

	Implementation schedule	Physically /remotely	Workload (hours) On site or remotely	Learning outcomes
Activity 1 Bioinformatic tools for antibody selection	<p>To provide an overview of bioinformatic techniques of importance in protein analysis. Bioinformatic tools can assist towards the research of a potentially suitable antibody to be utilized in developing a biosensor. An introduction to databases of sequence patterns and protein families will be given, databases with biological information are reviewed with emphasis on databases with three-dimensional structures and protein families.</p>	Physically/ remotely	25	<p>Introduce the students to databases of sequence patterns and protein families, databases with biological information with emphasis on databases with three-dimensional structures and protein families.</p>
Activity 2 Antibody-Based Affinity Tools for aquatic pathogens Biosensing	<p>Antibody-based detection systems have long been chosen to facilitate on-site monitoring of environmental markers. Antibodies were the first detection molecules to be seen as effective replacements to mouse bioassays, high-performance liquid chromatography (HPLC) and mass-spectrometry (MS)-based systems. Antibodies have progressed significantly in their capabilities over the</p>	Physically/ remotely	25	<p>Introduce the students to antibodies' immobilization techniques, optical and electrochemical biosensor assays.</p>

	<p>past 70 years, with much investigative research being carried out with regard to their production, purification, sensitivity enhancement and their incorporation into sensor platforms.</p>			
<p>Activity 3 Paper-Based Devices for Pathogens Detection in Water</p>	<p>Although conventional methods, e.g., polymerase chain reaction (PCR), can provide reliable and robust detection results, they are often time- and cost-consuming, limiting their application in resource-poor settings. Recently, paper-based devices, as a new biosensing technique, have emerged as promising tools to conventional methods for pathogen detection. A comprehensive introduction and insights on the development of paper-based devices for the pathogen detection in water will be given. Firstly, the substrate materials and fabrication methods for paper-based devices are introduced. Engineering assay onto paper-based devices for pathogens detection will be explained for the rapid and on-site monitoring. We will also compare the strengths and drawbacks between paper-based devices and the conventional analytical</p>	<p>Physically</p>	<p>25</p>	<p>Introduce the students to the development of paper-based biosensor assays, substrate materials and fabrication methods.</p>

	methods, including culture method, biochemical test, immune assay, and molecular method.			
Activity 4 Electrochemical MIP Sensors for Environmental Analysis	<p>Both voltammetric and potentiometric electrochemical sensors allow the sensitive online measurement by simple instrumentation; however, they are restricted to electroactive substances, and their specificity is frequently not sufficient.</p> <p>The combination of electrochemical sensors with biomimetic recognition elements, e.g., molecularly imprinted polymers (MIPs), has the potential for highly sensitive and specific analysis. In the MIP synthesis, functional monomers interact with the target analyte (so-called template) to the pre-polymerization complex. It is “frozen” by the formation of a polymer network around the template. Subsequently, the template is removed, and binding cavities are formed in the polymer: they mirror the size, shape, and functionality of the template, which is preferentially bound from complex media.</p> <p>Electrochemical MIP sensors unify the potentials</p>	Physically	25	Introduce the students to the development of molecularly imprinted polymers electrochemically sensors, biomimetic recognition elements and fabrication methods.

	of synthetic binders with simple electrochemical instrumentation.			
Activity 5 Report	Report on the abovementioned activities	Physically/ remotely	30	Deep understanding of the content of the abovementioned activities
Activity 6 Presentation	Presentation of the abovementioned activities at the online annual student's conference	Physically/ remotely	20	Deep understanding of the content of the abovementioned activities