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Comparative Genomic Analyses of Copper Transporters and Cuproproteomes Reveal Evolutionary Dynamics of Copper Utilization and Its Link to Oxygen

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Comparative Genomic Analyses of Copper Transporters and Cuproproteomes Reveal Evolutionary Dynamics of Copper Utilization and Its Link to Oxygen

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Copper is an essential trace element in many organisms and is utilized in all domains of life. It is often used as a cofactor of redox proteins, but is also a toxic metal ion. Intracellular copper must be carefully handled to prevent the formation of reactive oxygen species which pose a threat to DNA, lipids, and proteins. In this work, we examined patterns of copper utilization in prokaryotes by analyzing the occurrence of copper transporters and copper-containing proteins. Many organisms, including those that lack copper-dependent proteins, had copper exporters, likely to protect against copper ions that inadvertently enter the cell. We found that copper use is widespread among prokaryotes, but also identified several phyla that lack cuproproteins. This is in contrast to the use of other trace elements, such as selenium, which shows more scattered and reduced usage, yet larger selenoproteomes. Copper transporters had different patterns of occurrence than cuproproteins, suggesting that the pathways of copper utilization and copper detoxification are independent of each other. We present evidence that organisms living in oxygen-rich environments utilize copper, whereas the majority of anaerobic organisms do not. In addition, among copper users, cuproproteomes of aerobic organisms were larger than those of anaerobic organisms. Prokaryotic cuproproteomes were small and dominated by a single protein, cytochrome c oxidase. The data are consistent with the idea that proteins evolved to utilize copper following the oxygenation of the Earth.

INTRODUCTION

All organisms are thought to require metal ion cofactors (i.e., Fe, Zn, Mn, Co, Ni and Cu) which are involved in a wide variety of cellular processes. Additionally, certain non-metal trace elements, such as selenium (Se), and iodine (I) may be utilized. Most of these elements are necessary for redox catalysis and other enzymatic reactions, for sensing and signaling, and some serve structural roles in proteins. Defects in their homeostasis have been linked to a variety of diseases [1–4].

Metals are particularly important for life and may have been utilized by organisms since the time life originated on Earth. For example, before the advent of oxygenic photosynthesis, the most active ecosystems were probably driven by the cycling of H₂ and Fe⁺ through primary production conducted by anoxygenic phototrophs [5]. Additionally, it is thought that a substrate-level phosphorylation cycle may have been an early form of metabolism – one which required both iron and molybdenum [6].

Biological metal utilization has been driven, at least in part, by availability. As the Earth has evolved its chemical environment has significantly changed, which altered availability of certain metal ions [7,8]. For example, as environmental oxygen increased, various metal ions, such as Cu, Co, Ni, Zn, Cd, and Mo were released from their sulfide forms and became more soluble [8], making them more readily available for biological utilization. Oxygenation of the Earth also changed the redox state of some metal ions, such as Fe (Fe²⁺ to Fe³⁺), which reduced its availability [8]. Accordingly, organisms became less dependent on the metal ions that were scarce and adapted to use the available metal ions [7].

Studying metal use in organisms can provide various insights. In this study, we use the term metalloproteome, which is a subset of the proteins from a particular proteome, which bind metal ions. Improved understanding of the composition and functions of metalloproteomes in prokaryotes, combined with our knowledge of the chemical evolution of the earth, can help decipher the evolutionary relationships among organisms and improve understanding of the roles metals play in biology. Analyses of evolutionary trends in trace element utilization have been performed for several trace elements, such as Fe and Mn [9], Se [10,11], and Ni and Co [12].

One of the widely used trace elements is copper. This metal ion is known to be a cofactor in a number of proteins. Copper is redox-active (in biological systems it can exist as either Cu²⁺ or Cu⁺ and is more reactive in its reduced state [13]) and consequently, is a highly toxic element. The challenge, then, for copper-dependent organisms is to obtain sufficient levels of this metal ion to meet their needs, while tightly controlling intracellular copper to avoid toxicity. It is likely that little free copper exists in the cytoplasm (the same is not necessarily true for the periplasm [14]), both because of its toxicity, and because it exists at such low concentrations in the cytoplasm that it is unlikely to encounter its target proteins in a reasonable amount of time without assistance [15]. Thus, it is likely that copper is delivered to target proteins by metallochaperones.

To date, 10 Cu-containing proteins (cuproproteins) have been characterized in prokaryotes, including cytochrome c oxidase (COX), NADH dehydrogenase-2 (ND2), Cu,Zn-superoxide dis-
RESULTS

Identification of Cu-utilizing prokaryotes

We examined 450 sequenced bacterial genomes and 35 sequenced archael genomes for copper utilization by searching for occurrence of cuproproteins (see Table 1 for a list of reference proteins). A majority of bacteria (326 of the 450 analyzed, or 72%) were found to be copper-utilizing or users (i.e., organisms that had at least one copper-dependent protein), while the remaining 124 bacteria (28%), appeared to be nonusers (i.e., organisms in which we were unable to identify even a single cuproprotein). In contrast, among archaeas, most organisms appeared to be nonusers (24 archaea, or 69%), whereas 11 archaea, or 31%, were users. Overall, copper utilization was widely distributed in prokaryotes, with more than 2/3 of all organisms being dependent on this metal. Detailed distribution of copper utilization among prokaryotes is reported in Table S1.

Of 22 examined bacterial phyla represented by at least 4 completely sequenced genomes, 7 (enterobacteriales, vibrioaceae, pseudomonadaceae, xanthomonadaceae, burkholderiaceae, rhizobiaceae and cyanobacteria) consisted of bacteria that were all users. In addition, almost all bacteria from an additional 5 phyla (pasteurellaceae, rickettsiales, chloroflexi, actinobacteria, and bacillales) were users (Figure 1). Only a few bacterial phyla (thermotogae, chlorobi, lactobacillales, and mollicutes) consisted exclusively of apparent nonusers. In addition, all but one bacterium from each of an additional three phyla (chlamydiales, spirochaetes, and clostridia) appeared to be nonusers. The phyla with the highest number of apparent nonusers were subphyla of firmicutes, which are among the most ancient organisms. Interestingly, even though we found no connection between genome size and copper use in the bacterial domain, for firmicutes, users had an average genome size of 3.93 Mb while the genome size of nonusers was only 2.27 Mb.

In archaea, the trend was somewhat reversed. There were 5 phyla with 4 or more representative organisms and only 2 of these, sulfolobales and halobacteriales, consisted of exclusively users. Archaea from sulfolobales prefer a harsh environment (temperature of 74°C or higher and pH of 3 or lower). In contrast, halobacteriales prefer a mild environment (temperature of 25°C and neutral pH).

Lastly, archaea from two additional phyla (methanosarcinaceales and thermoacetococcales) all appeared to be nonusers, and all but one archaean (Picrophilus torridus) is the exception) from the final remaining phylum, thermosthomasales, were classified as nonusers (Figure 2).

Distribution of Cu transporter systems

Table 1 also shows all of the Cu importers/exporters analyzed in our study. CtaA (CopA in Enterococcus hirae [16]), the only identified Cu-specific importer, was only present in cyanobacteria. 13 different cyanobacteria were included in this study and all but one had CtaA (Figure 3). No archaea that utilize CtaA were identified (Figure 2). Each of the organisms that utilize CtaA also utilizes at least one cuproprotein.
In bacteria, PacS (CopA in *Escherichia coli* [32] or CopB in *Enterococcus hirae* [16]) was the most widespread copper exporter. PacS was identified in 355 of 450 bacteria and was present in 29 of 32 phyla (absent in mollicutes, thermotogae, and rickettsiales). In archaea, CopA (PacS) was the only transporter identified (Figure 2). It was present in 6 of 13 phyla (archaeoglobales, halobacteriales, methanobacteriales, methanomicrobiales, methanosarcinales, and thermococcales).

These two transporters, CtaA and PacS, have complimentary roles. CtaA is responsible for copper import from the periplasm to the cytoplasm and PacS is responsible for copper transport to the thylakoid [13,18,19]. Consistent with this, all of the examined organisms that appeared to utilize CtaA also utilize PacS.

We also examined the genomes for the other 7 copper exporters and observed some interesting features. Most organisms had copper exporters, even if they appeared to be nonusers. Nearly 50% of nonusers had copper exporters while about 25% of users appeared to lack these proteins. It is interesting to note that more than half of the bacteria that did not have exporters (79 of 142, or 56%) were parasites (overall, only 29% of the examined bacteria were parasites). Regarding the occurrence of exporters in archaea, we again observed a reversal of the trend compared to bacteria. Only 2 users (18%) had exporters while exactly half the nonusers had these proteins.

There did not appear to be any trend of importers and exporters co-occurring except for CtaA and PacS; however, PacS is nearly ubiquitous while CtaA is utilized by only a few organisms. CtaA and PacS as well as other importers and exporters are likely differentially regulated.

### Composition of cuproproteomes

For further discussion, we introduce and define the term cuproproteome. The cuproproteome of an organism is the set of proteins from its proteome which require a copper ion for their biological function (typically catalysis). Transporters, chaperones, and storage proteins constitute cellular Cu transport and maintenance machinery and are not part of the cuproproteome.
Figure 2. Occurrence of cuproproteins in Archaea. Reported is the occurrence (by phylum) of cuproproteins and Cu exporters in archaea. No importers, repressors, or chaperones were identified in archaea. See legend to Figure 1 for further details.

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| Nanoarchaota       | Crenarchaota       | Desulfuroccales   | Sulfolobales      | Thermoproteales   | Euryarchaota       |
|--------------------|--------------------|-------------------|-------------------|--------------------|--------------------|
| # Organisms        | 1                  | 3                  | 4                  | 6                  | 11                 |
| # Cuproproteins    | 0                  | 0                  | 0                  | 0                  | 0                  |
| # Users            | 0                  | 0                  | 0                  | 0                  | 0                  |
| # Nonusers         | 0                  | 0                  | 0                  | 0                  | 0                  |
| # Exporters        | 0                  | 0                  | 0                  | 0                  | 0                  |

Figure 3. Occurrence of transporters, repressors and chaperones in bacteria. Phylogenetic tree was adapted from [37]. Reported are the number of bacteria (by phylum) which utilized a given transporter, repressor, or chaperone. Numbers across the top refer to specific transporters or chaperones (see Table 1 for protein names). Columns 10–17 are exporters, column 18 is the sole importer, columns 19–20 are chaperones, and column 21 is a transporter whose exact function has not been characterized. The last four columns report the number of exporters, importers, and chaperones present in each phyla.

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Analysis of cuproproteomes revealed that organisms having cuproproteomes of identical size do not necessarily have the same set of cuproproteins. The biological function of copper is maintained by cuproproteomes, whereas the Cu transport and maintenance machinery serves an intermediate role and is not preserved during evolution when an organism lacks cuproproteins.

Distribution of cuproproteins is reported in Figures 1 and 2 for bacteria and archaea, respectively. In bacteria, the most frequently utilized cuproprotein was cytochrome c oxidase (COX). COX was identified in 296 bacteria, or 91% of the users. Moreover, among those that appeared to utilize a single cuproprotein, about 70% (94 out of 136 organisms) only utilized COX. The same was true for archaea. COX was utilized by all 11 of the archaeal users, 7 of the 11 (64%) archaeal users only utilized COX.

No other cuproproteins were nearly as widespread in bacteria. The second most frequently utilized cuproprotein was NADH dehydrogenase-2 (ND2) – utilized by 111 bacteria, or 34% of the users. Superoxide dismutase 1 (SOD1) was the only other cuproprotein utilized by more than 20% of the users (utilized by 21%), and was found predominantly in gram-negative bacteria. The remaining cuproproteins were utilized by 15% or less of the users and their frequencies were as follows:

- nitrosocyanin, 15%
- plastocyanin, 15%
- Cu-containing nitrite reductase, 10%
- Cu-amine oxidase, 6%
- pMMO, 2%
- CotA, 1%
- tyrosinase, 1%

Only four cuproproteins were identified in archaea: COX, SOD1, nitrosocyanin, and Cu-containing nitrite reductase. As previously mentioned, COX was utilized by 11 archaea (all of the users) and SOD1, Cu-containing nitrite reductase, and nitrosocyanin, were only utilized by 2 (14% of the users), 2 (14% of the users), and 1 (7% of the users) archaea, respectively.

Although 9 cuproproteins are known, none of the examined organisms utilized all of them. In fact, cuproproteomes of most bacteria were quite small, with the largest identified bacterial cuproproteome having only 5 cuproproteins. Only a single bacterium (Aerococcus vineae), less than 1% of all the bacteria included in the study, had a cuproproteome consisting of 5 cuproproteins. More common, although still infrequent, were bacteria having cuproproteomes of 4 cuproproteins; 29 bacteria or 6% had 4 cuproproteins in their cuproproteomes. The most common cuproproteomes had only one cuproprotein (128, or 28%, of all bacteria). It is interesting to note that the second most common cuproproteome size was 0 cuproproteins (124, or 28% of bacteria). So, while copper use was widespread in bacteria, most copper-dependent organisms utilized few cuproproteins (Figure 4).

Archaeal cuproproteomes appeared to be even smaller. The largest identified cuproproteome had only 3 cuproproteins (found only in Haloarcula marismortui). 3 archaea (Sulfolobus acidocaldarius, Sulfolobus solfataricus, and Natronomonas pharaonis), or 9%, had cuproproteomes consisting of two cuproproteins. Most archaea (~70%) appeared to utilize no cuproproteins (Figures 2 and 5).

Copper utilization in relation to environmental factors and organism features

We analyzed the following environmental factors and organism features to determine their effect on copper utilization:

- Habitat
- Oxygen requirement
- Genome size
- GC % in genome
- Gram strain (bacteria)
- Methanogen (archaea)
- Optimal temperature
- Optimal pH

One feature that showed a clear association was oxygen requirement. In our study, 82 (18%) bacteria were anaerobic, 205 (46%) aerobic, 140 (31%) facultative, and 23 (5%) microaerophilic. Most anaerobic bacteria (62 of 85, or 73%) were nonusers, while most aerobic bacteria (192 of 205, or 94%) were users. 99 of 140 facultative bacteria (71%) and 15 of 23 microaerophilic bacteria (65%) were users (Figure 6). Excluding facultative organisms, a Chi-square test showed a statistically significant difference in Cu utilization between aerobic (including microaerophilic) and anaerobic organisms (P-value<0.01).

This trend was even more pronounced in archaea (Figure 7). We examined 21 anaerobic, 9 aerobic, and 5 facultative archaea. All 21 anaerobic archaea were nonusers and all 9 aerobic archaea were users. Similarly, a Chi-square test suggested a significant difference in Cu utilization between aerobic and anaerobic species (P-value<0.01). Thus, such a striking preference for the use of copper in aerobic organisms is present in both kingdoms of prokaryotes.

Not surprising, based on these results, aerobic bacteria had the largest average cuproproteomes with an average size of 1.8 cuproproteins, compared to anaerobic bacteria which had the smallest average cuproproteomes (0.4 cuproproteins). Surprising, however, is that among users, facultative and microaerophilic bacteria had larger average cuproproteomes (2.26 cuproproteins) than aerobic users which had an average cuproproteome of 1.93 cuproproteins. In archaea, where all the aerobic organisms are users and all the anaerobic organisms are nonusers, aerobic organisms clearly have the larger average cuproproteomes.

DISCUSSION

Oxygen levels are thought to have been quite low until 2.45 billion years ago, but by 2.32 billion years ago had sharply risen [38]. Oxygen levels rose following the origin of oxygenic photosynthetic organisms [39]. At the same time, levels of bioavailable copper increased [40]. Prior to ocean oxygenation, copper likely existed as a sulfide and was insoluble in aqueous solutions. It was suggested [41] that copper was largely unavailable for cellular life; however, upon the rise of oxygen in the atmosphere, copper was converted, at least in part to Cu²⁺, and as such, became more soluble and more readily available for biological use [41]. It is possible that at least some bacteria evolved near hydrothermal vents in waters replete with heavy metal ions, where sulfides would likely have been more soluble. However, the large-scale evolution of cuproproteins likely occurred in oxygen-rich environments where copper was plentiful. Our analyses of copper utilizing prokaryotes clearly support this idea.

We found that in most prokaryotes that require oxygen are copper users, while most anaerobic prokaryotes are nonusers.

Prior to the evolution of cuproproteins, organisms may have already utilized copper exporters [16], but with the increase in soluble copper, this function became even more important as a means of removal of this metal ion. The presence of copper exporters in nonusers and the sheer number of known copper exporters suggest that copper can be taken up accidentally and these organisms need a defense mechanism against copper ions that inadvertently enter the cell.
Although exporters have been readily identified, importers have almost completely eluded researchers. As pointed out above, only one copper-dependent importer has been identified in prokaryotes. However, it is noteworthy that at least one example of an ABC transporter has been reported which has broad specificity for a number of metal ions, including copper, and this could potentially explain copper uptake by prokaryotes [42].

Additionally, while there are examples of cuproproteins that obtain copper from the cytoplasm (for example, plastocyanin gets copper from PacS, which exports copper from the cytoplasm to the thylakoid [18,19]; most cuproproteins are periplasmic or membrane proteins and therefore it is possible that little cytoplasmic copper is needed for these proteins, which could help explain the lack of copper-specific importers.

In this study we only included proteins that are unable to function without copper. While no reports of prokaryotic enzymes evolving by changing the catalytic copper to other metals exist, it is a possibility, although unlikely, that some of the proteins we have identified as cuproproteins actually utilize a different metal ion.

Various cuproproteins have been identified by researchers over the years. The two most widespread cuproproteins are COX and ND2, both of which are involved in the electron transport chain. The redox properties of copper make this metal ion a prime candidate for use in the active sites of oxidoreductases involved in energy generation. In fact, in bacteria, 84% of the cuproproteins, including COX and ND2, are involved in energy producing pathways, and in archaea 86% of the cuproproteins are involved in ATP production. These data suggest that ATP generation via...

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**Figure 4.** Bacterial cuproproteomes. Phylogenetic tree adapted from [37]. Numbers across the top (1–5) show the size of cuproproteomes (i.e., the number of cuproproteins in a phylum or organism). Displayed is the number of organisms from each phylum with the cuproproteome of the particular size. 
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oxygen-dependent respiration is the major use of copper in biology. Being readily available in the environment and with such wide use in oxygentic organisms, it is a paradox that the utilization of this metal is restricted to only a few enzymes in prokaryotes.

Copper use in organisms does have its associated dangers though, and organisms which have evolved to use this metal have to have ways to deal with copper toxicity. Copper toxicity comes from its ability to produce reactive oxygen species (ROS). Thus, copper is intimately involved in the cellular control of redox homeostasis. SODs are important proteins which protect the cell against ROS by removing superoxide anions. Each of the known SODs requires at least one metal cofactor. Among these is a cuproprotein, SOD1, which utilizes both copper and zinc. Other SODs are known to use iron, manganese, or nickel [25,43]. Interestingly, copper is used in both respiration and the associated removal of ROS, which are by-products of oxygen-dependent respiration.

Another interesting cuproprotein is a multicopper oxidase, CotA, which is a spore coat protein. Only four bacteria (and no archaea) were found to utilize CotA, all of which were Bacillales. It appears that CotA is a recently evolved cuproprotein. Other multicopper oxidases studied (CueO and PcoA) are components of efflux systems. Cuproproteomes appear to be quite small in prokaryotes. In both bacteria and archaea, the most common cuproproteome size for users was one, and frequently this single cuproprotein was COX. Interestingly, organisms with cuproproteomes of the same size do not necessarily utilize the same cuproproteins, and most cuproproteins are used in a limited number of organisms.

The use of copper can be compared (or rather contrasted) with that of another trace element, selenium. The size of prokaryotic selenoproteomes is highly variable, from 0 to 56 [10,44]. However, approximately 80% of prokaryotes do not have selenoproteins. Thus, whereas prokaryotic selenium use shows a mosaic pattern and most selenoprotein-rich organisms are anaerobic, copper is utilized by a limited number of processes (essentially restricted to respiration), but in many aerobic organisms. Our study was based on the premise that most cuproproteins are already known. The striking occurrence of these proteins in aerobic organisms suggests that we could reliably identify most users. The possibility cannot be excluded, however, that additional, unknown Cu-dependent proteins are present in some prokaryotes. Nevertheless, while additional cuproproteins would increase the size of cuproproteomes, it is unlikely that this would lead to identification of many additional users.

It would be interesting to expand this work to the third superkingdom, eukaryotes. By definition, these organisms evolved in oxygenated environments, but whether copper utilization remained widespread during evolution of eukaryotes is not known. There is some overlap between eukaryotes and prokaryotes on which a study of this nature could be based; for example, both prokaryotes and eukaryotes have COX and SOD1.

Finally, we have pointed out that some very important enzymes require a copper cofactor, and while many of them are periplasmic and membrane-bound, some are intracellular. In the future, it would be interesting to examine the means by which prokaryotes bring
copper into the cell under conditions of deficiency in this trace element. Very little is known about copper import in prokaryotes; in many cases unspecific import systems would likely be sufficient, but whether this is the major route for copper use is not known.

MATERIALS AND METHODS

Genomic sequence resources
In our study, we examined fully sequenced prokaryotic genomes (450 unique bacterial and 35 unique archaeal genomes were available as of January 31, 2007). Only a single strain of each species was included in this research. A list of fully sequenced prokaryotic genomes, both those used in this research and those completed since we began our research, can be found on the NCBI website at: http://www.ncbi.nlm.nih.gov/sutils/genom_table.cgi.

Identification of Cu-utilizing organisms, Cu-specific transporters, and cuproproteins
Initially, primary literature was used to identify Cu-dependent proteins, and Cu importers, exporters, and regulators. Cuproproteins were included in the set if their close homologs were experimentally demonstrated to be specific for copper. Copper transporters were included if they were previously reported to be copper-specific or if they had a much higher affinity for copper than other metal ions. A complete list of identified proteins, importers, exporters, and regulators is shown in Table 1.

Organisms that had at least one copper-dependent protein were considered copper-dependent, or users. If we were unable to find at least one cuproprotein in an organism it was designated as copper-independent or a nonuser. Determining if a specific organism had cuproproteins was accomplished in the following steps:

- Using primary literature, organisms were identified that had a particular cuproprotein;
- TBLastn [45] search with default parameters was performed against all organisms in the study using the protein sequences from the step above;
- The organism from each phylum having a proteome containing the examined cuproprotein and having the highest homology to the query sequence was identified;
- A new Blast search was performed using the protein sequence from the previous step as query sequence and only searching the genomes from that particular phylum. In the case that no organism from the phylum had the original protein, this additional search was not performed;
- Manual analysis of the resulting sequences to determine which organisms had the cuproprotein in question.

Other analysis tools
Inferred phylogenies were used to verify similarity to putative cuproprotein sequences. Multiple sequence alignments of proteins and inferred phylogenies were created using ClustalW [46] with default parameters. Manual analysis of the inferred phylogeny was performed to identify which candidate sequences clustered around the putative cuproprotein.

Identification of environmental and other factors for each organism
To examine trends of copper utilization we collected information for various environmental factors (e.g., habitat, oxygen requirement, optimal temperature and optimal pH), and other factors and properties (e.g., genome size, GC content and Gram strain) which were retrieved from the NCBI prokaryotic genome project database (http://www.ncbi.nlm.nih.gov/sites/entrez?cmd = File&db = genomeproj) for all examined archaeal and bacterial species.

SUPPORTING INFORMATION

Table S1
Found at: doi:10.1371/journal.pone.0001378.s001 (0.18 MB XLS)
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Author Contributions
Conceived and designed the experiments: VG YZ PR. Performed the experiments: PR. Analyzed the data: VG YZ PR. Wrote the paper: VG PR.
| Bacteria                          | Oxygen Req | Habitat  | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|----------------------------------|------------|----------|-------------|---------------|-----------|------------|-----------|---------------|
| Acidothermus cellulolyticus 11B  | Aerobic    | Aquatic  | +           | 1             | 0         | 0          | 1         |               |
| Arthrobacter auricescens TC1     | Aerobic    | Terrestrial | +         | 1             | 0         | 0          | 0         |               |
| Arthrobacter sp. FB24            | Aerobic    | Terrestrial | +         | 2             | 0         | 0          | 1         |               |
| Bifidobacterium adolescentis     | Anaerobic  | Host     | +           | 0             | 0         | 0          | 1         |               |
| Bifidobacterium longum DJO10A    | Anaerobic  | Host     | +           | 0             | 0         | 0          | 0         |               |
| Brevibacterium linens BL2        | Aerobic    | Multiple | +           | 2             | 0         | 0          | 1         |               |
| Collinsella aerofaciens ATCC 25986 | Anaerobic | Host     | +           | 0             | 0         | 0          | 1         |               |
| Corynebacterium diphtheriae NCTC 13129 | Aerobic | Multiple | +           | 1             | 0         | 0          | 2         |               |
| Corynebacterium efficiens YS-314 | Facultative | Host   | +           | 1             | 0         | 0          | 2         |               |
| Corynebacterium glutamicum ATCC 13032 | Facultative | Host | +          | 1             | 0         | 0          | 2         |               |
| Corynebacterium jeikeium K411    | Facultative | Host    | +           | 1             | 0         | 0          | 2         |               |
| Frankia ahni ACN14a              | Aerobic    | Host     | +           | 2             | 0         | 0          | 0         |               |
| Frankia sp. EAN1pec              | Aerobic    | Multiple | +           | 4             | 0         | 0          | 2         |               |
| Janibacter sp. HTCC2649          | Microaerophilic | Host    | +           | 2             | 0         | 0          | 2         |               |
| Kineococcus radiotolerans SRS30216 | Aerobic | Host     | +           | 1             | 0         | 0          | 1         |               |
| Leifsonia xylii subsp. xylii str. CTCB07 | Aerobic | Host      | +          | 2             | 0         | 0          | 2         |               |
| Mycobacterium avium subsp. paratuberculosis K-10 | Aerobic | Multiple | +           | 2             | 0         | 0          | 1         |               |
| Mycobacterium bovis AF2122/97    | Aerobic    | Multiple | +           | 2             | 0         | 0          | 1         |               |
| Mycobacterium flavescens PYR-GCK | Aerobic    | Multiple | +           | 2             | 0         | 0          | 1         |               |
| Mycobacterium leprae TN          | Aerobic    | Host     | +           | 1             | 0         | 0          | 1         |               |
| Mycobacterium smegmatis str. MC2 155 | Aerobic | Host    | +           | 1             | 0         | 0          | 0         |               |
| Mycobacterium sp. KMS            | Aerobic    | Host     | +           | 2             | 0         | 0          | 0         |               |
| Mycobacterium tuberculosis C     | Aerobic    | Host     | +           | 1             | 0         | 0          | 0         |               |
| Mycobacterium ulcerans Agy99     | Aerobic    | Host     | +           | 1             | 0         | 0          | 0         |               |
| Mycobacterium vanbaalenii PYR-1  | Aerobic    | Multiple | +           | 3             | 0         | 0          | 2         |               |
| Nocardia farcinica IFM 10152     | Aerobic    | Multiple | +           | 3             | 0         | 0          | 0         |               |
| Nocardioles sp. JS514            | Aerobic    | Host     | +           | 2             | 0         | 0          | 2         |               |
| Propionibacterium acnes KPA171202 | Anaerobic | Host    | +           | 2             | 0         | 0          | 1         |               |
| Rhodococcus sp. RHA1             | Aerobic    | Host     | +           | 3             | 0         | 0          | 1         |               |
| Rubrobacter xylanophilus DSM 9941 | Aerobic | Host    | +           | 2             | 0         | 0          | 0         |               |
| Salinispora arenicola CNS205      | Aerobic    | Aquatic  | -           | 0             | 0         | 0          | 0         |               |
| Salinispora tropica CNB-440       | Aerobic    | Multipe  | +           | 2             | 0         | 0          | 0         |               |
| Streptomyces avermitilis MA-4680  | Aerobic    | Multiple | +           | 2             | 0         | 0          | 3         |               |
| Streptomyes coelicolor A3(2)      | Aerobic    | Host     | +           | 1             | 0         | 0          | 2         |               |
| Symbiobacterium thermophilum IAM 14863 | Microaerophilic | Host | +          | 2             | 0         | 0          | 1         |               |
| Thermobifida fusca YX            | Aerobic    | Multiple | +           | 1             | 0         | 0          | 1         |               |
| Tropheryma whipplei TW08/27      | Aerobic    | Host     | +           | 1             | 0         | 0          | 1         |               |
| marine actinobacterium PHSC20C1   | Aerobic    | Aquatic  | +           | 1             | 0         | 0          | 2         |               |

**Bacteroides/Chlorobi**

| Bacteroides caccae ATCC 43185 | Anaerobic | Host | - | 0 | 0 | 0 | 0 |               |
| Bacteroides fragilis YCH46     | Anaerobic | Host | - | 0 | 0 | 0 | 2 |               |
| Bacteroides thetaiotaomicron VPI-5482 | Anaerobic | Host | + | 0 | 0 | 0 | 2 |               |
| Candidatus Sulcia muelleri str. Hc (Himalodisca coagulata) | Anaerobic | Host | - | 0 | 0 | 0 | 2 |               |
| Cellulophaga sp. MED134        | Aerobic   | Host | - | 0 | 0 | 0 | 0 |               |
| Chlorobium chlororhodanum CaD3 | Anaerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Chlorobium ferroxidans DSM 13031 | Anaerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Chlorobium limicola DSM 245    | Anaerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Chlorobium phaeobacteroides BS1 | Anaerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Chlorobium tepidum TLS         | Anaerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Croceibacter atlanticus HTCC2559 | Aerobic | Aquatic | - | 1 | 0 | 0 | 1 |               |
| Cytophaga hutchinsonii ATCC 33406 | Aerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Flavobacteria bacterium BBFL7   | Aerobic   | Host | - | 0 | 0 | 0 | 1 |               |
| Flavobacteriales bacterium HTCC2170 | Aerobic | Host | - | 0 | 0 | 0 | 1 |               |
| Flavobacterium johnsoniae UW101 | Aerobic   | Host | - | 0 | 0 | 0 | 2 |               |
| Gramella forsetii KT0803        | Aerobic   | Host | - | 0 | 0 | 0 | 0 |               |
| Leeuwenhoekiella blandidens MED217 | Aerobic | Aquatic | - | 1 | 0 | 0 | 2 |               |
| Microscilla marina ATCC 23134   | Aerobic   | Aquatic | - | 0 | 0 | 0 | 0 |               |
| Bacteria                                      | Oxygen Req | Habitat       | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|-----------------------------------------------|------------|---------------|-------------|---------------|-----------|------------|-----------|---------------|
| Pelodictyon luteolum DSM 273                 | Anaerobic  | Multiple      | -           | 0             | 0         | 1          |           |               |
| Pelodictyon phaeochlathroforme BU-1          | Anaerobic  | Multiple      | -           | 0             | 0         | 1          |           |               |
| Polaribacter irlgensii 23-P                  | Aerobic    | Aquatic       | -           | 1             | 0         | 0          | 2         |               |
| Porphyromonas gingivalis W83                 | Anaerobic  | Host          | -           | 0             | 0         | 0          | 2         |               |
| Prosthecocloris aestuarii DSM 271            | Anaerobic  | Aquatic       | -           | 0             | 0         | 0          | 0         |               |
| Prosthecocloris vibrioformis DSM 265         | Facultative| Aquatic       | -           | 0             | 0         | 0          | 0         |               |
| Psychroflexus torquis ATCC 700755            | Aerobic    | Aquatic       | -           | 2             | 0         | 0          | 0         |               |
| Robiginitalea bifornata HTCC2201             | Aerobic    | Aquatic       | -           | 2             | 0         | 0          | 0         |               |
| Salinibacter ruber DSM 13855                 | Aerobic    | Aquatic       | -           | 1             | 0         | 0          | 1         |               |
| Tenacibaculum sp. MED152                     | Aerobic    | Aquatic       | -           | 0             | 0         | 0          | 1         |               |
| Pelodictyon luteolum DSM 273                 | Anaerobic  | Host          | -           | 2             | 0         | 0          | 0         |               |
| Chlamydia trachomatis A/HAR-13               | Anaerobic  | Host          | -           | 0             | 0         | 0          | 0         |               |
| Chlamydia phageoidea phageoidea UWE25        | Anaerobic  | Host          | -           | 2             | 0         | 0          | 0         |               |
| Chlamydomonas reinhardtii Nigg               | Anaerobic  | Host          | -           | 0             | 0         | 0          | 0         |               |
| Chlamydomonas phageoidea phageoidea GPIC     | Anaerobic  | Host          | -           | 0             | 0         | 0          | 0         |               |
| Chlamydomonas phageoidea phageoidea Fe/C-56  | Anaerobic  | Host          | -           | 0             | 0         | 0          | 0         |               |
| Chlamydomonas pneumoniae AR39                | Anaerobic  | Host          | -           | 0             | 0         | 0          | 0         |               |
| Chlamydomonas variabilis ATCC 29413          | Aerobic    | Multiple      | -           | 3             | 1         | 0          | 1         |               |
| Prochlorococcus marinus str. MIT 9312        | Microaerophilic | Aquatic   | -           | 2             | 1         | 0          | 1         |               |
| Synechococcus elongatus PCC 6301             | Microaerophilic | Aquatic   | -           | 2             | 1         | 0          | 1         |               |
| Synechococcus sp. CC9311                     | Microaerophilic | Aquatic   | -           | 3             | 1         | 0          | 1         |               |
| Synechocystis sp. PCC 6803                   | Microaerophilic | Aquatic   | -           | 3             | 1         | 0          | 1         |               |
| Thermosynechococcus elongatus BP-1           | Aerobic    | Aquatic       | -           | 1             | 1         | 0          | 1         |               |
| Trichodesmium erythraeum IMS101              | Aerobic    | Aquatic       | -           | 3             | 1         | 0          | 1         |               |

**Firmicutes**

| Bacillus anthracis str. Ames                 | Facultative | Multiple      | +           | 2             | 0         | 2          | 2         |               |
| Bacillus cereus ATCC 10987                  | Aerobic     | Multiple      | +           | 3             | 0         | 2          | 2         |               |
| Bacillus clausi KSM-K16                     | Aerobic     | Terrestrial   | +           | 2             | 0         | 2          | 1         |               |
| Bacillus halodurans C-125                   | Facultative | Multiple      | +           | 1             | 0         | 1          | 1         |               |
| Bacillus licheniformis ATCC 14580           | Facultative | Terrestrial   | +           | 3             | 0         | 2          | 1         |               |
| Bacillus sp. NRRL B-14911                   | Facultative | Aquatic       | +           | 1             | 0         | 1          | 1         |               |
| Bacillus subtilis subsp. subtilis str. 168   | Facultative | Terrestrial   | +           | 3             | 0         | 1          | 1         |               |
| Bacillus thuringiensis serovar konkukian str. 97-27 | Facultative | Multiple      | 2           | 0             | 1         | 2         |          |               |
| Bacillus weihenstephanensis KBAB4           | Aerobic     | Terrestrial   | +           | 2             | 0         | 1          | 2         |               |
| Bacillus weihenstephanensis KBAB4           | Aerobic     | Terrestrial   | +           | 1             | 0         | 0          | 2         |               |
| Geobacillus kaustophilus HTA486             | Aerobic     | Aquatic       | +           | 2             | 0         | 1          | 1         |               |
| Listeria innocua Clp112624                 | Facultative | Multiple      | +           | 1             | 0         | 1          | 2         |               |
| Listeria monocytophages EGD-e               | Facultative | Multiple      | +           | 1             | 0         | 1          | 2         |               |
| Listeria welshimeri serovar 6b str. SLCC3334 | Facultative | Multiple      | +           | 0             | 0         | 1          | 2         |               |
| Oceanobacillus iheyensis HTE832             | Aerobic     | Aquatic       | +           | 3             | 0         | 1          | 2         |               |
| Paenibacillus larvae subsp. larvae BRL-230010 | Facultative | Terrestrial   | +           | 1             | 0         | 1          | 2         |               |
| Pasteuria nishizawai str. North American     | Facultative | Host          | +           | 0             | 0         | 0          | 0         |               |
| Staphylococcus aureus RF122                  | Facultative | Host          | +           | 1             | 0         | 1          | 1         |               |
| Staphylococcus epidermidis ATCC 12228        | Facultative | Host          | +           | 1             | 0         | 2          | 1         |               |
| Staphylococcus haemolyticus JCSC4135        | Facultative | Host          | +           | 1             | 0         | 2          | 1         |               |
| Staphylococcus saprophyticus subsp. saprophyticus A | Aerobic     | Host          | +           | 1             | 0         | 1          | 1         |               |

**Closstrida**

| Alkaliphilus metalliredigeneris QYMF       | Anaerobic   | Aquatic       | +           | 0             | 0         | 1          | 1         |               |
| Bacteria                                      | Oxygen Req | Habitat   | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|----------------------------------------------|------------|-----------|-------------|---------------|-----------|------------|-----------|---------------|
| Caldicellulosiruptor saccharolyticus DSM 8903| Anaerobic  | Aquatic   | +           | 0             | 0         | 2         | 1         |               |
| Carboxydothermus hydrogenoformans Z-2901      | Anaerobic  | Aquatic   | +           | 0             | 0         | 1         | 1         |               |
| Clostridium acetobutylicum ATCC 824          | Anaerobic  | Multiple  | +           | 0             | 0         | 2         | 2         |               |
| Clostridium beijerincki NCIMB 8052           | Anaerobic  | Multiple  | +           | 0             | 0         | 2         | 2         |               |
| Clostridium cellulolyticum H10               | Anaerobic  | Terrestrial| +           | 0             | 0         | 1         | 1         |               |
| Clostridium difficile QCD-32g8               | Anaerobic  | Multiple  | +           | 0             | 0         | 2         | 1         |               |
| Clostridium novyi NT                         | Anaerobic  | Terrestrial| +           | 0             | 0         | 0         | 1         |               |
| Clostridium perfringens ATCC 13124           | Anaerobic  | Multiple  | +           | 0             | 0         | 1         | 2         |               |
| Clostridium phytofermentans ISDg             | Anaerobic  | Terrestrial| +           | 0             | 0         | 1         | 2         |               |
| Clostridium sp. OhILAs                       | Anaerobic  | Aquatic   | +           | 0             | 0         | 1         | 1         |               |
| Clostridium tetani E88                       | Anaerobic  | Multiple  | +           | 0             | 0         | 1         | 1         |               |
| Clostridium thermocellum ATCC 27405          | Anaerobic  | Multiple  | +           | 0             | 0         | 2         | 1         |               |
| Desulfotobacterium hafniense DGB-2           | Anaerobic  | Multiple  | -           | 1             | 0         | 2         | 1         |               |
| Desulfotomaculum reducens MI-1               | Anaerobic  | Aquatic   | +           | 0             | 0         | 1         | 1         |               |
| Eubacterium ventriosum ATCC 27560            | Anaerobic  | Host      | +           | 0             | 0         | 0         | 0         |               |
| Halotermothrix orenii H 168                  | Anaerobic  | Aquatic   | -           | 0             | 0         | 1         | 1         |               |
| Moorella thermoacetica ATCC 39073            | Anaerobic  | Aquatic   | +           | 0             | 0         | 0         | 1         |               |
| Syntrophomonas wolffi subsp. wolffi str. Goettingen | Anaerobic | Multiple | -         | 0             | 0         | 1         | 1         |               |
| Thermoanaerobacter ethanolicus ATCC 33223    | Anaerobic  | Aquatic   | +           | 0             | 0         | 1         | 1         |               |
| Thermoanaerobacter tengcongensis MB4         | Anaerobic  | Aquatic   | -           | 0             | 0         | 2         | 1         |               |
| Thermosinus carboxydovorans Nor1             | Anaerobic  | Aquatic   | -           | 0             | 0         | 1         | 1         |               |
| **Lactobacillales**                          |            |           |             |               |           |           |           |               |
| Enterococcus faecalis V583                   | Facultative| Multiple  | +           | 0             | 0         | 1         | 2         |               |
| Enterococcus faecium DO                      | Facultative| Multiple  | +           | 0             | 0         | 1         | 1         |               |
| Lactobacillus acidophilus NCFM               | Facultative| Multiple  | +           | 0             | 0         | 2         | 1         |               |
| Lactobacillus brevis ATCC 367                | Facultative| Multiple  | +           | 0             | 0         | 1         | 0         |               |
| Lactobacillus casel ATCC 334                 | Facultative| Multiple  | +           | 0             | 0         | 2         | 1         |               |
| Lactobacillus delbrueckii subsp. bulgaricus ATCC 118| Facultative| Multiple  | +           | 0             | 0         | 2         | 2         |               |
| Lactobacillus gasseri ATCC 33323             | Facultative| Host      | +           | 0             | 0         | 2         | 2         |               |
| Lactobacillus johnsonii NCC 533              | Facultative| Host      | +           | 0             | 0         | 2         | 1         |               |
| Lactobacillus plantarum WCFS1                | Facultative| Host      | +           | 0             | 0         | 2         | 2         |               |
| Lactobacillus reuteri 100-23                 | Facultative| Host      | +           | 0             | 0         | 2         | 1         |               |
| Lactobacillus sakei subsp. sakei 23K         | Facultative| Host      | +           | 0             | 0         | 2         | 1         |               |
| Lactobacillus salivarius subsp. salivarius UCC118| Facultative| Host      | +           | 0             | 0         | 1         | 0         |               |
| Lactococcus lactis subsp. lactis I1403       | Facultative| Host      | +           | 0             | 0         | 2         | 2         |               |
| Leuconostoc mesenteroides subsp. mesenteroides AT1| Facultative| Host      | +           | 0             | 0         | 2         | 2         |               |
| Oenococcus oeni PSU-1                        | Facultative| Host      | +           | 0             | 0         | 2         | 1         |               |
| Pediococcus pentosaceus ATCC 2574S           | Facultative| Host      | +           | 0             | 0         | 2         | 2         |               |
| Streptococcus agalactiae 2603V/R             | Facultative| Host      | +           | 0             | 0         | 1         | 2         |               |
| Streptococcus mutans UA159                   | Facultative| Host      | +           | 0             | 0         | 1         | 1         |               |
| Streptococcus pneumoniae R6                  | Facultative| Host      | +           | 0             | 0         | 1         | 1         |               |
| Streptococcus pyogenes M1 GAS                | Facultative| Host      | +           | 0             | 0         | 1         | 2         |               |
| Streptococcus suis 89/1591                   | Facultative| Host      | +           | 0             | 0         | 1         | 2         |               |
| Streptococcus thermophilus CNRZ1066          | Anaerobic  | Multiple  | +           | 0             | 0         | 1         | 1         |               |
| **Mollicutes**                               |            |           |             |               |           |           |           |               |
| Aster yellows witches1-broom phytoplasma AYWB| Aerobic    | Host      | -           | 0             | 0         | 0         | 0         |               |
| Mesoplasma florum L1                         | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma capricolum subsp. capricolum ATCC 2734| Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma gallisepticum R                   | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma genitalium G37                    | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma hyopneumoniae 232                 | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma mobile 163K                       | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma mycoides subsp. mycoides SC str. PG1| Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma penetrans HF-2                    | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma pneumoniae M129                   | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma pulmonis UAB CTIP                 | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Mycoplasma synoviae 53                       | Facultative| Host      | -           | 0             | 0         | 0         | 0         |               |
| Bacteria                                      | Oxygen Req | Habitat         | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|-----------------------------------------------|------------|-----------------|-------------|---------------|-----------|------------|-----------|---------------|
| Onion yellows phytoplasma OY-M                | Facultative| Host            | -           | 0             | 0         | 0          | 0         | 0             |
| Ureaplasma parvum serovar 3 str. ATCC 700970  | Facultative| Host            | -           | 0             | 0         | 0          | 0         | 0             |
| **Others**                                    |            |                 |             |               |           |            |           |               |
| Acidobacteria Ellin345                        | Aerobic    | Terrestrial     | -           | 1             | 0         | 0          | 0         | 1             |
| Aquifex aequalis VF5                          | Aerobic    | Aquatic         | -           | 1             | 0         | 1          | 1         |               |
| Blastopirellula marina DSM 3645               | Aerobic    | Aquatic         | -           | 0             | 0         | 0          | 0         | 1             |
| Chloroflexus aggregans DSM 9485               | Facultative| Aquatic         | -           | 0             | 0         | 0          | 0         | 1             |
| Chloroflexus aurantiacus J-10-81              | Anaerobic  | Aquatic         | -           | 2             | 0         | 0          | 0         |               |
| Dehalococcoides ethenogenes 195               | Anaerobic  | Multiple        | +           | 0             | 0         | 0          | 0         | 1             |
| Dehalococcoides sp. CBDB1                     | Anaerobic  | Multiple        | +           | 0             | 0         | 0          | 0         |               |
| Deinococcus geothermalis DSM 11300            | Aerobic    | Aquatic         | +           | 1             | 0         | 0          | 0         | 1             |
| Deinococcus radiodurans R1                    | Aerobic    | Terrestrial     | 2           | 0             | 0         | 0          | 0         | 1             |
| Fervidobacterium nodosum R17-B1               | Anaerobic  | Aquatic         | -           | 0             | 0         | 0          | 0         |               |
| Fusobacterium nucleatum subsp. nucleatum ATCC 255| Anaerobic | Host            | -           | 0             | 0         | 0          | 0         | 2             |
| Herpetosiphon aurantiacus ATCC 23779          | Aerobic    | Aquatic         | -           | 1             | 0         | 0          | 0         | 1             |
| Rhodopirellula baltica SH 1                   | Aerobic    | Aquatic         | -           | 1             | 0         | 0          | 0         | 1             |
| Roseiflexus castenholzii DSM 13941            | Facultative| Aquatic         | -           | 1             | 0         | 0          | 0         |               |
| Roseiflexus sp. RS-1                          | Facultative| Aquatic         | -           | 3             | 0         | 0          | 0         |               |
| Solibacter usitatus Ellin6076                 | Aerobic    | Terrestrial     | -           | 3             | 0         | 0          | 0         |               |
| Thermosiphon melanesiensis BI429              | Anaerobic  | Aquatic         | -           | 0             | 0         | 0          | 0         |               |
| Thermotoga maritima MS88                      | Anaerobic  | Aquatic         | -           | 0             | 0         | 0          | 0         |               |
| Thermotoga petrophila RKU-1                   | Anaerobic  | Aquatic         | -           | 0             | 0         | 0          | 0         |               |
| Thermus thermophilus HB27                     | Aerobic    | Aquatic         | -           | 3             | 0         | 0          | 0         | 1             |
| **Proteobacteria**                            |            |                 |             |               |           |            |           |               |
| Magnetococcus sp. MC-1                        | Facultative| Aquatic         | -           | 0             | 0         | 0          | 0         | 1             |
| Mariprofundus ferrooxydans PV-1               | Anaerobic  | Aquatic         | -           | 0             | 0         | 0          | 0         |               |
| **Alph subdivision**                          |            |                 |             |               |           |            |           |               |
| **Others**                                    |            |                 |             |               |           |            |           |               |
| Acidiphilium cryptum JF-5                     | Aerobic    | Multiple        | -           | 2             | 0         | 0          | 0         | 1             |
| Aurantimonas sp. SI85-9A1                     | Aerobic    | Multiple        | -           | 2             | 0         | 0          | 0         |               |
| Bartonella baciliformis KC583                 | Aerobic    | Host            | -           | 2             | 0         | 0          | 0         |               |
| Bartonella henselae str. Houston-1            | Aerobic    | Host            | -           | 3             | 0         | 0          | 0         |               |
| Bartonella quintana str. Toulouse             | Aerobic    | Host            | -           | 2             | 0         | 0          | 0         |               |
| Bradyrhizobium japonicum USDA 110             | Aerobic    | Host            | -           | 4             | 0         | 0          | 0         | 1             |
| Bradyrhizobium sp. BTA1                       | Aerobic    | Host            | -           | 4             | 0         | 0          | 0         |               |
| Brucella abortus biovar 1 str. 9-941          | Facultative| Host            | -           | 4             | 0         | 1          | 2         |               |
| Brucella melitensis 16M                       | Aerobic    | Host            | -           | 4             | 0         | 0          | 2         |               |
| Brucella suis 1330                           | Aerobic    | Host            | -           | 4             | 0         | 0          | 2         |               |
| Caulobacter crescentus CB15                   | Aerobic    | Aquatic         | -           | 1             | 0         | 1          | 3         |               |
| Caulobacter sp. K31                          | Aerobic    | Aquatic         | -           | 2             | 0         | 1          | 3         |               |
| Dinoroseobacter shibae DFL 12                 | Aerobic    | Aquatic         | -           | 2             | 0         | 0          | 0         |               |
| Erythrobacter litoralis HTCC2594              | Aerobic    | Aquatic         | -           | 1             | 0         | 1          | 2         |               |
| Erythrobacter sp. NAP1                        | Aerobic    | Aquatic         | -           | 2             | 0         | 1          | 2         |               |
| Fulvimarina pelagi HTCC2506                   | Aerobic    | Aquatic         | -           | 2             | 0         | 0          | 1         |               |
| Gluconobacter oxydans 621H                    | Aerobic    | Multiple        | -           | 2             | 0         | 0          | 2         |               |
| Granulobacter bethesdensis CGDNIH1            | Aerobic    | Multiple        | -           | 2             | 0         | 0          | 2         |               |
| Hyphomonas neptunium ATCC 15444               | Aerobic    | Aquatic         | -           | 1             | 0         | 1          | 3         |               |
| Jannaschia sp. CCS1                           | Aerobic    | Aquatic         | -           | 1             | 0         | 0          | 1         |               |
| Loktanella vestfoldensis SKA53                | Aerobic    | Aquatic         | -           | 1             | 0         | 0          | 1         |               |
| Magnetospirillum magneticum AMB-1              | Microaerophilic | Aquatic     | -           | 3             | 0         | 0          | 1         |               |
| Magnetospirillum magnetotacticum MS-1          | Microaerophilic | Aquatic     | -           | 3             | 0         | 0          | 0         |               |
| Maricaulis maris MCS10                        | Facultative| Multiple        | -           | 1             | 0         | 0          | 0         |               |
| Mesorhizobium loti MAFF303099                 | Aerobic    | Multiple        | -           | 3             | 0         | 0          | 2         |               |
| Mesorhizobium sp. BNC1                        | Aerobic    | Multiple        | -           | 2             | 0         | 0          | 1         |               |
| Nitrobracte hamburgiensis X14                 | Aerobic    | Terrestrial     | -           | 1             | 0         | 0          | 2         |               |
| Nitrobracte sp. Nb-311A                       | Facultative| Aquatic         | -           | 1             | 0         | 0          | 1         |               |
| Bacteria                          | Oxygen Req | Habitat     | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|----------------------------------|------------|-------------|-------------|---------------|-----------|------------|-----------|---------------|
| Nitrobacter winogradskyi Nb-255  | Facultative| Terrestrial | -           | 1             | 0         | 0          | 1         |               |
| Novosphingobium aromaticivorans DSM 12444 | Aerobic | Multiple | -           | 1             | 1         | 1          | 3         |               |
| Oceanicaulis alexandrii HTCC2633 | Aerobic | Multiple | -           | 1             | 0         | 0          | 2         |               |
| Oceanicola batensis HTCC2597     | Aerobic | Aquatic    | -           | 1             | 0         | 0          | 2         |               |
| Oceanicola granulosus HTCC2516   | Aerobic | Aquatic    | -           | 1             | 0         | 0          | 2         |               |
| Parvibaculum lavamentivorans DS-1 | Aerobic | Multiple | -           | 1             | 0         | 0          | 2         |               |
| Parvularcula bermudensis HTCC2503| Aerobic | Aquatic    | -           | 1             | 0         | 0          | 2         |               |
| Rhodobacter sphaeroides 2.4.1    | Facultative| Multiple | -           | 1             | 0         | 0          | 1         |               |
| Rhodobacteriales bacterium HTCC2654| Aerobic | Aquatic    | -           | 2             | 0         | 0          | 1         |               |
| Rhodopseudomonas palustris BisA53| Facultative| Multiple | -           | 3             | 0         | 0          | 1         |               |
| Rhodospirillum rubrum ATCC 11170 | Facultative| Multiple | -           | 1             | 0         | 0          | 1         |               |
| Roseobacter denitrificans OCh 114| Aerobic | Multiple | -           | 2             | 0         | 0          | 2         |               |
| Roseobacter sp. MED193           | Aerobic | Aquatic    | -           | 1             | 0         | 0          | 1         |               |
| Roseovarius nubinhibens ISM      | Aerobic | Aquatic    | -           | 1             | 0         | 0          | 2         |               |
| Roseovarius sp. 217              | Aerobic | Aquatic    | -           | 2             | 0         | 0          | 1         |               |
| Silicibacter pomeroyi DSS-3       | Aerobic | Aquatic    | -           | 2             | 0         | 0          | 1         |               |
| Silicibacter sp. TM1040           | Aerobic | Multiple | -           | 2             | 0         | 0          | 1         |               |
| Sphingomonas sp. SKA58            | Aerobic | Aquatic    | -           | 2             | 1         | 2          | 3         |               |
| Sphingomonas wittichii RW1        | Aerobic | Aquatic    | -           | 1             | 0         | 1          | 0         |               |
| Sphingopyxis alaskensis RB2256    | Aerobic | Aquatic    | -           | 2             | 1         | 2          | 3         |               |
| Rhizobiaceae                      |           |             |             |               |           |            |           |               |
| Agrobacterium tumefaciens str. C58| Aerobic | Multiple | -           | 2             | 0         | 0          | 2         |               |
| Rhizobium etl CFN 42              | Aerobic | Host       | -           | 2             | 0         | 0          | 2         |               |
| Rhizobium leguminosarum bv. viciae 3841 | Aerobic |multiple | -           | 1             | 0         | 0          | 1         |               |
| Sinorhizobium medicae WSM419      | Aerobic | Host       | -           | 2             | 0         | 0          | 2         |               |
| Sinorhizobium meliloti 1021       | Aerobic | Host       | -           | 3             | 0         | 0          | 1         |               |
| Rickettsiales                     |           |             |             |               |           |            |           |               |
| Anaplasma marginale str. St. Maries | Aerobic | Host     | -           | 1             | 0         | 0          | 0         |               |
| Anaplasma phagocytophilum HZ      | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Candidatus Pelagibacter ubiquim HTCC1062 | Aerobic | Aquatic | -           | 1             | 0         | 0          | 0         |               |
| Ehrlichia canis str. Jake         | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Ehrlichia chaffeensis str. Arkansas | Aerobic | Host     | -           | 1             | 0         | 0          | 0         |               |
| Ehrlichia ruminantium str. Gardel | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Neorickettsia sennetsu str. Miyayama | Aerobic | Host     | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia africae ESF-5          | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia akari str. Hartford    | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia bellii RML369-C        | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia canadensis str. McKiel | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia conorii str. Malish 7  | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia felis URRWXXCaI2       | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia massiliæ MTU5          | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia prowazekii str. Madrid E | Aerobic | Host     | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia rickettsii             | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia sibirica 246           | Aerobic | Host       | -           | 1             | 0         | 0          | 0         |               |
| Rickettsia typhi str. Wilmington  | Aerobic | Host       | -           | 0             | 0         | 0          | 0         |               |
| Wolbachia endosymbiont of Drosophila melanogaster | Aerobic | Host | -           | 1             | 0         | 0          | 0         |               |

### Beta subdivision

| Bordetella                      |           |             |             |               |           |            |           |               |
|----------------------------------|------------|-------------|-------------|---------------|-----------|------------|-----------|---------------|
| Bordetella bronchiseptica RB50   | Aerobic | Host       | -           | 5             | 0         | 0          | 2         |               |
| Bordetella parapertussis 12822   | Aerobic | Host       | -           | 5             | 0         | 0          | 2         |               |
| Bordetella pertussis Tohama I    | Aerobic | Host       | -           | 5             | 0         | 0          | 2         |               |
| Bacteria                          | Oxygen Req | Habitat     | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|----------------------------------|------------|-------------|-------------|---------------|-----------|------------|-----------|---------------|
| Burkholderiaceae                 |            |             |             |               |           |            |           |               |
| Burkholderia ambifaria MC40-6    | Aerobic    | Multiple    | -           | 2             | 0         | 0          | 0         | 1             |
| Burkholderia cenocepaica AU1054  | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Burkholderia cepacia AMMD        | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Burkholderia dolosa AU0158       | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 1             |
| Burkholderia mallei ATCC 23344   | Aerobic    | Host        | -           | 4             | 0         | 0          | 1         | 2             |
| Burkholderia multivorans ATCC 17616 | Aerobic | Host        | -           | 3             | 1         | 1          | 3         | 2             |
| Burkholderia phymatum STM815     | Aerobic    | Host        | -           | 2             | 0         | 0          | 0         | 0             |
| Burkholderia phytofirmans PsJN   | Aerobic    | Terrestrial | -           | 2             | 0         | 0          | 0         | 2             |
| Burkholderia pseudomallei 1710b  | Aerobic    | Terrestrial | -           | 4             | 0         | 1          | 2         | 2             |
| Burkholderia sp. 383             | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Burkholderia thailandensis E264  | Aerobic    | Terrestrial | -           | 4             | 0         | 1          | 2         | 2             |
| Burkholderia vietnamiensis G4    | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Burkholderia xenovorans LB400    | Aerobic    | -           | -           | 3             | 0         | 0          | 0         | 2             |
| Polynucleobacter sp. QLW-P1DMWA-1| Anaerobic  | Aquatic     | -           | 2             | 0         | 0          | 0         | 2             |
| Ralstonia eutropha JMP134         | Faculative | Multiple    | -           | 3             | 1         | 1          | 2         | 2             |
| Ralstonia metallidurans CH34     | Faculative | Multiple    | -           | 4             | 1         | 1          | 3         | 2             |
| Ralstonia pickettii T2J           | Aerobic    | Host        | -           | 4             | 1         | 1          | 3         | 2             |
| Ralstonia solanacearum GM1000    | Aerobic    | -           | -           | 4             | 1         | 1          | 2         | 2             |
| Neisseriaceae                    |            |             |             |               |           |            |           |               |
| Chromobacterium violaceum ATCC 12472 | Faculative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Neisseria gonorrhoeae FA 1090    | Aerobic    | Host        | -           | 2             | 0         | 0          | 0         | 1             |
| Neisseria meningitidis MC58      | Aerobic    | Host        | -           | 2             | 0         | 0          | 0         | 1             |
| Others                           |            |             |             |               |           |            |           |               |
| Acidovorax avenue subsp. citrulli AAC00-1 | Aerobic | Multiple    | -           | 5             | 0         | 0          | 0         | 1             |
| Acidovorax sp. JS42              | Aerobic    | Terrestrial | -           | 4             | 0         | 0          | 0         | 2             |
| Azorarcus sp. EbN1                | Faculative | Terrestrial | -           | 3             | 0         | 0          | 0         | 1             |
| Comamonas testosteroni KF-1      | Aerobic    | Multiple    | -           | 2             | 1         | 1          | 2         | 2             |
| Dechloromonas aromatica RCB      | Faculative | Multiple    | -           | 1             | 0         | 0          | 0         | 1             |
| Delfia acidovorans SPH-1         | Aerobic    | -           | -           | 2             | 1         | 1          | 1         | 2             |
| Methylbium petroleiphilum PM1    | Aerobic    | Multiple    | -           | 1             | 0         | 0          | 0         | 0             |
| Methylbacterium flagellatus KT   | Aerobic    | Multiple    | -           | 4             | 0         | 0          | 0         | 1             |
| Methylphilales bacterium HTCC2181 | Aerobic | Aquatic     | -           | 2             | 0         | 0          | 0         | 1             |
| Nitrosomonas europaea ATCC 19718  | Aerobic    | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Nitrosomonas eutropha C71        | Aerobic    | -           | -           | 4             | 0         | 0          | 0         | 2             |
| Nitrososipira multiformis ATCC 25196 | Aerobic | Terrestrial | -           | 4             | 0         | 0          | 0         | 1             |
| Polaromonas naphthaleni vorans CJ2 | Aerobic  | Aquatic     | -           | 2             | 0         | 0          | 0         | 1             |
| Polaromonas sp. JS666            | Aerobic    | Multiple    | -           | 2             | 0         | 0          | 0         | 1             |
| Rhodotherax ferriferreducens T118 | Faculative | Multiple    | -           | 2             | 0         | 0          | 0         | 1             |
| Rubrivivax gelatinosus PM1       | Faculative | Aquatic     | -           | 2             | 0         | 0          | 0         | 2             |
| Thioacillus dentrificans ATCC 25259 | Faculative | Multiple    | -           | 4             | 0         | 0          | 0         | 3             |
| Verminephrobacter einseiiae EF01-2 | Anaerobic | Host        | -           | 1             | 0         | 0          | 0         | 1             |
| delta subdivision                |            |             |             |               |           |            |           |               |
| Anaeromyxobacter dehalogenans 2CP-C | Anaerobic | Terrestrial | -           | 2             | 0         | 0          | 0         | 1             |
| Anaeromyxobacter sp. Fw109-5     | Anaerobic  | Terrestrial | -           | 0             | 0         | 0          | 0         | 1             |
| Bdellovibrio bacteriovorus HD100 | Aerobic    | Multiple    | -           | 1             | 0         | 0          | 0         | 1             |
| Candidatus Desulfococcus oleovorans Hx3 | Anaerobic | Aquatic     | -           | 0             | 0         | 0          | 0         | 0             |
| Desulfotalea psychrophila LSv54  | Anaerobic  | Aquatic     | -           | 0             | 0         | 0          | 0         | 0             |
| Desulfuromonas desulfuricans G20  | Anaerobic  | Multiple    | -           | 1             | 0         | 0          | 0         | 1             |
| Desulfuromonas vulgaris subsp. vulgaris str. Hildenborough | Anaerobic | Multiple    | -           | 1             | 0         | 0          | 0         | 0             |
| Desulfuromonas acetoxidans DSM 684 | Anaerobic | Aquatic     | -           | 0             | 0         | 0          | 0         | 0             |
| Desulfuromonas acetoxidans DSM 684 | Anaerobic | Aquatic     | -           | 0             | 0         | 0          | 0         | 0             |
| Geobacter lovleyi SZ              | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 0             |
| Geobacter metallireducens GS-15   | Anaerobic  | Aquatic     | -           | 1             | 0         | 0          | 0         | 0             |
| Geobacter sp. FRC-32              | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 0             |
| Geobacter sulfurireducens PCA     | Anaerobic  | Multiple    | -           | 1             | 0         | 0          | 0         | 0             |
| Geobacter uranireducens RH4       | Anaerobic  | Multiple    | -           | 1             | 0         | 0          | 0         | 0             |
| Lawsonia intracellularis PHE/MN1-00 | Faculative | Host        | -           | 1             | 0         | 0          | 0         | 0             |
| Bacteria                                      | Oxygen Req | Habitat     | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|----------------------------------------------|------------|-------------|-------------|---------------|-----------|------------|-----------|---------------|
| Myxococcus xanthus DK 1622                   | Aerobic    | Terrestrial | -           | 1             | 0         | 0          | 0         | 1             |
| Pelobacter carbinolicus DSM 2380             | Anaerobic  | Aquatic     | -           | -             | 1         | 0          | 0         | 1             |
| Pelobacter propionicus DSM 2370              | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 1             |
| Stigmatella aurantiaca DW4/3-1               | Aerobic    | Terrestrial | -           | 2             | 0         | 0          | 0         | 1             |
| Syntrophobacter fumaroxidans MPOB            | Anaerobic  | Aquatic     | -           | -             | 0         | 0          | 0         | 1             |
| Syntrophus aciditrophicus SB                 | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 1             |
| delta proteobacterium MLMS-1                 | Microaerophilic | Terrestrial | -           | -             | 0         | 0          | 0         | 0             |
| Myxococcus xanthus DK 1622                   | Aerobic    | Terrestrial | -           | 1             | 0         | 0          | 0         | 1             |
| Pelobacter carbinolicus DSM 2380             | Anaerobic  | Aquatic     | -           | -             | 1         | 0          | 0         | 1             |
| Pelobacter propionicus DSM 2370              | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 1             |
| Stigmatella aurantiaca DW4/3-1               | Aerobic    | Terrestrial | -           | 2             | 0         | 0          | 0         | 1             |
| Syntrophobacter fumaroxidans MPOB            | Anaerobic  | Aquatic     | -           | -             | 0         | 0          | 0         | 1             |
| Syntrophus aciditrophicus SB                 | Anaerobic  | Multiple    | -           | 0             | 0         | 0          | 0         | 1             |
| Campylobacter coli RM2228                    | Microaerophilic | Multiple    | -           | 0             | 0         | 0          | 0         | 0             |
| Campylobacter concisus 13826                 | Microaerophilic | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Campylobacter curvus 525.92                  | Microaerophilic | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Campylobacter fetus subsp. fetus 82-40       | Microaerophilic | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Campylobacter jejuni RM1221                  | Microaerophilic | Multiple  | -           | 0             | 0         | 0          | 0         | 0             |
| Campylobacter lari RM2100                    | Microaerophilic | Multiple  | -           | 1             | 0         | 0          | 0         | 0             |
| Campylobacter upsaliensis RM3195             | Microaerophilic | Multiple  | -           | 0             | 0         | 0          | 0         | 0             |
| Helicobacter acinonychis str. Sheeba         | Microaerophilic | Host       | -           | 0             | 0         | 0          | 0         | 0             |
| Helicobacter hepatus ATCC 51449              | Microaerophilic | Host       | -           | 0             | 0         | 0          | 0         | 0             |
| Helicobacter pylori 26885                    | Aerobic    | Host        | -           | 0             | 0         | 0          | 0         | 0             |
| Thiomicrospora dentrificans ATCC 33889       | Anaerobic  | Multiple    | -           | 1             | 0         | 0          | 0         | 0             |
| Wolinella succinogenes DSM 1740              | Microaerophilic | Host       | -           | 0             | 0         | 0          | 0         | 0             |
| Buchnera aphidicola str. APS (Acyrthosiphon pisum) | Facultative | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Candidatus Blochmannia floridanus            | Facultative | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Enterobacter sp. 638                         | Facultative | Host       | -           | 3             | 0         | 0          | 0         | 3             |
| Erwinia carotovora subsp. atroseptica SCR1043 | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 4             |
| Escherichia coli 536                         | Facultative | Host       | -           | 5             | 0         | 0          | 0         | 5             |
| Photobacterium luminescens subsp. lau mouldi TT01 | Facultative | Host       | -           | 3             | 0         | 0          | 0         | 3             |
| Salmonella enterica subsp. enterica serovar Cholerae | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 4             |
| Salmonella typhimurium LT2                   | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 4             |
| Serratia proteamaculans 568                  | Facultative | Multiple    | -           | 3             | 0         | 0          | 0         | 2             |
| Shigella boydii Sb227                        | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 4             |
| Shigella dysenteriae Sd197                   | Facultative | Host       | -           | 3             | 0         | 0          | 0         | 5             |
| Shigella flexneri 2a str. 2457T              | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 5             |
| Shigella sonnei Ss046                        | Facultative | Host       | -           | 4             | 0         | 0          | 0         | 5             |
| Sodalis glossinisidius str. ‘morsitans’       | Microaerophilic | Host       | -           | 3             | 0         | 0          | 0         | 3             |
| Wigglesworthia glossinioides endosymbiont of Glossinia morsitans | Microaerophilic | Host       | -           | 3             | 0         | 0          | 0         | 0             |
| Yersinia bercovieri ATCC 43970               | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Yersinia enterocolitica subsp. enterocolitica 8081 | Facultative | Host       | -           | 3             | 0         | 0          | 0         | 3             |
| Yersinia frederiksenii ATCC 33641            | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Yersinia intermedia ATCC 29909               | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Yersinia mollaretii ATCC 43969               | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Yersinia pestis Antiqua                      | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Yersinia pseudotuberculosis IP 32953         | Facultative | Multiple    | -           | 4             | 0         | 0          | 0         | 4             |
| Acinetobacter sp. ADP1                       | Aerobic    | Multiple    | -           | 2             | 0         | 0          | 0         | 1             |
| Aeromonas hydrophila subsp. hydrophila ATCC 7966 | Facultative | Host       | -           | 3             | 0         | 0          | 0         | 3             |
| Alcanivorax borkumensis SK2                  | Aerobic    | Aquatic     | -           | 3             | 0         | 0          | 0         | 1             |
| Alkalilimnicola ehrichii MLHE-1              | Facultative | Aquatic     | -           | 2             | 0         | 0          | 0         | 0             |
| Altemomonadales bacterium TW-7               | Aerobic    | Aquatic     | -           | 2             | 0         | 0          | 0         | 0             |
| Alteromonas macleodii 'Deep ecotype'         | Aerobic    | Aquatic     | -           | 5             | 0         | 0          | 0         | 1             |
| Baumannia cicadellinicola str. Hc (Hornalodisca coagulata) | Facultative | Host       | -           | 2             | 0         | 0          | 0         | 0             |
| Candidatus Carsonella ruddii PV              | Facultative | Host       | -           | 0             | 0         | 0          | 0         | 0             |
| Candidatus Ruthia magnifica str. Cm (Calyptogena mag) | Facultative | Host       | -           | 0             | 0         | 0          | 0         | 0             |
| Chromohalobacter salexigens DSM 3043         | Aerobic    | Multiple    | -           | 4             | 0         | 0          | 0         | 0             |
| Colwellia psychrerythraea 34H                | Facultative | Aquatic     | -           | 2             | 0         | 0          | 0         | 1             |
| Congregibacter iloralis KT71                | Aerobic    | Aquatic     | -           | 0             | 0         | 0          | 0         | 0             |
| Bacteria                                      | Oxygen Req | Habitat      | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|-----------------------------------------------|------------|--------------|-------------|---------------|-----------|------------|-----------|---------------|
| Coxiella burnetii RSA 493                    | Facultative| Multiple     | -           | 3             | 0         | 0          | 0         | 0             |
| Endorhica persephone ‘Hot96_1+Hot96_2’       | Aerobic    | Host         | -           | 0             | 0         | 0          | 0         | 0             |
| Francisella tularensis subsp. holarctica     | Aerobic    | Host         | -           | 3             | 0         | 0          | 0         | 1             |
| Halhaella chejuensis KTC 2396                | Facultative| Aquatic      | -           | 3             | 0         | 0          | 0         | 1             |
| Halorhodospira halophila SL1                 | Facultative| Multiple     | -           | 0             | 0         | 0          | 0         | 0             |
| Idiomarina baltica OS145                     | Aquatic    | -            | 3           | 0             | 0         | 1          | 0         | 1             |
| Idiomarina liohiensis L2TR                   | Aerobic    | Aquatic      | -           | 3             | 0         | 1          | 2         | 0             |
| Legionella pneumophila str. Lens             | Aerobic    | Host         | -           | 2             | 0         | 0          | 0         | 0             |
| Marinobacter aquaeolei VT8                   | Facultative| Aquatic      | -           | 4             | 0         | 1          | 0         | 1             |
| Marinomonas sp. MED121                       | Aerobic    | Aquatic      | 2           | 0             | 0         | 0          | 0         | 0             |
| Methylococcus capsulatus str. Bath          | Aerobic    | Multiple     | -           | 3             | 0         | 0          | 0         | 1             |
| Nitrococcus mobilis Nb-231                   | Aerobic    | Aquatic      | -           | 2             | 0         | 0          | 0         | 0             |
| Nitrosococcus oceanis ATCC 19707             | Aerobic    | Aquatic      | -           | 3             | 0         | 1          | 0         | 0             |
| Oceanobacter sp. RED65                       | Aerobic    | Aquatic      | -           | 2             | 0         | 0          | 0         | 0             |
| Oceanospirillum sp. MED92                    | Aerobic    | Aquatic      | -           | 2             | 0         | 0          | 0         | 0             |
| Pseudoalteromonas atlantica T6c             | Aerobic    | Aquatic      | -           | 4             | 0         | 0          | 1         | 0             |
| Pseudoalteromonas haloplanktis TAC125        | Aerobic    | Aquatic      | -           | 3             | 0         | 0          | 0         | 2             |
| Pseudoalteromonas tunicata D2                | Facultative| Aquatic      | -           | 2             | 0         | 0          | 0         | 0             |
| Psychrobacter arcticus 273-4                | Aerobic    | Aquatic      | -           | 1             | 0         | 1          | 0         | 1             |
| Psychrobacter crythrahtentis K5             | Aerobic    | Multiple     | -           | 1             | 0         | 1          | 1         | 1             |
| Psychrobacter sp. PRwf-1                    | Aerobic    | Multiple     | -           | 1             | 0         | 1          | 1         | 1             |
| Psychromonas iningrami 37                    | Anaerobic  | Aquatic      | -           | 3             | 0         | 1          | 1         | 0             |
| Psychromonas sp. CNP53                      | Facultative| Aquatic      | -           | 1             | 0         | 0          | 1         | 0             |
| Reinekeia sp. MED297                        | Aerobic    | Aquatic      | -           | 3             | 0         | 1          | 0         | 0             |
| Rickettsiella rylli                         | Facultative| Host         | -           | 1             | 0         | 0          | 0         | 0             |
| Saccharophagus degradans 2-40               | Aerobic    | Aquatic      | -           | 1             | 0         | 0          | 2         | 0             |
| Shewanella amazonensis SB2B                 | Facultative| Multiple     | -           | 2             | 0         | 0          | 0         | 0             |
| Shewanella baltica OS155                    | Facultative| Aquatic      | -           | 3             | 0         | 0          | 0         | 3             |
| Shewanella dentrificans OS217               | Facultative| Aquatic      | -           | 4             | 0         | 0          | 0         | 3             |
| Shewanella fridigoritana NCIMB 400          | Facultative| Multiple     | -           | 3             | 0         | 0          | 0         | 3             |
| Shewanella oneidensis MR-1                  | Facultative| Multiple     | -           | 3             | 0         | 0          | 0         | 0             |
| Shewanella pealeana ATCC 700345             | Facultative| Multiple     | -           | 2             | 0         | 0          | 0         | 0             |
| Shewanella putrefaciens CN-32               | Facultative| Multiple     | -           | 5             | 0         | 0          | 0         | 3             |
| Shewanella sp. MR-4                         | Facultative| Multiple     | -           | 5             | 0         | 0          | 0         | 0             |
| Shewanella woodii ATCC 51908                | Facultative| Multiple     | -           | 4             | 0         | 0          | 0         | 0             |
| Thiomicrospira crunogena XCL-2              | Anaerobic  | Aquatic      | -           | 1             | 0         | 0          | 3         | 0             |
| marine gamma proteobacterium HTCC2080       | Aerobic    | Aquatic      | -           | 1             | 0         | 0          | 0         | 0             |
| marine gamma proteobacterium HTCC2143       | Aerobic    | Aquatic      | -           | 1             | 0         | 0          | 0         | 0             |
| marine gamma proteobacterium HTCC2207       | Aerobic    | Aquatic      | -           | 1             | 0         | 0          | 0         | 0             |
| Pasteurellaceae                              |            |              |             |               |           |            |           |               |
| Actinobacillus pleuropneumoniae serovar 1 str. 4074 | Facultative| Host         | -           | 2             | 0         | 0          | 0         | 0             |
| Actinobacillus succinogens 130Z             | Anaerobic  | Host         | 2           | 0             | 0         | 0          | 0         | 0             |
| Haemophilus ducrey 35000HP                  | Anaerobic  | Host         | -           | 2             | 0         | 0          | 0         | 0             |
| Haemophilus influenzae 86-028NP             | Facultative| Host         | -           | 1             | 0         | 1          | 2         | 0             |
| Haemophilus somnus 129PT                    | Facultative| Host         | -           | 0             | 0         | 0          | 0         | 1             |
| Mannheimia haemolytica PHL213               | Facultative| Multiple     | -           | 1             | 0         | 1          | 1         | 1             |
| Mannheimia succinciproducens MBEL55E        | Anaerobic  | Host         | -           | 2             | 0         | 0          | 0         | 0             |
| Pasteurella multocida subsp. multocida str. Pm70 | Facultative| Host         | -           | 1             | 0         | 0          | 0         | 0             |
| Pseudomonadaceae                            |            |              |             |               |           |            |           |               |
| Azotobacter vinelandii AvOOP                | Aerobic    | Multiple     | -           | 3             | 0         | 0          | 0         | 2             |
| Pseudomonas aeruginosa PAO1                 | Aerobic    | Multiple     | -           | 4             | 0         | 0          | 0         | 2             |
| Pseudomonas entomophila L48                 | Aerobic    | Multiple     | -           | 3             | 0         | 0          | 0         | 2             |
| Pseudomonas fluorescens FY-5                | Aerobic    | Multiple     | -           | 3             | 0         | 1          | 2         | 0             |
| Pseudomonas mendocina ymp                   | Aerobic    | Multiple     | -           | 4             | 0         | 0          | 0         | 2             |
| Pseudomonas putida KT2440                   | Aerobic    | Multiple     | -           | 4             | 0         | 0          | 0         | 2             |
| Pseudomonas syringae pv. phaseolicola 1448A | Aerobic    | Multiple     | -           | 5             | 0         | 0          | 0         | 2             |
| Vibrionaceae                                |            |              |             |               |           |            |           |               |
| Bacteria                        | Oxygen Req     | Habitat      | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins |
|--------------------------------|---------------|--------------|-------------|---------------|-----------|------------|-----------|--------------|
| Photobacterium profundum SS9   | Facultative   | Multiple     | -           | 4             | 0         | 0          | 0         | 2            |
| Photobacterium sp. SKA34       | Facultative   | Multiple     | -           | 3             | 0         | 0          | 0         | 1            |
| Vibrio alginolyticus 12G01     | Facultative   | Multiple     | -           | 5             | 0         | 0          | 0         | 1            |
| Vibrio angustum S14            | Facultative   | Aquatic      | -           | 3             | 0         | 0          | 0         | 1            |
| Vibrio cholerae O1 biovar eltor str. N16961 | Facultative   | Aquatic      | -           | 2             | 0         | 0          | 0         | 1            |
| Vibrio fischeri ES114          | Facultative   | Aquatic      | -           | 1             | 0         | 0          | 0         | 1            |
| Vibrio harveyi HY01            | Facultative   | Aquatic      | -           | 5             | 0         | 0          | 0         | 0            |
| Vibrio parahaemolyticus RIMD 2210633 | Facultative   | Aquatic      | -           | 5             | 0         | 0          | 0         | 1            |
| Vibrio sp. Ex25               | Facultative   | Aquatic      | -           | 5             | 0         | 0          | 0         | 1            |
| Vibrio splendidus 12B01        | Facultative   | Aquatic      | -           | 4             | 0         | 0          | 0         | 1            |
| Vibrio vulnificus CMCP6        | Facultative   | Aquatic      | -           | 3             | 0         | 0          | 0         | 1            |
| Xanthomonadaceae               |               |              |             |               |           |            |           |              |
| Stenotrophomonas maltophilia R551-3 | Aerobic   | Multiple     | -           | 2             | 0         | 0          | 0         | 2            |
| Xanthomonas axonopodis pv. citri str. 306 | Aerobic   | Host         | -           | 3             | 0         | 0          | 0         | 3            |
| Xanthomonas campestris pv. campestris str. 8004 | Aerobic   | Host         | -           | 3             | 0         | 0          | 0         | 3            |
| Xanthomonas oryzae pv. oryzae KACC10331 | Aerobic   | Host         | -           | 3             | 0         | 0          | 0         | 3            |
| Xylella fastidiosa 9aSc        | Aerobic       | Host         | -           | 3             | 0         | 0          | 0         | 3            |
| Spirochaetales                 |               |              |             |               |           |            |           |              |
| Borrelia afzelli PKo           | Aerobic       | Host         | -           | 0             | 0         | 0          | 0         | 0            |
| Borrelia burgdorferi B31       | Microaerophilic| Host        | -           | 0             | 0         | 0          | 0         | 0            |
| Borrelia garinii PBi           | Microaerophilic| Host        | -           | 0             | 0         | 0          | 0         | 0            |
| Leptospira borgpetersenii serovar Hardjo-bovis JB197 | Aerobic   | Host         | -           | 0             | 0         | 0          | 0         | 0            |
| Leptospira interrogans serovar Copenhageni str. FioC | Aerobic   | Host         | -           | 2             | 0         | 0          | 0         | 1            |
| Treponema dentica ATCC 35405   | Anaerobic     | Host         | -           | 0             | 0         | 0          | 0         | 1            |
| Treponema pallidum subsp. pallidum str. Nichols | Anaerobic     | Host         | -           | 0             | 0         | 0          | 0         | 0            |
| Archaea                        |               |              |             |               |           |            |           |              |
| Crenarchaeota                  |               |              |             |               |           |            |           |              |
| Desulfurococcales              |               |              |             |               |           |            |           |              |
| Aeropyrum pernix K1            | Aerobic       | Terrestrial  | -           | 1             | 0         | 0          | 0         | 0            |
| Hyperthermus butylicus DSM 5456 | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 0            |
| Sulfolobales                   |               |              |             |               |           |            |           |              |
| Metalsphera sedula DSM 5348    | Aerobic       | Aquatic      | -           | 1             | 0         | 0          | 0         | 0            |
| Sulfolobus acidocaldarius DSM 639 | Aerobic       | Aquatic      | -           | 2             | 0         | 0          | 0         | 0            |
| Sulfolobus sulfataricus P2     | Aerobic       | Aquatic      | -           | 2             | 0         | 0          | 0         | 0            |
| Sulfolobus tokodaii str. 7     | Aerobic       | Aquatic      | -           | 1             | 0         | 0          | 0         | 0            |
| Thermoproteales                |               |              |             |               |           |            |           |              |
| Pyrococcus aerophilum str. IM2  | Facultative   | Aquatic      | -           | 1             | 0         | 0          | 0         | 0            |
| Pyrococcus islandicum DSM 4184 | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 0            |
| Thermofilum pendens Hrk 5      | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 0            |
| Euryarchaeota                  |               |              |             |               |           |            |           |              |
| Archaeoglobales                |               |              |             |               |           |            |           |              |
| Archaeoglobus fulgidus DSM 4304 | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 1            |
| Halobacteriales                |               |              |             |               |           |            |           |              |
| Haloarcula marismortii ATCC 43049 | Aerobic   | Aquatic      | -           | 2             | 0         | 0          | 0         | 1            |
| Halo bacterium sp. NRC-1       | Aerobic       | Aquatic      | -           | 1             | 0         | 0          | 0         | 0            |
| Haloquadratum walsbyi DSM 16790 | Aerobic       | Aquatic      | -           | 1             | 0         | 0          | 0         | 0            |
| Natronomonas pharaonis DSM 2160 | Aerobic       | Aquatic      | -           | 1             | 0         | 0          | 0         | 1            |
| Methanobacteriales              |               |              |             |               |           |            |           |              |
| Methanosphaera stadtnanee DSM 3091 | Anaerobic     | Host         | -           | 0             | 0         | 0          | 0         | 1            |
| Methanothermobacter thermotrophicus str. Delta H | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 1            |
| Methanococcales                 |               |              |             |               |           |            |           |              |
| Methanocaldococcus jannaschii DSM 2661 | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 0            |
| Methanococcus maripaludis S2    | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 0            |
| Methanomicrobiales              |               |              |             |               |           |            |           |              |
| Methanoculleus marisnigri JR1   | Anaerobic     | Aquatic      | -           | 0             | 0         | 0          | 0         | 1            |
| Methanospirillum hungatei JF-1  | Anaerobic     | Multiple     | -           | 0             | 0         | 0          | 0         | 1            |
| Bacteria                  | Oxygen Req | Habitat  | Gram Strain | Cuproproteins | Importers | Chaperones | Exporters | Cuproproteins | 
|--------------------------|------------|----------|-------------|---------------|-----------|------------|-----------|---------------| 
| **Methanopyrales**       |            |          |             |               |           |            |           |               | 
| Methanopyrus kandleri AV19 | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 0         | 0             | 
| **Methanosarcinales**    |            |          |             |               |           |            |           |               | 
| Methanococcoides burtonii DSM 6242 | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| Methanoseta thermophila PT | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| Methanosarcina acetivorans C2A | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| Methanosarcina barkeri str. Fusaro | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| Methanosarcina mazei Go1  | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| **Thermcococcales**      |            |          |             |               |           |            |           |               | 
| Pyrococcus abyssi GE5     | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 0         |               | 
| Pyrococcus furiosus DSM 3638 | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| Pyrococcus horikoshii OT3 | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 0         |               | 
| Thermococcus kodakarensis KOD1 | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 1         |               | 
| **Thermoplasmales**      |            |          |             |               |           |            |           |               | 
| Ferroplasma acidarmanus Fer1 | Facultative | Terrestrial |         | 0             | 0         | 0          | 0         |               | 
| Picrophilus torridus DSM 9790 | Facultative | Terrestrial |         | 1             | 0         | 0          | 0         |               | 
| Thermoplasma acidophilum DSM 1728 | Facultative | Aquatic |             | 0             | 0         | 0          | 0         |               | 
| Thermoplasma volcanium GSS1 | Facultative | Aquatic |             | 0             | 0         | 0          | 0         |               | 
| **Nanoarchaeota**        |            |          |             |               |           |            |           |               | 
| Nanoarchaeum equitans Kin4-M | Anaerobic  | Aquatic  |             | 0             | 0         | 0          | 0         |               |
| Bacteria                                           | COX  | ND2  | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|----------------------------------------------------|------|------|------|---------------|--------------|--------------------------------|------------------|------|
| Acidothermus cellulolyticus 11B                    | +    |      |      |               |              |                                |                  |      |
| Arthrobacter aurescens TC1                         | +    |      |      |               |              |                                |                  |      |
| Arthrobacter sp. FB24                               | +    |      | +    |               |              |                                |                  |      |
| Bifidobacterium adolescentis                       | +    |      |      |               |              |                                |                  |      |
| Bifidobacterium longum DJO10A                       | +    |      |      |               |              |                                |                  |      |
| Brevibacterium linens BL2                           | +    |      |      |               |              |                                |                  |      |
| Collinsella aerofaciens ATCC 25986                  |      |      |      |               |              |                                |                  |      |
| Corynebacterium diphtheriae NCTC 13129              |      |      |      |               |              |                                |                  |      |
| Corynebacterium efficiens YS-314                    |      |      |      |               |              |                                |                  |      |
| Corynebacterium glutamicum ATCC 13032               |      |      |      |               |              |                                |                  |      |
| Corynebacterium jeikeium K411                       |      |      |      |               |              |                                |                  |      |
| Frankia alni ACN14a                                 |      |      |      |               |              |                                |                  |      |
| Frankia sp. EAN1pec                                 |      |      | +    |               |              |                                |                  |      |
| Janibacter sp. HTCC2649                             |      |      |      |               |              |                                |                  |      |
| Kineococcus radiotolerans SRS30216                  |      |      |      |               |              |                                |                  |      |
| Leifsonia xyi subsp. xyi str. CTCB07                |      |      |      |               |              |                                |                  |      |
| Mycobacterium avium subsp. paratuberculosis K-10    |      |      |      |               |              |                                |                  |      |
| Mycobacterium bovis AF21222/87                      |      |      |      |               |              |                                |                  |      |
| Mycobacterium flavescens PYR-GCK                    |      |      |      |               |              |                                |                  |      |
| Mycobacterium leprae TN                             |      |      |      |               |              |                                |                  |      |
| Mycobacterium smegmatis str. MC2 155                |      |      |      |               |              |                                |                  |      |
| Mycobacterium sp. KMS                               |      |      |      |               |              |                                |                  |      |
| Mycobacterium tuberculosis C                        |      |      |      |               |              |                                |                  |      |
| Mycobacterium ulcerans Agy99                        |      |      |      |               |              |                                |                  |      |
| Mycobacterium vanbaalenii PYR-1                     |      |      |      |               |              |                                |                  |      |
| Nocardia farcinica IFM 10152                        |      |      |      |               |              |                                |                  |      |
| Nocardiooides sp. JS614                             |      |      |      |               |              |                                |                  |      |
| Propionibacterium acnes KPA171202                   |      |      |      |               |              |                                |                  |      |
| Rhodococcus sp. RHA                                 |      |      |      |               |              |                                |                  |      |
| Rubrobacter xylanophilus DSM 9941                   |      |      |      |               |              |                                |                  |      |
| Salinispora arenicola CNS205                         |      |      |      |               |              |                                |                  |      |
| Salinispora tropica CNB-440                         |      |      |      |               |              |                                |                  |      |
| Streptomyces avermitilis MA-4680                    |      |      |      |               |              |                                |                  |      |
| Streptomyces coelicolor A3(2)                        |      |      |      |               |              |                                |                  |      |
| Symbiobacterium thermophilum IAM 14863              |      |      |      |               |              |                                |                  |      |
| Thermobifida fusca YX                               |      |      |      |               |              |                                |                  |      |
| Tropheryma whipplei TW08/27                         |      |      |      |               |              |                                |                  |      |
| marine actinobacterium PHSC29C1                     |      |      |      |               |              |                                |                  |      |

**Bacteroidetes/Chlorobi**

| Bacteroides caccae ATCC 43185                       |      |      |      |               |              |                                |                  |      |
| Bacteroides fragilis YCH46                          |      |      |      |               |              |                                |                  |      |
| Bacteroides thetaiotaomicron VPI-5482               |      |      |      |               |              |                                |                  |      |
| Candidatus Sulcia muelleri str. Hc (Homalodiscus coagulatus) |      |      |      |               |              |                                |                  |      |
| Cellulophaga sp. MED134                             |      |      |      |               |              |                                |                  |      |
| Chlorobium chlororhodanum CaD3                      |      |      |      |               |              |                                |                  |      |
| Chlorobium ferrooxidans DSM 13031                   |      |      |      |               |              |                                |                  |      |
| Chlorobium limicola DSM 245                         |      |      |      |               |              |                                |                  |      |
| Chlorobium phaeobacteroides BS1                     |      |      |      |               |              |                                |                  |      |
| Chlorobium tepidum TLS                              |      |      |      |               |              |                                |                  |      |
| Croceibacter atlanticus HTCC2559                    |      |      |      |               |              |                                |                  |      |
| Cytophaga hutchinsonii ATCC 33406                   |      |      |      |               |              |                                |                  |      |
| Flavobacteria bacterium BBFL7                        |      |      |      |               |              |                                |                  |      |
| Flavobacteriales bacterium HTCC2170                 |      |      |      |               |              |                                |                  |      |
| Flavobacterium johnsoniae UW101                      |      |      |      |               |              |                                |                  |      |
| Gramella forsetii KT0803                            |      |      |      |               |              |                                |                  |      |
| Leeuwenhoekiella blandensis MED217                  |      |      |      |               |              |                                |                  |      |
| Microscilla marina ATCC 23134                       |      |      |      |               |              |                                |                  |      |
| Bacteria | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|----------|-----|-----|------|---------------|-------------|-------------------------------|-----------------|-----|
| Pelodictyon luteolum DSM 273 | + | + | + | + | + | + | + | + |
| Pelodictyon phaeochlathriforme BU-1 | + | + | + | + | + | + | + | + |
| Polaribacter egseli 23-P | + | + | + | + | + | + | + | + |
| Porphyrmonas gingivalis W83 | + | + | + | + | + | + | + | + |
| Prosthecochloris aestuarii DSM 271 | + | + | + | + | + | + | + | + |
| Prosthecochloris vibrioformis DSM 265 | + | + | + | + | + | + | + | + |
| Psychroflexus torquis ATCC 700755 | + | + | + | + | + | + | + | + |
| Robignitalea biformata HTCC2501 | + | + | + | + | + | + | + | + |
| Salinibacter ruder DSM 13855 | + | + | + | + | + | + | + | + |
| Tenacibaculum sp. MED152 | + | + | + | + | + | + | + | + |
| **Chlamydiae** | | | | | | | | |
| Candidatus Protochlamydia amoebophila UWE25 | + | + | + | + | + | + | + | + |
| Chlamydia muridumum Nigg | + | + | + | + | + | + | + | + |
| Chlamydia trachomatis A/HAR-13 | + | + | + | + | + | + | + | + |
| Chlamydophila abortus S26/3 | + | + | + | + | + | + | + | + |
| Chlamydophila caviae GPIC | + | + | + | + | + | + | + | + |
| Chlamydophila felis Fe/C-56 | + | + | + | + | + | + | + | + |
| Chlamydophila pneumoniae AR39 | + | + | + | + | + | + | + | + |
| **Cyanobacteria** | | | | | | | | |
| Anabaena variabilis ATCC 29413 | + | + | + | + | + | + | + | + |
| Crocosphaera watsonii WH 8501 | + | + | + | + | + | + | + | + |
| Gloeobacter violaceus PCC 7421 | + | + | + | + | + | + | + | + |
| Lyngbya sp. PCC 8106 | + | + | + | + | + | + | + | + |
| Nodularia spumigena CCY9414 | + | + | + | + | + | + | + | + |
| Nostoc punctiforme PCC 73102 | + | + | + | + | + | + | + | + |
| Nostoc sp. PCC 7120 | + | + | + | + | + | + | + | + |
| Prochlorococcus marinus str. MIT 9312 | + | + | + | + | + | + | + | + |
| Synechococcus elongatus PCC 6301 | + | + | + | + | + | + | + | + |
| Synechococcus sp. CC9311 | + | + | + | + | + | + | + | + |
| Synechocystis sp. PCC 6803 | + | + | + | + | + | + | + | + |
| Thermosynechococcus elongatus BP-1 | + | + | + | + | + | + | + | + |
| Trichodesmium erythraeum IMS101 | + | + | + | + | + | + | + | + |
| **Firmicutes** | | | | | | | | |
| **Bacillales** | | | | | | | | |
| Bacillus anthracis str. Ames | + | + | + | + | + | + | + | + |
| Bacillus cereus ATCC 10987 | + | + | + | + | + | + | + | + |
| Bacillus clausi KSM-K16 | + | + | + | + | + | + | + | + |
| Bacillus halodurans C-125 | + | + | + | + | + | + | + | + |
| Bacillus licheniformis ATCC 14580 | + | + | + | + | + | + | + | + |
| Bacillus sp. NRRL B-14911 | + | + | + | + | + | + | + | + |
| Bacillus subtilis subsp. subtilis str. 168 | + | + | + | + | + | + | + | + |
| Bacillus thuringiensis serovar konkukian str. 97-27 | + | + | + | + | + | + | + | + |
| Bacillus weihenstephanensis KBAB4 | + | + | + | + | + | + | + | + |
| Exiguobacterium sibiricum 255-15 | + | + | + | + | + | + | + | + |
| Geobacillus kaustophilus HTA426 | + | + | + | + | + | + | + | + |
| Listeria innocua Clip112624 | + | + | + | + | + | + | + | + |
| Listeria monocytogenes EGD-e | + | + | + | + | + | + | + | + |
| Listeria welshimeri serovar 6b str. SLCC5334 | + | + | + | + | + | + | + | + |
| Oceanobacillus iheyensis HTE831 | + | + | + | + | + | + | + | + |
| Paenibacillus larvae subsp. larvae BRL-230010 | + | + | + | + | + | + | + | + |
| Pasteurella nishizawae str. North American | + | + | + | + | + | + | + | + |
| Staphylococcus aureus RF122 | + | + | + | + | + | + | + | + |
| Staphylococcus epidermidis ATCC 12228 | + | + | + | + | + | + | + | + |
| Staphylococcus haemolyticus JCSC1435 | + | + | + | + | + | + | + | + |
| Staphylococcus saprophyticus subsp. saprophyticus A | + | + | + | + | + | + | + | + |
| **Clostridia** | | | | | | | | |
| Alkaliphilus metalliredigenes QYMF | + | + | + | + | + | + | + | + |
| Bacteria                          | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrate Reductase | Cu amine oxidase | pMMO |
|----------------------------------|-----|-----|------|---------------|--------------|---------------------------------|----------------|------|
| Caldicellulosiruptor saccharolyticus DSM 8903 |     |     |      |               |              |                                 |                |      |
| Carboxydothermus hydrogenoformans Z-2901 |     |     |      |               |              |                                 |                |      |
| Clostridium acetobutylicum ATCC 824  |     |     |      |               |              |                                 |                |      |
| Clostridium beijerincki NCIMB 8052 |     |     |      |               |              |                                 |                |      |
| Clostridium cellulosolyticum H10  |     |     |      |               |              |                                 |                |      |
| Clostridium difficile QCD-32g58 |     |     |      |               |              |                                 |                |      |
| Clostridium novyi NT |     |     |      |               |              |                                 |                |      |
| Clostridium perfringens ATCC 13124 |     |     |      |               |              |                                 |                |      |
| Clostridium phytofermentans ISDg |     |     |      |               |              |                                 |                |      |
| Clostridium sp. OhILAs |     |     |      |               |              |                                 |                |      |
| Clostridium tetani E88 |     |     |      |               |              |                                 |                |      |
| Clostridium thermocellum ATCC 27405 |     |     |      |               |              |                                 |                |      |
| Desulfbacterium halophilum DGB-2 |     |     |      |               |              |                                 |                |      |
| Desulfovomaculum reducens MI-1 |     |     |      |               |              |                                 |                |      |
| Eubacterium ventriosum ATCC 27560 |     |     |      |               |              |                                 |                |      |
| Halothermotrix orei H 168 |     |     |      |               |              |                                 |                |      |
| Moorella thermoacetica ATCC 39073 |     |     |      |               |              |                                 |                |      |
| Syntrophomonas wolfei subsp. wolfei str. Goettingen | |   | | | | | | |
| Thermoanaerobacter ethanolicus ATCC 33233 | | | | | | | | |
| Thermoanaerobacter tengcongensis MB4 | | | | | | | | |
| Thermosinus carboxydivorans Nor1 | | | | | | | | |
| **Lactobacillales** | | | | | | | | |
| Enterococcus faecalis V583 | | | | | | | | |
| Enterococcus faecium DO | | | | | | | | |
| Lactobacillus acidophilus NCFM | | | | | | | | |
| Lactobacillus brevis ATCC 367 | | | | | | | | |
| Lactobacillus casei ATCC 334 | | | | | | | | |
| Lactobacillus delbrueckii subsp. bulgaricus ATCC 1184 | | | | | | | | |
| Lactobacillus gasseri ATCC 33323 | | | | | | | | |
| Lactobacillus johnsonii NCC 533 | | | | | | | | |
| Lactobacillus plantarum WCFS1 | | | | | | | | |
| Lactobacillus reuteri 100-23 | | | | | | | | |
| Lactobacillus sakei subsp. sakei 23K | | | | | | | | |
| Lactobacillus salivarius subsp. salivarius UCC118 | | | | | | | | |
| Lactococcus lactis subsp. lactis II1403 | | | | | | | | |
| Leuconostoc mesenteroides subsp. mesenteroides AT1 | | | | | | | | |
| Oenococcus oeni PSU-1 | | | | | | | | |
| Pediococcus pentosaceus ATCC 2574S | | | | | | | | |
| Streptococcus agalactiae 2603V/R | | | | | | | | |
| Streptococcus mutans UA159 | | | | | | | | |
| Streptococcus pneumoniae R6 | | | | | | | | |
| Streptococcus pyogenes M1 GAS | | | | | | | | |
| Streptococcus suis 89/1591 | | | | | | | | |
| Streptococcus thermophilus CNRZ1066 | | | | | | | | |
| **Mollicutes** | | | | | | | | |
| Aster yellows witches1-broom phytoplasma AYWB | | | | | | | | |
| Mesoplasma florium L1 | | | | | | | | |
| Mycoplasma capricolum subsp. capricolum ATCC 2734 | | | | | | | | |
| Mycoplasma gallisepticum R | | | | | | | | |
| Mycoplasma genitalium G37 | | | | | | | | |
| Mycoplasma hyopneumoniae 232 | | | | | | | | |
| Mycoplasma mobile 163K | | | | | | | | |
| Mycoplasma mycoides subsp. mycoides SC str. PG1 | | | | | | | | |
| Mycoplasma penetrans HF-2 | | | | | | | | |
| Mycoplasma pneumoniae M129 | | | | | | | | |
| Mycoplasma pulmonis UAB CTIP | | | | | | | | |
| Mycoplasma synoviae 53 | | | | | | | | |
| Bacteria                                      | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|---------------------------------------------|-----|-----|------|---------------|--------------|---------------------------------|------------------|------|
| Onion yellows phytoplasma OY-M             |     |     |      |               |              |                                 |                  |      |
| Ureaplasma parvum serovar 3 str. ATCC 700970 |     |     |      |               |              |                                 |                  |      |
| Others                                      |     |     |      |               |              |                                 |                  |      |
| Acidobacteria bacterium Ellin345            | +   |     |      |               |              |                                 |                  |      |
| Aquifex aeolicus VF5                        | +   |     |      |               |              |                                 |                  |      |
| Blastopirellula marina DSM 3645             | +   |     |      |               |              |                                 |                  |      |
| Chloroflexus aggregans DSM 9485             | +   |     |      |               |              |                                 |                  |      |
| Chloroflexus auranticus J-10-II             | +   |     |      |               |              |                                 |                  |      |
| Dehalococcoides ethenogenes 195             |     |     |      |               |              |                                 |                  |      |
| Dehalococcoides sp. CBDB1                   |     |     |      |               |              |                                 |                  |      |
| Deinococcus geothermalis DSM 11300           | +   |     |      |               |              |                                 |                  |      |
| Deinococcus radiodurans R1                  |     |     |      |               |              |                                 |                  |      |
| Fervidobacterium nodosum RI17-B1            |     |     |      |               |              |                                 |                  |      |
| Fusobacterium nucleatum subsp. nucleatum ATCC 255 |     |     |      |               |              |                                 |                  |      |
| Herpetosiphon auranticus ATCC 23779         |     |     |      |               |              |                                 |                  |      |
| Rhodopirellula baltica SH 1                |     |     |      |               |              |                                 |                  |      |
| Rodolflexus castenholzii DSM 13941          |     |     |      |               |              |                                 |                  |      |
| Rosiflexus sp. RS-1                         |     |     |      |               |              |                                 |                  |      |
| Solibacter usitatus Ellin6076               | +   |     |      |               |              |                                 |                  |      |
| Thermosiphon melanesiensis BI429            |     |     |      |               |              |                                 |                  |      |
| Thermotoga maritima MS8                      |     |     |      |               |              |                                 |                  |      |
| Thermotoga petrophila RKU-1                |     |     |      |               |              |                                 |                  |      |
| Thermus thermophilus HB27                  |     |     |      |               |              |                                 |                  |      |
| Proteobacteria                              |     |     |      |               |              |                                 |                  |      |
| Others                                      |     |     |      |               |              |                                 |                  |      |
| Magnetococcus sp. MC-1                      |     |     |      |               |              |                                 |                  |      |
| Mariprofundus ferrooxydans PV-1             |     |     |      |               |              |                                 |                  |      |
| Alpha subdivision                           |     |     |      |               |              |                                 |                  |      |
| Others                                      |     |     |      |               |              |                                 |                  |      |
| Acidiphilium cryptum JF-5                   |     |     |      |               |              |                                 |                  |      |
| Aurantimonas sp. Si85-9A1                   |     |     |      |               |              |                                 |                  |      |
| Bartonella baciliformis KC583               |     |     |      |               |              |                                 |                  |      |
| Bartonella henselae str. Houston-1          |     |     |      |               |              |                                 |                  |      |
| Bartonella quintana str. Toulouse           |     |     |      |               |              |                                 |                  |      |
| Bradyrhizobium japonicum USDA 110           |     |     |      |               |              |                                 |                  |      |
| Bradyrhizobium sp. BTA1                     |     |     |      |               |              |                                 |                  |      |
| Brucella abortus biovar 1 str. 9-941        |     |     |      |               |              |                                 |                  |      |
| Brucella melitensis 16M                      |     |     |      |               |              |                                 |                  |      |
| Brucella suis 1330                          |     |     |      |               |              |                                 |                  |      |
| Caulobacter crescentus CB15                 |     |     |      |               |              |                                 |                  |      |
| Caulobacter sp. K31                         |     |     |      |               |              |                                 |                  |      |
| Dinoroseobacter shibae DFL 12               |     |     |      |               |              |                                 |                  |      |
| Erythrobacter litoralis HTCC2594            |     |     |      |               |              |                                 |                  |      |
| Erythrobacter sp. NAP1                      |     |     |      |               |              |                                 |                  |      |
| Fulvimarina pelagi HTCC2506                 |     |     |      |               |              |                                 |                  |      |
| Glucobacter oxydans 621H                    |     |     |      |               |              |                                 |                  |      |
| Granulobacter bethesdensis CGDNH1           |     |     |      |               |              |                                 |                  |      |
| Hyphomonas neptunium ATCC 15444             |     |     |      |               |              |                                 |                  |      |
| Jannaschia sp. CCS1                         |     |     |      |               |              |                                 |                  |      |
| Loktanella vestfoldensis SKA53              |     |     |      |               |              |                                 |                  |      |
| Magnetospirillum magneticum AMB-1           |     |     |      |               |              |                                 |                  |      |
| Magnetospirillum magnetotacticum MS-1        |     |     |      |               |              |                                 |                  |      |
| Marinocapsus maris MCS10                    |     |     |      |               |              |                                 |                  |      |
| Mesophilobacter loti MAFF303099             |     |     |      |               |              |                                 |                  |      |
| Mesorhizobium sp. BNC1                      |     |     |      |               |              |                                 |                  |      |
| Nitrobacter hamburgensis X14                |     |     |      |               |              |                                 |                  |      |
| Nitrobacter sp. Nb-311A                     |     |     |      |               |              |                                 |                  |      |
| Bacteria | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing | Cu amine oxidase | pMMO |
|----------|-----|-----|------|--------------|-------------|--------------|-----------------|-----|
| Nitrobacter winogradskyi Nb-255 | + |   |     |              |             |              |                 |     |
| Novosphingobium aromaticivorans DSM 12444 | + |   |     |              |             |              |                 |     |
| Oceanicaulis alexandrii HTCC2633 | + |   |     |              |             |              |                 |     |
| Oceanicola batensis HTCC2597 | + |   |     |              |             |              |                 |     |
| Oceanicola granulosus HTCC2516 | + |   |     |              |             |              |                 |     |
| Paracoccus denitrificans PD1222 | + |   |     | +            | +           |              |                 |     |
| Parvibaculum lavamentivorans DS-1 | + |   |     |              |             |              |                 |     |
| Parvularcula bermudensis HTCC2503 | + |   |     |              |             |              |                 |     |
| Rhodobacter sphaeroides 2.4.1 | + |   |     |              |             |              |                 |     |
| Rhodobacterales bacterium HTCC2654 | + |   |     |              |             |              |                 |     |
| Rhodopseudomonas palustris BisA53 | + |   |     |              |             |              |                 |     |
| Rhodospirillum rubrum ATCC 11170 | + |   |     |              |             |              |                 |     |
| Roseobacter denitrificans OC1 114 | + |   |     |              |             |              |                 |     |
| Roseobacter sp. MED193 | + |   |     |              |             |              |                 |     |
| Roseovarius nubinhibens ISM | + |   |     |              |             |              |                 |     |
| Roseovarius sp. 217 | + |   |     |              |             |              |                 |     |
| Silicibacter pomeroyi DSS-3 | + |   |     |              |             |              |                 |     |
| Silicibacter sp. TM1040 | + |   |     |              |             |              |                 |     |
| Sphingomonas sp. SKA58 | + |   |     |              |             |              |                 |     |
| Sphingomonas wittichii RW1 | + |   |     |              |             |              |                 |     |
| Sphingopyxis alaskensis RB2256 | + |   |     |              |             |              |                 |     |
| Stappia aggregata IAM 12614 | + |   |     |              |             |              |                 |     |
| Sulfitobacter sp. EE-36 | + |   |     |              |             |              |                 |     |
| Xanthobacter autotrophicus Py2 | + |   |     |              |             |              |                 |     |
| Zymomonas mobilis subsp. mobilis ZM4 | + |   |     |              |             |              |                 |     |
| alpha proteobacterium HTCC2255 | + |   |     |              |             |              |                 |     |

**Rhizobiaceae**

| Agrobacterium tumefaciens str. C58 | + |   |     |              |             |              |                 |     |
| Agrobacterium etli CFN 42 | + |   |     |              |             |              |                 |     |
| Rhizobium leguminosarum bv. viciae 3841 | + |   |     |              |             |              |                 |     |
| Sinorhizobium medicae WSM419 | + |   |     |              |             |              |                 |     |
| Sinorhizobium melloti 1021 | + |   |     |              |             |              |                 |     |

**Rickettsiales**

| Anaplasma marginale str. St. Maries | + |   |     |              |             |              |                 |     |
| Anaplasma phagocytophilum HZ | + |   |     |              |             |              |                 |     |
| Candidatus Pelagibacter ubiquique HTCC1062 | + |   |     |              |             |              |                 |     |
| Ehrlichia canis str. Jake | + |   |     |              |             |              |                 |     |
| Ehrlichia chaffeensis str. Arkansas | + |   |     |              |             |              |                 |     |
| Ehrlichia ruminantium str. Garde | + |   |     |              |             |              |                 |     |
| Neorickettsia sennetsu str. Miyayama | + |   |     |              |             |              |                 |     |
| Rickettsia africae ESF-5 | + |   |     |              |             |              |                 |     |
| Rickettsia akari str. Hartford | + |   |     |              |             |              |                 |     |
| Rickettsia bellii RML369-C | + |   |     |              |             |              |                 |     |
| Rickettsia canadensis str. McKiel | + |   |     |              |             |              |                 |     |
| Rickettsia conorii str. Malish 7 | + |   |     |              |             |              |                 |     |
| Rickettsia felis URRWxCa12 | + |   |     |              |             |              |                 |     |
| Rickettsia massiliae MTU5 | + |   |     |              |             |              |                 |     |
| Rickettsia prowazekii str. Madrid E | + |   |     |              |             |              |                 |     |
| Rickettsia rickettsii | + |   |     |              |             |              |                 |     |
| Rickettsia sibirica 246 | + |   |     |              |             |              |                 |     |
| Rickettsia typhi str. Wilmington | + |   |     |              |             |              |                 |     |
| Wolbachia endosymbiont of Drosophila melanogaster | + |   |     |              |             |              |                 |     |

**Beta subdivision**

| Bordetella bronchiseptica RB50 | + | + | + |              |             |              |                 |     |
| Bordetella parapertussis 12822 | + | + | + |              |             |              |                 |     |
| Bordetella pertussis Tohama I | + | + | + |              |             |              |                 |     |
| Bacteria                     | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|------------------------------|-----|-----|------|---------------|--------------|---------------------------------|-----------------|------|
| **Burkholderiaceae**         |     |     |      |               |              |                                 |                 |      |
| Burkholderia ambifaria MC40-6 | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia cenocepacia AU 1054 | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia cepacia AMMD    |     |     |      |               |              |                                 |                 |      |
| Burkholderia dolosa AUO158   | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia malaei ATCC 23344 | +   | +   | +    | +            |              |                                 |                 |      |
| Burkholderia multivorans ATCC 17616 | +   | +   |      | +            |              |                                 |                 |      |
| Burkholderia phymatum STM815  |     |     |      |               |              |                                 |                 |      |
| Burkholderia phytofirmans PsJN | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia pseudomallei 1710b | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia sp. 383         | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia thailandensis E264 | +   | +   |      |               | +            |                                 |                 |      |
| Burkholderia vietnamiensis G4 | +   | +   |      |               |              |                                 |                 |      |
| Burkholderia xerovorans LB400 |     |     |      |               |              |                                 |                 |      |
| Polynucleobacter sp. QLV-P1DMWA-1 | +   | +   |      |               |              |                                 |                 |      |
| Ralstonia eutropha JMP134      | +   | +   | +    |               |              |                                 |                 |      |
| Ralstonia metalldurans CH34   | +   | +   | +    |               |              |                                 |                 |      |
| Ralstonia pickettii 12J       | +   | +   | +    |               | +            |                                 |                 |      |
| Ralstonia solanacearum GM11000 | +   | +   |      |               |              |                                 |                 |      |
| **Neisseriaceae**            |     |     |      |               |              |                                 |                 |      |
| Chromobacterium violaceum ATCC 12472 | +   | +   |      |               |              |                                 |                 |      |
| Neisseria gonorrhoeae FA 1090  |     |     |      |               |              |                                 |                 |      |
| Neisseria meningitidis MC58   | +   | +   |      |               |              |                                 |                 |      |
| **Others**                   |     |     |      |               |              |                                 |                 |      |
| Acidovorax avenae subsp. citrulli AAC00-1 | +   | +   | +    |               | +            |                                 |                 |      |
| Acidovorax sp. JS42           | +   | +   |      |               | +            |                                 |                 |      |
| Azotobacter sp. EbN1          | +   | +   |      |               | +            |                                 |                 |      |
| Comamonas testosteroni KF-1   | +   | +   |      |               | +            |                                 |                 |      |
| Dechloromonas aromatica RCB   | +   | +   |      |               |              |                                 |                 |      |
| Delftia acidovorans SPH-1     | +   | +   |      |               | +            |                                 |                 |      |
| Methylbium petroleiphilum PM1 | +   | +   |      |               |              |                                 |                 |      |
| Methyllobacillus flagellatus KT |     |     |      |               |              |                                 |                 |      |
| Methylphilales bacterium HTCC2181 | +   | +   |      |               | +            |                                 |                 |      |
| Nitrosomonas europaea ATCC 19718 | +   | +   |      |               | +            |                                 |                 |      |
| Nitrosomonas eutropha C71     | +   | +   |      |               | +            |                                 |                 |      |
| Nitrosospira multiformis ATCC 25196 | +   | +   |      |               | +            |                                 |                 |      |
| Pseudomonas naphthalenivorans CJ2 | +   | +   |      |               | +            |                                 |                 |      |
| Pseudomonas sp. JS666          | +   | +   |      |               | +            |                                 |                 |      |
| Rhodotherax ferrereducens T118 | +   | +   |      |               | +            |                                 |                 |      |
| Rubrivivax gelatinosus PM1    | +   | +   |      |               | +            |                                 |                 |      |
| Thiobacillus denitrificans ATCC 25259 | +   | +   | +    |               | +            |                                 |                 |      |
| Verminephrobacter eiseniae EF01-2 | +   | +   |      |               | +            |                                 |                 |      |
| **delta subdivision**         |     |     |      |               |              |                                 |                 |      |
| Anaeromycobacter dehalogenans 2CP-C | +   | +   |      |               |              |                                 |                 |      |
| Anaeromycobacter sp. Fw109-5  | +   | +   |      |               | +            |                                 |                 |      |
| Bodelloviibacter bacteriovorus HD100 | +   | +   |      |               | +            |                                 |                 |      |
| Candidatus Desulfococcus oleovorans Hxd3 | +   | +   |      |               | +            |                                 |                 |      |
| Desulfotalea psychrophila LSv54 | +   | +   |      |               | +            |                                 |                 |      |
| Desulfovibrio desulfuricans G20 | +   | +   |      |               | +            |                                 |                 |      |
| Desulfovibrio vulgaris subsp. vulgaris str. Hildenborough | +   | +   |      |               | +            |                                 |                 |      |
| Desulfomonas acetoxidans DSM 684 |     |     |      |               |              |                                 |                 |      |
| Geobacter lovleyi SZ           | +   | +   |      |               | +            |                                 |                 |      |
| Geobacter metallireducens GS-15 | +   | +   |      |               | +            |                                 |                 |      |
| Geobacter sp. FRC-32           | +   | +   |      |               | +            |                                 |                 |      |
| Geobacter sulfurreducens PCA   | +   | +   |      |               | +            |                                 |                 |      |
| Geobacter uranireducens R14   | +   | +   |      |               | +            |                                 |                 |      |
| Lawsonia intracellularis PHE/MN1-00 | +   | +   |      |               | +            |                                 |                 |      |
| Bacteria                                                                 | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrate Reductase | Cu amine oxidase | pMMO |
|--------------------------------------------------------------------------|-----|-----|------|---------------|--------------|-------------------------------|-----------------|------|
| Myxococcus xanthus DK 1622                                               |     |     |      |               |              |                               |                 |      |
| Pelobacter carbinolicus DSM 2380                                          |     |     |      |               |              |                               |                 |      |
| Pelobacter propionicus DSM 2379                                            | +   |     |      |               |              |                               |                 |      |
| Stigmatella aurantiaca DW4-3-1                                             |     |     |      |               |              |                               |                 |      |
| Syntrophobacter fumaroxidans MPOB                                         |     |     |      |               |              |                               |                 |      |
| Syntrophus aciditrophicus SB                                              |     |     |      |               |              |                               |                 |      |
| delta proteobacterium MLMS-1                                              |     |     |      |               |              |                               |                 |      |
| Campylobacter coli RM2228                                                 |     |     |      |               |              |                               |                 |      |
| Campylobacter concisus 13826                                              |     |     |      |               |              |                               |                 |      |
| Campylobacter curvus 525.92                                               |     |     |      |               |              |                               |                 |      |
| Campylobacter fetus subsp. fetus 82-40                                   |     |     |      |               |              |                               |                 |      |
| Campylobacter jejuni RM1221                                               |     |     |      |               |              |                               |                 |      |
| Campylobacter iani RM2100                                                 |     |     |      |               |              |                               |                 |      |
| Campylobacter upsaliensis RM3195                                           |     |     |      |               |              |                               |                 |      |
| Helicobacter acinonychis str. Sheeba                                       |     |     |      |               |              |                               |                 |      |
| Helicobacter hepaticus ATCC 51449                                         |     |     |      |               |              |                               |                 |      |
| Helicobacter pylori 26695                                                 |     |     |      |               |              |                               |                 |      |
| Thiomicrospira denitrificans ATCC 33889                                   |     |     |      |               |              |                               |                 |      |
| Wolinella succinogenes DSM 1740                                            |     |     |      |               |              |                               |                 |      |
| **gamma subdivision**                                                     |     |     |      |               |              |                               |                 |      |
| **Enterobacteriales**                                                     |     |     |      |               |              |                               |                 |      |
| Buchnera aphidicola str. APS (Acyrthosiphon pisum)                       | +   |     |      |               |              |                               |                 |      |
| Candidatus Blochmanni flavianus                                           |     |     |      |               |              |                               |                 |      |
| Enterobacter sp. 638                                                      | +   | +   |      |               |              |                               |                 |      |
| Erwinia carotovora subsp. atroseptica SCR11043                            | +   | +   |      |               |              |                               |                 |      |
| Escherichia coli 536                                                     |     |     |      |               |              |                               |                 |      |
| Photobacterium luminescens subsp. laevis TTO1                             | +   |     |      |               |              |                               |                 |      |
| Salmonella enterica subsp. enterica serovar Cholerae                      | +   |     |      |               |              |                               |                 |      |
| Salmonella typhimurium LT2                                                | +   |     |      |               |              |                               |                 |      |
| Serratia proteamaculans 568                                               | +   |     |      |               |              |                               |                 |      |
| Shigella boydii Sb227                                                     | +   |     |      |               |              |                               |                 |      |
| Shigella dysenteriae Sd197                                                | +   |     |      |               |              |                               |                 |      |
| Shigella flexneri 2a str. 2457T                                           | +   |     |      |               |              |                               |                 |      |
| Shigella sonnei Sso46                                                    | +   |     |      |               |              |                               |                 |      |
| Sodalis glossinidius str. 'morsitans'                                    |     |     |      |               |              |                               |                 |      |
| Wigglesworthia glossinidia endosymbiont of Glossina morsitans             | +   |     |      |               |              |                               |                 |      |
| Yersinia bercovieri ATCC 43970                                            | +   |     |      |               |              |                               |                 |      |
| Yersinia enterocolitica subsp. enterocolitica 8081                        | +   |     |      |               |              |                               |                 |      |
| Yersinia frederiksenii ATCC 33641                                        | +   |     |      |               |              |                               |                 |      |
| Yersinia intermedia ATCC 29909                                            | +   |     |      |               |              |                               |                 |      |
| Yersinia mollaretii ATCC 43969                                           | +   |     |      |               |              |                               |                 |      |
| Yersinia pestis Antiqia                                                  | +   |     |      |               |              |                               |                 |      |
| Yersinia pseudotuberculosis IP 32963                                     | +   |     |      |               |              |                               |                 |      |
| **Others**                                                               |     |     |      |               |              |                               |                 |      |
| Acinetobacter sp. ADP1                                                   | +   |     |      |               |              |                               |                 |      |
| Aeromonas hydrophila subsp. hydrophila ATCC 7966                          |     |     |      |               |              |                               |                 |      |
| Alcanivorax borkumensis SK2                                               | +   |     |      |               |              |                               |                 |      |
| Alkalimicrobium ehrichii MLHE-1                                          |     |     |      |               |              |                               |                 |      |
| Alteromonadales bacterium TW-7                                            | +   |     |      |               |              |                               |                 |      |
| Alteromonas macleodii 'Deep ecotype'                                     | +   | +   |      |               |              |                               |                 |      |
| Baumannia cicadellinicola str. Hc (Homalodisca coagulata)                |     |     |      |               |              |                               |                 |      |
| Candidatus Carsonella ruddii PV                                           |     |     |      |               |              |                               |                 |      |
| Candidatus Ruthia magna str. Cr (Calyptogena magna)                      |     |     |      |               |              |                               |                 |      |
| Chromohalobacter salexigens DSM 3043                                      |     |     |      |               |              |                               |                 |      |
| Colwellia psychrophythrea 34H                                             |     |     |      |               |              |                               |                 |      |
| Congregibacter litoralis KT71                                            |     |     |      |               |              |                               |                 |      |
| Bacteria | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|----------|-----|-----|------|---------------|--------------|-------------------------------|----------------|------|
| **Coxiella burnetii RSA 493** | +   |     | +    |               |              |                               |                |      |
| **Endoriftia persephone ‘Hot96_1+Hot96_2’** | +   |     | +    |               |              |                               |                |      |
| **Francisella tularensis subsp. holarctica** | +   |     | +    |               |              |                               |                |      |
| **Haella chejuenensis KCTC 2396** |     | +   | +    |               |              |                               |                |      |
| **Halorhodospira halophila SL1** |     | +   | +    |               |              |                               |                |      |
| **Idiornarina baltica OS145** | +   |     |     |               |              |                               |                |      |
| **Idiornarina loihiensis L2TR** | +   |     |     |               |              |                               |                |      |
| **Legionella pneumophila str. Lens** | +   |     |     |               |              |                               |                |      |
| **Marinobacter aequorei VT8** | +   | +   |     |               |              |                               |                |      |
| **Marinomonas sp. MED121** | +   |     |     |               |              |                               |                |      |
| **Methylococcus capsulatus str. Bath** | +   |     |     |               |              |                               |                |      |
| **Nitroccocus mobilis Nb-231** | +   |     |     |               |              |                               |                |      |
| **Nitrosporococcus oceani ATCC 19707** |     | +   |     |               |              |                               |                |      |
| **Oceanobacter sp. RED65** | +   |     |     |               |              |                               |                |      |
| **Oceanospirillum sp. MED92** | +   |     |     |               |              |                               |                |      |
| **Pseudoalteromonas atlantica T6c** | +   | +   |     |               |              |                               |                |      |
| **Pseudoalteromonas haloplanktis TAC125** | +   |     |     |               |              |                               |                |      |
| **Pseudoalteromonas tunicata D2** | +   |     |     |               |              |                               |                |      |
| **Psychrobacter arcticus 273-4** |     | +   |     |               |              |                               |                |      |
| **Psychrobacter cryohalolentis K5** |     |     |     |               |              |                               |                |      |
| **Psychrobacter sp. PRwf-1** |     |     |     |               |              |                               |                |      |
| **Psychromonas ingrahamii 37** | +   |     |     |               |              |                               |                |      |
| **Psychromonas sp. CNPT3** | +   |     |     |               |              |                               |                |      |
| **Reinekeia sp. MED297** | +   |     | +    |               |              |                               |                |      |
| **Rickettsiella grylli** |     | +   |     |               |              |                               |                |      |
| **Saccharophagus degradans 2-40** | +   |     |     |               |              |                               |                |      |
| **Shewanella amazonensis SB2B** | +   |     |     |               |              |                               |                |      |
| **Shewanella baltica OS155** | +   |     |     |               |              |                               |                |      |
| **Shewanella dentriticicans OS217** | +   |     |     |               |              |                               |                |      |
| **Shewanella frigidimarina NCIMB 400** | +   |     |     |               |              |                               |                |      |
| **Shewanella oneidensis MR-1** | +   |     |     |               |              |                               |                |      |
| **Shewanella peallenia ATCC 700345** | +   |     |     |               |              |                               |                |      |
| **Shewanella putrefaciens CN-32** | +   |     |     |               |              |                               |                |      |
| **Shewanella sp. MR-4** | +   |     |     |               |              |                               |                |      |
| **Shewanella woodyi ATCC 51908** | +   |     |     |               |              |                               |                |      |
| **Thiomicrospira crunogena XCL-2** |     | +   |     |               |              |                               |                |      |
| **marine gamma proteobacterium HTCC2080** | +   |     |     |               |              |                               |                |      |
| **marine gamma proteobacterium HTCC2143** | +   |     |     |               |              |                               |                |      |
| **marine gamma proteobacterium HTCC2207** | +   |     |     |               |              |                               |                |      |
| **Pasteurellaceae** |     |     |     |               |              |                               |                |      |
| **Actinobacillus pleuropneumoniae serovar 1 str. 4074** | +   |     |     |               |              |                               |                |      |
| **Actinobacillus succinogenes 130Z** | +   |     |     |               |              |                               |                |      |
| **Haemophilus ducryi 35000HP** | +   |     |     |               |              |                               |                |      |
| **Haemophilus influenzae B6-028NP** | +   |     |     |               |              |                               |                |      |
| **Haemophilus somnus 129PT** |     | +   |     |               |              |                               |                |      |
| **Mannheimia haemolytica PHL213** | +   |     |     |               |              |                               |                |      |
| **Mannheimia succinicivorans MBEL55E** | +   |     |     |               |              |                               |                |      |
| **Pasteurella multocida subsp. multocida str. Pm70** | +   |     |     |               |              |                               |                |      |
| **Pseudomonadaceae** |     |     |     |               |              |                               |                |      |
| **Azotobacter vinelandii AvOP** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas aeruginosa PAO1** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas entomophila L48** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas fluorescens Pf-5** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas mendocina ymp** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas putida KT2440** | +   |     |     |               |              |                               |                |      |
| **Pseudomonas syringae pv. phaseolicola 1448A** | +   |     |     |               |              |                               |                |      |
| **Vibrionaceae** |     |     |     |               |              |                               |                |      |
| Bacteria                                      | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|-----------------------------------------------|-----|-----|------|---------------|-------------|---------------------------------|------------------|------|
| Photobacterium profundum SS9                  |     |     |      |               |             |                                 |                  |      |
| Photobacterium sp. SKA34                       |     |     |      |               |             |                                 |                  |      |
| Vibrio alginolyticus 12G01                     |     |     |      |               |             |                                 |                  |      |
| Vibrio angustum S14                            |     |     |      |               |             |                                 |                  |      |
| Vibrio cholerae O1 biovar eltor str. N16961   |     |     |      |               |             |                                 |                  |      |
| Vibrio fischeri ES114                          |     |     |      |               |             |                                 |                  |      |
| Vibrio harveyi HY01                            |     |     |      |               |             |                                 |                  |      |
| Vibrio parahaemolyticus RMS 2210633            |     |     |      |               |             |                                 |                  |      |
| Vibrio sp. Ex25                                |     |     |      |               |             |                                 |                  |      |
| Vibrio splendidus 12B01                        |     |     |      |               |             |                                 |                  |      |
| Vibrio vulnificus CMCP6                        |     |     |      |               |             |                                 |                  |      |
| Xanthomonadaceae                               |     |     |      |               |             |                                 |                  |      |
| Stenotrophomonas maltophilia R551-3            |     |     |      |               |             |                                 |                  |      |
| Xanthomonas axonopodis pv. citri str. 306      |     |     |      |               |             |                                 |                  |      |
| Xanthomonas campestris pv. campestris str. 8004|     |     |      |               |             |                                 |                  |      |
| Xanthomonas oryzae pv. oryzae KACC10331        |     |     |      |               |             |                                 |                  |      |
| Xylella fastidiosa 9a5c                        |     |     |      |               |             |                                 |                  |      |
| Spirochaetales                                 |     |     |      |               |             |                                 |                  |      |
| Borrelia afzelli PKo                           |     |     |      |               |             |                                 |                  |      |
| Borrelia burgdorferi B31                       |     |     |      |               |             |                                 |                  |      |
| Borrelia garinii PBI                           |     |     |      |               |             |                                 |                  |      |
| Leptospira borgpetersenii serovar Hardjo-bovis JB197 |     |     |      |               |             |                                 |                  |      |
| Leptospira interrogans serovar Copenhageni str. Fiocon. |     |     |      |               |             |                                 |                  |      |
| Treponema denticola ATCC 35405                  |     |     |      |               |             |                                 |                  |      |
| Treponema pallidum subsp. pallidum str. Nichols |     |     |      |               |             |                                 |                  |      |
| Archaea                                       |     |     |      |               |             |                                 |                  |      |
| Crenarchaeota                                  |     |     |      |               |             |                                 |                  |      |
| Desulfurococcales                              |     |     |      |               |             |                                 |                  |      |
| Aeropyrum pernix K1                            |     |     |      |               |             |                                 |                  |      |
| Hyperthermus butyllicus DSM 5456               |     |     |      |               |             |                                 |                  |      |
| Desulfobacteria                               |     |     |      |               |             |                                 |                  |      |
| Metallosphaera sedula DSM 5348                 |     |     |      |               |             |                                 |                  |      |
| Sulfolobus acidocaldarius DSM 639              |     |     |      |               |             |                                 |                  |      |
| Sulfolobus solfataricus P2                     |     |     |      |               |             |                                 |                  |      |
| Sulfolobus tokodaii str. 7                     |     |     |      |               |             |                                 |                  |      |
| Thermoproteales                                |     |     |      |               |             |                                 |                  |      |
| Pyrolobaculum aerophilum str. IM2              |     |     |      |               |             |                                 |                  |      |
| Pyrobaculum islandicum DSM 4184                |     |     |      |               |             |                                 |                  |      |
| Thermofilum pendens Hrk 5                      |     |     |      |               |             |                                 |                  |      |
| Euryarchaeota                                  |     |     |      |               |             |                                 |                  |      |
| Archaeoglobales                                |     |     |      |               |             |                                 |                  |      |
| Archaeoglobus fulgidus DSM 4304                |     |     |      |               |             |                                 |                  |      |
| Halobacteria                                   |     |     |      |               |             |                                 |                  |      |
| Haloarcula marismortui ATCC 43049              |     |     |      |               |             |                                 |                  |      |
| Halobacterium sp. NRC-1                       |     |     |      |               |             |                                 |                  |      |
| Halococcus walsbyi DSM 16790                   |     |     |      |               |             |                                 |                  |      |
| Natronomonas pharaonis DSM 2160                |     |     |      |               |             |                                 |                  |      |
| Methanobacteria                                |     |     |      |               |             |                                 |                  |      |
| Methanosphaera stadtmannae DSM 3091            |     |     |      |               |             |                                 |                  |      |
| Methanothermobacter thermautotrophicus str. Delta H |     |     |      |               |             |                                 |                  |      |
| Methanococcales                                |     |     |      |               |             |                                 |                  |      |
| Methanocaldovorans jannaschii DSM 2606         |     |     |      |               |             |                                 |                  |      |
| Methanococcus maripaludis S2                   |     |     |      |               |             |                                 |                  |      |
| Methanomicrobiales                              |     |     |      |               |             |                                 |                  |      |
| Methanoculleus marisnigri JR1                  |     |     |      |               |             |                                 |                  |      |
| Methanospirillum hungatei JF-1                 |     |     |      |               |             |                                 |                  |      |
| Bacteria                        | COX | ND2 | SOD1 | Nitrosocyanin | Plastocyanin | Cu-containing Nitrite Reductase | Cu amine oxidase | pMMO |
|--------------------------------|-----|-----|------|---------------|--------------|---------------------------------|-----------------|------|
| Methanopyrales                 |     |     |      |               |              |                                 |                 |      |
| Methanopyrus kandleri AV19     |     |     |      |               |              |                                 |                 |      |
| Methanosarcinales              |     |     |      |               |              |                                 |                 |      |
| Methanococcoides burtonii DSM 6242 |     |     |      |               |              |                                 |                 |      |
| Methanoseta thermophila PT     |     |     |      |               |              |                                 |                 |      |
| Methanosarcina acetivorans C2A |     |     |      |               |              |                                 |                 |      |
| Methanosarcina barkeri str. Fusaro |     |     |      |               |              |                                 |                 |      |
| Methanosarcina mazei Go1       |     |     |      |               |              |                                 |                 |      |
| Thermococcales                 |     |     |      |               |              |                                 |                 |      |
| Pyrococcus abyssi GE5          |     |     |      |               |              |                                 |                 |      |
| Pyrococcus furiosus DSM 3638   |     |     |      |               |              |                                 |                 |      |
| Pyrococcus horikoshii OT3      |     |     |      |               |              |                                 |                 |      |
| Thermococcus kodakarensis KOD1 |     |     |      |               |              |                                 |                 |      |
| Thermoplasmales                |     |     |      |               |              |                                 |                 |      |
| Ferroplasma acidarmanus Fer1   |     |     |      |               |              |                                 |                 |      |
| Picrophilus torridus DSM 9790  |     |     |      |               |              |                                 |                 |      |
| Thermoplasma acidophilum DSM 1728 |     |     |      |               |              |                                 |                 |      |
| Thermoplasma volcanium GSS1    |     |     |      |               |              |                                 |                 |      |
| Nanoarchaeota                  |     |     |      |               |              |                                 |                 |      |
| Nanoarchaeum equitans Kin4-M   |     |     |      |               |              |                                 |                 |      |
| Bacteria                                                                 | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|-------------------------------------------------------------------------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| Acidothermus cellulolyticus 11B                                         |      |            |           | +         |      |      |      |      |      |         |
| Arthrobacter aurescens TC1                                              |      |            |           |           | +    |      |      |      |      |         |
| Arthrobacter sp. FB24                                                   |      |            |           |           |      | +    |      |      |      |         |
| Bifidobacterium adolescentis                                           |      |            |           |           | +    |      |      |      |      |         |
| Bifidobacterium longum DJ010A                                           |      |            |           |           |      |      | +    |      |      |         |
| Brevibacterium linens BL2                                               |      |            |           |           |      |      | +    |      |      |         |
| Collinsella aerofaciens ATCC 25086                                      |      |            |           |           | +    |      |      |      |      |         |
| Corynebacterium diphtheriae NCTC 13129                                  |      |            |           |           | +    |      |      |      |      |         |
| Corynebacterium efficiens YS-314                                       |      |            |           |           | +    |      |      |      |      |         |
| Corynebacterium glutamicum ATCC 13032                                   |      |            |           |           |      |      | +    |      |      |         |
| Corynebacterium jeikeium K411                                          |      |            |           |           |      |      |      |      |      |         |
| Frankia alni ACN14a                                                    |      |            |           |           |      |      |      |      |      |         |
| Frankia sp. EAN1pec                                                   |      |            |           |           | +    |      |      |      |      |         |
| Janibacter sp. HTCC2649                                                 |      |            |           |           |      |      | +    |      |      |         |
| Kineococcus radiotolerans SRS30216                                     |      |            |           |           | +    |      |      |      |      |         |
| Leifsonia xyli subsp. xyli str. CTCB07                                   |      |            |           |           |      |      |      | +    |      |         |
| Mycobacterium avium subsp. paratuberculosis K-10                       |      |            |           |           |      |      |      | +    |      |         |
| Mycobacterium bovis AF2122/97                                           |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium flavescens PYR-GCK                                        |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium leprae TN                                                |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium smegmatis str. MC2 155                                   |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium sp. KMS                                                  |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium tuberculosis C                                            |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium ulcerans Agy99                                            |      |            |           |           |      |      |      |      |      |         |
| Mycobacterium vanbaalenii PYR-1                                        |      |            |           |           |      |      |      |      |      |         |
| Nocardioides sp. JS614                                                 |      |            |           |           |      |      |      |      |      |         |
| Propionibacterium acnes KPA171202                                      |      |            |           |           | +    |      |      |      |      |         |
| Rhodococcus sp. RHA1                                                   |      |            |           |           |      |      |      |      |      |         |
| Rubrobacter xylanophilus DSM 9941                                      |      |            |           |           | +    |      |      |      |      |         |
| Salinispora arenicola CNS205                                            |      |            |           |           |      |      |      |      |      |         |
| Salinispora tropica CNB-440                                            |      |            |           |           | +    |      |      |      |      |         |
| Streptomyces avermitilis MA-4680                                       |      |            |           |           |      |      |      |      |      |         |
| Streptomyces coelicolor A3(2)                                          |      |            |           |           |      |      |      |      |      |         |
| Symbiobacterium thermophilum IAM 14863                                 |      |            |           |           |      |      |      |      |      |         |
| Thermotoga infantum YX                                                |      |            |           |           |      |      |      |      |      |         |
| Tropherya whipplei TW08/27                                            |      |            |           |           |      |      |      |      |      |         |
| marine actinobacterium PHSC20C2                                       |      |            |           |           |      |      |      |      |      |         |
| **Bacteroidetes/Chlorobi**                                             |      |            |           |           |      |      |      |      |      |         |
| Bacteroides caccae ATCC 43185                                          |      |            |           |           | +    |      |      |      |      |         |
| Bacteroides fragilis YCH46                                              |      |            |           |           | +    |      |      |      |      |         |
| Bacteroides thetaiotaomicron VPI-5482                                  |      |            |           |           | +    |      |      |      |      |         |
| Candidatus Sulcia muelleri str. Hc (Holomolosca coagulis)              |      |            |           |           |      |      |      |      |      |         |
| Cellulophaga sp. MED134                                                |      |            |           |           |      |      |      |      |      |         |
| Chlorobium chlororhodans CaD3                                          |      |            |           |           |      |      |      |      |      |         |
| Chlorobium ferrooxidans DSM 13031                                      |      |            |           |           |      |      |      |      |      |         |
| Chlorobium limicola DSM 245                                            |      |            |           |           |      |      |      |      |      |         |
| Chlorobium phaeobacteroides BS1                                        |      |            |           |           |      |      |      |      |      |         |
| Chlorobium tepidum TLS                                                |      |            |           |           |      |      |      |      |      |         |
| Croceibacter atlanticus HTCC2559                                       |      |            |           |           |      |      |      |      |      |         |
| Cytophaga hutchinsonii ATCC 33406                                      |      |            |           |           |      |      |      |      |      |         |
| Flavobacteria bacterium BBPL7                                          |      |            |           |           |      |      |      |      |      |         |
| Flavobacteriales bacterium HTCC2170                                    |      |            |           |           |      |      |      |      |      |         |
| Flavobacterium johnsoniae UW101                                        |      |            |           |           |      |      |      |      |      |         |
| Gramella forseti KT0803                                                |      |            |           |           |      |      |      |      |      |         |
| Leeuwenhoekella blandensis MED217                                      |      |            |           |           |      |      |      |      |      |         |
| Microscilla marina ATCC 23134                                          |      |            |           |           |      |      |      |      |      |         |
| Bacteria                               | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|---------------------------------------|------|-----------|-----------|----------|------|------|------|------|------|---------|
| Pelodictyon luteolium DSM 273         |      |           |           |          |      |      |      |      |      |         |
| Pelodictyon phaeoalplantiforme BU-1   |      |           |           |          |      |      |      |      |      |         |
| Polaribacter igersili 23-P            |      |           |           |          |      |      |      |      |      |         |
| Porphyromonas gingivalis W83          |      |           |           |          |      |      |      |      |      |         |
| Prosthecocloris aestuarii DSM 271      |      |           |           |          |      |      |      |      |      |         |
| Prosthecocloris vibrioformis DSM 265  |      |           |           |          |      |      |      |      |      |         |
| Psychroflexus torquis ATCC 700755     |      |           |           |          |      |      |      |      |      |         |
| Robiginitalea biformata HTCC2901      |      |           |           |          |      |      |      |      |      |         |
| Salinibacter ruber DSM 13855          |      |           |           |          |      |      |      |      |      |         |
| Tenacibaculum sp. MED152              |      |           |           |          |      |      |      |      |      |         |
| Chlamydia                             |      |           |           |          |      |      |      |      |      |         |
| Candidatus Protochlamydia amoebophila UWE25 |      |      |           |          |      |      |      |      |      |         |
| Chlamydia muridum Nigg               |      |           |           |          |      |      |      |      |      |         |
| Chlamydia trachomatis A/HAR-13        |      |           |           |          |      |      |      |      |      |         |
| Chlamydia abortus S26/3               |      |           |           |          |      |      |      |      |      |         |
| Chlamydiophila caviae GPIC            |      |           |           |          |      |      |      |      |      |         |
| Chlamydiophila felis Fe/C-56          |      |           |           |          |      |      |      |      |      |         |
| Chlamydiophila pneumoniae AR39        |      |           |           |          |      |      |      |      |      |         |
| Cyanobacteria                         |      |           |           |          |      |      |      |      |      |         |
| Anabaena variabilis ATCC 29413        |      |           |           |          |      |      |      |      |      |         |
| Crocosphaera watsonii WH 8501         |      |           |           |          |      |      |      |      |      |         |
| Gloeobacter violaceus PCC 7421        |      |           |           |          |      |      |      |      |      |         |
| Lyngbya sp. PCC 8106                 |      |           |           |          |      |      |      |      |      |         |
| Nodularia spumigena CCY9414           |      |           |           |          |      |      |      |      |      |         |
| Nostoc punctiforme PCC 73102          |      |           |           |          |      |      |      |      |      |         |
| Nostoc sp. PCC 7120                   |      |           |           |          |      |      |      |      |      |         |
| Prochlorococcus marinus str. MIT 9312 |      |           |           |          |      |      |      |      |      |         |
| Synechococcus elongatus PCC 6301      |      |           |           |          |      |      |      |      |      |         |
| Synechococcus sp. CC9311              |      |           |           |          |      |      |      |      |      |         |
| Synechocystis sp. PCC 6803            |      |           |           |          |      |      |      |      |      |         |
| Thermosynechococcus elongatus BP-1    |      |           |           |          |      |      |      |      |      |         |
| Trichodesmium erythraeum IMS101       |      |           |           |          |      |      |      |      |      |         |
| Firmicutes                             |      |           |           |          |      |      |      |      |      |         |
| Bacillales                             |      |           |           |          |      |      |      |      |      |         |
| Bacillus anthracis str. Ames          |      |           |           |          |      |      |      |      |      |         |
| Bacillus cereus ATCC 10987            |      |           |           |          |      |      |      |      |      |         |
| Bacillus clausii KSM-K16              |      |           |           |          |      |      |      |      |      |         |
| Bacillus halodurans C-125             |      |           |           |          |      |      |      |      |      |         |
| Bacillus licheniformis ATCC 14580     |      |           |           |          |      |      |      |      |      |         |
| Bacillus sp. NRRL B-149112            |      |           |           |          |      |      |      |      |      |         |
| Bacillus subtilis subsp. subtilis str. 168 |      |      |           |          |      |      |      |      |      |         |
| Bacillus thuringiensis serovar konkukian str. 97-27 |      |      |           |          |      |      |      |      |      |         |
| Bacillus weihenstephanensis KBAB4     |      |           |           |          |      |      |      |      |      |         |
| Exiguobacterium sibiricum 255-15      |      |           |           |          |      |      |      |      |      |         |
| Geobacillus kaustophilus HTA426        |      |           |           |          |      |      |      |      |      |         |
| Listeria innocua Clip112624           |      |           |           |          |      |      |      |      |      |         |
| Listeria monocytogenes EGD-e          |      |           |           |          |      |      |      |      |      |         |
| Listeria welshimeri serovar 6b str. SLCC5334 |      |      |           |          |      |      |      |      |      |         |
| Oceanobacillus iheyensis HTE831        |      |           |           |          |      |      |      |      |      |         |
| Paeonibacillus larvae subsp. larvae BRL-230010 |      |      |           |          |      |      |      |      |      |         |
| Pasteuria nishizawaiiae str. North American |      |      |           |          |      |      |      |      |      |         |
| Staphylococcus aureus RF122            |      |           |           |          |      |      |      |      |      |         |
| Staphylococcus epidermidis ATCC 12228  |      |           |           |          |      |      |      |      |      |         |
| Staphylococcus haemolyticus JCSC 1435  |      |           |           |          |      |      |      |      |      |         |
| Staphylococcus saprophyticus subsp. saprophyticus A |      |      |           |          |      |      |      |      |      |         |
| Clostridia                             |      |           |           |          |      |      |      |      |      |         |
| Alkalphilus metalliridigeneres QYMF   |      |           |           |          |      |      |      |      |      |         |
| Bacteria                                      | CotA   | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|----------------------------------------------|--------|------------|-----------|-----------|------|------|------|------|------|---------|
| *Caldicellulosiruptor saccharolyticus* DSM 8903 | +      |            |           |           |      |      |      |      |      |         |
| *Carboxythermus hydrogenoformans* Z-2901     | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium acetobutylicum* ATCC 824        | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium beijerinckii* NCIMB 8052        | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium cellulolyticum* H10             | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium difficile* QCD-32g58            | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium novyi* NT                       | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium perfringens* ATCC 13124         | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium phytofermentans* ISDg           | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium sp.* OhiLAs                     | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium tetani* E88                     | +      |            |           |           |      |      |      |      |      |         |
| *Clostridium thermocellum* ATCC 27405        | +      |            |           |           |      |      |      |      |      |         |
| *Desulfotobacterium hafniense* DCB-2         | +      |            |           |           |      |      |      |      |      |         |
| *Desulfotomaculum reducens* MI-1             | +      |            |           |           |      |      |      |      |      |         |
| *Eubacterium ventriosum* ATCC 27560          | +      |            |           |           |      |      |      |      |      |         |
| *Halothermoctrix orenii* H 168               | +      |            |           |           |      |      |      |      |      |         |
| *Moorella thermoacetica* ATCC 39073          | +      |            |           |           |      |      |      |      |      |         |
| *Syntrophomonas wolfei* subsp. wolfei str. Goettingen | + | | | | | | | | | |
| *Thermoanaerobacter ethanolicus* ATCC 33223  | +      |            |           |           |      |      |      |      |      |         |
| *Thermoanaerobacter tengcongensis* MB4       | +      |            |           |           |      |      |      |      |      |         |
| *Thermosinus carboxydovorans* Nor1            | +      |            |           |           |      |      |      |      |      |         |
| **Lactobacillales**                           |        |            |           |           |      |      |      |      |      |         |
| *Enterococcus faecalis* V583                 | +      |            |           |           |      |      |      |      |      |         |
| *Enterococcus faecium* DO                    | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus acidophilus* NCFM             | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus brevis* ATCC 367              | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus casei* ATCC 334               | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus delbrueckii* subsp. bulgaricus ATCC 1184 | + | | | | | | | | | |
| *Lactobacillus gasseri* ATCC 33323           | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus johnsonii* NCC 533            | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus plantarum* WCFS1              | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus reuteri* 100-23               | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus sakei* subsp. sakei 23K       | +      |            |           |           |      |      |      |      |      |         |
| *Lactobacillus salivarius* subsp. salivarius UCC118 | + | | | | | | | | | |
| *Lactococcus lactis* subsp. lactis* t1403    | +      |            |           |           |      |      |      |      |      |         |
| *Leuconostoc mesenteroides* subsp. mesenteroides* ATCC 33824 | + | | | | | | | | | |
| *Oenococcus oeni* PSU-1                      | +      |            |           |           |      |      |      |      |      |         |
| *Pediococcus pentosaceus* ATCC 25745         | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus agalactiae* 2603VR            | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus mutans* UA159                 | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus pneumoniae* R6                | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus pyogenes* M1 GAS              | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus suis* 89/1591                 | +      |            |           |           |      |      |      |      |      |         |
| *Streptococcus thermophilus* CNRZ1066        | +      |            |           |           |      |      |      |      |      |         |
| **Mollicutes**                               |        |            |           |           |      |      |      |      |      |         |
| *Aster yellows witches* 1-broom phytoplasma* AYWB | + | | | | | | | | | |
| *Mesoplasma florum* L1                       | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma capricolum* subsp. capricolum* ATCC 2734 | + | | | | | | | | | |
| *Mycoplasma gallisepticum* R                 | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma genitalium* G37                  | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma hyopneumoniae* 232               | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma mobile* 163K                     | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma mycoides* subsp. mycoides* SC str. PG1 | + | | | | | | | | | |
| *Mycoplasma penetrans* HF-2                  | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma pneumoniae* M129                 | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma pulmonis* UAB CTIP               | +      |            |           |           |      |      |      |      |      |         |
| *Mycoplasma synoviae* 53                     | +      |            |           |           |      |      |      |      |      |         |
| Bacteria                                                                 | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|--------------------------------------------------------------------------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| Onion yellows phytoplasma OY-M                                         |      |            |           |           |      |      |      |      |      |         |
| Ureaplasmata parvum serovar 3 str. ATCC 700970                            |      |            |           |           |      |      |      |      |      |         |
| Others                                                                   |      |            |           |           |      |      |      |      |      |         |
| Acidobacteria bacterium Ellin345                                        | +    |            |           |           |      |      |      |      |      |         |
| Aquifex aeolicus VF5                                                    |      |            |           |           |      |      |      |      |      |         |
| Blastopirellula marina DSM 3645                                         |      |            |           |           |      |      |      |      |      |         |
| Chloroflexus aggregans DSM 9485                                         |      |            |           |           |      |      |      |      |      |         |
| Chloroflexus aurantiacus J-10-II                                        |      |            |           |           |      |      |      |      |      |         |
| Dehalococcoides ethenogenes 195                                         | +    |            |           |           |      |      |      |      |      |         |
| Dehalococcoides sp. CBDB1                                               |      |            |           |           |      |      |      |      |      |         |
| Deinococcus geothermalis DSM 11300                                       |      |            |           |           |      |      |      |      |      |         |
| Deinococcus radiodurans R1                                               |      |            |           |           |      |      |      |      |      |         |
| Fervidobacterium nodosum R17-B1                                         |      |            |           |           |      |      |      |      |      |         |
| Fusobacterium nucleatum subsp. nucleatum ATCC 255                       | +    |            |           |           |      |      |      |      |      |         |
| Herpetosiphon aurantiacus ATCC 23779                                    |      |            |           |           |      |      |      |      |      |         |
| Rhodopirellula baltica SH 1                                              | +    |            |           |           |      |      |      |      |      |         |
| Roseiflexus castenholzii DSM 13941                                      |      |            |           |           |      |      |      |      |      |         |
| Roseiflexus sp. RS-1                                                    |      |            |           |           |      |      |      |      |      |         |
| Solibacter usitatus Ellin6076                                           |      |            |           |           |      |      |      |      |      |         |
| Thermosiphon melanesiensis BI429                                        |      |            |           |           |      |      |      |      |      |         |
| Thermotoga maritima MS8                                                 |      |            |           |           |      |      |      |      |      |         |
| Thermotoga petrophila RKU-1                                              |      |            |           |           |      |      |      |      |      |         |
| Thermus thermophilus HB27                                                |      |            |           |           |      |      |      |      |      |         |
| Proteobacteria                                                           |      |            |           |           |      |      |      |      |      |         |
| Others                                                                   |      |            |           |           |      |      |      |      |      |         |
| Magnetococcus sp. MC-1                                                  |      |            |           |           |      |      |      |      |      |         |
| Marinobacter ferrooxidans PV-1                                           | +    |            |           |           |      |      |      |      |      |         |
| Alpha subdivision                                                        |    |            |           |           |      |      |      |      |      |         |
| Others                                                                   |      |            |           |           |      |      |      |      |      |         |
| Acidiphilium cryptum JF-5                                               |      |            |           |           |      |      |      |      |      |         |
| Aurantimonas sp. S185-9A1                                               |      |            |           |           |      |      |      |      |      |         |
| Bartonella bacilliformis KC583                                          |      |            |           |           |      |      |      |      |      |         |
| Bartonella henselae str. Houston-1                                      |      |            |           |           |      |      |      |      |      |         |
| Bartonella quintana str. Toulouse                                       |      |            |           |           |      |      |      |      |      |         |
| Bradyrhizobium japonicum USDA 110                                        |      |            |           |           |      |      |      |      |      |         |
| Bradyrhizobium sp. BTA/1                                                |      |            |           |           |      |      |      |      |      |         |
| Brucella abortus biovar 1 str. 9-941                                    |      |            |           |           |      |      |      |      |      |         |
| Brucella melitensis 16M                                                 |      |            |           |           |      |      |      |      |      |         |
| Brucella suis 1330                                                     |      |            |           |           |      |      |      |      |      |         |
| Caulobacter crescentus CB15                                             |      |            |           |           |      |      |      |      |      |         |
| Caulobacter sp. K31                                                     |      |            |           |           |      |      |      |      |      |         |
| Dinoroseobacter shibae DFL 12                                           |      |            |           |           |      |      |      |      |      |         |
| Erythrobacter litoralis HTCC2594                                        |      |            |           |           |      |      |      |      |      |         |
| Erythrobacter sp. NAP1                                                 |      |            |           |           |      |      |      |      |      |         |
| Fulvimarina pelagi HTCC2506                                             |      |            |           |           |      |      |      |      |      |         |
| Gluconobacter oxydans 621H                                              |      |            |           |           |      |      |      |      |      |         |
| Granulobacter bethesdensis CGDNIH1                                     |      |            |           |           |      |      |      |      |      |         |
| Hyphomonas neptunium ATCC 15444                                        |      |            |           |           |      |      |      |      |      |         |
| Jannaschia sp. CCS1                                                    |      |            |           |           |      |      |      |      |      |         |
| Loktanella vestfoldensis SKA5                                           |      |            |           |           |      |      |      |      |      |         |
| Magnetospirillum magneticum AMB-1                                       |      |            |           |           |      |      |      |      |      |         |
| Magnetospirillum magnetotacticum MS-1                                   |      |            |           |           |      |      |      |      |      |         |
| Maricaulis maris MCS10                                                 |      |            |           |           |      |      |      |      |      |         |
| Mesorhizobium loti MAFF303099                                           |      |            |           |           |      |      |      |      |      |         |
| Mesorhizobium sp. BNC1                                                 |      |            |           |           |      |      |      |      |      |         |
| Nitrobacter hamburgenss X14                                             |      |            |           |           |      |      |      |      |      |         |
| Nitrobacter sp. Nb-311A                                                 |      |            |           |           |      |      |      |      |      |         |
| Bacteria                        | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|--------------------------------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| Nitrobacter winogradskyi Nb-255 |      |            |           | +         |      |      |      |      |      |         |
| Novosphingobium aromaticivorans DSM 12444 |      |            |           |           |      |      |      |      |      |         |
| Oceanicaulis alexandrii HTCC2933 |      |            |           |           |      |      |      |      |      |         |
| Oceanicola bermudensis HTCC2933 |      |            |           |           |      |      |      |      |      |         |
| Oceanicola granulosus HTCC2516 |      |            |           |           |      |      |      |      |      |         |
| Paracoccus denitrificans PD1222 |      |            |           |           |      |      |      |      |      |         |
| Parvibaculum lavamentivorans DS-1 |      |            |           |           |      |      |      |      |      |         |
| Panzularia bermudensis HTCC2503 |      |            |           |           |      |      |      |      |      |         |
| Rhodobacter sp.                             |      |            |           |           |      |      |      |      |      |         |
| Rhodobacterales bacterium HTCC2654 |      |            |           |           |      |      |      |      |      |         |
| Rhodopseudomonas palustris BisA53          |      |            |           |           |      |      |      |      |      |         |
| Rhodospirillum rubrum ATCC 11170           |      |            |           |           |      |      |      |      |      |         |
| Roseobacter denitrificans OCh 114          |      |            |           |           |      |      |      |      |      |         |
| Roseobacter sp. MED193                    |      |            |           |           |      |      |      |      |      |         |
| Roseovarius rubinhibens ISM                |      |            |           |           |      |      |      |      |      |         |
| Roseovarius sp. 217                       |      |            |           |           |      |      |      |      |      |         |
| Shewanella putrefaciens sp. TM1040         |      |            |           |           |      |      |      |      |      |         |
| Sphingomonas sp. SKA58                    |      |            |           |           |      |      |      |      |      |         |
| Sphingomonas wittichii RW1                 |      |            |           |           |      |      |      |      |      |         |
| Sphingopyxis alaskensis RB2256             |      |            |           |           |      |      |      |      |      |         |
| Stappia aggregata IAM 12614                |      |            |           |           |      |      |      |      |      |         |
| Sulfitobacter sp. EE-16                   |      |            |           |           |      |      |      |      |      |         |
| Xanthobacter autotrophicus Py2             |      |            |           |           |      |      |      |      |      |         |
| Zymomonas mobilis subsp. mobilis ZM4      |      |            |           |           |      |      |      |      |      |         |
| alpha proteobacterium HTCC2255            |      |            |           |           |      |      |      |      |      |         |
| **Rhizobiaceae**                          |      |            |           |           |      |      |      |      |      |         |
| Agrobacterium tumefaciens str. C58        |      |            |           |           |      |      |      |      |      |         |
| Rhizobium etl CFN 42                      |      |            |           |           |      |      |      |      |      |         |
| Rhizobium leguminosarum bv. viciae 3841   |      |            |           |           |      |      |      |      |      |         |
| Sinorhizobium medicae WSM419               |      |            |           |           |      |      |      |      |      |         |
| Sinorhizobium meliloti 1021               |      |            |           |           |      |      |      |      |      |         |
| **Rickettsiales**                         |      |            |           |           |      |      |      |      |      |         |
| Anaplasma marginale str. St. Maries       |      |            |           |           |      |      |      |      |      |         |
| Anaplasma phagocytophilum HZ              |      |            |           |           |      |      |      |      |      |         |
| Candidatus Pelagibacter ubiqure HTCC1062  |      |            |           |           |      |      |      |      |      |         |
| Ehrlichia canis str. Jake                 |      |            |           |           |      |      |      |      |      |         |
| Ehrlichia chaffeensis str. Arkansas       |      |            |           |           |      |      |      |      |      |         |
| Ehrlichia ruminantium str. Gardel         |      |            |           |           |      |      |      |      |      |         |
| Neorickettsia sennetsu str. Miyawama      |      |            |           |           |      |      |      |      |      |         |
| Rickettsia africae ESF-5                  |      |            |           |           |      |      |      |      |      |         |
| Rickettsia akari str. Hartford            |      |            |           |           |      |      |      |      |      |         |
| Rickettsia bellii RML369-C                |      |            |           |           |      |      |      |      |      |         |
| Rickettsia canadensis str. McKiel         |      |            |           |           |      |      |      |      |      |         |
| Rickettsia conorii str. Malish 7          |      |            |           |           |      |      |      |      |      |         |
| Rickettsia felis URRWXCal2                |      |            |           |           |      |      |      |      |      |         |
| Rickettsia massilae MTU5                  |      |            |           |           |      |      |      |      |      |         |
| Rickettsia prowazekii str. Madrid E       |      |            |           |           |      |      |      |      |      |         |
| Rickettsia rickettsii                     |      |            |           |           |      |      |      |      |      |         |
| Rickettsia sibirica 246                   |      |            |           |           |      |      |      |      |      |         |
| Rickettsia typhi str. Wilmington          |      |            |           |           |      |      |      |      |      |         |
| Wolbachia endosymbiont of Drosophila melanogaster | | | | | | | | | | |
| **Beta subdivision**                      |      |            |           |           |      |      |      |      |      |         |
| **Bordetella**                            |      |            |           |           |      |      |      |      |      |         |
| Bordetella bronchiseptica RB50            |      |            |           |           |      |      |      |      |      |         |
| Bordetella parapertussis 12822            |      |            |           |           |      |      |      |      |      |         |
| Bordetella pertussis Tohama I             |      |            |           |           |      |      |      |      |      |         |
| Bacteria               | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|------------------------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| **Burkholderiaceae**   |      |            |           |           |      |      |      |      |      |         |
| Burkholderia ambifaria MC40-6 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia cenocepa AU 1054 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia cepacia AMMD |      |            |           |           |      |      |      |      |      |         |
| Burkholderia dolosa AUO158 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia mallei ATCC 23344 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia multivorans ATCC 17616 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia phymatum STM815 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia phylotypens PsJN |      |            |           |           |      |      |      |      |      |         |
| Burkholderia pseudomallei 1710b |      |            |           |           |      |      |      |      |      |         |
| Burkholderia sp. 383 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia thailandensis E264 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia vietnamiensis G4 |      |            |           |           |      |      |      |      |      |         |
| Burkholderia xenovorans LB400 |      |            |           |           |      |      |      |      |      |         |
| Polynucleobacter sp. QLW-P1DMWA-1 |      |            |           |           |      |      |      |      |      |         |
| Ralstonia eutropha JMP134 |      |            |           |           |      |      |      |      |      |         |
| Ralstonia metalidurans CH34 |      |            |           |           |      |      |      |      |      |         |
| Ralstonia pickettii 12J |      |            |           |           |      |      |      |      |      |         |
| Ralstonia solanacearum GMI1000 |      |            |           |           |      |      |      |      |      |         |
| **Neisseriaceae**      |      |            |           |           |      |      |      |      |      |         |
| Chromobacterium violaceum ATCC 12472 |      |            |           |           |      |      |      |      |      |         |
| Neisseria gonorrhoeae FA 1090 |      |            |           |           |      |      |      |      |      |         |
| Neisseria meningitidis MC58 |      |            |           |           |      |      |      |      |      |         |
| **Others**             |      |            |           |           |      |      |      |      |      |         |
| Acidovorax avenae subsp. citrulli AAC00-1 |      |            |           |           |      |      |      |      |      |         |
| Acidovorax sp. JS42 |      |            |           |           |      |      |      |      |      |         |
| Azoarcus sp. EbN1 |      |            |           |           |      |      |      |      |      |         |
| Comamonas testosteroni KF-1 |      |            |           |           |      |      |      |      |      |         |
| Comamonas aromatica RC19 |      |            |           |           |      |      |      |      |      |         |
| Delta acidovorans SPH-1 |      |            |           |           |      |      |      |      |      |         |
| Methylobacterium petroleiphilum PM1 |      |            |           |           |      |      |      |      |      |         |
| Methylobacterium flagellatum KT |      |            |           |           |      |      |      |      |      |         |
| Methylophilales bacterium HTCC2181 |      |            |           |           |      |      |      |      |      |         |
| Nitrosomonas europaea ATCC 19718 |      |            |           |           |      |      |      |      |      |         |
| Nitrosomonas eutropha C71 |      |            |           |           |      |      |      |      |      |         |
| Nitrosospira multiformis ATCC 25196 |      |            |           |           |      |      |      |      |      |         |
| Polaromonas naphthalenivorans CJ2 |      |            |           |           |      |      |      |      |      |         |
| Polaromonas sp. JS666 |      |            |           |           |      |      |      |      |      |         |
| Rhodotherix ferrireducens T118 |      |            |           |           |      |      |      |      |      |         |
| Rubrivivax gelatinosus PM1 |      |            |           |           |      |      |      |      |      |         |
| Thiobacillus denitrificans ATCC 25259 |      |            |           |           |      |      |      |      |      |         |
| Verminephrobacter nitrifaciens EF01-2 |      |            |           |           |      |      |      |      |      |         |

**Delta subdivision**

| **Anaeromyxobacter dehalogenans 2CP-C** |      |            |           |           |      |      |      |      |      |         |
| **Anaeromyxobacter sp. Fw109-5** |      |            |           |           |      |      |      |      |      |         |
| **Bdellovibrio bacteriovorus HD100** |      |            |           |           |      |      |      |      |      |         |
| **Candidatus Desulfococcus oleovorans Hx3** |      |            |           |           |      |      |      |      |      |         |
| **Desulfatagla psychrophila LSv54** |      |            |           |           |      |      |      |      |      |         |
| **Desulfovibrio desulfuricans G20** |      |            |           |           |      |      |      |      |      |         |
| **Desulfovibrio vulgaris subsp. vulgaris str. Hildenborough** |      |            |           |           |      |      |      |      |      |         |
| **Desulfuromonas acetoxidans DSM 684** |      |            |           |           |      |      |      |      |      |         |
| **Geobacter lovleyi SZ** |      |            |           |           |      |      |      |      |      |         |
| **Geobacter metallireducens GS-15** |      |            |           |           |      |      |      |      |      |         |
| **Geobacter sp. FRC-32** |      |            |           |           |      |      |      |      |      |         |
| **Geobacter sulfurreducens PCA** |      |            |           |           |      |      |      |      |      |         |
| **Geobacter uranireducens R4** |      |            |           |           |      |      |      |      |      |         |
| **Lawsonia intracellularis PHE/MN1-00** |      |            |           |           |      |      |      |      |      |         |
| Bacteria | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|----------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| Myxococcus xanthus DK 1622 |     |            |           | +         |      |      |      |      |      |         |
| Pelobacter carbinolicus DSM 2380 |     |            |           |          |      |      |      |      |      |         |
| Pelobacter propionicus DSM 2379 |     |            |           |          |      |      |      |      |      |         |
| Stigmatella aurantiaica DW4/3-1 |     |            |           |          |      |      |      |      |      |         |
| Syntrophobacter fumaroxidans MPOB |     |            |           |          |      |      |      |      |      |         |
| Syntrophus aciditrophicus SB |     |            |           |          |      |      |      |      |      |         |
| delta proteobacterium MLMS-1 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter coli RM2228 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter concisus 13826 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter curvus 525.92 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter fetus subsp. fetus 82-40 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter jejuni RM1221 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter lari RM2100 |     |            |           |          |      |      |      |      |      |         |
| Campylobacter upsaliensis RM3195 |     |            |           |          |      |      |      |      |      |         |
| Helicobacter acinonychis str. Sheeba |     |            |           |          |      |      |      |      |      |         |
| Helicobacter hepaticus ATCC 51449 |     |            |           |          |      |      |      |      |      |         |
| Helicobacter pylori 26695 |     |            |           |          |      |      |      |      |      |         |
| Thioclcbacra spiralis ATCC 33889 |     |            |           |          |      |      |      |      |      |         |
| Wolinella succinogenes DSM 1740 |     |            |           |          |      |      |      |      |      |         |
| Enterobacteriales |     |            |           |          |      |      |      |      |      |         |
| Buchnera aphidicola str. APS (Acythosiphon pisum) |     |            |           |          |      |      |      |      |      |         |
| Candidatus Blochmannia floridanus |     |            |           |          |      |      |      |      |      |         |
| Enterobacter sp. 638 |     |            |           |          |      |      |      |      |      |         |
| Erwinia carotovora subsp. atroseptica SCRI1043 |     |            |           |          |      |      |      |      |      |         |
| Escherichia coli 536 |     |            |           |          |      |      |      |      |      |         |
| Photorhabdus luminescens subsp. laumondii TTO1 |     |            |           |          |      |      |      |      |      |         |
| Salmonella enterica subsp. enterica serovar Choleraes |     |            |           |          |      |      |      |      |      |         |
| Salmonella typhimurium LT2 |     |            |           |          |      |      |      |      |      |         |
| Serratia proteamaculans 568 |     |            |           |          |      |      |      |      |      |         |
| Shigella boydii Sb227 |     |            |           |          |      |      |      |      |      |         |
| Shigella dysenteriae Sd197 |     |            |           |          |      |      |      |      |      |         |
| Shigella flexneri 2a str. 2457T |     |            |           |          |      |      |      |      |      |         |
| Shigella sonnei Ss046 |     |            |           |          |      |      |      |      |      |         |
| Sodalis glossinidius str. 'morsitans' |     |            |           |          |      |      |      |      |      |         |
| Wigglesworthia glossinidii endosymbiont of Glossina b |     |            |           |          |      |      |      |      |      |         |
| Yersinia bercovieri ATCC 43970 |     |            |           |          |      |      |      |      |      |         |
| Yersinia enterocolitica subsp. enterocolitica 8081 |     |            |           |          |      |      |      |      |      |         |
| Yersinia frederiksenii ATCC 33641 |     |            |           |          |      |      |      |      |      |         |
| Yersinia intermedia ATCC 29909 |     |            |           |          |      |      |      |      |      |         |
| Yersinia molariae ATCC 43969 |     |            |           |          |      |      |      |      |      |         |
| Yersinia pestis Antiqua |     |            |           |          |      |      |      |      |      |         |
| Yersinia pseudotuberculosis IP 32953 |     |            |           |          |      |      |      |      |      |         |
| Others |     |            |           |          |      |      |      |      |      |         |
| Acinetobacter sp. ADP1 |     |            |           |          |      |      |      |      |      |         |
| Aeromonas hydrophila subsp. hydrophila ATCC 7966 |     |            |           |          |      |      |      |      |      |         |
| Alcanivorax borkumensis SK2 |     |            |           |          |      |      |      |      |      |         |
| Alkaliphilicola ehrlichii MLHE-1 |     |            |           |          |      |      |      |      |      |         |
| Alteromonadales bacterium TW-7 |     |            |           |          |      |      |      |      |      |         |
| Alteromonas macliodi 'Deep ecotype' |     |            |           |          |      |      |      |      |      |         |
| Baumannia cicadellinicola str. Hc (Homalodiscia coagulata) |     |            |           |          |      |      |      |      |      |         |
| Candidatus Carsonella ruddii PV |     |            |           |          |      |      |      |      |      |         |
| Candidatus Ruthia magnifica str. Cm (Calypogena magnifica) |     |            |           |          |      |      |      |      |      |         |
| Chromohalobacter salexigens DSM 3043 |     |            |           |          |      |      |      |      |      |         |
| Colwellia psychrerythraea 34H |     |            |           |          |      |      |      |      |      |         |
| Congregibacter litoralis KT71 |     |            |           |          |      |      |      |      |      |         |

CotA Tyrosinase Exporters PacS/CopA CutC CopB PcoA CueO PcoC CusCFBA
| Bacteria                                                                 | CotA | Tyrosinase | Exporters  | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|--------------------------------------------------------------------------|------|------------|------------|-----------|------|------|------|------|------|---------|
| Coxiella burnetii RSA 493                                                |      |            |            |           |      |      |      |      |      |         |
| Endoriftia persephone 'Hot96_1+Hot96_2'                                  |      |            |            |           |      |      |      |      |      |         |
| Francisella tularensis subsp. holarctica                                 |      |            |            |           |      |      |      |      |      |         |
| Haemella chejuensis KCTC 2396                                             |      |            |            |           |      |      |      |      |      |         |
| Halorhodospira halophila SL1                                              |      |            |            |           |      |      |      |      |      |         |
| Idiomarina ballica OS145                                                 |      |            |            |           |      |      |      |      |      |         |
| Idiomarina lohiensis L2TR                                                 |      |            |            |           |      |      |      |      |      |         |
| Legionella pneumophila str. _Lens_                                       |      |            |            |           |      |      |      |      |      |         |
| Marinobacter aquaeolei VT8                                               |      |            |            |           |      |      |      |      |      |         |
| Marinomonas sp. MED121                                                   |      |            |            |           |      |      |      |      |      |         |
| Methylococcus capsulatus str. _Bath_                                     |      |            |            |           |      |      |      |      |      |         |
| Nitrooccus mobilis Nb-231                                                |      |            |            |           |      |      |      |      |      |         |
| Nitrosococcus oceani ATCC 19707                                           |      |            |            |           |      |      |      |      |      |         |
| Oceanobacter sp. RED65                                                   |      |            |            |           |      |      |      |      |      |         |
| Oceanospirillum sp. MED92                                                |      |            |            |           |      |      |      |      |      |         |
| Pseudoalteromonas atlantica T6c                                          |      |            |            |           |      |      |      |      |      |         |
| Pseudoalteromonas haloplanktis TAC125                                   |      |            |            |           |      |      |      |      |      |         |
| Pseudoalteromonas tunicata D2                                             |      |            |            |           |      |      |      |      |      |         |
| Psychrobacter arcticus 273-4                                             |      |            |            |           |      |      |      |      |      |         |
| Psychrobacter cryohalolentis K5                                          |      |            |            |           |      |      |      |      |      |         |
| Psychrobacter sp. PRw1                                                   |      |            |            |           |      |      |      |      |      |         |
| Psychromonas ingrahamii 37                                                |      |            |            |           |      |      |      |      |      |         |
| Psychromonas sp. CNPT3                                                   |      |            |            |           |      |      |      |      |      |         |
| Reinekea sp. MED297                                                      |      |            |            |           |      |      |      |      |      |         |
| Rickettsiella grylli                                                     |      |            |            |           |      |      |      |      |      |         |
| Saccharophagus degradans 2-40                                            |      |            |            |           |      |      |      |      |      |         |
| Shewanella amazonensis SB2B                                               |      |            |            |           |      |      |      |      |      |         |
| Shewanella baltica OS155                                                 |      |            |            |           |      |      |      |      |      |         |
| Shewanella dentrificans OS217                                            |      |            |            |           |      |      |      |      |      |         |
| Shewanella frigidimarina NCIMB 400                                        |      |            |            |           |      |      |      |      |      |         |
| Shewanella oneidensis MR-1                                               |      |            |            |           |      |      |      |      |      |         |
| Shewanella pealeana ATCC 700345                                          |      |            |            |           |      |      |      |      |      |         |
| Shewanella putrefaciens CN-32                                            |      |            |            |           |      |      |      |      |      |         |
| Shewanella sp. MR-4                                                      |      |            |            |           |      |      |      |      |      |         |
| Shewanella woodii ATCC 51908                                             |      |            |            |           |      |      |      |      |      |         |
| Thiomicrospira crunogenbra XCL-2                                          |      |            |            |           |      |      |      |      |      |         |
| marine gamma proteobacterium HTCC2080                                   |      |            |            |           |      |      |      |      |      |         |
| marine gamma proteobacterium HTCC2143                                   |      |            |            |           |      |      |      |      |      |         |
| marine gamma proteobacterium HTCC2207                                    |      |            |            |           |      |      |      |      |      |         |
| **Pasteurellaceae**                                                      |      |            |            |           |      |      |      |      |      |         |
| Actinobacillus pleuropneumoniae serovar 1 str. 4074                      |      |            |            |           |      |      |      |      |      |         |
| Actinobacillus succinogenes 130Z                                          |      |            |            |           |      |      |      |      |      |         |
| Haemophilus ducreyi 35000HP                                               |      |            |            |           |      |      |      |      |      |         |
| Haemophilus influenzae 86-028NP                                          |      |            |            |           |      |      |      |      |      |         |
| Haemophilus somnus 129PT                                                  |      |            |            |           |      |      |      |      |      |         |
| Mannheimia haemolytica PHL213                                             |      |            |            |           |      |      |      |      |      |         |
| Mannheimia succiniciproducens MBEL55E                                    |      |            |            |           |      |      |      |      |      |         |
| Pasteurella multocida subsp. multocida str. Pm70                         |      |            |            |           |      |      |      |      |      |         |
| **Pseudomonadaceae**                                                     |      |            |            |           |      |      |      |      |      |         |
| Azotobacter vinelandii AvOP                                               |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas aeruginosa PAO1                                               |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas entomaphaga L48                                               |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas fluorescens Pf-5                                              |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas mendocina ymp                                                |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas putida KT2440                                                |      |            |            |           |      |      |      |      |      |         |
| Pseudomonas syringae pv. phaseolicola 1448A                              |      |            |            |           |      |      |      |      |      |         |
| **Vibrionaceae**                                                         |      |            |            |           |      |      |      |      |      |         |
| Bacteria | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|----------|------|------------|-----------|----------|------|------|------|------|------|---------|
| Photobacterium profundum SS9 |      |            |           |          |      |      |      |      |      |         |
| Photobacterium sp. SKA34 |      |            |           |          |      |      |      |      |      |         |
| Vibrio alginolyticus 12G01 |      |            |           |          |      |      |      |      |      |         |
| Vibrio angustum S14 |      |            |           |          |      |      |      |      |      |         |
| Vibrio cholerae O1 biovar eltor str. N16961 |      |            |           |          |      |      |      |      |      |         |
| Vibrio fischeri ES114 |      |            |           |          |      |      |      |      |      |         |
| Vibrio harveyi HY01 |      |            |           |          |      |      |      |      |      |         |
| Vibrio parahaemolyticus RIMD 2210633 |      |            |           |          |      |      |      |      |      |         |
| Vibrio sp. Ex25 |      |            |           |          |      |      |      |      |      |         |
| Vibrio splendidus 12B01 |      |            |           |          |      |      |      |      |      |         |
| Vibrio vulnificus CMCP6 |      |            |           |          |      |      |      |      |      |         |
| Xanthomonadaceae |      |            |           |          |      |      |      |      |      |         |
| Stenotrophomonas maltophilia R551-3 |      |            |           |          |      |      |      |      |      |         |
| Xanthomonas axonopodis pv. citri str. 306 |      |            |           |          |      |      |      |      |      |         |
| Xanthomonas campestris pv. campestris str. 8004 |      |            |           |          |      |      |      |      |      |         |
| Xanthomonas oryzae pv. oryzae KACC10331 |      |            |           |          |      |      |      |      |      |         |
| Xylella fastidiosa 9aS5 |      |            |           |          |      |      |      |      |      |         |
| Spirochaetales |      |            |           |          |      |      |      |      |      |         |
| Borrelia afzelii PKo |      |            |           |          |      |      |      |      |      |         |
| Borrelia burgdorferi B31 |      |            |           |          |      |      |      |      |      |         |
| Borrelia garinii PBi |      |            |           |          |      |      |      |      |      |         |
| Leptospira borgpetersenii serovar Hardjo-bovis JB197 |      |            |           |          |      |      |      |      |      |         |
| Leptospira interrogans serovar Copenhageni str. Fiocruz |      |            |           |          |      |      |      |      |      |         |
| Treponema denticola ATCC 35405 |      |            |           |          |      |      |      |      |      |         |
| Treponema pallidum subsp. pallidum str. Nichols |      |            |           |          |      |      |      |      |      |         |
| Archaea |      |            |           |          |      |      |      |      |      |         |
| Crenarchaeota |      |            |           |          |      |      |      |      |      |         |
| Desulfurococcales |      |            |           |          |      |      |      |      |      |         |
| Aeropyrum pernix K1 |      |            |           |          |      |      |      |      |      |         |
| Sulfolobales |      |            |           |          |      |      |      |      |      |         |
| Metallosphaera sedula DSM 5348 |      |            |           |          |      |      |      |      |      |         |
| Sulfolobus acidocaldarius DSM 639 |      |            |           |          |      |      |      |      |      |         |
| Sulfolobus solfatarius P2 |      |            |           |          |      |      |      |      |      |         |
| Sulfolobus tokodaii str. 7 |      |            |           |          |      |      |      |      |      |         |
| Thermoproteales |      |            |           |          |      |      |      |      |      |         |
| Pyrobaculum aerophilum str. IM2 |      |            |           |          |      |      |      |      |      |         |
| Pyrobaculum islandicum DSM 4184 |      |            |           |          |      |      |      |      |      |         |
| Thermofilum pendens Hrk 5 |      |            |           |          |      |      |      |      |      |         |
| Euryarchaeota |      |            |           |          |      |      |      |      |      |         |
| Archaeoglobales |      |            |           |          |      |      |      |      |      |         |
| Archaeoglobus fulgidus DSM 4304 |      |            |           |          |      |      |      |      |      |         |
| Halobacteriales |      |            |           |          |      |      |      |      |      |         |
| Haloarcula marismortui ATCC 43049 |      |            |           |          |      |      |      |      |      |         |
| Halobacterium sp. NRC-1 |      |            |           |          |      |      |      |      |      |         |
| Haloquadratum walsbyi DSM 16790 |      |            |           |          |      |      |      |      |      |         |
| Natronomonas pharaonis DSM 2160 |      |            |           |          |      |      |      |      |      |         |
| Methanobacteriales |      |            |           |          |      |      |      |      |      |         |
| Methanosaphaera stadtmannae DSM 3091 |      |            |           |          |      |      |      |      |      |         |
| Methanotherrabacter thermotrophicus str. Delta H |      |            |           |          |      |      |      |      |      |         |
| Methanococcales |      |            |           |          |      |      |      |      |      |         |
| Methanocaldococcus jannaschii DSM 2661 |      |            |           |          |      |      |      |      |      |         |
| Methanococcus maripaludis S2 |      |            |           |          |      |      |      |      |      |         |
| Methanomicrobiales |      |            |           |          |      |      |      |      |      |         |
| Methanoculleus marinigri JR1 |      |            |           |          |      |      |      |      |      |         |
| Methanospirillum hungatei JF-1 |      |            |           |          |      |      |      |      |      |         |
| Bacteria            | CotA | Tyrosinase | Exporters | PacS/CopA | CutC | CopB | PcoA | CueO | PcoC | CusCFBA |
|---------------------|------|------------|-----------|-----------|------|------|------|------|------|---------|
| **Methanopyrales**  |      |            |           |           |      |      |      |      |      |         |
| Methanopyrus kandleri AV19 |      |            |           |           |      |      |      |      |      |         |
| **Methanosarcinales** |      |            |           |           |      |      |      |      |      |         |
| Methanococcales burtonii DSM 6242 |      |            |           |           |      |      |      |      |      |         |
| Methanosaeta thermophila PT | +   |            |           |           |      |      |      |      |      |         |
| Methanococcales acetivorans C2A | +   |            |           |           |      |      |      |      |      |         |
| Methanosarcina barkeri str. Fusaro | +   |            |           |           |      |      |      |      |      |         |
| Methanosarcina mazei Go1 | +   |            |           |           |      |      |      |      |      |         |
| **Thermococcales**  |      |            |           |           |      |      |      |      |      |         |
| Pyrococcus abyssi GE5 |      |            |           |           |      |      |      |      |      |         |
| Pyrococcus furiosus DSM 3638 |      |            |           |           |      |      |      |      |      |         |
| Pyrococcus horikoshii OT3 |      |            |           |           |      |      |      |      |      |         |
| Thermococcus kodakarensis KOD1 | +   |            |           |           |      |      |      |      |      |         |
| **Thermoplasmales** |      |            |           |           |      |      |      |      |      |         |
| Ferroplasma acidarmanus Fer1 |      |            |           |           |      |      |      |      |      |         |
| Picrophilus torridus DSM 9790 |      |            |           |           |      |      |      |      |      |         |
| Thermoplasma acidophilum DSM 1728 |      |            |           |           |      |      |      |      |      |         |
| Thermoplasma volcanium GSS1 |      |            |           |           |      |      |      |      |      |         |
| **Nanoarchaeota**   |      |            |           |           |      |      |      |      |      |         |
| Nanoarchaeum equitans Kin4-M |      |            |           |           |      |      |      |      |      |         |
| Bacteria                                                                 | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclearn Function | CopD |
|------------------------------------------------------------------------|------|----------|------|-----------|------|------------|------|------|-------------------|------|
| Acidothermus cellulolyticus 11B                                       |      |          |      |           |      |            |      |      |                   |      |
| Arthrobacter aurescens TC1                                             |      |          |      |           |      |            |      |      |                   |      |
| Arthrobacter sp. FB24                                                  |      |          |      |           |      |            |      |      |                   |      |
| Bifidobacterium adolescentis                                            |      |          |      |           |      |            |      |      |                   |      |
| Bifidobacterium longum DJ010A                                           |      |          |      |           |      |            |      |      |                   |      |
| Brevibacterium linens BL2                                              |      |          |      |           |      |            |      |      |                   |      |
| Collinsella aerofaciens ATCC 25086                                     |      |          |      |           |      |            |      |      |                   |      |
| Corynebacterium diphtheriae NCTC 13129                                  |      |          |      |           |      |            |      |      |                   |      |
| Corynebacterium efficiens YS-314                                       |      |          |      |           |      |            |      |      |                   |      |
| Corynebacterium glutamicum ATCC 13032                                  |      |          |      |           |      |            |      |      |                   |      |
| Corynebacterium jeikeium K411                                           |      |          |      |           |      |            |      |      |                   |      |
| Frankia alni ACN14a                                                    |      |          |      |           |      |            |      |      |                   |      |
| Frankia sp. EAN1pec                                                    |      |          |      |           |      |            |      |      |                   |      |
| Janibacter sp. HTCC2649                                                 |      |          |      |           |      |            |      |      |                   |      |
| Kineococcus radiotolerans SRS30216                                     |      |          |      |           |      |            |      |      |                   |      |
| Leifsonia xyli subsp. xyli subsp. CTCB07                                |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium avium subsp. paratuberculosis K-10                       |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium bovis AF2122/87                                           |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium flavescens PYR-GCK                                       |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium leprae TN                                                |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium smegmatis str. MC2 155                                   |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium sp. KMS                                                  |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium tuberculosis C                                           |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium ulcerans Agy99                                           |      |          |      |           |      |            |      |      |                   |      |
| Mycobacterium vanbaalenii PYR-1                                       |      |          |      |           |      |            |      |      |                   |      |
| Nocardia farcinica DSM 10152                                           |      |          |      |           |      |            |      |      |                   |      |
| Nocardioides sp. JS614                                                 |      |          |      |           |      |            |      |      |                   |      |
| Propionibacterium acnes KPA171202                                      |      |          |      |           |      |            |      |      |                   |      |
| Rhodococcus sp. RHA1                                                   |      |          |      |           |      |            |      |      |                   |      |
| Rubrobacter xylanophilus DSM 9941                                      |      |          |      |           |      |            |      |      |                   |      |
| Salinispora arenicola CNS205                                            |      |          |      |           |      |            |      |      |                   |      |
| Salinispora tropica CNB-440                                            |      |          |      |           |      |            |      |      |                   |      |
| Streptomycies avermitilis MA-4680                                      |      |          |      |           |      |            |      |      |                   |      |
| Streptomycies coelicolor A3(2)                                         |      |          |      |           |      |            |      |      |                   |      |
| Symbiobacterium thermophilum IAM 14863                                 |      |          |      |           |      |            |      |      |                   |      |
| Thermotoga fusca YX                                                   |      |          |      |           |      |            |      |      |                   |      |
| Tropheyma whipplei TW08/27                                             |      |          |      |           |      |            |      |      |                   |      |
| marine actinobacterium PHSC20C1                                        |      |          |      |           |      |            |      |      |                   |      |
| Bacteroidetes/Chlorobi                                                 |      |          |      |           |      |            |      |      |                   |      |
| Bacteroides caccae ATCC 43185                                          |      |          |      |           |      |            |      |      |                   |      |
| Bacteroides fragilis YCH46                                             |      |          |      |           |      |            |      |      |                   |      |
| Bacteroides thetaiotaomicron VPI-5482                                  |      |          |      |           |      |            |      |      |                   |      |
| Candidatus Sulcia muelleri str. Hc (Himalodisca coagulata)             |      |          |      |           |      |            |      |      |                   |      |
| Cellulophaga sp. MED134                                                |      |          |      |           |      |            |      |      |                   |      |
| Chlorobium chlorochromatii CaD3                                        |      |          |      |           |      |            |      |      |                   |      |
| Chlorobium ferrooxidans DSM 13031                                      |      |          |      |           |      |            |      |      |                   |      |
| Chlorobium limicola DSM 245                                            |      |          |      |           |      |            |      |      |                   |      |
| Chlorobium phaeobacteroides BS1                                        |      |          |      |           |      |            |      |      |                   |      |
| Chlorobium tepidum TLS                                                |      |          |      |           |      |            |      |      |                   |      |
| Croceibacter atlanticus HTCC2559                                       |      |          |      |           |      |            |      |      |                   |      |
| Cytophaga hutchinsonii ATCC 33406                                      |      |          |      |           |      |            |      |      |                   |      |
| Flavobacteria bacterium BBPL7                                          |      |          |      |           |      |            |      |      |                   |      |
| Flavobacteriales bacterium HTCC217                                     |      |          |      |           |      |            |      |      |                   |      |
| Flavobacterium johnsoniae UW101                                        |      |          |      |           |      |            |      |      |                   |      |
| Gramella forsetii KT0803                                               |      |          |      |           |      |            |      |      |                   |      |
| Leeuwenhoekiella blandensis MED217                                     |      |          |      |           |      |            |      |      |                   |      |
| Microscilla marina ATCC 23134                                          |      |          |      |           |      |            |      |      |                   |      |
| Bacteria                   | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|---------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| Pelodictyon luteolum DSM 273 |      |          |      |           |      |            |      |      |                  |      |
| Pelodictyon phaeochlathroforme BU-1 |      |          |      |           |      |            |      |      |                  |      |
| Polaribacter igensii 23-P |      |          |      |           |      |            |      |      |                  |      |
| Porphyromonas gingivalis W83 |      |          |      |           |      |            |      |      |                  |      |
| Prosthecochloris australis DSM 271 |      |          |      |           |      |            |      |      |                  |      |
| Prosthecochloris vibrioforms DSM 265 |      |          |      |           |      |            |      |      |                  |      |
| Psychroflexus torquis ATCC 700755 |      |          |      |           |      |            |      |      |                  |      |
| Robiginitalea biformenta HTCC2901 |      |          |      |           |      |            |      |      |                  |      |
| Salinibacter ruber DSM 13855 |      |          |      |           |      |            |      |      |                  |      |
| Tenacibaculum sp. MED152 |      |          |      |           |      |            |      |      |                  |      |
| **Chlamydia**              |      |          |      |           |      |            |      |      |                  |      |
| Candidatus Protochlamydia amoebophila UWE25 |      |          |      |           |      |            |      |      |                  |      |
| Chlamydia muridarum Nigg |      |          |      |           |      |            |      |      |                  |      |
| Chlamydia trachomatis A/HAR-13 |      |          |      |           |      |            |      |      |                  |      |
| Chlamydophila abortus S26/3 |      |          |      |           |      |            |      |      |                  |      |
| Chlamydophila caviae GPIC |      |          |      |           |      |            |      |      |                  |      |
| Chlamydophila felis Fe/C-56 |      |          |      |           |      |            |      |      |                  |      |
| Chlamydophila pneumoniae AR39 |      |          |      |           |      |            |      |      |                  |      |
| **Cyanobacteria**          |      |          |      |           |      |            |      |      |                  |      |
| Anabaena variabilis ATCC 29413 |      |          |      |           |      |            |      |      |                  |      |
| Crocosphaera watsonii WH 8501 |      |          |      |           |      |            |      |      |                  |      |
| Gloeobacter violaceus PCC 7421 |      |          |      |           |      |            |      |      |                  |      |
| Lyngbya sp. PCC 8106 |      |          |      |           |      |            |      |      |                  |      |
| Nodularia spumigena CCY9414 |      |          |      |           |      |            |      |      |                  |      |
| Nostoc punctiforme PCC 73102 |      |          |      |           |      |            |      |      |                  |      |
| Nostoc sp. PCC 7120 |      |          |      |           |      |            |      |      |                  |      |
| Prochlorococcus marinus str. MIT 9312 |      |          |      |           |      |            |      |      |                  |      |
| Synechococcus elongatus PCC 6301 |      |          |      |           |      |            |      |      |                  |      |
| Synechococcus sp. CC9311 |      |          |      |           |      |            |      |      |                  |      |
| Synechocystis sp. PCC 6803 |      |          |      |           |      |            |      |      |                  |      |
| Thermosynechococcus elongatus BP-1 |      |          |      |           |      |            |      |      |                  |      |
| Trichodesmium erythraeum IMS101 |      |          |      |           |      |            |      |      |                  |      |
| **Firmicutes**             |      |          |      |           |      |            |      |      |                  |      |
| **Bacillales**             |      |          |      |           |      |            |      |      |                  |      |
| Bacillus anthracis str. Ames |      |          |      |           |      |            |      |      |                  |      |
| Bacillus cereus ATCC 10987 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus clausii KSM-16 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus halodurans C-125 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus licheniformis ATCC 14580 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus sp. NRRL B-14911 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus subtilis subsp. subtilis str. 168 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus thuringiensis serovar konkukian str. 97-27 |      |          |      |           |      |            |      |      |                  |      |
| Bacillus weihenstephanensis KBAB4 |      |          |      |           |      |            |      |      |                  |      |
| Exiguobacterium sibiricum 255-15 |      |          |      |           |      |            |      |      |                  |      |
| Geobacillus kaustophilus HTA426 |      |          |      |           |      |            |      |      |                  |      |
| Listeria innocua Clip112624 |      |          |      |           |      |            |      |      |                  |      |
| Listeria monocytogenes EGD-e |      |          |      |           |      |            |      |      |                  |      |
| Listeria welshimeri serovar 6b str. SLCC5334 |      |          |      |           |      |            |      |      |                  |      |
| Oceanobacillus iheyensis HTE831 |      |          |      |           |      |            |      |      |                  |      |
| Paenibacillus larvae subsp. larvae BRL-230010 |      |          |      |           |      |            |      |      |                  |      |
| Pasteuria nishizawaiiae str. North American |      |          |      |           |      |            |      |      |                  |      |
| Staphylococcus aureus RF122 |      |          |      |           |      |            |      |      |                  |      |
| Staphylococcus epidermidis ATCC 12228 |      |          |      |           |      |            |      |      |                  |      |
| Staphylococcus haemolyticus JCSC1435 |      |          |      |           |      |            |      |      |                  |      |
| Staphylococcus saprophyticus subsp. saprophyticus A |      |          |      |           |      |            |      |      |                  |      |
| **Clostridia**             |      |          |      |           |      |            |      |      |                  |      |
| Alkaliphilus metalirradiigenes QYMF |      |          |      |           |      |            |      |      |                  |      |
| Bacteria                                                                 | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|-------------------------------------------------------------------------|------|----------|------|-----------|------|------------|------|------|-----------------|------|
| Caldicellulosiruptor saccharolyticus DSM 8903                           |      |          |      |           | +    |            |      |      |                 |      |
| Carboxydothermus hydrogenoformans Z-2901                                |      |          |      |           |      |            |      |      |                 |      |
| Clostridium acetobutylicum ATCC 824                                      | +    |          |      |           |      |            |      |      |                 |      |
| Clostridium beijerinckii NCIMB 8052                                     |      |          |      |           |      |            |      |      |                 |      |
| Clostridium cellulolyticum H10                                          |      |          |      |           |      |            |      |      |                 |      |
| Clostridium difficile QCD-32g58                                         |      |          |      |           |      |            |      |      |                 |      |
| Clostridium novyi NT                                                   |      |          |      |           |      |            |      |      |                 |      |
| Clostridium perfringens ATCC 13124                                     |      |          |      |           |      |            |      |      |                 |      |
| Clostridium phytofermentans ISDg                                        |      |          |      |           |      |            |      |      |                 |      |
| Clostridium sp. OhILAs                                                 |      |          |      |           |      |            |      |      |                 |      |
| Clostridium tetani E88                                                 |      |          |      |           |      |            |      |      |                 |      |
| Clostridium thermocellum ATCC 27405                                    |      |          |      |           |      |            |      |      |                 |      |
| Desulfotobacterium hafniense DGB-2                                      |      |          |      |           |      |            |      |      |                 |      |
| Desulfotomaculum redesmus MI-1                                         |      |          |      |           |      |            |      |      |                 |      |
| Eubacterium ventriosum ATCC 27560                                      |      |          |      |           |      |            |      |      |                 |      |
| Halothermothrix orenii H 168                                           |      |          |      |           |      |            |      |      |                 |      |
| Moorella thermoacetica ATCC 39073                                      |      |          |      |           |      |            |      |      |                 |      |
| Syntrophomonas wolfei subsp. wolfei str. Goettingen                      |      |          |      |           |      |            |      |      |                 |      |
| Thermoanaerobacter ethanolicus ATCC 33223                               |      |          |      |           |      |            |      |      |                 |      |
| Thermoanaerobacter tengcongensis MB4                                    |      |          |      |           |      |            |      |      |                 |      |
| Thermosinus carboxydivorans Nor1                                        |      |          |      |           |      |            |      |      |                 |      |

**Lactobacillales**

| Lactobacillus vinelicus V583                                           |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus acidophilus NCFM                                         |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus brevis ATCC 367                                          |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus casei ATCC 334                                           |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus delbrueckii subsp. bulgaricus ATCC 1184                  |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus gasseri ATCC 33323                                       |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus johnsonii NCC 533                                       |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus plantarum WCFS1                                         |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus reuteri 100-23                                           |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus sakei subsp. sakei 23K                                   |      |          |      |           |      |            |      |      |                 |      |
| Lactobacillus salivarius subsp. salivarius UCC118                      |      |          |      |           |      |            |      |      |                 |      |
| Lactococcus lactis subsp. lactis IL1403                                |      |          |      |           |      |            |      |      |                 |      |
| Leuconostoc mesenteroides subsp. mesenteroides ATCC 1                    |      |          |      |           |      |            |      |      |                 |      |
| Oenococcus oeni PSU-1                                                 |      |          |      |           |      |            |      |      |                 |      |
| Pediococcus pentosaceus ATCC 25745                                     |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus agalactiae 2603V/R                                      |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus mutans UA159                                             |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus pneumoniae R                                             |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus pyogenes M1 GAS                                          |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus suis 89/1591                                             |      |          |      |           |      |            |      |      |                 |      |
| Streptococcus thermophilus CNRZ1066                                    |      |          |      |           |      |            |      |      |                 |      |

**Mollicutes**

| Aster yellows witches1-broom phytoplasma AYWB                         |      |          |      |           |      |            |      |      |                 |      |
| Mesoplasma florum L1                                                  |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma capricolum subsp. capricolum ATCC 2734                     |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma gallisepticum R                                            |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma genitalium G37                                             |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma hyopneumoniae 232                                          |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma mobile 163K                                                |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma mycoides subsp. mycoides SC str. PG1                       |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma penetrans HF-2                                             |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma pneumoniae M129                                            |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma pulmonis UAB CTIP                                          |      |          |      |           |      |            |      |      |                 |      |
| Mycoplasma synoviae 53                                                |      |          |      |           |      |            |      |      |                 |      |
| Bacteria                                                      | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|---------------------------------------------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| Onion yellows phytoplasma OY-M                               |      |          |      |           |      |            |      |      |                  |      |
| Ureaplasma parvum serovar 3 str. ATCC 700970                  |      |          |      |           |      |            |      |      |                  |      |
| **Others**                                                   |      |          |      |           |      |            |      |      |                  |      |
| Acidobacteria bacterium Ellin345                             |      |          |      |           |      |            |      |      |                  |      |
| Aquifex aeolicus VF5                                          |      |          |      |           |      |            |      |      |                  |      |
| Blastopirellula marina DSM 3645                               |      |          |      |           |      |            |      |      |                  |      |
| Chloroflexus aggregans DSM 9485                               |      |          |      |           |      |            |      |      |                  |      |
| Chloroflexus auranticus J-10-II                              |      |          |      |           |      |            |      |      |                  |      |
| Dehalococcoides ethenogenes 195                               |      |          |      |           |      |            |      |      |                  |      |
| Dehalococcoides sp. CBDB1                                     |      |          |      |           |      |            |      |      |                  |      |
| Deinococcus geothermalis DSM 11300                            |      |          |      |           |      |            |      |      |                  |      |
| Deinococcus radiodurans R1                                    |      |          |      |           |      |            |      |      |                  |      |
| Fervidobacterium nodosum Rt17-B1                              |      |          |      |           |      |            |      |      |                  |      |
| Fusobacterium nucleatum subsp. nucleatum ATCC 255             |      |          |      |           |      |            |      |      |                  |      |
| Herpetosiphon auranticus ATCC 23779                           |      |          |      |           |      |            |      |      |                  |      |
| Rhodopirellula baltica SH 1                                   |      |          |      |           |      |            |      |      |                  |      |
| Roseiflexus castenholzii DSM 13941                            |      |          |      |           |      |            |      |      |                  |      |
| Roseiflexus sp. RS-1                                          |      |          |      |           |      |            |      |      |                  |      |
| Solibacter usitatus Ellin6076                                 |      |          |      |           |      |            |      |      |                  |      |
| Thermosiphon melanesiensis BI429                              |      |          |      |           |      |            |      |      |                  |      |
| Thermotoga maritima MSB8                                      |      |          |      |           |      |            |      |      |                  |      |
| Thermotoga petrophila RKU-1                                   |      |          |      |           |      |            |      |      |                  |      |
| Thermus thermophilus HB27                                     |      |          |      |           |      |            |      |      |                  |      |
| **Proteobacteria**                                            |      |          |      |           |      |            |      |      |                  |      |
| Others                                                       |      |          |      |           |      |            |      |      |                  |      |
| Magnetococcus sp. MC-1                                       |      |          |      |           |      |            |      |      |                  |      |
| MARIPROFUNDUS FERROXYDANS PV-1                                |      |          |      |           |      |            |      |      |                  |      |
| **alpha subdivision**                                        |      |          |      |           |      |            |      |      |                  |      |
| Others                                                       |      |          |      |           |      |            |      |      |                  |      |
| Acidiphilium cryptum JF-5                                    |      |          |      |           |      |            |      |      |                  |      |
| Aurantimonas sp. Si85-9A1                                     |      |          |      |           |      |            |      |      |                  |      |
| Bartonella bacilliformis KC583                                |      |          |      |           |      |            |      |      |                  |      |
| Bartonella henselae str. Houston-1                            |      |          |      |           |      |            |      |      |                  |      |
| Bartonella quintana str. Toulouse                             |      |          |      |           |      |            |      |      |                  |      |
| Bradyrhizobium japonicum USDA 110                             |      |          |      |           |      |            |      |      |                  |      |
| Bradyrhizobium sp. BTA1                                       |      |          |      |           |      |            |      |      |                  |      |
| Brucella abortus biovar 1 str. 9-941                          |      |          |      |           |      |            |      |      |                  |      |
| Brucella melitensis 16M                                       |      |          |      |           |      |            |      |      |                  |      |
| Brucella suis 1330                                            |      |          |      |           |      |            |      |      |                  |      |
| Caulobacter crescentus CB15                                   |      |          |      |           |      |            |      |      |                  |      |
| Caulobacter sp. K31                                           |      |          |      |           |      |            |      |      |                  |      |
| Dinoroseobacter shibae DFL 12                                 |      |          |      |           |      |            |      |      |                  |      |
| Erythrobacter litoralis HTCC2594                              |      |          |      |           |      |            |      |      |                  |      |
| Erythrobacter sp. NAP1                                        |      |          |      |           |      |            |      |      |                  |      |
| Fulvimarina pelagi HTCC2506                                   |      |          |      |           |      |            |      |      |                  |      |
| Gluconobacter oxydans 621H                                    |      |          |      |           |      |            |      |      |                  |      |
| Granulobacter bethesdensis CGDNIH1                            |      |          |      |           |      |            |      |      |                  |      |
| Hyphomonas neptunium ATCC 15444                               |      |          |      |           |      |            |      |      |                  |      |
| Jannaschia sp. CCS1                                           |      |          |      |           |      |            |      |      |                  |      |
| Loktanella vestfoldensis SKA53                                 |      |          |      |           |      |            |      |      |                  |      |
| Magnetospirillum magneticum AMB-1                             |      |          |      |           |      |            |      |      |                  |      |
| Magnetospirillum magnetotacticum MS-1                         |      |          |      |           |      |            |      |      |                  |      |
| Maricaulis maris MCS10                                       |      |          |      |           |      |            |      |      |                  |      |
| Mesorhizobium loti MAFF303099                                 |      |          |      |           |      |            |      |      |                  |      |
| Mesorhizobium sp. BNC1                                       |      |          |      |           |      |            |      |      |                  |      |
| Nitrobacter hamburgensis X14                                  |      |          |      |           |      |            |      |      |                  |      |
| Nitrobacter sp. Nb-311A                                       |      |          |      |           |      |            |      |      |                  |      |
| Bacteria                          | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|----------------------------------|------|----------|------|-----------|------|------------|------|------|-----------------|------|
| Nitrobacter winogradskyi Nb-255  |      |          |      |           |      |            |      |      |                 |      |
| Novosphingobium aromaticivorans DSM 12444 |      |          |      |           |      |            |      |      |                 |      |
| Oceanicolaus alexandrii HTCC2833 |      |          |      |           |      |            |      |      |                 |      |
| Oceanocella batisensis HTCC2597  |      |          |      |           |      |            |      |      |                 |      |
| Oceanocella granulosus HTCC2516  |      |          |      |           |      |            |      |      |                 |      |
| Paracoccus denitrificans PD1222  |      |          |      |           |      |            |      |      |                 |      |
| Parvibaculum lavamentivorans DS-1 |      |          |      |           |      |            |      |      |                 |      |
| Parvularcula bermudensis HTCC2503 |      |          |      |           |      |            |      |      |                 |      |
| Rhodobacter sphaeroides 2.4.1    |      |          |      |           |      |            |      |      |                 |      |
| Rhodobacterales bacterium HTCC2654 |      |          |      |           |      |            |      |      |                 |      |
| Rhodopseudomonas palustris BisA53 |      |          |      |           |      |            |      |      |                 |      |
| Rhodospirillum rubrum ATCC 11170  |      |          |      |           |      |            |      |      |                 |      |
| Roseobacter denitrificans OCh 114 |      |          |      |           |      |            |      |      |                 |      |
| Roseobacter sp. MED193           |      |          |      |           |      |            |      |      |                 |      |
| Roseovarius rubinhibens ISM      |      |          |      |           |      |            |      |      |                 |      |
| Roseovarius sp. 217              |      |          |      |           |      |            |      |      |                 |      |
| Silicibacter pomeroyi DSS-3      |      |          |      |           |      |            |      |      |                 |      |
| Silicibacter sp. TM1040          |      |          |      |           |      |            |      |      |                 |      |
| Sphingomonas sp. SKA58           |      |          |      |           |      |            |      |      |                 |      |
| Sphingomonas wittichii RW1       |      |          |      |           |      |            |      |      |                 |      |
| Sphingopyxis alaskensis RB2256   |      |          |      |           |      |            |      |      |                 |      |
| Stappia aggregata IAM 12614      |      |          |      |           |      |            |      |      |                 |      |
| Sulfotobacter sp. EE-36          |      |          |      |           |      |            |      |      |                 |      |
| Xanthobacter automotrophicus Py2 |      |          |      |           |      |            |      |      |                 |      |
| Zymomonas mobilis subsp. mobilis ZM4 |      |          |      |           |      |            |      |      |                 |      |
| alpha proteobacterium HTCC2255   |      |          |      |           |      |            |      |      |                 |      |
| **Rhizobiaceae**                 |      |          |      |           |      |            |      |      |                 |      |
| Agrobacterium tumefaciens str. C58 |      |          |      |           |      |            |      |      |                 |      |
| Rhizobium etli CFN 42            |      |          |      |           |      |            |      |      |                 |      |
| Rhizobium leguminosarum bv. viciae 3841 |      |          |      |           |      |            |      |      |                 |      |
| Sinorhizobium medicae WSM419      |      |          |      |           |      |            |      |      |                 |      |
| Sinorhizobium meliloti 1021       |      |          |      |           |      |            |      |      |                 |      |
| **Rickettsiales**                |      |          |      |           |      |            |      |      |                 |      |
| Anaplasma marginale str. St. Maries |      |          |      |           |      |            |      |      |                 |      |
| Anaplasma phagocytophilum HZ     |      |          |      |           |      |            |      |      |                 |      |
| Candidatus Pelagibacter ubiquile HTCC1062 |      |          |      |           |      |            |      |      |                 |      |
| Ehrlichi canis str. Jake         |      |          |      |           |      |            |      |      |                 |      |
| Ehrlichi chaffeensis str. Arkansas |      |          |      |           |      |            |      |      |                 |      |
| Ehrlichi ruminantium str. Gardel |      |          |      |           |      |            |      |      |                 |      |
| Neorickettsia sennetsu str. Miyayama |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia africae ESF-5         |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia akari str. Hartford   |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia bellii RML369-C       |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia canadensis str. McKiel |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia conorii str. Malish 7 |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia felis URRWXCal2       |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia massiliiae MTU5       |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia prowazekii str. Madrid E |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia rickettsii            |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia sibirica 246          |      |          |      |           |      |            |      |      |                 |      |
| Rickettsia typhi str. Wilmington |      |          |      |           |      |            |      |      |                 |      |
| Wolbachia endosymbiot of Drosophila melanogaster |      |          |      |           |      |            |      |      |                 |      |
| **Beta subdivision**             |      |          |      |           |      |            |      |      |                 |      |
| **Bordetella**                   |      |          |      |           |      |            |      |      |                 |      |
| Bordetella bronchiseptica RB50   |      |          |      |           |      |            |      |      |                 |      |
| Bordetella parapertussis 12822   |      |          |      |           |      |            |      |      |                 |      |
| Bordetella pertussis Tohama I    |      |          |      |           |      |            |      |      |                 |      |
| Bacteria                  | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|---------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| **Burkholderiaceae**      |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia ambifaria MC40-6 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia cenocepacia AU 1054 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia cepacia AMMD  |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia dolosa AU0158 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia mallei ATCC 23344 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia multivorans ATCC 17616 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia phymatum STM815 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia phytofirmans PsJN |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia pseudomallei 1710b |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia sp. 383      |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia thaiandensis E264 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia vietnamiensis G4 |      |          |      |           |      |            |      |      |                  |      |
| Burkholderia xenovorans LB400 |      |          |      |           |      |            |      |      |                  |      |
| Polynucleobacter sp. QLW-P1DMWA-1 |      |          |      |           |      |            |      |      |                  |      |
| Ralstonia eutropha JMP134  |      |          |      |           |      |            |      |      |                  |      |
| Ralstonia metallidurans CH34 |      |          |      |           |      |            |      |      |                  |      |
| Ralstonia pickettii T2J    |      |          |      |           |      |            |      |      |                  |      |
| Ralstonia solanacearum GM1000 |      |          |      |           |      |            |      |      |                  |      |
| **Neisseriaceae**         |      |          |      |           |      |            |      |      |                  |      |
| Chromobacterium violaceum ATCC 12472 |      |          |      |           |      |            |      |      |                  |      |
| Neisseria gonorrhoeae FA 1090 |      |          |      |           |      |            |      |      |                  |      |
| Neisseria meningitidis MC58 |      |          |      |           |      |            |      |      |                  |      |
| **Others**                |      |          |      |           |      |            |      |      |                  |      |
| Acidovorax avenue subsp. citrulli AAC00-1 |      |          |      |           |      |            |      |      |                  |      |
| Acidovorax sp. JS42       |      |          |      |           |      |            |      |      |                  |      |
| Azorarcus sp. EbN1        |      |          |      |           |      |            |      |      |                  |      |
| Comamonas testosteroni KF-1 |      |          |      |           |      |            |      |      |                  |      |
| Dechloromonas aromatica RCB |      |          |      |           |      |            |      |      |                  |      |
| Delftia acidovorans SPH-1 |      |          |      |           |      |            |      |      |                  |      |
| Methylibium petroleiphum PM1 |      |          |      |           |      |            |      |      |                  |      |
| Methylobacillus flagellatus KT |      |          |      |           |      |            |      |      |                  |      |
| Methylophilales bacterium HTCC2181 |      |          |      |           |      |            |      |      |                  |      |
| Nitrosomonas europaea ATCC 19718 |      |          |      |           |      |            |      |      |                  |      |
| Nitrosomonas eutropha C71  |      |          |      |           |      |            |      |      |                  |      |
| Nitrosospira multiformis ATCC 25196 |      |          |      |           |      |            |      |      |                  |      |
| Polanromonas naphthalenivorans CJ2 |      |          |      |           |      |            |      |      |                  |      |
| Polanromonas sp. JS666    |      |          |      |           |      |            |      |      |                  |      |
| Rhodothermus ferrireducens T118 |      |          |      |           |      |            |      |      |                  |      |
| Rubrivivax gelatinosus PM1 |      |          |      |           |      |            |      |      |                  |      |
| Thiobacillus denitrificans ATCC 25259 |      |          |      |           |      |            |      |      |                  |      |
| Vermireprocharac eiseniae EF01-2 |      |          |      |           |      |            |      |      |                  |      |
| **delta subdivision**     |      |          |      |           |      |            |      |      |                  |      |
| Anaeromyxobacter dehalogenans 2CP-C |      |          |      |           |      |            |      |      |                  |      |
| Anaeromyxobacter sp. Fw109-5 |      |          |      |           |      |            |      |      |                  |      |
| Bdellovibrio bacteriovorus HD100 |      |          |      |           |      |            |      |      |                  |      |
| Candidatus Desulfococcus oleovorans Hxd3 |      |          |      |           |      |            |      |      |                  |      |
| Desulfotalea psychrophila LS64 |      |          |      |           |      |            |      |      |                  |      |
| Desulfovibrio desulfuricans G20 |      |          |      |           |      |            |      |      |                  |      |
| Desulfovibrio vulgaris subsp. vulgaris str. Hildenboroug |      |          |      |           |      |            |      |      |                  |      |
| Desulfuromonas acetoxidans DSM 684 |      |          |      |           |      |            |      |      |                  |      |
| Geobacter lovleyi SZ       |      |          |      |           |      |            |      |      |                  |      |
| Geobacter metallireducens GS-15 |      |          |      |           |      |            |      |      |                  |      |
| Geobacter sp. FRC-32       |      |          |      |           |      |            |      |      |                  |      |
| Geobacter sulfurreducens PCA |      |          |      |           |      |            |      |      |                  |      |
| Geobacter uranireducens R44 |      |          |      |           |      |            |      |      |                  |      |
| Lawsonia intracellularis PHE/MN1-00 |      |          |      |           |      |            |      |      |                  |      |
| Bacteria                                      | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|----------------------------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| Myxococcus xanthus DK 1622                   |      |          |      |           |      |            |      |      |                  |      |
| Pelobacter carbinolicus DSM 2380             |      |          |      |           |      |            |      |      |                  |      |
| Pelobacter propionicus DSM 2379              |      |          |      |           |      |            |      |      |                  |      |
| Stigmatella aurantiaca DW4/3-1               |      |          |      |           |      |            |      |      |                  |      |
| Syntrophobacter fumaroxidans MPOB            |      |          |      |           |      |            |      |      |                  |      |
| Syntrophus aciditrophicus SB                 |      |          |      |           |      |            |      |      |                  |      |
| delta proteobacterium MLMS-1                 |      |          |      |           |      |            |      |      |                  |      |
| epsilon subdivision                          |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter coli RM2228                    |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter concisus 13826                 |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter curvus 525.92                  |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter fetus subsp. fetus 82-40       |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter jejuni RM1221                  |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter lari RM2100                    |      |          |      |           |      |            |      |      |                  |      |
| Campylobacter upsaliensis RM3195              |      |          |      |           |      |            |      |      |                  |      |
| Helicobacter acinonychis str. Sheeba         |      |          |      |           |      |            |      |      |                  |      |
| Helicobacter hepaticus ATCC 51449            |      |          |      |           |      |            |      |      |                  |      |
| Helicobacter pylori 26695                    |      |          |      |           |      |            |      |      |                  |      |
| Thiobacillus denitrificans ATCC 33889         |      |          |      |           |      |            |      |      |                  |      |
| Wolinella succinogenes DSM 1740               |      |          |      |           |      |            |      |      |                  |      |
| gamma subdivision                             |      |          |      |           |      |            |      |      |                  |      |
| Enterobacteriales                             |      |          |      |           |      |            |      |      |                  |      |
| Buchnera aphidicola str. APS (Acrlythosiphon pisum) |      |      |      |           |      |            |      |      |                  |      |
| Candidatus Blochmannia fioridanus             |      |          |      |           |      |            |      |      |                  |      |
| Enterobacter sp. 638                         |      |          |      |           |      |            |      |      |                  |      |
| Escherichia coli 536                         |      |          |      |           |      |            |      |      |                  |      |
| Photobacter luminousens subsp. laumondii TTO1 |      |          |      |           |      |            |      |      |                  |      |
| Salmonella enterica subsp. enterica serovar Choleraes |      |      |      |           |      |            |      |      |                  |      |
| Salmonella typhimurium LT2                    |      |          |      |           |      |            |      |      |                  |      |
| Serratia proteamcanulans 568                  |      |          |      |           |      |            |      |      |                  |      |
| Shigella boydii Sb227                        |      |          |      |           |      |            |      |      |                  |      |
| Shigella dysenteriae Sd197                    |      |          |      |           |      |            |      |      |                  |      |
| Shigella flexneri 2a str. 2457T               |      |          |      |           |      |            |      |      |                  |      |
| Shigella sonnei Ss046                        |      |          |      |           |      |            |      |      |                  |      |
| Sodalis glossinidius str. ‘mositans’          |      |          |      |           |      |            |      |      |                  |      |
| Wigglesworthia glossinidii endosymbiont of Glossina b |      |      |      |           |      |            |      |      |                  |      |
| Yersinia berovieri ATCC 43970                 |      |          |      |           |      |            |      |      |                  |      |
| Yersinia enterocolitica subsp. enterocolitica 8081 |      |      |      |           |      |            |      |      |                  |      |
| Yersinia frederikenii ATCC 33641              |      |          |      |           |      |            |      |      |                  |      |
| Yersinia intermedia ATCC 29909                |      |          |      |           |      |            |      |      |                  |      |
| Yersinia mollaretii ATCC 43969                |      |          |      |           |      |            |      |      |                  |      |
| Yersinia pestis Antiqua                       |      |          |      |           |      |            |      |      |                  |      |
| Yersinia pseudotuberculosis IP 32953          |      |          |      |           |      |            |      |      |                  |      |
| Others                                        |      |          |      |           |      |            |      |      |                  |      |
| Acinetobacter sp. ADP1                       |      |          |      |           |      |            |      |      |                  |      |
| Aeromonas hydrophila subsp. hydrophila ATCC 7966 |      |      |      |           |      |            |      |      |                  |      |
| Alcanivorax borkumensis SK2                   |      |          |      |           |      |            |      |      |                  |      |
| Alkalilimnocola ehrlichei MLHE-1              |      |          |      |           |      |            |      |      |                  |      |
| Alteromonadales bacterium TW-7                |      |          |      |           |      |            |      |      |                  |      |
| Alteromonas maclodei 'Deep ecotype'           |      |          |      |           |      |            |      |      |                  |      |
| Baumannia cicadellinicola str. Hc (Homalodiscia coagulata) |      |      |      |           |      |            |      |      |                  |      |
| Candidatus Carsonella ruddii PV               |      |          |      |           |      |            |      |      |                  |      |
| Candidatus Ruthia magnifica str. Cm (Calyptogena magnifica) |      |      |      |           |      |            |      |      |                  |      |
| Chromohalobacter salexigens DSM 3043          |      |          |      |           |      |            |      |      |                  |      |
| Colwellia psychrethraea 34H                   |      |          |      |           |      |            |      |      |                  |      |
| Congregibacter lloralis KT71                 |      |          |      |           |      |            |      |      |                  |      |
| Bacteria | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclearn Function | CopD |
|----------|-----|----------|------|-----------|------|------------|------|------|-------------------|------|
| Coxiella burnetii RSA 493 | | | | | | | | | | |
| Endoriftia persephone ‘Hot96_1’+Hot96_2’ | | | | | | | | | | |
| Francisella tularensis subsp. holarctica | | | | | | | | | | |
| Haemolavirus tenuis KCTC 2396 | | | | | | | | | | |
| Halorhodospira halophila SL1 | | | | | | | | | | |
| Idiomarina baltica OS145 | | | | | | | | | | +
| Idiomarina loihiensis L2TR | | | | | | | | | | +
| Legionella pneumophila str. Lens | | | | | | | | | | +
| Marinobacter aquaeolei VT8 | | | | | | | | | | +
| Marinomonas sp. MED121 | | | | | | | | | | +
| Methylococcus capsulatus str. Bath | | | | | | | | | | +
| Nitrococcus mobilis Nc-231 | | | | | | | | | | +
| Nitrosomonas oceanica ATCC 19707 | | | | | | | | | | +
| Oceanobacter sp. RED65 | | | | | | | | | | +
| Oceanospirillum sp. MED92 | | | | | | | | | | +
| Pseudoalteromonas atlantica T6c | | | | | | | | | | +
| Pseudoalteromonas haloplanktis TAC125 | | | | | | | | | | +
| Pseudoalteromonas tunicata D2 | | | | | | | | | | +
| Psychrobacter arcticus 273-4 | | | | | | | | | | +
| Psychrobacter cryoalohilentis K5 | | | | | | | | | | +
| Psychrobacter sp. PRwf-1 | | | | | | | | | | +
| Psychromonas ingrahamii 37 | | | | | | | | | | +
| Psychromonas sp. CNPT3 | | | | | | | | | | +
| Reinekei sp. MED297 | | | | | | | | | | +
| Rickettsiella grylli | | | | | | | | | | +
| Saccharophagus degradans 2-40 | | | | | | | | | | +
| Shewanella amazonensis SB2B | | | | | | | | | | +
| Shewanella baltica OS155 | | | | | | | | | | +
| Shewanella dentrkii OS217 | | | | | | | | | | +
| Shewanella frigidimarina NCIMB 400 | | | | | | | | | | +
| Shewanella oneidensis MR-1 | | | | | | | | | | +
| Shewanella pealeana ATCC 700345 | | | | | | | | | | +
| Shewanella putrefaciens CN-32 | | | | | | | | | | +
| Shewanella putrefaciens OS115 | | | | | | | | | | +
| Shewanella sp. MR-4 | | | | | | | | | | +
| Shewanella woodyl ATCC 51908 | | | | | | | | | | +
| Thiomicrospira crunobena XCL-2 | | | | | | | | | | +
| marine gamma proteobacterium HTCC2080 | | | | | | | | | | +
| marine gamma proteobacterium HTCC2143 | | | | | | | | | | +
| marine gamma proteobacterium HTCC2207 | | | | | | | | | | +
| Pasteurellaceae | | | | | | | | | | +
| Actinobacillus pleuropneumoniae serovar 1 str. 4074 | | | | | | | | | | +
| Actinobacillus succinogenes 130Z | | | | | | | | | | +
| Haemophilus ducreyi 35000HP | | | | | | | | | | +
| Haemophilus influenzae 86-028NP | | | | | | | | | | +
| Haemophilus somnus 129PT | | | | | | | | | | +
| Mannheimia haemolytica PHP1213 | | | | | | | | | | +
| Mannheimia succiniciproducens MBEL55E | | | | | | | | | | +
| Pasteurella multocida subsp. multocida str. Pm70 | | | | | | | | | | +
| Pseudomonadaeae | | | | | | | | | | +
| Azotobacter vinelandii AvOP | | | | | | | | | | +
| Pseudomonas aeruginosa PAO1 | | | | | | | | | | +
| Pseudomonas entomophila L48 | | | | | | | | | | +
| Pseudomonas fluorescens Pf-5 | | | | | | | | | | +
| Pseudomonas mendocina ymp | | | | | | | | | | +
| Pseudomonas putida KT2440 | | | | | | | | | | +
| Pseudomonas syringae pv. phaseolicola 1448A | | | | | | | | | | +
| Vibrionaceae | | | | | | | | | | +
| Bacteria                                      | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclear Function | CopD |
|----------------------------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| Photobacterium profundum SS9                 |      |          |      |           |      |            |      |      |                  |      |
| Photobacterium sp. SKA34                     |      |          |      |           |      |            |      |      |                  |      |
| Vibrio alginolyticus 12G01                   |      |          |      |           |      |            |      |      |                  |      |
| Vibrio angustum S14                          |      |          |      |           |      |            |      |      |                  |      |
| Vibrio cholerae O1 biovar eltor str. N16961 |      |          |      |           |      |            |      |      |                  |      |
| Vibrio fischeri ES114                        |      |          |      |           |      |            |      |      |                  |      |
| Vibrio harveyi HY01                          |      |          |      |           |      |            |      |      |                  |      |
| Vibrio parahaemolyticus RIMD 2210633         |      |          |      |           |      |            |      |      |                  |      |
| Vibrio sp. Ex25                              |      |          |      |           |      |            |      |      |                  |      |
| Vibrio splendidus 12B01                      |      |          |      |           |      |            |      |      |                  |      |
| Vibrio vulnificus CMCP6                      |      |          |      |           |      |            |      |      |                  |      |
| **Xanthomonadaceae**                          |      |          |      |           |      |            |      |      |                  |      |
| Stenotrophomonas maltophilia R551-3          |      |          |      |           |      |            |      |      |                  |      |
| Xanthomonas axonopodis pv. citri str. 306    |      |          |      |           |      |            |      |      |                  |      |
| Xanthomonas campestris pv. campestris str. 8004 |      |          |      |           |      |            |      |      |                  |      |
| Xanthomonas oryzae pv. oryzae KACC10331      |      |          |      |           |      |            |      |      |                  |      |
| Xylella fastidiosa 9aSc                      |      |          |      |           |      |            |      |      |                  |      |
| **Spirochaetales**                           |      |          |      |           |      |            |      |      |                  |      |
| Borrelia afzeii PKo                          |      |          |      |           |      |            |      |      |                  |      |
| Borrelia burgdorferi B31                     |      |          |      |           |      |            |      |      |                  |      |
| Borrelia garinii PBI                         |      |          |      |           |      |            |      |      |                  |      |
| Leptospira borgpetersenii serovar Hardjo-bovis JB197 |      |          |      |           |      |            |      |      |                  |      |
| Leptospira interrogans serovar Copenhageni str. Fiocrn |      |          |      |           |      |            |      |      |                  |      |
| Treponema denticola ATCC 35405                |      |          |      |           |      |            |      |      |                  |      |
| Treponema pallidum subsp. pallidum str. Nichols |      |          |      |           |      |            |      |      |                  |      |
| **Archaea**                                  |      |          |      |           |      |            |      |      |                  |      |
| **Crenarchaeota**                            |      |          |      |           |      |            |      |      |                  |      |
| **Desulfurococcales**                        |      |          |      |           |      |            |      |      |                  |      |
| **Sulfobiales**                              |      |          |      |           |      |            |      |      |                  |      |
| Metallosphaera sedula DSM 5348                |      |          |      |           |      |            |      |      |                  |      |
| Sulfolobus acidocaldarius DSM 639             |      |          |      |           |      |            |      |      |                  |      |
| Sulfolobus solfataricus P2                   |      |          |      |           |      |            |      |      |                  |      |
| Sulfolobus tokodaii str. 7                   |      |          |      |           |      |            |      |      |                  |      |
| **Thermoproteales**                          |      |          |      |           |      |            |      |      |                  |      |
| Pyrobaculum aerophilum str. IM2              |      |          |      |           |      |            |      |      |                  |      |
| Pyrobaclum islandicum DSM 4184               |      |          |      |           |      |            |      |      |                  |      |
| Thermofilum pendens Hrk 5                    |      |          |      |           |      |            |      |      |                  |      |
| **Euryarchaeota**                            |      |          |      |           |      |            |      |      |                  |      |
| **Archaeoglobales**                          |      |          |      |           |      |            |      |      |                  |      |
| Archaeoglobus fulgidus DSM 4304              |      |          |      |           |      |            |      |      |                  |      |
| **Halobacterales**                           |      |          |      |           |      |            |      |      |                  |      |
| Haloarcula marismortui ATCC 43049            |      |          |      |           |      |            |      |      |                  |      |
| Halobacterium sp. NRC-1                      |      |          |      |           |      |            |      |      |                  |      |
| Halobactradium walsbyi DSM 16790             |      |          |      |           |      |            |      |      |                  |      |
| Natronomonas pharaonis DSM 2160              |      |          |      |           |      |            |      |      |                  |      |
| **Methanobacterales**                        |      |          |      |           |      |            |      |      |                  |      |
| Methanothermobacter thermautotrophicus str. Delta H |      |          |      |           |      |            |      |      |                  |      |
| **Methanococcales**                          |      |          |      |           |      |            |      |      |                  |      |
| Methanocaldovococcus jannaschii DSM 2661     |      |          |      |           |      |            |      |      |                  |      |
| Methanococcus maripaludis S2                 |      |          |      |           |      |            |      |      |                  |      |
| **Methanomicrobiales**                       |      |          |      |           |      |            |      |      |                  |      |
| Methanoculcileus marisnigri JR1              |      |          |      |           |      |            |      |      |                  |      |
| Methanosprillum hungatei JF-1                |      |          |      |           |      |            |      |      |                  |      |
| Bacteria                      | PcoE | Importer | CtaA | Repressor | CopY | Chaperones | CopZ | CopC | Unclearn Function | CopD |
|-------------------------------|------|----------|------|-----------|------|------------|------|------|------------------|------|
| Methanopyrales                |      |          |      |           |      |            |      |      |                  |      |
| Methanopyrus kandleri AV19    |      |          |      |           |      |            |      |      |                  |      |
| Methanosarcinales             |      |          |      |           |      |            |      |      |                  |      |
| Methanococcoides burtonii DSM 6242 |      |          |      |           |      |            |      |      |                  |      |
| Methanosaeta thermophila PT   |      |          |      |           |      |            |      |      |                  |      |
| Methanosarcina acetivorans C2A |      |          |      |           |      |            |      |      |                  |      |
| Methanosarcina barkeri str. Fusaro |      |          |      |           |      |            |      |      |                  |      |
| Methanosarcina mazei Go1     |      |          |      |           |      |            |      |      |                  |      |
| Thermococcales                |      |          |      |           |      |            |      |      |                  |      |
| Pyrococcus abyssi GE5         |      |          |      |           |      |            |      |      |                  |      |
| Pyrococcus furiosus DSM 3638  |      |          |      |           |      |            |      |      |                  |      |
| Pyrococcus horikoshii OT3     |      |          |      |           |      |            |      |      |                  |      |
| Thermococcus kodakarenensis KOD1 |      |          |      |           |      |            |      |      |                  |      |
| Thermoplasmales               |      |          |      |           |      |            |      |      |                  |      |
| Ferroplasma acidarmanus Fer1  |      |          |      |           |      |            |      |      |                  |      |
| Picophilus torridus DSM 9790  |      |          |      |           |      |            |      |      |                  |      |
| Thermoplasma acidophilum DSM 1728 |      |          |      |           |      |            |      |      |                  |      |
| Thermoplasma volcanium GSS1   |      |          |      |           |      |            |      |      |                  |      |
| Nanoarchaeota                 |      |          |      |           |      |            |      |      |                  |      |
| Nanoarchaeum equitans Kin4-M  |      |          |      |           |      |            |      |      |                  |      |