



**MESTECH Research Project**



**Project Title:** The optimisation of low-cost, autonomous phosphate and nitrate sensors for freshwater monitoring

**Project Researcher:** Gillian Duffy

**Funding Body:**

Naughton Graduate Fellowship Program 2013, University of Notre Dame

Educational Trust and Faculty of Science & Health, Dublin City University

**Project Summary:** Cultural eutrophication of our waters is a global challenge. Low-cost, autonomous environmental sensors will be critical in the effective nutrient management of freshwaters. Agriculture is a major source of nitrogen and phosphorus pollution in Irish rivers and estuaries. This is similar in the Midwestern United States. In both Ireland and the Midwestern US, there is a critical need to understand mechanistic controls on water quality in agricultural watersheds. Previous efforts have concentrated on measuring agricultural runoff directly using grab samples or spot measurements, but high frequency sampling will be essential to accurately characterize the extent and temporal resolution of agricultural impacts. An autonomous phosphate sensor utilising the molybdenum yellow method for phosphate determination has been developed in DCU. This sensor will be adapted to use the molybdenum blue method for phosphate determination in order to reduce the limit of detection (LOD). The current LOD of the sensor is  $0.2 \text{ mg L}^{-1} \text{ PO}_4^{3-} \text{-P}$  which is too high for use in rivers and estuaries as it is above the limits set by legislation.

Work will also be carried out in the University of Notre Dame on an autonomous nitrate sensor. Deployments of both sensors will be carried out.

**Key Outputs:**

- An autonomous, low-cost phosphate sensor with an LOD from  $2\text{-}500 \text{ }\mu\text{gP L}^{-1}$
- An autonomous, low-cost nitrate sensor
- Data contributing to an understanding of the impact of agricultural land use on freshwaters in Ireland and the Midwestern US
- Publication of journal articles and attending of conferences