The future of scientific research depends on a talented, diverse and inclusive workforce with high scientific proficiency. Undergraduate research experiences have been shown to play a key role in encouraging students, especially those from historically underrepresented groups, to pursue careers in science and healthcare professions. In response to these needs, Professor Hollie Swanson, from the University of Kentucky has developed the Summer Undergraduate Research Fellowship (STEPS), which offers individualized research experiences in different areas of pharmacology and environmental health sciences to undergraduate students from a variety of backgrounds.

The genesis of the STEPS project arose from Professor Hollie Swanson’s reflections about her own career goals whereby she sought to align her passion for research with the needs of the scientific community. Swanson’s expertise in research pertains to problems relating to environmental health sciences whereas her teaching activities focus on delivering pharmacology related concepts to undergraduate, graduate and professional students. Through her work, Swanson aims to use both her expertise and teaching experience to encourage students from all backgrounds to pursue careers in science and research.

Swanson was keen to develop a program which could offer individualised research experiences to undergraduate students. Funding from the American Society for Pharmacology and Experimental Therapeutics provided initial support for the STEPS project, whereby five undergraduate students were enrolled in a 10-week summer program. Subsequently, Swanson received a second source of funding from the National Institutes for Environmental Health Sciences, which provided support for an additional 12 undergraduate students as well as 12 peer mentors who offered career advice to students. The program is designed to introduce students to the highly interdisciplinary and collaborative nature of environmental health science research, which is focused on solving key global health problems. An additional focus is on preparing underprivileged and under-represented students for successful careers in relevant fields.

RECRUITING STUDENTS

Swanson carefully considered the target audience of the STEPS program. She sought to include students from her local area of Kentucky because of the large numbers from socioeconomically disadvantaged backgrounds whom she wanted to encourage and support. A particularly effective way to recruit onto the program was through obtaining recommendations from other academic staff members. Swanson has developed connections with a number of universities including Eastern Kentucky University and Morehead State University. Both institutions were actively looking for research opportunities for students so were keen to become involved.

Swanson realised that beginning recruiting early was essential in getting sufficient students on board and now begins the recruitment before the students leave for their Christmas break. The University of Kentucky also produced a video to help with recruiting students onto the STEPS project. In addition, as the program has become more established, word of mouth has become a useful way of encouraging more students to apply.

PROGRAM ACTIVITIES

In order to prepare students for the program, they participate in several days of orientation activities. This includes discussing ethics, lab books as well as the importance of communication in a way that is enjoyable for students. This enables them to get to know both the university campus and each other better. The strong group dynamics developed also help students to optimise their experience of the project.

The students participating in the program spend the majority of their time in their faculty mentor’s laboratories. Due to the highly interdisciplinary nature of environmental health sciences and pharmacology, this includes a wide variety of departments and colleges. Throughout the summer, the students also work on developing their skills, such as interview and oral communication skills.

Weekly activities are organised throughout the program, such as hiking. On one week of the program, a hike at Red River Gorge was arranged through an outdoor centre. Another week, students received a visit from rapper Farmer Brown, who raps about nutrition and sustainable farming. Students discussed the use of outreach and the importance of using culturally appropriate ways to reach an audience. In addition, on one week students worked with an agriculture extension agent to check stream health by collecting insects and measuring water quality. They discussed runoff and the range of substances that can end up in the water supply.

Careers are a key concern of the students participating so the program also involved lunches where researchers visited and discussed their research and career paths. Students are able to interact with these professionals to become aware of the wide variety of career options available to them. Shadowing opportunities were also organised for students where they could establish networks to help them progress towards their chosen career. These activities allow students to see how science is used in their local community whilst also having exposure to different potential career paths.

At the end of the program, the students prepare a poster that describes their research projects and presents them to the faculty and staff of the involved departments. An event with around 50 students and faculty members engaged in the improvisation workshop. Participants interacting in the improvisation workshop.

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Feedback from Students
Feedback is obtained from students by administering pre and post program surveys about their expectations and experiences of participating. Preliminary results from these surveys indicate that through participating students gain confidence, a greater understanding of the nature of scientific research, how to formulate a research question, how to work independently and how to discuss scientific concepts. Receiving this feedback from students has been hugely rewarding for Swanson, who has altered her view of professional success. Through experiencing their talent, zest for learning and continued curiosity, she now feels more confident about the future of society. Particularly significant for Swanson is the feedback from students that she has changed their lives and subsequently interacting with them in medical and graduate school classes, taking steps closer towards their future career in scientific research.

The Future of the Program
Many of the students from the first year of the program stayed in the lab and continued to work on their scientific research. Swanson has been impressed with their continual motivation in their studies. One of the students from the first year of the program has also been involved in training a new student for the project. Discussions have also started to take place about what phase two of the program may look like. Swanson is considering partnering with other institutions to provide students with different types of research experiences. For example, areas of particular interest would be those focusing on the relationship between climate change and environmental health. Another area of interest would be a partnership that would provide the students with insights pertaining to the global nature of science and research. The possibilities for the future are working with non-profit organisations like the Alan Alda Centre for Communicating Science or COMPASS. These are cross-disciplinary organisations which aim to help scientists learn to communicate more effectively with the public. Swanson would also like students to have the opportunity to participate in improvisation activities to allow them to become more confident in their communication skills.

Future plans for research in this area include:
1) Understanding the needs of the students with respect to their career progression in STEM.
2) Understanding how these needs differ amongst different groups (i.e., gender, socio-economic, racial, first generation, etc.).
3) Identifying how undergraduate research experiences (like the STEPS program) can be modified to better meet the needs of all the participating students.