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Design, Characterization, and Usage of Fluorescent-DHFR as a Visual Biochemistry Lab Teaching Tool to Enhance Learning

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Student feedback from an undergraduate biochemistry lab course suggested that usage of visibly traceable proteins may assist their learning. Based on this feedback, students developed and characterized a suite of fluorescent protein-dihydrofolate reductase (DHFR) fusions as tools for a biochemistry teaching lab. Unlike the wt versions, members of this suite are well-expressed, soluble, visible, highly stable, and easily characterized. The color of mCherry and EGFP fluorescent fusions with microbial DHFR allows students to visibly track their target protein from expression through purification, while fusions with BFP are visible under UV-light. Importantly, we found that fluorescent protein fusions with DHFR did not kinetically interfere as the KM and kcat values were not remarkably altered from the unfused variant. We observed potential learning gains on a course assessment when students used these visible variants, suggesting that the often overlooked element of visual cues in a biochemistry lab may be an exploitable component of learning.

Keywords: visible proteins, biochemistry

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