ΦNE 08886	SAV2328	73	107		
ΦNE 01836	SAV2329	105			
ΦNE 04251	SAV2330	100			
ΦNE 03839	SAV2331	95			
ΦNE 11894	SAV2332	88			
ΦNE 09848	SAV2333	105			
ΦNE 03723	SAV2334	71			
ΦNE 12843	SAV2335	100			
ΦNE 01722	SAV2337	84			
ΦNE 04091	SAV2338	112			
ΦNE 11404	SAV2339	132			
ΦNE 04934	SAV2340	45	80	58	98
ΦNE 06075	SAV2341	128			
ΦNE 01529	SAV2342	61	95		
ΦNE 03262	SAV2344	47	95		
ΦNE 00352	SAV2345	55	90	100	
ΦNE 00096	SAV2347	80			
ΦNE 06759	SAV2348	73	82, 77		100
ΦNE 11256	SAV2350	109			
ΦNE 03560	SAV2352	100			
ΦNE 05190	SAV2354	95			
ΦNE 02193	SAV2355	89			
ΦNE 00737	SAV2356	45			
ΦNE 01835	SAV2356	11	75	28	
ΦNE 05293	SAV2358	95			
ΦNE 03177	SAV2359	113			
ΦNE 02861	SAV2360	125			
ΦNE 08752	SAV2360	76	100		
ΦNE 02823	SAV2361	113			
ΦNE 01562	SAV2362	116			
ΦNE 08907	SAV2363	82	100		
ΦNE 00141	SAV2365	60	90	98	
ΦNE 03728	SAV2366	41	95		
ΦNE 00287	SAV2367	80			
ΦNE 02684	SAV2368	125			
ΦNE 09868	SAV2369	105			
ΦNE 03958	SAV2370	95			
ΦNE 04025	SAV2371	65	90		

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 03496	SAV2372	100			
ΦNE 00682	SAV2373	85			
ΦNE 01600	SAV2374	110			
ΦNE 02788	SAV2374	125			
ΦNE 07192	SAV2375	90			
ΦNE 04551	SAV2376	53	100		
ΦNE 01749	SAV2377	95			
ΦNE 08917	SAV2378	92			
ΦNE 09727	SAV2381	100	95		
ΦNE 09162	SAV2382	102			
ΦNE 03890	SAV2383	95			
ΦNE 09969	SAV2384	105			
ΦNE 00203	SAV2385	95			
ΦNE 02310	SAV2386	84			
ΦNE 11343	SAV2388	118			
ΦNE 01640	SAV2389	105			
ΦNE 13220	SAV2390	100			
ΦNE 00428	SAV2392	100			
ΦNE 10970	SAV2393	136			
ΦNE 00117	SAV2394	100			
ΦNE 03599	SAV2395	47	95		
ΦNE 04939	SAV2396	90			
ΦNE 01710	SAV2397	16	95		
ΦNE 05110	SAV2397	95			
ΦNE 12701	SAV2398*	73	79		98
ΦNE 05367	SAV2399	100			
ΦNE 09981	SAV2399	105			
ΦNE 00448	SAV2400	60	100		
ΦNE 02449	SAV2401	105			
ΦNE 05127	SAV2404	100			
ΦNE 00423	SAV2405	75			
ΦNE 05619	SAV2406	100			
ΦNE 00671	SAV2409	75			
ΦNE 10967	SAV2410	127			
ΦNE 02665	SAV2411	105			
ΦNE 05574	SAV2412	105			
ΦNE 10833	SAV2414	76	36.4	19.3	
ΦNE 03616	SAV2415	88			
ΦNE 01732	SAV2416	95			
ΦNE 01483	SAV2417	116			
ΦNE 03151	SAV2418	88			
ΦNE 00267	SAV2418	75			
ΦNE 05500	SAV2420	105			
ΦNE 11423	SAV2421	73			
ΦNE 09907	SAV2422	105			
ΦNE 04521	SAV2424	106			
ΦNE 00654	SAV2425	75			
ΦNE 12770	SAV2426	60	96		
ΦNE 09971	SAV2427	105			
ΦNE 05360	SAV2428	100			
ΦNE 12818	SAV2429	40	86		
ΦNE 11692	SAV2432	29	97		
ΦNE 01542	SAV2433	98			
ΦNE 04828	SAV2434	90			
ΦNE 03511	SAV2436	100			
ΦNE 00312	SAV2436	95			
ΦNE 06150	SAV2436	128			
ΦNE 02428	SAV2437	105			
ΦNE 03152	SAV2438	106			
ΦNE 04415	SAV2439	94			
ΦNE 10025	SAV2440	105			
ΦNE 04529	SAV2441	118			
ΦNE 11498	SAV2442	67	79		96
ΦNE 05078	SAV2443	100			
ΦNE 03490	SAV2444	95			
ΦNE 04878	SAV2445	100			
ΦNE 04718	SAV2446	100			
ΦNE 14285	SAV2448	100			
ΦNE 04078	SAV2449	100			
ΦNE 04825	SAV2450	80	100		
ΦNE 08781	SAV2451	76	105		
ΦNE 06100	SAV2452	78	100		
ΦNE 04174	SAV2453	74			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 00440	SAV2454	50	100		
ΦNE 05359	SAV2455	100			
ΦNE 05524	SAV2458	105			
ΦNE 04845	SAV2459	90			
ΦNE 09040	SAV2460	93			
ΦNE 03065	SAV2462	44	55	88	97
ΦNE 05105	SAV2463	100			
ΦNE 03694	SAV2464	76			
ΦNE 04010	SAV2466	60	90		
ΦNE 05145	SAV2467	95			
ΦNE 04787	SAV2468	100			
ΦNE 03991	SAV2469	100			
ΦNE 04552	SAV2469	118			
ΦNE 03928	SAV2470	90			
ΦNE 04362	SAV2473	112			
ΦNE 00313	SAV2476	100			
ΦNE 05047	SAV2477	90			
ΦNE 03921	SAV2478	95			
ΦNE 02065	SAV2479	84			
ΦNE 06614	SAV2480	163			
ΦNE 00282	SAV2481	80			
ΦNE 11149	SAV2483	27	90		
ΦNE 09762	SAV2484	105			
ΦNE 01846	SAV2487	89			
ΦNE 00390	SAV2488	30	95		
ΦNE 03411	SAV2488	95			
ΦNE 00306	SAV2489	100			
ΦNE 02020	SAV2490	95			
ΦNE 03705	SAV2492	41	95		
ΦNE 10624	SAV2493*	93			
ΦNE 11084	SAV2494	109			
ΦNE 04326	SAV2495	100			
ΦNE 12431	SAV2497	93			
ΦNE 03242	SAV2498	100			
ΦNE 01952	SAV2500	89			
ΦNE 02964	SAV2501	113			
ΦNE 05396	SAV2502	105			
ΦNE 02646	SAV2503	105			
ΦNE 05115	SAV2505	95			
ΦNE 00576	SAV2506	80			
ΦNE 02437	SAV2507	105			
ΦNE 02984	SAV2508	125			
ΦNE 05634	SAV2509	100			
ΦNE 10441	SAV2510	100			
ΦNE 04803	SAV2511	95			
ΦNE 05605	SAV2512	105			
ΦNE 00223	SAV2513	95			
ΦNE 10052	SAV2515	105			
ΦNE 01975	SAV2516	11	5		91
ΦNE 03402	SAV2517	84			
ΦNE 05603	SAV2518	105			
ΦNE 04104	SAV2519	112			
ΦNE 02392	SAV2520	105			
ΦNE 13298	SAV2521	82	104		
ΦNE 10416	SAV2522	83			
ΦNE 11429	SAV2523	83			
ΦNE 03861	SAV2525	100			
ΦNE 09879	SAV2526	100	100		
ΦNE 04500	SAV2526	118			
ΦNE 00284	SAV2527	100			
ΦNE 03486	SAV2528	100			96
ΦNE 04089	SAV2529	106			
ΦNE 08659	SAV2530	83			
ΦNE 03188	SAV2531	88			
ΦNE 05330	SAV2532	100			
ΦNE 10747	SAV2534	97			
ΦNE 00187	SAV2535	80			105
ΦNE 12724	SAV2537	90			
ΦNE 00373	SAV2538	70			
ΦNE 04017	SAV2539	90			
ΦNE 08702	SAV2540	86			
ΦNE 12224	SAV2541	42	100		
ΦNE 00643	SAV2542	80			

TABLE 1-continued

Mutant Number	ORF	Screen 1	Screen 2	Screen 3	Screen 4
ΦNE 11917	SAV2543	100			
ΦNE 06492	SAV2544	166			
ΦNE 14634	SAV2546	63	61		
ΦNE 00319	SAV2548	80			
ΦNE 04186	SAV2549	37	75	83	100
ΦNE 04437	SAV2550	76			
ΦNE 09781	SAV2550	105			
ΦNE 04953	SAV2551	95			
ΦNE 01546	SAV2552	91			
ΦNE 03159	SAV2552	6	20	50	98
ΦNE 00458	SAV2554	35	100		
ΦNE 02145	SAV2555	105			
ΦNE 04387	SAV2557	82			
ΦNE 11762	SAV2558	114			
ΦNE 01477	SAV2560	61	100		
ΦNE 00022	SAV2561	100			
ΦNE 03594	SAV2561	89			
ΦNE 01602	SAV2562	85			
ΦNE 02946	SAV2563	94			
ΦNE 09114	SAV2564	69	50	33.3	
ΦNE 04150	SAV2565	105			
ΦNE 00516	SAV2566	70			
ΦNE 03895	SAV2566	100			
ΦNE 00792	SAV2567	45	25	25	53
ΦNE 02863	SAV2567	75	55		48
ΦNE 02695	SAV2568	125			
ΦNE 00237	SAV2569	90			
ΦNE 06710	SAV2570	150			
ΦNE 08644	SAV2571	94			
ΦNE 03781	SAV2572	100			
ΦNE 10619	SAV2573	93			
ΦNE 00838	SAV2576	82			
ΦNE 04774	SAV2576	100			
ΦNE 03283	SAV2578	79			
ΦNE 11432	SAV2579	46	90		
ΦNE 04358	SAV2580	106			
ΦNE 14009	SAV2581	90			
ΦNE 05189	SAV2582	85			
ΦNE 11809	SAV2583	83			
ΦNE 00657	SAV2584	65			
ΦNE 02997	SAV2584	81			
ΦNE 00421	SAV2585	60	100		
ΦNE 10636	SAV2587	97			
ΦNE 04914	SAV2588	100			
ΦNE 04893	SAV2591	90			
ΦNE 03919	SAV2594	90			
ΦNE 02296	SAV2597	105			
ΦNE 06644	SAV2599	166			
ΦNE 05452	SAV2600	105			
ΦNE 12720	SAV2602	73	89		
ΦNE 13035	SAV2603	100			
ΦNE 00171	SAV2604	95			
ΦNE 02730	SAV2604	119			
ΦNE 04971	SAV2605	100			
ΦNE 12975	SAV2606	100			
ΦNE 00773	SAV2607	80			
ΦNE 11441	SAV2608	117			
ΦNE 04821	SAV2609	95			
ΦNE 08980	SAV2610	71	93		
ΦNE 04344	SAV2612	100			
ΦNE 04535	SAV2613	112			
ΦNE 06718	SAV2614	163			
ΦNE 02034	SAV2615	89			
ΦNE 04459	SAV2616	112			
ΦNE 04385	SAV2617	76			
ΦNE 02850	SAV2618	100			
ΦNE 12167	SAV2619	92	97		
ΦNE 13059	SAV2620	100			
ΦNE 02612	SAV2621	105			
ΦNE 04001	SAV2622	90			
ΦNE 03977	SAV2622	100			
ΦNE 03452	SAV2623	100			
ΦNE 05069	SAV2624	95			

TABLE 1-continued

Mutant Number	ORF	Screen			
		1	Screen 2	Screen 3	Screen 4
ΦNE 05304	SAV2625	75	90		
ΦNE 02121	SAV2627	105			
ΦNE 02802	SAV2629	125			
ΦNE 00826	SAV2630	103			103
ΦNE 13125	SAV2630*	4	75		76
ΦNE 13153	SAV2630*	98			
ΦNE 05159	SAV2631	100			
ΦNE 04271	SAV2632	68			
ΦNE 05038	SAV2633	100			
ΦNE 01608	SAV2634	110			
ΦNE 04557	SAV2635	112			
ΦNE 00400	SAV2636	95			
ΦNE 09030	SAV2637	80	79		100
ΦNE 08682	SAV2638	65	100		100
ΦNE 13671	SAV2639	86	104		
ΦNE 05231	SAV2640	100			
ΦNE 00382	SAV2641	95			
ΦNE 04717	SAV2642	95			
ΦNE 11406	SAV2643	114			
ΦNE 02659	SAV2644	105			
ΦNE 04073	SAV2645	118			
ΦNE 00505	SAV2646	55	95		
ΦNE 09723	SAV2646	105			
ΦNE 01876	SAV2647	95			
ΦNE 03626	SAV2647	100			
ΦNE 00083	SAV2648	85			
ΦNE 04051	SAV2649	106			
ΦNE 00878	SAV2650	51	95		
ΦNE 02762	SAV2651	119			
ΦNE 04305	SAV2652	32	100		
ΦNE 02681	SAV2652	125			
ΦNE 03558	SAV2652	95			
ΦNE 01583	SAV2653	37	100		
ΦNE 04676	SAV2654	100			98
ΦNE 04712	SAV2654	95			
ΦNE 06330	SAV2655	98			
ΦNE 11230	SAV2658	105			
ΦNE 11724	SAV2659	95			
ΦNE 04057	SAV2660	94			
ΦNE 02386	SAV2660	89			
ΦNE 03156	SAV2661	25	70	87	98
ΦNE 04689	SAV2662	100			
ΦNE 02030	SAV2663	100			
ΦNE 12143	SAV2664	42	90		
ΦNE 09269	SAV2665	93			
ΦNE 04722	SAV2666	100			
ΦNE 04780	SAV2666	100			
ΦNE 01598	SAV2667	91			
ΦNE 03146	SAV2668	81			
ΦNE 05081	SAV2669	65	90		
ΦNE 04872	SAV2671	90			
ΦNE 04758	SAV2672	100			
ΦNE 03963	SAV2673	65	90		
ΦNE 03892	SAV2674	95			
ΦNE 09374	SAV2674	82			
ΦNE 02790	SAV2675	125			
ΦNE 00062	SAV2676	56			
ΦNE 02701	SAV2676	125			
ΦNE 00731	SAV2677	70			
ΦNE 00416	SAV2678	80			
ΦNE 02009	SAV2678	89			
ΦNE 02348	SAV2679	100			
ΦNE 00619	SAV2680	90			
ΦNE 01573	SAV2681	110			
ΦNE 12301	SAV2683	67	79		
ΦNE 00726	SAV2684	60	100		
ΦNE 01613	SAV2685	84			
ΦNE 00734	SAV2686	60	95		
ΦNE 02732	SAV2688	119			
ΦNE 05335	SAV2689	95			
ΦNE 00709	SAV2689	85			
ΦNE 03122	SAV2690	122			
ΦNE 04754	SAV2691	100			

TABLE 1-continued

Mutant Number	ORF	Screen			
		1	Screen 2	Screen 3	Screen 4
ΦNE 02837	SAV2694	119			
ΦNE 04759	SAV2696	95			
ΦNE 00295	SAV2697	95			
ΦNE 03556	SAV2698	84			
ΦNE 09337	SAV2699	50	93		
ΦNE 02821	SAV2700	125			
ΦNE 09820	SAV2700	100	100		
ΦNE 03823	SAV2701	85			
ΦNE 03436	SAV2705	84			
ΦNE 03664	SAV2706	47	80	97	
ΦNE 02441	SAV2707	105			
ΦNE 09932	SAV2707	105			
ΦNE 13476	SAV2710	98			
ΦNE 02246	SAV2711	100			
ΦNE 03570	SAV2712	105			
ΦNE 02773	MW0055	113			
ΦNE 02293	MW0063	105			
ΦNE 02272	MW0064	105			
ΦNE 05443	MW0073	105			
ΦNE 04871	MW0098	85	95		
ΦNE 03653	MW0120	65			
ΦNE 02763	MW0387	119			
ΦNE 03693	MW0398	41	100		
ΦNE 04808	MW0554	100			
ΦNE 02045	MW0555	105			
ΦNE 04799	MW0558	100			
ΦNE 04898	MW0559	80	75	51	
ΦNE 03457	MW0562	100			
ΦNE 03435	MW0764	74			
ΦNE 03828	MW0765	85			
ΦNE 05133	MW0918	100			
ΦNE 02413	MW1201	105			
ΦNE 10206	MW1380	105			
ΦNE 05098	MW1442	100			
ΦNE 03507	MW1742	95			
ΦNE 00599	MW1743	105			
ΦNE 02003	MW1749	105			
ΦNE 02041	MW1760	105			
ΦNE 03278	MW1761	79			
ΦNE 03627	MW1762	47	75	97	
ΦNE 05631	MW1771	105			
ΦNE 03866	MW1947	95			
ΦNE 02690	MW2125	125			
ΦNE 02436	MW2197	105			
ΦNE 03736	MW2377	59	95		
ΦNE 03748	MW2534	71			
ΦNE 00038	SA0877	118			
ΦNE 00473	SA1787	85			
ΦNE 01711	SA1802	16	95		
ΦNE 03466	SA1806	105			
ΦNE 05547	SAS067	100			
ΦNE 02052	SA2074	105			

EXAMPLE 2: Creation of Transposon Element,  
*Bursa Aurealis*

[0136] *Bursa aurealis* was derived from the Himar 1 (mariner) element; it encompasses the short inverted repeats of the hornfly transposon (Somerville et al., 2002; Robertson et al., 1995) as well as the ermC resistance marker (Trieu-Cuot et al., 1990) and a promoterless *Aequorea victoria* green fluorescent protein gene (FIG. 1). Insertion of *bursa aurealis* into genome sequences confers resistance to erythromycin and expression of gfp if the insertion occurred in the vicinity of promoter sequences. *Bursa aurealis* was cloned into the pTS2 vector with a temperature-sensitive *S. aureus* replicon and chloramphenicol resistance gene (Fitzgerald et al., 2000), thereby generating pbursa (FIG. 1). The Himar 1 transposase (Lampe et al., 1996) was cloned

along with the xylose -repressor of pIK64 (Kullik et al., 1998) into plasmid pSPT246ts (Janzon et al., 1990), resulting in the transposase vector pFA545 (FIG. 1 top). Plasmids were transformed into *S. aureus* strain Newman by electroporation, and mutants were isolated by temperature shift to 43° C. and by streaking for erythromycin-resistant phenotype. Isolated mutants were stored frozen and the site of transposition for 10,325 isolates was examined by inverse PCR of *bursa aurealis* flanking sequences. Analysis of insertion sequences revealed that *bursa aurealis* generates TA duplications at the insertion sites and does not exhibit sequence preference in the *S. aureus* genome (FIG. 2).

EXAMPLE 3: Analysis of *bursa aurealis* and Tn917 transposition events

[0137] *Bursa aurealis* mutagenesis was compared to populations of transposon insertion mutants generated by Tn917. These Tn917 populations were created using plasmid pTV1 (Hartley et al., 1986), which carries Tn917—a transposon that has been the mobile genetic element of choice for insertional mutagenesis in gram-positive microbes and specifically in *S. aureus* strains (Mei et al., 1997; Schwan et al., 1998). After transformation of pTV1 and temperature-induced selection of transposon insertions, 960 *S. aureus* strain Newman mutants were generated with Tn917. Of 960 mutants, 585 mutants produced readable sequencing results and the Tn917 insertion site was determined using the same technique as described above for *bursa aurealis*. Insertion in non-coding DNA sequences of *S. aureus* occurred at a higher frequency for Tn917 (36% of all insertions as compared to 18% for *bursa aurealis*). Tn917 exhibited a strong bias for insertion in two regions on the staphylococcal chromosome centered at Mbp 0.75 and 1.7, respectively (FIG. 2). 587 insertions of Tn917 were located in 269 different genes, while the same number of *bursa aurealis* insertions hit 350 different genes. In addition, *bursa aurealis* insertions did not display the same bias for insertion at Mbp 0.75 and 1.7 as is reported here for Tn917 (FIG. 2).

EXAMPLE 4: *Bursa Aurealis* Mutagenesis of *S. Aureus* Newman

[0138] A total of 10,325 *bursa aurealis* isolates were generated, sequenced and the open reading frame (Orf) insertions mapped as outlined above (FIG. 3). Comparison of the data set with the genome sequence of *S. aureus* strain Mu50 indicated that 6,917 mutants carried *bursa aurealis* insertions within coding sequences, while 1,533 insertions occurred within intergenic or non-coding DNA sequences (ΦNE, Phoenix library, Table 3—located after Examples). The entire pBursa plasmid inserted at the *S. aureus* pre plasmid recombination site, yielding chloramphenicol, erythromycin double-resistant colonies that accounted for 7.6% of erythromycin-resistant colonies following mutagenesis. Together these experiments provided several insights. (i) The mutagenesis of the *S. aureus* chromosome with 10,325 *bursa aurealis* insertions was not saturated. Using the acquired data set for prediction, about 20,000 random insertion mutants would be required to achieve saturating mutagenesis. (ii) Based on the comparison of raw sequence data with the published genome sequence of *S. aureus* strain Mu50, it appears that *S. aureus* strain Newman encodes approximately 2,700 genes. Approximately 67% of all Orfs, 1,812 genes, have been disrupted by *bursa aurealis* insertion

(FIG. 3). Table 3 summarizes all insertion mutants that have an identifiable BLAST hit in one of three completed staphylococcal genomes (Mu50, MW2, and N315). The prefixes indicate which genome sequence the Newman insertion mutant matches: SAV corresponds to Mu50, MW2 to MW2, and SA and SAS to N315. An asterisk in the column marked IGR indicates an insertion in an intergenic region, but within ten nucleotides of a neighboring gene.

EXAMPLE 5: *S. Aureus* Strain Newman Genes

[0139] Previous work compared the contents of *S. aureus* genome sequences and pointed to genes that occur in some, but not in all, staphylococcal isolates (Kuroda et al., 2001; Baba et al., 2002). If one assumed that essential or house-keeping gene functions may be shared among staphylococci, some of the *S. aureus* Newman genes that are not found in other staphylococcal isolates may be uniquely responsible for animal virulence of strain Newman. For example, a comparison of the *S. aureus* MW2 genome sequence (a community-acquired MRSA strain) with the sequences of *S. aureus* strains N315 and Mu50 (hospital-acquired MRSA) revealed 94.7% and 94.8% sequence identities, respectively (N315 and Mu50 display 99.7% nucleotide match) (Baba et al., 2002). When analyzed with respect to the *bursa aurealis* pool of mutants, 234 insertions occurred in *S. aureus* strain Newman genes that did not display homology to other staphylococcal gene sequences and that may therefore represent mobile genetic elements or even virulence genes. FIG. 3 shows that several mobile gene elements of strain Mu50 display only limited or no homology to *S. aureus* Newman gene sequences.

EXAMPLE 6: *S. Aureus* Virulence Genes Identified by Nematode Killing

[0140] Ausubel, Sifri, Calderwood and colleagues introduced the nematode *Caenorhabditis elegans* as a model host for the pathogenesis of *S. aureus* infections (Garsin et al., 2001; Sifri et al., 2003). When incubated on agar plates with either L4 larvae or adult worms, staphylococci enter the worm oral cavity, pass the food grinder and multiply in the *C. elegans* digestive tract. Colonization with *S. aureus* causes distension of the digestive tract and ultimately killing of infected worms over a period of 2-7 days (Sifri et al., 2003). Using this assay, Sifri and colleagues demonstrated that several known *S. aureus* virulence factors are also required for the killing of *C. elegans* (Sifri et al., 2003). Nematode killing was chosen as a first assay to identify virulence genes. 1,736 *S. aureus* Newman mutants with a *bursa aurealis* insertion were screened on agar plates for the ability to kill between 30-50 worms. Adult *C. elegans* proved to be more susceptible to *S. aureus* infection than larvae and were therefore used the former to screen the population of inserts. Both live and dead worms were enumerated under a dissecting microscope after 48 hours incubation at 25° C. on agar plates. Statistical significance was examined by Chi-square analysis and mutants with a p value below 0.1 were submitted to a second and third screening procedure with the same parameters. After three screening assays, 174 insertion mutants displayed reduced virulence and were analyzed further (p<0.05). To determine whether unrelated mutations caused the observed reduced virulence phenotypes, each strain was lysed with phage φ 85 (Mazmanian et al., 2000) and transposon insertions were transduced into *S. aureus* wild-type strain Newman. The

transduced *bursa aurealis* insertion sites were again mapped by inverse PCR and DNA sequencing. The transduced variants were then screened for defects in virulence using agar plate infections of either adult worms or L4 larvae. 71 mutants of the original 174 displayed reduced virulence in

both assays ( $p < 0.05$ ) (Table 2), encompassing 41 genes with assigned function and 30 hypothetical open reading frames (Kuroda et al., 2001). Genes with assigned functions could be classified into three categories: metabolism, regulation, and extracellular functions.

TABLE 2

<u><i>S. aureus</i> strain Newman genes required for nematode killing</u>				
Phoenix		<u><i>C. elegans</i> killing (%)</u>		
Mutant	Orf	Adult	L4 Gene	Predicted Product
<u>Insertions in metabolic genes</u>				
ΦNE05074	SAV0185	Ns	64 argD1	ornithine aminotransferase
ΦNE05298	SAV0248	Ns	75 gutB	sorbitol dehydrogenase
ΦNE03871	SAV0475	10	11 agl	alpha-glucosidase
ΦNE01545	SAV0588	5	25 pta	phosphotransacetylase
ΦNE02038	SAV0643	23	32 abcA	ATP-binding cassette transporter A
ΦNE03711	SAV0711	90	69 ptpS	6-pyruvoyl tetrahydrobiopterin synthase homologue
ΦNE10868	SAV1094	22	0 phdB	pyruvate dehydrogenase E1 component
ΦNE00656	SAV1201	Ns	72 pyrC	dihydroorotase
ΦNE00678	SAV1202	Ns	77 pyrAA	carbamoyl-phosphate synthase small chain
ΦNE02887	SAV1203	88	ns pyrAB	carbamoyl-phosphate synthase large chain
ΦNE02904	SAV1205	Ns	64 pyrE	orotate phosphoribosyltransferase
ΦNE00263	SAV1350	58	34 citB	aconitase
ΦNE09110	SAV1356	Ns	41 alsT	sodium/alanine symporter
ΦNE10240	SAV1370	72	11 trpC	indole-3-glycerol phosphate synthase
ΦNE02026	SAV1413	Ns	30 odhA	oxoglutarate dehydrogenase
ΦNE10390	SAV1518	90	1 lpd	dihydrolipoamide dehydrogenase
ΦNE01982	SAV1687	77	36 gapB	glyceraldehyde 3-phosphate dehydrogenase 2
ΦNE05271	SAV1694	76	52 citC	isocitrate dehydrogenase
ΦNE11740	SAV1765	Ns	77	lysophospholipase homologue
ΦNE01969	SAV1791	Ns	77 pckA	phosphoenolpyruvate carboxykinase
ΦNE03937	SAV1851	63	30 citG	fumarate hydratase
ΦNE04769	SAV1918	82	80	pyrazinamidase/nicotinamidase homologue
ΦNE09246	SAV2164	Ns	77 arg	arginase
ΦNE01975	SAV2516	26	23 fbp	fructose-bisphosphatase
ΦNE04818	SAV0511	75	11 ftsH	ATP-dependent Zn metalloproteinase
ΦNE13116	SAV0768	31	2 clpP	ATP-dependent Clp protease
ΦNE09483	SAV0721	68	44 recQ	probable DNA helicase
ΦNE11173	SAV1227	84	10 recG	ATP-dependent DNA helicase
<u>Insertions in regulatory genes</u>				
ΦNE09725	SAV0705	Ns	61 saeS	sensor histidine kinase
ΦNE01594	SAV0706	Ns	73 saeR	response regulator
ΦNE12844	SAV1491	Ns	57 srrB	staphylococcal respiratory response protein
ΦNE01835	SAV2356	55	57 tcaA	TcaA protein
ΦNE06220	SAV2355	Ns	64 tcaB	TcaB protein
ΦNE11797	SAV1362	87	68 msrR	peptide methionine sulfoxide reductase regulator
ΦNE02575	SAV2499	Ns	73 sarH2	sarA homologue
<u>Insertions in genes encoding extracellular factors</u>				
ΦNE09823	SAV0815	93	66 nuc	staphylococcal nuclease
ΦNE02140	SAV1163	Ns	57 hla	alpha-hemolysin
ΦNE05448	SAV0154	63	67 cap5F	capsular polysaccharide synthesis enzyme
ΦNE03492	SAV0158	71	Ns capJ	capsular polysaccharide synthesis enzyme
ΦNE01957	SAV0161	76	Ns capM	capsular polysaccharide synthesis enzyme
ΦNE09330	SAV2161	35	40 glmM	phosphoglucosamine-mutase
<u>Insertions in unknown genes</u>				
ΦNE03224	SAV0258	85	Ns	similar to beta-glycosyltransferase
ΦNE01776	SAV0709	78	Ns	conserved hypothetical protein
ΦNE11117	SAV0713	Ns	50	hypothetical protein
ΦNE04880*	SAV0727*	Ns	80	similar to di-tripeptide ABC transporter
ΦNE04279	SAV0841	10	51	conserved hypothetical protein
ΦNE07262*	SAV0855*	70	18	hypothetical protein (phiMu50B)
ΦNE12478*	SAV0862*	Ns	21	hypothetical protein (phiMu50B)
ΦNE08772*	SAV0866*	Ns	50	hypothetical protein (phiMu50B)

TABLE 2-continued

<u><i>S. aureus</i> strain Newman genes required for nematode killing</u>				
Mutant	Orf	<i>C. elegans</i>		Predicted Product
		Adult	L4 Gene	
Phoenix		killing (%)		
ΦNE03004*	SAV0876*	17	13	hypothetical protein (phiMu50B)
ΦNE10876	SAV0940	Ns	66	conserved hypothetical protein
<u>ΦNE05437</u>	<u>SAV0944</u>	25	11	conserved hypothetical protein
ΦNE00126	SAV1012	35	78	hypothetical protein
ΦNE10949	SAV1190	Ns	73	conserved hypothetical protein
<u>ΦNE12600</u>	<u>SAV1221</u>	26	53	conserved hypothetical protein
ΦNE01851*	SAV1619*	71	63	similar to deoxyribonuclease
ΦNE01639	SAV1677	48	63	conserved hypothetical protein
ΦNE01819	SAV1706	Ns	51	conserved hypothetical protein
ΦNE09771	SAV1725	75	20	hypothetical protein
ΦNE04883*	SAV1926*	30	11	hypothetical protein
ΦNE11080*	SAV1927*	20	3	conserved hypothetical protein
ΦNE01449	SAV1928	15	13	hypothetical protein
ΦNE01508*	SAV1932*	Ns	13	hypothetical protein
ΦNE02679	SAV1978	15	15	hypothetical protein (phiMu50A)
<u>ΦNE03200*</u>	<u>SAV1986*</u>	28	59	hypothetical protein (phiMu50A)
ΦNE00556	SAV2068	86	Ns	hypothetical protein
<u>ΦNE03531</u>	<u>SAV2117</u>	Ns	61	similar to protoporphyrinogen oxidase HemK
ΦNE13125	SAV2123	76	Ns	conserved hypothetical protein
ΦNE36035	SAV2167	66	Ns	hypothetical protein
ΦNE02863	SAV2175	Ns	65	similar to ferrichrome ABC transporter
ΦNE04180*	SAV2567*	51	48	similar to acyltransferase

Data are reported as % worm killing based on 100% killing by wild type Newman.

ΦNE mutants with underlined orfs displayed growth defects in TSB medium at 37° C.

ΦNE mutants marked with an asterisks (\*) were tested in a mouse model of infection.

Ns, not significant.

#### EXAMPLE 7: *S. Aureus* Mutants with Insertions in Metabolic Genes

[0141] About 70% of the *bursa aurealis* mutants with virulence defects carry insertions in genes responsible for energy metabolism or intermediary metabolism. This observation corroborates earlier work using IVET transposon screening techniques to define virulence defects in *S. aureus*, *Salmonella* species or other enteric pathogens (Lowe et al., 1998; Mahan et al., 1993). Further, enzymes of the *S. aureus* TCA cycle such as OdhB and CitB are required for *S. aureus* virulence in a murine model of bacteremia. CitB (aconitase) uses an iron sulfur cluster to catalyze the conversion of citrate to isocitrate (Kohler et al., 2003). Limited iron conditions affect the integrity of this iron sulfur cluster, leading to an arrest of the TCA cycle, accumulation of citrate and a switch in the activity-of CitB from hydrolyase to RNA binding. In *E. coli* and *B. subtilis*, the regulatory RNA binding protein CitB is involved in the oxidative stress response. In *S. aureus*, CitB inactivation may affect the level of other factors such as RNAlII, the regulatory molecule that controls the output of the Agr-dependent quorum sensing system (Novick et al., 1993). Killing of *C. elegans* by *S. aureus* was markedly decreased in mutants interfering with other metabolic pathways such as urea cycle, pyrimidine biosynthesis, sugar and amino acid metabolism (Table 2). Nematode killing was also reduced for two mutants impaired in DNA helicase activity (recG and recQ). *Bursa aurealis* insertions of recA have thus far not been isolated. However, signature-tag mutagenesis previously identified recA as required for virulence in a murine bacteremia model (Mei et al., 1997). Together these results suggest that replication, recombination and thus functional maintenance of

chromosomal DNA are important for virulence. Quality control of protein biogenesis may also be required for virulence. An ftsH mutation exhibited decreased virulence in the nematode killing assay. This observation is in agreement with ftsH mutants displaying attenuated virulence in a murine skin abscess model (Lithgow et al., 2004). ATP-dependent proteases such as Clp and FtsH are key factors in bacterial adaptation to environmental stress (Lithgow et al., 2004). It seems plausible that these bifunctional chaperones/proteases may also modulate the activity of *S. aureus* virulence factors.

#### EXAMPLE 8: *S. Aureus* Mutants with Insertions in Regulatory Genes

[0142] The genome of *S. aureus* encodes five two-component regulatory systems and numerous transcription factors that are known to affect the production of virulence factors of *S. aureus*, albeit that important strain variations and differences in regulation are known to occur (Novick, 2003). Of these, three two-component regulatory systems were hit by *bursa aurealis* (saeRS, srrAB, agrAC), whereas insertions in arlRS were not identified (Fournier et al., 2001). The two-component regulator encoded by the yycGF genes is known to be essential for *S. aureus* growth (Dubrac et al., 2004). Only insertions in two of the sensory systems, saeRS and srrAB (Giraud et al., 1999; Pragman et al., 2004), caused defects in the worm killing assay. Previously, an agrA mutant was demonstrated to display reduced virulence in the nematode killing assay (Sifri et al., 2003). Interestingly, in the current experiments, agrA, agrB, and agrC mutants did not display a consistent and significant reduction in virulence and were therefore not included in the list of virulence genes. *Bursa aurealis* insertions in eleven

sarA homologs were isolated (Cheung et al., 2002). Surprisingly, insertion in SarA did not cause a significant defect in virulence and only insertions in the transcriptional regulator sarH2 diminished the ability of *S. aureus* Newman variants to kill worms. Mutations in msrR and tcaAB affect *S. aureus* susceptibility toward methicillin-and teicoplanin and are thought to affect cell wall metabolism (Rossi et al., 2003; Brandenberger et al., 2000). Inactivation of msrR or tcaAB also affected the virulence of *S. aureus* during *C. elegans* infection.

EXAMPLE 9: *S. Aureus* Mutants with Insertions in Genes Encoding Extracellular Factors

[0143] In *S. aureus*, synthesis and secretion of extracellular factors follows a quorum-controlled program, whereby surface adhesion genes are expressed prior to secreted hemolysins and host-tissue degradative or invasive enzymes (Novick, 2003). Only two extracellular factors, secreted nuclease and  $\alpha$ -hemolysin, were required for the killing of *C. elegans* during *S. aureus* Newman infection. Further, attenuation of virulence was observed only with infections of L4 larvae but not with infections of adult worms, suggesting that the screening assay conditions may be too stringent to identify secreted virulence factors that play redundant or at least partially overlapping functions during pathogenesis. Furthermore, the requirement for surface proteins in this model system was directly addressed by transducing and testing mutants with *bursa aurealis* insertions in 10 genes encoding surface proteins. None of the insertions reduced the *C. elegans* virulence properties of strain Newman, not even insertions in sortase (srtA), a gene required for the cell surface display of about twenty different adhesins (Mazmanian et al., 2000; Mazmanian et al., 2002). In *S. epidermidis*, biofilm production has been shown to involve synthesis and secretion of PIA, a  $\beta$ -1,6-linked N-acetylglucosamine polysaccharide. Several mechanisms contribute to biofilm formation, which requires the icaADBC genes for PIA biosynthesis, the atlE, sspl and clfA genes encoding adhesive surface proteins as well as genes specifying other co-factors (dltA, aap, bap) (Gotz 2002). Although all of these genes have been hit by *bursa aurealis*, the isolated mutants infected and killed worms in a manner that was indistinguishable from wild-type staphylococci. Thus, sortase-anchored surface adhesins and the PIA biofilm of *S. aureus* are dispensable for staphylococcal replication in the *C. elegans* digestive track (Table 2). In contrast, insertions in genes involved in capsular polysaccharide biosynthesis, a known virulence factor in animals (Albus et al., 1991; Lee et al., 1987; Sau et al., 1997), caused reduced killing of adult worms and L4 larvae (Table 2).

EXAMPLE 10: Murine Infection Experiments Identify Novel *S. Aureus* Virulence Genes

[0144] The screen identified 31 hypothetical genes that are required for the pathogenesis of *S. aureus* infection in *C. elegans*. To gauge whether these genes represent virulence factors that are involved in general disease strategies, *S. aureus* strains were inoculated intra-venously into mice, which were euthanized four days after infection (Albus et al., 1991). The kidney, spleen and liver were removed, inspected for abscess formation and then homogenized and plated on agar medium to quantify staphylococcal replication in host tissues. Of the eleven strains that were analyzed in this manner (Table 2), nine mutant strains caused organ abscesses in the liver and kidney in a manner that was indistinguishable from that of *S. aureus* wild-type strain Newman. Two strains, however, displayed significant defects in the ability to cause disease (FIG. 4). When compared to *S. aureus* Newman, strain ( $\Phi$ N $\Xi$ 12478 with a *bursa aurealis* insertion in SAV0862, a hypothetical gene encoded by a lysogenic phage of *S. aureus* Newman, displayed a two log reduction in the ability to cause kidney abscesses (FIG. 4). Orf SAV2567 encodes a putative acyl-transferase. *Bursa aurealis* insertion in SAV2567 caused a two log reduction in the ability of the mutant  $\Phi$ N $\Xi$ 02863 to establish liver abscesses in infected mice (FIG. 4). It should be noted that the observed defects in virulence for both strains were restricted to specific host organ tissues.  $\Phi$ N $\Xi$ 12478 did not show statistically significant defects in liver abscess formation, while the  $\Phi$ N $\Xi$ 02863 mutant caused kidney abscesses in a manner that was indistinguishable from that of wild-type strain Newman.

[0145] All of the compositions and/or methods and/or apparatus disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While the compositions and methods of this invention have been described in terms of preferred embodiments, it will be apparent to those of skill in the art that variations may be applied to the compositions and/or methods and/or apparatus and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit and scope of the invention. More specifically, it will be apparent that certain agents that are both chemically and physiologically related may be substituted for the agents described herein while the same or similar results would be achieved. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the invention as defined by the appended claims.

TABLE 3

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11965		coa	93	2165	651		
NMTN-13558		fnbB	504	3394	1972		
NMTN-08937		arsC	2383	2778	2731		
NMTN-13414			1	6779	3936		
NMTN-12542		spIE	4330	5046	4586		
NMTN-09697	SAV0006	gyrA	7005	9674	9648	+	DNA gyrase subunit A
NMTN-01964	SAV0007		9762	10592	10415	-	conserved hypothetical protein
NMTN-12782d	SAV0007		9762	10592	10579		
NMTN-02761	SAV0008	hutH	10879	12414	11114	+	histidine ammonia-lyase

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04440	SAV0008	hutH	10879	12414	11596		
NMTN-09321	SAV0010		14730	15425	14879	+	hypothetical protein
NMTN-06169	SAV0010		14730	15425	14919		
NMTN-02476	SAV0012		16094	17083	16919	+	hypothetical protein
NMTN-12827	SAV0012		16094	17083	17025		
NMTN-13102	SAV0013		17319	18314	17463	+	conserved hypothetical protein
NMTN-04509	SAV0013		17319	18314	17781		
NMTN-11727	SAV0013		17319	18314	18035		
NMTN-12713	SAV0017	purA	22449	23732	22464	+	adenylosuccinate synthase
NMTN-10703	SAV0017	purA	22449	23732	22594		
NMTN-03581	SAV0017	purA	22449	23732	22732		
NMTN-02689	SAV0017	purA	22449	23732	22853		
NMTN-10572	SAV0017	purA	22449	23732	22944		
NMTN-10831	SAV0017	purA	22449	23732	23251		
NMTN-11456	SAV0017	purA	22449	23732	23314		
NMTN-11756	SAV0017	purA	22449	23732	23448		
NMTN-10932	SAV0017	purA	22449	23732	23483		
NMTN-08533	SAV0017	purA	22449	23732	23540		
NMTN-04972	SAV0017	purA	22449	23732	23644		
NMTN-01530	SAV0017	purA	22449	23732	23664		
NMTN-11611	SAV0022		29980	30780	30503	+	conserved hypothetical protein
NMTN-14567	SAV0022		29980	30780	30771		
NMTN-11670	SAV0023		31007	33259	31023	+	hypothetical protein
NMTN-04297	SAV0023		31007	33259	31217		
NMTN-12828	SAV0023		31007	33259	31943		
NMTN-13505	SAV0023		31007	33259	31956		
NMTN-12936	SAV0023		31007	33259	32400		
NMTN-12965	SAV0023		31007	33259	32400		
NMTN-12983d	SAV0023		31007	33259	32400		
NMTN-13705	SAV0023		31007	33259	32464		
NMTN-09370	SAV0023		31007	33259	32510		
NMTN-02455	SAV0023		31007	33259	32685		
NMTN-03276	SAV0023		31007	33259	32691		
NMTN-11544	SAV0023		31007	33259	32765		
NMTN-03443	SAV0023		31007	33259	32823		
NMTN-03444	SAV0023		31007	33259	32823		
NMTN-07519	SAV0023		31007	33259	32907		
NMTN-06470	SAV0024		33697	34176	33793	+	conserved hypothetical protein orfX
NMTN-00158	SAV0024		33697	34176	33928		
NMTN-00007	SAV0031	pre	38433	39695	39416	-	plasmid recombination enzyme
NMTN-00008	SAV0031	pre	38433	39695	39416		
NMTN-06084	SAV0071	kdpD	74144	76777	75938	-	hypothetical protein
NMTN-12162	SAV0082		87657	89390	87668		
NMTN-02921	SAV0082		87657	89390	87959	+	hypothetical protein
NMTN-09041	SAV0082		87657	89390	87959		
NMTN-03246	SAV0082		87657	89390	87961		
NMTN-06236	SAV0082		87657	89390	87964		
NMTN-13445	SAV0082		87657	89390	88428		
NMTN-01632	SAV0082		87657	89390	88458		
NMTN-02903	SAV0082		87657	89390	88505		
NMTN-04544	SAV0082		87657	89390	88508		
NMTN-09132	SAV0082		87657	89390	89116		
NMTN-02710	SAV0084		90334	91089	90441	-	conserved hypothetical protein
NMTN-02569	SAV0084		90334	91089	91071		
NMTN-03605	SAV0084		90334	91089	91076		
NMTN-03606	SAV0084		90334	91089	91076		
NMTN-11469	SAV0085		91089	91349	91255	-	conserved hypothetical protein
NMTN-11477	SAV0085		91089	91349	91255		
NMTN-07569	SAV0086		91486	92550	92005	+	conserved hypothetical protein
NMTN-02897	SAV0087		92581	93915	92750	+	conserved hypothetical protein
NMTN-04982	SAV0087		92581	93915	92836		
NMTN-11277	SAV0087		92581	93915	92951		
NMTN-04395	SAV0087		92581	93915	92972		
NMTN-13061d	SAV0087		92581	93915	93034		
NMTN-06501	SAV0087		92581	93915	93679		
NMTN-11128	SAV0088		93934	95127	94213	+	hypothetical protein
NMTN-01747	SAV0088		93934	95127	94509		
NMTN-04903	SAV0088		93934	95127	94655		
NMTN-11384	SAV0088		93934	95127	94730		
NMTN-06573	SAV0088		93934	95127	94897		
NMTN-06559	SAV0088		93934	95127	95048		
NMTN-12760	SAV0088		93934	95127	95060		
NMTN-12760	SAV0088		93934	95127	95060		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00681	SAV0088		93934	95127	95068		
NMTN-06429	SAV0089		95794	96780	96641	-	conserved hypothetical protein
NMTN-04416	SAV0089		95794	96780	96778		
NMTN-12169	SAV0092		97836	98447	97923	+	hypothetical protein
NMTN-14422	SAV0092		97836	98447	98060		
NMTN-01701	SAV0092		97836	98447	98097		
NMTN-11771	SAV0092		97836	98447	98121		
NMTN-10640	SAV0093		98714	101866	98928	+	hypothetical protein
NMTN-11846	SAV0093		98714	101866	98928		
NMTN-14664	SAV0093		98714	101866	99313		
NMTN-04522	SAV0093		98714	101866	99602		
NMTN-09017	SAV0093		98714	101866	99684		
NMTN-12303	SAV0093		98714	101866	99702		
NMTN-09022	SAV0093		98714	101866	99714		
NMTN-06265	SAV0093		98714	101866	99858		
NMTN-10867	SAV0093		98714	101866	100121		
NMTN-10580	SAV0093		98714	101866	100198		
NMTN-12233	SAV0093		98714	101866	100352		
NMTN-04969	SAV0093		98714	101866	100947		
NMTN-06215	SAV0093		98714	101866	101306		
NMTN-14503	SAV0093		98714	101866	101463		
NMTN-08742	SAV0094		101923	102405	102066	+	hypothetical protein
NMTN-01578	SAV0094		101923	102405	102223		
NMTN-00113	SAV0095	plc	102611	103597	103281	+	1-phosphatidylinositol phosphodiesterase precursor
NMTN-12336	SAV0095	plc	102611	103597	103298		
NMTN-03522	SAV0095	plc	102611	103597	103391		
NMTN-06798	SAV0095	plc	102611	103597	103393		
NMTN-08856	SAV0095	plc	102611	103597	103440		
NMTN-14570	SAV0095	plc	102611	103597	103464		
NMTN-07542	SAV0095	plc	102611	103597	103526		
NMTN-04331	SAV0096		103818	104588	103896	+	hypothetical protein
NMTN-00584	SAV0096		103818	104588	104393		
NMTN-03737	SAV0099		106310	107080	106915	+	hypothetical protein
NMTN-04701	SAV0100		107147	107914	107274	+	hypothetical protein
NMTN-04709	SAV0100		107147	107914	107274		
NMTN-03975	SAV0100		107147	107914	107719		
NMTN-01752	SAV0101		108011	110248	108212	+	hypothetical protein
NMTN-10945	SAV0101		108011	110248	108313		
NMTN-01586	SAV0101		108011	110248	108501		
NMTN-05318	SAV0101		108011	110248	109852		
NMTN-10988	SAV0101		108011	110248	109869		
NMTN-04135	SAV0101		108011	110248	110153		
NMTN-12459	SAV0102		110399	111577	110731	+	hypothetical protein
NMTN-13495	SAV0103		111579	112967	111624	+	hypothetical protein
NMTN-11065	SAV0103		111579	112967	111669		
NMTN-12838	SAV0103		111579	112967	112212		
NMTN-10450	SAV0103		111579	112967	112341		
NMTN-04675	SAV0103		111579	112967	112499		
NMTN-14391	SAV0103		111579	112967	112503		
NMTN-06613	SAV0103		111579	112967	112821		
NMTN-07033	SAV0103		111579	112967	112824		
NMTN-08903	SAV0104		113451	115118	113486	-	conserved hypothetical protein
NMTN-08655	SAV0104		113451	115118	113665		
NMTN-03889	SAV0104		113451	115118	113829		
NMTN-12346	SAV0104		113451	115118	113829		
NMTN-12128	SAV0104		113451	115118	113923		
NMTN-07403	SAV0104		113451	115118	114275		
NMTN-06368	SAV0104		113451	115118	114866		
NMTN-09435	SAV0105		115210	115380	115227	-	hypothetical protein
NMTN-06817	SAV0106		115437	117212	115622	-	67 kDa Myosin-crossreactive streptococcal antigen homologue
NMTN-11705	SAV0106		115437	117212	115700		
NMTN-01885	SAV0106		115437	117212	115810		
NMTN-07690	SAV0106		115437	117212	115810		
NMTN-07060	SAV0106		115437	117212	115815		
NMTN-05474	SAV0107		117386	118258	117389	-	conserved hypothetical protein
NMTN-02908	SAV0107		117386	118258	117463		
NMTN-13514	SAV0107		117386	118258	117702		
NMTN-12584	SAV0107		117386	118258	117704		
NMTN-12353	SAV0107		117386	118258	117817		
NMTN-09396	SAV0107		117386	118258	117819		
NMTN-12785	SAV0107		117386	118258	117849		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-05622	SAV0107		117386	118258	117951		
NMTN-06307	SAV0107		117386	118258	118050		
NMTN-09023	SAV0107		117386	118258	118171		
NMTN-05033	SAV0107		117386	118258	118212		
NMTN-04993	SAV0108		118440	119768	118692	+	hypothetical protein
NMTN-03596	SAV0108		118440	119768	118698		
NMTN-03867	SAV0108		118440	119768	118698		
NMTN-06920	SAV0108		118440	119768	118765		
NMTN-05484	SAV0108		118440	119768	119188		
NMTN-04045	SAV0108		118440	119768	119536		
NMTN-06065	SAV0108		118440	119768	119750		
NMTN-02760	SAV0109		119958	120431	120067	+	hypothetical protein
NMTN-12136	SAV0109		119958	120431	120140		
NMTN-06243	SAV0109		119958	120431	120265		
NMTN-13863	SAV0109		119958	120431	120355		
NMTN-02284	SAV0110	lctP	120693	122285	121225	+	L-lactate permease homologue
NMTN-08722	SAV0110	lctP	120693	122285	121394		
NMTN-04338	SAV0110	lctP	120693	122285	121540		
NMTN-08768	SAV0110	lctP	120693	122285	121913		
NMTN-00590	SAV0110	lctP	120693	122285	121989		
NMTN-03637	SAV0111	spa	122614	123966	122814	-	Immunoglobulin G binding protein A precursor
NMTN-14676	SAV0112	sarH1	124387	125139	124714	-	staphylococcal accessory regulator A homologue
NMTN-11086	SAV0112	sarH1	1124387	125139	124962		
NMTN-05486	SAV0113	sirC	125508	126425	125535	-	lipoprotein
NMTN-13610	SAV0113	sirC	125508	126425	125538		
NMTN-13621	SAV0113	sirC	125508	126425	125538		
NMTN-11499d	SAV0113	sirC	125508	126425	125776		
NMTN-12265	SAV0113	sirC	125508	126425	125810		
NMTN-00251	SAV0113	sirC	125508	126425	125846		
NMTN-14599	SAV0113	sirC	125508	126425	125965		
NMTN-05329	SAV0113	sirC	125508	126425	126164		
NMTN-09386	SAV0113	sirC	125508	126425	126226		
NMTN-07861	SAV0113	sirC	125508	126425	126398		
NMTN-11583	SAV0113	sirC	125508	126425	126424		
NMTN-12605	SAV0113	sirB	126503	127498	126533	-	lipoprotein
NMTN-12605	SAV0114	sirB	126503	127498	126533		
NMTN-15246	SAV0114	sirB	126503	127498	127024		
NMTN-04101	SAV0115	sirA	127514	128506	128217	-	lipoprotein
NMTN-13438	SAV0115	sirA	127514	128506	128305		
NMTN-11162	SAV0116		128737	129717	128912	+	hypothetical protein
NMTN-06514	SAV0116		128737	129717	129038		
NMTN-05598	SAV0116		128737	129717	129192		
NMTN-11476	SAV0116		128737	129717	129651		
NMTN-12059	SAV0117		129714	130724	129734	+	hypothetical protein
NMTN-12593	SAV0117		129714	130724	129740		
NMTN-09964	SAV0117		129714	130724	129962		
NMTN-09972	SAV0117		129714	130724	129962		
NMTN-10523	SAV0117		129714	130724	130074		
NMTN-05406	SAV0117		129714	130724	130317		
NMTN-11504	SAV0117		129714	130724	130373		
NMTN-03646	SAV0117		129714	130724	130420		
NMTN-07204	SAV0118		130745	132499	130783	+	conserved hypothetical protein
NMTN-12707	SAV0118		130745	132499	130910		
NMTN-00750	SAV0118		130745	132499	130913		
NMTN-09730	SAV0118		130745	132499	131033		
NMTN-07518	SAV0118		130745	132499	131514		
NMTN-07479	SAV0118		130745	132499	131541		
NMTN-11959	SAV0119		132492	133748	132593	+	hypothetical protein
NMTN-04431	SAV0119		132492	133748	132741		
NMTN-09553	SAV0119		132492	133748	133099		
NMTN-10959	SAV0119		132492	133748	133193		
NMTN-08282	SAV0119		132492	133748	133245		
NMTN-04870	SAV0119		132492	133748	133358		
NMTN-11587	SAV0119		132492	133748	133687		
NMTN-07729	SAV0120		133738	135474	133855	+	hypothetical protein
NMTN-10719	SAV0120		133738	135474	134308		
NMTN-13771	SAV0120		133738	135474	134359		
NMTN-14774	SAV0120		133738	135474	134368		
NMTN-14561	SAV0120		133738	135474	134989		
NMTN-04528	SAV0120		133738	135474	135139		
NMTN-14678	SAV0120		133738	135474	135215		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09400	SAV0120		133738	135474	135408		
NMTN-09224	SAV0121		135455	137233	135630	+	hypothetical protein
NMTN-03981	SAV0121		135455	137233	135773		
NMTN-00568	SAV0121		135455	137233	136229		
NMTN-01773	SAV0121		135455	137233	136229		
NMTN-14720	SAV0121		135455	137233	137230		
NMTN-14720	SAV0122		137205	137984	137230	+	hypothetical protein
NMTN-06601	SAV0122		137205	137984	137635		
NMTN-13737	SAV0122		137205	137984	137783		
NMTN-13752	SAV0122		137205	137984	137784		
NMTN-12966	SAV0123		137984	139186	138084	+	hypothetical protein
NMTN-00693	SAV0123		137984	139186	139183		
NMTN-02682	SAV0124		139190	139954	139310	+	hypothetical protein
NMTN-09557	SAV0124		139190	139954	139350		
NMTN-10882	SAV0124		139190	139954	139935		
NMTN-14430	SAV0125		140150	140776	140144	+	hypothetical protein
NMTN-09159	SAV0125		140150	140776	140210		
NMTN-00114	SAV0125		140150	140776	140213		
NMTN-13916	SAV0125		140150	140776	140231		
NMTN-05201	SAV0125		140150	140776	140502		
NMTN-13518	SAV0125		140150	140776	140522		
NMTN-02811	SAV0126	butA	140988	141764	141446	+	acetoin(diacetyl)reductase
NMTN-13074	SAV0126	butA	140988	141764	141721		
NMTN-08640	SAV0128		142109	143080	142441	+	hypothetical protein
NMTN-06141	SAV0128		142109	143080	142604		
NMTN-09302	SAV0128		142109	143080	142756		
NMTN-00797	SAV0128		142109	143080	142763		
NMTN-07499	SAV0129		143043	143735	143401	+	hypothetical protein
NMTN-02789	SAV0129		143043	143735	143686		
NMTN-07925	SAV0129		143043	143735	143702		
NMTN-09466	SAV0130		143945	145111	143961	+	hypothetical protein
NMTN-11103d	SAV0130		143945	145111	144713		
NMTN-13876	SAV0130		143945	145111	144935		
NMTN-01699	SAV0130		143945	145111	144938		
NMTN-09350	SAV0131		145092	146330	145300	+	hypothetical protein
NMTN-12498	SAV0131		145092	146330	145506		
NMTN-08064	SAV0131		145092	146330	145706		
NMTN-08065	SAV0131		145092	146330	145708		
NMTN-12562	SAV0131		145092	146330	145832		
NMTN-00235	SAV0131		145092	146330	146074		
NMTN-00302	SAV0131		145092	146330	146074		
NMTN-06768t	SAV0131		145092	146330	146120		
NMTN-09206	SAV0132		146320	147750	146719	+	hypothetical protein
NMTN-14283	SAV0132		146320	147750	146785		
NMTN-00540	SAV0132		146320	147750	146886		
NMTN-05398	SAV0132		146320	147750	146903		
NMTN-02649	SAV0132		146320	147750	147010		
NMTN-09251	SAV0132		146320	147750	147028		
NMTN-01648	SAV0132		146320	147750	147316		
NMTN-02728	SAV0133	sodM	148018	148617	148072	+	superoxide dismutase
NMTN-10952	SAV0134	sasD*	148984	149709	149223	+	hypothetical protein
NMTN-01938	SAV0134	sasD	148984	149709	149226		
NMTN-03734	SAV0134	sasD	148984	149709	149291		
NMTN-08770	SAV0134	sasD	148984	149709	149344		
NMTN-00707	SAV0134	sasD	148984	149709	149552		
NMTN-00635	SAV0134	sasD	148984	149709	149633		
NMTN-00256	SAV0135		149900	150640	150553	-	hypothetical protein
NMTN-01871	SAV0135		149900	150640	150577		
NMTN-04115	SAV0136	pnp	150891	151598	151454	+	purine nucleoside phosphorylase
NMTN-06226	SAV0137		151605	152957	151776	+	hypothetical protein
NMTN-04163	SAV0137		151605	152957	151961		
NMTN-11633	SAV0137		151605	152957	151961		
NMTN-01998	SAV0137		151605	152957	152170		
NMTN-02864	SAV0137		151605	152957	152402		
NMTN-02866	SAV0137		151605	152957	152402		
NMTN-02867	SAV0137		151605	152957	152402		
NMTN-03656	SAV0137		151605	152957	152402		
NMTN-12889	SAV0137		151605	152957	152402		
NMTN-15245	SAV0137		151605	152957	152916		
NMTN-13850	SAV0138	dra	153038	153700	153705	+	deoxyribose-phosphate aldolase
NMTN-04768	SAV0139	drm	153728	154906	153945	+	phosphopentomutase
NMTN-13448	SAV0139	drm	153728	154906	154379		
NMTN-03891	SAV0139	drm	153728	154906	154842		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04628	SAV0140		155035	155850	155067	-	hypothetical protein
NMTN-04858	SAV0140		155035	155850	155067		
NMTN-04556	SAV0140		155035	155850	155205		
NMTN-09372	SAV0140		155035	155850	155650		
NMTN-09378	SAV0140		155035	155850	155650		
NMTN-07182	SAV0140		155035	155850	155838		
NMTN-07883	SAV0141		155847	156647	155902	-	hypothetical protein
NMTN-04840	SAV0141		155847	156647	156038		
NMTN-07545	SAV0141		155847	156647	156263		
NMTN-04813	SAV0142		156649	157422	156686	-	hypothetical protein
NMTN-12568	SAV0142		156649	157422	156694		
NMTN-03501	SAV0142		156649	157422	157003		
NMTN-05093	SAV0143		157617	158573	158258	-	hypothetical protein
NMTN-00754	SAV0143		157617	158573	158302		
NMTN-04512	SAV0143		157617	158573	158476		
NMTN-00009	SAV0144		158802	160346	158804	+	hypothetical protein
NMTN-00019	SAV0144		158802	160346	158815		
NMTN-00822	SAV0144		158802	160346	159340		
NMTN-05609	SAV0144		158802	160346	159454		
NMTN-06305	SAV0144		158802	160346	159555		
NMTN-09385	SAV0144		158802	160346	159668		
NMTN-03513	SAV0144		158802	160346	159829		
NMTN-09233	SAV0144		158802	160346	160080		
NMTN-13020	SAV0144		158802	160346	160080		
NMTN-11527	SAV0145		160397	161932	160409	+	hypothetical protein
NMTN-06375	SAV0145		160397	161932	161066		
NMTN-12594	SAV0145		160397	161932	161068		
NMTN-11012	SAV0145		160397	161932	161654		
NMTN-07766	SAV0145		160397	161932	161812		
NMTN-11933	SAV0145		160397	161932	161880		
NMTN-09395	SAV0147		162862	164037	163828	+	hypothetical protein
NMTN-07291	SAV0147		162862	164037	163849		
NMTN-06399	SAV0147		162862	164037	164045		
NMTN-08262	SAV0148	adhE	164422	167031	164641	+	alcohol-acetaldehyde dehydrogenase
NMTN-13252	SAV0148	adhE	164422	167031	164679		
NMTN-01814	SAV0148	adhE	164422	167031	164948		
NMTN-00652	SAV0148	adhE	164422	167031	165301		
NMTN-01590	SAV0148	adhE	164422	167031	165946		
NMTN-12618	SAV0148	adhE	164422	167031	165946		
NMTN-11427	SAV0148	adhE	164422	167031	166431		
NMTN-08701	SAV0148	adhE	164422	167031	166793		
NMTN-07517	SAV0148	adhE	164422	167031	166799		
NMTN-11236	SAV0148	adhE	164422	167031	166838		
NMTN-05613	SAV0148	adhE	164422	167031	167019		
NMTN-10032	SAV0149	capA	167374	168042	167388	+	capsular polysaccharide synthesis enzyme Cap5A
NMTN-13572	SAV0149	capA	167374	168042	167939		
NMTN-09402	SAV0150	capB	168058	168744	168118	+	capsular polysaccharide synthesis enzyme Cap5B
NMTN-05254	SAV0150	capB	168058	168744	168676		
NMTN-05268	SAV0150	capB	168058	168744	168676		
NMTN-05138	SAV0151	capC	168747	169511	168769	+	capsular polysaccharide synthesis enzyme Cap8C
NMTN-07374	SAV0151	capC	168747	169511	169192		
NMTN-12543	SAV0151	capC	168747	169511	169405		
NMTN-10890	SAV0152	capD	169531	171354	169823	+	capsular polysaccharide synthesis enzyme Cap5D
NMTN-14629	SAV0152	capD	169531	171354	169943		
NMTN-14637d	SAV0152	capD	169531	171354	169943		
NMTN-10711	SAV0152	capD	169531	171354	170355		
NMTN-02051	SAV0152	capD	169531	171354	170544		
NMTN-11025	SAV0152	capD	169531	171354	170598		
NMTN-11033	SAV0152	capD	169531	171354	170620		
NMTN-14665	SAV0152	capD	169531	171354	171244		
NMTN-12392	SAV0153	capE	171344	172372	171866	+	capsular polysaccharide synthesis enzyme Cap8E
NMTN-11309	SAV0153	capE	171344	172372	172272		
NMTN-06712	SAV0154	capF	172385	173494	172732	+	capsular polysaccharide synthesis enzyme Cap5F
NMTN-05448	SAV0154	capF	172385	173494	173142		
NMTN-06887	SAV0154	capF	172385	173494	173432		
NMTN-05573	SAV0155	capG	173498	174622	173597	+	capsular polysaccharide synthesis enzyme Cap5G

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00004	SAV0155	capG	173498	174622	173701		
NMTN-12183	SAV0155	capG	173498	174622	174443		
NMTN-11624	SAV0156	capH	174625	175251	174749	+	capsular polysaccharide synthesis enzyme O-acetyl transferase Cap5H
NMTN-12659	SAV0156	capH	174625	175251	174957		
NMTN-04851	SAV0157	capI	175256	176365	175688	+	capsular polysaccharide synthesis enzyme Cap5I
NMTN-06161	SAV0157	capI	175256	176365	176129		
NMTN-10865	SAV0158	capJ	176379	177545	176815	+	capsular polysaccharide synthesis enzyme Cap5J
NMTN-06124	SAV0158	capJ	176379	177545	176940		
NMTN-12264	SAV0158	capJ	176379	177545	177077		
NMTN-03492	SAV0158	capJ	176379	177545	177159		
NMTN-04856	SAV0159	capK	177538	178743	177688	+	capsular polysaccharide synthesis enzyme Cap5K
NMTN-10993	SAV0159	capK	177538	178743	177706		
NMTN-04144	SAV0159	capK	177538	178743	178073		
NMTN-07711	SAV0159	capK	177538	178743	178105		
NMTN-06095	SAV0159	capK	177538	178743	178316		
NMTN-13537	SAV0159	capK	177538	178743	178418		
NMTN-01929	SAV0159	capK	177538	178743	178490		
NMTN-12805	SAV0159	capK	177538	178743	178492		
NMTN-12976	SAV0159	capK	177538	178743	178492		
NMTN-08155	SAV0159	capK	177538	178743	178493		
NMTN-06218	SAV0159	capK	177538	178743	178495		
NMTN-13318	SAV0159	capK	177538	178743	178600		
NMTN-06426	SAV0160	capL	178744	179949	179152	+	capsular polysaccharide synthesis enzyme Cap5L
NMTN-07750	SAV0160	capL	178744	179949	179466		
NMTN-00618	SAV0160	capL	178744	179949	179744		
NMTN-10879	SAV0161	capM	179960	180517	180039	+	capsular polysaccharide synthesis enzyme Cap5M
NMTN-01957	SAV0161	capM	179960	180517	180123		
NMTN-01866	SAV0162	capN	180517	181404	180581	+	capsular polysaccharide synthesis enzyme Cap5N
NMTN-04136	SAV0162	capN	180517	181404	180722		
NMTN-06083	SAV0163	capO	181458	182720	181875	+	capsular polysaccharide synthesis enzyme Cap8O
NMTN-05283	SAV0163	capO	181458	182720	182050		
NMTN-12917	SAV0163	capO	181458	182720	182254		
NMTN-11669	SAV0163	capO	181458	182720	182382		
NMTN-04646	SAV0163	capO	181458	182720	182489		
NMTN-08890	SAV0163	capO	181458	182720	182505		
NMTN-04700	SAV0164	capP	182767	183942	182926	+	capsular polysaccharide synthesis enzyme Cap5P
NMTN-05644	SAV0164	capP	182767	183942	183501		
NMTN-04706	SAV0164	capP	182767	183942	183668		
NMTN-09847	SAV0164	capP	182767	183942	183792		
NMTN-09227	SAV0165	isdI	184007	184333	184034	-	conserved hypothetical protein
NMTN-11092	SAV0165	isdI	184007	184333	184116		
NMTN-11891	SAV0165	isdI	184007	184333	184170		
NMTN-12932	SAV0166		184340	184723	184477	-	conserved hypothetical protein
NMTN-04350	SAV0166	isdG**	184340	184723	184481		
NMTN-07301	SAV0167	aldA	185150	186637	185141		
NMTN-15192	SAV0167	aldA	185150	186637	185864	+	aldehyde dehydrogenase homologue
NMTN-02715	SAV0167	aldA	185150	186637	185925		
NMTN-06813	SAV0167	aldA	185150	186637	186032		
NMTN-03273	SAV0168		187284	188243	187488	+	hypothetical protein
NMTN-08279	SAV0168		187284	188243	187999		
NMTN-11701	SAV0168		187284	188243	188031		
NMTN-13649	SAV0168		187284	188243	188031		
NMTN-05237	SAV0171		188920	189432	189318	+	hypothetical protein
NMTN-07506	SAV0172		189774	190514	189822	+	hypothetical protein
NMTN-02635	SAV0172		189774	190514	189925		
NMTN-10948	SAV0172		189774	190514	189955		
NMTN-07554	SAV0173		190528	191499	190627	+	hypothetical protein
NMTN-11245	SAV0173		190528	191499	190670		
NMTN-07471	SAV0173		190528	191499	190976		
NMTN-03639	SAV0173		190528	191499	191031		
NMTN-07902	SAV0173		190528	191499	191290		
NMTN-06072	SAV0174		191496	192257	191601	+	hypothetical protein
NMTN-05563	SAV0174		191496	192257	191653		
NMTN-00861	SAV0174		191496	192257	192197		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00698	SAV0175		192270	193301	192626	+	hypothetical protein
NMTN-13362	SAV0175		192270	193301	192996		
NMTN-05305	SAV0175		192270	193301	193064		
NMTN-10577	SAV0175		192270	193301	193308		
NMTN-02233	SAV0176		193527	193877	193609	+	conserved hypothetical protein
NMTN-10905	SAV0176		193527	193877	193609		
NMTN-07878	SAV0177	fdh	193952	195076	194048	+	NAD-dependent formate dehydrogenase
NMTN-07526	SAV0177	fdh	193952	195076	194251		
NMTN-10911	SAV0178		195462	196712	195675	+	hypothetical protein
NMTN-02469	SAV0178		195462	196712	196090		
NMTN-09014	SAV0178		195462	196712	196575		
NMTN-12202	SAV0179		197159	204334	197203	+	hypothetical protein
NMTN-13575	SAV0179		197159	204334	197467		
NMTN-00016	SAV0179		197159	204334	197654		
NMTN-04439	SAV0179		197159	204334	197900		
NMTN-02049	SAV0179		197159	204334	197901		
NMTN-06946	SAV0179		197159	204334	197909		
NMTN-07190	SAV0179		197159	204334	197909		
NMTN-04853	SAV0179		197159	204334	197981		
NMTN-11262	SAV0179		197159	204334	198566		
NMTN-06633	SAV0179		197159	204334	199169		
NMTN-10667	SAV0179		197159	204334	199707		
NMTN-00811	SAV0179		197159	204334	199809		
NMTN-14695	SAV0179		197159	204334	199870		
NMTN-03234	SAV0179		197159	204334	200255		
NMTN-02766	SAV0179		197159	204334	200320		
NMTN-01820	SAV0179		197159	204334	200478		
NMTN-11721	SAV0179		197159	204334	200478		
NMTN-04446	SAV0179		197159	204334	200546		
NMTN-01854	SAV0179		197159	204334	200622		
NMTN-04641	SAV0179		197159	204334	200697		
NMTN-13211	SAV0179		197159	204334	201206		
NMTN-01891	SAV0179		197159	204334	201264		
NMTN-08612	SAV0179		197159	204334	201293		
NMTN-04365	SAV0179		197159	204334	201295		
NMTN-07825	SAV0179		197159	204334	201336		
NMTN-08323	SAV0179		197159	204334	201571		
NMTN-06437	SAV0179		197159	204334	201599		
NMTN-09393	SAV0179		197159	204334	201686		
NMTN-09666	SAV0179		197159	204334	201837		
NMTN-07956	SAV0179		197159	204334	202174		
NMTN-06385	SAV0179		197159	204334	202221		
NMTN-04381	SAV0179		197159	204334	202435		
NMTN-11449	SAV0179		197159	204334	203118		
NMTN-08671	SAV0179		197159	204334	203142		
NMTN-11184	SAV0179		197159	204334	203142		
NMTN-06485	SAV0179		197159	204334	203169		
NMTN-08756	SAV0179		197159	204334	203505		
NMTN-13062	SAV0179		197159	204334	203660		
NMTN-06835	SAV0179		197159	204334	203665		
NMTN-03491	SAV0179		197159	204334	203769		
NMTN-09354	SAV0179		197159	204334	203822		
NMTN-11799	SAV0179		197159	204334	203946		
NMTN-10880	SAV0179		197159	204334	204189		
NMTN-14532	SAV0180		204347	204991	204448	+	conserved hypothetical protein
NMTN-03096	SAV0180		204347	204991	204753		
NMTN-10581	SAV0182		206068	206832	206317	-	hypothetical protein
NMTN-06304	SAV0182		206068	206832	206488		
NMTN-03414	SAV0182		206068	206832	206538		
NMTN-02265	SAV0182		206068	206832	206795		
NMTN-12640	SAV0183	argJ	206848	208089	208055	-	arginine biosynthesis bifunctional protein homologue
NMTN-03127	SAV0184	argC	208101	209132	208251	-	N-acetylglutamate gamma-semialdehyde dehydrogenase
NMTN-02803	SAV0184	argC	208101	209132	208612		
NMTN-07307	SAV0184	argC	208101	209132	208985		
NMTN-02387	SAV0185		209171	210355	209256	-	ornithine aminotransferase
NMTN-00824	SAV0185		209171	210355	210144		
NMTN-05074	SAV0185		209171	210355	210235		
NMTN-12376	SAV0186		210614	211963	210942	-	hypothetical protein
NMTN-13213	SAV0186		210614	211963	211268		
NMTN-10656	SAV0186		210614	211963	211715		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08784	SAV0187		212242	212739	212621	-	hypothetical protein
NMTN-09016	SAV0188		212866	214506	213464	-	hypothetical protein
NMTN-02579	SAV0188		212866	214506	213929		
NMTN-07755	SAV0188		212866	214506	213929		
NMTN-03140	SAV0188		212866	214506	213931		
NMTN-06532	SAV0188		212866	214506	214099		
NMTN-12556	SAV0188		212866	214506	214148		
NMTN-06454	SAV0189	glcA	214778	216823	215026	-	PTS enzyme II
NMTN-03102	SAV0189	glcA	214778	216823	215642		
NMTN-05296	SAV0189	glcA	214778	216823	215704		
NMTN-01753	SAV0189	glcA	214778	216823	216550		
NMTN-04337	SAV0190		217408	218463	217432	+	conserved hypothetical protein
NMTN-00178	SAV0190		217408	218463	217985		
NMTN-12312	SAV0190		217408	218463	218168		
NMTN-11922	SAV0192		219371	220825	219473	+	hypothetical protein
NMTN-00006	SAV0192		219371	220825	219577		
NMTN-01763	SAV0192		219371	220825	219623		
NMTN-04956	SAV0192		219371	220825	219682		
NMTN-00863	SAV0192		219371	220825	220038		
NMTN-04361	SAV0192		219371	220825	220347		
NMTN-04951	SAV0192		219371	220825	220347		
NMTN-03927	SAV0192		219371	220825	220650		
NMTN-13067	SAV0193		220828	221703	220906	+	hypothetical protein
NMTN-02135	SAV0193		220828	221703	220967		
NMTN-08828	SAV0193		220828	221703	221067		
NMTN-02362	SAV0193		220828	221703	221456		
NMTN-02429	SAV0195	hsdR	222391	225180	222479	+	probable type I restriction enzyme restriction chain
NMTN-13443	SAV0195	hsdR	222391	225180	222743		
NMTN-12699	SAV0195	hsdR	222391	225180	222911		
NMTN-00710	SAV0195	hsdR	222391	225180	223058		
NMTN-09492	SAV0195	hsdR	222391	225180	223205		
NMTN-05126	SAV0195	hsdR	222391	225180	223655		
NMTN-09118	SAV0195	hsdR	222391	225180	223659		
NMTN-08992	SAV0195	hsdR	222391	225180	223693		
NMTN-15247	SAV0195	hsdR	222391	225180	224668		
NMTN-09050	SAV0195	hsdR	222391	225180	224757		
NMTN-07632	SAV0195	hsdR	222391	225180	224854		
NMTN-14427	SAV0195	hsdR	222391	225180	224946		
NMTN-08861	SAV0205	oppF	233309	234901	233824	-	oligopeptide transport ATP-binding protein
NMTN-11739	SAV0205	oppF	233309	234901	234790		
NMTN-10862	SAV0206	truncated-oppB	234999	236336	235224	+	truncated hypothetical protein
NMTN-12437	SAV0206	truncated-oppB	234999	236336	235540		
NMTN-07849	SAV0206	truncated-oppB	234999	236336	235961		
NMTN-11430	SAV0206	truncated-oppB	234999	236336	236240		
NMTN-14610	SAV0206	truncated-oppB	234999	236336	236250		
NMTN-04004	SAV0207		236342	237505	236667	+	hypothetical protein
NMTN-05315	SAV0207		236342	237505	236994		
NMTN-05454	SAV0207		236342	237505	237185		
NMTN-06052	SAV0207		236342	237505	237299		
NMTN-11760	SAV0207		236342	237505	237381		
NMTN-01926	SAV0208	rlp	237522	239297	237570	+	RGD-containing lipoprotein
NMTN-07795	SAV0208	rlp	237522	239297	237571		
NMTN-12525	SAV0208	rlp	237522	239297	238567		
NMTN-03751	SAV0209		239335	241341	239494	+	hypothetical protein
NMTN-03761	SAV0209		239335	241341	239494		
NMTN-03750	SAV0209/ SAV0103		239335	241341	239494		
NMTN-07928	SAV0209		239335	241341	239578		
NMTN-03566	SAV0209		239335	241341	239639		
NMTN-15333	SAV0209		239335	241341	239657		
NMTN-13268	SAV0209		239335	241341	239863		
NMTN-12316	SAV0209		239335	241341	239967		
NMTN-13896	SAV0209		239335	241341	241037		
NMTN-05324	SAV0209		239335	241341	241261		
NMTN-08994	SAV0209		239335	241341	241271		
NMTN-02891	SAV0209		239335	241341	241278		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06988	SAV0209		239335	241341	241296		
NMTN-00603	SAV0209		239335	241341	241311		
NMTN-12945	SAV0210		241654	242427	241925	-	hypothetical protein
NMTN-11515	SAV0210		241654	242427	242150		
NMTN-07427	SAV0210		241654	242427	242203		
NMTN-07298	SAV0210		241654	242427	242206		
NMTN-13516	SAV0210		241654	242427	242242		
NMTN-12256	SAV0211		242616	243242	242966	-	NAD(P)H dehydrogenase homologue
NMTN-09004	SAV0211		242616	243242	242967		
NMTN-07811	SAV0211		242616	243242	243049		
NMTN-10874	SAV0211		242616	243242	243156		
NMTN-10277	SAV0211		242616	243242	243244		
NMTN-11857	SAV0212		243451	244029	243505	+	hypothetical protein
NMTN-04162	SAV0212		243451	244029	243523		
NMTN-06068	SAV0212		243451	244029	243581		
NMTN-13778	SAV0212		243451	244029	243651		
NMTN-10402	SAV0212		243451	244029	243801		
NMTN-10403	SAV0212		243451	244029	243801		
NMTN-10405	SAV0212		243451	244029	243801		
NMTN-10410	SAV0212		243451	244029	243801		
NMTN-10411	SAV0212		243451	244029	243801		
NMTN-10419	SAV0212		243451	244029	243801		
NMTN-10420	SAV0212		243451	244029	243801		
NMTN-10423	SAV0212		243451	244029	243801		
NMTN-10428	SAV0212		243451	244029	243801		
NMTN-10430	SAV0212		243451	244029	243801		
NMTN-10460	SAV0212		243451	244029	243801		
NMTN-10462	SAV0212		243451	244029	243801		
NMTN-11738	SAV0212		243451	244029	243836		
NMTN-13376	SAV0212		243451	244029	243837		
NMTN-06383	SAV0213	msmX	244413	245510	244684	+	multiple sugar-binding transport ATP-binding protein
NMTN-08675	SAV0213	msmX	244413	245510	244864		
NMTN-06618	SAV0213	msmX	244413	245510	245076		
NMTN-12348	SAV0213	msmX	244413	245510	245097		
NMTN-06972	SAV0213	msmX	244413	245510	245467		
NMTN-03834	SAV0214		245523	246794	245568	+	hypothetical protein
NMTN-14479	SAV0214		245523	246794	245996		
NMTN-12263	SAV0214		245523	246794	246580		
NMTN-08291	SAV0215		246797	248065	247574	+	maltose/maltodextrin transport permease homologue
NMTN-13547	SAV0215		246797	248065	247607		
NMTN-12504	SAV0216		248067	248906	248139	+	maltose/maltodextrin transport permease homologue
NMTN-02950	SAV0216		248067	248906	248287		
NMTN-03194	SAV0216		248067	248906	248298		
NMTN-13904	SAV0216		248067	248906	248348		
NMTN-00051	SAV0216		248067	248906	248447		
NMTN-01515	SAV0216		248067	248906	248629		
NMTN-12364	SAV0217		248977	250056	249316	+	hypothetical protein
NMTN-04534	SAV0218		250081	251121	250298	+	hypothetical protein
NMTN-04548	SAV0218		250081	251121	250298		
NMTN-11575	SAV0218		250081	251121	250363		
NMTN-12211	SAV0218		250081	251121	250445		
NMTN-09449	SAV0218		250081	251121	250692		
NMTN-08362	SAV0218		250081	251121	251059		
NMTN-01858	SAV0218		250081	251121	251071		
NMTN-12429	SAV0218		250081	251121	251128		
NMTN-03836	SAV0219		251176	252144	251228	+	conserved hypothetical protein
NMTN-11513	SAV0219		251176	252144	251238		
NMTN-01499	SAV0219		251176	252144	251714		
NMTN-05230	SAV0219		251176	252144	252024		
NMTN-12663	SAV0220		252505	252999	252780	-	conserved hypothetical protein
NMTN-11730	SAV0220		252505	252999	252847		
NMTN-04364	SAV0220		252505	252999	252977		
NMTN-08995	SAV0222	uhpT	253232	253951	253056	+	hexose phosphate transport protein
NMTN-10780	SAV0222	uhpT	253232	253951	253416		
NMTN-07443	SAV0222	uhpT	253232	253951	253594		
NMTN-05413	SAV0222	uhpT	253232	254611	253784		
NMTN-00616	SAV0222	uhpT	253955	254611	254128		
NMTN-01873	SAV0222	uhpT	253955	254611	254186		
NMTN-01889	SAV0222	uhpT	253955	254611	254186		
NMTN-00592	SAV0222	uhpT	253955	254611	254527		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00716	SAV0222	uhpT	253955	254611	254527		
NMTN-00717	SAV0222	uhpT	253955	254611	254527		
NMTN-09482	SAV0223		254970	255728	255509	-	hypothetical protein
NMTN-12010	SAV0223		254970	255728	255633		
NMTN-00452	SAV0223		254970	255728	255719		
NMTN-02933	SAV0224		255721	257277	255729	-	hypothetical protein
NMTN-09571	SAV0224		255721	257277	256205		
NMTN-07304	SAV0224		255721	257277	256284		
NMTN-09538	SAV0224		255721	257277	256840		
NMTN-07461	SAV0224		255721	257277	256923		
NMTN-11248	SAV0224		255721	257277	257167		
NMTN-12666	SAV0225		257274	258242	257626	-	hypothetical protein
NMTN-09513	SAV0225		257274	258242	257720		
NMTN-02423	SAV0225		257274	258242	257728		
NMTN-00232	SAV0225		257274	258242	257889		
NMTN-13472	SAV0226	pflB	258830	261079	258836	+	formate acetyltransferase
NMTN-13723	SAV0226	pflB	258830	261079	258899		
NMTN-14058	SAV0226	pflB	258830	261079	258899		
NMTN-05431	SAV0226	pflB	258830	261079	259130		
NMTN-12999	SAV0226	pflB	258830	261079	259446		
NMTN-07509	SAV0226	pflB	258830	261079	259600		
NMTN-03884	SAV0226	pflB	258830	261079	260237		
NMTN-13055	SAV0226	pflB	258830	261079	260373		
NMTN-05414	SAV0226	pflB	258830	261079	260769		
NMTN-13028	SAV0228		262179	263942	262923	+	hypothetical protein
NMTN-04690	SAV0228		262179	263942	263028		
NMTN-09373	SAV0228		262179	263942	263168		
NMTN-09379	SAV0228		262179	263942	263168		
NMTN-12997	SAV0228		262179	263942	263784		
NMTN-14033	SAV0229		264106	264450	264341	-	hypothetical protein
NMTN-12830	SAV0230	coa	264640	266616	265432	+	staphylocoagulase precursor
NMTN-00492	SAV0230	coa	264640	266616	265946		
NMTN-02852	SAV0230	coa	264640	266616	266235		
NMTN-06144	SAV0231		267203	268387	267397	-	acetyl-CoA acetyltransferase homologue
NMTN-11460	SAV0231		267203	268387	267881		
NMTN-04061	SAV0231		267203	268387	267919		
NMTN-03669	SAV0231		267203	268387	267937		
NMTN-08823	SAV0231		267203	268387	267950		
NMTN-02733	SAV0231		267203	268387	267961		
NMTN-07137d	SAV0231		267203	268387	268048		
NMTN-13014d	SAV0232		268417	270678	268525	-	hypothetical protein
NMTN-14533	SAV0232		268417	270678	268708		
NMTN-12082	SAV0232		268417	270678	268980		
NMTN-13462	SAV0232		268417	270678	268980		
NMTN-09715	SAV0232		268417	270678	269108		
NMTN-12806	SAV0232		268417	270678	269405		
NMTN-09034	SAV0232		268417	270678	269645		
NMTN-05362	SAV0232		268417	270678	269980		
NMTN-10972	SAV0232		268417	270678	270098		
NMTN-08134	SAV0232		268417	270678	270185		
NMTN-01985	SAV0232		268417	270678	270230		
NMTN-01842	SAV0232		268417	270678	270423		
NMTN-00054	SAV0232		268417	270678	270498		
NMTN-12864	SAV0233		270864	272075	271000	-	hypothetical protein
NMTN-06234	SAV0233		270864	272075	271191		
NMTN-09469	SAV0233		270864	272075	271281		
NMTN-14512	SAV0233		270864	272075	271281		
NMTN-03997	SAV0233		270864	272075	271523		
NMTN-09518	SAV0233		270864	272075	271761		
NMTN-11991	SAV0233		270864	272075	272079		
NMTN-11657	SAV0234		272187	273692	272269	-	hypothetical protein
NMTN-06845	SAV0234		272187	273692	272369		
NMTN-04666	SAV0234		272187	273692	272971		
NMTN-09223	SAV0235		273718	275280	273709	-	conserved hypothetical protein
NMTN-00796	SAV0235		273718	275280	274053		
NMTN-03764	SAV0235		273718	275280	274595		
NMTN-08577	SAV0235		273718	275280	274931		
NMTN-11834d	SAV0235		273718	275280	274961		
NMTN-00015	SAV0236		275736	276878	275953	+	hypothetical protein
NMTN-13802	SAV0236		275736	276878	276226		
NMTN-12972	SAV0236		275736	276878	276591		
NMTN-03838	SAV0236		275736	276878	276708		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11407	SAV0237		277192	278667	277229	-	hypothetical protein
NMTN-07202	SAV0237		277192	278667	277667		
NMTN-09207	SAV0237		277192	278667	277759		
NMTN-09520	SAV0237		277192	278667	277874		
NMTN-11454	SAV0237		277192	278667	277895		
NMTN-03665	SAV0237		277192	278667	277901		
NMTN-06982	SAV0237		277192	278667	278200		
NMTN-01810	SAV0237		277192	278667	278344		
NMTN-11473	SAV0238		278865	279221	279187	-	conserved hypothetical protein
NMTN-06088	SAV0240		279577	280722	279828	-	hypothetical protein
NMTN-11180	SAV0240		279577	280722	279909		
NMTN-05886	SAV0240		279577	280722	279959		
NMTN-09163	SAV0240		279577	280722	280130		
NMTN-04861	SAV0240		279577	280722	280138		
NMTN-14418	SAV0240		279577	280722	280303		
NMTN-11105	SAV0240		279577	280722	280386		
NMTN-02831	SAV0241	lctE	281295	282248	281357	+	L-lactate dehydrogenase
NMTN-11741	SAV0241	lctE	281295	282248	281727		
NMTN-06726t	SAV0241	lctE	281295	282248	281990		
NMTN-12870	SAV0242		282568	284097	283082	-	PTS enzyme
NMTN-11718	SAV0242		282568	284097	283359		
NMTN-11720	SAV0242		282568	284097	283359		
NMTN-08010	SAV0242		282568	284097	283588		
NMTN-10824	SAV0242		282568	284097	283773		
NMTN-02365	SAV0243		284459	285394	285173	+	hypothetical protein
NMTN-12294	SAV0244		285731	287827	286723	+	hypothetical protein
NMTN-10705	SAV0244		285731	287827	286897		
NMTN-09375	SAV0244		285731	287827	287477		
NMTN-09381	SAV0244		285731	287827	287477		
NMTN-14293	SAV0244		285731	287827	287780		
NMTN-03950	SAV0245		287812	288279	288125	+	hypothetical protein
NMTN-13901	SAV0245		287812	288279	288148		
NMTN-06720	SAV0245		287812	288279	288272		
NMTN-05635	SAV0246		288302	288580	288320	+	hypothetical protein
NMTN-13103	SAV0247	gatC	288807	290066	289951	+	probable PTS galactitol-specific enzyme IIC component
NMTN-05298	SAV0248		290084	291139	290258	+	sorbitol dehydrogenase
NMTN-02456	SAV0248		290084	291139	290347		
NMTN-10639	SAV0248		290084	291139	290350		
NMTN-10934	SAV0248		290084	291139	290350		
NMTN-08061	SAV0248		290084	291139	290462		
NMTN-05235	SAV0250		291311	292354	291399	+	sorbitol dehydrogenase homologue
NMTN-12703	SAV0250		291311	292354	291463		
NMTN-02563	SAV0250		291311	292354	291506		
NMTN-00243	SAV0250		291311	292354	291643		
NMTN-12539	SAV0250		291311	292354	291884		
NMTN-10860	SAV0250		291311	292354	291885		
NMTN-02654	SAV0250		291311	292354	291890		
NMTN-04049	SAV0250		291311	292354	291890		
NMTN-09085	SAV0250		291311	292354	291906		
NMTN-12737	SAV0250		291311	292354	292007		
NMTN-01506	SAV0250		291311	292354	292222		
NMTN-15241	SAV0250		291311	292354	292257		
NMTN-01934	SAV0251		292882	293598	293284	+	hypothetical protein
NMTN-07739	SAV0252		293591	294616	294169	+	hypothetical protein
NMTN-07972	SAV0252		293591	294616	294192		
NMTN-05236	SAV0252		293591	294616	294477		
NMTN-06414	SAV0252		293591	294616	294533		
NMTN-06545	SAV0253		294638	296332	294857	+	hypothetical protein
NMTN-04632	SAV0253		294638	296332	295374		
NMTN-03224	SAV0258		301682	303403	301700	+	hypothetical protein
NMTN-07206	SAV0258		301682	303403	302075		
NMTN-04126	SAV0258		301682	303403	302528		
NMTN-08462	SAV0258		301682	303403	302661		
NMTN-06310	SAV0258		301682	303403	302928		
NMTN-06910	SAV0258		301682	303403	303100		
NMTN-00118	SAV0259	scdA	303547	304221	303944	+	cell division and morphogenesis-related protein
NMTN-02542	SAV0259	scdA	303547	304221	304003		
NMTN-02543	SAV0259	scdA	303547	304221	304003		
NMTN-04188	SAV0259	scdA	303547	304221	304094		
NMTN-12116	SAV0259	scdA	303547	304221	304094		
NMTN-11393	SAV0259	scdA	303547	304221	304201		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-02846	SAV0260	lytS	304466	306220	304602	+	two-component sensor histidine kinase
NMTN-08540	SAV0260	lytS	304466	306220	304602		
NMTN-03944	SAV0260	lytS	304466	306220	304810		
NMTN-13256	SAV0260	lytS	304466	306220	304851		
NMTN-07386	SAV0260	lytS	304466	306220	305276		
NMTN-00645	SAV0260	lytS	304466	306220	305741		
NMTN-05796	SAV0261	lytR	306223	306963	306277	+	two-component response regulator
NMTN-04539	SAV0261	lytR	306223	306963	306830		
NMTN-06542	SAV0261	lytR	306223	306963	306957		
NMTN-08827	SAV0262	lrgA	307082	307519	307235	+	holin-like protein
NMTN-00684	SAV0262	lrgA	307082	307519	307409		
NMTN-12275	SAV0264		308321	309025	308741	-	hypothetical protein
NMTN-05502	SAV0264		308321	309025	309014		
NMTN-13853	SAV0265		309174	309965	309184	+	hypothetical protein
NMTN-11126	SAV0265		309174	309965	309757		
NMTN-10715	SAV0265		309174	309965	309777		
NMTN-10852	SAV0266	bglA	309981	311417	310166	+	6-phospho-beta-glucosidase
NMTN-12650	SAV0266	bglA	309981	311417	311312		
NMTN-11711	SAV0267		311904	312665	311910	-	conserved hypothetical protein
NMTN-08331	SAV0267		311904	312665	311922		
NMTN-12288	SAV0267		311904	312665	312403		
NMTN-08149	SAV0267		311904	312665	312581		
NMTN-09554	SAV0267		311904	312665	312646		
NMTN-09840	SAV0268	rbsK	312916	313830	313312	-	probable ribokinase
NMTN-07989	SAV0269	rbsD	313858	314262	314040	-	ribose permease
NMTN-05444	SAV0270		314277	315158	314338	-	hypothetical protein
NMTN-08976	SAV0270		314277	315158	314506		
NMTN-09036	SAV0270		314277	315158	314509		
NMTN-07943	SAV0270		314277	315158	315162		
NMTN-03680	SAV0271		315390	316388	315393	-	hypothetical protein
NMTN-07021	SAV0271		315390	316388	315541		
NMTN-12824	SAV0271		315390	316388	316020		
NMTN-05434	SAV0271		315390	316388	316031		
NMTN-03097	SAV0271		315390	316388	316321		
NMTN-11540	SAV0271		315390	316388	316393		
NMTN-07234	SAV0272		316527	316727	316697	+	NADH dehydrogenase subunit
NMTN-12766	SAV0273		316765	317157	316815	+	hypothetical protein
NMTN-04884	SAV0274		317285	318661	317347	-	hypothetical protein
NMTN-11282	SAV0274		317285	318661	317434		
NMTN-07031	SAV0274		317285	318661	317496		
NMTN-10840	SAV0274		317285	318661	318057		
NMTN-00275	SAV0274		317285	318661	318145		
NMTN-09562	SAV0274		317285	318661	318150		
NMTN-14451	SAV0274		317285	318661	318241		
NMTN-06195	SAV0274		317285	318661	318376		
NMTN-01870	SAV0275		318895	319887	319279	+	hypothetical protein
NMTN-05529	SAV0275		318895	319887	319592		
NMTN-06423	SAV0275		318895	319887	319715		
NMTN-02987	SAV0276	lytM	320213	321163	320262	+	peptidoglycan hydrolase
NMTN-13071	SAV0276	lytM	320213	321163	320364		
NMTN-07010	SAV0276	lytM	320213	321163	320801		
NMTN-10851	SAV0277		321215	321874	321224	-	conserved hypothetical protein
NMTN-04752	SAV0277		321215	321874	321460		
NMTN-12831	SAV0277		321215	321874	321495		
NMTN-04665	SAV0277		321215	321874	321549		
NMTN-10915	SAV0277		321215	321874	321778		
NMTN-05460	SAV0278		321888	322808	321908	-	hypothetical protein
NMTN-12519	SAV0278		321888	322808	321934		
NMTN-07287	SAV0278		321888	322808	321937		
NMTN-11434	SAV0278		321888	322808	322015		
NMTN-05175	SAV0278		321888	322808	322120		
NMTN-13402d	SAV0278		321888	322808	322400		
NMTN-00493	SAV0278		321888	322808	322444		
NMTN-05550	SAV0278		321888	322808	322720		
NMTN-01681	SAV0279		322805	323971	322898	-	hypothetical protein
NMTN-00381	SAV0279		322805	323971	323117		
NMTN-10664	SAV0279		322805	323971	323298		
NMTN-00629	SAV0279		322805	323971	323604		
NMTN-13243	SAV0279		322805	323971	323612		
NMTN-07198	SAV0279		322805	323971	323625		
NMTN-01970	SAV0279		322805	323971	323824		
NMTN-04368	SAV0279		322805	323971	323906		
NMTN-11750	SAV0280		324039	325562	324319	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06456	SAV0280		324039	325562	324411		
NMTN-04994	SAV0280		324039	325562	324451		
NMTN-03794	SAV0280		324039	325562	324809		
NMTN-13900	SAV0280		324039	325562	325010		
NMTN-10570	SAV0280		324039	325562	325061		
NMTN-14462	SAV0281		325893	326786	326019		
NMTN-14809	SAV0281		325893	326786	326019	-	hypothetical protein
NMTN-02936	SAV0281		325893	326786	326184		
NMTN-07490	SAV0281		325893	326786	326184		
NMTN-14682	SAV0283		327410	330439	327923	+	hypothetical protein
NMTN-09349	SAV0283		327410	330439	328600		
NMTN-15360	SAV0283		327410	330439	330247		
NMTN-06301	SAV0283		327410	330439	330304		
NMTN-03742	SAV0284		330439	330897	330560	+	hypothetical protein
NMTN-13152	SAV0285		330869	331111	330912	+	conserved hypothetical protein
NMTN-11241	SAV0285		330869	331111	330968		
NMTN-02411	SAV0286		331124	332458	331322	+	conserved hypothetical protein
NMTN-11556	SAV0286		331124	332458	331322		
NMTN-15284	SAV0286		331124	332458	331340		
NMTN-05513	SAV0286		331124	332458	331452		
NMTN-00689	SAV0286		331124	332458	331890		
NMTN-00165	SAV0286		331124	332458	331950		
NMTN-00394	SAV0286		331124	332458	331950		
NMTN-00511	SAV0286		331124	332458	331950		
NMTN-07525	SAV0286		331124	332458	332163		
NMTN-10892	SAV0286		331124	332458	332458		
NMTN-06491	SAV0287		332480	333679	332547	+	conserved hypothetical protein
NMTN-07893	SAV0287		332480	333679	332566		
NMTN-03683	SAV0287		332480	333679	332895		
NMTN-04464	SAV0287		332480	333679	333271		
NMTN-11214	SAV0288		333672	336920	333773	+	conserved hypothetical protein
NMTN-02755	SAV0288		333672	336920	334140		
NMTN-02191	SAV0288		333672	336920	334334		
NMTN-02832	SAV0288		333672	336920	334641		
NMTN-10633	SAV0288		333672	336920	335132		
NMTN-11255	SAV0288		333672	336920	335135		
NMTN-13592	SAV0288		333672	336920	335364		
NMTN-04847	SAV0288		333672	336920	336087		
NMTN-05618	SAV0288		333672	336920	336152		
NMTN-13038	SAV0288		333672	336920	336315		
NMTN-13043	SAV0288		333672	336920	336738		
NMTN-08872	SAV0288		333672	336920	336799		
NMTN-09488	SAV0288		333672	336920	336856		
NMTN-07912	SAV0290		337358	337672	337359		
NMTN-08567	SAV0290		337358	337672	337612	+	hypothetical protein
NMTN-08340	SAV0293		338673	340517	338691	+	conserved hypothetical protein
NMTN-11068	SAV0293		338673	340517	338775		
NMTN-07570	SAV0293		338673	340517	338953		
NMTN-13293	SAV0293		338673	340517	338958		
NMTN-03493	SAV0293		338673	340517	338970		
NMTN-09277	SAV0293		338673	340517	339676		
NMTN-11663	SAV0293		338673	340517	339724		
NMTN-03911	SAV0293		338673	340517	340122		
NMTN-08495	SAV0293		338673	340517	340195		
NMTN-10978	SAV0294		340528	341019	341000	+	conserved hypothetical protein
NMTN-13089	SAV0295		341222	341905	341220	+	hypothetical protein
NMTN-04048	SAV0295		341222	341905	341247		
NMTN-13694	SAV0295		341222	341905	341248		
NMTN-06126	SAV0295		341222	341905	341598		
NMTN-06822	SAV0295		341222	341905	341712		
NMTN-12070	SAV0295		341222	341905	341846		
NMTN-00500	SAV0295		341222	341905	341857		
NMTN-07742	SAV0296		342051	342662	342145	+	hypothetical protein
NMTN-13914	SAV0296		342051	342662	342152		
NMTN-09573	SAV0296		342051	342662	342193		
NMTN-05120	SAV0296		342051	342662	342495		
NMTN-04317	SAV0297		342797	343015	342915	+	hypothetical protein
NMTN-05433	SAV0298		343147	343647	343317	+	conserved hypothetical protein
NMTN-10048	SAV0298		343147	343647	343320		
NMTN-02932	SAV0298		343147	343647	343493		
NMTN-04791	SAV0298		343147	343647	343544		
NMTN-06103	SAV0299		343658	344158	343759	+	conserved hypothetical protein
NMTN-11844	SAV0300		344169	344630	344582	+	conserved hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06534	SAV0301		344679	345179	344885	+	conserved hypothetical protein
NMTN-06634	SAV0302		345190	345675	345538	+	conserved hypothetical protein
NMTN-10684	SAV0302		345190	345675	345582		
NMTN-10920	SAV0302		345190	345675	345625		
NMTN-06648	SAV0302		345190	345675	345653		
NMTN-08543	SAV0303		346300	346674	346682	+	hypothetical protein
NMTN-06396	SAV0304		346824	347222	347078	+	hypothetical protein
NMTN-07501	SAV0304		346824	347222	347103		
NMTN-03864	SAV0304		346824	347222	347178		
NMTN-12220	SAV0305		347438	348262	347929	-	hypothetical protein
NMTN-00605	SAV0305		347438	348262	347977		
NMTN-09719	SAV0305		347438	348262	348228		
NMTN-14709	SAV0306		348499	349806	348660	-	hypothetical protein
NMTN-05155	SAV0306		348499	349806	348897		
NMTN-03413	SAV0306		348499	349806	349093		
NMTN-12867	SAV0306		348499	349806	349118		
NMTN-03089	SAV0307		350390	351280	350410	+	hypothetical protein
NMTN-12439	SAV0307		350390	351280	350410		
NMTN-07388	SAV0307		350390	351280	350669		
NMTN-02028	SAV0307		350390	351280	350750		
NMTN-02029	SAV0307		350390	351280	350750		
NMTN-04783	SAV0307		350390	351280	350982		
NMTN-08120	SAV0307		350390	351280	351098		
NMTN-07352	SAV0307		350390	351280	351138		
NMTN-06476	SAV0308		351529	352578	351916	+	conserved hypothetical protein
NMTN-00460	SAV0308		351529	352578	352279		
NMTN-02480	SAV0308		351529	352578	352515		
NMTN-13888	SAV0309		352591	353268	353054	+	hypothetical protein
NMTN-04052	SAV0310		353476	354507	353495	+	hypothetical protein
NMTN-07777	SAV0310		353476	354507	353518		
NMTN-08817	SAV0310		353476	354507	353743		
NMTN-05210	SAV0310		353476	354507	353745		
NMTN-00853	SAV0310		353476	354507	354387		
NMTN-02805	SAV0311		354850	355968	355283	+	hypothetical protein
NMTN-04086	SAV0311		354850	355968	355298		
NMTN-13883	SAV0311		354850	355968	355739		
NMTN-00108	SAV0311		354850	355968	355834		
NMTN-08765	SAV0312		355943	356866	356127	+	conserved hypothetical protein
NMTN-10783	SAV0312		355943	356866	356136		
NMTN-06575	SAV0312		355943	356866	356671		
NMTN-07340	SAV0312		355943	356866	356671		
NMTN-05564	SAV0313		356877	358097	357244	+	probable pyrimidine nucleoside transport protein
NMTN-10826	SAV0313		356877	358097	357373		
NMTN-03125	SAV0313		356877	358097	357417		
NMTN-04110	SAV0313		356877	358097	357425		
NMTN-02707	SAV0313		356877	358097	357684		
NMTN-02708	SAV0313		356877	358097	357684		
NMTN-04713	SAV0313		356877	358097	357691		
NMTN-03193	SAV0313		356877	358097	357693		
NMTN-13466	SAV0313		356877	358097	357916		
NMTN-07746	SAV0314		358202	359734	358195	-	hypothetical protein
NMTN-10632	SAV0314		358202	359734	358344		
NMTN-06445	SAV0314		358202	359734	358390		
NMTN-08831	SAV0314		358202	359734	358803		
NMTN-07456	SAV0314		358202	359734	358863		
NMTN-03729	SAV0314		358202	359734	358935		
NMTN-09701	SAV0314		358202	359734	359162		
NMTN-11215	SAV0314		358202	359734	359373		
NMTN-13697	SAV0314		358202	359734	359460		
NMTN-09108	SAV0315	nanA	359774	360655	360323	-	N-acetylneuraminate lyase subunit
NMTN-02871	SAV0316		360813	361673	360818	+	hypothetical protein
NMTN-08818	SAV0316		360813	361673	360954		
NMTN-11934	SAV0316		360813	361673	361003		
NMTN-06650	SAV0316		360813	361673	361408		
NMTN-14683	SAV0317		361950	362750	362584	-	conserved hypothetical protein
NMTN-08080	SAV0317		361950	362750	362691		
NMTN-13133	SAV0318		362890	363558	362949	+	conserved hypothetical protein
NMTN-13880	SAV0318		362890	363558	363217		
NMTN-03752	SAV0318		362890	363558	363222		
NMTN-06525	SAV0318		362890	363558	363338		
NMTN-07516	SAV0318		362890	363558	363453		
NMTN-06115	SAV0319		363689	365002	364533	-	conserved hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09174	SAV0319		363689	365002	364908		
NMTN-00040	SAV0320	geh	365420	367495	366732	+	glycerol ester hydrolase
NMTN-08795	SAV0321		367737	368564	367969	-	hypothetical protein
NMTN-15244	SAV0322		368637	369836	369085	-	hypothetical protein
NMTN-12426d	SAV0322		368637	369836	369838		
NMTN-07336	SAV0323		370138	371139	370447	+	hypothetical protein
NMTN-10723	SAV0323		370138	371139	370480		
NMTN-07949	SAV0323		370138	371139	370660		
NMTN-12538	SAV0323		370138	371139	370748		
NMTN-11496	SAV0324		371173	371505	371231	+	hypothetical protein
NMTN-05241	SAV0325		371506	372306	371698	+	conserved hypothetical protein
NMTN-09128	SAV0325		371506	372306	371855		
NMTN-11482	SAV0325		371506	372306	372204		
NMTN-14522	SAV0325		371506	372306	372247		
NMTN-04742	SAV0326		372293	373240	372306	+	hypothetical protein
NMTN-07407	SAV0326		372293	373240	372984		
NMTN-01707	SAV0326		372293	373240	373071		
NMTN-07189	SAV0326		372293	373240	373212		
NMTN-11764	SAV0327		373218	374240	373400		
NMTN-02961	SAV0327		373218	374240	373460	+	hypothetical protein
NMTN-04339	SAV0327		373218	374240	373561		
NMTN-12083	SAV0327		373218	374240	374243		
NMTN-08706	SAV0327		373218	374240	374247		
NMTN-08707	SAV0327		373218	374240	374247		
NMTN-06073	SAV0328		374556	375581	375132	+	hypothetical protein
NMTN-13813	SAV0328		374556	375581	375240		
NMTN-06254	SAV0328		374556	375581	375475		
NMTN-02086	SAV0329		375675	377021	375736	-	hypothetical protein
NMTN-11976	SAV0329		375675	377021	376153		
NMTN-04777	SAV0329		375675	377021	376175		
NMTN-05096	SAV0329		375675	377021	376207		
NMTN-10946	SAV0329		375675	377021	376351		
NMTN-07702	SAV0329		375675	377021	376484		
NMTN-05517	SAV0329		375675	377021	376516		
NMTN-11793	SAV0329		375675	377021	376556		
NMTN-09291	SAV0329		375675	377021	376754		
NMTN-11892	SAV0329		375675	377021	377030		
NMTN-11892	SAV0330		377036	377320	377030	-	conserved hypothetical protein
NMTN-08728	SAV0330		377036	377320	377091		
NMTN-02277	SAV0330		377036	377320	377302		
NMTN-04848	SAV0332		377770	379725	378044	-	hypothetical protein
NMTN-06548	SAV0332		377770	379725	378513		
NMTN-00014	SAV0332		377770	379725	378586		
NMTN-11684	SAV0332		377770	379725	378586		
NMTN-07503	SAV0332		377770	379725	378790		
NMTN-02510	SAV0332		377770	379725	378966		
NMTN-01509	SAV0332		377770	379725	379140		
NMTN-01510	SAV0332		377770	379725	379140		
NMTN-05320	SAV0332		377770	379725	379225		
NMTN-02134	SAV0334		380463	381818	380574	+	conserved hypothetical protein
NMTN-04148	SAV0334		380463	381818	380574		
NMTN-12814	SAV0334		380463	381818	380886		
NMTN-08652	SAV0334		380463	381818	381219		
NMTN-06133	SAV0334		380463	381818	381454		
NMTN-13808	SAV0334		380463	381818	381495		
NMTN-07308	SAV0334		380463	381818	381696		
NMTN-12875	SAV0334		380463	381818	381699		
NMTN-03498	SAV0335		381922	382380	382253	+	hypothetical protein
NMTN-08713	SAV0337	glpT	382444	382719	382623	-	glycerol-3-phosphate transporter
NMTN-05632	SAV0337	glpT	382738	383802	382799	-	glycerol-3-phosphate transporter
NMTN-12614	SAV0337	glpT	382738	383802	382944		
NMTN-02555	SAV0337	glpT	382738	383802	383214		
NMTN-07783	SAV0337	glpT	382738	383802	383581		
NMTN-04867	SAV0337	glpT	382738	383802	383744		
NMTN-03817	SAV0337	glpT	382738	383802	383771		
NMTN-13805	SAV0338		384114	385040	384245	+	conserved hypothetical protein
NMTN-08388	SAV0338		384114	385040	384418		
NMTN-13032	SAV0338		384114	385040	384535		
NMTN-12267	SAV0338		384114	385040	384815		
NMTN-02460	SAV0338		384114	385040	384904		
NMTN-10394	SAV0339		385054	386115	385169	+	conserved hypothetical protein
NMTN-00413	SAV0339		385054	386115	385462		
NMTN-12206	SAV0339		385054	386115	385462		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04056	SAV0339		385054	386115	385579		
NMTN-14638	SAV0339		385054	386115	385723		
NMTN-01514	SAV0339		385054	386115	385786		
NMTN-02044	SAV0339		385054	386115	385787		
NMTN-05037	SAV0340		386129	386695	386309	+	hypothetical protein
NMTN-03829	SAV0340		386129	386695	386441		
NMTN-00622	SAV0340		386129	386695	386483		
NMTN-06448	SAV0340		386129	386695	386502		
NMTN-07595	SAV0340		386129	386695	386567		
NMTN-11379	SAV0341		386754	387749	386758	-	conserved hypothetical protein
NMTN-09397	SAV0341		386754	387749	386802		
NMTN-06430	SAV0341		386754	387749	386955		
NMTN-07826	SAV0341		386754	387749	386955		
NMTN-12272	SAV0341		386754	387749	386959		
NMTN-09120	SAV0341		386754	387749	386962		
NMTN-09117	SAV0341		386754	387749	387072		
NMTN-02680	SAV0341		386754	387749	387234		
NMTN-03583	SAV0341		386754	387749	387235		
NMTN-13170	SAV0341		386754	387749	387245		
NMTN-08690	SAV0341		386754	387749	387524		
NMTN-01547	SAV0341		386754	387749	387579		
NMTN-07708	SAV0341		386754	387749	387611		
NMTN-00424	SAV0341		386754	387749	387613		
NMTN-09560	SAV0341		386754	387749	387698		
NMTN-12477	SAV0342		388114	388659	388397	+	hypothetical protein
NMTN-12469	SAV0342		388114	388659	388399		
NMTN-13656	SAV0343		388926	389780	389037	+	conserved hypothetical protein
NMTN-12557	SAV0343		388926	389780	389319		
NMTN-11302	SAV0344		389891	391006	390390	+	conserved hypothetical protein
NMTN-05333	SAV0344		389891	391006	390642		
NMTN-06246	SAV0344		389891	391006	390922		
NMTN-02522	SAV0344		389891	391006	390924		
NMTN-07975	SAV0344		389891	391006	390929		
NMTN-08222	SAV0344		389891	391006	390938		
NMTN-11665	SAV0345		390984	392699	391045	+	conserved hypothetical protein
NMTN-14527	SAV0345		390984	392699	391542		
NMTN-10980	SAV0345		390984	392699	391804		
NMTN-06058	SAV0345		390984	392699	391860		
NMTN-09219	SAV0345		390984	392699	392262		
NMTN-11735	SAV0345		390984	392699	392275		
NMTN-05694	SAV0345		390984	392699	392466		
NMTN-03885	SAV0345		390984	392699	392481		
NMTN-03887	SAV0345		390984	392699	392481		
NMTN-14491	SAV0345		390984	392699	392484		
NMTN-14795	SAV0345		390984	392699	392484		
NMTN-14801	SAV0345		390984	392699	392484		
NMTN-14803	SAV0345		390984	392699	392484		
NMTN-14811	SAV0345		390984	392699	392484		
NMTN-14836	SAV0345		390984	392699	392484		
NMTN-14849	SAV0345		390984	392699	392484		
NMTN-14853	SAV0345		390984	392699	392484		
NMTN-14887	SAV0345		390984	392699	392484		
NMTN-14915	SAV0345		390984	392699	392484		
NMTN-14921	SAV0345		390984	392699	392484		
NMTN-15053	SAV0345		390984	392699	392484		
NMTN-15007	SAV0345		390984	392699	392500		
NMTN-10082	SAV0345		390984	392699	392515		
NMTN-09556	SAV0345		390984	392699	392617		
NMTN-12868	SAV0345		390984	392699	392683		
NMTN-12780	SAV0346		392940	393602	393297	-	conserved hypothetical protein
NMTN-03851	SAV0346		392940	393602	393348		
NMTN-05420	SAV0346		392940	393602	393348		
NMTN-10661	SAV0348		393981	394370	394066	-	hypothetical protein
NMTN-10814	SAV0348		393981	394370	394363		
NMTN-14614	SAV0350		394810	395523	394925	+	hypothetical protein
NMTN-11890	SAV0350		394810	395523	395426		
NMTN-11900	SAV0350		394810	395523	395426		
NMTN-08896	SAV0350		394810	395523	395461		
NMTN-07402	SAV0351		395548	396390	395752	+	hypothetical protein
NMTN-09288	SAV0351		395548	396390	395785		
NMTN-04881	SAV0351		395548	396390	395788		
NMTN-06556	SAV0352		396390	397019	396581	+	conserved hypothetical protein
NMTN-12698	SAV0352		396390	397019	396831		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12079	SAV0352		396390	397019	396866		
NMTN-03635	SAV0352		396390	397019	396869		
NMTN-03562	SAV0353		397406	398539	397622	-	hypothetical protein
NMTN-04172	SAV0353		397406	398539	397640		
NMTN-11979	SAV0353		397406	398539	397650		
NMTN-05351	SAV0353		397406	398539	397845		
NMTN-05352	SAV0353		397406	398539	397845		
NMTN-05421	SAV0353		397406	398539	397845		
NMTN-06533	SAV0353		397406	398539	397996		
NMTN-02127	SAV0353		397406	398539	398257		
NMTN-08839d	SAV0354		399078	400259	399664	+	acetyl-CoA C-acetyltransferase homologue
NMTN-09086	SAV0354		399078	400259	399930		
NMTN-10526	SAV0355		400342	401094	400373	-	conserved hypothetical protein
NMTN-03134	SAV0355		400342	401094	400509		
NMTN-06551	SAV0355		400342	401094	400600		
NMTN-11313	SAV0355		400342	401094	400912		
NMTN-04642	SAV0356	metE	401137	403365	401477	-	5-methyltetrahydropteroyltryglutamate-homocysteine methyltransferase
NMTN-00724	SAV0356	metE	401137	403365	402278		
NMTN-02141	SAV0356	metE	401137	403365	403012		
NMTN-00735	SAV0356	metE	401137	403365	403019		
NMTN-00167	SAV0357		403362	405203	403823	-	conserved hypothetical protein
NMTN-00146	SAV0357		403362	405203	403825		
NMTN-00204	SAV0357		403362	405203	404047		
NMTN-00486	SAV0357		403362	405203	404047		
NMTN-02989	SAV0357		403362	405203	404905		
NMTN-13452	SAV0357		403362	405203	404907		
NMTN-12307	SAV0358		405172	406332	405483	-	hypothetical protein
NMTN-12166	SAV0358		405172	406332	405543		
NMTN-08730	SAV0358		405172	406332	405818		
NMTN-12463	SAV0359		406329	407432	406927	-	hypothetical protein
NMTN-04976	SAV0359		406329	407432	407150		
NMTN-07988	SAV0360		408103	408939	408745	+	hypothetical protein
NMTN-06558	SAV0360		408103	408939	408787		
NMTN-09137	SAV0360		408103	408939	408819		
NMTN-03281	SAV0360		408103	408939	408839		
NMTN-11678	SAV0361		409093	409974	409757	+	conserved hypothetical protein
NMTN-14769	SAV0363		410219	411316	410351	+	hypothetical protein
NMTN-12209	SAV0363		410219	411316	410601		
NMTN-06441	SAV0363		410219	411316	410877		
NMTN-06449	SAV0363		410219	411316	410967		
NMTN-13266	SAV0368		413228	414202	413859	-	hypothetical protein
NMTN-07510	SAV0368		413228	414202	413968		
NMTN-01611	SAV0368		413228	414202	413980		
NMTN-14444	SAV0368		413228	414202	413986		
NMTN-13684	SAV0369		414254	414508	415118	-	truncated integrase
NMTN-13684	SAV0370		415124	415735	415118	+	hypothetical protein
NMTN-08152	SAV0370		415124	415735	415475		
NMTN-13296	SAV0370		415124	415735	415521		
NMTN-09501	SAV0370		415124	415735	415622		
NMTN-02822	SAV0372		416653	417225	416654	+	conserved hypothetical protein
NMTN-07268	SAV0375		418215	418424	418275	-	hypothetical protein
NMTN-06108	SAV0376		418578	419183	418686	+	hypothetical protein
NMTN-14613d	SAV0376		418578	419183	418686		
NMTN-03854	SAV0376		418578	419183	418767		
NMTN-05334	SAV0376		418578	419183	419004		
NMTN-03425	SAV0377		419249	419632	419456	-	conserved hypothetical protein
NMTN-04161	SAV0377		419249	419632	419457		
NMTN-01781	SAV0377		419249	419632	419460		
NMTN-01991	SAV0377		419249	419632	419494		
NMTN-15342	SAV0377		419249	419632	419496		
NMTN-12266	SAV0378		419902	420528	420434	-	hypothetical protein
NMTN-11517	SAV0378		419902	420528	420477		
NMTN-01746	SAV0379		420601	420792	420716	-	hypothetical protein
NMTN-12691	SAV0381	ahpC	422511	423080	422638	-	alkyl hydroperoxide reductase subunit C
NMTN-14050	SAV0381	ahpC	422511	423080	422726		
NMTN-04519	SAV0382		423572	424327	423587	+	hypothetical protein
NMTN-05427	SAV0382		423572	424327	423589		
NMTN-13511	SAV0382		423572	424327	424030		
NMTN-06054	SAV0382		423572	424327	424128		
NMTN-05489	SAV0383		424407	425795	424649	-	hypothetical protein
NMTN-09471	SAV0383		424407	425795	425418		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12236	SAV0385		428293	429249	429061	-	conserved hypothetical protein
NMTN-09826	SAV0386		429367	430029	429401	-	hypothetical protein
NMTN-09238	SAV0388	xprT	431092	431670	431101	+	xanthine phosphoribosyltransferase
NMTN-08834	SAV0389	pbuX	431670	432938	431725	+	xanthine permease
NMTN-07938	SAV0389	pbuX	431670	432938	431798		
NMTN-04691	SAV0389	pbuX	431670	432938	432259		
NMTN-14620	SAV0389	pbuX	431670	432938	432765		
NMTN-02868	SAV0390	guaB	432976	434442	433027	+	inositol-monophosphate dehydrogenase
NMTN-06706	SAV0391	guaA	434467	436008	435130	+	GMP synthase
NMTN-02197	SAV0391	guaA	434467	436008	435193		
NMTN-10996		set21	435077	435775	435373		
NMTN-15177	SAV0391	guaA	434467	436008	435451		
NMTN-11946	SAV0391	guaA	434467	436008	435583		
NMTN-06940	SAV0391	guaA	434467	436008	435587		
NMTN-08349	SAV0391	guaA	434467	436008	435619		
NMTN-11810	SAV0391	guaA	434467	436008	435940		
NMTN-10413		set24	438308	439006	438550		
NMTN-10224	SAV0416		461922	462458	462194	-	hypothetical protein
NMTN-06701	SAV0417		462850	463554	462954	-	hypothetical protein
NMTN-09364	SAV0417		462850	463554	462988		
NMTN-11889	SAV0417		462850	463554	463489		
NMTN-11897	SAV0417		462850	463554	463492		
NMTN-11908	SAV0417		462850	463554	463516		
NMTN-00572	SAV0420		465170	465529	465329	-	conserved hypothetical protein
NMTN-11141	SAV0420		465170	465529	465471		
NMTN-06130	SAV0421		465548	466393	465927	-	conserved hypothetical protein
NMTN-12619	SAV0421		465548	466393	465984		
NMTN-09567	SAV0424	set8	468817	469887	469438	+	exotoxin 8
NMTN-04681	SAV0424	set8	468817	469887	469491		
NMTN-10262	SAV0424	set8	468817	469887	469674		
NMTN-10490	SAV0424	set8	468817	469887	469867		
NMTN-08867	SAV0425	set10	470251	470955	470290	+	exotoxin 10
NMTN-09122	SAV0425	set10	470251	470955	470335		
NMTN-13316	SAV0425	set10	470251	470955	470471		
NMTN-11488	SAV0425	set10	470251	470955	470512		
NMTN-12345	SAV0425	set10	470251	470955	470563		
NMTN-09645	SAV0425	set10	470251	470955	470644		
NMTN-03859	SAV0426	set11	471401	472096	471521	+	exotoxin 11
NMTN-15240	SAV0426	set11	471401	472096	471521		
NMTN-11318	SAV0426	set11	471401	472096	471528		
NMTN-03905	SAV0426	set11	471401	472096	471603		
NMTN-12292	SAV0426	set11	471401	472096	472097		
NMTN-02183	SAV0427	set12	472435	473133	472453	+	exotoxin 12
NMTN-07136	SAV0427	set12	472435	473133	472474		
NMTN-01980	SAV0427	set12	472435	473133	472855		
NMTN-01645	SAV0428	set13	473510	474208	473559	+	exotoxin 13
NMTN-10409	SAV0428	set13	473510	474208	473754		
NMTN-10261	SAV0428	set13	473510	474208	473758		
NMTN-09836	SAV0428	set13	473510	474208	473791		
NMTN-03059	SAV0428	set13	473510	474208	473909		
NMTN-06098	SAV0428	set13	473510	474208	474153		
NMTN-12470	SAV0429	set14	474574	475257	475177	+	exotoxin 14
NMTN-11723	SAV0429	set14	474574	475257	475202		
NMTN-06340	SAV0430		475310	475468	475404	+	hypothetical protein
NMTN-14715	SAV0432	hsdS	477070	478281	477173	+	probable restriction modification system specificity subunit
NMTN-09115	SAV0432	hsdS	477070	478281	477821		
NMTN-06674	SAV0432	hsdS	477070	478281	477988		
NMTN-00606	SAV0432	hsdS	477070	478281	477989		
NMTN-11974	SAV0432	hsdS	477070	478281	478095		
NMTN-14438	SAV0432	hsdS	477070	478281	478137		
NMTN-00661	SAV0432	hsdS	477070	478281	478144		
NMTN-04805	SAV0432	hsdS	477070	478281	478156		
NMTN-13910	SAV0433	set15	478664	479347	478806	+	exotoxin 15
NMTN-01618	SAV0434		479369	480856	479411	+	hypothetical protein
NMTN-09712	SAV0434		479369	480856	480149		
NMTN-08110	SAV0434		479369	480856	480357		
NMTN-00801	SAV0434		479369	480856	480560		
NMTN-01996	SAV0436	lpl1	481609	482412	481781	+	hypothetical protein
NMTN-00586	SAV0438	lpl3	483282	484070	483318	+	hypothetical protein
NMTN-12927	SAV0441	lpl5	485741	486523	485973	+	hypothetical protein
NMTN-12150	SAV0441	lpl5	485741	486523	486170		
NMTN-12268	SAV0442	lpl6	486580	487374	486600	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06425	SAV0444	lpl8	488245	489027	488272	+	hypothetical protein
NMTN-04371	SAV0444	lpl8	488245	489027	488474		
NMTN-00383	SAV0445	lpl9	489206	490021	489375	+	hypothetical protein
NMTN-12829	SAV0446		490011	491336	490395	+	hypothetical protein
NMTN-05045	SAV0446		490011	491336	490632		
NMTN-01489	SAV0446		490011	491336	490705		
NMTN-02862	SAV0446		490011	491336	490803		
NMTN-12950	SAV0446		490011	491336	490899		
NMTN-12452	SAV0446		490011	491336	491106		
NMTN-04779	SAV0446		490011	491336	491173		
NMTN-02881	SAV0446		490011	491336	491181		
NMTN-03660	SAV0446		490011	491336	491319		
NMTN-02829	SAV0448		491675	491989	491719	+	hypothetical protein
NMTN-05251	SAV0449		492278	492478	492373	-	hypothetical protein
NMTN-07283	SAV0450		492657	493859	492653	+	conserved hypothetical protein
NMTN-09060	SAV0450		492657	493859	492656		
NMTN-04173	SAV0450		492657	493859	492786		
NMTN-10015	SAV0450		492657	493859	493185		
NMTN-05506	SAV0450		492657	493859	493450		
NMTN-03754	SAV0450		492657	493859	493563		
NMTN-00537	SAV0455		500402	500644	500437	-	hypothetical protein
NMTN-10904	SAV0455		500402	500644	500534		
NMTN-03741	SAV0456		500856	501530	501167	+	conserved hypothetical protein
NMTN-02151	SAV0456		500856	501530	501216		
NMTN-02530	SAV0456		500856	501530	501233		
NMTN-05316	SAV0457		501567	502301	501630	+	hypothetical protein
NMTN-00687	SAV0457		501567	502301	501707		
NMTN-12744	SAV0457		501567	502301	501755		
NMTN-09422	SAV0457		501567	502301	501765		
NMTN-06560	SAV0457		501567	502301	502038		
NMTN-01138	SAV0458		502670	504010	503125	+	hypothetical protein
NMTN-11558	SAV0458		502670	504010	504013		
NMTN-14431	SAV0459	cysM	504227	505132	504411	+	cysteine synthase homologue
NMTN-04955	SAV0459	cysM	504227	505132	504480		
NMTN-06894	SAV0459	cysM	504227	505132	504670		
NMTN-12011	SAV0459	cysM	504227	505132	504670		
NMTN-03815	SAV0459	cysM	504227	505132	504675		
NMTN-09274	SAV0459	cysM	504227	505132	504983		
NMTN-03966	SAV0459	cysM	504227	505132	505086		
NMTN-08429	SAV0459	cysM	504227	505132	505087		
NMTN-06902	SAV0461	yrhB	505146	506266	505198		
NMTN-03554	SAV0461	yrhB	505146	506266	505213		
NMTN-00099	SAV0461	yrhB	505146	506266	505221	+	cystathionine gamma-synthase homolog
NMTN-04796	SAV0461	yrhB	505146	506266	505486		
NMTN-01861	SAV0461	yrhB	505146	506266	505725		
NMTN-09549	SAV0462		506561	507586	506603	+	hypothetical protein
NMTN-00841	SAV0462		506561	507586	506778		
NMTN-11775	SAV0463		507590	508249	507845	+	hypothetical protein
NMTN-08336	SAV0463		507590	508249	507941		
NMTN-02295	SAV0463		507590	508249	508003		
NMTN-03585	SAV0463		507590	508249	508129		
NMTN-05733	SAV0463		507590	508249	508181		
NMTN-01857	SAV0464		508286	509128	508325	+	hypothetical protein
NMTN-13917	SAV0464		508286	509128	508547		
NMTN-00339	SAV0464		508286	509128	508770		
NMTN-09977	SAV0464		508286	509128	508910		
NMTN-05539	SAV0464		508286	509128	508947		
NMTN-09353	SAV0465		509460	510263	509835	+	hypothetical protein
NMTN-11802	SAV0465		509460	510263	509947		
NMTN-01696	SAV0465		509460	510263	509950		
NMTN-12140	SAV0465		509460	510263	510007		
NMTN-04405	SAV0465		509460	510263	510090		
NMTN-08084	SAV0466		510448	510726	510435	-	hypothetical protein
NMTN-14425	SAV0466		510448	510726	510625		
NMTN-06582	SAV0466		510448	510726	510729		
NMTN-02115	SAV0467		510866	511261	511172	+	conserved hypothetical protein
NMTN-09534	SAV0467		510866	511261	511258		
NMTN-09534	SAV0468		511251	511736	511258	+	conserved hypothetical protein
NMTN-00464	SAV0468		511251	511736	511676		
NMTN-08141	SAV0469		511905	512687	512096	-	conserved hypothetical protein
NMTN-03852	SAV0469		511905	512687	512248		
NMTN-04062	SAV0469		511905	512687	512561		
NMTN-04068	SAV0469		511905	512687	512561		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04070	SAV0469		511905	512687	512561		
NMTN-04131	SAV0470		512684	513796	512813	-	conserved hypothetical protein
NMTN-05165	SAV0470		512684	513796	512856		
NMTN-03883	SAV0470		512684	513796	513127		
NMTN-06596	SAV0470		512684	513796	513382		
NMTN-11576	SAV0470		512684	513796	513561		
NMTN-12685	SAV0471	gltC	513917	514801	514401	-	transcription activator of glutamate synthase operon
NMTN-06250	SAV0471	gltC	513917	514801	514811		
NMTN-11578	SAV0472	gltB	514982	519481	515912	+	glutamate synthase large subunit
NMTN-10043	SAV0472	gltB	514982	519481	516259		
NMTN-14687	SAV0472	gltB	514982	519481	516562		
NMTN-04151	SAV0472	gltB	514982	519481	516821		
NMTN-04441	SAV0472	gltB	514982	519481	517008		
NMTN-11069	SAV0472	gltB	514982	519481	517104		
NMTN-10228	SAV0472	gltB	514982	519481	517297		
NMTN-03726	SAV0472	gltB	514982	519481	517651		
NMTN-04377	SAV0472	gltB	514982	519481	517817		
NMTN-09438	SAV0472	gltB	514982	519481	517925		
NMTN-11119	SAV0472	gltB	514982	519481	518147		
NMTN-00215	SAV0472	gltB	514982	519481	518838		
NMTN-00369	SAV0472	gltB	514982	519481	518838		
NMTN-00138	SAV0472	gltB	514982	519481	519098		
NMTN-10929	SAV0472	gltB	514982	519481	519123		
NMTN-13372	SAV0472	gltB	514982	519481	519237		
NMTN-12044	SAV0473	gltD	519499	520962	519675	+	NADH-glutamate synthase small subunit
NMTN-08561	SAV0473	gltD	519499	520962	519748		
NMTN-02133	SAV0473	gltD	519499	520962	520015		
NMTN-05001	SAV0473	gltD	519499	520962	520077		
NMTN-12442	SAV0473	gltD	519499	520962	520228		
NMTN-08530	SAV0473	gltD	519499	520962	520229		
NMTN-03677	SAV0473	gltD	519499	520962	520348		
NMTN-04723	SAV0473	gltD	519499	520962	520469		
NMTN-00072	SAV0474	treP	521792	523219	522098	+	phosphoenolpyruvate-dependent and trehalose-specific PTS enzyme II
NMTN-14632	SAV0474	treP	521792	523219	522808		
NMTN-09541	SAV0474	treP	521792	523219	522941		
NMTN-14604	SAV0474	treP	521792	523219	523117		
NMTN-03871	SAV0475		523283	524923	523899	+	alpha-glucosidase
NMTN-12360	SAV0476		524948	525676	525471	+	hypothetical protein
NMTN-03557	SAV0476		524948	525676	525541		
NMTN-11167	SAV0481		536410	537747	536996	+	hypothetical protein
NMTN-13561	SAV0481		536410	537747	537107		
NMTN-07048	SAV0481		536410	537747	537306		
NMTN-15220d	SAV0481		536410	537747	537524		
NMTN-12986	SAV0481		536410	537747	537528		
NMTN-14049	SAV0485		540032	540667	540183	+	hypothetical protein
NMTN-03926	SAV0487		541305	542030	541504	+	conserved hypothetical protein
NMTN-01943	SAV0487		541305	542030	541776		
NMTN-11308	SAV0487		541305	542030	541879		
NMTN-01612	SAV0488		542023	542271	542072	+	conserved hypothetical protein
NMTN-10845	SAV0488		542023	542271	542075		
NMTN-04831	SAV0489		542273	543112	542650	+	conserved hypothetical protein
NMTN-05607	SAV0489		542273	543112	543086		
NMTN-13072	SAV0489		542273	543112	543107		
NMTN-05397	SAV0490	metS	543397	545370	545072	+	methionyl-tRNA synthetase
NMTN-01766	SAV0490	metS	543397	545370	545075		
NMTN-03488	SAV0492		546341	546877	546337	+	conserved hypothetical protein
NMTN-06122	SAV0493	ksgA	546882	547772	547143	+	dimethyladenosine transferase
NMTN-05534	SAV0493	ksgA	546882	547772	547452		
NMTN-08899d	SAV0495		548453	549301	548875	+	hypothetical protein
NMTN-09720	SAV0499	gcaD	551317	552669	552649	+	UDP-N-acetylglucosamine pyrophosphorylase homologue
NMTN-11929	SAV0501	rplY	553931	554584	554021	+	50S ribosomal protein L25
NMTN-09944	SAV0501	rplY	553931	554584	554061		
NMTN-10050	SAV0501	rplY	553931	554584	554061		
NMTN-02410	SAV0501	rplY	553931	554584	554315		
NMTN-09430	SAV0503	mfd	555467	558973	555683	+	transcription-repair coupling factor
NMTN-10525	SAV0503	mfd	555467	558973	557549		
NMTN-11860	SAV0503	mfd	555467	558973	558256		
NMTN-11483	SAV0504		558963	560489	559588	+	hypothetical protein
NMTN-04818	SAV0511	ftsH	565134	567227	565240	+	cell-division protein
NMTN-13644	SAV0511	ftsH	565134	567227	565240		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11982	SAV0511	ftsH	565134	567227	567103		
NMTN-07872	SAV0512		567455	568336	567440	+	heat-shock protein HSP33 homologue
NMTN-07334	SAV0512		567455	568336	567504		
NMTN-04925	SAV0512		567455	568336	567721		
NMTN-06938	SAV0512		567455	568336	567838		
NMTN-06790	SAV0514	folP	569663	570466	569694	+	dihydropteroate synthase chain A synthetase
NMTN-02416	SAV0516	folK	570806	571282	571275	+	2-amino-4-hydroxy-6-hydroxymethylidihydropteridine pyrophosphokinase
NMTN-09310	SAV0516	folK	570806	571282	571282		
NMTN-09568	SAV0516	folK	570806	571282	571282		
NMTN-10020	SAV0518		580361	581743	580545	-	hypothetical protein
NMTN-10828	SAV0518		580361	581743	580563		
NMTN-13540	SAV0518		580361	581743	580876		
NMTN-06053	SAV0518		580361	581743	580879		
NMTN-09910	SAV0518		580361	581743	580944		
NMTN-07770	SAV0518		580361	581743	581042		
NMTN-09862	SAV0518		580361	581743	581148		
NMTN-10489	SAV0518		580361	581743	581402		
NMTN-09746	SAV0518		580361	581743	581427		
NMTN-04532	SAV0518		580361	581743	581438		
NMTN-10482	SAV0518		580361	581743	581496		
NMTN-03216	SAV0518		580361	581743	581692		
NMTN-15271d	SAV0519		581847	582734	581845	+	conserved hypothetical protein
NMTN-00222	SAV0519		581847	582734	582028		
NMTN-07952	SAV0520		582738	583298	582823	+	conserved hypothetical protein
NMTN-14498	SAV0520		582738	583298	583135		
NMTN-10259	SAV0520		582738	583298	583154		
NMTN-08330	SAV0520		582738	583298	583170		
NMTN-09357	SAV0520		582738	583298	583170		
NMTN-13570	SAV0520		582738	583298	583273		
NMTN-01480	SAV0521	nupC	583506	584720	583717	-	pyrimidine nucleoside transport protein
NMTN-08491	SAV0521	nupC	583506	584720	583717		
NMTN-03483	SAV0521	nupC	583506	584720	584083		
NMTN-04483	SAV0521	nupC	583506	584720	584420		
NMTN-14043	SAV0521	nupC	583506	584720	584615		
NMTN-00696	SAV0522	ctsR	584878	585339	584888	+	transcription repressor of class III stress genes homologue
NMTN-02037	SAV0523		585358	585924	585562	+	conserved hypothetical protein
NMTN-12880	SAV0523		585358	585924	585710		
NMTN-11531	SAV0524		585914	586921	586497	+	hypothetical protein
NMTN-11228	SAV0525	clpC	586935	589391	587758	+	endopeptidase
NMTN-03019	SAV0525	clpC	586935	589391	588453		
NMTN-00446	SAV0525	clpC	586935	589391	588760		
NMTN-12647	SAV0526	radA	589876	591240	590057	+	DNA repair protein homologue
NMTN-03634	SAV0526	radA	589876	591240	590235		
NMTN-09979	SAV0526	radA	589876	591240	590887		
NMTN-05910	SAV0527		591265	592338	591394	+	conserved hypothetical protein
NMTN-00437	SAV0527		591265	592338	591397		
NMTN-07475	SAV0527		591265	592338	591408		
NMTN-12850	SAV0527		591265	592338	591467		
NMTN-11391	SAV0527		591265	592338	591934		
NMTN-00666	SAV0527		591265	592338	591955		
NMTN-11689	SAV0528	gltX	592895	594349	594345	+	glutamyl-tRNA synthetase
NMTN-12388	SAV0528	gltX	592895	594349	594349		
NMTN-12390	SAV0528	gltX	592895	594349	594349		
NMTN-12391	SAV0528	gltX	592895	594349	594349		
NMTN-12400	SAV0528	gltX	592895	594349	594349		
NMTN-12403	SAV0528	gltX	592895	594349	594349		
NMTN-07942	SAV0530	cysS	595373	597199	596799	+	cysteinyl-tRNA synthetase
NMTN-12176	SAV0530	cysS	595373	597199	596887		
NMTN-02860	SAV0530	cysS	595373	597199	596951		
NMTN-00708	SAV0531		597207	597953	597504	+	hypothetical protein
NMTN-13498	SAV0531		597207	597953	597870		
NMTN-11988	SAV0532		597953	598477	598214	+	conserved hypothetical protein
NMTN-03612	SAV0541		603045	603653	603505	+	conserved hypothetical protein
NMTN-13622	SAV0541		603045	603653	603640		
NMTN-03510	SAV0549		616504	617679	616617	-	hypothetical protein
NMTN-13208	SAV0549		616504	617679	616774		
NMTN-04952	SAV0549		616504	617679	616889		
NMTN-12942	SAV0549		616504	617679	616919		
NMTN-03459	SAV0549		616504	617679	617639		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09539	SAV0550		617886	619037	617924	+	hypothetical protein
NMTN-03858	SAV0550		617886	619037	618380		
NMTN-06156	SAV0550		617886	619037	618403		
NMTN-13497	SAV0551		619307	620185	619607	+	conserved hypothetical protein
NMTN-06526	SAV0551		619307	620185	620040		
NMTN-10434	SAV0551		619307	620185	620119		
NMTN-01604	SAV0551		619307	620185	620162		
NMTN-09479	SAV0552	araB	620344	621981	620447	+	probable L-ribulokinase
NMTN-04399	SAV0552	araB	620344	621981	620492		
NMTN-02892	SAV0552	araB	620344	621981	620495		
NMTN-09249	SAV0552	araB	620344	621981	620552		
NMTN-09252	SAV0552	araB	620344	621981	620552		
NMTN-09253	SAV0552	araB	620344	621981	620552		
NMTN-09255	SAV0552	araB	620344	621981	620552		
NMTN-09256	SAV0552	araB	620344	621981	620552		
NMTN-09258	SAV0552	araB	620344	621981	620552		
NMTN-09260	SAV0552	araB	620344	621981	620552		
NMTN-09261	SAV0552	araB	620344	621981	620552		
NMTN-09262	SAV0552	araB	620344	621981	620552		
NMTN-09273	SAV0552	araB	620344	621981	620552		
NMTN-09275	SAV0552	araB	620344	621981	620552		
NMTN-08988	SAV0552	araB	620344	621981	620555		
NMTN-03229	SAV0552	araB	620344	621981	620587		
NMTN-04353	SAV0552	araB	620344	621981	621001		
NMTN-06281	SAV0552	araB	620344	621981	621037		
NMTN-10454	SAV0552	araB	620344	621981	621513		
NMTN-06335	SAV0552	araB	620344	621981	621567		
NMTN-10943	SAV0552	araB	620344	621981	621567		
NMTN-09259	SAV0552	araB	620344	621981	621635		
NMTN-00027	SAV0552	araB	620344	621981	621772		
NMTN-07226d	SAV0553		622195	623160	622298	+	hypothetical protein
NMTN-00610	SAV0553		622195	623160	622821		
NMTN-09073	SAV0554	ilvE	623496	624572	624025	+	branched-chain amino acid aminotransferase homologue
NMTN-08716	SAV0554	ilvE	623496	624572	624036		
NMTN-12385	SAV0554	ilvE	623496	624572	624153		
NMTN-12251	SAV0555		624822	625505	624851	+	conserved hypothetical protein
NMTN-08699	SAV0555		624822	625505	625054		
NMTN-14415	SAV0555		624822	625505	625347		
NMTN-13458	SAV0555		624822	625505	625446		
NMTN-06474	SAV0556		625621	626283	625721	-	hypothetical protein
NMTN-07026	SAV0556		625621	626283	625790		
NMTN-03850	SAV0556		625621	626283	625861		
NMTN-02743	SAV0559		627577	628446	627647		conserved hypothetical protein
NMTN-11104	SAV0559		627577	628446	627665		
NMTN-08528	SAV0559		627577	628446	628025		
NMTN-13068d	SAV0560		628468	629034	628789		conserved hypothetical protein
NMTN-09013	SAV0560		628468	629034	628894		
NMTN-06677	SAV0561	sdrC	629464	632325	629786	+	Ser-Asp rich fibrinogen-binding, bone sialoprotein-binding protein
NMTN-03932	SAV0561	sdrC	629464	632325	629876		
NMTN-08654	SAV0561	sdrC	629464	632325	629933		
NMTN-00071	SAV0561	sdrC	629464	632325	630306		
NMTN-12620	SAV0561	sdrC	629464	632325	630311		
NMTN-02927	SAV0561	sdrC	629464	632325	630325		
NMTN-06131	SAV0561	sdrC	629464	632325	630510		
NMTN-09994	SAV0561	sdrC	629464	632325	630597		
NMTN-07414	SAV0561	sdrC	629464	632325	630639		
NMTN-10232	SAV0561	sdrC	629464	632325	630739		
NMTN-06187	SAV0561	sdrC	629464	632325	630791		
NMTN-05174	SAV0561	sdrC	629464	632325	630899		
NMTN-06089	SAV0561	sdrC	629464	632325	630966		
NMTN-03888	SAV0561	sdrC	629464	632325	631255		
NMTN-01536	SAV0561	sdrC	629464	632325	632024		
NMTN-00318	SAV0561	sdrC	629464	632325	632194		
NMTN-00124	SAV0561	sdrC	629464	632325	632195		
NMTN-00255	SAV0561	sdrC	629464	632325	632195		
NMTN-09605	SAV0562	sdrD	632692	636849	633324	+	Ser-Asp rich fibrinogen-binding, bone sialoprotein-binding protein
NMTN-09045	SAV0562	sdrD	632692	636849	634409		
NMTN-05302	SAV0562	sdrD	632692	636849	634413		
NMTN-03506	SAV0562	sdrD	632692	636849	634416		
NMTN-10396	SAV0562	sdrD	632692	636849	635413		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11285	SAV0563	sdrE	637243	640668	637448	+	Ser-Asp rich fibrinogen-binding, bone sialoprotein-binding protein
NMTN-11826	SAV0563	sdrE	637243	640668	637465		
NMTN-09904	SAV0563	sdrE	637243	640668	637491		
NMTN-08963	SAV0563	sdrE	637243	640668	638120		
NMTN-03489	SAV0563	sdrE	637243	640668	638339		
NMTN-00583	SAV0563	sdrE	637243	640668	638367		
NMTN-00254	SAV0563	sdrE	637243	640668	638647		
NMTN-12588	SAV0563	sdrE	637243	640668	638707		
NMTN-01560	SAV0563	sdrE	637243	640668	638756		
NMTN-11817	SAV0563	sdrE	637243	640668	639167		
NMTN-01448	SAV0563	sdrE	637243	640668	639335		
NMTN-04553	SAV0563	sdrE	637243	640668	639515		
NMTN-04694	SAV0563	sdrE	637243	640668	640335		
NMTN-02509	SAV0564		640789	642261	640902	+	hypothetical protein
NMTN-11800	SAV0564		640789	642261	640902		
NMTN-05212	SAV0564		640789	642261	640971		
NMTN-03187	SAV0564		640789	642261	641095		
NMTN-08741	SAV0564		640789	642261	641224		
NMTN-00434	SAV0564/ SA1797		640789	642261	641282		
NMTN-00800	SAV0564		640789	642261	641614		
NMTN-10480	SAV0565		642386	643876	642394	-	hypothetical protein
NMTN-04788	SAV0565		642386	643876	643510		
NMTN-07891	SAV0565		642386	643876	643617		
NMTN-09690	SAV0567		645049	645714	645381	-	conserved hypothetical protein
NMTN-04823	SAV0568		645728	646087	645924	-	conserved hypothetical protein
NMTN-09062	SAV0568		645728	646087	645931		
NMTN-09065	SAV0568		645728	646087	645931		
NMTN-11650	SAV0569	nagB	646366	647124	646766	+	probable glucosamine-6-phosphate isomerase
NMTN-12246	SAV0570		647201	647833	647712	+	hypothetical protein
NMTN-03062	SAV0571		647835	648383	647949	+	conserved hypothetical protein
NMTN-13759	SAV0571		647835	648383	648117		
NMTN-08820	SAV0572		648496	649143	648627	+	hypothetical protein
NMTN-03520	SAV0572		648496	649143	648644		
NMTN-03735	SAV0572		648496	649143	648644		
NMTN-05026	SAV0572		648496	649143	648722		
NMTN-03856	SAV0573	proP	649645	651045	649913	+	proline/betaine transporter homologue
NMTN-04380	SAV0573	proP	649645	651045	650079		
NMTN-00690	SAV0573	proP	649645	651045	650392		
NMTN-03590	SAV0573	proP	649645	651045	650674		
NMTN-03745	SAV0573	proP	649645	651045	650753		
NMTN-14607	SAV0573	proP	649645	651045	650923		
NMTN-08116	SAV0573	proP	649645	651045	651007		
NMTN-08305	SAV0574		651380	651589	651453	+	hypothetical protein
NMTN-09443	SAV0574		651380	651589	651557		
NMTN-08717	SAV0575	vraA	651589	652965	651848	+	hypothetical protein
NMTN-06125	SAV0575	vraA	651589	652965	652331		
NMTN-02468	SAV0575	vraA	651589	652965	652516		
NMTN-04497	SAV0575	vraA	651589	652965	652526		
NMTN-13328	SAV0576	vraB	652967	654106	653076	+	acetyl-CoA c-acetyltransferase
NMTN-12947	SAV0576	vraB	652967	654106	653287		
NMTN-05028	SAV0576	vraB	652967	654106	653952		
NMTN-06188	SAV0577	vraC	654081	654446	654314	+	hypothetical protein
NMTN-04977	SAV0580		655593	656423	656185		hypothetical protein
NMTN-03482	SAV0580		655593	656423	656284		
NMTN-14469	SAV0581	ung	656607	657263	656836	+	uracil-DNA glycosylase
NMTN-10785	SAV0581	ung	656607	657263	656870		
NMTN-06170	SAV0583		657777	658145	657942	+	conserved hypothetical protein
NMTN-14460	SAV0584		658266	659750	658269	+	hypothetical protein
NMTN-12340	SAV0584		658266	659750	659307		
NMTN-05277	SAV0584		658266	659750	659385		
NMTN-09817	SAV0584		658266	659750	659691		
NMTN-02439	SAV0586		660356	661006	660655	-	conserved hypothetical protein
NMTN-01545	SAV0588	pta	662589	663575	663052	+	phosphotransacetylase
NMTN-07133	SAV0594		668568	670016	668643	-	mercuric reductase homologue
NMTN-03429	SAV0594		668568	670016	668708		
NMTN-09528	SAV0594		668568	670016	668795		
NMTN-13336	SAV0594		668568	670016	668988		
NMTN-04683	SAV0594		668568	670016	669190		
NMTN-06257	SAV0594		668568	670016	669580		
NMTN-04801	SAV0594		668568	670016	669635		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-01995	SAV0594		668568	670016	669728		
NMTN-10610	SAV0594		668568	670016	669752		
NMTN-13692	SAV0594		668568	670016	669881		
NMTN-13692	SAV0595		669877	670317	669881	-	hypothetical protein
NMTN-10439	SAV0595		669877	670317	670248		
NMTN-09988	SAV0596		670942	672336	671033	+	conserved hypothetical protein
NMTN-09234	SAV0596		670942	672336	671218		
NMTN-12757	SAV0596		670942	672336	671365		
NMTN-14716	SAV0596		670942	672336	671713		
NMTN-04142	SAV0596		670942	672336	671746		
NMTN-13135	SAV0596		670942	672336	671965		
NMTN-05481	SAV0596		670942	672336	672218		
NMTN-05200	SAV0597		672340	672972	672356	+	conserved hypothetical protein
NMTN-07877	SAV0597		672340	672972	672481		
NMTN-14639	SAV0597		672340	672972	672692		
NMTN-02981	SAV0598		673019	673639	673203		
NMTN-06547	SAV0598		673019	673639	673237	+	conserved hypothetical protein
NMTN-09457	SAV0598		673019	673639	673399		
NMTN-11522	SAV0598		673019	673639	673507		
NMTN-13785	SAV0598		673019	673639	673607		
NMTN-08656	SAV0600		674859	675797	674881	+	hypothetical protein
NMTN-02070	SAV0600		674859	675797	674931		
NMTN-03972	SAV0600		674859	675797	675227		
NMTN-00119	SAV0600		674859	675797	675230		
NMTN-04979	SAV0600		674859	675797	675399		
NMTN-04560	SAV0600		674859	675797	675606		
NMTN-14280	SAV0601		676243	676779	676380	+	conserved hypothetical protein
NMTN-05263	SAV0601		676243	676779	676678		
NMTN-12002	SAV0602		677463	677423	677288	+	conserved hypothetical protein
NMTN-01599	SAV0603		677463	678758	677478	+	conserved hypothetical protein
NMTN-11312	SAV0603		677463	678758	677481		
NMTN-12108	SAV0603		677463	678758	677932		
NMTN-04476	SAV0603		677463	678758	678032		
NMTN-13423	SAV0603		677463	678758	678340		
NMTN-11487	SAV0603		677463	678758	678727		
NMTN-05238	SAV0604		678801	679307	679228	+	conserved hypothetical protein
NMTN-04470	SAV0605	adh1	679806	680816	680646	+	alcohol dehydrogenase I
NMTN-09946	SAV0605	adh1	679806	680816	680730		
NMTN-08866	SAV0605	adh1	679806	680816	680787		
NMTN-06320	SAV0609		684323	685210	684729	+	hypothetical protein
NMTN-00139	SAV0609		684323	685210	684897		
NMTN-06300	SAV0609		684323	685210	684938		
NMTN-12062d	SAV0609		684323	685210	684996		
NMTN-06584	SAV0609		684323	685210	685079		
NMTN-04481	SAV0610		685359	686309	685414	+	hypothetical protein
NMTN-07453	SAV0610		685359	686309	685562		
NMTN-05594	SAV0610		685359	686309	685888		
NMTN-06185	SAV0610		685359	686309	685929		
NMTN-13687	SAV0611		686364	687083	686415	+	hypothetical protein
NMTN-01637	SAV0611		686364	687083	686459		
NMTN-13151	SAV0611		686364	687083	686645		
NMTN-09856	SAV0611		686364	687083	686796		
NMTN-12058	SAV0611		686364	687083	686842		
NMTN-14497	SAV0611		686364	687083	686878		
NMTN-00604	SAV0611		686364	687083	686881		
NMTN-03143	SAV0612		687067	687867	687379	+	hypothetical protein
NMTN-08159	SAV0612		687067	687867	687406		
NMTN-07275	SAV0614		688671	689387	689387	+	hypothetical protein
NMTN-06666	SAV0615		689556	690344	689628	+	hypothetical protein
NMTN-09461	SAV0615		689556	690344	689826		
NMTN-09652	SAV0615		689556	690344	690125		
NMTN-03663	SAV0615		689556	690344	690136		
NMTN-14744	SAV0615		689556	690344	690344		
NMTN-10017	SAV0616	sarA	690598	690972	690866	-	staphylococcal accessory regulator A
NMTN-13209	SAV0617		691920	692849	692308	-	conserved hypothetical protein
NMTN-00330	SAV0617		691920	692849	692323		
NMTN-03709	SAV0617		691920	692849	692549		
NMTN-05556	SAV0617		691920	692849	692627		
NMTN-06515	SAV0617		691920	692849	692676		
NMTN-09404	SAV0618		693044	693268	693100	-	hypothetical protein
NMTN-03162	SAV0620		693647	694207	693659	+	hypothetical protein
NMTN-04096	SAV0620		693647	694207	693899		
NMTN-13634	SAV0620		693647	694207	694031		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11927	SAV0620		693647	694207	694120		
NMTN-11296	SAV0620		693647	694207	694179		
NMTN-11754	SAV0621		694226	696250	694738	+	hypothetical protein
NMTN-08881	SAV0621		694226	696250	695280		
NMTN-10452	SAV0621		694226	696250	695443		
NMTN-04837	SAV0621		694226	696250	695569		
NMTN-12298	SAV0621		694226	696250	695861		
NMTN-11326	SAV0622		696296	696628	696440	+	hypothetical protein
NMTN-00286	SAV0625		697371	698867	697434	+	MnhD homologue
NMTN-11745	SAV0625		697371	698867	697456		
NMTN-02419	SAV0625		697371	698867	697809		
NMTN-01806	SAV0625		697371	698867	698129		
NMTN-00821	SAV0625		697371	698867	698412		
NMTN-14384	SAV0626		698868	699350	699265	+	hypothetical protein
NMTN-15297	SAV0626		698868	699350	699289		
NMTN-13291	SAV0628		699624	700061	699976	+	conserved hypothetical protein
NMTN-13474	SAV0629		700401	702443	700407	+	conserved hypothetical protein
NMTN-01786	SAV0629		700401	702443	701154		
NMTN-14555	SAV0629		700401	702443	701229		
NMTN-15296	SAV0629		700401	702443	701648		
NMTN-02474	SAV0629		700401	702443	701742		
NMTN-05555	SAV0629		700401	702443	701742		
NMTN-05588	SAV0629		700401	702443	701755		
NMTN-06410	SAV0629		700401	702443	701967		
NMTN-01956	SAV0629		700401	702443	702003		
NMTN-13725	SAV0629		700401	702443	702004		
NMTN-12361	SAV0629		700401	702443	702006		
NMTN-08490	SAV0629		700401	702443	702012		
NMTN-10554	SAV0629		700401	702443	702032		
NMTN-13312	SAV0629		700401	702443	702038		
NMTN-01485	SAV0631		704990	705919	705166	-	lipoprotein
NMTN-08869	SAV0631		704990	705919	705901		
NMTN-14394	SAV0632		705916	706752	706277	-	conserved hypothetical protein
NMTN-09063	SAV0632		705916	706752	706599		
NMTN-02717	SAV0632		705916	706752	706658		
NMTN-08894	SAV0633		706746	707489	707275	-	hypothetical protein
NMTN-09193	SAV0633		706746	707489	707452		
NMTN-04913	SAV0635		708335	709087	708946	-	hypothetical protein
NMTN-14463	SAV0635		708335	709087	708947		
NMTN-12156	SAV0635		708335	709087	709040		
NMTN-08883	SAV0640	tagX	713354	714361	713968	+	teichoic acid biosynthesis protein X
NMTN-05382	SAV0640	tagX	713354	714361	714040		
NMTN-11552	SAV0642	pbp4	714939	716234	715333	-	penicillin binding protein 4
NMTN-13662	SAV0643		716655	718382	717066	+	ATP-binding cassette transporter A
NMTN-02038	SAV0643		716655	718382	717187		
NMTN-09403	SAV0643		716655	718382	717645		
NMTN-11569	SAV0643		716655	718382	717805		
NMTN-12631	SAV0643		716655	718382	717868		
NMTN-05177	SAV0643		716655	718382	717931		
NMTN-14458	SAV0643		716655	718382	718050		
NMTN-12855	SAV0644		718451	718531	718460	+	hypothetical protein
NMTN-09195	SAV0644		718451	718531	718521		
NMTN-03704	SAV0645		718739	719968	719062	+	hypothetical protein
NMTN-10995	SAV0645		718739	719968	719111		
NMTN-13702	SAV0645		718739	719968	719533		
NMTN-02716	SAV0645		718739	719968	719553		
NMTN-03100	SAV0646		720715	721326	720713	+	conserved hypothetical protein
NMTN-11205	SAV0647	fhuA	721608	722405	722118	+	ferrichrome transport ATP-binding protein
NMTN-08160	SAV0647	fhuA	721608	722405	722302		
NMTN-08211	SAV0647	fhuA	721608	722405	722364		
NMTN-03749	SAV0648	fhuB	722441	723445	722573	+	ferrichrome transport permease
NMTN-12142	SAV0648	fhuB	722441	723445	722663		
NMTN-07433d	SAV0648	fhuB	722441	723445	722877		
NMTN-07881	SAV0648	fhuB	722441	723445	722942		
NMTN-07882	SAV0648	fhuB	722441	723445	722968		
NMTN-02314	SAV0648	fhuB	722441	723445	723344		
NMTN-02667	SAV0649	fhuG	723442	724458	723550	+	ferrichrome transport permease
NMTN-03223	SAV0649	fhuG	723442	724458	723725		
NMTN-05008	SAV0649	fhuG	723442	724458	723808		
NMTN-00285	SAV0649	fhuG	723442	724458	723959		
NMTN-12124	SAV0649	fhuG	723442	724458	723959		
NMTN-06179	SAV0649	fhuG	723442	724458	724133		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12862d	SAV0650		724695	725660	725492	+	hypothetical protein
NMTN-09237	SAV0650		724695	725660	725536		
NMTN-08830	SAV0652		726279	726641	726364	+	conserved hypothetical protein
NMTN-06391	SAV0652		726279	726641	726387		
NMTN-02257	SAV0652		726279	726641	726579		
NMTN-02489	SAV0653		726757	727254	726784	+	hypothetical protein
NMTN-02384	SAV0653		726757	727254	726918		
NMTN-01585	SAV0653		726757	727254	727109		
NMTN-09478	SAV0654		727798	728778	728068	+	conserved hypothetical protein
NMTN-02849	SAV0654		727798	728778	728131		
NMTN-12623	SAV0654		727798	728778	728170		
NMTN-12611	SAV0654		727798	728778	728436		
NMTN-06198	SAV0654		727798	728778	728513		
NMTN-09147	SAV0654		727798	728778	728621		
NMTN-12362	SAV0654		727798	728778	728668		
NMTN-02091	SAV0655		728929	729972	728956	+	hypothetical protein
NMTN-09658	SAV0655		728929	729972	729124		
NMTN-03120	SAV0655		728929	729972	729808		
NMTN-04905	SAV0655		728929	729972	729808		
NMTN-06583	SAV0656		730301	730729	730477	+	hypothetical protein
NMTN-14397	SAV0656		730301	730729	730622		
NMTN-00623	SAV0656		730301	730729	730691		
NMTN-11443	SAV0656		730301	730729	730691		
NMTN-11410	SAV0657		730938	731444	731218	-	conserved hypothetical protein
NMTN-03803	SAV0657		730938	731444	731422		
NMTN-09891	SAV0658		731557	732480	731574	+	hypothetical protein
NMTN-11269	SAV0658		731557	732480	731597		
NMTN-03813	SAV0658		731557	732480	731604		
NMTN-03115	SAV0658		731557	732480	731940		
NMTN-08281	SAV0658		731557	732480	731995		
NMTN-05150	SAV0658		731557	732480	732040		
NMTN-02700	SAV0658		731557	732480	732154		
NMTN-11930	SAV0658		731557	732480	732159		
NMTN-13761d	SAV0658		731557	732480	732161		
NMTN-04324	SAV0659		732496	733170	732608	+	hypothetical protein
NMTN-07802	SAV0659		732496	733170	732883		
NMTN-12529	SAV0659		732496	733170	733118		
NMTN-11539	SAV0660		733163	734203	733446	+	hypothetical protein
NMTN-13161	SAV0660		733163	734203	733630		
NMTN-03902	SAV0660		733163	734203	733669		
NMTN-03996	SAV0660		733163	734203	733677		
NMTN-05171	SAV0660		733163	734203	733816		
NMTN-08661	SAV0660		733163	734203	733971		
NMTN-12657	SAV0661	vraF	734347	735108	734497	+	ABC transporter ATP-binding protein
NMTN-12743	SAV0661	vraF	734347	735108	734756		
NMTN-00587	SAV0661	vraF	734347	735108	734822		
NMTN-12065	SAV0662	vraG	735086	736987	735287	+	ABC transporter permease
NMTN-04764	SAV0662	vraG	735086	736987	735383		
NMTN-10635	SAV0662	vraG	735086	736987	735407		
NMTN-10002	SAV0662	vraG	735086	736987	735614		
NMTN-12433	SAV0662	vraG	735086	736987	735716		
NMTN-04345	SAV0662	vraG	735086	736987	735748		
NMTN-11491	SAV0662	vraG	735086	736987	735893		
NMTN-14400	SAV0662	vraG	735086	736987	736002		
NMTN-12418	SAV0662	vraG	735086	736987	736179		
NMTN-08348	SAV0662	vraG	735086	736987	736224		
NMTN-12913	SAV0662	vraG	735086	736987	736241		
NMTN-07575	SAV0662	vraG	735086	736987	736402		
NMTN-13760	SAV0662	vraG	735086	736987	736569		
NMTN-13738	SAV0662	vraG	735086	736987	736781		
NMTN-07723	SAV0662	vraG	735086	736987	736833		
NMTN-03532	SAV0662	vraG	735086	736987	736927		
NMTN-03538	SAV0662	vraG	735086	736987	736927		
NMTN-03539	SAV0662	vraG	735086	736987	736927		
NMTN-11182	SAV0662	vraG	735086	736987	736948		
NMTN-11188	SAV0662	vraG	735086	736987	736948		
NMTN-09610	SAV0663		737710	738327	737791	+	conserved hypothetical protein
NMTN-05491	SAV0663		737710	738327	738009		
NMTN-03029	SAV0664		738343	739350	738351	+	hypothetical protein
NMTN-11854	SAV0664		738343	739350	739012		
NMTN-12204	SAV0665		739938	740735	739954	-	secretory antigen SsaA homologue
NMTN-09455	SAV0665		739938	740735	740035		
NMTN-06444	SAV0667		742437	744587	742740	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11776	SAV0667		742437	744587	743087		
NMTN-13409	SAV0667		742437	744587	743089		
NMTN-14641	SAV0667		742437	744587	743100		
NMTN-11555	SAV0667		742437	744587	743304		
NMTN-05202	SAV0667		742437	744587	743316		
NMTN-04824	SAV0667		742437	744587	744019		
NMTN-09757	SAV0667		742437	744587	744277		
NMTN-09616	SAV0667		742437	744587	744377		
NMTN-12771	SAV0668		744667	745092	745040	+	hypothetical protein
NMTN-04018	SAV0669		745558	745998	745963	+	conserved hypothetical protein
NMTN-03602	SAV0672		747770	748450	748055	+	hypothetical protein
NMTN-12715	SAV0672		747770	748450	748220		
NMTN-02263	SAV0672		747770	748450	748256		
NMTN-08050	SAV0673		748588	749802	749130	+	hypothetical protein
NMTN-06167	SAV0673		748588	749802	749292		
NMTN-14710	SAV0673		748588	749802	749380		
NMTN-11906	SAV0673		748588	749802	749509		
NMTN-01948	SAV0673		748588	749802	749567		
NMTN-11566	SAV0673		748588	749802	749574		
NMTN-03271	SAV0673		748588	749802	749752		
NMTN-01974	SAV0674		749799	750287	749889	+	conserved hypothetical protein
NMTN-06847	SAV0674		749799	750287	750007		
NMTN-10215	SAV0675		750386	751075	750409	-	conserved hypothetical protein
NMTN-05114	SAV0675		750386	751075	750649		
NMTN-05583	SAV0675		750386	751075	750822		
NMTN-07807	SAV0676		751202	751645	751203	+	hypothetical protein
NMTN-00507	SAV0676		751202	751645	751583		
NMTN-01633	SAV0676		751202	751645	751642		
NMTN-07528	SAV0679		752624	753166	752654	+	conserved hypothetical protein
NMTN-09638	SAV0679		752624	753166	752696		
NMTN-09740	SAV0679		752624	753166	752696		
NMTN-08055	SAV0679		752624	753166	752715		
NMTN-08045	SAV0679		752624	753166	752717		
NMTN-10406	SAV0679		752624	753166	752729		
NMTN-00785	SAV0679		752624	753166	752775		
NMTN-14448	SAV0679		752624	753166	752855		
NMTN-06329	SAV0679		752624	753166	752892		
NMTN-02793	SAV0679		752624	753166	752918		
NMTN-10019	SAV0679		752624	753166	753095		
NMTN-02754	SAV0679		752624	753166	753107		
NMTN-10083	SAV0679		752624	753166	753154		
NMTN-09951	SAV0680		753262	753828	753443	-	conserved hypothetical protein
NMTN-05086	SAV0680		753262	753828	753778		
NMTN-06973	SAV0681		753830	754288	754079	-	conserved hypothetical protein
NMTN-01789	SAV0681		753830	754288	754139		
NMTN-00836	SAV0681		753830	754288	754150		
NMTN-08015	SAV0682		754291	754974	754518	-	conserved hypothetical protein
NMTN-06681	SAV0684		756240	757871	756423	+	hypothetical protein
NMTN-00316	SAV0684		756240	757871	756948		
NMTN-04157	SAV0684		756240	757871	757181		
NMTN-07614	SAV0684		756240	757871	757383		
NMTN-00617	SAV0685		757868	759541	757916	+	hypothetical protein
NMTN-12930	SAV0685		757868	759541	758054		
NMTN-02741	SAV0685		757868	759541	758246		
NMTN-05141	SAV0685		757868	759541	758289		
NMTN-12352	SAV0685		757868	759541	758702		
NMTN-13905	SAV0685		757868	759541	758839		
NMTN-03671	SAV0685		757868	759541	759021		
NMTN-14881	SAV0685		757868	759541	759037		
NMTN-14437	SAV0685		757868	759541	759048		
NMTN-14454	SAV0685		757868	759541	759048		
NMTN-14461	SAV0685		757868	759541	759048		
NMTN-14474	SAV0685		757868	759541	759048		
NMTN-14540	SAV0685		757868	759541	759048		
NMTN-14543	SAV0685		757868	759541	759048		
NMTN-14545	SAV0685		757868	759541	759048		
NMTN-14546	SAV0685		757868	759541	759048		
NMTN-14548	SAV0685		757868	759541	759048		
NMTN-14550	SAV0685		757868	759541	759048		
NMTN-14791	SAV0685		757868	759541	759048		
NMTN-14856	SAV0685		757868	759541	759048		
NMTN-13763	SAV0685		757868	759541	759123		
NMTN-00577	SAV0685		757868	759541	759287		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-10266	SAV0685		757868	759541	759304		
NMTN-14538	SAV0685		757868	759541	759394		
NMTN-09679	SAV0685		757868	759541	759515		
NMTN-03040	SAV0686		759668	760111	760078	-	hypothetical protein
NMTN-11829	SAV0687		760338	761264	760424	+	hypothetical protein
NMTN-04065	SAV0687		760338	761264	760875		
NMTN-07605	SAV0687		760338	761264	760903		
NMTN-07605	SAV0687		760338	761264	760903		
NMTN-03974	SAV0688		761367	762275	761367	+	hypothetical protein
NMTN-02580	SAV0688		761367	762275	761465		
NMTN-10034	SAV0688		761367	762275	761738		
NMTN-14621	SAV0688		761367	762275	761797		
NMTN-08993	SAV0688		761367	762275	761902		
NMTN-09003	SAV0688		761367	762275	761902		
NMTN-10891	SAV0688		761367	762275	762177		
NMTN-06398	SAV0688		761367	762275	762277		
NMTN-10986	SAV0690		762880	764433	763171	+	conserved hypothetical protein
NMTN-13506	SAV0690		762880	764433	763538		
NMTN-12280	SAV0691		764519	765892	764941	+	hypothetical protein
NMTN-14693	SAV0691		764519	765892	765366		
NMTN-11360	SAV0692		766047	766331	766307	-	hypothetical protein
NMTN-02306	SAV0693		766328	766948	766389	-	conserved hypothetical protein
NMTN-04797	SAV0693		766328	766948	766646		
NMTN-12979d	SAV0693		766328	766948	766758		
NMTN-11397	SAV0693		766328	766948	766761		
NMTN-08465	SAV0693		766328	766948	766762		
NMTN-07256	SAV0693		766328	766948	766834		
NMTN-09710	SAV0694		767131	767553	767397	-	conserved hypothetical protein
NMTN-05267	SAV0695	norA	767762	768928	768480	+	quinolone resistance protein
NMTN-14499	SAV0695	norA	767762	768928	768489		
NMTN-11290	SAV0695	norA	767762	768928	768509		
NMTN-06619	SAV0695	norA	767762	768928	768529		
NMTN-09594	SAV0696		769221	769673	769538	+	hypothetical protein
NMTN-02147	SAV0696		769221	769673	769552		
NMTN-11344	SAV0696		769221	769673	769594		
NMTN-04834	SAV0696		769221	769673	769598		
NMTN-13306	SAV0696		769221	769673	769600		
NMTN-04999	SAV0696		769221	769673	769604		
NMTN-09918	SAV0698		770582	771343	770646	+	hypothetical protein
NMTN-13698	SAV0699	fruB	771340	772260	771544	+	fructose 1-phosphate kinase
NMTN-09835	SAV0699	fruB	771340	772260	771605		
NMTN-15260d	SAV0700	fruA	772266	774224	772790	+	fructose specific permease
NMTN-07862	SAV0700	fruA	772266	774224	773210		
NMTN-07866	SAV0700	fruA	772266	774224	773210		
NMTN-09792	SAV0700	fruA	772266	774224	773664		
NMTN-04930	SAV0700	fruA	772266	774224	773713		
NMTN-13355	SAV0700	fruA	772266	774224	773921		
NMTN-01714	SAV0700	fruA	772266	774224	774132		
NMTN-00659	SAV0701	nagA	774532	775713	774828	+	probable N-acetylglucosamine-6-phosphate deacetylase
NMTN-10016	SAV0701	nagA	774532	775713	775011		
NMTN-14408	SAV0701	nagA	774532	775713	775161		
NMTN-09968	SAV0701	nagA	774532	775713	775362		
NMTN-13343	SAV0702		775934	777283	775971	+	hypothetical protein
NMTN-05064	SAV0702		775934	777283	776087		
NMTN-06952	SAV0702		775934	777283	776254		
NMTN-06436	SAV0702		775934	777283	776898		
NMTN-09643	SAV0702		775934	777283	777005		
NMTN-09837	SAV0703		777505	778344	777578	+	hypothetical protein
NMTN-10218	SAV0703		777505	778344	777682		
NMTN-10069	SAV0703		777505	778344	777851		
NMTN-10602	SAV0703		777505	778344	778233		
NMTN-04645	SAV0704		778476	779459	778605	+	hypothetical protein
NMTN-12955	SAV0704		778476	779459	778711		
NMTN-11490	SAV0704		778476	779459	778855		
NMTN-09783	SAV0704		778476	779459	779125		
NMTN-10443	SAV0704		778476	779459	779125		
NMTN-07659	SAV0704		778476	779459	779195		
NMTN-09808	SAV0704		778476	779459	779204		
NMTN-07936	SAV0704		778476	779459	779344		
NMTN-08978	SAV0704		778476	779459	779345		
NMTN-12334	SAV0705	sacS	779531	780586	779584	-	histidine protein kinase
NMTN-06298	SAV0705	sacS	779531	780586	779587		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08696	SAV0705	saeS	779531	780586	779596		
NMTN-09887	SAV0705	saeS	779531	780586	779645		
NMTN-09810	SAV0705	saeS	779531	780586	779674		
NMTN-09885	SAV0705	saeS	779531	780586	779679		
NMTN-08778	SAV0705	saeS	779531	780586	779712		
NMTN-09752	SAV0705	saeS	779531	780586	779723		
NMTN-09755	SAV0705	saeS	779531	780586	779755		
NMTN-05467	SAV0705	saeS	779531	780586	779799		
NMTN-11987	SAV0705	saeS	779531	780586	779799		
NMTN-09734	SAV0705	saeS	779531	780586	779923		
NMTN-07762	SAV0705	saeS	779531	780586	779957		
NMTN-09754	SAV0705	saeS	779531	780586	779979		
NMTN-13260	SAV0705	saeS	779531	780586	780091		
NMTN-07904	SAV0705	saeS	779531	780586	780162		
NMTN-12384	SAV0705	saeS	779531	780586	780375		
NMTN-09725	SAV0705	saeS	779531	780586	780399		
NMTN-11179	SAV0705	saeS	779531	780586	780421		
NMTN-02321	SAV0705	saeS	779531	780586	780445		
NMTN-10567	SAV0705	saeS	779531	780586	780504		
NMTN-08853	SAV0705	saeS	779531	780586	780519		
NMTN-12661	SAV0705	saeS	779531	780586	780540		
NMTN-12747	SAV0706	saeR	780586	781272	780605	-	response regulator
NMTN-08517	SAV0706	saeR	780586	781272	780627		
NMTN-02945	SAV0706	saeR	780586	781272	780638		
NMTN-09648	SAV0706	saeR	780586	781272	780676		
NMTN-09655	SAV0706	saeR	780586	781272	780676		
NMTN-09778	SAV0706	saeR	780586	781272	780676		
NMTN-11354	SAV0706	saeR	780586	781272	780704		
NMTN-07103	SAV0706	saeR	780586	781272	780758		
NMTN-02564	SAV0706	saeR	780586	781272	780852		
NMTN-01594	SAV0706	saeR	780586	781272	780870		
NMTN-12583	SAV0706	saeR	780586	781272	780910		
NMTN-14421	SAV0707		781247	781429	781311	-	hypothetical protein
NMTN-02705	SAV0707		781247	781429	781395		
NMTN-13902	SAV0707		781247	781429	781416		
NMTN-13878	SAV0707		781247	781429	781423		
NMTN-12351	SAV0707		781247	781429	781428		
NMTN-11666	SAV0708		782063	782503	782126	-	hypothetical protein
NMTN-03947	SAV0708		782063	782503	782231		
NMTN-07547	SAV0708		782063	782503	782231		
NMTN-06932	SAV0708		782063	782503	782239		
NMTN-09654	SAV0708		782063	782503	782359		
NMTN-01776	SAV0709		782783	783367	783213	-	hypothetical protein
NMTN-03711	SAV0711		784183	784602	784362	-	6-pyruvoyl tetrahydrobiopterin synthase homologue
NMTN-09059	SAV0712		784604	785272	784996	-	conserved hypothetical protein
NMTN-11117	SAV0713		785623	786216	785657	+	hypothetical protein
NMTN-06611	SAV0713		785623	786216	785673		
NMTN-12284	SAV0713		785623	786216	785845		
NMTN-06730	SAV0713		785623	786216	785936		
NMTN-07478	SAV0713		785623	786216	786175		
NMTN-02930	SAV0714		786200	787351	786289	+	hypothetical protein
NMTN-11500	SAV0714		786200	787351	786289		
NMTN-08783	SAV0714		786200	787351	786441		
NMTN-14279	SAV0714		786200	787351	786697		
NMTN-09306	SAV0714		786200	787351	787346		
NMTN-04472	SAV0715		787351	787959	787351	+	hypothetical protein
NMTN-00549	SAV0715		787351	787959	787503		
NMTN-10837	SAV0715		787351	787959	787520		
NMTN-06655	SAV0715		787351	787959	787702		
NMTN-03503	SAV0715		787351	787959	787883		
NMTN-05377	SAV0717		788319	789029	788486	+	hypothetical protein
NMTN-13126	SAV0718		789013	790017	789206	+	conserved hypothetical protein
NMTN-04130	SAV0718		789013	790017	789274		
NMTN-13658	SAV0718		789013	790017	789984		
NMTN-04390	SAV0718		789013	790017	789988		
NMTN-10194	SAV0720		792707	794584	792734	+	hypothetical protein
NMTN-04908	SAV0720		792707	794584	792818		
NMTN-14663	SAV0720		792707	794584	792989		
NMTN-06242	SAV0720		792707	794584	793396		
NMTN-06521	SAV0720		792707	794584	793496		
NMTN-03480	SAV0720		792707	794584	793606		
NMTN-13091	SAV0720		792707	794584	793670		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09483	SAV0721	recQ	794596	796377	794717	+	probable DNA helicase
NMTN-06980	SAV0721	recQ	794596	796377	794948		
NMTN-06308	SAV0721	recQ	794596	796377	795914		
NMTN-09880	SAV0722		796599	797576	796620	+	hypothetical protein
NMTN-11507d	SAV0722		796599	797576	796808		
NMTN-05542	SAV0723		797569	799083	798112	+	hypothetical protein
NMTN-13814	SAV0723		797569	799083	798163		
NMTN-03050	SAV0723		797569	799083	798665		
NMTN-01575	SAV0723		797569	799083	798742		
NMTN-02726	SAV0723		797569	799083	798758		
NMTN-05084	SAV0723		797569	799083	798808		
NMTN-12500	SAV0724		799323	800381	799548	+	hypothetical protein
NMTN-02266	SAV0724		799323	800381	799713		
NMTN-09356	SAV0724		799323	800381	799816		
NMTN-05002	SAV0725		800720	801262	800766	+	conserved hypothetical protein
NMTN-13026	SAV0725		800720	801262	800978		
NMTN-07217	SAV0725		800720	801262	800982		
NMTN-00328	SAV0726		802085	803002	802516	-	hypothetical protein
NMTN-09786	SAV0726		802085	803002	803006		
NMTN-10568	SAV0727		803272	804777	803476	-	hypothetical protein
NMTN-10444	SAV0727		803272	804777	803724		
NMTN-10634	SAV0727		803272	804777	804077		
NMTN-09563	SAV0727		803272	804777	804314		
NMTN-09164	SAV0727		803272	804777	804317		
NMTN-11758	SAV0727		803272	804777	804438		
NMTN-12450	SAV0727		803272	804777	804449		
NMTN-13087	SAV0727		803272	804777	804541		
NMTN-08154	SAV0727		803272	804777	804624		
NMTN-04880	SAV0727		803272	804777	804625		
NMTN-10566	SAV0727		803272	804777	804780		
NMTN-13548	SAV0728		805118	805618	805115	-	conserved hypothetical protein
NMTN-10400	SAV0728		805118	805618	805189		
NMTN-10547	SAV0728		805118	805618	805503		
NMTN-02913	SAV0729		805638	806504	806071	-	conserved hypothetical protein
NMTN-14605	SAV0729		805638	806504	806227		
NMTN-02988	SAV0733		811235	812206	811562	+	hypothetical protein
NMTN-02275	SAV0733		811235	812206	811949		
NMTN-02670	SAV0733		811235	812206	812087		
NMTN-13846	SAV0734		812193	813149	812255	+	hypothetical protein
NMTN-02772	SAV0734		812193	813149	812511		
NMTN-08763	SAV0734		812193	813149	812644		
NMTN-09241	SAV0734		812193	813149	812692		
NMTN-13262	SAV0734		812193	813149	812754		
NMTN-02619	SAV0734		812193	813149	812792		
NMTN-13566	SAV0734		812193	813149	813024		
NMTN-14644	SAV0734		812193	813149	813084		
NMTN-08880	SAV0735		813146	813907	813284	+	hypothetical protein
NMTN-12408d	SAV0735		813146	813907	813639		
NMTN-14654	SAV0736		814026	815054	814695	+	lipoprotein
NMTN-00012	SAV0736		814026	815054	815008		
NMTN-01999	SAV0737		815371	815685	815448	-	conserved hypothetical protein
NMTN-13315	SAV0737		815371	815685	815684		
NMTN-10613	SAV0740		817391	818269	817439	+	hypothetical protein
NMTN-05052	SAV0740		817391	818269	817665		
NMTN-02004	SAV0740		817391	818269	817725		
NMTN-05187	SAV0740		817391	818269	818130		
NMTN-07067	SAV0742		819167	820291	819466	+	hypothetical protein
NMTN-09297	SAV0742		819167	820291	819775		
NMTN-06060	SAV0743	pepT	820478	821704	821055	-	aminotripeptidase
NMTN-00601	SAV0743	pepT	820478	821704	821118		
NMTN-02418	SAV0743	pepT	820478	821704	821121		
NMTN-04725	SAV0743	pepT	820478	821704	821634		
NMTN-05140	SAV0743	pepT	820478	821704	821672		
NMTN-09363	SAV0744		821718	822212	821799	-	conserved hypothetical protein
NMTN-14757d	SAV0745		822230	822991	822361	-	conserved hypothetical protein
NMTN-05370	SAV0745		822230	822991	822940		
NMTN-01804	SAV0746		823187	824257	823885	-	conserved hypothetical protein
NMTN-01849	SAV0746		823187	824257	823885		
NMTN-14380	SAV0746		823187	824257	824244		
NMTN-13309	SAV0748		825795	826436	826294	-	conserved hypothetical protein
NMTN-13833	SAV0749		826580	827446	826605	+	conserved hypothetical protein
NMTN-12261	SAV0749		826580	827446	826868		
NMTN-11101	SAV0750		827990	828892	828122	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00670	SAV0750		827990	828892	828323		
NMTN-01492	SAV0750		827990	828892	828534		
NMTN-14691	SAV0750		827990	828892	828562		
NMTN-13522	SAV0751		828885	829559	828940	+	hypothetical protein
NMTN-11533	SAV0751		828885	829559	829009		
NMTN-07108	SAV0751		828885	829559	829468		
NMTN-08563	SAV0755		834971	835810	835126	+	conserved hypothetical protein
NMTN-12918	SAV0755		834971	835810	835129		
NMTN-08563	SAV0755		834971	835810	835139		
NMTN-03632	SAV0755		834971	835810	835153		
NMTN-00872	SAV0755		834971	835810	835356		
NMTN-00148	SAV0755		834971	835810	835553		
NMTN-00513	SAV0755		834971	835810	835553		
NMTN-03587	SAV0755		834971	835810	835625		
NMTN-11364	SAV0758	uvrB	837130	839121	837128	+	exinuclease ABC subunit B
NMTN-11672	SAV0758	uvrB	837130	839121	837361		
NMTN-06591	SAV0758	uvrB	837130	839121	837362		
NMTN-13361	SAV0758	uvrB	837130	839121	837547		
NMTN-09516	SAV0758	uvrB	837130	839121	838194		
NMTN-13867	SAV0758	uvrB	837130	839121	838886		
NMTN-12378	SAV0759	uvrA	839129	841975	839390	+	exinuclease ABC subunit A
NMTN-14666	SAV0759	uvrA	839129	841975	839660		
NMTN-07896	SAV0759	uvrA	839129	841975	840308		
NMTN-06628	SAV0759	uvrA	839129	841975	840391		
NMTN-09244	SAV0759	uvrA	839129	841975	840612		
NMTN-05522	SAV0759	uvrA	839129	841975	840806		
NMTN-02611	SAV0759	uvrA	839129	841975	841234		
NMTN-13319	SAV0759	uvrA	839129	841975	841256		
NMTN-08136	SAV0759	uvrA	839129	841975	841697		
NMTN-00560	SAV0759	uvrA	839129	841975	841725		
NMTN-00056	SAV0759	uvrA	839129	841975	841728		
NMTN-11142	SAV0759	uvrA	839129	841975	841821		
NMTN-04343	SAV0759	uvrA	839129	841975	841863		
NMTN-04223	SAV0760	hprK	842639	843571	842678	+	HPr kinase/phosphatase
NMTN-14025	SAV0760	hprK	842639	843571	842729		
NMTN-13228	SAV0760	hprK	842639	843571	842741		
NMTN-06976	SAV0760	hprK	842639	843571	842961		
NMTN-15201	SAV0761	lgt	843577	844416	843594	+	prolipoprotein diacylglycerol transferase
NMTN-15206	SAV0761	lgt	843577	844416	843594		
NMTN-15207	SAV0761	lgt	843577	844416	843596		
NMTN-07358	SAV0761	lgt	843577	844416	843601		
NMTN-13881	SAV0761	lgt	843577	844416	843601		
NMTN-03114	SAV0761	lgt	843577	844416	843733		
NMTN-00106	SAV0761	lgt	843577	844416	844079		
NMTN-09213	SAV0761	lgt	843577	844416	844087		
NMTN-03713	SAV0761	lgt	843577	844416	844321		
NMTN-02399	SAV0762		844424	844909	844691	+	hypothetical protein
NMTN-05151	SAV0763		844917	846356	845539	+	conserved hypothetical protein
NMTN-11709	SAV0763		844917	846356	846007		
NMTN-06055	SAV0763		844917	846356	846316		
NMTN-06657	SAV0763		844917	846356	846319		
NMTN-08114	SAV0765		848303	849214	848939	+	conserved hypothetical protein
NMTN-13116	SAV0768	clpP	851825	852412	851966	+	ATP-dependent Clp protease proteolytic subunit homologue
NMTN-07860	SAV0769		852655	853557	852998	-	hypothetical protein
NMTN-11973	SAV0769		852655	853557	853241		
NMTN-00650	SAV0769		852655	853557	853250		
NMTN-00102	SAV0769		852655	853557	853349		
NMTN-11836	SAV0769		852655	853557	853421		
NMTN-03043	SAV0769		852655	853557	853423		
NMTN-15277	SAV0770		854260	854889	854609	+	conserved hypothetical protein
NMTN-03118	SAV0775	pgm	860104	861621	860211	+	2,3-diphosphoglycerate-independent phosphoglycerate mutase
NMTN-13775	SAV0775	pgm	860104	861621	860211		
NMTN-06684	SAV0775	pgm	860104	861621	860551		
NMTN-14656	SAV0775	pgm	860104	861621	860958		
NMTN-05319	SAV0775	pgm	860104	861621	860976		
NMTN-09208	SAV0775	pgm	860104	861621	861249		
NMTN-14436	SAV0779		864268	865008	864370	+	carboxyesterase precursor homologue
NMTN-14534		truncated-SA	874698	875576	875336		
NMTN-04111	SAV0800		878067	878636	878221	+	hypothetical protein
NMTN-06708	SAV0803		880845	881759	881232	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12006	SAV0803		880845	881759	881232		
NMTN-03793	SAV0803		880845	881759	881412		
NMTN-12000	SAV0804		881817	882665	882068	+	hypothetical protein
NMTN-06738	SAV0804		881817	882665	882130		
NMTN-02513	SAV0804		881817	882665	882190		
NMTN-10493	SAV0805		883041	883181	883071	+	hypothetical protein
NMTN-02360	SAV0805		883041	883181	883140		
NMTN-02656	SAV0805		883041	883181	883140		
NMTN-12858	SAV0808		884407	885135	885101	-	conserved hypothetical protein
NMTN-11273	SAV0809		885733	886254	885927	+	hypothetical protein
NMTN-09646	SAV0809		885733	886254	886092		
NMTN-06882	SAV0810		886393	886923	886892	+	conserved hypothetical protein
NMTN-07401	SAV0811	fnb	887186	889993	888251	+	fibrinogen-binding protein
NMTN-08738	SAV0811	fnb	887186	889993	888255		
NMTN-07317	SAV0811	fnb	887186	889993	888481		
NMTN-05280	SAV0811	fnb	887186	889993	888645		
NMTN-06933	SAV0812		890214	891716	891568	+	hypothetical protein
NMTN-07970	SAV0813	ssp	892069	893091	892618	+	extracellular ECM and plasma binding protein
NMTN-00036	SAV0813	ssp	892069	893091	892625		
NMTN-09415	SAV0813	ssp	892069	893091	892652		
NMTN-12513	SAV0813	ssp	892069	893091	893049		
NMTN-09823	SAV0815	nuc	894288	894974	894306	+	staphylococcal nuclease
NMTN-10057	SAV0815	nuc	894288	894974	894340		
NMTN-03877	SAV0815	nuc	894288	894974	894342		
NMTN-14464	SAV0815	nuc	894288	894974	894521		
NMTN-11524	SAV0815	nuc	894288	894974	894523		
NMTN-12201	SAV0815	nuc	894288	894974	894776		
NMTN-09519	SAV0819		896675	897244	896675	-	conserved hypothetical protein
NMTN-07534d	SAV0822		898250	898453	898341	+	hypothetical protein
NMTN-11151	SAV0825		899565	900182	899928	-	conserved hypothetical protein
NMTN-11590	SAV0825		899565	900182	900005		
NMTN-11279	SAV0825		899565	900182	900072		
NMTN-06610	SAV0826		900337	900831	900384	-	hypothetical protein
NMTN-12871	SAV0830		902599	903138	902608	+	conserved hypothetical protein
NMTN-15355	SAV0830		902599	903138	902695		
NMTN-06050	SAV0830		902599	903138	903069		
NMTN-07446	SAV0830		902599	903138	903121		
NMTN-06228	SAV0830		902599	903138	903142		
NMTN-02894	SAV0835		906501	906887	906612	+	conserved hypothetical protein
NMTN-05142	SAV0837		907426	908451	907633	+	ABC transporter ATP-binding protein homologue
NMTN-08443	SAV0837		907426	908451	908213		
NMTN-02404	SAV0838		908444	909139	908741	+	conserved hypothetical protein
NMTN-00555	SAV0838		908444	909139	909016		
NMTN-12909	SAV0839		909157	909978	909416	+	conserved hypothetical protein
NMTN-04279	SAV0841		910760	911611	911069	-	conserved hypothetical protein
NMTN-03788	SAV0845		915451	915915	915875	+	hypothetical protein
NMTN-09814	SAV0848	int	918692	918871	918712	+	excisionase
NMTN-11204	SAV0848	int	918692	918871	918724		
NMTN-13398	SAV0848	int	918692	918871	918724		
NMTN-11204	SAV0848	int	918692	918871	918724		
NMTN-09031	SAV0848	int	918692	918871	918753		
NMTN-08829	SAV0848	int	918692	918871	918864		
NMTN-08829	SAV0849		918851	919783	918864	-	hypothetical protein
NMTN-06091	SAV0849		918851	919783	918984		
NMTN-12286	SAV0849		918851	919783	919060		
NMTN-12689	SAV0849		918851	919783	919144		
NMTN-10197	SAV0849		918851	919783	919217		
NMTN-01443	SAV0849		918851	919783	919338		
NMTN-07294	SAV0849		918851	919783	919469		
NMTN-09514	SAV0849		918851	919783	919505		
NMTN-00029	SAV0849		918851	919783	919507		
NMTN-00225	SAV0849		918851	919783	919578		
NMTN-07262	SAV0855		921461	922240	921524		
NMTN-03416	SAV0855		921461	922240	921803	+	hypothetical protein
NMTN-05572	SAV0855		921461	922240	921890		
NMTN-00340	SAV0855		921461	922240	921935		
NMTN-02139	SAV0855		921461	922240	922032		
NMTN-15272d	SAV0855		921461	922240	922212		
NMTN-12671	SAV0858		922670	923317	923315	-	hypothetical protein
NMTN-04000	SAV0861		924300	924434	924295	-	hypothetical protein
NMTN-09143	SAV0861		924300	924434	924359		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12478	SAV0862		924433	924654	924542	+	hypothetical protein
NMTN-06544	SAV0862		924433	924654	924654		
NMTN-06544	SAV0863		924647	924769	924654	+	hypothetical protein
NMTN-12038	SAV0866		926259	926933	926732	+	hypothetical protein
NMTN-08772	SAV0866		926259	926933	926793		
NMTN-07325	SAV0868		927419	928150	927412	+	hypothetical protein
NMTN-12985	SAV0868		927419	928150	927412		
NMTN-06487	SAV0874		930315	930563	930509	+	hypothetical protein
NMTN-04743	SAV0875		930575	930826	930676	+	hypothetical protein
NMTN-06711	SAV0876		930819	931355	930895	+	hypothetical protein
NMTN-03004	SAV0876		930819	931355	931262		
NMTN-01478	SAV0877		931392	931598	931450	+	hypothetical protein
NMTN-12253	SAV0881		932208	932594	932330	+	hypothetical protein
NMTN-09411	SAV0881		932208	932594	932405		
NMTN-08472	SAV0881		932208	932594	932427		
NMTN-04372	SAV0881		932208	932594	932448		
NMTN-14628	SAV0881		932208	932594	932481		
NMTN-12793	SAV0881		932208	932594	932499		
NMTN-09388	SAV0881		932208	932594	932530		
NMTN-05470	SAV0881		932208	932594	932536		
NMTN-03184	SAV0881		932208	932594	932553		
NMTN-11073	SAV0882		932594	932767	932640	+	int gene activator RinB
NMTN-03060	SAV0882		932594	932767	932673		
NMTN-01698	SAV0882		932594	932767	932699		
NMTN-00024	SAV0883		932825	932914	932879	+	hypothetical protein
NMTN-05312	SAV0885		933535	933975	933567	+	hypothetical protein
NMTN-08673	SAV0885		933535	933975	933567		
NMTN-08726	SAV0885		933535	933975	933680		
NMTN-11632	SAV0885		933535	933975	933837		
NMTN-10789	SAV0885		933535	933975	933889		
NMTN-06264	SAV0886		933962	935239	934232	+	hypothetical protein
NMTN-08868	SAV0886		933962	935239	934289		
NMTN-06516	SAV0886		933962	935239	934434		
NMTN-00046	SAV0886		933962	935239	934485		
NMTN-14674	SAV0886		933962	935239	934539		
NMTN-08440	SAV0886		933962	935239	934793		
NMTN-08764	SAV0886		933962	935239	934824		
NMTN-08843c	SAV0886		933962	935239	934870		
NMTN-12881d	SAV0886		933962	935239	934881		
NMTN-04036	SAV0886		933962	935239	935128		
NMTN-05193	SAV0887		935250	936785	935339	+	hypothetical protein
NMTN-10805	SAV0887		935250	936785	935428		
NMTN-14481	SAV0887		935250	936785	935458		
NMTN-03820	SAV0887		935250	936785	935528		
NMTN-01646	SAV0887		935250	936785	935540		
NMTN-08108	SAV0887		935250	936785	935624		
NMTN-01676	SAV0887		935250	936785	935659		
NMTN-06181	SAV0887		935250	936785	935775		
NMTN-06090	SAV0887		935250	936785	935797		
NMTN-13389	SAV0887		935250	936785	935800		
NMTN-03684	SAV0887		935250	936785	935878		
NMTN-01869	SAV0887		935250	936785	935903		
NMTN-03001	SAV0887		935250	936785	935980		
NMTN-01729	SAV0887		935250	936785	936012		
NMTN-12852	SAV0887		935250	936785	936080		
NMTN-01827	SAV0887		935250	936785	936257		
NMTN-03204	SAV0887		935250	936785	936260		
NMTN-02736	SAV0887		935250	936785	936621		
NMTN-08106	SAV0887		935250	936785	936713		
NMTN-00084	SAV0888		936792	937787	937091	+	hypothetical protein
NMTN-10573	SAV0888		936792	937787	937094		
NMTN-10565	SAV0888		936792	937787	937096		
NMTN-06149	SAV0888		936792	937787	937125		
NMTN-02714	SAV0888		936792	937787	937278		
NMTN-01533	SAV0888		936792	937787	937282		
NMTN-07483	SAV0888		936792	937787	937480		
NMTN-02251	SAV0888		936792	937787	937568		
NMTN-11790	SAV0888		936792	937787	937568		
NMTN-06287	SAV0888		936792	937787	937571		
NMTN-06600	SAV0888		936792	937787	937571		
NMTN-04423	SAV0888		936792	937787	937587		
NMTN-03685	SAV0889		937860	938030	937893	+	hypothetical protein
NMTN-00176	SAV0889		937860	938030	938011		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00294	SAV0890		938165	938779	938229	+	hypothetical protein
NMTN-00497	SAV0890		938165	938779	938483		
NMTN-09919	SAV0891		938793	939101	938973	+	hypothetical protein
NMTN-08474	SAV0891		938793	939101	939096		
NMTN-08478	SAV0891		938793	939101	939096		
NMTN-08479	SAV0891		938793	939101	939096		
NMTN-08480	SAV0891		938793	939101	939096		
NMTN-08483	SAV0891		938793	939101	939096		
NMTN-08484	SAV0891		938793	939101	939096		
NMTN-08485	SAV0891		938793	939101	939096		
NMTN-08486	SAV0891		938793	939101	939096		
NMTN-08487	SAV0891		938793	939101	939096		
NMTN-08488	SAV0891		938793	939101	939096		
NMTN-08489	SAV0891		938793	939101	939096		
NMTN-08493	SAV0891		938793	939101	939096		
NMTN-08497	SAV0891		938793	939101	939096		
NMTN-08498	SAV0891		938793	939101	939096		
NMTN-08501	SAV0891		938793	939101	939096		
NMTN-08502	SAV0891		938793	939101	939096		
NMTN-08503	SAV0891		938793	939101	939096		
NMTN-08505	SAV0891		938793	939101	939096		
NMTN-08507	SAV0891		938793	939101	939096		
NMTN-08511	SAV0891		938793	939101	939096		
NMTN-08512	SAV0891		938793	939101	939096		
NMTN-08513	SAV0891		938793	939101	939096		
NMTN-08516	SAV0891		938793	939101	939096		
NMTN-08519	SAV0891		938793	939101	939096		
NMTN-08520	SAV0891		938793	939101	939096		
NMTN-08521	SAV0891		938793	939101	939096		
NMTN-08499	SAV0892		939233	939766	939291	+	hypothetical protein
NMTN-15214	SAV0892		939233	939766	939441		
NMTN-00667	SAV0892		939233	939766	939470		
NMTN-04129	SAV0892		939233	939766	939675		
NMTN-11287	SAV0893		939788	940075	939853	+	hypothetical protein
NMTN-14537	SAV0893		939788	940075	940083		
NMTN-14537	SAV0894		940084	940416	940083	+	hypothetical protein
NMTN-02185	SAV0894		940084	940416	940238		
NMTN-03655	SAV0895		940413	940715	940515	+	hypothetical protein
NMTN-08496	SAV0896		940715	941062	940751	+	hypothetical protein
NMTN-06748	SAV0896		940715	941062	940897		
NMTN-02232	SAV0896		940715	941062	941008		
NMTN-06484	SAV0897		941074	941457	941141	+	hypothetical protein
NMTN-12160	SAV0897		941074	941457	941393		
NMTN-03687	SAV0897		941074	941457	941399		
NMTN-10971	SAV0898		941476	942057	941507	+	hypothetical protein
NMTN-04734	SAV0898		941476	942057	941843		
NMTN-06680	SAV0898		941476	942057	942041		
NMTN-09552	SAV0900		942604	942858	942764	+	hypothetical protein
NMTN-14560	SAV0900		942604	942858	942833		
NMTN-09067	SAV0900		942604	942858	942869		
NMTN-10046	SAV0901		942875	946339	943089	+	hypothetical protein
NMTN-10062	SAV0901		942875	946339	943089		
NMTN-03708	SAV0901		942875	946339	943127		
NMTN-06253	SAV0901		942875	946339	943356		
NMTN-12796	SAV0901		942875	946339	943458		
NMTN-13838	SAV0901		942875	946339	943473		
NMTN-06620	SAV0901		942875	946339	943622		
NMTN-14523	SAV0901		942875	946339	943626		
NMTN-09458	SAV0901		942875	946339	943817		
NMTN-01917	SAV0901		942875	946339	944127		
NMTN-07916	SAV0901		942875	946339	944310		
NMTN-12335	SAV0901		942875	946339	944461		
NMTN-14047	SAV0901		942875	946339	944461		
NMTN-13605	SAV0901		942875	946339	944508		
NMTN-14483	SAV0901		942875	946339	944673		
NMTN-14818	SAV0901		942875	946339	944673		
NMTN-14850	SAV0901		942875	946339	944673		
NMTN-14858	SAV0901		942875	946339	944673		
NMTN-00064	SAV0901		942875	946339	944681		
NMTN-13611	SAV0901		942875	946339	944694		
NMTN-14100	SAV0901		942875	946339	944694		
NMTN-10885	SAV0901		942875	946339	944862		
NMTN-03865	SAV0901		942875	946339	944936		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03873	SAV0901		942875	946339	944936		
NMTN-13581	SAV0901		942875	946339	945173		
NMTN-11192	SAV0901		942875	946339	945311		
NMTN-14524	SAV0901		942875	946339	945348		
NMTN-06240	SAV0901		942875	946339	945534		
NMTN-08008	SAV0901		942875	946339	945656		
NMTN-04159	SAV0901		942875	946339	945741		
NMTN-08089	SAV0901		942875	946339	946111		
NMTN-10887	SAV0901		942875	946339	946134		
NMTN-00607	SAV0901		942875	946339	946161		
NMTN-13200	SAV0901		942875	946339	946196		
NMTN-07920	SAV0901		942875	946339	946349		
NMTN-07920	SAV0902		946352	947299	946349	+	hypothetical protein
NMTN-07215	SAV0902		946352	947299	946381		
NMTN-00226	SAV0902		946352	947299	946394		
NMTN-12885	SAV0902		946352	947299	946430		
NMTN-02791	SAV0902		946352	947299	946614		
NMTN-06112	SAV0902		946352	947299	946614		
NMTN-00465	SAV0902		946352	947299	946615		
NMTN-07271	SAV0902		946352	947299	946694		
NMTN-09632	SAV0902		946352	947299	946794		
NMTN-06860	SAV0902		946352	947299	946855		
NMTN-04745	SAV0902		946352	947299	947007		
NMTN-06483	SAV0902		946352	947299	947013		
NMTN-11378d	SAV0903		947308	949209	947317	+	hypothetical protein
NMTN-08824	SAV0903		947308	949209	947359		
NMTN-10528	SAV0903		947308	949209	947372		
NMTN-10630	SAV0903		947308	949209	947423		
NMTN-02017	SAV0903		947308	949209	947506		
NMTN-12635	SAV0903		947308	949209	947510		
NMTN-07759	SAV0903		947308	949209	947813		
NMTN-03000	SAV0903		947308	949209	948187		
NMTN-12740	SAV0903		947308	949209	948200		
NMTN-06191	SAV0903		947308	949209	948238		
NMTN-12823	SAV0903		947308	949209	948260		
NMTN-02845	SAV0903		947308	949209	948318		
NMTN-00701	SAV0903		947308	949209	948497		
NMTN-05339	SAV0903		947308	949209	948497		
NMTN-13033	SAV0903		947308	949209	948766		
NMTN-03165	SAV0903		947308	949209	948785		
NMTN-11107	SAV0903		947308	949209	948993		
NMTN-11438	SAV0903		947308	949209	949095		
NMTN-01552	SAV0904		949224	951134	949278	+	hypothetical protein
NMTN-07940	SAV0904		949224	951134	949302		
NMTN-12916	SAV0904		949224	951134	949302		
NMTN-01705	SAV0904		949224	951134	949372		
NMTN-08825	SAV0904		949224	951134	949425		
NMTN-03093	SAV0904		949224	951134	949439		
NMTN-07500	SAV0904		949224	951134	949524		
NMTN-13428	SAV0904		949224	951134	949699		
NMTN-02959	SAV0904		949224	951134	949702		
NMTN-11185	SAV0904		949224	951134	949784		
NMTN-06128	SAV0904		949224	951134	949804		
NMTN-07585	SAV0904		949224	951134	949887		
NMTN-07585	SAV0904		949224	951134	949887		
NMTN-06299	SAV0904		949224	951134	949967		
NMTN-03953	SAV0904		949224	951134	950001		
NMTN-05531	SAV0904		949224	951134	950001		
NMTN-04146	SAV0904		949224	951134	950020		
NMTN-05044	SAV0904		949224	951134	950020		
NMTN-12313	SAV0904		949224	951134	950041		
NMTN-03621	SAV0904		949224	951134	950160		
NMTN-03900	SAV0904		949224	951134	950240		
NMTN-03908	SAV0904		949224	951134	950240		
NMTN-03910	SAV0904		949224	951134	950240		
NMTN-06261	SAV0904		949224	951134	950240		
NMTN-14057	SAV0904		949224	951134	950251		
NMTN-06231	SAV0904		949224	951134	950286		
NMTN-14603	SAV0904		949224	951134	950588		
NMTN-10647	SAV0904		949224	951134	950620		
NMTN-03625	SAV0904		949224	951134	950872		
NMTN-03987	SAV0904		949224	951134	950913		
NMTN-00864	SAV0904		949224	951134	950994		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09341	SAV0904		949224	951134	951013		
NMTN-00876	SAV0904		949224	951134	951040		
NMTN-08710	SAV0904		949224	951134	951136		
NMTN-08710	SAV0905		951134	952957	951136	+	hypothetical protein
NMTN-15350	SAV0905		951134	952957	951173		
NMTN-00637	SAV0905		951134	952957	951287		
NMTN-13676	SAV0905		951134	952957	951506		
NMTN-08704	SAV0905		951134	952957	951905		
NMTN-12354	SAV0905		951134	952957	951967		
NMTN-12973	SAV0905		951134	952957	952148		
NMTN-14658	SAV0905		951134	952957	952244		
NMTN-11593	SAV0905		951134	952957	952310		
NMTN-12458	SAV0905		951134	952957	952310		
NMTN-03445	SAV0905		951134	952957	952371		
NMTN-01775	SAV0905		951134	952957	952411		
NMTN-14782	SAV0905		951134	952957	952418		
NMTN-09194	SAV0905		951134	952957	952484		
NMTN-07080	SAV0906		952957	953334	953038	+	hypothetical protein
NMTN-11792	SAV0908		953552	953851	953550	+	hypothetical protein
NMTN-06695	SAV0908		953552	953851	953763		
NMTN-11543	SAV0908		953552	953851	953774		
NMTN-04015	SAV0909		953988	955886	954056		
NMTN-06554	SAV0909		953988	955886	954074		hypothetical protein
NMTN-12488	SAV0909		953988	955886	954550		
NMTN-11630	SAV0909		953988	955886	954552		
NMTN-03088	SAV0909		953988	955886	954694		
NMTN-11535	SAV0909		953988	955886	954777		
NMTN-02487	SAV0909		953988	955886	954816		
NMTN-02254	SAV0909		953988	955886	954891		
NMTN-06371	SAV0909		953988	955886	955045		
NMTN-15334	SAV0909		953988	955886	955341		
NMTN-01519	SAV0909		953988	955886	955360		
NMTN-08047	SAV0909		953988	955886	955590		
NMTN-11325	SAV0909		953988	955886	955648		
NMTN-08591	SAV0909		953988	955886	955848		
NMTN-03217	SAV0910		955899	957137	955950	+	hypothetical protein
NMTN-11143	SAV0910		955899	957137	955990		
NMTN-06328	SAV0910		955899	957137	955999		
NMTN-04887	SAV0910		955899	957137	956124		
NMTN-10617	SAV0910		955899	957137	956156		
NMTN-06522	SAV0910		955899	957137	956302		
NMTN-00672	SAV0910		955899	957137	956446		
NMTN-11311	SAV0910		955899	957137	956551		
NMTN-09475	SAV0910		955899	957137	956701		
NMTN-11165	SAV0910		955899	957137	956781		
NMTN-06135	SAV0910		955899	957137	957092		
NMTN-02505	SAV0910		955899	957137	957094		
NMTN-07062	SAV0910		955899	957137	957096		
NMTN-11362	SAV0910		955899	957137	957096		
NMTN-06173	SAV0910		955899	957137	957098		
NMTN-07722	SAV0910		955899	957137	957105		
NMTN-01580	SAV0911		957143	957538	957198	+	hypothetical protein
NMTN-00455	SAV0911		957143	957538	957206		
NMTN-00487	SAV0911		957143	957538	957290		
NMTN-00559	SAV0911		957143	957538	957290		
NMTN-06996	SAV0911		957143	957538	957290		
NMTN-07058	SAV0911		957143	957538	957290		
NMTN-13651	SAV0911		957143	957538	957487		
NMTN-06605	SAV0912		957594	958031	957757	+	hypothetical protein
NMTN-00479	SAV0913		958012	959457	958121	+	amidase
NMTN-10896	SAV0913		958012	959457	958630		
NMTN-06570	SAV0913		958012	959457	959193		
NMTN-12527	SAV0920		964008	965075	964247	+	hypothetical protein
NMTN-14315	SAV0921		965460	966308	965459	+	conserved hypothetical protein
NMTN-04333	SAV0921		965460	966308	965514		
NMTN-00488	SAV0921		965460	966308	965743		
NMTN-06241	SAV0921		965460	966308	966264		
NMTN-06690	SAV0922		966321	967148	966450	+	conserved hypothetical protein
NMTN-11244	SAV0922		966321	967148	966457		
NMTN-11604	SAV0922		966321	967148	966781		
NMTN-08672	SAV0922		966321	967148	966829		
NMTN-11612	SAV0922		966321	967148	966925		
NMTN-03068	SAV0922		966321	967148	967121		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11050c	SAV0922		966321	967148	967122		
NMTN-01629	SAV0922/ SAV2176		966321	967148	967122		
NMTN-06165	SAV0922		966321	967148	967127		
NMTN-11053c	SAV0922		966321	967148	967137		
NMTN-11056c	SAV0922		966321	967148	967145		
NMTN-09216	SAV0923		967175	968494	967220	+	conserved hypothetical protein
NMTN-01811	SAV0923		967175	968494	967635		
NMTN-13174	SAV0923		967175	968494	967878		
NMTN-03980	SAV0923		967175	968494	967880		
NMTN-04926	SAV0923		967175	968494	968055		
NMTN-14624	SAV0923		967175	968494	968166		
NMTN-14703	SAV0923		967175	968494	968271		
NMTN-04030	SAV0923		967175	968494	968376		
NMTN-12149	SAV0924	lipA	968578	969495	968810	+	lipic acid synthetase
NMTN-00703	SAV0924	lipA	968578	969495	969268		
NMTN-12210	SAV0924	lipA	968578	969495	969268		
NMTN-10729	SAV0924	lipA	968578	969495	969308		
NMTN-02013	SAV0924	lipA	968578	969495	969420		
NMTN-11001	SAV0927		971607	971873	971660	-	conserved hypothetical protein
NMTN-00769	SAV0927		971607	971873	971685		
NMTN-05344	SAV0928		971971	972405	972012	+	conserved hypothetical protein
NMTN-01968	SAV0929		972405	973184	972672	+	hypothetical protein
NMTN-05388	SAV0929		972405	973184	972672		
NMTN-03519	SAV0929		972405	973184	973062		
NMTN-12314	SAV0929		972405	973184	973092		
NMTN-00653	SAV0930		973217	974176	973631	+	hypothetical protein
NMTN-11315	SAV0930		973217	974176	973670		
NMTN-11221	SAV0930		973217	974176	973743		
NMTN-01709	SAV0930		973217	974176	974060		
NMTN-05246	SAV0930		973217	974176	974128		
NMTN-12076	SAV0933	dltB	976210	977424	976498	+	DltB membrane protein
NMTN-14377	SAV0933	dltB	976210	977424	976940		
NMTN-09346	SAV0935	dltD	977675	978850	977907	+	poly (glycerophosphate chain) D-alanine transfer protein
NMTN-09243	SAV0937		979471	979779	979533		
NMTN-10387	SAV0937		979471	979779	979600	+	conserved hypothetical protein
NMTN-04728	SAV0937		979471	979779	979603		
NMTN-12008	SAV0937		979471	979779	979724		
NMTN-00231	SAV0938		979838	980902	979857	-	hypothetical protein
NMTN-07367	SAV0938		979838	980902	979990		
NMTN-12404	SAV0938		979838	980902	980396		
NMTN-12434	SAV0938		979838	980902	980455		
NMTN-13773	SAV0938		979838	980902	980541		
NMTN-10221	SAV0938		979838	980902	980629		
NMTN-10223	SAV0938		979838	980902	980629		
NMTN-10235	SAV0938		979838	980902	980629		
NMTN-13667	SAV0938		979838	980902	980665		
NMTN-09301	SAV0939		981219	981455	981207	+	conserved hypothetical protein
NMTN-13891d	SAV0939		981219	981455	981422		
NMTN-10876	SAV0940		981468	981827	981503	+	conserved hypothetical protein
NMTN-01739	SAV0941		982281	983489	982281	+	hypothetical protein
NMTN-05012	SAV0942	ampA	983620	985095	984403	+	probable cytosol aminopeptidase
NMTN-05015	SAV0942	ampA	983620	985095	984403		
NMTN-08115	SAV0942	ampA	983620	985095	984808		
NMTN-02308	SAV0942	ampA	983620	985095	984911		
NMTN-11584	SAV0943		985506	986822	986523	+	conserved hypothetical protein
NMTN-10576	SAV0944		986841	987215	986853	+	conserved hypothetical protein
NMTN-05437	SAV0944		986841	987215	986926		
NMTN-04008	SAV0945		987271	988425	987690	-	hypothetical protein
NMTN-08972	SAV0945		987271	988425	988239		
NMTN-07555	SAV0956		996763	997890	996759	+	hypothetical protein
NMTN-07359	SAV0956		996763	997890	996841		
NMTN-09242	SAV0956		996763	997890	997300		
NMTN-12501	SAV0956		996763	997890	997432		
NMTN-11078	SAV0956		996763	997890	997678		
NMTN-12260	SAV0956		996763	997890	997886		
NMTN-03954	SAV0957	rocD	998198	999388	998589	+	ornithine aminotransferase
NMTN-11547	SAV0957	rocD	998198	999388	998726		
NMTN-07736	SAV0958	gudB	999497	1000741	999884	+	NAD-specific glutamate dehydrogenase
NMTN-14019	SAV0958	gudB	999497	1000741	1000080		
NMTN-02830	SAV0958	gudB	999497	1000741	1000428		
NMTN-10720	SAV0958	gudB	999497	1000741	1000449		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00026	SAV0959	glpQ	1001078	1002007	1001197	-	glycerophosphoryl diester phosphodiesterase
NMTN-00806	SAV0959	glpQ	1001078	1002007	1001706		
NMTN-11755	SAV0960	argH	1002249	1003628	1002446	-	argininosuccinate lyase
NMTN-03785	SAV0960	argH	1002249	1003628	1002716		
NMTN-13726	SAV0960	argH	1002249	1003628	1002745		
NMTN-04599	SAV0960	argH	1002249	1003628	1002927		
NMTN-08885	SAV0962	pgi	1005174	1006505	1006452	+	glucose-6-phosphate isomerase A
NMTN-00327	SAV0963		1006830	1007405	1007280	+	conserved hypothetical protein
NMTN-02078	SAV0968		1015981	1016883	1016366	+	hypothetical protein
NMTN-08749	SAV0968		1015981	1016883	1016410		
NMTN-09319	SAV0968		1015981	1016883	1016871		
NMTN-02923	SAV0969		1017212	1017601	1017218	+	conserved hypothetical protein
NMTN-08231	SAV0969		1017212	1017601	1017226		
NMTN-09429	SAV0969		1017212	1017601	1017227		
NMTN-05804	SAV0969		1017212	1017601	1017228		
NMTN-10802	SAV0969		1017212	1017601	1017420		
NMTN-09957	SAV0969		1017212	1017601	1017422		
NMTN-08996	SAV0969		1017212	1017601	1017548		
NMTN-09924	SAV0969		1017212	1017601	1017550		
NMTN-04039	SAV0969		1017212	1017601	1017551		
NMTN-06962	SAV0970	cdr	1017773	1019089	1018098	-	coenzyme A disulfide reductase
NMTN-03101	SAV0970	cdr	1017773	1019089	1018179		
NMTN-11697	SAV0970	cdr	1017773	1019089	1018392		
NMTN-12928	SAV0974		1020935	1022749	1020976	+	hypothetical protein
NMTN-06647	SAV0974		1020935	1022749	1021193		
NMTN-05620	SAV0974		1020935	1022749	1021202		
NMTN-02941	SAV0974		1020935	1022749	1021620		
NMTN-06916	SAV0974		1020935	1022749	1021649		
NMTN-00524	SAV0974		1020935	1022749	1021670		
NMTN-11337	SAV0974		1020935	1022749	1021901		
NMTN-11403	SAV0974		1020935	1022749	1021915		
NMTN-02991	SAV0974		1020935	1022749	1021936		
NMTN-12060	SAV0974		1020935	1022749	1021939		
NMTN-11662	SAV0974		1020935	1022749	1022544		
NMTN-07833	SAV0975	clpB	1022952	1025561	1023086	+	ClpB chaperone homologue
NMTN-08275	SAV0975	clpB	1022952	1025561	1023099		
NMTN-14455	SAV0975	clpB	1022952	1025561	1024434		
NMTN-05214	SAV0976		1025620	1026489	1025701	-	hypothetical protein
NMTN-03545	SAV0976		1025620	1026489	1025777		
NMTN-06935	SAV0976		1025620	1026489	1025844		
NMTN-06518	SAV0976		1025620	1026489	1025978		
NMTN-11614	SAV0976		1025620	1026489	1026398		
NMTN-00694	SAV0977		1026599	1027744	1026902	+	hypothetical protein
NMTN-12509	SAV0977		1026599	1027744	1027045	+	conserved hypothetical protein
NMTN-06247	SAV0978		1027728	1028369	1028056		
NMTN-05299	SAV0978		1027728	1028369	1028149		
NMTN-02143	SAV0978		1027728	1028369	1028222		
NMTN-12884	SAV0979		1028362	1029483	1028460	+	hypothetical protein
NMTN-05409	SAV0979		1028362	1029483	1028526		
NMTN-14611	SAV0979		1028362	1029483	1028614		
NMTN-07415	SAV0979		1028362	1029483	1028791		
NMTN-09008	SAV0979		1028362	1029483	1029179		
NMTN-12613	SAV0979		1028362	1029483	1029182		
NMTN-03567	SAV0979		1028362	1029483	1029185		
NMTN-05568	SAV0979		1028362	1029483	1029305		
NMTN-11791	SAV0979		1028362	1029483	1029350		
NMTN-01532	SAV0981		1030287	1030721	1030506	+	hypothetical protein
NMTN-04633	SAV0982		1030978	1031163	1031099	-	hypothetical protein
NMTN-04047	SAV0985		1033710	1034081	1033786	-	hypothetical protein
NMTN-13898	SAV0986	oppB	1034324	1035250	1034398	+	oligopeptide transport system permease protein
NMTN-02880	SAV0986	oppB	1034324	1035250	1034988		
NMTN-08460	SAV0987		1035250	1036320	1035559	+	hypothetical protein
NMTN-02280	SAV0987		1035250	1036320	1036180		
NMTN-06450	SAV0987		1035250	1036320	1036261		
NMTN-14304	SAV0988	oppD	1036336	1037418	1037092	+	oligopeptide transport system ATP-binding protein OppD homologue
NMTN-08680	SAV0989	oppF	1037408	1038349	1037633	+	oligopeptide transport system ATP-binding protein OppF homologue
NMTN-04084	SAV0989	oppF	1037408	1038349	1037806		
NMTN-11394	SAV0989	oppF	1037408	1038349	1038263		
NMTN-10397	SAV0990		1038368	1040023	1038541	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-10486	SAV0990		1038368	1040023	1038654		
NMTN-02040	SAV0990		1038368	1040023	1038798		
NMTN-08760	SAV0990		1038368	1040023	1039040		
NMTN-09596	SAV0990		1038368	1040023	1039135		
NMTN-06703	SAV0990		1038368	1040023	1039910		
NMTN-12419	SAV0990		1038368	1040023	1039969		
NMTN-11494	SAV0990		1038368	1040023	1039976		
NMTN-00303	SAV0991		1040235	1041950	1040382	+	hypothetical protein
NMTN-03536	SAV0991		1040235	1041950	1040428		
NMTN-10854	SAV0991		1040235	1041950	1041368		
NMTN-06577	SAV0992		1042001	1042987	1042242	+	oligopeptide ABC transporter ATP-binding protein homologue
NMTN-01951	SAV0992		1042001	1042987	1042753		
NMTN-05621	SAV0993	appF	1042990	1043970	1043347	+	oligopeptide transport system ATP-binding protein AppF homologue
NMTN-03178	SAV0993	appF	1042990	1043970	1043416		
NMTN-04918	SAV0993	appF	1042990	1043970	1043435		
NMTN-05606	SAV0993	appF	1042990	1043970	1043530		
NMTN-13365d	SAV0993	appF	1042990	1043970	1043614		
NMTN-04720	SAV0993	appF	1042990	1043970	1043638		
NMTN-00272	SAV0993	appF	1042990	1043970	1043650		
NMTN-03960	SAV0993	appF	1042990	1043970	1043686		
NMTN-01992	SAV0993	appF	1042990	1043970	1043777		
NMTN-06455	SAV0994	oppB	1043963	1044925	1043982	+	probable oligopeptide transport system permease protein
NMTN-13513	SAV0994	oppB	1043963	1044925	1044185		
NMTN-14170	SAV0994	oppB	1043963	1044925	1044185		
NMTN-03876	SAV0994	oppB	1043963	1044925	1044292		
NMTN-14776	SAV0994	oppB	1043963	1044925	1044373		
NMTN-03912	SAV0994	oppB	1043963	1044925	1044514		
NMTN-08776	SAV0994	oppB	1043963	1044925	1044800		
NMTN-10014	SAV0994	oppB	1043963	1044925	1044893		
NMTN-10629	SAV0995		1044937	1045818	1045409	+	hypothetical protein
NMTN-11596	SAV0995		1044937	1045818	1045462		
NMTN-05436	SAV0998		1047909	1408628	1047961	+	hypothetical protein
NMTN-00680	SAV0998		1047909	1408628	1048424		
NMTN-03907	SAV1000		1049783	1051591	1049781	+	thimet oligopeptidase homologue
NMTN-04804	SAV1000		1049783	1051591	1049817		
NMTN-13731	SAV1000		1049783	1051591	1050013		
NMTN-11452	SAV1000		1049783	1051591	1050400		
NMTN-11270	SAV1000		1049783	1051591	1050462		
NMTN-12448	SAV1000		1049783	1051591	1050689		
NMTN-08998	SAV1000		1049783	1051591	1050723		
NMTN-13237	SAV1000		1049783	1051591	1050924		
NMTN-00315	SAV1000		1049783	1051591	1050944		
NMTN-05368	SAV1001	yjbM	1052051	1052605	1052187	-	GTP pyrophosphokinase
NMTN-06682	SAV1002		1052541	1052867	1052612	-	conserved hypothetical protein
NMTN-07348	SAV1004		1053353	1053946	1053766	-	conserved hypothetical protein
NMTN-02696	SAV1004		1053353	1053946	1053824		
NMTN-11970	SAV1004		1053353	1053946	1053955		
NMTN-04841	SAV1008		1055954	1056808	1056345	+	conserved hypothetical protein
NMTN-06475	SAV1008		1055954	1056808	1056609		
NMTN-11935	SAV1009		1056829	1058214	1057061	+	hypothetical protein
NMTN-04961	SAV1009		1056829	1058214	1057110		
NMTN-12106	SAV1009		1056829	1058214	1057284		
NMTN-11226	SAV1009		1056829	1058214	1057441		
NMTN-11218	SAV1009		1056829	1058214	1057451		
NMTN-02703	SAV1009		1056829	1058214	1058165		
NMTN-10401	SAV1010		1058224	1060068	1058362	+	Na <sup>+</sup> /H <sup>+</sup> antiporter homologue
NMTN-00142	SAV1010		1058224	1060068	1058581		
NMTN-12609	SAV1010		1058224	1060068	1058810		
NMTN-15202	SAV1010		1058224	1060068	1058847		
NMTN-01921	SAV1010		1058224	1060068	1059508		
NMTN-13330	SAV1010		1058224	1060068	1059881		
NMTN-10818	SAV1010		1058224	1060068	1059882		
NMTN-14708	SAV1012		1061313	1062398	1061585	-	conserved hypothetical protein
NMTN-14573	SAV1012		1061313	1062398	1061618		
NMTN-09644	SAV1012		1061313	1062398	1061637		
NMTN-00126	SAV1012		1061313	1062398	1061710		
NMTN-07981	SAV1012		1061313	1062398	1061842		
NMTN-13832	SAV1013		1062803	1064308	1062802	+	hypothetical protein
NMTN-11732	SAV1013		1062803	1064308	1063340		
NMTN-02794	SAV1013		1062803	1064308	1063387		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-15262	SAV1013		1062803	1064308	1063696		
NMTN-14646	SAV1013		1062803	1064308	1063810		
NMTN-10663	SAV1013		1062803	1064308	1064148		
NMTN-08774	SAV1014		1064453	1065211	1064563	+	conserved hypothetical protein
NMTN-08458	SAV1014		1064453	1065211	1065088		
NMTN-06998	SAV1019		1070277	1070528	1070510	+	hypothetical protein
NMTN-11246	SAV1019		1070277	1070528	1070537		
NMTN-04654	SAV1021		1070918	1072135	1070988	+	peptide chain release factor 3
NMTN-13507	SAV1021		1070918	1072135	1071005		
NMTN-12678	SAV1021		1070918	1072135	1071655		
NMTN-12188	SAV1021		1070918	1072135	1071656		
NMTN-08059	SAV1021		1070918	1072135	1071714		
NMTN-06388	SAV1021		1070918	1072135	1071838		
NMTN-12561	SAV1023	htrA	1073474	1075783	1074247	+	serine protease HtrA
NMTN-13714	SAV1023	htrA	1073474	1075783	1074690		
NMTN-09232	SAV1023	htrA	1073474	1075783	1074783		
NMTN-04400	SAV1023	htrA	1073474	1075783	1074999		
NMTN-09181	SAV1024		1075800	1077158	1075859	+	hypothetical protein
NMTN-13301	SAV1024		1075800	1077158	1075862		
NMTN-10850	SAV1024		1075800	1077158	1076319		
NMTN-07776	SAV1024		1075800	1077158	1076464		
NMTN-02935	SAV1024		1075800	1077158	1076878		
NMTN-10003	SAV1024		1075800	1077158	1077128		
NMTN-14045	SAV1025		1077294	1078808	1077349	+	hypothetical protein
NMTN-07756	SAV1025		1077294	1078808	1077821		
NMTN-05509	SAV1025		1077294	1078808	1078181		
NMTN-12367	SAV1025		1077294	1078808	1078334		
NMTN-11551	SAV1025		1077294	1078808	1078335		
NMTN-07277	SAV1025		1077294	1078808	1078468		
NMTN-05273	SAV1025		1077294	1078808	1078471		
NMTN-07536	SAV1025		1077294	1078808	1078510		
NMTN-10599	SAV1025		1077294	1078808	1078657		
NMTN-15349	SAV1025		1077294	1078808	1078718		
NMTN-03801	SAV1028		1080372	1081358	1080677	-	lipoate-protein ligase homolog
NMTN-11919	SAV1028		1080372	1081358	1080742		
NMTN-10696	SAV1029		1081557	1081733	1081552	+	conserved hypothetical protein
NMTN-00658	SAV1028		1080372	1081358	1081555		
NMTN-13251	SAV1030		1081748	1082350	1081818	+	hypothetical protein
NMTN-04348	SAV1030		1081748	1082350	1081853		
NMTN-06826	SAV1030		1081748	1082350	1081863		
NMTN-14485	SAV1030		1081748	1082350	1081967		
NMTN-02390	SAV1030		1081748	1082350	1082193		
NMTN-12523	SAV1030		1081748	1082350	1082291		
NMTN-02382	SAV1030		1081748	1082350	1082324		
NMTN-07020	SAV1030		1081748	1082350	1082327		
NMTN-05080	SAV1031		1082559	1082720	1082588	+	hypothetical protein
NMTN-02673	SAV1032		1083377	1083649	1083634	+	hypothetical protein
NMTN-00554	SAV1033		1083693	1085657	1083753	+	hypothetical protein
NMTN-14601	SAV1033		1083693	1085657	1083760		
NMTN-11250	SAV1033		1083693	1085657	1083942		
NMTN-02898	SAV1033		1083693	1085657	1083943		
NMTN-04931	SAV1033		1083693	1085657	1083943		
NMTN-12762	SAV1033		1083693	1085657	1084131		
NMTN-09504	SAV1033		1083693	1085657	1084389		
NMTN-10255	SAV1033		1083693	1085657	1084518		
NMTN-13829	SAV1033		1083693	1085657	1085122		
NMTN-01790	SAV1033		1083693	1085657	1085125		
NMTN-13563	SAV1033		1083693	1085657	1085309		
NMTN-08413	SAV1033		1083693	1085657	1085400		
NMTN-05363	SAV1033		1083693	1085657	1085499		
NMTN-06660	SAV1033		1083693	1085657	1085500		
NMTN-13234	SAV1034		1085660	1085980	1085945	+	conserved hypothetical protein
NMTN-03633	SAV1035		1085977	1086618	1086113	+	conserved hypothetical protein
NMTN-13696	SAV1037		1087363	1087719	1087706	-	conserved hypothetical protein
NMTN-13696	SAV1037		1087363	1087719	1087706		
NMTN-07906	SAV1038		1088207	1089166	1088926	+	hypothetical protein
NMTN-00261	SAV1039		1089407	1089622	1089571	-	hypothetical protein
NMTN-03175	SAV1039		1089407	1089622	1089612		
NMTN-05328	SAV1040		1089787	1090338	1089982	+	conserved hypothetical protein
NMTN-12607	SAV1040		1089787	1090338	1090002		
NMTN-03688	SAV1040		1089787	1090338	1090205		
NMTN-11267	SAV1043	menD	1092858	1094531	1093227	+	menaquinone biosynthesis protein
NMTN-08028	SAV1044		1094518	1095321	1094882	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09687	SAV1044		1094518	1095321	1095210		
NMTN-07533	SAV1044		1094518	1095321	1095216		
NMTN-12636	SAV1046	sspC	1096373	1096702	1096475	-	cysteine protease
NMTN-04732	SAV1046	sspC	1096373	1096702	1096648		
NMTN-01572	SAV1047	sspB	1096740	1097921	1096796	-	cysteine protease precursor
NMTN-10512	SAV1047	sspB	1096740	1097921	1097641		
NMTN-13070	SAV1048	sspA	1098003	1099031	1098494	-	serine protease
NMTN-03465	SAV1049		1099559	1100713	1099837	-	HisC homolog
NMTN-09873	SAV1049		1099559	1100713	1099935		
NMTN-12250	SAV1049		1099559	1100713	1100562		
NMTN-13484	SAV1050		1100909	1101919	1101113	-	conserved hypothetical protein
NMTN-13489	SAV1050		1100909	1101919	1101113		
NMTN-02963	SAV1050		1100909	1101919	1101137		
NMTN-08146	SAV1050		1100909	1101919	1101216		
NMTN-12951	SAV1050		1100909	1101919	1101384		
NMTN-02744	SAV1050		1100909	1101919	1101716		
NMTN-12102	SAV1052	truncated-atl	1102698	1103504	1102803	-	partial autolysin
NMTN-12110	SAV1052	truncated-atl	1102698	1103504	1102803		
NMTN-12112	SAV1052	truncated-atl	1102698	1103504	1102803		
NMTN-12121	SAV1052	truncated-atl	1102698	1103504	1102803		
NMTN-12103	SAV1052	truncated-atl	1102698	1103504	1102805		
NMTN-07710	SAV1052	truncated-atl	1102698	1103504	1102903		
NMTN-06238	SAV1052	truncated-atl	1102698	1103504	1103419		
NMTN-03732	SAV1053	atl	1103624	1106455	1104246	-	autolysin
NMTN-11530	SAV1053	atl	1103624	1106455	1104698		
NMTN-10038	SAV1053	atl	1103624	1106455	1105626		
NMTN-04043	SAV1053	atl	1103624	1106455	1105876		
NMTN-04970	SAV1053	atl	1103624	1106455	1106091		
NMTN-06233	SAV1054		1106662	1107096	1106723	-	conserved hypothetical protein
NMTN-10201	SAV1054		1106662	1107096	1107031		
NMTN-10442	SAV1057	fnt	1109437	1110630	1109757	+	autolysis and methicillin resistant-related protein
NMTN-06459	SAV1057	fnt	1109437	1110630	1109972		
NMTN-13704	SAV1057	fnt	1109437	1110630	1110340		
NMTN-05261	SAV1057	fnt	1109437	1110630	1110435		
NMTN-02055	SAV1060	qoxB	1112049	1114037	1112432	-	Quinol oxidase polypeptide I
NMTN-02302	SAV1060	qoxB	1112049	1114037	1112818		
NMTN-00741	SAV1062		1115708	1116025	1115721	-	hypothetical protein
NMTN-05543	SAV1062		1115708	1116025	1115726		
NMTN-02380	SAV1064		1117950	1118432	1118021	+	hypothetical protein
NMTN-14653	SAV1064		1117950	1118432	1118164		
NMTN-05091	SAV1065	purK	1118419	1119543	1118592	+	phosphoribosylaminoimidazole carboxylase carbon dioxide-fixation chain PurK homolog
NMTN-04806	SAV1065	purK	1118419	1119543	1118948		
NMTN-02006	SAV1065	purK	1118419	1119543	1119008		
NMTN-12746	SAV1065	purK	1118419	1119543	1119425		
NMTN-02393	SAV1065	purK	1118419	1119543	1119496		
NMTN-03769	SAV1065	purK	1118419	1119543	1119515		
NMTN-02924	SAV1066	purC	1119547	1120251	1119556	+	phosphoribosylaminoimidazolesuccinocarboxamide synthetase homolog
NMTN-06530	SAV1066	purC	1119547	1120251	1119556		
NMTN-01626	SAV1066	purC	1119547	1120251	1119707		
NMTN-08758	SAV1066	purC	1119547	1120251	1120043		
NMTN-01946	SAV1066	purC	1119547	1120251	1120127		
NMTN-07718	SAV1066	purC	1119547	1120251	1120180		
NMTN-02602	SAV1066	purC	1119547	1120251	1120181		
NMTN-12894	SAV1067		1120251	1120514	1120335	+	conserved hypothetical protein
NMTN-05399	SAV1068	purQ	1120516	1121187	1120616	+	phosphoribosylformylglycinamide synthase I
NMTN-06147	SAV1068	purQ	1120516	1121187	1121074		
NMTN-02002	SAV1069	purL	1121180	1123369	1122317	+	phosphoribosylformylglycinamide synthetase
NMTN-08158	SAV1069	purL	1121180	1123369	1122385		
NMTN-05314	SAV1069	purL	1121180	1123369	1122420		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-10940	SAV1069	purL	1121180	1123369	1122429		
NMTN-07153	SAV1069	purL	1121180	1123369	1122782		
NMTN-03227	SAV1069	purL	1121180	1123369	1123314		
NMTN-09570	SAV1069	purL	1121180	1123369	1123328		
NMTN-04992	SAV1070	purF	1123348	1124832	1123425	+	phosphoribosylpyrophosphate amidotransferase
NMTN-12566	SAV1070	purF	1123348	1124832	1123425		
NMTN-03038	SAV1070	purF	1123348	1124832	1123428		
NMTN-13190	SAV1070	purF	1123348	1124832	1124030		
NMTN-09228	SAV1070	purF	1123348	1124832	1124063		
NMTN-05294	SAV1070	purF	1123348	1124832	1124102		
NMTN-03419	SAV1070	purF	1123348	1124832	1124321		
NMTN-10821	SAV1070	purF	1123348	1124832	1124641		
NMTN-00869	SAV1070	purF	1123348	1124832	1124676		
NMTN-06381	SAV1071	purM	1124825	1125853	1125171	+	phosphoribosylformylglycinamide cyclo-ligase
NMTN-03863	SAV1071	purM	1124825	1125853	1125468		
NMTN-07785	SAV1072	purN	1125856	1126422	1126030	+	phosphoribosylglycinamide formyltransferase
NMTN-07721	SAV1072	purN	1125856	1126422	1126066		
NMTN-12649	SAV1073	purH	1126434	1127915	1126431	+	bifunctional purine biosynthesis protein
NMTN-04103	SAV1073	purH	1126434	1127915	1126528		
NMTN-10455	SAV1073	purH	1126434	1127915	1126546		
NMTN-11708	SAV1073	purH	1126434	1127915	1126710		
NMTN-02356	SAV1073	purH	1126434	1127915	1126902		
NMTN-02573	SAV1073	purH	1126434	1127915	1126930		
NMTN-02443	SAV1073	purH	1126434	1127915	1127238		
NMTN-02394	SAV1073	purH	1126434	1127915	1127394		
NMTN-10721	SAV1074	purD	1128045	1129184	1128409	+	phosphoribosylamine-glycine ligase
NMTN-09084	SAV1074	purD	1128045	1129184	1128571		
NMTN-03896	SAV1074	purD	1128045	1129184	1128966		
NMTN-06507	SAV1074	purD	1128045	1129184	1128966		
NMTN-11668	SAV1075		1129452	1130258	1129567	-	conserved hypothetical protein
NMTN-12839	SAV1075		1129452	1130258	1129682		
NMTN-12178	SAV1075		1129452	1130258	1129685		
NMTN-03789	SAV1075		1129452	1130258	1130162		
NMTN-06360	SAV1075		1129452	1130258	1130209		
NMTN-11127	SAV1076		1130251	1131651	1130672	-	hypothetical protein
NMTN-12840	SAV1076		1130251	1131651	1130992		
NMTN-05649	SAV1076		1130251	1131651	1131043		
NMTN-13746	SAV1077		1131666	1132241	1131846	-	conserved hypothetical protein
NMTN-07237	SAV1081		1135082	1136254	1135421	+	conserved hypothetical protein
NMTN-12731	SAV1081		1135082	1136254	1135935		
NMTN-00570	SAV1081		1135082	1136254	1136066		
NMTN-03266	SAV1081		1135082	1136254	1136089		
NMTN-09129	SAV1081		1135082	1136254	1136115		
NMTN-00870	SAV1084	ptsI	1137273	1138991	1137354	+	phosphoenolpyruvate-protein phosphatase
NMTN-13743	SAV1086		1139659	1141020	1139801	+	cytochrome D ubiquinol oxidase subunit I homolog
NMTN-07264	SAV1086		1139659	1141020	1140004		
NMTN-14450	SAV1086		1139659	1141020	1140055		
NMTN-06439	SAV1086		1139659	1141020	1140161		
NMTN-14445d	SAV1086		1139659	1141020	1140548		
NMTN-10388	SAV1086		1139659	1141020	1140997		
NMTN-07732d	SAV1086		1139659	1141020	1141027		
NMTN-07732d	SAV1087		1141017	1142036	1141027	+	cytochrome D ubiquinol oxidase subunit II homolog
NMTN-08761	SAV1087		1141017	1142036	1141414		
NMTN-13858	SAV1087		1141017	1142036	1141422		
NMTN-13642	SAV1087		1141017	1142036	1141426		
NMTN-02588	SAV1087		1141017	1142036	1141444		
NMTN-10071	SAV1087		1141017	1142036	1141665		
NMTN-09898	SAV1087		1141017	1142036	1141671		
NMTN-07272	SAV1087		1141017	1142036	1141901		
NMTN-09917	SAV1088		1142169	1142831	1142405	+	conserved hypothetical protein
NMTN-11316	SAV1088		1142169	1142831	1142689		
NMTN-01837	SAV1089		1143077	1144774	1143081	-	conserved hypothetical protein
NMTN-01838	SAV1089		1143077	1144774	1143081		
NMTN-06252	SAV1092		1146390	1147016	1146420	+	conserved hypothetical protein
NMTN-04761	SAV1092		1146390	1147016	1146826		
NMTN-08841c	SAV1092		1146390	1147016	1146899		
NMTN-02453	SAV1092		1146390	1147016	1146952		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-10868	SAV1094	phdB	1148303	1149280	1148326	+	pyruvate dehydrogenase E1 component beta subunit
NMTN-14671	SAV1096	pdhD	1150667	1152073	1151889	+	dihydrolipoamide dehydrogenase component of pyruvate dehydrogenase E3
NMTN-04312	SAV1098		1152660	1153199	1152673	+	conserved hypothetical protein
NMTN-11380	SAV1098		1152660	1153199	1153045		
NMTN-08945	SAV1098		1152660	1153199	1153174		
NMTN-11872	SAV1100	potB	1154299	1155096	1154309	+	spermidine/putrescine ABC transporter homolog
NMTN-13250	SAV1100	potB	1154299	1155096	1154351		
NMTN-11647d	SAV1100	potB	1154299	1155096	1154357		
NMTN-12516	SAV1100	potB	1154299	1155096	1155032		
NMTN-12133	SAV1101	potC	1155102	1155911	1155531	+	spermidine/putrescine ABC transporter homolog
NMTN-13079	SAV1102	potD	1155911	1156984	1155989	+	spermidine/putrescine-binding protein precursor homolog
NMTN-02669	SAV1102	potD	1155911	1156984	1156344		
NMTN-06164	SAV1104		1158360	1158779	1158409	+	hypothetical protein
NMTN-06070	SAV1105		1158858	1160210	1159058	-	hypothetical protein
NMTN-03662	SAV1105		1158858	1160210	1159882		
NMTN-08986	SAV1108		1162146	1162337	1162144	-	hypothetical protein
NMTN-12645	SAV1108		1162146	1162337	1162219		
NMTN-02729	SAV1109		1162439	1164286	1162970	+	GTP-binding elongation factor homologue
NMTN-04029	SAV1109		1162439	1164286	1163027		
NMTN-08961	SAV1109		1162439	1164286	1163361		
NMTN-12684	SAV1109		1162439	1164286	1163565		
NMTN-09092	SAV1109		1162439	1164286	1163754		
NMTN-03460	SAV1109		1162439	1164286	1163975		
NMTN-11571	SAV1109		1162439	1164286	1164012		
NMTN-06499	SAV1110		1164426	1164593	1164481	-	conserved hypothetical protein
NMTN-04166	SAV1111		1164595	1165077	1164615	-	conserved hypothetical protein
NMTN-06069	SAV1111		1164595	1165077	1164615		
NMTN-07725	SAV1111		1164595	1165077	1164720		
NMTN-01941	SAV1111		1164595	1165077	1164732		
NMTN-09768	SAV1112		1165218	1165493	1165303	+	conserved hypothetical protein
NMTN-12949	SAV1114	pycA	1167587	1171039	1167639	+	pyruvate carboxylase
NMTN-03965	SAV1114	pycA	1167587	1171039	1168983		
NMTN-04475	SAV1114	pycA	1167587	1171039	1169007		
NMTN-02885	SAV1114	pycA	1167587	1171039	1169344		
NMTN-07821	SAV1114	pycA	1167587	1171039	1169483		
NMTN-03778	SAV1114	pycA	1167587	1171039	1169690		
NMTN-06263	SAV1114	pycA	1167587	1171039	1169840		
NMTN-06749	SAV1114	pycA	1167587	1171039	1170523		
NMTN-14423	SAV1115		1171179	1172090	1171447	-	hypothetical protein
NMTN-02477	SAV1117		1173466	1173927	1173740	+	conserved hypothetical protein
NMTN-00441	SAV1118		1174254	1175291	1174272	+	conserved hypothetical protein
NMTN-09283	SAV1121		1175802	1176728	1175912	-	hypothetical protein
NMTN-01940	SAV1121		1175802	1176728	1176202		
NMTN-04298	SAV1121		1175802	1176728	1176307		
NMTN-03807	SAV1121		1175802	1176728	1176643		
NMTN-04820	SAV1122		1176967	1177221	1176992	+	conserved hypothetical protein
NMTN-05249	SAV1122		1176967	1177221	1176994		
NMTN-07870	SAV1122		1176967	1177221	1177184		
NMTN-12232	SAV1123		1177224	1177613	1177529	-	conserved hypothetical protein
NMTN-07969	SAV1126		1178771	1179910	1179699	-	conserved hypothetical protein
NMTN-11795	SAV1126		1178771	1179910	1179764		
NMTN-06230	SAV1127		1180037	1180594	1180224	+	conserved hypothetical protein
NMTN-11478	SAV1127		1180037	1180594	1180315		
NMTN-06622	SAV1127		1180037	1180594	1180356		
NMTN-10902	SAV1127		1180037	1180594	1180577		
NMTN-06127	SAV1129		1181001	1182938	1181169	-	conserved hypothetical protein
NMTN-02671	SAV1129		1181001	1182938	1181660		
NMTN-06572	SAV1129		1181001	1182938	1181698		
NMTN-05059	SAV1129		1181001	1182938	1181880		
NMTN-04990	SAV1129		1181001	1182938	1181892		
NMTN-12075	SAV1129		1181001	1182938	1182881		
NMTN-12628	SAV1130		1183141	1184193	1183685	-	cell surface protein
NMTN-01954	SAV1130		1183141	1184193	1184167		
NMTN-09284	SAV1131		1184402	1185085	1184758	+	conserved hypothetical protein
NMTN-09597	SAV1131		1184402	1185085	1185000		
NMTN-12630	SAV1131		1184402	1185085	1185001		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03054	SAV1132		1185085	1186161	1185121	+	conserved hypothetical protein
NMTN-04382	SAV1132		1185085	1186161	1185241		
NMTN-03458	SAV1133		1186158	1187036	1186708	+	hypothetical protein
NMTN-13865	SAV1133		1186158	1187036	1186776		
NMTN-12849	SAV1134		1187193	1188014	1187628	+	hypothetical protein
NMTN-03811	SAV1135		1188076	1188810	1188101	+	conserved hypothetical protein
NMTN-01454	SAV1135		1188076	1188810	1188401		
NMTN-11757	SAV1135		1188076	1188810	1188615		
NMTN-06585	SAV1136		1188838	1189152	1188874	+	conserved hypothetical protein
NMTN-13688	SAV1136		1188838	1189152	1189129		
NMTN-05067	SAV1136		1188838	1189152	1189143		
NMTN-04124	SAV1137		1189536	1190276	1190143	+	hypothetical protein
NMTN-06200	SAV1142		1196123	1196644	1196202	+	conserved hypothetical protein
NMTN-11954	SAV1142		1196123	1196644	1196204		
NMTN-04007	SAV1142		1196123	1196644	1196408		
NMTN-11871	SAV1143		1196717	1198429	1196764	+	DNA-dependent DNA polymerase beta chain
NMTN-11643	SAV1143		1196717	1198429	1197614		
NMTN-00668	SAV1143		1196717	1198429	1197690		
NMTN-06925	SAV1143		1196717	1198429	1197704		
NMTN-05571	SAV1143		1196717	1198429	1197903		
NMTN-05516	SAV1143		1196717	1198429	1197947		
NMTN-03259	SAV1143		1196717	1198429	1198100		
NMTN-02361	SAV1143		1196717	1198429	1198392		
NMTN-09072	SAV1144	mutS2	1198439	1200787	1198756	+	MutS-like protein
NMTN-05614	SAV1144	mutS2	1198439	1200787	1199207		
NMTN-06846	SAV1144	mutS2	1198439	1200787	1199667		
NMTN-06694	SAV1144	mutS2	1198439	1200787	1199670		
NMTN-14509	SAV1144	mutS2	1198439	1200787	1200027		
NMTN-10908	SAV1144	mutS2	1198439	1200787	1200210		
NMTN-05356	SAV1146	uvrC	1201598	1203379	1201647	+	excinuclease ABC subunit C
NMTN-04650	SAV1146	uvrC	1201598	1203379	1201693		
NMTN-01981	SAV1146	uvrC	1201598	1203379	1201787		
NMTN-12597	SAV1146	uvrC	1201598	1203379	1201873		
NMTN-05099	SAV1146	uvrC	1201598	1203379	1202033		
NMTN-03025	SAV1146	uvrC	1201598	1203379	1203080		
NMTN-06914	SAV1147	sdhC	1203703	1204317	1203326	+	succinate dehydrogenase cytochrome b-558
NMTN-02502	SAV1147	sdhC	1203703	1204317	1203845		
NMTN-10669	SAV1147	sdhC	1203703	1204317	1203886		
NMTN-09169	SAV1148	sdhA	1204369	1206135	1204726	+	succinate dehydrogenase flavoprotein subunit
NMTN-12329	SAV1148	sdhA	1204369	1206135	1204774		
NMTN-12873	SAV1148	sdhA	1204369	1206135	1204777		
NMTN-02471	SAV1148	sdhA	1204369	1206135	1205102		
NMTN-01442	SAV1148	sdhA	1204369	1206135	1205296		
NMTN-07394	SAV1150	sdhB	1206150	1206455	1206402	+	iron-sulphur subunit of succinate dehydrogenase
NMTN-04085	SAV1150	sdhB	1206359	1206949	1206782	+	iron-sulphur subunit of succinate dehydrogenase
NMTN-02844	SAV1152		1207997	1208584	1208243	+	conserved hypothetical protein
NMTN-11877	SAV1153		1208577	1209080	1208843	+	conserved hypothetical protein
NMTN-05369	SAV1153		1208577	1209080	1208896		
NMTN-13803	SAV1157		1211338	1211844	1211576	+	hypothetical protein
NMTN-03597	SAV1158		1212104	1212601	1212282	+	hypothetical protein
NMTN-11961	SAV1159		1212751	1213101	1212934	+	hypothetical protein
NMTN-11602	SAV1163		1216904	1217863	1217039	-	alpha-hemolysin precursor
NMTN-02140	SAV1163		1216904	1217863	1217218		
NMTN-11832	SAV1163		1216904	1217863	1217451		
NMTN-11217	SAV1163		1216904	1217863	1217666		
NMTN-11568	SAV1163		1216904	1217863	1217751		
NMTN-01440	SAV1166		1219400	1220116	1219631	-	hypothetical protein
NMTN-10229	SAV1168		1221044	1221769	1221223	-	hypothetical protein
NMTN-11955	SAV1168		1221044	1221769	1221552		
NMTN-11698	SAV1168		1221044	1221769	1221633		
NMTN-05014	SAV1169	argF	1222207	1223208	1222304	+	ornithine carbamoyltransferase
NMTN-05018	SAV1169	argF	1222207	1223208	1222304		
NMTN-05048	SAV1169	argF	1222207	1223208	1222304		
NMTN-05050	SAV1169	argF	1222207	1223208	1222304		
NMTN-04450	SAV1169	argF	1222207	1223208	1222683		
NMTN-12097	SAV1169	argF	1222207	1223208	1222967		
NMTN-12598	SAV1170		1223231	1224163	1223473	+	hypothetical protein
NMTN-11736	SAV1170		1223231	1224163	1223799		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11300	SAV1170		1223231	1224163	1223852		
NMTN-12554	SAV1171		1224335	1225891	1224728	+	conserved hypothetical protein
NMTN-04829	SAV1171		1224335	1225891	1225356		
NMTN-04830	SAV1171		1224335	1225891	1225356		
NMTN-06689	SAV1171		1224335	1225891	1225875		
NMTN-04507	SAV1172		1226198	1226425	1226286	+	hypothetical protein
NMTN-07029	SAV1173		1226731	1227678	1226742	-	conserved hypothetical protein
NMTN-00372	SAV1173		1226731	1227678	1226763		
NMTN-06420	SAV1173		1226731	1227678	1227038		
NMTN-06204	SAV1173		1226731	1227678	1227064		
NMTN-12273	SAV1173		1226731	1227678	1227067		
NMTN-11641	SAV1174		1227927	1228115	1227948	+	hypothetical protein
NMTN-07267	SAV1174		1227927	1228115	1227976		
NMTN-08529	SAV1174		1227927	1228115	1227976		
NMTN-08918	SAV1175		1229478	1230164	1229836	+	conserved hypothetical protein
NMTN-08919	SAV1175		1229478	1230164	1229836		
NMTN-08920	SAV1175		1229478	1230164	1229836		
NMTN-08928	SAV1175		1229478	1230164	1229836		
NMTN-08929	SAV1175		1229478	1230164	1229836		
NMTN-08931	SAV1175		1229478	1230164	1229836		
NMTN-08932	SAV1175		1229478	1230164	1229836		
NMTN-08933	SAV1175		1229478	1230164	1229836		
NMTN-08934	SAV1175		1229478	1230164	1229836		
NMTN-08935	SAV1175		1229478	1230164	1229836		
NMTN-08936	SAV1175		1229478	1230164	1229836		
NMTN-08938	SAV1175		1229478	1230164	1229836		
NMTN-08939	SAV1175		1229478	1230164	1229836		
NMTN-08940	SAV1175		1229478	1230164	1229836		
NMTN-08941	SAV1175		1229478	1230164	1229836		
NMTN-08943	SAV1175		1229478	1230164	1229836		
NMTN-08944	SAV1175		1229478	1230164	1229836		
NMTN-08946	SAV1175		1229478	1230164	1229836		
NMTN-08947	SAV1175		1229478	1230164	1229836		
NMTN-08949	SAV1175		1229478	1230164	1229836		
NMTN-08950	SAV1175		1229478	1230164	1229836		
NMTN-08951	SAV1175		1229478	1230164	1229836		
NMTN-08952	SAV1175		1229478	1230164	1229836		
NMTN-08954	SAV1175		1229478	1230164	1229836		
NMTN-08955	SAV1175		1229478	1230164	1229836		
NMTN-08956	SAV1175		1229478	1230164	1229836		
NMTN-08957	SAV1175		1229478	1230164	1229836		
NMTN-08958	SAV1175		1229478	1230164	1229836		
NMTN-08959	SAV1175		1229478	1230164	1229836		
NMTN-09081	SAV1175		1229478	1230164	1229836		
NMTN-09082	SAV1175		1229478	1230164	1229836		
NMTN-09083	SAV1175		1229478	1230164	1229836		
NMTN-09091	SAV1175		1229478	1230164	1229836		
NMTN-09093	SAV1175		1229478	1230164	1229836		
NMTN-09095	SAV1175		1229478	1230164	1229836		
NMTN-09096	SAV1175		1229478	1230164	1229836		
NMTN-09097	SAV1175		1229478	1230164	1229836		
NMTN-09100	SAV1175		1229478	1230164	1229836		
NMTN-09101	SAV1175		1229478	1230164	1229836		
NMTN-09102	SAV1175		1229478	1230164	1229836		
NMTN-09103	SAV1175		1229478	1230164	1229836		
NMTN-09104	SAV1175		1229478	1230164	1229836		
NMTN-09105	SAV1175		1229478	1230164	1229836		
NMTN-09106	SAV1175		1229478	1230164	1229836		
NMTN-09109	SAV1175		1229478	1230164	1229836		
NMTN-06915	SAV1175		1229478	1230164	1230042		
NMTN-07410	SAV1176		1230268	1230714	1230612	-	conserved hypothetical protein
NMTN-10530	SAV1176		1230268	1230714	1230726		
NMTN-12322	SAV1177		1230909	1232522	1231486	+	conserved hypothetical protein
NMTN-07527	SAV1177		1230909	1232522	1231768		
NMTN-13027	SAV1177		1230909	1232522	1231838		
NMTN-04044	SAV1177		1230909	1232522	1231995		
NMTN-10949	SAV1190		1245659	1245949	1245660	+	conserved hypothetical protein
NMTN-14291	SAV1191		1246200	1246838	1246431	+	hypothetical protein
NMTN-12315	SAV1191		1246200	1246838	1246830		
NMTN-00715	SAV1194		1250744	1251541	1251295	+	conserved hypothetical protein
NMTN-00857	SAV1194		1250744	1251541	1251433		
NMTN-02459	SAV1196	lsp	1252365	1252856	1252794	+	lipoprotein signal peptidase
NMTN-00656	SAV1201	pyrC	1257152	1258426	1257410	+	dihydroorotase

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-02980	SAV1201	pyrC	1257152	1258426	1258344		
NMTN-00609	SAV1201	pyrC	1257152	1258426	1258423		
NMTN-11122	SAV1202	pyrAA	1258428	1259528	1259074	+	carbamoyl-phosphate synthase small chain
NMTN-00678	SAV1202	pyrAA	1258428	1259528	1259466		
NMTN-02887	SAV1203	pyrAB	1259521	1262694	1259715	+	carbamoyl-phosphate synthase large chain
NMTN-04659	SAV1203	pyrAB	1259521	1262694	1259715		
NMTN-05220	SAV1203	pyrAB	1259521	1262694	1259715		
NMTN-03401	SAV1203	pyrAB	1259521	1262694	1260071		
NMTN-04640	SAV1203	pyrAB	1259521	1262694	1260211		
NMTN-02298	SAV1203	pyrAB	1259521	1262694	1260215		
NMTN-13691	SAV1203	pyrAB	1259521	1262694	1260327		
NMTN-10041	SAV1203	pyrAB	1259521	1262694	1260470		
NMTN-05726	SAV1203	pyrAB	1259521	1262694	1261633		
NMTN-05191	SAV1203	pyrAB	1259521	1262694	1261835		
NMTN-08897	SAV1203	pyrAB	1259521	1262694	1262037		
NMTN-12249	SAV1204	pyrF	1262804	1263496	1262800	+	orotidine-5-phosphate decarboxylase
NMTN-02904	SAV1205	pyrE	1263496	1264107	1263564	+	orotate phosphoribosyltransferase
NMTN-12091	SAV1206		1264137	1264349	1264167	+	hypothetical protein
NMTN-03984	SAV1206		1264137	1264349	1264282		
NMTN-04888	SAV1207		1264786	1265187	1264966	+	conserved hypothetical protein
NMTN-05132	SAV1208		1265450	1267147	1265761	-	hypothetical protein
NMTN-00463	SAV1208		1265450	1267147	1265800		
NMTN-04917	SAV1208		1265450	1267147	1265955		
NMTN-13392	SAV1208		1265450	1267147	1266144		
NMTN-09798	SAV1208		1265450	1267147	1266753		
NMTN-09735	SAV1213		1272592	1273545	1273265	+	hypothetical protein
NMTN-10522	SAV1213		1272592	1273545	1273363		
NMTN-00197	SAV1217		1275545	1276930	1275792	+	hypothetical protein
NMTN-00392	SAV1217		1275545	1276930	1275792		
NMTN-10603	SAV1217		1275545	1276930	1276244		
NMTN-07201	SAV1217		1275545	1276930	1276466		
NMTN-00032	SAV1218		1276933	1278027	1276936	+	conserved hypothetical protein
NMTN-14673d	SAV1219		1278034	1278777	1278278	+	conserved hypothetical protein
NMTN-10712	SAV1220		1278774	1280768	1280320	+	protein kinase
NMTN-06272	SAV1220		1278774	1280768	1280509		
NMTN-03940	SAV1220		1278774	1280768	1280550		
NMTN-12600	SAV1221		1280996	1281871	1281812	+	conserved hypothetical protein
NMTN-06693	SAV1224	rpmB	1283545	1283733	1283538	-	50S ribosomal protein L28
NMTN-12416	SAV1224	rpmB	1283545	1283733	1283647		
NMTN-11428	SAV1224	rpmB	1283545	1283733	1283651		
NMTN-00020	SAV1226		1284565	1286211	1284835	+	conserved hypothetical protein
NMTN-11173	SAV1227	recG	1286401	1288461	1287281	+	ATP-dependent DNA helicase
NMTN-10001	SAV1233	rnc	1292657	1293388	1293361	+	RNase III
NMTN-10529	SAV1234	smc	1293535	1297101	1297053	+	chromosome segregation SMC protein
NMTN-11999	SAV1240	tmmD	1301464	1302201	1302184	+	tRNA-methyltransferase
NMTN-09294	SAV1241	rplS	1302305	1302655	1302627	+	50S ribosomal protein L19
NMTN-13189	SAV1242		1302899	1305505	1302963	-	conserved hypothetical protein
NMTN-00744	SAV1242		1302899	1305505	1303982		
NMTN-05179	SAV1242		1302899	1305505	1304880		
NMTN-06465	SAV1242		1302899	1305505	1305335		
NMTN-06435	SAV1242		1302899	1305505	1305460		
NMTN-01541	SAV1244	rmhB	1306774	1307541	1306938	+	RNase HIII
NMTN-02806	SAV1244	rmhB	1306774	1307541	1307114		
NMTN-02853	SAV1244	rmhB	1306774	1307541	1307391		
NMTN-00594	SAV1247	lytN	1309974	1311092	1310749	+	LytN protein
NMTN-10497	SAV1247	lytN	1309974	1311092	1310945		
NMTN-11340	SAV1248	fihC (epri)	1311120	1312364	1311487	+	FihC protein
NMTN-12196	SAV1248	fihC (epri)	1311120	1312364	1311812		
NMTN-11358	SAV1248	fihC (epri)	1311120	1312364	1311831		
NMTN-12808	SAV1248	fihC (epri)	1311120	1312364	1311837		
NMTN-02920	SAV1248	fihC (epri)	1311120	1312364	1311865		
NMTN-12758	SAV1248	fihC (epri)	1311120	1312364	1311987		
NMTN-10449	SAV1248	fihC (epri)	1311120	1312364	1312099		
NMTN-06190	SAV1249		1312537	1313409	1312874	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12222	SAV1249		1312537	1313409	1312917		
NMTN-09503	SAV1249		1312537	1313409	1313153		
NMTN-03537	SAV1250		1313589	1315658	1315620	+	DNA topoisomerase I topA homologue
NMTN-03112	SAV1250		1313589	1315658	1315658		
NMTN-03407	SAV1251	gid	1315814	1317121	1315967	+	glucose-inhibited division protein gid
NMTN-01735	SAV1251	gid	1315814	1317121	1316731		
NMTN-01736	SAV1251	gid	1315814	1317121	1316731		
NMTN-09425	SAV1270	rbfA	1339660	1340010	1339993	+	ribosome-binding factor A
NMTN-02315	SAV1271	truB	1340179	1341096	1340184	+	tRNA pseudouridine 5S synthase
NMTN-13097	SAV1271	truB	1340179	1341096	1340762		
NMTN-10021	SAV1274	pnpA	1342835	1344931	1343059	+	polyribonucleotide nucleotidyltransferase
NMTN-05451	SAV1274	pnpA	1342835	1344931	1344453		
NMTN-12736	SAV1274	pnpA	1342835	1344931	1344491		
NMTN-05375	SAV1274	pnpA	1342835	1344931	1344627		
NMTN-04554	SAV1274	pnpA	1342835	1344931	1344748		
NMTN-10926	SAV1278		1350212	1351477	1350412	+	hypothetical protein
NMTN-09580	SAV1278		1350212	1351477	1350748		
NMTN-14030	SAV1279		1351477	1352763	1352044	+	hypothetical protein
NMTN-04737	SAV1280		1352763	1353467	1352990	+	hypothetical protein
NMTN-13632	SAV1280		1352763	1353467	1353336		
NMTN-14742	SAV1280		1352763	1353467	1353336		
NMTN-14747	SAV1280		1352763	1353467	1353336		
NMTN-08750	SAV1281		1353572	1354399	1353917	+	conserved hypothetical protein
NMTN-08622	SAV1281		1353572	1354399	1354117		
NMTN-01812	SAV1281		1353572	1354399	1354355		
NMTN-10468	SAV1284	cinA	1355646	1356797	1355941	+	competence-damage inducible protein
NMTN-06397	SAV1284	cinA	1355646	1356797	1356288		
NMTN-09773	SAV1284	cinA	1355646	1356797	1356424		
NMTN-12157	SAV1284	cinA	1355646	1356797	1356458		
NMTN-07371	SAV1289		1361541	1363301	1362828	+	hypothetical protein
NMTN-07373	SAV1289		1361541	1363301	1362828		
NMTN-07375	SAV1289		1361541	1363301	1362828		
NMTN-07376	SAV1289		1361541	1363301	1362828		
NMTN-07379	SAV1289		1361541	1363301	1362828		
NMTN-00206	SAV1292		1364689	1366233	1365344	+	conserved hypothetical protein
NMTN-09545	SAV1294		1366626	1367117	1366879	+	conserved hypothetical protein
NMTN-09387	SAV1294		1366626	1367117	1366891		
NMTN-04775	SAV1296	mutS	1367420	1370039	1367639	+	DNA mismatch repair protein
NMTN-00866	SAV1296	mutS	1367420	1370039	1367872		
NMTN-08510	SAV1296	mutS	1367420	1370039	1367953		
NMTN-09099	SAV1296	mutS	1367420	1370039	1368125		
NMTN-12900	SAV1296	mutS	1367420	1370039	1368125		
NMTN-06111	SAV1296	mutS	1367420	1370039	1368753		
NMTN-02925	SAV1296	mutS	1367420	1370039	1368850		
NMTN-06063	SAV1296	mutS	1367420	1370039	1369035		
NMTN-02609	SAV1297	mutL	1370052	1372061	1370809	+	DNA mismatch repair protein
NMTN-01512	SAV1297	mutL	1370052	1372061	1370908		
NMTN-04409	SAV1297	mutL	1370052	1372061	1370928		
NMTN-13276	SAV1297	mutL	1370052	1372061	1371239		
NMTN-09150	SAV1297	mutL	1370052	1372061	1371642		
NMTN-11299	SAV1297	mutL	1370052	1372061	1371814		
NMTN-00722	SAV1298	glpP	1372076	1372609	1372217	+	glycerol uptake operon antiterminator regulatory protein
NMTN-06061	SAV1298	glpP	1372076	1372609	1372311		
NMTN-03936	SAV1298	glpP	1372076	1372609	1372454		
NMTN-11481	SAV1300	glpF	1373084	1373902	1373099	+	glycerol uptake facilitator
NMTN-11671	SAV1300	glpF	1373084	1373902	1373099		
NMTN-10519	SAV1301	glpK	1374031	1375527	1374048	+	glycerol kinase
NMTN-08840	SAV1301	glpK	1374031	1375527	1374822		
NMTN-05496	SAV1301	glpK	1374031	1375527	1375475		
NMTN-02025	SAV1302	glpD	1375637	1377358	1375894	+	aerobic glycerol-3-phosphate dehydrogenase
NMTN-09995	SAV1302	glpD	1375637	1377358	1376256		
NMTN-13128d	SAV1302	glpD	1375637	1377358	1376580		
NMTN-13156d	SAV1302	glpD	1375637	1377358	1376580		
NMTN-03791	SAV1302	glpD	1375637	1377358	1376626		
NMTN-06177	SAV1302	glpD	1375637	1377358	1376647		
NMTN-06192	SAV1302	glpD	1375637	1377358	1376647		
NMTN-06197	SAV1302	glpD	1375637	1377358	1376647		
NMTN-06199	SAV1302	glpD	1375637	1377358	1376647		
NMTN-14027	SAV1302	glpD	1375637	1377358	1376778		
NMTN-06537	SAV1302	glpD	1375637	1377358	1377026		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03553	SAV1302	glpD	1375637	1377358	1377286		
NMTN-09695	SAV1303		1377508	1378422	1378047	+	hypothetical protein
NMTN-09861	SAV1303		1377508	1378422	1378047		
NMTN-09845	SAV1303		1377508	1378422	1378102		
NMTN-06616	SAV1305		1379390	1379623	1379515	+	hypothetical protein
NMTN-09936	SAV1306	bsaA	1379844	1380320	1379863	-	glutathione peroxidase
NMTN-09947	SAV1306	bsaA	1379844	1380320	1379863		
NMTN-10045	SAV1306	bsaA	1379844	1380320	1379863		
NMTN-12421	SAV1306	bsaA	1379844	1380320	1380158		
NMTN-01741	SAV1306	bsaA	1379844	1380320	1380256		
NMTN-04164	SAV1306	bsaA	1379844	1380320	1380263		
NMTN-11511	SAV1307		1380432	1381670	1380428	+	hypothetical protein
NMTN-00270	SAV1307		1380432	1381670	1380589		
NMTN-07320	SAV1307		1380432	1381670	1381621		
NMTN-07044	SAV1308		1381689	1382927	1381830	+	hypothetical protein
NMTN-02357	SAV1308		1381689	1382927	1382922		
NMTN-01862	SAV1314		1390138	1390332	1390155	+	hypothetical protein
NMTN-00442	SAV1314		1390138	1390332	1390287		
NMTN-13465	SAV1315		1390876	1391901	1390898	-	conserved hypothetical protein
NMTN-03189	SAV1315		1390876	1391901	1391019		
NMTN-03808	SAV1315		1390876	1391901	1391298		
NMTN-12629	SAV1315		1390876	1391901	1391394		
NMTN-11842	SAV1315		1390876	1391901	1391480		
NMTN-07019	SAV1317		1392389	1393906	1392412		
NMTN-13732	SAV1317		1392389	1393906	1392510	+	cardiolipin synthetase homolog
NMTN-00201	SAV1317		1392389	1393906	1392904		
NMTN-04854	SAV1318		1394090	1394587	1394303	+	ABC transporter homolog
NMTN-12468	SAV1318		1394090	1394587	1394569		
NMTN-09053	SAV1319		1394612	1394989	1394776	+	ABC transporter homolog
NMTN-12683	SAV1319		1394612	1394989	1394961		
NMTN-12683	SAV1320		1394958	1395689	1394961	+	hypothetical protein
NMTN-06285	SAV1320		1394958	1395689	1395112		
NMTN-09497	SAV1320		1394958	1395689	1395570		
NMTN-06746	SAV1321		1395693	1396784	1395800	+	hypothetical protein
NMTN-11164	SAV1321		1395693	1396784	1395865		
NMTN-08492	SAV1321		1395693	1396784	1396199		
NMTN-01824	SAV1321		1395693	1396784	1396558		
NMTN-11466	SAV1322		1396781	1397383	1396849	+	hypothetical protein
NMTN-00021	SAV1323		1397496	1397684	1397665	-	hypothetical protein
NMTN-03258	SAV1324	nuc	1397823	1398356	1397880	+	thermonuclease
NMTN-06615	SAV1324	nuc	1397823	1398356	1397880		
NMTN-12295	SAV1324	nuc	1397823	1398356	1398202		
NMTN-14502	SAV1326		1399671	1400261	1399714	+	hypothetical protein
NMTN-12506	SAV1326		1399671	1400261	1399885		
NMTN-09502	SAV1326		1399671	1400261	1399955		
NMTN-08589	SAV1326		1399671	1400261	1400029		
NMTN-11769	SAV1326		1399671	1400261	1400035		
NMTN-04891	SAV1326		1399671	1400261	1400121		
NMTN-07790	SAV1327		1400315	1401697	1400366	-	aspartate kinase homolog
NMTN-13143	SAV1327		1400315	1401697	1401124		
NMTN-03196	SAV1327		1400315	1401697	1401127		
NMTN-05492	SAV1327		1400315	1401697	1401128		
NMTN-11351	SAV1327		1400315	1401697	1401223		
NMTN-09599	SAV1327		1400315	1401697	1401352		
NMTN-11942	SAV1328	dhoM	1401888	1403168	1401982	+	homoserine dehydrogenase
NMTN-12625	SAV1329	thrC	1403174	1404235	1403597	+	threonine synthase
NMTN-09336	SAV1330	thrB	1404237	1405151	1404938	+	homoserine kinase homolog
NMTN-11455	SAV1331		1405209	1406012	1405348	+	conserved hypothetical protein
NMTN-10079	SAV1331		1405209	1406012	1405960		
NMTN-00210	SAV1332		1406305	1406619	1406361	-	hypothetical protein
NMTN-03920	SAV1333		1406837	1408291	1407265	-	gamma-aminobutyrate permease
NMTN-08285	SAV1333		1406837	1408291	1407275		
NMTN-12837	SAV1333		1406837	1408291	1407499		
NMTN-07353	SAV1334	katA	1408489	1410012	1409716	+	catalase
NMTN-12739	SAV1335	rpmG	1410103	1410252	1410230	+	50S ribosomal protein L33
NMTN-06121	SAV1336	rpsN	1410706	1410975	1410784	+	30S ribosomal protein S14 homolog
NMTN-10812	SAV1336	rpsN	1410706	1410975	1410914		
NMTN-10673	SAV1337		1411132	1412109	1411162	+	hypothetical protein
NMTN-03569	SAV1337		1411132	1412109	1411547		
NMTN-05206	SAV1337		1411132	1412109	1411713		
NMTN-13756	SAV1337		1411132	1412109	1411822		
NMTN-08926	SAV1337		1411132	1412109	1411890		
NMTN-12890	SAV1337		1411132	1412109	1411964		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-05032	SAV1338		1412131	1413147	1412387	+	conserved hypothetical protein
NMTN-05025	SAV1338		1412131	1413147	1412390		
NMTN-12269	SAV1338		1412131	1413147	1412484		
NMTN-06936	SAV1338		1412131	1413147	1412612		
NMTN-08135	SAV1338		1412131	1413147	1412854		
NMTN-06117	SAV1338		1412131	1413147	1412867		
NMTN-04545	SAV1340		1414293	1414526	1414328	+	hypothetical protein
NMTN-10517	SAV1341		1414663	1414902	1414726	+	conserved hypothetical protein
NMTN-09392	SAV1344		1417715	1418182	1418148	+	conserved hypothetical protein
NMTN-05227	SAV1345		1418305	1419426	1418338	+	hypothetical protein
NMTN-03935	SAV1345		1418305	1419426	1418474		
NMTN-11156	SAV1345		1418305	1419426	1419070		
NMTN-13069	SAV1346		1419430	1422459	1419732	+	hypothetical protein
NMTN-11888	SAV1346		1419430	1422459	1419734		
NMTN-00220	SAV1346		1419430	1422459	1421693		
NMTN-00491	SAV1346		1419430	1422459	1421693		
NMTN-08249	SAV1346		1419430	1422459	1421747		
NMTN-03758	SAV1346		1419430	1422459	1421901		
NMTN-07844	SAV1346		1419430	1422459	1422158		
NMTN-06464	SAV1349	opuD	1423662	1424741	1423937	+	glycine betaine transporter
NMTN-06752	SAV1349	opuD	1423662	1424741	1424211		
NMTN-12482	SAV1349	opuD	1423662	1424741	1424713		
NMTN-14562	SAV1350	citB	1425688	1428393	1425998	+	aconitate hydratase
NMTN-08221	SAV1350	citB	1425688	1428393	1426027		
NMTN-07535	SAV1350	citB	1425688	1428393	1426307		
NMTN-13526	SAV1350	citB	1425688	1428393	1426658		
NMTN-00263	SAV1350	citB	1425688	1428393	1427455		
NMTN-12465	SAV1350	citB	1425688	1428393	1427527		
NMTN-02780	SAV1350	citB	1425688	1428393	1427631		
NMTN-06317	SAV1351		1428573	1429040	1429017	+	conserved hypothetical protein
NMTN-11868	SAV1355	parC	1432724	1435126	1434834	+	topoisomerase IV subunit A
NMTN-09342	SAV1356	alsT	1435376	1436836	1435772	+	amino acid carrier protein
NMTN-09110	SAV1356	alsT	1435376	1436836	1436084		
NMTN-11968	SAV1357	glcT	1437336	1438187	1437366	+	transcription antiterminator
NMTN-11405	SAV1357	glcT	1437336	1438187	1437394		
NMTN-14381	SAV1357	glcT	1437336	1438187	1437691		
NMTN-11953	SAV1361	msrA	1442736	1443245	1443044	-	peptide methionine sulfoxide reductase homologue
NMTN-08767	SAV1361	msrA	1442736	1443245	1443120		
NMTN-11797	SAV1362	msrR	1443383	1444366	1443371	+	peptide methionine sulfoxide reductase regulator
NMTN-09419	SAV1362	msrR	1443383	1444366	1443936		
NMTN-04469	SAV1364		1444787	1446049	1444791	+	hypothetical protein
NMTN-10415	SAV1364		1444787	1446049	1445427		
NMTN-10263	SAV1364		1444787	1446049	1445436		
NMTN-05518	SAV1364		1444787	1446049	1445739		
NMTN-03640	SAV1364		1444787	1446049	1445778		
NMTN-09431	SAV1365	tyrA	1446186	1447277	1446275	-	prephenate dehydrogenase
NMTN-10030	SAV1365	tyrA	1446186	1447277	1446685		
NMTN-08757	SAV1365	tyrA	1446186	1447277	1447043		
NMTN-09750	SAV1365	tyrA	1446186	1447277	1447086		
NMTN-08643	SAV1365	tyrA	1446186	1447277	1447138		
NMTN-10614	SAV1366		1447442	1448473	1447616	+	hypothetical protein
NMTN-03998	SAV1366		1447442	1448473	1447944		
NMTN-05435	SAV1366		1447442	1448473	1448277		
NMTN-07306	SAV1366		1447442	1448473	1448300		
NMTN-00553	SAV1367		1448965	1450371	1449180	+	hypothetical protein
NMTN-11322	SAV1367		1448965	1450371	1449347		
NMTN-11402	SAV1367		1448965	1450371	1449406		
NMTN-10864	SAV1367		1448965	1450371	1449474		
NMTN-00219	SAV1367		1448965	1450371	1449764		
NMTN-08852	SAV1367		1448965	1450371	1449767		
NMTN-09377	SAV1367		1448965	1450371	1450050		
NMTN-09383	SAV1367		1448965	1450371	1450050		
NMTN-02467	SAV1367		1448965	1450371	1450204		
NMTN-04639	SAV1367		1448965	1450371	1450266		
NMTN-09333	SAV1368	trpG	1450368	1450934	1450403	+	anthranilate synthase component II
NMTN-12242	SAV1368	trpG	1450368	1450934	1450406		
NMTN-06482	SAV1368	trpG	1450368	1450934	1450848		
NMTN-03894	SAV1369	trpD	1450940	1451938	1451013	+	anthranilate phosphoribosyltransferase
NMTN-01859	SAV1369	trpD	1450940	1451938	1451028		
NMTN-11749	SAV1369	trpD	1450940	1451938	1451105		
NMTN-02572	SAV1369	trpD	1450940	1451938	1451259		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09521	SAV1369	trpD	1450940	1451938	1451321		
NMTN-02144	SAV1369	trpD	1450940	1451938	1451883		
NMTN-10240	SAV1370	trpC	1451940	1452722	1451994	+	indole-3-glycerol phosphate synthase
NMTN-13128	SAV1370	trpC	1451940	1452722	1452088		
NMTN-12365	SAV1370	trpC	1451940	1452722	1452504		
NMTN-01453	SAV1371	trpF	1452722	1453354	1452887	+	phosphoriborylanthranilate isomerase
NMTN-10638	SAV1371	trpF	1452722	1453354	1453088		
NMTN-10583	SAV1371	trpF	1452722	1453354	1453131		
NMTN-15232	SAV1371	trpF	1452722	1453354	1453274		
NMTN-13136	SAV1371	trpF	1452722	1453354	1453338		
NMTN-11658	SAV1372	trpB	1453347	1454561	1453397	+	tryptophan synthase beta chain
NMTN-11372	SAV1372	trpB	1453347	1454561	1453908		
NMTN-12217	SAV1372	trpB	1453347	1454561	1454401		
NMTN-07688	SAV1373	trpA	1454554	1455282	1454781	+	tryptophan synthase alpha chain
NMTN-03755	SAV1373	trpA	1454554	1455282	1454783		
NMTN-00727	SAV1373	trpA	1454554	1455282	1454787		
NMTN-11591	SAV1373	trpA	1454554	1455282	1454813		
NMTN-08044	SAV1377		1459409	1460176	1460055	+	conserved hypothetical protein
NMTN-09532	SAV1377		1459409	1460176	1460145		
NMTN-09617	SAV1378		1460224	1460697	1460700	-	hypothetical protein
NMTN-14539	SAV1379		1460821	1461522	1460852	-	oligopeptide transporter putative ATPase domain
NMTN-00134	SAV1379		1460821	1461522	1460988		
NMTN-06686	SAV1379		1460821	1461522	1461163		
NMTN-04936	SAV1379		1460821	1461522	1461224		
NMTN-10028	SAV1379		1460821	1461522	1461303		
NMTN-08400	SAV1379		1460821	1461522	1461437		
NMTN-12518	SAV1380		1461515	1462288	1461524	-	oligopeptide transport ATPase
NMTN-12101	SAV1381		1462275	1463105	1462572	-	oligopeptide transporter membrane permease domain
NMTN-00217	SAV1381		1462275	1463105	1462639		
NMTN-05051	SAV1381		1462275	1463105	1462639		
NMTN-09250	SAV1381		1462275	1463105	1462879		
NMTN-05892	SAV1382		1463098	1464084	1463352	-	oligopeptide transporter membrane permease domain
NMTN-11061	SAV1382		1463098	1464084	1463431		
NMTN-03860	SAV1382		1463098	1464084	1463586		
NMTN-04334	SAV1382		1463098	1464084	1463586		
NMTN-12330	SAV1382		1463098	1464084	1463586		
NMTN-04189	SAV1382		1463098	1464084	1464011		
NMTN-02100	SAV1383		1464388	1464732	1464513	-	hypothetical protein
NMTN-00562	SAV1383		1464388	1464732	1464549		
NMTN-03893	SAV1384		1464937	1466751	1465073	+	hypothetical protein
NMTN-04696	SAV1384		1464937	1466751	1465235		
NMTN-05049	SAV1384		1464937	1466751	1465238		
NMTN-11139	SAV1384		1464937	1466751	1465344		
NMTN-04664	SAV1384		1464937	1466751	1465924		
NMTN-09853	SAV1384	(?)	1464937	1466751	1466405		
NMTN-00092	SAV1385		1466891	1467532	1466982	-	hypothetical protein
NMTN-05416	SAV1385		1466891	1467532	1466983		
NMTN-00589	SAV1385		1466891	1467532	1467029		
NMTN-05195	SAV1386	pstB	1467539	1468390	1467855	-	phosphate ABC transporter
NMTN-09921	SAV1386	pstB	1467539	1468390	1468057		
NMTN-14434	SAV1386	pstB	1467539	1468390	1468189		
NMTN-05321	SAV1386	pstB	1467539	1468390	1468230		
NMTN-15249	SAV1386	pstB	1467539	1468390	1468296		
NMTN-10977	SAV1387		1468437	1469354	1469084	-	hypothetical protein
NMTN-05589	SAV1387		1468437	1469354	1469218		
NMTN-12326	SAV1387		1468437	1469354	1469242		
NMTN-13757d	SAV1388		1469356	1470282	1469676	-	hypothetical protein
NMTN-06387	SAV1388		1469356	1470282	1470153		
NMTN-01659	SAV1389		1470473	1471456	1470660	-	thioredoxine reductase
NMTN-01660	SAV1389		1470473	1471456	1470660		
NMTN-01661	SAV1389		1470473	1471456	1470660		
NMTN-01663	SAV1389		1470473	1471456	1470660		
NMTN-01665	SAV1389		1470473	1471456	1470660		
NMTN-01667	SAV1389		1470473	1471456	1470660		
NMTN-01668	SAV1389		1470473	1471456	1470660		
NMTN-03202	SAV1389		1470473	1471456	1471043		
NMTN-02833	SAV1389		1470473	1471456	1471072		
NMTN-04987	SAV1391		1472431	1473333	1472514	-	conserved hypothetical protein
NMTN-06216	SAV1391		1472431	1473333	1472929		
NMTN-12430	SAV1392		1473480	1475081	1473754	+	ABC transporter homolog

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04444	SAV1392		1473480	1475081	1474134		
NMTN-10598	SAV1392		1473480	1475081	1474930		
NMTN-07886	SAV1393	lysC	1476143	1477348	1476809	+	aspartokinase II
NMTN-09077	SAV1393	lysC	1476143	1477348	1476878		
NMTN-11396	SAV1393	lysC	1476143	1477348	1476977		
NMTN-12395	SAV1394	asd	1477412	1478401	1477448	+	aspartate semialdehyde dehydrogenase
NMTN-04943	SAV1394	asd	1477412	1478401	1477616		
NMTN-03495	SAV1394	asd	1477412	1478401	1477688		
NMTN-13095	SAV1394	asd	1477412	1478401	1477767		
NMTN-10556	SAV1395	dapA	1478403	1479290	1478460	+	dihydrodipicolinate synthase
NMTN-09171	SAV1395	dapA	1478403	1479290	1478610		
NMTN-13002	SAV1395	dapA	1478403	1479290	1478611		
NMTN-02057	SAV1395	dapA	1478403	1479290	1478686		
NMTN-12262	SAV1395	dapA	1478403	1479290	1478880		
NMTN-09152	SAV1395	dapA	1478403	1479290	1479088		
NMTN-06502	SAV1395	dapA	1478403	1479290	1479254		
NMTN-00844	SAV1396	dapB	1479287	1480009	1479993	+	dihydrodipicolinate reductase
NMTN-12571	SAV1397	dapD	1480036	1480755	1480075	+	tetrahydrodipicolinate acetyltransferase
NMTN-13105	SAV1397	dapD	1480036	1480755	1480474		
NMTN-07808	SAV1398		1480898	1482049	1481071	+	hippurate hydrolase
NMTN-07856	SAV1398		1480898	1482049	1481749		
NMTN-11121	SAV1399		1482054	1483139	1482996	+	hypothetical protein
NMTN-11130	SAV1399		1482054	1483139	1482996		
NMTN-06259	SAV1400	lysA	1483129	1484394	1483631	+	diaminopimelate decarboxylase
NMTN-06489	SAV1400	lysA	1483129	1484394	1483713		
NMTN-10233	SAV1400	lysA	1483129	1484394	1483890		
NMTN-10470	SAV1400	lysA	1483129	1484394	1483935		
NMTN-13776	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13782	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13783	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13789	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13790	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13791	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13792	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13794	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13801	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13804	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13811	SAV1400	lysA	1483129	1484394	1483958		
NMTN-13920	SAV1400	lysA	1483129	1484394	1483958		
NMTN-08157	SAV1400	lysA	1483129	1484394	1484002		
NMTN-10386	SAV1400	lysA	1483129	1484394	1484192		
NMTN-11703	SAV1401		1484634	1485035	1484700	-	hypothetical protein
NMTN-05537	SAV1401		1484634	1485035	1484787		
NMTN-12337	SAV1401		1484634	1485035	1484787		
NMTN-08971	SAV1404		1486074	1486343	1486135	+	conserved hypothetical protein
NMTN-09592	SAV1405		1486368	1486991	1486928	+	hypothetical protein
NMTN-09088	SAV1407	braB	1488232	1489575	1488485	-	branched-chain amino acid carrier protein
NMTN-03826	SAV1407	braB	1488232	1489575	1488507		
NMTN-06490	SAV1407	braB	1488232	1489575	1488507		
NMTN-06214	SAV1407	braB	1488232	1489575	1488847		
NMTN-10208	SAV1407	braB	1488232	1489575	1488852		
NMTN-02848	SAV1407	braB	1488232	1489575	1489245		
NMTN-00420	SAV1407	braB	1488232	1489575	1489313		
NMTN-10018	SAV1407	braB	1488232	1489575	1489381		
NMTN-06295	SAV1408		1489801	1491687	1490385	-	conserved hypothetical protein
NMTN-03005	SAV1408		1489801	1491687	1491156		
NMTN-11113	SAV1408		1489801	1491687	1491168		
NMTN-11700	SAV1408		1489801	1491687	1491271		
NMTN-06662	SAV1408		1489801	1491687	1491278		
NMTN-03580	SAV1408		1489801	1491687	1491465		
NMTN-03792	SAV1411		1492905	1493714	1493695		
NMTN-07930	SAV1412	odhB	1494294	1495562	1494578	-	dihydrodipicolinate succinyltransferase
NMTN-04792	SAV1412	odhB	1494294	1495562	1494677		
NMTN-01494	SAV1412	odhB	1494294	1495562	1494717		
NMTN-13678	SAV1412	odhB	1494294	1495562	1495516		
NMTN-07888	SAV1413	odhA	1495599	1498373	1495674	-	oxoglutarate dehydrogenase
NMTN-09416	SAV1413	odhA	1495599	1498373	1495692		
NMTN-10823	SAV1413	odhA	1495599	1498373	1495711		
NMTN-03753	SAV1413	odhA	1495599	1498373	1495725		
NMTN-13413	SAV1413	odhA	1495599	1498373	1496214		
NMTN-06555	SAV1413	odhA	1495599	1498373	1496554		
NMTN-07266	SAV1413	odhA	1495599	1498373	1496863		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-02026	SAV1413	odhA	1495599	1498373	1497020		
NMTN-01754	SAV1413	odhA	1495599	1498373	1497408		
NMTN-10214	SAV1413	odhA	1495599	1498373	1498069		
NMTN-13248	SAV1413	odhA	1495599	1498373	1498073		
NMTN-13411	SAV1413	odhA	1495599	1498373	1498076		
NMTN-06603	SAV1413	odhA	1495599	1498373	1498120		
NMTN-10023	SAV1413	odhA	1495599	1498373	1498206		
NMTN-13148	SAV1413	odhA	1495599	1498373	1498319		
NMTN-04120	SAV1416		1501139	1501339	1501262	-	hypothetical protein
NMTN-12235	SAV1417		1501456	1502070	1501496	-	conserved hypothetical protein
NMTN-12959	SAV1420	ctpA	1504078	1505568	1504331	-	probable carboxy-terminal processing proteinase
NMTN-10848	SAV1420	ctpA	1504078	1505568	1504371		
NMTN-08261	SAV1420	ctpA	1504078	1505568	1504470		
NMTN-09098	SAV1420	ctpA	1504078	1505568	1504613		
NMTN-09785	SAV1420	ctpA	1504078	1505568	1504678		
NMTN-13749	SAV1420	ctpA	1504078	1505568	1504891		
NMTN-09941	SAV1420	ctpA	1504078	1505568	1505031		
NMTN-10595	SAV1423		1506493	1506921	1506801	-	conserved hypothetical protein
NMTN-02406	SAV1423		1506493	1506921	1506888		
NMTN-03609	SAV1425		1507533	1508372	1507594	-	conserved hypothetical protein
NMTN-03610	SAV1425		1507533	1508372	1507594		
NMTN-12595	SAV1425		1507533	1508372	1507897		
NMTN-12679	SAV1425		1507533	1508372	1508096		
NMTN-11371	SAV1425		1507533	1508372	1508239		
NMTN-12821	SAV1425		1507533	1508372	1508239		
NMTN-12822	SAV1425		1507533	1508372	1508239		
NMTN-05309	SAV1425		1507533	1508372	1508278		
NMTN-05317	SAV1429		1510899	1512023	1511111	-	conserved hypothetical protein
NMTN-11431	SAV1429		1510899	1512023	1511959		
NMTN-05515	SAV1429		1510899	1512023	1512007		
NMTN-02155	SAV1432		1512763	1513467	1512788	+	conserved hypothetical protein
NMTN-07038	SAV1432		1512763	1513467	1512821		
NMTN-03810	SAV1432		1512763	1513467	1512824		
NMTN-13643	SAV1432		1512763	1513467	1512979		
NMTN-11448	SAV1433		1513950	1514351	1514095	+	hypothetical protein
NMTN-10593	SAV1433		1513950	1514351	1514101		
NMTN-09463	SAV1434	ebhA	1514410	1534551	1515246	-	hypothetical protein
NMTN-05505	SAV1434	ebhA	1514410	1534551	1515608		
NMTN-13081	SAV1434	ebhA	1514410	1534551	1516190		
NMTN-00579	SAV1434	ebhA	1514410	1534551	1517535		
NMTN-09418	SAV1434	ebhA	1514410	1534551	1517981		
NMTN-02432	SAV1434	ebhA	1514410	1534551	1518602		
NMTN-01690	SAV1434	ebhA	1514410	1534551	1518897		
NMTN-07924	SAV1434	ebhA	1514410	1534551	1519416		
NMTN-01692	SAV1434	ebhA	1514410	1534551	1520745		
NMTN-01726	SAV1434	ebhA	1514410	1534551	1520745		
NMTN-06873	SAV1434	ebhA	1514410	1534551	1520745		
NMTN-11210	SAV1434	ebhA	1514410	1534551	1520802		
NMTN-01731	SAV1434	ebhA	1514410	1534551	1520887		
NMTN-06642	SAV1434	ebhA	1514410	1534551	1521051		
NMTN-03287	SAV1434	ebhA	1514410	1534551	1521566		
NMTN-14060	SAV1434	ebhA	1514410	1534551	1521569		
NMTN-09629	SAV1434	ebhA	1514410	1534551	1522151		
NMTN-06508	SAV1434	ebhA	1514410	1534551	1522456		
NMTN-12072	SAV1434	ebhA	1514410	1534551	1522655		
NMTN-07393	SAV1434	ebhA	1514410	1534551	1522965		
NMTN-11977	SAV1434	ebhA	1514410	1534551	1524921		
NMTN-10974	SAV1434	ebhA	1514410	1534551	1526318		
NMTN-03812	SAV1434	ebhA	1514410	1534551	1526525		
NMTN-12449	SAV1434	ebhA	1514410	1534551	1526604		
NMTN-00580	SAV1434	ebhA	1514410	1534551	1527487		
NMTN-12003	SAV1434	ebhA	1514410	1534551	1528829		
NMTN-04942	SAV1434	ebhA	1514410	1534551	1528890		
NMTN-10853	SAV1434	ebhA	1514410	1534551	1529545		
NMTN-15257	SAV1434	ebhA	1514410	1534551	1529545		
NMTN-02585	SAV1434	ebhA	1514410	1534551	1531370		
NMTN-09796	SAV1434	ebhA	1514410	1534551	1531490		
NMTN-04384	SAV1434	ebhA	1514410	1534551	1531514		
NMTN-12813	SAV1434	ebhA	1514410	1534551	1531514		
NMTN-06753	SAV1434	ebhA	1514410	1534551	1531983		
NMTN-09156	SAV1434	ebhA	1514410	1534551	1531986		
NMTN-10992	SAV1434	ebhA	1514410	1534551	1532146		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09582	SAV1434	ebhA	1514410	1534551	1532509		
NMTN-12214	SAV1434	ebhA	1514410	1534551	1532521		
NMTN-09506	SAV1434	ebhA	1514410	1534551	1533133		
NMTN-06747	SAV1434	ebhA	1514410	1534551	1533537		
NMTN-03696	SAV1434	ebhA	1514410	1534551	1533620		
NMTN-07867	SAV1434	ebhA	1514410	1534551	1534531		
NMTN-00480	SAV1435	ebhB	1534612	1546284	1535735	-	hypothetical protein
NMTN-09542	SAV1435	ebhB	1534612	1546284	1536446		
NMTN-01535	SAV1435	ebhB	1534612	1546284	1536942		
NMTN-01563	SAV1435	ebhB	1534612	1546284	1537286		
NMTN-04863	SAV1435	ebhB	1534612	1546284	1537403		
NMTN-12200	SAV1435	ebhB	1534612	1546284	1538025		
NMTN-11589	SAV1435	ebhB	1534612	1546284	1538466		
NMTN-05027	SAV1435	ebhB	1534612	1546284	1538549		
NMTN-08732	SAV1435	ebhB	1534612	1546284	1538663		
NMTN-13754d	SAV1435	ebhB	1534612	1546284	1538876		
NMTN-01576	SAV1435	ebhB	1534612	1546284	1539059		
NMTN-03094	SAV1435	ebhB	1534612	1546284	1539948		
NMTN-13847	SAV1435	ebhB	1534612	1546284	1540175		
NMTN-01950	SAV1435	ebhB	1534612	1546284	1540265		
NMTN-10047	SAV1435	ebhB	1534612	1546284	1540676		
NMTN-10438	SAV1435	ebhB	1534612	1546284	1540810		
NMTN-06312	SAV1435	ebhB	1534612	1546284	1541409		
NMTN-09612	SAV1435	ebhB	1534612	1546284	1541438		
NMTN-06354	SAV1435	ebhB	1534612	1546284	1541928		
NMTN-14606	SAV1435	ebhB	1534612	1546284	1541993		
NMTN-00288	SAV1435	ebhB	1534612	1546284	1542480		
NMTN-09225	SAV1435	ebhB	1534612	1546284	1542518		
NMTN-10645	SAV1435	ebhB	1534612	1546284	1542905		
NMTN-06442	SAV1435	ebhB	1534612	1546284	1543679		
NMTN-13013d	SAV1435	ebhB	1534612	1546284	1543788		
NMTN-09529	SAV1435	ebhB	1534612	1546284	1543997		
NMTN-02417	SAV1435	ebhB	1534612	1546284	1544112		
NMTN-13553	SAV1435	ebhB	1534612	1546284	1544294		
NMTN-03648	SAV1435	ebhB	1534612	1546284	1544635		
NMTN-09044	SAV1435	ebhB	1534612	1546284	1544755		
NMTN-10238	SAV1435	ehbB	1534612	1546284	1546264		
NMTN-13073	SAV1436		1546682	1548073	1546926	-	Bit-like protein
NMTN-03505	SAV1436		1546682	1548073	1546978		
NMTN-07114	SAV1436		1546682	1548073	1548061		
NMTN-07769	SAV1437		1548229	1549551	1548638	-	hypothetical protein
NMTN-15210	SAV1437		1548229	1549551	1548656		
NMTN-02311	SAV1437		1548229	1549551	1548658		
NMTN-10391	SAV1437		1548229	1549551	1548907		
NMTN-09822	SAV1437		1548229	1549551	1549117		
NMTN-03573	SAV1438		1549582	1550622	1550492	-	threonine deaminase IIvA homolog
NMTN-05429	SAV1439		1550717	1551835	1551203	-	alanine dehydrogenase
NMTN-01628	SAV1439		1550717	1551835	1551505		
NMTN-06311	SAV1439		1550717	1551835	1551590		
NMTN-10883	SAV1440		1552311	1553189	1552837	-	hypothetical protein
NMTN-06178	SAV1441		1553209	1556649	1553442	-	conserved hypothetical protein
NMTN-13587	SAV1441		1553209	1556649	1553449		
NMTN-06279	SAV1441		1553209	1556649	1554557		
NMTN-00813	SAV1441		1553209	1556649	1554660		
NMTN-14000	SAV1441		1553209	1556649	1555066		
NMTN-10960	SAV1441		1553209	1556649	1556183		
NMTN-04669	SAV1441		1553209	1556649	1556539		
NMTN-10919	SAV1442		1556953	1558293	1557350	+	conserved hypothetical protein
NMTN-12248	SAV1442		1556953	1558293	1558039		
NMTN-13050	SAV1442		1556953	1558293	1558154		
NMTN-02819	SAV1442		1556953	1558293	1558171		
NMTN-05628	SAV1443		1558499	1558831	1558665	-	hypothetical protein
NMTN-10463	SAV1444		1558915	1560060	1558939	-	conserved hypothetical protein
NMTN-08469	SAV1444		1558915	1560060	1558959		
NMTN-13090	SAV1448		1561625	1561975	1561794	-	conserved hypothetical protein
NMTN-02660	SAV1448		1561625	1561975	1561858		
NMTN-00061	SAV1451		1565887	1566228	1565924	-	hypothetical protein
NMTN-08678	SAV1451		1565887	1566228	1566160		
NMTN-11116	SAV1454	asnS	1567896	1569188	1568202	-	asparaginyl-tRNA synthetase
NMTN-02119	SAV1455	dinG	1569510	1572203	1569790	-	probable ATP-dependent DNA helicase
NMTN-13660	SAV1455	dinG	1569510	1572203	1570043		
NMTN-12299	SAV1455	dinG	1569510	1572203	1570300		
NMTN-09305	SAV1455	dinG	1569510	1572203	1570336		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00788	SAV1455	dinG	1569510	1572203	1570869		
NMTN-01522	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01523	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01524	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01526	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01527	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01538	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01539	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01540	SAV1455	dinG	1569510	1572203	1570870		
NMTN-05585	SAV1455	dinG	1569510	1572203	1570870		
NMTN-01561	SAV1455	dinG	1569510	1572203	1570919		
NMTN-11510	SAV1455	dinG	1569510	1572203	1571325		
NMTN-07319	SAV1455	dinG	1569510	1572203	1571359		
NMTN-06258	SAV1455	dinG	1569510	1572203	1571414		
NMTN-12772	SAV1455	dinG	1569510	1572203	1571485		
NMTN-09834	SAV1455	dinG	1569510	1572203	1571545		
NMTN-10432	SAV1455	dinG	1569510	1572203	1572130		
NMTN-10521	SAV1458		1574392	1575534	1574778	-	hypothetical protein
NMTN-14032	SAV1459		1575778	1576095	1575896	-	conserved hypothetical protein
NMTN-12127	SAV1461		1577184	1577771	1577255	-	conserved hypothetical protein
NMTN-11002	SAV1461		1577184	1577771	1577420		
NMTN-04132	SAV1461		1577184	1577771	1577450		
NMTN-12066	SAV1461		1577184	1577771	1577679		
NMTN-09151	SAV1461		1577184	1577771	1577698		
NMTN-09155	SAV1461		1577184	1577771	1577698		
NMTN-09165	SAV1461		1577184	1577771	1577698		
NMTN-09168	SAV1461		1577184	1577771	1577698		
NMTN-09173	SAV1461		1577184	1577771	1577698		
NMTN-09177	SAV1461		1577184	1577771	1577698		
NMTN-09179	SAV1461		1577184	1577771	1577698		
NMTN-09913	SAV1463		1578350	1579594	1579154	-	conserved hypothetical protein
NMTN-01451	SAV1463		1578350	1579594	1579294		
NMTN-01457	SAV1463		1578350	1579594	1579294		
NMTN-01462	SAV1463		1578350	1579594	1579294		
NMTN-01463	SAV1463		1578350	1579594	1579294		
NMTN-01464	SAV1463		1578350	1579594	1579294		
NMTN-01465	SAV1463		1578350	1579594	1579294		
NMTN-01471	SAV1463		1578350	1579594	1579294		
NMTN-10524	SAV1467		1583551	1583751	1583763	-	hypothetical protein
NMTN-00200	SAV1469	ndk	1583960	1584409	1584298	-	nucleoside diphosphate kinase
NMTN-12690	SAV1476		1590183	1591358	1590319	-	30S ribosomal protein S1
NMTN-02484	SAV1476		1590183	1591358	1590452		
NMTN-09236	SAV1476		1590183	1591358	1591005		
NMTN-10445	SAV1478	cmk	1592070	1592729	1592225	-	cytidylate kinase
NMTN-15282	SAV1480		1593889	1594875	1594044	-	hypothetical protein
NMTN-13173	SAV1480		1593889	1594875	1594143		
NMTN-11276	SAV1480		1593889	1594875	1594323		
NMTN-00664	SAV1480		1593889	1594875	1594492		
NMTN-02088	SAV1480		1593889	1594875	1594547		
NMTN-07946	SAV1480		1593889	1594875	1594596		
NMTN-01733	SAV1482		1596890	1598269	1597122	-	probable ATP-dependent DNA helicase RecQ
NMTN-14600	SAV1482		1596890	1598269	1597246		
NMTN-08645	SAV1482		1596890	1598269	1598080		
NMTN-11560	SAV1482		1596890	1598269	1598080		
NMTN-11710	SAV1482		1596890	1598269	1598080		
NMTN-09531	SAV1483		1598259	1599212	1598687	-	conserved hypothetical protein
NMTN-04523	SAV1483		1598259	1599212	1599165		
NMTN-04516	SAV1483		1598259	1599212	1599171		
NMTN-04755	SAV1483		1598259	1599212	1599171		
NMTN-04911	SAV1483		1598259	1599212	1599171		
NMTN-11752	SAV1484	fer	1599319	1599567	1599404	+	ferredoxin
NMTN-09828	SAV1484	fer	1599319	1599567	1599563		
NMTN-02826	SAV1485		1599673	1600218	1599704	-	conserved hypothetical protein
NMTN-13673	SAV1485		1599673	1600218	1599902		
NMTN-00334	SAV1485		1599673	1600218	1600184		
NMTN-00347	SAV1485		1599673	1600218	1600184		
NMTN-09669	SAV1488		1602999	1603904	1603740	-	hypothetical protein
NMTN-10961	SAV1489		1603994	1606156	1604361	-	hypothetical protein
NMTN-13535	SAV1489		1603994	1606156	1604507		
NMTN-12761	SAV1489		1603994	1606156	1604531		
NMTN-06275	SAV1489		1603994	1606156	1604844		
NMTN-08496	SAV1489		1603994	1606156	1605077		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08794	SAV1489		1603994	1606156	1606159		
NMTN-12844	SAV1491	srrB	1607319	1609085	1608752	-	staphylococcal respiratory response protein
NMTN-00634	SAV1493	rluB	1609909	1610646	1610090	-	ribosomal large subunit pseudouridine synthase B
NMTN-08902	SAV1494		1610639	1611181	1610941	-	conserved hypothetical protein
NMTN-01764	SAV1495		1611174	1611929	1611789	-	conserved hypothetical protein
NMTN-11634	SAV1495		1611174	1611929	1611814		
NMTN-02742	SAV1495		1611174	1611929	1611900		
NMTN-10457	SAV1496		1611997	1612503	1612021	+	conserved hypothetical protein
NMTN-03765	SAV1499		1614071	1614613	1614287	-	conserved hypothetical protein
NMTN-08669	SAV1500		1614695	1615603	1614854	+	conserved hypothetical protein
NMTN-03270	SAV1501		1615819	1616067	1615832	-	hypothetical protein
NMTN-04692	SAV1501		1615819	1616067	1615938		
NMTN-09635	SAV1502		1616083	1616838	1616213	-	hypothetical protein
NMTN-02184	SAV1502		1616083	1616838	1616216		
NMTN-12283	SAV1502		1616083	1616838	1616461		
NMTN-03207	SAV1502		1616083	1616838	1616687		
NMTN-03208	SAV1502		1616083	1616838	1616687		
NMTN-03210	SAV1502		1616083	1616838	1616687		
NMTN-03211	SAV1502		1616083	1616838	1616687		
NMTN-03212	SAV1502		1616083	1616838	1616687		
NMTN-03219	SAV1502		1616083	1616838	1616687		
NMTN-14594	SAV1503		1616980	1617795	1617287	+	hypothetical protein
NMTN-12154	SAV1503		1616980	1617795	1617596		
NMTN-14689	SAV1503		1616980	1617795	1617714		
NMTN-14690	SAV1503		1616980	1617795	1617714		
NMTN-14696	SAV1503		1616980	1617795	1617714		
NMTN-14697	SAV1503		1616980	1617795	1617714		
NMTN-14698	SAV1503		1616980	1617795	1617714		
NMTN-14749	SAV1503		1616980	1617795	1617714		
NMTN-14762	SAV1503		1616980	1617795	1617714		
NMTN-14764	SAV1503		1616980	1617795	1617714		
NMTN-14768	SAV1503		1616980	1617795	1617714		
NMTN-14771	SAV1503		1616980	1617795	1617714		
NMTN-14773	SAV1503		1616980	1617795	1617714		
NMTN-09842	SAV1503		1616980	1617795	1617783		
NMTN-03915	SAV1506		1620845	1621711	1621146	+	transcription regulator AraC/XylS family homolog
NMTN-10195	SAV1507	malA	1621793	1623442	1621849	-	alpha-D-1,4-glucosidase
NMTN-10496	SAV1507	malA	1621793	1623442	1623338		
NMTN-14031	SAV1508	malR	1623458	1624477	1623688	-	maltose operon transcriptional repressor
NMTN-05490	SAV1508	malR	1623458	1624477	1623768		
NMTN-04920	SAV1508	malR	1623458	1624477	1624009		
NMTN-13798	SAV1508	malR	1623458	1624477	1624137		
NMTN-06273	SAV1508	malR	1623458	1624477	1624299		
NMTN-07692	SAV1508	malR	1624671	1625042	1624691		
NMTN-07430	SAV1509		1624671	1625042	1624727	-	conserved hypothetical protein
NMTN-00545	SAV1509		1624671	1625042	1624742		
NMTN-01616	SAV1509		1624671	1625042	1625016		
NMTN-06529	SAV1511	gnd	1627042	1628448	1627036	-	phosphogluconate dehydrogenase
NMTN-10611	SAV1512		1628516	1629649	1629153	-	hypothetical protein
NMTN-00153	SAV1512		1628516	1629649	1629560		
NMTN-10518	SAV1513		1630218	1631198	1630219	-	conserved hypothetical protein
NMTN-10029	SAV1513		1630218	1631198	1630230		
NMTN-05030	SAV1513		1630218	1631198	1630736		
NMTN-09889	SAV1513		1630218	1631198	1630840		
NMTN-10081	SAV1513		1630218	1631198	1630942		
NMTN-09950	SAV1514		1631212	1631649	1631259	-	conserved hypothetical protein
NMTN-09564	SAV1515	bmfBB	1632000	1633274	1632589	-	branched-chain alpha-keto acid dehydrogenase E2
NMTN-10858	SAV1515	bmfBB	1632000	1633274	1633041		
NMTN-13527	SAV1516	bfmBAB	1633287	1634270	1633995	-	branched-chain alpha-keto acid dehydrogenase E1
NMTN-13468	SAV1517	bfmBAA	1634270	1635262	1634864	-	branched-chain alpha-keto acid dehydrogenase E1
NMTN-13873	SAV1517	bfmBAA	1634270	1635262	1635029		
NMTN-08777	SAV1518		1635278	1636699	1635528	-	dihydrolipoamide dehydrogenase
NMTN-12287	SAV1518		1635278	1636699	1635684		
NMTN-10390	SAV1518		1635278	1636699	1635900		
NMTN-09439	SAV1519	recN	1636850	1638529	1638296	-	DNA repair protein
NMTN-02320	SAV1520	ahrC	1638545	1638997	1638618	-	arginine repressor
NMTN-02610	SAV1520	ahrC	1638545	1638997	1638692		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11035	SAV1520	ahrC	1638545	1638997	1638736		
NMTN-00598	SAV1520	ahrC	1638545	1638997	1638835		
NMTN-08966	SAV1521	ispA	1639429	1640310	1639526	-	geranyltranstransferase homolog
NMTN-03133	SAV1521	ispA	1639429	1640310	1639694		
NMTN-10447	SAV1521	ispA	1639429	1640310	1639924		
NMTN-08565	SAV1521	ispA	1639429	1640310	1639991		
NMTN-00218	SAV1521	ispA	1639429	1640310	1640007		
NMTN-13659	SAV1521	ispA	1639429	1640310	1640210		
NMTN-04349	SAV1523		1640511	1641848	1640552	-	hypothetical protein
NMTN-14596	SAV1523		1640511	1641848	1640915		
NMTN-08618	SAV1523		1640511	1641848	1640954		
NMTN-08432	SAV1523		1640511	1641848	1640966		
NMTN-14396	SAV1523		1640511	1641848	1641025		
NMTN-14694d	SAV1523		1640511	1641848	1641304		
NMTN-08782	SAV1523		1640511	1641848	1641377		
NMTN-01828	SAV1523		1640511	1641848	1641527		
NMTN-01978	SAV1523		1640511	1641848	1641536		
NMTN-12092	SAV1523		1640511	1641848	1641802		
NMTN-04651	SAV1523		1640511	1641848	1641849		
NMTN-13764	SAV1524		1641865	1642254	1641991	-	hypothetical protein
NMTN-14011	SAV1524		1641865	1642254	1641994		
NMTN-08273	SAV1524		1641865	1642254	1642064		
NMTN-08274	SAV1524		1641865	1642254	1642064		
NMTN-08278	SAV1524		1641865	1642254	1642064		
NMTN-09368	SAV1529		1645686	1645997	1645958	-	Xaa-Pro dipeptidase
NMTN-12331	SAV1530		1646053	1646628	1646193	-	Xaa-Pro dipeptidase
NMTN-10040	SAV1530		1646053	1646628	1646376		
NMTN-12974	SAV1535		1649349	1650821	1649697	-	glycine dehydrogenase subunit 2 homologue
NMTN-02082	SAV1535		1649349	1650821	1649881		
NMTN-09577	SAV1535		1649349	1650821	1650265		
NMTN-06418	SAV1535		1649349	1650821	1650768		
NMTN-10762	SAV1536		1650814	1652160	1650888	-	glycine dehydrogenase subunit 1
NMTN-12213	SAV1536		1650814	1652160	1650951		
NMTN-02182	SAV1536		1650814	1652160	1651019		
NMTN-11197	SAV1536		1650814	1652160	1651440		
NMTN-13786	SAV1536		1650814	1652160	1651636		
NMTN-01569	SAV1536		1650814	1652160	1651650		
NMTN-11615	SAV1537		1652180	1653271	1652626	-	aminomethyltransferase
NMTN-02594	SAV1537		1652180	1653271	1653241		
NMTN-02470	SAV1539		1654187	1654684	1654257	-	hypothetical protein
NMTN-04366	SAV1539		1654187	1654684	1654423		
NMTN-09937	SAV1540		1654602	1654901	1654890	-	hypothetical protein
NMTN-09268	SAV1541		1654888	1655322	1654935	-	hypothetical protein
NMTN-09270	SAV1541		1654888	1655322	1654935		
NMTN-07768	SAV1541		1654888	1655322	1655218		
NMTN-10049	SAV1542		1655312	1655623	1655460	-	exogenous DNA-binding protein comGC
NMTN-11174	SAV1542		1655312	1655623	1655569		
NMTN-06550	SAV1543		1655637	1656707	1655793	-	hypothetical protein
NMTN-03679	SAV1543		1655637	1656707	1655852		
NMTN-06373	SAV1543		1655637	1656707	1656182		
NMTN-10067	SAV1543		1655637	1656707	1656406		
NMTN-04447	SAV1544		1656679	1657653	1657002	-	hypothetical protein
NMTN-14616	SAV1544		1656679	1657653	1657260		
NMTN-10440	SAV1544		1656679	1657653	1657484		
NMTN-08997	SAV1544		1656679	1657653	1657562		
NMTN-05124	SAV1545		1657705	1658328	1657912	-	conserved hypothetical protein
NMTN-14429	SAV1545		1657705	1658328	1657912		
NMTN-10927	SAV1546		1658325	1658654	1658574	-	conserved hypothetical protein
NMTN-13005	SAV1547	glcK	1658654	1659640	1658868	-	glucokinase
NMTN-01495	SAV1547	glcK	1658654	1659640	1658900		
NMTN-08539	SAV1547	glcK	1658654	1659640	1659006		
NMTN-08650	SAV1547	glcK	1658654	1659640	1659286		
NMTN-13800	SAV1549		1659821	1661284	1660632	-	conserved hypothetical protein
NMTN-08948	SAV1549		1659821	1661284	1660962		
NMTN-15172	SAV1549		1659821	1661284	1660963		
NMTN-09413	SAV1549		1659821	1661284	1660981		
NMTN-09080	SAV1549		1659821	1661284	1661009		
NMTN-00130	SAV1550		1661296	1661835	1661310	-	conserved hypothetical protein
NMTN-11029	SAV1555		1665774	1666637	1666171	-	hypothetical protein
NMTN-01591	SAV1556		1666680	1667447	1666964	-	hypothetical protein
NMTN-00845	SAV1556		1666680	1667447	1667211		
NMTN-01864	SAV1556		1666680	1667447	1667211		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09048	SAV1556		1666680	1667447	1667216		
NMTN-10520	SAV1557		1667591	1668481	1667740	-	hypothetical protein
NMTN-05095	SAV1557		1667591	1668481	1668337		
NMTN-13559	SAV1558		1668491	1669837	1668496	-	hypothetical protein
NMTN-10627	SAV1558		1668491	1669837	1669362		
NMTN-11890	SAV1558		1668491	1669837	1669408		
NMTN-04886	SAV1563		1675070	1675888	1675184	-	conserved hypothetical protein
NMTN-12549	SAV1563		1675070	1675888	1675243		
NMTN-03872	SAV1563		1675070	1675888	1675323		
NMTN-03904	SAV1563		1675070	1675888	1675328		
NMTN-10421	SAV1563		1675070	1675888	1675485		
NMTN-12526	SAV1563		1675070	1675888	1675662		
NMTN-03909	SAV1563		1675070	1675888	1675788		
NMTN-10510	SAV1563		1675070	1675888	1675854		
NMTN-10839	SAV1571	phoH	1681302	1682249	1681677	-	phosphate starvation-induced protein phoH homologue
NMTN-08889	SAV1571	phoH	1681302	1682249	1682234		
NMTN-07544	SAV1572		1682553	1683251	1682692	-	conserved hypothetical protein
NMTN-09146	SAV1572		1682553	1683251	1682800		
NMTN-06393	SAV1572		1682553	1683251	1682953		
NMTN-11862	SAV1573		1683268	1684257	1683687	-	conserved hypothetical protein
NMTN-06402	SAV1573		1683268	1684257	1684101		
NMTN-07983	SAV1573		1683268	1684257	1684215		
NMTN-08686	SAV1573		1683268	1684257	1684253		
NMTN-10437	SAV1574		1684275	1684982	1684318	-	conserved hypothetical protein
NMTN-10954	SAV1574		1684275	1684982	1684336		
NMTN-10271	SAV1574		1684275	1684982	1684355		
NMTN-15190	SAV1574		1684275	1684982	1684373		
NMTN-11310	SAV1574		1684275	1684982	1684550		
NMTN-09721	SAV1574		1684275	1684982	1684617		
NMTN-05383	SAV1574		1684275	1684982	1684639		
NMTN-10399	SAV1576		1685671	1687017	1685740	-	conserved hypothetical protein
NMTN-05130	SAV1576		1685671	1687017	1687016		
NMTN-10031	SAV1577		1687024	1687776	1687551	-	conserved hypothetical protein
NMTN-00034	SAV1577		1687024	1687776	1687700		
NMTN-09459	SAV1583	hemN	1693631	1694755	1694092	-	oxygen-independent coproporphyrinogen oxidase III
NMTN-09074	SAV1583	hemN	1693631	1694755	1694647		
NMTN-00481	SAV1583	hemN	1693631	1694755	1694736		
NMTN-15237	SAV1585	lepA	1695321	1697144	1695827	-	GTP-binding protein
NMTN-09748	SAV1588		1698817	1701018	1699136	-	hypothetical protein
NMTN-01942	SAV1588		1698817	1701018	1699334		
NMTN-13467	SAV1588		1698817	1701018	1699334		
NMTN-04721	SAV1588		1698817	1701018	1699356		
NMTN-11840	SAV1588		1698817	1701018	1699428		
NMTN-13582	SAV1588		1698817	1701018	1699501		
NMTN-10072	SAV1588		1698817	1701018	1699617		
NMTN-03153	SAV1588		1698817	1701018	1700079		
NMTN-09905	SAV1588		1698817	1701018	1700578		
NMTN-02535	SAV1588		1698817	1701018	1700712		
NMTN-06704	SAV1588		1698817	1701018	1700827		
NMTN-15341	SAV1589	comEB	1701023	1701484	1701067	-	late competence operon required for DNA binding and uptake
NMTN-14510	SAV1590		1701576	1702253	1701752	-	hypothetical protein
NMTN-01528	SAV1590		1701576	1702253	1701928		
NMTN-03623	SAV1590		1701576	1702253	1701955		
NMTN-04436	SAV1590		1701576	1702253	1702137		
NMTN-03417	SAV1591		1702302	1703018	1702523	-	conserved hypothetical protein
NMTN-13165	SAV1593		1703375	1703959	1703417	-	conserved hypothetical protein
NMTN-09804	SAV1596	aroE	1704815	1705621	1705007	-	shikimate dehydrogenase
NMTN-00573	SAV1596	aroE	1704815	1705621	1705077		
NMTN-01788	SAV1596	aroE	1704815	1705621	1705329		
NMTN-07513	SAV1596	aroE	1704815	1705621	1705429		
NMTN-09942	SAV1596	aroE	1704815	1705621	1705562		
NMTN-14659	SAV1600		1708283	1708552	1708463	+	hypothetical protein
NMTN-10658	SAV1601		1708754	1708942	1708776	-	enterotoxin homolog
NMTN-14387	SAV1603		1710271	1711491	1710425	-	conserved hypothetical protein
NMTN-12817	SAV1603		1710271	1711491	1710691		
NMTN-10574	SAV1603		1710271	1711491	1710795		
NMTN-10488	SAV1603		1710271	1711491	1711001		
NMTN-05136	SAV1603		1710271	1711491	1711046		
NMTN-09087	SAV1603		1710271	1711491	1711377		
NMTN-04125	SAV1604		1711780	1713009	1712408	-	conserved hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09980	SAV1604		1711780	1713009	1712536		
NMTN-04677	SAV1604		1711780	1713009	1712586		
NMTN-10651	SAV1604		1711780	1713009	1712679		
NMTN-03405	SAV1604		1711780	1713009	1712796		
NMTN-10511	SAV1604		1711780	1713009	1712931		
NMTN-02099	SAV1606		1713774	1715135	1714634	-	acetyl-CoA carboxylase
NMTN-00048	SAV1606		1713774	1715135	1714978		
NMTN-12009	SAV1606		1713774	1715135	1715012		
NMTN-02005	SAV1606		1713774	1715135	1715084		
NMTN-10243	SAV1606		1713774	1715135	1715097		
NMTN-00810	SAV1607		1715149	1715598	1715159	-	hypothetical protein
NMTN-09590	SAV1608		1715600	1716610	1716166	-	conserved hypothetical protein
NMTN-02412	SAV1608		1715600	1716610	1716208		
NMTN-02324	SAV1608		1715600	1716610	1716450		
NMTN-03667	SAV1609		1716600	1717334	1716726	-	conserved hypothetical protein
NMTN-10608	SAV1609		1716600	1717334	1716839		
NMTN-06653	SAV1609		1716600	1717334	1716886		
NMTN-05512	SAV1609		1716600	1717334	1716945		
NMTN-06452	SAV1609		1716600	1717334	1716979		
NMTN-09775	SAV1609		1716600	1717334	1717028		
NMTN-09767	SAV1609		1716600	1717334	1717155		
NMTN-13426	SAV1610	greA	1717660	1718136	1717751	-	transcription elongation factor
NMTN-03914	SAV1611	udk	1718164	1718787	1718324	-	uridine kinase
NMTN-09647	SAV1611	udk	1718164	1718787	1718447		
NMTN-13380	SAV1611	udk	1718164	1718787	1718538		
NMTN-02786	SAV1611	udk	1718164	1718787	1718682		
NMTN-10251	SAV1612		1718787	1720055	1719139	-	hypothetical protein
NMTN-10375	SAV1612		1718787	1720055	1719139		
NMTN-13889	SAV1612		1718787	1720055	1719238		
NMTN-08658	SAV1612		1718787	1720055	1719475		
NMTN-07995	SAV1612		1718787	1720055	1719486		
NMTN-13271	SAV1612		1718787	1720055	1719645		
NMTN-11070	SAV1612		1718787	1720055	1719814		
NMTN-13394	SAV1612		1718787	1720055	1719956		
NMTN-07781	SAV1612		1718787	1720055	1720042		
NMTN-06599	SAV1613		1720067	1720990	1720085	-	hypothetical protein
NMTN-06403	SAV1613		1720067	1720990	1720230		
NMTN-09960	SAV1613		1720067	1720990	1720307		
NMTN-09909	SAV1613		1720067	1720990	1720466		
NMTN-05586	SAV1613		1720067	1720990	1720816		
NMTN-08097	SAV1614		1720993	1721631	1721028	-	hypothetical protein
NMTN-08257	SAV1614		1720993	1721631	1721046		
NMTN-08092	SAV1614		1720993	1721631	1721048		
NMTN-08271	SAV1614		1720993	1721631	1721048		
NMTN-08093	SAV1614		1720993	1721631	1721050		
NMTN-08099	SAV1614		1720993	1721631	1721050		
NMTN-02797	SAV1614		1720993	1721631	1721303		
NMTN-09933	SAV1614		1720993	1721631	1721608		
NMTN-13374	SAV1616		1722239	1722610	1722520	-	conserved hypothetical protein
NMTN-13118	SAV1617		1722671	1722931	1722824	-	conserved hypothetical protein
NMTN-01851	SAV1619		1725967	1728444	1726423	-	hypothetical protein
NMTN-13184	SAV1619		1725967	1728444	1727261		
NMTN-09046	SAV1619		1725967	1728444	1727316		
NMTN-03924	SAV1619		1725967	1728444	1727472		
NMTN-12141	SAV1620		1728446	1729114	1728886	-	conserved hypothetical protein
NMTN-12857t	SAV1620		1728446	1729114	1728892		
NMTN-02539	SAV1623		1732376	1733401	1732569	+	conserved hypothetical protein
NMTN-07404	SAV1623		1732376	1733401	1732832		
NMTN-00281	SAV1623		1732376	1733401	1733378		
NMTN-10429	SAV1624		1733633	1733779	1733623	-	hypothetical protein
NMTN-10418	SAV1624		1733633	1733779	1733751		
NMTN-09949	SAV1625	csbD	1733819	1734001	1733826	-	sigmaB-controlled gene product
NMTN-09912	SAV1627		1734608	1735882	1734930	+	conserved hypothetical protein
NMTN-03264	SAV1627		1734608	1735882	1734944		
NMTN-13834	SAV1627		1734608	1735882	1734986		
NMTN-03087	SAV1627		1734608	1735882	1735049		
NMTN-10053	SAV1627		1734608	1735882	1735413		
NMTN-09930	SAV1627		1734608	1735882	1735433		
NMTN-11865	SAV1628		1736043	1736816	1736441	-	conserved hypothetical protein
NMTN-09724	SAV1628		1736043	1736816	1736664		
NMTN-02307	SAV1632	lytH	1740783	1741658	1741078	-	N-acetylmuramoyl-L-alanine amidase
NMTN-08882	SAV1635	apt	1744736	1745254	1744894	-	adenine phosphoribosyl transferase
NMTN-12680	SAV1635	apt	1744736	1745254	1745237		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-14433	SAV1636		1745276	1747549	1745554	-	hypothetical protein
NMTN-12480	SAV1636		1745276	1747549	1745716		
NMTN-00874	SAV1636		1745276	1747549	1746481		
NMTN-09928	SAV1637	secF	1747752	1750031	1747796	-	protein-export membrane protein SecDF
NMTN-09005	SAV1638		1750306	1750566	1750415	-	conserved hypothetical protein
NMTN-02425	SAV1638		1750306	1750566	1750516		
NMTN-13469	SAV1638		1750306	1750566	1750541		
NMTN-03502	SAV1638		1750306	1750566	1750543		
NMTN-12732	SAV1638		1750306	1750566	1750543		
NMTN-10417	SAV1639	tgt	1750585	1751724	1750652	-	tRNA-guanine transglycosylase
NMTN-03576	SAV1639	tgt	1750585	1751724	1750767		
NMTN-08610	SAV1639	tgt	1750585	1751724	1750798		
NMTN-13096	SAV1640	queA	1751747	1752772	1751749	-	S-adenosylmethionine tRNA ribosyltransferase
NMTN-02724	SAV1640	queA	1751747	1752772	1751851		
NMTN-11811	SAV1640	queA	1751747	1752772	1752163		
NMTN-08942	SAV1645	rpmA	1756540	1756839	1756710	-	50S ribosomal protei L27
NMTN-04763	SAV1651		1760103	1760300	1760205	+	hypothetical protein
NMTN-07932	SAV1652		1760417	1760701	1760414	-	hypothetical protein
NMTN-10469	SAV1652		1760417	1760701	1760525		
NMTN-08113	SAV1652		1760417	1760701	1760703		
NMTN-09315	SAV1652		1760417	1760701	1760703		
NMTN-13114	SAV1660	truncated-radC	1767593	1768147	1768048	-	DNA repair protein RadC homolog
NMTN-13569	SAV1661		1768144	1768851	1768481	-	hypothetical protein
NMTN-02079	SAV1661		1768144	1768851	1768572		
NMTN-05225	SAV1661		1768144	1768851	1768591		
NMTN-04873	SAV1661		1768144	1768851	1768806		
NMTN-11138	SAV1664	tag	1773438	1773998	1773762	+	DNA-3-methyladenine glycosidase
NMTN-09611	SAV1664	tag	1773438	1773998	1773987		
NMTN-06627	SAV1665		1774221	1775294	1774327	-	conserved hypothetical protein
NMTN-09830	SAV1665		1774221	1775294	1774404		
NMTN-02083	SAV1665		1774221	1775294	1774471		
NMTN-05323	SAV1665		1774221	1775294	1774504		
NMTN-05056	SAV1665		1774221	1775294	1774554		
NMTN-00482	SAV1665		1774221	1775294	1774557		
NMTN-10592	SAV1665		1774221	1775294	1774627		
NMTN-09296	SAV1665		1774221	1775294	1775009		
NMTN-00691	SAV1667	hemL	1775490	1776776	1775814	-	glutamate-1-semialdehyde 2,1-aminomutase protease
NMTN-06270	SAV1674	clpX	1782603	1783865	1782623	-	protease
NMTN-10448	SAV1674	clpX	1782603	1783865	1782946		
NMTN-09787	SAV1674	clpX	1782603	1783865	1783707		
NMTN-11361	SAV1675	tig	1784016	1785317	1784101	-	prolyl isomerase
NMTN-08815	SAV1675	tig	1784016	1785317	1785131		
NMTN-06322	SAV1675	tig	1784016	1785317	1785175		
NMTN-09198	SAV1675	tig	1784016	1785317	1785294		
NMTN-06162	SAV1676		1785480	1786409	1785550	-	hypothetical protein
NMTN-09142	SAV1676		1785480	1786409	1785688		
NMTN-12778	SAV1676		1785480	1786409	1785698		
NMTN-02739	SAV1676		1785480	1786409	1785759		
NMTN-04542	SAV1676		1785480	1786409	1785870		
NMTN-12560	SAV1676		1785480	1786409	1786358		
NMTN-00815	SAV1676		1785480	1786409	1786367		
NMTN-13130	SAV1676		1785480	1786409	1786379		
NMTN-13158	SAV1676		1785480	1786409	1786379		
NMTN-14282	SAV1676		1785480	1786409	1786408		
NMTN-07572	SAV1676		1785480	1786409	1786410		
NMTN-01639	SAV1677		1786428	1787036	1786655	-	conserved hypothetical protein
NMTN-01982	SAV1687	gapB	1795836	1796861	1796586	-	glyceraldehyde 3-phosphate dehydrogenase 2
NMTN-10389	SAV1687	gapB	1795836	1796861	1796654		
NMTN-11111	SAV1689		1797670	1798542	1797866	-	hypothetical protein
NMTN-13363	SAV1689		1797670	1798542	1798281		
NMTN-15238	SAV1690	polA	1798558	1801188	1798599	-	DNA polymerase I
NMTN-04682	SAV1690	polA	1798558	1801188	1798871		
NMTN-08968	SAV1690	polA	1798558	1801188	1799246		
NMTN-11891	SAV1690	polA	1798558	1801188	1799441		
NMTN-11901	SAV1690	polA	1798558	1801188	1799441		
NMTN-05636	SAV1690	polA	1798558	1801188	1799848		
NMTN-02912	SAV1690	polA	1798558	1801188	1800041		
NMTN-04778	SAV1690	polA	1798558	1801188	1800365		
NMTN-10563	SAV1690	polA	1798558	1801188	1800731		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-05527	SAV1690	polA	1798558	1801188	1800756		
NMTN-07850	SAV1691		1801482	1802969	1801517	-	hypothetical protein
NMTN-07842	SAV1691		1801482	1802969	1801520		
NMTN-11747	SAV1691		1801482	1802969	1801599		
NMTN-12759	SAV1691		1801482	1802969	1801774		
NMTN-07819	SAV1691		1801482	1802969	1801949		
NMTN-06260	SAV1691		1801482	1802969	1802347		
NMTN-11804	SAV1692	phoR	1803468	1805132	1804598	-	alkaline phosphatase synthesis sensor protein
NMTN-09369	SAV1692	phoR	1803468	1805132	1804907		
NMTN-03695	SAV1692	phoR	1803468	1805132	1805037		
NMTN-14551	SAV1693	phoP	1805129	1805833	1805388	-	alkaline phosphatase synthesis transcriptional regulatory protein
NMTN-11620	SAV1694	citC	1806223	1807491	1807042	-	isocitrate dehydrogenase
NMTN-09707	SAV1694	citC	1806223	1807491	1807346		
NMTN-05271	SAV1694	citC	1806223	1807491	1807368		
NMTN-06106	SAV1695	citZ	1807540	1808661	1807907		
NMTN-14679	SAV1695	citZ	1807540	1808661	1807932		
NMTN-06897	SAV1695	citZ	1807540	1808661	1808045		
NMTN-06431	SAV1695	citZ	1807540	1808661	1808413		
NMTN-08586	SAV1695	citZ	1807540	1808661	1808426		
NMTN-11247	SAV1695	citZ	1807540	1808661	1808454		
NMTN-13092	SAV1697	pykA	1810718	1812475	1810778	-	pyruvate kinase
NMTN-15191	SAV1697	pykA	1810718	1812475	1812204		
NMTN-01819	SAV1706		1824903	1825316	1825069	+	conserved hypothetical protein
NMTN-14013	SAV1707		1825621	1826310	1826247	-	conserved hypothetical protein
NMTN-10478	SAV1708		1826464	1827540	1827380	+	Xaa-Pro dipeptidase homolog
NMTN-10382	SAV1709	ald	1827857	1828975	1828429	-	alanine dehydrogenase
NMTN-07146	SAV1709	ald	1827857	1828975	1828464		
NMTN-02179	SAV1709	ald	1827857	1828975	1828697		
NMTN-10024	SAV1710		1829116	1829616	1829317	+	conserved hypothetical protein
NMTN-14643	SAV1712		1831152	1832099	1831520	-	conserved hypothetical protein
NMTN-13852	SAV1712		1831152	1832099	1831979		
NMTN-09686	SAV1712		1831152	1832099	1832067		
NMTN-09756	SAV1713		1832222	1832716	1832322	-	hypothetical protein
NMTN-12153	SAV1714		1832814	1833584	1832950	-	conserved hypothetical protein
NMTN-00831	SAV1716		1834851	1835990	1835980	-	hypothetical protein
NMTN-13546	SAV1718		1838194	1838658	1838305	+	conserved hypothetical protein
NMTN-09295	SAV1721		1841240	1841983	1841491	-	hypothetical protein
NMTN-06110	SAV1722		1842063	1842509	1842141	+	conserved hypothetical protein
NMTN-12565	SAV1723		1842624	1843781	1843309	+	hypothetical protein
NMTN-09575	SAV1723		1842624	1843781	1843660		
NMTN-02692	SAV1723		1842624	1843781	1843730		
NMTN-08670	SAV1724	serA	1843768	1845372	1844323	+	D-3-phosphoglycerate dehydrogenase
NMTN-05575	SAV1724	serA	1843768	1845372	1844864		
NMTN-10466	SAV1724	serA	1843768	1845372	1844881		
NMTN-11691	SAV1724	serA	1843768	1845372	1845299		
NMTN-09771	SAV1725		1845522	1846652	1845768	-	hypothetical protein
NMTN-10054	SAV1725		1845522	1846652	1845772		
NMTN-14446	SAV1725		1845522	1846652	1846574		
NMTN-01769	SAV1726	ptaA	1846759	1848225	1846835	-	PTS system, N-acetylglucosamine-specific IIABC component
NMTN-10689	SAV1726	ptaA	1846759	1848225	1847009		
NMTN-06593	SAV1726	ptaA	1846759	1848225	1847429		
NMTN-12848	SAV1726	ptaA	1846759	1848225	1847724		
NMTN-12216	SAV1726	ptaA	1846759	1848225	1848081		
NMTN-12497	SAV1726	ptaA	1846759	1848225	1848081		
NMTN-10697	SAV1728		1849142	1850416	1849284	+	hypothetical protein
NMTN-11661	SAV1728		1849142	1850416	1849772		
NMTN-05535	SAV1728		1849142	1850416	1849919		
NMTN-02036	SAV1728		1849142	1850416	1850072		
NMTN-09264	SAV1730	sgtA	1852154	1853059	1852198	+	probable transglycosylase
NMTN-14018	SAV1730	sgtA	1852154	1853059	1852334		
NMTN-05285	SAV1730	sgtA	1852154	1853059	1852650		
NMTN-09211	SAV1730	sgtA	1852154	1853059	1852725		
NMTN-09729	SAV1730	sgtA	1852154	1853059	1852799		
	or SAV0504						
NMTN-13044	SAV1730	sgtA	1852154	1853059	1853025		
NMTN-04121	SAV1731	sasl	1853262	1855937	1853455	-	hypothetical protein
NMTN-04340	SAV1731	sasl	1853262	1855937	1853675		
NMTN-06315	SAV1731	sasl	1853262	1855937	1854698		
NMTN-05519	SAV1731	sasl	1853262	1855937	1854778		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-00742	SAV1731	sasl	1853262	1855937	1855414		
NMTN-13827	SAV1731	sasl	1853262	1855937	1855619		
NMTN-01649	SAV1732	fhs	1856270	1857937	1856841	-	formyltetrahydrofolate synthetase
NMTN-04341	SAV1732	fhs	1856270	1857937	1857495		
NMTN-11263	SAV1733	acsA	1858377	1860083	1858767	-	acetyl-CoA synthetase
NMTN-10957	SAV1733	acsA	1858377	1860083	1858898		
NMTN-01614	SAV1733	acsA	1858377	1860083	1859552		
NMTN-04398	SAV1733	acsA	1858377	1860083	1859626		
NMTN-03779	SAV1733	acsA	1858377	1860083	1859771		
NMTN-02713	SAV1733	acsA	1858377	1860083	1859863		
NMTN-01564	SAV1733	acsA	1858377	1860083	1859993		
NMTN-00456	SAV1733	acsA	1858377	1860083	1860019		
NMTN-09376	SAV1734	acuA	1860252	1860884	1860638	+	acetoin dehydrogenase homolog
NMTN-09382	SAV1734	acuA	1860252	1860884	1860638		
NMTN-09642	SAV1734	acuA	1860252	1860884	1860742		
NMTN-03717	SAV1735	acuC	1860909	1862078	1861575	+	acetoin utilization protein
NMTN-11458	SAV1735	acuC	1860909	1862078	1861987		
NMTN-06725	SAV1736	ccpA	1862176	1863120	1862328	-	catabolite control protein A
NMTN-11822	SAV1736	ccpA	1862176	1863120	1862951		
NMTN-07791	SAV1736	ccpA	1862176	1863120	1863051		
NMTN-12369	SAV1744		1874251	1874562	1874338	-	thioredoxin homolog
NMTN-11861	SAV1745		1874627	1875703	1874711	-	endo-1,4-beta-glucanase homolog
NMTN-09978	SAV1745		1874627	1875703	1875150		
NMTN-09049	SAV1745		1874627	1875703	1875179		
NMTN-13099	SAV1746		1875790	1876101	1876022	+	hypothetical protein
NMTN-02504	SAV1747		1876226	1877068	1876403	-	conserved hypothetical protein
NMTN-05495	SAV1747		1876226	1877068	1876527		
NMTN-13578	SAV1747		1876226	1877068	1876885		
NMTN-08693	SAV1750		1879539	1880387	1879560	-	D-alanine aminotransferase
NMTN-02855	SAV1750		1879539	1880387	1879583		
NMTN-04451	SAV1750		1879539	1880387	1879783		
NMTN-15243	SAV1750		1879539	1880387	1879789		
NMTN-11784	SAV1750		1879539	1880387	1879807		
NMTN-00182	SAV1750		1879539	1880387	1880096		
NMTN-00502	SAV1750		1879539	1880387	1880156		
NMTN-00370	SAV1750		1879539	1880387	1880272		
NMTN-06678	SAV1751		1880391	1881800	1880460	-	Xaa-His dipeptidase homolog
NMTN-06780	SAV1752		1882358	1882780	1882743	-	hypothetical protein
NMTN-13733	SAV1753		1882797	1883492	1882995	-	hypothetical protein
NMTN-03697	SAV1753		1882797	1883492	1882998		
NMTN-03027	SAV1753		1882797	1883492	1883348		
NMTN-01581	SAV1755		1885515	1886459	1885702	+	hypothetical protein
NMTN-04050	SAV1755		1885515	1886459	1885707		
NMTN-07832	SAV1755		1885515	1886459	1886032		
NMTN-06625	SAV1755		1885515	1886459	1886427		
NMTN-01809	SAV1756		1886434	1886706	1886450	+	conserved hypothetical protein
NMTN-11099	SAV1758	mrp	1886823	1887464	1886845	-	Mrp protein
NMTN-09839	SAV1758	mrp	1886823	1887464	1886975		
NMTN-11819	SAV1758	mrp	1886823	1887464	1887207		
NMTN-08746	SAV1758	mrp	1886823	1887464	1887262		
NMTN-04980	SAV1758	mrp	1886823	1887464	1887275		
NMTN-12007	SAV1758	mrp	1887431	1893382	1887895		
NMTN-14526	SAV1758	mrp	1887431	1893382	1889271		
NMTN-07809	SAV1758	mrp	1887431	1893382	1889355		
NMTN-07511	SAV1758	mrp	1887431	1893382	1889664		
NMTN-11707	SAV1758	mrp	1886823	1893382	1889664		
NMTN-00816	SAV1758	mrp	1887431	1893382	1889902		
NMTN-00208	SAV1758	mrp	1887431	1893382	1891275		
NMTN-00430	SAV1758	mrp	1887431	1893382	1891275		
NMTN-00485	SAV1758	mrp	1887431	1893382	1891275		
NMTN-05106	SAV1758	mrp	1887431	1893382	1891635		
NMTN-15347	SAV1758	mrp	1887431	1893382	1891947		
NMTN-06964	SAV1759		1893708	1894019	1893709	-	conserved hypothetical protein
NMTN-14685	SAV1761		1896746	1897927	1897039	-	multidrug resistance protein homolog
NMTN-09423	SAV1761		1896746	1897927	1897202		
NMTN-03453	SAV1761		1896746	1897927	1897203		
NMTN-12063d	SAV1761		1896746	1897927	1897424		
NMTN-04981	SAV1761		1896746	1897927	1897669		
NMTN-09444	SAV1762		1898037	1898990	1898865	+	conserved hypothetical protein
NMTN-00074	SAV1762		1898037	1898990	1898913		
NMTN-11223	SAV1762		1898987	1899550	1899036	+	conserved hypothetical protein
NMTN-05156	SAV1763		1898987	1899550	1899036		
NMTN-11223	SAV1763		1898987	1899550	1899036		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04006	SAV1763		1898987	1899550	1899162		
NMTN-08392	SAV1763		1898987	1899550	1899249		
NMTN-06245	SAV1763		1898987	1899550	1899359		
NMTN-04041	SAV1763		1898987	1899550	1899384		
NMTN-05428	SAV1763		1898987	1899550	1899395		
NMTN-11740	SAV1765		1900644	1901471	1901217	-	lysophospholipase homolog
NMTN-07701	SAV1765		1900644	1901471	1901391		
NMTN-13818	SAV1766		1901705	1902706	1901721	+	proline dehydrogenase homolog
NMTN-12386	SAV1766		1901705	1902706	1902093		
NMTN-06814	SAV1766		1901705	1902706	1902230		
NMTN-00862	SAV1768		1903201	1903293	1903245	-	6,7-dimethyl-8-ribityllumazine synthase
NMTN-06176	SAV1769	ribA	1903306	1904487	1903322	-	riboflavin biosynthesis protein
NMTN-06184	SAV1769	ribA	1903306	1904487	1903322		
NMTN-11586	SAV1769	ribA	1903306	1904487	1903322		
NMTN-14759	SAV1769	ribA	1903306	1904487	1904319		
NMTN-04855	SAV1770	ribB	1904498	1905130	1904524	-	riboflavin synthase alpha chain
NMTN-06309	SAV1770	ribB	1904498	1905130	1904692		
NMTN-11573	SAV1770	ribB	1904498	1905130	1904730		
NMTN-11553	SAV1771	ribD	1905137	1906180	1905569	-	riboflavin specific deaminase
NMTN-03534	SAV1771	ribD	1905137	1906180	1905582		
NMTN-15236	SAV1771	ribD	1905137	1906180	1905883		
NMTN-10921	SAV1772		1906661	1908163	1906806	-	hypothetical protein
NMTN-10652	SAV1772		1906661	1908163	1906987		
NMTN-02541	SAV1772		1906661	1908163	1906990		
NMTN-01922	SAV1772		1906661	1908163	1906996		
NMTN-02899	SAV1772		1906661	1908163	1907621		
NMTN-11737	SAV1772		1906661	1908163	1907667		
NMTN-06673	SAV1772		1906661	1908163	1907691		
NMTN-11489	SAV1772		1906661	1908163	1907752		
NMTN-06844	SAV1772		1906661	1908163	1908162		
NMTN-08006	SAV1773		1908686	1909000	1908852	+	arsenical resistance operon repressor homolog
NMTN-11851	SAV1773		1908686	1909000	1908942		
NMTN-03743	SAV1774		1909000	1910292	1909296	+	arsenical pump membrane protein homolog
NMTN-05075	SAV1774		1909000	1910292	1909369		
NMTN-12218	SAV1774		1909000	1910292	1909553		
NMTN-12716	SAV1774		1909000	1910292	1909817		
NMTN-08965	SAV1774		1909000	1910292	1909872		
NMTN-05013	SAV1774		1909000	1910292	1909875		
NMTN-13382	SAV1774		1909000	1910292	1909875		
NMTN-04924	SAV1784		1916652	1917005	1916805	+	hypothetical protein
NMTN-02929	SAV1785		1917467	1917817	1917728	+	truncated transposase
NMTN-12695	SAV1787		1918160	1918939	1918170	+	truncated transposase
NMTN-11090	SAV1787		1918160	1918939	1918311		
NMTN-08318	SAV1787		1918160	1918939	1918344		
NMTN-05157	SAV1787		1918160	1918939	1918467		
NMTN-09018	SAV1787		1918160	1918939	1918476		
NMTN-11190	SAV1787		1918160	1918939	1918477		
NMTN-05559	SAV1787		1918160	1918939	1918521		
NMTN-13297	SAV1787		1918160	1918939	1918665		
NMTN-10381	SAV1787		1918160	1918939	1918754		
NMTN-13264	SAV1788		1919002	1919835	1919428	-	plant metabolite dehydrogenase homolog
NMTN-01969	SAV1791	pckA	1922645	1924237	1923229	+	phosphoenolpyruvate carboxykinase
NMTN-08719	SAV1791	pckA	1922645	1924237	1923548		
NMTN-09685	SAV1791	pckA	1922645	1924237	1924070		
NMTN-11646	SAV1793		1924615	1925385	1925085	-	conserved hypothetical protein
NMTN-05533	SAV1793		1924615	1925385	1925223		
NMTN-07557	SAV1794		1925366	1925845	1925588	-	conserved hypothetical protein
NMTN-13076	SAV1794		1925366	1925845	1925793		
NMTN-13249	SAV1796	menC	1926159	1927160	1926179	-	o-succinylbenzoic acid synthetase
NMTN-11082	SAV1798		1928802	1929284	1929118	-	hypothetical protein
NMTN-04503	SAV1801		1931361	1931987	1931506	+	hypothetical protein
NMTN-04945	SAV1801		1931362	1931988	1931785		
NMTN-04108	SAV1803		1932470	1933042	1932649	+	hypothetical protein
NMTN-11925	SAV1803		1932470	1933042	1932778		
NMTN-04822	SAV1803		1932470	1933042	1932816		
NMTN-05478	SAV1805		1933831	1934085	1933953	-	truncated transposase
NMTN-12446	SAV1805		1933831	1934085	1934009		
NMTN-13371	SAV1805		1933831	1934085	1934022		
NMTN-04948	SAV1807		1935792	1937021	1936510	-	probable specificity determinant HsdS
NMTN-09595	SAV1807		1935792	1937021	1936682		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06428	SAV1807		1935792	1937021	1936732		
NMTN-03260	SAV1808		1937014	1938570	1937248	-	type I restriction enzyme EcoR124II M protein homolog
NMTN-11963	SAV1808		1937014	1938570	1937663		
NMTN-05473	SAV1808		1937014	1938570	1937798		
NMTN-12382	SAV1808		1937014	1938570	1938019		
	or SAV0431						
NMTN-06104	SAV1809	splF	1938931	1939650	1939158	-	serine protease
NMTN-04782	SAV1809/1810	splF/splD	1939808	1940527	1939202	-	serine protease
NMTN-02814	SAV1809				1940294		
	or SAV1810						
NMTN-03294	SAV1811	splC	1940648	1941367	1940807	-	serine protease
NMTN-11075	SAV1811	splC	1940648	1941367	1941075		
NMTN-12789	SAV1813	splA	1942272	1942979	1942431	-	serine protease
NMTN-01785	SAV1814		1943415	1943633	1943495	-	hypothetical protein
NMTN-03169	SAV1815		1943942	1944523	1944173	+	probable beta-lactamase
NMTN-14630d	SAV1819	lukD	1947093	1948091	1947646	-	leukotoxin F-subunit
NMTN-13601	SAV1819	lukD	1947093	1948091	1947863		
NMTN-14661	SAV1820	lukE	1948093	1949028	1948233	-	leukotoxin S-subunit
NMTN-08984	SAV1820	lukE	1948093	1949028	1948416		
NMTN-03521	SAV1821		1950392	1951180	1950522	+	hypothetical protein
NMTN-09153	SAV1835	traP	1965438	1965941	1965756	+	signal transduction protein
NMTN-07467	SAV1835	traP	1965438	1965941	1965844		
NMTN-15242	SAV1838	hit	1968155	1968577	1968248	+	Hit-like protein involved in cell-cycle regulation
NMTN-09173	SAV1838	hit	1968155	1968577	1968258		
NMTN-11581	SAV1839		1968719	1969084	1968910	+	conserved hypothetical protein
NMTN-10849	SAV1840		1969819	1970376	1969919	+	conserved hypothetical protein
NMTN-09667	SAV1840		1969819	1970376	1970043		
NMTN-10393	SAV1841	prsA	1970581	1971543	1971420	+	peptidyl-prolyl cis/trans isomerase
NMTN-09920	SAV1842		1971664	1972605	1971667	-	cmp-binding-factor 1
NMTN-07865	SAV1843		1972602	1975538	1972862	-	conserved hypothetical protein
NMTN-13866	SAV1843		1972602	1975538	1972923		
NMTN-07734	SAV1843		1972602	1975538	1973119		
NMTN-07512	SAV1843		1972602	1975538	1973162		
NMTN-12781d	SAV1843		1972602	1975538	1973162		
NMTN-10644	SAV1843		1972602	1975538	1974985		
NMTN-02336	SAV1843		1972602	1975538	1975094		
NMTN-02128	SAV1843		1972602	1975538	1975298		
NMTN-00631	SAV1843		1972602	1975538	1975322		
NMTN-01518	SAV1844		1975528	1976724	1975644	-	conserved hypothetical protein
NMTN-02947	SAV1844		1975528	1976724	1975719		
NMTN-07909	SAV1844		1975528	1976724	1975971		
NMTN-08718	SAV1844		1975528	1976724	1976096		
NMTN-06479	SAV1844		1975528	1976724	1976133		
NMTN-13817	SAV1844		1975528	1976724	1976464		
NMTN-03798	SAV1844		1975528	1976724	1976526		
NMTN-08153	SAV1846		1978065	1979189	1978174	-	conserved hypothetical protein
NMTN-04904	SAV1846		1978065	1979189	1979077		
NMTN-09366	SAV1848		1980189	1980812	1980192	-	two-component response regulator homolog
NMTN-06189	SAV1848		1980189	1980812	1980606		
NMTN-06325	SAV1849		1980834	1981946	1981010	-	two-component sensor histidine kinase homolog
NMTN-02615	SAV1849		1980834	1981946	1981012		
NMTN-03790	SAV1849		1980834	1981946	1981015		
NMTN-13819	SAV1849		1980834	1981946	1981538		
NMTN-13245	SAV1850		1982109	1982930	1982306	+	conserved hypothetical protein
NMTN-01596	SAV1851	citG	1983383	1984768	1983541	-	fumarate hydratase, class-II
NMTN-03937	SAV1851	citG	1983383	1984768	1984552		
NMTN-09007	SAV1851	citG	1983383	1984768	1984621		
NMTN-13064	SAV1852		1984964	1985359	1985016	-	hypothetical protein
NMTN-03642	SAV1852		1984964	1985359	1985017		
NMTN-03650	SAV1852		1984964	1985359	1985017		
NMTN-04347	SAV1852		1984964	1985359	1985021		
NMTN-13036	SAV1852		1984964	1985359	1985056		
NMTN-09688	SAV1852		1984964	1985359	1985111		
NMTN-07774	SAV1852		1984964	1985359	1985119		
NMTN-07515	SAV1852		1984964	1985359	1985253		
NMTN-12503	SAV1852		1984964	1985359	1985264		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12935	SAV1852		1984964	1985359	1985326		
NMTN-00748	SAV1852		1984964	1985359	1985335		
NMTN-10202	SAV1852		1984964	1985359	1985354		
NMTN-11183	SAV1854		1986084	1986683	1986247	-	hypothetical protein
NMTN-04023	SAV1856		1987317	1988444	1987741	-	conserved hypothetical protein
NMTN-09126	SAV1856		1987317	1988444	1987925		
NMTN-09706	SAV1857		1988595	1989323	1989075	-	glutamate ABC transporter ATP-binding protein
NMTN-15183	SAV1858		1989310	1990635	1989944	-	hypothetical protein
NMTN-09524	SAV1858		1989310	1990635	1990417		
NMTN-12582	SAV1859		1991025	1992086	1991028	-	hypothetical protein
NMTN-12615	SAV1859		1991025	1992086	1991665		
NMTN-05062	SAV1859		1991025	1992086	1991796		
NMTN-02488	SAV1859		1991025	1992086	1991893		
NMTN-06458	SAV1699/ 1720/ 1860	tnp	1992670	1993989	1992885	+	transposase
NMTN-09121			1994457	1994528	1994472	-	tRNA-glycine
NMTN-08450	SAV1862		2003031	2003981	2003064	-	hypothetical protein
NMTN-04175	SAV1862		2003031	2003981	2003312		
NMTN-12948	SAV1862		2003031	2003981	2003608		
NMTN-01520	SAV1862		2003031	2003981	2003854		
NMTN-06757	SAV1863		2003987	2004442	2004312	-	conserved hypothetical protein
NMTN-05104	SAV1863		2003987	2004442	2004441		
NMTN-15185d	SAV1864	gsaB	2004523	2005812	2004693	+	glutamate-1-semialdehyde aminotransferase
NMTN-01784	SAV1865		2006105	2007199	2006154	+	conserved hypothetical protein
NMTN-14615	SAV1865		2006105	2007199	2006235		
NMTN-06367	SAV1865		2006105	2007199	2006288		
NMTN-06370	SAV1865		2006105	2007199	2006288		
NMTN-05465	SAV1865		2006105	2007199	2006303		
NMTN-08780	SAV1865		2006105	2007199	2006376		
NMTN-13338	SAV1865		2006105	2007199	2006423		
NMTN-09201	SAV1865		2006105	2007199	2006641		
NMTN-09272	SAV1865		2006105	2007199	2006643		
NMTN-14420	SAV1865		2006105	2007199	2006666		
NMTN-02750	SAV1865		2006105	2007199	2006891		
NMTN-06155	SAV1865		2006105	2007199	2007155		
NMTN-11093	SAV1865		2006105	2007199	2007190		
NMTN-01574	SAV1866		2007389	2009125	2007529	-	ABC transporter homolog
NMTN-09304	SAV1866		2007389	2009125	2008258		
NMTN-08811	SAV1866		2007389	2009125	2008620		
NMTN-12175	SAV1866		2007389	2009125	2008885		
NMTN-04859	SAV1866		2007389	2009125	2009009		
NMTN-06107	SAV1868		2010261	2011298	2010295	-	hypothetical protein
NMTN-00194	SAV1868		2010261	2011298	2010307		
NMTN-11037	SAV1868		2010261	2011298	2010988		
NMTN-10276	SAV1868		2010261	2011298	2011050		
NMTN-07273d	SAV1870		2012688	2013524	2013200	-	hypothetical protein
NMTN-03703	SAV1870		2012688	2013524	2013403		
NMTN-12992	SAV1871		2013533	2015050	2013798	-	hypothetical protein
NMTN-12899	SAV1873		2015357	2016175	2015480	-	conserved hypothetical protein
NMTN-06284	SAV1874		2016435	2017244	2016975	-	conserved hypothetical protein
NMTN-08476	SAV1874		2016435	2017244	2017224		
NMTN-03774	SAV1875		2017584	2018099	2017763	-	conserved hypothetical protein
NMTN-12914	SAV1875		2017584	2018099	2017918		
NMTN-02538	SAV1877		2018615	2019766	2018949	+	conserved hypothetical protein
NMTN-06267	SAV1877		2018615	2019766	2019026		
NMTN-10893	SAV1877		2018615	2019766	2019224		
NMTN-09071	SAV1877		2018615	2019766	2019273		
NMTN-06180	SAV1877		2018615	2019766	2019383		
NMTN-06376	SAV1877		2018615	2019766	2019558		
NMTN-12444	SAV1877		2018615	2019766	2019735		
NMTN-12278	SAV1879	ampS	2020646	2021893	2020927	-	aminopeptidase ampS
NMTN-11495d	SAV1879	ampS	2020646	2021893	2021055		
NMTN-05290	SAV1879	ampS	2020646	2021893	2021091		
NMTN-09410	SAV1879	ampS	2020646	2021893	2021649		
NMTN-03400	SAV1879	ampS	2020646	2021893	2021722		
NMTN-03809	SAV1880		2021905	2022111	2021991	-	conserved hypothetical protein
NMTN-12085	SAV1880		2021905	2022111	2021993		
NMTN-12484	SAV1880		2021905	2022111	2021993		
NMTN-12080	SAV1880		2021905	2022111	2021995		
NMTN-03565	SAV1880		2021905	2022111	2021996		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03575	SAV1880		2021905	2022111	2021996		
NMTN-15208	SAV1881		2022252	2022716	2022288	+	hypothetical protein
NMTN-06353	SAV1883		2023276	2024493	2023391	+	hypothetical protein
NMTN-13242	SAV1883		2023276	2024493	2023391		
NMTN-10508	SAV1883		2023276	2024493	2024475		
NMTN-02993	SAV1884	vraR	2024606	2025235	2024988	-	two-component response regulator
NMTN-07438	SAV1885	vraS	2025225	2026268	2025278	-	two-component sensor histidine kinase
NMTN-02364	SAV1885	vraS	2025225	2026268	2025901		
NMTN-11639	SAV1885	vraS	2025225	2026268	2026087		
NMTN-03821	SAV1885	vraS	2025225	2026268	2026097		
NMTN-05255	SAV1885	vraS	2025225	2026268	2026219		
NMTN-15227	SAV1886		2026265	2026966	2026283	-	conserved hypothetical protein
NMTN-11863	SAV1886		2026265	2026966	2026575		
NMTN-04899	SAV1886		2026265	2026966	2026708		
NMTN-02960	SAV1886		2026265	2026966	2026840		
NMTN-11651	SAV1886		2026265	2026966	2026840		
NMTN-06266	SAV1886		2026265	2026966	2026951		
NMTN-11882	SAV1887		2026981	2027367	2027257	-	hypothetical protein
NMTN-08685	SAV1887		2026981	2027367	2027359		
NMTN-11839	SAV1889		2028873	2029859	2029101	+	conserved hypothetical protein
NMTN-07265	SAV1890		2030290	2030742	2030486	-	hypothetical protein
NMTN-07023	SAV1890		2030290	2030742	2030634		
NMTN-13487	SAV1890		2030290	2030742	2030665		
NMTN-06498	SAV1893		2033266	2033766	2033516	+	hypothetical protein
NMTN-06497	SAV1893		2033266	2033766	2033518		
NMTN-06672	SAV1893		2033266	2033766	2033604		
NMTN-07152	SAV1893		2033266	2033766	2033637		
NMTN-03231	SAV1894		2034156	2034710	2034211	+	hypothetical protein
NMTN-13545	SAV1894		2034156	2034710	2034358		
NMTN-09127	SAV1895		2034778	2035848	2035209	-	hypothetical protein
NMTN-07823	SAV1895		2034778	2035848	2035817		
NMTN-10378	SAV1896		2036095	2036625	2036095	-	conserved hypothetical protein
NMTN-04966	SAV1896		2036095	2036625	2036132		
NMTN-15178d	SAV1897		2036795	2038156	2036934	-	RNA methyltransferase homolog
NMTN-13475	SAV1897		2036795	2038156	2037145		
NMTN-00136	SAV1897		2036795	2038156	2037163		
NMTN-00137	SAV1897		2036795	2038156	2037163		
NMTN-11166	SAV1897		2036795	2038156	2037187		
NMTN-12187	SAV1897		2036795	2038156	2037234		
NMTN-10870	SAV1897		2036795	2038156	2037600		
NMTN-01468	SAV1899		2039952	2041379	2041338	-	glutamyl-tRNA <sup>Gln</sup> amidotransferase subunit B
NMTN-11673	SAV1902	putP	2043520	2045058	2044268	+	high affinity proline permease
NMTN-11997	SAV1903		2045147	2046346	2046334	-	conserved hypothetical protein
NMTN-01622	SAV1906	pcrB	2050555	2051247	2050607	-	conserved hypothetical protein
NMTN-14046	SAV1907		2051419	2051721	2051549	-	conserved hypothetical protein
NMTN-01592	SAV1907		2051419	2051721	2051613		
NMTN-10743	SAV1908	purB	2051830	2053125	2051984	-	adenylosuccinate lyase
NMTN-02875	SAV1908	purB	2051830	2053125	2052463		
NMTN-04589	SAV1908	purB	2051830	2053125	2052612		
NMTN-12131	SAV1908	purB	2051830	2053125	2052862		
NMTN-05144	SAV1908	purB	2051830	2053125	2052913		
NMTN-11242	SAV1908	purB	2051830	2053125	2052966		
NMTN-14022	SAV1909		2053985	2055151	2054315	+	staphopain
NMTN-06249	SAV1909		2053985	2055151	2054695		
NMTN-13520	SAV1909		2053985	2055151	2054709		
NMTN-09254	SAV1909		2053985	2055151	2054884		
NMTN-11243	SAV1909		2053985	2055151	2054915		
NMTN-13504	SAV1911		2055954	2056556	2056100	-	conserved hypothetical protein
NMTN-04478	SAV1911		2055954	2056556	2056404		
NMTN-11957	SAV1911		2055954	2056556	2056409		
NMTN-02554	SAV1914		2059294	2060370	2059304	+	nitric-oxide synthase homolog
NMTN-12727	SAV1914		2059294	2060370	2059333		
NMTN-12194	SAV1914		2059294	2060370	2059418		
NMTN-04134	SAV1914		2059294	2060370	2059439		
NMTN-06919	SAV1914		2059294	2060370	2059523		
NMTN-13840	SAV1914		2059294	2060370	2059610		
NMTN-13862	SAV1914		2059294	2060370	2059620		
NMTN-07497	SAV1914		2059294	2060370	2059857		
NMTN-00331	SAV1914		2059294	2060370	2059939		
NMTN-05355	SAV1914		2059294	2060370	2059939		
NMTN-09372	SAV1915		2060390	2061184	2060856	+	hypothetical protein
NMTN-09372	SAV1915		2060390	2061184	2060856		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09265	SAV1916		2061374	2062936	2061427	-	hypothetical protein
NMTN-12923	SAV1916		2061374	2062936	2061508		
NMTN-10888	SAV1916		2061374	2062936	2061582		
NMTN-07449	SAV1916		2061374	2062936	2061675		
NMTN-09025	SAV1916		2061374	2062936	2061694		
NMTN-02250	SAV1916		2061374	2062936	2061735		
NMTN-06567	SAV1916		2061374	2062936	2062036		
NMTN-04631	SAV1916		2061374	2062936	2062284		
NMTN-00718	SAV1916		2061374	2062936	2062458		
NMTN-13282	SAV1916		2061374	2062936	2062540		
NMTN-03182	SAV1917		2063141	2064238	2063215	-	conserved hypothetical protein
NMTN-12608	SAV1917		2063141	2064238	2063275		
NMTN-11064	SAV1917		2063141	2064238	2063317		
NMTN-13226	SAV1917		2063141	2064238	2063392		
NMTN-07922	SAV1917		2063141	2064238	2063716		
NMTN-02291	SAV1917		2063141	2064238	2063728		
NMTN-02518	SAV1917		2063141	2064238	2063799		
NMTN-06664	SAV1917		2063141	2064238	2064237		
NMTN-04769	SAV1918		2064607	2065167	2064865	+	pyrazinamidase/nicotinamidase homolog
NMTN-10631	SAV1918		2064607	2065167	2064901		
NMTN-08020	SAV1918		2064607	2065167	2065002		
NMTN-10965	SAV1919		2065220	2066149	2066149	+	manganese-dependent inorganic pyrophosphatase
NMTN-11459	SAV1920	aldH	2066567	2067946	2066713	+	aldehyde dehydrogenase
NMTN-04846	SAV1922		2069364	2069765	2069594	+	hypothetical protein
NMTN-01723	SAV1924		2070338	2070511	2070408	-	hypothetical protein
NMTN-05468	SAV1925		2070962	2072002	2071172	+	hypothetical protein
NMTN-11893	SAV1925		2070962	2072002	2071649		
NMTN-11893	SAV1925		2070962	2072002	2071649		
NMTN-03437	SAV1926		2072059	2072901	2072393	-	hypothetical protein
NMTN-06378	SAV1926		2072059	2072901	2072454		
NMTN-04883	SAV1926		2072059	2072901	2072620		
NMTN-13899	SAV1926		2072059	2072901	2072667		
NMTN-11080	SAV1927		2072898	2073455	2073179	-	conserved hypothetical protein
NMTN-01449	SAV1928		2073515	2074039	2073597	-	hypothetical protein
NMTN-12471	SAV1929		2074160	2074723	2074640	+	hypothetical protein
NMTN-11264	SAV1929		2074160	2074723	2074641		
NMTN-01508	SAV1932		2076398	2077078	2076660	-	hypothetical protein
NMTN-09076	SAV1933		2077079	2077975	2077096	-	hypothetical protein
NMTN-12158	SAV1933		2077079	2077975	2077758		
NMTN-09620	SAV1934		2077972	2078352	2078082	-	hypothetical protein
NMTN-06269	SAV1934		2077972	2078352	2078111		
NMTN-13110	SAV1935		2078610	2078786	2078723	-	hypothetical protein
NMTN-02967	SAV1936		2079326	2080612	2079482	+	hypothetical protein
NMTN-11293	SAV1936		2079326	2080612	2079872		
NMTN-11559	SAV1938	truncated-mapW	2079326	2081211	2080941	-	truncated map-w protein
NMTN-13870	SAV1938	truncated-mapW	2080891	2081211	2081008		
NMTN-10907	SAV1938	truncated-mapW	2081196	2082626	2081488		
NMTN-11729	SAV1938	truncated-mapW	2081196	2082626	2081506		
NMTN-11145	SAV1938	truncated-mapW	2081196	2082626	2081600		
NMTN-03882	SAV1938	truncated-mapW	2081196	2082626	2081649		
NMTN-03945	SAV1938	truncated-mapW	2081196	2082626	2081903		
NMTN-13766	SAV1938	truncated-mapW	2081196	2082626	2081903		
NMTN-04149	SAV1938	truncated-mapW	2081196	2082626	2081971		
NMTN-05094	SAV1938	truncated-mapW	2081196	2082626	2082297		
NMTN-09659	SAV1938	truncated-mapW	2081196	2082626	2082400		
NMTN-10055	SAV1939	truncated-hlb	2082969	2083211	2083063	+	truncated 6449-6450 beta-hemolysin
NMTN-03698	SAV1939	truncated-hlb	2082969	2083211	2083168		
NMTN-07384	SAV1939	truncated-	2082969	2083211	2083191		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
		hlb					
NMTN-09316	SAV1941		2083921	2084094	2083991	+	hypothetical protein
NMTN-12753	SAV1941		2083921	2084094	2084047		
NMTN-00001	SAV1943	truncated-lytA	2085246	2085713	2085371	-	truncated amidase
NMTN-12182	SAV1943	truncated-lytA	2085246	2085713	2085386		
NMTN-02464	SAV1944	sak	2086233	2086724	2086477	-	staphylokinase precursor
NMTN-08802	SAV1945		2086939	2087670	2087082	-	lytic enzyme
NMTN-06671	SAV1945		2086939	2087670	2087267		
NMTN-02996	SAV1945		2086939	2087670	2087617		
NMTN-14717	SAV1948	sep	2088433	2089215	2088550	-	enterotoxin P
NMTN-03552	SAV1948	sep	2088433	2089215	2088687		
NMTN-08265	SAV1949		2089299	2089538	2089412	+	hypothetical protein
NMTN-09512	SAV1950		2089579	2089953	2089965	-	hypothetical protein
NMTN-04335	SAV1951		2090009	2090338	2090283	-	hypothetical protein
NMTN-12961	SAV1952		2090342	2090494	2090358	-	hypothetical protein
NMTN-11644	SAV1953		2090487	2094269	2090578	-	phi PVL ORF 20 and 21 homologue
NMTN-13132	SAV1953		2090487	2094269	2091346		
NMTN-12627	SAV1953		2090487	2094269	2091486		
NMTN-05058	SAV1953		2090487	2094269	2091778		
NMTN-02627	SAV1953		2090487	2094269	2091953		
NMTN-06828t	SAV1953		2090487	2094269	2092309		
NMTN-02578	SAV1953		2090487	2094269	2093156		
NMTN-04092	SAV1953		2090487	2094269	2093269		
NMTN-02902	SAV1953		2090487	2094269	2093272		
NMTN-08857	SAV1953		2090487	2094269	2093272		
NMTN-11272	SAV1953		2090487	2094269	2093488		
NMTN-13166	SAV1953		2090487	2094269	2093661		
NMTN-10930	SAV1953		2090487	2094269	2093749		
NMTN-12228	SAV1953		2090487	2094269	2093861		
NMTN-06872	SAV1953		2090487	2094269	2093990		
NMTN-09827	SAV1953		2090487	2094269	2094244		
NMTN-06389	SAV1953		2090487	2094269	2094266		
NMTN-06390	SAV1954		2094285	2095769	2094309	-	hypothetical protein
NMTN-03922	SAV1954		2094285	2095769	2094584		
NMTN-13367	SAV1954		2094285	2095769	2094756		
NMTN-06538	SAV1954		2094285	2095769	2094821		
NMTN-12807	SAV1954		2094285	2095769	2094881		
NMTN-11767	SAV1954		2094285	2095769	2094904		
NMTN-01647	SAV1954		2094285	2095769	2095584		
NMTN-03245	SAV1954		2094285	2095769	2095645		
NMTN-11508	SAV1954		2094285	2095769	2095753		
NMTN-10886	SAV1955		2095766	2100295	2096063	-	phi PVL ORF 15 and 16 homologue
NMTN-03844	SAV1955		2095766	2100295	2096140		
NMTN-12567	SAV1955		2095766	2100295	2096237		
NMTN-05090	SAV1955		2095766	2100295	2096274		
NMTN-12922	SAV1955		2095766	2100295	2096400		
NMTN-08082	SAV1955		2095766	2100295	2096999		
NMTN-07974	SAV1955		2095766	2100295	2098045		
NMTN-03766	SAV1955		2095766	2100295	2098326		
NMTN-12005	SAV1955		2095766	2100295	2098938		
NMTN-11125	SAV1955		2095766	2100295	2099645		
NMTN-11134	SAV1955		2095766	2100295	2099663		
NMTN-00355	SAV1955		2095766	2100295	2099956		
NMTN-06840d	SAV1956	truncated int	2100364	2100711	2100435	-	hypothetical protein
NMTN-13772	SAV1957		2101206	2101850	2101209	-	hypothetical protein
NMTN-04011	SAV1957		2101206	2101850	2101339		
NMTN-04496	SAV1957		2101206	2101850	2101804		
NMTN-04346	SAV1958		2101851	2102258	2101990	-	hypothetical protein
NMTN-02206	SAV1958		2101851	2102258	2102065		
NMTN-11129	SAV1958		2101851	2102258	2102094		
NMTN-00548	SAV1958		2101851	2102258	2102209		
NMTN-06209	SAV1959		2102255	2102659	2102403	-	hypothetical protein
NMTN-05637	SAV1959		2102255	2102659	2102521		
NMTN-13129	SAV1960		2102656	2103018	2102660	-	hypothetical protein
NMTN-13157	SAV1960		2102656	2103018	2102660		
NMTN-12074	SAV1960		2102656	2103018	2102812		
NMTN-11198	SAV1960		2102656	2103018	2102898		
NMTN-09323	SAV1960		2102656	2103018	2102987		
NMTN-12540d	SAV1962		2103276	2103560	2103483	-	hypothetical protein
NMTN-11706	SAV1963		2103580	2104725	2103746	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11652	SAV1963		2103580	2104725	2104031		
NMTN-02544	SAV1963		2103580	2104725	2104137		
NMTN-12660	SAV1963		2103580	2104725	2104340		
NMTN-11213	SAV1964		2104749	2105486	2104825	-	hypothetical protein
NMTN-09161	SAV1964		2104749	2105486	2104828		
NMTN-11765	SAV1964		2104749	2105486	2105381		
NMTN-06327	SAV1965		2105470	2106657	2105873	-	hypothetical protein
NMTN-13045	SAV1965		2105470	2106657	2106298		
NMTN-13473	SAV1965		2105470	2106657	2106597		
NMTN-06277	SAV1966		2106673	2108334	2106966	-	hypothetical protein
NMTN-08860	SAV1966		2106673	2108334	2107280		
NMTN-06939	SAV1966		2106673	2108334	2108112		
NMTN-04147	SAV1966		2106673	2108334	2108249		
NMTN-07411	SAV1966		2106673	2108334	2108320		
NMTN-09536	SAV1967		2108331	2108675	2108335	-	hypothetical protein
NMTN-04974	SAV1967		2108331	2108675	2108431		
NMTN-03672	SAV1967		2108331	2108675	2108603		
NMTN-03674	SAV1967		2108331	2108675	2108603		
NMTN-03131	SAV1968		2108805	2109104	2108948	-	hypothetical protein
NMTN-03058	SAV1968		2108805	2109104	2109075		
NMTN-15248	SAV1969		2109336	2109752	2109388	-	hypothetical protein
NMTN-13638	SAV1969		2109336	2109752	2109529		
NMTN-00613	SAV1969		2109336	2109752	2109555		
NMTN-00246	SAV1970		2109780	2109983	2109857	-	hypothetical protein
NMTN-00311	SAV1970		2109780	2109983	2109857		
NMTN-11426	SAV1974		2110561	2111130	2110686	-	dUTP pyrophosphatase
NMTN-03622	SAV1974		2110561	2111130	2110715		
NMTN-03628	SAV1974		2110561	2111130	2110715		
NMTN-06446	SAV1976		2111319	2111555	2111537	-	hypothetical protein
NMTN-05162	SAV1977		2111548	2111913	2111805	-	hypothetical protein
NMTN-00630	SAV1977		2111548	2111913	2111888		
NMTN-02679	SAV1978		2111928	2112170	2112082	-	hypothetical protein
NMTN-11089	SAV1980		2112555	2112977	2112570	-	hypothetical protein
NMTN-09359	SAV1980		2112555	2112977	2112685		
NMTN-12532	SAV1980		2112555	2112977	2112700		
NMTN-11768	SAV1980		2112555	2112977	2112709		
NMTN-00143	SAV1980		2112555	2112977	2112710		
NMTN-10871	SAV1980		2112555	2112977	2112821		
NMTN-12718	SAV1980		2112555	2112977	2112821		
NMTN-04158	SAV1980		2112555	2112977	2112864		
NMTN-04765	SAV1980		2112555	2112977	2112865		
NMTN-12958d	SAV1980		2112555	2112977	2112867		
NMTN-09027	SAV1980		2112555	2112977	2112904		
NMTN-09203	SAV1980		2112555	2112977	2112904		
NMTN-12138	SAV1981		2112968	2113186	2112975	-	hypothetical protein
NMTN-00050	SAV1981		2112968	2113186	2113040		
NMTN-02109	SAV1982		2113193	2114086	2113836	-	hypothetical protein
NMTN-00349	SAV1983		2114116	2114586	2114427	-	single-strand DNA-binding protein
NMTN-05258	SAV1983		2114116	2114586	2114438		
NMTN-12674	SAV1984		2114587	2115072	2114592	-	hypothetical protein
NMTN-03200	SAV1986		2116207	2118150	2117088	-	hypothetical protein
NMTN-13591	SAV1986		2116207	2118150	2117495		
NMTN-12926	SAV1986		2116207	2118150	2117522		
NMTN-06292	SAV1986		2116207	2118150	2117860		
NMTN-07923	SAV1987		2118159	2118422	2118349	-	hypothetical protein
NMTN-06697	SAV1991		2119246	2119566	2119559	-	hypothetical protein
NMTN-02683	SAV1992		2119618	2120253	2119728	+	hypothetical protein
NMTN-01459	SAV1992		2119618	2120253	2120203		
NMTN-11341	SAV1994		2120652	2121407	2120670	-	hypothetical protein
NMTN-03814	SAV1994		2120652	2121407	2120714		
NMTN-08536	SAV1994		2120652	2121407	2121138		
NMTN-15273	SAV1994		2120652	2121407	2121360		
NMTN-07174	SAV2001		2124619	2125083	2125001	+	hypothetical protein
NMTN-09825	SAV2001		2124619	2125083	2125050		
NMTN-06967	SAV2001		2124619	2125083	2125066		
NMTN-13353	SAV2002	int	2125142	2126179	2125215	+	integrase
NMTN-09742	SAV2002	int	2125142	2126179	2125595		
NMTN-07339	SAV2002	int	2125142	2126179	2126059		
NMTN-10642	SAV2003	truncated-hlb	2126191	2127060	2126360	+	truncated beta-hemplysin
NMTN-06639	SAV2003	truncated-hlb	2126191	2127060	2126737		
NMTN-04193	SAV2003	hlb	2126191	2127060	2126740		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09993	SAV2003	hlb	2126191	2127060	2126820		
NMTN-08871	SAV2003	truncated-hlb	2126191	2127060	2127053		
NMTN-02723	SAV2004		2127298	2128314	2127340	-	hypothetical protein
NMTN-06289	SAV2004		2127298	2128314	2127364		
NMTN-07361	SAV2004		2127298	2128314	2127418		
NMTN-02595	SAV2004		2127298	2128314	2127767		
NMTN-02607	SAV2004		2127298	2128314	2127767		
NMTN-02608	SAV2004		2127298	2128314	2127767		
NMTN-03288	SAV2004		2127298	2128314	2127880		
NMTN-11907	SAV2004		2127298	2128314	2127880		
NMTN-11331	SAV2005		2128336	2129391	2128513	-	hypothetical protein
NMTN-13229	SAV2005		2128336	2129391	2128661		
NMTN-13179	SAV2005		2128336	2129391	2129076		
NMTN-09440	SAV2006		2129827	2131029	2129954	+	hypothetical protein
NMTN-07300	SAV2006		2129827	2131029	2130349		
NMTN-08720	SAV2007		2131337	2132644	2131514	+	hypothetical protein
NMTN-11638	SAV2007		2131337	2132644	2131514		
NMTN-12820	SAV2007		2131337	2132644	2131830		
NMTN-03441	SAV2007		2131337	2132644	2132156		
NMTN-09347	SAV2007		2131337	2132644	2132160		
NMTN-11617	SAV2007		2131337	2132644	2132517		
NMTN-12603	SAV2031		2150992	2151735	2151422	+	conserved hypothetical protein
NMTN-05419	SAV2032		2151760	2153007	2152460	-	hypothetical protein
NMTN-01679	SAV2033		2153204	2153830	2153340	+	conserved hypothetical protein
NMTN-01944	SAV2033		2153204	2153830	2153376		
NMTN-06409	SAV2034		2154191	2154976	2154530	+	hypothetical protein
NMTN-01971	SAV2034		2154191	2154976	2154817		
NMTN-04484	SAV2034		2154191	2154976	2154935		
NMTN-06509	SAV2036	agrB	2155946	2156509	2156008	+	accessory gene regulator B
NMTN-04055	SAV2036	agrB	2155946	2156509	2156088		
NMTN-12177	SAV2038	agrC	2156853	2157968	2157912	+	accessory gene regulator C
NMTN-03938	SAV2039	agrA	2157987	2158703	2158059	+	accessory gene regulator A
NMTN-09613	SAV2040		2159075	2160034	2159300	-	hypothetical protein
NMTN-15189	SAV2040		2159075	2160034	2159644		
NMTN-03962	SAV2040		2159075	2160034	2159910		
NMTN-03868	SAV2041	scrB	2160031	2161515	2160078	-	sucrose-6-phosphate hydrolase
NMTN-06670	SAV2041	scrB	2160031	2161515	2161140		
NMTN-02268	SAV2042	scrR	2161664	2162614	2161701	-	sucrose operon repressor
NMTN-12879	SAV2042	scrR	2161664	2162614	2161918		
NMTN-06232	SAV2042	scrR	2161664	2162614	2161987		
NMTN-05101	SAV2042	scrR	2161664	2162614	2161990		
NMTN-12507	SAV2042	scrR	2161664	2162614	2162045		
NMTN-06283	SAV2043	nrgA	2162797	2164047	2162789	-	probable ammonium transporter
NMTN-14554	SAV2043	nrgA	2162797	2164047	2162790		
NMTN-14468	SAV2043	nrgA	2162797	2164047	2162829		
NMTN-09626	SAV2043	nrgA	2162797	2164047	2162883		
NMTN-07745	SAV2043	nrgA	2162797	2164047	2162917		
NMTN-07935	SAV2043	nrgA	2162797	2164047	2163035		
NMTN-09965	SAV2043	nrgA	2162797	2164047	2163077		
NMTN-02624	SAV2043	nrgA	2162797	2164047	2163113		
NMTN-02532	SAV2043	nrgA	2162797	2164047	2163215		
NMTN-00075	SAV2043	nrgA	2162797	2164047	2163217		
NMTN-07406	SAV2043	nrgA	2162797	2164047	2163298		
NMTN-13113	SAV2043	nrgA	2162797	2164047	2163333		
NMTN-11607	SAV2043	nrgA	2162797	2164047	2163408		
NMTN-04946	SAV2043	nrgA	2162797	2164047	2163522		
NMTN-10012	SAV2043	nrgA	2162797	2164047	2163531		
NMTN-11062d	SAV2043	nrgA	2162797	2164047	2164046		
NMTN-12435	SAV2045		2164539	2165618	2164747	-	conserved hypothetical protein
NMTN-03968	SAV2045		2164539	2165618	2164827		
NMTN-07954	SAV2045		2164539	2165618	2165041		
NMTN-02872	SAV2045		2164539	2165618	2165059		
NMTN-04413	SAV2045		2164539	2165618	2165277		
NMTN-13217	SAV2045		2164539	2165618	2165304		
NMTN-13011	SAV2045		2164539	2165618	2165520		
NMTN-04397	SAV2046		2165921	2166556	2166497	-	conserved hypothetical protein
NMTN-11087	SAV2047	vga	2166809	2168737	2167179	+	hypothetical ABC transporter
NMTN-02486	SAV2047	vga	2166809	2168737	2167956		
NMTN-10273	SAV2047	vga	2166809	2168737	2168331		
NMTN-10710	SAV2048		2169099	2170709	2169408	+	hypothetical protein
NMTN-05103	SAV2048		2169099	2170709	2169469		
NMTN-08692	SAV2048		2169099	2170709	2169571		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09927	SAV2048		2169099	2170709	2169812		
NMTN-06756	SAV2048		2169099	2170709	2170171		
NMTN-00752	SAV2053	ilvD	2174094	2175782	2174203	+	dihydroxy-acid dehydratase
NMTN-06663	SAV2053	ilvD	2174094	2175782	2174441		
NMTN-11077	SAV2053	ilvD	2174094	2175782	2174923		
NMTN-06290	SAV2053	ilvD	2174094	2175782	2175442		
NMTN-11288	SAV2054	ilvB	2175810	2177579	2176016	+	acetolactate synthase large subunit
NMTN-08835d	SAV2054	ilvB	2175810	2177579	2176092		
NMTN-11983	SAV2054	ilvB	2175810	2177579	2176588		
NMTN-10582	SAV2054	ilvB	2175810	2177579	2176606		
NMTN-11886	SAV2054	ilvB	2175810	2177579	2176783		
NMTN-02287	SAV2054	ilvB	2175810	2177579	2177018		
NMTN-02664	SAV2054	ilvB	2175810	2177579	2177493		
NMTN-10637	SAV2054	ilvB	2175810	2177579	2177577		
NMTN-10637	SAV2055		2177579	2177833	2177577	+	hypothetical protein
NMTN-10056	SAV2055		2177579	2177833	2177759		
NMTN-12517	SAV2058	leuB	2180536	2181582	2180544	+	3-isopropylmalate dehydrogenase
NMTN-03592	SAV2058	leuB	2180536	2181582	2180628		
NMTN-08475	SAV2058	leuB	2180536	2181582	2181542		
NMTN-11921	SAV2059	leuC	2181596	2182966	2182534	+	3-isopropylmalate dehydratase large subunit
NMTN-04802	SAV2060	leuD	2182967	2183539	2182963	+	3-isopropylmalate dehydratase small subunit
NMTN-06357	SAV2060	leuD	2182967	2183539	2183169		
NMTN-13106	SAV2060	leuD	2182967	2183539	2183460		
NMTN-00820	SAV2061	ilvA	2183554	2184822	2183698	+	threonine dehydratase
NMTN-11374	SAV2061	ilvA	2183554	2184822	2183777		
NMTN-09079	SAV2061	ilvA	2183554	2184822	2183932		
NMTN-03897	SAV2061	ilvA	2183554	2184822	2183979		
NMTN-05169	SAV2061	ilvA	2183554	2184822	2184345		
NMTN-11772	SAV2061	ilvA	2183554	2184822	2184439		
NMTN-00010	SAV2061	ilvA	2183554	2184822	2184780		
NMTN-12622	SAV2061	ilvA	2183554	2184822	2184828		
NMTN-08635	SAV2062		2191620	2192075	2191620	-	conserved hypothetical protein
NMTN-12383	SAV2063		2192068	2194218	2192273	-	conserved hypothetical protein
NMTN-07484	SAV2063		2192068	2194218	2192421		
NMTN-04740	SAV2063		2192068	2194218	2192558		
NMTN-01890	SAV2063		2192068	2194218	2193488		
NMTN-08030	SAV2063		2192068	2194218	2193547		
NMTN-09958	SAV2063		2192068	2194218	2193848		
NMTN-11094	SAV2063		2192068	2194218	2193910		
NMTN-00789	SAV2063		2192068	2194218	2193912		
NMTN-08677	SAV2063		2192068	2194218	2194013		
NMTN-03805	SAV2063		2192068	2194218	2194034		
NMTN-11175	SAV2063		2192068	2194218	2194036		
NMTN-12693	SAV2063		2192068	2194218	2194078		
NMTN-10513	SAV2063		2192068	2194218	2194177		
NMTN-08891	SAV2064	sigB	2194652	2195422	2194806	-	sigma factor B
NMTN-05387	SAV2064	sigB	2194652	2195422	2195088		
NMTN-13410	SAV2064	sigB	2194652	2195422	2195129		
NMTN-04540	SAV2064	sigB	2194652	2195422	2195280		
NMTN-07757	SAV2065	rsbW	2195397	2195876	2195656	-	anti-sigmaB factor
NMTN-06056	SAV2066	rsbV	2195878	2196204	2195971	-	anti-sigmaB factor antagonist
NMTN-09149	SAV2066	rsbV	2195878	2196204	2196194		
NMTN-14501	SAV2067	rsbU	2196323	2197324	2196644	-	sigmaB regulation protein
NMTN-13666	SAV2067	rsbU	2196323	2197324	2196999		
NMTN-13680	SAV2067	rsbU	2196323	2197324	2197005		
NMTN-00527	SAV2067	rsbU	2196323	2197324	2197086		
NMTN-11599	SAV2067	rsbU	2196323	2197324	2197126		
NMTN-13280	SAV2067	rsbU	2196323	2197324	2197167		
NMTN-15179	SAV2068		2197673	2198035	2197732	-	conserved hypothetical protein
NMTN-12368	SAV2068		2197673	2198035	2197760		
NMTN-15331	SAV2068		2197673	2198035	2197767		
NMTN-04020	SAV2068		2197673	2198035	2197815		
NMTN-12505	SAV2068		2197673	2198035	2197815		
NMTN-03218	SAV2068		2197673	2198035	2197841		
NMTN-00556	SAV2068		2197673	2198035	2198012		
NMTN-08755	SAV2068		2197673	2198035	2198012		
NMTN-04819	SAV2069		2198032	2198202	2198059	-	hypothetical protein
NMTN-09718	SAV2069		2198032	2198202	2198156		
NMTN-11585	SAV2069		2198032	2198202	2198204		
NMTN-14652	SAV2069		2198032	2198202	2198204		
NMTN-13708d	SAV2070	alr	2198287	2199435	2198594	-	alanine racemase

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-13683	SAV2073		2200342	2201925	2200488	-	conserved hypothetical protein
NMTN-02995	SAV2073		2200342	2201925	2200964		
NMTN-04461	SAV2073		2200342	2201925	2201007		
NMTN-13104	SAV2073		2200342	2201925	2201027		
NMTN-11773	SAV2073		2200342	2201925	2201354		
NMTN-14407	SAV2073		2200342	2201925	2201686		
NMTN-03192	SAV2074		2201918	2202397	2202009	-	hypothetical protein
NMTN-11874	SAV2074		2201918	2202397	2202012		
NMTN-10901	SAV2074		2201918	2202397	2202211		
NMTN-06506	SAV2074		2201918	2202397	2202299		
NMTN-05113	SAV2075	kdpC	2202605	2203165	2202717	-	probable potassium-transporting ATPase C chain
NMTN-09662	SAV2075	kdpC	2202605	2203165	2203055		
NMTN-11944	SAV2075	kdpC	2202605	2203165	2203125		
NMTN-02668	SAV2076	kdpB	2203185	2205212	2203440	-	probable potassium-transporting ATPase B chain
NMTN-08660	SAV2076	kdpB	2203185	2205212	2204032		
NMTN-12406	SAV2076	kdpB	2203185	2205212	2204035		
NMTN-12407	SAV2076	kdpB	2203185	2205212	2204035		
NMTN-04652	SAV2076	kdpB	2203185	2205212	2204280		
NMTN-12197	SAV2076	kdpB	2203185	2205212	2204986		
NMTN-09039	SAV2076	kdpB	2203185	2205212	2205037		
NMTN-03183	SAV2077	kdpA	2205231	2206907	2205275	-	probable potassium-transporting ATPase A chain
NMTN-10655	SAV2077	kdpA	2205231	2206907	2205982		
NMTN-14531	SAV2077	kdpA	2205231	2206907	2205982		
NMTN-12670	SAV2077	kdpA	2205231	2206907	2206732		
NMTN-02877	SAV2078	kdpD	2207179	2209836	2207737	+	sensor protein
NMTN-11994	SAV2078	kdpD	2207179	2209836	2207787		
NMTN-00593	SAV2078	kdpD	2207179	2209836	2207998		
NMTN-06755	SAV2078	kdpD	2207179	2209836	2208018		
NMTN-03512	SAV2078	kdpD	2207179	2209836	2208026		
NMTN-12891	SAV2078	kdpD	2207179	2209836	2208239		
NMTN-10869	SAV2078	kdpD	2207179	2209836	2208338		
NMTN-07778	SAV2078	kdpD	2207179	2209836	2208578		
NMTN-11808	SAV2078	kdpD	2207179	2209836	2209291		
NMTN-04128	SAV2078	kdpD	2207179	2209836	2209808		
NMTN-03701	SAV2078	kdpD	2207179	2209836	2209831		
NMTN-00503	SAV2078	kdpD	2207179	2209836	2209834		
NMTN-04094	SAV2079	kdpE	2209836	2210531	2210425	+	KDP operon transcriptional regulatory protein
NMTN-12590	SAV2081		2212403	2213923	2213013	-	hypothetical protein
NMTN-09584	SAV2086		2218932	2219141	2218923	-	hypothetical protein
NMTN-02828	SAV2087		2219153	2219446	2219232	-	conserved hypothetical protein
NMTN-09428	SAV2088		2219612	2221096	2219621	+	hypothetical protein
NMTN-03083	SAV2088		2219612	2221096	2219971		
NMTN-00196	SAV2088		2219612	2221096	2220113		
NMTN-14553	SAV2088		2219612	2221096	2220335		
NMTN-07540	SAV2088		2219612	2221096	2220637		
NMTN-06337	SAV2088		2219612	2221096	2220863		
NMTN-05295	SAV2088		2219612	2221096	2220897		
NMTN-10615	SAV2091	thiE	2223542	2224183	2223872	-	thiamin phosphate synthase
NMTN-10618	SAV2091	thiE	2223542	2224183	2223872		
NMTN-11497	SAV2091	thiE	2223542	2224183	2223883		
NMTN-12882	SAV2092	thiM	2224185	2224976	2224960	-	hydroxyethyl thiazole kinase
NMTN-12882	SAV2093	thiD	2224960	2225790	2224960	-	phosphomethylpyrimidine kinase
NMTN-08417	SAV2093	thiD	2224960	2225790	2225073		
NMTN-11298	SAV2093	thiD	2224960	2225790	2225144		
NMTN-11211	SAV2093	thiD	2224960	2225790	2225558		
NMTN-01759	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01765	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01853	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01879	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01880	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01881	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01886	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01887	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01897	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01898	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01899	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01902	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01906	SAV2093	thiD	2224960	2225790	2225561		
NMTN-01909	SAV2093	thiD	2224960	2225790	2225561		



TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03108	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03121	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03132	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03144	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03150	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03170	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03180	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03190	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03195	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03403	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03415	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03430	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03561	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03574	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03577	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03762	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03782	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03800	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03832	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03983	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03988	SAV2093	thiD	2224960	2225790	2225561		
NMTN-03995	SAV2093	thiD	2224960	2225790	2225561		
NMTN-05639	SAV2093	thiD	2224960	2225790	2225561		
NMTN-11202	SAV2093	thiD	2224960	2225790	2225561		
NMTN-13711	SAV2093	thiD	2224960	2225790	2225774		
NMTN-05306	SAV2094		2225783	2226472	2225881	-	hypothetical protein
NMTN-02677	SAV2094		2225783	2226472	2226089		
NMTN-00834	SAV2094		2225783	2226472	2226122		
NMTN-00426	SAV2094		2225783	2226472	2226325		
NMTN-06531	SAV2096		2227943	2228338	2228057	-	hypothetical protein
NMTN-05459	SAV2096		2227943	2228338	2228060		
NMTN-02495	SAV2096		2227943	2228338	2228062		
NMTN-09009	SAV2096		2227943	2228338	2228335		
NMTN-02126	SAV2101		2230882	2231115	2231040	-	conserved hypothetical protein
NMTN-02208	SAV2104	atpG	2233535	2234401	2234066	-	ATP synthase gamma chain
NMTN-08119	SAV2111	mnaA	2238744	2239874	2238821	-	UDP-GlcNAc 2-epimerase
NMTN-00209	SAV2111	mnaA	2238744	2239874	2238863		
NMTN-14642	SAV2111	mnaA	2238744	2239874	2239850		
NMTN-03277	SAV2112	upp	2239895	2240524	2240127	-	uracil phosphoribosyl transferase
NMTN-09033	SAV2113	glyA	2240552	2241790	2241713	-	serine hydroxymethyl transferase
NMTN-08850	SAV2114		2241817	2242341	2241924	-	conserved hypothetical protein
NMTN-11642	SAV2114		2241817	2242341	2241983		
NMTN-03186	SAV2115		2242448	2242867	2242537	-	hypothetical protein
NMTN-03191	SAV2115		2242448	2242867	2242537		
NMTN-05055	SAV2117		2243994	2244830	2244032	-	hypothetical protein
NMTN-03531	SAV2117		2243994	2244830	2244271		
NMTN-08127		tdk	2245894	2246493	2246234		
NMTN-10641	SAV2121	rho	2247212	2248528	2247475	-	transcription termination factor Rho
NMTN-04809	SAV2121	rho	2247212	2248528	2247660		
NMTN-10653	SAV2121	rho	2247212	2248528	2247705		
NMTN-07423	SAV2121	rho	2247212	2248528	2247780		
NMTN-02746	SAV2121	rho	2247212	2248528	2247859		
NMTN-04536	SAV2121	rho	2247212	2248528	2248263		
NMTN-08915	SAV2121	rho	2247212	2248528	2248312		
NMTN-04296	SAV2121	rho	2247212	2248528	2248318		
NMTN-04684	SAV2121	rho	2247212	2248528	2248318		
NMTN-01625	SAV2121	rho	2247212	2248528	2248327		
NMTN-13781	SAV2121	rho	2247212	2248528	2248327		
NMTN-11444	SAV2121	rho	2247212	2248528	2248350		
NMTN-09187	SAV2121	rho	2247212	2248528	2248384		
NMTN-03903	SAV2122		2248775	2250202	2249033	-	hypothetical protein
NMTN-12558	SAV2122		2248775	2250202	2249772		
NMTN-07480	SAV2123		2250440	2250778	2250697	-	conserved hypothetical protein
NMTN-13125	SAV2123		2250440	2250778	2250736		
NMTN-01548	SAV2124	murZ	2250864	2252123	2251399	-	UDP-N-acetylglucosamine 1-carboxylvinyl transferase 2
NMTN-01549	SAV2124	murZ	2250864	2252123	2251399		
NMTN-01588	SAV2124	murZ	2250864	2252123	2251399		
NMTN-01605	SAV2124	murZ	2250864	2252123	2251399		
NMTN-04316	SAV2124	murZ	2250864	2252123	2251401		
NMTN-04714	SAV2124	murZ	2250864	2252123	2251541		
NMTN-01447	SAV2129		2256885	2257745	2257371	-	hypothetical protein
NMTN-00608	SAV2129		2256885	2257745	2257634		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09408	SAV2131		2259104	2259775	2259446	-	hypothetical protein
NMTN-08895	SAV2132		2260174	2261367	2260319	-	hypothetical protein
NMTN-11744	SAV2132		2260174	2261367	2260615		
NMTN-14419	SAV2132		2260174	2261367	2261243		
NMTN-11140	SAV2132		2260174	2261367	2261287		
NMTN-09186	SAV2133	hmrA	2261367	2262551	2261672	-	HmrA
NMTN-01579	SAV2133	hmrA	2261367	2262551	2261798		
NMTN-07765	SAV2133	hmrA	2261367	2262551	2262132		
NMTN-03816	SAV2133	hmrA	2261367	2262551	2262501		
NMTN-15294	SAV2134	luxS	2262862	2263332	2263196	+	autoinducer-2 production protein
NMTN-11493	SAV2135		2263484	2263834	2263615	-	conserved hypothetical protein
NMTN-11538	SAV2135		2263484	2263834	2263825		
NMTN-00230	SAV2136	pdp	2263848	2265188	2264555	-	pyrimidine nucleoside phosphorylase
NMTN-11366	SAV2136	pdp	2263848	2265188	2264555		
NMTN-04729	SAV2136	pdp	2263848	2265188	2264696		
NMTN-03771	SAV2137		2265428	2266090	2265459	-	deoxyribose-phosphate aldolase
NMTN-04697	SAV2137		2265428	2266090	2265940		
NMTN-08131	SAV2138	deoD	2266404	2267114	2266461	+	purine nucleoside phosphorylase
NMTN-00644	SAV2138	deoD	2266404	2267114	2266860		
NMTN-02008	SAV2138	deoD	2266404	2267114	2266974		
NMTN-11386	SAV2138	deoD	2266404	2267114	2267100		
NMTN-13004d	SAV2142		2270793	2271023	2270921	-	hypothetical protein
NMTN-11342	SAV2143		2271054	2271992	2271470	-	hypothetical protein
NMTN-00297	SAV2143		2271054	2271992	2271986		
NMTN-01875	SAV2144		2272428	2273093	2273057	-	conserved hypothetical protein
NMTN-13492	SAV2145	czrA	2273245	2273565	2273513	+	repressor protein
NMTN-13346	SAV2145	czrA	2273245	2273565	2273530		
NMTN-00173	SAV2146	czrB	2273567	2274544	2273664	+	cation-efflux system membrane protein homolog
NMTN-14517	SAV2146	czrB	2273567	2274544	2274029		
NMTN-02876	SAV2146	czrB	2273567	2274544	2274236		
NMTN-09812	SAV2146	czrB	2273567	2274544	2274382		
NMTN-01487	SAV2146	czrB	2273567	2274544	2274429		
NMTN-04069	SAV2147		2274810	2275901	2274937	+	lytic regulatory protein truncated with Tn554
NMTN-09622	SAV2147		2274810	2275901	2275132		
NMTN-01507	SAV2147		2274810	2275901	2275294		
NMTN-14662	SAV2152		2277934	2278791	2278055	-	conserved hypothetical protein
NMTN-12714	SAV2152		2277934	2278791	2278280		
NMTN-06880d	SAV2153		2278859	2279641	2279091	-	hypothetical protein
NMTN-09672	SAV2153		2278859	2279641	2279379		
NMTN-11623d	SAV2153		2278859	2279641	2279403		
NMTN-08466	SAV2153		2278859	2279641	2279523		
NMTN-09777	SAV2153		2278859	2279641	2279631		
NMTN-01551	SAV2156	mtfF	2282359	2283897	2282419	+	mannitol specific IIBC component of PTS system
NMTN-03006	SAV2156	mtfF	2282359	2283897	2282647		
NMTN-05248	SAV2156	mtfF	2282359	2283897	2283437		
NMTN-08676	SAV2157		2283932	2286064	2284357	+	hypothetical protein
NMTN-15337	SAV2157		2283932	2286064	2284913		
NMTN-04123	SAV2157		2283932	2286064	2284934		
NMTN-11023	SAV2157		2283932	2286064	2284996		
NMTN-12774	SAV2158	mtlA	2286076	2286510	2286392	+	PTS system, mannitol specific IIA component
NMTN-05401	SAV2159	mtlD	2286510	2287616	2287097	+	mannitol-1-phosphate 5-dehydrogenase
NMTN-09210	SAV2159	mtlD	2286510	2287616	2287302		
NMTN-06251	SAV2159	mtlD	2286510	2287616	2287409		
NMTN-09420	SAV2159	mtlD	2286510	2287616	2287419		
NMTN-09280	SAV2160	fntB(mrp)	2287935	2295380	2287990	-	FntB protein
NMTN-04354	SAV2160	fntB(mrp)	2287935	2295380	2288641		
NMTN-11254	SAV2160	fntB(mrp)	2287935	2295380	2288708		
NMTN-07408	SAV2160	fntB(mrp)	2287935	2295380	2289189		
NMTN-07395	SAV2160	fntB(mrp)	2287935	2295380	2289200		
NMTN-07398	SAV2160	fntB(mrp)	2287935	2295380	2289200		
NMTN-14699	SAV2160	fntB(mrp)	2287935	2295380	2289653		
NMTN-00057	SAV2160	fntB(mrp)	2287935	2295380	2290443		
NMTN-10662	SAV2160	fntB(mrp)	2287935	2295380	2290760		
NMTN-09935	SAV2160	fntB(mrp)	2287935	2295380	2290800		
NMTN-02138	SAV2160	fntB(mrp)	2287935	2295380	2291860		
NMTN-14507	SAV2160	fntB(mrp)	2287935	2295380	2292229		
NMTN-06206	SAV2160	fntB(mrp)	2287935	2295380	2292317		
NMTN-14565	SAV2160	fntB(mrp)	2287935	2295380	2292652		
NMTN-06719	SAV2160	fntB(mrp)	2287935	2295380	2292728		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11679	SAV2160	fntB(mrp)	2287935	2295380	2293214		
NMTN-06152	SAV2160	fntB(mrp)	2287935	2295380	2293585		
NMTN-06158	SAV2160	fntB(mrp)	2287935	2295380	2293585		
NMTN-09670	SAV2160	fntB(mrp)	2287935	2295380	2294043		
NMTN-13098	SAV2160	fntB(mrp)	2287935	2295380	2294151		
NMTN-04909	SAV2160	fntB(mrp)	2287935	2295380	2294324		
NMTN-11008	SAV2160	fntB(mrp)	2287935	2295380	2294576		
NMTN-14053	SAV2160	fntB(mrp)	2287935	2295380	2294777		
NMTN-09330	SAV2161	glmM (femD)	2295658	2297013	2296079	-	phosphoglucosamine-mutase
NMTN-09505	SAV2162		2297040	2297972	2297051	-	conserved hypothetical protein
NMTN-11545	SAV2162		2297040	2297972	2297099		
NMTN-13821	SAV2162		2297040	2297972	2297658		
NMTN-10979	SAV2164	arg	2298972	2299880	2298977	-	arginase
NMTN-09246	SAV2164	arg	2298972	2299880	2299853		
NMTN-01990		rRNA-23S			2300935		
NMTN-02023		rRNA-23S			2302735		
NMTN-01955		rRNA-16S			2305514		
NMTN-10407	SAV2166		2307333	2308775	2307345	-	hypothetical protein
NMTN-04726	SAV2166		2307333	2308775	2307346		
NMTN-09240	SAV2166		2307333	2308775	2308096		
NMTN-01617	SAV2166		2307333	2308775	2308161		
NMTN-14530	SAV2166		2307333	2308775	2308605		
NMTN-08740	SAV2166		2307333	2308775	2308683		
NMTN-10377	SAV2167		2309098	2309571	2309114	-	hypothetical protein
NMTN-07474	SAV2167		2309098	2309571	2309136		
NMTN-00329	SAV2167		2309098	2309571	2309202		
NMTN-03220	SAV2167		2309098	2309571	2309410		
NMTN-05118	SAV2167		2309098	2309571	2309448		
NMTN-03603	SAV2167		2309098	2309571	2309525		
NMTN-03228	SAV2168		2309670	2310191	2309673	-	putative multidrug transporter
NMTN-01945	SAV2168		2309670	2310191	2310017		
NMTN-03831	SAV2169		2310155	2310814	2310155	-	hypothetical protein
NMTN-12451	SAV2169		2310155	2310814	2310337		
NMTN-14595	SAV2169		2310155	2310814	2310357		
NMTN-03806	SAV2169		2310155	2310814	2310523		
NMTN-02101	SAV2169		2310155	2310814	2310534		
NMTN-07951	SAV2170		2310970	2311656	2311460	-	hypothetical protein
NMTN-04933	SAV2170		2310970	2311656	2311496		
NMTN-12401	SAV2170		2310970	2311656	2311655		
NMTN-03929	SAV2171		2311672	2312859	2311799	-	hypothetical protein
NMTN-09215	SAV2171		2311672	2312859	2312087		
NMTN-07502	SAV2171		2311672	2312859	2312475		
NMTN-08769	SAV2171		2311672	2312859	2312724		
NMTN-12456	SAV2172		2312903	2313418	2312932	-	conserved hypothetical protein
NMTN-13381	SAV2172		2312903	2313418	2312937		
NMTN-13416	SAV2172		2312903	2313418	2312966		
NMTN-04558	SAV2172		2312903	2313418	2313310		
NMTN-00602	SAV2174		2313924	2315294	2313959	-	conserved hypothetical protein
NMTN-07383	SAV2174		2313924	2315294	2314113		
NMTN-11690	SAV2174		2313924	2315294	2314129		
NMTN-00414	SAV2174		2313924	2315294	2314684		
NMTN-06566	SAV2174		2313924	2315294	2314762		
NMTN-11619d	SAV2174		2313924	2315294	2314868		
NMTN-06675	SAV2174		2313924	2315294	2315056		
NMTN-06676	SAV2174		2313924	2315294	2315056		
NMTN-06356	SAV2174		2313924	2315294	2315129		
NMTN-03244	SAV2174		2313924	2315294	2315242		
NMTN-02878	SAV2175		2315530	2316498	2315948	-	hypothetical protein
NMTN-02884	SAV2175		2315530	2316498	2315948		
NMTN-08117	SAV2175		2315530	2316498	2316019		
NMTN-03504	SAV2175		2315530	2316498	2316041		
NMTN-04180	SAV2175		2315530	2316498	2316317		
NMTN-09698	SAV2175		2315530	2316498	2316388		
NMTN-09717	SAV2175		2315530	2316498	2316388		
NMTN-05526	SAV2176		2316495	2317526	2316608	-	hypothetical protein
NMTN-06607	SAV2176		2316495	2317526	2316755		
NMTN-10535	SAV2176		2316495	2317526	2317007		
NMTN-07448	SAV2176		2316495	2317526	2317109		
NMTN-09257	SAV2176		2316495	2317526	2317131		
NMTN-08990	SAV2177		2317538	2318521	2317875	-	hypothetical protein
NMTN-06699	SAV2177		2317538	2318521	2317880		
NMTN-12756	SAV2178		2318913	2319983	2318990	-	conserved hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-13716	SAV2178		2318913	2319983	2319154		
NMTN-00049	SAV2178		2318913	2319983	2319771		
NMTN-12545	SAV2179		2319990	2321747	2321548	-	conserved hypothetical protein
NMTN-12547	SAV2179		2319990	2321747	2321548		
NMTN-12559	SAV2179		2319990	2321747	2321548		
NMTN-11814	SAV2180		2321734	2322927	2321813	-	hypothetical protein
NMTN-00252	SAV2180		2321734	2322927	2322248		
NMTN-05624	SAV2180		2321734	2322927	2322393		
NMTN-02896	SAV2180		2321734	2322927	2322402		
NMTN-11608	SAV2180		2321734	2322927	2322506		
NMTN-08977	SAV2181		2323029	2325005	2323538	+	hypothetical protein
NMTN-11381	SAV2181		2323029	2325005	2323879		
NMTN-11653	SAV2181		2323029	2325005	2324342		
NMTN-10198	SAV2181		2323029	2325005	2324504		
NMTN-11306	SAV2184		2325990	2326526	2326348	-	hypothetical protein
NMTN-03969	SAV2185		2326701	2328263	2327048	-	glycine betaine transporter opuD homolog
NMTN-02520	SAV2185		2326701	2328263	2327464		
NMTN-09843	SAV2185		2326701	2328263	2327479		
NMTN-14647	SAV2185		2326701	2328263	2327486		
NMTN-07372	SAV2185		2326701	2328263	2327765		
NMTN-10709	SAV2185		2326701	2328263	2327820		
NMTN-06255	SAV2186		2328571	2329578	2328820	-	hypothetical protein
NMTN-11621	SAV2186		2328571	2329578	2328884		
NMTN-10701	SAV2186		2328571	2329578	2329345		
NMTN-00377	SAV2187		2329813	2330814	2329989	-	hypothetical protein
NMTN-00323	SAV2187		2329813	2330814	2330033		
NMTN-11314	SAV2187		2329813	2330814	2330039		
NMTN-00615	SAV2187		2329813	2330814	2330709		
NMTN-11943	SAV2188		2331092	2331961	2331221	-	conserved hypothetical protein
NMTN-05259	SAV2188		2331092	2331961	2331340		
NMTN-04401	SAV2188		2331092	2331961	2331396		
NMTN-10622	SAV2189	lacG	2332227	2333639	2332411	-	6-phospho-beta-galactosidase
NMTN-15318d	SAV2189	lacG	2332227	2333639	2332446		
NMTN-08395	SAV2189	lacG	2332227	2333639	2332808		
NMTN-04314	SAV2189	lacG	2332227	2333639	2332886		
NMTN-14399	SAV2189	lacG	2332227	2333639	2333132		
NMTN-05243	SAV2189	lacG	2332227	2333639	2333358		
NMTN-09001	SAV2190	lacE	2333657	2335369	2333778	-	PTS system, lactose-specific IIBC component
NMTN-11521	SAV2190	lacE	2333657	2335369	2333991		
NMTN-08745	SAV2190	lacE	2333657	2335369	2334180		
NMTN-13796d	SAV2190	lacE	2333657	2335369	2334841		
NMTN-06472	SAV2190	lacE	2333657	2335369	2335303		
NMTN-11685	SAV2190	lacE	2333657	2335369	2335305		
NMTN-06631	SAV2191	lacF	2335375	2335686	2335691	-	PTS system, lactose-specific IIA component
NMTN-03563	SAV2192	lacD	2335708	2336688	2335784	-	tagatose 1,6-diphosphate aldolase
NMTN-08603	SAV2192	lacD	2335708	2336688	2336300		
NMTN-09340	SAV2193	lacC	2336692	2337624	2337089	-	tagatose-6-phosphate kinase
NMTN-02796	SAV2193	lacC	2336692	2337624	2337209		
NMTN-12681	SAV2193	lacC	2336692	2337624	2337377		
NMTN-00103	SAV2194	lacB	2337637	2338152	2337722	-	galactose-6-phosphate isomerase LacB subunit
NMTN-03251	SAV2194	lacB	2337637	2338152	2337894		
NMTN-11333	SAV2197		2339969	2340700	2340332	+	hypothetical protein
NMTN-00445	SAV2197		2339969	2340700	2340405		
NMTN-10928	SAV2197		2339969	2340700	2340536		
NMTN-09119	SAV2200		2341421	2342269	2341570	-	hypothetical protein
NMTN-15274	SAV2201		2342339	2342755	2342523	-	hypothetical protein
NMTN-03517	SAV2202	hysA	2343163	2345592	2343173	+	hyaluronate lyase precursor
NMTN-07810	SAV2202	hysA	2343163	2345592	2343213		
NMTN-09175	SAV2202	hysA	2343163	2345592	2343330		
NMTN-12632	SAV2202	hysA	2343163	2345592	2344019		
NMTN-12734	SAV2202	hysA	2343163	2345592	2344495		
NMTN-07492	SAV2202	hysA	2343163	2345592	2344531		
NMTN-05181	SAV2202	hysA	2343163	2345592	2344645		
NMTN-09176	SAV2202	hysA	2343163	2345592	2345140		
NMTN-12358	SAV2202	hysA	2343163	2345592	2345249		
NMTN-09278	SAV2202	hysA	2343163	2345592	2345553		
NMTN-08970	SAV2203		2345652	2346506	2345768	-	conserved hypothetical protein
NMTN-12521	SAV2203		2345652	2346506	2345768		
NMTN-12117	SAV2203		2345652	2346506	2346414		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04489	SAV2204		2346717	2347532	2347084	-	conserved hypothetical protein
NMTN-02906	SAV2204		2346717	2347532	2347201		
NMTN-08826	SAV2206		2348636	2349340	2349110	-	hypothetical protein
NMTN-11932	SAV2207	alsS	2349377	2351041	2350115	-	alpha-acetolactate synthase
NMTN-08611	SAV2207	alsS	2349377	2351041	2350642		
NMTN-01630	SAV2207	alsS	2349377	2351041	2350750		
NMTN-05445	SAV2207	alsS	2349377	2351041	2350750		
NMTN-03959	SAV2207	alsS	2349377	2351041	2350804		
NMTN-12811	SAV2207	alsS	2349377	2351041	2350902		
NMTN-06362	SAV2219	truA	2360488	2361291	2361035	-	tRNA pseudouridine synthase A
NMTN-05576	SAV2252		2378567	2378956	2378726	+	hypothetical protein
NMTN-06866	SAV2252		2378567	2378956	2378762		
NMTN-14302	SAV2252		2378567	2378956	2378871		
NMTN-06286	SAV2252		2378567	2378956	2378895		
NMTN-01570	SAV2252		2378567	2378956	2378935		
NMTN-12745	SAV2253		2379147	2380481	2379386	-	conserved hypothetical protein
NMTN-00068	SAV2253		2379147	2380481	2379974		
NMTN-05204	SAV2253		2379147	2380481	2379979		
NMTN-05438	SAV2253		2379147	2380481	2380133		
NMTN-09409	SAV2253		2379147	2380481	2380191		
NMTN-05017	SAV2254	topB	2380594	2382729	2381734	-	DNA topoisomerase III topB
NMTN-13837	SAV2254	topB	2380594	2382729	2381734		
NMTN-12573	SAV2254	topB	2380594	2382729	2381768		
NMTN-11561d	SAV2254	topB	2380594	2382729	2381855		
NMTN-07127	SAV2254	topB	2380594	2382729	2381870		
NMTN-04663	SAV2254	topB	2380594	2382729	2381897		
NMTN-03690	SAV2254	topB	2380594	2382729	2381900		
NMTN-12971	SAV2254	topB	2380594	2382729	2382131		
NMTN-13163	SAV2254	topB	2380594	2382729	2382131		
NMTN-13550	SAV2254	topB	2380594	2382729	2382131		
NMTN-13552	SAV2254	topB	2380594	2382729	2382131		
NMTN-05391	SAV2254	topB	2380594	2382729	2382187		
NMTN-04643	SAV2254	topB	2380594	2382729	2382262		
NMTN-12279	SAV2254	topB	2380594	2382729	2382690		
NMTN-04767	SAV2254	topB	2380594	2382729	2382717		
NMTN-11660	SAV2255		2382814	2383791	2383516	+	conserved hypothetical protein
NMTN-03598	SAV2255		2382814	2383791	2383557		
NMTN-01500	SAV2256		2383972	2384835	2384236	+	glucose uptake protein homolog
NMTN-00123	SAV2256		2383972	2384835	2384473		
NMTN-07706	SAV2256		2383972	2384835	2384810		
NMTN-02909	SAV2258		2385490	2386398	2385685	-	conserved hypothetical protein
NMTN-02917	SAV2258		2385490	2386398	2385685		
NMTN-02745	SAV2258		2385490	2386398	2385690		
NMTN-06951	SAV2258		2385490	2386398	2385729		
NMTN-01901	SAV2258		2385490	2386398	2385755		
NMTN-10666	SAV2258		2385490	2386398	2385871		
NMTN-11869	SAV2258		2385490	2386398	2385898		
NMTN-07061	SAV2258		2385490	2386398	2386197		
NMTN-11883	SAV2261		2387441	2390608	2388535	-	hypothetical protein
NMTN-00283	SAV2261		2387441	2390608	2388663		
NMTN-05054	SAV2261		2387441	2390608	2389165		
NMTN-07468	SAV2261		2387441	2390608	2389249		
NMTN-00436	SAV2261		2387441	2390608	2389336		
NMTN-03285	SAV2261		2387441	2390608	2389671		
NMTN-10966	SAV2265		2393548	2393988	2393633	+	hypothetical protein
NMTN-13918	SAV2265		2393548	2393988	2393638		
NMTN-03874	SAV2266		2393981	2395192	2394434	+	hypothetical protein
NMTN-04875	SAV2266		2393981	2395192	2394467		
NMTN-04394	SAV2266		2393981	2395192	2394682		
NMTN-13333	SAV2266		2393981	2395192	2394751		
NMTN-01597	SAV2266		2393981	2395192	2394789		
NMTN-06524	SAV2266		2393981	2395192	2394872		
NMTN-07695	SAV2266		2393981	2395192	2395000		
NMTN-13636	SAV2268	moaA	2396221	2397243	2396489	-	molybdenum cofactor biosynthesis protein A
NMTN-11964	SAV2268	moaA	2396221	2397243	2396687		
NMTN-11592	SAV2268	moaA	2396221	2397243	2396994		
NMTN-05250	SAV2268	moaA	2396221	2397243	2397048		
NMTN-09182	SAV2269	mobA	2397263	2397862	2397258	-	molybdopterin-guanine dinucleotide biosynthesis
NMTN-10620	SAV2269	mobA	2397263	2397862	2397409		
NMTN-04699	SAV2269	mobA	2397263	2397862	2397757		
NMTN-03509	SAV2270	moaD	2397869	2398102	2398066	-	probable molybdopterin synthase small subunit

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-01567	SAV2271	moaE	2398108	2398554	2398353	-	molybdopterin converting factor
NMTN-03209	SAV2271	moaE	2398108	2398554	2398399		
NMTN-11375	SAV2273	moaA	2399050	2400309	2399100	-	molybdopterin biosynthesis protein
NMTN-12113	SAV2273	moaA	2399050	2400309	2399208		
NMTN-13820	SAV2273	moaA	2399050	2400309	2399211		
NMTN-14649	SAV2273	moaA	2399050	2400309	2399927		
NMTN-00662	SAV2273	moaA	2399050	2400309	2399930		
NMTN-12616	SAV2274	moaC	2400372	2400866	2400519	+	molybdenum cofactor biosynthesis protein C
NMTN-12987	SAV2274	moaC	2400372	2400866	2400561		
NMTN-03257	SAV2274	moaC	2400372	2400866	2400623		
NMTN-12467	SAV2276	moeB	2401405	2402409	2401931	-	molybdopterin biosynthesis protein
NMTN-04648	SAV2277	modC	2402579	2403184	2403043	-	molybdenum transport ATP-binding protein
NMTN-02985	SAV2279		2403826	2404038	2403961	+	probable molybdate-binding protein
NMTN-04839	SAV2280	narQ	2404380	2405177	2404457	+	FdhD protein homolog
NMTN-05029	SAV2280	narQ	2404380	2405177	2404457		
NMTN-09544	SAV2280	narQ	2404380	2405177	2404579		
NMTN-07077	SAV2280	narQ	2404380	2405177	2404648		
NMTN-03843	SAV2281		2405349	2406119	2406093	-	hypothetical protein
NMTN-08709	SAV2281		2405349	2406119	2406093		
NMTN-09551	SAV2281		2405349	2406119	2406106		
NMTN-04375	SAV2283		2406871	2407812	2406924	-	hypothetical protein
NMTN-03239	SAV2283		2406871	2407812	2407374		
NMTN-11554	SAV2284		2408210	2409118	2408265	-	hypothetical protein
NMTN-06626	SAV2284		2408210	2409118	2408277		
NMTN-13637	SAV2284		2408210	2409118	2408509		
NMTN-03275	SAV2285		2409332	2410486	2410380	-	hypothetical protein
NMTN-02966	SAV2287		2410703	2411608	2411059	-	hypothetical protein
NMTN-14486	SAV2287		2410703	2411608	2411320		
NMTN-05057	SAV2287		2410703	2411608	2411530		
NMTN-03011	SAV2287		2410703	2411608	2411560		
NMTN-15250	SAV2288	ureA	2411868	2412170	2412174	+	urease gamma subunit
NMTN-15250	SAV2289	ureB	2412184	2412594	2412174	+	urease beta subunit
NMTN-07749d	SAV2289	ureB	2412184	2412594	2412351		
NMTN-05068	SAV2290	ureC	2412591	2414306	2412913	+	urease alpha subunit
NMTN-00837	SAV2290	ureC	2412591	2414306	2413999		
NMTN-02942	SAV2290	ureC	2412591	2414306	2414231		
NMTN-09184	SAV2292	ureF	2414764	2415453	2415230	+	urease accessory protein
NMTN-14054	SAV2292	ureF	2414764	2415453	2415310		
NMTN-14482	SAV2293	ureG	2415466	2416080	2415749	+	urease accessory protein
NMTN-01475	SAV2293	ureG	2415466	2416080	2415763		
NMTN-14648	SAV2293	ureG	2415466	2416080	2415882		
NMTN-12725	SAV2294	ureD	2416272	2416916	2416333	+	urease accessory protein
NMTN-03045	SAV2297		2418270	2419013	2418646	-	hypothetical protein
NMTN-11387	SAV2297		2418270	2419013	2418707		
NMTN-06774	SAV2298		2419039	2420994	2419175	-	hypothetical protein
NMTN-10717	SAV2298		2419039	2420994	2419208		
NMTN-10804	SAV2298		2419039	2420994	2419323		
NMTN-03399	SAV2298		2419039	2420994	2419732		
NMTN-06159	SAV2298		2419039	2420994	2419854		
NMTN-13119	SAV2298		2419039	2420994	2420360		
NMTN-03776	SAV2298		2419039	2420994	2420432		
NMTN-02820	SAV2298		2419039	2420994	2420598		
NMTN-10716	SAV2298		2419039	2420994	2420715		
NMTN-13598	SAV2298		2419039	2420994	2420793		
NMTN-03952	SAV2298		2419039	2420994	2420900		
NMTN-03230	SAV2298		2419039	2420994	2420925		
NMTN-09996	SAV2300		2422425	2422553	2422450	-	hypothetical protein
NMTN-09197	SAV2301		2422841	2424241	2422879	-	hypothetical protein
NMTN-00354	SAV2301		2422841	2424241	2422915		
NMTN-06511	SAV2301		2422841	2424241	2423160		
NMTN-10267	SAV2301		2422841	2424241	2423186		
NMTN-10990	SAV2301		2422841	2424241	2423218		
NMTN-04678	SAV2301		2422841	2424241	2423359		
NMTN-05291	SAV2301		2422841	2424241	2423533		
NMTN-03158	SAV2301		2422841	2424241	2423688		
NMTN-11699	SAV2301		2422841	2424241	2423695		
NMTN-02916	SAV2301		2422841	2424241	2423778		
NMTN-11716	SAV2302		2424336	2425418	2424922	-	hypothetical protein
NMTN-05455	SAV2304		2426325	2426825	2426514	+	hypothetical protein
NMTN-09630	SAV2305		2427186	2428139	2427190	+	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11098	SAV2305		2427186	2428139	2427921		
NMTN-09992	SAV2306		2428231	2429355	2428303	-	hypothetical protein
NMTN-12425	SAV2306		2428231	2429355	2428416		
NMTN-11352	SAV2306		2428231	2429355	2428746		
NMTN-07910	SAV2306		2428231	2429355	2428802		
NMTN-05523	SAV2306		2428231	2429355	2428863		
NMTN-03759	SAV2306		2428231	2429355	2428929		
NMTN-09916	SAV2306		2428231	2429355	2428994		
NMTN-06775	SAV2306		2428231	2429355	2429112		
NMTN-07399	SAV2306		2428231	2429355	2429112		
NMTN-11146	SAV2306		2428231	2429355	2429195		
NMTN-09134	SAV2307		2429666	2430442	2430373	-	hypothetical protein
NMTN-14520	SAV2308		2430925	2431398	2431160	-	conserved hypothetical protein
NMTN-07728	SAV2309		2431398	2434352	2431625	-	formate dehydrogenase homolog
NMTN-02123	SAV2309		2431398	2434352	2431976		
NMTN-12601	SAV2309		2431398	2434352	2432603		
NMTN-11680	SAV2309		2431398	2434352	2432743		
NMTN-04836	SAV2309		2431398	2434352	2432992		
NMTN-07161	SAV2309		2431398	2434352	2433079		
NMTN-06344	SAV2309		2431398	2434352	2433168		
NMTN-07944	SAV2309		2431398	2434352	2433232		
NMTN-07435	SAV2309		2431398	2434352	2433353		
NMTN-07293	SAV2309		2431398	2434352	2433406		
NMTN-11081	SAV2309		2431398	2434352	2434068		
NMTN-03707	SAV2310		2434955	2435902	2435772	-	hypothetical protein
NMTN-13576	SAV2311		2436035	2436832	2436038	-	hypothetical protein
NMTN-05647	SAV2311		2436035	2436832	2436475		
NMTN-05648	SAV2311		2436035	2436832	2436475		
NMTN-13415	SAV2311		2436035	2436832	2436475		
NMTN-03164	SAV2311		2436035	2436832	2436524		
NMTN-11659	SAV2311		2436035	2436832	2436697		
NMTN-10183	SAV2313		2437934	2438671	2437950	-	hypothetical protein
NMTN-11440	SAV2313		2437934	2438671	2438139		
NMTN-06248	SAV2313		2437934	2438671	2438180		
NMTN-06318	SAV2313		2437934	2438671	2438193		
NMTN-11367	SAV2313		2437934	2438671	2438217		
NMTN-12135	SAV2313		2437934	2438671	2438326		
NMTN-00848	SAV2313		2437934	2438671	2438345		
NMTN-12984	SAV2313		2437934	2438671	2438367		
NMTN-12172	SAV2313		2437934	2438671	2438462		
NMTN-09178	SAV2313		2437934	2438671	2438561		
NMTN-04299	SAV2313		2437934	2438671	2438584		
NMTN-03658	SAV2313		2437934	2438671	2438604		
NMTN-09064	SAV2313		2437934	2438671	2438634		
NMTN-12825	SAV2313		2437934	2438671	2438635		
NMTN-02969	SAV2314		2438720	2439049	2438895	+	hypothetical protein
NMTN-05372	SAV2315		2439494	2440366	2439518	+	hypothetical protein
NMTN-10942	SAV2315		2439494	2440366	2440002		
NMTN-02289	SAV2315		2439494	2440366	2440086		
NMTN-13744	SAV2316		2440753	2442132	2440887	-	hypothetical protein
NMTN-13793	SAV2316		2440753	2442132	2440887		
NMTN-13797	SAV2316		2440753	2442132	2440887		
NMTN-13810	SAV2316		2440753	2442132	2440887		
NMTN-13823	SAV2316		2440753	2442132	2440887		
NMTN-13836	SAV2316		2440753	2442132	2440887		
NMTN-13842	SAV2316		2440753	2442132	2440887		
NMTN-13844	SAV2316		2440753	2442132	2440887		
NMTN-13848	SAV2316		2440753	2442132	2440887		
NMTN-13855	SAV2316		2440753	2442132	2440887		
NMTN-13845	SAV2316		2440753	2442132	2440888		
NMTN-13851	SAV2316		2440753	2442132	2440890		
NMTN-11847	SAV2316		2440753	2442132	2440893		
NMTN-04443	SAV2316		2440753	2442132	2440903		
NMTN-14572	SAV2316		2440753	2442132	2441240		
NMTN-01488	SAV2316		2440753	2442132	2441265		
NMTN-13109	SAV2316		2440753	2442132	2441652		
NMTN-11066	SAV2316		2440753	2442132	2441654		
NMTN-14409	SAV2317		2442412	2442768	2442511	+	hypothetical protein
NMTN-10856	SAV2317		2442412	2442768	2442567		
NMTN-10918	SAV2318		2442765	2442950	2442909	+	hypothetical protein
NMTN-04077	SAV2318		2442765	2442950	2442941		
NMTN-12860d	SAV2320		2443248	2443883	2443819	-	hypothetical protein
NMTN-13016	SAV2321		2443958	2444875	2443949	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-09522	SAV2321		2443958	2444875	2443999		
NMTN-03233	SAV2321		2443958	2444875	2444325		
NMTN-12634	SAV2321		2443958	2444875	2444400		
NMTN-09158	SAV2321		2443958	2444875	2444533		
NMTN-12342	SAV2322		2445143	2445673	2445649	+	hypothetical protein
NMTN-12084	SAV2323	glvC	2445739	2447343	2445809	-	PTS system, arbutin-like IIBC component
NMTN-08461	SAV2323	glvC	2445739	2447343	2445986		
NMTN-13046	SAV2323	glvC	2445739	2447343	2446457		
NMTN-09671	SAV2323	glvC	2445739	2447343	2446548		
NMTN-08862	SAV2323	glvC	2445739	2447343	2446642		
NMTN-11950	SAV2323	glvC	2445739	2447343	2446880		
NMTN-13912	SAV2323	glvC	2445739	2447343	2446882		
NMTN-09308	SAV2323	glvC	2445739	2447343	2447013		
NMTN-12551	SAV2324		2447673	2448437	2448305	+	hypothetical protein
NMTN-12788	SAV2324		2447673	2448437	2448373		
NMTN-05514	SAV2326		2449168	2450547	2449256	-	hypothetical protein
NMTN-12089	SAV2326		2449168	2450547	2449367		
NMTN-05520	SAV2326		2449168	2450547	2449637		
NMTN-11827	SAV2326		2449168	2450547	2449637		
NMTN-11688	SAV2326		2449168	2450547	2449813		
NMTN-06256	SAV2326		2449168	2450547	2449902		
NMTN-06359	SAV2326		2449168	2450547	2449905		
NMTN-03267	SAV2326		2449168	2450547	2449916		
NMTN-00431	SAV2326		2449168	2450547	2450108		
NMTN-00733	SAV2326		2449168	2450547	2450109		
NMTN-13882	SAV2326		2449168	2450547	2450472		
NMTN-07553	SAV2326		2449168	2450547	2450522		
NMTN-07378	SAV2327		2450706	2451275	2450975	-	hypothetical protein
NMTN-04511	SAV2327		2450706	2451275	2451020		
NMTN-00675	SAV2327		2450706	2451275	2451087		
NMTN-04482	SAV2327		2450706	2451275	2451183		
NMTN-08886	SAV2328		2451762	2452643	2452435	-	hypothetical protein
NMTN-14623	SAV2329		2452754	2453875	2452829	-	hypothetical protein
NMTN-02709	SAV2329		2452754	2453875	2453259		
NMTN-01836	SAV2329		2452754	2453875	2453367		
NMTN-08148	SAV2329		2452754	2453875	2453383		
NMTN-02283	SAV2330	hutI	2454151	2455389	2454294	-	imidazolonepropionase
NMTN-11618d	SAV2330	hutI	2454151	2455389	2454543		
NMTN-11803	SAV2330	hutI	2454151	2455389	2454543		
NMTN-00804	SAV2330	hutI	2454151	2455389	2454731		
NMTN-04251	SAV2330	hutI	2454151	2455389	2454866		
NMTN-11400	SAV2330	hutI	2454151	2455389	2454990		
NMTN-07634	SAV2331	hutU	2455389	2457050	2455768	-	urocanate hydratase
NMTN-03839	SAV2331	hutU	2455389	2457050	2456688		
NMTN-11095	SAV2331	hutU	2455389	2457050	2456871		
NMTN-11894	SAV2332		2457210	2458094	2457283	+	hypothetical protein
NMTN-12577	SAV2332		2457210	2458094	2457434		
NMTN-02817	SAV2332		2457210	2458094	2457602		
NMTN-11235	SAV2332		2457210	2458094	2457907		
NMTN-09848	SAV2333(?)	fosB	2458336	2458755	2458416		
NMTN-06569	SAV2333	fosB	2458336	2458755	2458563	+	fosfomycin resistance protein fofB
NMTN-09451	SAV2333	fosB	2458336	2458755	2458634		
NMTN-03723	SAV2334		2459011	2459946	2459822	-	hypothetical protein
NMTN-12843	SAV2335		2460236	2461495	2460360	+	hypothetical protein
NMTN-09166	SAV2335		2460236	2461495	2461142		
NMTN-12541	SAV2336		2461561	2462247	2461679	-	hypothetical protein
NMTN-02438	SAV2336		2461561	2462247	2462037		
NMTN-01722	SAV2337		2462421	2463074	2462427	+	conserved hypothetical protein
NMTN-04698	SAV2337		2462421	2463074	2462617		
NMTN-08290	SAV2337		2462421	2463074	2462828		
NMTN-05245	SAV2337		2462421	2463074	2462833		
NMTN-08112	SAV2337		2462421	2463074	2462867		
NMTN-11425	SAV2337		2462421	2463074	2462967		
NMTN-00614	SAV2337		2462421	2463074	2463071		
NMTN-10459	SAV2338		2463310	2464329	2463338	-	hypothetical protein
NMTN-08910	SAV2338		2463310	2464329	2463572		
NMTN-00669	SAV2338		2463310	2464329	2463590		
NMTN-07753	SAV2338		2463310	2464329	2463730		
NMTN-08527	SAV2338		2463310	2464329	2463735		
NMTN-11766	SAV2338		2463310	2464329	2463745		
NMTN-09180	SAV2338		2463310	2464329	2463753		
NMTN-04091	SAV2338		2463310	2464329	2463898		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-14700	SAV2338		2463310	2464329	2464208		
NMTN-11404	SAV2339		2464359	2464685	2464660	-	conserved hypothetical protein
NMTN-03272	SAV2340		2464903	2466135	2464970	-	conserved hypothetical protein
NMTN-02355	SAV2340		2464903	2466135	2465260		
NMTN-11015	SAV2340		2464903	2466135	2465915		
NMTN-09204	SAV2340		2464903	2466135	2465950		
NMTN-13403	SAV2340		2464903	2466135	2465953		
NMTN-04934	SAV2340		2464903	2466135	2466113		
NMTN-06075	SAV2341		2466128	2467027	2466160	-	hypothetical protein
NMTN-12933	SAV2341		2466128	2467027	2466568		
NMTN-11486d	SAV2342		2467258	2467878	2467407	-	conserved hypothetical protein
NMTN-08332	SAV2342		2467258	2467878	2467484		
NMTN-01529	SAV2342		2467258	2467878	2467563		
NMTN-09226	SAV2342		2467258	2467878	2467860		
NMTN-07869	SAV2344		2468277	2468885	2468325	+	hypothetical protein
NMTN-12094	SAV2344		2468277	2468885	2468325		
NMTN-12247	SAV2344		2468277	2468885	2468363		
NMTN-03262	SAV2344		2468277	2468885	2468728		
NMTN-00352	SAV2345		2469218	2470426	2469835	+	hypothetical protein
NMTN-01587	SAV2347		2471554	2472501	2471718	-	hypothetical protein
NMTN-03137	SAV2347		2471554	2472501	2471883		
NMTN-12748	SAV2347		2471554	2472501	2471883		
NMTN-13356	SAV2347		2471554	2472501	2471970		
NMTN-00098	SAV2347		2471554	2472501	2471975		
NMTN-07253	SAV2347		2471554	2472501	2472041		
NMTN-00096	SAV2347		2471554	2472501	2472145		
NMTN-07667	SAV2347		2471554	2472501	2472184		
NMTN-06759	SAV2348		2472604	2473089	2472671	+	conserved hypothetical protein
NMTN-08427	SAV2348		2472604	2473089	2473059		
NMTN-01008	SAV2349		2473086	2473505	2473238	+	hypothetical protein
NMTN-11582	SAV2350		2473613	2474533	2473627	-	hypothetical protein
NMTN-13287	SAV2350		2473613	2474533	2473708		
NMTN-06350	SAV2350		2473613	2474533	2473736		
NMTN-09183	SAV2350		2473613	2474533	2474125		
NMTN-11256	SAV2350		2473613	2474533	2474212		
NMTN-03654	SAV2352		2475625	2477556	2476084	-	hypothetical protein
NMTN-05224	SAV2352		2475625	2477556	2476084		
NMTN-03560	SAV2352		2475625	2477556	2477360		
NMTN-05190	SAV2354		2478337	2478891	2478737	+	hypothetical protein
NMTN-02808	SAV2354		2478337	2478891	2478772		
NMTN-05284	SAV2354		2478337	2478891	2478772		
NMTN-02193	SAV2355	tcaB	2479118	2480326	2479305	-	TcaB protein
NMTN-12474	SAV2355	tcaB	2479118	2480326	2479524		
NMTN-06220	SAV2355	tcaB	2479118	2480326	2480173		
NMTN-08156	SAV2355	tcaB	2479118	2480326	2480213		
NMTN-07025	SAV2356	tcaA	2480595	2481977	2480671	-	TcaA protein
NMTN-00737	SAV2356	tcaA	2480595	2481977	2480986		
NMTN-07469	SAV2356	tcaA	2480595	2481977	2481077		
NMTN-11450	SAV2356	tcaA	2480595	2481977	2481199		
NMTN-06280	SAV2356	tcaA	2480595	2481977	2481627		
NMTN-01835	SAV2356	tcaA	2480595	2481977	2481638		
NMTN-05293	SAV2358		2482867	2483835	2482884	+	hypothetical protein
NMTN-05203	SAV2358		2482867	2483835	2483171		
NMTN-12350	SAV2358		2482867	2483835	2483242		
NMTN-08005	SAV2358		2482867	2483835	2483352		
NMTN-09058	SAV2358		2482867	2483835	2483539		
NMTN-06457	SAV2358		2482867	2483835	2483749		
NMTN-03177	SAV2359		2484066	2484731	2484218	-	hypothetical protein
NMTN-05158	SAV2360		2484731	2485786	2484814	-	conserved hypothetical protein
NMTN-11356	SAV2360		2484731	2485786	2484814		
NMTN-13048	SAV2360		2484731	2485786	2484816		
NMTN-04342	SAV2360		2484731	2485786	2484885		
NMTN-02054	SAV2360		2484731	2485786	2485134		
NMTN-01762	SAV2360		2484731	2485786	2485338		
NMTN-05560	SAV2360		2484731	2485786	2485444		
NMTN-02861	SAV2360		2484731	2485786	2485659		
NMTN-08752	SAV2360		2484731	2485786	2485738		
NMTN-02823	SAV2361		2485922	2486596	2486008	+	hypothetical protein
NMTN-07744	SAV2362		2486589	2487962	2486748	+	hypothetical protein
NMTN-01562	SAV2362		2486589	2487962	2486878		
NMTN-12100	SAV2362		2486589	2487962	2487601		
NMTN-08907	SAV2363		2488125	2488568	2488252	+	conserved hypothetical protein
NMTN-11074	SAV2365		2489086	2490621	2489364	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12238	SAV2365		2489086	2490621	2489487		
NMTN-08335	SAV2365		2489086	2490621	2490175		
NMTN-02616	SAV2365		2489086	2490621	2490255		
NMTN-11336	SAV2365		2489086	2490621	2490255		
NMTN-00141	SAV2365		2489086	2490621	2490320		
NMTN-06225	SAV2365		2489086	2490621	2490485		
NMTN-09784	SAV2366		2490945	2492543	2490971	-	L-lactate permease lctP homolog
NMTN-12184	SAV2366		2490945	2492543	2491447		
NMTN-13172	SAV2366		2490945	2492543	2491577		
NMTN-12729	SAV2366		2490945	2492543	2491708		
NMTN-03728	SAV2366		2490945	2492543	2491897		
NMTN-12585	SAV2366		2490945	2492543	2492320		
NMTN-12244	SAV2367		2492860	2494533	2493262	+	hypothetical protein
NMTN-09006	SAV2367		2492860	2494533	2493350		
NMTN-00287	SAV2367		2492860	2494533	2493583		
NMTN-07919	SAV2367		2492860	2494533	2493784		
NMTN-14020	SAV2367		2492860	2494533	2494081		
NMTN-08909	SAV2367		2492860	2494533	2494502		
NMTN-12925	SAV2367		2492860	2494533	2494505		
NMTN-04661	SAV2367		2492860	2494533	2494526		
NMTN-13460	SAV2368		2494687	2495301	2494679	-	hypothetical protein
NMTN-02684	SAV2368		2494687	2495301	2494830		
NMTN-09868	SAV2369		2495615	2496130	2495678	-	hypothetical protein
NMTN-07712	SAV2369		2495615	2496130	2495996		
NMTN-14755	SAV2370		2496321	2497325	2496603	+	conserved hypothetical protein
NMTN-08714	SAV2370		2496321	2497325	2497019		
NMTN-03958	SAV2370		2496321	2497325	2497078		
NMTN-12606	SAV2370		2496321	2497325	2497081		
NMTN-08444	SAV2370		2496321	2497325	2497097		
NMTN-00825	SAV2371		2497371	2497772	2497383	-	hypothetical protein
NMTN-04025	SAV2371		2497371	2497772	2497383		
NMTN-12872	SAV2372		2497808	2498803	2497813	-	hypothetical protein
NMTN-05076	SAV2372		2497808	2498803	2498003		
NMTN-09222	SAV2372		2497808	2498803	2498191		
NMTN-03494	SAV2372		2497808	2498803	2498717		
NMTN-03496	SAV2372		2497808	2498803	2498717		
NMTN-02339	SAV2373		2499074	2499505	2499213	-	hypothetical protein
NMTN-06415	SAV2373		2499074	2499505	2499271		
NMTN-00035	SAV2373		2499074	2499505	2499277		
NMTN-00682	SAV2373		2499074	2499505	2499378		
NMTN-06604	SAV2374		2499712	2500989	2499956	-	hypothetical protein
NMTN-01600	SAV2374		2499712	2500989	2500220		
NMTN-02788	SAV2374		2499712	2500989	2500748		
NMTN-13740	SAV2374		2499712	2500989	2500799		
NMTN-07192	SAV2375		2501150	2501773	2501172	+	hypothetical protein
NMTN-12259	SAV2376		2501819	2502763	2501859	+	hypothetical protein
NMTN-04551	SAV2376		2501819	2502763	2502318		
NMTN-11435	SAV2376		2501819	2502763	2502524		
NMTN-06379	SAV2376		2501819	2502763	2502672		
NMTN-09345	SAV2376		2501819	2502763	2502674		
NMTN-02978	SAV2376		2501819	2502763	2502675		
NMTN-11695	SAV2376		2501819	2502763	2502676		
NMTN-10973	SAV2376		2501819	2502763	2502681		
NMTN-09938	SAV2377	scrA	2502848	2504290	2502877	-	PTS system, sucrose-specific IIBC component
NMTN-04741	SAV2377	scrA	2502848	2504290	2503326		
NMTN-10649	SAV2377	scrA	2502848	2504290	2503444		
NMTN-01749	SAV2377	scrA	2502848	2504290	2503702		
NMTN-10433	SAV2377	scrA	2502848	2504290	2504107		
NMTN-08917	SAV2378		2504335	2504811	2504441	+	probable type II DNA modification enzyme
NMTN-12432	SAV2381		2507864	2509969	2508087	+	hypothetical protein
NMTN-10953	SAV2381		2507864	2509969	2508156		
NMTN-09727	SAV2381		2507864	2509969	2508198		
NMTN-14440	SAV2381		2507864	2509969	2508228		
NMTN-13437	SAV2381		2507864	2509969	2508591		
NMTN-12704	SAV2381		2507864	2509969	2508734		
NMTN-11240	SAV2381		2507864	2509969	2508923		
NMTN-10838	SAV2381		2507864	2509969	2508959		
NMTN-05394	SAV2381		2507864	2509969	2509061		
NMTN-11858	SAV2381		2507864	2509969	2509246		
NMTN-03472	SAV2381		2507864	2509969	2509389		
NMTN-05469	SAV2381		2507864	2509969	2509454		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-07405	SAV2381		2507864	2509969	2509681		
NMTN-08874	SAV2381		2507864	2509969	2509695		
NMTN-14416	SAV2382		2510040	2510462	2510172		
NMTN-09162	SAV2382		2510040	2510462	2510249	+	hypothetical protein
NMTN-03890	SAV2383		2510726	2511082	2510783	+	hypothetical protein
NMTN-12863t	SAV2383		2510726	2511082	2510934		
NMTN-09969	SAV2384	gltT	2511400	2512677	2511443	-	proton/sodium-glutamate symport protein
NMTN-14044	SAV2384	gltT	2511400	2512677	2511516		
NMTN-13401	SAV2384	gltT	2511400	2512677	2512507		
NMTN-14198	SAV2384	gltT	2511400	2512677	2512529		
NMTN-00393	SAV2385		2512859	2513224	2513019	-	hypothetical protein
NMTN-11825	SAV2385		2512859	2513224	2513161		
NMTN-00203	SAV2385		2512859	2513224	2513207		
NMTN-02310	SAV2386		2513621	2514067	2513626	+	hypothetical protein
NMTN-13735	SAV2386		2513621	2514067	2513646		
NMTN-11343	SAV2388	narK	2514818	2515987	2515129	-	nitrite extrusion protein
NMTN-09494	SAV2389		2516356	2517270	2516486	+	conserved hypothetical protein
NMTN-01640	SAV2389		2516356	2517270	2516732		
NMTN-04935	SAV2389		2516356	2517270	2516740		
NMTN-08759	SAV2389		2516356	2517270	2516770		
NMTN-00175	SAV2389		2516356	2517270	2516807		
NMTN-04739	SAV2389		2516356	2517270	2516851		
NMTN-10379	SAV2389		2516356	2517270	2517175		
NMTN-05073	SAV2389		2516356	2517270	2517183		
NMTN-13220	SAV2389		2516356	2517270	2517254		
NMTN-13220	SAV2390		2517249	2517989	2517254	+	hypothetical protein
NMTN-07053	SAV2390		2517249	2517989	2517840		
NMTN-11392	SAV2392		2518923	2519957	2519129	-	hypothetical protein
NMTN-12130	SAV2392		2518923	2519957	2519236		
NMTN-10861	SAV2392		2518923	2519957	2519351		
NMTN-09170	SAV2392		2518923	2519957	2519549		
NMTN-11284	SAV2392		2518923	2519957	2519683		
NMTN-00428	SAV2392		2518923	2519957	2519723		
NMTN-03252	SAV2392		2518923	2519957	2519926		
NMTN-10970	SAV2393		2519981	2520433	2520330	-	hypothetical protein
NMTN-03286	SAV2394	narI	2520453	2521130	2520569	-	nitrate reductase gamma chain
NMTN-11610	SAV2394	narI	2520453	2521130	2520688		
NMTN-05446	SAV2394	narI	2520453	2521130	2520839		
NMTN-14635	SAV2394	narI	2520453	2521130	2520841		
NMTN-00117	SAV2394	narI	2520453	2521130	2520872		
NMTN-10203	SAV2394	narI	2520453	2521130	2521126		
NMTN-11370	SAV2395		2521123	2521698	2521238	-	hypothetical protein
NMTN-11516	SAV2395		2521123	2521698	2521240		
NMTN-03599	SAV2395		2521123	2521698	2521462		
NMTN-12302	SAV2395		2521123	2521698	2521462		
NMTN-12245	SAV2396	narH	2521691	2523250	2521824	-	nitrate reductase beta chain
NMTN-11725	SAV2396	narH	2521691	2523250	2521916		
NMTN-10950	SAV2396	narH	2521691	2523250	2522077		
NMTN-11915	SAV2396	narH	2521691	2523250	2522166		
NMTN-13856	SAV2396	narH	2521691	2523250	2522297		
NMTN-07613	SAV2396	narH	2521691	2523250	2522325		
NMTN-13049	SAV2396	narH	2521691	2523250	2522358		
NMTN-06688	SAV2396	narH	2521691	2523250	2522362		
NMTN-12779	SAV2396	narH	2521691	2523250	2522431		
NMTN-00827	SAV2396	narH	2521691	2523250	2522623		
NMTN-04939	SAV2396	narH	2521691	2523250	2522748		
NMTN-02731	SAV2397	narG	2523240	2526929	2523451	-	respiratory nitrate reductase alpha chain
NMTN-02734	SAV2397	narG	2523240	2526929	2523451		
NMTN-12489	SAV2397	narG	2523240	2526929	2523647		
NMTN-12768	SAV2397	narG	2523240	2526929	2524116		
NMTN-01566	SAV2397	narG	2523240	2526929	2524547		
NMTN-05440	SAV2397	narG	2523240	2526929	2524547		
NMTN-13332	SAV2397	narG	2523240	2526929	2524547		
NMTN-00490	SAV2397	narG	2523240	2526929	2524550		
NMTN-01710	SAV2397	narG	2523240	2526929	2525133		
NMTN-12856	SAV2397	narG	2523240	2526929	2525408		
NMTN-11083	SAV2397	narG	2523240	2526929	2525422		
NMTN-05625	SAV2397	narG	2523240	2526929	2525887		
NMTN-09985	SAV2397	narG	2523240	2526929	2525988		
NMTN-11108	SAV2397	narG	2523240	2526929	2526077		
NMTN-06924	SAV2397	narG	2523240	2526929	2526114		
NMTN-05110	SAV2397	narG	2523240	2526929	2526601		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-14598	SAV2397	narG	2523240	2526929	2526775		
NMTN-12701	SAV2398	nasF	2527238	2528215	2528216	-	uroporphyrin-III C-methyl transferase
NMTN-05367	SAV2399	nasE	2528206	2528520	2528216	-	assimilatory nitrite reductase
NMTN-02571	SAV2399	nasE	2528206	2528520	2528219		
NMTN-09981	SAV2399	nasE	2528206	2528520	2528269		
NMTN-02285	SAV2400	nasD	2528524	2530929	2528719	-	nitrite reductase
NMTN-00457	SAV2400	nasD	2528524	2530929	2529425		
NMTN-00535	SAV2400	nasD	2528524	2530929	2529425		
NMTN-00829	SAV2400	nasD	2528524	2530929	2529645		
NMTN-05082	SAV2400	nasD	2528524	2530929	2529653		
NMTN-04784	SAV2400	nasD	2528524	2530929	2529828		
NMTN-06612	SAV2400	nasD	2528524	2530929	2529831		
NMTN-10956	SAV2400	nasD	2528524	2530929	2529946		
NMTN-13822	SAV2400	nasD	2528524	2530929	2530043		
NMTN-04087	SAV2400	nasD	2528524	2530929	2530325		
NMTN-00448	SAV2400	nasD	2528524	2530929	2530338		
NMTN-13849	SAV2400	nasD	2528524	2530929	2530424		
NMTN-04629	SAV2400	nasD	2528524	2530929	2530742		
NMTN-02449	SAV2401		2530995	2531726	2531630	-	hypothetical protein
NMTN-05301	SAV2404		2533767	2533949	2533774	-	hypothetical protein
NMTN-05127	SAV2404		2533767	2533949	2533912		
NMTN-00423	SAV2405		2534033	2534500	2534163	-	conserved hypothetical protein
NMTN-15346	SAV2405		2534033	2534500	2534244		
NMTN-00011	SAV2406		2534686	2536233	2535052	-	hypothetical protein
NMTN-03564	SAV2406		2534686	2536233	2535602		
NMTN-05619	SAV2406		2534686	2536233	2535758		
NMTN-08315	SAV2408		2536794	2537045	2536930	-	conserved hypothetical protein
NMTN-04656	SAV2409		2537318	2537917	2537582	-	conserved hypothetical protein
NMTN-00671	SAV2409		2537318	2537917	2537728		
NMTN-02970	SAV2409		2537318	2537917	2537728		
NMTN-09559	SAV2409		2537318	2537917	2537783		
NMTN-10967	SAV2410		2537936	2538298	2538118	-	hypothetical protein
NMTN-12387	SAV2410		2537936	2538298	2538119		
NMTN-07573	SAV2410		2537936	2538298	2538262		
NMTN-02665	SAV2411	fmhA	2538553	2539803	2539107	+	fmhA protein
NMTN-09776	SAV2411	fmhA	2538553	2539803	2539741		
NMTN-10985	SAV2411	fmhA	2538553	2539803	2539779		
NMTN-05574	SAV2412		2539900	2540631	2540458	-	hypothetical protein
NMTN-10833	SAV2414		2541328	2542107	2542013	-	hypothetical protein
NMTN-05357	SAV2415		2542228	2543667	2542632	-	hypothetical protein
NMTN-03616	SAV2415		2542228	2543667	2543055		
NMTN-12359	SAV2415		2542228	2543667	2543132		
NMTN-12181	SAV2416		2544099	2544785	2544286	-	phosphoglycerate mutase
NMTN-01732	SAV2416		2544099	2544785	2544496		
NMTN-01483	SAV2417		2545112	2545978	2545843	-	conserved hypothetical protein
NMTN-03151	SAV2418	sbi	2546792	2548078	2546856	+	IgG-binding protein
NMTN-09075	SAV2418	sbi	2546792	2548078	2547753		
NMTN-00267	SAV2418	sbi	2546792	2548078	2547919		
NMTN-07312	SAV2419	hlgA	2548614	2549543	2549090	+	gamma-hemolysin chain II precursor
NMTN-05500	SAV2420	hlgC	2550110	2551057	2550530	+	gamma-hemolysin component C
NMTN-11423	SAV2421	hlgB	2551059	2552036	2551951	+	gamma-hemolysin component B
NMTN-07727	SAV2422		2552088	2552555	2552222	-	hypothetical protein
NMTN-09907	SAV2422		2552088	2552555	2552321		
NMTN-13739	SAV2424		2553269	2554384	2553300	-	hypothetical protein
NMTN-08368	SAV2424		2553269	2554384	2553343		
NMTN-07531	SAV2424		2553269	2554384	2553455		
NMTN-03643	SAV2424		2553269	2554384	2553528		
NMTN-10204	SAV2424		2553269	2554384	2553716		
NMTN-13142	SAV2424		2553269	2554384	2553947		
NMTN-09343	SAV2424		2553269	2554384	2553949		
NMTN-01444	SAV2424		2553269	2554384	2553990		
NMTN-01761	SAV2424		2553269	2554384	2554089		
NMTN-04521	SAV2424		2553269	2554384	2554101		
NMTN-04986	SAV2425	bioB	2554362	2555369	2554544	-	biotin synthase
NMTN-13648	SAV2425	bioB	2554362	2555369	2554789		
NMTN-00654	SAV2425	bioB	2554362	2555369	2554891		
NMTN-12859d	SAV2426	bioA	2555371	2556729	2555973	-	adenosylmethionine-8-amino-7-oxononanoate aminotransferase
NMTN-12809	SAV2426	bioA	2555371	2556729	2556539		
NMTN-12770t	SAV2426	bioA	2555371	2556729	2556653		
NMTN-09971	SAV2427	bioD	2556707	2557393	2557071	-	dethiobiotin synthetase
NMTN-04957	SAV2428		2557846	2559579	2557967	-	hypothetical protein
NMTN-05313	SAV2428		2557846	2559579	2558456		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11096	SAV2428		2557846	2559579	2558572		
NMTN-02292	SAV2428		2557846	2559579	2558741		
NMTN-04634	SAV2428		2557846	2559579	2558777		
NMTN-07859	SAV2428		2557846	2559579	2559233		
NMTN-07841	SAV2428		2557846	2559579	2559353		
NMTN-05360	SAV2428		2557846	2559579	2559421		
NMTN-12722	SAV2429		2559604	2561367	2559602	-	hypothetical protein
NMTN-06331	SAV2429		2559604	2561367	2559639		
NMTN-15221d	SAV2429		2559604	2561367	2560214		
NMTN-12818	SAV2429		2559604	2561367	2560506		
NMTN-07187	SAV2429		2559604	2561367	2561209		
NMTN-11692	SAV2432		2562965	2564107	2563161	+	conserved hypothetical protein
NMTN-01542	SAV2433		2564167	2564826	2564301	+	hypothetical protein
NMTN-12398	SAV2433		2564167	2564826	2564513		
NMTN-04828	SAV2434		2565008	2566219	2565098	+	hypothetical protein
NMTN-11807	SAV2434		2565008	2566219	2565102		
NMTN-04538	SAV2434		2565008	2566219	2565534		
NMTN-09530	SAV2434		2565008	2566219	2566098		
NMTN-07737	SAV2434		2565008	2566219	2566132		
NMTN-08352	SAV2434		2565008	2566219	2566144		
NMTN-12445	SAV2434		2565008	2566219	2566229		
NMTN-07043	SAV2436		2566928	2567584	2567117	+	hypothetical protein
NMTN-03511	SAV2436		2566928	2567584	2567167		
NMTN-00312	SAV2436		2566928	2567584	2567171		
NMTN-00314	SAV2436		2566928	2567584	2567171		
NMTN-06150	SAV2436		2566928	2567584	2567274		
NMTN-00144	SAV2436		2566928	2567584	2567277		
NMTN-12144	SAV2436		2566928	2567584	2567317		
NMTN-09139	SAV2436		2566928	2567584	2567429		
NMTN-08723	SAV2437		2567647	2568453	2567818	-	conserved hypothetical protein
NMTN-08724	SAV2437		2567647	2568453	2567818		
NMTN-08725	SAV2437		2567647	2568453	2567818		
NMTN-08735	SAV2437		2567647	2568453	2567818		
NMTN-08785	SAV2437		2567647	2568453	2567818		
NMTN-08786	SAV2437		2567647	2568453	2567818		
NMTN-08787	SAV2437		2567647	2568453	2567818		
NMTN-08788	SAV2437		2567647	2568453	2567818		
NMTN-08789	SAV2437		2567647	2568453	2567818		
NMTN-08790	SAV2437		2567647	2568453	2567818		
NMTN-08791	SAV2437		2567647	2568453	2567818		
NMTN-08793	SAV2437		2567647	2568453	2567818		
NMTN-08799	SAV2437		2567647	2568453	2567818		
NMTN-08801	SAV2437		2567647	2568453	2567818		
NMTN-08803	SAV2437		2567647	2568453	2567818		
NMTN-08804	SAV2437		2567647	2568453	2567818		
NMTN-08805	SAV2437		2567647	2568453	2567818		
NMTN-08806	SAV2437		2567647	2568453	2567818		
NMTN-08807	SAV2437		2567647	2568453	2567818		
NMTN-08808	SAV2437		2567647	2568453	2567818		
NMTN-08809	SAV2437		2567647	2568453	2567818		
NMTN-08810	SAV2437		2567647	2568453	2567818		
NMTN-08816	SAV2437		2567647	2568453	2567818		
NMTN-08837d	SAV2437		2567647	2568453	2567818		
NMTN-08842c	SAV2437		2567647	2568453	2567818		
NMTN-08845	SAV2437		2567647	2568453	2567818		
NMTN-08846	SAV2437		2567647	2568453	2567818		
NMTN-08849	SAV2437		2567647	2568453	2567818		
NMTN-08892	SAV2437		2567647	2568453	2567818		
NMTN-06528	SAV2437		2567647	2568453	2568108		
NMTN-13871	SAV2437		2567647	2568453	2568263		
NMTN-02428	SAV2437		2567647	2568453	2568264		
NMTN-03152	SAV2438		2568739	2570148	2569760	+	amino add ABC transporter homolog
NMTN-03550	SAV2438		2568739	2570148	2569804		
NMTN-14476	SAV2438		2568739	2570148	2569876		
NMTN-05507	SAV2438		2568739	2570148	2569907		
NMTN-07801	SAV2438		2568739	2570148	2570063		
NMTN-04415	SAV2439		2570287	2572365	2570854	+	hypothetical protein
NMTN-03085	SAV2439		2570287	2572365	2571088		
NMTN-04386	SAV2439		2570287	2572365	2571164		
NMTN-11389	SAV2439		2570287	2572365	2571437		
NMTN-10543	SAV2439		2570287	2572365	2571773		
NMTN-07576	SAV2440		2572506	2574335	2572591	-	conserved hypothetical protein
NMTN-07812	SAV2440		2572506	2574335	2572651		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-07120	SAV2440		2572506	2574335	2572674		
NMTN-10025	SAV2440		2572506	2574335	2573498		
NMTN-07875	SAV2440		2572506	2574335	2573829		
NMTN-04529	SAV2441		2574567	2576063	2574633	+	hypothetical protein
NMTN-08695	SAV2441		2574567	2576063	2574637		
NMTN-05172	SAV2441		2574567	2576063	2574638		
NMTN-08150	SAV2441		2574567	2576063	2574639		
NMTN-05097	SAV2441		2574567	2576063	2574642		
NMTN-13742	SAV2441		2574567	2576063	2574648		
NMTN-00030	SAV2441		2574567	2576063	2574781		
NMTN-04889	SAV2441		2574567	2576063	2575017		
NMTN-04941	SAV2441		2574567	2576063	2575018		
NMTN-13461	SAV2441		2574567	2576063	2575021		
NMTN-13273	SAV2441		2574567	2576063	2575023		
NMTN-11170	SAV2441		2574567	2576063	2575234		
NMTN-14465	SAV2441		2574567	2576063	2575245		
NMTN-09042	SAV2441		2574567	2576063	2575362		
NMTN-09394	SAV2441		2574567	2576063	2575663		
NMTN-13191	SAV2441		2574567	2576063	2575665		
NMTN-10962	SAV2441		2574567	2576063	2575779		
NMTN-02352	SAV2441		2574567	2576063	2575782		
NMTN-02548	SAV2441		2574567	2576063	2575876		
NMTN-02914	SAV2441		2574567	2576063	2575876		
NMTN-03117	SAV2441		2574567	2576063	2575876		
NMTN-05354	SAV2441		2574567	2576063	2575977		
NMTN-15322	SAV2442		2576155	2577006	2576506	-	hypothetical protein
NMTN-11498	SAV2442		2576155	2577006	2576750		
NMTN-05078	SAV2443		2577328	2578263	2577916	-	hypothetical protein
NMTN-03490	SAV2444		2578489	2579889	2578745	-	hypothetical protein
NMTN-08390	SAV2444		2578489	2579889	2578746		
NMTN-12198	SAV2444		2578489	2579889	2579002		
NMTN-07498	SAV2445	opuCD	2580183	2580878	2580629	-	probable glycine betaine/carnitine/choline ABC transporter
NMTN-04878	SAV2445	opuCD	2580183	2580878	2580697		
NMTN-11649	SAV2446	opuCC	2580878	2581819	2581312	-	glycine betaine/carnitine/choline ABC transporter
NMTN-00085	SAV2446	opuCC	2580878	2581819	2581400		
NMTN-12081	SAV2446	opuCC	2580878	2581819	2581737		
NMTN-12575	SAV2446	opuCC	2580878	2581819	2581737		
NMTN-04718	SAV2446	opuCC	2580878	2581819	2581741		
NMTN-07417	SAV2447	opuCB	2581836	2582471	2581907	-	probable glycine betaine/carnitine/choline ABC transporter
NMTN-14285	SAV2448	opuCA	2582468	2583700	2582821	-	glycine betaine/carnitine/choline ABC transporter
NMTN-11368	SAV2449		2584364	2584963	2584464	-	conserved hypothetical protein
NMTN-11763	SAV2449		2584364	2584963	2584464		
NMTN-04078	SAV2449		2584364	2584963	2584489		
NMTN-13491	SAV2449		2584364	2584963	2584610		
NMTN-11648	SAV2450		2585143	2586780	2585305	+	hypothetical protein
NMTN-04825	SAV2450		2585143	2586780	2585387		
NMTN-06349	SAV2450		2585143	2586780	2585481		
NMTN-09926	SAV2450		2585143	2586780	2585610		
NMTN-12548	SAV2450		2585143	2586780	2585650		
NMTN-10811	SAV2450		2585143	2586780	2585895		
NMTN-08647	SAV2450		2585143	2586780	2585909		
NMTN-08775	SAV2450		2585143	2586780	2586780		
NMTN-08981	SAV2451		2587089	2588441	2587251	+	hypothetical protein
NMTN-08781	SAV2451		2587089	2588441	2588295		
NMTN-06100	SAV2452		2588503	2589690	2588534	-	hypothetical protein
NMTN-12775	SAV2452		2588503	2589690	2588590		
NMTN-12664	SAV2452		2588503	2589690	2588591		
NMTN-13230	SAV2452		2588503	2589690	2589158		
NMTN-12257	SAV2452		2588503	2589690	2589282		
NMTN-07413	SAV2452		2588503	2589690	2589497		
NMTN-11609	SAV2453		2590086	2590862	2590247	-	conserved hypothetical protein
NMTN-13082	SAV2453		2590086	2590862	2590414		
NMTN-03016	SAV2453		2590086	2590862	2590579		
NMTN-03485	SAV2453		2590086	2590862	2590579		
NMTN-03487	SAV2453		2590086	2590862	2590579		
NMTN-04174	SAV2453		2590086	2590862	2590630		
NMTN-06326	SAV2454		2590855	2591517	2591323	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06334	SAV2454		2590855	2591517	2591323		
NMTN-00440	SAV2454		2590855	2591517	2591415		
NMTN-13218	SAV2454		2590855	2591517	2591468		
NMTN-13294	SAV2455		2591765	2592841	2591934	-	hypothetical protein
NMTN-11161	SAV2455		2591765	2592841	2591980		
NMTN-08665	SAV2455		2591765	2592841	2592045		
NMTN-10586	SAV2455		2591765	2592841	2592111		
NMTN-07464	SAV2455		2591765	2592841	2592271		
NMTN-05359	SAV2455		2591765	2592841	2592372		
NMTN-09312	SAV2457		2593463	2593720	2593679	-	hypothetical protein
NMTN-05524	SAV2458		2594079	2594534	2594329	+	conserved hypothetical protein
NMTN-03535	SAV2459		2594702	2596279	2594852	-	hypothetical protein
NMTN-13892	SAV2459		2594702	2596279	2595225		
NMTN-08251	SAV2459		2594702	2596279	2595772		
NMTN-00743	SAV2459		2594702	2596279	2596179		
NMTN-06183	SAV2459		2594702	2596279	2596215		
NMTN-04845	SAV2459		2594702	2596279	2596248		
NMTN-08545	SAV2460		2596474	2597223	2596501	+	hypothetical protein
NMTN-11616	SAV2460		2596474	2597223	2596772		
NMTN-09040	SAV2460		2596474	2597223	2597087		
NMTN-12372	SAV2460		2596474	2597223	2597139		
NMTN-15193	SAV2462		2597585	2598778	2598103	-	hypothetical protein
NMTN-12341	SAV2462		2597585	2598778	2598385		
NMTN-11376	SAV2462		2597585	2598778	2598670		
NMTN-03046	SAV2462		2597585	2598778	2598739		
NMTN-03047	SAV2462		2597585	2598778	2598739		
NMTN-03052	SAV2462		2597585	2598778	2598739		
NMTN-03057	SAV2462		2597585	2598778	2598739		
NMTN-03065	SAV2462		2597585	2598778	2598739		
NMTN-04005	SAV2463		2598790	2599539	2598827	-	oligopeptide transporter putative ATPase domain
NMTN-07837	SAV2463		2598790	2599539	2598932		
NMTN-07864	SAV2463		2598790	2599539	2598974		
NMTN-05105	SAV2463		2598790	2599539	2599371		
NMTN-06696	SAV2463		2598790	2599539	2599375		
NMTN-09136	SAV2464		2599532	2600347	2599833	-	oligopeptide transporter putative ATPase domain
NMTN-08046	SAV2464		2599532	2600347	2599955		
NMTN-03694	SAV2464		2599532	2600347	2600001		
NMTN-13066	SAV2464		2599532	2600347	2600001		
NMTN-01677	SAV2465		2600344	2601213	2600867	-	oligopeptide transporter putative membrane permease domain
NMTN-12978	SAV2465		2600344	2601213	2600870		
NMTN-11728	SAV2465		2600344	2601213	2601098		
NMTN-02472	SAV2466		2601210	2602145	2601239	-	oligopeptide transporter putative membrane permease domain
NMTN-05350	SAV2466		2601210	2602145	2601516		
NMTN-04010	SAV2466		2601210	2602145	2601568		
NMTN-10589	SAV2466		2601210	2602145	2601891		
NMTN-13633	SAV2466		2601210	2602145	2601895		
NMTN-10778	SAV2467		2602158	2603756	2602166	-	oligopeptide transporter putative substrate binding domain
NMTN-14290	SAV2467		2602158	2603756	2602494		
NMTN-02792	SAV2467		2602158	2603756	2602580		
NMTN-07110	SAV2467		2602158	2603756	2602728		
NMTN-08100	SAV2467		2602158	2603756	2602775		
NMTN-04194	SAV2467		2602158	2603756	2603329		
NMTN-00595	SAV2467		2602158	2603756	2603410		
NMTN-05145	SAV2467		2602158	2603756	2603629	-	conserved hypothetical protein
NMTN-13700	SAV2468		2603899	2605200	2603987		
NMTN-04787	SAV2468		2603899	2605200	2604742		
NMTN-10983	SAV2469		2605193	2606011	2605495	-	conserved hypothetical protein
NMTN-03991	SAV2469		2605193	2606011	2605693		
NMTN-04552	SAV2469		2605193	2606011	2605696		
NMTN-09476	SAV2469		2605193	2606011	2605859		
NMTN-12653	SAV2469		2605193	2606011	2605936		
NMTN-03579	SAV2470		2606022	2606843	2606027	-	hypothetical protein
NMTN-09320	SAV2470		2606022	2606843	2606063		
NMTN-03768	SAV2470		2606022	2606843	2606253		
NMTN-13551	SAV2470		2606022	2606843	2606296		
NMTN-07780	SAV2470		2606022	2606843	2606384		
NMTN-03928	SAV2470		2606022	2606843	2606402		
NMTN-06926	SAV2470		2606022	2606843	2606711		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04362	SAV2473		2609453	2610991	2609606	+	hypothetical protein
NMTN-08002	SAV2473		2609453	2610991	2609630		
NMTN-05371	SAV2473		2609453	2610991	2609691		
NMTN-13406	SAV2473		2609453	2610991	2610140		
NMTN-11580	SAV2473		2609453	2610991	2610178		
NMTN-12708	SAV2473		2609453	2610991	2610318		
NMTN-01504	SAV2473		2609453	2610991	2610950		
NMTN-05121	SAV2473		2609453	2610991	2610950		
NMTN-05552	SAV2476		2612424	2612834	2612438	-	hypothetical protein
NMTN-00313	SAV2476		2612424	2612834	2612695		
NMTN-11667	SAV2476		2612424	2612834	2612800		
NMTN-04707	SAV2477		2613101	2613613	2613267	-	hypothetical protein
NMTN-05047	SAV2477		2613101	2613613	2613477		
NMTN-03921	SAV2478		2613773	2614468	2613830	-	hypothetical protein
NMTN-12495	SAV2478		2613773	2614468	2613835		
NMTN-12332	SAV2478		2613773	2614468	2614023		
NMTN-11265	SAV2478		2613773	2614468	2614422		
NMTN-12835	SAV2479		2614757	2615038	2614765	+	hypothetical protein
NMTN-02065	SAV2479		2614757	2615038	2614853		
NMTN-06614	SAV2480		2615298	2615489	2615378	-	hypothetical protein
NMTN-00282	SAV2481		2616050	2616844	2616557	-	hypothetical protein
NMTN-11149	SAV2483		2617670	2617996	2617867	-	hypothetical protein
NMTN-09762	SAV2484		2617996	2619321	2618605	-	hypothetical protein
NMTN-14535	SAV2484		2617996	2619321	2618983		
NMTN-06333	SAV2484		2617996	2619321	2618985		
NMTN-01846	SAV2487		2621231	2622007	2621431	-	hypothetical protein
NMTN-06282	SAV2487		2621231	2622007	2621870		
NMTN-06578	SAV2487		2621231	2622007	2621970		
NMTN-09447	SAV2488		2622311	2623801	2622332	-	conserved hypothetical protein
NMTN-11039	SAV2488		2622311	2623801	2623003		
NMTN-01935	SAV2488		2622311	2623801	2623170		
NMTN-07691	SAV2488		2622311	2623801	2623225		
NMTN-00745	SAV2488		2622311	2623801	2623227		
NMTN-00216	SAV2488		2622311	2623801	2623275		
NMTN-00390	SAV2488		2622311	2623801	2623275		
NMTN-03411	SAV2488		2622311	2623801	2623390		
NMTN-02576	SAV2488		2622311	2623801	2623664		
NMTN-02568	SAV2489		2623841	2625172	2623984	-	conserved hypothetical protein
NMTN-14766	SAV2489		2623841	2625172	2623986		
NMTN-00582	SAV2489		2623841	2625172	2624479		
NMTN-06424	SAV2489		2623841	2625172	2624616		
NMTN-12174	SAV2489		2623841	2625172	2624778		
NMTN-15357	SAV2489		2623841	2625172	2624781		
NMTN-08751	SAV2489		2623841	2625172	2624804		
NMTN-11196	SAV2489		2623841	2625172	2624898		
NMTN-00239	SAV2489		2623841	2625172	2625037		
NMTN-00306	SAV2489		2623841	2625172	2625037		
NMTN-02020	SAV2490		2625174	2625566	2625190	-	hypothetical protein
NMTN-10209	SAV2492		2627790	2628056	2627821	+	hypothetical protein
NMTN-03705	SAV2492		2627790	2628056	2627959		
NMTN-05393	SAV2492		2627790	2628056	2627959		
NMTN-11601	SAV2493		2628200	2628508	2628350	+	hypothetical protein
NMTN-10624	SAV2493		2628200	2628508	2628515		
NMTN-11084	SAV2494		2628616	2628849	2628663	-	hypothetical protein
NMTN-08431	SAV2494		2628616	2628849	2628800		
NMTN-09984	SAV2494		2628616	2628849	2628800		
NMTN-06119	SAV2495		2628946	2630022	2629096	-	conserved hypothetical protein
NMTN-04772	SAV2495		2628946	2630022	2629256		
NMTN-04326	SAV2495		2628946	2630022	2629257		
NMTN-06709	SAV2495		2628946	2630022	2629282		
NMTN-09493	SAV2495		2628946	2630022	2629530		
NMTN-14625	SAV2495		2628946	2630022	2629802		
NMTN-12431	SAV2497		2632418	2633752	2632605	-	hypothetical protein
NMTN-03242	SAV2498	sarH3	2634057	2634416	2634157	-	staphylococcal accessory regulator A homolog
NMTN-02575	SAV2499	sarH2	2634737	2635480	2635232	+	staphylococcal accessory regulator A homolog
NMTN-01952	SAV2500	gtaB	2635691	2636557	2635884	-	UTP-glucose-1-phosphate uridylyltransferase
NMTN-02270	SAV2501	tnp	2636730	2638049	2637083	-	transposase
NMTN-02964	SAV2501	tnp	2636730	2638049	2637994		
NMTN-02992	SAV2502	fmbB	2638258	2641143	2638763	-	fibronectin-binding protein homolog
NMTN-00088	SAV2502	fmbB	2638258	2641143	2638886		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-06235	SAV2502	fnbB	2638258	2641143	2639739		
NMTN-00140	SAV2502	fnbB	2638258	2641143	2639958		
NMTN-14017	SAV2502	fnbB	2638258	2641143	2640018		
NMTN-00627	SAV2502	fnbB	2638258	2641143	2640424		
NMTN-05396	SAV2502	fnbB	2638258	2641143	2640873		
NMTN-02446	SAV2503	fnb	2641824	2644940	2644305	-	fibronectin-binding protein homolog
NMTN-02646	SAV2503	fnb	2641824	2644940	2644523		
NMTN-11549	SAV2505	gntP	2645409	2646767	2645660	-	gluconate permease
NMTN-12924	SAV2505	gntP	2645409	2646767	2646026		
NMTN-11806	SAV2505	gntP	2645409	2646767	2646179		
NMTN-05112	SAV2505	gntP	2645409	2646767	2646676		
NMTN-05115	SAV2505	gntP	2645409	2646767	2646676		
NMTN-01589	SAV2506	gntK	2646884	2648437	2647108	-	gluconokinase
NMTN-03786	SAV2506	gntK	2646884	2648437	2647460		
NMTN-00576	SAV2506	gntK	2646884	2648437	2647542		
NMTN-09486	SAV2506	gntK	2646884	2648437	2648043		
NMTN-02437	SAV2507	gntR	2648461	2649141	2648542	-	gluconate operon transcriptional repressor
NMTN-14622	SAV2507	gntR	2648461	2649141	2649133		
NMTN-05616	SAV2508		2649294	2650058	2649548	-	hypothetical protein
NMTN-02984	SAV2508		2649294	2650058	2649863		
NMTN-12801	SAV2508		2649294	2650058	2650050		
NMTN-09462	SAV2509		2650223	2650915	2650367	-	hypothetical protein
NMTN-05634	SAV2509		2650223	2650915	2650500		
NMTN-10441	SAV2510		2651146	2651634	2651218	-	conserved hypothetical protein
NMTN-12937	SAV2511		2651701	2653524	2651912	-	conserved hypothetical protein
NMTN-08737	SAV2511		2651701	2653524	2651956		
NMTN-09154	SAV2511		2651701	2653524	2651996		
NMTN-10894	SAV2511		2651701	2653524	2652079		
NMTN-12086	SAV2511		2651701	2653524	2652305		
NMTN-09231	SAV2511		2651701	2653524	2652492		
NMTN-08003	SAV2511		2651701	2653524	2652590		
NMTN-04449	SAV2511		2651701	2653524	2652599		
NMTN-10842	SAV2511		2651701	2653524	2652599		
NMTN-04773	SAV2511		2651701	2653524	2652725		
NMTN-11294	SAV2511		2651701	2653524	2652818		
NMTN-09527	SAV2511		2651701	2653524	2653068		
NMTN-04803	SAV2511		2651701	2653524	2653189		
NMTN-05000	SAV2511		2651701	2653524	2653287		
NMTN-07937	SAV2512		2654001	2655278	2654186	-	hypothetical protein
NMTN-02069	SAV2512		2654001	2655278	2654300		
NMTN-05605	SAV2512		2654001	2655278	2654304		
NMTN-11594	SAV2512		2654001	2655278	2654543		
NMTN-12915	SAV2512		2654001	2655278	2654931		
NMTN-00223	SAV2513		2655825	2656436	2655904	+	hypothetical protein
NMTN-10052	SAV2515		2657651	2658421	2657730	+	hypothetical protein
NMTN-14411	SAV2515		2657651	2658421	2657735		
NMTN-14496	SAV2515		2657651	2658421	2657852		
NMTN-13631	SAV2515		2657651	2658421	2657853		
NMTN-13923	SAV2515		2657651	2658421	2657853		
NMTN-13925	SAV2515		2657651	2658421	2657853		
NMTN-13927	SAV2515		2657651	2658421	2657853		
NMTN-13930	SAV2515		2657651	2658421	2657853		
NMTN-13936	SAV2515		2657651	2658421	2657853		
NMTN-13978	SAV2515		2657651	2658421	2657853		
NMTN-14368	SAV2515		2657651	2658421	2657853		
NMTN-14492	SAV2515		2657651	2658421	2657853		
NMTN-14493	SAV2515		2657651	2658421	2657853		
NMTN-14494	SAV2515		2657651	2658421	2657853		
NMTN-14495	SAV2515		2657651	2658421	2657853		
NMTN-14575	SAV2515		2657651	2658421	2657853		
NMTN-14576	SAV2515		2657651	2658421	2657853		
NMTN-14577	SAV2515		2657651	2658421	2657853		
NMTN-14578	SAV2515		2657651	2658421	2657853		
NMTN-14579	SAV2515		2657651	2658421	2657853		
NMTN-14580	SAV2515		2657651	2658421	2657853		
NMTN-14582	SAV2515		2657651	2658421	2657853		
NMTN-14584	SAV2515		2657651	2658421	2657853		
NMTN-14586	SAV2515		2657651	2658421	2657853		
NMTN-14587	SAV2515		2657651	2658421	2657853		
NMTN-14591	SAV2515		2657651	2658421	2657853		
NMTN-14667	SAV2515		2657651	2658421	2657853		
NMTN-14668	SAV2515		2657651	2658421	2657853		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-14669	SAV2515		2657651	2658421	2657853		
NMTN-14726	SAV2515		2657651	2658421	2657853		
NMTN-14728	SAV2515		2657651	2658421	2657853		
NMTN-14729	SAV2515		2657651	2658421	2657853		
NMTN-14733	SAV2515		2657651	2658421	2657853		
NMTN-14734	SAV2515		2657651	2658421	2657853		
NMTN-14735	SAV2515		2657651	2658421	2657853		
NMTN-14736	SAV2515		2657651	2658421	2657853		
NMTN-14737	SAV2515		2657651	2658421	2657853		
NMTN-14738	SAV2515		2657651	2658421	2657853		
NMTN-14740	SAV2515		2657651	2658421	2657853		
NMTN-14741	SAV2515		2657651	2658421	2657853		
NMTN-14743	SAV2515		2657651	2658421	2657853		
NMTN-14745	SAV2515		2657651	2658421	2657853		
NMTN-14746	SAV2515		2657651	2658421	2657853		
NMTN-14748	SAV2515		2657651	2658421	2657853		
NMTN-14752	SAV2515		2657651	2658421	2657853		
NMTN-14754	SAV2515		2657651	2658421	2657853		
NMTN-14775	SAV2515		2657651	2658421	2657853		
NMTN-14785	SAV2515		2657651	2658421	2657853		
NMTN-14882	SAV2515		2657651	2658421	2657853		
NMTN-14899	SAV2515		2657651	2658421	2657853		
NMTN-14900	SAV2515		2657651	2658421	2657853		
NMTN-14900	SAV2515		2657651	2658421	2657853		
NMTN-14969	SAV2515		2657651	2658421	2657853		
NMTN-15079	SAV2515		2657651	2658421	2657853		
NMTN-15083	SAV2515		2657651	2658421	2657853		
NMTN-15089	SAV2515		2657651	2658421	2657853		
NMTN-15093	SAV2515		2657651	2658421	2657853		
NMTN-15099	SAV2515		2657651	2658421	2657853		
NMTN-15106	SAV2515		2657651	2658421	2657853		
NMTN-15144	SAV2515		2657651	2658421	2657853		
NMTN-14750	SAV2515		2657651	2658421	2657854		
NMTN-15141	SAV2515		2657651	2658421	2657854		
NMTN-10994	SAV2515		2657651	2658421	2658080		
NMTN-08143	SAV2516	fbp	2658794	2660758	2658979	+	fructose-bisphosphatase
NMTN-01975	SAV2516	fbp	2658794	2660758	2659350		
NMTN-02338	SAV2516	fbp	2658794	2660758	2659350		
NMTN-06609	SAV2516	fbp	2658794	2660758	2659873		
NMTN-02774	SAV2516	fbp	2658794	2660758	2660044		
NMTN-02445	SAV2516	fbp	2658794	2660758	2660275		
NMTN-02463	SAV2516	fbp	2658794	2660758	2660335		
NMTN-10881	SAV2517		2661100	2662179	2661170	+	conserved hypothetical protein
NMTN-03402	SAV2517		2661100	2662179	2661853		
NMTN-12163	SAV2517		2661100	2662179	2662181		
NMTN-05603	SAV2518		2662284	2662877	2662552	-	conserved hypothetical protein
NMTN-11951	SAV2519		2662908	2663867	2663088	-	hypothetical protein
NMTN-13391d	SAV2519		2662908	2663867	2663338		
NMTN-09546	SAV2519		2662908	2663867	2663733		
NMTN-13650	SAV2519		2662908	2663867	2663774		
NMTN-04104	SAV2519		2662908	2663867	2663861		
NMTN-11239	SAV2520		2663945	2664379	2664106	-	hypothetical protein
NMTN-02392	SAV2520		2663945	2664379	2664286		
NMTN-06196	SAV2521		2664605	2664889	2664603	+	conserved hypothetical protein
NMTN-13298	SAV2521		2664605	2664889	2664606		
NMTN-10416	SAV2522		2665060	2665866	2665279	+	conserved hypothetical protein
NMTN-06488	SAV2522		2665060	2665866	2665573		
NMTN-11704	SAV2522		2665060	2665866	2665697		
NMTN-06870	SAV2523		2665987	2666658	2666379	-	hypothetical protein
NMTN-11429	SAV2523		2665987	2666658	2666543		
NMTN-07315	SAV2524	ddh	2666865	2667920	2667019	+	D-specific D-2-hydroxyacid dehydrogenase
NMTN-13284	SAV2525		2668167	2668967	2668163	-	conserved hypothetical protein
NMTN-13859	SAV2525		2668167	2668967	2668417		
NMTN-13860	SAV2525		2668167	2668967	2668417		
NMTN-08482	SAV2525		2668167	2668967	2668722		
NMTN-03857	SAV2525		2668167	2668967	2668801		
NMTN-03861	SAV2525		2668167	2668967	2668801		
NMTN-09879	SAV2526		2669287	2669922	2669414	+	hypothetical protein
NMTN-14514	SAV2526		2669287	2669922	2669811		
NMTN-04500	SAV2526		2669287	2669922	2669915		
NMTN-00284	SAV2527		2669937	2670659	2670015	+	conserved hypothetical protein
NMTN-02253	SAV2527		2669937	2670659	2670088		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-03197	SAV2527		2669937	2670659	2670091		
NMTN-02600	SAV2527		2669937	2670659	2670291		
NMTN-11401	SAV2527		2669937	2670659	2670324		
NMTN-11249	SAV2527		2669937	2670659	2670345		
NMTN-13022	SAV2527		2669937	2670659	2670604		
NMTN-03486	SAV2528	srtA	2670821	2671441	2670951	-	sortase
NMTN-13599	SAV2529		2671635	2672126	2671701	+	hypothetical protein
NMTN-04089	SAV2529		2671635	2672126	2671705		
NMTN-11627	SAV2529		2671635	2672126	2671779		
NMTN-08659	SAV2530		2672619	2673518	2673380	-	hypothetical protein
NMTN-01751	SAV2531/ SAV922		2673532	2674212	2673621		
NMTN-08339	SAV2531		2673532	2674212	2673756	-	hypothetical protein
NMTN-03188	SAV2531		2673532	2674212	2673791		
NMTN-06735	SAV2532		2674215	2675258	2674564	-	hypothetical protein
NMTN-06563	SAV2532		2674215	2675258	2674679		
NMTN-08308	SAV2532		2674215	2675258	2674760		
NMTN-05330	SAV2532		2674215	2675258	2675237		
NMTN-10747	SAV2534		2676203	2677129	2676378	+	conserved hypothetical protein
NMTN-13034	SAV2534		2676203	2677129	2676785		
NMTN-12580	SAV2534		2676203	2677129	2676956		
NMTN-08619	SAV2535		2677210	2678178	2677501	-	conserved hypothetical protein
NMTN-00187	SAV2535		2677210	2678178	2677522		
NMTN-12724	SAV2537		2678697	2679107	2678866	-	conserved hypothetical protein
NMTN-09292	SAV2538	ptsG	2679487	2681553	2679810	-	PTS system, glucose-specific II ABC component
NMTN-05528	SAV2538	ptsG	2679487	2681553	2680043		
NMTN-10609	SAV2538	ptsG	2679487	2681553	2680367		
NMTN-09373	SAV2538	ptsG	2679487	2681553	2680581		
NMTN-09373	SAV2538	ptsG	2679487	2681553	2680581		
NMTN-14412	SAV2538	ptsG	2679487	2681553	2680925		
NMTN-00211	SAV2538	ptsG	2679487	2681553	2681096		
NMTN-00373	SAV2538	ptsG	2679487	2681553	2681096		
NMTN-03274	SAV2538	ptsG	2679487	2681553	2681396		
NMTN-12306	SAV2539		2681854	2683593	2682234	-	hypothetical protein
NMTN-07818	SAV2539		2681854	2683593	2683101		
NMTN-04814	SAV2539		2681854	2683593	2683316		
NMTN-07476	SAV2539		2681854	2683593	2683333		
NMTN-00047	SAV2539		2681854	2683593	2683449		
NMTN-04017	SAV2539		2681854	2683593	2683485		
NMTN-08313	SAV2539		2681854	2683593	2683541		
NMTN-08702	SAV2540		2683644	2684333	2683720	-	conserved hypothetical protein
NMTN-11998	SAV2540		2683644	2684333	2683844		
NMTN-12224	SAV2541		2684326	2684721	2684445	-	conserved hypothetical protein
NMTN-14640	SAV2541		2684326	2684721	2684688		
NMTN-09433	SAV2542		2684934	2685821	2685029	-	hypothetical protein
NMTN-12036	SAV2542		2684934	2685821	2685029		
NMTN-13139	SAV2542		2684934	2685821	2685029		
NMTN-06771d	SAV2542		2684934	2685821	2685135		
NMTN-11209	SAV2542		2684934	2685821	2685351		
NMTN-11159	SAV2542		2684934	2685821	2685489		
NMTN-00643	SAV2542		2684934	2685821	2685538		
NMTN-08297	SAV2542		2684934	2685821	2685626		
NMTN-11917	SAV2543		2685979	2686197	2686151	+	hypothetical protein
NMTN-06492	SAV2544		2686587	2687018	2687010	+	hypothetical protein
NMTN-08964	SAV2544		2686587	2687018	2687010		
NMTN-11357	SAV2545	mvaA	2687157	2688434	2687881	-	hydroxymethylglutaryl-CoA reductase
NMTN-14634	SAV2546	mvaS	2688689	2689855	2689263	+	3-hydroxy-3-methylglutaryl CoA synthase
NMTN-07991	SAV2548	clpL	2690950	2693055	2691042	+	ATP-dependent Clp proteinase chain
NMTN-00319	SAV2548	clpL	2690950	2693055	2691045		
NMTN-08133	SAV2548	clpL	2690950	2693055	2691488		
NMTN-11419	SAV2548	clpL	2690950	2693055	2691546		
NMTN-00686	SAV2548	clpL	2690950	2693055	2692490		
NMTN-05348	SAV2548	clpL	2690950	2693055	2693017		
NMTN-06146	SAV2548	clpL	2690950	2693055	2693017		
NMTN-11788	SAV2548	clpL	2690950	2693055	2693017		
NMTN-06146	SAV2548	clpL	2690950	2693055	2693017		
NMTN-11788	SAV2548	clpL	2690950	2693055	2693017		
NMTN-05131	SAV2549		2693124	2693294	2693194	-	hypothetical protein
NMTN-05154	SAV2549		2693124	2693294	2693194		
NMTN-05161	SAV2549		2693124	2693294	2693194		
NMTN-04186	SAV2549		2693124	2693294	2693236		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08409	SAV2550	feoB	2693307	2695301	2693392	-	ferrous iron transport protein B homolog
NMTN-04437	SAV2550	feoB	2693307	2695301	2693448		
NMTN-09781	SAV2550	feoB	2693307	2695301	2694204		
NMTN-12591	SAV2550	feoB	2693307	2695301	2694346		
NMTN-14475	SAV2550	feoB	2693307	2695301	2694792		
NMTN-10189	SAV2550	feoB	2693307	2695301	2695071		
NMTN-13212	SAV2550	feoB	2693307	2695301	2695135		
NMTN-04953	SAV2551		2695313	2695540	2695386	-	hypothetical protein
NMTN-11912	SAV2551		2695313	2695540	2695453		
NMTN-09037	SAV2551		2695313	2695540	2695542		
NMTN-14609	SAV2552		2695756	2698245	2695893	-	hypothetical protein
NMTN-10855	SAV2552		2695756	2698245	2696205		
NMTN-13305	SAV2552		2695756	2698245	2697506		
NMTN-01546	SAV2552		2695756	2698245	2697580		
NMTN-07908	SAV2552		2695756	2698245	2697603		
NMTN-03159	SAV2552		2695756	2698245	2697850		
NMTN-09561	SAV2552		2695756	2698245	2698082		
NMTN-11169	SAV2554	rocA	2699294	2700838	2699779	-	1-pyrroline-5-carboxylate dehydrogenase
NMTN-04868	SAV2554	rocA	2699294	2700838	2699931		
NMTN-08467	SAV2554	rocA	2699294	2700838	2699956		
NMTN-11464	SAV2554	rocA	2699294	2700838	2700048		
NMTN-00458	SAV2554	rocA	2699294	2700838	2700378		
NMTN-07409	SAV2554	rocA	2699294	2700838	2700639		
NMTN-08445	SAV2555		2701028	2701627	2701025	-	hypothetical protein
NMTN-08913	SAV2555		2701028	2701627	2701314		
NMTN-03601	SAV2555		2701028	2701627	2701367		
NMTN-07473	SAV2555		2701028	2701627	2701382		
NMTN-02145	SAV2555		2701028	2701627	2701444		
NMTN-04387	SAV2557	copA	2702297	2704705	2702439	+	copper-transporting ATPase
NMTN-06372	SAV2557	copA	2702297	2704705	2702763		
NMTN-09344	SAV2557	copA	2702297	2704705	2702856		
NMTN-04996	SAV2557	copA	2702297	2704705	2703065		
NMTN-05541	SAV2557	copA	2702297	2704705	2703227		
NMTN-11363	SAV2557	copA	2702297	2704705	2703233		
NMTN-11079	SAV2557	copA	2702297	2704705	2704038		
NMTN-12878	SAV2557	copA	2702297	2704705	2704274		
NMTN-09427	SAV2557	copA	2702297	2704705	2704392		
NMTN-11762	SAV2558		2705243	2705449	2705434	+	hypothetical protein
NMTN-08473	SAV2559		2705540	2706538	2705734	-	hypothetical protein
NMTN-12617	SAV2560		2706561	2707715	2706764	-	hypothetical protein
NMTN-01831	SAV2560		2706561	2707715	2706765		
NMTN-01878	SAV2560		2706561	2707715	2706765		
NMTN-02271	SAV2560		2706561	2707715	2706905		
NMTN-06348	SAV2560		2706561	2707715	2707072		
NMTN-01477	SAV2560		2706561	2707715	2707400		
NMTN-13593	SAV2560		2706561	2707715	2707585		
NMTN-13594	SAV2560		2706561	2707715	2707585		
NMTN-00022	SAV2561	crtN	2708143	2709651	2708287	-	squalene synthase
NMTN-11447	SAV2561	crtN	2708143	2709651	2708393		
NMTN-03594	SAV2561	crtN	2708143	2709651	2709131		
NMTN-15226	SAV2561	crtN	2708143	2709651	2709202		
NMTN-13713	SAV2562	crtM	2709663	2710526	2709663	-	squalene desaturase
NMTN-07303	SAV2562	crtM	2709663	2710526	2709665		
NMTN-03760	SAV2562	crtM	2709663	2710526	2709783		
NMTN-14521	SAV2562	crtM	2709663	2710526	2709786		
NMTN-12847	SAV2562	crtM	2709663	2710526	2709790		
NMTN-08294	SAV2562	crtM	2709663	2710526	2709801		
NMTN-01557	SAV2562	crtM	2709663	2710526	2709826		
NMTN-06949	SAV2562	crtM	2709663	2710526	2709877		
NMTN-07682	SAV2562	crtM	2709663	2710526	2710037		
NMTN-00663	SAV2562	crtM	2709663	2710526	2710068		
NMTN-01593	SAV2562	crtM	2709663	2710526	2710194		
NMTN-01602	SAV2562	crtM	2709663	2710526	2710194		
NMTN-06581	SAV2562	crtM	2709663	2710526	2710537		
NMTN-08865	SAV2563		2710563	2711690	2711070	-	conserved hypothetical protein
NMTN-02946	SAV2563		2710563	2711690	2711210		
NMTN-12883	SAV2564		2711696	2713189	2711949	-	hypothetical protein
NMTN-11414	SAV2564		2711696	2713189	2712018		
NMTN-14780	SAV2564		2711696	2713189	2712156		
NMTN-09114	SAV2564		2711696	2713189	2712342		
NMTN-14702	SAV2564		2711696	2713189	2712441		
NMTN-11654	SAV2564		2711696	2713189	2712809		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08373	SAV2565		2713182	2713679	2713445	-	hypothetical protein
NMTN-04150	SAV2565		2713182	2713679	2713659		
NMTN-05085	SAV2566		2713845	2714612	2714152	-	hypothetical protein
NMTN-04670	SAV2566		2713845	2714612	2714325		
NMTN-00179	SAV2566		2713845	2714612	2714370		
NMTN-00516	SAV2566		2713845	2714612	2714370		
NMTN-06336	SAV2566		2713845	2714612	2714371		
NMTN-14402	SAV2566		2713845	2714612	2714394		
NMTN-03895	SAV2566		2713845	2714612	2714476		
NMTN-08500	SAV2567		2714973	2716784	2715119	-	hypothetical protein
NMTN-10792	SAV2567		2714973	2716784	2715226		
NMTN-12964	SAV2567		2714973	2716784	2715306		
NMTN-12969	SAV2567		2714973	2716784	2715306		
NMTN-12970	SAV2567		2714973	2716784	2715306		
NMTN-12988	SAV2567		2714973	2716784	2715306		
NMTN-12994	SAV2567		2714973	2716784	2715306		
NMTN-13000	SAV2567		2714973	2716784	2715306		
NMTN-13012	SAV2567		2714973	2716784	2715306		
NMTN-13018	SAV2567		2714973	2716784	2715306		
NMTN-13024	SAV2567		2714973	2716784	2715306		
NMTN-13030	SAV2567		2714973	2716784	2715306		
NMTN-13031	SAV2567		2714973	2716784	2715306		
NMTN-09897	SAV2567		2714973	2716784	2715397		
NMTN-08343	SAV2567		2714973	2716784	2715665		
NMTN-07465	SAV2567		2714973	2716784	2715793		
NMTN-04546	SAV2567		2714973	2716784	2715839		
NMTN-12132	SAV2567		2714973	2716784	2715848		
NMTN-02562	SAV2567		2714973	2716784	2715853		
NMTN-03636	SAV2567		2714973	2716784	2715853		
NMTN-04076	SAV2567		2714973	2716784	2715872		
NMTN-01688	SAV2567		2714973	2716784	2715875		
NMTN-08515	SAV2567		2714973	2716784	2715978		
NMTN-14763	SAV2567		2714973	2716784	2716123		
NMTN-13728	SAV2567		2714973	2716784	2716286		
NMTN-07459	SAV2567		2714973	2716784	2716328		
NMTN-12078	SAV2567		2714973	2716784	2716380		
NMTN-13369	SAV2567		2714973	2716784	2716387		
NMTN-00792	SAV2567		2714973	2716784	2716421		
NMTN-02863	SAV2567		2714973	2716784	2716423		
NMTN-13285	SAV2568		2717297	2717785	2717325	-	conserved hypothetical protein
NMTN-11346	SAV2568		2717297	2717785	2717341		
NMTN-02695	SAV2568		2717297	2717785	2717581		
NMTN-00237	SAV2569	isaA	2718061	2718762	2718061	-	immunodominant antigen A
NMTN-13112	SAV2570		2719370	2720425	2719477	-	hypothetical protein
NMTN-06710	SAV2570		2719370	2720425	2719594		
NMTN-09324	SAV2570		2719370	2720425	2719668		
NMTN-13770	SAV2570		2719370	2720425	2719798		
NMTN-08644	SAV2571		2720835	2721404	2720846	+	hypothetical protein
NMTN-14301	SAV2571		2720835	2721404	2721128		
NMTN-03781	SAV2572		2721782	2722102	2721825	+	hypothetical protein
NMTN-03529	SAV2572		2721782	2722102	2721827		
NMTN-12347	SAV2572		2721782	2722102	2721949		
NMTN-12355	SAV2572		2721782	2722102	2721951		
NMTN-03508	SAV2572		2721782	2722102	2721963		
NMTN-05596	SAV2572		2721782	2722102	2722015		
NMTN-09298	SAV2572		2721782	2722102	2722015		
NMTN-11528	SAV2572		2721782	2722102	2722015		
NMTN-10619	SAV2573		2722322	2722552	2722448	+	conserved hypothetical protein
NMTN-00838	SAV2576		2723248	2724069	2723529	-	conserved hypothetical protein
NMTN-09414	SAV2576		2723248	2724069	2723753		
NMTN-04774	SAV2576		2723248	2724069	2723940		
NMTN-02527	SAV2576		2723248	2724069	2723942		
NMTN-07871	SAV2576		2723248	2724069	2723972		
NMTN-11841	SAV2578		2724519	2725076	2724627	+	hypothetical protein
NMTN-03283	SAV2578		2724519	2725076	2724932		
NMTN-11432	SAV2579		2725069	2725773	2725159	+	hypothetical protein
NMTN-14297	SAV2579		2725069	2725773	2725178		
NMTN-11570	SAV2579		2725069	2725773	2725223		
NMTN-12234	SAV2579		2725069	2725773	2725228		
NMTN-12596	SAV2580		2725871	2726881	2725902	+	conserved hypothetical protein
NMTN-04358	SAV2580		2725871	2726881	2726834		
NMTN-14009	SAV2581		2726901	2727731	2727191	+	conserved hypothetical protein
NMTN-07148	SAV2582		2727878	2728768	2727899	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-07148	SAV2582		2727878	2728768	2727899		
NMTN-04499	SAV2582		2727878	2728768	2728468		
NMTN-05189	SAV2582		2727878	2728768	2728762		
NMTN-08001	SAV2583		2728865	2730205	2729090	-	hypothetical protein
NMTN-11809	SAV2583		2728865	2730205	2729632		
NMTN-13519	SAV2584		2730199	2731305	2730353	-	conserved hypothetical protein
NMTN-00657	SAV2584		2730199	2731305	2730395		
NMTN-06313	SAV2584		2730199	2731305	2730606		
NMTN-13422	SAV2584		2730199	2731305	2730722		
NMTN-07887	SAV2584		2730199	2731305	2731059		
NMTN-12457	SAV2584		2730199	2731305	2731076		
NMTN-02598	SAV2584		2730199	2731305	2731257		
NMTN-02997	SAV2584		2730199	2731305	2731292		
NMTN-00421	SAV2585		2731638	2731934	2731922	-	conserved hypothetical protein
NMTN-10636	SAV2587		2732305	2732580	2732376	-	hypothetical protein
NMTN-10654	SAV2587		2732305	2732580	2732376		
NMTN-10910	SAV2587		2732305	2732580	2732376		
NMTN-10922	SAV2587		2732305	2732580	2732376		
NMTN-10643	SAV2587		2732305	2732580	2732382		
NMTN-10939	SAV2587		2732305	2732580	2732399		
NMTN-04914	SAV2588		2732924	2733790	2733226	-	conserved hypothetical protein
NMTN-04893	SAV2591		2735688	2736410	2736259	-	conserved hypothetical protein
NMTN-12366	SAV2591		2735688	2736410	2736286		
NMTN-12473	SAV2594		2738024	2739706	2738057	+	conserved hypothetical protein
NMTN-03919	SAV2594		2738024	2739706	2739296		
NMTN-03406	SAV2594		2738024	2739706	2739354		
NMTN-09691	SAV2594		2738024	2739706	2739470		
NMTN-02296	SAV2597	panD	2741874	2742245	2741965	-	aspartate 1-decarboxylase
NMTN-02521	SAV2598	panC	2742259	2743110	2742276	-	pantoate beta-alanine ligase
NMTN-15175	SAV2598	panC	2742259	2743110	2742280		
NMTN-07451	SAV2598	panC	2742259	2743110	2742423		
NMTN-09121	SAV2598	panC	2742259	2743110	2742813		
NMTN-11785	SAV2598	panC	2742259	2743110	2742813		
NMTN-13997	SAV2599	panB	2743103	2743921	2743390	-	3-methyl-2-oxobutanoate hydroxymethyltransferase
NMTN-06644	SAV2599	panB	2743103	2743921	2743753		
NMTN-06886	SAV2600		2743994	2744854	2744051	+	hypothetical protein
NMTN-13807	SAV2600		2743994	2744854	2744241		
NMTN-10884	SAV2600		2743994	2744854	2744284		
NMTN-05452	SAV2600		2743994	2744854	2744403		
NMTN-06081	SAV2600		2743994	2744854	2744462		
NMTN-09112	SAV2600		2743994	2744854	2744487		
NMTN-00189	SAV2600		2743994	2744854	2744533		
NMTN-04810	SAV2600		2743994	2744854	2744597		
NMTN-12720	SAV2602		2745922	2746881	2746068	-	L-lactate dehydrogenase
NMTN-07805	SAV2602		2745922	2746881	2746189		
NMTN-13035	SAV2603		2747567	2749015	2748068	+	hypothetical protein
NMTN-14529	SAV2603		2747567	2749015	2748399		
NMTN-07788	SAV2603		2747567	2749015	2748419		
NMTN-13324	SAV2603		2747567	2749015	2748756		
NMTN-06796	SAV2603		2747567	2749015	2748793		
NMTN-09991	SAV2604		2749096	2750469	2749169	-	hypothetical protein
NMTN-14466d	SAV2604		2749096	2750469	2749250		
NMTN-14968	SAV2604		2749096	2750469	2749250		
NMTN-15091	SAV2604		2749096	2750469	2749250		
NMTN-00171	SAV2604		2749096	2750469	2749286		
NMTN-00265	SAV2604		2749096	2750469	2749286		
NMTN-13360	SAV2604		2749096	2750469	2749387		
NMTN-02730	SAV2604		2749096	2750469	2749391		
NMTN-11036	SAV2604		2749096	2750469	2749805		
NMTN-13720	SAV2604		2749096	2750469	2750192		
NMTN-04971	SAV2605		2750691	2751107	2750817	+	hypothetical protein
NMTN-00109	SAV2605		2750691	2751107	2750939		
NMTN-08555	SAV2606		2751230	2752120	2751484	+	fructose-bisphosphate aldolase homolog
NMTN-08558	SAV2606		2751230	2752120	2751484		
NMTN-12975	SAV2606		2751230	2752120	2751485		
NMTN-08544	SAV2606		2751230	2752120	2751496		
NMTN-08556	SAV2606		2751230	2752120	2751498		
NMTN-00773	SAV2607	mgo2	2752314	2753810	2752712	-	malate/quinone oxidoreductase
NMTN-11441	SAV2608		2754187	2754435	2754251	+	hypothetical protein
NMTN-07242	SAV2608		2754187	2754435	2754260		
NMTN-11969	SAV2608		2754187	2754435	2754346		
NMTN-04821	SAV2609		2754495	2756114	2754730	-	acetate-CoA ligase

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-14556	SAV2609		2754495	2756114	2755876		
NMTN-10562	SAV2610		2756287	2756730	2756573	-	conserved hypothetical protein
NMTN-08980	SAV2610		2756287	2756730	2756579		
NMTN-01537	SAV2612	betA	2757500	2759209	2757572	-	choline dehydrogenase
NMTN-06805	SAV2612	betA	2757500	2759209	2758094		
NMTN-09266	SAV2612	betA	2757500	2759209	2758298		
NMTN-08137	SAV2612	betA	2757500	2759209	2758405		
NMTN-04344	SAV2612	betA	2757500	2759209	2758468		
NMTN-07263	SAV2612	betA	2757500	2759209	2758468		
NMTN-11071	SAV2612	betA	2757500	2759209	2758680		
NMTN-04143	SAV2613	gbsA	2759470	2760960	2759536	-	glycine betaine aldehyde dehydrogenase
NMTN-02851	SAV2613	gbsA	2759470	2760960	2759716		
NMTN-02132	SAV2613	gbsA	2759470	2760960	2759766		
NMTN-05070	SAV2613	gbsA	2759470	2760960	2759948		
NMTN-06306	SAV2613	gbsA	2759470	2760960	2760516		
NMTN-04535	SAV2613	gbsA	2759470	2760960	2760638		
NMTN-06718	SAV2614		2761210	2761776	2761327	+	conserved hypothetical protein
NMTN-01962	SAV2615	culT	2761947	2763569	2762451	-	choline transporter
NMTN-04088	SAV2615	culT	2761947	2763569	2762577		
NMTN-04054	SAV2615	culT	2761947	2763569	2762595		
NMTN-06875	SAV2615	culT	2761947	2763569	2762900		
NMTN-11177	SAV2615	culT	2761947	2763569	2763069		
NMTN-05071	SAV2615	culT	2761947	2763569	2763126		
NMTN-02034	SAV2615	culT	2761947	2763569	2763312		
NMTN-12512	SAV2616		2764088	2764624	2764144	-	hypothetical protein
NMTN-04459	SAV2616		2764088	2764624	2764234		
NMTN-04385	SAV2617	nrdD	2764621	2766471	2765009	-	anaerobic ribonucleoside-triphosphate reductase
NMTN-07822	SAV2617	nrdD	2764621	2766471	2765015		
NMTN-11600	SAV2617	nrdD	2764621	2766471	2765354		
NMTN-09460	SAV2617	nrdD	2764621	2766471	2765713		
NMTN-12940	SAV2617	nrdD	2764621	2766471	2766171		
NMTN-03796	SAV2618		2766661	2768031	2766739	-	hypothetical protein
NMTN-13806	SAV2618		2766661	2768031	2766746		
NMTN-12389	SAV2618		2766661	2768031	2766789		
NMTN-14506	SAV2618		2766661	2768031	2766855		
NMTN-03822	SAV2618		2766661	2768031	2767182		
NMTN-02850	SAV2618		2766661	2768031	2767353		
NMTN-13493	SAV2618		2766661	2768031	2767353		
NMTN-12152	SAV2618		2766661	2768031	2767356		
NMTN-02491	SAV2618		2766661	2768031	2767622		
NMTN-12676	SAV2618		2766661	2768031	2767639		
NMTN-07957	SAV2618		2766661	2768031	2767704		
NMTN-07118	SAV2619		2768524	2769129	2768661	-	hypothetical protein
NMTN-12167	SAV2619		2768524	2769129	2768765		
NMTN-08426	SAV2619		2768524	2769129	2768971		
NMTN-03468	SAV2620		2769192	2771072	2769410	-	sulfite reductase flavoprotein
NMTN-11305	SAV2620		2769192	2771072	2769689		
NMTN-12193	SAV2620		2769192	2771072	2769786		
NMTN-07081	SAV2620		2769192	2771072	2770030		
NMTN-10714	SAV2620		2769192	2771072	2770051		
NMTN-11923	SAV2620		2769192	2771072	2770225		
NMTN-00268	SAV2620		2769192	2771072	2770457		
NMTN-01461	SAV2620		2769192	2771072	2770477		
NMTN-02085	SAV2620		2769192	2771072	2770698		
NMTN-13059	SAV2620		2769192	2771072	2770854		
NMTN-12700	SAV2621		2771466	2771963	2771495	-	hypothetical protein
NMTN-03913	SAV2621		2771466	2771963	2771507		
NMTN-02612	SAV2621		2771466	2771963	2771630		
NMTN-13290	SAV2621		2771466	2771963	2771803		
NMTN-10657	SAV2621		2771466	2771963	2771851		
NMTN-14036d	SAV2621		2771466	2771963	2771851		
NMTN-03424	SAV2622		2773387	2775387	2773453	-	hypothetical protein
NMTN-04001	SAV2622		2773387	2775387	2773476		
NMTN-09285	SAV2622		2773387	2775387	2773483		
NMTN-10873	SAV2622		2773387	2775387	2773499		
NMTN-03533	SAV2622		2773387	2775387	2773767		
NMTN-03977	SAV2622		2773387	2775387	2773936		
NMTN-11160	SAV2622		2773387	2775387	2774394		
NMTN-14619	SAV2622		2773387	2775387	2774621		
NMTN-06543	SAV2622		2773387	2775387	2775249		
NMTN-13515	SAV2623		2775384	2776139	2775482	-	hypothetical protein

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-01691	SAV2623		2775384	2776139	2775647		
NMTN-05569	SAV2623		2775384	2776139	2775769		
NMTN-03689	SAV2623		2775384	2776139	2775785		
NMTN-03452	SAV2623		2775384	2776139	2775799		
NMTN-05069	SAV2624		2776247	2777134	2776740	-	hypothetical protein
NMTN-06186	SAV2624		2776247	2777134	2776984		
NMTN-05304	SAV2625		2777145	2777810	2777457	-	hypothetical protein
NMTN-12784	SAV2625		2777145	2777810	2777660		
NMTN-02121	SAV2627	phoB	2778234	2779658	2779030	+	alkaline phosphatase III precursor
NMTN-15181	SAV2627	phoB	2778234	2779658	2779089		
NMTN-04781	SAV2627	phoB	2778234	2779658	2779195		
NMTN-13911d	SAV2627	phoB	2778234	2779658	2779195		
NMTN-09454	SAV2627	phoB	2778234	2779658	2779309		
NMTN-13140	SAV2629		2780641	2781402	2781185	-	hypothetical protein
NMTN-08684	SAV2629		2780641	2781402	2781195		
NMTN-02802	SAV2629		2780641	2781402	2781227		
NMTN-06861	SAV2629		2780641	2781402	2781238		
NMTN-14705	SAV2629		2780641	2781402	2781238		
NMTN-13125	SAV2630	clfB	2781518	2784151	2781516		
NMTN-13153	SAV2630	clfB	2781518	2784151	2781516		
NMTN-07323	SAV2630	clfB	2781518	2784151	2782704	-	Clumping factor B
NMTN-03615	SAV2630	clfB	2781518	2784151	2782814		
NMTN-02818	SAV2630	clfB	2781518	2784151	2782956		
NMTN-11940	SAV2630	clfB	2781518	2784151	2783056		
NMTN-11936	SAV2630	clfB	2781518	2784151	2783081		
NMTN-00642	SAV2630	clfB	2781518	2784151	2783132		
NMTN-03129	SAV2630	clfB	2781518	2784151	2783211		
NMTN-12227	SAV2630	clfB	2781518	2784151	2783212		
NMTN-08433	SAV2630	clfB	2781518	2784151	2783298		
NMTN-00826	SAV2630	clfB	2781518	2784151	2783316		
NMTN-15231	SAV2630	clfB	2781518	2784151	2783557		
NMTN-07441	SAV2630	clfB	2781518	2784151	2783954		
NMTN-05159	SAV2631		2784501	2785205	2784971	-	hypothetical protein
NMTN-13909	SAV2631		2784501	2785205	2785060		
NMTN-07559	SAV2631		2784501	2785205	2785120		
NMTN-10668	SAV2632	arcC	2785304	2786272	2785332	-	carbamate kinase
NMTN-04271	SAV2632	arcC	2785304	2786272	2785550		
NMTN-07288	SAV2633	arcD	2786262	2787692	2786315	-	arginine/ornithine antiporter
NMTN-00539	SAV2633	arcD	2786262	2787692	2786433		
NMTN-12496	SAV2633	arcD	2786262	2787692	2786456		
NMTN-03994	SAV2633	arcD	2786262	2787692	2786458		
NMTN-04673	SAV2633	arcD	2786262	2787692	2786503		
NMTN-05038	SAV2633	arcD	2786262	2787692	2786927		
NMTN-02118	SAV2633	arcD	2786262	2787692	2786940		
NMTN-00746	SAV2634	arcB	2787783	2788793	2788093	-	ornithine transcarbamoylase
NMTN-03256	SAV2634	arcB	2787783	2788793	2788188		
NMTN-13890	SAV2634	arcB	2787783	2788793	2788319		
NMTN-01608	SAV2634	arcB	2787783	2788793	2788498		
NMTN-04053	SAV2635	arcA	2788826	2790061	2788948	-	arginine deiminase
NMTN-03618	SAV2635	arcA	2788826	2790061	2788949		
NMTN-05244	SAV2635	arcA	2788826	2790061	2788986		
NMTN-14719d	SAV2635	arcA	2788826	2790061	2788998		
NMTN-02276	SAV2635	arcA	2788826	2790061	2789164		
NMTN-12461	SAV2635	arcA	2788826	2790061	2789227		
NMTN-07482	SAV2635	arcA	2788826	2790061	2789246		
NMTN-10660	SAV2635	arcA	2788826	2790061	2789358		
NMTN-04557	SAV2635	arcA	2788826	2790061	2789361		
NMTN-13137	SAV2635	arcA	2788826	2790061	2789628		
NMTN-11542d	SAV2635	arcA	2788826	2790061	2789858		
NMTN-06838	SAV2635	arcA	2788826	2790061	2790016		
NMTN-13057d	SAV2636		2790408	2790857	2790506	-	hypothetical protein
NMTN-11761	SAV2636		2790408	2790857	2790576		
NMTN-14597	SAV2636		2790408	2790857	2790576		
NMTN-00400	SAV2636		2790408	2790857	2790618		
NMTN-12533	SAV2636		2790408	2790857	2790658		
NMTN-12752	SAV2636		2790408	2790857	2790748		
NMTN-09030	SAV2637	aur	2791224	2792753	2792521	-	zinc metalloproteinase aureolysin
NMTN-08682	SAV2638	isaB	2793177	2793704	2793212	-	immunodominant antigen B
NMTN-07630	SAV2639		2793962	2794420	2794006	+	conserved hypothetical protein
NMTN-13671	SAV2639		2793962	2794420	2794287		
NMTN-11257	SAV2640		2794660	2796534	2794724	+	hypothetical protein
NMTN-12185	SAV2640		2794660	2796534	2795247		
NMTN-05231	SAV2640		2794660	2796534	2795540		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-04751	SAV2640		2794660	2796534	2795731		
NMTN-05700	SAV2640		2794660	2796534	2795947		
NMTN-00195	SAV2640		2794660	2796534	2796034		
NMTN-00389	SAV2640		2794660	2796534	2796034		
NMTN-04988	SAV2640		2794660	2796534	2796136		
NMTN-07828	SAV2640		2794660	2796534	2796487		
NMTN-00382	SAV2641		2796610	2798562	2796656	+	fructose phosphotransferase system enzyme fruA homolog
NMTN-02784	SAV2641		2796610	2798562	2796657		
NMTN-13387	SAV2641		2796610	2798562	2796658		
NMTN-00588	SAV2641		2796610	2798562	2796660		
NMTN-00597	SAV2641		2796610	2798562	2796660		
NMTN-01473	SAV2641		2796610	2798562	2796660		
NMTN-12783d	SAV2641		2796610	2798562	2796660		
NMTN-13358	SAV2641		2796610	2798562	2796660		
NMTN-13366	SAV2641		2796610	2798562	2796660		
NMTN-13383	SAV2641		2796610	2798562	2796660		
NMTN-13384	SAV2641		2796610	2798562	2796660		
NMTN-13418	SAV2641		2796610	2798562	2796660		
NMTN-13429	SAV2641		2796610	2798562	2796660		
NMTN-13431	SAV2641		2796610	2798562	2796660		
NMTN-05456	SAV2641		2796610	2798562	2797695		
NMTN-05040	SAV2641		2796610	2798562	2798288		
NMTN-08302	SAV2641		2796610	2798562	2798548		
NMTN-07093	SAV2642	pmi	2798576	2799514	2798642	+	mannose-6-phosphate isomerase
NMTN-07094	SAV2642	pmi	2798576	2799514	2798706		
NMTN-12815	SAV2642	pmi	2798576	2799514	2798728		
NMTN-04717	SAV2642	pmi	2798576	2799514	2799358		
NMTN-06343	SAV2643		2799626	2802607	2799954	-	hypothetical protein
NMTN-08272	SAV2643		2799626	2802607	2800203		
NMTN-11406	SAV2643		2799626	2802607	2802003		
NMTN-02659	SAV2644		2802818	2804677	2803509	+	hypothetical protein
NMTN-14542	SAV2644		2802818	2804677	2803731		
NMTN-12767	SAV2644		2802818	2804677	2804324		
NMTN-07147	SAV2644		2802818	2804677	2804543		
NMTN-10479	SAV2644		2802818	2804677	2804625		
NMTN-05462	SAV2645		2804942	2805502	2805063	-	hypothetical protein
NMTN-04073	SAV2645		2804942	2805502	2805068		
NMTN-00505	SAV2646		2805671	2807578	2805693	-	conserved hypothetical protein
NMTN-12751	SAV2646		2805671	2807578	2805796		
NMTN-03078	SAV2646		2805671	2807578	2805931		
NMTN-09723	SAV2646		2805671	2807578	2806013		
NMTN-11485	SAV2646		2805671	2807578	2806581		
NMTN-10751	SAV2646		2805671	2807578	2806602		
NMTN-07999	SAV2646		2805671	2807578	2807267		
NMTN-02604	SAV2646		2805671	2807578	2807583		
NMTN-02354	SAV2647		2807819	2809177	2808116	-	hypothetical protein
NMTN-12096	SAV2647		2807819	2809177	2808921		
NMTN-01876	SAV2647		2807819	2809177	2808973		
NMTN-12898	SAV2647		2807819	2809177	2809113		
NMTN-03626	SAV2647		2807819	2809177	2809133		
NMTN-03013	SAV2648		2809170	2810678	2809426	-	hypothetical protein
NMTN-11879	SAV2648		2809170	2810678	2809528		
NMTN-13433	SAV2648		2809170	2810678	2809779		
NMTN-08657	SAV2648		2809170	2810678	2809899		
NMTN-03692	SAV2648		2809170	2810678	2810098		
NMTN-03105	SAV2648		2809170	2810678	2810123		
NMTN-13682	SAV2648		2809170	2810678	2810193		
NMTN-06262	SAV2648		2809170	2810678	2810248		
NMTN-00083	SAV2648		2809170	2810678	2810498		
NMTN-07965	SAV2649		2810696	2813086	2810739	-	preprotein translocase secA homolog
NMTN-15186	SAV2649		2810696	2813086	2811202		
NMTN-06606	SAV2649		2810696	2813086	2811385		
NMTN-06536	SAV2649		2810696	2813086	2811395		
NMTN-07764	SAV2649		2810696	2813086	2811465		
NMTN-12755	SAV2649		2810696	2813086	2811537		
NMTN-00063	SAV2649		2810696	2813086	2811724		
NMTN-11870	SAV2649		2810696	2813086	2812243		
NMTN-06770	SAV2649		2810696	2813086	2812655		
NMTN-12662	SAV2649		2810696	2813086	2812865		
NMTN-04051	SAV2649		2810696	2813086	2812918		
NMTN-03906	SAV2650		2813076	2814116	2813317	-	hypothetical protein
NMTN-06809	SAV2650		2813076	2814116	2813348		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-11845	SAV2650		2813076	2814116	2813645		
NMTN-00878	SAV2650		2813076	2814116	2813986		
NMTN-00273	SAV2651		2814013	2815581	2814119	-	hypothetical protein
NMTN-11289	SAV2651		2814013	2815581	2814177		
NMTN-02497	SAV2651		2814013	2815581	2814180		
NMTN-15303	SAV2651		2814013	2815581	2814214		
NMTN-05152	SAV2651		2814013	2815581	2814220		
NMTN-04967	SAV2651		2814013	2815581	2814221		
NMTN-08126	SAV2651		2814013	2815581	2814342		
NMTN-15204	SAV2651		2814013	2815581	2814476		
NMTN-11731	SAV2651		2814013	2815581	2814824		
NMTN-02762	SAV2651		2814013	2815581	2814828		
NMTN-09267	SAV2652		2815571	2817124	2815629	-	hypothetical protein
NMTN-04305	SAV2652		2815571	2817124	2816152		
NMTN-04313	SAV2652		2815571	2817124	2816152		
NMTN-11124	SAV2652		2815571	2817124	2816152		
NMTN-09398	SAV2652		2815571	2817124	2816158		
NMTN-08021	SAV2652		2815571	2817124	2816216		
NMTN-11181	SAV2652		2815571	2817124	2816296		
NMTN-02681	SAV2652		2815571	2817124	2816321		
NMTN-03558	SAV2652		2815571	2817124	2816920		
NMTN-09790	SAV2653		2817135	2818346	2817261	-	hypothetical protein
NMTN-10579	SAV2653		2817135	2818346	2817314		
NMTN-12290	SAV2653		2817135	2818346	2817317		
NMTN-02810	SAV2653		2817135	2818346	2817359		
NMTN-08822	SAV2653		2817135	2818346	2817548		
NMTN-08053	SAV2653		2817135	2818346	2817560		
NMTN-07973	SAV2653		2817135	2818346	2817561		
NMTN-01728	SAV2653		2817135	2818346	2817671		
NMTN-01583	SAV2653		2817135	2818346	2817671		
NMTN-10706	SAV2653		2817135	2818346	2817702		
NMTN-13893	SAV2653		2817135	2818346	2817702		
NMTN-06395	SAV2653		2817135	2818346	2817705		
NMTN-07279	SAV2653		2817135	2818346	2817800		
NMTN-11024	SAV2653		2817135	2818346	2817803		
NMTN-07537	SAV2653		2817135	2818346	2817878		
NMTN-11118	SAV2653		2817135	2818346	2817944		
NMTN-03661	SAV2654		2818476	2825291	2818846	-	hypothetical protein
NMTN-13337d	SAV2654		2818476	2825291	2819383		
NMTN-13342	SAV2654		2818476	2825291	2819987		
NMTN-00264	SAV2654		2818476	2825291	2820277		
NMTN-09452	SAV2654		2818476	2825291	2820352		
NMTN-12564	SAV2654		2818476	2825291	2820352		
NMTN-11529	SAV2654		2818476	2825291	2822530		
NMTN-04676	SAV2654		2818476	2825291	2822536		
NMTN-02011	SAV2654		2818476	2825291	2823121		
NMTN-08225	SAV2654		2818476	2825291	2823198		
NMTN-08662	SAV2654		2818476	2825291	2823934		
NMTN-11137	SAV2654		2818476	2825291	2824069		
NMTN-11967	SAV2654		2818476	2825291	2824072		
NMTN-14518	SAV2654		2818476	2825291	2824483		
NMTN-05415	SAV2654		2818476	2825291	2824485		
NMTN-04712	SAV2654		2818476	2825291	2824739		
NMTN-12370	SAV2654		2818476	2825291	2824966		
NMTN-12578	SAV2654		2818476	2825291	2825236		
NMTN-06330	SAV2655		2825835	2826527	2825876	-	conserved hypothetical protein
NMTN-11230	SAV2658		2827664	2828023	2827789	+	hypothetical protein
NMTN-11724	SAV2659		2828108	2828719	2828635	-	conserved hypothetical protein
NMTN-04485	SAV2660		2828798	2829274	2828829	-	hypothetical protein
NMTN-03481	SAV2660		2828798	2829274	2828838		
NMTN-07977	SAV2660		2828798	2829274	2828839		
NMTN-06434	SAV2660		2828798	2829274	2828841		
NMTN-04057	SAV2660		2828798	2829274	2828897		
NMTN-11474	SAV2660		2828798	2829274	2828997		
NMTN-02386	SAV2660		2828798	2829274	2829137		
NMTN-02687	SAV2661		2829277	2829777	2829317		
NMTN-14612	SAV2661		2829277	2829777	2829526	-	conserved hypothetical protein
NMTN-03156	SAV2661		2829277	2829777	2829647		
NMTN-07326	SAV2662	capC	2830012	2830779	2830372	-	capsular polysaccharide biosynthesis
NMTN-12920	SAV2662	capC	2830012	2830779	2830437		
NMTN-11295	SAV2662	capC	2830012	2830779	2830499		
NMTN-04689	SAV2662	capC	2830012	2830779	2830509		
NMTN-02030	SAV2663	capB	2830776	2831468	2830850	-	capsular polysaccharide biosynthesis

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-08394	SAV2663	capB	2830776	2831468	2830899		
NMTN-11334	SAV2663	capB	2830776	2831468	2831460		
NMTN-12143	SAV2664	capA	2831485	2832147	2832019	-	capsular polysaccharide biosynthesis
NMTN-11052c	SAV2665	icaR	2832996	2833556	2833178	-	ica operon transcriptional regulator
NMTN-11044	SAV2665	icaR	2832996	2833556	2833193		
NMTN-11831	SAV2665	icaR	2832996	2833556	2833214		
NMTN-09269	SAV2665	icaR	2832996	2833556	2833446		
NMTN-04722	SAV2666	icaA	2833720	2834958	2833794	+	intercellular adhesion protein A
NMTN-14410	SAV2666	icaA	2833720	2834958	2833797		
NMTN-09625	SAV2666	icaA	2833720	2834958	2833856		
NMTN-09758	SAV2666	icaA	2833720	2834958	2833856		
NMTN-09770	SAV2666	icaA	2833720	2834958	2833856		
NMTN-09806	SAV2666	icaA	2833720	2834958	2833856		
NMTN-09841	SAV2666	icaA	2833720	2834958	2833856		
NMTN-11465	SAV2666	icaA	2833720	2834958	2834106		
NMTN-12499	SAV2666	icaA	2833720	2834958	2834636		
NMTN-04780	SAV2666	icaA	2833720	2834958	2834642		
NMTN-11914	SAV2666	icaA	2833720	2834958	2834702		
NMTN-08875	SAV2666	icaA	2833720	2834958	2834722		
NMTN-09217	SAV2666	icaA	2833720	2834958	2834722		
NMTN-11413	SAV2666	icaA	2833720	2834958	2834866		
NMTN-06087	SAV2667	icaD	2834922	2835227	2835055	+	intercellular adhesion protein D
NMTN-11335	SAV2667	icaD	2834922	2835227	2835057		
NMTN-01598	SAV2667	icaD	2834922	2835227	2835058		
NMTN-03146	SAV2668	icaB	2835224	2836096	2835342	+	intercellular adhesion protein B
NMTN-14557d	SAV2669	icaC	2836083	2837135	2836128	+	intercellular adhesion protein C
NMTN-05081	SAV2669	icaC	2836083	2837135	2836763		
NMTN-06051	SAV2669	icaC	2836083	2837135	2837047		
NMTN-12308	SAV2669	icaC	2836083	2837135	2837047		
NMTN-00266	SAV2669	icaC	2836083	2837135	2837113		
NMTN-00325	SAV2669	icaC	2836083	2837135	2837113		
NMTN-12300	SAV2669	icaC	2836083	2837135	2837130		
NMTN-04872	SAV2671	lip	2837470	2839515	2839112	-	triacylglycerol lipase precursor
NMTN-12464	SAV2672	hisI	2840605	2841237	2840858	-	histidine biosynthesis bifunctional protein HisIE
NMTN-04758	SAV2672	hisI	2840605	2841237	2841047		
NMTN-12061d	SAV2673	hisF	2841234	2841992	2841469	-	cyclase-like protein hisF
NMTN-03963	SAV2673	hisF	2841234	2841992	2841562		
NMTN-04869	SAV2674		2841989	2842693	2842191	-	hypothetical protein
NMTN-03892	SAV2674		2841989	2842693	2842195		
NMTN-09374	SAV2674		2841989	2842693	2842216		
NMTN-09380	SAV2674		2841989	2842693	2842216		
NMTN-08447	SAV2674		2841989	2842693	2842334		
NMTN-12151	SAV2675	hisH	2842686	2843264	2842824	-	amidotransferase hisH
NMTN-11258	SAV2675	hisH	2842686	2843264	2842888		
NMTN-11259	SAV2675	hisH	2842686	2843264	2842891		
NMTN-02790	SAV2675	hisH	2842686	2843264	2843041		
NMTN-08819	SAV2675	hisH	2842686	2843264	2843041		
NMTN-05034	SAV2675	hisH	2842686	2843264	2843059		
NMTN-00062	SAV2676	hisB	2843261	2843839	2843458	-	imidazoleglycerol-phosphate dehydratase
NMTN-06380	SAV2676	hisB	2843261	2843839	2843518		
NMTN-02701	SAV2676	hisB	2843261	2843839	2843561		
NMTN-13480d	SAV2676	hisB	2843261	2843839	2843564		
NMTN-13145	SAV2676	hisB	2843261	2843839	2843670		
NMTN-02252	SAV2677		2843808	2844821	2843870	-	hypothetical protein
NMTN-13560	SAV2677		2843808	2844821	2844127		
NMTN-14349	SAV2677		2843808	2844821	2844127		
NMTN-00731	SAV2677		2843808	2844821	2844164		
NMTN-10193	SAV2677		2843808	2844821	2844402		
NMTN-14028	SAV2677		2843808	2844821	2844760		
NMTN-00416	SAV2678		2844837	2846087	2844873	-	hypothetical protein
NMTN-02448	SAV2678		2844837	2846087	2845323		
NMTN-02001	SAV2678		2844837	2846087	2845700		
NMTN-02009	SAV2678		2844837	2846087	2845700		
NMTN-01818	SAV2679	hisG	2846080	2846694	2846359	-	ATP phosphoribosyltransferase
NMTN-02348	SAV2679	hisG	2846080	2846694	2846634		
NMTN-15276	SAV2679	hisG	2846080	2846694	2846645		
NMTN-09578	SAV2680		2846712	2847530	2846760	-	hypothetical protein
NMTN-03523	SAV2680		2846712	2847530	2847227		
NMTN-00619	SAV2680		2846712	2847530	2847311		
NMTN-14435	SAV2681		2847834	2848958	2848147	-	hypothetical protein
NMTN-13874	SAV2681		2847834	2848958	2848647		

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-01573	SAV2681		2847834	2848958	2848741		
NMTN-12301	SAV2682		2849076	2849573	2849483	-	conserved hypothetical protein
NMTN-12301	SAV2683		2849076	2849573	2849483		
NMTN-06467	SAV2683		2849620	2850453	2849621	-	conserved hypothetical protein
NMTN-02640	SAV2684		2850450	2852057	2850478	-	hypothetical protein
NMTN-00726	SAV2684		2850450	2852057	2851213		
NMTN-00683	SAV2685		2852215	2852769	2852231	-	conserved hypothetical protein
NMTN-01613	SAV2685		2852215	2852769	2852499		
NMTN-04657	SAV2686		2852798	2853646	2853239	-	conserved hypothetical protein
NMTN-07854	SAV2686		2852798	2853646	2853341		
NMTN-00734	SAV2686		2852798	2853646	2853372		
NMTN-02732	SAV2688	drp35	2854693	2855667	2854835	-	Drp35
NMTN-12111	SAV2688	drp35	2854693	2855667	2854952		
NMTN-13419	SAV2689		2855908	2856864	2855937	+	conserved hypothetical protein
NMTN-07083	SAV2689		2855908	2856864	2855990		
NMTN-05335	SAV2689		2855908	2856864	2856080		
NMTN-08989	SAV2689		2855908	2856864	2856169		
NMTN-12851	SAV2689		2855908	2856864	2856169		
NMTN-13869	SAV2689		2855908	2856864	2856638		
NMTN-00709	SAV2689		2855908	2856864	2856674		
NMTN-14602	SAV2690	pcp	2857016	2857654	2857091	+	pyrrolidone-carboxylate peptidase
NMTN-03122	SAV2690	pcp	2857016	2857654	2857157		
NMTN-03122	SAV2690	pcp	2857016	2857654	2857157		
NMTN-11060	SAV2690	pcp	2857016	2857654	2857260		
NMTN-04754	SAV2691		2857773	2858540	2858313	-	hypothetical protein
NMTN-09586	SAV2691		2857773	2858540	2858354		
NMTN-12749	SAV2691		2857773	2858540	2858409		
NMTN-09329	SAV2693		2859035	2859499	2859239	+	hypothetical protein
NMTN-02592	SAV2693		2859035	2859499	2859422		
NMTN-02837	SAV2694		2859737	2860555	2860062	+	2-oxoglutarate/malate translocator
NMTN-09484	SAV2696		2861568	2862476	2861624	-	hypothetical protein
NMTN-13670	SAV2696		2861568	2862476	2861669		
NMTN-11439	SAV2696		2861568	2862476	2861929		
NMTN-06096	SAV2696		2861568	2862476	2861998		
NMTN-04759	SAV2696		2861568	2862476	2862143		
NMTN-10026	SAV2696		2861568	2862476	2862150		
NMTN-14292	SAV2697		2862698	2863273	2862754	+	hypothetical protein
NMTN-00295	SAV2697		2862698	2863273	2862890		
NMTN-03149	SAV2697		2862698	2863273	2863054		
NMTN-08648	SAV2698		2863435	2864451	2863477	+	hypothetical protein
NMTN-03556	SAV2698		2863435	2864451	2863481		
NMTN-12053	SAV2698		2863435	2864451	2863484		
NMTN-12056	SAV2698		2863435	2864451	2863484		
NMTN-13695	SAV2698		2863435	2864451	2863579		
NMTN-12455	SAV2698		2863435	2864451	2863996		
NMTN-07874	SAV2698		2863435	2864451	2864023		
NMTN-09337	SAV2699		2864688	2865488	2865252	+	hypothetical protein
NMTN-02821	SAV2700		2865622	2866134	2865887	-	conserved hypothetical protein
NMTN-09820	SAV2700		2865622	2866134	2866091		
NMTN-11238	SAV2701	vraD	2866417	2867175	2866810	+	hypothetical protein
NMTN-07568	SAV2701	vraD	2866417	2867175	2866826		
NMTN-03823	SAV2701	vraD	2866417	2867175	2867118		
NMTN-07472	SAV2702	vraE	2867165	2869045	2867235	+	hypothetical protein
NMTN-06193	SAV2702	vraE	2867165	2869045	2867568		
NMTN-09390	SAV2702	vraE	2867165	2869045	2868328		
NMTN-02496	SAV2702	vraE	2867165	2869045	2868479		
NMTN-05599	SAV2702	vraE	2867165	2869045	2868643		
NMTN-03993	SAV2702	vraE	2867165	2869045	2868841		
NMTN-12126	SAV2705		2870038	2870607	2870177	-	hypothetical protein
NMTN-03720	SAV2705		2870038	2870607	2870180		
NMTN-09317	SAV2705		2870038	2870607	2870359		
NMTN-08451	SAV2705		2870038	2870607	2870420		
NMTN-01767	SAV2705		2870038	2870607	2870421		
NMTN-03436	SAV2705		2870038	2870607	2870533		
NMTN-13101	SAV2705		2870038	2870607	2870608		
NMTN-10895	SAV2705		2870038	2870607	2870612		
NMTN-14388	SAV2706		2870867	2871262	2870874	-	hypothetical protein
NMTN-03664	SAV2706		2870867	2871262	2871132		
NMTN-02441	SAV2707		2871330	2871683	2871509	-	hypothetical protein
NMTN-09932	SAV2707		2871330	2871683	2871577		
NMTN-13476	SAV2704	cspB	2873016	2873735	2873161	+	cold shock protein
NMTN-13476	SAV2710	gidB	2873016	2873735	2873161	-	glucose inhibited division protein B
NMTN-13747	SAV2711	gidA	2873735	2875612	2873902	-	glucose inhibited division protein A

TABLE 3-continued

Mutant Number	Gene Number	gene name	gene begin	gene end	hit begin	Strand	Product
NMTN-12375	SAV2711	gidA	2873735	2875612	2874522		
NMTN-07232	SAV2711	gidA	2873735	2875612	2874915		
NMTN-05453	SAV2711	gidA	2873735	2875612	2874917		
NMTN-02858	SAV2711	gidA	2873735	2875612	2875072		
NMTN-13310	SAV2711	gidA	2873735	2875612	2875218		
NMTN-02246	SAV2711	gidA	2873735	2875612	2875236		
NMTN-08904	SAV2711	gidA	2873735	2875612	2875251		
NMTN-14505	SAV2712	thdF	2875679	2877058	2875888	-	possible thiophene and furan oxidation protein
NMTN-10847	SAV2712	thdF	2875679	2877058	2876202		
NMTN-07508	SAV2712	thdF	2875679	2877058	2876314		
NMTN-03570	SAV2712	thdF	2875679	2877058	2876559		
NMTN-14721	SAV2712	thdF	2875679	2877058	2876634		
NMTN-15315	SAV0819		896675	897244			
NMTN-05384	SAV2038	agrC					

## REFERENCES

[0146] The following references are specifically incorporated herein by reference.

- U.S. Pat. No. 4,430,434
- U.S. Pat. No. 4,559,302
- U.S. Pat. No. 4,683,202
- U.S. Pat. No. 4,727,028
- U.S. Pat. No. 4,960,704
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What is claimed is:

1. A transposable nucleic acid element comprising an selectable marker gene and a pair of inverted repeat sequences recognized by a Himar 1 transposase, wherein an inverted repeat sequence is toward each end of the element.

2. The transposable nucleic acid element of claim 1, wherein the inverted repeat sequences are SEQ ID NO:4 and SEQ ID NO:5.

3. The transposable nucleic acid element of claim 1, wherein the selectable marker gene encodes a polypeptide that confers antibiotic resistance.

4. The transposable nucleic acid element of claim 1, wherein the selectable marker gene encodes a polypeptide that confers resistance to erythromycin or tetracycline.

5. The transposable element of claim 1, further comprising a gene encoding a green fluorescent protein.

6. The transposable element of claim 1, wherein the element is in a plasmid.

7. The transposable element of claim 6, wherein the plasmid further comprises a temperature-sensitive replicon.

8. The transposable element of claim 1, wherein the plasmid is in a bacteria.

9. The transposable element of claim 8, wherein the bacteria is a gram positive bacteria.

10. The transposable element of claim 9, wherein the gram positive bacteria is a staphylococcus bacteria.

11. The transposable element of claim 8, wherein the bacteria further comprises a Himar 1 transposase-encoding nucleic acid.

12. The transposable element of claim 11, wherein the Himar 1 transposase-encoding nucleic acid is not contained in the plasmid with the transposable element.

13. The transposable element of claim 12, wherein the Himar 1 transposase-encoding nucleic acid is contained in a different plasmid than the plasmid with the transposable element.

14. The transposable element of claim 1, wherein the element is *Bursa aurealis*.

15. The transposable element of claim 14, wherein the element has the sequence of SEQ ID NO:3.

16. An *Staphylococcus aureus* Newman strain bacterium comprising a transposon insertion.

17. The bacterium of claim 16, wherein the transposon comprises a pair of inverted repeats recognized by a Himar 1 transposase.

18. The bacterium of claim 17, wherein the transposon further comprises a marker gene.

19. The bacterium of claim 18, wherein the marker gene is a selectable gene.

20. The bacterium of claim 19, wherein the selectable gene encoded a polypeptide that confers antibiotic resistance.

21. The bacterium of claim 17, wherein the transposon is *Bursa aurealis*.

22. The bacterium of claim 16, wherein the insertion is in a gene selected from the group consisting of: metabolic gene, regulatory gene, extracellular factor gene, cellular or secreted gene, conserved hypothetical gene, and hypothetical gene.

23. The bacterium of claim 16, wherein the insertion is in a gene encoding an RNA or protein selected from the group consisting of: rRNA, tRNA, enzyme, structural protein, transporter, symporter, and membrane protein.

24. The bacterium of claim 21, wherein the insertion negatively affects virulence.

25. The bacterium of claim 21, wherein the insertion positively affects virulence.

26. A method for generating one or more gram positive bacterial mutants comprising:

- a) transfecting into a gram positive bacterium i) a nucleic acid comprising a transposable element comprising a screenable marker gene and a pair of inverted repeats recognized by a Himar 1 transposase at each end of the element and ii) a gene encoding a Himar 1 transposase, wherein the gene is under the control of a promoter that expresses the transposase in the bacterium;

b) screening the bacterium using the phenotype conferred by the screenable marker gene, wherein integration of the transposable element creates a genetic mutation.

27. The method of claim 26, wherein the screenable marker gene is a selectable marker gene and the screening involves selecting the bacterium using the phenotype conferred by the selectable marker gene

28. The method of claim 26, wherein the nucleic acid comprising the transposable element is a plasmid that also includes a temperature-sensitive gram positive replicon.

29. The method of claim 28, further comprising raising the temperature to a nonpermissive temperature of the replicon between steps a) and b).

30. The method of claim 27, wherein the bacterium is selected using antibiotic resistance conferred by a selectable marker encoding an antibiotic resistance polypeptide.

31. The method of claim 30, wherein the antibiotic is erythromycin.

32. The method of claim 26, further comprising identifying the location of the genetic mutation.

33. The method of claim 32, wherein identifying the location of the genetic mutation involves sequencing a region on one or both sides of the integrated transposable element.

34. The method of claim 26, further comprising identifying a transposon insertion mutation in a virulence gene.

35. The method of claim 34, wherein a transposon insertion mutation in a virulence gene is identified using a nematode killing assay.

36. The method of claim 35, further comprising infecting a mouse with a mutant having a mutation identified using the nematode killing assay and analyzing the mouse for organ abscesses.

37. A method of identifying a gram positive bacterium having a mutation in a putative virulence gene comprising:

- a) obtaining a gram positive bacteria with a transposon insertion, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase;
- b) incubating the bacteria with nematodes on an agar plate; and,
- c) assaying for nematode killing, wherein reduced nematode killing compared to nematode killing by gram positive bacteria without a transposon insertion identifies a bacterium with a mutation in a putative virulence gene.

38. The method of claim 37, further comprising identifying the putative virulence gene.

39. The method of claim 38, further comprising screening for an inhibitor of the identified putative virulence gene.

40. The method of claim 37, wherein a pool of gram positive bacteria with transposon insertions is incubated with nematodes on an agar plate, wherein the pool includes between 2 and 500 bacteria with different transposon insertions.

41. The method of claim 40, wherein the pool includes between 5 and 400 bacteria with different transposon insertions.

42. The method of claim 41, wherein the pool includes between 10 and 200 bacteria with different transposon insertions.

43. The method of claim 42, wherein the pool includes between 50 and 100 bacteria with different transposon insertions.

44. The method of claim 37, further comprising lysing the bacteria with a transposon insertion in a putative virulence gene; transducing the insertion into a gram positive bacterium lacking a transposon insertion; and, evaluating the transduced bacteria with a nematode killing assay, wherein reduced killing compared to gram positive bacteria without a transposon insertion is further indicative of an insertion in a putative virulence gene.

45. The method of claim 44, further comprising infecting a mouse with the bacteria having a transposon insertion in a putative virulence gene and assaying the mouse for organ abscesses, wherein a reduced amount of organ abscesses compared to a mouse incubated with gram positive bacteria without a transposon insertion is further indicative of an insertion in a putative virulence gene.

46. The method of claim 37, further comprising sequencing the insertion site.

47. A method of identifying or characterizing a virulence gene in a gram positive bacterium comprising:

- a) incubating with nematodes on an agar plate a gram positive bacterium with a transposon insertion in a putative virulence gene, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase; and,
- b) assaying for nematode killing, wherein reduced nematode killing compared to nematode killing by gram positive bacteria without a transposon insertion is indicative of an insertion in a putative virulence gene.

48. A method of screening for a virulence gene in a gram positive bacteria comprising:

- a) obtaining a gram positive bacteria with a transposon insertion, wherein the transposon insertion comprises a pair of inverted repeats recognized by a Himar 1 transposase;
- b) infecting a mouse with the bacteria having a transposon insertion and assaying the mouse for organ abscesses, wherein a reduced amount of organ abscesses compared to a mouse incubated with the gram positive bacteria without a transposon insertion is indicative of an insertion in a putative virulence gene.

49. The method of claim 48, wherein the mouse is infected with a pool of gram positive bacteria having transposon insertions, wherein the pool includes between 2 and 10,000 bacteria with different transposon insertions.

50. A collection of *S. aureas* Newman mutants having a transposon insertion.

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