Figure S1．Sequence alignment of the C－type oxygen reductase family．The sequence identifiers are from table S2．The alignment is truncated at the beginning of helix I and the end of helix XII for space considerations．Residues with $100 \%$ and $95 \%$ conservation are marked with stars． We define $100 \%$ sequence conservation to be $>99 \%$ to account for potential sequencing errors．Interfamily residue conservation between the C－ type oxygen reductases and other heme－copper families are indicated below the alignment．Transmembrane helices predicted with TMAP from the full sequence alignment are delineated in green．Regions in the alignment which are unreliable are delineated in red．
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Figure S2. Sequence alignment of helices III and IV between the C-type oxygen reductases and the cNOR's. The sequence identifiers are from Table S 2 (The sequence identifiers for the C-type oxygen reductases start with 11 and cNOR's start with 19 ). The conserved glutamates are indicated in red below the alignment. The positions of the non-conserved tyrosine and arginine/lysine are identified by $\#$.

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 FDIAIAIIWVAFGANLIGTILKR FDIAIALIWVAFGANLIGTILKR IDIMIALVWVAFGVNMIWTILKR IDIAITLVWVVFAWNFIGTVLKR FDIAIALVWVAFGANLIGTILKR IDILVALVWVIFAINFFGTLLKR पర̃ฯITHKH
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Table S1. Database accession. The database accession information for each genome is listed below. Web links for the databases are given after the genome list. The genomes highlighted in bold are from completed sequences.

## Individual Genomes

Data Access

JGI/NCBI
Anaeromyxobacter (Fw109-5)
Anaeromyxobacter dehalogenans (2CP-C) Anaplasma marginale (Florida) Anaplasma marginale (St. Maries) Anaplasma phagocytophilum (HZ) Archaeoglobus fulgidus (DSM 4304/ATCC 49558) Arthrobacter (FB24)
Arthrobacter aurescens (TC1) Aurantimonas (SI85-9A1) Azoarcus (BH72) Azotobacter vinelandii (AvOP)
Bacillus (B14905)
Bacillus (NRRL B-14911) Bacillus anthracis (A1055) Bacillus anthracis (A2012) Bacillus anthracis (Ames A Bacillus anthracis (Ames) Bacillus anthracis (Australia 94) Bacillus anthracis (CNEVA-9066) Bacillus anthracis (Kruger B) Bacillus anthracis (Western North America USA6153)
Bacillus cereus (AH187)
Bacillus cereus (AH820)
Bacillus cereus (ATCC 10987)
Bacillus cereus (ATCC 14579/DSM 31) Bacillus cereus (ATCC 14579/DSM 31)
Bacillus cereus (E33L/ZK)
Bacillus cereus (G9241)
Bacillus cereus (NVH391-98)
Bacillus clausii (KSM-K16)

Bacillus halodurans (C-125/JCM 9153)
Bacillus licheniformis (DSM 13/ATCC 14580) Bacillus subtilis (168)
Bacillus thuringiensis (Al Hakam)


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Bacillus thuringiensis (konkukian/97-27) Bacillus weihenstephanensis (KBAB4) Bacteriovorax marinus (SJ) Bacteroides caccae (ATCC 43185) Bacteroides distasonis
Bacteroides forsythus (ATCC 43037) Bacteroides fragilis (638R) Bacteroides fragilis (NCTC 9434)
Bacteroides fragilis (YCH46) Bacteroides thetaiotaomicron (VPI-5482/ATCC 29148) Bacteroides vulgatus

Bartonella bacilliformis (KC583)
(Homalodisca coagulata) Bartonella quintana (Toulouse)
Bdellovibrio bacteriovorus (HD100/DSM 50701/ATCC 15356) Bifidobacterium adolescentis
Bifidobacterium longum (DJO10A) Bifidobacterium longum (NCC 2705) Blastopirellula marina (DSM 3645)
Blochmannia floridanus
Blochmannia pennsylvanicus (BPEN) Bordetella avium (197N) BAA-587/12822) Bordetella pertussis (Tohama I/NCTC 13251)

## Borrelia afzelii (Pko) <br> Borrelia burgdorferi (B31/ATCC 35210)

Borrelia garinii (Pbi)
Bradyrhizobium (USDA 110) Brevibacterium linens (BL2)
Brucella abortus (2308)
Brucella abortus (9-941)
Brucella melitensis (16M/ATCC 23456)
Brucella ovis (ATCC 25840)
Buchnera aphidicola (Acyrthosiphon pisum/Tokyo 1998)
Buchnera aphidicola (Baizongia pistaciae)
Buchnera aphidicola (Cinara cedri) Buchnera aphidicola (Schizaphis graminum)
Burkholderia ambifaria (AMMD) Burkholderia ambifaria (AMMD)
Burkholderia ambifaria (MC40-6) Burkholderia cenocepacia (AU 1054) Burkholderia cenocepacia (HI2424) Burkholderia cenocepacia (J2315) Burkholderia cenocepacia (MC0-3)
Burkholderia cepacia (R18194/383/ATCC 17660) Burkholderia dolosa (AUO158) Burkholderia mallei (10229) Burkholderia mallei (10399) Burkholderia mallei (2002721280) Burkholderia mallei (ATCC 23344)
Burkholderia mallei (FMH)
Burkholderia mallei (GB8 horse 4) Burkholderia mallei (JHU) Burkholderia mallei (NCTC 10247)
Burkholderia mallei (SAVP1) Burkholderia multivorans (ATCC 17616) Burkholderia phymatum (STM815) Burkholderia phytofirmans (PsJN) Burkholderia pseudomallei (1106a) Burkholderia pseudomallei (1106b) Burkholderia pseudomallei (1655) Burkholderia pseudomallei (1710a) Burkholderia pseudomallei (406e)
Burkholderia pseudomallei (668)
Burkholderia pseudomallei (K96243) Burkholderia pseudomallei (Pasteur) Burkholderia pseudomallei (S13) Burkholderia thailandensis (E264) Burkholderia vietnamiensis (R1808/G4) Burkholderia xenovorans (LB400) Caldicellulosiruptor saccharolyticus (DSM 8903)

Chlorobium phaeobacteroides (DSMZ 266(T)) Chlorobium tepidum (TLS/ATCC 49652/DSM 12025)
Chloroflexus aggregans (DSM 9485)
Chloroflexus aurantiacus (J-10-fl)
Chromobacterium violaceum (ATCC 12472/DSM 30191)
Chromohalobacter salexigens (DSM 3043)
Chrysiogenes arsenatis (DSM 11915)
Citrobacter rodentium (ICC168)
Clavibacter michiganensis (sepedonicus/ATCC 33113)
Clostridium (OhILAs)
Clostridium acetobutylicum (ATCC 824/DSM 792/VKM B-1787)
Clostridium beijerincki (NCIMB 8052)
Clostridium botulinum (Hall A/ATCC 3502)
Clostridium cellulolyticum (H10)
Clostridium difficile (630)
Clostridium difficile (QCD-32g58)
Clostridium novyi (NT)
Clostridium perfringens (13/type A)
Clostridium perfringens (ATCC 13124)
Clostridium perfringens (SM101)
Clostridium phytofermentans (ISDg/ATCC 700394)
Clostridium tetani (E88/Massachusetts)
Clostridium thermocellum (ATCC 27405)
Collinsella aerofaciens (ATCC 25986)
Colwellia (MT41)
Colwellia psychrerythraea (34H)
Comamonas testosteroni (KF-1)
Congregibacter litoralis (KT 71)
Coprothermobacter proteolyticus (DSM 5265)
Corynebacterium diphtheriae (NCTC 13129/gravis)
Corynebacterium efficiens (YS-314T/DSM 44549)
Corynebacterium glutamicum (ATCC 13032/DSM 20300)
Corynebacterium jeikeium (K411)
Coxiella burnetii (Dugway 7E9-12)
Coxiella burnetii (MSU Goat Q177)
Coxiella burnetii (RSA 331)
Coxiella burnetii (RSA 493/nine mile)
Croceibacter atlanticus (HTCC2559)
(His)

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Crocosphaera watsonii (WH 8501)
Cytophaga hutchinsonii (ATCC 33406)
Dechloromonas aromatica (RCB)
Dehalococcoides (BAV1)
Dehalococcoides (CBDB1)
Dehalococcoides ethenogenes (195)
Deinococcus geothermalis (DSM 11300)
Deinococcus radiodurans (R1/DSM 20539/ATCC 13939)
Delftia acidovorans (SPH-1)
Desulfitobacterium hafniense (DCB-2)
Desulfitobacterium hafniense (Y51)
Desulfobacterium autotrophicum (HRM2)
Desulfococcus oleovorans (Hxd3)
Desulfotalea psychrophila (LSv54/DSM 12343)
Desulfotomaculum (SAGM)
Desulfotomaculum reducens (MI-1)
Desulfovibrio desulfuricans (G20)
Desulfovibrio vulgaris (DP4)
Desulfovibrio vulgaris (Hildenborough/ATCC 29579)
Desulfuromonas acetoxidans (DSM 684)
Dichelobacter nodosus (VCS1703A) Dictyoglomus thermophilum (H-6-12) Dinoroseobacter shibae (DF L12) Ehrlichia chaffeensis (Arkansas) Ehrlichia chaffeensis (Sapulpa) Ehrlichia ruminantium (Gardel) Ehrlichia ruminantium (Welgevonden) Endoriftia persephone (Hot96_1+Hot96_2)
Enterococcus faecalis (V583/ATCC 700802)
Erwinia carotovora (atroseptica /SCRI 1043/ATCC BAA-672) Erwinia chrysanthemi (3937) Erythrobacter (NAP1)
Erythrobacter litoralis (HTCC2594)
Escherichia coli (042)

Escherichia coli (042)

Fulvimarina pelagi (HTCC2506) Fusobacterium nucleatum (ATCC 25586) Fusobacterium nucleatum (ATCC 49256) Fusobacterium nucleatum (polymorphum/ATCC 10953) Gemmata obscuriglobus (UQM 2246) Geobacillus kaustophilus (HTA426) Geobacillus stearothermophilus (10) Geobacter (FRC-32) Geobacter lovleyi (SZ)
Geobacter metallireducens (GS-15) Geobacter sulfurreducens (PCA/ATCC 51573) Geobacter uraniumreducens (Rf4)

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\begin{aligned}
& \text { Geovibrio ter violaceus (PCC 7421) } \\
& \text { Gloeobacter viol }
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$$ Gluconobacter oxydans ( $\mathbf{6 2 1 H}$ ) Gramelia forsetii (KT0803) Haemophilus ducreyi $\mathbf{( 3 5 0 0 0 H P} / \mathbf{A T C C} 700724)$ Haemophilus influenzae (10810) Haemophilus influenzae (86-028NP) Haemophilus influenzae (R2846) Haemophilus influenzae (R2866) Haemophilus influenzae (Rd/KW20/ATCC 51907) Haemophilus parainfluenzae (T3T1) Haemophilus somnus (129PT) Haemophilus somnus (2336)

Hahella chejuensis (KCTC 2386) Haloarcula marismortui (ATCC 43049) Halobacterium salinarum (NRC-1/ATCC 700922/JCM 11081) Halobacterium salinarum (R1/ATCC 19700) Haloferax volcanii (DS2/ATCC 29605) Haloquadratum walsbyi (DSM 16790) Halorhodospira halophila (SL1/DSM 244) Halothermothrix orenii (H168) Helicobacter acinonychis (Sheeba) Helicobacter hepaticus (ATCC 51449/3B1) Helicobacter mustelae (ATCC 43772)

[^1] Helicobacter pylori (HPAG1)
Helicobacter pylori (J99)
Heliobacterium modesticaldum
Herpetosiphon aurantiacus (DSM 785) Hyphomonas neptunium (ATCC 15444) Idiomarina baltica (OS145) Idiomarina loihiensis (L2TR) Ignicoccus (Kin4-I) Janibacter (HTCC2649) Jannaschia (CCS1) Kineococcus radiotolerans (SRS30216) Kineococcus radiotolerans (SRS30216)
Klebsiella oxytoca (M5al/VJSK009) Klebsiella oxytoca (M5al/VJSK009) Klebsiella pneumoniae (MGH 78578) Kuenenia stuttgartiensis Lactobacillus acidophilus (NCFM/ATCC 700396) Lactobacillus brevis (ATCC 367) Lactobacilus delbrueki (bicC BAA-365) 11842) Lactobacillus delbrueckii (ATCC BAA-365) Lactobacillus delbrueckii (bulgaricus/ATCC 11842) Lactobacillus gasseri (ATCC 33323) Lactobacillus plantarum (WCFS1/NCIMB 8826)
Lactobacillus reuteri (100-23) Lactobacillus reuteri (F 275/ATCC 23272/DSM 20016) Lactobacillus salivarius (UCC118)
Lactobacillus salivarius (UCC118)
Lactococcus lactis (Cremoris SK11) Lactococcus lactis (II1403) Lawsonia intracellularis (PHE/MN1-00) Legionella pneumophila (Lens) Legionella pneumophila (Paris) Legionella pneumophila (Philadelphia 1) Leifsonia xyli (CTCB07) Leptospira borgpetersenii (Hardjo-bovis JB197)
Leptospira interrogans (Copenhageni/Fiocruz L1-130) Leptospira interrogans (Lai/56601) Leptospirillum (type II)

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Leuconostoc mesenteroides (ATCC 8293) Listeria innocua (Clip11262/6a) Listeria monocytogenes (1/2a F6854) Listeria monocytogenes ( $1 / 2 \mathrm{a} /$ EGD-e) Listeria monocytogenes (10403S)
Listeria monocytogenes (4b/F2365) Listeria monocytogenes (4b/H7858) Listeria monocytogenes (F6900) Listeria monocytogenes (FSL F2-515) Listeria monocytogenes (FSL J1-175) Listeria monocytogenes (FSL J1-194) Listeria monocytogenes (FSL J1-208) Listeria monocytogenes (FSL J2-003) Listeria monocytogenes (FSL J2-064) Listeria monocytogenes (FSL J2-071) Listeria monocytogenes (FSL N1-017) Listeria monocytogenes (FSL N3-165) Listeria monocytogenes (FSL R2-503) Listeria monocytogenes (HPB2262) Listeria monocytogenes (J0161) Listeria monocytogenes (J2818) Listeria monocytogenes (LO28) Listeria welshimeri (6B/SLCC5334) Loktanella vestfoldensis (SKA53) Lyngbya aestuarii (CCY9616) Magnetococcus (MC-1) Magnetospirillum magnetotacticum (MS-1/ATCC 31632) Mannheimia haemolytica (PHL213) Mannheimia haemolytica (PHL213)
Marinobacter aquaeolei (VT8/ATCC 700491/DSM 11845) Marinomonas (MED121)


Mesorhizobium (BNC1)
Mesorhizobium loti (MAFF303099)
Methanocaldococcus jannaschii (DSM 2661/ATCC 43067/JAL-1) Methanococcoides burtonii (DSM 6242)
Methanococcus maripaludis (C5)
Methanococcus maripaludis (S2/LL)
Methanoculleus marisnigri (JR1) Methanopyrus kandleri (AV19/DSM 6324/JCM 9639) Methanosaeta thermophila (PT/DSM 6194) Methanosarcina acetivorans (C2A/ATCC 35395/DSM 2834) Methanosarcina barkeri (fusaro)
Methanosarcina mazei (Go1/ATCC BAA-199/DSM 3647/OCM 88) Methanosphaera stadtmanae (DSM 3091)
Methanothermobacter thermautotrophicum (Delta H)
Methylobacillus flagellatus (KT)
Methylobacterium extorquens (AM1)
Methylococcus capsulatus (Bath/NCIMB 11132)
Methylophilales (HTCC2181)
Microscilla marina (ATCC 23134)
Moorella thermoacetica (ATCC 39073)
Mycobacterium (JLS)
Mycobacterium avium (104)
Mycobacterium avium (paratuberculosis /k10)
Mycobacterium bovis (AF2122/97)
Mycobacterium bovis (BCG Pasteur 1173P2)
Mycobacterium flavescens (PYR-GCK)
Mycobacterium leprae (TN)
Mycobacterium marinum (M)
Mycobacterium microti (OV254)
Mycobacterium (KMS)
Mycobacterium tuberculosis (210)
Mycobacterium tuberculosis (C)
Mycobacterium tuberculosis (CDC 1551)


Nocardia farcinica (IFM 10152) Nocardioides (JS614) Nodularia spumigena (CCY9414)
Nostoc punctiforme (PCC 73102/ATCC 29133)
Novosphingobium aromaticivorans (DSM 12444/F199)
Oceanicaulis alexandrii (HTCC2633)
Oceanicola batsensis (HTCC2597)
Oceanicola granulosus (HTCC2516)
Oceanobacillus iheyensis (HTE831/DSM 14371/JCM 11309)
Oceanobacter (RED65)
Oceanospirillum (MED92)
Oenococcus oeni (ATCC BAA-1163) Oenococcus oeni (ATCC BAA-1163)
Oenococcus oeni (MCW/PSU-1)
Paenibacillus larvae (ABC)
Paenibacillus larvae (BRL-230010)
Pantoea stewartii (DC283)
Paracoccus denitrificans (PD1222)
Parvibaculum lavamentivorans (DS-1)
Parvularcula bermudensis (HTCC2503)
Pasteurella multocida (Pm70)
Pediococcus pentosaceus (ATCC 25745)
Pelagibacter ubique (HTCC1002)
Pelagibacter ubique (HTCC1062)
Pelobacter carbinolicus (DSM 2380) Pelobacter propionicus (DSM 2379)
Pelodictyon luteolum (DSMZ 273(T))
Pelodictyon phaeoclathhratiforme (BU-1/DSMZ 5477(T)) Persephonella marina (EX-H1) Photobacterium (SKA34)

Photobacterium profundum (SS9) Photorhabdus luminescens (laumondii/TTO1)
Phytoplasma (AYWB)
Phytoplasma asteris (OY-M)
Picrophilus torridus (DSM 9790/ATCC 70027)
Polaribacter irgensii (23-P)
Polaromonas (JS666)

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Polaromonas napthalenivorans (cJ2)
Porphyromonas gingivalis (W83) Prevotella intermedia (17) Prevotella ruminicola (23) Prochlorococcus marinus (AS9601) Prochlorococcus marinus (CCMP1986/MED4/CCMP1378) Prochlorococcus marinus (MIT 9211) Prochlorococcus marinus (MIT 9301) Prochlorococcus marinus (MI 9303) Prochlorococcus marinus (MIT 9312) Prochlorococcus marinus (MIT 9313) Prochlorococcus marinus (MIT 9515) Prochlorococcus marinus (NATL1A) Prochlorococcus marinus (NATL2A) Prochloron didemni
Propionibacterium acnes (KPA171202/DSM 16379) Prosthecochloris aestuarii (SK413/DSM 271(t)) Prosthecochloris vibrioformis (DSM 265)
Proteus mirabilis (HI4320)
Protochlamydia amoebophila (UWE25)
Pseudoalteromonas atlantica (T6c)
Pseudoalteromonas haloplanktis (TAC125) Pseudoalteromonas tunicata (D2)
Pseudomonas aeruginosa (2192) Pseudomonas aeruginosa (C3719)
Pseudomonas aeruginosa Pseudomonas aeruginosa (PAO1/ATCC 15692) Pseudomonas aeruginosa (UCBPP-PA14) Pseudomonas entomophila (L48) Pseudomonas fluorescens (Pf-5) Pseudomonas fluorescens (PfO-1) Pseudomonas fluorescens (SBW25) Pseudomonas mendocina (ymp) Pseudomonas putida (F1)
Pseudomonas putida (KT2440)
Pseudomonas putida (W619)
Pseudomonas syringae (B728a)
Pseudomonas syringae (phaseolicola/1448a) Pseudomonas syringae (tomato/DC3000)
Psychrobacter (PRwf-1)
Psychrobacter arcticus (273-4)
Psychrobacter cryohalolentis (K5) Psychroflexus torquis (ATCC 700755)
Psychromonas (CNPT3)
Pyrococcus furiosus (DSM 3638/ATCC 43587/JCM 8422/Vc1) Pyrococcus horikoshii (OT3)
Ralstonia eutropha (H16)
Ralstonia eutropha (JMP134)
Ralstonia metallidurans (CH34)
Ralstonia solanacearum (GMI1000) Ralstonia solanacearum (UW551)
Renibacterium salmoninarum (ATCC 33209)
Rhizobium etli (CFN 42)
Rhizobium leguminosarum (viciae/3841) Rhodobacter capsulatus (SB1003)
Rhodobacter sphaeroides (2.4.1)
Rhodobacter sphaeroides (ATCC 17025) Rhodobacter sphaeroides (ATCC 17029) Rhodobacterales bacterium (HTCC2150) Rhodobacterales bacterium (HTCC2654) Rhodocista centenaria
Rhodococcus (RHA1)
Rhodococcus equi (103S)
Rhodoferax ferrireducens (DSM 15236)
Rhodopirellula baltica (SH 1)
Rhodopseudomonas palustris (BisA53)
Rhodopseudomonas palustris (BisB18)

Rhodopseudomonas palustris (BisB5)
Rhodopseudomonas palustris (BisBy) Rhodopseudomonas palustris (HaA2) Rhodospirillum rubrum (ATCC 11170) Rickettsia africae (ESF-5)
Rickettsia akari (Hartford)
Rickettsia bellii (OSU 85-389) Rickettsia bellii (RML369-C) Rickettsia canadensis (McKiel) Rickettsia conorii (Malish 7) Rickettsia felis (URRWXCal2)
Rickettsia massiliae (MTU5)
Rickettsia prowazekii (Madrid E) Rickettsia rickettsii
Rickettsia sibirica (246)
Rickettsia typhi (Wilmington)
Rickettsiella grylli
Robiginitalea biformata (HTCC2501)
Robiginitalea biformata (HTCC2501)
Roseiflexus (RS1)
Roseiflexus castenholzii (HLO8)
Roseobacter (MED193)
Roseobacter (SK209-2-6) Roseobacter denitrificans
Roseovarius (217) Roseovarius (HTCC2601)
Roseovarius nubinhibens (ISM) Rubrobacter xylanophilus (DSM 9941) Ruminococcus albus (8)
Salmonella enterica (Choleraesuis/SC-B67) Salmonella enterica (Hadar)
Salmonella enterica (Infantis)
Salmonella enterica (Paratyphi A/ATCC 9150)
Salmonella enterica (Typhi/CT18) Salmonella enterica (Typhi/Ty2/ATCC 700931) Salmonella enteritidis (PT4) Salmonella typhimurium (DT2)
Salmonella typhimurium (LT2/ATCC 700720/SGSC1412) Salmonella typhimurium (SL1344) Serratia marcescens (Db11) Serratia proteamaculans (568) Shewanella (ANA-3) Shewanella (W3-18-1) Shewanella baltica (OS1155) Shewanella baltica (OS195) Shewanella denitrificans (OS217) Shewanella frigidimarina (NCMIB400) Shewanella oneidensis (MR-1/ATCC700550) Shewanella pealeana (ATCC 700345) Shewanella putrefaciens (CN-32) Shewanella woodyi (ATCC 51908) Shigella boydii (BS512) Shigella boydii (Sb227)
Shigella dysenteriae (1012) Shigella flexneri (2a/2457T/ATCC 700930) Shigella flexneri (2a/301) Shigella sonnei (53G) sonnei (Ss046) Silicibacter (TM1040) Silicibacter pomeroyi (DSS-3) Simkania negevensis (Z)
Sinorhizobium medicae (WSM419)
Sinorhizobium meliloti (1021)
Sodalis glossinidius (morsitans)
Solibacter usitatus (Ellin6076)
Sphingomonas (SKA58)
Sphingomonas wittichii (RW1) Sphingopyxis alaskensis (RB2256 T)
Spiroplasma kunkelii (CR2-3x)
 Stappia (IAM12614)
Stenotrophomonas maltophilia (K279a)
Stenotrophomonas maltophilia (R551-3) Stigmatella aurantica
Streptococcus agalactiae (18RS21) Streptococcus agalactiae ( $2603 \mathrm{~V} / \mathrm{R}$ )
Streptococcus agalactiae (515)
Streptococcus agalactiae (A909)
Streptococcus agalactiae (CJB111) Streptococcus agalactiae (COH1)
Streptococcus agalactiae (H36B)
Streptococcus agalactiae (NEM316/III)
Streptococcus equi
 Streptococcus mitis (NCTC 12261)

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Streptococcus mutans (UA159/ATCC 700610/C) Streptococcus mutans (UA159/ATCC 700610/C)
Streptococcus pneumoniae (23F)
Strep Streptococcus pneumoniae (D39)
Streptococcus pneumoniae (INV104B) Streptococcus pneumoniae (INV200) Streptococcus pnewn (OX14) Streptococcus pneumoniae (TIGR4/ATCC BAA-334) Streptococcus pyogenes (M1/GAS/ATCC 700294/SF370) Streptococcus pyogenes (M49/591) Streptococcus pyogenes (Manfredo/M5) Streptococcus pyogenes (MGAS10270) Streptococcus pyogenes (MGAS10394/M6) Streptococcus pyogenes (MGAS10750) Streptococcus pyogenes (MGAS2096) Streptococcus pyogenes (MGAS315/M3) Streptococcus pyogenes (MGAS5005) Streptococcus pyogenes (MGAS6180) Streptococcus pyogenes (MGAS8232/M18) Streptococcus pyogenes (MGAS9429) Streptococcus pyogenes (SSI-1/M3) Streptococcus sanguinis (SK36)
Streptomyces avermitilis (MA-4680/ATCC 31267/NCIMB 12804) Streptomyces coelicolor (A3(2)/M145)
Streptomyces scabies (87.22)
Sulcia muelleri (Homalodisca coagulata)
Sulfitobacter (EE-36)
Sulfitobacter (NAS-14.1)
Sulfolobus acidocaldarius (DSM 639)
Sulfolobus solfataricus (P2/ATCC 35092/DSM 1617)
Sulfolobus tokodaii (7/JCM 10545)
Sulfurihydrogenibium azorense (AZ-Fu1)
Symbiobacterium thermophilum (IAM 1 Synechococcus (BL107) Synechococcus (CC9311) Synechococcus (CC9605)
Synechococcus (CC9902)
Synechococcus (JA-2-3B'a(2-13))
Synechococcus (JA-3-3Ab)
Synechococcus (PCC 7002)
(LOED习У) snээоэочวәиКS
Synechococcus (RS9916)
Synechococcus (RS
Synechococcus (WH 5701)
Synechococcus (WH 7803)
Synechococcus (WH 7805)
Synechococcus (WH 8102)
Synechococcus elongatus (PCC 6301) Synechococcus elongatus (PCC 7942)
Synechocystis (PCC 6803)
Synergistes jonesii (MPOB)
Syntrophobacter fumaroxidans (MPOB)
Syntrophomonas wolfei (Goettingen)
Syntrophus aciditrophicus (SB)
Thermoanaerobacter ethanolicus (39E/ATCC 33223) Thermoanaerobacter ethanolicus (X514)

 Thermobifida fusca (YX)
Thermococcus kodakaraensis (KOD1) Thermodesulfovibrio yellowstonii (DSM 11347) Thermofilum pendens (Hrk5)
Thermomicrobium roseum (DSM 5159)
Thermoplasma acidophilum (DSM 1728)
Thermoplasma volcanium (GSS1/DSM 4299/JCM 9571)
Thermosinus carboxydivorans (Nor1)
Thermosipho melanesiensis (BI429) Thermosynechococcus elongatus (BP-1)
Thermotoga maritima (MSB8/ATCC 43589/DSM 3109) Thermotoga neapolitana (DSM 4359) Thermotoga petrophil Thermus thermophilus (HB27/ATCC BAA-163/DSM 7039) Thermus thermophilus (HB8)
Thiobacillus denitrificans (ATCC 25259) Thiomicrospira crunogena (XCL-2) 33889 ) Treponema denticola (ATCC 35405/DSM 14222) Treponema pallidum (Nichols)
Trichodesmium erythraeum (IMS101) Tropheryma whipplei (TW08/27)
Ureaplasma parvum (3/ATCC 700970)
Verminephrobacter eiseniae (EF01-2) Verrucomicrobium spinosum (DSM 4136) Vibrio (Ex25)

## Vibrio (MED222)


Vibrio angustum (S14)
Vibrio cholerae (1587)
Vibrio cholerae (623-39) Vibrio cholerae (AM-19226)
Vibrio cholerae (B33)
Vibrio cholerae (MAK 757) Vibrio cholerae (MO10) Vibrio cholerae (MZO-2) Vibrio cholerae (MZO-3) Vibrio cholerae (NCTC 8457) Vibrio cholerae (O1/eltor Vibrio cholerae (O395) Vibrio cholerae (RC385) Vibrio cholerae (V51) Vibrio cholerae (V52) Vibrio fischeri (ES114) Vibrio fischeri (IG-30)

Vibrio harveyi (HY01)
Vibrio parahaemolyticus (AQ3810)
Vibrio parahaemolyticus (RIMD 2210633/O3:K6) Vibrio salmonicida (LFI1238) Vibrio vulnificus (CMCP6)
Vibrio vulnificus (YJ016)
Wigglesworthia glossinidia (Glossina brevipalpis)
Wolbachia (Brugia malayi)
Wolbachia (Drosophila ananassae)
Wolbachia (Drosophila melanogaster/wMel)
Wolbachia (Drosophila simulans)
Wolbachia (Drosophila willistoni)
Wolbachia pipientis (Culex quinquefasciatus)
Wolinella succinogenes (DSM 1740) (I0I $\Lambda X / Z 06 \varepsilon I$ OOLV/90ع/(.u!) S!podouoxe seuowoqдueX Xanthomonas campestris (8004)
Xanthomonas campestris (ATCC 33913/NCPPB 528) Xanthomonas campestris (vesicatoria/85-10) Xanthomonas oryzae (KAXCC10331) Xanthomonas oryzae (MAFF 311018) Xanthomonas oryzae (oryzicola BLS256) Xenorhabdus bovienii
Xenorhabdus nematophila (ATCC 19061)
Xylella fastidiosa (9a5c)
Xylella fastidiosa (Ann-1)
Xylella fastidiosa (Dixon)
Xylella fastidiosa (Temecula1/ATCC 700964) Yersinia bercovieri (ATCC 43970)
Yersinia enterocolitica (8081/type 0:8/NCTC 13174) Yersinia frederiksenii (ATCC 33641)
Yersinia intermedia (ATCC 29909)
 Yersinia pestis (Angola)
Yersinia pestis (Antiqua)
Yersinia pestis (CO92/Orientalis)

Data Access
NCBI Env
NCBI GSS
NCBI Env
NCBI
NCBI Env
NCBI Env
JCVI/NCBI Env
IMG
NCBI Env

## Data Access

NCBI - National Center for Biotechnology Information http://www.ncbi.nlm.nih.gov/genomes/lproks.cgi
NCBI Env - National Center for Biotechnology Information Environmental Sequences http://www.ncbi.nlm.nih.gov/BLAST/
JGI - Department of Energy Joint Genome Institute http://genome.jgi-psf.org/mic home.html Sanger - Welcome Trust Sanger Institute
http://www.sanger.ac.uk/Projects/Microbes/
TIGR - The Institute for Genomic Research http://tigrblast.tigr.org/ufmg/
JCVI - J. Craig Venter Institute
https://research.venterinstitute.org/blast/

## UO - University of Oklahoma http://www.genome.ou.edu/

http://maizeapache.danforthcenter.org/xeno blast/
IG - Integrated Genomics
http://www.ergo-light.com/ERGO/
http://www.bmb.psu.edu/faculty/bryant/lab/synechococcus7002genome/index.html
VCU - Virginia Commonwealth University
http://www.sanguinis.mic.vcu.edu/
GC - Genome Canada
http://www.bcgsc.ca/gc/rhodococcus
UWGC - University of Washington Genome Center
http://www.genome.washington.edu/UWGC/index.cfm

[^2]http://genopole.pasteur.fr/Mulc/BuruList.html
WU - Washington University


> REGX - Real Environmental Genomics http://www.regx.de/

> WSU - Washington State University
$\underline{\mathrm{http}: / / \text { www.vetmed.wsu.edu/research_vmp/anagenome/ }}$
> Genoscope
http://bart.sb
> http://bart.sb-roscoff.fr/blast/blast WH RCC.html
PPSP - Phototrophic Prokaryotes Sequencing Project
EBI - European Bioinformatics Institute
http://www.ebi.ac.uk/genomes/
Table S2. Organisms in which C-type oxygen reductase genes were found are listed in alphabetical order in Genus species (strain) format. Organisms in bold are from completed genomes, those in plain font are from incomplete genomes, while those in italics are from individual submissions to GenBank. Each gene is given a unique ID number.




Geobacter (FRC-32)
Geovibrio thiophilus
Gramella forsetii (KT0803) [1]
Hahella chejuensis (KCTC 2386) Halomonas maura (S-31) Helicobacter acinonychis (Sheeba) Helicobacter hepaticus (ATCC 51449/3B1) Helicobacter mustelae (ATCC 43772) Helicobacter pylori (26695/ATCC 700392) Helicobacter pylori (HPAG1) Helicobacter pylori (J99) Hyphomonas neptunium (ATCC 15444) Idiomarina baltica (OS145) Idiomarina loihiensis (L2TR) Jannaschia (CCS1)

## Kuenenia stuttgartiensis

Leptospira borgpetersenii (Hardjo-bovis JB197) Leptospira borgpetersenii (Hardjo-bovis L550) Loktanella vestfoldensis (SKA53) Magnetococcus (MC-1) Magnetospirillum magneticum (AMB-1) Magnetospirillum magnetotacticu Maricaulis maris (MCS10)

Marinobacter aquaeolei (VT8/ATCC 700491/DSM 11845) Marinomonas (MED121)

Mariprofundus ferrooxydans (PV-1) [1] Mariprofundus ferrooxydans (PV-1) [2] Mesorhizobium (BNC1)
 Mesorhizobium loti (MAFF303099) [2] Mesorhizobium loti (R7A)

Methylobacillus flagellatus (KT) [1] Methylobacillus flagellatus (KT) [1]
Methylobacillus flagellatus (KT) [2] Methylobium petroleophilum (PM1) Moritella marina

Myxococcus xanthus (DK 1622)
Neisseria gonorrhoeae (FA 1090)



Pseudomonas aeruginosa (PAO1/ATCC 15692) [4] Pseudomonas aeruginosa (UCBPP-PA14) [2] Pseudomonas aeruginosa (UCBPP-PA14) [3] Pseudomonas entomophila (L48) [1] Pseudomonas entomophila (L48) [2] Pseudomonas fluorescens (Pf-5) [2] Pseudomonas fluorescens (Pf-5) [3] Pseudomonas fluorescens (PfO-1) [1] Pseudomonas fluorescens (PfO-1) $[2]$ Pseudomonas fluorescens (SBW25) 1 Pseudomonas fluorescens (SBW25) [3] Pseudomonas fluorescens (SBW25) Pseudomonas mendocina (ymp) [1] Pseudomonas mendocina (ymp) [2] Pseudomonas putida (F1) [1]

## Pseudomonas putida (KT2440) [1]

 Pseudomonas putida (KT2440) [2] Pseudomonas putida (W619) [1] Pseudomonas putida (W619) [2] Pseudomonas stutzeri Pseudomonas syringae (B728a)Pseudomonas syringae (phaseolicola/1448a) Pseudomonas syringae (tomato/DC3000) Psychrobacter (PRwf-1)

Psychrobacter arcticus (273-4)
Psychrobacter cryohalolentis (K5) Psychroflexus torquis (ATCC 700755) Psychromonas (CNPT3) Psychromonas ingrahamii (37)

Ralstonia eutropha (H16)
Ralstonia eutropha (JMP134)
Ralstonia metallidurans (CH34) [1] Ralstonia metallidurans (CH34) [2] Ralstonia metallidurans (CH34) [3] Ralstonia pickettii (12J) Ralstonia solanacearum (GMI1000) [1] Ralstonia solanacearum (UW551) [1]

Ralstonia solanacearum (UW551) [2] Reinekea (MED297) Rhizobium etli (8C-3) Rhizobium etli (CFN 42) plasmid p42f
Rhizobium etli (CFN42-symbiotic plasmid p42d)
Rhizobium etli [1]
Rhizobium etli [3]
Rhizobium leguminosarum (VF39)
Rhizobium leguminosarum (viciae/3841) [1]
Rhizobium leguminosarum (viciae/3841) [2]
Rhizobium leguminosarum (viciae/3841) [3]
Rhodobacter capsulatus (SB1003)
Rhodobacter capsulatus
Rhodobacter sphaeroides (2.4.1)
Rhodobacter sphaeroides (ATCC 17025)
Rhodobacter sphaeroides (ATCC 17029)
Rhodobacterales bacterium (HTCC2654)
Rhodocista centenaria [1]
Rhodoferax ferrireducens (DSM 15236) [1] Rhodoferax ferrireducens (DSM 15236) [2] Rhodopirellula baltica (SH 1) Rhodopseudomonas palustris (BisA53) Rhodopseudomonas palustris (CGA009/ATCC BAA-98) Rhodopseudomonas palustris (HaA2) Rhodospirillum rubrum (ATCC 11170) Robiginitalea biformata (HTCC2501) Roseobacter (MED193) Roseobacter denitrificans Roseovarius (217) [1] Roseovarius (HTCC2601) Ruthia magnifica Saccharophagus degradans (2-40) Shewanella (ANA-3) Shewanella (MR-4)

Shewanella (MR-7)

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112200255
112800105
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112200111
112200193
112200267
112200231
112200277
112200213
112200278
112200214

Trichodesmium erythraeum (IMS101)
Verminephrobacter eiseniae (EF01-2) Vibrio (Ex25)

Partial Sequences: Chlorobium phaeobacteroides (BS1) [2] Beggiatoa leptomitiformis
Rhizobium etli (BRA 5)
Rhizobium etli (CIAT)




Sludge/US
Sludge/US
Sludge/US
Whale fall 1
Whale fall 1
Whale fall 1
Whale fall 1
Whale fall 2
Whale fall 2
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Whale fall 2
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Whale fall 3


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[^1]:    Helicobacter pylori (26695/ATCC 700392)

[^2]:    BCM - Baylor College of Medicine
    http://www.hgsc.bem.tmc.edu/projects/microbial/

