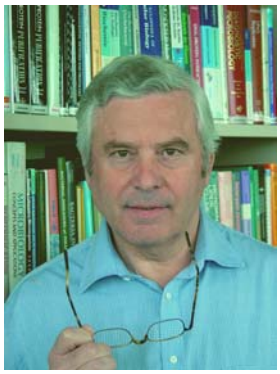
Walter G. Zumft



Full Professor. Microbiology since 1982. Biology diploma 1968, Doctoral degree 1970, Habilitation 1974, Assoc. Professor 1980, University of Erlangen-Nürnberg. 1971-74 Research Associate, Purdue University, West Lafayette, IN. 1978-79 Visiting Professor, University of Georgia, Athens, GA, 1980 Visiting Scientist, Arrhenius Laboratory, University of Stockholm.
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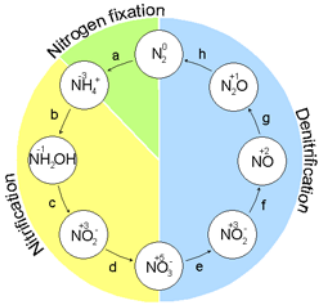
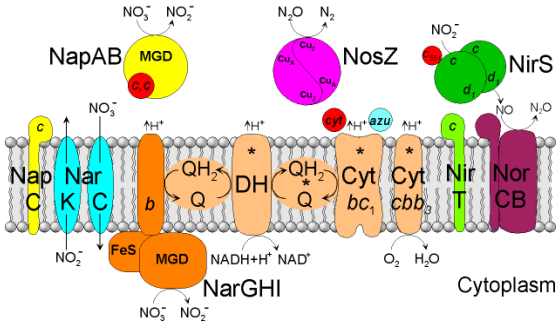
Principal Research Interests

Denitrification provides a distinct mode of bacterial energy conservation. It makes use of N-oxides as terminal electron acceptors for cellular bioenergetics and thereby reverses dinitrogen fixation. The process is part of the global N-cycle, essential for all life forms. Our main research organism is a denitrifying pseudomonad.



The activation and enzymatic transformation of N-oxides is based on Fe, Cu, and Mo and their redox chemistry. The metal ions are found in the denitrification enzymes in distinct organic cofactors or as protein-bound metal clusters. We have isolated the novel enzymes nitric oxide reductase and nitrous oxide reductase, and provided their first biochemical characterization and access to the genetic basis of the process. Around 40 genes are required to encode the core structures of the denitrification apparatus.
We are investigating the components of the process, their topology with respect to the bacterial cytoplasmic membrane, and their regulation. Nitrate and nitric oxide, in addition to being respiratory substrates, are signal molecules for the induction of N-oxide-metabolizing enzymes. The NO signal is processed by transcription factors of the Crp-Fnr superfamily.

Denitrification is intimately related to other cellular processes such as primary and secondary transport, protein translocation, cytochrome *c* biogenesis, anaerobic and N-oxide-dependent gene regulation, metalloprotein assembly, and the biosynthesis of cofactors. Thus, the research topic provides a fascinating area for interdisciplinary approaches and integrated methodology.



Selected Publications

1. Körner, H., Sofia, H., Zumft, W. G. (2003) Phylogeny of the bacterial superfamily of Crp-Fnr transcription regulators: exploiting the metabolic spectrum by controlling alternative gene programs. FEMS Microbiol. Rev., in press.
2. Wunsch, P., Herb, M., Wieland, H., Schiek, U., and Zumft, W. G. (2003) Requirements for Cu_A and Cu-S center assembly of nitrous oxide reductase deduced from complete periplasmic enzyme maturation in the nondenitrifier *Pseudomonas putida*. J. Bacteriol., 185:887-896.
3. Zumft, W. G. (2002) Nitric oxide signaling and NO dependent transcriptional control in bacterial denitrification by members of the Fnr-Crp regulator family. J. Mol. Microbiol. Biotechnol., 4:277-286.
4. Alvarez, M. L., Ai, J., Zumft, W. G., Sanders-Loehr, J., Dooley, D. M. (2001) Characterization of the copper-sulfur chromophores in nitrous oxide reductase by resonance Raman spectroscopy: evidence for sulfur coordination in the catalytic cluster. J. Am. Chem. Soc., 123:576-587.
5. Charnock, J., Dreusch, A. Körner, H., Neese, F., Nelson, J., Kannt, A., Michel, H., Garner, D., Kroneck, P. M. H., Zumft, W. G. (2000) Structural investigations of the Cu_A center of nitrous oxide reductase from *Pseudomonas stutzeri* by site-directed mutagenesis and X-ray absorption spectroscopy. Eur. J. Biochem., 267:1368-1381.
6. Härtig, E., Schiek, U., Vollack, K-U., Zumft, W. G. (1999) Nitrate and nitrite control of respiratory nitrate reduction in denitrifying *Pseudomonas stutzeri* by a two-component regulatory system homologous to NarXL of *Escherichia coli*. J. Bacteriol., 181:3658-3665.
7. Zumft, W. G. (1997) Cell biology and molecular basis of denitrification. Microbiol. Mol. Biol. Rev., 61:533-616.