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H.G. Trueper: PHOTOTROPHIC BACTERIA AND THEIR ROLE IN THE BIOSEOCHEMICAL SULFUR CYCLE

An essential step that cannot be bypassed in the biogeochemical cycle of sulfur today is dissimilatory sulfate reduction by anaerobic bacteria. The enormous amounts of sulfides produced by these are oxidized again either anaerobically by phototrophic bacteria or aerobically by thiobacilli and large chemotrophic bacteria (Beggiatoa, Thiovalum, etc.) Phototrophic bacteria use sulfide, sulfur, thiosulfate, and sulfite as electron donors for photosynthesis. The most obvious intermediate in their oxidative sulfur metabolism is a long chain polysulfide that appears as so-called sulfur globules either inside (Chromatiaceae) or outside (Ectothiorhodospiraceae, Chlorobiaceae, and some of the Rhodospirillaceae) the ceils. The enzymes involved in phototrophic bacterial sulfur metabolism are cytochrome c, flavocytochrome c, reverse siroheme sulfite reductase, thiosulfate sulfur transferase, thiosulfate:acceptor oxidoreductase, adenylylsulfate reductase, ADP sulfurylase, ATP sulfurylase, and sulfite:acceptor oxidoreductase. Molecular oxygen is not involved in any of these steps. The amount of carbon assimilated by phototrophic bacteria per mole sulfide oxidized to sulfate is about 10 fold higher than that assimilated by chemolithotrophic sulfur-oxidizing bacteria. Phototrophic sulfur bacteria therefore are the predominant primary producers in the sulfuretum. During dark periods under anoxic conditions phototrophic bacteria perform a slow fermentative maintenance metabolism, during which they reduce elemental sulfur and polysulfides to H_2S . At low partial pressures of oxygen several species of the Chromatiaceae (e.g., Chromatium vinosum, Thiocystis violacea) are also capable of oxidizing reduced sulfur compounds in the dark. They possess an energy metabolism like that of chemolithotrophic bacteria. The assimilation of sulfur compounds in phototrophic bacteria is in principle identical with that of non-phototrophic bacteria. However the Chlorobiaceae and some of the Chromatiaceae and Rhodospirillaceae, unable to reduce sulfate, rely upon reduced sulfur for biosynthetic purposes.

- Kondratieva, E.N., Ivanovsky, R.N., and Krasilnikova, E.N., 1981. Light and dark metabolism in ourple sulfur bacteria, Soviet Scientific Reviews, <u>2</u>:325-364
- Pfennig, N., and Trueper, H. G., 1983. Taxonomy of the photosynthetic green and purple sulfur bacteria, Annales de Microbiologie (Institut Pasteur), <u>1349</u>:9-20.

- Trudinger. P.A. and Loughlin, R.E., 1981. Metabolism of simple sulphur compounds. In *Comprehensive Biochemistry*. (M. Florkin and E.H. Stotz, eds.), Vol. 19A (A. Neuberger and L.L.M. van Deenen, eds.), Elsevier. Amster .am. pp. 165-256.
- Trueper, H. G., 1981. Photolithotrophic sulfur oxidation. In Biology of Inorganic Nitrogen and Sulfur. (H. Bothe and A. Trebst. eds.), Springer Verlag, New York. pp. 199-211.
- Trueper, H. G. 1984a. Microorganisms and the sulfur cycle. In Sulfur - The Significance for Chemistry, Biology and Geology. (A. Mueller and B. Krebs, eds.), Elsevier, Amsterdam.
- Trueper, H. G. 1784b. Phototrophic bacteria and their sulfur metabolism. In Sulfur - The Significance for Chemistry, Biology and Geology. (A. Mueller and B. Krebs, eds.), Elsevier, Amsterdam.
- Trueper H. G. and Fischer, U.. 1982. Anaerobic oxidation of sulphur compounds as electron donors for bacterial photosynthesis, Phil. Trans. R. Soc. London B, <u>298</u>:529-542.
- Starr, M.P., Stolp, H., Trueper, H.G., Balows, A., and Schlegel, H.G., (eds.), 1981. The Prokaryotes, Springer Verlag, New York.

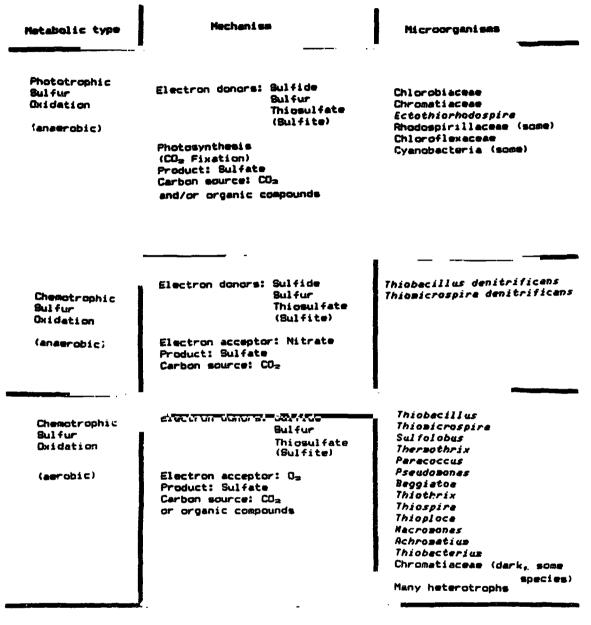
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Netabolic type (all anasrobic)	Hochanises	Microorganisma
	Electron acceptors:	
	Bulfate	Besalfovibrio
Dissimilatory	Thiosulfate	Besul fotopacul up
<u>Sulfate</u>	Bulfite	Desul fopopes
Reduction		Besul fobacter
		Besyl fobyl bus
		Bosul fococcus
		Besul fosercipe
	Electron donors:	Besulfonese
	Organic compounds	Thermodesal fobacteria
	or Ha	
	Product: He Cerbon source: organic	
	concounds or COm	
	COMPOUNDS OF USE	
	Electron ecceptors: Sulfur	Besalfaromones Besalfovibrio (some) Campylobecter (some) Nolinella Chromatiaceme (dark) Chlorgbiaceme (dark)
	Electron donors: Organic cos- pounds or H ₂	Beggistos Thermoproteus Thermodiscus Pyrodictium Thermococcus
	Product: H _a S Carbon source: organic compounds or CO ₂	
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For list of references see Trueper, 19846.

Table I-6. Inorganic sulfur compounds as electron acceptors in bacteria.

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For list of references see Trueper, 19846.

Table I-7. Inorganic sulfur compounds as electron donors in bacteria.