Kumar Saurav's Group

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Title of the project: Practical Molecular Technique Course to Isolate and Assemble Cyanobacterial BGC

For how many student/s: 1

Description of the Project

Cyanobacteria are ancient photosynthetic microorganisms and an important source of diverse, bioactive natural products. Many of these compounds including RiPPs like lassopeptides. These are encoded by biosynthetic gene clusters (BGCs), which remain largely unexplored despite their strong potential in biotechnology and drug discovery. Understanding how to identify, isolate, and assemble these BGCs is key to unlocking new chemistry and enabling their expression in tractable hosts.

This short practical course introduces students to the essential molecular techniques needed to isolate and assemble a cyanobacterial BGC. Participants will work through a complete cloning workflow, from sequence analysis and primer design to PCR amplification, construct assembly, and transformation. A model cyanobacterial BGC will be used to demonstrate each step within a manageable timeframe.

Students will use the pET::ptet::GFP_v2 plasmid as a cloning backbone, gaining hands-on experience with modern cloning strategies. If time permits, the workflow will extend to heterologous expression to illustrate how assembled BGCs can be functionally expressed.

The course combines wet-lab training with basic bioinformatics, including sequence analysis and primer design using Geneious Prime**.** Emphasis is placed on understanding the purpose behind each step while building practical laboratory confidence. By the end, students will have completed a full BGC cloning pipeline: an excellent foundation for research in natural products, synthetic biology, and molecular biotechnology.

In this project student will mainly focus on:

1. Develop the understanding of cyanobacterial BGC identification and primer designing using Geneious Prime for target amplification.
2. Isolate plasmid and genomic DNA from bacterial and cyanobacterial samples.
3. Amplify DNA fragments using PCR and verify products by gel electrophoresis. Followed by gel purification of DNA fragments.
4. Assemble DNA constructs using HiFi assembly using the pET::ptet::GFP_v2 plasmid backbone.
5. Transform recombinant plasmids into *E. coli*.
6. Screen and verify positive clones using colony PCR.
7. Develop an understanding of BGC organization and cloning strategies.

Requirements:

The student must have a good command of spoken and written English for understanding instructions and basic scientific communication. A fundamental understanding of molecular biology concepts (such as DNA, plasmid and PCR) is essential.

Prior experience working in a molecular biology laboratory is highly appreciated, though not strictly required. The student should be comfortable following basic experimental protocols and handling standard laboratory equipment.