Essential Bacillus subtilis genes

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Communicated by Richard M. Losick, Harvard University, Cambridge, MA, January 27, 2003 (received for review November 10, 2002)

To estimate the minimal gene set required to sustain bacterial life in nutritious conditions, we carried out a systematic inactivation of Bacillus subtilis genes. Among ≈4,100 genes of the organism, only 192 were shown to be indispensable by this or previous work. Another 79 genes were predicted to be essential. The vast majority of essential genes were categorized in relatively few domains of cell metabolism, with about half involved in information processing, one-fifth involved in the synthesis of cell envelope and the determination of cell shape and division, and one-tenth related to cell energetics. Only 4% of essential genes encode unknown functions. Most essential genes are present throughout a wide range of Bacteria, and almost 70% can also be found in Archaea and Eucarya. However, essential genes related to cell envelope, shape, division, and respiration tend to be lost from bacteria with small genomes. Unexpectedly, most genes involved in the Embden-Meverhof-Parnas pathway are essential. Identification of unknown and unexpected essential genes opens research avenues to better understanding of processes that sustain bacterial life.

The definition of the minimal gene set required to sustain a living cell is of considerable interest. The functions specified by such a set are likely to provide a view of a "minimal" bacterial cell. Many functions should be essential in all cells and could be considered as a foundation of life itself. The determination of the range of essential functions in different cells should reveal possible solutions for sustaining life. Computational and experimental research has previously been carried out to define a minimal protein-encoding gene set. An upper-limit estimate of a minimal bacterial gene set was obtained from the sequence of the entire *Mycoplasma genitalium* genome, which contains only ≈480 genes (1). A computational approach, based on the assumption that essential genes are conserved in the genomes of

M. genitalium and Haemophilus influenzae, led to a description of a smaller set of some 260 genes (2). More recently, an experimental approach involving high-density transposon mutagenesis of the H. influenzae genome led to a much higher estimate of ≈670 putative essential genes (3), whereas transposon mutagenesis of two mycoplasma species led to an estimate of 265-360 essential genes (4). Another experimental approach using antisense RNA to inhibit gene expression led to the identification of some 150 essential genes in Staphylococcus aureus (5). However, these approaches have limitations. Computation is likely to underestimate the minimal gene set because it takes into account only those genes that have remained similar enough during the course of evolution to be recognized as true orthologues. Transposon mutagenesis might overestimate the set by misclassification of nonessential genes that slow down the growth without arresting it but can also miss essential genes that tolerate transposon insertions (3, 6). Finally, the use of antisense RNA is limited to the genes for which an adequate expression of the inhibitory RNA can be obtained in the organism under study.

To obtain an independent and possibly more reliable estimate of a minimal protein-encoding gene set for bacteria, we systematically inactivated *Bacillus subtilis* genes. *B. subtilis* was chosen because it is one of the best studied bacteria (7) and is a model for low-G+C Gram-positive bacteria, which include both deadly pathogens, such as *Bacillus anthracis*, and bacteria widely used in food and industry, such as lactococci and bacilli. Because the essentiality of a gene depends on the conditions under which the organism is propagated, we used an environment likely to be optimal for *B. subtilis* and thus carried out inactivation on a

 $[\]label{thm:constraint} \begin{tabular}{ll} \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@jouy.inra.fr and ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@jouy.inra.fr and ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@jouy.inra.fr and ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@jouy.inra.fr and ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@jouy.inra.fr and ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. E-mail: ehrlich@is.aist-nara.ac.jp. \parbox{0.5cm} To whom correspondence should be addressed. \parbox{$

Table 1. Essential and nonessential B. subtilis genes

	Essential	Nonessential	Total
This study*	150	2,807	2,957
Previous studies [†]	42	614	656
Prediction [‡]	79	106	185
Phage genes	0	303	303
Total§	271 (6.6%)	3,830 (94.4%)	4,101

A list of the genes and their classifications can be accessed at http://bacillus.genome.ad.ip.

standard laboratory rich medium at 37°C. This choice also allowed for a comparison of the results obtained in many laboratories and many previous studies, nevertheless leaving open the possibility that a different gene set is essential under different growth conditions. Analysis of the mutants, in conjunction with the literature data, leads us to conclude that there are only 271 genes indispensable for growth in LB when inactivated singly. These fall into a relatively few large domains of cell physiology and are very broadly conserved in microorganisms.

Methods

The approach used for gene inactivation has been described (8). Briefly, it involved insertion of a nonreplicating plasmid into the target gene via a single crossover recombination. The expression of the downstream genes from the same operon was controlled by an isopropyl β -D-thiogalactoside (IPTG)-regulated promoter present on the inserted plasmid. A gene was deemed essential if it could not be inactivated by insertion (i.e., no transformants were obtained when competent recipient cells were mixed with the insertional plasmid) and if the strain became IPTG dependent when an intact copy of the gene was placed under control of the regulated promoter (8). IPTG-dependent strains could not be constructed for six essential genes, possibly because the regulated promoter was either not strong enough or not sufficiently tuned to provide appropriate gene expression levels. An alternative strategy was followed for ≈160 genes shorter than 300 bp, where insertional inactivation was limited by the insufficient gene length. These genes were replaced by a chloramphenicol resistance marker, and if replacement failed they were rendered IPTG-dependent. All mutations were made in the standard laboratory strain 168. Inactivation was not attempted for 656 genes studied previously in B. subtilis, and 185 genes having a high degree of similarity with genes well characterized in other bacteria or involved in well characterized processes, for which we could predict essentiality with confidence (Table 3, which is published as supporting information on the PNAS web site, www.pnas.org). Complete microbial genomes included in the Microbial Genome Database for Comparative Analysis (http://mbgd.genome.ad.jp/), comprising 54 bacteria, 16 archaea, and 2 yeasts, were analyzed for the presence of the B. subtilis essential gene homologs by using the default parameters, with 10^{-3} as a cut-off value.

Results

There are \approx 4,100 annotated genes in the *B. subtilis* genome (9). Some 303 are encoded on prophages that can be eliminated from the genome and are not essential. Previous studies on 656 *B. subtilis* genes identified 42 that are essential (Table 1). Through predictions we propose that 79 other genes are essential, whereas

Table 2. B. subtilis essential genes

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DNA metabolism	27
Basic replication machinery	16
Packaging and segregation	9
Methylation	2
RNA metabolism	14
Basic transcription machinery	4
RNA modification	6
Regulation	4
Protein synthesis	95
Ribosomal proteins	52
Aminoacyl-tRNA synthetases	24
Translation factors	10
Protein folding and modification	3
Protein translocation	6
Cell envelope	44
Membrane lipids	16
Cell wall	28
Cell shape and division	10
Glycolysis	8
Respiratory pathways	22
Isoprenoids	8
Menaquinone	8
Cytochrome biogenesis	3
Thioredoxin	3
Nucleotides	10
Cofactors	15
CoA	1
Folate	3
NAD	4
S-Adenosylmethionine	1
Iron–sulfur cluster	6
Other	15
Unknown	11
Total	271

A complete list of genes and the evidence used to ascertain their essential nature are presented in Table 4.

106 are not (Table 3). We inactivated all but 4 of the remaining genes and found that 150 are essential. This analysis leads us to conclude that there are 271 genes indispensable for growth when inactivated singly (Table 1). For $\approx\!96\%$ of these, we propose assignment to various domains of cell metabolism (Table 2; the complete list of genes is given in Table 4, which is published as supporting information on the PNAS web site).

Functional Assignment of Essential Genes. Information processing. About half of the essential genes are involved in DNA and RNA metabolism and protein synthesis. Sixteen genes encode the basic DNA replication machinery. They comprise five genes involved in the initiation of replication (dnaA, B, D, and I, and priA), eight genes encoding components of the replisome (dnaC, E, G, N, and X, holA and B, and polC), DNA ligase, and the Ssb protein. One gene, pcrA, has no clearly identified role, but could be involved in the progression of the replication fork (10). Among genes involved in DNA packaging and segregation, five encode topoisomerases (topA, gyrA and B, and parD and E), one encodes the general DNA-binding protein Hbsu, and three encode the proteins that act in the condensation of the nucleoid (smc, and scpA and B; ref. 11). The remaining two genes encode modification methylases, expected to be essential unless the cognate nucleases are inactivated.

Among 14 essential genes involved in RNA metabolism, four (rpoA, B, and C, and sigA) encode components of the basic transcription machinery, whereas six are involved in RNA modification. rnc and rnpA encode RNases, cspR and trmD and

^{*}We included 18 essential genes here that were inactivated in the course of this study and also studied previously.

[†]Carried out in B. subtilis.

[‡]Full list is presented as Table 3.

[§]Excluded are four genes that were not studied because of technical reasons (too short for insertional inactivation and too inconveniently placed for chloramphenicol replacement).

U encode methylases, and cca encodes tRNA nucleotidyl transferase. Only four genes are involved in regulation of RNA synthesis: a two-component system yycF and G (12), a gene involved in the coupling between translation and termination of RNA synthesis, nusA (13), and an anti-sigma factor, YhdL (14).

The largest category, comprising 95 essential genes, is that involved in protein synthesis. Over half of the genes encode ribosomal proteins. Although there is no experimental evidence that they are essential in B. subtilis, we suggest that they belong to the essential set, because the ribosome itself is essential. This suggestion is supported by the observation that the inhibition of synthesis of 21 different ribosomal proteins is lethal in S. aureus (5). Among these are proteins such as L24, which was not absolutely essential in E. coli, but cells that lacked it grew very slowly and were thermosensitive (15). We suggest that there are 20 essential genes that encode aminoacyl-tRNA synthetases, corresponding to 18 amino acids. All but two are present in unique copies. We showed that one of the unique copy genes, lysS, is essential and assumed that others are too, without seeking further experimental evidence. There are two genes encoding tRNA-Tyr and tRNA-Thr synthetases. Only tyrS was essential when inactivated singly whereas either thrS or thrZ could assure the viability. We grouped with the synthetases three genes that are required for the conversion of the tRNA-Glu to tRNA-Gln (gatC, B, and A) and one gene that is required for the formylation of methionyl tRNA (fmt). Of the 10 essential genes involved in mRNA translation, 3 are required for initiation (*infA*, *B*, and *C*), 3 are required for elongation (tufA, tsf, and fusA), and 4 are required for termination and ribosome recycling (prfA and B, pth, and frr). There is one essential gene involved in posttranslation modification, map, that encodes methionine aminopeptidase. Deformylation is also required, but can be carried out by products of two genes, def and ykrB, neither of which is essential when inactivated singly (16). Two essential genes, groEL and ES, are involved in protein folding. Finally, there are six essential genes that encode key components of the machinery for protein insertion into the membrane and secretion. These include the targeting factors Ffh and FtsY, the translocation motor SecA, two components of the translocation channel, SecY and E, and the folding catalyst PrsA. The essential DNA-binding protein Hbsu is also a part of the signal recognition particle (17).

Cell envelope, shape, and division. About one-fifth of the essential genes are required for these processes (Table 2). The synthesis of the cell envelope involves 44 essential genes, all required for membrane and cell wall formation. Membrane lipids, phospholipids, and glycolipids are synthesized from fatty acids. Fatty acid synthesis (Fig. 4, which is published as supporting information on the PNAS web site) is initiated by products of four genes, accA, B, C, and D, together with acpA and fabD gene products. acpS is required for the conversion of AcpA from the apo to the holo form, whereas birA is required for the addition of a biotinyl group to carboxylase. The fatty acid chains are elongated by the products of two essential genes, fabFG. The elongation cycle involves two additional steps that are catalyzed by pairs of genes with overlapping functions (ycsD and ywpB, and fabI and L), none of which is essential when inactivated singly (18). Two of the essential genes required for phospholipid synthesis (Fig. 5, which is published as supporting information on the PNAS web site), gpsA and yhdO, are involved in the conversion of dihvdroxyacetone phosphate to phosphatidic acid, which is a precursor of complex lipids. Interestingly, yerQ, which encodes an enzyme with a diacylglycerol kinase catalytic domain found in eukaryotes and presumably catalyses synthesis of phosphatidic acid from another precursor (diacylglycerol), is also essential, whereas a homologue, dgkA, is not. Two essential genes, cdsA and pgsA, are required for synthesis of phosphatidylglycerol phosphate, which might be converted into phosphoglycerol by a nonspecific phosphatase. The remaining essential gene, plsX, appears to be required for both fatty acid and phospholipid biosynthesis in a way that is not well understood (19).

Synthesis of peptidoglycan, the main component of the cell wall, comprises two stages, the synthesis of the precursor molecules and the polymerization of peptidoglycan (20). All of the essential genes are involved in the first stage, which encompasses a variety of biosynthetic pathways: (i) Synthesis of aminosugars (Fig. 6, which is published as supporting information on the PNAS web site) by conversion of fructose-6-phosphate to UDP-N-acetyl-glucosamine and UDP-N-acetyl-manosamine. The first two steps, leading to glucosamine-1-phosphate, are catalyzed by the products of glmS and ybbT genes. The last two steps are carried out by the products of the gcaD and yvyH. More than one gene product seems to be able to acetylate glucosamine-1phosphate, because there is no single essential gene for this step. (ii) Diaminopimelate (Fig. 7, which is published as supporting information on the PNAS web site) is synthesized from Laspartate by eight successive reactions, six of which are carried out by products of essential genes asd, dapA, B, and F, and ykuQ and R. The first and the fifth step can be catalyzed by products of three (dapG, lysC, and yclM) and two genes (mtnV and ywfG), respectively; thus, none of the five is essential if inactivated singly. (iii) Two essential genes, racE and alr, encode racemases that convert L-glutamate and L-alanine into the corresponding D isomers. racE cannot be replaced by a homologue, yrpC. The essential ddl gene is required for synthesis of the dipeptide D-Ala-D-Ala. (iv) Eight essential genes, murAA, murB, C, D, E, F, and G, and mraY, are required for synthesis of the lipid-linked disaccharide-pentapeptide peptidoglycan precursor (Fig. 8, which is published as supporting information on the PNAS web site) from UDP-N-acetyl-glucosamine, phosphoenolpyruvate, D-glutamine, diaminopimelate, D-ala dipeptide, and an isoprenylphosphate. Polymerization of peptidoglycan is carried out by the products of functionally redundant genes in B. subtilis. The cell wall of B. subtilis contains teichoic acid (21), and there are seven essential genes involved in its synthesis. Four, tagA, B, D, and O, are required for the synthesis of linkage units and three, tagF, G, and H, are required for chain polymerization, translocation, and linkage to peptidoglycan (Fig. 9, which is published as supporting information on the PNAS web site).

Ten essential genes are involved in cell shape and division. Septum formation requires seven (ftsA, L, W, and Z, divIB and C, and pbpB; ref. 21), whereas cell shape requires three (rodA, and mreB and C).

Embden–Meyerhof–Parnas (EMP) pathway and respiration. About 10%of essential genes, which have in common the provision of energy for the cell, are required for these processes. A majority of genes composing the ubiquitous EMP pathway are essential (Fig. 10, which is published as supporting information on the PNAS web site). The process can be viewed as consisting of two parts: the top, which converts hexose sugars to trioses, and the bottom, which converts these compounds to pyruvate, funneled into pyruvate dehydrogenase. The top part comprises four steps when glucose is the carbon source, the last two of which are catalyzed by products of essential genes pfkA and fbaA, whereas the bottom part comprises six steps, four of which are encoded by essential genes tpiA, pgk, pgm, and eno. The two remaining essential genes related to glycolysis are tkt and prs. The first encodes a transketolase, involved in the pentose pathway, whereas the second gene codes for a pyrophosphokinase that converts ribose-5-phosphate to 5-phospho-ribose-1-diphosphate, a common precursor of nucleotides and cofactors, such as NAD, which likely accounts for its essential role. Taken together, these results are rather unexpected. First, our experiments were carried out on a rich medium, which contains numerous compounds that could provide the energy and building blocks for cell life, the two known functions of the EMP pathway. Addition of glucose to LB did not restore growth of any of the nonviable EMP mutants. Second, in B.

subtilis a part of the EMP pathway can be bypassed via the pentose shunt, and it is surprising that both are simultaneously required for viability. Possibly, the enzymes revealed as essential have novel and unexpected functions in the cell. It should be noted that pgm and eno mutants have been isolated previously and had very slow growth (22), suggesting that the difference between lethal and almost-lethal mutation can be due to subtle differences in the experimental conditions and the strain background.

Respiration can provide energy for the cell, in the absence of glycolysis. We identified 22 essential genes involved in this process. Under the aerobic condition used in our experiments, respiration involves the transfer of electrons by various dehydrogenases to menaquinone and then to cytochromes (23). Menaquinone is synthesized from chorismate in seven steps, the last six of which are catalyzed by products of essential genes, menA, B, C, D, E, and H (Fig. 11, which is published as supporting information on the PNAS web site). Two genes, menF and dhbC, appear to be able to catalyze the first step, and neither is essential if inactivated singly. The penultimate step involves condensation of dihydroxynaphthoic acid with an isoprenoid biphosphate. Isoprenoids (Fig. 12, which is published as supporting information on the PNAS web site) are synthesized from pyruvate and glyceraldehyde-3-phosphate by a nonmevalonate pathway in B. subtilis. The first six steps, leading to isopentenyl diphosphate, involve seven essential genes, dxs, dxr, ispE, yacM and N, and yafP and Y. Three other essential genes, hepS and T and yqiD, are required for the synthesis of farnesyl diphosphate and more complex compounds that are used for menaquinone synthesis. Altogether, of 22 essential genes involved in respiration, 16 are required for menaguinone synthesis. There are only three essential genes involved in cytochrome biogenesis, resA, B, and C. No cytochrome structural genes are essential, possibly reflecting overlapping functions of their products (24). We have included trxA and B, which encode thioredoxin and thioredoxin reductase with the respiration genes, because of the role of TrxA in electron transport, although this protein is involved in many other oxido-reduction reactions. We also included here a putative thioredoxin reductase gene, yumC.

Nucleotides and cofactors. Metabolism of these compounds requires ≈10% of the essential genes (Table 2). The metabolism of nucleotides is quite complex, comprising complementary de novo synthesis and salvage pathways (25). Nevertheless, we found 10 essential genes involved in this process. Among the four that participate in purine metabolism (Fig. 13, which is published as supporting information on the PNAS web site), two (adk and gmk) specify kinases, which phosphorylate AMP or GMP to the respective diphosphates. Absence of guanine from the medium accounts for the essential nature of guaB. Surprisingly, hprT, a gene from the purine salvage, is also essential, raising a possibility that its product has a second, unsuspected role in the cell. Two essential genes involved in pyrimidine metabolism (Fig. 14, which is published as supporting information on the PNAS web site), cmk and tmk, also encode kinases that phosphorylate CMP and TMP to corresponding diphosphates. The remaining essential gene, pyrG, encodes cytidylate synthetase, which converts UTP into CTP. This might reflect the paucity of cytidine in the rich medium. Interestingly, two B. subtilis essential genes encode enzymes present in the E. coli degradosome [yjbN (ppnK) and eno, a member of the EMP pathway], which provides CDP for DNA synthesis and further nucleotide metabolism, while controlling mRNA turnover (26). Finally, there are three essential genes involved simultaneously in purine and pyrimidine metabolism, nrdE and F and ymaA, that encode subunits of nucleosidediphosphate reductase, which converts the ribose into deoxyribose derivatives.

Synthesis of only five cofactors, involving 16 genes, was required under our experimental conditions. NAD synthesis can take place *de novo* or by salvaging of precursors (Fig. 15, which

is published as supporting information on the PNAS web site), and only the four genes involved in the salvage pathway (yueK, yqeI, nadE, and yjbN) were essential. We speculate that the accumulation of nicotinate might repress de novo synthesis of nicotine mononucleotide in the absence of yueK, rendering this gene essential. There are three essential genes involved in folate metabolism (Fig. 16, which is published as supporting information on the PNAS web site). One, dfrA, codes for dihydrofolate reductase, which converts folate, presumably imported from the medium, to tetrahydrofolate. Two other genes, glyA and folD, are required for conversion of the latter compound to 10-formyl tetrahydrofolate, a one-carbon donor molecule for a number of reactions. Sadenosylmethionine (SAM) is another one-carbon donor, synthesized from ATP and methionine by SAM synthetase, encoded by the essential *metK* gene. There is only one essential gene involved in the biosynthesis of CoA, ytaG, that is required for the last step in the pathway (Fig. 17, which is published as supporting information on the PNAS web site), suggesting that the precursor, dephospho-CoA, is transported from the medium into the cell. The remaining cofactor is an iron-sulfur cluster, which forms part of proteins that participate in many aspects of the cell physiology, including redox and nonredox catalysis, as well as sensing for regulatory processes. There are five essential genes, yurU, V, W, X, and Z, involved in the synthesis of this cluster. We included here yrvO, a homologue of yurV.

Other processes. Only 15 essential genes that have a clear biochemical function were not associated with any of the large domains of cellular physiology discussed above. Among these are six GTP-binding proteins of the Era/Obg family. Only one, obg, has been studied previously in B. subtilis and been shown to affect the stress response mediated by σ^B . Five other genes, mrpA, B, C, D and F, encode a sodium-hydrogen antiporter, which is required to maintain pH homeostasis in the presence of sodium chloride concentrations similar to those found in LB (27). ppaC encodes the inorganic pyrophosphatase, which drives the anabolic fluxes by pyrophosphate hydrolysis in various biochemical reactions, whereas gcp encodes a sialopeptidase of

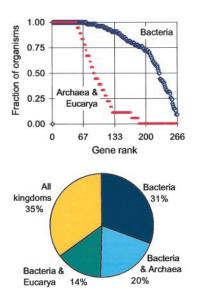
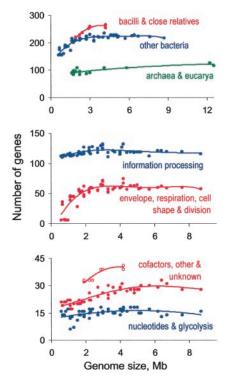


Fig. 1. B. subtilis essential gene homologues are widely conserved. (Upper) Genes are ordered by their relative abundance among 54 Bacteria (blue) and 18 Archaea and Eucarya (red). The position (rank) of a gene is shown on abscissa and the fraction of organisms in which a gene is present is shown on the ordinate. (Lower) Fraction of genes present in different kingdoms of life (a gene counted as "all kingdoms" is present in at least one archaeon and one eukaryote, in addition to bacteria, whereas a gene counted as "bacteria" is not present in any archae or eukaryote). The list of genes and organisms is presented in Table 4.



The number of B. subtilis essential gene homologues depends on genome size. (Top) All genes. Bacilli and close relatives denote Bacillus species and other low-G+C Gram-positive bacteria, but not clostridia, mycoplasma, and ureaplasma. (Middle and Bottom) Different bacterial gene categories. Empty red circles in Bottom refer to Bacilli and close relatives, whereas filled red circles refer to other bacteria. Interpolated lines throughout the figure correspond to the best fitting polynomial of the second or the fourth order. The number of genes is: information processing, 136; envelope, respiration, cell shape, and division, 76; cofactors, other, and unknown, 41; and nucleotides and glycolysis, 18.

unknown role. The last two genes, pdhA and odh, encode subunits of pyruvate and 2-oxoglutarate dehydrogenase, respectively; growth of the mutants could be restored by addition to LB of the metabolites (acetate and succinate, respectively) related to the activity of the proteins they encode.

Unknown. The last category groups 11 essential genes for which we were unable to suggest a role in cell physiology. Biochemical functions, a protease and a hydrolase of the metallo- β -lactamase superfamily, can be suggested for products of two gene, ydiC and ykqC. One gene, yneS, encodes a putative membrane protein, and another, ymdA, encodes a protein with an HD domain of metal-dependent phosphohydrolases, whereas three, yloQ, yqjK, and ywlC, encode proteins with recognizable signatures, an ATP/GTP-binding site, a metallo- β -lactamase motif, and a putative RNA-binding motif, respectively. Four genes, vacA, ydiB, ylaN, and yqeI, have no easily recognizable features.

Conservation of Essential Genes. The average level at which homologues of essential B. subtilis genes are present in bacteria is rather high (approaching 80%), one-fourth being found in all bacteria and three-fourths in at least 75% (Fig. 1 Upper). The average is ≈36% in Eucarya and Archaea, but some 20% of the genes are nevertheless present in all 18 organisms we analyzed (Fig. 1 *Upper*). About one-third of the genes are found in all three kingdoms of life, and a further one-third are shared between Bacteria and either Archaea or Eucarya (Fig. 1 Lower).

The number of B. subtilis essential gene homologues present in an organism depends on at least two parameters: phylogenetic proximity to B. subtilis and genome size (Fig. 2 Top). The highest number is found in bacilli and close relatives, having genomes of

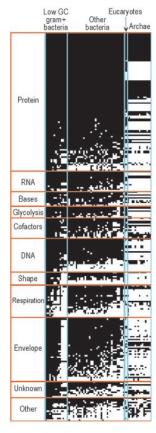


Fig. 3. Phylogenetic profiling of essential genes. The 271 B. subtilis genes were grouped in 266 clusters. Only one gene, yhdL, which encodes a possible anti-sigma protein, had no orthologues in the database and is not presented here. Each line and column corresponds to individual gene and organism, respectively. Presence and absence of a gene is indicated by a black and white square, respectively. The list of genes and organisms is given in Table 5, which is published as supporting information on the PNAS web site and the ordering is described in the text.

>3 Mb (highlighted in red). Other bacteria with genomes of a similar size have, on average, slightly >80% of the B. subtilis essential gene homologues. This proportion drops to 57% with decreasing bacterial genome size, indicating progressive loss of essential genes. Archaea and Eucarya maintain, on average, 36% of the essential gene homologues, with the proportion varying between 33% and 44% almost linearly with genome size. In bacteria, gene loss occurs mainly in three categories (cell envelope, shape and division, and respiratory pathways) and to a lower extent in three other categories (cofactor synthesis, other processes, and unknown functions). In contrast, information processing, glycolysis, and nucleotide synthesis genes are largely retained (Fig. 2 Middle and Bottom).

Phylogenetic profiling of essential B. subtilis genes is summarized in Fig. 3. Organisms were grouped into four classes and ordered within each class on the basis of the number of essential gene homologues they share with B. subtilis, placing the organisms with fewest conserved genes at the right of each class. Genes were grouped in categories and ordered by abundance among all bacteria, which placed the less abundant genes at the bottom of each category. A number of general features are easily discernible from this analysis. (i) The five top categories are composed of genes present in >80% of Bacteria and at least 40% of Eucarya and Archaea, with the exception of RNA synthesis, which is less well conserved in the last two kingdoms. (ii) The next two categories, DNA metabolism and cell shape and division, contain genes present in most bacteria and genes specific for Gram-positive organisms. This can most easily be seen from the appearance of the relatively broad horizontal white bars at the bottom of the two classes. (iii) The categories that contain genes missing from bacteria with small genomes are easily identified by the presence of the vertical white band at the right of the low-G+C Gram-positive bacteria class, corresponding to *Mycoplasma* and *Ureaplasma urealyticum*. In addition, there is an enlargement of the white zone at the right end of the "Other bacteria" class, noticeable for cell envelope, respiration, and unknown functions. (iv) Genes in the last two categories, unknown and other, although often found only in the closest relatives of *B. subtilis*, are nevertheless present in over a half of other bacteria.

Discussion

A Simple Bacterial Cell. Of some 4,100 genes of *B. subtilis*, only 271 are essential for growth under our experimental conditions when inactivated singly. About 80% of the functions they encode fall in a few large categories; namely, information processing, cell envelope, shape, division, and energetics. These observations lead to a view of a rather simple bacterial cell, consisting of a compartment, formed by a membrane and a wall, enclosing the elements necessary to synthesize proteins that carry out reactions required for (*i*) the duplication and inheritance of the genetic information; (*ii*) the division of the compartment; and (*iii*) the provision of energy. These processes do not appear to be coordinated by modulation of gene expression, because the expression regulators are by and large not essential. We suggest that the coordination might be carried out, at least in part, by the essential GTP-binding proteins, as appears to be the case in eukaryotes.

Broad Distribution of Essential Genes and Functions. Over 80% of essential B. subtilis gene homologues are present in all bacteria with genomes above ≈ 3 Mb, and 57% are found even in bacteria with the smallest genomes (mycoplasma). Almost 70% of genes are present in at least one kingdom other than Bacteria. Many organisms thus appear to rely on a similar set of essential functions, supporting the simple microbial cell view outlined above. The similarity might be even higher, because some of the genes might have diverged beyond recognition and some functions can be encoded by unrelated genes (28). However, genes involved in the synthesis of the cell envelope tend to be lost from

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bacteria with smaller genomes. Concomitantly, genes involved in the determination of cell shape, division, and respiration are also lost. This suggests that it may be possible to build, maintain, and reproduce the cell compartment in a simpler way than that used by bacteria with larger genomes, and that glycolysis can be sufficient to generate energy for the cell. A minimal essential gene set could thus be significantly smaller than the one present in bacteria with genomes larger than ≈ 3 Mb.

Unexpected Essential Genes. Notwithstanding the grouping of most essential functions in a few large categories, our study has revealed genes that were not expected to have an essential function under the experimental conditions used, such as eight EMP pathway genes and a gene involved in purine biosynthesis. These observations suggest previously unsuspected links between different domains of cell physiology.

Redundant Genes for Essential Functions. Our analysis does not detect essential functions encoded by redundant genes, because only a single gene was inactivated in each mutant strain. The list of the essential genes given here is thus likely to be underestimated, because synthetic lethal mutants are well known. A rigorous detection of the missing functions would require the systematic combination of all of the mutations in a single strain, which is beyond the present genetic technology. However, it is remarkable that single gene inactivation did reveal large categories of essential functions, suggesting that most of the vital cell processes are encoded by nonredundant genes. The presence of paralogues for $\approx 50\%$ of B. subtilis genes (9) might thus allow the cell to respond to changing environmental conditions rather than provide back-up for vital processes.

Isogenic Mutant Collection. Finally, it should be noted that the isogenic set of $\approx 3,000$ mutants that we have generated can be used to identify genes, and thus functions, that are essential under conditions different from those used here. Furthermore, the mutant set is a unique bacterial resource for studying various phenotypes and may thus lead to deeper insight into the metabolism of the bacterial cell.

This work was supported, in part, by European Union Grant BIO4-CT95-0278 and a Grant-in-Aid for Scientific Research on Priority Areas (C) "Genome Biology" from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

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Table 3. Predicted essential and non-essential genes

Gene	Product
Essential	
асрА	acyl carrier protein
alaS	alanyl-tRNA synthetase
argS	arginyl-tRNA synthetase
asnS	asparaginyl-tRNA synthetase
aspS	aspartyl-tRNA synthetase
cysS	cysteinyl-tRNA synthetase
gatC	glutamyl-tRNA (Gln) amidotransferase subunit C
gltX	glutamyl-tRNA synthetase
glyQ	glycyl-tRNA synthetase alpha chain
glyS	glycyl-tRNA synthetase beta chain
gyrA	DNA gyrase subunit A
gyrB	DNA gyrase subunit B
ileS	isoleucyl-tRNA synthetase
leuS	leucyl-tRNA synthetase
metS	methionyl-tRNA synthetase
mraY	phospho-N-acetylmuramoyl-pentapeptide-transferase
murE	UDP-N-acetylmuramoylalanyl-D-glutamate2,6-diaminopimelate ligase
pheS	phenylalanyl-tRNA synthetase $lpha$ chain
pheT	phenylalanyl-tRNA synthetase $oldsymbol{eta}$ chain
proS	prolyl-tRNA synthetase
rnpA	ribonuclease P protein component
rplA	50S ribosomal protein L1
rplB	50S ribosomal protein L2
rplC	50S ribosomal protein L3
rplD	50S ribosomal protein L4
rplE	50S ribosomal protein L5
rplF	50S ribosomal protein L6
rpll	50S ribosomal protein L9
rpIJ	50S ribosomal protein L10
rplL	50S ribosomal protein L7/L12
rplM	50S ribosomal protein L13
rplN	50S ribosomal protein L14
rplO	50S ribosomal protein L15
rplP	50S ribosomal protein L16
rplQ	50S ribosomal protein L17
rplR	50S ribosomal protein L18
rplS	50S ribosomal protein L19
rplT	50S ribosomal protein L20
rplU	50S ribosomal protein L21
rplV	50S ribosomal protein L22
rplW	50S ribosomal protein L23
rplX	50S ribosomal protein L24
rpmA	50S ribosomal protein L27
rpmB	50S ribosomal protein L28

rpmC 50S ribosomal protein L29 rpmD 50S ribosomal protein L30 rpmE 50S ribosomal protein L31 rpmF 50S ribosomal protein L32 rpmGA possible ribosomal protein L33 rpmGB 50S ribosomal protein L33 rpmH 50S ribosomal protein L34 rpml 50S ribosomal protein L35 rpmJ 50S ribosomal protein L36

rpoA DNA-directed RNA polymerase α chain rpoB DNA-directed RNA polymerase β chain

rpsB 30S ribosomal protein S2 rpsC 30S ribosomal protein S3 rpsD 30S ribosomal protein S4 rpsE 30S ribosomal protein S5 rpsF 30S ribosomal protein S6 rpsG 30S ribosomal protein S7 rpsH 30S ribosomal protein S8 rpsl 30S ribosomal protein S9 rpsJ 30S ribosomal protein S10 rpsK 30S ribosomal protein S11 rpsL 30S ribosomal protein S12 rpsM 30S ribosomal protein S13 rpsN 30S ribosomal protein S14 rpsO 30S ribosomal protein S15 rpsP 30S ribosomal protein S16 rpsQ 30S ribosomal protein S17 rpsR 30S ribosomal protein S18 rpsS 30S ribosomal protein S19 rpsT 30S ribosomal protein S20 rpsU 30S ribosomal protein S21 serS seryl-tRNA synthetase ssb single-strand binding protein

trpS tryptophanyl-tRNA synthetase valS valyl-tRNA synthetase

Nonessential

abnA arabinan-endo 1,5-alpha-L-arabinase

ahpF alkyl hydroperoxide reductase large subunit amyD multiple sugar transport system permease protein

amyX pullulanase

argB N-acetylglutamate 5-phosphotransferase

argC N-acetylglutamate γ -semialdehyde dehydrogenase

argD acetylornithine aminotransferase

argF ornithine carbamoyltransferase, anabolic

argG argininosuccinate synthase argH argininosuccinate lyase

argJ glutamate N-acetyltransferase/amino-acid N-acetyltransferase

aspB aspartate aminotransferase

atpB ATP synthase a chain atpE ATP synthase c chain atpl ATP synthase protein i

bgIH β -glucosidase

bioD dethiobiotin synthetase

bmrU multidrug resistance protein cotranscribed with bmr
fhuB ferrichrome transport system permease protein
fhuC ferrichrome transport system ATP-binding protein
fhuD ferrichrome transport system substrate-binding protein

fhuG ferrichrome transport system permease protein

flgB flagellar basal-body rod protein flgC flagellar basal-body rod protein

flgL flagellar hook-associated protein 3 (HAP3)

flhP flagellar hook-basal body protein

fliE flagellar hook-basal body complex protein

fliF flagellar basal-body M-ring protein gerKA spore germination protein KA gerKB spore germination protein KB gerKC spore germination protein KC

glnH glutamine transport system substrate-binding protein

glnM glutamine transport system permease protein
glnP glutamine transport system permease protein
glnQ glutamine transport system ATP-binding protein

gltB glutamate synthase (NADPH) small chain

gltP proton/glutamate symport protein

gltT proton/sodium-glutamate symport protein hisB imidazoleglycerol-phosphate dehydratase

hisD histidinol dehydrogenase

hisF cyclase

hisI phosphoribosyl-AMP cyclohydrolase/phosphoribosyl-ATP pyrophosphohydrolase

ilvH acetolactate synthase small subunit

licA PTS lichenan-specific enzyme IIA component licB PTS lichenan-specific enzyme IIB component

licH 6-phospho-β-glucosidase

lysA diaminopimelate decarboxylase metA homoserine *O*-succinyltransferase

metE cobalamin-independent methionine synthase moaD molybdopterin converting factor subunit 1

opuAA glycine betaine transport system ATP-binding protein

opuBA glycine betaine/proline/choline transport system ATP-binding protein opuBB glycine betaine/proline/choline transport system permease protein

opuBC glycine betaine/proline/choline transport system substrate-binding protein

opuBD glycine betaine/proline/choline transport system permease protein opuCA glycine betaine/carnitine/choline transport system ATP-binding protein opuCB glycine betaine/carnitine/choline transport system permease protein

opuCC glycine betaine/carnitine/choline transport system substrate-binding protein

opuCD glycine betaine/carnitine/choline transport system permease protein

padC phenolic acid decarboxylase

panC pantothenate synthetase
panD aspartate 1-decarboxylase
pheA prephenate dehydratase
pheB chorismate mutase

phrF regulator of the activity of phosphatase RapF phrK regulator of the activity of phosphatase RapK

proJ glutamate 5-kinase

rapJ response regulator aspartate phosphatase
rapK response regulator aspartate phosphatase
rbsA D-ribose transport system ATP-binding protein
rbsB D-ribose transport system substrate-binding protein

rbsC D-ribose transport system permease protein rbsD D-ribose transport system permease protein

rbsK ribokinase

rbsR transcriptional repressor of the ribose operon (Lacl family)

ribA GTP cyclohydrolase II/3,4-dihydroxy-2-butanone 4-phosphate synthase (dhbp synthase)

 $\begin{array}{ll} \text{ribE} & \text{riboflavin synthase } \alpha \text{ chain} \\ \text{ribH} & \text{riboflavin synthase } \beta \text{ chain} \end{array}$

ribT riboflabin biosynthesis, reductase

rocA 1-pyrroline-5-carboxylate dehydrogenase rocB arginine and ornithine utilization protein

rocC amino-acid permease sodF superoxide dismutase

spsA nucleotide-diphospho-sugar transferase

spsB spore coat polysaccharide biosynthesis protein spsB spsC spore coat polysaccharide biosynthesis protein spsD spore coat polysaccharide biosynthesis protein spsD spsE spore coat polysaccharide biosynthesis protein spsE spsF spore coat polysaccharide biosynthesis protein spsF spsG spore coat polysaccharide biosynthesis protein spsG spsl spore coat polysaccharide biosynthesis protein spsl spsJ spore coat polysaccharide biosynthesis protein spsJ spsK spore coat polysaccharide biosynthesis protein spsK spsL spore coat polysaccharide biosynthesis protein spsL

 $\begin{array}{ll} \text{sucC} & \text{succinyl-CoA synthetase } \beta \text{ chain} \\ \text{sucD} & \text{succinyl-CoA synthetase } \alpha \text{ chain} \\ \text{thiD} & \text{phosphomethylpyrimidine kinase} \end{array}$

thiE thiamine-phosphate pyrophosphorylase

thiM hydroxyethylthiazole kinase (thiamine biosynthesis)

thrB homoserine kinase

uvrB excinuclease ABC subunit B

xlyB N-acetylmuramoyl-L-alanine amidase, peptidoglycan hydrolase

 α -L-arabinofuranosidase 2 (arabinosidase)

xynD endo-1,4-β-xylanase (xylanase D)

yodQ acetylornitine deacetylase

ytmN polar amino acid transport system ATP-binding protein

Table 4. Essential genes

Category	Subcategory	Gene		Function	Evidence [†]
DNA metabolism	Basic replication	dnaA	DNA replication	initiation of chromosome replication	RB
	machinery	dnaB	DNA replication	initiation of chromosome replication/membrane attachment protein	RB
		dnaC	DNA replication	replicative DNA helicase	RB
		dnaD	DNA replication	initiation of chromosome replication	RB
		dnaE	DNA replication	DNA polymerase III (α subunit)	RB, TW
		dnaG	DNA replication	DNA primase	RB
		dnal	DNA replication	primosome component (helicase loader)	RB
		dnaN	DNA replication	DNA polymerase III (β subunit)	RB
		dnaX	DNA replication	DNA polymerase III (γ and τ subunits)	TW
		yqeN	DNA replication	DNA polymerase III (δ subunit)	TW
		holB	DNA replication	DNA polymerase III (δ' subunit)	TW
		ligA	DNA replication	DNA ligase (NAD-dependent)	TW
		pcrA	DNA replication	ATP-dependent DNA helicase	RB, TW
		polC	DNA replication	DNA polymerase III (α subunit)	RB, TW
		priA	DNA replication	primosomal replication factor Y	RB, TW
		ssb	DNA replication	single-strand DNA-binding protein	RO
	Packaging and	gyrA	DNA packaging	DNA gyrase (subunit A)	RO
	segregation	gyrB	DNA packaging	DNA gyrase (subunit B)	RO
		hbs	DNA packaging	nonspecific DNA-binding protein HBsu	RB
		parC	DNA packaging	subunit of DNA topoisomerase IV	RB
		parE	DNA packaging	subunit of DNA topoisomerase IV	RB
		smc	DNA packaging	chromosome condensation and segregation SMC protein	RB, TW
		topA	DNA packaging	DNA topoisomerase I	TW
		ypuG	DNA packaging	SMC interacting protein	RB, TW
		ypuH	DNA packaging	SMC interacting protein	RB, TW
	Methylation	ydiO	DNA methylation	DNA-methyltransferase (cytosine-specific)	RB, TW
		ydiP	DNA methylation	DNA-methyltransferase (cytosine-specific)	RB, TW
RNA metabolism	Basic transcription	rpoA	transcription	RNA polymerase (α subunit)	RO
	machinery	rpoB	transcription	RNA polymerase (β subunit)	RO
		rpoC	transcription	RNA polymerase (β' subunit)	TW
		sigA	transcription	RNA polymerase major σ factor	TW
	RNA modification	cca	RNA modification	tRNA nucleotidyltransferase	TW
		cspR	RNA modification	pobable rRNA methylase	TW

		rnc	RNA modification	ribonuclease III	RB
		rnpA	RNA modification	protein component of ribonuclease P (RNase P)	RO
		trmD	RNA modification	probable tRNA (guanine-N(1)-)-methyltransferase	TW
		trmU	RNA modification	probable tRNA (5-methylaminomethyl-2-thiouridylate) methyltransferase	TW
	Regulation	yycF	transcription	two-component response regulator	RB, TW
		yycG	transcription	two-component sensor histidine kinase	RB, TW
		yhdL	transcription	possible anti-SigM protein	TW
		nusA	transcription	transcription translation coupling	RB
Protein synthesis	Ribosomal proteins	rpIA	ribosomal protein	ribosomal protein L1 (BL1)	RO
		rpIB	ribosomal protein	ribosomal protein L2 (BL2)	RO
		rplC	ribosomal protein	ribosomal protein L3 (BL3)	RO
		rpID	ribosomal protein	ribosomal protein L4	RO
		rpIE	ribosomal protein	ribosomal protein L5 (BL6)	RO
		rpIF	ribosomal protein	ribosomal protein L6 (BL8)	RO
		rpll	ribosomal protein	ribosomal protein L9	RO
		rplJ	ribosomal protein	ribosomal protein L10 (BL5)	RO
		rpIL	ribosomal protein	ribosomal protein L12 (BL9)	RO
		rplM	ribosomal protein	ribosomal protein L13	RO
		rpIN	ribosomal protein	ribosomal protein L14	RO
		rplO	ribosomal protein	ribosomal protein L15	RO
		rpIP	ribosomal protein	ribosomal protein L16	RO
		rplQ	ribosomal protein	ribosomal protein L17 (BL15)	RO
		rpIR	ribosomal protein	ribosomal protein L18	RO
		rpIS	ribosomal protein	ribosomal protein L19	RO
		rpIT	ribosomal protein	ribosomal protein L20	RO
		rpIU	ribosomal protein	ribosomal protein L21 (BL20)	RO
		rpIV	ribosomal protein	ribosomal protein L22 (BL17)	RO
		rpIW	ribosomal protein	ribosomal protein L23	RO
		rpIX	ribosomal protein	ribosomal protein L24 (BL23) (histone-like protein HPB12)	RO
		rpmA	ribosomal protein	ribosomal protein L27 (BL24)	RO
		rpmB	ribosomal protein	ribosomal protein L28	RO
		rpmC	ribosomal protein	ribosomal protein L29	RO
		rpmD	ribosomal protein	ribosomal protein L30 (BL27)	RO
		rpmE	ribosomal protein	ribosomal protein L31	RO
		rpmF	ribosomal protein	ribosomal protein L32	RO
		rpmGA	ribosomal protein	possible ribosomal protein L33	RO
		rpmGB	ribosomal protein	ribosomal protein L33	RO

	rpmH	ribosomal protein	ribosomal protein L34	RO
	rpml	ribosomal protein	ribosomal protein L35	RO
	rpmJ	ribosomal protein	ribosomal protein L36 (ribosomal protein B)	RO
	rpsB	ribosomal protein	ribosomal protein S2	RO
	rpsC	ribosomal protein	ribosomal protein S3 (BS3)	RO
	rpsD	ribosomal protein	ribosomal protein S4 (BS4)	RO
	rpsE	ribosomal protein	ribosomal protein S5	RO
	rpsF	ribosomal protein	ribosomal protein S6 (BS9)	RO
	rpsG	ribosomal protein	ribosomal protein S7 (BS7)	RO
	rpsH	ribosomal protein	ribosomal protein S8 (BS8)	RO
	rpsl	ribosomal protein	ribosomal protein S9	RO
	rpsJ	ribosomal protein	ribosomal protein S10 (BS13)	RO
	rpsK	ribosomal protein	ribosomal protein S11 (BS11)	RO
	rpsL	ribosomal protein	ribosomal protein S12 (BS12)	RO
	rpsM	ribosomal protein	ribosomal protein S13	RO
	rpsN	ribosomal protein	ribosomal protein S14	RO
	rpsO	ribosomal protein	ribosomal protein S15 (BS18)	RO
	rpsP	ribosomal protein	ribosomal protein S16 (BS17)	RO
	rpsQ	ribosomal protein	ribosomal protein S17 (BS16)	RO
	rpsR	ribosomal protein	ribosomal protein S18	RO
	rpsS	ribosomal protein	ribosomal protein S19 (BS19)	RO
	rpsT	ribosomal protein	ribosomal protein S20 (BS20)	RO
	rpsU	ribosomal protein	ribosomal protein S21	RO
nthetases	alaS	tRNA synthetase	alanyl-tRNA synthetase	RO
	argS	tRNA synthetase	arginyl-tRNA synthetase	RO
	asnS	tRNA synthetase	asparaginyl-tRNA synthetase	RO
	aspS	tRNA synthetase	aspartyl-tRNA synthetase	RO
	cysS	tRNA synthetase	cysteinyl-tRNA synthetase	RO
	gltX	tRNA synthetase	glutamyl-tRNA synthetase	RO
	glyQ	tRNA synthetase	glycyl-tRNA synthetase (α subunit)	RO
	glyS	tRNA synthetase	glycyl-tRNA synthetase (β subunit)	RO
	hisS	tRNA synthetase	histidyl-tRNA synthetase	TW
	ileS	tRNA synthetase	isoleucyl-tRNA synthetase	RO
	leuS	tRNA synthetase	leucyl-tRNA synthetase	RO
	lysS	tRNA synthetase	lysyl-tRNA synthetase	TW
	metS	tRNA synthetase	methionyl-tRNA synthetase	RO
	pheS	tRNA synthetase	phenylalanyl-tRNA synthetase (α subunit)	RO
	pheT	tRNA synthetase	phenylalanyl-tRNA synthetase (β subunit)	RO

tRNA synthetases

		proS	tRNA synthetase	prolyl-tRNA synthetase	RO
		serS	tRNA synthetase	seryl-tRNA synthetase	RO
		trpS	tRNA synthetase	tryptophanyl-tRNA synthetase	RO
		tyrS	tRNA synthetase	tyrosyl-tRNA synthetase (major)	TW*
		valS	tRNA synthetase	valyl-tRNA synthetase	RO
		gatA	tRNA synthetase	glutamyl-tRNA(Gln) amidotransferase (subunit A)	TW
		gatB	tRNA synthetase	glutamyl-tRNA(Gln) amidotransferase (subunit B)	TW
		gatC	tRNA synthetase	glutamyl-tRNA(Gln) amidotransferase (subunit C)	RO
		fmt	tRNA met modification	methionyl-tRNA formyltransferase	TW
	Translation factors	frr	translation	ribosome recycling factor	TW
		fusA	translation	elongation factor G	TW
		infA	translation	initiation factor IF-1	TW
		infB	translation	initiation factor IF-2	TW
		infC	translation	initiation factor IF-3	TW*
		prfA	translation	peptide chain release factor 1	TW
		prfB	translation	peptide chain release factor 2	TW
		tsf	translation	elongation factor Ts	TW
		tufA	translation	elongation factor Tu	TW*
		spoVC	RNA modification	peptidyl-tRNA hydrolase	RB, TW
	Protein folding and	groEL	protein folding	class I heat-shock protein (chaperonin)	RB
	modification	groES	protein folding	class I heat-shock protein (chaperonin)	RB
		map	protein modification	methionine aminopeptidase	TW*
	Protein translocation	ffh	secretion	signal recognition particle (SRP) like component	RB
		ftsY	secretion	signal recognition particle	RB
		prsA	secretion	protein secretion (posttranslocation molecular chaperone)	TW
		secA	secretion	preprotein translocase subunit (ATPase)	RB
		secE	secretion	preprotein translocase subunit	RB
		secY	secretion	preprotein translocase subunit	RB
Cell envelope	Membrane lipids	accA	fatty acid biosynthesis	acetyl-CoA carboxylase (α subunit)	TW
·	·	accB	fatty acid biosynthesis	acetyl-CoA carboxylase (biotin carboxyl carrier subunit)	TW
		accC	fatty acid biosynthesis	acetyl-CoA carboxylase (biotin carboxylase subunit)	TW
		accD	fatty acid biosynthesis	acetyl-CoA carboxylase (β subunit)	TW
		асрА	fatty acid biosynthesis	acyl carrier protein	RO
		acpS	fatty acid biosynthesis	holo-acyl carrier protein synthase	TW
		birA	fatty acid biosynthesis	transcriptional repressor of the biotin operon/biotin acetyl-CoA	TW
				carboxylase synthetase	
		fabD	fatty acid biosynthesis	malonyl CoA-acyl carrier protein transacylase	TW
		fabF	fatty acid biosynthesis	β-ketoacyl-acyl carrier protein synthase II	TW*

fabG	fatty acid biosynthesis	β-ketoacyl-acyl carrier protein reductase	TW
cdsA	phospholipids biosynthesis	phosphatidate cytidylyltransferase	TW
gpsA	phospholipids biosynthesis	NAD(P)H-dependent glycerol-3-phosphate dehydrogenase	RB
pgsA	phospholipids biosynthesis	phosphatidylglycerophosphate synthase	TW
yhdO	phospholipids biosynthesis	1-acylglycerol-3-phosphate O-acyltransferase	TW
yerQ	phospholipids biosynthesis	putative kinase related to diacylglycerol kinase	TW
plsX	fatty acid biosynthesis	involved in fatty acid/phospholipid synthesis	TW
gcaD	aminosugar metabolism	UDP-N-acetylglucosamine pyrophosphorylase	TW
glmS	aminosugar metabolism	L-glutamine-D-fructose-6-phosphate amidotransferase	TW
ybbT	aminosugar metabolism	phosphoglucomutase (gluconeogenesis)	TW
yvyH	aminosugar metabolism	UDP-N-acetylglucosamine 2-epimerase	TW
asd	diaminopimelate biosynthesis	aspartate-semialdehyde dehydrogenase	TW
dapA	diaminopimelate biosynthesis	dihydrodipicolinate synthase	TW
dapB	diaminopimelate biosynthesis	dihydrodipicolinate reductase	TW
dapF	diaminopimelate biosynthesis	diaminopimelate epimerase	TW
ykuQ	diaminopimelate biosynthesis	tetrahydrodipicolinate succinylase	TW
ykuR	diaminopimelate biosynthesis	similar to deacetylases	TW
alr	peptidoglycan biosynthesis	D-alanine racemase	TW
ddl	peptidoglycan biosynthesis	D-alanyl-D-alanine ligase A	TW
racE	peptidoglycan biosynthesis	glutamate racemase	TW
mraY	peptidoglycan biosynthesis	phospho-N-acetylmuramoyl-pentapeptide transferase	RO
murAA	peptidoglycan biosynthesis	UDP-N-acetylglucosamine 1-carboxyvinyltransferase	TW
murB	peptidoglycan biosynthesis	UDP-N-acetylenolpyruvoylglucosamine reductase	RB
murC	peptidoglycan biosynthesis	UDP-N-acetylmuramate-alanine ligase	TW
murD	peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamate ligase	RB
murE	peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamate-2,6-	RO
		diaminopimelate ligase	
murF	peptidoglycan biosynthesis	UDP-N-acetylmuramoylalanyl-D-glutamyl-2,6-	TW
		diaminopimelate-D-alanyl-D-alanine ligase	
murG	peptidoglycan biosynthesis	UDP-N-acetylglucosamine-N-acetylmuramyl-	RB
		(pentapeptide)pyrophosphoryl-undecaprenol N-	
		acetylglucosamine transferase	
tagA	teichoic acid biosynthesis	involved in polyglycerol phosphate teichoic acid biosynthesis	TW
tagB	teichoic acid biosynthesis	involved in polyglycerol phosphate teichoic acid biosynthesis	TW
tagD	teichoic acid biosynthesis	glycerol-3-phosphate cytidylyltransferase	TW
tagF	teichoic acid biosynthesis	CDP-glycerol:polyglycerol phosphate glycero-	TW
(= - 0	Catalanta antalat di di di	phosphotransferase	
tagG	teichoic acid biosynthesis	teichoic acid translocation (permease)	RB

Cell wall

		tagH	teichoic acid biosynthesis	teichoic acid translocation (ATP-binding protein)	RB
		tagO	teichoic acid biosynthesis	teichoic acid linkage unit synthesis	TW
Cell shape and		divlB	cell division	cell-division initiation protein (septum formation)	RB
division		divIC	cell division	cell-division initiation protein (septum formation)	TW
		ftsA	cell division	cell-division protein (septum formation)	RB
		ftsL	cell division	cell-division protein (septum formation)	RB
		ftsW	cell division	cell-division protein	TW
		ftsZ	cell division	cell-division initiation protein (septum formation)	RB
		pbpB	cell division	penicillin-binding protein 2B (cell-division septum)	RB
		rodA	cell division	control of cell shape and elongation	RB
		mreB	cell shape	cell-shape determining protein	TW
		mreC	cell shape	cell-shape determining protein	TW
Glycolysis		eno	glycolysis	enolase	TW
, ,		fbaA	glycolysis	fructose-1,6-bisphosphate aldolase	TW
		pfkA	glycolysis	6-phosphofructokinase	TW
		pgk	glycolysis	phosphoglycerate kinase	TW
		pgm	glycolysis	phosphoglycerate mutase	TW
		prs	glycolysis	phosphoribosylpyrophosphate synthetase	TW
		tkt	glycolysis	transketolase	TW
		tpiA	glycolysis	triose phosphate isomerase	TW
Respiratory	Isoprenoids	dxr	isoprenoid biosynthesis	1-deoxy-D-xylulose-5-phosphate reductoisomerase	TW
pathways	·	dxs	isoprenoid biosynthesis	1-deoxyxylulose-5-phosphate synthase	TW
		ispE	isoprenoid biosynthesis	4-diphosphocytidyl-2-C-methyl-D-erythritol kinase	TW
		yacM	isoprenoid biosynthesis	2-C-methyl-D-erythritol 4-phosphate cytidylyltransferase	TW
		yacN	isoprenoid biosynthesis	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase	TW
		yqfP	isoprenoid biosynthesis	isopentenyl diphosphate biosynthesis	TW
		yqfY	isoprenoid biosynthesis	1-hydroxy-2-methyl-2-(E)-butenyl 4-diphosphate synthase	TW
		yqiD	isoprenoid biosynthesis	geranyltranstransferase	TW
	Menaquinone	hepS	menaquinone biosynthesis	heptaprenyl diphosphate synthase component I	RB
	·	hepT	menaquinone biosynthesis	heptaprenyl diphosphate synthase component II	RB
		menA	menaquinone biosynthesis	1,4-dihydroxy-2-naphthoate octaprenyltransferase	TW
		menB	menaquinone biosynthesis	dihydroxynapthoic acid synthetase	TW
		menC	menaquinone biosynthesis	O-succinylbenzoate-CoA synthase	TW
		menD	menaquinone biosynthesis	2-succinyl-6-hydroxy-2,4-cyclohexadiene-1-carboxylate	TW
			•	synthase/2-oxoglutarate decarboxylase	
		menE	menaquinone biosynthesis	O-succinylbenzoic acid-CoA ligase	TW
		menH	menaquinone biosynthesis	menaquinone biosynthesis methyltransferase	RB
	Cytochrome biogenesis	resA	cytochrome c synthesis	cytochrome c biogenesis protein	RB
	-		-	· ·	

		resB	cytochrome c synthesis	cytochrome c biogenesis protein	RB
		resC	cytochrome c synthesis	cytochrome c biogenesis protein	RB
	Thioredoxin	trxA	thioredoxin	thioredoxin	TW
		trxB	thioredoxin	thioredoxin reductase	TW
		yumC	unknown	similar to thioredoxin reductase	TW
Nucleotides		adk	purine biosynthesis	adenylate kinase	TW*
		gmk	purine biosynthesis	guanylate kinase	TW
		guaB	purine biosynthesis	inosine-monophosphate dehydrogenase	TW
		hprT	purine biosynthesis	hypoxanthine-guanine phosphoribosyltransferase	TW
		nrdE	purine/pyrimidine biosynthesis	ribonucleoside-diphosphate reductase (major subunit)	RB
		nrdF		ribonucleoside-diphosphate reductase (minor subunit)	RB
		ymaA		ribonucleoside-diphosphate reductase subunit	TW
		cmk	pyrimidine biosynthesis	cytidylate kinase	RB
		pyrG	pyrimidine biosynthesis	CTP synthetase	TW
		tmk	pyrimidine biosynthesis	thymidylate kinase	TW
Cofactors	CoA	ytaG	CoA biosynthesis	desphospho-coenzyme A kinase	TW
	Folate	dfrA	folate	dihydrofolate reductase	TW
		folD	folate	methylenetetrahydrofolate dehydrogenase /	TW
				methenyltetrahydrofolate cyclohydrolase	
		glyA	folate	serine hydroxymethyltransferase	TW
	NAD	nadE	NAD biosynthesis	NH ₃ -dependent NAD+ synthetase	RB
		ppnK	NAD biosynthesis	inorganic polyphosphate/ATP-NAD kinase	TW
		yqeJ	NAD biosynthesis	nicotinate-nucleotide adenylyltransferase	TW
		yueK	NAD biosynthesis	nicotinate phosphoribosyltransferase	TW
	S-adenosyl-methionine	metK	SAM	S-adenosylmethionine synthetase	TW
	Fe-sulfate cluster	csd	Fe-sulfate cluster	cysteine desulfurase-NifS homolog	TW
		yurU	Fe-sulfate cluster	Synthesis of iron sulfur clusters-NifZ homolog	TW
		yurV	Fe-sulfate cluster	Synthesis of iron sulfur clusters-NifU homolog	TW
		yurX	Fe-sulfate cluster	Synthesis of iron sulfur clusters-NifZ homolog	TW
		yurY	Fe-sulfate cluster	Synthesis of iron sulfur clusters-ABC transporter (ATP-binding protein)	TW
		yrvO	unknown	NifS protein homolog	TW
Other		mrpA	Na/H transporter	multiple resistance and pH homeostasis (Na ⁺ /H ⁺ antiporter)	TW
		mrpB	Na/H transporter	multiple resistance and pH homeostasis (Na /11 antiporter)	TW
		mrpC	Na/H transporter	multiple resistance and pH homeostasis	TW
		mrpD	Na/H transporter	multiple resistance and pH homeostasis	TW
		mrpF	Na/H transporter	multiple resistance and pH homeostasis	TW
		ppaC	unknown	inorganic pyrophosphatase	TW
		F F		J 17 -11	

	era	GTP-binding	GTP-binding protein	RB, TW
	obg	GTP-binding	GTP-binding protein	RB, TW
	ylqF	GTP-binding	GTP-binding protein	RB, TW
	yphC	GTP-binding	GTP-binding protein	RB, TW
	yqeH	GTP-binding	GTP-binding protein	RB, TW
	ysxC	GTP-binding	GTP-binding protein	RB, TW
	gcp	unknown	probable O-sialoglycoprotein endopeptidase	TW
	odhB	unknown	2-oxoglutarate dehydrogenase (dihydrolipoamide transsuccinylase, E2 subunit)	TW
	pdhA	unknown	pyruvate dehydrogenase E1 component, α subunit	RB
Unknown	ydiC	unknown	probable protease	TW
	ykqC	unknown	conserved protein with metallo-β-lactamase motif	TW
	yneS	unknown	conserved membrane protein	TW
	ymdA	unknown	conserved protein with HD domain of metal-dependent	TW
			phosphohydrolase	
	yloQ	unknown	conserved protein with ATP/GTP-binding site motif	TW
	yqjK	unknown	conserved protein with metallo- β -lactamase motif	TW
	ywlC	unknown	conserved protein with a putative RNA binding motif	TW
	yacA	unknown	conserved protein	TW
	ydiB	unknown	conserved protein	TW
	ylaN	unknown	conserved protein	TW
	yqel	unknown	conserved protein	TW

[†] RB, reference to study with *Bacillus subtilis*; RO, reference to study with other bacteria; TW, this work; TW*, inactivation failed but IPTG mutant could not be made.

| sategory
subcategory
ortholog call number | acillus subtilis
sacillus subtilis | isteria inocua | sacilus halodurans
Staphylococcus aureus | actococcus lactis
 | am positive, low GC

 | streptococcus pyogenes | usobacterium nucleatum
Vycoplasma pulmonis | Jreaplasma urealyticum
Aycoplasma genitalium | /ycoplasma pneumoniae | salmonella typhimurium
Vostoc sp.
 | scherichia coli
salmonella enterica | seudomonas aeruginosa | ersinia pestis
hermoanaerobacter
angcongsensis | Sinorhizobium mellioti
Sinorhizobium mellioti
 | orucella melitensis | Aesorhizobium loti
//brio cholerae | ýnechocystis
kanthomonas campestris | kalstonia solanacearum
Saulobacter crescentus | streptomyces coelicolor

 | Other bacteria Peisseria meningitidis Grobacterium tumelaciens | kquifex aeolicus
aseurella multocida | chlorobium tepidum
 | ylella fastidiosa
Mycobacterium leprae | laemophilus influenzae | sampylobacter jejuni
Helicobacter pylori | reponema palidum
Phamidia muridarum | chlamidia trachomatis
chlamydophila pneumoniae
stokettsia conorii
 | čickettsia prowazekii
Suchnera sp.
Suchnera aphidicola | Enrelia burgdorferii Eaccharomyces cerevisiae | schizosaccharomyoes
ombe
alobacterium sp. | Aethanosarcina acetivorans Aethanosarcina mazei Vyococcus abyssi | Tructucus anyssa. Yrococcus horikoshii vrcheoglobus fulgidus
 | yrococcus furiosus lethanobacterium hermoautotrophicum | Sulfolobus solfataricus Thermopasma acidophilum | hermopasma volcanium
Aethanococcus janaschii
Aethanopyrus kandleri | Sulfolobus tokodai
Aeropyrum pernix
Ayrobaculum aerophilum |
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Protein symbasis Ribosomal proteins 016202 rplA Protein symbasis Ribosomal proteins 016202 rplA Protein symbasis Ribosomal proteins 019860 rplC Protein symbasis Ribosomal proteins 019860 rplC Protein symbasis Ribosomal proteins 013770 rplE Protein symbasis Ribosomal proteins 018230 rplF Protein symbasis Ribosomal proteins 020144 rplM Protein symbasis Ribosomal proteins 014647 rplM Protein symbasis Ribosomal proteins 014467 rplM	RPLA RPLB RPLB RPLB RPLC RPLC APLE RPLE RPLF RPLM RPLM RPLM RPLN RPLV RPSB RPSB	RPLA BH0120 RPLB BH0137 RPLC BH0134 RPLE BH0146 RPLF BH0149 RPLM BH0168 RPLN BH0164 RPLN BH0163 RPLN BH0139 RPSB BH2427	MY01403 L0399 MY02166 L0400 MY02169 L0401 MY02157 L0403 MY02154 L0404 MY02159 L0401 MY02159 L0401 MY02159 L0401 MY02159 L0401 MY02164 L0418

 | SPY0461 FN2039 SPY0461 FN2039 SPY0052 FN1642 SPY0049 FN1646 SPY0063 FN1632 SPY0066 FN1629 SPY1932 FN0329 SPY0061 FN1636 SPY0065 FN1640 | MYPU_0100 MYPU_0800 MYPU_0800 MYPU_0750 MYPU_0720 MYPU_0720 MYPU_0800 MYPU_0800 MYPU_0800 MYPU_0800 | UU244 MG154 UU231 MG154 UU231 MG163 UU243 MG163 UU246 MG166 UU577 MG416 UU277 MG416 UU226 MG166 UU2061 MG166 | G07_0RF226 STM4150 RPLB STM5437 RPLC STM3460 RPLE STM428 RPLF STM425 C12_0RF146 STM3345 RPLN STM3345 RPLN STM5436 G07_0RF284 STM256 G07_0RF284 STM256 | O Z 0 ALRS501 B3 7 ALL4212 B3 0 ALL4215 B3 8 ALL4203 B3 5 ALL4201 B3 6 ALL4205 B3 6 ALL4270 B0
 | ## 5773735 ### 5774361 ### 5774361 ### 5774361 ### 5774361 ### 5774370 ### 5774370 ### 5774370 ### 5774373 ### 577437 | PA273 YPO275 PA280 YPO275 PA283 YPO275 PA281 YPO275 PA281 YPO202 PA288 YPO202 PA4433 YPO202 PA4433 YPO202 PA4430 YPO202 PA429 YPO202 PA366 YPO206 | D3750 TTE2005 D3213 TTE2290 D3210 TTE2293 D3222 TTE2279 D3224 TTE2276 D3563 TTE2267 D3200 TTE2287 D3201 TTE2287 | SMC01330 XAC0822 SMC01330 XAC0875 SMC01309 XAC0872 SMC01297 XAC084 SMC01294 XAC087 SMC01294 XAC087 SMC01294 XAC087 SMC01294 XAC087 SMC01304 XAC087 SMC01304 XAC087 SMC01304 XAC087 | BME0790 MLR0293 BME0790 MLR0295 BME0790 MLR02091 BME0790 MLR0308
BME0772 MLR0312 BME0797 MLR0312 BME0797 MLR0308 BME0792 MLR0308 BME0792 MLR0308 | VC2598 SLL1802 VC2598 SLL1802 VC2598 SLL1802 VC2598 SLL1803 VC2598 SLL1803 VC2598 SLL1803 VC2599 SLL1803 VC2599 SLL1803 | O XC00885 RSC000 XC00886 RSC301 XC00886 RSC301 XC00807 RSC300 XC00910 RSC300 XC00916 RSC006 XC00906 RSC300 XC00907 RSC300 XC00917 RSC300 XC00918 RSC300 XC01917 RSC140 | CC1281 1016 CC1281 1019 CC1248 1007 CC1260 1004 CC1263 1009 CC1268 1014 CC1263 | O ≥ SCOM49 RV0641 SCO4705 RV0704 SCO4702 RV0701 SCO4714 RV0716 SCO4714 RV0719 SCO4714 RV0719 SCO4712 RV0716 SCO4707 RV0706 SCO6824 RV2860C

 | NMB0128 AGR.C.3850 NMB0145 AGR.C.3850 NMB0142 AGR.C.3856 NMB0154 AGR.C.3858 NMB0157 AGR.C.3832 NMB0167 AGR.C.3832 NMB0167 AGR.C.3839 NMB0182 AGR.C.3839 NMB0141 AGR.C.3848 | AQ_1935 PM1742 AQ_013 PM1412 AQ_009 PM1415 AQ_1652 PM1403 AQ_1649 PM1400 AQ_1677 PM0520 AQ_1644 PM1405 AQ_0164 PM1410 AQ_0007 PM1984 | CT0152 TM0405 CT2186 TM14697 CT2189 TM1500 CT2177 TM1488 CT2174 TM1485 CT1783 TM1454 CT279 TM4590 CT2184 TM1469 CT1781 TM092 | XF2836 ML1904 XF1156 ML1960 XF1152 ML1963 XF1152 ML1963 XF1164 ML1847 XF1167 ML1844 XF1537 ML0964 XF1162 ML1849 XF1167 ML1849 XF1167 ML1849 XF1167 ML1849
 | H00518 DR2045 H00780 DR0314 H00777 DR0311 H00790 DR0323 H00793 DR2111 H11443 DR0174 H00788 DR0321 H00782 DR0316 H00783 DR316 | C.10476 HP1201 C.11704C HP1316 C.11707C HP1319 C.1168C HP1307 C.1168C HP1304 C.1168C HP1304 C.1168C HP1304 C.1168C HP1304 C.1168C HP1304 C.1168C HP1304 C.1168C HP1306 C.1170C HP1314 C.1118C HP1564 | TP0228 TC0552 CT TP0192 TC0512 CT TP0189 TC0515 CT TP0201 TC0503 CT TP0204 TC0501 CT TP1025 TC0401 CT TP0199 TC0505 CT TP0194 TC0505 CT TP0194 TC0505 CT TP0194 TC0505 CT | 18 CPN0078 RC0178 25 CPN0084 RC1003 28 CPN00847 RC1006 16 CPN0083 RC0098 14 CPN0083 RC0099 25 CPN0087 RC0091 26 CPN0087 RC0096 28 CPN0087 RC0096 29 CPN0086 RC0112 | RP137 BU037 BUSG038 RP456 BU521 BUSG602 RP459 BU534 BUSG605 RP647 BU512 BUSG403 RP644 BU509 BUSG400 RP233 BU391 BUSG378
RP499 BU514 BUSG465 RP694 BU519 BUSG600 RP696 BU231 BUSG225 | BB0493 YGL130W YFL20W SPBC30C10. BB0491 YELXXXX YGR20C YFR031C-A YLL09W SPBC3F12.0 BB0478 YGR20C YFR031C-A YLL09W SPC3F12.0 BB0478 YGR20C YGR03W SFACE36.0 BB0490 YDR237W YGR08C YFR10C SPBC178.0 BB0493 YGL137C YHR19C YFR10C SPC3F12.0 BB0493 YUL137C YHR19C YHR19W SPC3F12.0 BB0493 YUL137C YHR19C YGR19W SPC3F12.0 BB0493 YUL137C YHR19C YGR19W SPC3F12.0 BB0493 YGL19F7 YFR17W YHL19W SPC3F12.0 BB0493 YGL19F7 YHR19W YGL19W SPC3F12.0 BB0493 YGL19F7 YHR19W YGL19W SPC3F12.0 SPC3F12W YGG19W SPC3F12W SPC3F1 | C | MAI-102 PAB-1166 | PH1000 PH2000 PH2000 PH1000 PH10000 PH10 | D. ≥ ±5 PF1922 MTH1980 PF1822 MTH6 PF1825 MTH2 PF1811 MTH16 PF1808 MTH19 PF1808 MTH09(1) PF1814 MTH13 PF1800 MTH19 PF1800 MTH7 PF1800 MTH4 | O I ISSO0345 TA0360 TVG0408391 ISSO0716 TA1268 TVG0334954 ISSO0719 TA1271 TVG03334954 ISSO0704 TA1258 TVG0339696 ISSO0702 TA1255 TVG0340711 ISSO0708 TA0433 TVG1187479 ISO0708 TA1261 TVG0335944 ISO0709 TA1267 TVG0335940 ISO0709 TA1268 TVG0335940
 | MADESTO MECREZ MECREZ MADESTO MECREZ MECREZ MADESTO MECREZ MECREZ | CO CL ST1367 APE2173 PAE3106 ST0427 APE0218 PAE0803 ST0429 APE0227 PAE1970 ST0420 APE0354 PAE3575 ST0418 APE0350 PAE2377 ST2065 APE1747 PAE0673 ST0422 APE0396 PAE3196 ST0425 APE0396 PAE1782 ST2063 APE1782 PAE0817 |
| Protein synthesis Ribosomal proteins O13334 rpsC | RPSC RPSC RPSD RPSD RPSE RPSE RPSG RPSG RPSH RPSH RPSK RPSK RPSK RPSK RPSL RPSL RPSM RPSM RPSM RPSM RPSS RPSS | RPSC BH0140 RPSD B13200 RPSE BH0151 RPSG BH0130 RPSH BH0164 RPSI BH0169 RPSK BH0161 RPSL BH0129 RPSM BH0160 RPSM BH0160 RPSS BH01338 | MW2145 L0380 MW1662 L0381 MW2152 L0382 MW0501 L0384 MW2155 L0385 MW2156 L0386 MW2144 L0388 MW0500 L0389 MW2445 L0386 | CAC3127 CAC147 CAC317 CAC147 CAC31 CAC316 CAC316 CAC319 CAC319 CAC319 CAC316 CAC316 CAC316 CAC316 CAC316 CAC316 CAC316 CAC316
 | CPE2399 SP0215 5 CPE2399 CPE2377 SP0025 CPE3409 SP0272 CPE3409 SP0272 CPE3369 SP0224 CPE3269 SP0225 CPE2410 SP0225 CPE2410 SP0271 CPE2410 SP0274 CPE2410 SP0274 CPE2410 SP0274 CPE2410 SP0274

 | SPY0066 FN1638 SPY2178 FN1284 SPY0069 FN1627 SPY0072 FN1527 SPY0065 FN1630 SPY1931 FN1030 SPY0078 FN1285 SPY0271 FN1526 SPY0077 FN1286 SPY0075 FN1286 SPY0076 FN1286 | MYPU_5810 MYPU_7160 MYPU_5700 MYPU_5700 MYPU_5730 MYPU_5800 MYPU_5800 MYPU_5800 MYPU_5800 MYPU_5800 MYPU_5800 | UU227 MG197 UU488 MG311 UU248 MG168 UU324 MG688 UU245 MG165 UU376 MG417 UU256 MG176 UU325 MG697 UU325 MG175 | RPSC STM344 RPSD STM346 RPSE STM3423 G07_0RF155 STM3447 RPSH STM3446 C12_0RF132 STM344 RPSK STM3416 G07_0RF139 STM344 RPSM STM3418 RPSM STM3418 RPSS STM3417 | 4 ALL4209 B3 6 ALR2737 B3 3 ALL4199 B5 7 ALL4339 B3 6 ALL4202 B3 4 ALL4187 B3 7 ALL4182 B3 8
ALL4340 B3 8 ALL4340 B3 8 ALL4793 B3 6 ASL4211 B3 | B3314 \$TY4364 B1296 \$TY4382 B3303 \$TY4476 B3341 \$TY4361 B3306 \$TY4372 B3290 \$TY4362 B3297 \$TY4381 B3342 \$TY4360 B3298 \$TY4360 B3316 \$TY4362 | PA4297 YPO021 PA4299 YPO022 PA4296 YPO022 PA4299 YPO022 PA4290 YPO022 PA4412 YPO032 PA4290 YPC022 PA4290 YPC022 PA4290 YPC022 PA4290 YPC022 | D0216 TTE2286 TTE2286 D0233 TTE2264 TTE2274 D0201 TTE2297 D0223 TTE277 D0223 TTE277 D0226 TTE2266 D021 TTE2266 E.1 TTE2288 D0231 TTE2288 | SMC01303 XAC0978 SMC01485 XAC0998 SMC01292 XAC0989 SMC01313 XAC0988 SMC01295 XAC0988 SMC01295 XAC0988 SMC01295 XAC0988 SMC01296 XAC0984 SMC01297 XAC0987 SMC01314 XAC0987 SMC013287 XAC0993 SMC01305 XAC0993
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 | NAMD0148 | AQ_977 PM1499 AQ_972 PM1391 AQ_1645 PM1398 AQ_1645 PM1396 AQ_1632 AQ_734 PM1355 AQ_1651 PM4001 AQ_17878 PM00021 AQ_073 PM1392 AQ_173 PM1393 AQ_074 PM1393 AQ_074 PM1393 AQ_015 PM1411 | CT2183 TM1694 CT2163 TM1472 CT2172 TM163 CT2172 TM1630 CT2175 TM1696 CT1782 TM1653 CT1782 TM1653 CT2164 TM1675 CT2164 TM1675 CT2165 TM1676 CT2165 TM1676 | XF1106 ML 1657 XF1175 ML 1958 XF1109 ML 1642 XF2630 ML 1647 XF166 ML 1645 XF1536 ML 1650 XF1137 ML 1959 XF2631 ML 1950 XF1173 ML 1960 XF1173 ML 1960 XF1156 ML 1650
 | HI00783 DR0317 HI00801 DR2127 HI00795 DR2113 HI00800 DR0306 HI00792 DR2110 HI1442 DR0175 HI16000 DR2126 HI0081 DR0305 HI00799 DR2125 HI00791 DR0315 | CJ1701C HP1313 CJ1594 HP1294 CJ1690C HP1302 CJ0492 HP1196 CJ1693C HP1305 CJ1479C HP0083 CJ1593 HP1295 CJ0491 HP1197 CJ1592 HP1296 CJ1703C HP1315 | TP0195 TC0899 CT TP0306 TC0915 CT TP0206 TC0799 CT TP0244 TC0722 CT TP0203 TC0862 CT TP1024 TC0462 CT TP0211 TC0795 CT TP0243 TC0723 CT TP0210 TC0796 CT TP0210 TC0796 CT | 22 CPN0681 RC1000 28 CPN0733 RC0488 172 CPN0681 RC0173 38 CPN0681 RC0173 15 CPN0684 RC0316 08 CPN0624 RC0316 08 CPN0652 RC0172 09 CPN0628 RC0172 | RP653 BU518 BUSC499 RP345 BU500 BUSC481 RP422 BU507 BUSC498 RP131 BU528 BUSC509 RP445 BU510 BUSC491 RP234 BU390 BUSC491 RP236 BU501 BUSC482 RP130 BU529 BUSC510 RP637 BU502 BUSC483 RP655 BU500 BUSC501
 | BB0484 YNL178W SPEC.160.50 | 4C VKJ6987G MA1070 CS PAC24H6.07 VKJ6133G MA1070 CS PAC24H6.07 VKJ6133G MA101 CS PAC2548.0C VKJ6133G MA102 CS PAC258.0C VKJ62587G MA128 VKJ62587G MA128 VKJ62587G MA128 VKJ6139G MA059 CS PAC264.0C VKJ6139G MA059 CS PAC264.0C VKJ6139G MA129 CS PAC2798.07 CS PAC1798.07 C | B MMC150 PAB2125 MMC144 PAB2136 MMC266 PAB0261 MMC206 PAB0262 MMC139 PAB2131 MMC177 PAB0366 MMC197 PAB0366 MMC287 PAB0427 MMC155 PAB0360 MMC287 PAB0360 MMC287 PAB0360 MMC287 PAB0360 MMC155 PAB0360 | PH1772 AF1919 PH1640 AF2284 PH1767 AF1905 PH1541 AF1993 PH1764 AF1910 PH1633 AF1129 PH1638 AF2283 PH1642 AF1992 PH1641 AF2286 PH1774 AF1921 | PF1819 MTH6 PF1649 MTH05 PF1804 MTH23 PF1808 MTH1056 PF1809 MTH18 PF1644 MTH08(2) PF1648 MTH06 PF1659 MTH105 PF1650 MTH04 PF1650 MTH04 | \$500712 TA1285 TVG038522 \$50073 TA1032 TVG0585705 \$500898 TA1251 TVG0452708 \$500217 TA0982 TVG0172869 \$50073 TA1266 TVG034708 \$500768 TA4252 TVG1187879 \$500772 TA1091 TVG051985 \$500772 TA1091 TVG051985 \$500774 TA1033 TVG0550986 \$500774 TA1033 TVG0550986
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| Protein synthesis Ribosomal proteins O16855 rpsiS Protein synthesis Ribosomal proteins O14122 psiC Protein synthesis Ribosomal proteins O14122 psiC Protein synthesis Ribosomal proteins O14122 psiC Protein synthesis Ribosomal proteins O14522 psiC Protein synthesis Ribosomal proteins O13688 rpsiC Protein synthesis Ribosomal proteins O21868 rpsiC Protein synthesis Ribosomal proteins O14722 rpmA Protein synthesis Ribosomal proteins O15658 rpsi Protein synthesis RibAs privintases O15667 rpsiC Protein synthesis Ribasomal proteins O15667 rpsiC Protein synthesis Ribasomal proteins O15667 rpsiC Protein synthesis Ribasomal proteins O15667 rpsiC Protein synthesis Ribasomal pro | RPSS RPSS RPLK RPLK RPLD RPLS | RPLS BH0138 RPLK BH0119 BH0136 RPLD BH0136 RPLD BH0136 RPLD BH0153 RPLD BH0153 RPLD BH0153 RPLD BH0153 RPLD BH0154 RPLD BH0154 RPLD BH0154 RPLD BH0155 RPLT BH3108 RPLL BH3101 RPLT BH31008 RPLT BH3101 RPLT BH31008 RPS BH3100 RPS BH3101 R | MV2165 L0396 MV0542 L0468 MV2166 L0462 MV2166 L0462 MV2167 L0411 MV2167 L0411 MV2167 L0411 MV2167 L0411 MV2167 L0411 MV2167 L0411 MV2167 L0416 MV1067 L0417 MV2167 L0417 MV2167 L0417 MV2167 L0417 MV1627 L0417 MV1628 L0416 MV1629 L0417 MV1629 L0417 MV1621 L0364 MV1622 L0373 MV0622 L0373 MV0622 L0373 MV1624 L0364 MV1624 L0367 MV1624 L0367 MV1624 L0364 | 3 | OPE2401 SP0213 CPE2417 SP0800 CPE2444 SP0210 CPE2444 SP0210 CPE2368 SP0229 CPE2389 SP0229 CPE2380 SP0229 CPE2381 SP1107 CPE2382 SP0220 CPE2383 SP1107 CPE2384 SP0220 CPE4385 SP1305 CPE2486 SP0220 CPE4887 SP0200 CPE1880 SP0200 CPE1880 SP0200 CPE1890 SP0200 CPE1891 SP0200 CPE1893 SP0200 CPE1894 SP0201 CPE1995 SP0204 CPE1996 SP0204 CPE1997 SP0204 CPE2022 SP0211 CPE2028 SP0212 CPE2029 SP0204 CPE2029 SP0204 CPE2031 SP140 CPE2032 SP1100 CPE2033 SP214 <t< th=""><th></th><th>MYPU_SAIO MYPU_SAIO MYPU_SETO MYPU_SETO</th><th>UU251 UU361 UU361 UU362 UU362 UU369 MG182 UU369 MG182 UU369 MG182 UU369 MG182 UU369 MG183 UU360 MG292 UU360 UU360 MG393 UU361 UU361 MG393 UU361 UU362 MG193 UU362 UU363 MG193 UU364 MG193 UU364 MG193 UU367 UU272 MG196 MG292 UU278 MG197 UU288 MG197 UU288 MG197 UU279 MG292 UU278 MG292 UU278 MG292 UU278 MG292 UU278 MG292 UU278 MG393 UU377 MG298 UU377 MG298 UU377 MG298 UU377 MG298 UU360 UU177 MG298 UU360 UU176 MG393 UU360 UU177 MG298 UU360 UU176 MG298 UU360 UU177 MG298 UU360 UU178 MG298 UU360 UU179 MG298 UU378 MG298 UU378 MG298 UU378 MG298 UU378 UU368 MG003 UU378 MG298 UU378 UU368 MG003 UU379 MG498 UU369 MG498 UU369 MG498 UU369 MG498 UU378 UU369 MG498 UU378 MG298 UU379 MG498 UU379 MG498 UU379 MG498 UU379 UU370 MG398 UU370 MG190 UU370 MG190 UU371 UU371 MG298 UU372 MG498 UU373 MG190 UU374 UU376 MG197 UU376 MG398 UU377 UU376 MG197 UU377 UU370 MG198 UU378 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG198 UU371 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG198 UU370 MG197 UU370 MG197 UU370 MG198 UU370 MG197 U370 MG197 U370 MG197 MG198 MG197 MG198 MG197 MG198 MG28 MG198 MG198 MG28 MG198 MG28</th><th>RPSS STMANSE G07_GRF137 STM419 G12_GRF122 STM4192 G12_GRF122 STM4192 RPLD STM4391 RPLD STM4391 RO_GRF124 STM4192 F10_GRF104 STM4093 F10_GRF104 STM4093 G12_GRF104 STM4093 G12_GRF105 STM4093 G12_GRF105 STM4093 G12_GRF106 STM4093 G12_GRF106 STM4093 G12_GRF107 STM4093 G10_GRF107 STM4093 G10_GRF108 STM4093 G10_GR</th><th>6 ASL4711 B3 9 ALR5300 B3 9 ALR5300 B3 9 ALL5214 B3 9 ALL5216 B3 1 ALL418 B3 3 ALL5208 B3 3 ALL4208 B3 4 ALL4209 B3 4 ALL4209 B3 4 ALL4209 B3 4 ALL4200 B3 6 ALL5237 B1 1 ALL5207 B3 6 ALL5237 B1 1 ALL5207 B3 6 ALL5217 B1 6 ALL5217 B1 6 ALL5217 B1 7 ALL5218 B2 8 B1 8 B1</th><th>B3316 STV-SQE B3983 STY3296 B3319 STY4596 B3986 STY3733 B3301 STY4977 B3313 STY4965 B3066 STY3738 B3185 STY346 B3186 STY346 B1868 STY9744 B1988 STY9748 B1717 STY1776 B1717 STY1778 B1717 STY1778 B1876 STY2117 B1876 STY217 B0841(1) STY0989 B1174 STY1778 B0542(1) STY0989 B1714 STY1772 B0543 STY0989 B1744 STY1778 B0544 STY298 B1744 STY1778 B0545 STY089 B1744 STY1779 B065 STY089 B174 STY1779 B074 STY489 B174 STY489
B174 <</th><th>PA4299 YPO201 PA4292 YPO201 PA4292 YPO201 PA4292 YPO201 PA4294 YPO202 PA4294 YPO202 PA4294 YPO202 PA4296 YPO201 PA4397 YPO201 PA4397 YPO201 PA4397 YPO201 PA4397 YPO202 PA4397 YPO202 PA4397 YPO202 PA4397 YPO202 PA4397 YPO202 PA4398 YPO203 PA5091 YPO203 PA</th><th> TIE2288 TIE2289 TIE2282 TIE2283 TIE2283 TIE2283 TIE2282 TIE2283 TIE2</th><th>SMC01305 SMC01305 SMC01316 SMC01317 SMC01316 SMC01317 SMC</th><th>BMED7961 MSR0297 BMED745 MR.R0291 BMED756 MR.R0291 BMED756 MR.R0292 BMED746 MR.R02932 BMED7676 MR.R02932 BMED7076 MR.R02931 BMED036 MR.R02931 BMED036 MR.R02931 BMED0376 MR.R02931 BMED0377 MR.B0274 BMED0777 MR.D0274 BMED077 MR.D0274 BMED077 MR.D0274 BMED039 MR.R0293 BMED039 MR.B0293 BMED039 MR.B0293 BMED039 MR.B0293 BMED039 MR.B0293 BMED039 MR.L0391 BMED036 MR.B0293 BMED037 MR.B0274 BMED036 MR.B0293 BMED037 MR.B0293 B</th><th>VC25692 SS.1.429 VC2595 SL.1749 VC2596 SL.1749 VC2597 SL.1749 VC2597 SL.1749 VC2598 SL.1606 VC0504 SS.7779 VC0504 SS.7779 VC0506 SS.1779 VC0508 SL.1746 VC0508 SL.1746 VC0508 SL.1746 VC0508 SL.1747 VC1008 SL.1747 VC1008 SL.1747 VC1008 SL.1747 VC1008 SL.1050 VC1010 SL.10</th><th>XCC0889 RSC289 XCC0884 RSC289 XCC0887 RSC389 XCC0887 RSC389 XCC0887 RSC389 XCC0887 RSC389 XCC0887 RSC389 XCC1802 RSC389 XCC1802 RSC389 XCC1802 RSC389 XCC1803 RSC389 XCC1804 RSC389 XCC1806 RSC389 XCC1806 RSC389 XCC1806 RSC389 XCC1807 RSC389 XCC1808 RSC389 XCC1808 RSC389 XCC1808 RSC389 XCC1808 RSC389 XCC1808 RSC389 XCC1808 RSC389 XCC1809 RSC389 XCC1809 RSC389 XCC1809 RSC289 XCC1809 RSC289</th><th> 1915 CC1282 </th><th>SCHOPION RYMOTOS SCOMERIA RYMERIA SCOMERIA RYMERIA</th><th> NAMBO146 AGR. C. 3849 </th><th>AQ_1915 AQ_1913 AQ_1911 AQ_1917 AQ_1917 AQ_1917 AQ_1917 AQ_1918 AQ_</th><th>CT2185 TM4698 CT0191 TM0684 CT2188 TM1699 CT0184 TM0687 CT2182 TM4691 CT1183 TM4691 CT1183 TM4691 CT1183 TM1691 CT1183 TM1691 CT1184 TM1691 CT1185 TM1691 CT1185 TM1691 CT1185 TM1691 CT1185 TM1691 CT1185 TM1691 CT1018 TM1691 CT1019 TM1692 CT1182 TM1693 CT1182 TM1693 CT1182 TM1693 CT1182 TM1693 CT1182 TM1693 CT1199 TM1693 C</th><th>XF1156 M. 1899 XF2837 M. 1905 XF1153 M. 1895 XF1153 M. 1895 XF2154 M. 1895 XF2155 M. 1896 XF1171 M. 1896 XF1177 M. 1896 XF1199 M. 1896 XF1199 M. 1896 XF1199 M. 1896 XF2130 M. 1896 XF2130 M. 1896 XF2135 M. 1896 XF2135 M. 1896 XF2135 M. 1896 XF116 M. 1896 XF117 M. 1896 XF117 M. 1896 XF218 M. 1897 XF219 M. 1897 XF219 M. 1897 XF219 M. 1897 XF219 M. 1896 XF2116 M. 1896 XF2116 M. 1896 XF2117 M. 1896 XF2117 M. 1896 XF2117 M. 1896 XF2117 M. 1896 XF2116 M. 1896 XF2117 M. 1896 XF2117 M. 1996 XF2117 M. 1996 XF2118 M. 1896 XF2117 M. 1996 XF2117 M. 1996 XF2117 M. 1996 XF2118 M. 1896 XF2117 M. 1996 XF2117 M. 1996 XF2117 M. 1996 XF2118 M. 1996 XF2117 M. 1996 XF2118 M. 1996 XF2117 M. 1996 XF2117</th><th>HIGHER DROJES HIGHER DROJES HI</th><th>CJ1703IC HP1315 CJ0474 HP1202 CJ1706C HP1318 CJ0477 HP1199 CJ1680C HP1301 CJ1706C HP1301 CJ1706C HP1301 CJ1706C HP1301 CJ1706C HP1301 CJ0477 HP1199 CJ0714 HP1147 CJ0066 HP1301 CJ0714 HP1147 CJ0066 HP1202 CJ0716 HP1302 CJ0044 HP1302 CJ0044 HP1302 CJ0044 HP1303 CJ004 HP1306 CJ004 HP1308 CJ004 HP1308 CJ004 HP1308 CJ004 HP1308 CJ006 HP1241 CJ0066C HP1301 CJ068C(1) HP15071 CJ068C(1) HP15071 CJ068C(1) HP15071 CJ068C(1) HP15071 CJ068C(1) HP1507 CJ068C(1) HP1507 CJ068C(1) HP1507 CJ068C(1) HP1507 CJ068C(1) HP1507 CJ068C(1) HP1506 CJ1707 CJ068C(1) HP1506 CJ008C(1) HP1506 CJ168C(1) HP1506 CJ168C(1) HP1300 CJ168C(1) HP1301 CJ008C(1) HP1301 CJ168C(1) HP1301 CJ168</th><th> TP0193</th><th>50 CPN0250 RC1360
17 CPN0836 RC0995</th><th>RP655 BU520 BU53001 RP136 BU038 BU53039 RP668 BU523 BU530604 RP139 BU035 BU530604 RP139 BU035 BU530606 RP640 BU555 BU55084 RP112 BU337 BU53034 RP712 BU337 BU53034 RP712 BU338 BU53073 BU53078 RP741 BU542 BU55075 BU53078 RP744 BU542 BU55077 RP644 BU568 BU5007 RP745 BU568 BU5007 RP746 BU568 BU5007 RP643 BU508 BU50077 RP643 BU508 BU50374 RP608 BU122 BU50110 RP751 BU337 BU50110 RP666 BU443 BU50390 RP766 BU443 BU50277 RP668 BU443 BU50390 RP668 BU440 BU50277 RP641 BU50110 RP668 BU440 BU50277 RP668 BU440 BU50217 RP688 BU169 BU50100 RP7417 BU128 BU50110 RP641 BU50100 RP411 BU50110 RP641 BU50110 RP643 BU109 BU50110 RP648 BU109 BU50110 RP731 BU3131 BU50110 RP733 BU3131 BU50303 RP668 BU447 BU50117 RP668 BU447 RP668 BU121 BU50117 RP668 BU5017 RP668 BU121 BU50117 RP668 BU121 BU50117 RP668 BU121 BU5017 RP668 BU121 B</th><th>BB0396 YML009C
BB0489</th><th>11) SPCC1886 08C(1) VNG2190G(1) MA243 VNG1997G MA152 SPBC3E7.10 VNG1866G MAG21:</th><th>MAC128 PAB2123 MAC147 PAB2263 MAC147 PAB2263 MAC147 PAB2263 MAC147 PAB2263 MAC147 PAB2263 MAC147 PAB1111 MAC151 PAB1111</th><th>PH1774 AF1921 PH0001 AF038 PH0001 AF038 PH0001 AF238 PH1478 AF089 PH1978 AF1894 PH0000 AF1802 PH0000 AF1802 PH0000 AF1800 PH00710 AF2305 PH1901 AF090 PH0710 AF2305 PH1901 AF090 PH0011 AF090 PH1901 AF090 PH1901 AF1904 PH1001 AF2305 PH1901 AF1904 PH1001 AF7076 PH0036 AF9000 PH1901 AF7076 PH0036 AF9111 PH0036 AF9111 PH1189(1) AF1902 PH1894(1) AF1902 PH1894(1) AF1902 PH1994(1) AF0802 PH1995(2) AF0803 PH1995(2) AF0803</th><th>PF1821 MTH68 PF1991 MTH1879 PF1991 MTH1879 PF1300 MTH183 PF1300 MTH1447 PF1908 MTH24 PF1909 MTH742 PF1909 MTH742 PF1909 MTH742 PF1909 MTH787 PF1909 MTH787 PF1909 MTH787 PF1909 MTH787 PF1909 MTH787 PF1904 MTH787 PF1909 MTH787 PF1909 MTH787 PF1909 MTH787 PF1909 MTH1909 PF1901 MTH008 PF1731(1) MTH009 PF1918 MTH1909 PF1919 MTH1</th><th> SOO716</th><th>MADDED MADDED MADDED</th><th> ST1366 APE2174 PAE3104 </th></t<> | | MYPU_SAIO MYPU_SAIO MYPU_SETO | UU251 UU361 UU361 UU362 UU362 UU369 MG182 UU369 MG182 UU369 MG182 UU369 MG182 UU369 MG183 UU360 MG292 UU360 UU360 MG393 UU361 UU361 MG393 UU361 UU362 MG193 UU362 UU363 MG193 UU364 MG193 UU364 MG193 UU367 UU272 MG196 MG292 UU278 MG197 UU288 MG197 UU288 MG197 UU279 MG292 UU278 MG292 UU278 MG292 UU278 MG292 UU278 MG292 UU278 MG393 UU377 MG298 UU377 MG298 UU377 MG298 UU377 MG298 UU360 UU177 MG298 UU360 UU176 MG393 UU360 UU177 MG298 UU360 UU176 MG298 UU360 UU177 MG298 UU360 UU178 MG298 UU360 UU179 MG298 UU378 MG298 UU378 MG298 UU378 MG298 UU378 UU368 MG003 UU378 MG298 UU378 UU368 MG003 UU379 MG498 UU369 MG498 UU369 MG498 UU369 MG498 UU378 UU369 MG498 UU378 MG298 UU379 MG498 UU379 MG498 UU379 MG498 UU379 UU370 MG398 UU370 MG190 UU370 MG190 UU371 UU371 MG298 UU372 MG498 UU373 MG190 UU374 UU376 MG197 UU376 MG398 UU377 UU376 MG197 UU377 UU370 MG198 UU378 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG198 UU371 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG197 UU370 MG198 UU370 MG197 UU370 MG197 UU370 MG198 UU370 MG197 U370 MG197 U370 MG197 MG198 MG197 MG198 MG197 MG198 MG28 MG198 MG198 MG28 | RPSS STMANSE G07_GRF137 STM419 G12_GRF122 STM4192 G12_GRF122 STM4192 RPLD STM4391 RPLD STM4391 RO_GRF124 STM4192 F10_GRF104 STM4093 F10_GRF104 STM4093 G12_GRF104 STM4093 G12_GRF105 STM4093 G12_GRF105 STM4093 G12_GRF106 STM4093 G12_GRF106 STM4093 G12_GRF107 STM4093 G10_GRF107 STM4093 G10_GRF108 STM4093 G10_GR | 6 ASL4711 B3 9 ALR5300 B3 9 ALR5300 B3 9 ALL5214 B3 9 ALL5216 B3 1 ALL418 B3 3 ALL5208 B3 3 ALL4208 B3 4 ALL4209 B3 4 ALL4209 B3 4 ALL4209 B3 4 ALL4200 B3 6 ALL5237 B1 1 ALL5207 B3 6 ALL5237 B1 1 ALL5207 B3 6 ALL5217 B1 6 ALL5217 B1 6 ALL5217 B1 7 ALL5218 B2 8 B1
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17 CPN0836 RC0995 | RP655 BU520 BU53001 RP136 BU038 BU53039 RP668 BU523 BU530604 RP139 BU035 BU530604 RP139 BU035 BU530606 RP640 BU555 BU55084 RP112 BU337 BU53034 RP712 BU337 BU53034 RP712 BU338 BU53073 BU53078 RP741 BU542 BU55075 BU53078 RP744 BU542 BU55077 RP644 BU568 BU5007 RP745 BU568 BU5007 RP746 BU568 BU5007 RP643 BU508 BU50077 RP643 BU508 BU50374 RP608 BU122 BU50110 RP751 BU337
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| Protein synthesis | GROEL GROEL GROES GROES RPLW RPLW RPME RPMH RPMH RPMC RPMC LYSS LYSS RPSU RPPU YERM GATA YERN GATB PRFB PRFB D PRFB PRFB | GROEL BH0562 GROES BH0561 RPLW BH0780 RPME BH3780 RPM4 BH4066 RPMC BH0142 LYSS BH0098 RPSU BH1354 GATA BH0667 ATT BH0667 PRFB BH3605 | MV1903 L19808 MV1904 L19851 MV20767 L0419 MV2042 L0425 MV2032 L13377 MV2161 L0423 MV90472 L0547 MV1927 L0567 MV1927 L0567 MV1927 L0568 MV19164 L0474 MV1964 L0474 MV1964 L0474 MV1969 L0374 | 193
 | CPE2299 SP1006 CPE2290 SP1007 CPE2403 SP1021 CPE2005 SP1209 CPE2606 SP1003 CPE2006 SP1003 CPE2006 SP1017 CPE2466 SP0713 CPE2466 SP0713 SP0437 SP0437 SP0437 SP0437 CPE2170 CPE20283110 SP0881(1)

 | \$PY2070 FN0675 \$PY2072 FN0675 \$PY2071 FN1642 \$PY00717 FN0482 \$PY0050 FN1637 \$PY0050 FN1637 \$PY0050 FN1637 \$PY0079 \$PY1771 FN0757 \$PY1770 FN0753 \$PY0043 FN1341 \$PY1300(1) \$PY2037(1) | MYPU_5860
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 | 84143 STY4669 84142 STY4669 83318 STY4669 80296 83936 STY0512 STY3774 83703 STY3939A 83312 STY4366 82890 84129 84155 STY3196 STY4704 83066 STY3398 82891 STY3197 80053(2) 80441 83775(1) STY04641 | PA-3386 YPC035 PA-3386 YPC035 PA-3261 YPC025 PA-3261 PA-3261 YPC026 PA-3250 YPC026 PA-3250 YPC036 PA-3250 YPC036 PA-4351 YPC036 PA-4431 PA-4434 YPC036 PA-4434 YPC036 PA-4436 YPC036 PA-4436 YPC036 PA-4436 YPC036 PA-4437 YPC036 PA-4437 YPC036 PA-366(1) PA-367(1) YPC036 PA-186(1) PA-367(1) YPC036 | 00111 / PO3134 TTE0139 E.8 TTE2802 00218 TTE2284 00022 / PO0888 TTE2372 00645 TTE0064 TTE0067 TTE0008 | SMC01907 XAC6974 SMC0990 XAC3899 SMC04434 XAC4374 SMC01301 XAC0980 SMC00368 SMC03173 XAC1628 XAC181 SMC039394 SMC04320 XAC3872 SMC01302 SMC01302 | BMEI0729 MRRAZISI BMEI0322 MSR 3935 BMEI0276 MSR 4095 BMEI0765 MSR 0303 G ML R2200 BMEI0332 MSR 3117 BMEI0075 ML L0675 BMEI0675 ML L0675
 | LB202 MLR2939 VC2865 VCA0819 VC2865 VCA0819 VC0878 VC2679 VC0878 VC2679 VC0007 VC1588 VC0067 SMR001 VC0664 VC2665 VC0002 SL14165 VC0620 SL1066 SL1466 MLR0813 VC0445(2) VC1918 VCA085(1) | XCC9298 RSC118 XCC4242 RSC0000 XC09803 RSC128 XCC1857 XCC1853 RSC120 XCC3817 RSC000 RSC0006 | 142 CC0688 141 CC0686 141 CC0686 142 CC1250 182 CC3275 101 CC0769 101 CC1266 1028 CC0720 1080 CC3397 107 CC2437 107 CC2437 107 CC2436 1080 CC1874 10802 RSC1714 RSC1744(1) CC1688(2) CC1694 CC3067(1) | SCOLARIS GOLARIZ RIVINISTO ROLLINISTO ROLLINISTO RIVINISTO RIVINIS

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 | C.11220 HP0010 C.11220 HP0011 C.11705C HP1317 C.01056C HP0551 C.0061C HP1447 C.11699C HP1311 C.0401 HP0182 C.00370 HP0582 C.11099C HP0830 C.11199C HP0830 C.11199C HP0850 C.11495 HP0171 | TPH000 TC0188 TC0388 TC088 TC0887 TP1013 TC0387 CT TP0191 TP0255 TC0281 CT TP0967 TC0168 CT TP0197 TP1040 TC0163 CT TP0756 TC0620 CT TP1020 TC0271 CT TP1020 TC0272 CT TP1021 TC0272 CT TP1027 CT TP1016 | 10 CTE04 GROEL_3 CPN0888 RC0889 11 CPN0115 RC0889 RC1004 22 CPN0112 85 CPN0835 RC0896 RC0988 81 CPN0831 42 CPN0831 RC0949 03 CPN0003 RC194 04 CPN0004 RC0193 99 RC0368 | RP626 BU019 BUSG019 RP627 BU018 BUSG018 RP647 BU522 BU556G3 RP610 BU517 BUSG566 RP610 BU013 BUSG013 RP611 BU516 RP615 BU516 BU5437 BU5422 BU56422 RP615 BU567 BU56422 RP615 BU567 BU56422 RP151 BU564 RP152 BU564 | BB0741 YCR020C SPCC560.06 BB05469 YOL127W SPBC106.18 BB05259 BB05469 BB05469 YOR037W YNL073W SPBC117G0.0 BB05469 YOR037W YNL073W SPBC117G0.0 BB05256 SPC54640.3
 | C | MANTON PAR2341 MANTON PAR2341 MANTON PARTONS MANTON PARTONS MANTON MANTON | PH5017 AF1451 AF2238 PH5049 AF1923 AF2329 AF2116 | PF1974 MTH-218 MTH-94 PF1823 MTH4 MTH-1496 MTH-1280 | SOCIET SSOCIET SSOCI | TVC1191974 MJ0999 M6C1006 MJ0178 M6C0413 MJ1160 M6C0238 MJ0160 M6C0960
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| Protein symbols Ribocomal proteins C00044 rgmJ Protein symbols Ribocomal proteins C028/73 rgmD Protein symbols RMA pymhatase C008/3 ghG Protein symbols RMA pymhatase C038/0 ghG Protein symbols RMA pymhatase C038/0 ghG Protein symbols RMA pymhatase C038/0 ghG Protein symbols Ribocomal proteins C048/0 axc3 Protein symbols Ribocomal proteins C048/0 rgmA Protein symbols Ribocomal proteins C028/0 rgmF Protein symbols Ribocomal proteins C028/0 rgmF Protein symbols Ribocomal proteins C028/0 rgmF RMA metabolism marchinary C018/3 rgmB RMA metabolism RMA modification C018/6 rgmG RMA metabolism RMA medication C018/6 rg | RPMJ RPMJ RPMJ RPMD RPMD RPMD GLYG GLYG GLYG GLYG GLYS GLYS GLYG GATC ASNS ANSB-2 RPSN RPSN RPSN RPMF RPMF-2 RPMS RPM | RPMJ BH0152 RPMD BH0152 GLYO BH1370 GLYO BH1370 GLYO BH0377 GATC BH0006 RPSN BH1090 RPSN BH1090 RPSN BH0147 RPMR BH2283 RPMR BH2283 RPMR BH2283 RPMR BH2281 RPMR B | MV21-40 L1538 MV2151 L0424 L10562 L0560 MV1542 L0475 MV1544 L0365 MV17160 L0391 MV17107 MV34107 MV3407 MV34 | N83 | CPE2380 SP0238 SP1475 SP1475 SP1476 SP1474 SP0438 CPE2380 CPE2380 CPE2382 CPE2382 CPE1744 SP0441 CPE2419 CPE2419 CPE2419 SP1642 CPE2419 SP1671 SP1671 CPE2376 SP0236 CPE1779 SP10236

 | SPYCO76 | MYPU_5640 MYPU_7710 MYPU_7710 MYPU_5740 MYPU_5400 (1) MYPU_560(1) MYPU_5610 MYPU_5610 | UU364 MG174 UU365 MG113 UU244 MG164 UU333 MG893 UU209.1 MG428 UU187(1) MG341(1) UU557 MG177 UU557 MG177
 | RPMJ STIMAH19 STIMAH22 STIMAGE STIMAGE STIMAGE KOL_ORF4550 RPSM G12_ORF67 C12_ORF65 G12_ORF65 G12_ORF7101(1) STIMAH15, KO_ORF210 STIMAGE STI | 9 AS.4194 B.S. 2 B.S. 6 AL.1985 B.S. 5 ALRH11 B.S. AS.3192 0 ALR3658 B.O 3(1) ALR1564(1) B.S. 5 ALL4191 B.S. 4 ALL4191 B.S. | B3299 STY_3ETY_342 B3502 STY4376 B3560 STY4143 B3559 STY4144 B0930 STY1004 B3867(1) STY3732(1) B38295 STY4883 B2207 STY2861 | PA4-245 YPO202 PA0000 YPO407 PA0000 YPO407 PA4482 YPO407 PA4482 YPO407 PA4270(1) YPO374 PA228 YPO208 PA3743 YPO308 | 00020 TTE2867 00027 04072 04072 04071 TTE0606 01412 TTE278 TTE495 TTE2308 00074 TTE2301(1) 000054 TTE283 TTE1496 TTE283 | SMC01281 XAC0990 SMC0885 XAC4211 SMC0885 XAC4210 SMC01353 XAC1818 SMC01353 XAC1818 SMC0137(1) XAC0986(1) SMC01285 XAC0996 SMC03861 XAC1924 SMC03861 XAC1924
 | BMEI0775 MSR0316 BMEI1530 M.R7434 BMEI1529 M.R7435 BMEI0674 MSL0677 BMEI0741 MLR0275(1) BMEI0741 MLR0275(1) BMEI0741 MLR0275(1) BMEI0741 MLR0275 BMEI0740 MLL0277 | \(\text{VC2579}\) \(\text{VC2579}\) \(\text{VC2578}\) \(\text{VC0021}\) \(\text{SLR0638}\) \(\text{VC0000}\) \(\text{SLR0638}\) \(\text{VC0000}\) \(\text{SLL0030}\) \(\text{VC1297}\) \(\text{SLL0495}\) \(\text{VC0028(1)}\) \(\text{VC0028(1)}\) \(\text{VC0563}\) \(\text{SLL1787}\) \(\text{VC5663}\) \(\text{SLL1616}\) | RSC2089 RSC308 | 1997 D01 | SCO4726 RV4341C
SCO4720 RV9722
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SCO5694 RV2866C

 | NAMID164 NAMID182 NAMID182 AGR.C.1133 NAMID182 AGR.C.1444 NAMID1365 AGR.C.2429 NAMID1365 AGR.C.3669(1) NAMID132(1) AGR.C.3669(1) NAMID168 AGR.C.3818 NAMID168 AGR.C.4898 | AQ.,076 PM1394 AQ.,1644 PM1397 AQ.,945 PM1098 AQ.,2414 PM1102 GATC PM0643 AQ.,1651A AQ.,1602 AQ.,060 AQ.,1630(1) PM1737(1) AQ.,070 PM1390 AQ.,1489 PM1297 | CT2166 TM-10°E CT2171 TM-1822 TM-1822 TM-1823 TM-1822 TM-1823 TM-1827 CT1833 TM-1827 CT2112 TM-1827 TM-1827 CT0149 TM-1825 CT0149 TM-1825 CT0146 TM-1825 CT0146 TM-1825 CT1164 TM-1825 | M.1981 XF1170 M.1.1841 XF1990 XF1999 M.1.1703 XF2963 M.1.1846 M.1.1907 XF2633(1) M.1.1891(1) XF1176 M.1.1957 XF1176 M.1.1957 XF1099 M.1.165
 | H0798 1 DR2124 H00927 H00927 H00924 DR1275 H11302 DR2266 H100515(1) DR0912(1) H00802 DR2129 H10002 DR2119 | CJ0478(1) HP1198(1) | TP0241(1) TC0589(1) CT | 15(1) CPN0081(1) RC0181(1) | RP274 BU496 2 RP576(1) RP622 BU140(2) BU478 BUSG133(2) BUSG462 BU503 BU50447 RP640 BU150 BU50128 RP149 BU155 BU50127 RP153 BU360 BU5G348 RP144 RP140(1) BU034(1) BU5G035(1) RP635 BU499 BU5G440 RP111 BU396 BU5G348
 | BB0389(1) YOR151C(2) YPR010C(1) SPAC23G3.0 | VNG0870G MA452
CC SPBC1773.10C VNG0870G MA452
1(2) SPBP23A10.07(1) VNG2885Q(1) MA126 | 2 MM1226 PAB2293 4(1) MM2272(1) PAB0423(2) | AF2328
PH0241
PH1546(2) AF1887(1) | PF1564(2) MTH1555(1)
 | SSO8855 TA0519 TVG1050051 SSO0227(1) TA0590(2) TVG1237894(2) | 1(2) M41041(1) MKG688(1) | STS140 PAE2873 ST0277(2) APE1866(2) PAE0866(2) |
| RNA metabolism Regulation O22536 musA Basic Insnarcipsion RNA metabolism machinery O4865 rpoC RNA metabolism RNA modification O19125 mc RNA metabolism RNA modification O0096 trmU Basic Insnarcipsion RNA metabolism RNA modification O13707 por88, cca | | NUSA B12416 RPOC(1) B10127(1) RNCS B12489 LIN1547 B11261 RPOD B11376 CCA B11684 | |
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 | | | |
 | | VC1128 SLL0844 VC0517 SLL2012 VC0594 SLL0925 | | 215 CC0897
215 CC3047
227 CC0408 |

 | | AQ_299 PANORO AQ_1945(1) PM1736(1) AQ_946 PM0091 AQ_1946 PM1336 AQ_1224 PM1336 AQ_1289 PM0864 1118 131 141 141 151 151 151 151 151 151 151 15 |
 | | | CJ0479(1) HP1198(3)
CJ1636C HP0682
CJ0053C HP1335
CJ1001 HP0688
HP0640 | TP0242(1) TC0588(1) CT TP0809 TC0570 CT TC0580 CT TF0493 TC0905 CT TF04270 TP0596 TC0977 TC0891 CT | 14(1) CPN0082(1) RC0182(1) 97 CPN0054 RC0187 87 CPN043 RC0410 15 CPN0786 RC1329 10 CT704 CPN0848 CPN0866 RC0015
 | RP141(1) BU033(1) BU53034(1)
RP117 BU258 BU50249
RP306 BU261 BU50252
RP688 BU055 BU50052
RP915 | BB0388(1) | VNG2661G MA120
2(1) SPBC651.08C(1) VNG2664G(1) MA126
1 | O MM2288 PAB0458 3(1) MM2271(1) PAB0454(1) | PH1543 AF1891 PH1545(1) AF1888(1)
 | PF1560 MTH1054 PF1563(1) MTH1051(1) | \$\$00220 TA0383 TVG1233261 TA0381(t) TA0381(t) TVG1235237(t) | MJ1045 M60882 7(1) MJ1042(1) M60885(1) | \$T0279 APE1860 PAG0696 \$T0276(1) APE1863(1) PAG0666(1) |
| RNA metabolism Regulation O19643 pkeP, yeeF
RNA metabolism RNA modification O11315 yekC, capR
RNA metabolism RNA modification O22133 mpA | PHOP RESD YBOJ YORL YOLL LISIN LIMOSBY LIMOTHIS YMOJ YBOP YTSA YYOP YVOA LIMOSBY LIMOSBY LIMOTHIS LIMOS RESD RESD REPA RNPA RNPA RNPA | BH0271 BH0075 BH | | |

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 | | 2) MA2866 | 1(2) MM0046(2) | |
 | | | |
| RNA metabolism Regulation O13895 reC_bMR RNA metabolism Regulation Q22633 phoR, sycC Nucleorides O13891 adx Nucleorides O16510 gmX Nucleorides O2023 pyG | ACOR(4) ROCR(2) YPLP YGR(3) G PHOR(1) RESE(1) YYCG(1) ADK YLOO LMO2288(1) PHOR(1) RES ADK YLOO LMO1277 PYRG | BH182(4) LIN2276(2) BH399(3) BH39(3) BH39(3) BH39(3) BH39(3) BH39(3) BH399(3) BH399(3) BH399(3) BH399(3) BH399(| H187762) H1824(21) M1924(21) M1924(21) M1924(21) M1924(21) M1924(21) M1924(21) M1924(21) M1924(21) M1925(21) M1925(2 | CAC0459(3) CAC3088(3) CAC1701(1) 714 CAC3112 129 CAC1718 124 CAC292 | CPE2384(3) CPE1787(1) CPE2384 SP0231 CPE1748 SP1738 CPE2208 SP0444

 | FN1321
SPY0074 FN1298
SPY1632 FN2033
SPY1694 | (2) FN1831(2) MYPU_5670 MYPU_6670 MYPU_6600
 | UU291 MG171
UU213 MG107
UU284 | STM/992/5
STM-999/2
STM-999/2
STM-999/5
ADK STM-999/5
KOA_ORF239 STM/999
STM-999/5 | 22(3) STANSSERIES 12 12 12 13 13 13 13 13 | B249 (2) 82544(2) 82709(2) \$77259(2) \$77269(2) 8279 (2) (2000(2) 83422(2) \$7320(2) \$77269(2) 82808(2) \$77269(2) \$77269(2) 82219 (1) 82786(1) \$77269(2) \$77269(2) 80474 \$770532 83468 \$774662 82790 \$774662
 | PA478(2) PA415(5) YPO020 PA478(2) PA4515(5) YPO234 PA511(2) PA518(2) YPO234 PA6928(1) PA1611(1) YPO336 PA6928(1) PA1611(1) YPO336 PA3666 YPO311 PA3636 YPO037 PA3637 YPO337 | D0022(2) YP00712 TE008(2) TE00 | SMB201612() SMB21200(2) SMC196(3) SMC1046(2) SMC096(1) SMC96(1) SMC96(1) SMC96(1) XAC1283(2) SMC91288 XAC2437 XAC2437 XAC2436 SMC90977 XAC2396 SMC91025 XAC1716(1) | 987(2) BMEIOS66(2) BMEIOS66(2) MR.ROS02(2) MR.ROS007(2) MR.ROS02(2) MR.ROS007(2) MR.ROS02(2) MR.ROS02(2) MR.ROS02(2) BMEIO-0778 MR.ROS02(2) BMEI1-69 MR.ROS02 BMEIO-69 MR.ROS02(2) | MLR0308(2) VC2748(2) VCA0117(2) VCA0182(2) VCA0182(2) SLR152 VCA0754(2) SLL153 VC2483(1) SL135 VC2483(1) VC0086 SLL1059 VC2708 SLR122 VC2486 SLL1408 | XCC1990(3) XCC1933(2)
 | 00(2) REPO12(3) REPO22(6)
00(2) REPO19(2) REPO60(2) CC0909 CC1741(2) CC1743(2)
66 CC3319(2)
333 CC1269
555 CC1681
526 CC1681 | SC05748(10) SC07327(4) SC01479 RV1389 SC01479 RV1499

 | AGR. C. 178(2) AGR. C. 2666 AGR. C. 2667(2) AGR. L. 278(4) AGR. L. 3046 NMB0115(2) AGR. L. 278(4) AGR. L. 3046 NMB0823 AGR. C. 3621 NMB1661 AGR. C. 2038 NMB1664 AGR. C. 2038
 | 66(2) AQ_083 AQ_1117(2) AQ_164(2) H14(2) AQ_178(2) AQ_218(2) PM0508 PM14600 AQ_230(2) PM0508 PM14600 AQ_2078 PM05284 AQ_1344 PM0522 AQ_1344 PM1872 | CT0108(2) CT1487 CT1829(2) CT1185 TM1479 CT0247 TM6699 CT0142 TM6603 | XF1848(2) XF2545(2) XF0275 ML1832 XF1933 ML0541 XF1288 ML1933 | HI0349 DR2117
HI1743 DR2289
HI1077 DR1573 | CJ1024C(2) HP0703(2) CJ0639C HP0618 CJ1177C HP0321 CJ0027 HP0349
 | TP0082(2) TC0783(2) CT TP0595 TC0464 CT TP0305 TC0495 CT | 28 CPN0244 RC0885
00 CPN020 RC1194
83 CPN026 RC1194 | RP62(2) RP638 BU484 BUSG469 RP785 BU434 BUSG49 RP778 BU416 BUSG399 | BB0417 | SPCC1796.66C VNG1724G MA109
GC VNG1830G MA32P
 | 6 MMC148 PAB0739
0 MM018 PAB0231 | PH1117 AF0676 PH1792 AF0552 | PF1045
PF1839 MTH419 | 1500201 TA0044 TVG0038820 | 0 MJ1174 MK02005
 | ST0237 APE1604 PAE3518 |
| Nucleotides O12164 cmk Nucleotides Q21541 mk Nucleotides O13883 rrdfl. rreff Nucleotides O12797 rnstA. rreff Nucleotides O423 gual8 Nucleotides O131419 hpt, tp-T | CMK CAK TMK LM02693 F NRDF Y0SP LM02154 IRNDE(1) Y0SN(1) Y0SN(1) LM02156(1) GLIAB GUAB LM00132 HPRT | CMK BH1034
LIN2841 BH1034
LIN2258 BH0002
LIN2259(1) BH0001(1)
GUAB LIN0179 BH0020
BH0004 | MAY1366 L14379
MAY0437 L3846
MAY0684 L0285
MAY0684(1) L0284(1
MAY0366 L18044
MAY0465 L16044 | 791 CAC1848 CAC3276 CAC3277(1) A(1) CAC2701 CAC2701 CAC2702 CAC2702 CAC2703
 | CPE1084 SP1603 SP0335 CPE2360 SP1180 CPE2361(1) SP1179(1) CPE2276 SP2228 CPE1960 CPE2471 SP0012

 | SPY0803 FN1607
SPY0399 FN0103
SPY0425 SPY1378 FN0103
SPY0427(1) SPY1375(1) FN0102
SPY2206 FN1231 | MYPU_0890
MYPU_0820
MYPU_5830
MYPU_5410(1)
MYPU_5610 | UU342 MG330 UU020 MG006 MG029 MG231(1) UU104 MG468 | POI_0RF217 STM0000 D12_0RF210 STM200 F10_0RF230 STM200 F10_0RF2310 STM2276 S F10_0RF721(1) STM227761 STM27771 K06_0RF726 STM0170 | 0 ALR2836(2) 80 0 ALL4708 81 8TM2808 82 7(1) STM2807(1) 82 0 0 80 0 80
 | 80910 \$TY0980 817098 \$TY1239 82238 82876 \$TY2507 \$TY2903 \$TY_ 82234(1) \$82675(1) \$TY2502 \$TY2502(1) \$TY2502(1) \$TY2502 | PA3163 YPO138
PA2962 YPO160
STY_363 PA1166 YPO121
32(1) PA1166(2) YPO121
PA3770 YPO287
PA4666 YPO346 | 0.1591 TTE1360
0.1605 TTE0094
0.1213.YP02648
0.1214(1) YP02649(1)
0.124(1) YP02649(1)
0.20271 TTE0682
0.3066 TTE2394 | SMC00334 XAC2299 SMC01189 XAC4014 XAC4074 XAC4076[1] SMC00815 XAC2288 SMC00719 XAC1335 | BME1916 MLL5212 BME10929 MLL0424 BME10929 BME10930(1) BME10996 MLR9350 BME10096 ML.3500
 | VC1916 SLL1249 VC2016 SLR0376 VC1285 SLR0581 VC1286(1) SLR1164 VC0767 VC0865 | (r) XCC2196 RSC096
XCC3981 RSC178
XCC3985 RSC286
(r) XCC3986(1) RSC286
XCC2184 RSC142
XCC1284 RSC328 | 2098 CC3598 CC1624 1004 CC0260 1005(2) CC1617 1229 CC1617 122 CC2214 | SCO1780 RV1712 SCO3542(1) SCO5225 RV1981C RV3048C SCO5226(1) RV0570(1) RV0570(1) RV3051C(1) SCO1461 SCO4770 RV1843C RV3411C SCO3465 RV3624C

 | NMB120 | AQ_2153 PA00022 AQ_909 PM1673 AQ_1505 PM0719 AQ_004(1) PM0717(1) AQ_2023 PM0295 AQ_544 PM0121 | CT0286 TM1443 CT1313 TM1098 CT1289 TM1547 CT1429 TM0006 | XF2439 ML1371 XF0800 ML1731 XF1197 ML1731 XF1196(1) ML1734(1) XF2430 ML097 ML008 XF234 ML0214 | H11219 H11646
DR2543
HI0456 DR0111
H11660 DR80109
H11669(1) DR80109(1)
H00221 DR1878
H1153 DR1376 | CJ0766C HP1474 CJ0231C HP0364 CJ0024(1) HP0680(1) CJ1068C HP0829 | TP0279(1) TC0737 CT TP0304 TC0460 CT TP0053 TC0215 CT TP1008(2) TC0214(2) CT TC0443(1) | 22 CPH0588 RC0748
88 CPH0273 RC1047
28 CPH0585 RC0651
27(2) CPH0584(2) | RP922 RP684 BU353 BU55341 RP512 BU178 BU56172 BU179(1) BU56173(1)
 | 889 139 V.RRSTW SPCC70.07C YGR180C YLL028W SPBC25012. YER070W(1) YL086C(1) YAR073W YH216W YLR432W YHL056C SPBC2F12.1 | VWG1929G MA443
04 VVG2389G VVG2384G(1)
VVG2384G(1)
VVG1001G | PAB0319 PAB1057(1) PAB1250 | PH1885 AF0061 PH0363(1) PH0307 | PF1730 MTH1785 PF0440(1) PF0285 MTH142
 | \$\$00780 \$\$01191 \$\$01192 TA0081 TVQ0181531 \$\$00929(1) TA1475(1) TVG0090526(TA0219 TVG1445839 | MA0283 MK0101 | ST0462 ST1642 ST1643 APE2090 PAE0964 ST1259(1) PAE3155(1) APE1507 |
| Calcolorates | WARN TURN | ENO BH3556 PGK BH3559 LIN0364 TPI BH3558 PRS PRS-2 BH0566 | MVV09/2 L4702 MVV0738 L0007 MVV0736 L0006 MVV0466 L10033 | 7 L0008 CAC0713 0 CAC0710 1 CAC0711 3 CAC0711
 | CPE1209 SP1128 CPE1303 SP0409 CPE1302 SP1574 CPE1309 CPE2469 SP0627 SP1095

 | SPY0326 SPY11984 SPY0731 FN1764 SPY1881 FN0554 SPY0613 FN1366 SPY0020 SPY1123 FN1982 | MYPU_5400 MYPU_5180 MYPU_4600 MYPU_4580 | M0230 UU184 MG407 UU279 MG300 UU181 MG431 UU193 MG058 | F10_CHF153 S1M2806 C12_ORF456 STM2852 A05_ORF409 STM0081 C12_ORF244 STM4081 D09_ORF388 STM1780 | 2 ALI3538 B2 9 ALI4131 B2 1 ALR4385 B3 0 ALR4670 B1
 | B2674 STY2091 B2779 STY2081 B2926 STY227 B3919 STY2789 B1207 STY1906 | PA3636 YPO387 PA0682 YPO088 PA4748 YPO088 PA4670 YPO291 | 203276 TTE1759 20021 TTE1761 200085 TTE1760 20013 TTE2571 | SMC01028 XAC1719
SMC03981 XAC3947
SMC01023 SMC01614 XAC2707
SMC02086 XAC0960
 | BMEI00931 MLR0376 BMEI00951 MLR0376 BMEI00409 MLR3753 BMEI0468 BMEI0425 MLL0610 ML BMEI0483 MLR2685 | VC2447 SLR075/27
VC0477 SLR039-0
R7275 VC2670 SLR078:
VC2183 SLL0469 | XCC1700 RSC112 XCC3188 RSC097 XCC2531 RSC206 XCC0873 RSC020 | 129 CC1724
571 CC3249
584 CC1893 | SC03086 SC07938 RV1023
SC01946 RV1427
SC00578 SC01945 RV1438

 | AGR_C_104 NMB1285 AGR_C_2631 NMB0100 AGR_L_2193 NMB1887 AGR_C_2887 NMB0875 AGR_C_4031 | AQ_484 PM1871 AQ_118 PM1860 AQ_360 PM1311 PM1640 AQ_1636 PM0244 | CT0146 CT1962 TM0897 CT2222 TM089(1) CT1444 TM089(2) CT1361 TM1628
 | ML1735 XF1291 ML0295 XF0823 ML0971 XF0303 ML0672 XF2644 ML0248 | H00932 DR3637
H00935 DR1342
H00978 DR1339
H11609 DR1456 | C.11672C HP0154 C.11402C HP1345 C.11401C HP0194 C.0018C HP0742 | TP0817 TC0876 CT TP0538 TC0665 CT TP0537 TC0604 CT TP0294 | 87 CPN0800
93 CPN0879
28 CPN1083
 | BU417 BUSG400
BU450 BUSG435
BU507 BUSG297
BU169 BUSG163 | 980337 YGR356W YRR176W YMR32W YGR366W YPL281C SPRC1815.0 880056 YCR015W SPRC1475.0 880055 YCR015W SPC24810 YGR066W YRR096C YHL011C SPAC4A8.14 4WL181W YRR096C YHL011C SPAC4A8.14 YKL181W YGR096C YHL011C SPAC4A8.14 YKL181W YRL061W SPCC1620.0 | VNG1142G MA167
 IC VNG1216G MA266
 21 SPBC3D6.66C | 2 MAGISS PAB 1126
MAGISS PAB 1679
7 MAG205 PAB 1144 | PH1942 AF1132
PH1218 AF1146
PH1923 AF0589 AF1419
 | PF0215 MTH43 PF1057 MTH1042 PF0226 MTH7784 | \$500913 TA0882 TVG1033459
\$500827 TA1075 TVG0521991
\$501045 TA0119 TVG0201915 | 0 MJ0232 MK1647
MJ0041 MK1602 | ST1212 APE2468 PAE0912
ST1367 APE0173 PAE1742
ST0946 APE1834 PAE2980 |
| Glycolysis C2000 694, 64 Glycolysis C16643 p8A Glycolysis C16545 fba, fbas Glycolysis C3316 ppm | TKT LM00342 LM02860 TKT PFK PFK PFK FBA LM02350 LM02313 | TT LIN0360 LIN2309 TKT BH2352 LIN1606 BH3164 133 FBAA LIN0378 LIN2238 LIN2239 BH2214 BH1 POM BH3057 | MRV1229 L0043
MV1642 L0002
786 MV2049 L0009
MVV737 | CAC0944 CAC1348 CAC0917 CAC0927 CAC2962 CAC0712
 | SP2030 CPE0361 CPE1185 CPE1467 SP0896 CPE0366 CPE1350 CPE2626 SP0605 CPE1301 CPE1301 CPE3626

 | SPY1676 SPY1283 FN0410 SPY1889 | MYPU_6010
MYPU_100 MYPU_3000
MYPU_100 MYPU_3000 | UU596 MG086 UU185 MG215 UU596 MG023 UU199 MG430 | R02_ORF648 STM0474 S
H10_ORF328 STM4062
B01_ORF388 STM0068 S
C12_ORF508 STM3704 | 4 STM3076 ALR3344 B2 2 ALL7336 ALR1913 B3 8 STM3223 STM3780 ALL4563 B1 4 ALL4162 B3
 | B2465 B2935 STV2711 STV3236
B3916 STV3899
B1773 B2096 B2925 B3137 STV3226 STV3435
B3612 STV6899 | PA0548 YPO082 YPO087 PA0555 YPO084 PA5131 YPO08 | D00006 TTE0190 D00078 TTE1818 D00044 YPC0020 YPC3060 TTE0137 | SMB20200 SMC02342
SMC03978 XAC3372
SMC01852 XAC3438
SMB20199 SMB21192
 | BMEI0311 MLR3749 MLL5025 BMEI0423 MLL7273 | VC0473 VCA6824 SLL1070
VC2689 SLL0745
VC0478 SLL0016
VC0336 SLR1945 | XCC3220 RSC276 LL1196 XCC3292 RSC067 | 750 CC3620 | SCO1933 SCO6663 RV1449C
SCO1214 SCO2119 SCO6426 RV3010C
SCO3649 SCO5652 RV333C
SCO6818

 | NMB1467 AGR_L_2197 AGR_C_3836 NMB1869 AGR_L_2721 | AQ_1785 PM1242 PM1638 AQ_1708 PM0069 AQ_1900 PM1373 PM1661 | CT1870 CT0250 CT1603 TM0209 TM02289 CT1053 TM02273
 | XF1936 ML0883
XF0274 ML1701
ML0286 | H11023 DR2256
H10082 DR0635
H10524 DR1589 | C.11645 HP1088 C.10697 HP0176 C.106434 HP0974 | TP0560 TC0131 CT TP0108 TP0542 TC0477 TC0479 CT TP0662 | 50 CPN0883 05 CT207 CPN0160 CPN0208
 | 8US0086
8U305 8US0295
8U451 8US0436 | \text{VBR117C YPR074C} \text{SPBC2GS.06} \text{BB00009 BB0727} \text{YBR296C} \text{YBR296C} \text{SPBC1646.0} \text{SPBC1646.0} \text{VBR066W(1) YGR26W(1)} \text{SPBC1711.0} \text{SPBC171.0} \text{SPBC1711.0} \text{SPBC1711.0} | 2 | 1 MA4007 MM0004 | |
 | VAN- | | |
| Collectors CoA O21507 yerfit, yed Colactors Foliate O8047 glyA Colactors NAD O16051 yffit, pprK Colactors 3-adenonylmethionine O3942 meth Colactors NAD O19365 nast institute | GLYA GLYA LMO1563 GLYA VJEN YTDI LMO0568 LMO1586 METK METK METK NADE LMO1503 MES NET YEVO LMO1551 LMO1561 | LIN1598 BH3150 GLYA BH3785 LIN0987 LIN1628 BH2248 BH4 METK BH3300 LIN1078 BH2285 | MW1631 L99930 MW2037 L0082 199 MW0888 L16661 MW1728 L15340 MW1853 L0203 | CAC1099 CAC284 514 CAC2075 CAC2866 CAC2866 CAC360(CAC1782(3)) | CPE1993 SP0971 CPE1929 SP1024 CPE1817 SP1098 CPE2177 SP0782 CPE1058(2) SP1420

 | SPY0498 FN1932 SPY1145 FN267 SPY1126 FN267 SPY139 FN356 SPY1652 FN1202
 | MYPU_7210
MYPU_3390
MYPU_7020
MYPU_0230 | MG264 MG394 UU177 MG128 UU42 MG047 UU460 MG383 | A19_ORF200 STM0140 D02_ORF406 STM255 A65_ORF259 STM2683 D09_ORF383 STM090 H03_ORF248 STM1310 | 0 ALL1754 B0 5 ALR4806 B2 3 ALL4751 ALR0227 B2 0 ALL3244 ALR4124 B2 0 ALR2485(3) B1
 | B0103 STY0162 B2551 STY2802 STY3764 B2615 STY2869 B2942 STY3243 B1740 STY1803 | PA4529 YPO343 PA2444 PA4602 PA5415 YPO290 PA3088 YPO110 PA0546 YPO090 PA4920 YPO291 | 02430 TTE0875 02607 TTE2130 01106 TTE1300 0081 TTE0488 02912(3) TTE0640(3) | SMC02780 XAC3244 GLYA2 SMC01770 XAC0743 SMC01331 XAC1695 SMC01109 XAC0813 SMB20649 SMC00161(3) XAC3220(3) | BME(2057 MLR4493 BME(1191 BME(1192 MLR6114 M BME(1036 MLL0225 BME(1970 MLR5545 M BME(0090(3) MLL0816(3)
 | \(\text{VC2427}\) SLR0953 \(\text{R8400}\) \(\text{VC0961}\) \(\text{VC0853}\) SLL1493 \(\text{VC0853}\) SLL1415 \(\text{R6116}\) \(\text{VC0472}\) SLL0927 \(\text{R61644}\) \(\text{VCA0207}\) SLR1691 | XCC3102 RSC2802 XCC0860 RSC072 LR0400 XCC1546 RSC286 XCC0761 RSC013 XCX091(3) RSC234 | 129 CC0004 129 RSP0055 CC1367 C01221 334 CC0050 CC1221 CC0619(3) | SC01996 RV1631 SC0-6837 SC05364 SC06470 RV0070C RV1093 SC00410 SC01781 RV1595 SC01476 RV1392 SC00568 SC02238(3) RV2438C(3)

 | AGR.C.5 NMB1065 AGR.C.2156 AGR.L.1099 NAB0607 AGR.C.2483 NMB1799 AGR.C.632 NMB1364 AGR.C.3052(3) | AQ_1985 PM0088
9 AQ_479 PM0225
AQ_909 PM0333
AQ_1154 PM1027
AQ_959(3) | CT1209 TM1387 CT1590 TM0720 CT0085 TM1723 CT0722 TM1608 CT0560 TM0645 TM1253(3) | XF2536 ML1383 XF0946 ML1953 XF7090 ML1559 XF7030 ML1564 XF1961(3) ML1463(3)
 | H0889 DR0038 H0072 H1172 DR0640 DR40201 | CJ1630 HP0831 CJ0402 HP0183 CJ0641 HP1394 CJ1080C HP0197 CJ0610 HP0329 | TP0296 TC0779 CT TP0329 TC0716 CT TP0441 TP0794 TP0780(3) | 92 CPN0611 RC1111 32 CPN0621 RC1146 RC0612 | RP731 BU203 BU50197 RP743 BU289 BU50278 RP440 BU165 BU50278 BU408 BU50393 BU174 BU50168
 | BB0547 YDR196C SPCC1885.1 BB0601 YBR263W YLR058C SPAC1806.0 BB0311 YEL041W YJR049C YPL188W SPBC1475.0 BB0378 YDR362C YL1189W SPBC1475.0 BB0522 YH8074W) SPBC2635.0 YCL017C SPBC21010. | 2 4C SPAC24C9.12C VNG1414G MA362 VNG1900C MA334 UC VNG2031G MA103 | D MM0442 PAB2018
3 MM2794 PAB1756
0 MM3508 MM3715 MM046 MM0812 PAB2244 | PH1654 AF0852 PH1074 AF2373 PH0182 AF1000 | PF1778 MTH1360 PF1103 MTH972 PF0098 MTH1510
 | TX0811 TA1509 TV000482251 TX08219 TX0622 TVG108870 TX082772 TX0899 TVG1071522 | 17VG0811706 MJ1597 MK0122
MM0917(2) MK09142
2 MJ1562 MK1418 | ST1364 APE1902 PAE0798 ST2136 APE1904 PAE0824 PAE3116 ST2159 APE1968 PAE1219 |
| Cohactors Fe-sulfate cluster O10078 rells, yn-O Cohactors NAD O15356 readD Cohactors Fesulfate cluster 018235 rill, yn-V Cohactors Foiate 022176 folA, dris Cohactors Fe-sulfate cluster 05842 rell5, cad Cohactors Fe-sulfate cluster 08845 yn-PD, yn-Y | YQEJ LM01488 YURV LM02412 DFRA LM01873 YURV LM02413 Y YURY LM02415 | LIN1523 BH1326
LIN2507 BH0369 BH1
LIN1987 BH3450
LIN2508 BH3459
LIN2510 BH34571 | 260 BH3204 MW1572 MW1699 L11112
MW1545 L10637
468 MW0798 L31137
MW1316 L16287
MW0797 L32195 | 20 L12222
 | CPE1413 CPE1785 SP0880 SP1094 CPE2125 SP1747 CPE1784 SP0870 CPE0044 SP1571 SP0889 SP0887

 | SPY0816 SPY1122 FN0058
SPY0308 FN1132
SPY0289 FN0059
SPY0883 FN0241
SPY0288
SPY0285 | MYPU_3350(1)
MYPU_1740
MYPU_5370
MYPU_1720 MYPU_1730 | UU469(1) MG240(1)
UU453
UU114 MG213(1) MG228
UU454 MG336 | \$TM2543
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\$TM2542
\$TM2542
\$TF10_ORF160 H10_ORF506(1)
\$TM0087
\$TM1373 \$
\$TM1373 \$ | 3 ALL1457 ALR2605 ALR3088 B2 6 ALL5063 B0 2 ALL1469(1) B2 7 STN2984 ALR2495 B1 1 ALR2493 B1
 | B253.0 STY2789 B063.9 STY0696 B252.9 STY2788 B0048 STY0102 STY_138 STY_186 STY_186 STY_186 STY_187 B1680 B2810 STY1750 STY3124 B1682 STY1752 | PA2062 PA3814 YPO213
PA4006 YPO280
PA3813 YPO289
STY_359 PA0350 YPO489
PA3667 YPO102 | D2138 YPO2896 TTE1663 TTE2465 D2607 TTE0918 TTE2669 TTE2669 D1028 YPO2400 TTE2670 D2402 TTE2673 | SMC00529 SMC003778 SMC01006 SMC01042 XAC0844 SMC00533 XAC2936 SMC00531 XAC2936
 | BMETO43 MLL5865 MI
BMEI0209 MLL0900
BMEI0911 MLL0920 MI
BMEI0009 MLL1657
BMET0439 MLR0021
BMET041 MLR0021 | R6015 VC0748 SLL0704 L5941 VC0749 VC0440 VC2309 SLR0077 SLR0077 | LRO387 RSC101 XCC2616 RSC210 RSC102 XCC0788 RSC004 XCC2769 XCC2767 | 1918 RSP0173 CC1865
193 CC2431
2020 CC0462
M6 CC2126
CC1860
CC1862 | SCO1921 RV1464 SCO1922 RV1464 SCO1922 RV1464 SCO1922 RV1464

 | NAM1379 AGR. C. 3350
NAM12024 AGR. C. 5040
NAM12030 AGR. C. 3210
NAM03308 AGR. C. 33708
AGR. C. 3344
AGR. C. 3346 | AQ_1053 AQ_739 PM0318
AQ_036 PM0319
AQ_896 PM0319
PM1893
PM0882 | CT1995 TM1692 CT0016 TM0097 CT1994 TM1372 TM1371 TM13971 TM1398 TM1417
 | ML1708 XF2179 ML1454 ML0597 XF2331 ML1518 XF1473 ML0596 ML0592 XF1475 ML0595 | HI0378 DR0215 HI0377 HI0899 DR2632 HI1295 HI1343 DR2107 | CJ0240C HP0220
CJ1404 HP1337
CJ0239C(1) HP0221(1) | TP0863 TC0529 CT TP0741 TP0615 TC0802 CT TP0614 TC0869 CT TP0611 TC0857 CT | RC0739 RC0731 RC0729 12 CPN0759 RC0034 67 CPN0689 85 CPN0681
 | RP486 RP487 BU602 BUSG677 BU446 BU5G431 RP485 BU6G3 BU5G678 BU143 BUSG136 | BB0782 YOR226C YPL135W SPAC227.131 YOR236W | | B MAZZIB MAZZIB MAZZIG MM0109 MM1995 7 MAZZIT MAZZIS MM0110 MM1954 S MM1517 PAB0157 7 MAJ4408 MM1987 MM2055 PAB185 | AF0186 AF0564
 | PF0164 MTH1389
PF1287 MTH149 | ISO0925 TA0202 TVG1464820 | MK1437
0 MJ0036 MK1233 | APE2023
ST1201 APE1702 PAE1808 |
| Codectors | VOEL | LIN1523 BH1326 LIN1527 BH0369 BH5 LIN1987 BH3460 LIN2508 BH3460 LIN2508 BH3461 LIN2508 BH3461 LIN2508 LIN2509 BH3471 LIN2508 LIN2509 BH3477 BH5 LIN1077 BH32840 DNAX LIN2205(1) BH0034 BH6 PCRA BH0048 BH5 DNAC BH4020 | 280 BH2X04 MW152 MW1969 L1113 MW166 L1037 MW166 L1037 MW166 L1037 MW1716 L1037 MW1717 L2216 MW1717 L2216 MW1717 L2216 MW1717 L2216 MW1717 L2216 MW17184 WW17184 L1074 MW17184 L1074 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 L221 MW17184 MW17184 MW17184 MW17184 MW17184 L221 MW17184 MW17184 MW17184 L221 MW17184 MW17 | 161 1222 | CPE 143 CPE 1785 SP0880 SP1094 CPE 1775 CPE 1786 SP1097 CPE 1784 SP1097 CPE 1784 SP1097 SP1089 SP1087 SP1089 SP1087 CPE 1207 SP1089 SP1087 CPE 1207 SP1089 SP1087 CPE 1207 SP1089 SP1087 CPE 1207 SP1089 SP1087 CPE 1208 SP1087

 | SPY016 SPY1122 FN0056 SPY016 SPY016 SPY016 SPY018 FN1132 SPY0289 FN0056 SPY0289 SPY0289 SPY0289 SPY0289 SPY0290 SPY1653 FN0346 SPY0287 SPY1287 FN0524 SPY1287 FN0524 SPY1287 FN0524 SPY182 FN1820
 | MYPL_3350(1) MYPL_1740 MYPL_1740 MYPL_1720 MYPL_1720 MYPL_1730 MYPL_4830 MYPL_0480(1) (1) FN0592 MYPL_5800 MYPL_7880 | UU1469(1) MG240(1) UU1453 MG213(1) MG228 UU114 MG213(1) MG228 UU276 UU087(1) MG420(1) UU551 MG244 UU550 MG094 | F10_ORF291(1) STM0646 F10_ORF400 H10_ORF500(1) STM0076 F02_ORF400 STM077 STM1371 STM1371 STM1371 C12_ORF601(1) STM0641 H91_ORF529 H91_ORF715 STM1075 S G07_ORF473 STM4266 | 3 ALL 1467 ALP200 ALP20 | B2590 STV2799 | PA0002 PA3814 VP0215 PA000 YP0200 PA3813 VP0280 STY_359 PA0300 YP0240 PA3607 YP0240 YP0240 YP0240 PA1532 PA3981 VP0144 STY3642 PA298 PA4543 VP0144 PA4931 VP0290
 | 22188 YP02096 TTE (463 TTE2465 TTE0267 TTE0267 TTE0267 TTE0275 TTE0275 TTE0275 TTE0275 TTE0275 TTE0275 TTE0277 | SMC00589 SMC03778 SMC01742 SMC01442 SMC00533 SMC00531 SMC00531 SMC00531 SMC02306 SMC00530 SMC00530 SMC00530 SMC00530 SMC00530 SMC01180 SMC02806 SMC01180 SMC02806 SMC01461 UVRD2 SMC01461 UVRD2 SMC01461 SMC02861 SMC01461 XAC1477 | BMIT1043 MLL8968 ML10909 BMIT10919 BMIT10919 BMIT10919 BMIT10919 MLL4067 BMIT10919 BMIT10919 BMIT10919 BMIT1041 MLR00119 BMIT1042 MLR00119 BMIT1042 MLR00119 BMIT1042 BMIT1042 BMIT1042 BMIT1042 BMIT1042 BMIT1042 BMIT10918 B | R6015 VC0748 SLL0704 VC0749 VC0309 SLR0077 SLR0074 R8600 VC1064 VC2015 SLL1140 VC0371 SLR00371 SLL1140 | RC0397 RSC101 RSC102 R | 199 RB-1973 CU1865 193 CC1341 200 CC1462 1466 CC2126 CC1860 CC1860 CC1862 CC1864 191 RBC1785 CC0267 CC1823 226 RBC1288 RBP1276 CC1528 | SC02979 SC02980 PR2221C
SC01220 R71485
SC01221 R71485
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SC02977 R70872C R7130C
SC02977 SC012977 R70872C R7130C

 | NM81399 AGR.C.,3386 NM81300 AGR.C.,3510 NM80208 AGR.C.,3708 AGR.C.,3344 AGR.C.,3346 AGR.C.,3348 NM80709 AGR.C.,147 AGR.C.,2759 NM80232 NM81447 AGR.C.,3728 AGR.L.,527 NM80885 AGR.C.,306 | AQ_1053 AQ_739 PM0318 AQ_056 PM0319 PM0319 PM0319 PM08319 PM0882 PM0882 PM0882 AQ_1056 PM0364 PM1674 AQ_1056 PM0364 PM1674 PM1059 AQ_1472 PM0411 PM1059 AQ_1472 PM0412 PM1629 PM0412 PM0 | CT1994 TAM1902 CT0916 TAM2907 CT1994 TM1372 TM1371 TM1380 TM1417 TM1380 TM0474 CT1324 CT1606(1) TM0686 TM0771 CT0343 TM1286 CT0205 TM1736 | M.1.708 XF2179 M.1.646 M.0597 XF2231 XF1473 M.0596 XF1476 M.0596 XF1476 M.0593 XF1476 M.0593 XF0076 XF1807 M.0202(1) M.2336 XF0050 XF2680 M.01283 M.0537(1) XF0061 M.12680 | HI0379 DR0215 HI0377 HI0899 DR2632 HI1285 HI1343 DR2107 DR2101 DR2106 DRA0272 HI0465 HI1229 DR2332 DR2410 HI0649 HI1188 DR1775 HI1574 DR0549
 | CJ0240C HP0220 CJ1404 HP1337 CJ0239C(1) HP0221(1) CJ0230C CJ1167 HP0717 CJ0777(1) CJ1101 HP0911(1) HP1478 CJ0562 HP1362 | TP0663 TC0529 CT TP0615 TC0602 CT TP0614 TC0069 CT TP0611 TC0067 CT TP0612 TC0066 CT TP0628 TP0628 TC0469 TC0611 CT TP0620 TC0666 CT TP0620 TC0666 CT | 12 CPN0599 RC0739 12 CPN0759 RC0034 87 CPN0689 65 CPN0689 64 CPN0689 87 CT334 CPN0640 CPN0272 RC0213 RC1336 08 CPN0772 RC0624 97 CPN0616 RC0803 | RP486 RP487 BU602 BU50577 BU46 BU50431 RP485 BU603 BU50578 BU143 BU505136 RP172 RP805 BU354 BU481 BU50342 BU50466 RP447 BU598 BU50574 RP542 BU546 BU50528 | BB0782
 | | | AF0186 AF0565 AF0188 AF0565 PH0882 PH1384 AF2364 PH1385 AF2366 PH1868 AF0321 B0009(2) PH0112 PH0113(2) AF1186(2) AF2066 | PF0164 MTH1389 PF1287 MTH149 PF1286 MTH150 PF1004 MTH2022 MTH24022 MTH241(1) MTH472(1) MTH611 | 1500955 TA0002 TVG1464820
1500957 TA0003 TVG1463274
TA1145 TVG1506977
TA128520354 TA1145 TVG1506977
TVG0548972
TA1000(1) TVG0754205(1)
 | MACC4437 MADD385 MCC4233 MCC4400 (12) MCC4000 (12) MADD84(2) M11422 MCC0005(2) MCC0001(1) (11) | ST1201 APE2023 ST1201 APE1702 PAE1808 ST1200 APE1703 PAL1813 ST1276 APE1273 PAL2900 ST0472(1) ST0472(1) APE1522(1) APE1524(1) PAE0728(2) PAE1646(1) |
| Colactors NAID O15664 pndl, youk DNA metabolism Basic replication machinery O18432 dnaX DNA metabolism Basic replication machinery 018405 vvrO, pcoA | VOEL LMO1488 VURV LMO2412 LMO1488 VURV LMO2412 VURV LMO2413 VURV LMO2413 VURV LMO2414 LMO2414 LMO2414 LMO2416 LMO2 | LIN1523 BH1326 LIN15267 BH0368 BH13460 LIN2506 BH33460 LIN2506 BH33460 LIN2506 BH33461 LIN1507 BH3248 LIN1507 BH3248 DNAX LIN205(1) BH0348 BH3 DNAC BH4029 DNAC BH4029 DNAC BH4029 DNAC BH4029 DNAC BH4029 LIN1516 BH0049 BH3467 LIN1516 BH0049 BH2467 DNAA BH0049 DNAG BH4049 BH3467 DNAG BH4029 DNAG BH4029 DNAG BH4029 DNAG BH4029 DNAG BH4029 DNAG BH4049 BH3467 DNAA BH0049 TOPA BH2467 DNAA BH0049 TOPA BH2467 DNAA BH0001 LIN1516 BH1038 BH4049 HUP BH1309 BH5 | 280 BY12/2 MWY15/2 MWYTS/M | 19 (1.2840) | CPE 13 CPE 1785 SP1898 SP1994 CPE 1775 CPE 1785 SP1898 SP1994 CPE 1785 SP1897 CPE 1785 SP1897 CPE 1785 SP1897 SP1898 SP18

 | SPY016 SPY1122 FN0058 SPY0289 FN1059 SPY0289 FN0059 SPY0289 FN0059 SPY0289 SPY1287 FN0524 SPY1287 FN0524 SPY1284 FN1820 SPY1284 FN1820 SPY1284 FN1820 SPY010 SPY1152(1) FN2125 SPY0281 FN1580 SPY010 SPY1152(1) FN2125 SPY0781 FN159 SPY0781 FN159 SPY0781 FN159 SPY0809 FN1504 SPY0809 FN1504 SPY1830 FN1504 SPY1830 FN1504 SPY1830 FN1504 SPY1830 FN1504 SPY1839 FN1516 SPY1849 FN1516 S | MYPL_3350(1) MYPL_3370 MYPL_1730 MYPL_1730 MYPL_1730 MYPL_4830 MYPL_680(1) MYPL_680 WYPL_780 MYPL_580 MYPL_580 MYPL_580 MYPL_780 | UU1469(1) UU4693 UU114 UU4693 UU114 MG213(1) MG228 UU276 UU097(1) MG420(1) UU501 MG244 UU500 MG094 UU415 MG094 UU415 MG094 UU415 MG094 UU4079 MG001 UU0071 UU0081 UU4084 MG03MG203 UU4084 UU150 MG254 UU150 UU501 MG254 UU1501 UU501 MG254 UU1501 MG254 UU1501 UU501 MG254 UU1501 UU501 MG469 UU328
 | F10_ORF201(1) F10_ORF408 F10 | 3 ALL 1407 ALR2006 ALR3008 DS 15 ALL15083 ALR3008 DS 16 ALL15083 DS 16 ALL15083 DS 16 ALL15083 DS 16 ALL2008 DS 17 ALR2009 DS 18 ALL2009 DS 18 | BZ250 STY2799 BD0599 STY0006 BZ259 STY0068 BD048 STY0102 STY_138 STY_4 BD048 STY1012 STY_124 B1660 B2810 STY1972 STY1244 B1662 STY1722 B0470 B1099 STY0628 STY1240 STY0672 STY068 STY1260 STY1672 STY068 STY126 B062 STY4442 STY4522 B0184 STY0254 STY_287 B3701 STY39941 B2221(1) B8019 STY3496(1) STY3351 B3000 B3699 STY3389 B2411 STY2663 B1724 STY1306 B3702 STY0463 STY0682 STY16 B069 STY4461 STY4506 B0408 STY3775 B0640 STY07775 | PA3082 PA3814 VPC020 PA3813 VPC020 PA3813 VPC020 PA3813 VPC020 PA3827 VPC020 PA3827 VPC020 PA3827 VPC020 PA3827 VPC020 PA3827 VPC020 PA3828 PA3821 VPC020 PA3828 PA3821 VPC020 PA0002 VPC020 PA0002 VPC020 PA0004 PA3824 VPC020 PA3821 VPC020 PA3821 VPC020 PA3821 VPC020 PA3821 VPC020 PA3821 VPC020 PA3822 VPC020 PA | 2018 PCP20996 TFE 663 TFE2465 TTE2019 | SMC01939 SMC019778 SMC019778 SMC01066 SMC01442 SMC01033 SMC00033 SMC00033 SMC00031 SMC00030 SMC00030 SMC01190 SMC02906 SMC01190 SMC02906 SMC01461 LVRD2 SMC01461 LVRD2 SMC01461 LVRD2 SMC01461 LVRD2 SMC01461 SMC01788 SMC011375 SMC037788 XAC1199 XAC149 SMC01231(1) SMC01781 SMC01461 XAC0002 SMC01231(1) SMC01781 SMC01167 SMC01167 SMC01167 SMC01167 SMC01167 SMC011786 SM | BMITIO43 MLL8968 MLL6008 BMIED090 MLL1607 MLL6008 BMIED090 MLL1607 BMIED090 MLL1607 BMIED090 BMIED040 MLR0021 BMIED040 MLR0021 BMIED041 MLR0016 BMIED041 BMIED041 MLR00176 BMIED030 MLR0030 MLR00176 MLR00189 BMIED040 MLR00189 BMIED040 MLR00189 BMIED040 MLR00189 BMIED040 MLR00189 MLR00189 BMIED040 MLR00189 MLR00189 BMIED040 MLR00189 MLR00189 MLR00189 BMIED040 MLR00189 MLR00189 BMIED040 MLR00189 MLR00189 MLR00189 BMIED040 MLR00189 MLR0 | R6915 VC0748 SLL0764 VC0749 VC0399 SLR0777 R6903 VC1064 VC2016 SLL1360 R7946 MLR8166 VC0167 VC0190 VCA0717 SLL1143 VC00371 SLR0933 VC0071 SLR0933 MLR8360 VC1226 SLR0901 VC0013 SLR0964 VC0014 VC1268(1) VC2430 SLL1944 VC0071 VC1730 SLR096 VC0071 SLL1206 VC0071 SLL1206 VC0072 VC1226 VC1222 VC19144 VC0097 SLR0925 VC0073 VC0073 SLR0964 VC0073 VC0073 SLR0965 VC0073 VC0073 SLL0946 VC0073 VC0073 SLL0946 VC0073 VC0073 SLL0946 VC00779 SLL0947 | REC191 XCC2918 XCC2918 XCC2778 XCC2 | 199 R39-1973 C01863 200 C03461 200 C03462 C01860 C0 | SC02919 SC02918 PR2221G SC01920 RV1485 SC01921 RV1485 SC01921 RV1485 SC01921 RV1485 SC01922 RV1483 SC01922 RV1483 SC01922 RV1483 SC01922 RV1483 SC01923 RV1481 SC02917 SC02917 RV2972G RV1330C SC02917 SC02917 RV2972G

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 | AQ_1058 AQ_739 PM0318 AQ_006 AQ_006 AQ_006 PM0319 PM0319 AQ_006 AQ_006 PM0319 PM08319 PM0882 PM0882 PM0882 PM0882 PM0882 PM0882 PM0882 PM0841 PM1893 PM0841 PM1950 AQ_108 PM0334 PM0934 PM160 PM0334 PM160 PM0330 PM0834 AQ_108 PM0834 PM160 PM0330 PM0831 AQ_108 PM08370 PM160 PM0330 PM0831 AQ_108 PM0832 PM1160 AQ_108 PM0832 PM1160 AQ_108 PM0832 PM1161 AQ_108 PM1950 PM08615 AQ_064 PM1950 PM08615 PM08615 AQ_064 PM1950 | CT1986 TM1692 CT0016 TM0097 CT1994 TM1372 TM1371 TM1386 TM1417 TM1386 TM0474 CT1224 CT1606(1) TM0087 CT0043 TM1238 CT0040 TM0974 CT0441 TM0082 CT0040 TM0082 CT0141 TM0082 CT0141 TM0082 CT0141 TM0083 CT1688 TM1622 CT047 TM0083 CT1088 TM083 CT1088 TM0084 CT1087 TM0006 CT1987 TM0006 CT1987 TM0006 CT1987 TM0006 CT1987 TM0006 CT1988 TM0086 CT1187 TM0178 CT1948 | MI. 1708 MI. 164 MI.0597 XF22331 MI. 1518 XF1473 MI.0598 XF1475 MI.0598 XF1476 MI.0596 XF1476 MI.0593 XF1477 MI.0596 MI.0593 XF0076 XF1807 MI.0503 MI.0503 MI.0503 MI.0506 XF0004 MI.1207 MI.0002 XF1323 XF2562(1) MI.0006 XF0005 XF0005 MI.0005 MI.0005 MI.0006 XF0000 MI.0006 XF0000 MI.0006 XF0000 MI.0006 XF0000 MI.0006 XF0000 MI.0006 XF0000 MI.0006 MI.0006 XF0000 MI.0006 | HI0379 DR0215 HI0377 HI0899 DR2632 HI1395 HI1343 DR2107 OR2101 DR2106 DRA0272 HI0465 HI1229 DR2332 DR2410 HI0569 DR2332 DR2410 HI0569 HI1188 DR1775 HI1574 DR0649 HI0739 DR0607 HI0992 DR0001 HI1564 (1) HI1529 DR1913 HI0678 HI1528 DR0016 HI100 DR2069 HI0532 DR0001 HI100 DR2069 HI0993 DR0002 HI0993 DR0002 HI0993 DR0009 HI0430 HI1221 HI1313 DRA0065 HI09339 DR0009 | CJ0230C CJ1464 HP1337 CJ0230C(1) CJ0230C CJ1167 CJ0777(1) CJ1191 HP09717 CJ0777(1) CJ1191 HP0981 (1) HP1478 CJ0562 HP1362 CJ0718 HP1460 CJ0002 HP0500 CJ1027C(1) HP0701(1) CJ0003 HP0501 CJ1638(1) HP0116 CJ0001 HP1529 CJ1071 HP1245 CJ0913C HP0387 | TP0663 TC0692 CT TP0614 TC0669 CT TP0614 TC0669 CT TP0612 TC0666 CT TP0612 TC0666 CT TP0621 TF0628 TC0616 CT TP0621 TF0628 TC0666 CT TP0628 TC0764 TC0698 CT TP0628 TC0764 TC0698 CT TP0669 TC0682 CT TP0669 TC0682 CT TP0600 TC0682 CT TP08001 TC0682 CT TP06001 TC0682 CT TP06001 TC0682 CT TP0200 TC0681 CT TP0200 TC0681 CT
 | RC0739 RC0739 RC0739 RC0729 RC07213 RC1336 RC0729 RC07213 RC1336 RC07272 RC0824 RC0824 RC0824 RC0828 RC1211 RC0883 RC1211 RC0883 RC1211 RC0883 RC1076 CPN0274(1) CPN0716 RC0683 RC1211 RC0309 RC0781 RC0309 RC0781 RC1330 RC1301 RC1306 RC1295 RC0308 | RP486 RP487 BUGG2 BUGG77 BU468 BUGG3 BUGG77 BU468 BUGG3 BUGG77 BU463 BUGG3 BUGG78 BU143 BUGG136 RP172 RP865 BU354 BU481 BUGG342 BUGG468 RP447 BU598 BU56674 RP542 BU566 BU56628 RP778 BU298 BU56233 RP419 BU011 BU5G111 RP267 RP260 BU010 BU5G114(1) RP267 RP260 BU010 BU5G170 RP269 BU056 BU5G053 RP720 BU67 RP260 BU567 RP260 BU567 RP260 BU567 RP270 BU568 BU560527 RP401 BU56827 RP401 BU56828 | BB0782 | VNG2472G MAGBC VNG2471G MAGBC VNG0524G MAGBC VNG0529G VNG0527C MAGBC VNG0529G VNG0527C MAGBC VNG0528G VNG0527C MAGBC VNG0528G VNG052AG(1) VNG128GG(1) MAG18 MA181 VNG28GGG MA236 |
 | AF0188 AF0585 PH0882 PH1394 AF2364 PH1384 AF2365 PH1868 AF0821 B0009(2) PH0112 PH0113(2) AF1196(2) AF2066 AF085 AF0530 PH0822(1) AF1806 | PF0164 MTH1389 PF1287 MTH1149 PF1286 MTH150 PF1380 MTH26023 MTG24(1) MTH272(1) MTG511 PF0494(1) MTH424(1) | 8500958 TA0002 TVG 1464820
8500957 TA0003 TVG 1463274
S500364 TA1146 TVG 1506977
TA0064 TVG 1506977
TA1006(1) S500768(1) S500768(1) TA1285(2) TA1500(1) TVG 1570738(1)
TA1000(1) TVG 754205(1)
TA1064 TVG 533645
TA1065 TVG 533645
TA0063(1) TVG 0517184(1) | MAJOSS MACHATY MAJOSS MACHATY MACHATO MC1400 | ### ST1201 APE1702 PAE1808 ### ST1201 APE1703 PAL1813 ### ST1276 APE1703 PAL273 ### ST0473(1) ST0475(1) APE1522(1) APE1524(1) PAE0734(1) PAE0736(2) ### PAE0734(1) PAE0736(2) PAE184(4) ### ST0473(1) ST0475(1) APE1794(1) PAE2993 |
| Colactors NAIO O15664 profil, youk DNA metabolism Basic replication machinery 018432 dnaX DNA metabolism Basic replication machinery 018606 vvrD, pcoA DNA metabolism Basic replication machinery 02919 dnaE DNA metabolism Basic replication machinery 02919 dnaE DNA metabolism Packaging a segregation 01422 gnyRapard DNA metabolism Packaging a segregation 02927 gryRipard DNA metabolism Basic replication machinery 05723 dnaG DNA metabolism Basic replication machinery 05723 dpackaging a segregation 07227 topA DNA metabolism Basic replication machinery 05723 dnaG DNA metabolism Basic replication machinery 05723 dnaA DNA metabolism Basic replication machinery 05723 ssb. DNA metabolism Basic replication machinery 07233 dnaA DNA metabolism Basic replication machinery 07234 bba DNA metabolism Basic replication machinery 07236 ssb. DNA metabolism Basic replication machinery 074289 piA | NOTE NOTE | LIN1523 | ### MY152 MY | 19 (1286) | CPE104 SP104 CPE104 SP104 CPE104 SP104 CPE107 SP104 CPE004 SP106 CPE004 SP106 CPE004 SP106 CPE006 CPE006 SP106 CPE006 CPE006 SP107 CPE006 CPE006 SP107 CPE006 CPE006 SP107 CPE006 CPE007 CPE007 CPE006 SP107 CPE007 CPE008 SP107 CPE008 CPE009 SP107 CPE008 CPE009 SP107 CPE008 CPE009 SP107 CPE009 SP107 CPE009 SP107 CPE009 SP107 CPE009 SP107 CPE009 SP117 SP117 CPE009 SP117 SP117 CPE009 SP117 SP117 CPE009 SP117 SP

 | SPY016 SPY1122 FN0050 SPY0289 FN0261 SPY0289 FN0261 SPY0289 FN0261 SPY0289 FN0261 SPY0289 SPY0280 SPY1820 SPY1820 SPY1821 FN1282 SPY0390 S | MYPU_3350(1) MYPU_1720 MYPU_1720 MYPU_1720 MYPU_1720 MYPU_1720 MYPU_64830 MYPU_64830 MYPU_64830 MYPU_54830 MYPU_5480 MYPU_7480 MYPU_7480 MYPU_7480 MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_7480(1) MYPU_6480(1) MYPU_6480(1) MYPU_1880(1)
 | UU1469 (1) UU4693 UU114 UU4693 UU114 UU4694 MG336 UU276 UU0776 UU087(1) MG420(1) UU550 MG094 UU415 MG094 UU415 MG096 UU415 MG096 UU416 MG030 MG096 UU419 MG096 UU419 MG096 UU419 MG096 UU499 MG096 UU499 UU599 UU499 UU599 UU499 UU599 UU499 UU599 UU599 UU599 UU599 UU599 UU599 UU599 UU599 UU599 UU399 UU | F10_ORF201(1) F10_ORF408 F10 | 3 | B2530 STY2798 B0539 STY0068 B0539 STY0068 B0549 STY0102 STY_138 STY B048 STY1012 STY_138 STY B1660 B2810 STY1975 STY1244 B1683 STY1722 B0476 B1099 STY0628 STY1240 S062 STY1928 STY4692 STY069 STY268 B4052 STY4442 STY4522 B0164 STY0254 STY_287 B3701 STY3941 B223(1) B3019 STY249(1) STY3351 B3006 STY3389 B2411 STY2663 B1724 STY1336 B3702 STY3840 B4069 STY0395 STY062 STY18 B040 STY0395 STY062 STY16 B040 STY0395 STY062 STY16 B0640 STY07976 B0924(6) STY0696(5) | PA3002 PA3814 VPC0200 PA3813 VPC0200 PA3813 VPC0200 PA3813 VPC0200 PA3827 VPC0200 PA3827 VPC0200 PA3827 VPC0200 PA3827 VPC0200 PA3827 PA3821 VPC0200 PA3828 PA3821 VPC0200 PA3829 PA3821 VPC0200 PA3829 VPC0200 PA3827 VPC0400 | D2189 YPC20996 TF 6663 TFL2465 TTE02097 TTE02097 TTE02097 TTE0209 TTE02097 TTE02097 TTE02097 TTE0209 TTE02097 TTE0273 TTE02097 TTE0209 TTE02097 TTE02097 TTE02097 TTE02097 TTE02093 TTE02097 TTE02093 TTE02097 TTE02093 TTE02097 TTE02097 TTE02097 TTE02097 | SMC02496(1) XAC3818
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 | VNG2472G MAGBC VNG2471G MAGBC VNG0524G MAGBC VNG0529G VNG0527C MAGBC VNG0529G VNG0527C MAGBC VNG0528G VNG0527C MAGBC VNG0528G VNG052AG(1) VNG128GG(1) MAG18 MA181 VNG28GGG MA236 | | AF0188 AF0585 PH0882 PH1394 AF2566 PH1808 AF2565 PH1808 AF0821 AF196(2) AF196(2) AF196(2) AF196(2) AF2066 AF082(1) AF196(2) AF2066 AF0965 AF0530 PH0822(1) AF1966 AF1950 PH1797 AF1950 PH1891 AF1950 | PF0164 MTH1389 PF1287 MTH1149 PF1286 MTH150 PF1380 MTH26023 MTG24(1) MTH272(1) MTH611 PF0494(1) MTH424(1) PF1444(1) PF1442 PF2421 | 8500958 TA0002 TVG 1464820 8500957 TA0003 TVG 1463274 8500364 TA1146 TVG 1306877 TA0003 TVG 1463274 SSO0768(1) SSO0768(1) TA1285(2) TA1500(1) TVG 150738(2) TA1000(1) TVG 2533645 TA1064 TVG 2533645 TA1065 TVG 2533645 TA0063 TVG 25712 TA0063(1) TVG 2571266 TA0063 TVG 2571266 TA0063 TVG 2571266 TA0063 TVG 2571266 TA0063 TVG 2571266 TA0063 TVG 2571266
 | | ### ST1201 APE1702 PAE1808 ### ST1201 APE1703 PAE1813 ### ST1207 APE1703 PAE1813 ### ST0473(1) ST0475(1) APE1522(1) APE1524(1) PAE0734(1) PAE0736(2) ### ST0473(1) ST0475(1) APE1522(1) APE1524(1) PAE0934 ### ST1216(1) APE1784(1) PAE2993 ### ST1216(1) APE1784(1) PAE2993 |
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 | SPY016 SPY1122 | MYPU_5300(1) MYPU_1720 MYPU_1720 MYPU_1720 MYPU_1720 MYPU_6400(1) MYPU_6400 MYPU_5400 MYPU_5400 MYPU_5400 MYPU_5400 MYPU_5400 MYPU_1720 | UU1469(1) UU4693 UU114 UU4643 UU176 UU0876 UU0876 UU087(1) UU087(1) UU0801 U00801 U0 | STM4095 STM0646 A05_ORF982 F10_ORF1818(4) H10_ORF908(2) H10_ORF908(1) STM1015 S B01_ORF1443(3) F10_ORF380 STM0127 S STM0127 S
 | 6 ALL-248 B3 6 ALR-344 ALR7574 B0 4(5) ALR-34128(1) B0 ALR-3399 ALL-3166 5 STNAS-25 STNAS-43 B1 3 ALR-3858 B0 7 STNAS-39 ALL-314 ALR-3653 B0 | | | TTE2693 TTE1398(3) TTE0997(2) D0560 TTE1639 D0564 YPO2603 TTE0905 TTE1646 TTE196 TTE1651(1) TTE196 TTE1905 TTE1643 TTE1917 TTE099 TTE1643 | SMC02496(1) XAC3818 SMC02802 XAC2779 SMC00024 XAC1823 SMC00024 XAC1823 SMC02070 XAC2316 SMC02070 XAC2317(1) SMC01874 SMC04296 XAC0784 SMC01873 SMC01860 XAC0774 SMC01873 XAC0886 XAC0887
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 | NMB0769 AGR.C.147 AGR.C.2759 NMB0232 MMB1447 AGR.C.3725 AGR.L.927 NMB0885 AGR.C.2006 NMB1827 AGR.C.279 AGR.L.3173 NMB1902 AGR.C.920 NMB1902 AGR.C.520 NMB1902 AGR.C.382 NMB1902 AGR.C.383 NMB0921 AGR.C.3833 NMB0922 AGR.C.3932 NMB1537 AGR.C.3938 NMB1603 AGR.C.2398 NMB1903 AGR.C.2389 NMB1903 AGR.C.2789 AGR.C.2789 AGR.C.2789 AGR.C.2780 AGR.C.2780 AGR.C.288 NMB0729 NMB1230 NMB1302 AGR.C.2878 (P.E.22 NMB0739 AGR.C.3810 AGR.C.3810 AGR.C.3139 (NMB07302) AGR.C.3137(1) NMB0730 AGR.C.3130 (NMB07302) AGR.C.3137(1) NMB0421 AGR.C.3784 AGR.L.1286 (NMB042) NMB0421 AGR.C.3786 | | CT1969 CT0295 TM0096 CT1187 TM0178 CT1948 CT1948 CT197 TM1182 CT0136 TM093 CT0479(1) TM0944 TM0978(3) CT1608(2) CT0030 TM0636 CT0030 CT00390 TM0638
 | MIL 1708 | HI0379 DR0215 HI0377 HI0899 DR2832 HI1289 HI1343 DR2107 DR2101 DR2106 DRA0272 HI0465 HI1229 DR2332 DR2410 HI0469 HI1188 DR1775 HI1574 DR0669 HI0739 DR0607 HI0992 DR0001 HI1264(1) HI1529 DR3006 HI0532 DR8001 HI100 DR2069 HI100 DR2069 HI0430 HI1231 DR2066 HI0532 DR0001 HI1368 DR0002 HI0374 HI0993 DR0002 HI0430 HI1281 HI1313 DRA0066 HI0339 DR0004 HI0430 HI1281 HI1313 DRA0066 HI0339 DR0004 HI0339 DR0004 HI0339 DR1244 HI1374(6) DR1861(1) | C.10230C C.11644 HP1337 C.10230C(1) HP0327(11) C.10230C C.1167 HP0717 C.10777(1) C.11101 HP0811(1) HP1478 C.10562 HP1362 C.10781 HP0800 C.10002 HP0800 C.10003 HP0801 C.10003 HP0801 C.10003 HP0801 C.10003 HP0801 C.1003 HP0815 C.1003 HP0815 C.1003 HP0815 C.1003 HP0815 C.1003 HP0815 C.1003 HP0815 C.1004 HP0828 C.10080 HP0835 C.10080 HP0835 C.10080 HP0837 C.10080 HP0879 C.11038 C.11282 HP0879 C.11038 C.11282 HP0879 C.10080 HP0879 C.10080 HP0879 C.10080 HP0878 | TPOMS TOMOS CT TPOMS TOMOS CT TOMOS CT TROST TROST TOMOS CT TROST TROST TOMOS CT TROST TROST TOMOS CT TROST TROST CT TROST TOMOS CT TROST TOM | RC0739 RC0739 RC0739 RC0739 RC0739 RC0739 RC0739 RC0739 RC0034 RC0739 RC0034 RC0034 RC0034 RC0034 RC0034 RC0034 RC0034 RC0034 RC0034 RC00213 RC1336 RC00213 RC1336 RC00213 RC1336 RC00213 RC1336 RC0083 RC07N0772 RC0024 RC0083 RC0083 RC19N0772 RC0083 RC0083 RC1117 RC0087 RC0083 RC0338 RC1330 RC0338 RC1330 RC0338 RC1330 RC0338 RC1396 RC0338 RC0916 RC0238 RC0212 RC0238 RC1296 RC0238 RC0039 RC00378 RC0238 RC1197 RC0039 RC00356 RC1197 RC0039 RC00358 RC1197 | RP486 RP487 BU662 BU56677 BU463 BU56378 BU143 BU56318 RP172 RP865 BU354 BU481 BU56342 BU56466 RP447 BU598 BU56674 RP542 BU546 BU56328 RP778 BU228 BU56233 RP419 BU011 BU56011 RP227 RP806 BU056 BU56053 RP200 BU067 BU56012 RP808 BU056 BU56053 RP720 BU067 RP328 BU564 BU560527 RP498 BU564 BU56072 RP898 BU564 BU56072 RP189 BU465 BU560527 RP189 BU465 BU560527 RP401 BU012 BU56012 RP401 BU012 BU56012 RP406 BU564 BU56227 RP401 BU052 BU564 BU56227 RP401 BU052 BU56053 RP5040(1) BU150 BU56012 RP408 BU465 BU560228 RP401 BU120 BU56012 RP409 BU465 BU560229 RP409 BU465 BU56022 | BB0084 YOR236W BB0084 YOR236W BB0084 YOR236W BB0085 BB0085 WB0087W(1) YJR008W(1) YRL008W(1) YJR008W(1) SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC1687.07 SPAC166.1
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 | | ### ST1201 APE1022 ### ST1201 APE1023 PALEI03 ### ST1201 APE1023 PALEI03 ### ST0473(1) \$T0475(1) APE1522(1) APE1524(1) PALE0736(2) ### ST0473(1) \$T0475(1) APE1522(1) APE1524(1) PALE0736(2) ### ST0473(1) \$T0475(1) APE1524(1) PALE0736(2) ### ST0473(1) APE1524(1) APE1524(1) APE1524(1) PALE0736(2) ### ST0473(1) APE1524(1) APE1524(1) PALE0736(2) ### ST0473(1) APE1524(1) APE1524(1) APE1524(1) PALE0736(2) ### ST0473(1) APE1524(1) APE1524(1) APE1524(1) PALE0736(2) ### ST0473(1) APE1524(1) APE1524(1 |
| Colectors NAD O15664 profil, youk DNA metabolism Basic replication machinery 016432 dnaX DNA metabolism Basic replication machinery 016606 vvrD, pcoA DNA metabolism Basic replication machinery 00878 dnaC DNA metabolism Basic replication machinery 00919 dnaE DNA metabolism Packaging a segregation 01420 gr/NparG DNA metabolism Basic replication machinery 00573 lig DNA metabolism Basic replication machinery 00753 lig DNA metabolism Packaging a segregation 07527 topA DNA metabolism Basic replication machinery 00753 lig DNA metabolism Basic replication machinery 0753 lig DNA metabolism Basic replication machinery 0753 lig DNA metabolism Basic replication machinery 0753 sab DNA metabolism Basic replication machinery 0753 sab DNA metabolism Basic replication machinery 07583 sab DNA metabolism Basic replication machinery 07583 sab DNA metabolism Basic replication machinery 07584 bbs DNA metabolism Basic replication machinery 074280 piA DNA metabolism Basic replication machinery 074280 piG DNA metabolism Basic replication machinery 074480 piG DNA metabolism DNA metabolism 074484 piG | NAME NAME NAME | DNAX LIND205(1) BH0034 BH4 PCRA BH0048 BH4 PCRA BH0048 BH4 DNAE BH3169 DNAE BH3169 DNAE BH3169 DNAE BH00071 BH0006 BH4 GYMR1] PARC BH0006 BH4 GYMR1] PARC BH0006 BH4 DNAG BH1267 BH0049 BH267 DNAA BH1267 DNAA BH0001 BH267 DNAA BH0001 BH1267 DNAA BH0001 BH1337 HUP BH1309 BH4 BH269 BH1337 BH156 | MWV1864 L10746 MWV1864 L0287 MWV1646 L0287 MWV1646 L0287 MWV1646 L0287 MWV0006 MW1742 L0281 MWV1646 L0287 MWV1646 L0287 MWV1646 L0281 MWV1841 L0288 MWV1846 L0284 MWV1846 L0284 MWV1846 L0294 MWV1846 L0294 MWV1846 L0294 MWV1846 L0294 MWV1847 L10284 MWV1848 L10284 MWV184 | 5 CAC1647 CAC3083 5 CAC0869 S31(2) L180259(2) L80459 CAC2080 CAC3184 CAC2080 CAC2077 CACA0544 | SP0335 CPE0739 CPE0783(2) CPE2350 SP1776 CPE0783(1) CPE2440 SP1458 CPE1820 CPE249 SP1271 CPE2121 CPE189 CPE2186

 | SPY1655 SPY1835 FN093 FN1964 SPY1498 FN1327 FN1506 FN1207 FN1206 | MYPU_5300(1) MYPU_1720 MYPU_1720 MYPU_1720 MYPU_6800 MYPU_6800 MYPU_6800 MYPU_7800 MYPU_6800 MYPU_6800 MYPU_6800 MYPU_6800 MYPU_6800 MYPU_6800 MYPU_7800 MYP | UU1469(1) UU463 UU1464 UU1464 UU1976 UU097(1) UU501 UU500 UU415 UU0979 MG004 UU415 UU0979 MG001 MG0023 UU191 MG0023 UU191 MG0023 UU191 MG0024 MG003 UU191 MG003 UU191 MG003 UU191 MG004 MG003 MG012(1) UU306 UU191 MG012(1) UU397(1) MG012(1) MG012(1) UU0974 MG1124 UU0974 MG1124
 | STM4095 STM4095 STM4095 A05_ORF982 F10_ORF1818(4) H10_ORF206(2) H10_ORF206(1) STM1015 S B01_ORF1443(3) F10_ORF380 STM012 S STM012 S STM012 S STM012 S STM327 S STM32 | 5 ALL246 B3 6 ALL246 B3 6 ALR344 ALR7574 B0 4(6) ALR3128(1) B0 ALR31399 ALL3186 B1 5 STM2825 STM4543 B1 7 STM6539 ALL516 ALR0653 B0 7 STM6539 ALL0154 ALR0653 B0 2 STM1836 ALR0718 B0 8 ALL0987 B3 ALL0987 B3 ALL2514 ALL267 ALR0652 ALR2264 ALR0659 B2 9 STM3915 ALL2514 ALL267 ALR0652 ALR2264 ALR0659 B2 8 STM2915 ALL251 ALR267 B3 1 ALR06962 B2 8 ALR06962 B3 8 ALR0696 B3 8 ALR06962 | B2562 B3781 STY2842 STY3639 | PASS40 YPO327 PAG649(1) PA2616(1) YPO327 PAG643 YPO336 PA644 YPO316 PAG644 YPO36 PAG644 YPO36 PAG669(2) PA2616(2) YPO336 PAG669(2) PA2616(2) YPO376 PAG669(2) PA2616(2) YPO376 PAG69 YPO366 PAG69 YPO366 PAG69 YPO366 PAG69 YPO367 | TTE2693 TTE1398(3) TTE1398(3) TTE1398(3) TTE1398(3) TTE0097(2) D05660 TTE1639 D05660 TTE1609 TTE1609 TTE1609 TTE1609 TTE1609 TTE1609 TTE1609 TTE1609 TTE1604 TTE1009 TTE1643 D03666 TTE1019 TTE1043 D0370 VPO3668 TTE1233 D03714(1) TTE1881 TTE2220 D03376 TTE1232 TTE232 D03376 TTE2320 D03376 TTE2320 D03376 TTE2320 D03377 TTE2320 D03377 TTE2320 D03377 TTE2320 D03377 TTE2320 D03377 TTE3230 TTE2320 D03377 TTE3230 TTE2320 D03377 TTE3230 TTE2320 D03377 TTE3230 TTE3381 TTE338 | SMC02486(1) XAC2979 SMC00024 XAC2779 SMC00024 XAC1623 SMC00024 XAC1623 SMC00070 XAC2317(1) SMC00069(1) XAC2317(1) SMC01874 SMC04296 XAC0794 SMC01873 XAC086 XAC0774 SMC01873 XAC086 XAC0774 SMC01873 XAC0867 SMC01873 XAC1878 SMC01875 XAC1878 SMC01875 XAC1878 SMC01875 XAC1878 SMC01875 XAC1886 SMC01876 XAC1878 SMC01876 XAC1878 SMC01876 XAC1886 SMC01876 XAC1886 SMC00880 XAC1878 | BMEIDO215 MLL1568 MLL1 | VC2678 VC2678 SLL0270 VC0963 SLL10544 VC1714(6) SLL1120 SLR1057 MLR6199(1) SLR1057 VC3997 SLL1633 VC2997 SLL1633 VC2989 VC2989 VC2989 VC2989 VC3989 SLR1057 VC3989 VC3989 VC3989 VC3989 VC3989 VC3989 VC3989 VC3989 SLR1054 VC00899 SLR1054 VC00899 SLR1054 VC00769 VC2344 SLR0034 VC0083 SLR2134 VC0083 SLR2134 VC0083 SLR2134 VC0083 SLL1653
 | XCC0730 RSC285 XCC0724 XCC1486 RSC006 XCC0720 RSC285 XCC1720 RSC286 XCC1460 RSC006 XCC3469 RSC006 XCC1460 XCC3777 RSC146 XCC1971(1) RSC234 XCC1971(1) RSC234 XCC1972 RSC166 XCC1972 RSC166 XCC1973 RSC244 XCC1702 RSC166 XCC1703 RSC166 XCC1704 XCC1701 RSC124 XCC1704 XCC1701 RSC124 XCC1705 RSC146 XCC1705 RSC146 XCC1707 RSC124 XCC1707 | 339 CC2540 368 RSC2846 CC1547 CC2552 360 CC2560 400 CC2541 368 CC1543 360 CC1544 360 CC15461 360 CC2871(1) 360 CC1738(1) 360 CC1738(1) 360 CC1738(1) 361 CC2738(1) 362 CC2738(1) 363 CC2738(1) 364 CC1738(1) 365 CC3738 365 CC3738 365 CC3738 | SCO20082 RV2159C SCO2008 SCO2007 SCO3044 SCO5030 RV2163C SCO2008 SCO2007 SCO3044 SCO2010 RV2163C SCO2008 SCO2007 SCO400 RV2163C SCO2008 SCO2007 SCO400 RV2163C SCO2008 SCO2009 SCO400 RV1470 RV1471 RV2914 SCO2008 SCO2009 SCO400 RV1470 RV1471 RV2914 SCO2008 SCO2009 RV2000(2) RV2000

 | NMB0769 AGR_C_147 AGR_C_2759 NMB0232 NMB1447 AGR_C_3725 AGR_L_527 NMB0885 AGR_C_2795 AGR_L_527 NMB01827 AGR_C_2796 AGR_C_1373 NMB1827 AGR_C_520 NMB1902 AGR_C_520 NMB1902 AGR_C_520 NMB1903 AGR_C_3776 NMB01903 AGR_C_3776 NMB1903 AGR_C_3786 NMB1903 AGR_C_288 NMB1903 AGR_C_2789 AGR_C_2789 AGR_C_2789 AGR_C_2789 AGR_C_3786 AGR_C_3831 AGR_C_3831 AGR_C_3831 AGR_C_3766 AGR_C_3776 AGR_C_3776 AGR_C_3776 AGR_C_3786 AGR_C_3831 AGR_C_3831 AGR_C_3776 AG | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_748 PM0533 AQ_1123 PM1608 AQ_916 PM0522 AQ_917 PM1609 AQ_1640 PM05010 AQ_1640 PM05010 AQ_1640 PM1608 AQ_1739 PM1604 AQ_1739 PM1604 AQ_1866 PM1686 | #1732 CT0160 CT0295 TM0266 CT1187 TM0178 CT1948 CT1948 CT1707 TM1182 CT036 TM0693 CT0478(1) TM0693 CT0478(1) TM0694 CT0478(1) TM0576(3) CT1000C TM0576 CT000C TM0575 CT0047 CT0470 TM0595 TM1544 CT0775 CT0647 TM0595 TM1544 CT0775 CT0647 TM0595 TM1544 CT0776 CT047 TM0595 TM1545 CT0377 TM1595 CT0377 TM0595 TM1770 CT047 TM0595 TM1770 CT047 TM0595 CT047 TM0595 CT047 TM0595 CT047 TM0595 CT047 TM0699 CT0482 CT0462 TM0753 TM1444 CT0566(1) CT1206 CT0462 TM0753
 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF0661 ML2277(2) XF193 ML0321 XF249 ML0321 XF249 ML0323 XF1246 ML1581 XF1468(2) ML2703(2) XF255 ML1581 XF146 ML1583 XF2416 ML1583 XF2416 ML1583 XF2416 ML1583 | HI0084 DR0944 DR00164 HI1159(1) DR1982 HI1438 DR0932(2) DR1395 HI0097 DR2504 HI1499 DR4175 HI1499 DR4175 HI0096 DR0230 HI1158(2) HI0086 DR0286 HI0097 DR3164 HI0097 DR3164 HI0097 DR3164 HI0097 DR3164 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ0541(2) CJ1644 HP0825 CJ0541(2) CJ1644 HP0826(2) HP0929 CJ054 HP0524 CJ056 HP0525 CJ056 HP0625 CJ1346C HP0426 CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) | TP0819 TC0826 CT TP0814 TC0375(1) CT TP0883(2) TC0917 CT TP083(21) TC0747 CT TP03271 TC0167 CT TP0824 TC0666 CT | 39 CPN0859 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0748 62 CPN0579 04 31 CPN1010
 | RP666 BU212 BUSG206
RP280 RP411 BU217 BUSG211 | WORDSHY WORD | CL(1) SPAC1488.34C(4) VNG0949C(1) VNG094PC(1) VNG094PC | | AP0188 AP0566 PH0882 PH1394 AP2366 PH1808 AP2366 AP0821 AP1395 AP2366 AP0821 AP150(2) AP150(2) AP150(2) AP306 AP0820 AP0830 AP1806 AP1807 AP1806 AP180 | PF1004 MTH100 PF1286 MTH110 PF1286 MTH150 PF1086 MTH150 PF1081 MTH2021 MTH611 PF0092(2) PF0093 MTG24(1) MTH422(1) MTH611 PF1843(1) PF1842 PF2021 PF1042 MTH624 MTH624 PF102(2) MTH62(2) PF1102(2) MTH60(1) | SCO0085 | 9(1) MJ1643(1) MJ134 2 3 TVG0806423 MJ0370 MJ0622 MK0821 MK0851 MK0188 2 3 TVG113868(2) MJ0800(2) MK0774(2)
 | ### ST1201 |
| Colectors NAD O15664 profil, youk DNA metabolism Basic replication machinery O16605 ovr.D. pool DNA metabolism Basic replication machinery O16605 ovr.D. pool DNA metabolism Basic replication machinery O16205 data DNA metabolism Packaging a segregation O14220 gra/pace DNA metabolism Basic replication machinery O16205 data DNA metabolism Packaging a segregation O1422 gra/pace DNA metabolism Packaging a segregation O1420 gra/pace DNA metabolism Packaging a segregation O1620 gra/pace DNA metabolism Packaging a segregation O1627 gra/pace DNA metabolism Basic replication machinery O2023 data DNA metabolism Basic replication machinery O1723 ig DNA metabolism Basic replication machinery O1723 gra/pace DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1728 leba Replication packing Segregation | NAME NAME NAME | LINTO77 | MAY1864 L10746 MAY1864 L0287 MAY1646 L0281 MAY1646 L0281 MAY1646 L0281 MAY1646 L0281 MAY1133 L0288 MAY1133 L0288 MAY1134 L0288 MAY1646 L0294 MAY164 L0294 MAY164 L1084 MAY164 L1084 MAY164 L1084 MAY164 L1084 MAY164 L0286 MAY165 L0286 MAY165 L0286 MAY164 L0286 MAY165 L0286 MAY165 L0286 MAY166 L0286 MAY1 | 5 CAC1647 CAC3083 5 CAC0869 S31(2) L186258(2) L80456 CAC2080 GAC194 GAC2992 GAC2997 GAC3644 S81(2) CAC1684 GAC3082 GAC197 GAC1985 GAC1985 GAC1985 GAC1985 GAC1985 GAC1985 GAC1985 GAC1985 GAC1847(1) | SP0335 CPE0739 CPE0783(2) CPE2395 SP1776 CPE0733(1) CPE2440 SP1458 CPE1820 CPE249 SP1271 CPE2212 CPE2314 CPE2314 CPE2314 CPE2364 SP1653(2) CPE1682 CPE1684 CPE1685 CPE2685 SP1653(2) SP0415

 | SPY1835 FN0033 SPY1836 FN1003 SPY1898 FN1506 FN1002 FN1788 SPY0850(2) FN1163 FN1787 FN1324 FN1784 FN1543 SPY1788 FN0271
 | (f) | UU1469(1) UU463 UU1464 UU1464 UU1464 UU1976 UU087(1) UU087(1) UU0501 UU079 MG004 UU1415 UU079 MG001 UU0802(1) UU462(1) UU0802(1) UU462(1) UU0901 MG0214(1) MG0224 UU0900 UU0900 UU0900 UU0900 MG0214(1) MG0224 UU0900 UU0900 UU0900 MG0214(1) MG0224 UU0900 MG0224 UU0900 MG0234 UU0900 MG0234 MG0224 UU0900 MG0234 UU0900 MG0234 MG0234 MG0234 UU0900 MG0234 MG0234 UU0900 MG0234 UU0900 MG0234 MG0234 MG0234 MG0234 UU0900 MG0234 MG0234 UU0900 MG0234 MG0234 MG0234 MG0234 MG0234 MG0234 MG0234 UU0900 MG0234 MG0234 MG0234 MG0234 MG0234 MG0234 MG0234 UU0900 MG0234 M | STM00846 AOS_ORF802 F13_ORF1818(4) H10_ORF208(1) F10_ORF300 F10_ORF300 STM0133 STM0127 S STM0127 S STM0128 S STM0374 STM0373 TRX STM0642 S STM0374 STM0376 STM0376 STM0376 STM0377 STM0428 S STM0377 STM0428 S STM0378 STM0970 STM058(2) STM058(2 | 5 ALL248 B3 6 ALR3444 ALR7574 B0 6 ALR3444 ALR7574 B0 6 ALR3494 ALR7574 B0 6 ALR3499 B0 ALS196 B1 7 STM0639 ALL5196 B0 7 STM0639 ALL0164 ALR0653 B0 7 STM0639 ALL0164 ALR0653 B0 8 STM3915 ALR0653 B0 8 STM3915 ALR066 B3 8 STM3916 ALR0718 B0 8 STM3916 ALR0718 B0 8 ALR0737(1) ALR2204(1) B0 10 ALL5167 ALR0602 B1 11 ALR0737(1) ALR2204(1) B0 11 ALR0320 B1 12 ALR0399 B0 13 ALR0399 B0 14 ALR0330 B1 15 ALR0399 B0 16 ALR0399 B0 17 ALR0391 B1 18 ALR091 B1 | B2562 B3781 STY2942 STY3639 B0888(1) STY0956(1) B021 STY0462 B2747 STY3055 B1208 STY1905 B020 STY061 B2746 STY3054 B3746 STY3056 B0173 STY3054 B0173 STY045 B0173 STY045 B0173 STY045 B0173 STY045 B0174 STY3589 | PA6540 YPO327 PA6649(1) PA2616(1) YPO337 PA6043 YPO333 YPO336 PA604 YPO301 PA6044 YPO301 PA6049 PA2616(2) PA2616(2) PA605(2) PA2616(2) YPO327 PA3600 YPO306 PA6503 YPO307 PA6503 YPO307 PA6503 YPO307 PA6503 YPO307 PA6503 YPO307 PA6509 PA6508 PA177 PA151 PA744 PA0746 PA1617 PA151 PA7276 PA2614 PA151 PA7276 PA2614 PA1520 PA2616 PA26179 PA1521 PA7276 PA2614 PA1520 PA2616 PA26179 PA1521 PA7276 PA2614 PA1521 PA7276 PA2614 | TTE2693 TTE1398(3) TTE1398(3) TTE1398(3) TTE0097(2) D0560 TTE1639 D0564 TTE16005 TTE1646 TTE196 D0569 TTE1640 TTE1960 TTE1640 TTE1900 TTE1640 TTE1900 TTE1643 D1574(1) TTE1981 TTE220 D1574(1) TTE1981 TTE222 D1576 TTE1233 D1574(1) TTE1981 TTE222 D1576 TTE1236 D1574(1) TTE1981 TTE222 D1577 TTE1230 D1574(2) D1574(2) D1574(2) D1574(2) D1574(3) TTE1402 D1575(3) D1574(2) D1574(3) TTE1402 D1575(3) D1574(3) D1575(3) D | SMC02486(1) XAC3818 SMC028602 XAC2779 XAC3818 SMC028602 XAC2779 XAC2779 XAC2816 SMC02870 XAC2779 XAC2816 SMC02870 XAC2816 XAC2 | BMEIDO215 BMEIDO246 MLL4071(1) BMEIDO211 MLR4475
 | VC2678 VC2663 SLL0270 VC0663 SLL10644 VC1714(6) SLL1102 SLR1937 MLR6199(1) KR7566 VC2997 SLL1633 VC0669 VC2467 VC2467 VC2467 VC2986 VC2467 VC2467 VC2467 VC2986 VC2467 VC2468 SLR044 VC0668 S | XCC07730 RSC283 XCC07724 XCC34466 RSC066 XCC07720 RSC2846 XCC0729 RSC2846 XCC3729 RSC2846 XCC3470 RSC066 XCC3400 RSC066 XCC180 XCC3777 RSC116 XCC180 XCC3777 RSC116 XCC1971 RSC1244 XCC7720 RSC164 XCC1703 RSC164 XCC1704 RSC121 XCC1705 RSC164 XCC1705 RSC164 XCC1705 RSC164 XCC1706 RSC166 XCC3786 RSC286 XCC386 RSC286 | 1399 CC2540 169 RSC2846 CC1647 CC2562 150 CC2560 150 CC2560 150 CC2561 150 CC2561 150 CC2561 150 CC2561 150 CC2561 150 CC25761 150 CC2871(1) 150 CC2871(1) 150 CC2871(1) 150 CC2750 150 | SC02082 RV2150C SC02085 SC020807 SC020844 SC02080 RV2150C SC02080 RV2163C SC02080 RV2163C SC02080 RV2163C SC02080 SC02080 SC02080 RV2163C SC020810 SC020810 RV2163C SC020810 SC020810 RV2163C SC020810 SC020810 RV2180C(2) R

 | NMB0769 AGR.C.147 AGR.C.2759 NMB0232 MMB1447 AGR.C.3725 AGR.L.927 NMB0885 AGR.C.2079 AGR.L.3173 NMB1827 AGR.C.3290 AGR.L.3173 NMB1902 AGR.C.520 NMB1902 AGR.C.520 NMB1902 AGR.C.184 AGR.C.2778 NMB1903 AGR.C.3333 NMB0666 AGR.C.396 NMB1903 AGR.C.566 NMB1903 AGR.C.566 NMB1903 AGR.C.589 AGR.C.2789 AGR.C.589 AGR.PT.B02 NMB0739 NMB1230 NMB1302 AGR.C.589 AGR.PT.B02 NMB0739 NMB1230 NMB1304 AGR.C.389 AGR.PT.B02 NMB0739 NMB1230 NMB1304 AGR.C.3810(1) NMB0730 AGR.C.3810(1) AGR.C.3137(1) NMB0730 AGR.C.3137(1) AGR.C.3137(1) NMB0451 AGR.C.3130(1) AGR.C.3137(1) NMB0427 AGR.C.330(1) AGR.C.3784 AGR.C.1286(1) NMB0421 AGR.C.330(1) AGR.C.3378(1) NMB0422 AGR.C.3378(1) AGR.C.3870(1) NMB0433 AGR.C.3810(1) AGR.C.3870(1) NMB03131 AGR.C.3810(1) AGR.C.3810(1) NMB1324(1) | AQ_1916 PM0994 AQ_500 PM0673(1) AQ_748 PM0533 AQ_1323 PM1608 AQ_915 PM2026 AQ_881 PM0532 AQ_967 PM1609 AQ_1640 PM0673(2) AQ_1640 PM1988 AQ_1739 PM1666 AQ_1895 PM0346 PM1686
 | #1732 CT0160 CT0285 TM0266 CT1187 TM0178 CT1948 CT1948 CT1948 CT197 TM182 CT0136 TM0693 CT0136 TM0693 CT0476(1) TM0693 CT0476(1) TM0693 CT0476(2) CT0035 CT0290 TM0233 TM0839 CT00476(1) TM0576(3) CT0035 CT0290 TM0233 TM0839 CT00477 TM0576(3) CT0047 TM0576(3) CT0047 TM0576(3) CT0477 CT0477 TM0576 TM1577 CT047 CT0477 CT0477 TM0576 TM1577 CT047 CT0477 TM0576 TM1577 CT047 TM1770 CT0472 TM1770 CT0472 TM1770 CT0472 TM0577 CT0472 TM057 CT047 CT04 | XF2696 ML1818 ML2703(3) XF1448(1) ML2703(1) XF00661 ML227772) XF283 M0.021 XF2845 M0.024 XF2846 M1.038 | HI0084 DR0944 DR00164 HI1158(1) DR1982 HI1438 DR0932(2) DR1395 HI0072 DR2004 HI1590 DR2005 HI159(2) H00086 H0007 DR1508 H0007 DR1508 H10007 DR2164 H0081 DR0932(1) DR2405 | CJ0147C HP0824 HP1458 CJ0140C HP0825 CJ0140C HP0825 CJ0541[2] CJ1644 HP0240[2] HP0929 CJ1607(1) HP1020(1) CJ1104 HP143 CJ0321 HP0354 CJ1607(2) HP1020[2] CJ0686 HP0825 CJ1346C HP0216 CJ0684C HP0400 CJ0541[1] HP0400[1] CJ0324 HP1483 | TP0819 TC0826 CT TP0814 TC0375(1) CT TP0883(2) TC0917 CT TP083(21) TC0747 CT TP03271 TC0167 CT TP0824 TC06668 CT | 39 CPN0859 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0748 62 CPN0579 04 31 CPN1010
 | RP666 BU212 BU5G206 RP280 RP411 BU217 BU5G211 RP967 BU222 BU5G216 RP281 BU213 BU5G207 RP988 RP7987 RP002 BU597 BU5G573 RP445(1) BU314(1) BU5G304(1) BU465 BU5G449 BU460 BU5G46 BU170 BU5G164 BU5G465 BU5G465 BU170 BU5G164 | WORDSHY WORD | CC SPRC12012.07C C SPRC12012.07C VNG0426C VNG0426C VNG048C(1) SPAC1486.0C(1) VNG048C(1) SPAC1486. | | AP0188 AP0666 PH0882 PH1394 | PF1064 PF1287 PF1286 MTH1150 PF1080 MTH4202) MTG44[1) MTH422[1) MTG51 PF0494[1) MTH424[1) PF1422 PF2021 PF1422 PF2021 MTH4024 MTH4024 MTH4024 MTH4024 MTH4024 | \$50085 TA0092 TVG146420 \$50087 TA0093 TVG1464374 \$500867 TA146 TVG1506877 \$5008697 TA146 TVG1506877 \$500869(1) \$5008768(1) TA1285(2) TA1509(1) TVG1570738(1) TA1094 TVG0533645 TA1095 TVG051165 \$500807(1) TA0083(1) TVG0771266 \$500807(1) TA0083(1) TVG06171266 \$500807(1) TA0084 TVG06171266 \$500807(1) TA0084 TVG07729002 \$500808 \$5002232 TA0086 TVG07729002 \$500808 \$5002232 TA0084 TVG07729002 \$500808 \$500808 TA0084 TVG07729002 | (1) MAHSAR(1) MATSAR
STYGORG6423 MARSYO MAGG22 MKG0821 MKG0651 MKG168 STYG1113858(2) MARSO(2) MKG774(2) | ST2123 ST5171 APE2430 ST0438 ST0546 APE1061 PAE1726 PAE2744 ST2056(2) APE1764(2) PAE1013(2) |
| Colectors NAD O15664 profil, youk DNA metabolism Basic replication machinery O16605 ovr.D. pool DNA metabolism Basic replication machinery O16605 ovr.D. pool DNA metabolism Basic replication machinery O16205 data DNA metabolism Packaging a segregation O14220 gra/pace DNA metabolism Basic replication machinery O16205 data DNA metabolism Packaging a segregation O1422 gra/pace DNA metabolism Packaging a segregation O1420 gra/pace DNA metabolism Packaging a segregation O1620 gra/pace DNA metabolism Packaging a segregation O1627 gra/pace DNA metabolism Basic replication machinery O2023 data DNA metabolism Basic replication machinery O1723 ig DNA metabolism Basic replication machinery O1723 gra/pace DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1724 leba DNA metabolism Basic replication machinery O1728 leba Replication packing Segregation | NAME | LINTO77 | MWY1864 L10746 | 19 CAC1947 CAC3083 3 CAC1947 CAC3083 3 CAC0889 3 CAC0889 5 CAC2080 5 CAC2082 5 CAC2087 5 CAC394 6 CAC2087 6 CAC397 7 CAC0844 6 CAC3082 6 CAC1987 6 CAC1987 6 CAC1987 6 CAC2072 7 CAC1988 6 CAC2072 7 CAC2072 7 CAC1988 6 CAC2072 7 CAC2072 7 CAC2073 7 | SP0335 CPE0739 CPE073(2) CPE2395 SP1776 CPE0731(1) CPE2440 SP1458 SP1458 SP1458 SP1271 CPE249 SP1271 CPE2316 CPE2316 CPE2316 CPE2316 CPE2364 SP1553(2) CPE1682 CPE1684 CPE1085 CPE2741(2) SP0415 CPE0741(2) CPE0741(2) SP0489 CPE184 SP1222 CPE1696 CPE2363 SP04881 CPE2364 CPE2364 CPE2364 SP1553(2) CPE664 CPE0741(2) SP0415 CPE0741(2) CPE0741(2) CPE0741(2) CPE1864 CPE1866 SP0282 CPE1867 CPE2868 SP0282 CPE1867 CPE2868 SP0282 CPE3868 SP0

 | SPY1835 FN0033 SPY1836 FN1003 SPY1898 FN1506 FN1002 FN1788 SPY0850(2) FN1163 FN1787 FN1324 FN1784 FN1543 SPY1788 FN0271 | (f)
 | UU519 MG124 UU600 UU511 MG437 UU364 MG114 | ### ADS. ORF327 ### ADS. ORF328 ### ADS. ORF327 ### AD | 5 ALL246 B3 6 ALL246 B3 6 ALC3444 ALR7574 B0 6 ALC3444 ALR7574 B0 6 ALC3444 ALR7574 B0 6 ALC3464 ALR7574 B0 6 ALC3466 B1 7 STM2025 STM4443 B1 7 STM2025 STM4443 B1 8 STM2025 STM2025 B1 8 STM2025 STM2026 B1 8 STM2025 B1 8 STM2025 STM2026 B1 8 STM2025 B1 8 STM2025 B1 8 STM2025 STM2026 B1 8 STM2025 B1 8 STM2025 B1 8 STM2025 B1 8 STM2026 B1 8 STM2026 B1 8 STM2027 STM2026 B1 8 STM2027 STM2026 B1 8 STM2026 B1 8 STM2027 STM2026 B1 8 STM2027 STM2026 B1 8 STM2026 B1 8 STM2027 | BJ056 B3781 STY2842 STY3839 | PA0540 YPO327 PA0640(1) PA2616(1) YPO327 PA0640(1) PA2616(1) YPO337 PA3533 YPO336 PA0640(2) PA2616(2) YPO337 PA3536 YPO366 PA3500 YPO367 PA3500 PA350 PA360 YPO367 PA3500 PA350 PA360 YPO367 PA3500 PA350 PA360 YPO367 PA3500 PA350 PA360 YPO360 PA3500 YPO360 PA3500 YPO360 PA3500 PA360 YPO360 PA3500 PA360 YPO360 PA3600 YP | TTE2693 TTE1398(3) TTE1398(3) TTE1398(3) TTE1398(3) TTE0097(2) D0560 TTE1607 TTE1609 TTE1605 TTE1605 TTE1605 TTE1605 TTE1605 TTE1607 TTE1008 TTE1607 TTE1009 TTE1604 TTE1009 TTE1604 TTE1009 TTE1604 TTE1009 TTE1604 TTE1208 D1377(1) TTE1801 TTE220 D1377(1) TTE1208 D1377(1) TTE1402 D1477 TTE1208 D1577(1) TTE1008 TTE2403(1) D1600 YPO2816 TTE2403 TTE1608 D1600 YPO2816 TTE1608 TTE1608 TTE171 TTE1008 TTE171 TTE1008 TTE171 TTE008 TTE171 TTE008 TTE171 TTE008 TTE171 TTE008 TTE172 | SMC02969(1) XAC2779 SMC00024 XAC2779 SMC00024 XAC1929 SMC00024 XAC1929 SMC0002970 XAC2317(1) SMC020970 XAC2317(1) SMC020970 XAC2317(1) SMC020970 XAC2317(1) SMC020971 XAC2317(1) SMC01874 SMC04296 XAC0774 SMC01873 XAC0860 XAC0774 SMC01884 XAC2782 SMC01040(1) XAC1272 SMC01884 XAC2782 SMC01040(1) XAC1721 SMC00886 XAC0789 SMC01040(2) XAC1860 SMC01155 XAC1960 SMC01155 XAC0862 SMC01155 XAC1960 SMC01155 XAC | BMEIDO216 BMEIDO246 MLL10071(1) BMEIDO211 MLR7927 BMEIDO216 MLL1008 MLL1008(1) MLL1008 | VC2678 SLL0270
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 | HI0084 DR0944 DR00164 HI1158(1) DR1982 HI1438 DR0932(2) DR1395 HI0072 DR2004 HI1590 DR2005 HI159(2) H00086 H0007 DR1508 H0007 DR1508 H10007 DR2164 H0081 DR0932(1) DR2405 | CJ0147C HP0824 HP1458 CJ0140C HP0825 CJ0140C HP0825 CJ0541[2] CJ1644 HP0240[2] HP0929 CJ1607(1) HP1020(1) CJ1104 HP143 CJ0321 HP0354 CJ1607(2) HP1020[2] CJ0686 HP0825 CJ1346C HP0216 CJ0684C HP0400 CJ0541[1] HP0400[1] CJ0324 HP1483 | TP0819 TC0826 CT TP0814 TC0375(1) CT TP0883(2) TC0917 CT TP083(21) TC0747 CT TP03271 TC0167 CT TP0824 TC06668 CT | 39 CPN0859 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0748 62 CPN0579 04 31 CPN1010 | RP666 BU212 BU5G206 RP280 RP411 BU217 BU5G211 RP967 BU222 BU5G216 RP281 BU213 BU5G207 RP988 RP7987 RP002 BU597 BU5G573 RP445(1) BU314(1) BU5G304(1) BU465 BU5G449 BU460 BU5G46 BU170 BU5G164 BU5G465 BU5G465 BU170 BU5G164
 | WORDSHY WORD | CC1) SPAC1486.04C(4) CC1) SPAC1486.04C(4) CC2 SPRC181.14C(1) CC2 SPRC181.14C(1) CC3 SPRC181.06C(4) CC4 VNG0889G VNG089G(1) VNG0849G(1) VNG0849G(| 7 MAZTT MADDES MADDIS MADDIS PABOSE P | ### APOBBA PHI394 APOBBA APO | PF1064 PF1287 PF1286 MTH1150 PF1080 MTH4202) MTG44[1) MTH422[1) MTG51 PF0494[1) MTH424[1) PF1422 PF2021 PF1422 PF2021 MTH4024 MTH4024 MTH4024 MTH4024 MTH4024 | \$502241(4) TA0787(1) TV00831148(1) TA0796 TV00813191 TA0996 TV00615712 TA0972 TA0508 TV00027936 1 TA0772 TA0508 TV00027936 1 TA0436(2) TA1313 TV00278764 1 \$500861(2) TA0436(2) TA1313 TV00278764 1 \$500222(2) \$500861(1) TA0436(1) TVG1083723 | (1) MAHSAR(1) MATSAR STYGORG6423 MARSYO MAGG22 MKG0821 MKG0651 MKG168 STYG1113858(2) MARSO(2) MKG774(2) | ST2123 ST5171 APE2430 ST0438 ST0546 APE1061 PAE1726 PAE2744 ST2056(2) APE1764(2) PAE1013(2) |
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 | SPY1835 FN0033 SPY1836 FN1003 SPY1898 FN1506 FN1002 FN1788 SPY0850(2) FN1163 FN1787 FN1324 FN1784 FN1543 SPY1788 FN0271 | FN1020 FN2087 FN1226 MYPJ_4740 MYPJ_1680 (1)
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 | NMB0769 | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_501 PM0573 AQ_1915 PM2035 AQ_1915 PM2036 AQ_1915 PM2036 AQ_897 PM1600 AQ_1640 PM2010 AQ_1640 PM2010 AQ_1640 PM2010 AQ_1640 PM3010 AQ_1777 PM0142 AQ_1777 PM0142 AQ_1777 PM1917 AQ_1776 PM1916 PM00186 PM20266 PM20266 PM2026 300 AQ_1882 PM1915 PM1915 PM0186 PM1612 | #1732 CT0160 CT0295 TM0206 CT1187 TM0178 CT1948 CT1948 CT1948 CT1707 TM1182 CT036 TM0693 CT0478(1) TM0694 CT036 TM0693 CT0478(1) TM0694 CT0030 TM0233 TM0639 CT0040(1) TM0597 CT0040(1) TM0597 CT0047 CT1470 TM0698 TM1544 CT0647 CT1470 TM0698 CT0026 TM0241 TM0597 CT0047 CT1470 TM0698 CT0256(2) TM071 TM0597 CT047 TM1333 CT1047 CT047 TM1333 TM0699 CT0256(2) TM071 TM0597 CT047 TM1333 TM0699 CT047 TM1333 TM0699 CT047 TM0699 CT047 TM0699 CT047 TM0699 CT048 TM179 CT048 TM0699 CT048 TM179 CT048 TM0699 CT049 TM069 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF9681 ML2707(1) XF9681 ML2021 XF3246 ML024 XF2465 ML024 XF2246 ML1038 XF1291 ML032 XF2257 ML1581 XF146 ML583 XF246 ML938 XF246 ML938 XF1497 ML277(1) XF1487 ML201 XF2460 ML200 ML2412 ML240 ML200 XF2460 ML150 XF2460 ML200 | HI0084 DR0944 DRA0164 HI156(1) DR1982 HI4439 DR0932(2) DR1305 HI4439 DR0932(2) DR1305 HI4500 DR2006 HI4439 DR4475 HI0097 DR1508 HI0097 DR1508 HI0097 DR2164 HI0098 DR092(1) DR2264 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2266 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR2266 HI0099 DR2266 HI0099 DR0928 HI0154 DR1942 HI138 DR0928 HI0154 DR1942 HI139 DR0927 HI13 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0825 CJ1607(1) HP1626 CJ1607(2) HP1020(2) CJ0621 HP0826 CJ1067(2) HP0826 CJ1346C HP0216 CJ084(1) HP0826 CJ1346C HP0246 CJ084(1) HP08278 CJ0541(1) HP08278 CJ0541(1) HP08278 CJ1067 HP1483 DR1151 CJ1013C HP08378 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0868 CJ1067 HP0868 CJ1067 HP0868 CJ1068 HP0868 CJ068 HP1888 CJ06 | TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TT084 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC03 | 39 CPN0859 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0718 60 CPN0879 31 CPN1000 33 CPN0801 34 CPN0877 67 CPN0373 77 CPN0373 77 CPN0373 78 RC0724 80 CPN1017 28 CPN0815 RC0372 RC0744 81 CPN0815 RC0075 RC0374 RC1080 RC0544 81 CPN0817 RC0088 RC0374 RC1080 RC0544 81 CPN0888 RC0322 RC0883 31 CPN0888 RC0382 82 CPN081 RC0333 82 CPN0898 RC0311 83 CPN0898 RC0333 84 CPN0898 RC0331 85 CPN0898 RC0331 85 CPN0898 RC0311 86 CPN0898 RC0331 87 CPN0898 RC0331 87 CPN0898 RC0311 88 CPN0898 RC0311 89 CPN0898 RC0311 80 CPN0898 RC0313 80 CPN0897 RC1116 | RP666 BU212 BU50206 RP280 RP411 BU217 BU50211 RP677 BU222 BU50216 RP788 RP788 BU213 BU50207 RP446(1) BU314(1) BU50304(1) RP446(1) BU314(1) BU50304(1) BU468 BU400 BU50406 BU170 BU50164 BU444 BU50446 BU440 BU50406 BU170 BU50164 BU441 BU50446 BU441 BU50446 BU442 BU50448 BU449 BU50406 BU170 BU50106 BU170 BU50106 BU170 BU50106 BU50106 BU419 BU50106 BU50106 BU419 BU50106 BU50106 BU50106 BP279 BU50106 BP2010 BU502338 BP2020 BU50243 BP203 BU50241 BP203 BU50241 BP203 BU50243 BP206 BU502338 BP206 BU502433 BP206 BU502433 BU5024(1) BU502433
 | BB0084 YORZ36W SPAC227.33 BB0084 YORZ36W SPAC227.33 BB0085 SPAC364(1) YORZ36W SPAC227.33 BB0085 SPAC364(1) YORZ36W(1) YORZ36W(1) SPAC3627E.14 BB0086 SPAC37 YAL088W(1) YORZ36W(1) SPAC37E.15 BB0086 SPAC37 YAL088W(1) YORZ36W(1) SPAC37E.16 BB0086 SPAC37 YAL088W(1) YORZ36W(1) SPAC37E.16 BB0087 YORZ36W YAL088W(1) YORZ36W(1) SPAC37E.16 BB0087 YAL088W(1) YORZ36W(1) YOR | CC(1) SPAC1486.04C(4) | MANDESS | ### APO188 APO666 PH0882 PH1394 | PF1027 MTH024 PF108 MTH150 PF108 MTH150 PF108 MTH150 PF108 MTH2021 MTG41(1) MTH422(1) MTG511 PF0694(1) MTH624(1) PF1843(1) PF1842 PF2021 PF1842 PF2021 MTH024 MTH024 MTH024 MTH024 MTH024 MTH024 MTH024 MTH0023 | \$502241(4) TA0787(1) TV00831148(1) TA0796 TV00813191 TA0996 TV00615712 TA0972 TA0508 TV00027936 1 TA0772 TA0508 TV00027936 1 TA0436(2) TA1313 TV00278764 1 \$500861(2) TA0436(2) TA1313 TV00278764 1 \$500222(2) \$500861(1) TA0436(1) TVG1083723 | (1) MAHSAR(1) MATSAR STYGORG6423 MARSYO MAGG22 MKG0821 MKG0651 MKG168 STYG1113858(2) MARSO(2) MKG774(2)
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 | NMB0769 | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_501 PM0573 AQ_1915 PM2035 AQ_1915 PM2036 AQ_1915 PM2036 AQ_897 PM1600 AQ_1640 PM2010 AQ_1640 PM2010 AQ_1640 PM2010 AQ_1640 PM3010 AQ_1777 PM0142 AQ_1777 PM0142 AQ_1777 PM1917 AQ_1776 PM1916 PM00186 PM20266 PM20266 PM2026 300 AQ_1882 PM1915 PM1915 PM0186 PM1612 | #1732 CT0160 CT0295 TM0206 CT1187 TM0178 CT1948 CT1948 CT1948 CT1707 TM1182 CT036 TM0693 CT0478(1) TM0694 CT036 TM0693 CT0478(1) TM0694 CT0030 TM0233 TM0639 CT0040(1) TM0597 CT0040(1) TM0597 CT0047 CT1470 TM0698 TM1544 CT0647 CT1470 TM0698 CT0026 TM0241 TM0597 CT0047 CT1470 TM0698 CT0256(2) TM071 TM0597 CT047 TM1333 CT1047 CT047 TM1333 TM0699 CT0256(2) TM071 TM0597 CT047 TM1333 TM0699 CT047 TM1333 TM0699 CT047 TM0699 CT047 TM0699 CT047 TM0699 CT048 TM179 CT048 TM0699 CT048 TM179 CT048 TM0699 CT049 TM069 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF9681 ML2707(1) XF9681 ML2021 XF3246 ML024 XF2465 ML024 XF2246 ML1038 XF1291 ML032 XF2257 ML1581 XF146 ML583 XF246 ML938 XF246 ML938 XF1497 ML277(1) XF1487 ML201 XF2460 ML200 ML2412 ML240 ML200 XF2460 ML150 XF2460 ML200 | HI0084 DR0944 DRA0164 HI156(1) DR1982 HI4439 DR0932(2) DR1305 HI4439 DR0932(2) DR1305 HI4500 DR2006 HI4439 DR4475 HI0097 DR1508 HI0097 DR1508 HI0097 DR2164 HI0098 DR092(1) DR2264 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2266 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR2266 HI0099 DR2266 HI0099 DR0928 HI0154 DR1942 HI138 DR0928 HI0154 DR1942 HI139 DR0927 HI13 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0825 CJ1607(1) HP1626 CJ1607(2) HP1020(2) CJ0621 HP0826 CJ1067(2) HP0826 CJ1346C HP0216 CJ084(1) HP0826 CJ1346C HP0246 CJ084(1) HP08278 CJ0541(1) HP08278 CJ0541(1) HP08278 CJ1067 HP1483 DR1151 CJ1013C HP08378 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0868 CJ1067 HP0868 CJ1067 HP0868 CJ1068 HP0868 CJ068 HP1888 CJ06 | TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TT084 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC03 | 39 CPN0859 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0718 60 CPN0879 31 CPN1000 33 CPN0801 34 CPN0877 67 CPN0373 77 CPN0373 77 CPN0373 78 RC0724 80 CPN1017 28 CPN0815 RC0372 RC0744 81 CPN0815 RC0075 RC0372 RC0544 81 CPN0817 RC0088 81 CPN0817 RC0088 81 CPN0818 RC0372 81 CPN0818 RC0372 81 CPN0888 RC0372 82 CPN0818 RC0372 83 CPN0888 RC0372 84 CPN0888 RC0372 85 CPN0888 RC0372 86 CPN0888 RC0372 86 CPN0888 RC0372 87 CPN0888 RC0372 87 CPN0888 RC0372 88 CPN0888 RC0377 89 CPN0888 RC0377 80 CPN0888 RC0378 80 CPN0888 RC0378 80 CPN0888 RC04180 80 CPN | RP666 BU212 BU5G206 RP280 RP411 BU217 BU5G211 RP967 BU222 BU5G216 RP281 BU213 BU5G207 RP988 RP7987 RP002 BU597 BU5G573 RP445(1) BU314(1) BU5G304(1) BU465 BU5G449 BU460 BU5G46 BU170 BU5G164 BU5G465 BU5G465 BU170 BU5G164 | BB0084 YORZ36W SPAC227.33 BB0084 YORZ36W SPAC227.33 BB0085 SPAC364(1) YORZ36W SPAC227.33 BB0085 SPAC364(1) YORZ36W(1) YORZ36W(1)
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 | NMB0769 | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_1916 PM0533 PM1608 AQ_1915 PM0624 AQ_1916 PM06252 AQ_891 PM1608 AQ_891 PM1608 AQ_891 PM1608 AQ_1040 PM0070 AQ_404 PM1998 AQ_1799 PM1604 AQ_1799 PM1604 AQ_1799 PM1606 AQ_162 PM0071 AQ_162 PM0054 AQ_2082 AQ_2164 AQ_868 PM1608 PM1608 AQ_2082 AQ_2164 AQ_868 PM1608 AQ_2082 AQ_1164 PM0164 AQ_1717 PM0164 AQ_1717 PM0164 AQ_1717 PM0164 AQ_1717 PM0164 AQ_1717 PM0165 AQ_1718 PM0168 AQ_1718 PM0168 PM1691 AQ_1718 PM0169 PM0169 AQ_1718 PM0169 PM0169 AQ_1718 PM0169 PM0169 AQ_166 PM0173(1) AQ_566 PM0173 | #1732 CT0160 CT0295 TM0206 CT1187 TM0178 CT1948 CT1948 CT1948 CT1707 TM1182 CT036 TM0693 CT0478(1) TM0694 CT036 TM0693 CT0478(1) TM0694 CT0030 TM0233 TM0639 CT0040(1) TM0597 CT0040(1) TM0597 CT0047 CT1470 TM0698 TM1544 CT0647 CT1470 TM0698 CT0026 TM0241 TM0597 CT0047 CT1470 TM0698 CT0256(2) TM071 TM0597 CT047 TM1333 CT1047 CT047 TM1333 TM0699 CT0256(2) TM071 TM0597 CT047 TM1333 TM0699 CT047 TM1333 TM0699 CT047 TM0699 CT047 TM0699 CT047 TM0699 CT048 TM179 CT048 TM0699 CT048 TM179 CT048 TM0699 CT049 TM069 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF9681 ML2707(1) XF9681 ML2021 XF3246 ML024 XF2465 ML024 XF2246 ML1038 XF1291 ML032 XF2257 ML1581 XF146 ML583 XF246 ML938 XF246 ML938 XF1497 ML277(1) XF1487 ML201 XF2460 ML200 ML2412 ML240 ML200 XF2460 ML150 XF2460 ML200 | HI0084 DR0944 DRA0164 HI156(1) DR1982 HI4439 DR0932(2) DR1305 HI4439 DR0932(2) DR1305 HI4500 DR2006 HI4439 DR4475 HI0097 DR1508 HI0097 DR1508 HI0097 DR2164 HI0098 DR092(1) DR2264 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2266 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR2266 HI0099 DR2266 HI0099 DR0928 HI0154 DR1942 HI138 DR0928 HI0154 DR1942 HI139 DR0927 HI13 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0825 CJ1607(1) HP1626 CJ1607(2) HP1020(2) CJ0621 HP0826 CJ1067(2) HP0826 CJ1346C HP0216 CJ084(1) HP0826 CJ1346C HP0246 CJ084(1) HP08278 CJ0541(1) HP08278 CJ0541(1) HP08278 CJ1067 HP1483 DR1151 CJ1013C HP08378 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0868 CJ1067 HP0868 CJ1067 HP0868 CJ1068 HP0868 CJ068 HP1888 CJ06 | TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TT084 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC03 | 399 CPN0659 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0579 04 CPN0579 04 CPN0579 05 CPN0577 99(2) CPN0314(2) RC0618(2) RC06 77 CPN0373 771 CPN0365 06 CPN1017 28 CPN0515 RC01337 28 CPN0515 RC01337 RC1080 RC0544 61 CPN0667 RC0058 61 CPN0671 RC068(1) 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0688 RC0332 62 CPN0571 RC0883 63 CPN0571 RC0883 64 CPN058 RC0185 65 CPN0687 RC0331 66 CPN0688 RC0332 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC081183 68 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 60 CPN0689 RC0911 61 CPN0686(1) 62 CPN0687 RC01186 63 CPN0687 RC01186 64 CPN1087 RC0189 65 CPN0687 RC0128 66 CPN0687 RC0128 67 CPN0687 RC0128 68 CPN0687 RC01186 69 CPN0687 RC01186 60 CPN0687 RC0128 60 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128
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 | NMB0769 | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_1916 PM0533 AQ_1915 PM0608 AQ_915 PM0608 AQ_915 PM0608 AQ_916 PM0608 AQ_916 PM06073(2) AQ_1640 PM0601 AQ_1640 PM0601 AQ_1640 PM0601 AQ_1640 PM1606 AQ_1799 PM1664 AQ_1799 PM1664 AQ_1799 PM1664 AQ_1799 PM1668 AQ_162 PM0610 AQ_162 PM0610 AQ_1640 PM06054 AQ_2082 AQ_2164 AQ_868 PM1606 PM1606 AQ_2076(1) PM01610 AQ_1117 PM0161 AQ_1117 PM0161 AQ_1117 PM0161 AQ_1717 PM0161 AQ_166 PM0761 AQ_166 PM0761 AQ_666 PM0761 AQ_666 PM0761 AQ_166 PM0766 AQ_166 PM0761 AQ_166 PM0676 AQ_1661 PM0761 AQ_166 PM0676 AQ_1661 PM06761 AQ_1661 PM06761 AQ_1662 PM06761 AQ_1663 PM06761 AQ_1664 PM06761 AQ_1665 PM06761 AQ_1665 PM06761 AQ_1666 PM06761 AQ_1666 PM06761 AQ_1666 PM06761 AQ_1667 PM06761 AQ_1667 PM06761 AQ_1668 PM06761 A | #1732 CT0160 CT0295 TM0206 CT1187 TM0178 CT1948 CT1948 CT1948 CT1707 TM1182 CT036 TM0693 CT0478(1) TM0694 CT036 TM0693 CT0478(1) TM0694 CT0030 TM0233 TM0639 CT0040(1) TM0597 CT0040(1) TM0597 CT0047 CT1470 TM0698 TM1544 CT0647 CT1470 TM0698 CT0026 TM0241 TM0597 CT0047 CT1470 TM0698 CT0256(2) TM071 TM0597 CT047 TM1333 CT1047 CT047 TM1333 TM0699 CT0256(2) TM071 TM0597 CT047 TM1333 TM0699 CT047 TM1333 TM0699 CT047 TM0699 CT047 TM0699 CT047 TM0699 CT048 TM179 CT048 TM0699 CT048 TM179 CT048 TM0699 CT049 TM069 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF9681 ML2707(1) XF9681 ML2021 XF3246 ML024 XF2465 ML024 XF2246 ML1038 XF1291 ML032 XF2257 ML1581 XF146 ML583 XF246 ML938 XF246 ML938 XF1497 ML277(1) XF1487 ML201 XF2460 ML200 ML2412 ML240 ML200 XF2460 ML150 XF2460 ML200 | HI0084 DR0944 DRA0164 HI156(1) DR1982 HI4439 DR0932(2) DR1305 HI4439 DR0932(2) DR1305 HI4500 DR2006 HI4439 DR4475 HI0097 DR1508 HI0097 DR1508 HI0097 DR2164 HI0098 DR092(1) DR2264 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2265 HI0098 DR092(1) DR2266 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR1508 HI0099 DR2266 HI0099 DR2266 HI0099 DR0928 HI0154 DR1942 HI138 DR0928 HI0154 DR1942 HI139 DR0927 HI13 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0825 CJ1607(1) HP1626 CJ1607(2) HP1020(2) CJ0621 HP0826 CJ1067(2) HP0826 CJ1346C HP0216 CJ084(1) HP0826 CJ1346C HP0246
CJ084(1) HP08278 CJ0541(1) HP08278 CJ0541(1) HP08278 CJ1067 HP1483 DR1151 CJ1013C HP08378 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0866 CJ1067 HP0868 CJ1067 HP0868 CJ1067 HP0868 CJ1068 HP0868 CJ068 HP1888 CJ06 | TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TT084 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC03 | 399 CPN0659 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0579 04 CPN0579 04 CPN0579 05 CPN0577 99(2) CPN0314(2) RC0618(2) RC06 77 CPN0373 771 CPN0365 06 CPN1017 28 CPN0515 RC01337 28 CPN0515 RC01337 RC1080 RC0544 61 CPN0667 RC0058 61 CPN0671 RC068(1) 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0688 RC0332 62 CPN0571 RC0883 63 CPN0571 RC0883 64 CPN058 RC0185 65 CPN0687 RC0331 66 CPN0688 RC0332 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC081183 68 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 60 CPN0689 RC0911 61 CPN0686(1) 62 CPN0687 RC01186 63 CPN0687 RC01186 64 CPN1087 RC0189 65 CPN0687 RC0128 66 CPN0687 RC0128 67 CPN0687 RC0128 68 CPN0687 RC01186 69 CPN0687 RC01186 60 CPN0687 RC0128 60 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 | RP466 8U212 8U5G206 RP260 RP411 8U217 8U5G211 RP567 8U222 8U5G216 RP768 RP781 8U213 8U5G207 RP468 8U431 8U5G207 RP446(1) 8U314(1) 8U5G304(1) RP446(1) 8U314(1) 8U5G304(1) RP446(2) RP514(2) 8U314(2) 8U5G304(2) 8U3170 8U5G207 RP419 8U5G207 RP420 8U319 8U5G207 RP420 8U319 8U5G207 RP793 8U327 8U5G207 RP794 8U308 8U5G208 RP793 8U308 8U5G208 RP427 8U308 8U5G208 RP428 8U408 8U5G208 RP429 8U408 8U5G208 RP429 8U408 8U5G208 RP420 8U216 RP20 8U221 RP906 8U220 RP720 8U351 RP507 8U221 RP908 8U352 RP508 8U220 RP721 8U351 RP722 8U351 RP723 8U216 RP908 8U220 RP729 8U351 RP720 8U351 RP721 8U351 RP723 8U361 RP723 8U361 RP726 8U221 RP908 8U220 RP727 8U351 RP728 8U351 RP729 8U351 RP736 8U351 RP748 8U351 RP748 8U351 RP748 8U361 RP409 8U468 8U5G028 RP409 8U468 8U5G028 RP410 8U361 RP406 8U5G2339 RP410 8U361 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP777 8U366 8U5G268 RP411 8U361 RP777 8U368 RP416 8U361 RP777 8U368 RP416 8U361 RP577 8U356 RP618(1) RP777 8U356 RP416 8U3636 RP618(1) RP777 8U368 RP416 8U5G368 RP416 8U5G368 | NOTICE N | C. PACCISSO PACC | 7 MAZTYT MADDES MAMTOST MADDES PABDEST PABBES AMTOSES 8 MANDEST MADDES MATERIAL (1) MANDEST MADDES PABBES AMTOSES (2) MANTOSES (1) PABBES PA | ### PHOSE PHOSE PHOSE APOSE APOS APOS APOS APOS APOS APOS APOS APOS | PF00022 PF0003 MTH004 MTH005 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 MTH001 M | \$502241(4) TA0787(1) TVG0831149(1) TA0786 TVG0618911 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T | MATHEMATICAL MACHES AND MACHES AN | ST2123 ST8171 APE2430 ST0438 ST0546 APE1061 PAE1725 PAE2744 ST2058(2) APE1764(2) PAE1013(2) ST2133(3) **** **** **** **** **** **** **** |
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H100170 DR2061 H10016 DR2061 H10070 DR2061 H10</td> <td>CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412] CJ1644 HP0302(2) CJ1607(2) HP1464 CJ1607(2) HP1020(2) CJ0521 HP0304 CJ1607(2) HP1020(2) CJ064C HP0216 CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0483 CJ1167C HP0278 CJ1067C HP0278 CJ1067C HP0278 CJ1067C HP0278 CJ1067C HP0280 CJ1068C HP0480 CJ1068C HP0480 CJ1068C HP0480 CJ1079C HP0281 CJ0641 HP0481 CJ0641 HP0484 CJ0798C HP0780 CJ0641 HP0681 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0570 CJ0648 HP0570 CJ0648 HP0570 CJ0648 HP0570 CJ1647C HP0580 CJ1648C HP05871 CJ1648C HP05871</td> <td>TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 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TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T</td> <td>MATHEMATICAL MACHES AND MACHES AN</td> <td>ST2123 ST8171 APE2430 ST0438 ST0546 APE1061 PAE1725 PAE2744 ST2058(2) APE1764(2) PAE1013(2) ST2133(3) **** **** **** **** **** **** ****</td> | NMB0769 | AQ_1916 PM0994 AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_500 PM0573(1) AQ_1916 PM0533 AQ_1915 PM0608 AQ_915 PM0608 AQ_915 PM0608 AQ_916 PM0608 AQ_916 PM06073(2) AQ_1640 PM0601 AQ_1640 PM0601 AQ_1640 PM0601 AQ_1640 PM1606 AQ_1799 PM1664 AQ_1799 PM1664 AQ_1799 PM1664 AQ_1799 PM1668 AQ_162 PM0610 AQ_162 PM0610 AQ_1640 PM06054 AQ_2082 AQ_2164 AQ_868 PM1606 PM1606 AQ_2076(1) PM01610 AQ_1117 PM0161 AQ_1117 PM0161 AQ_1117 PM0161 AQ_1717 PM0161 AQ_166 PM0761 AQ_166 PM0761 AQ_666 PM0761 AQ_666 PM0761 AQ_166 PM0766 AQ_166 PM0761 AQ_166 PM0676 AQ_1661 PM0761 AQ_166 PM0676 AQ_1661 PM06761 AQ_1661 PM06761 AQ_1662 PM06761 AQ_1663 PM06761 AQ_1664 PM06761 AQ_1665 PM06761 AQ_1665 PM06761 AQ_1666 PM06761 AQ_1666 PM06761 AQ_1666 PM06761 AQ_1667 PM06761 AQ_1667 PM06761 AQ_1668 PM06761 A | 1732 CTO160 CT0295 | XF2698 ML1818 ML2703(3) XF1448(1) ML2703(1) XF9681 ML2707(1) XF9681 ML2021 XF3246 ML024 XF2465 ML024 XF2246 ML1038 XF1291 ML032 XF2257 ML1581 XF146 ML583 XF246 ML938 XF246 ML938 XF1497 ML277(1) XF1487 ML201 XF2460 ML200 ML2412 ML240 ML200 XF2460 ML150 XF2460 ML200 | H10084 DR0944 DRA0164 H1156(1) DR1882 H14439 DR09342) DR1305 H14000 DR2006 H14000 DR1475 H00071 DR2006 H14007 DR1508 H00007 DR1508 H00007 DR2164 H00081 DR002(1) DR2406 H00081 DR002(1) DR2406 H00080 DR1471 H00080 DR1471 H00080 DR1471 H00080 DR14871 DR0240 H00019 DR1508 H00019 DR2061 H10014 DR1910 H10014 DR1910 H10014 DR1910 H10014 DR1910 H10015 DR2061 H10016 DR2061 H10016 DR2061 H10016 DR2061 H10016 DR2061 H100170 DR2061 H10016 DR2061 H10070 DR2061 H10 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412] CJ1644 HP0302(2) CJ1607(2) HP1464 CJ1607(2) HP1020(2) CJ0521 HP0304 CJ1607(2) HP1020(2) CJ064C HP0216 CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0240(1) CJ0541(1) HP0483 CJ1167C HP0278 CJ1067C HP0278 CJ1067C HP0278 CJ1067C HP0278 CJ1067C HP0280 CJ1068C HP0480 CJ1068C HP0480 CJ1068C HP0480 CJ1079C HP0281 CJ0641 HP0481 CJ0641 HP0484 CJ0798C HP0780 CJ0641 HP0681 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0770 CJ0648 HP0570 CJ0648 HP0570 CJ0648 HP0570 CJ0648 HP0570 CJ1647C HP0580 CJ1648C HP05871 | TP0819 TC0826 CT TP0814 TC0378(1) CT TP0812(1) TC0377 CT TP0812(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0817(1) TC0377 CT TP0824 TC0868 CT TP0812(2) TC0718 CT TP081 TC0337 CT TP081 TC0337 CT TP081 TC0334 CT TP081 TC0343 CT TP082 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0343 CT TP083 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TP084 TC0344 CT TT084 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC034 TC03 | 399 CPN0659 RC0002 99(1) CPN0314(1) RC0618(1) 28 CPN0579 04 CPN0579 04 CPN0579 05 CPN0577 99(2) CPN0314(2) RC0618(2) RC06 77 CPN0373 771 CPN0365 06 CPN1017 28 CPN0515 RC01337 28 CPN0515 RC01337 RC1080 RC0544 61 CPN0667 RC0058 61 CPN0671 RC068(1) 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0687 RC0331 61 CPN0688 RC0332 62 CPN0571 RC0883 63 CPN0571 RC0883 64 CPN058 RC0185 65 CPN0687 RC0331 66 CPN0688 RC0332 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC0333 67 CPN0688 RC081183 68 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 69 CPN0689 RC0911 60 CPN0689 RC0911 61 CPN0686(1) 62 CPN0687 RC01186 63 CPN0687 RC01186 64 CPN1087 RC0189 65 CPN0687 RC0128 66 CPN0687 RC0128 67 CPN0687 RC0128 68 CPN0687 RC01186 69 CPN0687 RC01186 60 CPN0687 RC0128 60 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 61 CPN0687 RC0128 | RP466 8U212 8U5G206 RP260 RP411 8U217 8U5G211 RP567 8U222 8U5G216 RP768 RP781 8U213 8U5G207 RP468 8U431 8U5G207 RP446(1) 8U314(1)
8U5G304(1) RP446(1) 8U314(1) 8U5G304(1) RP446(2) RP514(2) 8U314(2) 8U5G304(2) 8U3170 8U5G207 RP419 8U5G207 RP420 8U319 8U5G207 RP420 8U319 8U5G207 RP793 8U327 8U5G207 RP794 8U308 8U5G208 RP793 8U308 8U5G208 RP427 8U308 8U5G208 RP428 8U408 8U5G208 RP429 8U408 8U5G208 RP429 8U408 8U5G208 RP420 8U216 RP20 8U221 RP906 8U220 RP720 8U351 RP507 8U221 RP908 8U352 RP508 8U220 RP721 8U351 RP722 8U351 RP723 8U216 RP908 8U220 RP729 8U351 RP720 8U351 RP721 8U351 RP723 8U361 RP723 8U361 RP726 8U221 RP908 8U220 RP727 8U351 RP728 8U351 RP729 8U351 RP736 8U351 RP748 8U351 RP748 8U351 RP748 8U361 RP409 8U468 8U5G028 RP409 8U468 8U5G028 RP410 8U361 RP406 8U5G2339 RP410 8U361 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP410 8U361 RP784 8U381 RP406 8U5G238 RP410 8U361 RP777 8U366 8U5G268 RP411 8U361 RP777 8U368 RP416 8U361 RP777 8U368 RP416 8U361 RP577 8U356 RP618(1) RP777 8U356 RP416 8U3636 RP618(1) RP777 8U368 RP416 8U5G368 RP416 8U5G368 | NOTESTAND PROCESSOR PROCESSOR PROCESSOR | No. | 7 MAZTYT MADDES MAMTOST MADDES PABDEST PABBES AMTOSES 8 MANDEST MADDES MATERIAL (1) MANDEST MADDES PABBES AMTOSES (2) MANTOSES (1) PABBES PA | PHOBE PH1384 AF384 AF386 AF0825 PH1888 AF0826 AF0830 AF1886 AF0826 AF082 | PF00022 PF0003 MTH004 MTH005 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 MTH001 M | \$502241(4) TA0787(1) TVG0831149(1) TA0786 TVG0618911 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T | MATHEMATICAL MACHES AND MACHES AN | ST2123 ST8171 APE2430 ST0438 ST0546 APE1061 PAE1725 PAE2744 ST2058(2) APE1764(2) PAE1013(2) ST2133(3) **** **** **** **** **** **** **** |
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 | SPY1068 | (1) FN1020 FN2067 FN1325 MYPU_4740 MYPU_1680 (1) MYPU_1680 (1) (1) (1) (1) MYPU_1620(1)
 | UU569 MG124 UU674 MG102 UU511 MG437 UU364 MG114 UU382 UU206(1) MG368(1) | TRAMPORE ADS.ORF380 F10.ORF1818(4) H10.ORF380(1) F10.ORF380 TRAMPORE F10.ORF380 TRAMPORE F10.ORF380 TRAMPORE TR | 6 ALL246 B B3 6 ALL246 ART STATE 6 ALL246 ART STATE 6 ALL246 ART STATE 8 ALR326 ART STATE 8 ALR326 ART STATE 8 ALL336 ART STATE 8 ALR326 ART STATE 8 ALL336 | B2562 B3781 STY2842 STY2829 B068(1) STY086(1) B0421 STY086(2) STY086 STY2829 STY3829 STY | PAGE | TTE 1398(3) | SMC002969 | BMEIDO246 BMEIDO246 MALFO7510 MALFO560 | VC29678 SLL0279
 | XCC0730 RSC283 | 1399 CC2546 | SCO2082 RV2150C SCO2086 SCO2087 SCO3084 RV2160C SCO2086 SCO2087 SCO3084 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2088 SCO3088 SCO308

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 | AQ_1016 | 1732 CTO160 CTO295 | XF2698 | HI0084 DR0944 DRA0164 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0320(2) HP0929 CJ1607(2) HP1020(2) CJ1607(2) HP1020(2) CJ0321 HP0304 CJ1067(2) HP0216 CJ064C HP0216 CJ064(1) HP0240(1) CJ0541(1) HP0240(1) CJ0651(1) HP0648 CJ167C HP0216 CJ0641 HP0268 CJ167C HP0268 CJ1166C HP0648 CJ1167C HP0261 CJ0641 HP0658 HP0661 CJ0641 HP0778 CJ0641 HP0661 CJ0642 HP0661 CJ0643 HP0661 CJ0642 HP0661 CJ0642 HP0661 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0646 HP0676 CJ0646 HP0676 CJ0646 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676
 | TP0819 TC0826 CT | CPN0859 RC0002 | RP506 BUZ12 BU50211 RP507 BUZ22 BU50211 RP507 BUZ23 BU50217 RP40(1) BU314(1) BU50304(1) RP40(1) BU40 BU50304(1) RP40(1) BU41 BU50304(1) RP50(1) BU21 BU50304(1) RP60(1) BU22 BU50304(1) RP60(1) BU50(1) BU50(1) RP60(1) BU50(1) BU50(1) RP60(1) BU50(1) RP60(2) BU50(1) BU50(2) RP60(2) BU50(1) RP60(2) BU50(1) RP60(2) BU50(1) RP60(2) BU50(2) RP60(2) BU50(2) RP60(2) BU50(2) RP60(2) BU50(2) RP60(3) BU30(4) BU50(2) RP60(4) BU50(4) RP60(4) BU50(4) RP60(4) BU50(4) RP60(5) BU50(4) RP60(4) BU50(4) RP60(5) BU50(4) RP60(4) BU50(4) RP60(5) BU50(4) RP60(4) BU50(4) RP60(5) BU50(4) RP60(5) BU50(4) RP60(6) BU50(6) RP60(7) BU50(6) RP60(8) BU50(6) RP60(8) BU50(8) | NOTICE N | No. | 7 MAZTYT MADDES MAMTOST MADDES PABDEST PABBES AMTOSES 8 MANDEST MADDES MATERIAL (1) MANDEST MADDES PABBES AMTOSES (2) MANTOSES (1) PABBES PA | PHOBE PH1384 AF384 AF386 AF0825 PH1888 AF0826 AF0830 AF1886 AF0826 AF082 | PF00022 PF0003 MTH004 MTH005 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 MTH001 M | \$502241(4) TA0787(1) TVG0831149(1) TA0786 TVG0618911 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T | No. | ### PACCOSC PACCOSC |
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 | SPY1068 | (1) FN1020 FN2067 FN1325 MYPU_4740 MYPU_1680 (1) MYPU_1680 (1) (1) (1) (1) MYPU_1620(1)
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 | XCC0730 RSC283 | 1399 CC2546 | SCO2082 RV2150C SCO2086 SCO2087 SCO3084 RV2160C SCO2086 SCO2087 SCO3084 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2088 SCO3088 SCO308

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 | AQ_1016 | 1732 CTO160 CT0295 | XF2698 | HI0084 DR0944 DRA0164 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0320(2) HP0929 CJ1607(2) HP1020(2) CJ1607(2) HP1020(2) CJ0321 HP0304 CJ1067(2) HP0216 CJ064C HP0216 CJ064(1) HP0240(1) CJ0541(1) HP0240(1) CJ0651(1) HP0648 CJ167C HP0216 CJ0641 HP0268 CJ167C HP0268 CJ1166C HP0648 CJ1167C HP0261 CJ0641 HP0658 HP0661 CJ0641 HP0778 CJ0641 HP0661 CJ0642 HP0661 CJ0643 HP0661 CJ0642 HP0661 CJ0642 HP0661 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0646 HP0676 CJ0646 HP0676 CJ0646 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676
 | TPO0819 TC00826 CT TPO0814 TC00877 CT TPO0824 TC00877 CT TPO0824 TC00877 CT TPO0824 TC00877 CT TPO0826 TC00877 CT TPO081 TC00343 CT TPO081 TC00343 CT TPO087 TC00343 CT TPO087 TC0087 CT TPO087 TC0087 CT TPO080 TC0740 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0080 CT TC0080 CT TPO080 TC0080 CT TC0 | CPN0859 RC0002 | RP000 | NOTESTAME NOTE | CET SPACE MARCHES | 7 MAZTYT MADDES MAMTOST MADDES PABDEST PABBES AMTOSES 8 MANDEST MADDES MATERIAL (1) MANDEST MADDES PABBES AMTOSES (2) MANTOSES (1) PABBES PA | PHOBE PH1384 AF384 AF386 AF0825 PH1888 AF0826 AF0830 AF1886 AF0826 AF082 | PF00022 PF0003 MTH004 MTH005 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 MTH001 M | \$502241(4) TA0787(1) TVG0831149(1) TA0786 TVG0618911 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T | No. | ST2123 ST8171 APE2430 ST0438 ST0546 APE1061 PAE1725 PAE2744 ST2058(2) APE1764(2) PAE1013(2) ST2133(3) **** **** **** **** **** **** **** |
| District | NOME | LINTO77 | MWY1864 L0766 L0267 MWY1864 L0268 MWY1864 L0268 MWY1864 L0268 MWY1864 MWY1864 L0268 MWY1864 MWY1864 L0268 MWY1864 MWY1864 MWY1864 MWY1864 L0268 MWY1864 MWY186 | 198 198 199 199 199 199 199 199 199 199 | SP0335 SP1335

 | SPY1895 | FN1020 FN2067 FN1025 MYPU_4740 MYPU_1680 (1) MYPU_1240 (1) MYPU_1240 (1) MYPU_1820(1) MYPU_1920
 | UU369 MG124 UU374 MG102 UU374 MG102 UU3800 UU3811 UU384 MG437 UU384 MG141 UU382 UU382 UU382 UU382 UU382 UU491 MG388 UU393 MG19 UU396 MG19 UU396 MG19 UU396 MG19 UU396 MG19 UU396 MG39 MG39 MG39 MG39 MG39 MG39 MG39 MG39 | TRAMPORE ADS.ORF380 F10.ORF1818(4) H10.ORF380(1) F10.ORF380 TRAMPORE F10.ORF380 TRAMPORE F10.ORF380 TRAMPORE TR | 6 ALL246 B B3 6 ALL246 ART STATE 6 ALL246 ART STATE 6 ALL246 ART STATE 8 ALR326 ART STATE 8 ALR326 ART STATE 8 ALL336 ART STATE 8 ALR326 ART STATE 8 ALL336 | B2562 B3781 STY2842 STY2829 B068(1) STY086(1) B0421 STY086(2) STY086 STY2829 STY3829 STY | PAGE | TTE 1398(3) | SMC002969 | BMEIDO246 BMEIDO246 MALFO7510 MALFO560 | VC29678 SLL0279
 | XCC0730 RSC283 | 1399 CC2546 | SCO2082 RV2150C SCO2086 SCO2087 SCO3084 RV2160C SCO2086 SCO2087 SCO3084 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2081 RV2160C SCO2080 SCO2088 SCO3088 SCO308

 | NAMBOTYSD
 | AQ_1916 | 1732 CTO160 CT0295 | XF2698 | HI0084 DR0944 DRA0164 | CJ0147C HP0824 HP1458 CJ0146C HP0825 CJ05412) CJ1644 HP0320(2) HP0929 CJ1607(2) HP1020(2) CJ1607(2) HP1020(2) CJ0321 HP0304 CJ1067(2) HP0216 CJ064C HP0216 CJ064(1) HP0240(1) CJ0541(1) HP0240(1) CJ0651(1) HP0648 CJ167C HP0216 CJ0641 HP0268 CJ167C HP0268 CJ1166C HP0648 CJ1167C HP0261 CJ0641 HP0658 HP0661 CJ0641 HP0778 CJ0641 HP0661 CJ0642 HP0661 CJ0643 HP0661 CJ0642 HP0661 CJ0642 HP0661 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06441 HP0666 CJ06442 HP0666 CJ06442 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ06444 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0644 HP0666 CJ0646 HP0676 CJ0646 HP0676 CJ0646 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676 CJ0666 HP0676
 | TPO0819 TC00826 CT TPO0814 TC00877 CT TPO0824 TC00877 CT TPO0824 TC00877 CT TPO0824 TC00877 CT TPO0826 TC00877 CT TPO081 TC00343 CT TPO081 TC00343 CT TPO087 TC00343 CT TPO087 TC0087 CT TPO087 TC0087 CT TPO080 TC0740 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0087 CT TPO080 TC0080 CT TC0080 CT TPO080 TC0080 CT TC0 | 1991 | RP000 | NOTICE N | Part | 7 MAZTYT MADDES MAMTOST MADDES PABDEST PABBES AMTOSES 8 MANDEST MADDES MATERIAL (1) MANDEST MADDES PABBES AMTOSES (2) MANTOSES (1) PABBES PA | PHOBE PH1384 AF384 AF386 AF0825 PH1888 AF0826 AF0830 AF1886 AF0826 AF082 | PF00022 PF0003 MTH004 MTH005 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 PF1006 MTH100 MTH001 M | \$502241(4) TA0787(1) TVG0831149(1) TA0786 TVG0618911 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0618912 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA0986 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TVG0729961 TA09861 TA09861 TVG0729764 TA09861 TA09861 TVG0729764 TA09861 TA09861 TA098723 TA0988 T | No. | ###################################### |