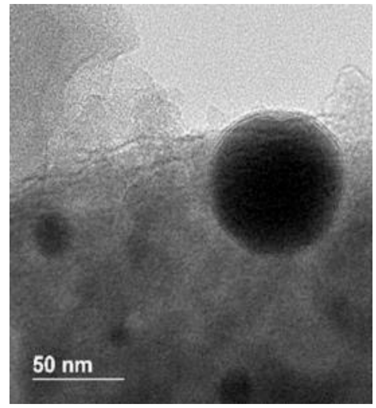
Nanotechnology and Environmental Remediation: Dr. Dungey's Lab

Nanotechnology, the manipulation of matter at the nanometer scale, produces new effects not seen in bulk materials (Atkinson 2003).

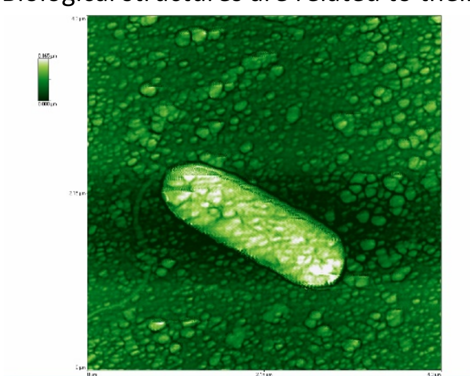
Project 1: Nanoparticles for Environmental Remediation

Nanoparticles are effective catalysts due to their large surface area to volume ratios. Due to these enhanced properties, nanoparticles are being explored for environmental remediation applications. Our approach to nanotechnology is to use environmentally benign materials, prepared using green chemistry principles (ACS). In particular, we are using Zero-Valent Iron Nanoparticles (nZVI) to enhance bacterial denitrification in agricultural soils (Kerr and Dungey 2019). Excess nitrates in agricultural fields are pollutants and should be reduced to prevent degradation of environmental waters (lakes, rivers, oceans). We will measure denitrification rates of the bacteria cultures as a function of nanoparticle preparation and support material. Ion chromatography will be used to separate the nitrate peaks from background so that we can quantify the denitrification process.



Project 2: Atomic Force Microscopy for Imaging Biological Samples

Biological structures are related to their function, so measuring biological samples at the nanoscale can increase our understanding of biological processes. In collaboration with other faculty in the department, students will use the atomic force microscope (AFM) to measure bacteria and DNA and how their structure changes in the presence of chemicals. In particular, Dr. Sanchez-Diaz is studying how bacteria respond to nutrients by chemotaxis—moving towards the source (Bi and Sourjik 2018). And Dr. Yang is studying molecules that cleave DNA. The interaction of these molecules with DNA will change the shape and length, which can be measured by AFM (Bordelon, Feierabend et al. 2002).



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