

First Year Course-Based Undergraduate Research Experience (CURE) Using CRISPR/Cas9 Genome Engineering Technology in Zebrafish

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CRISPR-Cas9 has rapidly emerged as the most important advance in molecular biology in the past 20 years. As this technology is currently and will continue to make significant impacts in research across the life sciences, it is imperative that undergraduates become conversant in the workings of CRISPR-Cas9. Unfortunately, the relative novelty of CRISPR-Cas9 means that teaching options involving this technology are limited. In this workshop, we present a semester-long course-based undergraduate research experience in which CRISPR-Cas9 is utilized in a zebrafish model system to develop gene knockouts that can be used for a variety of research questions. Using a workflow developed largely by undergraduate student researchers, we will demonstrate how CRISPR-Cas9 can be made accessible to first-year undergraduate students using bioinformatics and molecular biology techniques. Students select their own putative target gene for CRISPR-Cas9-mediated disruption based on personal interests in particular aspects of zebrafish development and genetics. Preliminary assessment of this laboratory project suggests that students develop not only an appreciation for CRISPR-Cas9 technology but also the process of life science research as a whole as a result of the authentic nature of the research project. While our project revolves around zebrafish, similar lab modules could be developed for other model systems using our course structure.

Keywords: Course-Based Undergraduate Research Experience (CURE), CRISPR/Cas9, zebrafish

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