



Education News

Science from Home: Adapting Summer Research Experiences for Undergraduates During a Pandemic

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Rutgers University closed its doors to undergraduate education in March 2020 as SARS-CoV-2 infections began to spread quickly across New Jersey. Courses moved online for the second half of the semester similar to many colleges across the country. In short time, it became increasingly evident that experiential programs would need to adapt to a virtual format. We have hosted the Summer Undergraduate Research Fellowship (SURF) program, sponsored in part by an institutional ASPET award, for over 10 years. But in 2020, this would be the first summer with no undergraduate students permitted on campus. Confronting this new normal required SURF leadership to re-think the methods traditionally employed for the summer program. With 20 SURF students spread across the United States and 6 weeks to run our program, we had many questions that needed to be considered. These are just a few that we tackled in launching a virtual summer research program:

How does a program focused largely on wet lab research develop virtual projects?

Faculty mentors developed a number of research projects that could be completed by undergraduate interns at home. These included computational toxicology projects using existing big data, secondary analysis of RNA-Sequencing datasets, as well as quantification of histochemical and immunohistochemical stains using online software. Other students involved in yearlong research at Rutgers pursued literature-based projects to design future experiments. Keys to successful research projects were well-defined milestones, weekly one-on-one meetings with near peer and faculty mentors, and access to university VPNs and file sharing services.



Intern Tanvi Banota displays the welcome package sent to her home containing materials for the virtual SURF program.



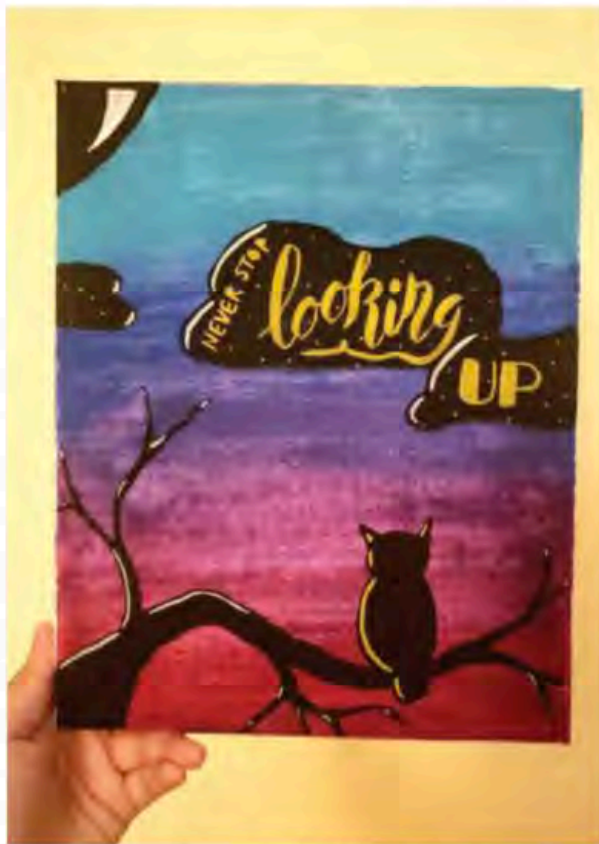
Intern Andrés Rivera Ruiz displays the lab coat that he tie-dyed as part of the virtual SURF program.

What approaches can be used to provide a community experience among the interns?

We expanded the number of graduate student and postdoctoral fellow instructors from two to six for the summer of 2020 to improve instructor-to-intern ratios. The community experience was developed by placing students in small teams with one or two instructors. Teams were used for group projects and discussions in Zoom breakout rooms. A sense of community was also accomplished upfront with welcome packages sent to the students' homes. Boxes included program swag (t-shirt, lab coat, water bottle, pen), kits to simulate experiments at home, and welcome materials (instructor photos and fun facts, BINGO cards, painting canvas and paint, and a tie-dye kit). During the first few days, students were required to tie-dye their lab coats, submit their goals for SURF to a video compilation website, and participate in a BINGO-based networking game on Zoom—all key steps to get interns engaged upfront.

How do we recapitulate the experience of experimentation from home?

Rutgers SURF took two approaches to tackle this question. First, we adapted three kits from Science Takeout© on lead-induced neurotoxicity, infectious epidemiology, and clinical toxicology to an undergraduate level. Using these kits, students pipetted simulated materials to answer scientific research questions from their homes. Instructors guided students with cases and questions as they advanced through the exercises over Zoom. Second, interns were also provided tubes for testing drinking water in their homes for heavy metals such as lead. Following instruction on proper sampling, students returned samples by week 3 of the program using prepaid postage envelopes. By week 6, Rutgers scientists had their data ready to review over Zoom with the interns. Thankfully, the homes of our interns all had low levels of lead in their drinking water.



Artwork from the virtual painting night with interns, graduate students, and postdoctoral fellows.



SURF interns were asked to describe SURF using 5 words. The assembled word cloud reflects the collective descriptions of all 20 interns.

What opportunities are there for informal networking among interns and with graduate students when running a virtual program?

The formal structure of the SURF program included twice weekly career development and research meetings with instructors and program directors. In addition, we hosted three optional events during the 6-week program. These included two evenings playing Jackbox games in small groups as well as a painting night with graduate students and postdocs. For the painting night, students received a canvas, brushes, and a small paint set in their welcome packages. They logged into Zoom and every 20 minutes students "moved" across breakout rooms where they discussed their summers as well as post-graduate career options such as graduate education. Instructors also held weekly online open meetings where interns selected topics for discussion—ranging from the preparation of competitive applications for graduate school to instruction on how to effectively use reference and graphical software. The open nature of these unstructured meetings spurred informal networking and deeper connections between interns.

What new opportunities could an all-virtual program provide?

Moving to an online format opened new avenues for engagement that were previously unconsidered. We were able to collaborate more effectively with other Rutgers summer programs on responsible conduct of research and science communication training. The breadth of speakers and career panelists

was wider than past years as we hosted scientists from NIH, US Coast Guard, US FDA, and numerous pharmaceutical, environmental, chemical, and consumer product companies. We were also able to invite numerous scientists to share their latest research findings. In collaboration with the Protein Databank, we hosted scientists and clinicians who shared their latest experiences with testing and managing patients with COVID-19 including the first saliva test for SARS-CoV-2 developed at Rutgers.

Going forward, we certainly prefer an in-person research internship program for Summer 2021. However, the limitations of the current summer challenged us to develop innovative approaches to student engagement. Many of these new activities will continue beyond COVID-19. When asked to describe their experiences during the virtual SURF 2020 program, students generated a collective word cloud centered on "informative," "educational," and "engaging"—affirming that a number of our goals were achieved. While all 20 students would have preferred a summer in Rutgers laboratories, their gratitude for an adapted online program and their virtual mentors was evident. Over the upcoming years, we will continue to learn from these unprecedented times to educate and train the next generation of biomedical scientists in new and creative ways.

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