SYNOPSES of PRESENTATIONS

"Using chemically modified carbon nanotubes in a robust, solid-state, reagentless pH sensor: making measurements in places other pH sensors can not reach" [*Dr Greg Wildgoose, University of East Anglia*]

Until recently little has changed in pH sensing technology over the past ca. 70 years since Beckman first invented the familiar glass pH sensor for the Californian citrus fruit growing industry in the 1930s. This talk will briefly describe a new pH sensing technology, developed around the turn of this century, that replaces fragile glass pH meters and membrane based ISFET pH sensors, with a robust, solid-state, reagentless, membrane free, temperature-independent sensor utilising chemically modified carbon nanotubes. The sensor was originally designed for making pH measurements over the pH range 1.0-14.0 under relatively "extreme" conditions of temperature and pressure found "down-well" in the oilfield industry. Areas of potential application or collaboration to use this pH sensing technology in deep sea and sea bed measurements will be open for discussion.

"Sensing Change in the Marine Environment"[*Dr Silke Kroeger, CEFAS*]

The European Marine Strategy Framework Directive came into force last year and stipulates that member states have to manage their seas to achieve good environmental (GES) status by 2020. The strategy specifies eleven descriptors of good environmental status, but work on identifying what these descriptors mean in detail, what indicators can be used to measure GES and how to design adequate monitoring programmes to allow assessments to be made is work in progress. This paper describes the current measurement needs in the marine environment and speculates what future contribution sensors, and in particular biosensors, can make to measuring status, processes and important changes in the context of the ecosystem approach to marine management.

Making meaningful marine measurements relies on covering extensive temporal and spatial scales, as relevant processes range from very short term spatially restricted phenomena, such as a pollutant spill or pathogen occurrence, to long lasting and wide ranging effects, such as shifts in pH or oxygenation, and their secondary effects on biota, such as changes in biodiversity or species composition. Therefore a wide range of measurement strategies has to be employed, utilising diverse platforms and corresponding measurement instruments and sensors. This presentation aims to give an overview of some of the relevant parameters, measurement platforms and sensors. The aim is to stimulate discussion and future research into biosensors for marine applications, as this important field is rarely the focus of development efforts within the biosensor community, but could significantly benefit from technology transfer and adaptation.

"Automated sensing technologies for estuaries, coastal areas and seas" [*Prof. Oyvind Mikkelsen, Norwegian University of Science and Technology*]

The talk will focus on recent development of new materials for use as working electrodes in voltammetry (alloy based), development of microelectrodes for increased sensitivity and development of effective cleaning procedures for use in field apparatus to both secure high sensitivity and long time stability. Presentation will show examples of longtime monitoring in costal water and will focus on alternative methods like DGTs to increase quality assurance of environmental data.

“Development and application of novel sensor systems for marine waters” [*Prof. Eric Achterberg, University of Southampton*.]

Estuarine, coastal and oceanic waters are characterized by high spatial and temporal changes in chemical and biological variables. Physical, biological and chemical processes act to change concentrations in trace metals, nutrients and carbonate system parameters such as pH. Antropogenic perturbations, including climate change, require improved high resolution chemical monitoring approaches in marine systems.

The saline matrix and often very low concentrations of target variables in marine waters poses a strong challenge for the development and applications of robust methods. Whilst good laboratory techniques are now available for many of the target variables in seawater, our next challenge is to undertake the measurements in an unattended manner on-board ships of opportunity (e.g. ferries) or *in situ* on moorings, thereby improving our understanding of ocean biogeochemical processes.

In this talk I will present our approaches to dissolved trace metal analyses in marine waters, including the latest developments in laboratory and in situ techniques. In addition, I will discuss our recent work on spectrophotometric pH and nanomolar nutrient sensors. Descriptions of advances in sensor technologies will be accompanied by recent results from coastal and open ocean applications of the sensor systems.