In the nitrogen cycle two anaerobic respiration pathways compete for nitrate: denitrification and dissimilatory nitrate reduction to ammonia. Denitrifiers reduce nitrate mainly to nitrogen whereas dissimilatory nitrate reducers produce ammonia. The outcome of this competition has important environmental consequences, because denitrification leads to the emission of the greenhouse gas nitrous oxide to the atmosphere and a loss of fixed nitrogen, which often limits primary productivity.

It is generally assumed that the outcome of the competition is mainly determined by the relative supply of electron donors and acceptors. Denitrifiers are assumed to outcompete dissimilatory nitrate reducers, if nitrate is supplied in excess. Under nitrate limitation, denitrifiers are expected to be outcompeted. Biochemically this makes sense because denitrifiers conserve more energy per electron while dissimilatory nitrate reducers conserve less energy per electron but turn over more electrons.

To investigate the effect of the relative supplies of electron donors and acceptors on the competition between the two pathways in a natural community, sediments of a tidal flat active in nitrogen cycling are incubated in batch culture experiments and laboratory bioreactors. The outcome of the competition is assayed by mass balancing of nitrogen compounds.