GENE EDITING PRACTICAL ACTIVITIES FOR PLANT SCIENCE UNDERGRADUATES

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SUBTHEME: Experiential learning

PROBLEM

Experiential learning is an integral part of science undergraduate training. In all disciplines, it is an ongoing challenge for educators to provide students with practical experiences that will prepare students for the cutting-edge techniques they will encounter in their careers.

One of the most important developments in biology this century is CRISPR-Cas9 and related gene editing technology. This technology has revolutionised scientists' ability to edit gene functions by making targeted mutations and is used widely in biotechnology and biomedical research. In plant science CRISPR-Cas9 technology is being used to modify plant traits to respond to global challenges including climate change and food security.

Our challenge was to develop a series of practical activities for undergraduate students that used emerging technologies. These practicals aimed to help students apply their theoretical knowledge in a real-world context. A further challenge was navigating the regulatory and compliance framework for using gene editing technologies in this context.

PLAN

Our plan for this action research was to identify existing CRISPR-Cas9 experimental protocols that had been used successfully for student cohorts. We obtained relevant approvals to establish these protocols in our own teaching laboratories using the model organism, *Saccharomyces cerevisiae*.

ACTION

Our technical and teaching team adapted methods for gene editing in *S. cerevisiae* from published reports and developed accompanying learning materials. A small cohort of third year plant science students undertook a series of bioinformatic and practical activities over a 4-week period during weekly 3-hour practical classes in 2024 and 2025. After completing these activities students wrote a practical report about these experiments. In the second iteration we introduced a new assessment where students wrote a research proposal to apply their knowledge about CRISPR-Cas9 approaches to new directions relevant to the subject material.

REFLECTION

The first iterations of these practical activities received positive feedback from students through the End of Semester Survey and verbal comments. The academic and technical team members involved in this project overcame challenges in establishing the protocols in our own teaching laboratories and in navigating the regulatory framework for students to undertake these activities. In future iterations the written learning materials will be improved to better scaffold students' understanding about the methods used in the activities. This experience provides insights and guidance to other educators about developing a coherent series of practical classes using emerging technologies.

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