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Through the looking glass: identifying cells through fluorescence labelling

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Abstract:

Histology staining enables non-invasive visualization of a biological system's structure and operational processes. The demand for bioimaging tools, particularly for biological applications and research, has risen steadily in recent years, giving rise to numerous cutting-edge technologies with infinite spatial resolution, such as magnetic resonance imaging. However, their limited usage in scientific and professional studies is due to their low specificity and poor biocompatibility. A superior alternative, fluorescence biosensors, has emerged as a potent tool for the real-time, high-resolution, non-invasive imaging of biological analytes, structures, and processes. The development of biosensors is not well understood outside of the academic community, and few pedagogical initiatives keep up with the rapid pace of associated research. Although optical imaging is a common subject covered in educational programs, many institutions have not yet adopted the problem-based learning (PBL) strategy for teaching biosensors.

As students follow a planned and pre-determined teaching style, referred to as a "recipe," most well-established instructional methods rely on developing and evaluating published designs in literature for well-known applications. In this proposal, UG students in the module of BME2106 will undergo a series of sessions to take on experimental design and statistical analysis. Through lectures, the cohort will first be trained on fundamental biological, fluorescence labelling and bioimaging principles. During the tutorials, students will be presented with a range of fluorescence probes. They will be allowed to identify a potential application that complements the use of the fluorescence probe. Students will then implement their experimental design through hands-on laboratory sessions to validate their research idea. This concept of the student-led learning method will provide students with excellent learning opportunities to experience the real process of scientific discovery, problem-solving, and design verification process. Students can summarize project results through assignment presentations and train their communication skills.