— Bacteria-Abditibacteriota-Abditibacteria-Abditibacteriales-Abitibacteriaceae-Abditibacterium\_utsteinense\_WP\_105483197.1 Bacteria-Armatimonadetes-Chthonomonadetes-Chthonomonadales-Chthonomonadaceae-Chthonomonas\_calidirosea\_WP\_044950371.1 —— Bacteria-Cyanobacteria-NA-Oscillatoriales-NA-Oscillatoriales\_cyanobacterium\_JSC12\_WP\_009556687.1 Bacteria-Cyanobacteria-NA-Synechococcales-Synechococcaceae-NA\_WP\_011429853.1 Eukaryota-Glaucophyta-Glaucophyta-Gloeochaetales-Gloeochaetaceae-Gloeochaete wittrockiana YP 009546059.1 - Bacteria-NA-NA-NA-NA WP 038324095.1 — Bacteria-Actinobacteria-Actinobacteria-Micrococcales-Microbacteriaceae-Chitinimonas\_sp.\_R344\_WP\_143856644.1 — Bacteria-Armatimonadetes-NA-NA-NA-Armatimonadetes\_bacterium\_UphvlAr1\_WP\_146669747.1 Archaea — Bacteria-DeinococcusThermus-Deinococci-Deinococcales-Deinococcaceae-Deinococcus indicus WP 088250051.1 Bacteria-DeinococcusThermus-Deinococci-Thermales-Thermaceae-Meiothermus\_chliarophilus\_WP\_027891902.1 Bacteria — Bacteria-DeinococcusThermus-Deinococci-Thermales-Thermaceae-Thermus\_arciformis\_WP\_093005704.1 oda-Malacostraca-Amphipoda-Hyalellidae-Hyalella\_azteca\_XP\_018006306.1 — Eukaryota-Chordata-Actinopteri-Salmoniformes-Salmonidae-Oncorhynchus\_tshawytscha\_XP\_024267420.1 Bacteria-Aquificae-Aquificae-Aquificales-Aquificaceae-Aquifex\_aeolicus\_NP\_213503.1 — Bacteria-Aquificae-Aquificae-Aquificales-Hydrogenothermaceae-Persephonella\_sp.\_KM09Lau8\_WP\_029522877.1 Bacteria-Planctomycetes-Planctomycetia-Planctomycetales-Planctomycetaceae-Thermogutta\_terrifontis\_WP\_095415614.1 ——— Bacteria-Planctomycetes-NA-NA-NA-Planctomycetes\_bacterium\_Mal4\_WP\_145367214.1 — Bacteria-Planctomycetes-Planctomycetia-Planctomycetales-Planctomycetaceae-Planctomyces\_sp.\_SHPL14\_WP\_075094248.1 Bacteria-Aquificae-Aquificae-Aquificales-NA-Thermosulfidibacter\_takaii\_WP\_068550664.1 Bacteria-Nitrospinae-Nitrospinia-Nitrospinales-Nitrospinaceae-Nitrospina\_gracilis\_WP\_005011754.1 — Bacteria-Nitrospirae-Nitrospira-Nitrospirales-Nitrospiraceae-Nitrospira\_defluvii\_WP\_013247571.1 — Bacteria-Deferribacteres-Deferribacteres-Deferribacterales-Deferribacteraceae-Calditerrivibrio\_nitroreducens\_WP\_013452050.1 — Bacteria-Deferribacteres-Deferribacteres-Deferribacterales-Deferribacteraceae-Flexistipes\_sinusarabici\_WP\_013887203.1 — Bacteria-Deferribacteres-Deferribacteres-Deferribacterales-Deferribacteraceae-Denitrovibrio\_acetiphilus\_WP\_013012038.1 Bacteria-Nitrospirae-Nitrospira-Nitrospirales-Nitrospiraceae-NA\_WP\_028842138.1 — Bacteria-Nitrospirae-Nitrospira-Nitrospirales-Nitrospiraceae-Thermodesulfovibrio\_thiophilus\_WP\_028844329.1 —— Bacteria-Cyanobacteria-NA-Nostocales-Rivulariaceae-Calothrix\_sp.\_PCC\_7507\_WP\_015131474.1 — Bacteria-Kiritimatiellaeota-Kiritimatiellae-Kiritimatiellales-Kiritimatiellaceae-Kiritimatiella\_glycovorans\_WP\_052882448.1 Bacteria-Verrucomicrobia-NA-NA-NA-Verrucomicrobia\_bacterium\_LW23\_WP\_108040840.1 Bacteria-Verrucomicrobia-NA-NA-NA WP 019111941.1 — Bacteria-Verrucomicrobia-Verrucomicrobiae-Verrucomicrobiales-Verrucomicrobiaceae-Haloferula\_sp.\_BvORR071\_WP\_035616422.1 - Bacteria-NA-NA-NA-NA-Vampirococcus sp. LiM WP 128700964.1 —— Bacteria-Bacteroidetes-Bacteroidia-Bacteroidales-Rikenellaceae-Millionella\_massiliensis\_WP\_071134431.1 — Bacteria-Bacteroidetes-Saprospiria-Saprospirales-Haliscomenobacteraceae-Phaeodactylibacter\_luteus\_WP\_147166514.1 —— Bacteria-Balneolaeota-Balneolia-Balneolales-Balneolaceae-Gracilimonas\_tropica\_WP\_020404693.1 Bacteria-Balneolaeota-Balneolia-Balneolales-Balneolaceae-Rhodohalobacter\_sp.\_SW132\_WP\_116037561.1 Bacteria-Fibrobacteres-Fibrobacteria-Fibrobacterales-Fibrobacteraceae-Fibrobacter\_sp.\_UWB1\_WP\_088656412.1 Bacteria-Fibrobacteres-Fibrobacteria-Fibrobacterales-Fibrobacteraceae-NA\_WP\_072827564.1 Bacteria-Lentisphaerae-Lentisphaeria-Lentisphaerales-Lentisphaeraceae-Lentisphaera\_araneosa\_WP\_007279076.1 — Bacteria-Spirochaetes-Spirochaetia-Spirochaetales-Spirochaetaceae-Marispirochaeta aestuarii WP 083052402.1 — Bacteria-Spirochaetes-Spirochaetia-Spirochaetales-Spirochaetaceae-Oceanispirochaeta\_sp.\_M1\_WP\_114631704.1 ——— Bacteria-Chloroflexi-Dehalococcoidia-NA-NA-Dehalogenimonas\_formicexedens\_WP\_076004083.1 — Bacteria-Bacteroidetes-Flavobacteriia-Flavobacteriales-Flavobacteriaceae-Muricauda\_beolgyonensis\_WP\_127023268.1 — Bacteria-Chlorobi-Chlorobia-Chlorobiales-Chlorobiaceae-Chlorobaculum\_limnaeum\_WP\_069810451.1 —— Bacteria-Chlorobi-Chlorobia-Chlorobiales-Chlorobiaceae-Chlorobium\_chlorochromatii\_WP\_011361585.1 — Bacteria-Chlorobi-Chlorobia-Chlorobiales-Chlorobiaceae-Chloroherpeton\_thalassium\_WP\_012499947.1 ———— Bacteria-Chloroflexi-Anaerolineae-Anaerolineales-Anaerolineaceae-Anaerolinea\_thermolimosa\_WP\_062193185.1 —— Bacteria-Chloroflexi-Anaerolineae-NA-NA-anaerobic\_bacterium\_MOCFX2\_WP\_119065185.1 — Bacteria-Tenericutes-Mollicutes-Anaeroplasmatales-Anaeroplasmataceae-Anaeroplasma\_bactoclasticum\_WP\_119016388.1 — Bacteria-NA-NA-NA-NA-bacterium\_1XD876\_WP\_120398861.1 — Bacteria-Spirochaetes-Spirochaetia-Leptospirales-Leptospiraceae-Leptospira\_jelokensis\_WP\_135752233.1 - Bacteria-Synergistetes-Synergistia-Synergistales-Synergistaceae-Cloacibacillus\_porcorum\_WP\_066748062.1 ——— Bacteria-Synergistetes-Synergistia-Synergistales-Synergistaceae-Synergistes\_jonesii\_WP\_037975798.1 - Eukaryota-Chlorophyta-Chlorophyceae-Chlamydomonadales-Chlamydomonadaceae-Chlamydomonas\_chlamydogama\_MMETSP1392\_c34649\_g1\_i1.p1 Eukaryota-Chlorophyta-Nephroselmidophyceae-NA-NA-Nephroselmis\_pyriformis\_MMETSP0034\_c31548\_g1\_i1.p1 Eukaryota-Streptophyta-NA-Lamiales-Pedaliaceae-Sesamum indicum XP 011097857.1 · Eukaryota-Choanoflagellata-Choanoflagellata-Choanoflagellata-NA-Acanthoeca sp MMETSP0105 c14879 g1 i1.p1 ———— Eukaryota-Choanoflagellata-Choanoflagellata-Choanoflagellata-Salpingoecidae-Monosiga\_brevicollis\_XP\_001745246.1 Eukaryota-Choanoflagellata-Choanoflagellata-Choanoflagellata-Salpingoecidae-Salpingoeca\_rosetta\_XP\_004994594.1 ——— Eukaryota-Mesomycetozoea-Ichthyosporea-NA-NA-Capsaspora\_owczarzaki\_XP\_004347554.1 saryota-Apicomplexa-NA-Unranked-NA-Alveolata\_sp\_MMETSP0288\_c3379\_g1\_i1.p1 neraceae-NA-NA-NA-Vitrella brassicaformis MMETSP1451 c43323 g1 i1.p1 ——— Eukaryota-Chromeraceae-NA-NA-NA-Chromera\_velia\_MMETSP0290\_c228\_g1\_i1.p1 —— Eukaryota-Alveolata-Dinophyceae-NA-Unranked-Symbiodinium\_sp\_MMETSP1369\_c47007\_g1\_i1.p1 Eukaryota-Retaria-NA-NA-NA-Sorites\_sp\_MMETSP0191\_c8745\_g1\_i1.p1 Eukaryota-Alveolata-Dinophyceae-NA-Unranked-Glenodinium\_foliaceum\_MMETSP0118\_c1165\_g1\_i1.p1 —— Eukaryota-Ciliophora-NA-Unranked-NA-Tiarina\_fusus\_MMETSP0472\_c91217\_g1\_i1.p1 Eukaryota-Stramenopiles-NA-NA-NA-Thalassionema\_frauenfeldii\_MMETSP0786\_c13713\_g1\_i1.p1 Eukaryota-Stramenopiles-NA-NA-NA-Minutocellus\_polymorphus\_MMETSP1070\_c2802\_g1\_i1.p1 Eukaryota-Stramenopiles-NA-NA-NA-Phaeomonas\_parva\_MMETSP1163\_c3653\_g1\_i1.p1 Paulinella\_chromatophora\_CCAC0185\_nuclear\_\_\_scaffold2039-m24429 ukaryota-Ciliophora-NA-Unranked-NA-Strombidinopsis\_acuminatum\_MMETSP0126\_c14186\_g1\_i1.p1 Haptophyta-NA-Prymnesiales-NA-Isochrysis\_galbana\_MMETSP0595\_c9986\_g1\_i1.p1 Eukaryota-Haptophyta-NA-Prymnesiales-NA-Coccolithus\_pelagicussspbraarudi\_MMETSP0164\_c36304\_g1\_i1.p1 Eukaryota-Haptophyta-NA-Pavlovales-Pavlovaceae-Pavlova\_lutheri\_MMETSP1463\_c1824\_g1\_i1.p1 Eukaryota-Cercozoa-Chlorarachniophyceae-NA-NA-Bigelowiella\_natans\_CCMP2755\_igi92164 Eukaryota-Cryptophyta-NA-Pyrenomonadales-Geminigeraceae-Guillardia\_theta\_MMETSP0046\_c5977\_g1\_i1.p1 Eukaryota-Cryptophyta-NA-Pyrenomonadales-Chroomonadaceae-Chroomonas\_mesostigmaticacf\_MMETSP0047\_c2979\_g1\_i1.p1 - Eukaryota-Mesomycetozoea-Ichthyosporea-Ichthyophonida-NA-Sphaeroforma\_arctica\_XP\_014150583.1 — Bacteria-Proteobacteria-Gammaproteobacteria-Chromatiales-Chromatiaceae-Allochromatium\_vinosum\_WP\_012970352.1 — Bacteria-Proteobacteria-Gammaproteobacteria-Chromatiales-Chromatiaceae-Thiobaca\_trueperi\_WP\_132975044.1 Bacteria-Proteobacteria-Gammaproteobacteria-Chromatiales-Chromatiaceae-Imhoffiella\_purpurea\_WP\_043749393.1 Bacteria-Thermodesulfobacteria-Thermodesulfobacteria-Thermodesulfobacteriales-Thermodesulfobacteriaceae-Thermodesulfatator\_autotrophicus\_WP\_068541014.1 - Bacteria-Thermodesulfobacteria-Thermodesulfobacteria-Thermodesulfobacteriales-Thermodesulfobacteriaceae-Thermosulfurimonas dismutans WP 068670543.1 ——— Archaea-Euryarchaeota-Halobacteria-Halobacteriales-Halobacteriaceae-Halarchaeum\_sp.\_CBA1220\_WP\_123076248.1 — Archaea-Euryarchaeota-Halobacteria-Haloferacales-Halorubraceae-Halolamina\_sediminis\_WP\_053948519.1 Archaea-NA-NA-NA-NA-archaeon\_AArcSI\_WP\_119818786.1 — Archaea-Euryarchaeota-Archaeoglobi-Archaeoglobales-Archaeoglobaceae-Archaeoglobus\_profundus\_WP\_012939434.1 Bacteria-Acidobacteria-Acidobacteriia-Acidobacteriales-Acidobacteriaceae-Acidobacteria\_bacterium\_KBS\_146\_WP\_026387165.1 Bacteria-Acidobacteria-Acidobacteriia-Acidobacteriales-Acidobacteriaceae-Edaphobacter\_modestus\_WP\_130418885.1 —— Bacteria-Acidobacteria-Acidobacteriia-Acidobacteriales-Acidobacteriaceae-Granulicella\_rosea\_WP\_089408759.1 Bacteria-Firmicutes-Clostridia-Clostridiales-Ruminococcaceae-Anaerotruncus\_rubiinfantis\_WP\_066459515.1
Bacteria-Firmicutes-Clostridia-Clostridiales-Ruminococcaceae-NA\_WP\_118477711.1 Bacteria-Actinobacteria-Actinobacteria-Micrococcales-Ruaniaceae-Ruania albidiflava WP 022916464.1 — Bacteria-Actinobacteria-Actinobacteria-Pseudonocardiales-Pseudonocardiaceae-Haloechinothrix\_alba\_WP\_089300782.1 Eukaryota-Chordata-Mammalia-Cetacea-Lipotidae-Lipotes\_vexillifer\_XP\_007454880.1 Eukaryota-Nematoda-Chromadorea-Rhabditida-Rhabditidae-Caenorhabditis remanei XP 003087045.1 — Bacteria-Firmicutes-Clostridia-Clostridiales-ClostridialesFamilyXVII.IncertaeSedis-Thermaerobacter\_marianensis\_WP\_013495017.1 Eukaryota-Glaucophyta-Glaucophyta-NA-Cyanophoraceae-Cyanophora\_paradoxa\_tig00000342\_g24237.t1 Eukaryota-Glaucophyta-Glaucophyta-NA-NA-Cyanoptyche gloeocystis MMETSP1086 c10268 g1 i1.p1 ——— Archaea-CandidatusBathyarchaeota-NA-NA-NA-Candidatus\_Bathyarchaeota\_archaeon\_WP\_116577327.1 Archaea-Crenarchaeota-Thermoprotei-Desulfurococcales-Desulfurococcaceae-Ignicoccus\_hospitalis\_WP\_012122919.1 — Archaea-Crenarchaeota-Thermoprotei-Sulfolobales-Sulfolobaceae-Acidianus sulfidivorans WP 110380476.1 Archaea-Crenarchaeota-Thermoprotei-Sulfolobales-Sulfolobaceae-Sulfolobus\_metallicus\_WP\_054838248.1 ——— Archaea-Thaumarchaeota-NA-NA-NA-Candidatus\_Nitrosotalea\_bavarica\_WP\_101477041.1 ——— Archaea-Thaumarchaeota-NA-NA-NA-Thaumarchaeota\_archaeon\_N4\_WP\_048196685.1 — Archaea-Thaumarchaeota-Nitrososphaeria-Nitrososphaerales-Nitrososphaeraceae-Candidatus Nitrososphaera gargensis WP 015020523.1 —— Eukaryota-Amoebozoa-NA-NA-Paramoebidae-Mayorella sp MMETSP0417 c5007 g1 i1.p1 ukaryota-Longamoebia-Longamoebia-Longamoebia-Acanthamoebidae-Acanthamoeba\_castellanii\_XP\_004333513.1 Eukaryota-Amoebozoa-NA-NA-Paramoebidae-Paramoeba\_atlantica\_MMETSP0151 c2770 g1 i1.p1

ukaryota-Apusomonadidae-NA-NA-NA-Thecamonas trahens XP 013762851.1

Legend

Groups

■ Paulinella ■ Archaea

BacteriaEukaryota

Nodos

● *BS* ≥ 95%

BS: ultrafast bootstrap support

Organelle targeting peptides

Mitochondrial
 Chromatophore (≥100aa)

ΔliStat

Cr 0

