PROJECTS FOR THE 2013 UWA-ZHEJIANG RESEARCH TRAINING PROGRAM

1. Supervisors: Professor Anas Ghadouani and Dr Elke Reichwaldt

Project Title - Impact of hydrogen peroxide on zooplankton dynamics in wastewater stabilisation ponds

Recently, hydrogen peroxide (H2O2) has been shown to be an environmentally friendly chemical to decrease nuisance blooms in wastewater stabilisation ponds (WSP). However, as WSP are biologically complex systems, the effect H2O2 has on other important components within the systems have to be assessed. A first laboratory test with *Moina* and *Daphnia*, two important zooplankton genera that are common in WSP, showed that H2O2 concentrations that are suggested for use in WSPs have a strong negative effect on survival of both genera. However, the two genera have a different sensitivity to this chemical: *Daphnia* are more robust and can withstand higher concentrations of hydrogen peroxide than *Moina*. As these two genera fulfill different functions within WSPs, this can have far-reaching consequences for the functioning of the systems.

The proposed project would look into the impact of H2O2 on zooplankton dynamics in WSP. This will be done by comparing pre- and post-application zooplankton dynamics.

2. Professor Jim Whelan

Using Forward Genetics and Next Generation Mapping to identify Regulators or gene expression in Plants.

Forward genetic approaches are very powerful to identify novel regulators of gene expression. Typically this involved setting up a genetic screen, where mutants can be visually identified. Once identified the gene involved have been traditionally identified using map-based cloning. While this is a powerful approach, the limitation is that map-based cloning can take several years to identify the gene in question.

However with the advent of next generation sequencing, novel mapping approaches have been developed. These approaches are based on complete genome sequencing of mutant and parental varieties, and the use of bio-informatics to identify the causative genes.

In our laboratory we have established a forward-genetic screen for regulation of a mitochondrial protein, called the alternative oxidase. Using next generation mapping we have identified a number of mutants, but a number still remain to be characterised. This project will take one of these mutants, and use next generation mapping to identify the causative gene.
The techniques used will be screening to verify mutant, isolation of genomic DNA, construction of DNA libraries for sequencing, whole genome sequencing using an Illumina HiSeq, bio-informatic analysis of the data to identify the causative gene.

Please ask your International Centre for the ppt of this project.

3. Professor Mark Cassidy and A/Prof Muhammad Hossain

Project title: Investigation of capacity of suction caissons under horizontal and cyclic loadings on clay over sand

Background: Suction caissons are large diameter steel cylinders, open ended at the bottom and closed at the top, as shown in Figure 1. The caisson is installed by pumping water from inside the caisson after it is allowed to penetrate under self-weight. The difference between the hydrostatic water pressure outside the cylinder and the reduced water pressure inside provides a differential pressure, or suction, that acts as a penetration force.

Figure 1. Suction caisson

Suction caissons are used widely in the offshore oil and gas industry, and are an attractive foundation solution for future deep water developments. They have been proven as a cost-effective alternative to more traditional anchoring solutions

such as piles and drag anchors (Colliat, 2002; Eltaher *et al*., 2003; Ehlers *et al*., 2004). Caissons have been used for foundations of gravity platform jackets, offshore current and wind turbines, riser towers, pipeline manifolds; and as anchors for floaters, e.g. floating production storage and offloading (FPSO) units, tension leg platforms (TLPs), SPAR platforms (Sparrevik, 2002; Randolph *et al*., 2011). Caissons will be equally applicable to various emerging new concepts, including floating LNG (FLNG) facilities, subsea systems, seabed protection structures and hybrid risers.

Objectives: The performance of suction caissons under operational horizontal and cyclic loadings will be investigated through 1g model tests on typical Australian clay-over-sand sediments. The key objectives are to:

1. Assess caisson horizontal capacity on layered soils compared to that on single layer soil.
2. Assess the effect of amplitudes and number of cycles on caisson capacity under cyclic loading.

4. Winthrop Professor Tim Colmer

(Email: timothy.colmer@uwa.edu.au) Professor Colmer is a plant physiologist (http://www.uwa.edu.au/people/timothy.colmer) with projects available in the biophysics of transport processes in plants. In particular, projects are available related to oxygen uptake and distribution through the plant body and the role of underwater photosynthesis in submergence tolerance:

- Using advanced techniques (oxygen electrodes) the project will study oxygen transport from shoots to root tips of flooding-tolerant wetland plants, via the specialised aeration tissue (aerenchyma).
- Gas exchange underwater. Complete submergence caused by overland floods can devastate crops, pastures and also natural plant communities. This project will evaluate gas exchange by leaves when submerged, for the processes of underwater photosynthesis (carbon-dioxide uptake) and respiration (oxygen uptake).