

A UROP perspective by Hairuo Li

Summer 2023 (undertaken in the Department of Bioengineering)

Hairuo was a year 3 (penultimate year) undergraduate at Imperial College London in 2022-2023: MEng Molecular Bioengineering, Department of Bioengineering.

UROP title: Targeted E.coli and yeast conjugation mediated by synthetic cell-to-cell adhesion for long DNA sequence transfer

Having the UROP opportunity in Professor Ellis' lab marks the beginning of my first individual research project. Throughout this process, I have received a great amount of help from Professor Ellis, who assisted me in planning my research schedules, and from my day-to-day supervisors, Fankang Meng (PhD) and Linde Van Landuyt (Research Associate). They guided me from acquiring basic molecular biology lab skills to understanding the logistics of setting up an experiment, analysing and presenting results, and learning from mistakes to enhance current protocols.

Before my UROP started in July, I felt slightly perturbed because the projects and experiments I had done in the past did not require me to write my own protocols or design experiments. Additionally, I lacked basic lab skills such as preparing cell growth medium and culturing cells. Most of the preparation steps for my previous lab sessions and group projects were handled by lab technicians and GTAs. However, it turned out that I had been overthinking, as both of my day-to-day supervisors are truly approachable and willing to teach me from the very beginning. I learned everyday molecular biology lab techniques, including plasmid extraction, DNA cleaning and concentrating, primer design, DNA and plasmid sequencing mechanisms, as well as operating the gel imaging system, spectrophotometer, thermal cycler (for PCR, Gibson Assembly, Golden Gate Assembly, and much more), and microplate reader.

In addition to acquiring basic lab skills, I gained knowledge in designing experiments, such as understanding the logic behind setting up control and experiment groups, minimizing group numbers to ensure experiment efficiency, learning from previous results, and adjusting parameters to improve the next round of experiments. Preparing next-day schedules and creating daily plans are also essential skills, enabling all past work to be traced back. Another valuable skill I learned from Fankang is numbering all the primers, plasmids, strains, and transformations designed, and then summarizing all the important information about each design in an online table. Given the limited space on tubes and microplates, numbering facilitates labelling, making it easier to track even if the tube is discarded or the writing becomes faded.

Another valuable facet that this experience provided me with is an insight into the realm of research life. Within the IC-CSynB centre, which encompasses five PIs, the interactive and friendly environment fosters easy communication and idea sharing among various groups. Equipment sharing and reagent borrowing are commonplace practices among members. I actively engaged with the group, seeking conversations with as many members as possible. At the same time, I've been invited to participate in all group and sub-group meetings, as well as team-building activities. During our weekly meetings, a group member presents their research from the past few months, offering me a glimpse into Ph.D. projects and the planning of larger research endeavours.

Guest speakers are occasionally invited to share their projects in related fields, enabling me to stay updated on cutting-edge technologies and recent findings. In bi-weekly sub-group meetings, we summarize our recent work with a few slides and engage in discussions with Professor Ellis and fellow researchers. During specific sub-group meetings, scenarios emerged in which unexpected experimental outcomes appeared within the research of certain members. This led to concerns about potential contamination, which were raised by others. Fellow lab members stepped in with supportive replication efforts to ascertain whether contamination was indeed the cause. These experiences underscore the collaborative nature of research, where while it's often an individual task, researchers are never alone.

Overall, I truly gained more than I expected from my UROP experience. It equipped me with the skills for planning experiments, conducting experiments, and analysing data to enhance current setups. I am now confident that I will take my further steps in the field of synthetic biology, and I believe I am better prepared for my upcoming final year master project and PhD application processes. I would also like to take this opportunity to express my sincere gratitude to Professor Tom Ellis, Fankang Meng, and Linde Van Landuyt for their generous help, patience, care, and encouragement, which I deeply appreciate.