iUTAH Undergraduate Research Fellows (iFellows) Program: A Road Map
Compiled July 2018

Beginning in 2012, the iUTAH Undergraduate Research Fellows (iFellows) program was acknowledged across Utah's academic institutions as offering an exemplary undergraduate research experience. As it's parent program, iUTAH (innovative Urban Transitions and Aridregion Hydro-Sustainability) completed in 2018, we offer this description of the iFellows program operations as a model that can guide development of future efforts to offer interdisciplinary summer research experiences for undergraduate students.

Program Overview

The iUTAH Undergraduate Research Fellows (iFellows) Program provided an opportunity for undergraduate students from institutions across Utah to gain first-hand research experience in the labs of iUTAH project scientists. The program was a flagship element of iUTAH's efforts to enhance Utah's STEM workforce and understanding about environmental sustainability. iFellows participated in an 11-week paid research experience, receiving a competitive stipend for REU_type programs training side-by-side with iUTAH researchers and graduate students learning about sustainability challenges facing the state. The program expanded beyond a typical research experience for undergraduate students, engaging participants in multi-disciplinary and cross-institutional research and collaboration during the summer by leveraging iUTAH's statewide network of researchers. All iFellows, regardless of their home institution, were paired with an iUTAH-participating faculty mentor and placed at either the University of Utah (UU), Utah State University (USU), or Brigham Young University (BYU) for the summer.

A key component of the program is that iFellows were viewed as partners in the research process, often participating in research design, quality control, and occasionally publication. Another unique aspect of the iFellows program is the cohort approach, wherein students training at various institutions meet regularly in order to learn from each other, as well as from their near-peer and faculty mentors. Throughout the program, iFellows trained side-by-side with iUTAH researchers and graduate students, participated in professional skill development sessions, expanded science communication skills, practiced science poster and oral presentations, and engaged with panels of STEM professionals from a number of different careers.

The program began summer 2013, in the first year the iUTAH grant was active, and continued for 5 successful summers, ending in 2017. The program hosted 78 iFellows during this time.

<p style="text-align:center"><u>Program Goals</u></p>

The iFellows Program was developed to give undergraduates students from across Utah the opportunity to engage with iUTAH-related research. The program aimed in particular to engage students from Primarily Undergraduate Institutions (PUIs) who do not have ample access to research opportunities or labs. Student research topics reflected iUTAH's broad research focus; exposing students to research from each of the project's three Research Focus Areas (RFAs).

<p style="text-align:center"><u>Program Events</u></p>

Orientation:

Orientation typically took place the second or third Monday in May, being the first time the entire summer cohort (faculty mentors, near peer mentors, iFellows, iFellows Committee) gathers together. Because of its central location, this meeting was held in Salt Lake City at the University of Utah.

During this meeting, the iUTAH program was introduced, and expectations for the summer were outlined. Additionally, the agenda allowed time in the afternoon for iFellows and mentors to meet, and begin discussing summer research plans. Because of this, faculty and near-peer mentors were highly encouraged to attend. Occasionally, a faculty member was unable to attend orientation. In this case, the near-peer mentor was expected to represent the lab, and mentors were encouraged to reach out to iFellows prior to the meeting.

Housekeeping items were also accomplished at this meeting, including:
- iFellows fill out direct deposit forms (based on need)
- iUTAH staff member takes headshots of each iFellow
- iFellows fill out an introductory survey asking for; full name, date of birth, hometown, mailing address, phone number.

Cohort Sessions:

Cohort sessions were designed to bring the group together for networking, professional development, and learning about various types of iUTAH research. Sessions were held throughout the summer on Mondays approximately every other week. Occasionally, these meetings would occur on adjacent weeks. Excluding Orientation and the iFellows Symposium, there were 4 total cohort sessions throughout the summer. Sessions alternated location between the three research institutions hosting iFellows, to give students breaks from driving long distances at every meeting. Typically, meetings began at 9am, provided lunch, and wrapped by 3pm, to allow commuters time to return home by the end of the working day.

Poster Session:

The poster session was hosted in conjunction with the iUTAH Symposium, typically in mid-late July. This session was traditionally only been open to iUTAH summer programs (iFellows, Summer Research Institute, Traineeship), and took place following lunch. Ensuring there is a large enough space to host all of the participating posters was essential.

iFellows Symposium:

The iFellows Symposium was the final event for the summer, taking place during the last week of the program. iFellows were required to prepare a 10 minute (max) oral presentation of their summer research to present to attendees.

This event was open to all iFellow research groups and collaborators, and typically drew 40-50 individuals. A press release of the event was also sent out by the iUTAH Communications Specialist to attract potential media attention.

Following Q&A for each student, a certificate of completion (created and printed by the iUTAH Staff Assistant) was presented to the iFellow by their research mentors. Prior to the event, and email was sent to mentors, informing them of the certificate, and asking them to prepare some remarks about their iFellow to share when presenting them with the certificate. In the event that a mentor was unable to attend, remarks were sent to the EOD Director and EOD Coordinator, who shared these comments on the mentor's behalf.

<center>Cohort Session Content</center>

Cohort sessions were designed to provide multiple experiences for participants:

1. **Bring the group together.** Because iFellows were spread accross different labs on three separate university campuses, cohort sessions provided an opportunity for the group to spend time together. Facilitated activities like "This Cool Thing Happened," the sharing of homework assignments, and lightning presentations of introductions and methods of student research allowed students to share their unique research experience with the group, and to learn about other types of research and experiences in the program.

2. **Professional and science communication skill development and training.** iFellows often had little to no experience with navigating research groups or presenting research. To expand these skills cohort sessions included:
   - Responsible Conduct of Research
   - What is research, and what does it look like?
   - Creating and optimizing mentoring networks
   - Improvisation for scientists

- o Data quality control
- o How to talk to the media
- o Research presentation by former iFellow
- o Creating an elevator pitch
- o The ins and outs of presenting research (posters, powerpoints, papers)
- o Nuts and Bolts of publishing
- o Diversity discussions
- o Panel presentations by STEM professionals
- o Resource Building: Literature Searches and Citation Managers
- o Attending conferences (submitting abstracts, finding conferences to attend, what to do when you are there)
- o Life after the iFellows program (how to take advantage of the work you have done)

3. **Practicing poster and oral presentations.** iFellows were required to create and present a research poster for the annual iUTAH Symposium, held in mid-July. To prepare for the symposium, iFellows brought a draft digital version of their posters to a designated cohort session, giving a practice presentation to the cohort. The group then provided feedback. This allowed students to practice presenting their poster, receive constructive feedback for improvement, and ask questions of the group. Additionally, this also provided the cohort the opportunity to see other posters and presentations.

   iFellows were also required to give oral presentations of their research at the final iFellows Symposium. These Powerpoint presentations were 10 minutes in length, and given to the cohort and invited guests at the end of the program.

Field Trips

Cohort sessions also offerd an opportunity for iFellows to see and engage with active iUTAH research and outreach. iFellow cohorts took field trips to the following sites:
- Red Butte Creek GAMUT sites
- Red Butte Damn
- Logan GAMUT sites
- Provo GAMUT sites
- Provo Canyon (for water sampling exercise)
- Natural History Museum of Utah

Mentor Discussions

In the third year of the program, a Mentor Discussion/Training program was instituted. These discussions were designed for near-peer and faculty member

participants to work together to develop and improve their mentoring skills. The goal of these sessions was to provide participants with multiple strategies for dealing with mentoring challenges by the end of the summer. Discussion were spearheaded by an iFellows Committee member who had previous experience leading mentor discussions at the University of Wisconsin – Madison.

The content of each session in these research mentor discussions was designed to address the key concerns and challenges identified by research mentors. The topics included:

- Aligning Expectations

- Promoting Professional Development

- Maintaining Effective Communication

- Assessing Understanding

- Fostering Independence

- Cultivating Ethical Behavior

In addition to the general content about research mentoring, all of the case studies and some of the discussion questions presented in the sessions drew specific attention to the issues related to multidisciplinary research mentoring. Much of the content of these discussions was adapted from Entering Mentoring: A Seminar to Train a New Generation of Scientists; created by Jo Handelsman, Christine Pfund, Sarah Miller, and Christine Pribbenow, with support from Howard Hughes Medical Institute Professors Program (PI: Jo Handelsman).

These discussions commenced during an online meeting for all faculty and near-peer mentors in April, following the conclusion of the school year. This meeting began by outlining iFellows Program expectations, and providing mentors the opportunity to ask questions of the program coordinators. Following this overview, the first mentor discussion was facilitated, asking seasoned mentors to share successes and failures in mentoring undergraduates. The summer schedule for mentor discussions was also introduced.

Discussions continued at cohort sessions throughout the summer. Mentors were provided with a separate space to host these discussions concurrently with iFellow sessions. Typically, mentor discussion were an hour in length, and attended by the near-peer and faculty mentors at the cohort session.

<u>Program Timeline</u>

The iFellows Program ran for 11 weeks. Anchored by the program Orientation, typically occurring the second or third Monday in May, and the final iFellows Symposium, taking place the final Wednesday of the Program, typically the final week of July. Table 1 outlines a typical 11 week schedule.

Table 1. Typical schedule of activities during 11-week program

Week	Description of Activity
Week 1	Cohort Session 1 – Orientation. Research activities in mentor's lab for the remainder of the week. Homework – 1. Create a map of the network in your research lab. Who is in the lab, and what do they do? You will share this during our next iFellow Cohort meeting. 2. Make a list of what you expect to learn during the iFellow program this summer, including skills you would like to develop. Share this list with your mentor. Students also must being to work on any training (lab safety, field safety, human subjects) required for their particular project.
Week 2	Research activities in mentor's lab.
Week 3	Cohort Session 2 (Responsible Conduct for Research, research ethics and diversity, presenting research). Research activities in mentor's lab. Homework – Develop a working Introduction and Methods portion of your research poster to share with the group next meeting.
Week 4	Research activities in mentor's lab.
Week 5	Cohort Session 3 (Practicing lighting talks of homework, Mentoring Networks, GAMUT site tour). Homework – Bring drafts of figures (data, study design, conceptual model, etc.) you are planning on putting in your poster to share with the group. Research activities in mentor's lab.
Week 6	Research activities in mentor's lab.
Week 7	Cohort Session 4 (Data management, GAMUT site tour). Homework – create draft poster, and bring digital copy to present at the next meeting. Research activities in mentor's lab.
Week 8	Cohort Session 5 (iUTAH Symposium prep, tour of Red Butte Creek Natural Area). Research activities in mentor's lab.
Week 9	Poster Presentation at iUTAH Symposium. Research activities in mentor's lab.
Week 10	Research activities in mentor's lab, prepare final presentation
Week 11	iFellows Symposium (oral presentations of research). Wrap-up research activities in mentor's lab, complete program survey.

Program Structure and Planning

The iFellows Program was chiefly coordinated by iUTAH's Education, Outreach and Diversity (EOD) Coordinator, with assistance by iUTAH's EOD Director, and the iFellows Committee.

iFellows Committee:

The iFellows Committee was comprised of iUTAH staff (EOD Director, EOD Coordinator), and university faculty (3 individuals). At least one member of the committee represented a Primarily Undergraduate Institution (PUI). The committee meet online starting in October, first discussing program dates for the upcoming summer, then updating the program application, discussing cohort session content, and reviewing/placing applicants.

The iFellows Committee also played a key role in cohort sessions, presenting relevant topics to the cohort. While these topics contribute key concepts and practical knowledge to iFellows, they also reflect the strengths and backgrounds of committee members. Examples of presentations by committee members include; mentoring networks, how to present research, improve for scientists. A full archive of presentation titles can be found in past cohort session agendas.

Program Planning:

Planning for the iFellows program began 6 months ahead of the program start, with a call for possible research projects from iUTAH faculty, and continued through the end of the program. Table 2 lists program coordination activities.

Table 2. Timeline of iFellows Program Coordination

Date	Description of Activity
November	Set program dates
November	Call for projects and mentoring teams from research faculty
December	Work with communications office to create recruitment materials (flyer, Powerpoint presentation, mailchimp emails, updated webpage)
December	Update program application, transfer to online data-gathering utility, such as Qualtrics, so students can electronically submit
Early January	Application and research project descriptions available online
January	Committee begins planning cohort session content
Mid February	Applications due
Feb-March	Committee reviews applications, pairs desired students with faculty mentors
Mid-March	Participant selection and notification, connect students with faculty mentors via email
Mid-March	Reserve on-campus housing for students who need it
April	Finalize summer cohort schedule, reserve motor pool vehicles, and venues for meetings
April	Host online introductory meeting for faculty and near-peer mentors
May	Begin to organize cohort session meals
~3rd week of May	Program commences, orientation
May-July	Create and email cohort session agendas, arrange carpool for meetings, track cohort session attendance, assist iFellows and mentors with purchasing of research materials.
Mid July	Facilitate iFellow poster session at iUTAH Symposium
Late July	Facilitate iFellow oral presentation at iFellows symposium
Late July	Assessment of annual program sent out to student and mentors

The EOD Coordinator spearheaded all planning efforts, collaborating with other iUTAH staff members. The iUTAH Staff Assistant worked closely with the EOD Coordinator to reserve meeting venues and cohort session meals/snacks, organizing carpool, and arranging delivery/pick-up of cohort session food.

Venues:

Both Orientation and the iFellows Symposium have been held in Salt Lake City, because of its central location among the research institutions. These meetings were

attended by 40-50 individuals, and have been held in larger spaces that occasionally required payment for use. Cohort Sessions had smaller attendance (typically just iFellows, several mentors, and the iFellows Committee), and are held in smaller, free to use spaces on the hosting campus.

Student Recruitment:

Undergraduate students from across Utah were recruited to participate in the program. Particular focus is put on advertising to students at PUIs. When recruiting for the program, it was important to recruit students from a wide variety of disciplines that potentially related to the planned summer research projects.

Because institutions in the state are so spread apart geographically, our most successful recruitment tool proved to be faculty members introducing and encouraging their students to apply to the program. This has meant that we also needed to recruit and retain faculty advocates on campuses who championed the program on our behalf. PUI campuses where we had faculty advocates yielded the highest number of PUI applicants. The EOD Coordinator visited PUI campuses during the iUTAH program to recruit faculty advocates.

To develop recruitment tools, the EOD Coordinator worked with iUTAH's Communications Specialist to create various materials that could be printed and emailed to advertise the program; 1. iFellows Program Flyer, 2. iFellows Program PowerPoint (for faculty to present in their class), 3. An email created through an e-communications automation platform such as MailChimp to send to the iUTAH listserv, 4. Updating the iFellows page of the website.

iUTAH also utilized video as a recruitment tool. A promotional video was created by the Utah Education Network describing the program. Additionally, in response to questionable quality of some program applications in the program's first year, the EOD Coordinator created a short video with suggestions on how to submit a competitive application. This video has been updated as needed. Both of these videos are available of the iFellows page of the iUTAH website.

<div align="center">Program Evaluation</div>

iUTAH collaborated with STEM Evaluation Associates, Jacque Ewing-Taylor, PhD, to conduct program evaluation. During the final two weeks of the program, Jacque sent out a survey link for students to complete by the end of the program. Jacque used a modification of the URSSA student evaluation model, including only questions that related to the iFellows research experience.

Jacque also sent evaluations to both near-peer and faculty mentor groups to gather feedback from these individuals.

Surveys proved integral to the evaluation and continued improvement of the iFellows Program.