Rhodopseudomonas

R. palustris is acknowledged by microbiologists to be one of the most metabolically versatile bacteria ever described. Not only can it convert carbon dioxide gas into cell material but nitrogen gas into ammonia and it can produce hydrogen gas. It grows both in the absence and presence of oxygen. In the absence of oxygen, it prefers to generate all its energy from light by photosynthesis. It grows and increases its biomass by absorbing carbon dioxide, but it also can increase biomass by degrading organic compounds including such toxic compounds as 3chlorobenzoateto cellular building blocks. When oxygen is present, R. palustris generates energy by degrading a variety of carbon containing compounds (including sugars, lignin monomers, and methanol) and by carrying out respiration.

R. palustris undergoes two major developmental processes. The first is cell division by budding. This process of asymmetric cell division results in two different kinds of daughter cells, one a motile swarmer cell and the other a stalked non-motile cell. The second is the differentiation of an elaborate system of intra cytoplasmic membrane vesicles when cells run out of oxygen and are placed in light. The membranes are used to house photosynthetic pigments and associated proteins. Budding division and differentiation to photosynthetically competent cells both require a temporally regulated program of gene expression followed by a pattern of precise localization of protein products.

R. palustris has a genetic system -- genes can be moved in and out of this bacterium easily, and specific genes thus can be targeted for mutagenesis -- which will allow researchers to rapidly apply information gained from genome sequencing to the developing area of functional genomics and Waste Recycling.

Rhodopseudomonas palustris, along with Rhodospirillum rubrum and Rhodospirillum photometricum, grow phototrophically on several two- and three-carbon halo carboxylic acids in the presence of CO_2 through reductive dehalogenation and assimilation of the resulting acid. This ability to utilize halo carboxylic acids suggests that they might be able to assist in the removal of these environmental pollutants from illuminated anaerobic habitats like lakes, waste lagoons, sediments of ditches and ponds, mud, and moist soil (McGrath and Harfoot 1997). This bacterium also has the ability to convert N_2 into NH_4 and H_2, which can be used as a biofuel.

Studies have shown that Rhodopseudomonas viridis grows well at 30°C in light under at a 13 hour generation and under microaerophilic growth conditions in the dark at a 24 hour generation time. In addition, the bacterium did not grow anaerobically in the darkness or aerobically in the light. The bacterium was able to use dimethyl sulfoxide, potassium nitrate, or sodium nitrite as a terminal electron acceptor instead of oxygen. (Lang and Oesterhelt 1989) In general, this bacterium can be found in many different soils and marine environments. Rhodopseudomonas bacteria have a photosynthetic reaction centre containing bacterio-chlorophyll b that was first found in 1963 and classified 3 years later and have a range of metabolic processes (Lang and Oesterhelt 1989). R. viridis is an anaerobic, photosynthetic bacterium that has microaerophilic growth capacity. It is one of the most metabolically versatile bacteria known with the ability to convert carbon dioxide gas into cell mass and nitrogen gas into ammonia and hydrogen gas.

R. palustris has an interesting reproduction through budding and asymmetric cell division: one daughter cell is a motile swarmer cell and the other is a stalked non motile cell. Another major developmental process of R. palustris is the differentiation of "an elaborate system of intra- cytoplasmic membrane vesicles when cells run out of oxygen and are placed in light" (DOE). These intra-cytoplasmic membranes, which are named thylakoids, contain the photosynthetic reaction centres and occur only in anaerobic conditions. The thylakoids are integral membrane protein-reaction centre complexes that catalyse light-induced electron transport through the photosynthetic membrane. (Lang and Oesterhelt 1989) They also house photosynthetic pigments and associated proteins (DOE). Also during anaerobic conditions, R. palustris increases its biomass by absorbing carbon dioxide and "degrading organic compounds including such toxic compounds as 3-chlorobenzoateto cellular building blocks" (DOE). When oxygen is available, the bacterium degrades several types of carbon-containing compounds like sugars, lignin, monomers, and methanol through respiration (DOE).