

1 Starness

The chosen groups vary in starness and surprisingly exhibit a non-uniform dependence on the mean branch length. Figure S1 illustrates the finding that the starness generally increases with evolutionary distance. This may be due to the tendency for the existence of a large number of closely related sequenced organisms which make for low starness trees.

2 Computing the expected gene frequencies

Figure S2 illustrates the computational steps involved in computing the contribution of a particular pattern of keep/replace events on the branches of a tree to the total gene frequency histogram including the computation of the probability of occurrence of the pattern.

3 Stochastic population model with additive per-gene fitness effects

Figure S3 illustrates the evolutionary model based on a Moran process with selection in which the replicating individuals are chosen with the probability proportional to the sum of the fitness contributions of their constituent genes. The individual that is replaced is chosen at random.

4 Distribution of gene replacement rates in the stochastic population model

Figure S4 shows the effect of increasing selection strength reflected by the ratio of the population size to the genome size on the distribution of gene replacement rates. When the genome size is large compared to the population size, genes are fixed in an essentially neutral manner through drift which results in a sharply peaked distribution of replacement rates. Under high selection each decade in replacement rate contributes a roughly equal weight into the distribution. For example, there are roughly the same number of genes with replacement rates between 10^{-4} and 10^{-3} as there are genes with replacement rates between 10^{-3} and 10^{-2} .

5 Stochastic population model with fluctuating genome size

To test the fixed genome size assumption made in the rest of the manuscript, we explore a population model with a fluctuating genome size. As before the organism's fitness is the sum of the fitness contributions of its constituent genes.

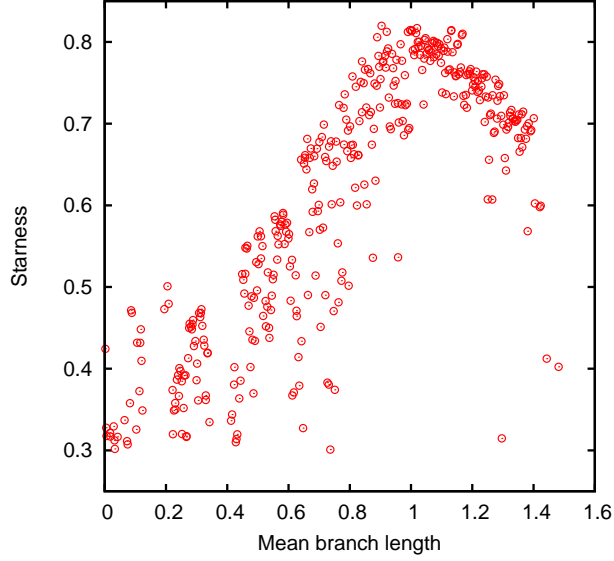


Figure S1: Starness of the chosen groups as a function of the mean branch length.

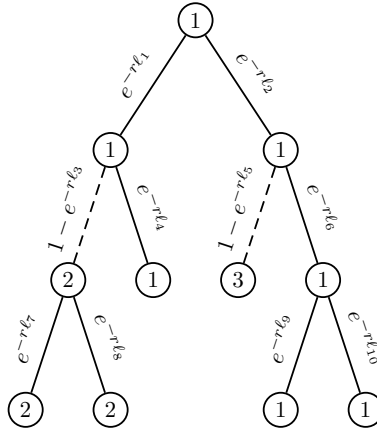


Figure S2: The schematic of the computation of the contribution to the gene frequency histogram of a particular pattern of replacements of a gene with replacement rate r . The gene was kept on branches drawn as solid lines and replaced on dashed branches. The probability of occurrence of this pattern $P = e^{-rL}(1 - e^{-r\ell_3})(1 - e^{-r\ell_5})$ is the product of factors indicated on the branches. Here $L = \ell_1 + \ell_2 + \ell_4 + \ell_6 + \ell_7 + \ell_8 + \ell_9 + \ell_{10}$ is the sum of the lengths of branches on which replacement did not occur. The contribution of this pattern to the total commonality plot is the product of P and gene frequencies c_k ($c_1 = 1/6$, $c_2 = 1/3$, $c_3 = 1/2$, $c_4 = c_5 = c_6 = 0$) that result from it.

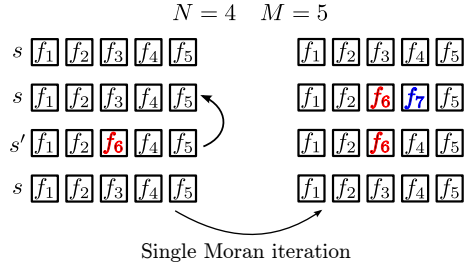


Figure S3: The iteration of the Moran process with selection consists of selecting an individual with the probability proportional to its fitness. In this figure, the mutant with the fitness $s' = f_1 + f_2 + f_4 + f_5 + f_6$ is chosen with probability $s'/(s' + 3s)$ where $s = f_1 + f_2 + f_3 + f_4 + f_5$. The chosen individual undergoes the mutation process and replaces an organism chosen at random. The mutation process in the figure replaced gene f_4 with a new gene f_7 drawn from an exponential distribution with unit mean.

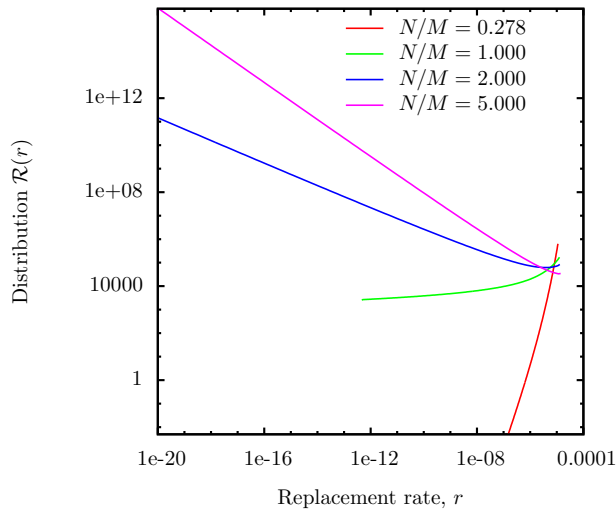


Figure S4: Steady state distribution of gene replacement rates derived from the stochastic population model.

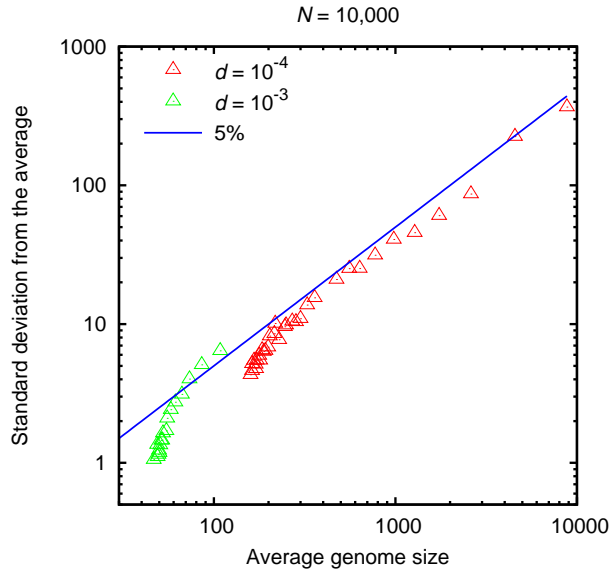


Figure S5: Standard deviation of the genome size from the average in steady state for a fixed population size and two values of the deletion probability.

Each gene is identified only by its fitness contribution. The fixed population size Wright-Fisher dynamics with selection are implemented. In each generation each surviving genome is subjected to two mutation steps: 1) random genes are deleted with a small per-gene probability d ; 2) new genes are added to the genome with a smaller per-gene innovation probability. Each new gene's fitness contribution is drawn from an exponential distribution with unit mean.

The steady state genome size is set by the duplication, deletion, selection balance. We vary the steady state genome size by almost two orders of magnitude by varying the deletion and innovation probabilities while fixing the population size. Figure S5 displays the standard deviation of the genome size fluctuations about the mean. These fluctuations are at most a few percent of the steady state genome size for the full range of sizes studied (the solid line is the 5% of the genome size).

6 Non-overlapping groups of closely related organisms

To address the issues that stem from the overlapping content of the chosen groups we select 17 groups with distinct species content and the average tip-to-root distance less than 0.5. The fits to the non-overlapping groups exhibit the same patterns that were found in the complete dataset.

Table 1: Model fits to 16 non-overlapping groups of closely related prokaryotes

Group	Mean branch length	Model A			Model B			Model C			Model D			
		Rate	AIC	AIC	Fast rate	Slow rate	Slow fraction	AIC	Rate	Shape parameter	AIC	Rate	N/M	AIC
1	0.002	75.86	-0.76	-0.76	429.34	14.76	0.80	-14.9	706.5	0.102	-12.51	1.10	11.79	-16.37
2	0.005	38.69	-6.24	-6.24	307.94	13.98	0.85	-15.4	858.7	0.004	-23.21	1.00	14.12	-17.35
10	0.065	2.75	-1.82	-1.82	27.93	0.61	0.78	-13.6	417.7	0.000	-18.79	0.84	14.77	-19.05
14	0.086	1.82	-3.13	-3.13	9.14	0.28	0.71	-22.2	30.4	0.111	-22.16	0.38	9.62	-26.88
16	0.103	2.72	-7.17	-7.17	10.05	0.64	0.65	-14.0	15.5	0.294	-19.64	0.91	6.03	-18.28
17	0.106	2.25	-3.24	-3.24	7.58	0.22	0.59	-12.0	27.1	0.217	-12.49	1.35	6.49	-14.28
23	0.195	1.09	-0.32	-0.32	4.42	0.10	0.62	-27.4	19.4	0.167	-17.47	0.43	7.88	-25.66
31	0.236	1.05	-4.05	-4.05	4.28	0.20	0.63	-15.2	11.3	0.232	-21.36	0.77	6.79	-19.96
35	0.248	1.10	-4.41	-4.41	6.74	0.37	0.66	-29.4	16.2	0.235	-31.45	0.36	6.49	-27.50
37	0.252	1.45	-3.23	-3.23	7.88	0.36	0.66	-12.5	17.8	0.211	-15.10	1.42	6.94	-13.81
62	0.330	1.00	-2.88	-2.88	4.36	0.22	0.59	-13.0	14.4	0.245	-18.36	1.05	6.11	-16.82
70	0.424	0.72	-4.80	-4.80	2.22	0.09	0.55	-13.7	7.4	0.285	-21.33	0.71	6.02	-20.76
77	0.452	0.59	-1.58	-1.58	1.96	0.06	0.50	-24.4	6.6	0.365	-22.76	0.17	5.23	-34.88
88	0.485	0.87	-0.54	-0.54	2.98	0.09	0.53	-27.2	10.7	0.315	-20.48	0.27	5.68	-30.24
91	0.495	0.61	-0.13	-0.13	2.01	0.08	0.52	-25.8	5.4	0.381	-18.39	0.38	5.14	-27.10
93	0.499	0.47	-2.20	-2.20	1.69	0.06	0.53	-18.5	6.4	0.323	-26.22	0.13	5.46	-37.45

7 List of species in chosen group

1

331111 *Escherichia coli* E24377A
344610 *Escherichia coli* 53638
364106 *Escherichia coli* UTI89
409438 *Escherichia coli* SE11
444451 *Escherichia coli* O157:H7 str. EC4196
444452 *Escherichia coli* O157:H7 str. EC4113
585056 *Escherichia coli* UMN026
585395 *Escherichia coli* O103:H2 str. 12009
585397 *Escherichia coli* ED1a
701177 *Escherichia coli* O55:H7 str. CB9615

2

37762 *Escherichia coli* B
198214 *Shigella flexneri* 2a str. 301
300268 *Shigella boydii* Sb227
316407 *Escherichia coli* str. K-12 substr. W3110
331112 *Escherichia coli* HS
358709 *Escherichia coli* 101-1
502347 *Escherichia albertii* TW07627
585034 *Escherichia coli* IAI1
585054 *Escherichia fergusonii* ATCC 35469
866768 *Escherichia coli* 'BL21-Gold(DE3)pLysS AG'

3

41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
321314 *Salmonella enterica* subsp. *enterica* serovar Choleraesuis str. SC-B67
439847 *Salmonella enterica* subsp. *enterica* serovar Saintpaul str. SARA29
439851 *Salmonella enterica* subsp. *enterica* serovar Dublin str. CT_02021853
440534 *Salmonella enterica* subsp. *enterica* serovar 4,[5],12:i:- str. CVM23701
454165 *Salmonella enterica* subsp. *enterica* serovar Schwarzengrund str. SL480
454166 *Salmonella enterica* subsp. *enterica* serovar Agona str. SL483
465516 *Salmonella enterica* subsp. *enterica* serovar Hadar str. RI_05P066
476213 *Salmonella enterica* subsp. *enterica* serovar Paratyphi C strain RKS4594
497974 *Salmonella enterica* subsp. *enterica* serovar Typhi str. E02-1180

4

290338 *Citrobacter koseri* ATCC BAA-895
331111 *Escherichia coli* E24377A
344610 *Escherichia coli* 53638
409438 *Escherichia coli* SE11

439855 *Escherichia coli* SMS-3-5
444451 *Escherichia coli* O157:H7 str. EC4196
454167 *Salmonella enterica* subsp. *enterica* serovar Javiana str. GA_MM04042433
585056 *Escherichia coli* UMN026
585397 *Escherichia coli* ED1a
637910 *Citrobacter rodentium* ICC168

5

290338 *Citrobacter koseri* ATCC BAA-895
331111 *Escherichia coli* E24377A
405955 *Escherichia coli* APEC 01
409438 *Escherichia coli* SE11
423368 *Salmonella enterica* subsp. *enterica* serovar Newport str. SL254
439855 *Escherichia coli* SMS-3-5
454167 *Salmonella enterica* subsp. *enterica* serovar Javiana str. GA_MM04042433
585055 *Escherichia coli* 55989
585056 *Escherichia coli* UMN026
637910 *Citrobacter rodentium* ICC168

6

290338 *Citrobacter koseri* ATCC BAA-895
331111 *Escherichia coli* E24377A
344610 *Escherichia coli* 53638
409438 *Escherichia coli* SE11
444451 *Escherichia coli* O157:H7 str. EC4196
454167 *Salmonella enterica* subsp. *enterica* serovar Javiana str. GA_MM04042433
585056 *Escherichia coli* UMN026
585397 *Escherichia coli* ED1a
637910 *Citrobacter rodentium* ICC168
640131 *Klebsiella variicola* At-22

7

37762 *Escherichia coli* B
41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
198214 *Shigella flexneri* 2a str. 301
300267 *Shigella dysenteriae* Sd197
340197 *Escherichia coli* F11
344609 *Shigella boydii* CDC 3083-94
454165 *Salmonella enterica* subsp. *enterica* serovar Schwarzengrund str. SL480
454231 *Salmonella enterica* subsp. *enterica* serovar Kentucky str. CDC 191
500639 *Enterobacter cancerogenus* ATCC 35316
502347 *Escherichia albertii* TW07627

8

41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
198214 *Shigella flexneri* 2a str. 301
300267 *Shigella dysenteriae* Sd197
321314 *Salmonella enterica* subsp. *enterica* serovar Choleraesuis str. SC-B67
340184 *Escherichia coli* B7A
340197 *Escherichia coli* F11
344609 *Shigella boydii* CDC 3083-94
454164 *Salmonella enterica* subsp. *enterica* serovar Heidelberg str. SL486
497974 *Salmonella enterica* subsp. *enterica* serovar Typhi str. E02-1180
500639 *Enterobacter cancerogenus* ATCC 35316

9

37762 *Escherichia coli* B
41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
198214 *Shigella flexneri* 2a str. 301
290339 *Cronobacter sakazakii* ATCC BAA-894
300267 *Shigella dysenteriae* Sd197
340197 *Escherichia coli* F11
344609 *Shigella boydii* CDC 3083-94
454231 *Salmonella enterica* subsp. *enterica* serovar Kentucky str. CDC 191
500639 *Enterobacter cancerogenus* ATCC 35316
502347 *Escherichia albertii* TW07627

10

216591 *Burkholderia cenocepacia* J2315
320373 *Burkholderia pseudomallei* 668
331272 *Burkholderia cenocepacia* HI2424
396596 *Burkholderia ambifaria* IOP40-10
396597 *Burkholderia ambifaria* MEX-5
398527 *Burkholderia phytofirmans* PsJN
406425 *Burkholderia cenocepacia* MC0-3
441163 *Burkholderia oklahomensis* E0147
441166 *Burkholderia ubonensis* Bu
640511 *Burkholderia* sp. CCGE1002

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37762 *Escherichia coli* B
290339 *Cronobacter sakazakii* ATCC BAA-894
300268 *Shigella boydii* Sb227
399742 *Enterobacter* sp. 638
496064 *Salmonella enterica* subsp. *enterica* serovar Typhi str. E98-3139

502347 *Escherichia albertii* TW07627
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
585054 *Escherichia fergusonii* ATCC 35469
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

12

37762 *Escherichia coli* B
300268 *Shigella boydii* Sb227
399742 *Enterobacter* sp. 638
454231 *Salmonella enterica* subsp. *enterica* serovar *Kentucky* str. CDC 191
496064 *Salmonella enterica* subsp. *enterica* serovar *Typhi* str. E98-3139
502347 *Escherichia albertii* TW07627
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
585054 *Escherichia fergusonii* ATCC 35469
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

13

214092 *Yersinia pestis* C092
349966 *Yersinia frederiksenii* ATCC 33641
360099 *Yersinia pestis* biovar *Antiqua* str. E1979001
393305 *Yersinia enterocolitica* subsp. *enterocolitica* 8081
404218 *Yersinia pestis* biovar *Antiqua* str. UG05-0454
481805 *Escherichia coli* ATCC 8739
502800 *Yersinia pseudotuberculosis* YPIII
561229 *Dickeya zeae* Ech1591
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032

14

214092 *Yersinia pestis* C092
349966 *Yersinia frederiksenii* ATCC 33641
393305 *Yersinia enterocolitica* subsp. *enterocolitica* 8081
481805 *Escherichia coli* ATCC 8739
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

15

349966 *Yersinia frederiksenii* ATCC 33641
358709 *Escherichia coli* 101-1
399742 *Enterobacter* sp. 638
404216 *Yersinia pestis* biovar *Mediaevalis* str. K1973002
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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208435 *Streptococcus agalactiae* 2603V/R
342617 *Streptococcus agalactiae* CJB111
391295 *Streptococcus suis* 05ZYH33
391296 *Streptococcus suis* 98HAH33
487214 *Streptococcus pneumoniae* Hungary19A-6
488221 *Streptococcus pneumoniae* 70585
488222 *Streptococcus pneumoniae* JJA
512566 *Streptococcus pneumoniae* G54
516950 *Streptococcus pneumoniae* CGSP14
637909 *Streptococcus gallolyticus* UCN34

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205921 *Streptococcus agalactiae* A909
210007 *Streptococcus mutans* UA159
299768 *Streptococcus thermophilus* CNRZ1066
365659 *Streptococcus mitis* B6
370554 *Streptococcus pyogenes* MGAS10750
373153 *Streptococcus pneumoniae* D39
453363 *Streptococcus pneumoniae* SP195
453366 *Streptococcus pneumoniae* MLV-016
561276 *Streptococcus pneumoniae* ATCC 700669
568814 *Streptococcus suis* BM407

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37762 *Escherichia coli* B
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
300269 *Shigella sonnei* Ss046
360102 *Yersinia pestis* Antiqua

406818 *Xenorhabdus bovienii* SS-2004
502347 *Escherichia albertii* TW07627
561231 *Pectobacterium wasabiae* WPP163
585034 *Escherichia coli* IAI1

19

290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
360102 *Yersinia pestis* Antiqua
399742 *Enterobacter* sp. 638
406818 *Xenorhabdus bovienii* SS-2004
454231 *Salmonella enterica* subsp. *enterica* serovar Kentucky str. CDC 191
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561231 *Pectobacterium wasabiae* WPP163
706191 *Pantoea ananatis* LMG 20103
866768 *Escherichia coli* 'BL21-Gold(DE3)pLysS AG'

20

214092 *Yersinia pestis* C092
349966 *Yersinia frederiksenii* ATCC 33641
406818 *Xenorhabdus bovienii* SS-2004
481805 *Escherichia coli* ATCC 8739
550537 *Salmonella enterica* subsp. *enterica* serovar Enteritidis str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

21

349966 *Yersinia frederiksenii* ATCC 33641
358709 *Escherichia coli* 101-1
360102 *Yersinia pestis* Antiqua
399742 *Enterobacter* sp. 638
406818 *Xenorhabdus bovienii* SS-2004
550537 *Salmonella enterica* subsp. *enterica* serovar Enteritidis str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
585054 *Escherichia fergusonii* ATCC 35469
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
198628 *Dickeya dadantii* 3937
243265 *Photobacterium luminescens* subsp. *laumondii* TT01
300267 *Shigella dysenteriae* Sd197
321314 *Salmonella enterica* subsp. *enterica* serovar *Choleraesuis* str. SC-B67
340184 *Escherichia coli* B7A
344609 *Shigella boydii* CDC 3083-94
454165 *Salmonella enterica* subsp. *enterica* serovar *Schwarzengrund* str. SL480
500639 *Enterobacter cancerogenus* ATCC 35316
521000 *Providencia rettgeri* DSM 1131

23

246200 *Ruegeria pomeroyi* DSS-3
252305 *Oceanicola batsensis* HTCC2597
272943 *Rhodobacter sphaeroides* 2.4.1
290400 *Jannaschia* sp. CCS1
349101 *Rhodobacter sphaeroides* ATCC 17029
349102 *Rhodobacter sphaeroides* ATCC 17025
351016 *Roseobacter* sp. AzwK-3b
375451 *Roseobacter denitrificans* OCh 114
391624 *Oceanibulbus indolifex* HEL-45
398580 *Dinoroseobacter shibae* DFL 12

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246200 *Ruegeria pomeroyi* DSS-3
252305 *Oceanicola batsensis* HTCC2597
272943 *Rhodobacter sphaeroides* 2.4.1
290400 *Jannaschia* sp. CCS1
349101 *Rhodobacter sphaeroides* ATCC 17029
351016 *Roseobacter* sp. AzwK-3b
375451 *Roseobacter denitrificans* OCh 114
391613 *Roseovarius* sp. TM1035
391624 *Oceanibulbus indolifex* HEL-45
398580 *Dinoroseobacter shibae* DFL 12

25

246200 *Ruegeria pomeroyi* DSS-3
252305 *Oceanicola batsensis* HTCC2597
272943 *Rhodobacter sphaeroides* 2.4.1
349101 *Rhodobacter sphaeroides* ATCC 17029
351016 *Roseobacter* sp. AzwK-3b
375451 *Roseobacter denitrificans* OCh 114
391613 *Roseovarius* sp. TM1035

391619 *Phaeobacter gallaeciensis* DSM 17395
391624 *Oceanibulbus indolifex* HEL-45
398580 *Dinoroseobacter shibae* DFL 12

26

121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
198628 *Dickeya dadantii* 3937
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photorhabdus asymbiotica*
314290 *Vibrio* sp. MED222
404217 *Yersinia pestis* biovar *Orientalis* str. MG05-1020
502347 *Escherichia albertii* TW07627

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41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
198628 *Dickeya dadantii* 3937
243265 *Photorhabdus luminescens* subsp. *laumondii* TT01
300267 *Shigella dysenteriae* Sd197
314290 *Vibrio* sp. MED222
314292 *Photobacterium angustum* S14
439843 *Salmonella enterica* subsp. *enterica* serovar *Schwarzengrund* str. CVM19633
500639 *Enterobacter cancerogenus* ATCC 35316

28

121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
198628 *Dickeya dadantii* 3937
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
243265 *Photorhabdus luminescens* subsp. *laumondii* TT01
300267 *Shigella dysenteriae* Sd197
314290 *Vibrio* sp. MED222
439847 *Salmonella enterica* subsp. *enterica* serovar *Saintpaul* str. SARA29
500639 *Enterobacter cancerogenus* ATCC 35316

29

216895 *Vibrio vulnificus* CMCP6

218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
360102 *Yersinia pestis* Antiqua
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
561231 *Pectobacterium wasabiae* WPP163
575788 *Vibrio splendidus* LGP32
585034 *Escherichia coli* IAI1

30

41514 *Salmonella enterica* subsp. *arizonae* serovar 62:z4,z23:-
121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
198628 *Dickeya dadantii* 3937
243265 *Photobacterium luminescens* subsp. *laumondii* TT01
300267 *Shigella dysenteriae* Sd197
314290 *Vibrio* sp. MED222
439847 *Salmonella enterica* subsp. *enterica* serovar Saintpaul str. SARA29
500639 *Enterobacter cancerogenus* ATCC 35316
521000 *Providencia rettgeri* DSM 1131

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243277 *Vibrio cholerae* O1 biovar El Tor str. N16961
312309 *Vibrio fischeri* ES114
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
349965 *Yersinia intermedia* ATCC 29909
417397 *Vibrio cholerae* 623-39
500637 *Providencia rustigianii* DSM 4541
550538 *Salmonella enterica* subsp. *enterica* serovar Gallinarum str. 287/91
579405 *Dickeya dadantii* Ech703
634503 *Edwardsiella ictaluri* 93-146

32

37762 *Escherichia coli* B
121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
360102 *Yersinia pestis* Antiqua

382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
575788 *Vibrio splendidus* LGP32

33

198215 *Shigella flexneri* 2a str. 2457T
214092 *Yersinia pestis* C092
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
349965 *Yersinia intermedia* ATCC 29909
393305 *Yersinia enterocolitica* subsp. *enterocolitica* 8081
417399 *Vibrio cholerae* NCTC 8457
520999 *Providencia alcalifaciens* DSM 30120
550538 *Salmonella enterica* subsp. *enterica* serovar *Gallinarum* str. 287/91
579405 *Dickeya dadantii* Ech703

34

121723 *Photobacterium* sp. SKA34
198628 *Dickeya dadantii* 3937
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
314290 *Vibrio* sp. MED222
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
404217 *Yersinia pestis* biovar *Orientalis* str. MG05-1020
502347 *Escherichia albertii* TW07627

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216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
561231 *Pectobacterium wasabiae* WPP163
575788 *Vibrio splendidus* LGP32

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290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*

360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561231 *Pectobacterium wasabiae* WPP163
575788 *Vibrio splendidus* LGP32
706191 *Pantoea ananatis* LMG 20103

37

349967 *Yersinia mollaretii* ATCC 43969
349968 *Yersinia bercovieri* ATCC 43970
417400 *Vibrio cholerae* B33
465817 *Erwinia tasmaniensis* Et1/99
498217 *Edwardsiella tarda* EIB202
529507 *Proteus mirabilis* HI4320
579112 *Vibrio cholerae* M66-2
634499 *Erwinia pyrifoliae* Ep1/96
637386 *Yersinia pestis* Z176003
665029 *Erwinia amylovora* CFBP1430

38

214092 *Yersinia pestis* C092
349966 *Yersinia frederiksenii* ATCC 33641
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
393305 *Yersinia enterocolitica* subsp. *enterocolitica* 8081
481805 *Escherichia coli* ATCC 8739
520999 *Providencia alcalifaciens* DSM 30120
561229 *Dickeya zeae* Ech1591
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032

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214092 *Yersinia pestis* C092
314289 *Vibrio* sp. AND4
373384 *Shigella flexneri* 5 str. 8401
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
393305 *Yersinia enterocolitica* subsp. *enterocolitica* 8081
417399 *Vibrio cholerae* NCTC 8457
520999 *Providencia alcalifaciens* DSM 30120
550538 *Salmonella enterica* subsp. *enterica* serovar *Gallinarum* str. 287/91

579405 *Dickeya dadantii* Ech703

40

349966 *Yersinia frederiksenii* ATCC 33641
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
481805 *Escherichia coli* ATCC 8739
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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349966 *Yersinia frederiksenii* ATCC 33641
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
399742 *Enterobacter* sp. 638
406818 *Xenorhabdus bovienii* SS-2004
481805 *Escherichia coli* ATCC 8739
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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349966 *Yersinia frederiksenii* ATCC 33641
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
399742 *Enterobacter* sp. 638
406818 *Xenorhabdus bovienii* SS-2004
481805 *Escherichia coli* ATCC 8739
550537 *Salmonella enterica* subsp. *enterica* serovar *Enteritidis* str. P125109
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
590409 *Dickeya dadantii* Ech586
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

43

60480 *Shewanella* sp. MR-4
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238

318161 *Shewanella denitrificans* OS217
323850 *Shewanella loihica* PV-4
349967 *Yersinia mollaretii* ATCC 43969
500637 *Providencia rustigianii* DSM 4541
550540 *Ferrimonas balearica* DSM 9799
593588 *Vibrio cholerae* MJ-1236
634503 *Edwardsiella ictaluri* 93-146

44

121723 *Photobacterium* sp. SKA34
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium* sp. asymbiotica
325240 *Shewanella baltica* OS155
360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
425104 *Shewanella sediminis* HAW-EB3
575788 *Vibrio splendidus* LGP32

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121723 *Photobacterium* sp. SKA34
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium* sp. asymbiotica
325240 *Shewanella baltica* OS155
360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
575788 *Vibrio splendidus* LGP32
637905 *Shewanella violacea* DSS12

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218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium* sp. asymbiotica
325240 *Shewanella baltica* OS155
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
404217 *Yersinia pestis* biovar *Orientalis* str. MG05-1020
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
575788 *Vibrio splendidus* LGP32
637905 *Shewanella violacea* DSS12

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216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium damela* strain 395
325240 *Shewanella baltica* OS155
360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
410291 *Vibrio harveyi* HY01
575788 *Vibrio splendidus* LGP32
637905 *Shewanella violacea* DSS12

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218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium damela* strain 395
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
402882 *Shewanella baltica* OS185
404215 *Yersinia pestis* biovar *Antiqua* str. B42003004
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
637905 *Shewanella violacea* DSS12

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290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium damela* strain 395
314608 *Shewanella benthica* KT99
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
402882 *Shewanella baltica* OS185
404214 *Yersinia pestis* biovar *Orientalis* str. F1991016
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14

50

243277 *Vibrio cholerae* O1 biovar *El Tor* str. N16961
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
323850 *Shewanella loihica* PV-4

349965 *Yersinia intermedia* ATCC 29909
500637 *Providencia rustigianii* DSM 4541
550538 *Salmonella enterica* subsp. *enterica* serovar *Gallinarum* str. 287/91
550540 *Ferrimonas balearica* DSM 9799
579405 *Dickeya dadantii* Ech703
634503 *Edwardsiella ictaluri* 93-146

51

60480 *Shewanella* sp. MR-4
156578 *Alteromonadales* bacterium TW-7
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
318161 *Shewanella denitrificans* OS217
323850 *Shewanella loihica* PV-4
349967 *Yersinia mollaretii* ATCC 43969
500637 *Providencia rustigianii* DSM 4541
550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146

52

60480 *Shewanella* sp. MR-4
198215 *Shigella flexneri* 2a str. 2457T
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
318167 *Shewanella frigidimarina* NCIMB 400
386656 *Yersinia pestis* *Pestoides* F
417399 *Vibrio cholerae* NCTC 8457
520999 *Providencia alcalifaciens* DSM 30120
550538 *Salmonella enterica* subsp. *enterica* serovar *Gallinarum* str. 287/91
579405 *Dickeya dadantii* Ech703

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94122 *Shewanella* sp. ANA-3
314608 *Shewanella benthica* KT99
349966 *Yersinia frederiksenii* ATCC 33641
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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318161 *Shewanella denitrificans* OS217
326297 *Shewanella amazonensis* SB2B
349968 *Yersinia bercovieri* ATCC 43970
465817 *Erwinia tasmaniensis* Et1/99
498217 *Edwardsiella tarda* EIB202
529507 *Proteus mirabilis* HI4320
579112 *Vibrio cholerae* M66-2
634499 *Erwinia pyrifoliae* Ep1/96
637386 *Yersinia pestis* Z176003
665029 *Erwinia amylovora* CFBP1430

55

87626 *Pseudoalteromonas tunicata* D2
121723 *Photobacterium* sp. SKA34
216895 *Vibrio vulnificus* CMCP6
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
325240 *Shewanella baltica* OS155
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
404217 *Yersinia pestis* biovar *Orientalis* str. MG05-1020
637905 *Shewanella violacea* DSS12

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87626 *Pseudoalteromonas tunicata* D2
218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
325240 *Shewanella baltica* OS155
360102 *Yersinia pestis* Antiqua
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
410291 *Vibrio harveyi* HY01
575788 *Vibrio splendidus* LGP32
637905 *Shewanella violacea* DSS12

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218491 *Pectobacterium atrosepticum* SCRI1043
290339 *Cronobacter sakazakii* ATCC BAA-894
342610 *Pseudoalteromonas atlantica* T6c
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
402882 *Shewanella baltica* OS185

404215 *Yersinia pestis* biovar Antiqua str. B42003004
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
637905 *Shewanella violacea* DSS12

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290339 *Cronobacter sakazakii* ATCC BAA-894
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
360099 *Yersinia pestis* biovar Antiqua str. E1979001
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
402882 *Shewanella baltica* OS185
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14

59

60481 *Shewanella* sp. MR-7
214092 *Yersinia pestis* C092
314275 *Alteromonas macleodii* str. 'Deep ecotype'
318167 *Shewanella frigidimarina* NCIMB 400
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
417399 *Vibrio cholerae* NCTC 8457
520999 *Providencia alcalifaciens* DSM 30120
550538 *Salmonella enterica* subsp. *enterica* serovar Gallinarum str. 287/91
579405 *Dickeya dadantii* Ech703

60

290339 *Cronobacter sakazakii* ATCC BAA-894
291112 *Photobacterium asymbiotica*
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
360102 *Yersinia pestis* Antiqua
402882 *Shewanella baltica* OS185
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14

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94122 *Shewanella* sp. ANA-3
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
349966 *Yersinia frederiksenii* ATCC 33641
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032

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167879 *Colwellia psychrerythraea* 34H
196600 *Vibrio vulnificus* YJ016
223926 *Vibrio parahaemolyticus* RIMD 2210633
225849 *Shewanella piezotolerans* WP3
290338 *Citrobacter koseri* ATCC BAA-895
375450 *Yersinia pestis* FV-1
392500 *Shewanella woodyi* ATCC 51908
399741 *Serratia proteamaculans* 568
585035 *Escherichia coli* S88
640131 *Klebsiella variicola* At-22

63

167879 *Colwellia psychrerythraea* 34H
196600 *Vibrio vulnificus* YJ016
223926 *Vibrio parahaemolyticus* RIMD 2210633
225849 *Shewanella piezotolerans* WP3
290338 *Citrobacter koseri* ATCC BAA-895
375450 *Yersinia pestis* FV-1
392500 *Shewanella woodyi* ATCC 51908
399741 *Serratia proteamaculans* 568
585035 *Escherichia coli* S88
637910 *Citrobacter rodentium* ICC168

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314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
404216 *Yersinia pestis* biovar *Mediaevalis* str. K1973002
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4

558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

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314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
349966 *Yersinia frederiksenii* ATCC 33641
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
458817 *Shewanella halifaxensis* HAW-EB4
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
561229 *Dickeya zeae* Ech1591
693216 *Cronobacter turicensis* z3032
706191 *Pantoea ananatis* LMG 20103

66

167879 *Colwellia psychrerythraea* 34H
196600 *Vibrio vulnificus* YJ016
225849 *Shewanella piezotolerans* WP3
290338 *Citrobacter koseri* ATCC BAA-895
399741 *Serratia proteamaculans* 568
409438 *Escherichia coli* SE11
444451 *Escherichia coli* O157:H7 str. EC4196
454167 *Salmonella enterica* subsp. *enterica* serovar *Javiana* str. GA_MM04042433
637910 *Citrobacter rodentium* ICC168
640131 *Klebsiella variicola* At-22

67

205921 *Streptococcus agalactiae* A909
210007 *Streptococcus mutans* UA159
299768 *Streptococcus thermophilus* CNRZ1066
349123 *Lactobacillus reuteri* 100-23
362948 *Lactobacillus salivarius* UCC118
365659 *Streptococcus mitis* B6
370552 *Streptococcus pyogenes* MGAS10270
453363 *Streptococcus pneumoniae* SP195
553482 *Streptococcus equi* subsp. *equi* 4047
568814 *Streptococcus suis* BM407

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198466 *Streptococcus pyogenes* MGAS315
210007 *Streptococcus mutans* UA159
264199 *Streptococcus thermophilus* LMG 18311
293653 *Streptococcus pyogenes* MGAS5005
314315 *Lactobacillus sakei* subsp. *sakei* 23K
319701 *Streptococcus pyogenes* MGAS6180
453363 *Streptococcus pneumoniae* SP195
552526 *Streptococcus equi* subsp. *zooepidemicus* MGCS10565
557436 *Lactobacillus reuteri* DSM 20016
568813 *Streptococcus suis* SC84

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40041 *Streptococcus equi* subsp. *zooepidemicus*
198466 *Streptococcus pyogenes* MGAS315
264199 *Streptococcus thermophilus* LMG 18311
272621 *Lactobacillus acidophilus* NCFM
293653 *Streptococcus pyogenes* MGAS5005
314315 *Lactobacillus sakei* subsp. *sakei* 23K
453363 *Streptococcus pneumoniae* SP195
511691 *Streptococcus mutans* NN2025
557436 *Lactobacillus reuteri* DSM 20016
568813 *Streptococcus suis* SC84

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40041 *Streptococcus equi* subsp. *zooepidemicus*
264199 *Streptococcus thermophilus* LMG 18311
272621 *Lactobacillus acidophilus* NCFM
286636 *Streptococcus pyogenes* MGAS10394
314315 *Lactobacillus sakei* subsp. *sakei* 23K
334390 *Lactobacillus fermentum* IFO 3956
453364 *Streptococcus pneumoniae* CDC0288-04
511691 *Streptococcus mutans* NN2025
557436 *Lactobacillus reuteri* DSM 20016
568813 *Streptococcus suis* SC84

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170187 *Streptococcus pneumoniae* TIGR4
171101 *Streptococcus pneumoniae* R6
203120 *Leuconostoc mesenteroides* subsp. *mesenteroides* ATCC 8293
211110 *Streptococcus agalactiae* NEM316
362948 *Lactobacillus salivarius* UCC118
365659 *Streptococcus mitis* B6
453362 *Streptococcus pneumoniae* CDC1873-00

467705 *Streptococcus gordonii* str. Challis substr. CH1
486410 *Streptococcus dysgalactiae* subsp. *equisimilis* GGS_124
748671 *Lactobacillus crispatus* ST1

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203120 *Leuconostoc mesenteroides* subsp. *mesenteroides* ATCC 8293
205921 *Streptococcus agalactiae* A909
362948 *Lactobacillus salivarius* UCC118
365659 *Streptococcus mitis* B6
453365 *Streptococcus pneumoniae* CDC3059-06
467705 *Streptococcus gordonii* str. Challis substr. CH1
488223 *Streptococcus pneumoniae* P1031
553482 *Streptococcus equi* subsp. *equi* 4047
561276 *Streptococcus pneumoniae* ATCC 700669
748671 *Lactobacillus crispatus* ST1

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203120 *Leuconostoc mesenteroides* subsp. *mesenteroides* ATCC 8293
205921 *Streptococcus agalactiae* A909
362948 *Lactobacillus salivarius* UCC118
365659 *Streptococcus mitis* B6
453362 *Streptococcus pneumoniae* CDC1873-00
453365 *Streptococcus pneumoniae* CDC3059-06
467705 *Streptococcus gordonii* str. Challis substr. CH1
486410 *Streptococcus dysgalactiae* subsp. *equisimilis* GGS_124
553482 *Streptococcus equi* subsp. *equi* 4047
748671 *Lactobacillus crispatus* ST1

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203120 *Leuconostoc mesenteroides* subsp. *mesenteroides* ATCC 8293
205921 *Streptococcus agalactiae* A909
349123 *Lactobacillus reuteri* 100-23
362948 *Lactobacillus salivarius* UCC118
365659 *Streptococcus mitis* B6
370552 *Streptococcus pyogenes* MGAS10270
467705 *Streptococcus gordonii* str. Challis substr. CH1
553482 *Streptococcus equi* subsp. *equi* 4047
561276 *Streptococcus pneumoniae* ATCC 700669
748671 *Lactobacillus crispatus* ST1

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203120 *Leuconostoc mesenteroides* subsp. *mesenteroides* ATCC 8293

205921 *Streptococcus agalactiae* A909
210007 *Streptococcus mutans* UA159
349123 *Lactobacillus reuteri* 100-23
362948 *Lactobacillus salivarius* UCC118
370552 *Streptococcus pyogenes* MGAS10270
453363 *Streptococcus pneumoniae* SP195
553482 *Streptococcus equi* subsp. *equi* 4047
568814 *Streptococcus suis* BM407
748671 *Lactobacillus crispatus* ST1

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203122 *Saccharophagus degradans* 2-40
314275 *Alteromonas macleodii* str. 'Deep ecotype'
314285 *Congregibacter litoralis* KT71
314289 *Vibrio* sp. AND4
318167 *Shewanella frigidimarina* NCIMB 400
377628 *Yersinia pestis* Nepal516
379731 *Pseudomonas stutzeri* A1501
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
443152 *Marinobacter algicola* DG893

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203122 *Saccharophagus degradans* 2-40
314275 *Alteromonas macleodii* str. 'Deep ecotype'
314285 *Congregibacter litoralis* KT71
318167 *Shewanella frigidimarina* NCIMB 400
377628 *Yersinia pestis* Nepal516
379731 *Pseudomonas stutzeri* A1501
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
443152 *Marinobacter algicola* DG893
520999 *Providencia alcalifaciens* DSM 30120

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156578 *Alteromonadales bacterium* TW-7
314285 *Congregibacter litoralis* KT71
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
318161 *Shewanella denitrificans* OS217
323850 *Shewanella loihica* PV-4
405416 *Acinetobacter baumannii* ACICU
498211 *Cellvibrio japonicus* Ueda107

550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146

79

314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
360099 *Yersinia pestis* biovar Antiqua str. E1979001
377629 *Teredinibacter turnerae* T7901
379731 *Pseudomonas stutzeri* A1501
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
406818 *Xenorhabdus bovienii* SS-2004
443152 *Marinobacter algicola* DG893
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14

80

314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
360099 *Yersinia pestis* biovar Antiqua str. E1979001
377629 *Teredinibacter turnerae* T7901
379731 *Pseudomonas stutzeri* A1501
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
443152 *Marinobacter algicola* DG893

81

314283 *Reinekea blandensis* MED297
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
400668 *Marinomonas* sp. MWYL1
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
502801 *Yersinia pseudotuberculosis* PB1/+
637905 *Shewanella violacea* DSS12

82

314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99

342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
400668 *Marinomonas* sp. MWYL1
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
502801 *Yersinia pseudotuberculosis* PB1/+

83

156578 *Alteromonadales bacterium* TW-7
207954 *Neptuniibacter caesariensis*
318161 *Shewanella denitrificans* OS217
498211 *Cellvibrio japonicus* Ueda107
509173 *Acinetobacter baumannii* AYE
529507 *Proteus mirabilis* HI4320
550540 *Ferrimonas balearica* DSM 9799
579112 *Vibrio cholerae* M66-2
634499 *Erwinia pyrifoliae* Ep1/96
637386 *Yersinia pestis* Z176003

84

218491 *Pectobacterium atrosepticum* SCRI1043
291112 *Photorhabdus asymbiotica*
325240 *Shewanella baltica* OS155
342610 *Pseudoalteromonas atlantica* T6c
349747 *Yersinia pseudotuberculosis* IP 31758
351348 *Marinobacter aquaeolei* VT8
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
400668 *Marinomonas* sp. MWYL1
410291 *Vibrio harveyi* HY01
637905 *Shewanella violacea* DSS12

85

246200 *Ruegeria pomeroyi* DSS-3
252305 *Oceanicola batsensis* HTCC2597
272943 *Rhodobacter sphaeroides* 2.4.1
290400 *Jannaschia* sp. CCS1
314253 *Nitrobacter* sp. Nb-311A
323097 *Nitrobacter hamburgensis* X14
351016 *Roseobacter* sp. AzwK-3b
391624 *Oceanibulbus indolifex* HEL-45
398580 *Dinoroseobacter shibae* DFL 12

411684 *Hoeflea phototrophica* DFL-43

86

290339 *Cronobacter sakazakii* ATCC BAA-894
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
402882 *Shewanella baltica* OS185
404214 *Yersinia pestis* biovar *Orientalis* str. F1991016
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01

87

207954 *Neptuniibacter caesariensis*
318161 *Shewanella denitrificans* OS217
326297 *Shewanella amazonensis* SB2B
349967 *Yersinia mollaretii* ATCC 43969
498211 *Cellvibrio japonicus* Ueda107
498217 *Edwardsiella tarda* EIB202
509173 *Acinetobacter baumannii* AYE
529507 *Proteus mirabilis* HI4320
579112 *Vibrio cholerae* M66-2
634499 *Erwinia pyrifoliae* Ep1/96

88

87626 *Pseudoalteromonas tunicata* D2
121723 *Photobacterium* sp. SKA34
150340 *Vibrio* sp. Ex25
198628 *Dickeya dadantii* 3937
243265 *Photorhabdus luminescens* subsp. *laumondii* TT01
344609 *Shigella boydii* CDC 3083-94
399599 *Shewanella baltica* OS195
399739 *Pseudomonas mendocina* ymp
425104 *Shewanella sediminis* HAW-EB3
521000 *Providencia rettgeri* DSM 1131

89

314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342610 *Pseudoalteromonas atlantica* T6c

351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
404216 *Yersinia pestis* biovar *Mediaevalis* str. K1973002
406818 *Xenorhabdus bovienii* SS-2004
410291 *Vibrio harveyi* HY01
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14
693216 *Cronobacter turicensis* z3032

90

246200 *Ruegeria pomeroyi* DSS-3
252305 *Oceanicola batsensis* HTCC2597
272943 *Rhodobacter sphaeroides* 2.4.1
290400 *Jannaschia* sp. CCS1
314253 *Nitrobacter* sp. Nb-311A
351016 *Roseobacter* sp. AzwK-3b
375451 *Roseobacter denitrificans* OCh 114
391613 *Roseovarius* sp. TM1035
398580 *Dinoroseobacter shibae* DFL 12
509190 *Caulobacter segnis* ATCC 21756

91

279238 *Novosphingobium aromaticivorans* DSM 12444
292414 *Ruegeria* sp. TM1040
314231 *Fulvimarina pelagi* HTCC2506
314256 *Oceanicola granulosus* HTCC2516
314266 *Sphingomonas* sp. SKA58
395963 *Beijerinckia indica* subsp. *indica* ATCC 9039
395965 *Methylocella silvestris* BL2
450851 *Phenylobacterium zucineum* HLK1
504832 *Oligotropha carboxidovorans* OM5
565050 *Caulobacter crescentus* NA1000

92

190650 *Caulobacter crescentus* CB15
292414 *Ruegeria* sp. TM1040
314231 *Fulvimarina pelagi* HTCC2506
314256 *Oceanicola granulosus* HTCC2516
314266 *Sphingomonas* sp. SKA58
395963 *Beijerinckia indica* subsp. *indica* ATCC 9039
395965 *Methylocella silvestris* BL2
450851 *Phenylobacterium zucineum* HLK1
504832 *Oligotropha carboxidovorans* OM5
565050 *Caulobacter crescentus* NA1000

93

62977 *Acinetobacter* sp. ADP1
204773 *Herminiimonas arsenicoxydans*
207949 *Bermanella marisrubri*
290398 *Chromohalobacter salexigens* DSM 3043
360910 *Bordetella avium* 197N
391597 *Limnobacter* sp. MED105
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
400667 *Acinetobacter baumannii* ATCC 17978
557598 *Laribacter hongkongensis* HLHK9
572477 *Allochromatium vinosum* DSM 180

94

269796 *Rhodospirillum rubrum* ATCC 11170
279238 *Novosphingobium aromaticivorans* DSM 12444
292414 *Ruegeria* sp. TM1040
314266 *Sphingomonas* sp. SKA58
314267 *Sulfitobacter* sp. NAS-14.1
395965 *Methylocella silvestris* BL2
414684 *Rhodospirillum centenum* SW
450851 *Phenylobacterium zucineum* HLK1
504832 *Oligotropha carboxidovorans* OM5
565050 *Caulobacter crescentus* NA1000

95

62977 *Acinetobacter* sp. ADP1
204773 *Herminiimonas arsenicoxydans*
207949 *Bermanella marisrubri*
290398 *Chromohalobacter salexigens* DSM 3043
391597 *Limnobacter* sp. MED105
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
400667 *Acinetobacter baumannii* ATCC 17978
400673 *Legionella pneumophila* str. Corby
557598 *Laribacter hongkongensis* HLHK9
572477 *Allochromatium vinosum* DSM 180

96

62977 *Acinetobacter* sp. ADP1
204773 *Herminiimonas arsenicoxydans*
207949 *Bermanella marisrubri*
290398 *Chromohalobacter salexigens* DSM 3043

297246 *Legionella pneumophila* str. Paris
391597 *Limnobacter* sp. MED105
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
400673 *Legionella pneumophila* str. Corby
557598 *Laribacter hongkongensis* HLHK9
572477 *Allochromatium vinosum* DSM 180

97

190650 *Caulobacter crescentus* CB15
269796 *Rhodospirillum rubrum* ATCC 11170
292414 *Ruegeria* sp. TM1040
314231 *Fulvimarina pelagi* HTCC2506
314256 *Oceanicola granulosus* HTCC2516
314266 *Sphingomonas* sp. SKA58
395963 *Beijerinckia indica* subsp. *indica* ATCC 9039
395965 *Methylocella silvestris* BL2
450851 *Phenylobacterium zucineum* HLK1
504832 *Oligotropha carboxidovorans* OM5

98

269796 *Rhodospirillum rubrum* ATCC 11170
279238 *Novosphingobium aromaticivorans* DSM 12444
292414 *Ruegeria* sp. TM1040
314231 *Fulvimarina pelagi* HTCC2506
314256 *Oceanicola granulosus* HTCC2516
314266 *Sphingomonas* sp. SKA58
395963 *Beijerinckia indica* subsp. *indica* ATCC 9039
450851 *Phenylobacterium zucineum* HLK1
504832 *Oligotropha carboxidovorans* OM5
565050 *Caulobacter crescentus* NA1000

99

156578 *Alteromonadales bacterium* TW-7
207954 *Neptuniibacter caesariensis*
312309 *Vibrio fischeri* ES114
318161 *Shewanella denitrificans* OS217
472759 *Nitrosococcus halophilus* Nc4
498211 *Cellvibrio japonicus* Ueda107
509173 *Acinetobacter baumannii* AYE
550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146
637386 *Yersinia pestis* Z176003

100

156578 *Alteromonadales bacterium* TW-7
314285 *Congregibacter litoralis* KT71
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
318161 *Shewanella denitrificans* OS217
405416 *Acinetobacter baumannii* ACICU
472759 *Nitrosococcus halophilus* Nc4
498211 *Cellvibrio japonicus* Ueda107
550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146

101

60480 *Shewanella* sp. MR-4
156578 *Alteromonadales bacterium* TW-7
314285 *Congregibacter litoralis* KT71
314289 *Vibrio* sp. AND4
316275 *Aliivibrio salmonicida* LFI1238
323850 *Shewanella loihica* PV-4
472759 *Nitrosococcus halophilus* Nc4
480119 *Acinetobacter baumannii* AB0057
550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146

102

262698 *Brucella abortus* bv. 1 str. 9-941
314225 *Erythrobacter litoralis* HTCC2594
314232 *Loktanella vestfoldensis* SKA53
314254 *Oceanicaulis* sp. HTCC2633
323098 *Nitrobacter winogradskyi* Nb-255
359391 *Brucella melitensis* biovar Abortus 2308
394221 *Maricaulis maris* MCS10
430066 *Brucella abortus* S19
546272 *Brucella melitensis* ATCC 23457
634452 *Acetobacter pasteurianus* IFO 3283-01

103

224914 *Brucella melitensis* bv. 1 str. 16M
237727 *Erythrobacter* sp. NAP1
262698 *Brucella abortus* bv. 1 str. 9-941
314232 *Loktanella vestfoldensis* SKA53
317655 *Sphingopyxis alaskensis* RB2256

323098 *Nitrobacter winogradskyi* Nb-255
394221 *Maricaulis maris* MCS10
546272 *Brucella melitensis* ATCC 23457
582402 *Hirschia baltica* ATCC 49814
634452 *Acetobacter pasteurianus* IFO 3283-01

104

354 *Azotobacter vinelandii*
58051 *Moritella* sp. PE36
270374 *Marinobacter* sp. ELB17
314277 *Marinomonas* sp. MED121
314288 *Vibrio alginolyticus* 12G01
375450 *Yersinia pestis* FV-1
392500 *Shewanella woodyi* ATCC 51908
521000 *Providencia rettgeri* DSM 1131
585057 *Escherichia coli* IAI39
870187 *Thiothrix nivea* DSM 5205

105

87626 *Pseudoalteromonas tunicata* D2
121723 *Photobacterium* sp. SKA34
198628 *Dickeya dadantii* 3937
216895 *Vibrio vulnificus* CMCP6
300269 *Shigella sonnei* Ss046
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
399739 *Pseudomonas mendocina* ymp
400668 *Marinomonas* sp. MWYL1
425104 *Shewanella sediminis* HAW-EB3
870187 *Thiothrix nivea* DSM 5205

106

203122 *Saccharophagus degradans* 2-40
291331 *Xanthomonas oryzae* pv. *oryzae* KACC 10331
314275 *Alteromonas macleodii* str. 'Deep ecotype'
318167 *Shewanella frigidimarina* NCIMB 400
349746 *Yersinia pestis* Angola
379731 *Pseudomonas stutzeri* A1501
380703 *Aeromonas hydrophila* subsp. *hydrophila* ATCC 7966
388396 *Vibrio fischeri* MJ11
391008 *Stenotrophomonas maltophilia* R551-3
443152 *Marinobacter algicola* DG893

107

354 *Azotobacter vinelandii*
58051 *Moritella* sp. PE36
270374 *Marinobacter* sp. ELB17
314277 *Marinomonas* sp. MED121
314288 *Vibrio alginolyticus* 12G01
316273 *Xanthomonas campestris* pv. *vesicatoria* str. 85-10
399599 *Shewanella baltica* OS195
405955 *Escherichia coli* APEC 01
521000 *Providencia rettgeri* DSM 1131
870187 *Thiothrix nivea* DSM 5205

108

62977 *Acinetobacter* sp. ADP1
204773 *Herminiimonas arsenicoxydans*
207949 *Bermanella marisrubri*
290398 *Chromohalobacter salexigens* DSM 3043
345075 *Vibrio cholerae* V51
360910 *Bordetella avium* 197N
391597 *Limnobacter* sp. MED105
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
400667 *Acinetobacter baumannii* ATCC 17978
661367 *Legionella longbeachae* NSW150

109

76114 *Aromatoleum aromaticum* EbN1
87626 *Pseudoalteromonas tunicata* D2
216895 *Vibrio vulnificus* CMCP6
362663 *Escherichia coli* 536
399739 *Pseudomonas mendocina* ymp
425104 *Shewanella sediminis* HAW-EB3
509169 *Xanthomonas campestris* pv. *campestris* str. B100
522306 *Candidatus Accumulibacter phosphatis* clade IIA str. UW-1
564066 *Ralstonia solanacearum* IPO1609
870187 *Thiothrix nivea* DSM 5205

110

87626 *Pseudoalteromonas tunicata* D2
243365 *Chromobacterium violaceum* ATCC 12472
314290 *Vibrio* sp. MED222
338969 *Rhodospirillum rubrum* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
399739 *Pseudomonas mendocina* ymp

400668 *Marinomonas* sp. MWYL1
425104 *Shewanella sediminis* HAW-EB3
522306 *Candidatus Accumulibacter phosphatis* clade IIA str. UW-1
564066 *Ralstonia solanacearum* IP01609

111

87626 *Pseudoalteromonas tunicata* D2
150340 *Vibrio* sp. Ex25
243365 *Chromobacterium violaceum* ATCC 12472
338969 *Rhodoferrax ferrireducens* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
399739 *Pseudomonas mendocina* ymp
400668 *Marinomonas* sp. MWYL1
425104 *Shewanella sediminis* HAW-EB3
522306 *Candidatus Accumulibacter phosphatis* clade IIA str. UW-1
564066 *Ralstonia solanacearum* IP01609

112

87626 *Pseudoalteromonas tunicata* D2
190486 *Xanthomonas axonopodis* pv. *citri* str. 306
243365 *Chromobacterium violaceum* ATCC 12472
291112 *Photorhabdus asymbiotica*
338969 *Rhodoferrax ferrireducens* T118
399739 *Pseudomonas mendocina* ymp
400668 *Marinomonas* sp. MWYL1
425104 *Shewanella sediminis* HAW-EB3
522306 *Candidatus Accumulibacter phosphatis* clade IIA str. UW-1
564066 *Ralstonia solanacearum* IP01609

113

159087 *Dechloromonas aromatica* RCB
232721 *Acidovorax* sp. JS42
257311 *Bordetella parapertussis* 12822
291331 *Xanthomonas oryzae* pv. *oryzae* KACC 10331
314275 *Alteromonas macleodii* str. 'Deep ecotype'
318167 *Shewanella frigidimarina* NCIMB 400
360099 *Yersinia pestis* biovar *Antiqua* str. E1979001
379731 *Pseudomonas stutzeri* A1501
443152 *Marinobacter algicola* DG893
536230 *Burkholderia pseudomallei* MSHR346

114

87626 *Pseudoalteromonas tunicata* D2
150340 *Vibrio* sp. Ex25
243365 *Chromobacterium violaceum* ATCC 12472
338969 *Rhodospirillum rubrum* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
382245 *Aeromonas salmonicida* subsp. *salmonicida* A449
400668 *Marinomonas* sp. MWYL1
425104 *Shewanella sediminis* HAW-EB3
522306 *Candidatus Accumulibacter phosphatis* clade IIA str. UW-1
564066 *Ralstonia solanacearum* IP01609

115

159087 *Dechloromonas aromatica* RCB
203122 *Saccharophagus degradans* 2-40
232721 *Acidovorax* sp. JS42
291331 *Xanthomonas oryzae* pv. *oryzae* KACC 10331
314275 *Alteromonas macleodii* str. 'Deep ecotype'
318167 *Shewanella frigidimarina* NCIMB 400
377628 *Yersinia pestis* Nepal516
379731 *Pseudomonas stutzeri* A1501
443152 *Marinobacter algicola* DG893
536230 *Burkholderia pseudomallei* MSHR346

116

243365 *Chromobacterium violaceum* ATCC 12472
291112 *Photobacterium asymbiotica*
338969 *Rhodospirillum rubrum* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
342110 *Ralstonia solanacearum* UW551
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
400668 *Marinomonas* sp. MWYL1
637905 *Shewanella violacea* DSS12

117

159087 *Dechloromonas aromatica* RCB
232721 *Acidovorax* sp. JS42
291331 *Xanthomonas oryzae* pv. *oryzae* KACC 10331
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
377629 *Teredinibacter turnerae* T7901
379731 *Pseudomonas stutzeri* A1501

443152 *Marinobacter algicola* DG893
502800 *Yersinia pseudotuberculosis* YPIII
536230 *Burkholderia pseudomallei* MSHR346

118

354 *Azotobacter vinelandii*
243265 *Photobacterium luminescens* subsp. *laumondii* TT01
270374 *Marinobacter* sp. ELB17
314277 *Marinomonas* sp. MED121
314288 *Vibrio alginolyticus* 12G01
316273 *Xanthomonas campestris* pv. *vesicatoria* str. 85-10
334803 *Burkholderia mallei* JHU
392500 *Shewanella woodyi* ATCC 51908
688245 *Comamonas testosteroni* CNB-2
870187 *Thiothrix nivea* DSM 5205

119

243365 *Chromobacterium violaceum* ATCC 12472
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
338969 *Rhodospirillum rubrum* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
400668 *Marinomonas* sp. MWYL1
561230 *Pectobacterium carotovorum* subsp. *carotovorum* PC1

120

243365 *Chromobacterium violaceum* ATCC 12472
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
338969 *Rhodospirillum rubrum* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
400668 *Marinomonas* sp. MWYL1
561231 *Pectobacterium wasabiae* WPP163

121

58051 *Moritella* sp. PE36

314277 *Marinomonas* sp. MED121
314288 *Vibrio alginolyticus* 12G01
316273 *Xanthomonas campestris* pv. *vesicatoria* str. 85-10
334803 *Burkholderia mallei* JHU
399599 *Shewanella baltica* OS195
399739 *Pseudomonas mendocina* ymp
585057 *Escherichia coli* IAI39
688245 *Comamonas testosteroni* CNB-2
870187 *Thiothrix nivea* DSM 5205

122

243365 *Chromobacterium violaceum* ATCC 12472
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
349747 *Yersinia pseudotuberculosis* IP 31758
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
395495 *Leptothrix cholodnii* SP-6
410291 *Vibrio harveyi* HY01
536230 *Burkholderia pseudomallei* MSHR346

123

159087 *Dechloromonas aromatica* RCB
232721 *Acidovorax* sp. JS42
291331 *Xanthomonas oryzae* pv. *oryzae* KACC 10331
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
410291 *Vibrio harveyi* HY01
502801 *Yersinia pseudotuberculosis* PB1/+
536230 *Burkholderia pseudomallei* MSHR346

124

243365 *Chromobacterium violaceum* ATCC 12472
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
338969 *Rhodiferax ferrireducens* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
342610 *Pseudoalteromonas atlantica* T6c
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901

410291 *Vibrio harveyi* HY01
558270 *Pectobacterium carotovorum* subsp. *carotovorum* WPP14

125

167879 *Colwellia psychrerythraea* 34H
196600 *Vibrio vulnificus* YJ016
205918 *Pseudomonas syringae* pv. *syringae* B728a
270374 *Marinobacter* sp. ELB17
334802 *Burkholderia mallei* FMH
340100 *Bordetella petrii* DSM 12804
360094 *Xanthomonas oryzae* pv. *oryzae* PX099A
365044 *Polaromonas naphthalenivorans* CJ2
392500 *Shewanella woodyi* ATCC 51908
399741 *Serratia proteamaculans* 568

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257311 *Bordetella parapertussis* 12822
314283 *Reinekea blandensis* MED297
314608 *Shewanella benthica* KT99
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
349747 *Yersinia pseudotuberculosis* IP 31758
351348 *Marinobacter aquaeolei* VT8
377629 *Teredinibacter turnerae* T7901
395495 *Leptothrix cholodnii* SP-6
410291 *Vibrio harveyi* HY01
536230 *Burkholderia pseudomallei* MSHR346

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58051 *Moritella* sp. PE36
314277 *Marinomonas* sp. MED121
314288 *Vibrio alginolyticus* 12G01
316273 *Xanthomonas campestris* pv. *vesicatoria* str. 85-10
334803 *Burkholderia mallei* JHU
362663 *Escherichia coli* 536
399599 *Shewanella baltica* OS195
521000 *Providencia rettgeri* DSM 1131
688245 *Comamonas testosteroni* CNB-2
870187 *Thiothrix nivea* DSM 5205

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257313 *Bordetella pertussis* Tohama I
314278 *Nitrococcus mobilis* Nb-231

326442 *Pseudoalteromonas haloplanktis* TAC125
357804 *Psychromonas ingrahamii* 37
360910 *Bordetella avium* 197N
412967 *Vibrio cholerae* MAK 757
417398 *Vibrio cholerae* MZO-2
535289 *Acidovorax ebreus* TPSY
557600 *Acinetobacter baumannii* AB307-0294
661367 *Legionella longbeachae* NSW150

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167879 *Colwellia psychrerythraea* 34H
196600 *Vibrio vulnificus* YJ016
205918 *Pseudomonas syringae* pv. *syringae* B728a
243160 *Burkholderia mallei* ATCC 23344
340100 *Bordetella petrii* DSM 12804
360094 *Xanthomonas oryzae* pv. *oryzae* PX099A
365044 *Polaromonas naphthalenivorans* CJ2
391735 *Verminephrobacter eiseniae* EF01-2
392500 *Shewanella woodyi* ATCC 51908
399741 *Serratia proteamaculans* 568

130

205922 *Pseudomonas fluorescens* Pf0-1
296591 *Polaromonas* sp. JS666
298386 *Photobacterium profundum* SS9
314280 *Photobacterium profundum* 3TCK
350704 *Pseudomonas aeruginosa* C3719
360118 *Burkholderia pseudomallei* 406e
399795 *Comamonas testosteroni* KF-1
419109 *Vibrio parahaemolyticus* AQ3810
444450 *Escherichia coli* O157:H7 str. EC4115
546231 *Pseudomonas syringae* pv. *tomato* T1

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160488 *Pseudomonas putida* KT2440
199310 *Escherichia coli* CFT073
296591 *Polaromonas* sp. JS666
314291 *Vibrio splendidus* 12B01
331109 *Burkholderia pseudomallei* 1655
350701 *Burkholderia dolosa* AU0158
391591 *Vibrio shilonii* AK1
399795 *Comamonas testosteroni* KF-1
428406 *Ralstonia pickettii* 12D

484021 *Klebsiella pneumoniae* subsp. *pneumoniae* NTUH-K2044

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257313 *Bordetella pertussis* Tohama I
314278 *Nitrococcus mobilis* Nb-231
326442 *Pseudoalteromonas haloplanktis* TAC125
357804 *Psychromonas ingrahamii* 37
412967 *Vibrio cholerae* MAK 757
417398 *Vibrio cholerae* MZO-2
535289 *Acidovorax ebreus* TPSY
557600 *Acinetobacter baumannii* AB307-0294
661367 *Legionella longbeachae* NSW150
716540 *Erwinia amylovora* ATCC 49946

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122586 *Neisseria meningitidis* MC58
183190 *Xylella fastidiosa* Temecula1
259536 *Psychrobacter arcticus* 273-4
312153 *Polynucleobacter necessarius* subsp. *asymbioticus* QLW-P1DMWA-1
339671 *Actinobacillus succinogenes* 130Z
374833 *Neisseria meningitidis* 053442
405440 *Xylella fastidiosa* M12
434271 *Actinobacillus pleuropneumoniae* serovar 3 str. JL03
434922 *Coxiella burnetii* Dugway 5J108-111
557723 *Haemophilus parasuis* SH0165

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257313 *Bordetella pertussis* Tohama I
314278 *Nitrococcus mobilis* Nb-231
326442 *Pseudoalteromonas haloplanktis* TAC125
349968 *Yersinia bercovieri* ATCC 43970
357804 *Psychromonas ingrahamii* 37
412967 *Vibrio cholerae* MAK 757
498217 *Edwardsiella tarda* EIB202
535289 *Acidovorax ebreus* TPSY
557600 *Acinetobacter baumannii* AB307-0294
716540 *Erwinia amylovora* ATCC 49946

135

207954 *Neptuniibacter caesariensis*
326297 *Shewanella amazonensis* SB2B
357804 *Psychromonas ingrahamii* 37

375286 *Janthinobacterium* sp. Marseille
498217 *Edwardsiella tarda* EIB202
509173 *Acinetobacter baumannii* AYE
529507 *Proteus mirabilis* HI4320
579112 *Vibrio cholerae* M66-2
637386 *Yersinia pestis* Z176003
716540 *Erwinia amylovora* ATCC 49946

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207954 *Neptuniibacter caesariensis*
326297 *Shewanella amazonensis* SB2B
349968 *Yersinia bercovieri* ATCC 43970
375286 *Janthinobacterium* sp. Marseille
498217 *Edwardsiella tarda* EIB202
509173 *Acinetobacter baumannii* AYE
529507 *Proteus mirabilis* HI4320
579112 *Vibrio cholerae* M66-2
634499 *Erwinia pyrifoliae* Ep1/96
637386 *Yersinia pestis* Z176003

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195103 *Clostridium perfringens* ATCC 13124
370438 *Pelotomaculum thermopropionicum* SI
393130 *Listeria monocytogenes* J0161
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
492476 *Clostridium thermocellum* JW20
498761 *Heliobacterium modesticaldum* Ice1
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

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314278 *Nitrococcus mobilis* Nb-231
326442 *Pseudoalteromonas haloplanktis* TAC125
349968 *Yersinia bercovieri* ATCC 43970
357804 *Psychromonas ingrahamii* 37
412967 *Vibrio cholerae* MAK 757
465817 *Erwinia tasmaniensis* Et1/99
498217 *Edwardsiella tarda* EIB202
535289 *Acidovorax ebreus* TPSY
557600 *Acinetobacter baumannii* AB307-0294
716540 *Erwinia amylovora* ATCC 49946

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122587 *Neisseria meningitidis* Z2491
228400 *Haemophilus somnus* 2336
242231 *Neisseria gonorrhoeae* FA 1090
272831 *Neisseria meningitidis* FAM18
351581 *Francisella tularensis* subsp. *holarctica* FSC200
360115 *Coxiella burnetii* RSA 331
374928 *Haemophilus influenzae* PittAA
374932 *Haemophilus influenzae* PittHH
375177 *Haemophilus influenzae* 3655
484022 *Francisella philomiragia* subsp. *philomiragia* ATCC 25017

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28187 *Acetohalobium arabaticum*
373903 *Halothermothrix orenii* H 168
386415 *Clostridium novyi* NT
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
644966 *Thermaerobacter marianensis* DSM 12885
656914 *Desulfonispota thiosulfatigenes* DSM 11270
714315 *Leptotrichia goodfellowii* DSM 19756

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
373903 *Halothermothrix orenii* H 168
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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195103 *Clostridium perfringens* ATCC 13124
267409 *Listeria monocytogenes* serotype 1/2a str. F6854
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI

411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
492476 *Clostridium thermocellum* JW20
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428126 *Clostridium spiroforme* DSM 1552
428127 *Eubacterium dolichum* DSM 3991
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

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183190 *Xylella fastidiosa* Temecula1
228400 *Haemophilus somnus* 2336
242231 *Neisseria gonorrhoeae* FA 1090
272843 *Pasteurella multocida* subsp. *multocida* str. Pm70
312153 *Polynucleobacter necessarius* subsp. *asymbioticus* QLW-P1DMWA-1
351581 *Francisella tularensis* subsp. *holarctica* FSC200
374933 *Haemophilus influenzae* PittII
434271 *Actinobacillus pleuropneumoniae* serovar 3 str. JL03
434922 *Coxiella burnetii* Dugway 5J108-111
557723 *Haemophilus parasuis* SH0165

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169963 *Listeria monocytogenes* EGD-e
195103 *Clostridium perfringens* ATCC 13124
265669 *Listeria monocytogenes* serotype 4b str. F2365
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
491915 *Anoxybacillus flavithermus* WK1
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

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195103 *Clostridium perfringens* ATCC 13124
262543 *Exiguobacterium sibiricum* 255-15
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

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262543 *Exiguobacterium sibiricum* 255-15
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

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28187 *Acetohalobium arabaticum*
209882 *Fusobacterium nucleatum* subsp. *vincentii* ATCC 49256
373903 *Halothermothrix orenii* H 168
386415 *Clostridium novyi* NT
393121 *Listeria monocytogenes* FSL J2-071

428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
500633 *Clostridium hiranonis* DSM 13275
580331 *Thermoanaerobacter italicus* Ab9
714315 *Leptotrichia goodfellowii* DSM 19756

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264732 *Moorella thermoacetica* ATCC 39073
273068 *Thermoanaerobacter tengcongensis* MB4
289380 *Clostridium perfringens* SM101
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
393128 *Listeria monocytogenes* F6900
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300
428126 *Clostridium spiroforme* DSM 1552
445337 *Clostridium botulinum* C str. Eklund
445975 *Collinsella stercoris* DSM 13279
748449 *Halobacteroides halobius* DSM 5150

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
333990 *Carnobacterium* sp. AT7
373903 *Haloferoxylum orenii* H 168
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300
399726 *Thermoanaerobacter* sp. X514
428127 *Eubacterium dolichum* DSM 3991
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonitrospira thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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262543 *Exiguobacterium sibiricum* 255-15
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

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195103 *Clostridium perfringens* ATCC 13124
265669 *Listeria monocytogenes* serotype 4b str. F2365
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI
393126 *Listeria monocytogenes* FSL R2-561
393130 *Listeria monocytogenes* J0161
411489 *Clostridium* sp. L2-50
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
491915 *Anoxybacillus flavithermus* WK1
572544 *Ilyobacter polytropus* DSM 2926

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262543 *Exiguobacterium sibiricum* 255-15
267410 *Listeria monocytogenes* serotype 4b str. H7858
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
479437 *Eggerthella lenta* DSM 2243
492476 *Clostridium thermocellum* JW20
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
697281 *Mahella australiensis* 50-1 BON

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345219 *Bacillus coagulans* 36D1
351627 *Caldicellulosiruptor saccharolyticus* DSM 8903
393116 *Listeria monocytogenes* FSL F2-515
401526 *Thermosinus carboxydivorans* Nor1
428128 *Eubacterium siraeum* DSM 15702
445973 *Clostridium bartlettii* DSM 16795
451757 *Clostridium perfringens* NCTC 8239
471855 *Slackia heliotrinireducens* DSM 20476
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
333990 *Carnobacterium* sp. AT7
393132 *Listeria monocytogenes* L028
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300

428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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28187 *Acetohalobium arabaticum*
373903 *Halothermothrix orenii* H 168
386415 *Clostridium novyi* NT
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
445971 *Anaerofustis stercorihominis* DSM 17244
584708 *Aminomonas paucivorans* DSM 12260
644966 *Thermaerobacter marianensis* DSM 12885
656914 *Desulfonispota thiosulfatigenes* DSM 11270
714315 *Leptotrichia goodfellowii* DSM 19756

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203119 *Clostridium thermocellum* ATCC 27405
267410 *Listeria monocytogenes* serotype 4b str. H7858
411484 *Clostridium* sp. SS2/1
445334 *Clostridium perfringens* C str. JGS1495
445974 *Clostridium ramosum* DSM 1402
471223 *Geobacillus* sp. WCH70
479437 *Eggerthella lenta* DSM 2243
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
537007 *Blautia hansenii* DSM 20583
562970 *Kyrpidia tusciae* DSM 2912

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246194 *Carboxydotherrmus hydrogenoformans* Z-2901
273068 *Thermoanaerobacter tengcongensis* MB4
279808 *Staphylococcus haemolyticus* JCSC1435
289380 *Clostridium perfringens* SM101
345219 *Bacillus coagulans* 36D1
393128 *Listeria monocytogenes* F6900
445337 *Clostridium botulinum* C str. Eklund
451516 *Staphylococcus aureus* subsp. *aureus* USA300_TCH1516
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
273036 *Staphylococcus aureus* RF122
333990 *Carnobacterium* sp. AT7
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
393132 *Listeria monocytogenes* L028
428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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262543 *Exiguobacterium sibiricum* 255-15
267409 *Listeria monocytogenes* serotype 1/2a str. F6854
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
479437 *Eggerthella lenta* DSM 2243
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

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28187 *Acetohalobium arabaticum*
212717 *Clostridium tetani* E88
373903 *Halothermothrix orenii* H 168
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428127 *Eubacterium dolichum* DSM 3991
546271 *Selenomonas sputigena* ATCC 35185

584708 *Aminomonas paucivorans* DSM 12260
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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246194 *Carboxydotherrmus hydrogenoformans* Z-2901
273068 *Thermoanaerobacter tengcongensis* MB4
279808 *Staphylococcus haemolyticus* JCSC1435
289380 *Clostridium perfringens* SM101
345219 *Bacillus coagulans* 36D1
393127 *Listeria monocytogenes* Finland 1998
428128 *Eubacterium siraeum* DSM 15702
451516 *Staphylococcus aureus* subsp. *aureus* USA300_TCH1516
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725

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212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
273036 *Staphylococcus aureus* RF122
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
428126 *Clostridium spiroforme* DSM 1552
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
748449 *Halobacteroides halobius* DSM 5150
867903 *Thermaerobacter subterraneus* DSM 13965

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156578 *Alteromonadales bacterium* TW-7
156889 *Magnetococcus marinus* MC-1
312309 *Vibrio fischeri* ES114
318161 *Shewanella denitrificans* OS217
323850 *Shewanella loihica* PV-4
472759 *Nitrosococcus halophilus* Nc4
498211 *Cellvibrio japonicus* Ueda107
509173 *Acinetobacter baumannii* AYE
550540 *Ferrimonas balearica* DSM 9799
634503 *Edwardsiella ictaluri* 93-146

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176279 *Staphylococcus epidermidis* RP62A

264732 *Moorella thermoacetica* ATCC 39073
273036 *Staphylococcus aureus* RF122
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
393117 *Listeria monocytogenes* FSL J1-194
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300
546271 *Selenomonas sputigena* ATCC 35185
698737 *Staphylococcus lugdunensis* HKU09-01
867903 *Thermaerobacter subterraneus* DSM 13965

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212717 *Clostridium tetani* E88
273036 *Staphylococcus aureus* RF122
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
428126 *Clostridium spiroforme* DSM 1552
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
656914 *Desulfonispota thiosulfatigenes* DSM 11270
748449 *Halobacteroides halobius* DSM 5150
867903 *Thermaerobacter subterraneus* DSM 13965

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279808 *Staphylococcus haemolyticus* JCSC1435
333849 *Enterococcus faecium* D0
345219 *Bacillus coagulans* 36D1
386043 *Listeria welshimeri* serovar 6b str. SLCC5334
393116 *Listeria monocytogenes* FSL F2-515
393119 *Listeria monocytogenes* FSL J1-208
401526 *Thermosinus carboxydivorans* Nor1
451516 *Staphylococcus aureus* subsp. *aureus* USA300_TCH1516
500635 *Mitsuokella multacida* DSM 20544
683837 *Listeria seeligeri* serovar 1/2b str. SLCC3954

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212717 *Clostridium tetani* E88
373903 *Halothermothrix orenii* H 168
393132 *Listeria monocytogenes* L028
399726 *Thermoanaerobacter* sp. X514
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260

656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

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195103 *Clostridium perfringens* ATCC 13124
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI
393126 *Listeria monocytogenes* FSL R2-561
411489 *Clostridium* sp. L2-50
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
491915 *Anoxybacillus flavithermus* WK1
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

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195103 *Clostridium perfringens* ATCC 13124
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

173

160492 *Xylella fastidiosa* 9a5c
187272 *Alkalilimnicola ehrlichii* MLHE-1
243233 *Methylococcus capsulatus* str. Bath
272624 *Legionella pneumophila* subsp. *pneumophila* str. Philadelphia 1
297245 *Legionella pneumophila* str. Lens
314345 *Mariprofundus ferrooxydans* PV-1
396595 *Thioalkalivibrio* sp. K90mix
509170 *Acinetobacter baumannii* SDF
582744 *Methylovorus glucosetrophus* SIP3-4
716541 *Enterobacter cloacae* subsp. *cloacae* ATCC 13047

174

176279 *Staphylococcus epidermidis* RP62A
264732 *Moorella thermoacetica* ATCC 39073

273036 *Staphylococcus aureus* RF122
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
393128 *Listeria monocytogenes* F6900
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300
546271 *Selenomonas sputigena* ATCC 35185
698737 *Staphylococcus lugdunensis* HKU09-01
748449 *Halobacteroides halobius* DSM 5150

175

240015 *Acidobacterium capsulatum* ATCC 51196
243231 *Geobacter sulfurreducens* PCA
292459 *Symbiobacterium thermophilum* IAM 14863
338963 *Pelobacter carbinolicus* DSM 2380
394503 *Clostridium cellulolyticum* H10
441771 *Clostridium botulinum* A str. Hall
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
577650 *Desulfobulbus propionicus* DSM 2032
645462 *Clostridium difficile* CD196

176

195103 *Clostridium perfringens* ATCC 13124
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI
393130 *Listeria monocytogenes* J0161
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
572544 *Ilyobacter polytropus* DSM 2926
697281 *Mahella australiensis* 50-1 BON

177

195103 *Clostridium perfringens* ATCC 13124
265669 *Listeria monocytogenes* serotype 4b str. F2365
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
370438 *Pelotomaculum thermopropionicum* SI
393126 *Listeria monocytogenes* FSL R2-561
411489 *Clostridium* sp. L2-50
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
491915 *Anoxybacillus flavithermus* WK1

572544 *Ilyobacter polytropus* DSM 2926

178

195102 *Clostridium perfringens* str. 13
246194 *Carboxydotherrmus hydrogenoformans* Z-2901
279808 *Staphylococcus haemolyticus* JCSC1435
333849 *Enterococcus faecium* D0
345219 *Bacillus coagulans* 36D1
393127 *Listeria monocytogenes* Finland 1998
418127 *Staphylococcus aureus* subsp. *aureus* Mu3
428128 *Eubacterium siraeum* DSM 15702
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725

179

28187 *Acetohalobium arabaticum*
197221 *Thermosynechococcus elongatus* BP-1
212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
393132 *Listeria monocytogenes* L028
428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
656914 *Desulfonispota thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

180

883 *Desulfovibrio vulgaris* str. 'Miyazaki F'
56780 *Syntrophus aciditrophicus* SB
96561 *Desulfococcus oleovorans* Hxd3
177439 *Desulfotalea psychrophila* LSv54
204773 *Herminiimonas arsenicoxydans*
281689 *Desulfuromonas acetoxidans* DSM 684
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
557598 *Laribacter hongkongensis* HLHK9
568815 *Brucella microti* CCM 4915
572477 *Allochromatium vinosum* DSM 180

181

160492 *Xylella fastidiosa* 9a5c
187272 *Alkalilimnicola ehrlichii* MLHE-1
265072 *Methylobacillus flagellatus* KT

292415 *Thiobacillus denitrificans* ATCC 25259
314345 *Mariprofundus ferrooxydans* PV-1
323848 *Nitrosospira multiformis* ATCC 25196
380394 *Acidithiobacillus ferrooxidans* ATCC 53993
393595 *Alcanivorax borkumensis* SK2
396595 *Thioalkalivibrio* sp. K90mix
444178 *Brucella ovis* ATCC 25840

182

160492 *Xylella fastidiosa* 9a5c
187272 *Alkalilimnicola ehrlichii* MLHE-1
243233 *Methylococcus capsulatus* str. Bath
292415 *Thiobacillus denitrificans* ATCC 25259
297245 *Legionella pneumophila* str. Lens
314345 *Mariprofundus ferrooxydans* PV-1
380394 *Acidithiobacillus ferrooxidans* ATCC 53993
396595 *Thioalkalivibrio* sp. K90mix
444178 *Brucella ovis* ATCC 25840
582744 *Methylovorus glucosetrophus* SIP3-4

183

411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
479437 *Eggerthella lenta* DSM 2243
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON
866499 *Cloacibacillus evryensis* DSM 19522

184

882 *Desulfovibrio vulgaris* str. Hildenborough
240015 *Acidobacterium capsulatum* ATCC 51196
292459 *Symbiobacterium thermophilum* IAM 14863
338963 *Pelobacter carbinolicus* DSM 2380
394503 *Clostridium cellulolyticum* H10
441771 *Clostridium botulinum* A str. Hall
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
577650 *Desulfobulbus propionicus* DSM 2032
645462 *Clostridium difficile* CD196

185

882 *Desulfovibrio vulgaris* str. Hildenborough
240015 *Acidobacterium capsulatum* ATCC 51196
292459 *Symbiobacterium thermophilum* IAM 14863
338963 *Pelobacter carbinolicus* DSM 2380
394503 *Clostridium cellulolyticum* H10
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
441771 *Clostridium botulinum* A str. Hall
544556 *Geobacillus* sp. Y412MC61
577650 *Desulfobulbus propionicus* DSM 2032
645991 *Syntrophobotulus glycolicus* DSM 8271

186

882 *Desulfovibrio vulgaris* str. Hildenborough
240015 *Acidobacterium capsulatum* ATCC 51196
292459 *Symbiobacterium thermophilum* IAM 14863
338963 *Pelobacter carbinolicus* DSM 2380
394503 *Clostridium cellulolyticum* H10
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
441771 *Clostridium botulinum* A str. Hall
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
577650 *Desulfobulbus propionicus* DSM 2032

187

355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

188

32049 *Synechococcus* sp. PCC 7002
203119 *Clostridium thermocellum* ATCC 27405
267410 *Listeria monocytogenes* serotype 4b str. H7858
411484 *Clostridium* sp. SS2/1

445334 *Clostridium perfringens* C str. JGS1495
445974 *Clostridium ramosum* DSM 1402
479437 *Eggerthella lenta* DSM 2243
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
562970 *Kyrpidia tusciae* DSM 2912
866499 *Cloacibacillus evryensis* DSM 19522

189

32049 *Synechococcus* sp. PCC 7002
203119 *Clostridium thermocellum* ATCC 27405
267410 *Listeria monocytogenes* serotype 4b str. H7858
411484 *Clostridium* sp. SS2/1
445334 *Clostridium perfringens* C str. JGS1495
445974 *Clostridium ramosum* DSM 1402
471223 *Geobacillus* sp. WCH70
483218 [*Bacteroides*] *pectinophilus* ATCC 43243
562970 *Kyrpidia tusciae* DSM 2912
653938 *Listeria monocytogenes* 08-5578

190

321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

191

355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

192

355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
451756 *Clostridium perfringens* CPE str. F4969
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
697281 *Mahella australiensis* 50-1 BON

193

882 *Desulfovibrio vulgaris* str. Hildenborough
96561 *Desulfococcus oleovorans* Hxd3
240015 *Acidobacterium capsulatum* ATCC 51196
292459 *Symbiobacterium thermophilum* IAM 14863
394503 *Clostridium cellulolyticum* H10
396588 *Thioalkalivibrio sulfidophilus* HL-EbGr7
439292 *Bacillus selenitireducens* MLS10
508767 *Clostridium botulinum* E3 str. Alaska E43
577650 *Desulfobulbus propionicus* DSM 2032
645991 *Syntrophobotulus glycolicus* DSM 8271

194

212717 *Clostridium tetani* E88
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
428126 *Clostridium spiroforme* DSM 1552
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
748449 *Halobacteroides halobius* DSM 5150
867903 *Thermaerobacter subterraneus* DSM 13965

195

197221 *Thermosynechococcus elongatus* BP-1
212717 *Clostridium tetani* E88
264732 *Moorella thermoacetica* ATCC 39073
333990 *Carnobacterium* sp. AT7
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300

428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
656914 *Desulfonispora thiosulfatigenes* DSM 11270
867903 *Thermaerobacter subterraneus* DSM 13965

196

246194 *Carboxydotherrmus hydrogenoformans* Z-2901
273068 *Thermoanaerobacter tengcongensis* MB4
282459 *Staphylococcus aureus* subsp. *aureus* MSSA476
316278 *Synechococcus* sp. RCC307
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
393128 *Listeria monocytogenes* F6900
445337 *Clostridium botulinum* C str. Eklund
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
748449 *Halobacteroides halobius* DSM 5150

197

243233 *Methylococcus capsulatus* str. Bath
314345 *Mariprofundus ferrooxydans* PV-1
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
370438 *Pelotomaculum thermopropionicum* SI
411489 *Clostridium* sp. L2-50
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
522772 *Denitrovibrio acetiphilus* DSM 12809
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923

198

96561 *Desulfococcus oleovorans* Hxd3
177439 *Desulfotalea psychrophila* LSv54
204773 *Herminiimonas arsenicoxydans*
207559 *Desulfovibrio alaskensis* G20
281689 *Desulfuromonas acetoxidans* DSM 684
290398 *Chromohalobacter salexigens* DSM 3043
317655 *Sphingopyxis alaskensis* RB2256
483179 *Brucella canis* ATCC 23365
557598 *Laribacter hongkongensis* HLHK9
572477 *Allochromatium vinosum* DSM 180

199

1140 *Synechococcus elongatus* PCC 7942
195102 *Clostridium perfringens* str. 13
321327 *Synechococcus* sp. JA-3-3Ab
345219 *Bacillus coagulans* 36D1
393131 *Listeria monocytogenes* J2818
428128 *Eubacterium siraeum* DSM 15702
471855 *Slackia heliotrinireducens* DSM 20476
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725
565034 *Brachyspira hyodysenteriae* WA1

200

1140 *Synechococcus elongatus* PCC 7942
195102 *Clostridium perfringens* str. 13
321327 *Synechococcus* sp. JA-3-3Ab
345219 *Bacillus coagulans* 36D1
393119 *Listeria monocytogenes* FSL J1-208
428128 *Eubacterium siraeum* DSM 15702
471855 *Slackia heliotrinireducens* DSM 20476
500635 *Mitsuokella multacida* DSM 20544
521460 *Caldicellulosiruptor bescii* DSM 6725
565034 *Brachyspira hyodysenteriae* WA1

201

292415 *Thiobacillus denitrificans* ATCC 25259
314345 *Mariprofundus ferrooxydans* PV-1
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
370438 *Pelotomaculum thermopropionicum* SI
393133 *Listeria monocytogenes* 10403S
444178 *Brucella ovis* ATCC 25840
457570 *Natronaerobius thermophilus* JW/NM-WN-LF
572544 *Ilyobacter polytropus* DSM 2926

202

32049 *Synechococcus* sp. PCC 7002
56780 *Syntrophus aciditrophicus* SB
177439 *Desulfotalea psychrophila* LSv54
281689 *Desulfuromonas acetoxidans* DSM 684
391774 *Desulfovibrio vulgaris* DP4
411484 *Clostridium* sp. SS2/1

445974 *Clostridium ramosum* DSM 1402
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578

203

197221 *Thermosynechococcus elongatus* BP-1
212717 *Clostridium tetani* E88
273036 *Staphylococcus aureus* RF122
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
748449 *Halobacteroides halobius* DSM 5150
867903 *Thermaerobacter subterraneus* DSM 13965

204

243233 *Methylococcus capsulatus* str. Bath
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
522772 *Denitrovibrio acetiphilus* DSM 12809
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
880072 *Desulfobacca acetoxidans* DSM 11109

205

355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
582744 *Methylovorus glucosetrophus* SIP3-4
637381 *Listeria monocytogenes* 08-5923
880072 *Desulfobacca acetoxidans* DSM 11109

206

197221 *Thermosynechococcus elongatus* BP-1
273068 *Thermoanaerobacter tengcongensis* MB4
316278 *Synechococcus* sp. RCC307
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
428126 *Clostridium spiroforme* DSM 1552
445337 *Clostridium botulinum* C str. Eklund
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
748449 *Halobacteroides halobius* DSM 5150

207

243233 *Methylococcus capsulatus* str. Bath
314345 *Mariprofundus ferrooxydans* PV-1
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
457570 *Natranaerobius thermophilus* JW/NM-WN-LF
522772 *Denitrovibrio acetiphilus* DSM 12809
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923

208

176280 *Staphylococcus epidermidis* ATCC 12228
212717 *Clostridium tetani* E88
316278 *Synechococcus* sp. RCC307
335541 *Syntrophomonas wolfei* subsp. *wolfei* str. Goettingen
445975 *Collinsella stercoris* DSM 13279
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
748449 *Halobacteroides halobius* DSM 5150
867903 *Thermaerobacter subterraneus* DSM 13965

209

321332 *Synechococcus* sp. JA-2-3B'a(2-13)
350688 *Alkaliphilus oremlandii* OhILAs
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
359787 *Staphylococcus aureus* subsp. *aureus* JH1
393130 *Listeria monocytogenes* J0161
401526 *Thermosinus carboxydivorans* Nor1
445973 *Clostridium bartlettii* DSM 16795

451757 *Clostridium perfringens* NCTC 8239
471855 *Slackia heliotrinireducens* DSM 20476
515620 *Eubacterium eligens* ATCC 27750

210

32049 *Synechococcus* sp. PCC 7002
56780 *Syntrophus aciditrophicus* SB
391774 *Desulfovibrio vulgaris* DP4
411484 *Clostridium* sp. SS2/1
445334 *Clostridium perfringens* C str. JGS1495
445974 *Clostridium ramosum* DSM 1402
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

211

187272 *Alkalilimnicola ehrlichii* MLHE-1
292415 *Thiobacillus denitrificans* ATCC 25259
314345 *Mariprofundus ferrooxydans* PV-1
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar *Hardjo-bovis* str. JB197
380394 *Acidithiobacillus ferrooxidans* ATCC 53993
393116 *Listeria monocytogenes* FSL F2-515
401526 *Thermosinus carboxydivorans* Nor1
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476

212

373903 *Halothermothrix orenii* H 168
391165 *Granulibacter bethesdensis* CGDNIH1
393132 *Listeria monocytogenes* L028
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
555778 *Halothiobacillus neapolitanus* c2
584708 *Aminomonas paucivorans* DSM 12260
639282 *Deferribacter desulfuricans* SSM1
867903 *Thermaerobacter subterraneus* DSM 13965

213

96561 *Desulfococcus oleovorans* Hxd3

177439 *Desulfotalea psychrophila* Lsv54
204722 *Brucella suis* 1330
204773 *Herminiimonas arsenicoxydans*
207559 *Desulfovibrio alaskensis* G20
240015 *Acidobacterium capsulatum* ATCC 51196
292459 *Symbiobacterium thermophilum* IAM 14863
439292 *Bacillus selenitireducens* MLS10
483218 [*Bacteroides*] *pectinophilus* ATCC 43243
645991 *Syntrophobotulus glycolicus* DSM 8271

214

1148 *Synechocystis* sp. PCC 6803
221109 *Oceanobacillus iheyensis* HTE831
235909 *Geobacillus kaustophilus* HTA426
267671 *Leptospira interrogans* serovar Copenhageni str. Fiocruz L1-130
269799 *Geobacter metallireducens* GS-15
272568 *Gluconacetobacter diazotrophicus* PA1 5
314278 *Nitrococcus mobilis* Nb-231
402881 *Parvibaculum lavamentivorans* DS-1
583346 *Clostridium kluveri* NBRC 12016
645463 *Clostridium difficile* R20291

215

29447 *Xanthomonas albilineans*
224914 *Brucella melitensis* bv. 1 str. 16M
314232 *Loktanella vestfoldensis* SKA53
317655 *Sphingopyxis alaskensis* RB2256
323098 *Nitrobacter winogradskyi* Nb-255
394221 *Maricaulis maris* MCS10
400673 *Legionella pneumophila* str. Corby
572477 *Allochromatium vinosum* DSM 180
582402 *Hirschia baltica* ATCC 49814
595494 *Tolomonas auensis* DSM 9187

216

333990 *Carnobacterium* sp. AT7
373903 *Halothermothrix orenii* H 168
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
555778 *Halothiobacillus neapolitanus* c2
583345 *Methylotenera mobilis* JLW8
639282 *Deferribacter desulfuricans* SSM1

667014 *Thermodesulfatator indicus* DSM 15286
714315 *Leptotrichia goodfellowii* DSM 19756

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323261 *Nitrosococcus oceani* ATCC 19707
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
411474 *Coprococcus eutactus* ATCC 27759
444178 *Brucella ovis* ATCC 25840
451640 *Catenibacterium mitsuokai* DSM 15897
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
880072 *Desulfobacca acetoxidans* DSM 11109

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246194 *Carboxydotherrmus hydrogenoformans* Z-2901
273068 *Thermoanaerobacter tengcongensis* MB4
282458 *Staphylococcus aureus* subsp. *aureus* MRSA252
290633 *Gluconobacter oxydans* 621H
314276 *Idiomarina baltica* OS145
445337 *Clostridium botulinum* C str. Eklund
500635 *Mitsuokella multacida* DSM 20544
521006 *Neisseria gonorrhoeae* NCCP11945
521460 *Caldicellulosiruptor bescii* DSM 6725
565034 *Brachyspira hyodysenteriae* WA1

219

32049 *Synechococcus* sp. PCC 7002
56780 *Syntrophus aciditrophicus* SB
177439 *Desulfotalea psychrophila* LSv54
224914 *Brucella melitensis* bv. 1 str. 16M
281689 *Desulfuromonas acetoxidans* DSM 684
411464 *Desulfovibrio piger* ATCC 29098
445974 *Clostridium ramosum* DSM 1402
483218 [*Bacteroides*] *pectinophilus* ATCC 43243
557598 *Laribacter hongkongensis* HLHK9
653938 *Listeria monocytogenes* 08-5578

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323261 *Nitrosococcus oceani* ATCC 19707
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550

411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923
866499 *Cloacibacillus evryensis* DSM 19522
880072 *Desulfobacca acetoxidans* DSM 11109

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391165 *Granulibacter bethesdensis* CGDNIH1
393132 *Listeria monocytogenes* L028
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
546271 *Selenomonas sputigena* ATCC 35185
583345 *Methylotenera mobilis* JLW8
584708 *Aminomonas paucivorans* DSM 12260
639282 *Deferribacter desulfuricans* SSM1
867903 *Thermaerobacter subterraneus* DSM 13965

222

197221 *Thermosynechococcus elongatus* BP-1
212717 *Clostridium tetani* E88
333990 *Carnobacterium* sp. AT7
349124 *Halorhodospira halophila* SL1
391165 *Granulibacter bethesdensis* CGDNIH1
428126 *Clostridium spiroforme* DSM 1552
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
717231 *Flexistipes sinusarabici* DSM 4947
867903 *Thermaerobacter subterraneus* DSM 13965

223

189518 *Leptospira interrogans* serovar *Lai* str. 56601
207954 *Neptuniibacter caesariensis*
315750 *Bacillus pumilus* SAFR-032
375286 *Janthinobacterium* sp. Marseille
392423 *Hydrogenivirga* sp. 128-5-R1-1
395965 *Methylocella silvestris* BL2
398767 *Geobacter lovleyi* SZ
411490 *Anaerostipes caccae* DSM 14662
447214 *Clostridium butyricum* 5521

526222 *Desulfovibrio salexigens* DSM 2638

224

883 *Desulfovibrio vulgaris* str. 'Miyazaki F'
32049 *Synechococcus* sp. PCC 7002
96561 *Desulfococcus oleovorans* Hxd3
177439 *Desulfotalea psychrophila* Lsv54
445974 *Clostridium ramosum* DSM 1402
470137 *Brucella suis* ATCC 23445
471223 *Geobacillus* sp. WCH70
483218 [*Bacteroides*] *pectinophilus* ATCC 43243
557598 *Laribacter hongkongensis* HLHK9
645991 *Syntrophobotulus glycolicus* DSM 8271

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323261 *Nitrosococcus oceani* ATCC 19707
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
391774 *Desulfovibrio vulgaris* DP4
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

226

243233 *Methylococcus capsulatus* str. Bath
359391 *Brucella melitensis* biovar Abortus 2308
391774 *Desulfovibrio vulgaris* DP4
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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323261 *Nitrosococcus oceani* ATCC 19707
359391 *Brucella melitensis* biovar Abortus 2308
391774 *Desulfovibrio vulgaris* DP4

411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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323261 *Nitrosococcus oceani* ATCC 19707
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
359391 *Brucella melitensis* biovar Abortus 2308
411462 *Dorea longicatena* DSM 13814
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
637381 *Listeria monocytogenes* 08-5923
866499 *Cloacibacillus evryensis* DSM 19522
880072 *Desulfobacca acetoxidans* DSM 11109

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323261 *Nitrosococcus oceani* ATCC 19707
359391 *Brucella melitensis* biovar Abortus 2308
411464 *Desulfovibrio piger* ATCC 29098
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
498761 *Heliobacterium modesticaldum* Ice1
543302 *Alicyclobacillus acidocaldarius* LAA1
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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197221 *Thermosynechococcus elongatus* BP-1
212717 *Clostridium tetani* E88
349124 *Halorhodospira halophila* SL1
391165 *Granulibacter bethesdensis* CGDNIH1
396513 *Staphylococcus carnosus* subsp. *carnosus* TM300
428126 *Clostridium spiroforme* DSM 1552
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
717231 *Flexistipes sinusarabici* DSM 4947

231

323261 *Nitrosococcus oceani* ATCC 19707
359391 *Brucella melitensis* biovar Abortus 2308
411464 *Desulfovibrio piger* ATCC 29098
411474 *Coprococcus eutactus* ATCC 27759
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
543302 *Alicyclobacillus acidocaldarius* LAA1
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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32049 *Synechococcus* sp. PCC 7002
411464 *Desulfovibrio piger* ATCC 29098
411484 *Clostridium* sp. SS2/1
445974 *Clostridium ramosum* DSM 1402
479437 *Eggerthella lenta* DSM 2243
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
546272 *Brucella melitensis* ATCC 23457
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

233

1140 *Synechococcus elongatus* PCC 7942
292415 *Thiobacillus denitrificans* ATCC 25259
309807 *Salinibacter ruber* DSM 13855
314345 *Mariprofundus ferrooxydans* PV-1
393119 *Listeria monocytogenes* FSL J1-208
401526 *Thermosinus carboxydivorans* Nor1
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476
525904 *Thermobaculum terrenum* ATCC BAA-798
693977 *Deinococcus proteolyticus* MRP

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29447 *Xanthomonas albilineans*
262543 *Exiguobacterium sibiricum* 255-15
323261 *Nitrosococcus oceani* ATCC 19707
411464 *Desulfovibrio piger* ATCC 29098

451756 *Clostridium perfringens* CPE str. F4969
479437 *Eggerthella lenta* DSM 2243
543302 *Alicyclobacillus acidocaldarius* LAA1
546272 *Brucella melitensis* ATCC 23457
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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1148 *Synechocystis* sp. PCC 6803
189518 *Leptospira interrogans* serovar Lai str. 56601
207954 *Neptuniibacter caesariensis*
272568 *Gluconacetobacter diazotrophicus* PA1 5
314231 *Fulvimarina pelagi* HTCC2506
375286 *Janthinobacterium* sp. Marseille
398767 *Geobacter lovleyi* SZ
413999 *Clostridium botulinum* A str. ATCC 3502
495036 *Geobacillus* sp. G11MC16
515619 *Eubacterium rectale* ATCC 33656

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29447 *Xanthomonas albilineans*
32049 *Synechococcus* sp. PCC 7002
411464 *Desulfovibrio piger* ATCC 29098
411484 *Clostridium* sp. SS2/1
445974 *Clostridium ramosum* DSM 1402
479437 *Eggerthella lenta* DSM 2243
521098 *Alicyclobacillus acidocaldarius* subsp. *acidocaldarius* DSM 446
546272 *Brucella melitensis* ATCC 23457
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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68909 *Deinococcus geothermalis*
243233 *Methylococcus capsulatus* str. Bath
309807 *Salinibacter ruber* DSM 13855
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
411489 *Clostridium* sp. L2-50
522772 *Denitrovibrio acetiphilus* DSM 12809
525904 *Thermobaculum terrenum* ATCC BAA-798
572544 *Ilyobacter polytropus* DSM 2926
637381 *Listeria monocytogenes* 08-5923

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309807 *Salinibacter ruber* DSM 13855
314345 *Mariprofundus ferrooxydans* PV-1
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
380394 *Acidithiobacillus ferrooxidans* ATCC 53993
393133 *Listeria monocytogenes* 10403S
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476
525904 *Thermobaculum terrenum* ATCC BAA-798
693977 *Deinococcus proteolyticus* MRP

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883 *Desulfovibrio vulgaris* str. 'Miyazaki F'
32049 *Synechococcus* sp. PCC 7002
96561 *Desulfococcus oleovorans* Hxd3
177439 *Desulfotalea psychrophila* LSv54
204773 *Herminiimonas arsenicoxydans*
207949 *Bermanella marisrubri*
226185 *Enterococcus faecalis* V583
483218 [*Bacteroides*] *pectinophilus* ATCC 43243
568815 *Brucella microti* CCM 4915
645991 *Syntrophobotulus glycolicus* DSM 8271

240

314276 *Idiomarina baltica* OS145
316278 *Synechococcus* sp. RCC307
335283 *Nitrosomonas eutropha* C91
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
445337 *Clostridium botulinum* C str. Eklund
445975 *Collinsella stercoris* DSM 13279
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
565034 *Brachyspira hyodysenteriae* WA1
748449 *Halobacteroides halobius* DSM 5150

241

68909 *Deinococcus geothermalis*
243233 *Methylococcus capsulatus* str. Bath
309807 *Salinibacter ruber* DSM 13855
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197

411489 *Clostridium* sp. L2-50
451640 *Catenibacterium mitsuokai* DSM 15897
522772 *Denitrovibrio acetiphilus* DSM 12809
525904 *Thermobaculum terrenum* ATCC BAA-798
637381 *Listeria monocytogenes* 08-5923

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292415 *Thiobacillus denitrificans* ATCC 25259
321332 *Synechococcus* sp. JA-2-3B'a(2-13)
355277 *Leptospira borgpetersenii* serovar Hardjo-bovis str. JB197
393116 *Listeria monocytogenes* FSL F2-515
393595 *Alcanivorax borkumensis* SK2
444178 *Brucella ovis* ATCC 25840
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476
515620 *Eubacterium eligens* ATCC 27750
709032 *Sulfuricurvum kujiense* DSM 16994

243

290400 *Jannaschia* sp. CCS1
314283 *Reinekea blandensis* MED297
316057 *Rhodopseudomonas palustris* BisB5
338969 *Rhodoferax ferrireducens* T118
342109 *Xanthomonas oryzae* pv. *oryzae* MAFF 311018
351605 *Geobacter uraniireducens* Rf4
377629 *Teredinibacter turnerae* T7901
398579 *Shewanella pealeana* ATCC 700345
411684 *Hoeflea phototrophica* DFL-43
452662 *Sphingobium japonicum* UT26S

244

1140 *Synechococcus elongatus* PCC 7942
290633 *Gluconobacter oxydans* 621H
314260 *Parvularcula bermudensis* HTCC2503
314276 *Idiomarina baltica* OS145
428128 *Eubacterium siraeum* DSM 15702
451516 *Staphylococcus aureus* subsp. *aureus* USA300_TCH1516
500635 *Mitsuokella multacida* DSM 20544
521006 *Neisseria gonorrhoeae* NCCP11945
521460 *Caldicellulosiruptor bescii* DSM 6725
565034 *Brachyspira hydysenteriae* WA1

245

32049 *Synechococcus* sp. PCC 7002
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
266117 *Rubrobacter xylanophilus* DSM 9941
391774 *Desulfovibrio vulgaris* DP4
411484 *Clostridium* sp. SS2/1
443906 *Clavibacter michiganensis* subsp. *michiganensis* NCPPB 382
445974 *Clostridium ramosum* DSM 1402
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578

246

882 *Desulfovibrio vulgaris* str. Hildenborough
240015 *Acidobacterium capsulatum* ATCC 51196
313603 *Maribacter* sp. HTCC2170
314278 *Nitrococcus mobilis* Nb-231
446471 *Xylanimonas cellulositica* DSM 15894
479434 *Sphaerobacter thermophilus* DSM 20745
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
577650 *Desulfobulbus propionicus* DSM 2032
583346 *Clostridium kluveri* NBRC 12016

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31964 *Clavibacter michiganensis* subsp. *sepedonicus*
32049 *Synechococcus* sp. PCC 7002
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
266117 *Rubrobacter xylanophilus* DSM 9941
391774 *Desulfovibrio vulgaris* DP4
411484 *Clostridium* sp. SS2/1
445974 *Clostridium ramosum* DSM 1402
557598 *Laribacter hongkongensis* HLHK9
653938 *Listeria monocytogenes* 08-5578

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1140 *Synechococcus elongatus* PCC 7942
323848 *Nitrosospora multififormis* ATCC 25196
324925 *Pelodictyon phaeoclathratiforme* BU-1
380394 *Acidithiobacillus ferrooxidans* ATCC 53993
393116 *Listeria monocytogenes* FSL F2-515
401526 *Thermosinus carboxydivorans* Nor1

428128 *Eubacterium siraeum* DSM 15702
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476
693977 *Deinococcus proteolyticus* MRP

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1148 *Synechocystis* sp. PCC 6803
189518 *Leptospira interrogans* serovar Lai str. 56601
207954 *Neptuniibacter caesariensis*
235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PA1 5
375286 *Janthinobacterium* sp. Marseille
398767 *Geobacter lovleyi* SZ
413999 *Clostridium botulinum* A str. ATCC 3502
515619 *Eubacterium rectale* ATCC 33656

250

1148 *Synechocystis* sp. PCC 6803
235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
267671 *Leptospira interrogans* serovar Copenhageni str. Fiocruz L1-130
272568 *Gluconacetobacter diazotrophicus* PA1 5
288705 *Renibacterium salmoninarum* ATCC 33209
398767 *Geobacter lovleyi* SZ
583346 *Clostridium kluuyveri* NBRC 12016
645463 *Clostridium difficile* R20291
649349 *Leadbetterella byssophila* DSM 17132

251

882 *Desulfovibrio vulgaris* str. Hildenborough
313603 *Maribacter* sp. HTCC2170
314278 *Nitrococcus mobilis* Nb-231
349163 *Acidiphilium cryptum* JF-5
394503 *Clostridium cellulolyticum* H10
446471 *Xylanimonas cellulolytica* DSM 15894
479434 *Sphaerobacter thermophilus* DSM 20745
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
583346 *Clostridium kluuyveri* NBRC 12016

252

1140 *Synechococcus elongatus* PCC 7942
265072 *Methylobacillus flagellatus* KT
324925 *Pelodictyon phaeoclathratiforme* BU-1
393116 *Listeria monocytogenes* FSL F2-515
401526 *Thermosinus carboxydivorans* Nor1
428128 *Eubacterium siraeum* DSM 15702
445973 *Clostridium bartlettii* DSM 16795
471855 *Slackia heliotrinireducens* DSM 20476
553177 *Capnocytophaga sputigena* ATCC 33612
693977 *Deinococcus proteolyticus* MRP

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32049 *Synechococcus* sp. PCC 7002
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
391774 *Desulfovibrio vulgaris* DP4
411484 *Clostridium* sp. SS2/1
443906 *Clavibacter michiganensis* subsp. *michiganensis* NCPPB 382
445974 *Clostridium ramosum* DSM 1402
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

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123214 *Persephonella marina* EX-H1
183190 *Xylella fastidiosa* Temecula1
190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
289376 *Thermodesulfovibrio yellowstonii* DSM 11347
306254 *Campylobacter coli* RM2228
362948 *Lactobacillus salivarius* UCC118
416591 *Thermotoga lettingae* TMO
434271 *Actinobacillus pleuropneumoniae* serovar 3 str. JL03
561177 *Anaerococcus hydrogenalis* DSM 7454
591001 *Acidaminococcus fermentans* DSM 20731

255

290512 *Prosthecochloris aestuarii* DSM 271
300852 *Thermus thermophilus* HB8
373903 *Halothermothrix orenii* H 168
445971 *Anaerofustis stercorihominis* DSM 17244
500633 *Clostridium hiranonis* DSM 13275
525898 *Sulfurospirillum deleyianum* DSM 6946
553212 *Staphylococcus capitis* SK14

583345 *Methylotenera mobilis* JLW8
714315 *Leptotrichia goodfellowii* DSM 19756
880526 *Rikenella microfus* DSM 15922

256

32049 *Synechococcus* sp. PCC 7002
59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
391774 *Desulfovibrio vulgaris* DP4
443906 *Clavibacter michiganensis* subsp. *michiganensis* NCPPB 382
445974 *Clostridium ramosum* DSM 1402
572477 *Allochromatium vinosum* DSM 180
583355 *Coralimargarita akajimensis* DSM 45221
653938 *Listeria monocytogenes* 08-5578

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273036 *Staphylococcus aureus* RF122
316278 *Synechococcus* sp. RCC307
335283 *Nitrosomonas eutropha* C91
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
445975 *Collinsella stercoris* DSM 13279
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260

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228410 *Nitrosomonas europaea* ATCC 19718
316278 *Synechococcus* sp. RCC307
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
445975 *Collinsella stercoris* DSM 13279
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
698737 *Staphylococcus lugdunensis* HKU09-01

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1148 *Synechocystis* sp. PCC 6803

235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5
314278 *Nitrococcus mobilis* Nb-231
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
479434 *Sphaerobacter thermophilus* DSM 20745
583346 *Clostridium kluuyveri* NBRC 12016
709991 *Odoribacter splanchnicus* DSM 20712
710696 *Intrasporangium calvum* DSM 43043

260

1148 *Synechocystis* sp. PCC 6803
189518 *Leptospira interrogans* serovar Lai str. 56601
235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5
375286 *Janthinobacterium* sp. Marseille
398767 *Geobacter lovleyi* SZ
583346 *Clostridium kluuyveri* NBRC 12016
649349 *Leadbetterella byssophila* DSM 17132
710696 *Intrasporangium calvum* DSM 43043

261

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
340101 *Victivallis vadensis* ATCC BAA-548
349163 *Acidiphilium cryptum* JF-5
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
446471 *Xylanimonas cellulositytica* DSM 15894
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
583346 *Clostridium kluuyveri* NBRC 12016

262

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5
288705 *Renibacterium salmoninarum* ATCC 33209
314278 *Nitrococcus mobilis* Nb-231
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115

583346 *Clostridium kluveri* NBRC 12016
649349 *Leadbetterella byssophila* DSM 17132

263

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PA1 5
314278 *Nitrococcus mobilis* Nb-231
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
446471 *Xylanimonas cellulosilytica* DSM 15894
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
649349 *Leadbetterella byssophila* DSM 17132

264

32049 *Synechococcus* sp. PCC 7002
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
411464 *Desulfovibrio piger* ATCC 29098
445974 *Clostridium ramosum* DSM 1402
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
572477 *Allochromatium vinosum* DSM 180
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

265

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PA1 5
313603 *Maribacter* sp. HTCC2170
314278 *Nitrococcus mobilis* Nb-231
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
446471 *Xylanimonas cellulosilytica* DSM 15894
525897 *Desulfomicrobium baculatum* DSM 4028
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115

266

32049 *Synechococcus* sp. PCC 7002
59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85

146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
411464 *Desulfovibrio piger* ATCC 29098
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
572477 *Allochromatium vinosum* DSM 180
583355 *Coralimargarita akajimensis* DSM 45221
866499 *Cloacibacillus evryensis* DSM 19522

267

319795 *Deinococcus geothermalis* DSM 11300
323261 *Nitrosococcus oceani* ATCC 19707
411464 *Desulfovibrio piger* ATCC 29098
411474 *Coprococcus eutactus* ATCC 27759
446465 *Brachybacterium faecium* DSM 4810
451640 *Catenibacterium mitsuokai* DSM 15897
479437 *Eggerthella lenta* DSM 2243
522772 *Denitrovibrio acetiphilus* DSM 12809
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

268

32049 *Synechococcus* sp. PCC 7002
146919 *Salinibacter ruber*
243230 *Deinococcus radiodurans* R1
411464 *Desulfovibrio piger* ATCC 29098
445974 *Clostridium ramosum* DSM 1402
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
546272 *Brucella melitensis* ATCC 23457
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

269

333990 *Carnobacterium* sp. AT7
349124 *Halorhodospira halophila* SL1
378753 *Kocuria rhizophila* DC2201
428127 *Eubacterium dolichum* DSM 3991
445971 *Anaerofustis stercorihominis* DSM 17244
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
639282 *Deferribacter desulfuricans* SSM1
670487 *Oceanithermus profundus* DSM 14977
714315 *Leptotrichia goodfellowii* DSM 19756

880526 *Rikenella microfus* DSM 15922

270

190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
259536 *Psychrobacter arcticus* 273-4
312153 *Polynucleobacter necessarius* subsp. *asymbiomaticus* QLW-P1DMWA-1
326298 *Sulfurimonas denitrificans* DSM 1251
382640 *Bartonella tribocorum* CIP 105476
405440 *Xylella fastidiosa* M12
416591 *Thermotoga lettingae* TMO
429009 *Ammonifex degensii* KC4
458233 *Macrococcus caseolyticus* JCSC5402
561177 *Anaerococcus hydrogenalis* DSM 7454

271

189518 *Leptospira interrogans* serovar *Lai* str. 56601
264462 *Bdellovibrio bacteriovorus* HD100
314231 *Fulvimarina pelagi* HTCC2506
326427 *Chloroflexus aggregans* DSM 9485
375286 *Janthinobacterium* sp. Marseille
411490 *Anaerostipes caccae* DSM 14662
495036 *Geobacillus* sp. G11MC16
575540 *Isosphaera pallida* ATCC 43644
709991 *Odoribacter splanchnicus* DSM 20712
710696 *Intrasporangium calvum* DSM 43043

272

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5
288705 *Renibacterium salmoninarum* ATCC 33209
314278 *Nitrococcus mobilis* Nb-231
340101 *Victivallis vadensis* ATCC BAA-548
355278 *Leptospira biflexa* serovar *Patoc* strain 'Patoc 1 (Ames)'
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
649349 *Leadbetterella byssophila* DSM 17132

273

1148 *Synechocystis* sp. PCC 6803
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5

314278 *Nitrococcus mobilis* Nb-231
340101 *Victivallis vadensis* ATCC BAA-548
355278 *Leptospira biflexa* serovar Patoc strain 'Patoc 1 (Ames)'
446471 *Xylanimonas cellulositytica* DSM 15894
544556 *Geobacillus* sp. Y412MC61
546414 *Deinococcus deserti* VCD115
649349 *Leadbetterella byssophila* DSM 17132

274

59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85
319795 *Deinococcus geothermalis* DSM 11300
323261 *Nitrosococcus oceani* ATCC 19707
411464 *Desulfovibrio piger* ATCC 29098
445974 *Clostridium ramosum* DSM 1402
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
583355 *Coralimargarita akajimensis* DSM 45221
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

275

59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85
319795 *Deinococcus geothermalis* DSM 11300
323261 *Nitrosococcus oceani* ATCC 19707
411464 *Desulfovibrio piger* ATCC 29098
411474 *Coprococcus eutactus* ATCC 27759
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
583355 *Coralimargarita akajimensis* DSM 45221
653938 *Listeria monocytogenes* 08-5578
866499 *Cloacibacillus evryensis* DSM 19522

276

1148 *Synechocystis* sp. PCC 6803
189518 *Leptospira interrogans* serovar Lai str. 56601
235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PAL 5
340101 *Victivallis vadensis* ATCC BAA-548
375286 *Janthinobacterium* sp. Marseille
413999 *Clostridium botulinum* A str. ATCC 3502
709991 *Odoribacter splanchnicus* DSM 20712
710696 *Intrasporangium calvum* DSM 43043

277

1148 *Synechocystis* sp. PCC 6803
189518 *Leptospira interrogans* serovar Lai str. 56601
235909 *Geobacillus kaustophilus* HTA426
264462 *Bdellovibrio bacteriovorus* HD100
272568 *Gluconacetobacter diazotrophicus* PA1 5
340101 *Victivallis vadensis* ATCC BAA-548
375286 *Janthinobacterium* sp. Marseille
583346 *Clostridium kluveri* NBRC 12016
649349 *Leadbetterella byssophila* DSM 17132
710696 *Intrasporangium calvum* DSM 43043

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319795 *Deinococcus geothermalis* DSM 11300
355276 *Leptospira borgpetersenii* serovar Hardjo-bovis str. L550
411462 *Dorea longicatena* DSM 13814
430066 *Brucella abortus* S19
446465 *Brachybacterium faecium* DSM 4810
451640 *Catenibacterium mitsuokai* DSM 15897
509170 *Acinetobacter baumannii* SDF
522772 *Denitrovibrio acetiphilus* DSM 12809
637381 *Listeria monocytogenes* 08-5923
694427 *Paludibacter propionigenes* WB4

279

197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
471856 *Jonesia denitrificans* DSM 20603
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
717231 *Flexistipes sinusarabici* DSM 4947

280

333990 *Carnobacterium* sp. AT7
378753 *Kocuria rhizophila* DC2201
391165 *Granulibacter bethesdensis* CGDNIH1
428127 *Eubacterium dolichum* DSM 3991

525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
546271 *Selenomonas sputigena* ATCC 35185
583345 *Methylotenera mobilis* JLW8
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977
880526 *Rikenella microfusus* DSM 15922

281

197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
333990 *Carnobacterium* sp. AT7
378753 *Kocuria rhizophila* DC2201
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977

282

189518 *Leptospira interrogans* serovar Lai str. 56601
207954 *Neptuniibacter caesariensis*
315750 *Bacillus pumilus* SAFR-032
392423 *Hydrogenivirga* sp. 128-5-R1-1
395965 *Methylocella silvestris* BL2
411490 *Anaerostipes caccae* DSM 14662
526222 *Desulfovibrio salexigens* DSM 2638
575540 *Isosphaera pallida* ATCC 43644
709991 *Odoribacter splanchnicus* DSM 20712
710696 *Intrasporangium calvum* DSM 43043

283

29447 *Xanthomonas albilineans*
32049 *Synechococcus* sp. PCC 7002
243230 *Deinococcus radiodurans* R1
411464 *Desulfovibrio piger* ATCC 29098
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
546272 *Brucella melitensis* ATCC 23457
653938 *Listeria monocytogenes* 08-5578
694427 *Paludibacter propionisigenes* WB4
866499 *Cloacibacillus evryensis* DSM 19522

284

29447 *Xanthomonas albilineans*
59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85
243230 *Deinococcus radiodurans* R1
411464 *Desulfovibrio piger* ATCC 29098
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
546272 *Brucella melitensis* ATCC 23457
583355 *Coralimargarita akajimensis* DSM 45221
694427 *Paludibacter propionicigenes* WB4
866499 *Cloacibacillus evryensis* DSM 19522

285

314276 *Idiomarina baltica* OS145
316278 *Synechococcus* sp. RCC307
391598 *Flavobacteria bacterium* BAL38
445975 *Collinsella stercoris* DSM 13279
451515 *Staphylococcus aureus* subsp. *aureus* USA300_FPR3757
478801 *Kytococcus sedentarius* DSM 20547
485915 *Desulfohalobium retbaense* DSM 5692
498848 *Thermus aquaticus* Y51MC23
518637 *Eubacterium bifforme* DSM 3989
565034 *Brachyspira hyodysenteriae* WA1

286

319795 *Deinococcus geothermalis* DSM 11300
355276 *Leptospira borgpetersenii* serovar *Hardjo-bovis* str. L550
359391 *Brucella melitensis* biovar *Abortus* 2308
411462 *Dorea longicatena* DSM 13814
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243
509170 *Acinetobacter baumannii* SDF
653938 *Listeria monocytogenes* 08-5578
694427 *Paludibacter propionicigenes* WB4
866499 *Cloacibacillus evryensis* DSM 19522

287

29447 *Xanthomonas albilineans*
59374 *Fibrobacter succinogenes* subsp. *succinogenes* S85
411464 *Desulfovibrio piger* ATCC 29098
446465 *Brachybacterium faecium* DSM 4810
479437 *Eggerthella lenta* DSM 2243

546272 *Brucella melitensis* ATCC 23457
583355 *Coralimargarita akajimensis* DSM 45221
653938 *Listeria monocytogenes* 08-5578
694427 *Paludibacter propionicipigenes* WB4
866499 *Cloacibacillus evryensis* DSM 19522

288

197221 *Thermosynechococcus elongatus* BP-1
333990 *Carnobacterium* sp. AT7
378753 *Kocuria rhizophila* DC2201
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
481448 *Methylacidiphilum inferorum* V4
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
555778 *Halothiobacillus neapolitanus* c2
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977

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197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
333990 *Carnobacterium* sp. AT7
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
481448 *Methylacidiphilum inferorum* V4
546271 *Selenomonas sputigena* ATCC 35185
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977

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197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
273036 *Staphylococcus aureus* RF122
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
471856 *Jonesia denitrificans* DSM 20603
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977

291

357808 *Roseiflexus* sp. RS-1
369723 *Salinispora tropica* CNB-440
388400 *Bacillus* sp. B14905
388739 *Roseobacter* sp. SK209-2-6
395962 *Cyanothece* sp. PCC 8802
445972 *Anaerotruncus colihominis* DSM 17241
447217 *Anaeromyxobacter* sp. K
452637 *Opitutus terrae* PB90-1
483215 *Bacteroides finegoldii* DSM 17565
575788 *Vibrio splendidus* LGP32

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273036 *Staphylococcus aureus* RF122
316278 *Synechococcus* sp. RCC307
335283 *Nitrosomonas eutropha* C91
445975 *Collinsella stercoris* DSM 13279
471856 *Jonesia denitrificans* DSM 20603
485915 *Desulfohalobium retbaense* DSM 5692
498848 *Thermus aquaticus* Y51MC23
518637 *Eubacterium bifforme* DSM 3989
546271 *Selenomonas sputigena* ATCC 35185
880074 *Barnesiella viscericola* DSM 18177

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197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
273036 *Staphylococcus aureus* RF122
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428126 *Clostridium spiroforme* DSM 1552
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum infernorum* V4
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977

294

32049 *Synechococcus* sp. PCC 7002
96561 *Desulfococcus oleovorans* Hxd3
226185 *Enterococcus faecalis* V583
243230 *Deinococcus radiodurans* R1
323098 *Nitrobacter winogradskyi* Nb-255
411461 *Dorea formicigenerans* ATCC 27755

445974 *Clostridium ramosum* DSM 1402
557598 *Laribacter hongkongensis* HLHK9
583355 *Coralimargarita akajimensis* DSM 45221
746697 *Aequorivita sublithicola* DSM 14238

295

93059 *Prochlorococcus marinus* str. MIT 9211
195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
453364 *Streptococcus pneumoniae* CDC0288-04
479436 *Veillonella parvula* DSM 2008
525919 *Anaerococcus prevotii* DSM 20548
572547 *Aminobacterium colombiense* DSM 12261
700015 *Coriobacterium glomerans* PW2
747365 *Thermodesulfobium narugense* DSM 14796

296

197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
584708 *Aminomonas paucivorans* DSM 12260
698737 *Staphylococcus lugdunensis* HKU09-01
880074 *Barnesiella viscericola* DSM 18177

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31964 *Clavibacter michiganensis* subsp. *sepedonicus*
32049 *Synechococcus* sp. PCC 7002
226185 *Enterococcus faecalis* V583
243230 *Deinococcus radiodurans* R1
323098 *Nitrobacter winogradskyi* Nb-255
391597 *Limnobacter* sp. MED105
411464 *Desulfovibrio piger* ATCC 29098
537007 *Blautia hansenii* DSM 20583
583355 *Coralimargarita akajimensis* DSM 45221
746697 *Aequorivita sublithicola* DSM 14238

298

58051 *Moritella* sp. PE36
204669 *Candidatus Koribacter versatilis* Ellin345
313624 *Nodularia spumigena* CCY9414
314271 *Maritimibacter alkaliphilus* HTCC2654
411467 *Pseudoflavonifractor capillosus* ATCC 29799
412694 *Bacillus thuringiensis* str. Al Hakam
526225 *Geodermatophilus obscurus* DSM 43160
530564 *Pirellula staleyi* DSM 6068
573370 *Desulfovibrio magneticus* RS-1
655815 *Zunongwangia profunda* SM-A87

299

183190 *Xylella fastidiosa* Temecula1
190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
281090 *Leifsonia xyli* subsp. *xyli* str. CTCB07
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
382640 *Bartonella tribocorum* CIP 105476
416591 *Thermotoga lettingae* TMO
458233 *Macrococcus caseolyticus* JCSC5402
561177 *Anaerococcus hydrogenalis* DSM 7454
865938 *Weeksella virosa* DSM 16922

300

273036 *Staphylococcus aureus* RF122
316278 *Synechococcus* sp. RCC307
335283 *Nitrosomonas eutropha* C91
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
584708 *Aminomonas paucivorans* DSM 12260
880074 *Barnesiella viscericola* DSM 18177

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228410 *Nitrosomonas europaea* ATCC 19718
316278 *Synechococcus* sp. RCC307
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989

584708 *Aminomonas paucivorans* DSM 12260
698737 *Staphylococcus lugdunensis* HKU09-01
880074 *Barnesiella viscericola* DSM 18177

302

316278 *Synechococcus* sp. RCC307
335283 *Nitrosomonas eutropha* C91
445975 *Collinsella stercoris* DSM 13279
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum inferorum* V4
485915 *Desulfohalobium retbaense* DSM 5692
498848 *Thermus aquaticus* Y51MC23
518637 *Eubacterium bifforme* DSM 3989
698737 *Staphylococcus lugdunensis* HKU09-01
880074 *Barnesiella viscericola* DSM 18177

303

167879 *Colwellia psychrerythraea* 34H
177437 *Desulfobacterium autotrophicum* HRM2
272564 *Desulfitobacterium hafniense* DCB-2
313624 *Nodularia spumigena* CCY9414
316056 *Rhodopseudomonas palustris* BisB18
340100 *Bordetella petrii* DSM 12804
391037 *Salinispora arenicola* CNS-205
411467 *Pseudoflavonifractor capillosus* ATCC 29799
483217 *Bacteroides dorei* DSM 17855
756272 *Planctomyces brasiliensis* DSM 5305

304

177437 *Desulfobacterium autotrophicum* HRM2
258594 *Rhodopseudomonas palustris* CGA009
313624 *Nodularia spumigena* CCY9414
314277 *Marinomonas* sp. MED121
340100 *Bordetella petrii* DSM 12804
376686 *Flavobacterium johnsoniae* UW101
411467 *Pseudoflavonifractor capillosus* ATCC 29799
412694 *Bacillus thuringiensis* str. Al Hakam
526225 *Geodermatophilus obscurus* DSM 43160
756272 *Planctomyces brasiliensis* DSM 5305

305

264201 *Candidatus Protochlamydia amoebophila* UWE25

281090 *Leifsonia xyli* subsp. *xyli* str. CTCB07
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
382640 *Bartonella tribocorum* CIP 105476
405440 *Xylella fastidiosa* M12
416591 *Thermotoga lettingae* TMO
458233 *Macrococcus caseolyticus* JCSC5402
561177 *Anaerococcus hydrogenalis* DSM 7454
865938 *Weeksella virosa* DSM 16922

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183190 *Xylella fastidiosa* Temecula1
264201 *Candidatus Protochlamydia amoebophila* UWE25
281090 *Leifsonia xyli* subsp. *xyli* str. CTCB07
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
382640 *Bartonella tribocorum* CIP 105476
416591 *Thermotoga lettingae* TMO
458233 *Macrococcus caseolyticus* JCSC5402
561177 *Anaerococcus hydrogenalis* DSM 7454
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

307

197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
342451 *Staphylococcus saprophyticus* subsp. *saprophyticus* ATCC 15305
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum infernorum* V4
518637 *Eubacterium bifforme* DSM 3989
584708 *Aminomonas paucivorans* DSM 12260
880074 *Barnesiella viscericola* DSM 18177

308

197221 *Thermosynechococcus elongatus* BP-1
228410 *Nitrosomonas europaea* ATCC 19718
273036 *Staphylococcus aureus* RF122
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum infernorum* V4
518637 *Eubacterium bifforme* DSM 3989

584708 *Aminomonas paucivorans* DSM 12260
880074 *Barnesiella viscericola* DSM 18177

309

190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
259536 *Psychrobacter arcticus* 273-4
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
351607 *Acidothermus cellulolyticus* 11B
382640 *Bartonella tribocorum* CIP 105476
393125 *Listeria monocytogenes* FSL R2-503
431947 *Porphyromonas gingivalis* ATCC 33277
521045 *Kosmotoga olearia* TBF 19.5.1
561177 *Anaerococcus hydrogenalis* DSM 7454

310

190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
259536 *Psychrobacter arcticus* 273-4
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
351607 *Acidothermus cellulolyticus* 11B
382640 *Bartonella tribocorum* CIP 105476
431947 *Porphyromonas gingivalis* ATCC 33277
458233 *Macrococcus caseolyticus* JCSC5402
521045 *Kosmotoga olearia* TBF 19.5.1
561177 *Anaerococcus hydrogenalis* DSM 7454

311

281090 *Leifsonia xyli* subsp. *xyli* str. CTCB07
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
362948 *Lactobacillus salivarius* UCC118
382640 *Bartonella tribocorum* CIP 105476
416591 *Thermotoga lettingae* TMO
431947 *Porphyromonas gingivalis* ATCC 33277
557723 *Haemophilus parasuis* SH0165
561177 *Anaerococcus hydrogenalis* DSM 7454
591001 *Acidaminococcus fermentans* DSM 20731

312

228410 *Nitrosomonas europaea* ATCC 19718
273036 *Staphylococcus aureus* RF122

316278 *Synechococcus* sp. RCC307
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum inferorum* V4
518637 *Eubacterium bifforme* DSM 3989
584708 *Aminomonas paucivorans* DSM 12260
880074 *Barnesiella viscericola* DSM 18177

313

228410 *Nitrosomonas europaea* ATCC 19718
316278 *Synechococcus* sp. RCC307
387093 *Sulfurovum* sp. NBC37-1
391165 *Granulibacter bethesdensis* CGDNIH1
471856 *Jonesia denitrificans* DSM 20603
481448 *Methylacidiphilum inferorum* V4
518637 *Eubacterium bifforme* DSM 3989
584708 *Aminomonas paucivorans* DSM 12260
698737 *Staphylococcus lugdunensis* HKU09-01
880074 *Barnesiella viscericola* DSM 18177

314

311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
349741 *Akkermansia muciniphila* ATCC BAA-835
351607 *Acidothermus cellulolyticus* 11B
393125 *Listeria monocytogenes* FSL R2-503
420336 *Epulopiscium* sp. 'N.t. morphotype B'
521045 *Kosmotoga olearia* TBF 19.5.1
537457 *Actinobacillus pleuropneumoniae* serovar 7 str. AP76
573058 *Peptoniphilus asaccharolyticus* DSM 20463
865938 *Weeksella virosa* DSM 16922

315

333990 *Carnobacterium* sp. AT7
378753 *Kocuria rhizophila* DC2201
391165 *Granulibacter bethesdensis* CGDNIH1
428127 *Eubacterium dolichum* DSM 3991
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
583345 *Methylotenera mobilis* JLW8
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977
869211 *Spirochaeta thermophila* DSM 6578

880526 *Rikenella microfus* DSM 15922

316

195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
264199 *Streptococcus thermophilus* LMG 18311
403833 *Petrotoga mobilis* SJ95
456827 *Candidatus Cloacamonas acidaminovorans*
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

317

264201 *Candidatus Protochlamydia amoebophila* UWE25
281090 *Leifsonia xyli* subsp. *xyli* str. CTCB07
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
362948 *Lactobacillus salivarius* UCC118
382640 *Bartonella tribocorum* CIP 105476
416591 *Thermotoga lettingae* TMO
431947 *Porphyromonas gingivalis* ATCC 33277
557723 *Haemophilus parasuis* SH0165
561177 *Anaerococcus hydrogenalis* DSM 7454

318

228410 *Nitrosomonas europaea* ATCC 19718
333990 *Carnobacterium* sp. AT7
378753 *Kocuria rhizophila* DC2201
391165 *Granulibacter bethesdensis* CGDNIH1
402612 *Flavobacterium psychrophilum* JIP02/86
428127 *Eubacterium dolichum* DSM 3991
525146 *Desulfovibrio desulfuricans* subsp. *desulfuricans* str. ATCC 27774
584708 *Aminomonas paucivorans* DSM 12260
670487 *Oceanithermus profundus* DSM 14977
869211 *Spirochaeta thermophila* DSM 6578

319

259536 *Psychrobacter arcticus* 273-4
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251

349741 Akkermansia muciniphila ATCC BAA-835
351607 Acidothermus cellulolyticus 11B
382640 Bartonella tribocorum CIP 105476
393125 Listeria monocytogenes FSL R2-503
431947 Porphyromonas gingivalis ATCC 33277
521045 Kosmotoga olearia TBF 19.5.1
573058 Peptoniphilus asaccharolyticus DSM 20463

320

259536 Psychrobacter arcticus 273-4
311424 Dehalococcoides sp. VS
326298 Sulfurimonas denitrificans DSM 1251
349741 Akkermansia muciniphila ATCC BAA-835
351607 Acidothermus cellulolyticus 11B
382640 Bartonella tribocorum CIP 105476
393125 Listeria monocytogenes FSL R2-503
431947 Porphyromonas gingivalis ATCC 33277
521045 Kosmotoga olearia TBF 19.5.1
561177 Anaerococcus hydrogenalis DSM 7454

321

311424 Dehalococcoides sp. VS
326298 Sulfurimonas denitrificans DSM 1251
349741 Akkermansia muciniphila ATCC BAA-835
351607 Acidothermus cellulolyticus 11B
382640 Bartonella tribocorum CIP 105476
393125 Listeria monocytogenes FSL R2-503
431947 Porphyromonas gingivalis ATCC 33277
521045 Kosmotoga olearia TBF 19.5.1
537457 Actinobacillus pleuropneumoniae serovar 7 str. AP76
573058 Peptoniphilus asaccharolyticus DSM 20463

322

259536 Psychrobacter arcticus 273-4
311424 Dehalococcoides sp. VS
326298 Sulfurimonas denitrificans DSM 1251
349741 Akkermansia muciniphila ATCC BAA-835
351607 Acidothermus cellulolyticus 11B
382640 Bartonella tribocorum CIP 105476
431947 Porphyromonas gingivalis ATCC 33277
458233 Macrococcus caseolyticus JCSC5402
521045 Kosmotoga olearia TBF 19.5.1
561177 Anaerococcus hydrogenalis DSM 7454

323

299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. holarctica FSC200
484019 *Thermosipho africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
580340 *Thermovirga lienii* DSM 17291
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

324

195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
314315 *Lactobacillus sakei* subsp. sakei 23K
391009 *Thermosipho melanesiensis* BI429
456827 *Candidatus Cloacamonas acidaminovorans*
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
700015 *Coriobacterium glomerans* PW2
747365 *Thermodesulfobium narugense* DSM 14796

325

190304 *Fusobacterium nucleatum* subsp. nucleatum ATCC 25586
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
375432 *Haemophilus influenzae* R3021
382640 *Bartonella tribocorum* CIP 105476
401473 *Bifidobacterium dentium* Bd1
431947 *Porphyromonas gingivalis* ATCC 33277
467705 *Streptococcus gordonii* str. Challis substr. CH1
521045 *Kosmotoga olearia* TBF 19.5.1
561177 *Anaerococcus hydrogenalis* DSM 7454

326

195099 *Campylobacter jejuni* RM1221
242619 *Porphyromonas gingivalis* W83
262728 *Haemophilus influenzae* R2866
264199 *Streptococcus thermophilus* LMG 18311

403833 *Petrotoga mobilis* SJ95
479436 *Veillonella parvula* DSM 2008
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

327

190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
205913 *Bifidobacterium longum* DJ010A
272843 *Pasteurella multocida* subsp. *multocida* str. Pm70
306254 *Campylobacter coli* RM2228
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
416591 *Thermotoga lettingae* TMO
561276 *Streptococcus pneumoniae* ATCC 700669
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

328

190304 *Fusobacterium nucleatum* subsp. *nucleatum* ATCC 25586
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
375432 *Haemophilus influenzae* R3021
382640 *Bartonella tribocorum* CIP 105476
401473 *Bifidobacterium dentium* Bd1
416591 *Thermotoga lettingae* TMO
431947 *Porphyromonas gingivalis* ATCC 33277
467705 *Streptococcus gordonii* str. Challis substr. CH1
561177 *Anaerococcus hydrogenalis* DSM 7454

329

205913 *Bifidobacterium longum* DJ010A
306254 *Campylobacter coli* RM2228
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. *holarctica* FSC200
484019 *Thermosipho africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
561276 *Streptococcus pneumoniae* ATCC 700669
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

330

242619 Porphyromonas gingivalis W83
299768 Streptococcus thermophilus CNRZ1066
306264 Campylobacter upsaliensis RM3195
309799 Dictyoglomus thermophilum H-6-12
334380 Orientia tsutsugamushi str. Ikeda
374932 Haemophilus influenzae PittHH
403833 Petrotoga mobilis SJ95
525909 Acidimicrobium ferrooxidans DSM 10331
566552 Bifidobacterium catenulatum DSM 16992 = JCM 1194
608538 Hydrogenobacter thermophilus TK-6

331

262728 Haemophilus influenzae R2866
307502 Wolbachia endosymbiont of Drosophila ananassae
360111 Campylobacter jejuni subsp. jejuni CF93-6
390874 Thermotoga petrophila RKU-1
398513 Bifidobacterium bifidum NCIMB 41171
453364 Streptococcus pneumoniae CDC0288-04
456827 Candidatus Cloacamonas acidaminovorans
525919 Anaerococcus prevotii DSM 20548
634504 Bartonella grahamii as4aup
700015 Coriobacterium glomerans PW2

332

316278 Synechococcus sp. RCC307
335283 Nitrosomonas eutropha C91
445975 Collinsella stercoris DSM 13279
471856 Jonesia denitrificans DSM 20603
485915 Desulfohalobium retbaense DSM 5692
498848 Thermus aquaticus Y51MC23
518637 Eubacterium bifforme DSM 3989
698737 Staphylococcus lugdunensis HKU09-01
880074 Barnesiella viscericola DSM 18177
906968 Treponema brennaboreense DSM 12168

333

316278 Synechococcus sp. RCC307
335283 Nitrosomonas eutropha C91
445975 Collinsella stercoris DSM 13279
471856 Jonesia denitrificans DSM 20603
481448 Methylacidiphilum inferorum V4

485915 *Desulfohalobium retbaense* DSM 5692
518637 *Eubacterium bifforme* DSM 3989
698737 *Staphylococcus lugdunensis* HKU09-01
880074 *Barnesiella viscericola* DSM 18177
906968 *Treponema brennaboreense* DSM 12168

334

259536 *Psychrobacter arcticus* 273-4
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
349741 *Akkermansia muciniphila* ATCC BAA-835
382640 *Bartonella tribocorum* CIP 105476
401473 *Bifidobacterium dentium* Bd1
431947 *Porphyromonas gingivalis* ATCC 33277
467705 *Streptococcus gordonii* str. Challis substr. CH1
521045 *Kosmotoga olearia* TBF 19.5.1
561177 *Anaerococcus hydrogenalis* DSM 7454

335

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
403833 *Petrotoga mobilis* SJ95
484022 *Francisella philomiragia* subsp. *philomiragia* ATCC 25017
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
572547 *Aminobacterium colombiense* DSM 12261
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

336

311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
349741 *Akkermansia muciniphila* ATCC BAA-835
375432 *Haemophilus influenzae* R3021
382640 *Bartonella tribocorum* CIP 105476
401473 *Bifidobacterium dentium* Bd1
431947 *Porphyromonas gingivalis* ATCC 33277
467705 *Streptococcus gordonii* str. Challis substr. CH1
521045 *Kosmotoga olearia* TBF 19.5.1
561177 *Anaerococcus hydrogenalis* DSM 7454

337

262724 *Thermus thermophilus* HB27
349741 *Akkermansia muciniphila* ATCC BAA-835
351607 *Acidothermus cellulolyticus* 11B
393125 *Listeria monocytogenes* FSL R2-503
498738 *Borrelia burgdorferi* 29805
521045 *Kosmotoga olearia* TBF 19.5.1
537457 *Actinobacillus pleuropneumoniae* serovar 7 str. AP76
563040 *Sulfurimonas autotrophica* DSM 16294
573058 *Peptoniphilus asaccharolyticus* DSM 20463
865938 *Weeksella virosa* DSM 16922

338

206672 *Bifidobacterium longum* NCC2705
381764 *Fervidobacterium nodosum* Rt17-B1
453361 *Streptococcus pneumoniae* CDC1087-00
515635 *Dictyoglomus turgidum* DSM 6724
521003 *Collinsella intestinalis* DSM 13280
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
545422 *Francisella novicida* FTE
634504 *Bartonella grahamii* as4aup
879243 *Porphyromonas asaccharolytica* DSM 20707

339

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
374932 *Haemophilus influenzae* PittHH
403833 *Petrotoga mobilis* SJ95
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

340

85962 *Helicobacter pylori* 26695
192222 *Campylobacter jejuni* subsp. *jejuni* NCTC 11168 = ATCC 700819
243164 *Dehalococcoides ethenogenes* 195
367928 *Bifidobacterium adolescentis* ATCC 15703
374930 *Haemophilus influenzae* PittEE
380749 *Hydrogenobaculum* sp. Y04AAS1

393115 *Francisella tularensis* subsp. *tularensis* FSC198
405566 *Lactobacillus helveticus* DPC 4571
561304 *Mycobacterium leprae* Br4923
868864 *Desulfurobacterium thermolithotrophum* DSM 11699

341

306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. *holarctica* FSC200
365659 *Streptococcus mitis* B6
374932 *Haemophilus influenzae* PittHH
484019 *Thermosiphon africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

342

59196 *Rickettsiella grylli*
294934 *Streptococcus pyogenes* M49 591
314261 *Candidatus Pelagibacter ubique* HTCC1002
441768 *Acholeplasma laidlawii* PG-8A
441952 *Francisella tularensis* subsp. *mediasiatica* FSC147
452659 *Rickettsia rickettsii* str. Iowa
521095 *Atopobium parvulum* DSM 20469
569881 *Wolbachia endosymbiont* of *Culex quinquefasciatus* JHB
633145 *Dehalococcoides* sp. GT
679897 *Helicobacter mustelae* 12198

343

205914 *Haemophilus somnus* 129PT
218495 *Streptococcus uberis* 0140J
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
360111 *Campylobacter jejuni* subsp. *jejuni* CF93-6
381764 *Fervidobacterium nodosum* Rt17-B1
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
525919 *Anaerococcus prevotii* DSM 20548
634504 *Bartonella grahamii* as4aup
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

344

119857 *Francisella tularensis* subsp. *holarctica*
218495 *Streptococcus uberis* 0140J
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
360111 *Campylobacter jejuni* subsp. *jejuni* CF93-6
381764 *Fervidobacterium nodosum* Rt17-B1
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
525919 *Anaerococcus prevotii* DSM 20548
634504 *Bartonella grahamii* as4aup
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

345

71421 *Haemophilus influenzae* Rd KW20
192222 *Campylobacter jejuni* subsp. *jejuni* NCTC 11168 = ATCC 700819
367928 *Bifidobacterium adolescentis* ATCC 15703
380749 *Hydrogenobaculum* sp. Y04AAS1
382638 *Helicobacter acinonychis* str. Sheeba
393115 *Francisella tularensis* subsp. *tularensis* FSC198
405566 *Lactobacillus helveticus* DPC 4571
411465 *Parvimonas micra* ATCC 33270
561304 *Mycobacterium leprae* Br4923
868864 *Desulfurobacterium thermolithotrophum* DSM 11699

346

167539 *Prochlorococcus marinus* subsp. *marinus* str. CCMP1375
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. *holarctica* FSC200
365659 *Streptococcus mitis* B6
484019 *Thermosipho africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

347

262724 *Thermus thermophilus* HB27
349741 *Akkermansia muciniphila* ATCC BAA-835
351607 *Acidothermus cellulolyticus* 11B
420336 *Epulopiscium* sp. 'N.t. morphotype B'
456298 *Haemophilus parasuis* 29755
498738 *Borrelia burgdorferi* 29805
521097 *Capnocytophaga ochracea* DSM 7271

523794 *Leptotrichia buccalis* C-1013-b
563040 *Sulfurimonas autotrophica* DSM 16294
637909 *Streptococcus gallolyticus* UCN34

348

228399 *Actinobacillus pleuropneumoniae* serovar 1 str. 4074
262724 *Thermus thermophilus* HB27
349741 *Akkermansia muciniphila* ATCC BAA-835
420336 *Epulopiscium* sp. 'N.t. morphotype B'
498738 *Borrelia burgdorferi* 29805
521097 *Capnocytophaga ochracea* DSM 7271
523794 *Leptotrichia buccalis* C-1013-b
553199 *Propionibacterium acnes* SK137
563040 *Sulfurimonas autotrophica* DSM 16294
637909 *Streptococcus gallolyticus* UCN34

349

205914 *Haemophilus somnus* 129PT
206672 *Bifidobacterium longum* NCC2705
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
381764 *Fervidobacterium nodosum* Rt17-B1
453361 *Streptococcus pneumoniae* CDC1087-00
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
525919 *Anaerococcus prevotii* DSM 20548
544406 *Helicobacter pylori* B128
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

350

59920 *Prochlorococcus marinus* str. NATL2A
262724 *Thermus thermophilus* HB27
342613 *Streptococcus agalactiae* 18RS21
420336 *Epulopiscium* sp. 'N.t. morphotype B'
518634 *Bifidobacterium breve* DSM 20213 = JCM 1192
523794 *Leptotrichia buccalis* C-1013-b
553199 *Propionibacterium acnes* SK137
563040 *Sulfurimonas autotrophica* DSM 16294
634176 *Aggregatibacter aphrophilus* NJ8700
868129 *Prevotella bivia* DSM 20514

351

259536 *Psychrobacter arcticus* 273-4

311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
349741 *Akkermansia muciniphila* ATCC BAA-835
351607 *Acidothermus cellulolyticus* 11B
382640 *Bartonella tribocorum* CIP 105476
393125 *Listeria monocytogenes* FSL R2-503
431947 *Porphyromonas gingivalis* ATCC 33277
498738 *Borrelia burgdorferi* 29805
573058 *Peptoniphilus asaccharolyticus* DSM 20463

352

206672 *Bifidobacterium longum* NCC2705
281310 *Haemophilus influenzae* 86-028NP
307502 *Wolbachia endosymbiont of Drosophila ananassae*
381764 *Fervidobacterium nodosum* Rt17-B1
453361 *Streptococcus pneumoniae* CDC1087-00
521003 *Collinsella intestinalis* DSM 13280
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
634504 *Bartonella grahamii* as4aup
879243 *Porphyromonas asaccharolytica* DSM 20707

353

205914 *Haemophilus somnus* 129PT
206672 *Bifidobacterium longum* NCC2705
307502 *Wolbachia endosymbiont of Drosophila ananassae*
381764 *Fervidobacterium nodosum* Rt17-B1
453361 *Streptococcus pneumoniae* CDC1087-00
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
634504 *Bartonella grahamii* as4aup
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

354

259536 *Psychrobacter arcticus* 273-4
311424 *Dehalococcoides* sp. VS
326298 *Sulfurimonas denitrificans* DSM 1251
349741 *Akkermansia muciniphila* ATCC BAA-835
351607 *Acidothermus cellulolyticus* 11B
382640 *Bartonella tribocorum* CIP 105476
431947 *Porphyromonas gingivalis* ATCC 33277
458233 *Macrococcus caseolyticus* JCSC5402

498738 *Borrelia burgdorferi* 29805
561177 *Anaerococcus hydrogenalis* DSM 7454

355

167555 *Prochlorococcus marinus* str. NATL1A
257309 *Corynebacterium diphtheriae* NCTC 13129
262724 *Thermus thermophilus* HB27
342614 *Streptococcus agalactiae* 515
420336 *Epulopiscium* sp. 'N.t. morphotype B'
523794 *Leptotrichia buccalis* C-1013-b
553199 *Propionibacterium acnes* SK137
563040 *Sulfurimonas autotrophica* DSM 16294
634176 *Aggregatibacter aphrophilus* NJ8700
868129 *Prevotella bivia* DSM 20514

356

243161 *Chlamydia muridarum* Nigg
254945 *Ehrlichia ruminantium* str. Welgevonden
269484 *Ehrlichia canis* str. Jake
272561 *Chlamydia trachomatis* D/UW-3/CX
315277 *Chlamydia trachomatis* A/HAR-13
434131 *Neorickettsia risticii* str. Illinois
436113 *Mycoplasma mycoides* subsp. capri str. GM12
574556 *Anaplasma centrale* str. Israel
580049 *Chlamydia trachomatis* B/Jali20/OT
672161 *Chlamydia trachomatis* B/TZ1A828/OT

357

205913 *Bifidobacterium longum* DJ010A
264201 *Candidatus Protochlamydia amoebophila* UWE25
360104 *Campylobacter concisus* 13826
416269 *Actinobacillus pleuropneumoniae* serovar 5b str. L20
416591 *Thermotoga lettingae* TMO
498736 *Borrelia burgdorferi* 80a
561177 *Anaerococcus hydrogenalis* DSM 7454
561276 *Streptococcus pneumoniae* ATCC 700669
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

358

167539 *Prochlorococcus marinus* subsp. *marinus* str. CCMP1375
306264 *Campylobacter upsaliensis* RM3195

334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. *holarctica* FSC200
365659 *Streptococcus mitis* B6
484019 *Thermosiphon africanus* TCF52B
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
645127 *Corynebacterium kroppenstedtii* DSM 44385
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

359

262724 *Thermus thermophilus* HB27
267747 *Propionibacterium acnes* KPA171202
367737 *Arcobacter butzleri* RM4018
445983 *Borrelia burgdorferi* 156a
500633 *Clostridium hiranonis* DSM 13275
518634 *Bifidobacterium breve* DSM 20213 = JCM 1192
523794 *Leptotrichia buccalis* C-1013-b
634176 *Aggregatibacter aphrophilus* NJ8700
637909 *Streptococcus gallolyticus* UCN34
867902 *Ornithobacterium rhinotracheale* DSM 15997

360

95663 *Ureaplasma urealyticum* serovar 9
243164 *Dehalococcoides ethenogenes* 195
306263 *Campylobacter lari* RM2100
390333 *Lactobacillus delbrueckii* subsp. *bulgaricus* ATCC 11842
393011 *Francisella tularensis* subsp. *holarctica* OSU18
512562 *Helicobacter pylori* Shi470
553184 *Atopobium rimae* ATCC 49626
555970 *Bifidobacterium animalis* subsp. *lactis* DSM 10140
561304 *Mycobacterium leprae* Br4923
638303 *Thermocrinis albus* DSM 14484

361

195099 *Campylobacter jejuni* RM1221
242619 *Porphyromonas gingivalis* W83
314315 *Lactobacillus sakei* subsp. *sakei* 23K
403833 *Petroglossina mobilis* SJ95
434923 *Coxiella burnetii* CbuG_Q212
476211 *Borrelia burgdorferi* 72a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

747365 *Thermodesulfobium narugense* DSM 14796

362

195099 *Campylobacter jejuni* RM1221
242619 *Porphyromonas gingivalis* W83
264199 *Streptococcus thermophilus* LMG 18311
403833 *Petrotoga mobilis* SJ95
434923 *Coxiella burnetii* CbuG_Q212
476211 *Borrelia burgdorferi* 72a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

363

242619 *Porphyromonas gingivalis* W83
306264 *Campylobacter upsaliensis* RM3195
314315 *Lactobacillus sakei* subsp. *sakei* 23K
375177 *Haemophilus influenzae* 3655
403833 *Petrotoga mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
572547 *Aminobacterium colombiense* DSM 12261
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

364

264201 *Candidatus Protochlamydia amoebophila* UWE25
306254 *Campylobacter coli* RM2228
334380 *Orientia tsutsugamushi* str. Ikeda
351581 *Francisella tularensis* subsp. *holarctica* FSC200
365659 *Streptococcus mitis* B6
484019 *Thermosiphon africanus* TCF52B
498736 *Borrelia burgdorferi* 80a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

365

205913 *Bifidobacterium longum* DJ010A
264201 *Candidatus Protochlamydia amoebophila* UWE25
272843 *Pasteurella multocida* subsp. *multocida* str. Pm70

306254 *Campylobacter coli* RM2228
334380 *Orientia tsutsugamushi* str. Ikeda
484019 *Thermosiphon africanus* TCF52B
498736 *Borrelia burgdorferi* 80a
561276 *Streptococcus pneumoniae* ATCC 700669
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

366

264201 *Candidatus Protochlamydia amoebophila* UWE25
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
365659 *Streptococcus mitis* B6
374932 *Haemophilus influenzae* PittHH
484019 *Thermosiphon africanus* TCF52B
498736 *Borrelia burgdorferi* 80a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

367

195099 *Campylobacter jejuni* RM1221
242619 *Porphyromonas gingivalis* W83
262728 *Haemophilus influenzae* R2866
264199 *Streptococcus thermophilus* LMG 18311
403833 *Petrogorgia mobilis* SJ95
476211 *Borrelia burgdorferi* 72a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

368

242619 *Porphyromonas gingivalis* W83
306264 *Campylobacter upsaliensis* RM3195
314315 *Lactobacillus sakei* subsp. *sakei* 23K
375177 *Haemophilus influenzae* 3655
403833 *Petrogorgia mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

369

306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
365659 *Streptococcus mitis* B6
374933 *Haemophilus influenzae* PittII
484019 *Thermosipho africanus* TCF52B
498736 *Borrelia burgdorferi* 80a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
591001 *Acidaminococcus fermentans* DSM 20731
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

370

299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
351581 *Francisella tularensis* subsp. *holarctica* FSC200
476212 *Borrelia burgdorferi* 94a
484019 *Thermosipho africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
693978 *Riemerella anatipestifer* ATCC 11845 = DSM 15868

371

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
340177 *Chlorobium chlorochromatii* CaD3
374932 *Haemophilus influenzae* PittHH
476212 *Borrelia burgdorferi* 94a
484019 *Thermosipho africanus* TCF52B
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194

372

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
309799 *Dictyoglomus thermophilum* H-6-12

334380 *Orientia tsutsugamushi* str. Ikeda
374932 *Haemophilus influenzae* PittHH
403833 *Petrotoga mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194

373

93059 *Prochlorococcus marinus* str. MIT 9211
195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
264199 *Streptococcus thermophilus* LMG 18311
456827 *Candidatus Cloacamonas acidaminovorans*
476211 *Borrelia burgdorferi* 72a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
747365 *Thermodesulfobium narugense* DSM 14796

374

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
374932 *Haemophilus influenzae* PittHH
403833 *Petrotoga mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
525909 *Acidimicrobium ferrooxidans* DSM 10331
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
608538 *Hydrogenobacter thermophilus* TK-6

375

205914 *Haemophilus somnus* 129PT
218495 *Streptococcus uberis* 0140J
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
360111 *Campylobacter jejuni* subsp. *jejuni* CF93-6
381764 *Fervidobacterium nodosum* Rt17-B1
445984 *Borrelia burgdorferi* Bol26
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
525919 *Anaerococcus prevotii* DSM 20548
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

376

206672 *Bifidobacterium longum* NCC2705
381764 *Fervidobacterium nodosum* Rt17-B1
445984 *Borrelia burgdorferi* Bol26
453361 *Streptococcus pneumoniae* CDC1087-00
515635 *Dictyoglomus turgidum* DSM 6724
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
545422 *Francisella novicida* FTE
634504 *Bartonella grahamii* as4aup
879243 *Porphyromonas asaccharolytica* DSM 20707

377

242619 *Porphyromonas gingivalis* W83
306264 *Campylobacter upsaliensis* RM3195
314315 *Lactobacillus sakei* subsp. *sakei* 23K
334380 *Orientia tsutsugamushi* str. Ikeda
375177 *Haemophilus influenzae* 3655
403833 *Petrotoga mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

378

167555 *Prochlorococcus marinus* str. NATL1A
262724 *Thermus thermophilus* HB27
342614 *Streptococcus agalactiae* 515
420336 *Epulopiscium* sp. 'N.t. morphotype B'
445983 *Borrelia burgdorferi* 156a
456298 *Haemophilus parasuis* 29755
523794 *Leptotrichia buccalis* C-1013-b
553199 *Propionibacterium acnes* SK137
563040 *Sulfurimonas autotrophica* DSM 16294
868129 *Prevotella bivia* DSM 20514

379

242619 *Porphyromonas gingivalis* W83
299768 *Streptococcus thermophilus* CNRZ1066
306264 *Campylobacter upsaliensis* RM3195
334380 *Orientia tsutsugamushi* str. Ikeda
375177 *Haemophilus influenzae* 3655

403833 *Petrotoga mobilis* SJ95
476212 *Borrelia burgdorferi* 94a
566552 *Bifidobacterium catenulatum* DSM 16992 = JCM 1194
608538 *Hydrogenobacter thermophilus* TK-6
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163

380

206672 *Bifidobacterium longum* NCC2705
233412 *Haemophilus ducreyi* 35000HP
360109 *Campylobacter jejuni* subsp. *doylei* 269.97
381764 *Fervidobacterium nodosum* Rt17-B1
445984 *Borrelia burgdorferi* Bol26
453361 *Streptococcus pneumoniae* CDC1087-00
521003 *Collinsella intestinalis* DSM 13280
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
634504 *Bartonella grahamii* as4aup
879243 *Porphyromonas asaccharolytica* DSM 20707

381

93059 *Prochlorococcus marinus* str. MIT 9211
195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
314315 *Lactobacillus sakei* subsp. *sakei* 23K
476211 *Borrelia burgdorferi* 72a
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
622759 *Zymomonas mobilis* subsp. *mobilis* NCIMB 11163
700015 *Coriobacterium glomerans* PW2
747365 *Thermodesulfobium narugense* DSM 14796

382

205914 *Haemophilus somnus* 129PT
206672 *Bifidobacterium longum* NCC2705
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
381764 *Fervidobacterium nodosum* Rt17-B1
445984 *Borrelia burgdorferi* Bol26
453361 *Streptococcus pneumoniae* CDC1087-00
521003 *Collinsella intestinalis* DSM 13280
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
879243 *Porphyromonas asaccharolytica* DSM 20707

383

71421 *Haemophilus influenzae* Rd KW20
192222 *Campylobacter jejuni* subsp. *jejuni* NCTC 11168 = ATCC 700819
224326 *Borrelia burgdorferi* B31
367928 *Bifidobacterium adolescentis* ATCC 15703
380749 *Hydrogenobaculum* sp. Y04AAS1
382638 *Helicobacter acinonychis* str. Sheeba
393115 *Francisella tularensis* subsp. *tularensis* FSC198
405566 *Lactobacillus helveticus* DPC 4571
561304 *Mycobacterium leprae* Br4923
868864 *Desulfurobacterium thermolithotrophum* DSM 11699

384

205914 *Haemophilus somnus* 129PT
206672 *Bifidobacterium longum* NCC2705
307502 *Wolbachia* endosymbiont of *Drosophila ananassae*
381764 *Fervidobacterium nodosum* Rt17-B1
445984 *Borrelia burgdorferi* Bol26
453361 *Streptococcus pneumoniae* CDC1087-00
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
544406 *Helicobacter pylori* B128
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

385

93059 *Prochlorococcus marinus* str. MIT 9211
195099 *Campylobacter jejuni* RM1221
205914 *Haemophilus somnus* 129PT
307502 *Wolbachia* endosymbiont of *Drosophila ananassae*
445987 *Borrelia valaisiana* VS116
453364 *Streptococcus pneumoniae* CDC0288-04
518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
700015 *Coriobacterium glomerans* PW2
747365 *Thermodesulfobium narugense* DSM 14796

386

93059 *Prochlorococcus marinus* str. MIT 9211
195099 *Campylobacter jejuni* RM1221
262728 *Haemophilus influenzae* R2866
307502 *Wolbachia* endosymbiont of *Drosophila ananassae*
445987 *Borrelia valaisiana* VS116
453364 *Streptococcus pneumoniae* CDC0288-04

518635 *Bifidobacterium angulatum* DSM 20098 = JCM 7096
525919 *Anaerococcus prevotii* DSM 20548
700015 *Coriobacterium glomerans* PW2
747365 *Thermodesulfobium narugense* DSM 14796

387

119857 *Francisella tularensis* subsp. *holarctica*
206672 *Bifidobacterium longum* NCC2705
307502 *Wolbachia endosymbiont* of *Drosophila ananassae*
445984 *Borrelia burgdorferi* Bol26
453361 *Streptococcus pneumoniae* CDC1087-00
525903 *Thermanaerovibrio acidaminovorans* DSM 6589
525919 *Anaerococcus prevotii* DSM 20548
544406 *Helicobacter pylori* B128
700015 *Coriobacterium glomerans* PW2
879243 *Porphyromonas asaccharolytica* DSM 20707

388

85962 *Helicobacter pylori* 26695
192222 *Campylobacter jejuni* subsp. *jejuni* NCTC 11168 = ATCC 700819
224326 *Borrelia burgdorferi* B31
243164 *Dehalococcoides ethenogenes* 195
367928 *Bifidobacterium adolescentis* ATCC 15703
374930 *Haemophilus influenzae* PittEE
380749 *Hydrogenobaculum* sp. Y04AAS1
390333 *Lactobacillus delbrueckii* subsp. *bulgaricus* ATCC 11842
393115 *Francisella tularensis* subsp. *tularensis* FSC198
561304 *Mycobacterium leprae* Br4923

389

71421 *Haemophilus influenzae* Rd KW20
192222 *Campylobacter jejuni* subsp. *jejuni* NCTC 11168 = ATCC 700819
224326 *Borrelia burgdorferi* B31
367928 *Bifidobacterium adolescentis* ATCC 15703
380749 *Hydrogenobaculum* sp. Y04AAS1
382638 *Helicobacter acinonychis* str. Sheeba
393115 *Francisella tularensis* subsp. *tularensis* FSC198
405566 *Lactobacillus helveticus* DPC 4571
411465 *Parvimonas micra* ATCC 33270
561304 *Mycobacterium leprae* Br4923

390

224326 *Borrelia burgdorferi* B31
 272631 *Mycobacterium leprae* TN
 360107 *Campylobacter hominis* ATCC BAA-381
 367928 *Bifidobacterium adolescentis* ATCC 15703
 374930 *Haemophilus influenzae* PittEE
 380749 *Hydrogenobaculum* sp. Y04AAS1
 382638 *Helicobacter acinonychis* str. Sheeba
 393115 *Francisella tularensis* subsp. *tularensis* FSC198
 405566 *Lactobacillus helveticus* DPC 4571
 411465 *Parvimonas micra* ATCC 33270

391

2110 *Mycoplasma agalactiae*
 95662 *Ureaplasma urealyticum* serovar 8
 203267 *Tropheryma whipplei* str. Twist
 257363 *Rickettsia typhi* str. Wilmington
 272947 *Rickettsia prowazekii* str. Madrid E
 292805 *Wolbachia endosymbiont* strain TRS of *Brugia malayi*
 314723 *Borrelia hermsii* DAH
 314724 *Borrelia turicatae* 91E135
 332415 *Ehrlichia chaffeensis* str. Sapulpa
 340047 *Mycoplasma capricolum* subsp. *capricolum* ATCC 27343

392

2110 *Mycoplasma agalactiae*
 95662 *Ureaplasma urealyticum* serovar 8
 203267 *Tropheryma whipplei* str. Twist
 218496 *Tropheryma whipplei* TW08/27
 272635 *Mycoplasma pulmonis* UAB CTIP
 292805 *Wolbachia endosymbiont* strain TRS of *Brugia malayi*
 314723 *Borrelia hermsii* DAH
 314724 *Borrelia turicatae* 91E135
 332415 *Ehrlichia chaffeensis* str. Sapulpa
 340047 *Mycoplasma capricolum* subsp. *capricolum* ATCC 27343

8 Branch lengths and AICs

group,mean branch length,starness,AIC_A,AIC_B,AIC_C,AIC_D
 1,0.002145,0.424372759856631,-0.762497,-14.8684,-12.5064,-16.3677
 2,0.004837,0.327665317139001,-6.23579,-15.3834,-23.206,-17.3506
 3,0.006014,0.317697841726619,2.36828,-9.96101,-13.2039,-16.3255
 4,0.017595,0.321339434276206,2.35116,-8.59394,-13.0881,-11.8394
 5,0.01837,0.316998341625207,-0.121898,-3.86915,-11.0026,-8.98409

6,0.029227,0.329421720733427,-1.48357,-2.64225,-10.3076,-9.62952
7,0.03201,0.312285480795424,-4.0044,-4.92424,-13.998,-10.9644
8,0.033017,0.301856335754641,4.14718,4.23086,-3.2514,-1.02741
9,0.042381,0.316513386470468,-5.51885,-9.45743,-26.7544,-20.3119
10,0.064715,0.337087912087912,-1.82122,-13.5813,-18.7926,-19.0539
11,0.073075,0.311365475777547,-4.19177,-19.6564,-23.0474,-21.319
12,0.075029,0.307422823447797,-5.3567,-8.02841,-16.9606,-13.5739
13,0.082322,0.357802050824788,0.626494,-2.90461,-10.1097,-8.47701
14,0.086183,0.471554074522872,-3.12968,-22.1831,-22.1623,-26.8778
15,0.088503,0.468407237273835,-5.73247,-27.5162,-32.3327,-37.8199
16,0.103068,0.325540609569215,-7.16866,-13.9601,-19.6422,-18.2808
17,0.105677,0.431879769506307,-3.24437,-12.0005,-12.4944,-14.2826
18,0.113241,0.372454318602592,-3.19197,-13.2729,-16.8214,-16.7067
19,0.116173,0.43168968725399,-3.60825,-24.2087,-26.3,-32.5752
20,0.117907,0.44814898932546,-3.40176,-30.7033,-21.6536,-30.2999
21,0.120271,0.409625706720103,-4.99294,-28.6933,-31.9322,-35.879
22,0.12332,0.348850531393683,-2.85211,-5.68786,-11.0313,-10.2121
23,0.194852,0.472927766076075,-0.324677,-27.4037,-17.4661,-25.6619
24,0.205083,0.500912732829472,1.64161,-25.0898,-12.0537,-21.3383
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