Motivation
Production of sufficient clean water becomes more and more difficult with the increasing numbers of human, agricultural, and industrial users. In a lot of cases sustainable use of clean groundwater is not possible and surface water (sea, river) is used as an alternative source for clean water production. Reverse osmosis is a powerful technology to remove the large variety of contaminants in surface water. However, the membranes are susceptible to (bio-) fouling and need to be cleaned on a regular basis. Secondly, (bio-) fouling results in a higher energy consumption during the water production and a shortening of the life-time of the membranes. Knowledge of the processes involved in biofilm formation leads to improved cleaning strategies. Control of biofilm formation on membranes reduces the energy requirement and the amount of cleaning cycles in order to produce clean and safe water.

Technological challenge
A subpopulation of the bacteria that are present in the feedwater will attach to the surface of the membrane and spacers in spiral wound modules. After attachment they produce exopolysacharides resulting in a slimy layer that obstructs the feed channel and block the membrane (fig 1).

The challenge in this project is to control the bacterial population, attachment and subsequent exopolysacharide formation.

Approach
Previously, Bereschenko et al identified several bacteria that were involved in initial biofilm formation and maturation (fig 2).

The properties of these keyplayers will be determined and used to inhibit and/or remove biofouling. The effectiveness of cleaning procedures will be determined and optimized with biofilms from full scale installations and laboratory cultivated biofilms. The sensitivity and resistance of bacteria to chemical and physical treatment will be investigated with, among others, Live/Dead staining in combination with CSLM, SEM, and AFM (fig 3).