

# Bioengineering team develops a remote lab to teach enzyme kinetics

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Abhishek Bhattacharjee, an undergraduate student in Bioengineering, optimized the protocols and is the first author in the study. Credit: Abhishek Bhattacharjee

The COVID-19 pandemic forced teachers across the globe to embrace remote learning. Although adapting existing materials was relatively easy for lecture-based courses that revolved around theory, teaching laboratory classes remotely presented a formidable challenge. In a new paper published in the *Journal of Microbiology & Biology Education*,

researchers from the Department of Bioengineering at the The Carl R. Woese Institute for Genomic Biology at the University of Illinois at Urbana-Champaign demonstrate the implementation of a remote laboratory activity to teach students about enzyme kinetics.

"A significant challenge for [online learning](#) is the delivery of hands-on lab coursework. During the COVID-19 pandemic, we developed and shipped kits with supplies and reagents to provide lab experience to remote students," said Karin Jensen, a Teaching Assistant Professor of Bioengineering. "We wanted to help students practice techniques and perform experiments remotely using protocols that do not require large and expensive equipment that students normally have access to in our instructional lab."

Previously, the researchers had developed remote exercises to teach students how to use micropipettes using at-home kits. Now, they are focusing on how to teach [undergraduate students](#) about enzyme kinetics, which looks at how quickly an enzyme breaks down its target to form a product. To do so, the team has developed an at-home enzyme kinetics kit that can be used as an alternative to traditional techniques that are performed in a laboratory setting.

"While other instructors have developed lab kits in the past, none of those were focused on teaching enzyme kinetics, which is particularly challenging given the specialized equipment normally required to accurately measure the products of the enzymatic reactions," said Pablo Perez-Pinera (ACPP), an associate professor of bioengineering. "We used very basic and affordable equipment to teach students how to perform simple experiments and rapidly collect data to study enzyme kinetics."

The students were studying how the enzyme lactase converts lactose to glucose. The kit included micropipettes, scales, lactose, lactase pills and

a glucose meter. In the weeks prior to the exercise, the students were trained remotely to use micropipettes and were taught to record data in electronic lab notebooks. After watching a prerecorded lecture on enzymes, they were provided with instructions on how to carry out the experiments.

Eileen Johnson, a graduate student teaching assistant in bioengineering who taught the remote lab sections, engaged students in the activity by creating a friendly competition for students to design and conduct their own experiments. After meeting with the instructors and learning the basics of the experiment, the students were asked to investigate how different perturbations changed the kinetics of the reaction: Do different brands of lactase make a difference, does boiling the lactase change anything, and does freezing the enzyme change the outcome? After introducing such variables, the students met with the instructors and presented their results.

"Several students reported that the [enzyme](#) kinetics lab was one of their favorite parts of the course," said Abhishek Bhattacharjee, an undergraduate student in the Department of Bioengineering and lead course lab assistant who developed and optimized the protocols. "Our main limitation was the small number of students who provided feedback. Our future work will include additional and formal assessment of student feedback."

The need for such at-home kits will remain long after the pandemic. For example, [students](#) who cannot attend in-person labs, those in summer camps, or participants of online programs may still require remote lab learning opportunities. The researchers hope that similar lab activities will also help in increasing access to STEM education.

**More information:** Abhishek Bhattacharjee et al, Development and Implementation of a Remote Enzyme Kinetics Laboratory Exercise,

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