

Development of a virtual laboratory for the teaching of

IMMUNOHISTOCHEMISTRY

Members

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Abstract

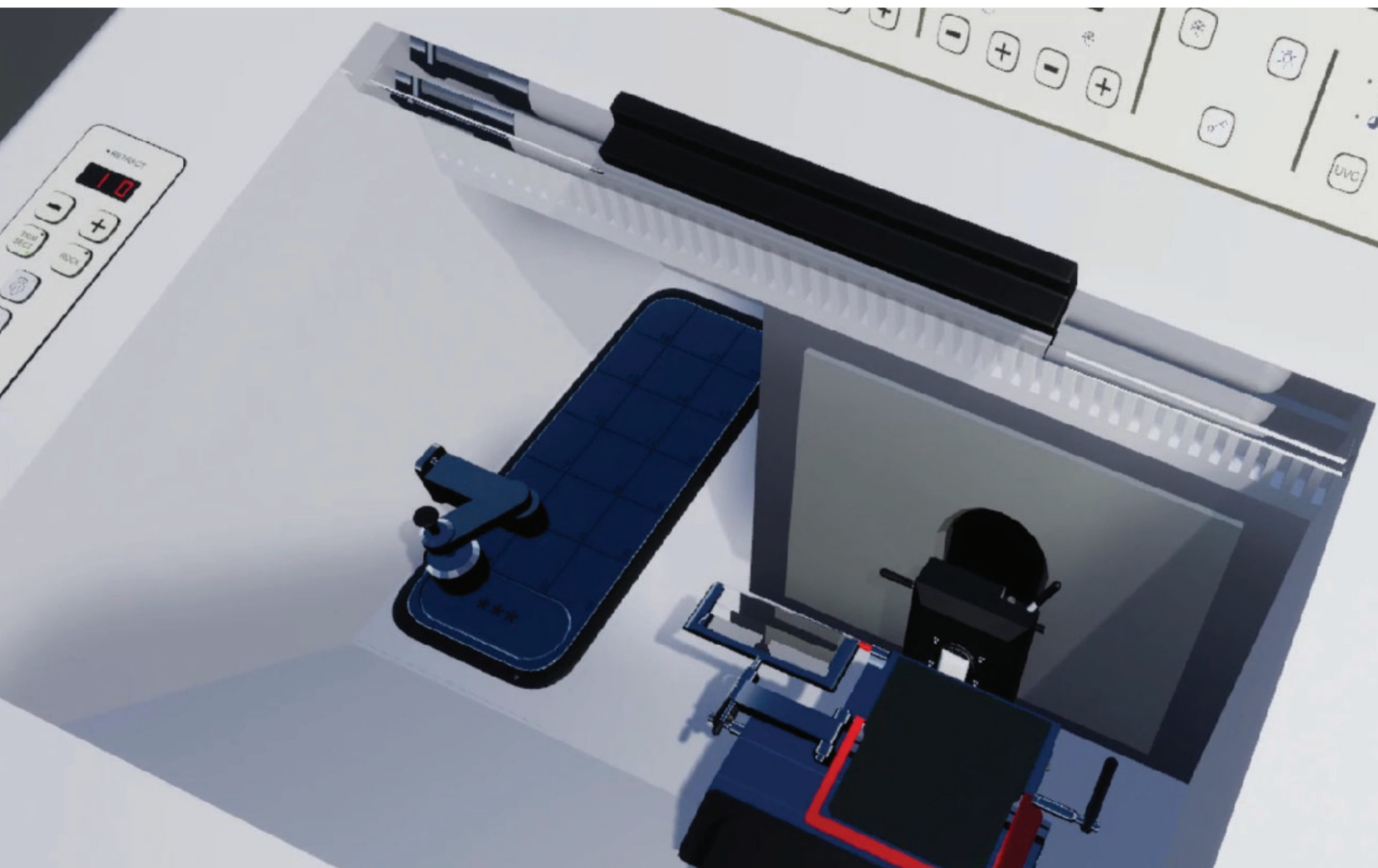
Mass spectrometry (MS) is a commonly used technique to analyze biochemical samples such as peptides, cellular metabolites and other organic compounds. The properties of biomolecules or their fragments can be revealed by ionization and separation processes according to their mass-to-charge ratios. With 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.

Technology

- Virtual Reality (VR) technology is used to construct the virtual laboratory for the teaching of immunohistochemistry (IHC) of human tissues, which are normally unavailable in a teaching laboratory of undergraduate study. In the virtual lab, students can experience all the key steps of IHC interactively with the aid of VR technology.
- Protein Data Bank (PDB) 3D protein modelling (www.rcsb.org/pdb) is incorporated in the virtual lab for the construction of the ribbon structures of protein molecules, such as antigens, antibodies, and enzymes.
- PubChem 3D biomolecule modelling (pubchem.ncbi.nlm.nih.gov) is also incorporated in the virtual lab for the construction of 3 dimensional ball-and-stick structure of simple biomolecules, such as enzymatic substrates.
- Cryo-sectioning is a fundamental technique in cellular pathology to process human tissue for pathological examination. In this virtual lab, one of the major educational objectives is to provide foundation training of cryo-sectioning techniques by allowing the students to experience the key procedures by VR.
- Immunohistochemistry (IHC) is another fundamental technique in cytopathology. The virtual aims at providing several interactive animations of the principles involved.

Prospects & Applications

In this virtual laboratory, VR technology is employed to allow students to experience the key steps of cryo-sectioning of human tissues for the subsequent IHC analysis. This educational activity was not possible in the past owing to the limited availability of human sample for IHC analysis; another limiting factor was the cost of the equipment for cryo-section. With the application of VR, the limiting factors have been overcome; further applications, such as the teaching of gas chromatography-mass spectrometry (GC-MS) will also be made possible to further enhance the e-learning activity of the students through the flipped-classroom approach in biochemistry.



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