

# Transitioning undergraduate research from wet lab to the virtual in the wake of a pandemic

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## Abstract

The COVID-19 outbreak has shut down universities, and teaching faculty have moved to online classrooms to address students. This change has been supported by numerous online teaching tools and development of virtual classrooms. Undergraduate research programs in the sciences and biochemistry/molecular biology teaching labs, however, are affected by this change due to inaccessibility to laboratories. This communication outlines three concepts to engage undergraduate students who are involved in research: (a) remote data analysis, (b) literature review and science writing, and (c) science journal clubs.

## KEYWORDS

COVID-19, online teaching, student engagement, undergraduate research

## 1 | INTRODUCTION

The increasing cases of infections in the recent COVID-19 outbreak has made universities worldwide cancel the traditional style of classes and move to online teaching wherever possible.<sup>1</sup> While online teaching tools have always existed, this large-scale transition to online teaching was sudden for most teaching professionals. In this scenario, many useful resources have been put forward to aid educators accomplish their classes on an online modality.<sup>2–4</sup> For regular course work, lectures are given online and students continue to work on assignments and homework as they usually do. Another aspect of teaching that has not been given enough attention is the online management of undergraduate research and biochemistry/molecular biology teaching labs.<sup>5–7</sup> In our undergraduate program (as in most institutions), students take research for credits, and earn it by committing to lab work for a few hours per week (3 hr per credit in our institution). Typically, undergraduate students in the sciences work with their mentors in the lab on a specific project, doing lab-based experiments and analyses. While remote experiments are ruled out, undergraduate researchers can be

engaged remotely in a few streamlined ways, to attain their 9–10 hr lab work per week (Figure 1).

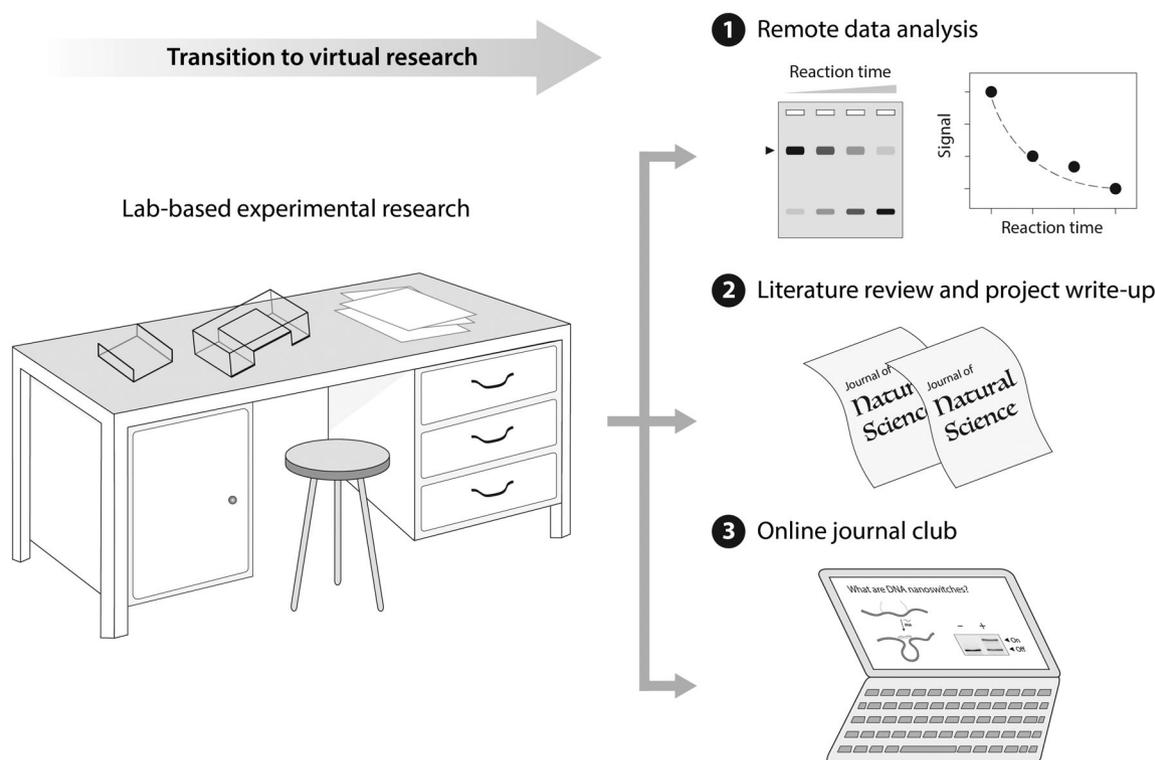
## 2 | ENGAGING UNDERGRADUATE RESEARCHERS

### 2.1 | Remote Data Analysis

Students work on research projects through the semester, and while online experiments are not possible, they can be guided to analyze the data collected over the past few months. In our own lab, we work on DNA-based biosensing and DNA nanotechnology, with some experiments tailor-made for undergraduate students.<sup>8</sup> Some of these data can be analyzed, plotted and be discussed in online lab meetings. For labs involved in simulations, students can be given computational projects that can be performed remotely.

### 2.2 | Literature Review

Students can be made to read and understand previous research that is relevant to their project. In some



**FIGURE 1** Undergraduate students in science research programs can be engaged online through remote data analysis, literature review, and journal club presentations

institutions, writing a research report at the end of the semester is a requirement. Guiding students in literature review will also help them write their research papers and work toward their final submission.

### 2.3 | Journal Club

As part of online lab meetings, students can be provided new research papers and asked to present to the group. This keeps everyone in the lab updated on current research, especially with the large volume of research output in recent years. As undergraduate students, guidance from mentors in understanding research papers outside their field and in preparation of a presentation will be a valuable learning process outside of a lab setting.<sup>9,10</sup> Students can present to the group online by sharing their screen using virtual collaborating programs.

Many research-oriented universities involve undergraduate students in their academic labs, either as volunteers or as part of a credit-based program. Having a defined online engagement plan will help connect with students off-campus, and help in maintaining the enthusiasm of students in research. For educators, this

alternate engagement will also provide a scale to grade students in the absence of regular lab work.

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