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Genera-potential function inventory

For each genus identified by post-sequencing processing (using Greengenes\_13\_8 via mothur or QIIME, or SILVA\_132\_99 via QIIME2), a potential function was identified through a literature review. When formally describing a new genus, a battery of physiological tests is conducted on the cultured type species. These studies provided the potential function of each genus. Some notable exceptions are when a genus or type species could not be cultured in isolation and were cultured in consortia or observed in its natural habitat.

\*\*\*NOTE: The presence of genes that often indicate physiological traits will be added as another literature review is conducted.

“Potential function” denotes the broad functional group used for downstream analyses.

\*\*\*NOTE: Genera without a reference in “Citation” are currently being investigated.

Running total: 759 genera, 212 EndNote citations

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *genus* | Function combined | Citation combined | | | Notes | | | | | | |
| *A17* | non-N |  | | | family: Pirellulaceae | | | | | | |
| *Acetivibrio* | Cellulolytic |  | | | 0 | | | | | | |
| *Acetobacteroides* | Hydrogen-producing | (Su et al., 2014) | | | carbohydrate-fermenting, aerobic, produce CO2, H2, acetate | | | | | | |
| *Acetogenic* | Acetogenic |  | | |  | | | | | | |
| *Achromobacter* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Acidibacter* | Fe3 reduction | (Falagán and Johnson, 2014) | | | acidophilic, obligate heterotroph, tolerant of arsenic (V), feeric iron reduction under microaerobic or aerobic conditions | | | | | | |
| *Acidobacteria* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Acidobacterium* | non-N | (Kishimoto et al., 1991) (Jones et al., 2008) | | | acidophilic, found in mineral environments | | | | | | |
| *Acidothermus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Acidovorax* | non-N | (Jones et al., 2008) , (Graf et al., 2014) | | | causes bacterial fruit blotch on cucurbits | | | | | | |
| *Acinetobacter* | non-N | {Cicconi et al} (Anantharaman et al., 2016) | | | isolated from Loyalsock Creek as part of undergraduate course, only identification is from poster | | | | | | |
| *Actinobacillus* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Actinobacteria* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Actinobacteria\_phylum\_hgcI clade* | varied | 0 | | | phylum level clade, cannot assign potential function | | | | | | |
| *Actinomyces* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Actinoplanes* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Actinosynnema* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Actinotalea* | Cellulolytic+ | (Bagnara et al., 1985). (Yi et al., 2007) | | |  | | | | | | |
| *ADurb.Bin063-1* | varied\_archaea |  | | |  | | | | | | |
| *Aequorivita* | nirK nosZ | | (Graf et al., 2014) | | | |  | | | | |
| *Anaerococcus* | non-N | (Ezaki et al., 2001) | | | can be found in vagil discharges | | | | | | |
| *Anaerolinaceae WCHB1-05* | Cellulolytic | (Xia et al., 2016) | | | Aerolineae lineage {Chloroflexi phylum}, found in aerobic digesters, fermentative lifestyle, may be able to use ethanol as carbon source | | | | | | |
| *Anaerolinea* | Cellulolytic | (Graf et al., 2014) , (Anantharaman et al., 2016) | | | 0 | | | | | | |
| *Aeromonas* | non-N | (Janda and Abbott, 1998) (Graf et al., 2014) | | | human pathogen | | | | | | |
| *Anaeromyxobacter* | Denitrification | (He and Sanford, 2003) (Jones et al., 2008) , (Graf et al., 2014) , (Anantharaman et al., 2016) | | |  | | | | | | |
| *Anaerospora* | non-N | (Woo et al., 2005)¾ | | |  | | | | | | |
| *Aetherobacter* | non-N | (Garcia et al., 2016) | | | myxobacteria | | | | | | |
| *Afipia* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Agrobacterium* | non-N | (Jones et al., 2008) , (Graf et al., 2014) | | | disease forming, uses nitroglycerine as sole N source (microbewiki) | | | | | | |
| *Ajellomyces* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Akkermansia* | non-N | (Derrien et al., 2004) | | | found in human gut microbiota, use mucin as sole nitrogen source | | | | | | |
| *Alcaligenes* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Alcanivorax* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Algorimarina* | non-N | (Kendall et al., 2006) | | | syntrophic with methanogens | | | | | | |
| *Alicycliphilus* | nirK nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Alicyclobacillus* | Denitrification | (Wisotzkey et al., 1992) (Graf et al., 2014) , (Anantharaman et al., 2016) | | | can grow in acidic environments | | | | | | |
| *Alkalilimnicola* | norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Alkanibacter* | non-N | (Friedrich and Lipski, 2008) | | |  | | | | | | |
| *Alkanindiges* | non-N | (Bogan et al., 2003) | | | alkane-degrading | | | | | | |
| *Allorhizobium-Neorhizobium-Pararhizobium-Rhizobium* | N fixation | (Mousavi et al., 2014) | | | can enter N fixing symbioses with legumes | | | | | | |
| *Alphaproteobacteria* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Altererythrobacter* | non-N | (Kwon and Shin, 2008) | | | aerobes | | | | | | |
| *Ambiguous\_taxa* | unclassified |  | | | 0 | | | | | | |
| *Aquabacterium* | Denitrification | (Kalmbach et al., 1999) | | | isolated from biofilms | | | | | | |
| *Aquicella* | non-N | (Santos et al., 2003) | | | related to Rickettsiella and Legionella | | | | | | |
| *archaeon* | C\_fix S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Arcobacter* | Denitrification | (Pati et al., 2010) | | | genome of A. nitrofigilis sequenced by | | | | | | |
| *Arenimonas* | non-N | (Kwon et al., 2007) | | | described by | | | | | | |
| *Armatimonadetes* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Aromatoleum* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Arthrobacter* | Nitrite oxidation | (Graf et al., 2014) | | | 0 | | | | | | |
| *Arthroderma* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Aspergillus* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Atopobium* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Aurantimicrobium* | non-N | (Nakai et al., 2015) | | | aerobic | | | | | | |
| *Austwickia* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Avibacterium* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Azoarcus* | N fixation | (Reinhold-Hurek et al., 1993) (Jones et al., 2008) , (Graf et al., 2014) | | | can be found in endophytic chambers of some plants | | | | | | |
| *Azospirillium* | nirS nosZ | (Jones et al., 2008) | | |  | | | | | | |
| *Azospirillum* | N fixation | (Steenhoudt and Vanderleyden, 2000) (Graf et al., 2014) | | | rhizobacterium | | | | | | |
| *Azovibrio* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Bacillus* | Denitrification | (Jones et al., 2008) , (Graf et al., 2014) | | | 0 | | | | | | |
| *Bacteriovorax* | non-N | (Davidov and Jurkevitch, 2004) | | | Predators | | | | | | |
| *Bacteroides* | non-N |  | | | can be motile or nonmotile, usually mutualistic, especially in guts | | | | | | |
| *Bacteroidetes* | N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Bauldia* | non-N | (Yee et al., 2010) | | | obligate aerobe | | | | | | |
| *Bdellovibrio* | non-N | (Jones et al., 2008) , (Graf et al., 2014) | | | wikipedia | | | | | | |
| *Bdellovibrionales* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Belliella* | nirK nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Betaproteobacteria* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Bifidobacterium* | non-N | (Graf et al., 2014) | | | wikipedia | | | | | | |
| *Bizionia* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Blastocatellaceae\_family\_JGI 0001001-H03* | varied |  | | | family level, cannot assign potential function | | | | | | |
| *Blastococcus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Blautia* | Denitrification | (Liu et al., 2008) (Müller and Frerichs, 2013) | | | isolated from human and animal feces some acetogenic | | | | | | |
| *Blvii28* | non-N |  | | | family: Rikenellaceae, found in gastrointestil tract {wikipedia} | | | | | | |
| *Bordetella* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Bosea* | Thiosulfate oxidation | (Das et al., 1996) (Jones et al., 2008) | | |  | | | | | | |
| *Brachybacterium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Bradyrhizobium* | N fixation | (Jordan, 1982) (Jones et al., 2008) , (Graf et al., 2014) | | | found in root nodules | | | | | | |
| *Brevundimonas* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Brucella* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Bryobacter* | non-N | (Kulichevskaya et al., 2010) | | |  | | | | | | |
| *Burkholderia* | non-N | (Yabuuchi et al., 1992) (Graf et al., 2014) | | |  | | | | | | |
| *Burkholderiales* | nirS norB , C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Graf et al., 2014) , (Anantharaman et al., 2016) | | |  | | | | | | |
| *Butyrivibrio* | Cellulolytic |  | | | 0 | | | | | | |
| *C39* | non-N |  | | | family: Rhodocyclaceae, wikipedia | | | | | | |
| *Caldanaerobacter* | Cellulolytic |  | | | 0 | | | | | | |
| *Caldalkalibacillus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Caldicellulosiruptor* | Cellulolytic |  | | | 0 | | | | | | |
| *Caldilinea* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Caldithrix* | H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Caldivirga* | nirK norB | (Jones et al., 2008) | | |  | | | | | | |
| *Campylobacter* | norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *candidate division CPR2* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division CPR3* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division Kaza* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division KSB1* | H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division NC1* | N\_cycle Fe\_Cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division TM6* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division WOR-1* | S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division WOR-3* | H2\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division WS6* | S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division WWE3* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *candidate division Zixibacteria* | N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Abawacabacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Accumulibacter* | Polyphosphate-accumulating | (Mao et al., 2015) (Graf et al., 2014) | | | accumulate P, reduce nitrate | | | | | | |
| *Candidatus Adlerbacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Amesbacteria* | S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Aminicenantes* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Andersenbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Atribacteria* | H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Azambacteria* | N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus babela* | non-N | (Pagnier et al., 2015) | | | genome sequenced by | | | | | | |
| *Candidatus Bathyarchaeota* | C\_fix S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Beckwithbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Berkelbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Blackburnbacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Brennerbacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Brocadia* | Ammox |  | | |  | | | | | | |
| *Candidatus Buchananbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Campbellbacteria* | S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Chisholmbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Coatesbacteria* | H2\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Collierbacteria* | C\_fix N\_fix S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Colwellbacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Curtissbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Dadabacteria* | N\_cycle S\_cycle Fe\_Cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Daviesbacteria* | N\_fix aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Delongbacteria* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Diapherotrites\_phylum* | varied\_archaea | 0 | | | phylum level, cannot assign potential function | | | | | | |
| *Candidatus Doudnabacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Edwardsbacteria* | H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Eisenbacteria* | N\_cycle S\_cycle Fe\_Cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Falkowbacteria* | C\_fix S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Firestonebacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Fischerbacteria* | S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Fraserbacteria* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Giovannonibacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Glassbacteria* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Gottesmanbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Handelsmanbacteria* | N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Harrisonbacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Jacksonbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Jettenia* | Ammox |  | | |  | | | | | | |
| *Candidatus Jorgensenbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Kaiserbacteria* | N\_fix N\_cycle S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Kerfeldbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Komeilibacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus koribacter* | Denitrification+ | 0 | | |  | | | | | | |
| *Candidatus Kuenenbacteria* | C\_fix H2\_prod aerobic | | (Anantharaman et al., 2016) | | | |  | | | | |
| *Candidatus Kuenenia* | Ammox |  | | |  | | | | | | |
| *Candidatus Lambdaproteobacteria* | N\_cycle S\_cycle H2\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Levybacteria* | C\_fix S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Lindowbacteria* | N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Liptonbacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Lloydbacteria* | N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Magasanikbacteria* | N\_fix N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Magasanikbacteria bacterium RIFCSPHIGHO2\_02\_FULL\_50\_9b* | CPR-OD1 |  | | |  | | | | | | |
| *Candidatus Margulisbacteria* | S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Melainabacteria* | N\_cycle S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus metachlamydia* | non-N |  | | | chlamydia-like intracellular parasite | | | | | | |
| *Candidatus Methylomirabilis* | nirS norB | (Graf et al., 2014) | | |  | | | | | | |
| *Candidatus Micrarchaeota* | C\_fix S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Microthrix* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Candidatus Moranbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Muproteobacteria* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Nealsonbacteria* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus nitrosoarchaeum* | Ammonia oxidation | (Lehtovirta-Morley et al., 2011) (Graf et al., 2014) | | | acidophilic ammonia oxidizer, could provide missing link between acidic soils and high ammonia oxidation rates | | | | | | |
| *Candidatus nitrosocaldus* | Ammonia oxidation | (De la Torre et al., 2008) | | |  | | | | | | |
| *Candidatus Nitrosopumilus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Candidatus Nitrososphaera* | Ammonia oxidation | (Graf et al., 2014) | | |  | | | | | | |
| *Candidatus nitrosotalea* | Ammonia oxidation | (Lehtovirta-Morley et al., 2011) | | | acidophilic ammonia oxidizer, could provide missing link between acidic soils and high ammonia oxidation rates | | | | | | |
| *Candidatus Nitrosotenuis* | Ammonia oxidation | (Li et al., 2016) | | | 0 | | | | | | |
| *Candidatus Nitrospira* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Candidatus nitrotoga* | Nitrite oxidation | (Alawi et al., 2007) | | | described by psychrophilic | | | | | | |
| *Candidatus Niyogibacteria* | N\_cycle S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Nomurabacteria* | N\_fix N\_cycle S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Omnitrophus* | Magnetatactic+ | (Kolinko et al., 2016) | | | contains Nif\_specific ferredoxin III, maybe N fixation, may reduce S, contains genes for magnetatism | | | | | | |
| *Candidatus Pacearchaeota* | C\_fix N\_fix S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Pacearchaeota\_phylum* | varied\_archaea | 0 | | | phylum level, cannot assign potential function | | | | | | |
| *Candidatus Pacebacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Peregrinibacteria* | C\_fix N\_fix S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Peribacteria* | N\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Phytoplasma* | non-N |  | | |  | | | | | | |
| *Candidatus planktophila* | non-N | (Jezbera et al., 2009) | | | found in freshwater, no axenic culture | | | | | | |
| *Candidatus Portnoybacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus protistobacter* | non-N | (Vannini et al., 2013) | | | obliate symbiont of ciliate from Euplotes genus | | | | | | |
| *Candidatus protochlamydia* | non-N | (Collingro et al., 2005b) | | |  | | | | | | |
| *Candidatus rhabdochlamydia* | non-N | (Kostanjsek et al., 2004) | | | share lots of genetic similarity to chlamydia | | | | | | |
| *Candidatus Riflebacteria* | C\_fix S\_cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Roizmanbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Rokubacteria* | N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Ryanbacteria* | N\_cycle S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Saccharibacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Saccharimonas* | Denitrification | (Kindaichi et al., 2016) | | | genomes sequenced from WWTPs | | | | | | |
| *Candidatus Schekmanbacteria* | N\_cycle S\_cycle Fe\_Cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Shapirobacteria* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus solibacter* | Denitrification+ | (Kindaichi et al., 2016) | | | genomes sequenced from WWTPs | | | | | | |
| *Candidatus Spechtbacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Staskawiczbacteria* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Sungbacteria* | N\_fix N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Tagabacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Taylorbacteria* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Tectomicrobia* | N\_cycle S\_cycle Fe\_Cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Terrybacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Uhrbacteria* | N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Veblenbacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus vidania* | non-N | (Gonella et al., 2011) | | |  | | | | | | |
| *Candidatus Vogelbacteria* | S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Wallbacteria* | N\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Wildermuthbacteria* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Woesearchaeota* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Woesebacteria* | S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Wolfebacteria* | N\_cycle S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Woykebacteria* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Yanofskybacteria* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Yonathbacteria* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus Zambryskibacteria* | N\_cycle S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Candidatus\_brocadia* | Ammox | (Gonella et al., 2011) | | |  | | | | | | |
| *Candidatus\_Koribacter* | Denitrification+ |  | | |  | | | | | | |
| *Candidatus\_methanoregula* | Methanogen | | (Bräuer et al., 2011) | | | | hydrogenotrophic methanogen | | | | |
| *Candidatus\_Nitrosocosmicus* | Ammonia oxidation |  | | |  | | | | | | |
| *Candidatus\_Nitrososphaera* | Ammonia oxidation | | | |  | | | | | | |
| *Candidatus\_protochlamydia* | non-N | | (Bräuer et al., 2011) | | | |  | | | | |
| *Candidatus\_rhabdochlamydia* | non-N | (Brune et al., 2002) | | |  | | | | | | |
| *Candidatus\_Solibacter* | Denitrification+ |  | | |  | | | | | | |
| *Candidatus\_xiphinematobacter* | non-N | | (Vandekerckhove et al., 2002) | | | | endosymbiont of nematodes | | | | |
| *Capnocytophaga* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Cardiobacterium* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Caulobacter* | non-N | (MacRae and Smit, 1991) (Graf et al., 2014) | | | isolated from various WWTPs | | | | | | |
| *Caulobacterales* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Cecembia* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Celeribacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Cellulomonas* | Cellulolytic+ | (Bagnara et al., 1985) (Graf et al., 2014) | | |  | | | | | | |
| *Cellulophaga* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Cellvibrio* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Cenarchaeum* | Ammonia oxidation | (Hallam et al., 2006) | | | only contain one species that is symbiont of sponges, have amoA genes | | | | | | |
| *Chaetomium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Chelatococcus* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Chitinophaga* | non-N | (SANGKHOBOL and Skerman, 1981) | | | hydrolyze chitin but not cellulose | | | | | | |
| *Chlamydia* | non-N | (Collingro et al., 2005a) | | | interacellular pathogen, cannot synthesize its own ATP or grow on artificial medium, | | | | | | |
| *Chlamydiae* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Chloroflexi* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Chloroflexus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Chromatiales* | S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Chromobacterium* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Chryseobacterium* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Chthoniobacter* | non-N | (Sangwan et al., 2004) (Graf et al., 2014) | | |  | | | | | | |
| *Citreicella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Cloacibacterium* | non-N | (Allen et al., 2006) | | | isolated from wastewater | | | | | | |
| *Clostridiales* | N\_fix S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Clostridium* | Cellulolytic |  | | | 0 | | | | | | |
| *Coccidioides* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Colwellia* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Comamonas* | nirS | (Jones et al., 2008) | | |  | | | | | | |
| *Compostimonas* | Denitrification | (Kim et al., 2012) | | |  | | | | | | |
| *Conexibacter* | Denitrification | (Monciardini et al., 2003) | | |  | | | | | | |
| *Coprococcus* | non-N | (HOLDEMAN and Moore, 1974) | | | peptones used as nitrogen source | | | | | | |
| *Corynebacterium* | non-N | (Graf et al., 2014) | | | found in gut microbiome {wikipedia} | | | | | | |
| *Coxiella* | non-N | (Anantharaman et al., 2016) | | | 5 genomes of C. burnetii exist https://www.patricbrc.org/portal/portal/patric/GenomeList?cType=taxon&cId=777&displayMode=Complete&dataSource=RAST&pk=1178009952#key=1178009952&pS=20&aP=1&aT=0&cwG=false&cF=&gId=&gme=&gdir=ASC&gsort=genome\_me&sdir=ASC&ssort=genome\_me | | | | | | |
| *Crenothrix* | Methanogen | (Stoecker et al., 2006) | | | methane oxidation, weird pmmoA, can precipitate iron | | | | | | |
| *Crocinitomix* | non-N | (Bowman et al., 2003) | | | described by | | | | | | |
| *Cupriavidus* | non-N | (Vandamme and Coenye, 2004) (Jones et al., 2008) , (Graf et al., 2014) | | | genus described by | | | | | | |
| *Curtobacterium* | non-N | (Funke et al., 2005) | | | acid produced from glucose breakdown | | | | | | |
| *Curvibacter* | C\_fix N\_cycle S\_cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Cytophaga* | non-N |  | | | 0 | | | | | | |
| *Dechloromonas* | Denitrification | (Coates et al., 2001) (Jones et al., 2008) , (Graf et al., 2014) | | | can couple benzene oxidation to nitrate reduction in pure culture | | | | | | |
| *Dechlorosoma* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Delftia* | non-N | (Wen et al., 1999) | | |  | | | | | | |
| *Deltaproteobacteria* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Demequina* | non-N | (Yi et al., 2007) | | |  | | | | | | |
| *Denitratisoma* | non-N |  | | | 0 | | | | | | |
| *Denitrification* | Denitrification |  | | |  | | | | | | |
| *Denitrobacterium* | Denitrification | | | | 0 | | | | | | |
| *Denitrovibrio* | nosZ | | (Graf et al., 2014) | | | | | | |  | |
| *Desulfitobacterium* | norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Desulfobacca* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Desulfobacterales* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Desulfobacula* | C\_fix S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Desulfobulbus* | non-N |  | | | inhabitants of human gastrointestil tract {wikipedia} | | | | | | |
| *Desulfomonile* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Desulfosporosinus* | Sulfur reduction | (Stackebrandt et al., 1997) (Graf et al., 2014) | | | reduces thiosulfate and sulfate | | | | | | |
| *Desulfotomaculum* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Desulfovibrio* | Denitrification | (microbewiki) | | | can reduce sulfate, sulfur, nitrate, nitrite, uranium, chromium, and iron | | | | | | |
| *Desulfovibrionales* | N\_cycle S\_cycle H2\_ox H2\_prod aerobic | | (Anantharaman et al., 2016) | | | | | | |  | |
| *Desulfuromonadales* | N\_fix N\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Devosia* | Denitrification | (Nakagawa et al., 1996) | | | some species can N fixation | | | | | | |
| *Dialister* | non-N | (Moore and Moore, 1994) | | | found in human mouths, can cause gingivitis | | | | | | |
| *Diaphorobacter* | nirK norB | (Jones et al., 2008) | | |  | | | | | | |
| *Dietzia* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Dinghuibacter* | non-N | (Lv et al., 2016) | | |  | | | | | | |
| *Dinoroseobacter* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Dokdonella* | Denitrification | (Yoon et al., 2006) | | |  | | | | | | |
| *Dongia* | Denitrification | (Liu et al., 2010) | | |  | | | | | | |
| *Duganella* | non-N | (Hiraishi et al., 1997) | | | aerobic, chemoorganotrophic | | | | | | |
| *Dyadobacter* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Dyella* | Denitrification | (Xie and Yokota, 2005) (Graf et al., 2014) | | |  | | | | | | |
| *Ellin6067* | Ammonia oxidation |  | | |  | | | | | | |
| *Elusimicrobia* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | | (Anantharaman et al., 2016) | | | | | | |  | |
| *endosymbiont* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Ensifer* | nirK norB | (Jones et al., 2008) | | |  | | | | | | |
| *Enterococcus* | nirK norB | (Jones et al., 2008) | | |  | | | | | | |
| *Erythrobacter* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Ethanoligenens* | non-N | (Xing et al., 2006) | | |  | | | | | | |
| *Eubacterium* | Cellulolytic |  | | | 0 | | | | | | |
| *Euryarchaeota* | C\_fix N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Faecalibacterium* | non-N | (Duncan et al., 2002) | | | found in human gut microbiota, produce butyrate | | | | | | |
| *family\_Candidatus Diapherotrites archaeon\_ADurb.Bin063-1* | varied\_archaea |  | | |  | | | | | | |
| *family\_Microscillaceae\_OLB12* | varied | | (Hahnke et al., 2016) | | | | | | |  | |
| *family\_Nitrosomonadaceae\_IS-44* | Ammonia oxidation |  | | |  | | | | | | |
| *Ferribacterium* | Denitrification | | (Cummings et al., 1999) | | dissimilatory Fe(III) reducing, couples oxidation of acetate and other org compounds to iron reduction or nitrate reduction | | | | | | |
| *Ferritrophicum* | Fe2 oxidation | (Weiss et al., 2007) | | | microaerophilic, lithotrophic | | | | | | |
| *Ferroglobus* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Ferruginibacter* | non-N | (Lim et al., 2009) | | |  | | | | | | |
| *Fimbriimonas* | non-N | (Im et al., 2012) | | |  | | | | | | |
| *Firmicutes* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Flavisolibacter* | non-N | (Yoon and Im, 2007) | | |  | | | | | | |
| *Flavobacteria* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Flavobacteriaceae* | nirK nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Flavobacteriales* | nirK norB nosZ | (Carlson et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Flavobacterium* | non-N | (Jones et al., 2008) , (Graf et al., 2014) | | | (microbewiki) | | | | | | |
| *Flexibacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Fluviicola* | aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Fusarium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *g\_\_Wchb1-05\_f\_\_Anaerolineacaea* | varied |  | | | family: Aeroliceae | | | | | | |
| *Gaiella* | Denitrification | (Albuquerque et al., 2011) | | |  | | | | | | |
| *Galbibacter* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Gallibacterium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Gallionella* | Nitric oxide reduction | (Anderson and Pedersen, 2003; Emerson et al., 2013) | | | found in deep sea hydrothermal vents, only have in situ growth conditions, reduces iron, only one species in genus found nitric oxide reductases in the genome of gallionella | | | | | | |
| *Gallionellales* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *gamma* | nirK nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Gammaproteobacteria* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Gemmata* | varied | http://www.cell.com/current-biology/fulltext/S0960-9822(13)00836-1 | | | wide variety of metabolisms within genus | | | | | | |
| *Gemmatimonadetes* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Gemmatimonas* | nirS nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Geobacillus* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Geobacter* | non-N | (Jones et al., 2008) | | | can oxidize metals, including iron and radioactive metals | | | | | | |
| *Geobacteraceae* | N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Georgfuchsia* | Denitrification | (Weelink et al., 2009) | | | isolated from polluted aquifer | | | | | | |
| *Geothrix* | Denitrification | microbewiki | | | 94% similarity to Holophaga, use fe (III) ase electron acceptor | | | | | | |
| *Gibberella* | nirK norB | | (Graf et al., 2014) | |  | | | | | | |
| *Giesbergeria* | non-N | (Grabovich et al., 2006) | | | isolated from activated sludge | | | | | | |
| *Gillisia* | nirK nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Glaciecola* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Glomus* | non-N |  | | | 0 | | | | | | |
| *Gouta19* | Sulfur reduction | may be Thermodesulfovibrio | | |  | | | | | | |
| *Gramella* | nosZ | | (Graf et al., 2014) | |  | | | | | | |
| *Haemophilus* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Hahella* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Haliangium* | non-N | (Fudou et al., 2002) | | | obligate aerobe | | | | | | |
| *Haliscomenobacter* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Haloarcula* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Halobacterium* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Halocella* | Cellulolytic |  | | | 0 | | | | | | |
| *Haloferax* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Halogeometricum* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Halomicrobium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Halomonas* | Denitrification | (Vreeland et al., 1980) (Graf et al., 2014) | | | high salt tolerance | | | | | | |
| *Halopiger* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Halorhabdus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Halorubrum* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Haloterrigena* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Herbaspirillum* | Denitrification | (Baldani et al., 1986) (Graf et al., 2014) | | |  | | | | | | |
| *Herminiimonas* | non-N | (Fernandes et al., 2005) (Graf et al., 2014) | | |  | | | | | | |
| *Herpetosiphon* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Heteroc45\_4W* | non-N |  | | | family: Chthoniobacteraceae, copy from Chthoniobacter | | | | | | |
| *hgcI clade* | varied |  | | |  | | | | | | |
| *Histoplasma* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Holophaga* | non-N | (Liesack et al., 1994) | | | genus described by | | | | | | |
| *Hydrogenobacter* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Hydrogenophaga* | Denitrification | (Willems et al., 1989) | | |  | | | | | | |
| *Hydrogenophilales* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Hymenobacter* | non-N | (Reddy, 2013) | | | diverse genus | | | | | | |
| *Hyphomicrobium* | Denitrification | (Moore, 1981) (Graf et al., 2014) | | | genus described by | | | | | | |
| *Hyphomonadaceae\_family\_SWB02* | varied |  | | | family leve, cannot assign potential function | | | | | | |
| *Ideonella* | non-N | (Malmqvist et al., 1994) | | | chlorate as electron acceptor | | | | | | |
| *Idiomarina* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Ignavibacteria* | N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Ignavibacterium* | Sulfur reduction | (Iino et al., 2010) (Graf et al., 2014) | | | KEY: use of ferredoxins | | | | | | |
| *Imtechella* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Incisomonas* | non-N | (Cavalier-Smith and Scoble, 2013) | | | marine heterokont flagellate | | | | | | |
| *Indibacter* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Intrasporangium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *IS-44* | Ammonia oxidation |  | | |  | | | | | | |
| *Janthinobacterium* | non-N | (Ciesielski et al., 2014) (Shoemaker et al., 2015) (Hornung et al., 2013) | | | ability to produce short and potentially medium length chain PHAs Chemoorganoheterotroph found in soils. Aerobic, can form antifungal compounds | | | | | | |
| *JGI 0001001-H03* | varied |  | | |  | | | | | | |
| *Jonesia* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Kaistia* | Denitrification | (Im et al., 2004) | | |  | | | | | | |
| *Kaistobacter* | non-N |  | | | in Sphingomodaceae, use metabolism of Sphingomod | | | | | | |
| *Kangiella* | nirK nirS norB | (Graf et al., 2014) | | |  | | | | | | |
| *Kineosphaera* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Kingella* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Knoellia* | Denitrification | (Groth et al., 2002) | | |  | | | | | | |
| *Kuenenia* | Ammox | (Groth et al., 2002) (Jones et al., 2008) | | |  | | | | | | |
| *Labrenzia* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Lacunisphaera* | non-N | (Rast et al., 2017) | | | aerobic | | | | | | |
| *Lautropia* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Legionella* | non-N | (Jones et al., 2008) | | | use amino acids to grow and can be parasitic, most species are motile (microbewiki) | | | | | | |
| *Legionellales* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Lentisphaerae* | C\_fix N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Leptolinea* | non-N | (Yamada and Suzumura)? | | | isolated from activated sludge | | | | | | |
| *Leptolyngbya* | N fixation | (Shimura et al., 2015) | | | terrestrial and FW cyanobacterium | | | | | | |
| *Leptonema* | non-N | (Graf et al., 2014) | | | wikipedia | | | | | | |
| *Leptospira* | non-N | (Graf et al., 2014) | | | disease causing or saprobic {wikipedia} | | | | | | |
| *Leptothrix* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Leptotrichia* | non-N | (Couturier et al., 2012) | | | aerobic, part of normal human flora, can be pathogenic in immunosuppressed patients | | | | | | |
| *Levilinea* | non-N | (Yamada et al., 2006) | | | aerobic | | | | | | |
| *Limnobacter* | Sulfur oxidation | (Spring et al., 2001) | | | thiosulfate oxidation | | | | | | |
| *Luteimonas* | Denitrification | (Finkmann et al., 2000) | | | only reduce to N2O | | | | | | |
| *Luteolibacter* | non-N | (Glaeser et al., 2012) | | | Verrucomicorbium | | | | | | |
| *Lutiella* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Lysobacter* | Degrade chitin | (CHRISTENSEN and Cook, 1978) | | |  | | | | | | |
| *Macellibacteroides* | non-N | (Jabari et al., 2012) | | |  | | | | | | |
| *Magnetococcus* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Magnetospirillum* | non-N | (Thrash et al., 2010) (Graf et al., 2014) , (Graf et al., 2014) | | | can use perchlorate as termil electron acceptor, exhibit aerotaxis and magnetotaxis | | | | | | |
| *Malikia* | Denitrification | (Spring et al., 2005) | | |  | | | | | | |
| *Mannheimia* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Maribacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Marine* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Marinilabilia* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Marinobacter* | nirK nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Maritimibacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Massilia* | Denitrification | (Lindquist et al., 2003) | | | isolated from human blood and tissue samples | | | | | | |
| *Megasphaera* | non-N | (Rogosa, 1971) | | |  | | | | | | |
| *Melioribacter* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Mesorhizobium* | N fixation | https://en.wikipedia.org/wiki/Mesorhizobium (Jones et al., 2008) , (Graf et al., 2014) | | | one species can N fixation, M. loti {root nodules} | | | | | | |
| *metagenome* | unclassified |  | | | 0 | | | | | | |
| *Methanobacterium* | non-N | (Zeikus and Wolee, 1972) | | | methanogenic | | | | | | |
| *Methanobrevibacter* | Methanogen | archaea, wikipedia | | |  | | | | | | |
| *Methanomassiliicoccus* | Methanogen | | (Dridi et al., 2012) | | | | | archaea | | | |
| *Methanosaeta* | non-N | (Smith and Ingram-Smith, 2007) | | | acetoclastic methanogen | | | | | | |
| *Methanosarcina* | Methanogen | microbewiki | | |  | | | | | | |
| *Methanospirillum* | Methanogen | (Ferry et al., 1974) | | | | hydrogenotrophic methanogen | | | | | |
| *Methylacidiphilum* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Methylobacter* | Methanotroph | {wikipedia} | | | family Methylococcaceae are all methanotrophs | | | | | | |
| *Methylobacterium* | non-N | (Jones et al., 2008) , (Graf et al., 2014) | | | 0 | | | | | | |
| *Methylocella* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Methylococcaceae* | Methanotroph | (Bowman, 2006) | | |  | | | | | | |
| *Methylococcus* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Methylocystis* | non-N | (Belova et al., 2013) (Graf et al., 2014) | | | facultative methanotroph | | | | | | |
| *Methylomonas* | Methanotroph | wikipedia | | |  | | | | | | |
| *Methylophaga* | non-N | | | (Graf et al., 2014) | | | | | strict methylotrophs | | |
| *Methylophilales* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Methylosarcina* | non-N |  | | | methanotrophic | | | | | | |
| *Methylosinus* | Denitrification | (Sullivan et al., 1998) | | |  | | | | | | |
| *Methylotenera* | non-N | (Kalyuzhnaya et al., 2006a) (Graf et al., 2014) , (Anantharaman et al., 2016) | | | use methylamine as sole N source | | | | | | |
| *Methylothermus* | Denitrification | (Tsubota et al., 2005) | | | methanotroph | | | | | | |
| *Methyloversatilis* | non-N | (Kalyuzhnaya et al., 2006b) | | | methylotroph, closest relationship to denitrifier | | | | | | |
| *Methylovulum* | Methanotroph | (Iguchi et al., 2011) | | |  | | | | | | |
| *Microgenomates group* | S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Microlunatus* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Micromonospora* | non-N | (Graf et al., 2014) | | | wikipedia | | | | | | |
| *Mobilicoccus* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Moraxella* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Moritella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Mucilaginibacter* | non-N | (Pankratov et al., 2007) | | |  | | | | | | |
| *Muricauda* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Mycobacterium* | non-N | (Butler et al., 1993) (Jones et al., 2008) , (Graf et al., 2014) | | | potentially disease causing | | | | | | |
| *Mycoplasma* | non-N | (Wodke et al., 2013) | | |  | | | | | | |
| *Myroides* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Neisseria* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Neochlamydia* | obligate parasite | (Horn et al., 2000) | | | obligate intracytoplasmatic parasite of H. vermiformis | | | | | | |
| *Neosartorya* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Nevskia* | non-N | (Kim et al., 2011) | | | 0 | | | | | | |
| *Niabella* | non-N | (Kim et al., 2007) (Graf et al., 2014) | | |  | | | | | | |
| *Niastella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Nisaea* | nirK nosZ | (Jones et al., 2008) | | |  | | | | | | |
| *Nitratifractor* | Denitrification | (Nakagawa et al., 2005) (Graf et al., 2014) | | |  | | | | | | |
| *Nitratireductor* | Denitrification | (Labbé et al., 2004) (Graf et al., 2014) | | |  | | | | | | |
| *Nitratiruptor* | Denitrification | (Nakagawa et al., 2005) (Graf et al., 2014) | | |  | | | | | | |
| *Nitrobacter* | Nitrite oxidation | (Jones et al., 2008) , (Graf et al., 2014) | | | 0 | | | | | | |
| *Nitrosococcus* | Nitrite oxidation | (Graf et al., 2014) | | |  | | | | | | |
| *Nitrosocosmicus* | Ammonia oxidation | (Sauder et al.) | | |  | | | | | | |
| *Nitrosomonadaceae\_family\_Ellin6067* | Ammonia oxidation | |  | | type genus is Nitrosomonas | | | | | | |
| *Nitrosomonadaceae\_family\_GOUTA6* | Ammonia oxidation | | 0 | | type genus is Nitrosomonas | | | | | | |
| *Nitrosomonadaceae\_family\_MND1* | Ammonia oxidation | 0 | | | type genus is Nitrosomonas | | | | | | |
| *Nitrosomonas* | Ammonia oxidation | (Jones et al., 2008) , (Graf et al., 2014) | | | 0 | | | | | | |
| *Nitrosopumilus* | Ammonia oxidation | (Graf et al., 2014) | | | 0 | | | | | | |
| *Nitrososphaera* | Ammonia oxidation | 0 | | |  | | | | | | |
| *Nitrosospira* | Ammonia oxidation | | | (Meincke et al., 1989) (Jones et al., 2008) , (Graf et al., 2014) | | | | |  | | |
| *Nitrosovibrio* | Ammonia oxidation |  | | | 0 | | | | | | |
| *Nitrospina* | Nitrite oxidation |  | | | 0 | | | | | | |
| *Nitrospinae* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Nitrospira* | Nitrite oxidation | 0 | | |  | | | | | | |
| *Nitrospirae* | C\_fix N\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | | | (Anantharaman et al., 2016) | | | | |  | | |
| *Nitrospirillum* | N fixation | (Chung et al., 2015) | | |  | | | | | | |
| *Nocardia* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Nocardioides* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *non-N* | non-N |  | | |  | | | | | | |
| *Novosphingobium* | non-N |  | | | http://genome.jgi.doe.gov/novar/novar.home.html | | | | | | |
| *Oceanimonas* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Oceaniovalibus* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Oceanithermus* | nirS norB | (Graf et al., 2014) | | |  | | | | | | |
| *Ochrobactrum* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Octadecabacter* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Oligotropha* | nirK nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Omnitrophica* | C\_fix N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Omnitrophica WOR\_2* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Opitutaceae* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Opitutus* | Denitrification | (Chin et al., 2001) (Graf et al., 2014) | | | isolated from anoxic rice paddies, grow better in syntrophic assembalges with methanogens | | | | | | |
| *Or-59* | non-N | (Sangwan et al., 2004) | | | same family as Chthoniobacter | | | | | | |
| *Owenweeksia* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Paenibacillus* | N fixation | (Graf et al., 2014) , (Anantharaman et al., 2016) | | | wikipedia | | | | | | |
| *Pajaroellobacter* | obligate parasite | (Brooks et al., 2016) | | | cause of bovine abortion | | | | | | |
| *Paludibacter* | non-N | (Ueki et al., 2006) | | |  | | | | | | |
| *Paludibaculum* | Fe3 reduction | (Kulichevskaya et al., 2014) | | | facultative aerobe, can reduce nitrate, produce CO2, acetate | | | | | | |
| *Paracoccidioides* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Paracoccus* | nirK nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Parascardovia* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Parcubacteria group* | N\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Parcubacteria\_family\_Candidatus Magasanikbacteria bacterium RIFCSPHIGHO2\_02\_FULL\_50\_9b* | OD-1 | http://www.uniprot.org/taxonomy/1752731 | | |  | | | | | | |
| *Parvibaculum* | Oxidize surfactants | (Schleheck et al., 2004) (Graf et al., 2014) | | |  | | | | | | |
| *Pasteurella* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Pedobacter* | non-N | (Steyn et al., 1998) (Graf et al., 2014) | | |  | | | | | | |
| *Pedomicrobium* | Denitrification | (Gebers and Beese, 1988) | | | found on biofilms, can oxidize manganese | | | | | | |
| *Pedosphaera* | non-N | (Kant et al., 2011) | | | genome sequenced | | | | | | |
| *Pelagicoccus* | OD-1? |  | | | 0 | | | | | | |
| *Pelobacter* | non-N |  | | | iron and sulfur reducing (microbewiki) | | | | | | |
| *Pelobacteraceae* | N\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Pelosinus* | non-N | (Shelobolina et al., 2007) | | |  | | | | | | |
| *Pelotomaculum* | non-N | (Imachi et al., 2007) (Imachi et al., 2002) | | | all publications about this genus are anerobic, syntrophic, most with methanogens {http://www.bacterio.net/pelotomaculum.html}. Novel genus Pelotomaculum. Cannot degrade sulfur, sulfite, and thiosulfate | | | | | | |
| *Penicillium* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Peredibacter* | non-N | (Davidov and Jurkevitch, 2004) | | |  | | | | | | |
| *Perlucidibaca* | Denitrification | (Song et al., 2008). | | |  | | | | | | |
| *Persephonella* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Phaeobacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Phascolarctobacterium* | non-N | (Del Dot et al., 1993) | | |  | | | | | | |
| *Phenylobacterium* | non-N | (Lingens et al., 1985) (Graf et al., 2014) , (Anantharaman et al., 2016) | | |  | | | | | | |
| *Phocaeicola* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Photobacterium* | norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Phycisphaeraceae\_family\_SM1A02* | Denitrification | (Fukunaga et al., 2009) | | | nitrate reduction observed in type species of type genus {only description of family is type genuse} | | | | | | |
| *Pilimelia* | non-N |  | | | same family as Micromonospora, wikipedia | | | | | | |
| *Planctomyces* | Ammox |  | | | microbewiki, seem to be same as Planctomycetes? | | | | | | |
| *planctomycete* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Planctomycetes* | C\_fix N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Polaromonas* | non-N | (Weon et al., 2008) (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Polymorphum* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Polynucleobacter* | non-N | (Heckmann and Schmidt, 1987) (Anantharaman et al., 2016) | | | obligate ciliate endosymbiont | | | | | | |
| *Pontibacter* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Prevotella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Prochlorococcus* | OD-1? |  | | | 0 | | | | | | |
| *Prolixibacter* | non-N | (Holmes et al., 2007) | | |  | | | | | | |
| *Prolixibacteraceae\_family* | N fixation | (Huang et al., 2014) | | | proposed family | | | | | | |
| *Prolixibacteraceae\_family\_BSV13* | N fixation | (Huang et al., 2014) | | | proposed family | | | | | | |
| *Propionbacterium* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Propionibacterium* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Propionivibrio* | Denitrification | (Brune et al., 2002) | | | extended description of genus | | | | | | |
| *Prosthecobacter* | non-N |  | | | https://microbewiki.kenyon.edu/index.php/Prosthecobacter | | | | | | |
| *Pseudarthrobacter* | Denitrification | (Busse, 2016) | | | 0 | | | | | | |
| *Pseudoalteromonas* | nirK norB | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Pseudogulbenkiania* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Pseudolabrys* | non-N | (Kämpfer et al., 2006) | | |  | | | | | | |
| *Pseudomonadales* | N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Pseudomonas* | Denitrification | (Nishimori et al., 2000) (Jones et al., 2008) , (Graf et al., 2014) | | | intracellular parasite of fish | | | | | | |
| *Pseudorhodobacter* | non-N | (Uchino et al., 2002) | | | 0 | | | | | | |
| *Pseudovibrio* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Pseudoxanthomonas* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Psychrobacter* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Psychroflexus* | nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Psychromonas* | nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Pusillimonas* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Pyrobaculum* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Ralstonia* | Denitrification | (Yabuuchi et al., 1995) (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Reinekea* | nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Reyranella* | Denitrification | (Pagnier et al., 2011) | | | isolated from freshwater, co-cultured with amoeba | | | | | | |
| *Rhizobium* | N fixation | (Jones et al., 2008) , (Graf et al., 2014) | | | same as Brachyrhizobium | | | | | | |
| *Rhodanobacter* | Denitrification | (Prakash et al., 2012) (Graf et al., 2014) , (Anantharaman et al., 2016) | | | 6 species had full genome sequencing, all had most genes involved in full nitrate reduction to dinitrogen gas | | | | | | |
| *Rhodobacter* | N fixation | (Jones et al., 2008) , (Graf et al., 2014) | | | varied metabolisms within the genus, some N fixation (microbewiki) | | | | | | |
| *Rhodobacteraceae* | C\_fix N\_cycle S\_cycle H2\_ox C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Rhodobacterales* | nirK norB nosZ , N\_cycle S\_cycle C1\_ox aerobic | (Graf et al., 2014) , (Anantharaman et al., 2016) | | |  | | | | | | |
| *Rhodococcus* | non-N | (Graf et al., 2014) | | | (microbewiki) | | | | | | |
| *Rhodocyclaceae dok59* | Denitrification | (Van der Zaan et al., 2012) | | | Rhodocyclaceae may degrade benzenes | | | | | | |
| *Rhodocyclales* | C\_fix N\_cycle S\_cycle Fe\_Cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Rhodocyclus* | non-N |  | | | all references say purple nonsulfur bacteria http://www.bacterio.net/rhodocyclus.html | | | | | | |
| *Rhodoferax* | Denitrification | (Finneran et al., 2003) (Jones et al., 2008) , (Graf et al., 2014) , (Anantharaman et al., 2016) | | | species can undergo fermentative respiration, photoautotrophy under aerobic conditions, or aerobic respiration {http://www.bacterio.net/rhodoferax.html}. R. ferrireductans can reduce Fe (III) | | | | | | |
| *Rhodomicrobium* | non-N |  | | | 0 | | | | | | |
| *Rhodoplanes* | Denitrification | (Hiraishi and Ueda, 1994) | | | Hiraishi and Ueda | | | | | | |
| *Rhodopseudomonas* | N fixation+ | https://microbewiki.kenyon.edu/index.php/Rhodopseudomos (Jones et al., 2008) , (Graf et al., 2014) | | | purple nonsulfur pohotrophic organisms, one species can degrade several constituent of lignin, one fixes N, | | | | | | |
| *Rhodospirillales* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Rhodospirillum* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Rhodothermus* | nirK nirS nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Rhodovulum* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Rickettsia* | non-N |  | | | obligate intracellular pathogens of eukaryotes https://microbewiki.kenyon.edu/index.php/Rickettsia | | | | | | |
| *Riemerella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Rikenellaceae\_family\_Bact-08* | non-N | 0 | | | gut microbiome member {wikipedia} | | | | | | |
| *Robiginitalea* | nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Romboutsia* | Acetogenic | (Gerritsen et al., 2014) | | |  | | | | | | |
| *Roseburia* | non-N |  | | | found in human colon {wikipedia} | | | | | | |
| *Roseibium* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Roseiflexus* | nirS | (Graf et al., 2014) | | |  | | | | | | |
| *Roseimarinus* | non-N | (Wu et al., 2015) | | | facultative aerobic | | | | | | |
| *Roseobacter* | nirK nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Roseomonas* | Denitrification | (Rihs et al., 1993) | | |  | | | | | | |
| *Roseovarius* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Rothia* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Rubrivivax* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Rubrobacter* | Denitrification | (microbewiki) | | |  | | | | | | |
| *Ruegeria* | nirS norB nosZ | (Graf et al., 2014) | | | |  | | | | | |
| *Ruminiclostridium 1* | Cellulolytic | refs in (Ravachol et al., 2015), Sheng, T., et al. (Sheng et al.) | | | mesophilic, also metabolizes some hemicellulosic polysaccharides, produces ehtanol, acetate, and lactate | | | | | | |
| *Ruminococcus* | Cellulolytic |  | | | 0 | | | | | | |
| *Rummeliibacillus* | non-N | (Vaishampayan et al., 2009) | | |  | | | | | | |
| *Runella* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Saccharibacter* | non-N | (Jojima et al., 2004) | | | only one species, isolated from pollen | | | | | | |
| *Saccharomonospora* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Saccharophagus* | non-N |  | | | degrades polysaccharides {microwiki https://microbewiki.kenyon.edu/index.php/Saccharophagus\_degradans} | | | | | | |
| *Saccharospirillum* | Denitrification | isolated from hypersaline environments | | |  | | | | | | |
| *Salinibacter* | nosZ | | | (Jones et al., 2008) , (Graf et al., 2014) | | | | |  | | |
| *Salinibacterium* | non-N | (Han et al., 2003) | | |  | | | | | | |
| *Salinisphaera* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Sanguibacter* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Scardovia* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Sediminibacterium* | non-N | (Qu and Yuan, 2008) | | |  | | | | | | |
| *Serinicoccus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Shd-14* | Cellulolytic |  | | | family: Aeroliceae, copy from Aeroliea | | | | | | |
| *Shewanella* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Sideroxydans* | N fixation | (Beckwith et al., 2015) (Emerson et al., 2013) (Graf et al., 2014) , (Anantharaman et al., 2016) | | | oxidize ferrous iron and reduces oxygen | | | | | | |
| *Silicibacter* | nirK nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Siluania* | non-N | (Karpov et al., 1998) | | | one of the smallest 18S flagellate | | | | | | |
| *Simkania* | non-N |  | | | obligate intracellular bacteria, can cause disease (microbewiki) | | | | | | |
| *Simonsiella* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Simplicispira* | Denitrification | (Grabovich et al., 2006) | | | isolated from activated sludge | | | | | | |
| *Sinorhizobium* | nirK norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *SM1A02* | Denitrification |  | | |  | | | | | | |
| *Smb53* | Cellulolytic | | |  | | | | | family: Clostridiaceae, copy from Clostridia | | |
| *Smithella* | Propiote oxidation-syntrophy | (Liu et al., 1999) | | | aerobic, syntrophic, propiote-oxidizing, co culture with methanogens, form acetate, co2, methane | | | | | | |
| *Solibacillus* | non-N | (Krishnamurthi et al., 2009) | | | Krishmurthi, S., et al. | | | | | | |
| *Solibacter* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Solitalea* | Denitrification | (Weon et al., 2009) (Graf et al., 2014) | | | one strain reduces nitrate, one does not | | | | | | |
| *Sphaerobacter* | non-N | (Demharter et al., 1989) (Graf et al., 2014) | | | thermophilic | | | | | | |
| *Sphingobacteriia* | N\_cycle S\_cycle aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Sphingobacterium* | non-N | (YABUUCHI et al., 1983) | | | genus first described by | | | | | | |
| *Sphingobium* | non-N | (Takeuchi et al., 2001) | | |  | | | | | | |
| *Sphingomonadales* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Sphingomonas* | non-N | (Graf et al., 2014) | | | (microbewiki) | | | | | | |
| *Sphingopyxis* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Sphingorhabdus* | non-N | (Jogler et al., 2013) | | | aerobic | | | | | | |
| *Spirobacillus* | non-N | (Rodrigues et al., 2008) | | | parasites of Daphnia, contain carotenoids | | | | | | |
| *Spirochaeta* | Cellulolytic |  | | | 0 | | | | | | |
| *Spirochaeta 2* | Cellulolytic |  | | |  | | | | | | |
| *Spirochaetes* | C\_fix N\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Sporobacter* | Methanotroph | (Grech-Mora et al., 1996) | | |  | | | | | | |
| *Staphylococcus* | non-N | (Jones et al., 2008) | | | wikipedia | | | | | | |
| *Stappia* | nirS norB nosZ | (Jones et al., 2008) | | |  | | | | | | |
| *Starkeya* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Stenotrophomonas* | non-N |  | | | wikipedia | | | | | | |
| *Steroidobacter* | Denitrification+ | (Fahrbach et al., 2006) | | |  | | | | | | |
| *Sterolibacterium* | Denitrification | (Tarlera and Denner, 2003) | | | isolated from USB, oxidizes cholesterol to co2 | | | | | | |
| *Streptococcus* | non-N |  | | | human pathogen {wikipedia} | | | | | | |
| *Streptomyces* | non-N | (Graf et al., 2014) | | | create antibiotics {wikipedia} | | | | | | |
| *Streptosporangium* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Subgroup 10* | varied |  | | |  | | | | | | |
| *Sulfobacillus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Sulfolobus* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Sulfuricella* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Sulfuricurvum* | Denitrification | (Kodama and Watanabe, 2004) (Anantharaman et al., 2016) | | | isolated from crude oil, utilized sulfide, elemental sulfur, thiosulfate, hydrogen, nitrate, oxygen as electron acceptors | | | | | | |
| *Sulfurimonas* | Denitrification | (Jones et al., 2008) , (Graf et al., 2014) , (Anantharaman et al., 2016) | | | can use zero valent surlfur, molecular hydrogen, or reduced sulfur as electron donors; nitrate, nitrite, oxygen as electron acceptors {Wikipedia} | | | | | | |
| *Sulfurisoma* | Denitrification | (Kojima and Fukui, 2014) | | | oxidizes thiosulfate, elemental sulfur, and hydrogen | | | | | | |
| *Sulfuritalea* | Denitrification | 0 | | |  | | | | | | |
| *Sulfurospirillum* | Sulfur reduction | | | refs in (Buttet et al., 2013) | | | | | microaerophilic or facultative aerobes, versatile metabolism | | |
| *Sulfurovum* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Sunxiuqinia* | non-N | (Qu et al., 2011) | | |  | | | | | | |
| *Sutterella* | Denitrification | (Wexler et al., 1996) | | |  | | | | | | |
| *SWB02* | varied |  | | |  | | | | | | |
| *Symbiobacterium* | nirK | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Synechocystis* | norB | (Jones et al., 2008) | | |  | | | | | | |
| *Syntrophobacter* | Methanotroph | (Boone and Bryant, 1980) (Jones et al., 2008) | | | syntrophic, degrades propriote while cocultured with methanogens | | | | | | |
| *Syntrophobacterales* | C\_fix S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Syntrophorhabdus* | Denitrification+ | (Qiu et al., 2008) | | | obligate aerobe, flexible metabolism, in syntrophy with hydrogenotrophic methanogens | | | | | | |
| *Syntrophus* | Methanotroph | (Mountfort et al., 1984) (Anantharaman et al., 2016) | | | syntrophic, needs hydrogenic methanogen | | | | | | |
| *Taylorella* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Telmatospirillum* | N fixation-methanogen | (Sizova et al., 2007) | | | chemoorganotrophs/autotrophs, microaerophilic, contain NifH, found in methanogenic consortia | | | | | | |
| *Tenericutes* | H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Terrimonas* | non-N | (Xie and Yokota, 2006) | | | obligate aerobe | | | | | | |
| *Thalassospira* | nirS norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Thauera* | nirS norB nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Thaumarchaeota* | C\_fix S\_cycle Fe\_Cycle H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Thermaerobacter* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Thermoanaerobaculaceae\_family\_Subgroup 10* | varied |  | | | unknown Acidobacteria | | | | | | |
| *Thermobaculum* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Thermobifida* | nirK | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Thermobispora* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Thermodesulfovibrio* | C\_fix N\_cycle S\_cycle H2\_ox H2\_prod C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Thermomicrobium* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Thermomonas* | non-N | (Busse et al., 2002) | | |  | | | | | | |
| *Thermus* | nirK nirS norB | (Graf et al., 2014) | | |  | | | | | | |
| *Thioalkalivibrio* | nirK norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Thiobacillus* | Sulfur oxidation | (Jones et al., 2008) , (Graf et al., 2014) , (Anantharaman et al., 2016) | | | wikipedia | | | | | | |
| *Thiobacter* | non-N | (Hirayama et al., 2005) | | | obligate thermophilic, sulfur-oxidizing, high growth on thiosulfate or elemental sulfate as an energy source and oxygen as electron acceptor | | | | | | |
| *Thiocapsa* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Thiohalophilus* | Denitrification | (Sorokin et al., 2014)? | | |  | | | | | | |
| *Thiothrix* | Denitrification | (Williams and Unz, 1985) | | |  | | | | | | |
| *Tolumonas* | non-N | (Fischer-Romero et al., 1996) | | | facultative aerobic, toluene producing, can produce acetate, ethanol, and formate | | | | | | |
| *Treponema* | non-N | (Anantharaman et al., 2016) | | | human pathogens, many obligate (microbewiki) | | | | | | |
| *Trichococcus* | Denitrification | (Liu et al., 2002) | | |  | | | | | | |
| *Trichophyton* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *Natronomonas* | nirK | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Turneriella* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Uncinocarpus* | nirK norB | (Graf et al., 2014) | | |  | | | | | | |
| *uncultured* | uncultured\_bacteria | (Graf et al., 2014) | | | 0 | | | | | | |
| *uncultured archaeon* | uncultured\_archaea | 0 | | |  | | | | | | |
| *uncultured bacterium* | uncultured\_bacteria | | |  | 0 | | | | | | |
| *uncultured Bacteroidetes bacterium* | non-N | | | 0 | | | | | 0 | | |
| *uncultured Candidatus Omnitrophus* | Magnetatactic+ | (Kolinko et al., 2016) | | | contains Nif\_specific ferredoxin III, maybe N fixation, may reduce S, contains genes for magnetatism | | | | | | |
| *uncultured Chlorobi bacterium* | Sulfur oxidation | https://en.wikipedia.org/wiki/Green\_sulfur\_bacteria | | | phylum: \green sulfur\", all are obligate aerobic photoautotrophs, and non-autotrophs, use sulfide ions to produce CO2" | | | | | | |
| *uncultured euryarchaeote* | uncultured\_eukaryote | 0 | | |  | | | | | | |
| *uncultured Microgenomates group bacterium* | uncultured\_bacteria | | |  | 0 | | | | | | |
| *uncultured organism* | uncultured | | |  | | | | | 0 | | |
| *uncultured Parcubacteria group bacterium* | CPR-OD1 | (Nelson and Stegen, 2015) | | | one candidate species may be capable of nitrogen reactions [Castelle, C. J., et al. (Castelle et al.) | | | | | | |
| *uncultured soil bacterium* | uncultured\_bacteria | 0 | | |  | | | | | | |
| *Undibacterium* | non-N | | | (Kämpfer et al., 2007) | | | | | isolated from drinking water | |
| *varied* | varied |  | | |  | | | | | | |
| *Variovorax* | non-N | (Willems et al., 1991) | | | aerobic, some strains capable of hydrogen-fueled autotrophic growth {not type species} | | | | | | |
| *Veillonella* | non-N |  | | | gut and oral microbiome member {wikipedia} | | | | | | |
| *Verrucomicrobia* | N\_cycle S\_cycle H2\_prod aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Verrucomicrobium* | non-N |  | | | (microbewiki) | | | | | | |
| *Vibrio* | nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Virgibacillus* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *WCHB1-05* | Cellulolytic |  | | |  | | | | | | |
| *Wchb1-05\_f\_\_Anaerolineacaea* | varied |  | | |  | | | | | | |
| *Wolinella* | nosZ | (Jones et al., 2008) , (Graf et al., 2014) | | |  | | | | | | |
| *Xanthomonadales* | N\_cycle S\_cycle C1\_ox aerobic | (Anantharaman et al., 2016) | | |  | | | | | | |
| *Xylanimonas* | nirK | (Graf et al., 2014) | | |  | | | | | | |
| *Zobellia* | norB nosZ | (Graf et al., 2014) | | |  | | | | | | |
| *Zoogloea* | non-N |  | | | important in reducing BOD in wastewater sludge https://microbewiki.kenyon.edu/index.php/Zoogloea | | | | | | |
| *A17* |  |  | | |  | | | | | | |

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