
Synechococcus sp. RCC307
Synechococcus sp. CC9311
Synechococcus sp. CC9605
Synechococcus sp. CC9902
Synechococcus sp. WH 8102
Synechococcus sp. WH 7803
Prochlorococcus marinus str. MIT 9313
Prochlorococcus marinus str. MIT 9303
Prochlorococcus marinus str. MIT 9211
Prochlorococcus marinus str. NATL2A
Prochlorococcus marinus str. NATL1A
Prochlorococcus marinus SUBSP. PASTORIS str. CCMP1986
Prochlorococcus marinus str. MIT 9515
Prochlorococcus marinus str. AS9601
Prochlorococcus marinus str. MIT 9312
Prochlorococcus marinus str. MIT 9215
Prochlorococcus marinus str. MIT 9301
Prochlorococcus marinus SUBSP. MARINUS str. CCMP1375
Trichodesmium erythraeum IMS101
Synechococcus elongatus PCC 6301
Synechococcus elongatus PCC 7942
Gloeobacter violaceus PCC 7421
Synechocystis sp. PCC 6803
Synechococcus sp. PCC 7002
Microcystis aeruginosa NIES-843
Cyanothece sp. PCC 7424
Cyanothece sp. PCC 7822
Cyanothece sp. PCC 8801
Cyanothece sp. PCC 8802
Cyanobacterium ucyn-a
Cyanothece sp. ATCC 51142
Synechococcus sp. JA-2-3B'A 2-13.
Synechococcus sp. JA-3-3AB
Cyanothece sp. ATCC 51142
Ostreococcus tauri
Ostreococcus lucimarinus CCE9901
Micromonas sp. RCC299
Chlamydomonas reinhardtii
Physcomitrella patens
Physcomitrella patens
Physcomitrella patens
Physcomitrella patens
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Sorghum bicolor
Zea mays
Zea mays
Zea mays
Zea mays
Zea mays
Zea mays
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Zea mays
Zea mays
Brachypodium distachyon
Brachypodium distachyon
Brachypodium distachyon
Arabidopsis thaliana
Arabidopsis lyrata
Vitis vinifera
Populus trichocarpa
Arabidopsis lyrata
Vitis vinifera
Populus trichocarpa
Populus trichocarpa
Arabidopsis thaliana
Arabidopsis lyrata
Ostreococcus tauri
Ostreococcus lucimarinus CCE9901
Micromonas sp. RCC299
Chlamydomonas reinhardtii
Physcomitrella patens
Physcomitrella patens
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Physcomitrella patens
Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Zea mays
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Zea mays
Brachypodium distachyon
Brachypodium distachyon
Vitis vinifera
Populus trichocarpa
Arabidopsis thaliana
Arabidopsis lyrata
Vitis vinifera
Populus trichocarpa
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Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Zea mays
Brachypodium distachyon
Oryza sativa japonica group
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Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Zea mays
Zea mays
Oryza sativa japonica group
Oryza sativa japonica group
Oryza sativa indica group
Sorghum bicolor
Zea mays
Zea mays
Zea mays
Brachypodium distachyon
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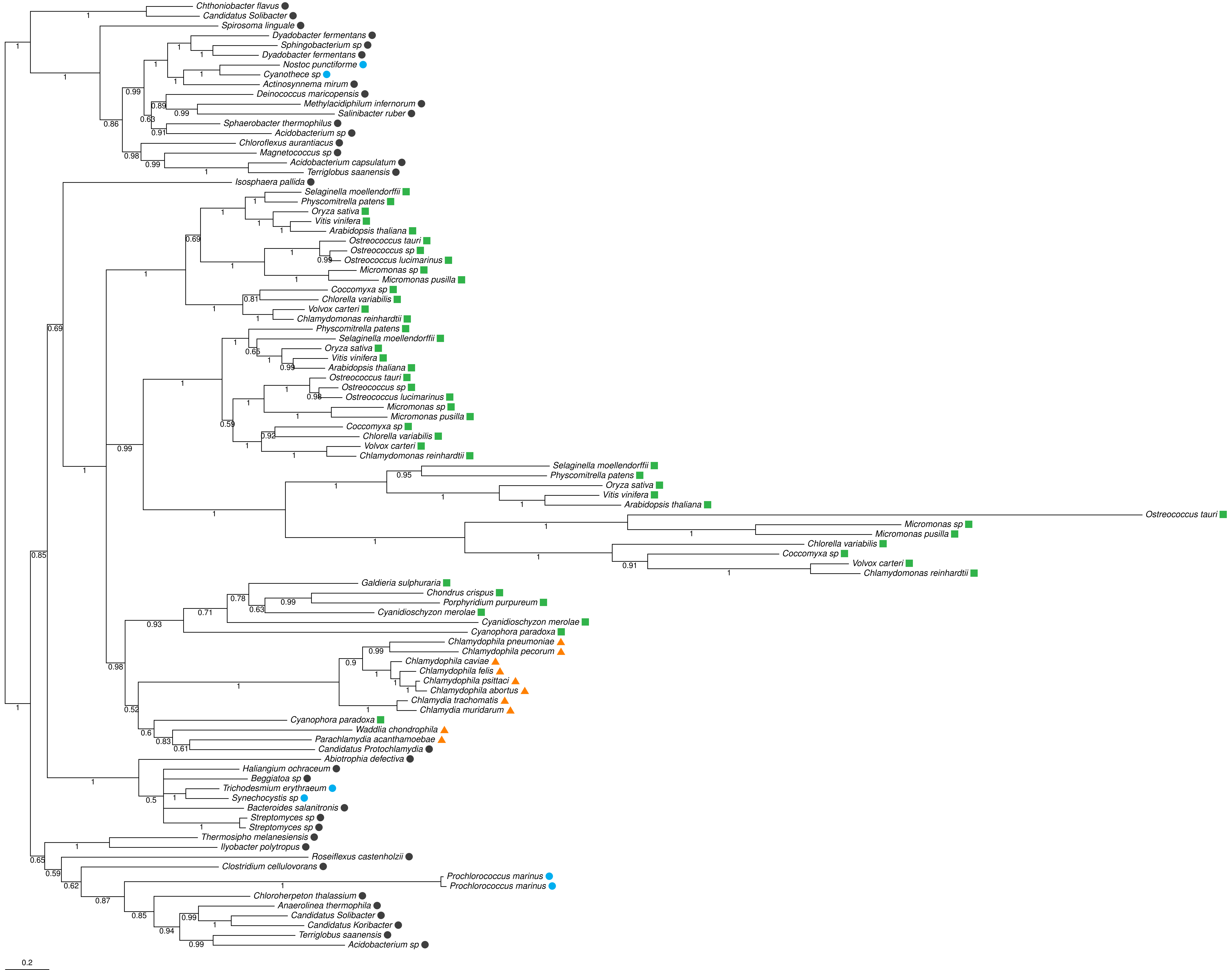
Vitis vinifera
Populus trichocarpa
Populus trichocarpa
Arabidopsis thaliana
Arabidopsis lyrata
Arabidopsis thaliana
Arabidopsis thaliana
Arabidopsis lyrata
Vitis vinifera
Populus trichocarpa
Populus trichocarpa
Arabidopsis thaliana
Arabidopsis lyrata
Nostoc punctiforme PCC 73102
Nostoc azollae 0708
Nostoc sp. PCC 7120
Anabaena variabilis ATCC 29413
Acaryochloris marina MBIC11017
Thermosynechococcus elongatus BP-1
Cyanothece sp. PCC 7425
Acaryochloris marina MBIC11017
Ostreococcus tauri
Ostreococcus lucimarinus CCE9901
Chlamydomonas reinhardtii
Planctomyces limnophilus DSM 3776
Rhodopirellula baltica SH 1
Pirellula staleyi DSM 6068
Isosphaera pallida ATCC 43644
Salinibacter ruber M8
Salinibacter ruber DSM 13855
Rhodothermus marinus DSM 4252
Flavobacteriaceae bacterium 3519-10
Pedobacter heparinus DSM 2366
Flavobacterium johnsoniae UW101
Chitinophaga pinensis DSM 2588
Sorangium cellulosum SO CE 56
Desulfobacterium autotrophicum HRM2
Dehalogenimonas lykanthroporepellens BL-DC-9
Anaerolinea thermophila UNI-1
Treponema denticola ATCC 35405
Spirochaeta thermophila DSM 6192
Spirochaeta smaragdinae DSM 11293
Opitutus terrae PB90-1
Coraliomargarita akajimensis DSM 45221
Leptospira biflexa serovar PATOC str. PATOC1 PARIS
Leptospira biflexa serovar PATOC str. PATOC1 AMES
Protochlamydia amoebophila UWE25
Protochlamydia amoebophila UWE25
Protochlamydia sp EI2
Parachlamydia acanthamoebae UV7
Parachlamydia sp OEW1
Simkania negevensis Z
Chlamydia muridarum NIGG
Chlamydia trachomatis D/UW-3/CX
Chlamydia trachomatis B/TZ1A828/OT
Chlamydia trachomatis SWEDEN2
Chlamydia trachomatis D-LC
Chlamydia trachomatis B/JALI20/OT
Chlamydia trachomatis G/11074
Chlamydia trachomatis D-EC
Chlamydia trachomatis A/HAR-13
Chlamydia trachomatis G/9768
Chlamydia trachomatis E/150
Chlamydia trachomatis L2B/UCH-1/PROCTITIS
Chlamydia trachomatis 434/BU
Chlamydia trachomatis E/11023
Chlamydia trachomatis G/11222
Chlamydophila pneumoniae TW-183
Chlamydophila pneumoniae J138
Chlamydophila pneumoniae AR39
Chlamydophila pneumoniae CWL029
Chlamydophila pneumoniae LPCOLN
Chlamydophila felis FE/C-56
Chlamydophila caviae GPIC
Chlamydophila abortus S26/3
Brachyspira pilosicoli 95/1000
Brachyspira murdochii DSM 12563
Brachyspira hyodysenteriae WA1
Methylacidiphilum infernorum V4
Planctomyces limnophilus DSM 3776
Alkalilimnicola ehrlichii MLHE-1
0.2

Supplementary Figure 1: **Phylogenetic analysis of the GlgC gene under the CAT+GTR model.** This is the complete tree upon which Fig. 3(a) is based. Archaeplastida sequences are denoted with green squares, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, and other bacterial groups with black circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Burkholderia sp. strain CCGE1003
Edwardsiella tarda strain EIB202
Edwardsiella ictaluri strain 93-146
Providencia stuartii strain MRSN 2154
Yersinia pestis strain Z176003
Yersinia pestis bv. Antiqua strain Nepal516
Yersinia pseudotuberculosis serotype IB strain PB1/+
Yersinia enterocolitica subsp. palearctica serotype O_9
Serratia proteamaculans strain 568
Rahnella sp. strain Y9602
Pectobacterium carotovorum subsp. carotovorum strain PC1
Pectobacterium atrosepticum SCRI1043
Dickeya zeae strain Ech1591
Pantoea sp. strain At-9b
Pantoea vagans strain C9-1
Pantoea ananatis strain AJ13355
Erwinia billingiae strain Eb661
Cronobacter turicensis strain DSM 18703
Cronobacter sakazakii strain ATCC BAA-894
Enterobacter lignolyticus SCF1
Klebsiella variicola strain At-22
Enterobacter aerogenes strain ATCC 13048
Enterobacter asburiae strain LF7a
Enterobacter sp. strain 638
Salmonella bongori strain ATCC 43975
Salmonella typhi
Salmonella pullorum strain RKS5078
Salmonella paratyphi C strain RKS4594
Salmonella heidelberg strain SL476
Salmonella enteritidis PT4 strain P125109
Salmonella arizonae strain ATCC BAA-731
Escherichia fergusonii strain ATCC 35469
Shigella sonnei strain Ss046
Escherichia coli strain SMS-3-5
Escherichia coli strain ATCC 55124
Escherichia coli strain B
Escherichia coli O157_H7 strain TW14359
Escherichia coli O150_H5 strain SE15
Escherichia coli O45_K1 strain S88
Escherichia coli O44_H18 strain 042
Citrobacter rodentium strain ICC168
Haemophilus somnus 2336
Haemophilus somnus 129PT
Pasteurella multocida strain Pm70
Haemophilus influenzae strain 86-028NP
Haemophilus influenzae strain ATCC 51907
Haemophilus influenzae strain R2866
Haemophilus influenzae strain PittGG
Haemophilus influenzae strain PittEE
Haemophilus influenzae strain R2846
Aggregatibacter aphrophilus strain NJ8700
Aggregatibacter actinomycetemcomitans serotype C strain D11S-1
Mannheimia succiniciproducens strain MBEL55E
Actinobacillus succinogenes strain ATCC 55618
Actinobacillus pleuropneumoniae serotype 3 strain JL03
Actinobacillus pleuropneumoniae serotype 5b strain L20
Thioalkalivibrio sp. strain HL-EbGR7
Methylovorus glucosetrophus SIP3-4
Methylotenera mobilis strain JLW8
Giardia intestinalis strain ATCC 50803
Volvox carteri f. nagariensis
Chlamydomonas reinhardtii
Ostreococcus lucimarinus CCE9901
Micromonas pusilla CCMP1545
Arabidopsis thaliana
Oryza sativa Japonica Group
Selaginella moellendorffii
Physcomitrella patens
Arabidopsis thaliana
Populus trichocarpa
Vitis vinifera
Sorghum bicolor
Zea mays
Debaryomyces hansenii strain ATCC 36239
Leptospira biflexa serovar Patoc strain Patoc 1
Desulfurispirillum indicum strain ATCC BAA-1389
Magnetococcus sp. strain MC-1
Desulfovibrio magneticus strain ATCC 700980
Desulfomicrobium baculatum strain DSM 4028
Desulfobulbus propionicus strain ATCC 33891
Desulfurivibrio alkaliphilus strain DSM 19089
Chloracidobacterium thermophilum strain B
Geobacter lovleyi strain ATCC BAA-1151
Chlamydia trachomatis serovar E strain E/150
Chlamydia trachomatis serovar L2 strain 434/Bu
Chlamydia trachomatis serovar G strain G/11222
Chlamydophila pneumoniae strain LPCoLN
Chlamydia pneumoniae
Chlamydophila felis strain Fe/C-56
Monosiga brevicollis
Helobdella robusta
Caenorhabditis briggsae
Lottia gigantea
Ciona savignyi
Oreochromis niloticus
Xenopus tropicalis
Gallus gallus
Apis mellifera
Bombyx mori
Anopheles gambiae
Aedes aegypti
Spirochaeta smaragdinae strain DSM 11293
Thermosipho melanesiensis strain BI429
Simkania negevensis Z
Candidatus Protochlamydia amoebophila
Slackia heliotrinireducens strain ATCC 29202
Treponema succinifaciens strain ATCC 33096
Sebaldella termitidis strain ATCC 33386
Eubacterium rectale strain ATCC 33656
Eubacterium eligens strain ATCC 27750
Clostridium saccharolyticum strain ATCC 35040
Streptococcus intermedius strain JTH08
Streptococcus sanguinis strain SK36
Streptococcus gordonii strain Challis
Streptococcus gallolyticus strain UCN34
Streptococcus salivarius strain JIM8777
Streptococcus salivarius strain 57.I
Streptococcus uberis strain ATCC BAA-854
Streptococcus equi subsp. zooepidemicus strain MGCS10565
Streptococcus equi subsp. equi strain 4047
Lactococcus lactis subsp. lactis strain CV56
Lactococcus lactis subsp. cremoris strain SK11
Lactococcus lactis subsp. cremoris strain MG1363
Lactococcus garvieae strain ATCC 49156
Lactobacillus rhamnosus strain Lc 705
Lactobacillus rhamnosus strain ATCC 53103
Lactobacillus casei strain BD-II
Desulfitobacterium hafniense strain Y51
Desulfitobacterium hafniense strain DCB-2
Coriobacterium glomerans strain ATCC 49209
Atopobium parvulum strain ATCC 33793
Peptoclostridium difficile R20291
Peptoclostridium difficile 630
Clostridium botulinum strain Alaska E43
Clostridium cellulovorans strain ATCC 35296
Clostridium acetobutylicum strain EA 2018
Caldicellulosiruptor bescii DSM 6725
Exiguobacterium sibiricum strain DSM 17290
Paenibacillus terrae strain HPL-003
Oceanobacillus iheyensis strain DSM 14371
Bacillus selenitireducens strain ATCC 700615
Bacillus halodurans strain ATCC BAA-125
Natranaerobius thermophilus strain ATCC BAA-1301
Bacillus subtilis strain 168
Bacillus subtilis subsp. spizizenii strain ATCC 23059
Bacillus licheniformis strain DSM 13
Bacillus cereus strain B4264
Bacillus weihenstephanensis strain KBAB4
Bacillus cereus strain G9842
Bacillus cereus strain Q1
Bacillus cereus strain AH187
Bacillus cereus strain ZK
Bacillus cereus strain AH820
Bacillus cereus var. anthracis strain CI
Bacillus thuringiensis strain Al Hakam
Geobacillus thermodenitrificans strain NG80-2
Geobacillus sp. strain Y4.1MC1
Anoxybacillus flavithermus strain DSM 21510
Acidaminococcus fermentans strain ATCC 25085
Saccharophagus degradans strain 2-40
Shewanella frigidimarina strain NCIMB 400
Shewanella violacea strain JCM 10179
Shewanella piezotolerans strain WP3
Shewanella sp. strain MR-7
Shewanella sp. strain W3-18-1
Shewanella putrefaciens strain CN-32
Shewanella baltica strain OS185
Shewanella baltica strain OS155
Shewanella baltica strain OS223
Shewanella amazonensis strain ATCC BAA-1098
Pseudoalteromonas sp. strain SM9913
Thiomicrospira crunogena strain XCL-2
Methylomonas methanica strain MC09
Nitrosococcus watsoni strain C-113
Nitrosococcus oceani strain ATCC 19707
Acidithiobacillus ferrooxidans strain ATCC 23270
Myxococcus fulvus strain ATCC BAA-855
Desulfatibacillum alkenivorans strain AK-01
Anaeromyxobacter sp. strain Fw109-5
Xylanimonas cellulosilytica strain DSM 15894
Jonesia denitrificans strain ATCC 14870
Bifidobacterium longum subsp. infantis strain ATCC 15697
Bifidobacterium longum subsp. longum strain JDM301
Bifidobacterium longum strain DJO10A
Bifidobacterium longum subsp. longum strain ATCC 15707
Bifidobacterium longum subsp. infantis strain 157F
Bifidobacterium dentium strain ATCC 27534
Bifidobacterium bifidum strain S17
Actinoplanes sp. strain ATCC 31044
Cyanothece sp. strain PCC 7425
Microcoleus sp. PCC 7113
Microcystis aeruginosa
Lyngbya aestuarii
Trichodesmium erythraeum strain IMS101
Synechococcus sp. strain ATCC 27144
Gloeobacter violaceus strain PCC 7421
Cyanothece sp. PCC 7424
Synechocystis sp. PCC 6803
Calothrix sp. PCC 7103
Acaryochloris marina
Synechococcus sp. PCC 7335
Terriglobus roseus strain DSM 18391
Mycobacterium sp. strain Spyr1
Mycobacterium gilvum strain PYR-GCK
Mycobacterium abscessus strain ATCC 19977
Parachlamydia sp OEW1
Parachlamydia acanthamoeba UV7
Rhodobacter sphaeroides strain ATCC 17025
Rhodobacter sphaeroides strain ATCC 17029
Granulibacter bethesdensis strain ATCC BAA-1260
Novosphingobium aromaticivorans strain DSM 12444
Hirschia baltica strain ATCC 49814
Rhizobium sp. strain NGR234
Sinorhizobium meliloti strain AK83
Rhizobium meliloti strain 1021
Rhizobium leguminosarum bv. trifolii strain WSM2304
Rhizobium leguminosarum bv. trifolii strain WSM1325
Rhizobium leguminosarum bv. viciae strain 3841
Rhizobium etli strain CIAT 652
Agrobacterium vitis strain S4
Pseudomonas mendocina strain ymp
Pseudomonas fulva strain 12-X
Pseudomonas aeruginosa strain ATCC 15692
Pseudomonas aeruginosa strain UCBPP-PA14
Pseudomonas stutzeri strain A1501
Pseudomonas putida strain KT2440
Pseudomonas putida strain GB-1
Pseudomonas fluorescens strain SBW25
Pseudomonas fluorescens strain Pf-5
Pseudomonas syringae pv. tomato strain DC3000
Pseudomonas syringae pv. phaseolicola strain 1448A
Azotobacter vinelandii strain DJ
Methylobacterium populi strain ATCC BAA-705
Methylobacterium extorquens strain DSM 5838
Methylobacterium extorquens strain ATCC 14718
Rhodopseudomonas palustris strain BisB18
Rhodopseudomonas palustris strain TIE-1
Rhodopseudomonas palustris strain HaA2
Bradyrhizobium sp. strain ORS278
Bradyrhizobium sp. strain BTAi1
Methylocella silvestris strain BL2
Acidiphilium cryptum strain JF-5
0.2

Supplementary Figure 2: **Phylogenetic analysis of the GlgP gene under the CAT+GTR model.** This is the complete tree upon which Fig. 3(b) is based. Archaeplastida sequences are denoted with green squares, other eukaryotes with purple circles, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, and other bacterial groups with black circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Chthoniobacter flavus ●
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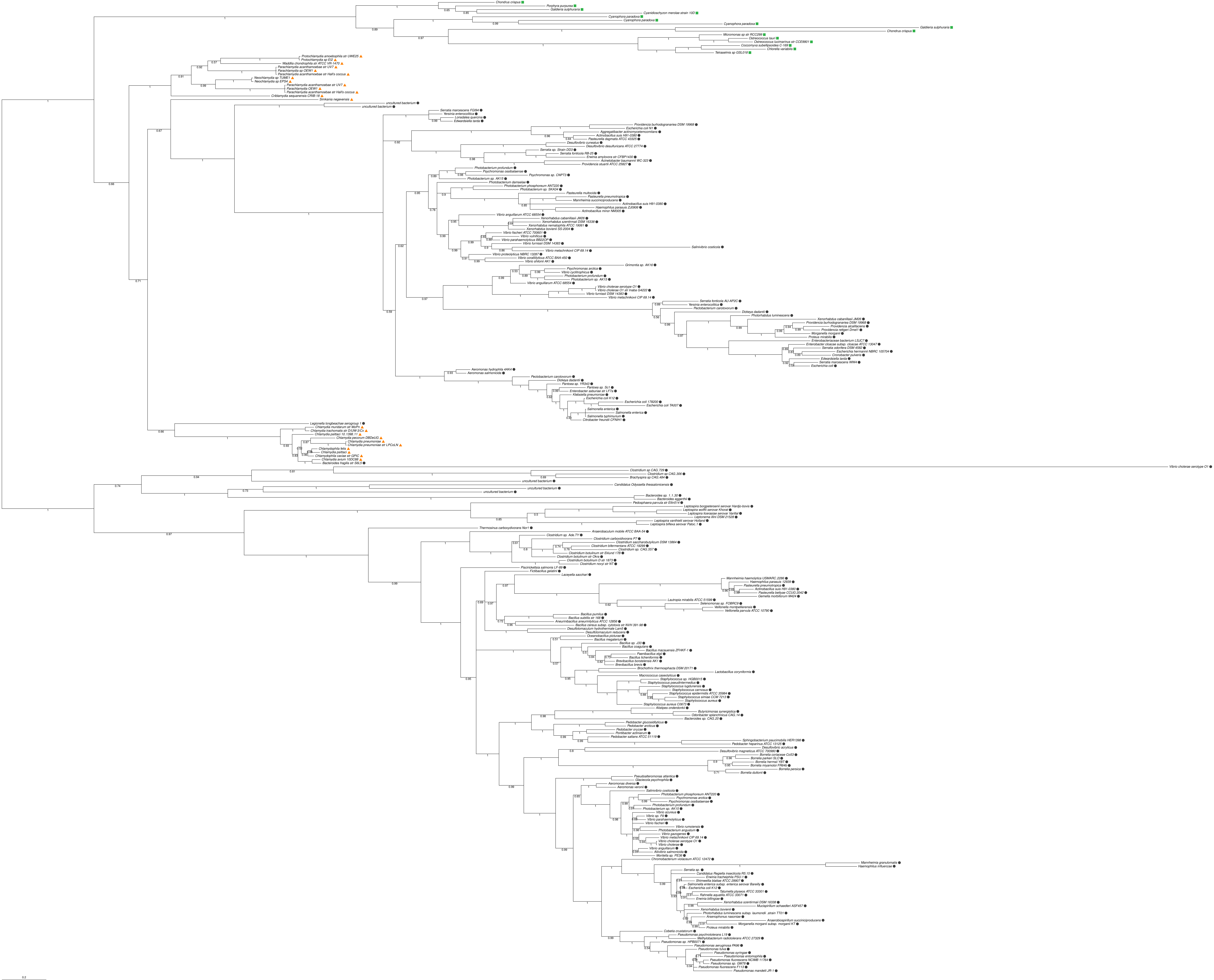
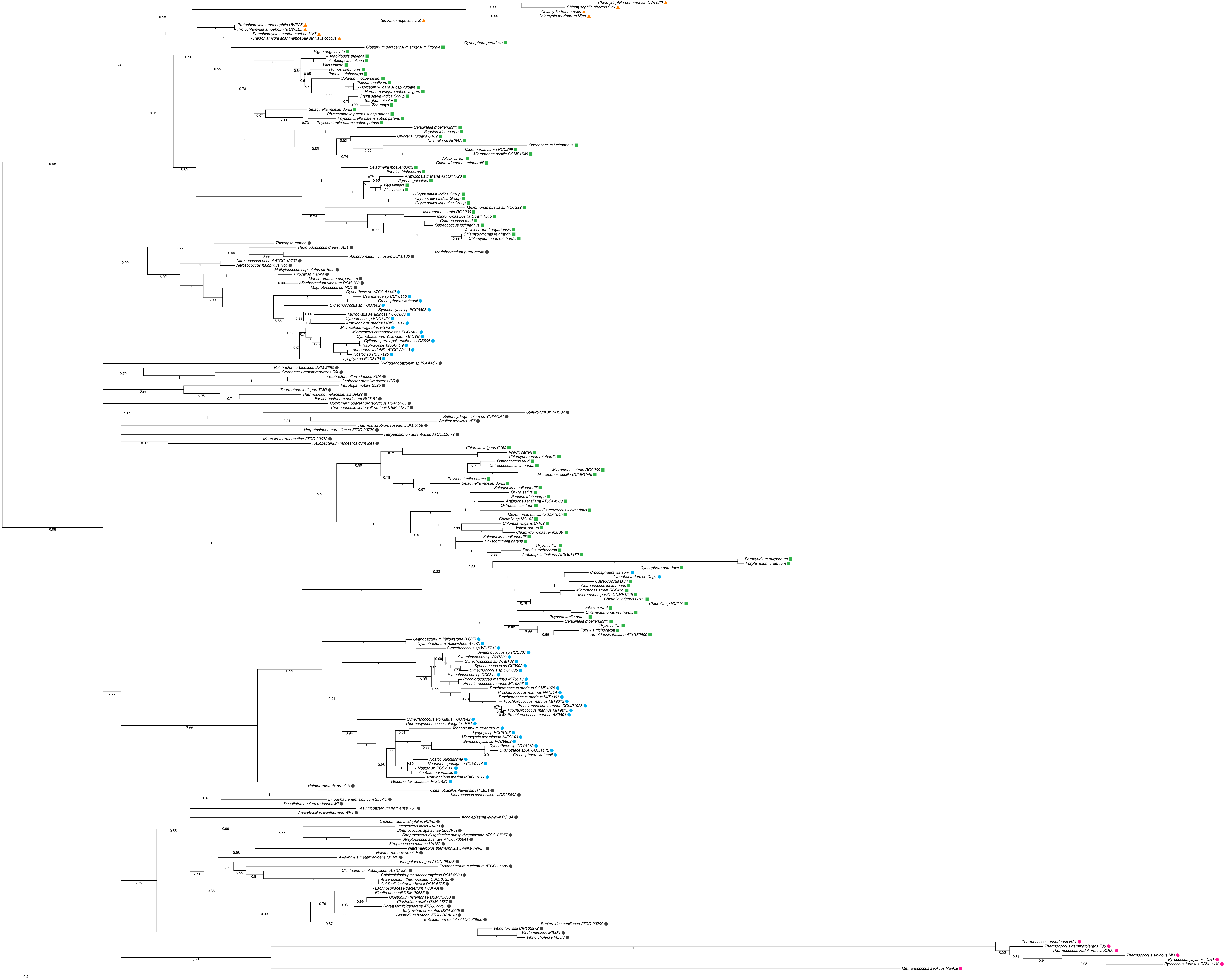
Candidatus Solibacter ●
Spirosoma linguale ●
Dyadobacter fermentans ●
1
Sphingobacterium sp ●
1
Dyadobacter fermentans ●
1
Nostoc punctiforme ●
1
Cyanothece sp ●
1
1
Actinosynnema mirum ●
0.99
Deinococcus maricopensis ●
Methylacidiphilum infernorum ●
0.89
0.99
Salinibacter ruber ●
0.63
0.86
Sphaerobacter thermophilus ●
0.91
Acidobacterium sp ●
Chloroflexus aurantiacus ●
Magnetococcus sp ●
0.98
Acidobacterium capsulatum ●
0.99
1
Terriglobus saanensis ●
Isosphaera pallida ●
Selaginella moellendorffii 🟩
1
Physcomitrella patens 🟩
1
Oryza sativa 🟩
Vitis vinifera 🟩
1
1
Arabidopsis thaliana 🟩
0.69
Ostreococcus tauri 🟩
1
Ostreococcus sp 🟩
0.99
Ostreococcus lucimarinus 🟩
1
Micromonas sp 🟩
1
Micromonas pusilla 🟩
1
Coccomyxa sp 🟩
0.81
Chlorella variabilis 🟩
1
Volvox carteri 🟩
1
Chlamydomonas reinhardtii 🟩
0.69
Physcomitrella patens 🟩
Selaginella moellendorffii 🟩
1
Oryza sativa 🟩
0.65
1
Vitis vinifera 🟩
0.99
Arabidopsis thaliana 🟩
Ostreococcus tauri 🟩
1
1
Ostreococcus sp 🟩
0.98
Ostreococcus lucimarinus 🟩
1
Micromonas sp 🟩
1
Micromonas pusilla 🟩
0.59
Coccomyxa sp 🟩
0.92
Chlorella variabilis 🟩
1
Volvox carteri 🟩
0.99
1
Chlamydomonas reinhardtii 🟩
1
Selaginella moellendorffii 🟩
0.95
Physcomitrella patens 🟩
1
Oryza sativa 🟩
1
Vitis vinifera 🟩
1
Arabidopsis thaliana 🟩
1
Ostreococcus tauri 🟩
Micromonas sp 🟩
1
1
Micromonas pusilla 🟩
1
Chlorella variabilis 🟩
1
Coccomyxa sp 🟩
0.91
Volvox carteri 🟩
1
Chlamydomonas reinhardtii 🟩
0.85
Galdieria sulphuraria 🟩
Chondrus crispus 🟩
0.78
0.99
Porphyridium purpureum 🟩
0.71
0.63
Cyanidioschyzon merolae 🟩
0.93
Cyanidioschyzon merolae 🟩
Cyanophora paradoxa 🟩
Chlamydophila pneumoniae ▲
0.99
Chlamydophila pecorum ▲
0.9
Chlamydophila caviae ▲
0.98
1
Chlamydophila felis ▲
1
Chlamydophila psittaci ▲
1
1
Chlamydophila abortus ▲
Chlamydia trachomatis ▲
1
0.52
Chlamydia muridarum ▲
1
Cyanophora paradoxa 🟩
0.6
Waddlia chondrophila ▲
0.83
Parachlamydia acanthamoebae ▲
0.61
Candidatus Protochlamydia ●
Abiotrophia defectiva ●
Haliangium ochraceum ●
1
Beggiatoa sp ●
Trichodesmium erythraeum ●
0.5
1
Synechocystis sp ●
Bacteroides salanitronis ●
Streptomyces sp ●
1
Streptomyces sp ●
Thermosipho melanesiensis ●
1
Ilyobacter polytropus ●
0.65
Roseiflexus castenholzii ●
0.59
Clostridium cellulovorans ●
0.62
Prochlorococcus marinus ●
1
Prochlorococcus marinus ●
0.87
Chloroherpeton thalassium ●
0.85
Anaerolinea thermophila ●
0.99
Candidatus Solibacter ●
0.94
1
Candidatus Koribacter ●
Terriglobus saanensis ●
0.99
Acidobacterium sp ●
0.2

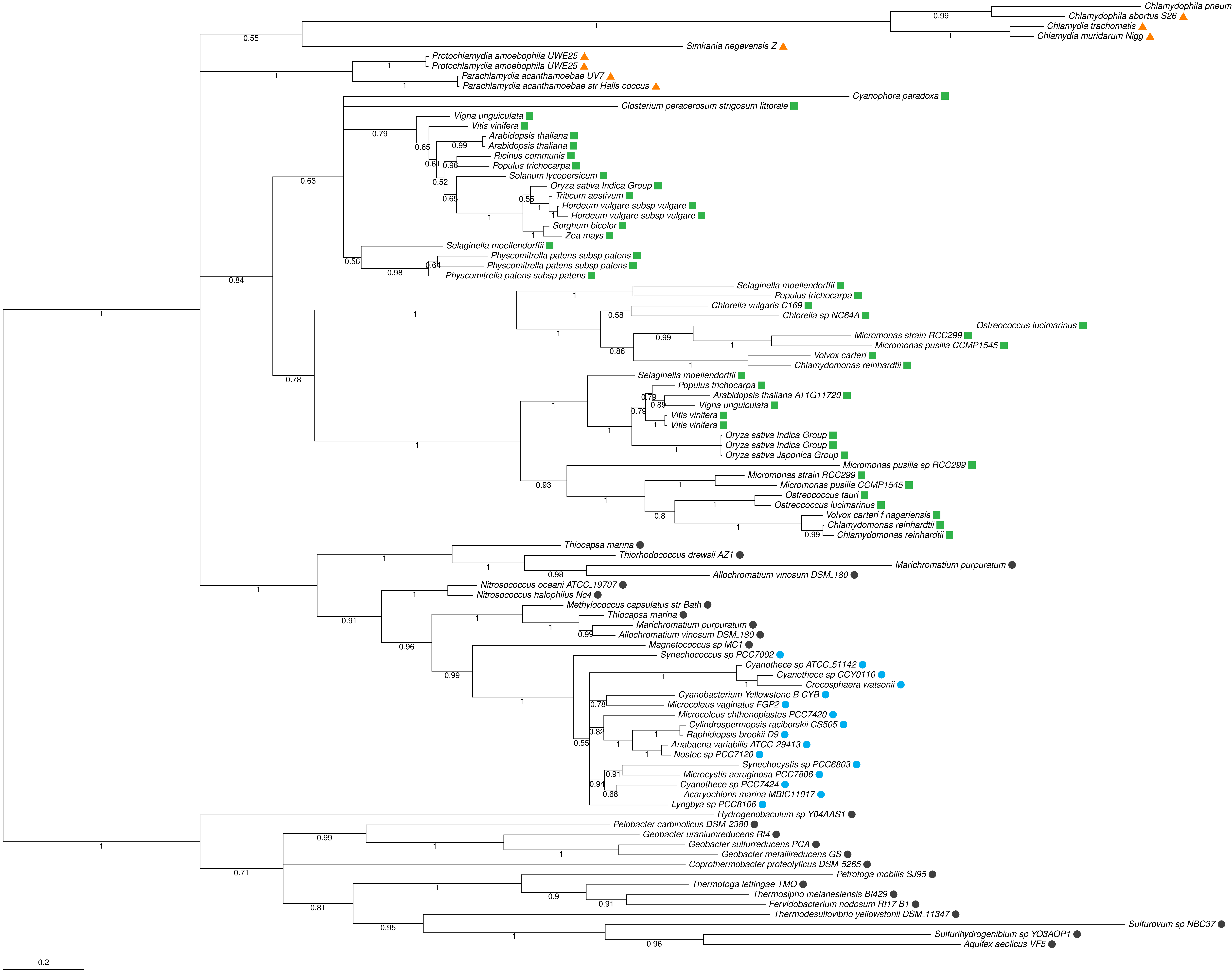
Supplementary Figure 3: **Phylogenetic analysis of the GlgX gene under the CAT+GTR model.** This is the complete tree upon which Fig. 3(c) is based. Archaeplastida sequences are denoted with green squares, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, and other bacterial groups with black circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Chondrus crispus 🟩
Porphyra purpurea 🟩
Galdieria sulphuraria 🟩
Cyanidioschyzon merolae strain 10D 🟩
Cyanophora paradoxa 🟩
Cyanophora paradoxa 🟩
Cyanophora paradoxa 🟩
Galdieria sulphuraria 🟩
Chondrus crispus 🟩
Micromonas sp str RCC299 🟩
Ostreococcus tauri 🟩
Ostreococcus lucimarinus str CCE9901 🟩
Coccomyxa subellipsoidea C-169 🟩
Chlorella variabilis 🟩
Tetraselmis sp GSL018 🟩
Protochlamydia amoebophila str UWE25 ▲
Protochlamydia sp EI2 ▲
Waddlia chondrophila str ATCC VR-1470 ▲
Parachlamydia acanthamoebae str UV7 ▲
Parachlamydia sp OEW1 ▲
Parachlamydia acanthamoebae str Hall's coccus ▲
Neochlamydia sp TUME1 ▲
Neochlamydia sp EPS4 ▲
Parachlamydia acanthamoebae str UV7 ▲
Parachlamydia OEW1 ▲
Parachlamydia acanthamoebae str Hall's coccus ▲
Criblamydia sequanensis CRIB-18 ▲
Simkania negevensis ▲
uncultured bacterium ●
uncultured bacterium ●
Serratia marcescens FGI94 ●
Yersinia enterocolitica ●
Lonsdalea quercina ●
Edwardsiella tarda ●
Providencia burhodogranariea DSM 19968 ●
Escherichia coli N1 ●
Aggregatibacter actinomycetemcomitans ●
Actinobacillus suis H91-0380 ●
Pasteurella dagmatis ATCC 43325 ●
Desulfovibrio cuneatus ●
Desulfovibrio desulfuricans ATCC 27774 ●
Serratia sp. Strain DD3 ●
Serratia fonticola RB-25 ●
Erwinia amylovora str CFBP1430 ●
Acinetobacter baumannii WC-323 ●
Providencia stuartii ATCC 25827 ●
Photobacterium profundum ●
Psychromonas ossibalaenae ●
Psychromonas sp. CNPT3 ●
Photobacterium sp. AK15 ●
Photobacterium damselae ●
Photobacterium phosphoreum ANT220 ●
Photobacterium sp. SKA34 ●
Pasteurella multocida ●
Pasteurella pneumotropica ●
Mannheimia succiniciproducens ●
Actinobacillus suis H91-0380 ●
Haemophilus parasuis ZJ0906 ●
Actinobacillus minor NM305 ●
Vibrio anguillarum ATCC 68554 ●
Xenorhabdus cabanillasii JM26 ●
Xenorhabdus szentirmaii DSM 16338 ●
Xenorhabdus nematophila ATCC 19061 ●
Xenorhabdus bovienii SS-2004 ●
Vibrio fischeri ATCC 700601 ●
Vibrio vulnificus ●
Vibrio parahaemolyticus BB22OP ●
Vibrio furnissii DSM 14383 ●
Vibrio metschnikovii CIP 69.14 ●
Salinivibrio costicola ●
Vibrio proteolyticus NBRC 13287 ●
Vibrio coralliilyticus ATCC BAA-450 ●
Vibrio shilonii AK1 ●
Grimontia sp. AK16 ●
Psychromonas arctica ●
Vibrio cyclitrophicus ●
Photobacterium profundum ●
Photobacterium sp. AK15 ●
Vibrio anguillarum ATCC 68554 ●
Vibrio cholerae serotype O1 ●
Vibrio cholerae O1 str Inaba G4222 ●
Vibrio furnissii DSM 14383 ●
Vibrio metschnikovii CIP 69.14 ●
Serratia fonticola AU-AP2C ●
Yersinia enterocolitica ●
Pectobacterium carotovorum ●
Dickeya dadantii ●
Photorhabdus luminescens ●
Xenorhabdus cabanillasii JM26 ●
Providencia burhodogranariea DSM 19968 ●
Providencia alcalifaciens ●
Providencia rettgeri Dmel1 ●
Morganella morganii ●
Proteus mirabilis ●
Enterobacteriaceae bacterium LSJC7 ●
Enterobacter cloacae subsp. cloacae ATCC 13047 ●
Serratia odorifera DSM 4582 ●
Escherichia hermannii NBRC 105704 ●
Cronobacter pulveris ●
Edwardsiella tarda ●
Serratia marcescens WW4 ●
Escherichia coli ●
Aeromonas hydrophila 4AK4 ●
Aeromonas salmonicida ●
Pectobacterium carotovorum ●
Dickeya dadantii ●
Pantoea sp. YR343 ●
Pantoea sp. Sc1 ●
Enterobacter asburiae str LF7a ●
Klebsiella pneumoniae ●
Escherichia coli K12 ●
Escherichia coli 178200 ●
Escherichia coli TA007 ●
Salmonella enterica ●
Salmonella enterica ●
Salmonella typhimurium ●
Citrobacter freundii CFNIH1 ●
Legionella longbeachae serogroup 1 ●
Chlamydia muridarum str MoPn ▲
Chlamydia trachomatis str D/UW-3/Cx ▲
Chlamydia psittaci 10.1398.11 ▲
Chlamydia pecorum DBDeUG ▲
Chlamydia pneumoniae ▲
Chlamydia pneumoniae str LPCoLN ▲
Chlamydophila felis ▲
Chlamydia psittaci ▲
Chlamydia caviae str GPIC ▲
Chlamydia avium 10DC88 ▲
Bacteroides fragilis str S6L5 ●
Vibrio cholerae serotype O1 ●
Clostridium sp CAG.729 ●
Clostridium sp CAG.306 ●
Brachyspira sp CAG.484 ●
uncultured bacterium ●
Candidatus Odyssella thessalonicensis ●
uncultured bacterium ●
uncultured bacterium ●
Bacteroides sp. 1.1.30 ●
Bacteroides eggerthii ●
Pedosphaera parvula str Ellin514 ●
Leptospira borgpetersenii serovar Hardjo-bovis ●
Leptospira wolffii serovar Khorat ●
Leptospira licerasiae serovar Varillal ●
Leptonema illini DSM 21528 ●
Leptospira vanthielii serovar Holland ●
Leptospira biflexa serovar Patoc 1 ●
Thermosinus carboxydivorans Nor1 ●
Anaerobaculum mobile ATCC BAA-54 ●
Clostridium sp. Ade.TY ●
Clostridium carboxidivorans P7 ●
Clostridium saccharobutylicum DSM 13864 ●
Clostridium bifermentans ATCC 19299 ●
Clostridium sp. CAG.557 ●
Clostridium botulinum str Eklund 17B ●
Clostridium botulinum str Okra ●
Clostridium botulinum D str 1873 ●
Clostridium novyi str NT ●
Piscirickettsia salmonis LF-89 ●
Fictibacillus gelatini ●
Laceyella sacchari ●
Mannheimia haemolytica USMARC 2286 ●
Haemophilus parasuis 12939 ●
Pasteurella pneumotropica ●
Actinobacillus suis H91-0380 ●
Pasteurella bettyae CCUG 2042 ●
Gemella morbillorum M424 ●
Lautropia mirabilis ATCC 51599 ●
Selenomonas sp. FOBRC9 ●
Veillonella montpellierensis ●
Veillonella parvula ATCC 10790 ●
Bacillus pumilus ●
Bacillus subtilis str 168 ●
Aneurinibacillus aneurinilyticus ATCC 12856 ●
Bacillus cereus subsp. cytotoxis str NVH 391-98 ●
Desulfotomaculum hydrothermale Lam5 ●
Desulfotomaculum reducens ●
Oceanobacillus picturae ●
Bacillus megaterium ●
Bacillus sp. J33 ●
Bacillus coagulans ●
Bacillus macauensis ZFHKF-1 ●
Paenibacillus elgii ●
Bacillus licheniformis ●
Brevibacillus borstelensis AK1 ●
Brevibacillus brevis ●
Brochothrix thermosphacta DSM 20171 ●
Lactobacillus coryniformis ●
Macrococcus caseolyticus ●
Staphylococcus sp. HGB0015 ●
Staphylococcus pseudintermedius ●
Staphylococcus lugdunensis ●
Staphylococcus carnosus ●
Staphylococcus epidermidis ATCC 35984 ●
Staphylococcus simiae CCM 7213 ●
Staphylococcus aureus ●
Staphylococcus aureus C0673 ●
Alistipes onderdonkii ●
Butyricimonas synergistica ●
Odoribacter splanchnicus CAG.14 ●
Bacteroides sp. CAG.20 ●
Pedobacter glucosidilyticus ●
Pedobacter arcticus ●
Pedobacter oryzae ●
Pontibacter actiniarum ●
Pedobacter saltans ATCC 51119 ●
Sphingobacterium paucimobilis HER1398 ●
Pedobacter heparinus ATCC 13125 ●
Desulfovibrio magneticus ATCC 700980 ●
Desulfovibrio africanus ●
Borrelia coriaceae Co53 ●
Borrelia parkeri SLO ●
Borrelia hermsii YBT ●
Borrelia miyamotoi FR64b ●
Borrelia persica ●
Borrelia duttonii ●
Pseudoalteromonas atlantica ●
Glaciecola psychrophila ●
Aeromonas diversa ●
Aeromonas veronii ●
Salinivibrio costicola ●
Photobacterium phosphoreum ANT220 ●
Psychromonas arctica ●
Psychromonas ossibalaenae ●
Photobacterium profundum ●
Photobacterium sp. AK15 ●
Vibrio azureus ●
Vibrio sp. F6 ●
Vibrio parahaemolyticus ●
Vibrio fischeri ●
Vibrio rumoiensis ●
Photobacterium angustum ●
Vibrio ezurae ●
Vibrio metschnikovii CIP 69.14 ●
Vibrio cholerae serotype O1 ●
Vibrio cholerae ●
Vibrio anguillarum ●
Aliivibrio salmonicida ●
Moritella sp. PE36 ●
Chromobacterium violaceum ATCC 12472 ●
Mannheimia granulomatis ●
Haemophilus influenzae ●
Serratia sp. ●
Candidatus Regiella insecticola R5.15 ●
Erwinia tracheiphila PSU-1 ●
Shimwellia blattae ATCC 29907 ●
Salmonella enterica subsp. enterica serovar Bareilly ●
Escherichia coli K12 ●
Tatumella ptyseos ATCC 33301 ●
Rahnella aquatilis ATCC 33071 ●
Erwinia billingiae ●
Xenorhabdus szentirmaii DSM 16338 ●
Mucispirillum schaedleri ASF457 ●
Xenorhabdus bovienii ●
Photorhabdus luminescens subsp. laumondii strain TT01 ●
Arsenophonus nasoniae ●
Anaerobiospirillum succiniciproducens ●
Morganella morganii subsp. morganii KT ●
Proteus mirabilis ●
Cobetia crustatorum ●
Pseudomonas psychrotolerans L19 ●
Methylobacterium radiotolerans ATCC 27329 ●
Pseudomonas sp. HPB0071 ●
Pseudomonas aeruginosa PA96 ●
Pseudomonas fulva ●
Pseudomonas syringae ●
Pseudomonas entomophila ●
Pseudomonas fluorescens NCIMB 11764 ●
Pseudomonas sp. GM78 ●
Pseudomonas fluorescens F113 ●
Pseudomonas mandelii JR-1 ●
0.2

Supplementary Figure 4: **Phylogenetic analysis of the UhpC gene under the CAT+GTR model.** This is the complete tree upon which Fig. 3(d) is based. Archaeplastida sequences are denoted with green squares, *Chlamydiae* with orange triangles, and other bacterial groups with black circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Chlamydophila pneumoniae CWL029
Chlamydophila abortus S26
Chlamydia trachomatis
Chlamydia muridarum Nigg
Simkania negevensis Z
Protochlamydia amoebophila UWE25
Protochlamydia amoebophila UWE25
Parachlamydia acanthamoebae UV7
Parachlamydia acanthamoebae str Halls coccus
Cyanophora paradoxa
Closterium peracerosum strigosum littorale
Vigna unguiculata
Arabidopsis thaliana
Arabidopsis thaliana
Vitis vinifera
Ricinus communis
Populus trichocarpa
Solanum lycopersicum
Triticum aestivum
Hordeum vulgare subsp vulgare
Hordeum vulgare subsp vulgare
Oryza sativa Indica Group
Sorghum bicolor
Zea mays
Selaginella moellendorffii
Physcomitrella patens subsp patens
Physcomitrella patens subsp patens
Physcomitrella patens subsp patens
Selaginella moellendorffii
Populus trichocarpa
Chlorella vulgaris C169
Chlorella sp NC64A
Ostreococcus lucimarinus
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Volvox carteri
Chlamydomonas reinhardtii
Selaginella moellendorffii
Populus trichocarpa
Arabidopsis thaliana AT1G11720
Vigna unguiculata
Vitis vinifera
Vitis vinifera
Oryza sativa Indica Group
Oryza sativa Indica Group
Oryza sativa Japonica Group
Micromonas pusilla sp RCC299
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Ostreococcus tauri
Ostreococcus lucimarinus
Volvox carteri f nagariensis
Chlamydomonas reinhardtii
Chlamydomonas reinhardtii
Thiocapsa marina
Thiorhodococcus drewsii AZ1
Marichromatium purpuratum
Allochromatium vinosum DSM.180
Nitrosococcus oceani ATCC.19707
Nitrosococcus halophilus Nc4
Methylococcus capsulatus str Bath
Thiocapsa marina
Marichromatium purpuratum
Allochromatium vinosum DSM.180
Magnetococcus sp MC1
Cyanothece sp ATCC.51142
Cyanothece sp CCY0110
Crocosphaera watsonii
Synechococcus sp PCC7002
Synechocystis sp PCC6803
Microcystis aeruginosa PCC7806
Cyanothece sp PCC7424
Acaryochloris marina MBIC11017
Microcoleus vaginatus FGP2
Microcoleus chthonoplastes PCC7420
Cyanobacterium Yellowstone B CYB
Cylindrospermopsis raciborskii CS505
Raphidiopsis brookii D9
Anabaena variabilis ATCC.29413
Nostoc sp PCC7120
Lyngbya sp PCC8106
Hydrogenobaculum sp Y04AAS1
Pelobacter carbinolicus DSM.2380
Geobacter uraniumreducens Rf4
Geobacter sulfurreducens PCA
Geobacter metallireducens GS
Petrotoga mobilis SJ95
Thermotoga lettingae TMO
Thermosipho melanesiensis BI429
Fervidobacterium nodosum Rt17 B1
Coprothermobacter proteolyticus DSM.5265
Thermodesulfovibrio yellowstonii DSM.11347
Sulfurovum sp NBC37
Sulfurihydrogenibium sp YO3AOP1
Aquifex aeolicus VF5
Thermomicrobium roseum DSM.5159
Herpetosiphon aurantiacus ATCC.23779
Herpetosiphon aurantiacus ATCC.23779
Moorella thermoacetica ATCC.39073
Heliobacterium modesticaldum Ice1
Chlorella vulgaris C169
Volvox carteri
Chlamydomonas reinhardtii
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Physcomitrella patens
Selaginella moellendorffii
Selaginella moellendorffii
Oryza sativa
Populus trichocarpa
Arabidopsis thaliana AT5G24300
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas pusilla CCMP1545
Chlorella sp NC64A
Chlorella vulgaris C-169
Volvox carteri
Chlamydomonas reinhardtii
Selaginella moellendorffii
Physcomitrella patens
Oryza sativa
Populus trichocarpa
Arabidopsis thaliana AT3G01180
Porphyridium purpureum
Porphyridium cruentum
Cyanophora paradoxa
Crocosphaera watsonii
Cyanobacterium sp CLg1
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Chlorella vulgaris C169
Chlorella sp NC64A
Volvox carteri
Chlamydomonas reinhardtii
Physcomitrella patens
Selaginella moellendorffii
Oryza sativa
Populus trichocarpa
Arabidopsis thaliana AT1G32900
Cyanobacterium Yellowstone B CYB
Cyanobacterium Yellowstone A CYA
Synechococcus sp WH5701
Synechococcus sp RCC307
Synechococcus sp WH7803
Synechococcus sp WH8102
Synechococcus sp CC9902
Synechococcus sp CC9605
Synechococcus sp CC9311
Prochlorococcus marinus MIT9313
Prochlorococcus marinus MIT9303
Prochlorococcus marinus CCMP1375
Prochlorococcus marinus NATL1A
Prochlorococcus marinus MIT9301
Prochlorococcus marinus MIT9312
Prochlorococcus marinus CCMP1986
Prochlorococcus marinus MIT9215
Prochlorococcus marinus AS9601
Synechococcus elongatus PCC7942
Thermosynechococcus elongatus BP1
Trichodesmium erythraeum
Lyngbya sp PCC8106
Microcystis aeruginosa NIES843
Synechocystis sp PCC6803
Cyanothece sp CCY0110
Cyanothece sp ATCC.51142
Crocosphaera watsonii
Nostoc punctiforme
Nodularia spumigena CCY9414
Nostoc sp PCC7120
Anabaena variabilis
Acaryochloris marina MBIC11017
Gloeobacter violaceus PCC7421
Halothermothrix orenii H
Oceanobacillus iheyensis HTE831
Macrococcus caseolyticus JCSC5402
Exiguobacterium sibiricum 255-15
Desulfotomaculum reducens MI
Desulfitobacterium hafniense Y51
Anoxybacillus flavithermus WK1
Acholeplasma laidlawii PG 8A
Lactobacillus acidophilus NCFM
Lactococcus lactis Il1403
Streptococcus agalactiae 2603V R
Streptococcus dysgalactiae subsp dysgalactiae ATCC.27957
Streptococcus australis ATCC.700641
Streptococcus mutans UA159
Natranaerobius thermophilus JWNM-WN-LF
Halothermothrix orenii H
Alkaliphilus metalliredigens QYMF
Finegoldia magna ATCC.29328
Fusobacterium nucleatum ATCC.25586
Clostridium acetobutylicum ATCC.824
Caldicellulosiruptor saccharolyticus DSM.8903
Anaerocellum thermophilum DSM.6725
Caldicellulosiruptor bescii DSM.6725
Lachnospiraceae bacterium 1 63FAA
Blautia hansenii DSM.20583
Clostridium hylemonae DSM.15053
Clostridium nexile DSM.1787
Dorea formicigenerans ATCC.27755
Butyrivibrio crossotus DSM.2876
Clostridium bolteae ATCC.BAA613
Eubacterium rectale ATCC.33656
Bacteroides capillosus ATCC.29799
Vibrio furnissii CIP102972
Vibrio mimicus MB451
Vibrio cholerae MZO3
Thermococcus onnurineus NA1
Thermococcus gammatolerans EJ3
Thermococcus kodakarensis KOD1
Thermococcus sibiricus MM
Pyrococcus yayanosii CH1
Pyrococcus furiosus DSM.3638
Methanococcus aeolicus Nankai
0.2

Supplementary Figure 5: **Phylogenetic analysis of the GlgA gene under the CAT+GTR model.** This is the complete tree upon which Fig. 4(a) is based. Archaeplastida sequences are denoted with green squares, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, other bacterial groups with black circles, and Archaea with pink circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Chlamydophila pneumoniae CWL029 ▲
Chlamydophila abortus S26 ▲
0.99
1
Chlamydia trachomatis ▲
Chlamydia muridarum Nigg ▲
1
0.55
Simkania negevensis Z ▲
Protochlamydia amoebophila UWE25 ▲
1
Protochlamydia amoebophila UWE25 ▲
1
Parachlamydia acanthamoebae UV7 ▲
1
Parachlamydia acanthamoebae str Halls coccus ▲
Cyanophora paradoxa 🟩
Closterium peracerosum strigosum littorale 🟩
Vigna unguiculata 🟩
Vitis vinifera 🟩
0.79
Arabidopsis thaliana 🟩
0.65
0.99
Arabidopsis thaliana 🟩
Ricinus communis 🟩
0.61
0.96
Populus trichocarpa 🟩
Solanum lycopersicum 🟩
0.52
0.63
Oryza sativa Indica Group 🟩
Triticum aestivum 🟩
0.65
0.55
1
Hordeum vulgare subsp vulgare 🟩
1
Hordeum vulgare subsp vulgare 🟩
1
Sorghum bicolor 🟩
1
Zea mays 🟩
Selaginella moellendorffii 🟩
Physcomitrella patens subsp patens 🟩
0.56
0.64
Physcomitrella patens subsp patens 🟩
0.98
Physcomitrella patens subsp patens 🟩
0.84
Selaginella moellendorffii 🟩
1
Populus trichocarpa 🟩
1
Chlorella vulgaris C169 🟩
0.58
Chlorella sp NC64A 🟩
1
Ostreococcus lucimarinus 🟩
0.99
Micromonas strain RCC299 🟩
1
Micromonas pusilla CCMP1545 🟩
0.86
Volvox carteri 🟩
1
Chlamydomonas reinhardtii 🟩
0.78
Selaginella moellendorffii 🟩
Populus trichocarpa 🟩
0.79
Arabidopsis thaliana AT1G11720 🟩
1
0.89
Vigna unguiculata 🟩
0.79
Vitis vinifera 🟩
1
Vitis vinifera 🟩
1
Oryza sativa Indica Group 🟩
1
Oryza sativa Indica Group 🟩
1
Oryza sativa Japonica Group 🟩
Micromonas pusilla sp RCC299 🟩
Micromonas strain RCC299 🟩
1
Micromonas pusilla CCMP1545 🟩
0.93
Ostreococcus tauri 🟩
1
1
Ostreococcus lucimarinus 🟩
0.8
Volvox carteri f nagariensis 🟩
1
Chlamydomonas reinhardtii 🟩
0.99
Chlamydomonas reinhardtii 🟩
Thiocapsa marina ●
Thiorhodococcus drewsii AZ1 ●
1
1
Marichromatium purpuratum ●
0.98
Allochromatium vinosum DSM_180 ●
1
Nitrosococcus oceani ATCC_19707 ●
1
Nitrosococcus halophilus Nc4 ●
0.91
Methylococcus capsulatus str Bath ●
1
Thiocapsa marina ●
1
Marichromatium purpuratum ●
0.99
Allochromatium vinosum DSM_180 ●
0.96
Magnetococcus sp MC1 ●
Synechococcus sp PCC7002 ●
0.99
Cyanothece sp ATCC_51142 ●
1
Cyanothece sp CCY0110 ●
1
Crocosphaera watsonii ●
1
Cyanobacterium Yellowstone B CYB ●
0.78
Microcoleus vaginatus FGP2 ●
Microcoleus chthonoplastes PCC7420 ●
Cylindrospermopsis raciborskii CS505 ●
0.82
1
Raphidiopsis brookii D9 ●
0.55
1
Anabaena variabilis ATCC_29413 ●
1
Nostoc sp PCC7120 ●
Synechocystis sp PCC6803 ●
0.91
Microcystis aeruginosa PCC7806 ●
0.94
Cyanothece sp PCC7424 ●
0.68
Acaryochloris marina MBIC11017 ●
Lyngbya sp PCC8106 ●
1
Hydrogenobaculum sp Y04AAS1 ●
Pelobacter carbinolicus DSM_2380 ●
0.99
Geobacter uraniumreducens Rf4 ●
1
Geobacter sulfurreducens PCA ●
1
Geobacter metallireducens GS ●
1
Coprothermobacter proteolyticus DSM_5265 ●
0.71
Petrotoga mobilis SJ95 ●
1
Thermotoga lettingae TMO ●
0.9
Thermosipho melanesiensis BI429 ●
0.91
Fervidobacterium nodosum Rt17 B1 ●
0.81
Thermodesulfovibrio yellowstonii DSM_11347 ●
0.95
Sulfurovum sp NBC37 ●
1
Sulfurihydrogenibium sp YO3AOP1 ●
0.96
Aquifex aeolicus VF5 ●
0.2

Supplementary Figure 6: **Phylogenetic analysis of the GlgA gene with only the closest outgroup clade under the CAT+GTR model.** This is the complete tree upon which Fig. 4(b) is based. Archaeplastida sequences are denoted with green squares, other eukaryotes with purple circles, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, and other bacterial groups with black circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Cyanophora paradoxa
Chlamydophila pneumoniae CWL029
Chlamydophila abortus S26
Chlamydia trachomatis
Chlamydia muridarum Nigg
Simkania negevensis Z
Protochlamydia amoebophila UWE25
Candidatus Protochlamydia amoebophila UWE25
Parachlamydia acanthamoebae UV7
Parachlamydia acanthamoebae str Halls coccus
Closterium peracerosum strigosum littorale
Selaginella moellendorffii
Vigna unguiculata
Arabidopsis thaliana
Arabidopsis thaliana
Vitis vinifera
Ricinus communis
Populus trichocarpa
Solanum lycopersicum
Oryza sativa Indica Group
Triticum aestivum
Hordeum vulgare subsp vulgare
Hordeum vulgare subsp vulgare
Sorghum bicolor
Zea mays
Physcomitrella patens subsp patens
Physcomitrella patens subsp patens
Physcomitrella patens subsp patens
Micromonas strain RCC299
Ostreococcus lucimarinus
Micromonas pusilla CCMP1545
Selaginella moellendorffii
Populus trichocarpa
Chlorella vulgaris C169
Chlorella sp NC64A
Volvox carteri
Chlamydomonas reinhardtii
Micromonas pusilla sp RCC299
Populus trichocarpa
Arabidopsis thaliana AT1G11720
Vigna unguiculata
Vitis vinifera
Vitis vinifera
Oryza sativa Indica Group
Oryza sativa Indica Group
Oryza sativa Japonica Group
Selaginella moellendorffii
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Ostreococcus tauri
Ostreococcus lucimarinus
Volvox carteri f nagariensis
Chlamydomonas reinhardtii
Chlamydomonas reinhardtii
Thiocapsa marina
Thiorhodococcus drewsii AZ1
Marichromatium purpuratum
Allochromatium vinosum DSM_180
Nitrosococcus oceani ATCC_19707
Nitrosococcus halophilus Nc4
Methylococcus capsulatus str Bath
Thiocapsa marina
Marichromatium purpuratum
Allochromatium vinosum DSM_180
Magnetococcus sp MC1
Synechococcus sp PCC7002
Microcoleus vaginatus FGP2
Cyanothece sp ATCC_51142
Cyanothece sp CCY0110
Crocosphaera watsonii
Microcoleus chthonoplastes PCC7420
Cyanobacterium Yellowstone B CYB
Cylindrospermopsis raciborskii CS505
Raphidiopsis brookii D9
Anabaena variabilis ATCC_29413
Nostoc sp PCC7120
Synechocystis sp PCC6803
Microcystis aeruginosa PCC7806
Cyanothece sp PCC7424
Acaryochloris marina MBIC11017
Lyngbya sp PCC8106
Thermomicrobium roseum DSM_5159
Thermodesulfovibrio yellowstonii DSM_11347
Oceanobacillus iheyensis HTE831
Macrococcus caseolyticus JCSC5402
Hydrogenobaculum sp Y04AAS1
Herpetosiphon aurantiacus ATCC_23779
Herpetosiphon aurantiacus ATCC_23779
Moorella thermoacetica ATCC_39073
Heliobacterium modesticaldum Ice1
Halothermothrix orenii H
Natranaerobius thermophilus JWNM-WN-LF
Halothermothrix orenii H
Pelobacter carbinolicus DSM_2380
Geobacter uraniumreducens Rf4
Geobacter sulfurreducens PCA
Geobacter metallireducens GS
Finegoldia magna ATCC_29328
Exiguobacterium sibiricum 255-15
Desulfitobacterium hafniense Y51
Coprothermobacter proteolyticus DSM_5265
Selaginella moellendorffii
Selaginella moellendorffii
Physcomitrella patens
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas strain RCC299
Micromonas pusilla CCMP1545
Chlorella vulgaris C169
Volvox carteri
Chlamydomonas reinhardtii
Oryza sativa
Populus trichocarpa
Arabidopsis thaliana AT5G24300
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas pusilla CCMP1545
Chlorella vulgaris C-169
Chlorella sp NC64A
Volvox carteri
Chlamydomonas reinhardtii
Selaginella moellendorffii
Physcomitrella patens
Populus trichocarpa
Oryza sativa
Arabidopsis thaliana AT3G01180
Cyanophora paradoxa
Porphyridium purpureum
Porphyridium cruentum
Crocosphaera watsonii
Cyanobacterium sp CLg1
Micromonas strain RCC299
Ostreococcus tauri
Ostreococcus lucimarinus
Micromonas pusilla CCMP1545
Chlorella vulgaris C169
Chlorella sp NC64A
Volvox carteri
Chlamydomonas reinhardtii
Selaginella moellendorffii
Physcomitrella patens
Oryza sativa
Populus trichocarpa
Arabidopsis thaliana AT1G32900
Desulfotomaculum reducens MI
Anoxybacillus flavithermus WK1
Alkaliphilus metalliredigens QYMF
Sulfurovum sp NBC37
Sulfurihydrogenibium sp YO3AOP1
Aquifex aeolicus VF5
Acholeplasma laidlawii PG 8A
Lactobacillus acidophilus NCFM
Lactococcus lactis Il1403
Streptococcus agalactiae 2603V R
Streptococcus dysgalactiae subsp dysgalactiae ATCC_27957
Streptococcus australis ATCC_700641
Streptococcus mutans UA159
Fusobacterium nucleatum ATCC_25586
Clostridium acetobutylicum ATCC_824
Caldicellulosiruptor saccharolyticus DSM_8903
Anaerocellum thermophilum DSM_6725
Caldicellulosiruptor bescii DSM_6725
Thermotoga lettingae TMO
Thermosipho melanesiensis BI429
Fervidobacterium nodosum Rt17 B1
Petrotoga mobilis SJ95
Pyrococcus yayanosii CH1
Thermococcus sibiricus MM
Thermococcus kodakarensis KOD1
Thermococcus gammatolerans EJ3
Thermococcus onnurineus NA1
Pyrococcus furiosus DSM_3638
Lachnospiraceae bacterium 1 63FAA
Blautia hansenii DSM_20583
Butyrivibrio crossotus DSM_2876
Clostridium nexile DSM_1787
Clostridium hylemonae DSM_15053
Dorea formicigenerans ATCC_27755
Eubacterium rectale ATCC_33656
Clostridium bolteae ATCC_BAA613
Bacteroides capillosus ATCC_29799
Vibrio furnissii CIP102972
Vibrio mimicus MB451
Vibrio cholerae MZO3
Gloeobacter violaceus PCC7421
Trichodesmium erythraeum
Thermosynechococcus elongatus BP1
Synechocystis sp PCC6803
Synechococcus elongatus PCC7942
Microcystis aeruginosa NIES843
Lyngbya sp PCC8106
Synechococcus sp WH5701
Synechococcus sp WH7803
Synechococcus sp RCC307
Synechococcus sp CC9902
Synechococcus sp WH8102
Synechococcus sp CC9605
Synechococcus sp CC9311
Prochlorococcus marinus MIT9313
Prochlorococcus marinus MIT9303
Prochlorococcus marinus NATL1A
Prochlorococcus marinus CCMP1375
Prochlorococcus marinus MIT9312
Prochlorococcus marinus MIT9301
Prochlorococcus marinus CCMP1986
Prochlorococcus marinus MIT9215
Prochlorococcus marinus AS9601
Cyanobacterium Yellowstone B CYB
Cyanobacterium Yellowstone A CYA
Cyanothece sp ATCC_51142
Cyanothece sp CCY0110
Crocosphaera watsonii
Nostoc punctiforme
Nodularia spumigena CCY9414
Nostoc sp PCC7120
Anabaena variabilis
Acaryochloris marina MBIC11017
Methanococcus aeolicus Nankai
0.2

Supplementary Figure 7: **Phylogenetic analysis of the Dayhoff-recoded GlgA alignment under the CAT+GTR model.** This is the complete tree upon which Fig. 4(c) is based. Archaeplastida sequences are denoted with green squares, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, other bacterial groups with black circles, and Archaea with pink circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.


Herpetosiphon aurantiacus ATCC.23779 ●
Coprothermobacter proteolyticus DSM.5265 ●
Gloeobacter violaceus PCC7421 ●
Cyanobacterium Yellowstone B CYB ●
Cyanobacterium Yellowstone A CYA ●
Synechococcus sp WH5701 ●
Prochlorococcus marinus MIT9303 ●
Prochlorococcus marinus MIT9313 ●
Prochlorococcus marinus CCMP1375 ●
Prochlorococcus marinus CCMP1986 ●
Prochlorococcus marinus MIT9301 ●
Prochlorococcus marinus MIT9312 ●
Prochlorococcus marinus AS9601 ●
Prochlorococcus marinus MIT9215 ●
Prochlorococcus marinus NATL1A ●
Synechococcus sp CC9311 ●
Synechococcus sp WH7803 ●
Synechococcus sp RCC307 ●
Synechococcus sp CC9902 ●
Synechococcus sp CC9605 ●
Synechococcus sp WH8102 ●
Thermosynechococcus elongatus BP1 ●
Acaryochloris marina MBIC11017 ●
Anabaena variabilis ●
Nostoc sp PCC7120 ●
Nodularia spumigena CCY9414 ●
Nostoc punctiforme ●
Microcystis aeruginosa NIES843 ●
Synechocystis sp PCC6803 ●
Crocosphaera watsonii ●
Cyanothece sp ATCC.51142 ●
Cyanothece sp CCY0110 ●
Trichodesmium erythraeum ●
Lyngbya sp PCC8106 ●
Synechococcus elongatus PCC7942 ●
Thermomicrobium roseum DSM.5159 ●
Pelobacter carbinolicus DSM.2380 ●
Geobacter uraniumreducens Rf4 ●
Geobacter sulfurreducens PCA ●
Geobacter metallireducens GS ●
Desulfitobacterium hafniense Y51 ●
Macrococcus caseolyticus JCSC5402 ●
Oceanobacillus iheyensis HTE831 ●
Exiguobacterium sibiricum 255-15 ●
Desulfotomaculum reducens MI ●
Alkaliphilus metalliredigens QYMF ●
Natranaerobius thermophilus JWNM-WN-LF ●
Halothermothrix orenii H ●
Bacteroides capillosus ATCC.29799 ●
Eubacterium rectale ATCC.33656 ●
Blautia hansenii DSM.20583 ●
Lachnospiraceae bacterium 1 63FAA ●
Butyrivibrio crossotus DSM.2876 ●
Clostridium bolteae ATCC.BAA613 ●
Dorea formicigenerans ATCC.27755 ●
Clostridium hylemonae DSM.15053 ●
Clostridium nexile DSM.1787 ●
Finegoldia magna ATCC.29328 ●
Clostridium acetobutylicum ATCC.824 ●
Caldicellulosiruptor saccharolyticus DSM.8903 ●
Anaerocellum thermophilum DSM.6725 ●
Caldicellulosiruptor bescii DSM.6725 ●
Acholeplasma laidlawii PG 8A ●
Fusobacterium nucleatum ATCC.25586 ●
Anoxybacillus flavithermus WK1 ●
Lactobacillus acidophilus NCFM ●
Streptococcus australis ATCC.700641 ●
Streptococcus agalactiae 2603V R ●
Streptococcus mutans UA159 ●
Streptococcus dysgalactiae subsp dysgalactiae ATCC.27957 ●
Lactococcus lactis Il1403 ●
Halothermothrix orenii H ●
Heliobacterium modesticaldum Ice1 ●
Moorella thermoacetica ATCC.39073 ●
Physcomitrella patens ■
Arabidopsis thaliana AT1G32900 ■
Oryza sativa ■
Populus trichocarpa ■
Selaginella moellendorffii ■
Chlorella sp NC64A ■
Chlorella vulgaris C169 ■
Volvox carteri ■
Chlamydomonas reinhardtii ■
Micromonas pusilla CCMP1545 ■
Micromonas strain RCC299 ■
Ostreococcus tauri ■
Ostreococcus lucimarinus ■
Cyanobacterium sp CLg1 ●
Crocosphaera watsonii ●
Porphyridium purpureum ■
Porphyridium cruentum ■
Cyanophora paradoxa ■
Physcomitrella patens ■
Selaginella moellendorffii ■
Oryza sativa ■
Populus trichocarpa ■
Arabidopsis thaliana AT5G24300 ■
Selaginella moellendorffii ■
Micromonas pusilla CCMP1545 ■
Micromonas strain RCC299 ■
Ostreococcus lucimarinus ■
Ostreococcus tauri ■
Chlamydomonas reinhardtii ■
Volvox carteri ■
Chlorella vulgaris C169 ■
Micromonas pusilla CCMP1545 ■
Ostreococcus lucimarinus ■
Ostreococcus tauri ■
Selaginella moellendorffii ■
Physcomitrella patens ■
Populus trichocarpa ■
Arabidopsis thaliana AT3G01180 ■
Oryza sativa ■
Chlorella sp NC64A ■
Chlorella vulgaris C-169 ■
Chlamydomonas reinhardtii ■
Volvox carteri ■
Herpetosiphon aurantiacus ATCC.23779 ●
Vibrio furnissii CIP102972 ●
Vibrio mimicus MB451 ●
Vibrio cholerae MZO3 ●
Hydrogenobaculum sp Y04AAS1 ●
Thermodesulfovibrio yellowstonii DSM.11347 ●
Sulfurovum sp NBC37 ●
Aquifex aeolicus VF5 ●
Sulfurihydrogenibium sp YO3AOP1 ●
Thermotoga lettingae TMO ●
Thermosipho melanesiensis BI429 ●
Fervidobacterium nodosum Rt17 B1 ●
Petrotoga mobilis SJ95 ●
Methanococcus aeolicus Nankai ●
Pyrococcus yayanosii CH1 ●
Thermococcus sibiricus MM ●
Thermococcus kodakarensis KOD1 ●
Thermococcus onnurineus NA1 ●
Thermococcus gammatolerans EJ3 ●
Pyrococcus furiosus DSM.3638 ●
Chlamydomonas reinhardtii ■
Volvox carteri ■
Ostreococcus lucimarinus ■
Micromonas pusilla CCMP1545 ■
Micromonas strain RCC299 ■
Chlorella vulgaris C169 ■
Chlorella sp NC64A ■
Selaginella moellendorffii ■
Populus trichocarpa ■
Selaginella moellendorffii ■
Vitis vinifera ■
Vitis vinifera ■
Populus trichocarpa ■
Vigna unguiculata ■
Arabidopsis thaliana AT1G11720 ■
Oryza sativa Japonica Group ■
Oryza sativa Indica Group ■
Oryza sativa Indica Group ■
Micromonas pusilla sp RCC299 ■
Volvox carteri f nagariensis ■
Chlamydomonas reinhardtii ■
Chlamydomonas reinhardtii ■
Ostreococcus tauri ■
Ostreococcus lucimarinus ■
Micromonas strain RCC299 ■
Micromonas pusilla CCMP1545 ■
Cyanophora paradoxa ■
Simkania negevensis Z ▲
Chlamydia trachomatis ▲
Chlamydia muridarum Nigg ▲
Chlamydophila abortus S26 ▲
Chlamydophila pneumoniae CWL029 ▲
Thiocapsa marina ●
Marichromatium purpuratum ●
Allochromatium vinosum DSM.180 ●
Methylococcus capsulatus str Bath ●
Nitrosococcus oceani ATCC.19707 ●
Nitrosococcus halophilus Nc4 ●
Thiocapsa marina ●
Thiorhodococcus drewsii AZ1 ●
Allochromatium vinosum DSM.180 ●
Marichromatium purpuratum ●
Cyanobacterium Yellowstone B CYB ●
Microcoleus vaginatus FGP2 ●
Lyngbya sp PCC8106 ●
Raphidiopsis brookii D9 ●
Cylindrospermopsis raciborskii CS505 ●
Nostoc sp PCC7120 ●
Anabaena variabilis ATCC.29413 ●
Microcoleus chthonoplastes PCC7420 ●
Microcystis aeruginosa PCC7806 ●
Cyanothece sp ATCC.51142 ●
Crocosphaera watsonii ●
Cyanothece sp CCY0110 ●
Synechococcus sp PCC7002 ●
Cyanothece sp PCC7424 ●
Synechocystis sp PCC6803 ●
Acaryochloris marina MBIC11017 ●
Magnetococcus sp MC1 ●
Parachlamydia acanthamoebae str Halls coccus ▲
Parachlamydia acanthamoebae UV7 ▲
Candidatus Protochlamydia amoebophila UWE25 ●
Protochlamydia amoebophila UWE25 ▲
Closterium peracerosum strigosum littorale ■
Physcomitrella patens subsp patens ■
Physcomitrella patens subsp patens ■
Physcomitrella patens subsp patens ■
Selaginella moellendorffii ■
Sorghum bicolor ■
Zea mays ■
Triticum aestivum ■
Hordeum vulgare subsp vulgare ■
Hordeum vulgare subsp vulgare ■
Oryza sativa Indica Group ■
Solanum lycopersicum ■
Populus trichocarpa ■
Ricinus communis ■
Vitis vinifera ■
Vigna unguiculata ■
Arabidopsis thaliana ■
Arabidopsis thaliana ■
0.2

Supplementary Figure 8: **Phylogenetic analysis of the GlgA gene under the nonstationary CAT+BP model.** This is the complete tree upon which Fig. 4(d) is based. Archaeplastida sequences are denoted with green squares, other eukaryotes with purple circles, *Chlamydiae* with orange triangles, *Cyanobacteria* with cyan circles, other bacterial groups with black circles, and Archaea with pink circles. Branch supports are Bayesian posterior probabilities, and branch lengths are proportional to the expected number of substitutions per site, as indicated by the scale bar.

Supplementary Table 1: Posterior predictive simulations of compositional heterogeneity for the single gene alignments analyzed in this study.

	Across-site composition			Across-branch composition		
	Observed	Predicted	*P*-value	Observed	Predicted	*P*-value
GlgC						
LG	7.78	9.71 +/- 0.1	**0**	0.0016	0.0014	0.069
CAT+GTR	7.78	7.86 +/- 0.19	0.33	0.004	0.0047 +/- 0.0009	0.63
GlgP						
LG	8.51	11.61 +/- 0.09	**0**	0.008	0.0026	**0**
CAT+GTR	8.51	8.91 +/- 0.09	**0**	0.008	0.0049 +/- 0.00057	**0**
GlgX						
LG	9.43	11.17 +/- 0.09	**0**	0.015	0.004	**0**
CAT+GTR	9.43	9.54 +/- 0.16697	0.24	0.015	0.0059 +/- 0.001	**0**
UhpC						
LG	8.465	9.84 +/- 0.14	**0**	0.009	0.0069 +/- 0.0007	**0.008**
CAT+GTR	8.465	8.41 +/- 0.09	0.71	0.009	0.0068 +/- 0.0008	**0.008**
GlgA						
LG	10.97	13.64 +/- 0.11	**0**	0.016	0.0083	**0.002**
CAT+GTR	10.97	11.49 +/- 0.16	**0**	0.016	0.009	**0.017**
CAT+GTR (closest outgroup)	8.253	8.414 +/- 0.2	0.21	0.017	0.008 +/- 0.001	**0**
CAT+GTR +Dayhoff	4.409	4.408 +/- 0.04	0.49	0.012	0.008	0.1