Cell Biology of 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 3 Cell Biology. Anammox bacteria have a unique cell plan not observed in any other prokaryote so far, that includes a prokaryotic organelle, called the anammoxosome, the possible locus of anammox catabolism. Using state of the art electron tomography on 400 nm sections of cryofixed, freeze-substituted and Epon-embedded anammox cells, it was shown that this organelle had no obvious connections to other compartments and that the membrane of the organelle was strongly curved. The aim of this part of the project is to elucidate the function and composition of this peculiar organelle and the other anammox compartments. For this purpose, it will be attempted to purify and isolate intact anammoxosome organelles in sufficient quantities. The purified preparations will be analyzed by LC-MS-MS to identify the proteins present in this organelle. The anammoxosome isolation approach will be complemented by electron microscopy in close collaboration with Utrecht University. Anammox cells will be prepared for immunogold labeling by the recently developed “rehydration method” to determine the exact location of key enzymes involved anammox metabolism. We have raised antibodies against various important anammox proteins that can be used in this study.

Expected qualifications of the PhD Student Cell Biology of anammox bacteria

- M.Sc. degree with a relevant background in, for example; (molecular) cell biology, microbiology, biochemistry or biotechnology
- Experience with electron microscopy is an advantage
- Enthusiasm, perseverance, patience and courage
- Independent and well-structured working style
- Excellent communication skills and a 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.

For 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, curriculum vitae and two outstanding references.

The application can be sent to the following address, until 16 March 2009
Radboud University, Personnel Department, Vacancy number: 62.09.09
PO Box 9010, 6500 GL Nijmegen, The Netherlands
For more information on the vacancy you can contact:
Prof. dr. Mike Jetten, Tel: +31 24 3652941, e-mail: m.jetten@science.ru.nl
Dr. Laura van Niftrik Tel +31 24 3652563, e mail: l.vanniftrik@science.ru.nl

Water has been identified as the major environmental issue of the 21st century. Many parts of the world will experience increasing fresh water shortage, while other parts will have a higher risk of flooding. Poor water quality is a threat for human society as well as for natural ecosystems. The research focus of the Institute for Water and Wetland Research (IWWR) is the natural environment, in particular aquatic ecosystems and wetlands. Many of these environments have been substantially altered by human impact. The changes have resulted in stress responses of all biota and impose major challenges to individuals, populations and the ecosystem as a whole. The IWWR studies the mechanisms of adaptation of microorganisms, plants and animals to these changes at the level of the molecule, the cell, the organism and the ecosystem. The tight coupling of fundamental scientific research to application, distinguishes the IWWR from other national and international institutes on water research. The novel applications for current water problems are developed from innovative fundamental insights in molecular, physiological and ecological processes.

www.ru.nl/iwwr