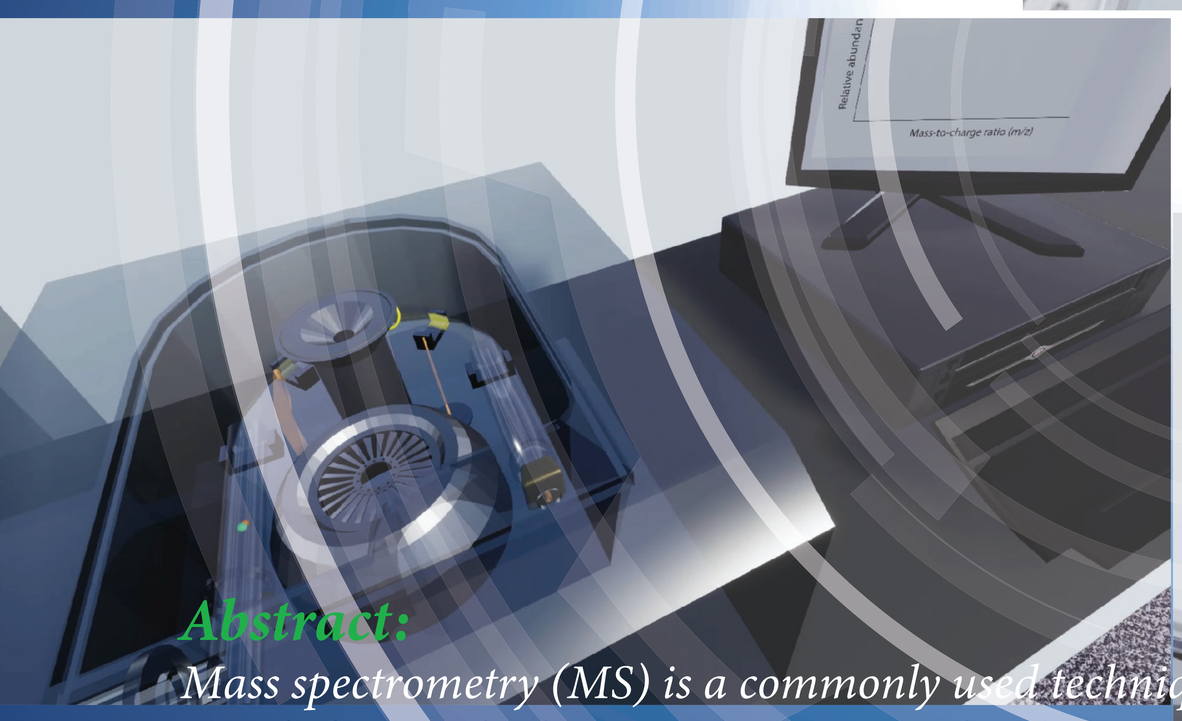
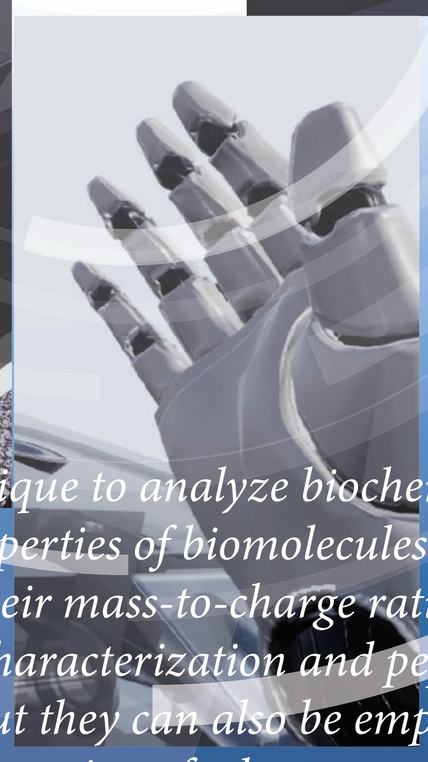
School of Life Sciences
The Chinese University of Hong Kong
生命科學學院

Application of Virtual Reality on the Teaching and Learning of

Mass Spectrometry





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Abstract:

Mass spectrometry (MS) is a commonly used technique to analyze biochemical samples such as peptides, cellular metabolites and other organic compounds. The properties of biomolecules or their fragments can be revealed by ionization and separation processes according to their mass-to-charge ratios. With different machine designs, MS has become one of the important methods for protein characterization and peptide sequencing. Not only can mass spectrometers be used in different research fields, but they can also be employed to study both pure samples and cellular mixtures. Despite its powerful functions, operation of a large mass spectrometer can only be conducted under the supervision of skilled technicians and in a specialized lab facility. Both of which, however, may not be readily available for a large undergraduate class. Furthermore, life science students are often daunted by abstract physical concepts of mass spectrometry. It could also be difficult for some students to acquire the skills to handle a sophisticated mass spectrometer and to prepare biological specimens for analysis. In light of the immersive nature of visual reality (VR) technology, an interactive e-learning module has been developed to help students overcome these learning difficulties. In the poster presentation session, the design of our VR learning module and its implementation in classroom will be discussed.

Learning objectives:

- Virtual Reality (VR) technology is used to construct the virtual laboratory for the teaching of MS, in particular, gas chromatography (GC)-MS, which is normally unavailable in a teaching laboratory of undergraduate study. In the virtual lab, students can visualize the overall workflow of a GC-MS for sample analysis.

- Sample preparation: students will notice there is a standard procedure of sample preparation before it is applied to the GC-MS.

- GC: students can visualize and revise the process of gas chromatography they have learnt from other Biochemistry courses.

- MS: students can visualize the overall design of a MS and learn about the key steps of MS for sample analysis.

- Data presentation: students can learn about the basic principle of signal collection and data presentation of MS.

- All the components above are very useful in the field of medical biochemistry nowadays, which are very likely to benefit our students and improve their competitive edge.

Prospects & applications:

In this virtual laboratory, VR technology is employed to allow students to revise, visualize, and experience the key steps of GC-MS of samples, for example, to analyze clinical specimens. This educational activity was not possible in the past owing to the limited availability of the hardware of GC-MS for undergraduate laboratory courses. With the application of VR, the limiting factors have been overcome; further applications, such as the teaching of experiments with high risk samples, such as pathological microorganisms, will also be made possible to further enhance the e-learning activity of the students through the flipped-classroom approach in biochemistry.

This project is supported by Micro-Module Courseware Development Grant (2017-18).