Table S4. Phylogenetic distribution of bacterial and archaea genomes in groups A, B, C, D, and X.

**Group A**

| a: Total number of genomes in the taxon | b: Number of group A genomes in the taxon | c: Percentage of group A genomes in the taxon | a | b | c |
|----------------------------------------|-------------------------------------------|---------------------------------------------|---|---|---|
| cellular organisms                     |                                           |                                            | 5007 | 2974 | 59.4 |
| |__ Bacteria                            |                                           |                                            | 4769 | 2935 | 61.5 |
| |    |__ Proteobacteria                      |                                           |                                            | 1854 | 1570 | 84.7 |
| |    |    |__ Gammaproteobacteria                 |                                           |                                            | 711  | 631  | 88.7 |
| |    |    |    |__ Enterobacterales                    |                                           |                                            | 112  | 97   | 86.6 |
| |    |    |    |    |__ unclassified Enterobacterae         |                                           |                                            | 41   | 32   | 78.0 |
| |    |    |    |    |__ Erwiniaceae                         |                                           |                                            | 13   | 7    | 53.8 |
| |    |    |    |    |    |__ Erwinia                             |                                           |                                            | 10   | 8    | 80.0 |
| |    |    |    |    |    |    |__ Buchnera                            |                                           |                                            | 8    | 8    | 100.0 |
| |    |    |    |    |    |    |    |__ Buchnera aphidicola                 |                                           |                                            | 8    | 8    | 100.0 |
| |    |    |    |    |    |    |__ Pantoea                             |                                           |                                            | 8    | 8    | 100.0 |
| |    |    |    |__ Yersiniaceae                        |                                           |                                            | 14   | 14   | 100.0 |
| |    |    |    |    |__ Serratia                            |                                           |                                            | 8    | 8    | 100.0 |
| |    |    |    |    |__ Morganellaceae                      |                                           |                                            | 13   | 10   | 76.9 |
| |    |    |    |    |__ Pectobacteriaceae                   |                                           |                                            | 8    | 8    | 100.0 |
| |    |__ Alteromonadales                      |                                           |                                            | 94   | 94   | 100.0 |
| |    |    |__ Alteromonadaceae                    |                                           |                                            | 34   | 34   | 100.0 |
| |    |    |    |__ Marinobacter                        |                                           |                                            | 12   | 12   | 100.0 |
| |    |    |    |__ Shewanellace                        |                                           |                                            | 17   | 17   | 100.0 |
| |    |    |    |    |__ Shewanella                          |                                           |                                            | 17   | 17   | 100.0 |
| |    |    |    |__ Pseudoalteromonadaceae              |                                           |                                            | 16   | 16   | 100.0 |
| |    |    |    |    |__ Pseudoalteromonas                   |                                           |                                            | 15   | 15   | 100.0 |
| |    |    |    |__ Idiomarinaceae                      |                                           |                                            | 9    | 9    | 100.0 |
| |    |    |    |    |__ Idiomarina                          |                                           |                                            | 9    | 9    | 100.0 |
| |    |    |    |__ Colwelliaceae                       |                                           |                                            | 6    | 6    | 100.0 |
| |    |    |__ Pseudomonadales                     |                                           |                                            | 81   | 81   | 100.0 |
| Class                  | Order            | Family            | Genus            | Number | Identity |
|-----------------------|------------------|-------------------|------------------|--------|----------|
| Alphaproteobacteria   | Rhizobiales      | Bradyrhizobiaceae | Bradyrhizobium   | 44     | 97.7     |
|                       |                  |                   | Bosea            | 8      | 100.0    |
|                       |                  |                   | Rhodopseudomonas | 8      | 87.5     |
|                       |                  |                   | Afipia           | 6      | 100.0    |
|                       |                  | Rhizobiaceae      |                  | 41     | 97.6     |
|                       |                  |                   |                  | 29     | 100.0    |
|                       |                  | Phyllobacteriaceae|                  | 28     | 96.4     |
|                       |                  | Bartonellaceae    | Bartonella       | 23     | 100.0    |
|                       |                  |                   | Hyphomicrobiaceae| 23     | 100.0    |
|                       |                  |                   | Devosia          | 11     | 100.0    |
|                       |                  | Methylbacteriaceae|                  | 19     | 94.7     |
|                       |                  |                   | Methylobacterium | 14     | 92.9     |
|                       |                  |                   | Aurantimonadaceae| 11     | 100.0    |
|                       |                  |                   | Methylocystaceae | 10     | 100.0    |
|                       |                  |                   | Beijerinckiaceae | 7      | 100.0    |
|                       |                  |                   | Xanthobacteraceae| 7      | 100.0    |
|                       |                  | Rhodobiaceae      |                  | 6      | 100.0    |
| Rhodobacterales       |                  |                   |                  | 166    | 97.0     |
|                       |                  | Rhodobacteraceae  |                  | 145    | 96.6     |
|                       |                  |                   | Paracoccus       | 12     | 100.0    |
|                       |                  |                   | Sulfitobacter     | 8      | 100.0    |
|                       |                  |                   | Loktanella       | 6      | 100.0    |
|                       |                  |                   | Roseobacter      | 6      | 100.0    |
|                       |                  | Hyphomonadaceae   |                  | 20     | 100.0    |
|                       |                  |                   | Hyphomonas       | 9      | 100.0    |
| Sphingomonadales      |                  |                   |                  | 105    | 86.7     |
|                       |                  | Sphingomonadaceae |                  | 83     | 86.7     |
|                       |                  |                   | Sphingomonas     | 34     | 70.6     |
|                       |                  |                   | Novosphingobium  | 17     | 100.0    |
|                       |                  |                   | Sphingobium      | 13     | 100.0    |
|                       |                  |                   | Sphingopyxis     | 9      | 100.0    |
|                       |                  |                   | Erythrobacteraceae| 22    | 86.4     |
| Taxonomy                    | Count | Percent |
|----------------------------|-------|---------|
| Erythrobacter               | 12    | 83.3    |
| Rhodospirillales            | 72    | 88.9    |
| Rhodospirillaceae           | 32    | 96.9    |
| Acetobacteraceae            | 37    | 83.8    |
| Acetobacter                 | 10    | 80.0    |
| Caulobacterales             | 23    | 87.0    |
| Caulobacteraceae            | 23    | 87.0    |
| Brevundimonas               | 10    | 70.0    |
| unclassified Alphaproteobacteria | 13 | 92.3    |
| unclassified Alphaproteobacteria (miscellaneous) | 7 | 85.7    |
| Betaproteobacteria          | 273   | 64.8    |
| Burkholderiales             | 166   | 53.0    |
| Oxalobacteraceae            | 30    | 86.7    |
| Massilia                    | 8     | 100.0   |
| Herbaspirillum              | 7     | 100.0   |
| Burkholderiaceae            | 34    | 73.5    |
| Paraburkholderia            | 8     | 87.5    |
| Alcaligenaceae              | 23    | 87.0    |
| Commonadaceae               | 50    | 20.0    |
| Neisseriales                | 42    | 100.0   |
| Neisseriaceae               | 23    | 100.0   |
| Neisseria                   | 10    | 100.0   |
| Chromobacteriaceae          | 19    | 100.0   |
| Rhodocyclales               | 19    | 100.0   |
| Rhodocyclaceae              | 19    | 100.0   |
| Methylophilales             | 14    | 71.4    |
| Methylophilaceae            | 12    | 83.3    |
| delta/epsilon subdivisions  | 196   | 73%     |
| Deltaproteobacteria         | 123   | 89.4    |
| Desulfovibionales           | 44    | 100.0   |
| Desulfovibrio               | 31    | 100.0   |
| Desulfobacterales           | 22    | 100.0   |
| Desulfobacteraceae          | 15    | 100.0   |
| Desulfobulbaceae            | 7     | 100.0   |
| Desulfuromonadales          | 16    | 100.0   |
| Geobacteraceae              | 10    | 100.0   |
| Geobacter                   | 7     | 100.0   |
| Desulfuromonadaceae         | 6     | 100.0   |
| Myxococcales                | 15    | 73.3    |
| Cystobacterineae            | 11    | 90.9    |
| Epsilonproteobacteria       | 73    | 86.3    |
| Campylobacterales           | 67    | 86.6    |
| Phylum                          | Class                | Order               | Family             | Genus               | Species          | Percentage |
|--------------------------------|----------------------|---------------------|--------------------|---------------------|------------------|-------------|
| **Terrabacteria group**        |                      |                     |                    |                     |                  |             |
| **Firmicutes**                 |                      |                     |                    |                     |                  |             |
| **Bacilli**                    |                      |                     |                    |                     |                  |             |
| **Bacillales**                 |                      |                     |                    |                     |                  |             |
| **Bacillaceae**                |                      |                     |                    |                     |                  |             |
| **Bacillus**                   |                      |                     |                    |                     |                  |             |
| **Lysinibacillus**             |                      |                     |                    |                     |                  |             |
| **Oceanobacillus**             |                      |                     |                    |                     |                  |             |
| **Paenibacillaceae**           |                      |                     |                    |                     |                  |             |
| **Paenibacillus**              |                      |                     |                    |                     |                  |             |
| **Brevibacillus**              |                      |                     |                    |                     |                  |             |
| **Staphylococcaceae**          |                      |                     |                    |                     |                  |             |
| **Staphylococcus**             |                      |                     |                    |                     |                  |             |
| **Listeriaceae**               |                      |                     |                    |                     |                  |             |
| **Listeria**                   |                      |                     |                    |                     |                  |             |
| **Alicyclobacillaceae**        |                      |                     |                    |                     |                  |             |
| **Alicyclobacillus**           |                      |                     |                    |                     |                  |             |
| **Bacillales incertae sedis**  |                      |                     |                    |                     |                  |             |
| **Thermoactinomycetaceae**     |                      |                     |                    |                     |                  |             |
| **Clostridia**                 |                      |                     |                    |                     |                  |             |
| **Clostridiales**              |                      |                     |                    |                     |                  |             |
| **Lachnospiraceae**            |                      |                     |                    |                     |                  |             |
| **unclassified Lachnospiraceae**|                      |                     |                    |                     |                  |             |
| Kingdom    | Order               | Family                      | Genus           | Percentage | Count  |
|------------|---------------------|-----------------------------|-----------------|------------|--------|
| Actinobacteria | Actinobacteria   | Actinobacteria               | Lachnoclostridium | 14         | 14     |
|             | Actinobacteria   | Actinobacteria               | Butyrivibrio    | 10         | 10     |
|             | Actinobacteria   | Actinobacteria               | Blautia         | 9          | 9      |
|             | Actinobacteria   | Clostridaceae                | Clostridium     | 57         | 100.0  |
|             | Actinobacteria   | Clostridaceae                | Ruminococcaceae | 100.0      | 10     |
|             | Actinobacteria   | Clostridaceae                | Ruminococcus   | 14         | 100.0  |
|             | Actinobacteria   | Clostridaceae                | Ruminiclostridium | 13       | 100.0  |
|             | Actinobacteria   | Clostridaceae                | Peptococcaceae  | 28         | 96.4   |
|             | Actinobacteria   | Clostridaceae                | Desulfotomaculum | 9         | 100.0  |
|             | Actinobacteria   | Clostridaceae                | Desulfosporosinus | 7       | 100.0  |
|             | Actinobacteria   | Clostridaceae                | Peptostreptococcaceae | 19 | 100.0  |
|             | Actinobacteria   | Clostridaceae                | unclassified Clostridiales | 18 | 100.0  |
|             | Actinobacteria   | Clostridaceae                | unclassified Clostridiales (miscellaneous) | 6 | 100.0  |
|             | Actinobacteria   | Eubacteriaceae               | Eubacterium   | 12         | 100.0  |
|             | Actinobacteria   | Clostridiales                 | Clostridiales incertae sedis | 10 | 100.0  |
|             | Actinobacteria   | Clostridiales                 | Clostridiales Family XIII. Incertae Sedis | 7 | 100.0  |
|             | Actinobacteria   | Thermoanaerobacterales       | Thermoanaerobacteriales | 24 | 87.5   |
|             | Actinobacteria   | Thermoanaerobacterales       | Thermoanaerobacterales Family III. Incertae Sedis | 7 | 100.0  |
|             | Actinobacteria   | Halanaerobiales              | Halanaerobiales | 8          | 100.0  |
| Negativicutes | Selenomonadales   | Selenomonadaceae             | Selenomonas     | 8          | 100.0  |
|             | Selenomonadales   | Selenomonadaceae             | Sporomusaes    | 6          | 100.0  |
|             | Veillonellales    | Veillonellaceae              | Veillonella     | 16         | 100.0  |
|             | Veillonellales    | Veillonellaceae              | Megasphaera    | 7          | 100.0  |
| Tissierellia | Tissierellales    | Tissierellales               | Tissierella    | 32         | 90.6   |
|             | Tissierellales    | Tissierellales               | Peptoniphilaceae | 26       | 88.5   |
|             | Tissierellales    | Tissierellales               | Peptoniphilus   | 13         | 76.9   |
|             | Tissierellales    | Tissierellales               | Anaerococcus   | 8          | 100.0  |
|             | Tissierellales    | unclassified Tissierellia    | Erysipelotrichia | 6          | 100.0  |
| Erysipelotrichia | Erysipelotrichiales | Erysipelotrichiales       | Erysipelotrichia | 21       | 81.0   |
|             | Erysipelotrichias | Erysipelotrichias | Erysipelotrichia | 21 | 81.0   |
| Actinobacteria | Actinobacteria   | Actinobacteria               | Bifidobacteriales | 36 | 44.4   |
|             | Actinobacteria   | Actinobacteria               | Bifidobacteriaceae | 36 | 44.4   |
| | | | __ Methanococcaceae                                                                                                                                                                           | 7 | 7 | 100.0 |
| | __ TACK group                                                                                                                                                                                                                                         | 47 | 12 | 25.5 |
| | | __ Crenarchaeota                                                                                                                                                                                                                                    | 35 | 12 | 34.3 |
| | | | __ Thermoprotei                                                                                                                                                                                                                                     | 35 | 12 | 34.3 |
| | | | | __ Desulfurococcales                                                                                                                                                                     | 13 | 12 | 92.3 |
| | | | | | __ Desulfurococcaceae                                                                                                                                                                   | 9 | 9 | 100.0 |
Group B

a: Total number of genomes in the taxon
b: Number of group B genomes in the taxon
c: Percentage of group B genomes in the taxon

| cellular organisms          | a    | b   | c   |
|-----------------------------|------|-----|-----|
| __ Bacteria                 | 5007 | 495 | 9.9 |
|   | Bacteria FCB group         |      |     |     |
|   | Bacteroidetes/Chlorobi group |      |     |     |
|   | Bacteroidetes              | 4769 | 495 | 10.4|
|   | Flavobacteria              | 455  | 409 | 89.9|
|   | Flavobacteriales           | 450  | 408 | 90.7|
|   | Flavobacteriaceae          | 436  | 400 | 91.7|
|   | Flavobacterium             | 190  | 187 | 98.4|
|   | Chryseobacterium           | 188  | 185 | 98.4|
|   | Capnocytophaga             |      |     |     |
|   | Lacinutrix                 |      |     |     |
|   | Aquimarina                 |      |     |     |
|   | Psychroserpens             |      |     |     |
|   | Maribacter                 |      |     |     |
|   | Polaribacter               |      |     |     |
|   | Nonlabens                  |      |     |     |
|   | Cellulophaga               |      |     |     |
|   | Tenacibaculum              |      |     |     |
|   | Arenibacter                |      |     |     |
|   | Mangrovimonas              |      |     |     |
|   | Leeuwenhoekiella           |      |     |     |
|   | Muricauda                  |      |     |     |
|   | Kordia                     |      |     |     |
|   | Gillisia                   |      |     |     |
|   | Psychroflexus              |      |     |     |
|   | Blattabacteriae            |      |     |     |
|   | Blattabacterium            | 137  | 130 | 94.9|
| __ Bacteroidia              | 127  | 120 | 94.5|
|   | Bacteroidales              | 52   | 51  | 98.1|
|   | Prevotellaceae             | 49   | 49  | 100.0|
|   | Porphyromonadaceae         | 33   | 31  | 93.9|
|   | Porphyromonas              | 15   | 13  | 86.7|
|   | Dysgonomonas               | 5    | 5   | 100.0|
Parabacteroides 3 3 100.0
Bacteroides 23 21 91.3
Rikenellaceae 12 11 91.7
Alistipes 10 10 100.0
Odoribacteraceae 4 4 100.0
Marinilabiliaceae 10 10 100.0
Marinilabiaceae 5 5 100.0
Prolixibacteraceae 3 3 100.0
Cytophagia 70 46 65.7
Cytophagales 70 46 65.7
Cyclobacteriaceae 16 16 100.0
Algoriphagus 6 6 100.0
Cytophagaceae 22 11 50.0
Dyadobacter 4 3 75.0
Hymenobacteraceae 14 7 50.0
Pontibacter 4 3 75.0
Hymenobacter 8 3 37.5
Flameovirgaceae 8 4 50.0
Amoebophilaceae 3 3 100.0
Sphingobacteriia 21 20 95.2
Sphingobacteriales 21 20 95.2
Sphingobacteriaceae 21 20 95.2
Sphingobacterium 8 8 100.0
Pedobacter 7 7 100.0
Chitinophagia 12 12 100.0
Chitinophagales 12 12 100.0
Flaveovirgaceae 3 3 100.0
Chlorobi 18 7 63.6
Chlorobi 7 7 63.6
Chlorobiales 11 7 63.6
Chlorobiaceae 11 7 63.6
Chlorobium/Pelodictyon group 8 6 75.0
Chlorobium 6 4 66.7
Proteobacteria 1854 38 2.0
Alphaproteobacteria 667 24 3.6
Rickettsiales 42 16 38.1
Rickettsiaceae 18 12 66.7
Rickettsiae 18 12 66.7
Rickettsia 15 10 66.7
spotted fever group 12 8 66.7
Anaplasmataceae 21 4 19.0
| Taxon                             | Count | Percentage |
|----------------------------------|-------|------------|
| Pelagibacterales                 | 8     | 75.0       |
|    | Pelagibacteraceae               | 8     | 75.0       |
|    | Candidatus Pelagibacter         | 5     | 60.0       |
|    | Candidatus Pelagibacter ubique  | 3     | 100.0      |
|    | unclassified Pelagibacteraceae  | 3     | 100.0      |
| Gammaproteobacteria              | 711   | 1.3        |
|    | Enterobacterales                | 112   | 4.5        |
|    | Enterobacteriaceae              | 41    | 7.3        |
| Betaproteobacteria               | 273   | 1.8        |
|    | unclassified Betaproteobacteria | 12    | 41.7       |
|    | Kinetoplastibacterium           | 5     | 80.0       |
| Terrabacteria group              | 2228  | 1.7        |
|    | Cyanobacteria/Melainabacteria group | 127 | 25.2       |
|    | Cyanobacteria                   | 127   | 25.2       |
|    | Nostocales                      | 31    | 41.9       |
|    | Nostocaceae                     | 10    | 90.0       |
|    | Nostoc                          | 4     | 100.0      |
|    | Anabaena                        | 3     | 100.0      |
|    | Oscillatoriophycideae           | 31    | 29.0       |
|    | Oscillatoriales                 | 22    | 31.8       |
|    | Synechococcales                 | 55    | 14.5       |
|    | Synechococcaceae                | 27    | 14.8       |
|    | Synechococcus                   | 24    | 16.7       |
| Tenericutes                      | 116   | 3.4        |
|    | Mollicutes                      | 115   | 3.5        |
|    | Mycoplasmatales                 | 73    | 5.5        |
|    | Mycoplasmataceae                | 73    | 5.5        |
|    | Mycoplasma                      | 70    | 5.7        |
| PVC group                        | 52    | 13.5       |
|    | Verrucomicrobia                 | 17    | 29.4       |
| Spirochaetes                     | 60    | 3.3        |
| Acidobacteria                    | 24    | 4.2        |
### Group C

**a:** Total number of genomes in the taxon  
**b:** Number of group C genomes in the taxon  
**c:** Percentage of group C genomes in the taxon  
**d:** Average percentage of first-genes-in-operon in the genomes of the taxon in prediction  
**e:** Average percentage of predicted leaderless genes among FGIO  
**f:** Average percentage of predicted leaderless genes among all genes

**Colors Legend - Column c**  
- Individual colors have no specific meaning - colors are used to highlight members of the same “cluster”, in particular, those clusters with a significant number of genomes that have been classified as class C.

**Colors Legend - Column f**  
- Values between 10 and 20 percent  
- Values between 20 and 30 percent  
- Values between 30 and 40 percent  
- Values between 40 and 60 percent  
- “Higher level” groups that contain several of the above ranges have been left blank

| cellular organisms       | a   | b   | c    | d    | e    | f    |
|--------------------------|-----|-----|------|------|------|------|
| **Bacteria**             |     |     |      |      |      |      |
| **Terrabacteria group**  |     |     |      |      |      |      |
| **Actinobacteria**       | 859 | 773 | 90.0 | 72.1 | 37.7 | 32.2 |
| **Micrococcaceae**       | 211 | 198 | 93.8 | 69.6 | 39.5 | 33.2 |
| **Microbacteriaceae**    | 82  | 78  | 95.1 | 68.3 | 41.0 | 34.0 |
| **Microbacterium**       | 34  | 34  | 100.0| 67.0 | 41.7 | 33.9 |
| **Leifsonia**            | 9   | 8   | 88.9 | 68.4 | 39.8 | 33.6 |
| **Leucobacter**          | 8   | 7   | 87.5 | 68.8 | 38.4 | 31.7 |
| **Micrococcales**        | 51  | 43  | 84.3 | 72.3 | 35.4 | 31.0 |
| **Arthrobacter**         | 19  | 16  | 84.2 | 71.8 | 36.3 | 31.7 |
| **Kocuria**              | 9   | 9   | 100.0| 73.7 | 32.0 | 28.5 |
| **Intrasporangiaceae**   | 25  | 25  | 100.0| 67.4 | 42.9 | 35.5 |
| **Cellulomonadaceae**    | 17  | 17  | 100.0| 69.6 | 40.5 | 33.6 |
| **Cellulomonas**         | 14  | 14  | 100.0| 69.6 | 40.3 | 33.4 |
| **Brevibacteriaceae**    | 7   | 7   | 100.0| 69.8 | 35.2 | 29.5 |
| **Brevibacterium**       | 7   | 7   | 100.0| 69.8 | 35.2 | 29.5 |
| **Dermcocaceae**         | 6   | 6   | 100.0| 70.5 | 42.4 | 35.2 |
| **Corynebacteriales**    | 202 | 197 | 97.5 | 70.4 | 41.0 | 35.0 |
| **Corynebacteriaceae**   | 72  | 70  | 97.2 | 70.7 | 40.8 | 35.3 |
| **Corynebacterium**      | 70  | 68  | 97.1 | 70.7 | 40.9 | 35.4 |
| **Mycobacteriaceae**     | 57  | 56  | 98.2 | 67.2 | 43.6 | 36.7 |
| **Mycobacterium**        | 56  | 55  | 98.2 | 67.2 | 43.7 | 36.8 |
| Family                  | Genus                           | Total | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| phylum            | order / class                              | nodes | % of total | % of phyla | % of order | % of family |
|-------------------|--------------------------------------------|-------|------------|------------|------------|-------------|
| **Firmicutes**    |                                            | 1064  | 3.4        | 64.1       | 19.4       | 17.1        |
| **Bacilli**       |                                            | 597   | 24         | 66.8       | 19.8       | 17.6        |
| **Lactobacillales** |                                            | 255   | 24         | 66.8       | 19.8       | 17.6        |
| **Streptococcales** | **Streptococcus**                            | 41    | 19         | 66.3       | 18.8       | 16.9        |
| **Tenericutes**   |                                            | 116   | 30         | 61.5       | 32.7       | 26.5        |
| **Mollicutes**    |                                            | 115   | 30         | 61.5       | 32.7       | 26.5        |
| **Mycoplasmatales** | **Mycoplasma**                             | 73    | 26         | 59.5       | 33.8       | 26.8        |
| **Proteobacteria** |                                            | 1854  | 104        | 66.5       | 32.2       | 29.9        |
| **Gammaproteobacteria** | **Xanthomonadales**                          | 62    | 18         | 69.8       | 35.7       | 32.4        |
| **Alphaproteobacteria** | **Sphingomonadales**                        | 105   | 34         | 67.9       | 33.2       | 31.4        |
| **delta/epsilon subdivisions** | **Deltaproteobacteria**                   | 123   | 10        | 60.7       | 30.8       | 27.0        |
| **Betaproteobacteria** | **Burkholderiales**                        | 166   | 15         | 68.8       | 32.5       | 30.4        |
| **Spirochaetes**  | **Burkholderiales**                        | 166   | 15         | 68.8       | 32.5       | 30.4        |
| **Spirochaetia**  |                                            | 60    | 24         | 63.5       | 28.6       | 22.7        |
| **Spirochaetales** |                                            | 40    | 24         | 63.5       | 28.6       | 22.7        |
| **Spirochaetaceae** | **Trepnonea**                               | 17    | 12         | 64.3       | 29.7       | 23.6        |
| **FCB group**     |                                            | 455   | 8          | 70.2       | 36.9       | 32.5        |
| **Bacteroidetes/Chlorobi group** | **Bacteroidetes**                          | 450   | 7          | 70.3       | 59.9       | 55.7        |
| **Deferribacteres** |                                            | 436   | 7          | 70.3       | 59.9       | 55.7        |
| **Aquificae**     |                                            | 14    | 3          | 45.4       | 39.4       | 29.9        |
| **PVC group**     |                                            | 52    | 2          | 74.8       | 50.8       | 46.1        |
| **Acidobacteria** |                                            | 24    | 2          | 67.5       | 31.1       | 25.5        |
| **Elusimicrobia** |                                            | 2     | 2          | 58.4       | 30.3       | 29.5        |
| **unclassified Bacteria** |                                            | 5     | 1          | 70.9       | 41.4       | 35.3        |
| **Fusobacteria**  |                                            | 19    | 1          | 49.7       | 16.9       | 11.3        |
| **Thermodesulfbacteria** |                                            | 6     | 1          | 53.0       | 33.0       | 30.0        |
Group D

a: Total number of genomes in the taxon  
b: Number of group D genomes in the taxon  
c: Percentage of group D genomes in the taxon  
d: Average percentage of first-genes-in-operon in the genomes of the taxon in prediction  
e: Average percentage of predicted leaderless genes among FGIO  
f: Average percentage of predicted leaderless genes among all genes

Colors Legend - Column f  
- Values between 10 and 25 percent  
- Values between 25 and 40 percent  
- Values between 40 and 55 percent  
- Values between 55 and 70 percent  
- “Higher level” groups that contain several of the above ranges have been left blank

| Taxon                  | a     | b      | c    | d     | e     | f     |
|------------------------|-------|--------|------|-------|-------|-------|
| cellular organisms     | 5007  | 199    | 4.0  | 72.4  | 56.6  | 44.9  |
| __ Archaea             | 238   | 199    | 83.6 | 72.4  | 56.6  | 44.9  |
| | __ Euryarchaeota      | 190   | 163    | 85.8 | 72.7  | 53.9  | 42.8  |
| | | __ Halobacteria      | 74    | 74     | 100.0| 79.2  | 70.8  | 58.8  |
| | | | __ Halobacteriales  | 26    | 26     | 100.0| 78.1  | 70.5  | 57.9  |
| | | | | __ Halocarculaceae | 9     | 9      | 100.0| 78.4  | 73.4  | 60.0  |
| | | | | __ Halococcaceae    | 7     | 7      | 100.0| 78.0  | 66.8  | 55.2  |
| | | | | | __ Halococcus       | 7     | 7      | 100.0| 78.0  | 66.8  | 55.2  |
| | | | | __ Halobacteriaceae | 7     | 7      | 100.0| 77.9  | 68.4  | 56.4  |
| | | | | | __ Halobacterium    | 3     | 3      | 100.0| 77.2  | 70.7  | 57.6  |
| | | | | | unclassified Halobacteriales | 3 | 3 | 100.0 | 78.3 | 75.0 | 61.4 |
| | __ Natrialbales       | 25    | 25     | 100.0| 81.5  | 71.1  | 60.5  |
| | | __ Natrimalbaceae    | 25    | 25     | 100.0| 81.5  | 71.1  | 60.5  |
| | | | __ Halopiger        | 4     | 4      | 100.0| 81.9  | 73.0  | 62.2  |
| | | | __ Natronorubrum    | 3     | 3      | 100.0| 81.2  | 71.9  | 61.2  |
| | | | __ Natrinema        | 3     | 3      | 100.0| 81.2  | 70.0  | 59.4  |
| | | | | __ Natronococcus   | 3     | 3      | 100.0| 81.9  | 65.7  | 56.0  |
| | | | | __ Natrialba       | 3     | 3      | 100.0| 81.8  | 70.8  | 60.7  |
| | __ Haloferaceales     | 23    | 23     | 100.0| 77.8  | 71.0  | 57.9  |
| | | __ Halorubraceae    | 12    | 12     | 100.0| 77.2  | 72.0  | 58.0  |
| | | | __ Halorubrum       | 9     | 9      | 100.0| 77.5  | 70.7  | 57.2  |
| | | __ Haloferaceae      | 11    | 11     | 100.0| 78.5  | 69.8  | 57.8  |
| | | | __ Haloferax        | 5     | 5      | 100.0| 77.7  | 71.7  | 58.8  |
| | __ Methanomicrobia    | 42    | 40     | 95.2 | 72.5  | 36.4  | 28.8  |
| | | __ Methanosarcinales| 26    | 24     | 92.3 | 76.6  | 29.6  | 24.9  |
| | | | __ Methanosarcinaceae | 22   | 20     | 90.9 | 78.6  | 28.2  | 24.4  |
|          | __ Methanosarcina | 13 | 12 | 92.3 | 83.0 | 27.4 | 24.5 |
|----------|-------------------|----|----|------|------|------|------|
|          | __ Methanococoides | 3  | 3  | 100.0 | 71.9 | 29.2 | 24.1 |
|          | __ Methanomicrobiales | 14 | 14 | 100.0 | 65.8 | 47.0 | 35.1 |
|          | | __ Methanomicrobiaceae | 7  | 7  | 100.0 | 67.0 | 47.3 | 35.6 |
|          | | __ Methanocaldococcaceae | 8  | 3  | 100.0 | 66.6 | 69.0 | 52.0 |

### Thermococci

|          | __ Thermococcales | 21 | 21 | 100.0 | 63.0 | 30.3 | 21.4 |
|----------|-------------------|----|----|------|------|------|------|
|          | __ Thermococcaceae | 21 | 21 | 100.0 | 63.0 | 30.3 | 21.4 |
|          | | __ Thermococcus | 14 | 14 | 100.0 | 64.2 | 31.7 | 22.8 |
|          | | __ Pyrococcus | 5  | 5  | 100.0 | 69.1 | 28.3 | 19.0 |

### Thermoplasmata

|          | __ Thermoplasmales | 11 | 11 | 100.0 | 65.7 | 63.2 | 45.8 |
|----------|-------------------|----|----|------|------|------|------|
|          | __ Methanomassiliicoccales | 5  | 5  | 100.0 | 63.5 | 52.3 | 37.6 |

### Thermoprotei

|          | __ Sulfolobales | 11 | 11 | 100.0 | 66.6 | 69.0 | 52.0 |
|----------|-----------------|----|----|------|------|------|------|
|          | | __ Sulfolobaceae | 11 | 11 | 100.0 | 66.6 | 69.0 | 52.0 |
|          | | __ Metallosphaera | 6  | 6  | 100.0 | 66.4 | 67.2 | 51.2 |
|          | | __ Thermoproteales | 9  | 9  | 100.0 | 71.6 | 71.6 | 59.9 |
|          | | __ Thermofilaceae | 3  | 3  | 100.0 | 69.3 | 65.6 | 48.4 |

### Thaumarchaeota

|          | __ Nitrosopumilales | 7  | 7  | 100.0 | 74.6 | 72.4 | 59.4 |
|----------|---------------------|----|----|------|------|------|------|
|          | | __ Nitrosopumilaceae | 7  | 7  | 100.0 | 74.6 | 72.4 | 59.4 |
|          | | | __ Nitrosopumilus | 5  | 5  | 100.0 | 74.8 | 73.1 | 59.7 |
|          | unclassified Thaumarchaeota | 3  | 3  | 100.0 | 72.2 | 78.1 | 61.7 |

### unclassified Archaea

|          | 1  | 1 | 100.0 | 77.6 | 71.9 | 59.0 |
## Group X

A: Total number of genomes in the taxon  
B: Number of group X genomes in the taxon  
C: Percentage of group X genomes in the taxon

| Organism                        | A     | B     | C     |
|---------------------------------|-------|-------|-------|
| Cellular organisms              | 5007  | 311   | 6.2   |
| **Bacteria**                    |       |       |       |
| Proteobacteria                  |       |       |       |
| Betaproteobacteria              |       |       |       |
| Burkholderiales                 | 1854  | 142   | 7.7   |
| Acidovorax                      | 273   | 76    | 27.8  |
| Comamonas                       | 166   | 63    | 38.0  |
| unclassified Burkholderiales    | 24    | 16    | 66.7  |
| Burkholderiales Genera incertae sedis | 21  | 14    | 66.7  |
| Thiomonas                       | 4     | 3     | 75.0  |
| Burkholderiaceae                | 34    | 8     | 23.5  |
| Oxalobacteraceae                | 30    | 3     | 10.0  |
| Alcaligenaceae                  | 23    | 3     | 13.0  |
| unclassified Betaproteobacteria | 12    | 5     | 41.7  |
| unclassified Betaproteobacteria (miscellaneous) | 5    | 4     | 80.0  |
| Methylphilales                  | 14    | 4     | 28.6  |
| Nitrosomonadales                | 9     | 4     | 44.4  |
| Nitrosomonadaceae               | 9     | 4     | 44.4  |
| **Gammaproteobacteria**         | 711   | 37    | 5.2   |
| Xanthomonadales                 | 62    | 9     | 14.5  |
| Xanthomonadaceae                | 48    | 8     | 16.7  |
| Xanthomonas                     | 6     | 3     | 50.0  |
| Methylococcales                 | 20    | 8     | 40.0  |
| Methylococcaceae                | 19    | 8     | 42.1  |
| Methylmicobiurn                 | 3     | 3     | 100.0 |
| unclassified Gammaproteobacteria| 26    | 6     | 23.1  |
| Enterobacteriales               | 112   | 5     | 4.5   |
| Enterobacteriaceae              | 41    | 5     | 12.2  |
| unclassified Enterobacteriaceae | 13   | 5     | 38.5  |
| ant, tsetse, mealybug, aphid, etc. endosymbionts | 10  | 5     | 50.0  |
| ant endosymbionts               | 5     | 4     | 80.0  |
| Candidatus Blochmannia          | 5     | 4     | 80.0  |
| **Legionellales**               | 38    | 3     | 7.9   |
| **Alphaproteobacteria**         | 667   | 26    | 3.9   |
| Domain                        | Order                        | Family                           | Genus                        | Species                  | % Identification |
|-------------------------------|------------------------------|----------------------------------|------------------------------|--------------------------|------------------|
| __ Terrabacteria group        | __ Cyanobacteria/Melanabacteria group | __ Cyanobacteria                 |                             |                          | 2228 107 4.8    |
|                               |                              | __ Cyanobacteria                 | __ Synechococcales           |                          | 127 90 70.9     |
|                               |                              | __ Synechococcales               | __ Synechococcaceae         |                          | 55 43 78.2      |
|                               |                              | __ Synechococcales               | __ Synechococcus            |                          | 27 20 74.1      |
|                               |                              | __ Synechococcales               | __ Prochlorococcus          |                          | 24 17 70.8      |
|                               |                              | __ Prochlorococcus               | __ Prochlorococcus marinus  |                          | 11 9 81.8       |
|                               |                              | __ Prochlorococcus               | __ Leptolyngbyaceae         |                          | 11 9 81.8       |
|                               |                              | __ Prochlorococcus               | __ Leptolyngbya             |                          | 10 9 90.0       |
|                               |                              | __ Prochlorococcus               | __ Pseudanabaenaceae        |                          | 8 7 87.5        |
|                               |                              | __ Oscillatorioiaphycideae       | __ Oscillatoriales          |                          | 4 3 75.0        |
|                               |                              | __ Oscillatoriales               | __ Microcoleaceae           |                          | 6 5 83.3        |
|                               |                              | __ Oscillatoriales               | __ Oscillariaceae           |                          | 6 4 66.7        |
|                               |                              | __ Oscillatoriales               | __ Cynothecaceae            | __ Cynothecaceae        | 5 3 60.0        |
|                               |                              | __ Oscillatoriales               | __ Cynothecaceae            | __ Cynothecaceae        | 5 3 60.0        |
|                               |                              | __ Oscillatoriales               | __ Chroococcaceae           | __ Chroococcaceae       | 9 7 77.8        |
|                               |                              | __ Oscillatoriales               | __ Chroococcaceae           | __ Chroococcaceae       | 4 3 75.0        |
|                               |                              | __ Nostocales                    | __ Nostocales               | __ Nostocales           | 31 22 71.0      |
|                               |                              | __ Nostocales                    | __ Rivulariaceae            | __ Rivulariaceae        | 5 4 80.0        |
|                               |                              | __ Nostocales                    | __ Calothrix                | __ Calothrix            | 4 4 100.0       |
|                               |                              | __ Nostocales                    | __ Hapalosiphonaceae        | __ Hapalosiphonaceae    | 4 4 100.0       |
|                               |                              | __ Nostocales                    | __ Aphanizomenonaceae       | __ Aphanizomenonaceae   | 4 4 100.0       |
|                               |                              | __ Nostocales                    | __ Tolypothrichaceae        | __ Tolypothrichaceae    | 4 3 75.0        |
|                               |                              | __ Nostocales                    | __ Tolypothrichaceae        | __ Tolypothrichaceae    | 4 3 75.0        |
|                               |                              | __ Nostocales                    | __ Pleurocapsales           | __ Pleurocapsales       | 5 5 100.0       |
| Class                  | Order                          | Family                           | Genus         | Species | Percentage |
|-----------------------|--------------------------------|----------------------------------|---------------|---------|------------|
| **Hyellaceae**        |                                |                                  |               |         | 100.0      |
| **Tenericutes**       |                                |                                  |               |         | 10.0       |
| **Mollicutes**        |                                |                                  |               |         | 8.7        |
| **Mycoplasmatales**   |                                |                                  |               |         | 13.7       |
| **Mycoplasmataceae**  |                                |                                  |               |         | 13.7       |
| **Mycoplasma**        |                                |                                  |               |         | 14.3       |
| **Actinobacteria**    |                                |                                  |               |         | 7.6        |
| **Actinobacteria**    |                                |                                  |               |         | 0.5        |
| **Thermoleophilia**   |                                |                                  |               |         | 37.5       |
| **Solirubrobacterales** |                            |                                  |               |         | 37.5       |
| **FCB group**         |                                |                                  |               |         | 7.7        |
| **Bacteroidetes/Chlorobi group** |                 |                                  |               |         | 7.6        |
| **Bacteroidetes**     |                                |                                  |               |         | 6.7        |
| **Cytophagia**        |                                |                                  |               |         | 34.3       |
| **Cytophagales**      |                                |                                  |               |         | 34.3       |
| **Cytophagaceae**     |                                |                                  |               |         | 50.0       |
| **Spirosoma**         |                                |                                  |               |         | 100.0      |
| **Hymenobacteraceae** |                                |                                  |               |         | 62.5       |
| **Flammeovirgaceae**  |                                |                                  |               |         | 50.0       |
| **Bacteroidia**       |                                |                                  |               |         | 2.2        |
| **Bacteroidales**     |                                |                                  |               |         | 2.4        |
| **Chlorobi**          |                                |                                  |               |         | 36.4       |
| **Chlorobi**          |                                |                                  |               |         | 36.4       |
| **Chlorobiales**      |                                |                                  |               |         | 36.4       |
| **Chlorobiaceae**     |                                |                                  |               |         | 36.4       |
| **Verrucomicrobia**   |                                |                                  |               |         | 70.6       |
| **Verrucomicrobiae**  |                                |                                  |               |         | 71.4       |
| **Opitutae**          |                                |                                  |               |         | 71.4       |
| **Planctomycetes**    |                                |                                  |               |         | 75.0       |
| **Planctomycetia**    |                                |                                  |               |         | 18.8       |
| **Planctomycetales**  |                                |                                  |               |         | 20.0       |
| **Planctomycetaceae** |                                |                                  |               |         | 23.1       |
| **PVC group**         |                                |                                  |               |         | 33.3       |
| **Spirochaetes**      |                                |                                  |               |         | 13.3       |
| **Spirochaetia**      |                                |                                  |               |         | 13.3       |
| **Leptospiras**       |                                |                                  |               |         | 50.0       |
| **Leptospirales**     |                                |                                  |               |         | 50.0       |
| **Leptospiraceae**    |                                |                                  |               |         | 50.0       |
| **Leptospira**        |                                |                                  |               |         | 42.9       |
| **Acidobacteria**     |                                |                                  |               |         | 16.7       |