Enrichment of new anammox bacteria
PhD position at Microbiology, IWWR

For over a century it was believed that ammonium could only be oxidized by microbes in the presence of oxygen. Anaerobic ammonium oxidation (anammox) was considered impossible. However, about 10 years ago the microbes responsible for the anammox reaction were discovered in a pilot wastewater treatment plant. This was followed by the development of dedicated cultivation and molecular approaches that resulted in the identification of the responsible anammox bacteria in our laboratory. Recently, the widespread environmental occurrence of the anammox bacteria was demonstrated leading to the realization that anammox bacteria may play a major role in biological nitrogen cycling. Currently it is estimated that every other molecule of N₂ gas in our atmosphere has been produced by an anammox bacterium. Furthermore, the anammox process is an innovative way to remove nitrogen from wastewater, and already 5 full scale plants are in operation. The anammox bacteria are unique microbes with many unusual properties that we hardly understand. These include the biological turn-over of hydrazine, a well known rocket fuel, the biological synthesis of ladderane lipids, and the presence of a prokaryotic organelle in the cytoplasm of anammox bacteria. The ERC and ALW have funded the anammox research with the aim to obtain a fundamental understanding of the metabolism, genome, proteome and ecological importance of the anammox bacteria. Such understanding contributes directly to our environment and economy because the anammox bacteria form a new opportunity for nitrogen removal from wastewater: cheaper, with lower carbon dioxide emissions than existing technology. Scientifically the results will contribute to the understanding how our planet’s atmosphere is made.

Project 4 Environmental detection and importance: new sources for enrichment of anammox bacteria. At the moment we know very little of how and to what extent the different groups of nitrogen cycle bacteria contribute to the biogeochemical cycling of (marine) nitrogen. In 2003, we provided the first direct evidence for the presence of anammox bacteria in the world’s largest anoxic basin, the Black Sea, based on nutrient profiles, 16S rRNA gene clone libraries, FISH, ¹⁵N activity tests, and ladderane lipid analysis. Since then joint follow-up studies in collaboration with various international partners have been conducted to investigate the marine anammox process in oxygen minimum zones (OMZs), and marine sediments. Based on these studies, it is now estimated that anammox bacteria might contribute more than 50% to global, present day nitrogen losses from the oceans. Thus, anammox bacteria represent a large but presently unexplored sink in the biogeochemical cycling of nitrogen in the ocean with large consequences for the past and present marine carbon cycle. Also in terrestrial ecosystems high ammonium and low oxygen concentrations may prevail, but the presence and activity of anammox in such ecosystems has never been investigated. However, very recently molecular surveys showed that anammox 16S ribosomal RNA sequences could be retrieved from several soil and wetland samples. Using available molecular biomarkers (16S rRNA, hzo, lipids) and ¹⁵N isotope experiments, the presence and contribution of anammox bacteria to nitrogen cycling in suitable (anoxic or oxygen-limited) ecosystems will be investigated. These will include wetland ecosystems, riparian buffer zones and subsurface samples. Once a suitable ecosystem is found, these soils may also be used to enrich and characterize new anammox bacteria. The properties of these new soil anammox bacteria will be compared to those of wastewater treatment plant and marine ecosystems.

Expected qualifications of the PhD Student Environmental detection and importance

- M.Sc. degree in environmental engineering (sciences), microbiology, biochemistry or biotechnology
- Enthusiasm, perseverance, patience and courage
- Excellent communication skills, team spirit.
- Excellent computer and software skills
- Fluency in English.

The salary will be between EURO 2.042 and 2.612 gross per month on a full-time basis, depending on qualifications and experience. PhD positions a 1.5 + 2.5 year contract is available after yearly evaluation. Benefits are according to central Radboud University Nijmegen package.

Applications should include a cover letter and a curriculum vitae and 2 outstanding references.

The application can be sent to the following address, until 16 March 2009
Radboud University, Personnel Department, Vacancy number: 62.08.09
PO Box 9010, 6500 GL Nijmegen, The Netherlands

More information:
For more information on the vacancy you can contact:

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