Bacteria can be seen as tiny but incredibly efficient chemical factories, both in nature and in our industrial processes. While these microscopic workhorses are essential for producing valuable biochemicals, they often operate below their full potential. Our previous research has uncovered that bacteria typically produce more enzymes (their chemical processing machinery) than they actually use in their day-to-day operations. We believe a newly discovered approach, termed the "carbon PUSH" strategy, can unleash this hidden potential. By introducing specially designed "gateways" (transporters) into bacterial cells, it becomes possible to flood them with raw materials (sugar substrates), enabling their internal machinery to work at maximum capacity.

This research project aims to perfect this strategy across different types of bacteria and different sugars. We will use cutting-edge computer simulations and laboratory experiments to design and test these new cellular gateways, particularly focusing on a sugar transporter from the bacterium *Zymomonas mobilis*. The work also includes developing heat-resistant versions of these transporters for high-temperature industrial processes.

Understanding how to unlock bacteria's full potential could revolutionize biotechnology applications - from biofuel production to pharmaceutical manufacturing. As such, this project has the potential not only to advance our understanding of bacterial metabolism but also to pave the way for more sustainable and efficient industrial processes.