# Redefine, Reinvent, Reinvigorate

CCURI
Community College Undergraduate Research Initiative

Recommendations from the Meeting on the Sustainability and Growth of the Community College Undergraduate Research Initiative (CCURI)

NSF

hhmi
Howard Hughes Medical Institute

CCURI

COMMUNITY COLLEGE UNDERGRADUATE RESEARCH INITIATIVE


## Acknowledgements

CCURI would particularly like to acknowledge David Asai, senior director for Science Education at the Howard Hughes Medical Institute, for hosting the meeting and V. Celeste Carter, lead program director for the Advanced Technological Education program at the National Science Foundation, for continued encouragement and support of the CCURI project. CCURI would also like to sincerely thank all the meeting participants for their time and thoughtful contributions during the meeting.


## Disclaimer

This publication was prepared for the Community College Undergraduate Research Initiative (CCURI) with support from the National Science Foundation under grant DUE-1524353 (CCURI: Creating a culture of change). Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the principal investigator, co-principal investigators, and the writer-editor. They do not necessarily reflect the views of the National Science Foundation.


**Principal Investigator:**
*James Hewlett*

**Co-Principal Investigators:**
*Virginia Balke, Darren Mattone, Diana Spencer, John Van Niel*

**Project Director:**
*Heather Bock*

**Writer:**
*Madeline Patton*





Printed in the United States of America

# Executive Summary

Throughout its history the Community College Undergraduate Research Initiative (CCURI) has allowed its community college partners to define its mission and determine the services it offers.

This philosophy carried over to the strategic planning meeting that CCURI convened April 30 to May 2, 2019, at the Howard Hughes Medical Institute Conference Center. As CCURI Principal Investigator and Executive Director James Hewlett explained to the 18 meeting participants, the meeting sessions were designed to provoke participants' thinking and capture their insights to inform CCURI's effort to explain its work to potential funders and potential partner institutions. "The whole goal of this meeting is to define us, but also figure out how to be sustainable and grow. How do we get what we know into more and more opportunities for students?"

Throughout the small group and large group discussions the meeting participants remarked on CCURI's unparalleled knowledge of undergraduate research at community colleges and reached consensus on several points.

Participants identified CCURI's faculty workshops, networking, and the national student poster sessions at its student colloquia as its most valuable services.

They recommended CCURI add multi-discipline research projects, guidance services to help community colleges navigate the cultural shift to "teaching is research," marketing support with CCURI-brand messages, and more student-centered scholarly activities.

Participants agreed that CCURI's sustainability will necessitate building on its strongest, most-sought-after services and resources. To accomplish this they recommended 1) archiving CCURI's curricula and best practices with an established digital repository of materials for community college instructors; 2) transferring CCURI's online community forum to a forum with more connections to more community colleges and universities; and 3) linking CCURI's publications to the websites of the organizations with which CCURI partnered to produce them.

After mapping how CCURI could continue its operations at four funding levels, the participants wrote value propositions to help CCURI promote its work with potential funders and community college partners. Hewlett has selected this as CCURI's value proposition:

## *Education Redefined, Reinvented, Reinvigorated*

*CCURI provides a new model for the classroom experience at community colleges through the incorporation of course-based undergraduate research as a teaching tool. CCURI educates faculty in new pedagogical methods, provides presentation opportunities to students, and provides a model for growth and success in developing a culture of innovation at community colleges.*

## *History of CCURI — An Ongoing Research Project*

The Community College Undergraduate Research Initiative is itself an ongoing research project.

From an initial exploration into the value of undergraduate research as an instructional tool at associate-degree-granting institutions, CCURI has evolved into a large experiment that identifies effective pedagogies for incorporating research in various disciplines and shares information to help community colleges increase undergraduate research opportunities on their campuses.

Utilizing the scientific discovery processes that CCURI encourages community college faculty to incorporate in their teaching, CCURI has sought answers to new questions and built innovative practices based on its findings at each phase of its exploration of undergraduate research at community colleges.

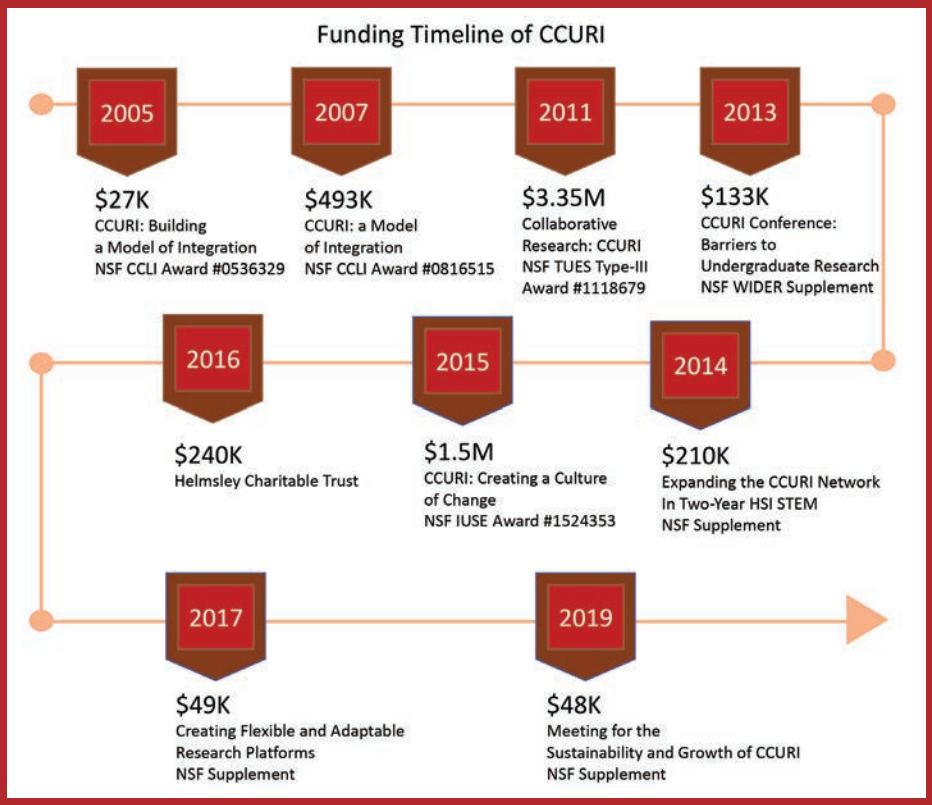
To inform their thinking about CCURI's future, CCURI Executive Director James A. Hewlett provided the meeting participants with a brief history of the initiative and the key questions it has explored.

Hewlett, a professor of Science and Technology and director of Biotechnology/ Biomanufacturing at Finger Lakes Community College in Canandaigua, New York, began CCURI in 2005 with a $27,000 grant from Course, Curriculum and Laboratory Improvement (CCLI) program of the National Science Foundation (NSF) for a pilot project to test the concept of offering community college students undergraduate research opportunities.

From this initial focus on one college in Upstate New York, Hewlett determined that it is feasible to add undergraduate research to community college curricula and that research experiences benefit students.

Hewlett then obtained a sequence of larger NSF grants that helped CCURI grow into a network of 128 community colleges.

In spring 2019 CCURI's network included 43 partner colleges that had received funding from CCURI's then-current Improving Undergraduate STEM Education (IUSE) grant from NSF; 82 affiliate colleges that are funding their research initiatives without financial support from CCURI; and three collaborator colleges that had established undergraduate research programs prior to their involvement with CCURI.




***With financial support from a sequence of National Science Foundation grants CCURI grew from Finger Lakes Community College into a national network of two-year colleges that incorporate undergraduate research into teaching.***

**Source: CCURI**

## *Details of CCURI Network Growth with NSF Support*

After completing the pilot project, Finger Lakes Community College was awarded a $493,000 CCLI grant from NSF in 2008 for Hewlett to lead an initiative that developed undergraduate research opportunities at six community colleges in the Northeast. Building institutional capacity for undergraduate research was the focus of this phase of CCURI.

In 2011, further expansion of CCURI was made possible by a $3.35 million grant from NSF's Transforming Undergraduate Education in STEM (TUES) program. CCURI was the only biology project and only community college initiative to receive this significant level of TUES support. Expansion nationally to 27 colleges, identification of barriers to undergraduate research, exploration of the impact of research experiences on students, and analysis of CCURI's impact on institutions' capacity were the goals of this phase. Supplemental NSF grants totaling $343,000 supported a CCURI conference about barriers to undergraduate research and helped CCURI expand to Hispanic-serving institutions in Arizona and California.

This phase also included the development of low-cost ways for community college faculty to add research experiences to their courses. In 2013, CCURI collaborated with faculty at University of California San Diego to bring protocols used in the San Diego Biodiversity Project to

colleges in CCURI's network. Since the initial workshop in 2013, numerous CCURI colleges have used the San Diego Biodiversity Project protocols to develop biodiversity research projects on their own campuses. In 2015, CCURI expanded the barcoding biodiversity project to include barcoding of plants and freshwater sponges.

CCURI also developed the protocols for using remotely-operated cameras or "camera traps" to record wildlife activity. This inexpensive technology lends itself to collecting a wide array of wildlife data and teaching students numerous research skills.

"We spend a lot of time with our partners when we bring them into to our workshops of showing them the characteristics of research projects that we know are sustainable at community colleges," Hewlett explained.

A $1.5 million IUSE grant from NSF in 2015 helped CCURI expand its network to include more partner and affiliate institutions. This phase has also included an in-depth evaluation of the culture of colleges that have adopted CCURI's model with varying degrees of success.

## *Move Toward Sustainability*

In 2016 CCURI received a $240,000 grant from the Leona A. and Harry B. Helmsley Charitable Trust to plan for future growth and sustainability.

The strategic planning meeting at the Howard Hughes Medical Institute (HHMI) was funded by a supplemental grant of $48,120 from NSF and in-kind support from HHMI, which provided the meeting room, as well as lodging and food for the meeting participants at its conference center.

"CCURI is in the business of changing academic culture," Hewlett said, adding he plans to continue searching for funders to help sustain this work.

## Why CCURI's Logo is a Red-tail Hawk

A red-tail hawk dominates CCURI's logo because a research project with juvenile hawks first prompted James Hewlett's advocacy of research as a pedagogical tool for community college educators.

In 2003 a biologist studying the red-tail hawk population asked Hewlett if he could do blood tests on juvenile hawks to determine their gender. Hewlett enlisted two students to help him gather blood samples and collect 40 other measures on each fledgling in the study.

"It was a really cool project," Hewlett said. Though the research tasks came without any financial compensation for Hewlett, he found that the experience made him more excited about teaching biology. "I felt my engagement go way up after that project," he said.

The students received no additional credit but afterward tackled their academic work with more gusto.

When colleagues asked Hewlett about what he had done to spark the two students' enthusiasm for work in their classes, it solidified Hewlett's conviction that conducting authentic research can be a powerful educational experience for students and faculty.

This insight prompted Hewlett to seek National Science Foundation funding to explore how to add undergraduate research experiences at community colleges. The grant that he received in 2005 then led to other NSF grants that supported the creation of CCURI's national network.

CCURI
Community College Undergraduate Research Initiative

***Students at Finger Lakes Community College use camera traps that take photos of wildlife for research on biodiversity and other topics. CCURI workshops have instructed faculty on ways to use these cameras, which has led to their use by student researchers at other CCURI network colleges.***

**Source: CCURI**

## Community College Students Report Great Gains from Research Experiences

To collect students' reflections about their undergraduate research experiences, CCURI invited partner institutions to use the Undergraduate Research Student Self-Assessment developed by the University of Colorado at Boulder with NSF funding. With the developers' permission, CCURI modified the survey slightly to fit community college students. Then CCURI made the questionnaire available on the Qualtrics web survey platform for students to use at the end of summer 2018, fall 2018, and spring 2019 semesters. The survey was completed or partially completed by 591 students. The results include the following:

- 74% of students (n=539) report good or great gain in "comfort in working collaboratively with others" as a result of the research experience.
- 65% of students (n=536) agree or strongly agree that "My research experience prepared me for a job."
- 75% of students (n=536) agree or strongly agree that "doing research confirmed my interest in my field of study"

## *CCURI Offers Multiple Approaches to Undergraduate Research*

Recognizing a wide range of community college faculty members' interests and institutions' capacities for curricula changes, CCURI has developed multiple approaches to make transformative undergraduate research experiences available to students.

CCURI broadly defines undergraduate research as inquiries conducted by undergraduates that make an original intellectual or creative contribution to the discipline. CCURI emphasizes giving students opportunities to explore questions using the scientific method without setting publication in peer-reviewed journals as a goal.

CCURI's model begins with case studies in freshman courses to teach basic scientific concepts within the context of an ongoing research project.

CCURI funding provides professional development workshops, model curricula, networking opportunities, and guidance to help instructors at CCURI partner and affiliated institutions offer students one or more of the following:

- Course Undergraduate Research Experience (CURE): 89% of partners have embedded research experiences in courses.
- Program Undergraduate Research Experience (PURE): 33% of partners have implemented program-wide research experiences. Students often move in cohorts through these research opportunities that are "scaffolded" across the program.
- Summer Undergraduate Research Experience (SURE): 22% of partners offer summer research experiences. The most robust of these offer paid internships.

To add another dimension to students' research experiences, CCURI encourages community colleges to hold poster sessions on their campuses to give students the opportunity to share their research findings with their fellow students, faculty, and the general public.

CCURI Executive Director James Hewlett considers the student poster sessions "signature events" for CCURI.

"Those opportunities are really important for our students because one of the things they [students] tell us is they like talking to other students and seeing the research they are doing. It also validates that their research has meaning to the education community," Hewlett told the meeting participants.

CCURI has devoted a portion of its NSF grants to provide travel support for students to participate in regional and national CCURI student poster sessions.

Fifty-five percent of the 777 students who participated in CCURI programs in 2017-2018 and who responded to the Undergraduate Research Student Self–Assessment (URSSA) reported that they had presented a talk or poster to other students or faculty on their campuses. Sixteen percent (n=775) had presented a talk or poster at a professional conference off campus.

At the May 2, 2019, national poster session at the Hart Senate Office Building in Washington, D.C., 47 former and current community college students shared information about their research methods and findings. The students' earnestness, intellectual curiosity, and interest in STEM careers were evident as they talked about projects. The projects included a pure mathematics study by one student at Everett Community College (Washington), a six-year wildlife investigation conducted by dozens of students over multiple semesters at Moreno Valley College (California), and examinations of plant extracts for cancer treatment by two students at Muskegon Community College (Michigan).

Emily Sample, a freshman at Redlands Community College (Oklahoma) talked excitedly about flipping over rocks to gather cells from freshwater sponges for a research study that CCURI developed for easy, low-cost implementation at community colleges. “This allowed me to be hands on, to get in the lab and actually conduct one experiment … It was really exciting,” Sample said. She spent more than 20 hours on her research outside of class time and presented her findings at an honors symposium at the college.

Chanele Rodriguez, a New York University engineering major, summarized multiple semesters of research on the energy storage potential of ionic liquids that she and other Queensborough Community College students did during internships at Brookhaven National Laboratory.

Ingrid Phillips, one of the youngest presenters, earned her high school diploma and associate degree from Everett Community College in spring 2019 and plans to continue exploring the interaction between river flows and tidal patterns as an engineering student at the University of Washington. While working on her research project, Phillips and another Everett Community College student collaborated with Gravity Consulting to create a tool that improves the collection of surface water samples.

Antibiotic-resistant bacteria were the focus of two distinct projects detailed on posters presented by Mideyshka Vazquez and Autumn Allen of Gaston College (North Carolina). Both women received scholarships that Gaston College provided with support from the NSF Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) program.

## CCURI Network Colleges Offer Research Opportunities in Many Disciplines

Community colleges in CCURI’s network offer a wide array of research opportunities to students in more than 50 disciplines. The disciplines include

- Agriculture
- Biology
- Biotechnology
- Chemistry
- Engineering
- English
- Math
- Nursing
- Oceanography
- Political Science

## *CCURI Model Shifts Colleges from “Research* or *Teaching” to “Research* is *Teaching”*

The Community College Undergraduate Research Initiative (CCURI) is a national consortium of community colleges, four-year schools, government agencies, and private organizations dedicated to the development, implementation, and assessment of sustainable models for integrating an undergraduate research experience into community college STEM programs. (For more info see https://www.ccuri.org)

With an IUSE grant from the National Science Foundation, CCURI supported 43 community colleges in the development of their undergraduate research programs using the CCURI Model for Change. CCURI's IUSE project intentionally aligned with recommendations from *Vision and Change in Undergraduate Education, A Call to Action* and The President's Council of Advisors on Science and Technology (PCAST) report *Engage to Excel: Producing one million additional college graduates with degrees in science, technology, engineering, and mathematics.*

Another key driver for CCURI's work has been its own analysis of the barriers to undergraduate research. A study that CCURI completed in 2007 determined that successful implementation of undergraduate research at community colleges requires a paradigm shift from a culture of research or teaching, to one where research is teaching.

In response to this finding, CCURI constructed a comprehensive model to help colleges make the cultural shift so their campuses become places where research is teaching. The CCURI Model for Change includes the following components:

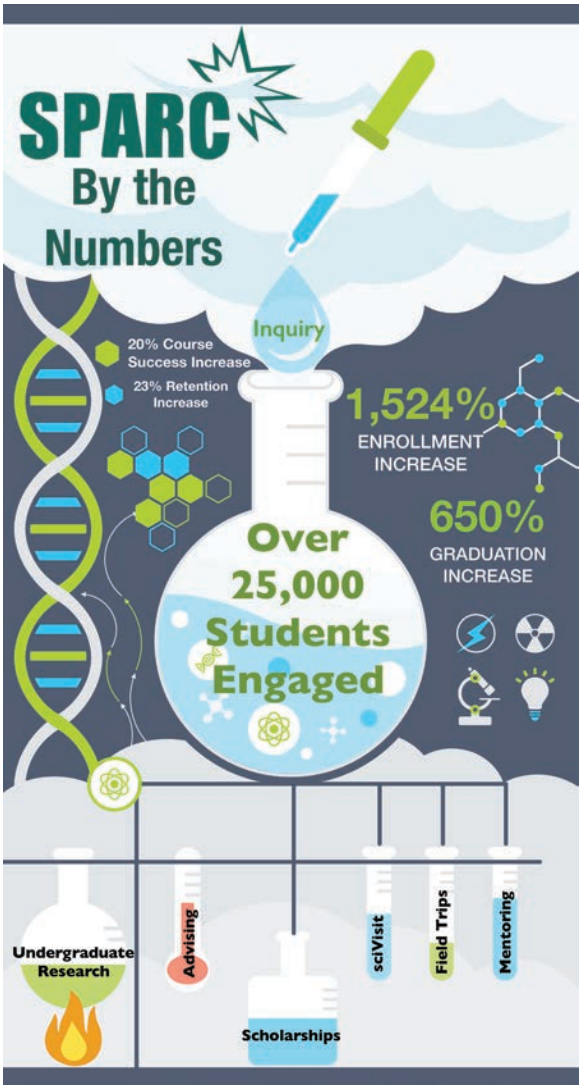
**Adaptation of active learning instructional strategies.** CCURI recommends that students' research experiences align with other widely accepted instructional strategies, including case-based learning, problem-based learning, and teaching with data.

**Creation of opportunities for advanced exploration of student research questions.** CCURI encourages institutions to create credit-bearing, transferable programs or courses that provide opportunities for students to explore research questions independently.

**Incorporation of a customized faculty development program.** CCURI offers faculty development programs designed to help community college instructors build their research and instructional skills to facilitate students' active engagement in learning.

**Adoption of CCURI's Community College Faculty Model.** To address the potential for heavy teaching loads impeding the development of undergraduate research at community colleges, CCURI's Faculty Model guides institutions in the development of course-embedded research experiences and implementation of other strategies to create a culture where research is teaching.

**Establishment of sustainable networks committed to STEM reform.** CCURI provides access to a network of partner institutions that are focused on undergraduate research and STEM reform. CCURI's dissemination and networking activities promote the broader use of primary research questions and foster peer mentoring among faculty.




***Since the inception of SPARC, Associate of Science (A.S.) enrollments at Gaston College increased from 38 in 2010-2011 to 617 in 2017-2018. The number of students who passed three gateway courses increased from 68 in biology, 58 in chemistry, and 74 in statistics in 2008-2009 to 83 in biology, 87 in chemistry, and 81 in statistics in 2017-2018. The number of A.S. graduates increased from 17 in 2009-2010 to 127 in 2017-2018. The 25,000 students impacted by Gaston research include secondary school students who participated in activities that were the focus of research projects.***

**Source: Gaston College**

## CCURI Workshops Equipped Gaston Faculty To Take Research Opportunities to Scale

Since 2009 Gaston College has gone from having no undergraduate research options to offering students at least one research opportunity in every associate of science degree program.

CCURI's professional development workshops provided critical knowledge and skills that Gaston faculty have used to change the culture of the college by embedding research in a wide variety of STEM courses.

"CCURI really has provided for a huge amount of professional development, which has allowed for our instructors to have the confidence to do this [research] in their classes and also has helped provide them with ideas of projects to work on," said Ashley Hagler, director of the STEM Persistence and Retention through Curriculum, Cohort, and Centralization (SPARC) program.

She traces current Gaston research projects that involve DNA barcoding, use camera traps to monitor wildlife, cultivate freshwater sponges for lab experiments, and test water quality to the lessons that faculty learned at CCURI workshops.

CCURI has provided workshops on lab methods, field methods, and other topics from its NSF grants. These funds have also provided support for Gaston faculty to attend professional society conferences.

"Through that, we have been able to network with people in the field who have other projects going," she said. These professional connections led to Gaston students' participation in the Small World Initiative, which uses crowdsourcing for antibiotic discovery.

Hagler instigated undergraduate research at Gaston when she added a research project to her mammalian cell culture course. The positive outcomes with students prompted a small group of faculty to add research experiences to their courses.

"We were just trying to figure out how to make it [learning] more engaging," Hagler said of this pilot project. The faculty group connected with CCURI while searching for no-cost and low-cost research projects.

Hagler credits the support from Heather Woodson, who was then the dean and is now associate vice president, with research becoming a widely used pedagogical method at Gaston. "We had full administrative support to try new things, to try to make these changes."

Data that show the connection between undergraduate research and improvements in students' grades and persistence helped SPARC win the 2016 Bellwether Award.

Hagler explains how research experiences that require students to explore open-ended questions transform learning: "By helping them [students] learn to fail, they actually learn to succeed because they have a lot more self-efficacy. They start trying to troubleshoot. They start trying to think about what happened … they engage. They have ownership for their projects. It has been fabulous for our students whether it's a two-week project or a semester-long project."

## *Process of Strategic Meeting*

Throughout its history the Community College Undergraduate Research Initiative (CCURI) has allowed its community college partners to define its mission and determine the services it offers.

For the strategic planning meeting convened April 30 to May 2, 2019 at the Howard Hughes Medical Institute Conference Center, CCURI's use of the civil engineering practice of "letting pedestrians define pathways" provided an overarching theme for the participants' discussions.

"You are going to tell us where the sidewalks are," CCURI Executive Director James Hewlett said as he described the meeting's process for provoking participants' thinking and capturing their insights to inform CCURI's effort to explain its work to potential funders and potential partner institutions.

"The whole goal of this meeting is to define us, but also figure out how to be sustainable and grow. How do we get what we know into more and more opportunities for students?" he asked.

CCURI received National Science Foundation support to convene the meeting of 15 thought leaders from its partner institutions, funders, and unaffiliated entities to accomplish three objectives:

- Review CCURI's growth plan and identify key program features to leverage for the development of a sustainability pathway for CCURI.
- Develop value proposition statements to explain the purposes of CCURI and the goal of expanding its stakeholder network.
- Construct sustainability plans for CCURI under different funding scenarios.

To help drive the construction of the sustainability plan, participants were asked to think about the following questions:

1. *What current services and resources provided by CCURI do our partners value?*
2. *Are there services and resources that CCURI does not provide that would add value to our mission and vision?*
3. *Are there services and resources that could be transferred to and managed by other organizations that currently are sustainable?*
4. *Beyond CCURI community college partners, what agencies, organizations, or groups have an interest in sustaining the CCURI program?*
5. *How would the elimination of CCURI affect the quality, growth, and sustainability of individual partner undergraduate research programs?*
6. *What are the potential funding sources that could help support the sustainability and growth of CCURI?*
7. *What are the most appropriate organizational management strategies for sustaining CCURI as a program? (E.g. centralized vs. disseminated leadership models)*
8. *Are there organizational partnerships that would help support the sustainability of CCURI, and how would those partnerships operate?*
9. *If CCURI were not to be sustained as an organization, what would be the most effective exit strategy that minimizes any negative impacts on current CCURI partner programs?*

On the morning of May 1, participants were separated into small groups that were assigned a mix of the questions. The groups' responses were then shared during open sessions where the ensuing dialogue and questions helped advance the sustainability planning process.

In the afternoon participants were assigned to groups to identify what CCURI could do at four different funding levels ranging from zero funds and no staff to $7 million and five staff members.

On May 2 all the discussions built toward a brainstorming session in which participants worked individually and together on developing value propositions.

To encourage participants' thinking about CCURI throughout their time at the Howard Hughes Medical Institute, Hewlett asked people to use "and" statements to piggyback on ideas that others share rather than knocking them down with "but" statements or other discouraging words.

In addition to engaging in the small and large group discussions of the strategic planning questions that CCURI posed, participants were asked by Hewlett to share ideas that popped up during informal conversations and that occurred to them when they were alone. He suggested participants write their thoughts on sticky notes and place them under the questions on the poster papers hanging in the meeting room, add comments to an electronic digital idea board set up for the meeting, or talk with him or Heather Bock, CCURI project director, at the meeting or afterward via email or phone.

## *Sustainability Recommendations*

Meeting participants were assigned to small groups to discuss three to four of the questions that CCURI's team prepared in advance to provide a framework for participants' recommendations regarding CCURI's sustainability.

After the small groups shared the responses to their assigned questions, Hewlett facilitated a large-group discussion. Most of the attendees expressed an opinion on or offered a counterpoint to one or more of the questions. Participants then used colored stickers — 1) red: least important, 2) green: less important, 3) yellow: important, 4) blue: most important — to indicate their opinions about the points from the small-group discussions that were listed on poster papers displayed in the room. This weighted voting process helped identify the full group's recommendations, which were then shared during a meeting of all the participants. The several hours that participants spent considering and conversing about the questions informed their work on value statements on the following morning, May 2.

**1. What current services and resources by CCURI do our partners value?**

Expressions of appreciation dominated the small group reports on this question. The partners highly value Hewlett's leadership; Heather Bock's coordination of resources, services, and programs; CCURI's faculty workshops, national student poster sessions, network, and low-cost research projects.

They pointed out that a beneficial sense of community has developed among the people involved in CCURI's network. CCURI network participants' knowledge of community college culture and their willingness to share information about incorporating research into community college curricula are considered strong attributes.

One person observed that CCURI's centralized voice on behalf of community college STEM educators "is more powerful than the sum of its parts."

Participants identify these CCURI services and resources as the most valuable:

- Faculty workshops
- Networking—both formal and informal
- National student poster sessions for community college students to share their research findings

**2. Are there services and resources CCURI does not provide that would add value to our mission?**

Regional CCURI meetings and having CCURI leaders serve as "outside authorities" who travel to colleges to advise faculty about implementing undergraduate research and to facilitate their interactions with particular industries were among the services participants considered adding to CCURI's offerings.

Multiple speakers mentioned the need for CCURI to branch out beyond its historic focus on biology projects. Because undergraduate research helps students and instructors succeed in many different ways, one speaker urged CCURI to leverage its data to market itself so administrators and other stakeholders understand how undergraduate research can improve student retention and help with other student success issues.

Participants recommend that CCURI add these services and resources:

- Multi-discipline research projects
- Marketing support with CCURI-brand messages
- Guidance to navigate the cultural shift to "teaching is research"
- Student-centered scholarly activities

**3. Are there services and resources that could be transferred to and managed by other organizations?**

There was consensus that CCURI's sustainability will necessitate building on its strongest, most-sought-after services and resources.

Participants recommend

- archiving CCURI's curricula and best practices with an established digital repository of materials for community college instructors;
- transferring CCURI's online community forum to a forum with more connections to more community colleges and universities; and
- linking CCURI's publications to the websites of the organizations with which CCURI partnered to produce them.

**4. Beyond CCURI community college partners, what agencies, organizations, or groups have an interest in sustaining CCURI?**

Participants discussed the possibility of CCURI recruiting partners among national companies, workforce boards, and regional economic development agencies with clear messages about the value of undergraduate research experiences. Several speakers mentioned their usefulness in helping students to learn soft skills. One speaker noted that teamwork, trouble shooting, and other skills that students develop while working on research projects fit various industry skill standards.

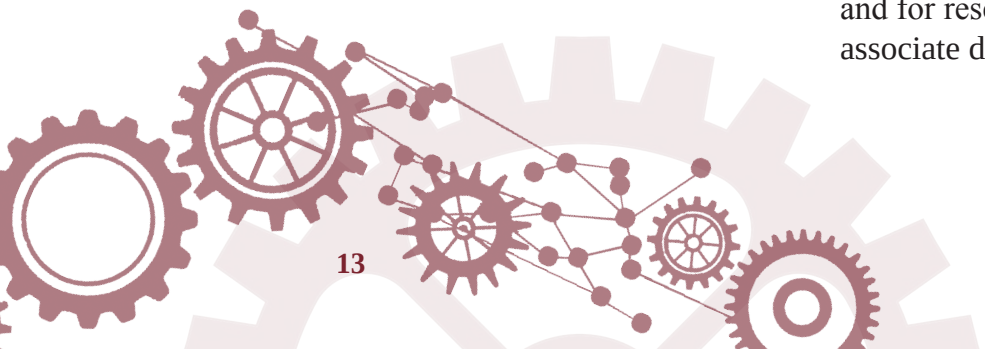
Other entities interested in STEM workforce development include state governments, accreditation agencies, professional societies, and education unions.

After one person asserted that every community college student should have the opportunity to do research, the following organizations were identified as potential allies for spreading the CCURI Model to every community college:

- American Association of Community Colleges (AACC)
- Achieving the Dream
- The Center for Excellence in Research, Teaching and Learning (CERTL)

**5. How would the elimination of CCURI affect the quality, growth, and sustainability of individual CCURI partners' undergraduate research programs?**

If CCURI ceases its operations, the consensus among the meeting participants was that over time undergraduate research programs at community colleges would diminish. Participants agreed that without CCURI, faculty would not have a high-quality source for training in techniques and for research projects tailored to fit associate degree-granting programs.



During the meeting participants lamented that without the incentive of CCURI's student poster sessions both students' and faculty members' interest in research would wane.

All agreed that CCURI's positive reputation provides an imprimatur of validity to the individual colleges' and faculty members' efforts. Without CCURI, participants said it would be challenging for individual community colleges or faculty to sustain their efforts.

**6. What are potential funding sources that could help support the sustainability and growth of CCURI?**

Potential funders were identified as large corporations, non-profit organizations, professional membership societies, education unions, regional foundations, and state higher education systems. It was agreed that persuading investors would require showing them how the attributes of undergraduate research align with their goals. For instance, large employers would have to see how the troubleshooting and teamwork skills students learn while working on research projects could meet the expectations contained in industry standards.

**7. What are the most appropriate organizational management strategies for sustaining CCURI as a program?**

Concern about preserving the power of CCURI's brand caused people to hesitate when it was suggested that CCURI merge with the Council of Undergraduate Research (CUR). About half of the 30 community colleges that are members of CUR also participate in CCURI. The two organizations have collaborated on projects and have overlapping missions. However, most of CUR's members are universities.

In addition to discussing a potential merger of CCURI with CUR, participants discussed the pros and cons of CCURI continuing its centralized operations or utilizing a regional model that might appeal to particular funders.

**8. Are there organizational partnerships that would help support the sustainability of CCURI, and how would those partnerships operate?**

Participants talked about the pros and cons of CCURI merging with various non-profits. These conversations were brief, however, because of consensus on two points: the difficulty of a non-profit or community college taking on responsibility for CCURI without new funding and the potential erosion of CCURI's focus on research at community colleges if it joined an organization with different priorities.

**9. If CCURI were not to be sustained as an organization, what would be the most effective exit strategy that minimizes any negative impacts on current CCURI partner programs?**

Participants discussed potential repositories for CCURI's archives. Speakers were concerned about preserving the curricula from CCURI's faculty workshops and guidance for starting low-cost research projects speakers. Others expressed concern about difficulty of ensuring that archived materials are accessible, easy to find, and up to date.

# CCURI Identifies Critical Factors for a Culture of Research at Community Colleges

As the CCURI network grew, CCURI leaders became curious about the combination of factors necessary for a community college to move from a culture of "no research" to a culture where "research is the norm."

By learning what promotes and constrains institutional culture changes for undergraduate research, CCURI leaders hoped to learn what CCURI can do to help institutions embrace the "research is teaching" philosophy and practice.

Over the years CCURI leaders have observed that community colleges with robust research cultures and sustainable research programs have the following elements:

- Undergraduate research programs align with institutional priorities from the top down.
- The community college has utilized a self-study or established a strategic plan that encourages undergraduate research opportunities.
- Students' research experiences are embedded in courses.
- Faculty participate in CCURI professional development opportunities.
- Faculty collaborate with CCURI partners on research projects.
- Faculty engage in activities offered by disciplinary societies (such as American Society for Microbiology).

From this anecdotal identification of elements, institutions were scored along the culture spectrum of "no research" to "research as the norm" using data from CCURI management team assessments, CCURI partner reporting forms, and surveys from 42 faculty members and 94 students.

CCURI leaders find that community colleges with research programs aligned with institutional priorities are more likely to have a research culture. Institutions with a culture of research engage large numbers of faculty and students in undergraduate research projects in a wide range of disciplines.

Data support the idea that by utilizing communities of practice, CCURI could further drive a culture of research among and across institutions.

## *CCURI: a National Organization that Makes Research Possible in Local Communities*

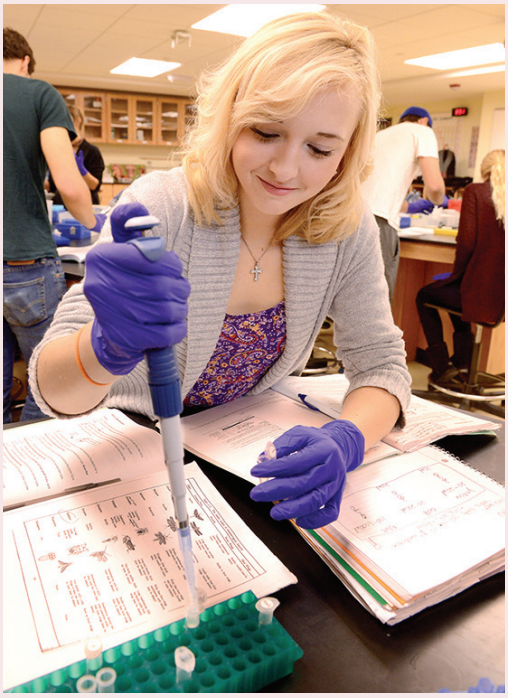
**Source: CCURI**

In 2013, CCURI collaborated with faculty at University of California San Diego to bring the protocols used in the San Diego Biodiversity Project to CCURI partner colleges. Since then numerous CCURI partner colleges have used DNA barcoding as a central research method for biodiversity projects on their campuses. In 2015, CCURI expanded the biodiversity project to include plant DNA barcoding.

CCURI workshops help faculty adapt both the plant and arthropod methods to fit their curricula and their students' needs.

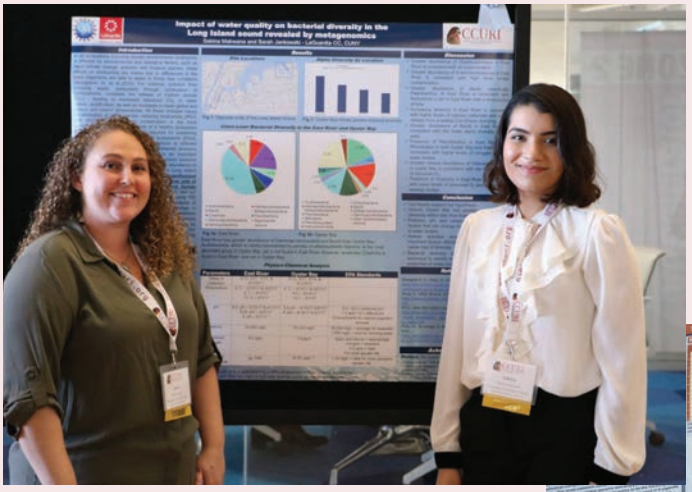
The DNA barcoding protocol is effective because it

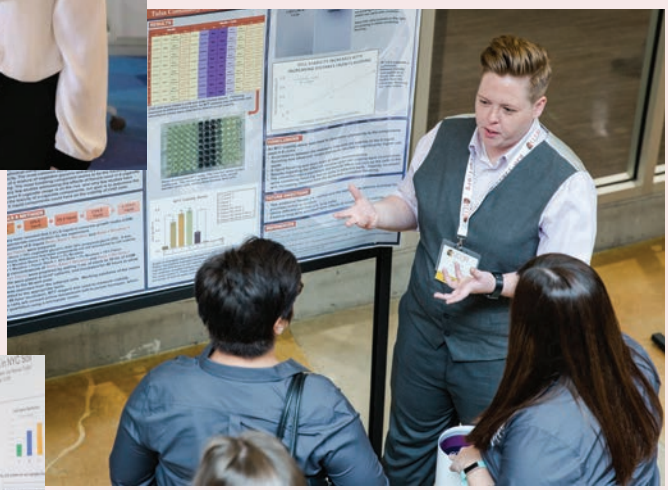
- provides opportunities for students to explore real-life questions such as: What is the diversity of arthropods or plants in a particular area? How is climate change affecting the population?
- uses basic laboratory tools such as microscopes;
- allows students to practice advanced skills such as PCR and DNA sequencing; and
- aligns with biology and biotech curricula.



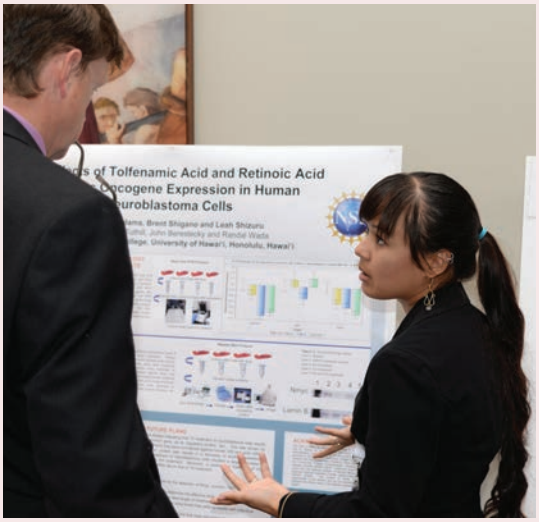
***In these photos, students in the Introduction to Biology course at Finger Lakes Community College prepare insect tissue samples for DNA barcoding to identify the species of insects on the campus in Canandaigua, New York. The students' research results are added to a database of biodiversity at the college and uploaded to the International Barcode of Life (iBOL), an inventory of biodiversity on the planet.***

## *Unique Course Experiences Lead to Extraordinary Outcomes*



***These photographs are of students presenting their research at various poster sessions from 2013 to 2019.***




**Source: CCURI**

Course-based undergraduate research experiences cause students to become more engaged in the discipline which leads to increased student retention and degree completion. CCURI provides support for faculty, administrators, and students at community colleges to make these radical changes in instruction work for them, so they can be proud not only of their students and faculty, but also of their data.

CCURI has run 12 poster sessions as part of student colloquia since 2013. Six hundred forty-seven individual students have presented and a total of 944 individual students and faculty have attended CCURI colloquia. (This is unduplicated headcount. Some students and faculty attended multiple colloquia.)

## *Summit Participants Consider Four Funding Scenarios*

Late in the afternoon of May 1, participants were assigned to work in small groups to identify what CCURI could do at four different funding levels ranging from zero funds and no staff to $7 million and five staff members for a period of five years.

At the time of the meeting, CCURI's $1.5 million budget covered the costs for 1.3 full-time equivalent staff people who provided the following to its national network of colleges:

**Faculty Services**

Faculty Development Workshops
Strategic Planning to Implement Undergraduate Research
Faculty Mentoring
Best Practice Dissemination
Site Visits to Partner and Affiliate Colleges
Facilitation of Network Collaborations
Research Project Development
Technical Support for New Project Development
Travel Funds to CCURI Events

**Student Services**

Student Poster Sessions
Student Professional Development
Travel Funds to CCURI Events
Travel Funds to Professional Meetings

**General Services**

Publications on Undergraduate Research at Community Colleges
Support for Members' Publications
Meta-analysis Data
Evaluation Tools
Grant Development Assistance
Start-up Funds

***Option One:* No Money, No Paid Staff**

Continuation of operations with no funds and no paid staff would require leveraging the existing CCURI network and other fans of CCURI to work as volunteers to run the smallest high-impact activities and services. The group listed mentoring and professional development as possible services. A college or other entity would have to agree to host CCURI's website.

The group suggested tapping into a network of alumni — both faculty and students — who learned in partner and affiliate colleges. Whether students are employed in academia or commercial enterprises, it was suggested that they could be enlisted to donate their time.

The group urged CCURI to restructure from a central, national location to regional hubs. More robust digital connections could help save more money on travel for meetings. Decentralization would also facilitate tying regional clusters to regional economic development programs.

The group acknowledged that being absorbed by a larger organization (such as CUR, AtD, or HHMI ) may be necessary.

***Option Two:* $1 Million with Two Full-time Staff Members**

With $1 million for four years, the group allocated $150,000 per year for two full-time staff members whose duties would include fundraising, partnership development, and evaluation as well as programming for faculty and students. The group budgeted $100,000 per year for programs that would provide travel support.

Investing in a full-time executive director is expected to add value through partnerships and successful proposals to funders.

### *Option Three:* $5 Million with Four Full-time Staff Members

The group with a $5 million budget over four years reorganized CCURI to have a central office and three hubs. With this arrangement the central office would have one full-time staff member to take care of marketing and to define research initiatives, and a part-time executive director. The paid leaders of the three hubs would lead initiatives in molecular methods, field methods, humanities, and arts.

With this level of funding, CCURI could host three professional development workshops per year, including two that would focus on bringing in new partner institutions. More assessments, which could provide evidence that would gain more support from funders, would also be possible.

This group envisioned CCURI leveraging the knowledge and skills of current and former principal investigators of the National Science Foundation's Advanced Technological Education program. It also proposed utilizing some of the students and faculty members who participate in workshops and posters sessions as program representatives at conferences to increase awareness of CCURI with key audiences of community college STEM educators and administrators.

### *Option Four:* $7 Million with Five Full-time Staff Members

With a $7 million, five-year budget CCURI could afford a full-time executive director and four other staff members to focus on member services, financial development, program assessment, and administrative tasks. In this scenario 1.5 staff members would work on bringing in money to sustain the program.

At this level of support CCURI could develop research projects and faculty professional development programs in natural sciences and social sciences, as well as the arts and humanities. CCURI could also offer in-person national and regional student poster sessions with travel support, three faculty professional development workshops, and online student and faculty resources.

> **"One of the things to me that comes out of an undergraduate research experience is that you are beginning to set in their mind that they are going to need to be and should be lifelong learners. That is one of the things that industry is pushing right now. You cannot get a job and stay there doing the same thing for even 10 years."**
>
> **V. Celeste Carter**
> **Lead Program Director**
> **Advanced Technological Education**
> **National Science Foundation**

# Value Proposition Statements

One of the primary tasks of the meeting participants was to come up with value propositions that have the potential to capture people's attention and summarize CCURI's mission. Hewlett and Bock introduced this assignment at the group's initial meeting and revisited it again on the second day.

A significant portion of the final meeting session was devoted to participants working alone and in groups writing and rewriting value propositions.

Six statements stood out from the various drafts because they so accurately capture the various aspects of what CCURI does for students and faculty.

After the meeting Hewlett decided to use this statement as CCURI's value proposition going forward:

## EDUCATION REDEFINED, REINVENTED, REINVIGORATED

CCURI provides a new model for the classroom experience at community colleges through the incorporation of course-based undergraduate research as a teaching tool. CCURI educates faculty in new pedagogical methods, provides presentation opportunities to students, and provides a model for growth and success in developing a culture of innovation at community colleges.

Source: CCURI

***For more than a decade, students from Finger Lakes Community College have gathered data for an international coral reef research project in the Caribbean Ocean. The data collected through this project is sent to Reef Check Foundation, an organization that works to protect tropical coral reefs through education, research, and conservation.***

**Here are the five other value propositions that have been incorporated in the text and photo captions of this publication:**

## A National Organization Making a Difference in Your Local Community

CCURI leverages the authority and power of a national network to allow local instructors to be effective agents of pedagogical change in their home communities through faculty professional development workshops, engaged subject-matter experts, and the open sharing of developed research resources.

## Evidence-based Practices & Validated Impacts

CCURI's research and evaluation of the impact of undergraduate research at its two-year colleges capture the undeniably positive impacts for students, faculty, institutions and their partners, and communities helping to justify undergraduate research programs and resources needed to support them.

## Proven Practices for STEM Completion

CCURI provides proven undergraduate research practices and resources designed to assist community colleges in engaging and retaining students in STEM.

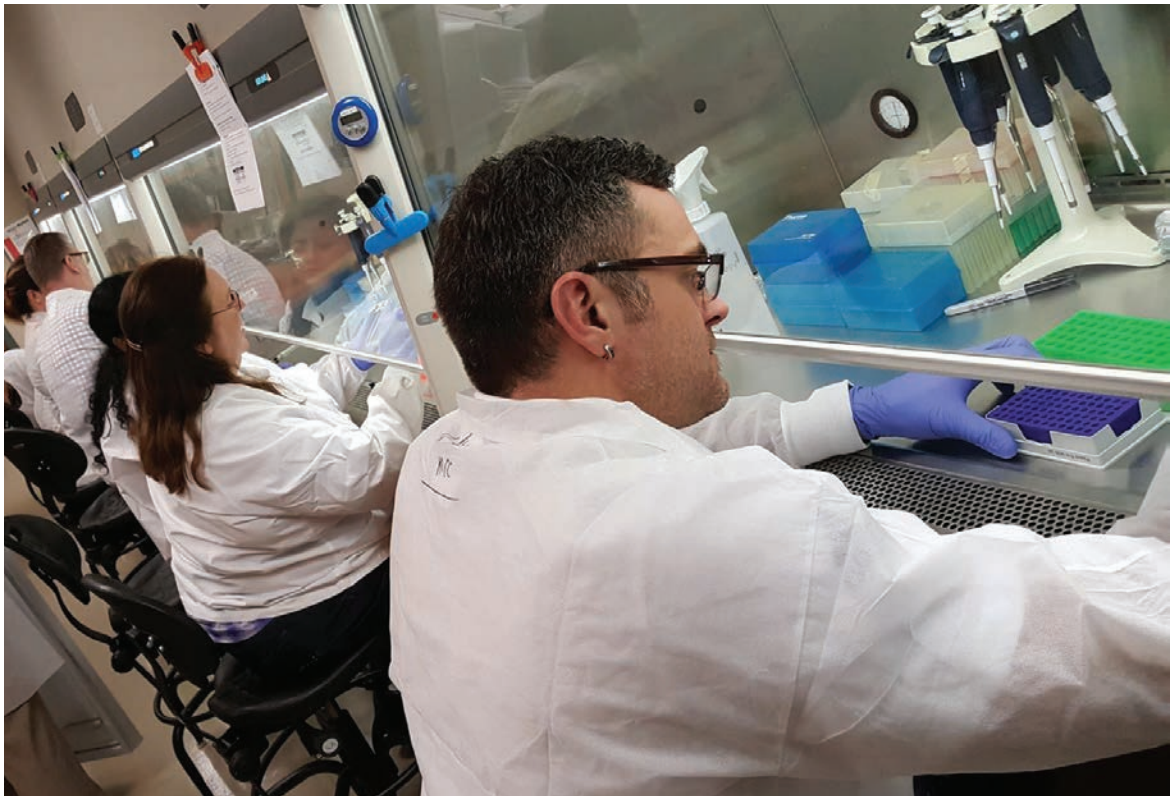
## Professionals Who Share a Passion to Provide Research Experiences for Community College Students

CCURI offers an established and ever-growing network of community college faculty and administrators who understand the challenges of teaching in the community college environment and endeavor to overcome barriers and facilitate institutional change. Educators feel supported when they join CCURI's network of successful professionals who openly share their resources and knowledge to make the community college educational experience an exceptional experience.

## Unparalleled Knowledge

With more than 14 years of experience designing and implementing meaningful and engaging STEM learning at community colleges, The Community College Undergraduate Research Initiative (CCURI) is the go-to organization for guidance when starting and expanding research at community colleges.

## *CCURI Springboards Faculty Use of Research*



Source: CCURI

***CCURI runs four different Lab Methods Workshops simultaneously in Tulsa Community College's state-of-the-art biotechnology laboratories at the Southeast Campus Health Sciences and Biotechnology Learning Center.***

Since 2014 Tulsa Community College has hosted five CCURI's Lab Methods Workshops in its state-of-the-art biotechnology laboratories.

"It is a premier lab with everything we need to help community college faculty add research to their teaching," said Heather Bock, CCURI project director.

TCC's two multimedia classrooms with cell culture facilities and eight HEPA bio hoods are large enough to accommodate four tracks of professional development simultaneously. This arrangement maximizes the time of expert presenters and increases networking among participants.

CCURI's workshops have covered DNA barcoding, CRISPR/Cas9 gene editing, cell culture methods, bioinformatics, and the use of *Tetrahymena* as model organisms.

"These workshops offer different levels of presentation and engagement while providing enough background information to stimulate further research by the participants," said Diana S. Spencer. She has been involved with the workshops as the George Kaiser Family Foundation Endowed Chair for Undergraduate Research and associate professor of biotechnology at Tulsa Community College (TCC) and as a co-principal investigator of CCURI and CCURI workshop presenter.

Altogether 116 community college educators from all over the U.S. have learned not only cutting-edge biotech lab methods at CCURI's workshops in Tulsa, but also the pedagogy for teaching those skills to students. All CCURI workshops are designed to be fundable through community colleges' departmental budgets without unusual instrumentation.

As an indication of the quality of the Lab Methods Workshops at TCC, 95% of the 21 educators who participated in the 2014 workshop reported in a survey conducted six months after it that they had implemented the knowledge and skills they learned.

That is important to Spencer who not only agrees with CCURI's motto that research is teaching, but she also asserts, "Research is the best teaching."

Making research opportunities in multiple disciplines available to the 22,000 students who take classes at TCC's four campuses is the goal of the Search and Aspire program that Spencer leads.

Spencer describes her involvement with CCURI as integral to the positive sequence of events that have helped her spread undergraduate research in Tulsa and across Oklahoma while raising the national profile of community colleges as places where students do authentic research.

"CCURI has just given us a real springboard of connecting across the nation and realizing the possibilities, and just lots of opportunities — over and over again," she said.

At Bock's suggestion Spencer became a biology councilor for the Council on Undergraduate Research (CUR) in 2013. In that role and as a *CUR Biology Newsletter* editor, Spencer has worked to show "that undergrad research necessarily should start in the first two years, no matter where the student is, and that it is valuable to move the students forward. And the community college is the absolutely perfect fit for increasing diversity in all of our disciplines."

Spencer is grateful for the opportunities CCURI has provided for her both to learn and contribute and for the "stellar" support of TCC's administrators, faculty, and lab coordinators.

"It's just kind of been this perfect coming together of many different groups — the NIH, OK INBRE (Oklahoma IDeA Network of Biomedical Research Excellence), CUR, CCURI, TCC, George Kaiser Family Foundation, the biotech program, and a lot of good faculty," she said.

## *Cold Call to CCURI Leads to Research Experiences for Baton Rouge Community College Students*

***BRCC students collect freshwater sponge samples as paid interns for a 2019 statewide study led by Mary Miller, associate professor of biology and undergraduate research coordinator at BRCC. Miller learned field techniques and DNA barcoding methodologies at a CCURI workshop. Afterward she taught those lessons and obtained funding to carry out the multifaceted research project with students.***

**Source: Baton Rouge Community College**

When Mary Miller, associate professor of biology at Baton Rouge Community College (BRCC), called CCURI in 2016, she was seeking advice for herself and for colleagues. What she learned has been pivotal for her, her colleagues, and BRCC students.

Within three years Miller was leading a statewide biodiversity study that employed student interns as research assistants. The federal grant Miller obtained covered not only that study's costs but also funded other student interns, whose placement Miller facilitated, and impacted all of the college's STEM students by underwriting the cost of incorporating research experiences into the introductory biology course.

During that 2016 phone call CCURI Project Director Heather Bock suggested that Miller, who was already doing a soil study with microbiology students, and other BRCC faculty attend CCURI's workshops. Three years later, the seven faculty members who participated in CCURI's professional development had woven various research opportunities into their biology and chemistry courses—Miller most ambitiously.

Based on Bock's description, Miller chose to attend a 2017 workshop on DNA barcoding of freshwater sponges. "I didn't know what a freshwater sponge was; I didn't know they existed," Miller recalled. By the time she finished the workshop, Miller was making plans for a Louisiana-wide study of the creatures.

She immediately taught the students in the college's Citizen Science Club how to find freshwater sponges on rocks and logs in ponds. To obtain money for the study she envisioned, Miller began applying for grants.

In 2019, with funding from a $750,000 Minority Science Engineering Improvement Program grant from the U.S. Department of Education and a $20,000 award from Capital One, Miller and six students, whom she employed as paid interns, conducted the first statewide study of freshwater sponges in Louisiana since 1969. Michael A. Poirrer, who did the survey in 1969 for his doctoral dissertation and then spent his career at Tulane University, met with the student interns to talk about his research and their sampling methods and lab techniques.

In addition to reporting the genetic information about the sponges, Miller hopes to co-author with students an ecological health map of the state based on their 15-point analysis of water samples at each sampling site.

The three-year federal grant not only funds at least 10 student interns each year (Miller placed 15 interns in 2019.) and lab equipment, it also supports revamping the Introduction to Biology lab course with career modules to inform students' STEM career decisions. For example, pH lessons include an examination of food science careers, a visit to a creamery, conversations with lab personnel there, and then testing pH while making cheese in the campus lab. For the forensic science module, students visit a crime lab and then isolate the DNA in their own hair strands.

> **"Doing undergraduate research is one of best ways to train people for the workforce."**
>
> **Linnea Fletcher**
> **Principal Investigator**
> **InnovATEBIO National Biotechnology Education Center**
> **Chair, Biotech Department, Austin Community College**

Research is the centerpiece for all these efforts, Miller says, because it "really shows what science can be and what fields you can go into."

She traces the Louisiana freshwater sponge study and curricula changes to her first phone call to CCURI and the professional development that followed.

"All these experiences that I've gone through, as far as the CCURI workshops, I've been able to put my own creativity into that, and then put the spin on it with the careers to really bring it all together. I think by planting that seed when they [the students] first come in—in Intro Bio—we can change their whole career outlook from the beginning. For a community college student that is so important."

# CCURI Experiences Fuel Alexa Bennett's Path to Doctorate

*Alexa Bennett*

Doing research at Delaware Technical Community College profoundly influenced Alexa Bennett's career.

First, it gave her the confidence to change her major from production agriculture to biological sciences. Then it led to a paid summer internship at the University of Delaware, where she transferred after earning an associate degree. When she completed her bachelor's degree it was her hands-on lab skills that helped her obtain full-time employment as a microbiology lab technician in industry.

The cumulative benefit of those experiences came together in 2019 when she began a bioinformatics data science Ph.D. program at the University of Delaware. Her doctoral program under the direction of Thomas Hanson, professor and associate director of the Marine Bioscience, is funded for five years by the Water in the Changing Coastal Environment of Delaware (WiCCED) project, which has NSF and state grant support. It was Hanson's lab that Bennett interned in first as a Delaware Tech student and then as a university student.

Bennett traces "the natural progression" of her career to Virginia Balke's announcement in her Delaware Tech biology class that the Biochemistry Club was expanding its activities to include hands-on research projects. Balke, a biotechnology and biology professor at Delaware Tech, was involved in CCURI (she is now a co-principal investigator) so the students who did research in the college lab then participated in CCURI's student colloquia.

"Attending a poster session or symposium, or particularly the CCURI workshops … you kind of get this boost of inspiration and energy out of it," Bennett said. Having to talk to people about her research at poster sessions pushed Bennett to think "more holistically." It is a skill she now utilizes for WiCCED's outreach to elementary and secondary school students who are collecting soil, water, and sediment samples for her and other researchers to analyze.

"I'm so happy to have had that opportunity as an undergrad — particularly as an undergrad at a community college — to put together a poster and learn from those mistakes early, as opposed to graduate school," Bennett said.

# Undergraduate Research Puts Kaliopi Bousses on Track for Ph.D.

*Kaliopi Bousses*

Kaliopi Bousses considers enrolling in the biotechnology program at Delaware Technical Community College "one of the best decisions of my life" because of the research experiences she gained under the tutelage of Virginia Balke, a biotechnology and biology professor at Delaware Tech and a CCURI co-principal investigator.

As a Delaware Tech student Bousses did course-based research that Balke adopted from CCURI, independent research on big brown bats that Balke mentored, and a summer research internship. She also participated in CCURI colloquia and presented her research findings at student poster sessions.

"I learned a lot of molecular techniques through the project that I was working on with her [Balke] that I knew I wanted to continue developing and learning about," Bousses explained during a phone interview in August 2019.

Bousses, a doctoral student in the Earth and Environmental Sciences Department at the University of Pennsylvania, plans to be a geomicrobiologist. After earning her associate degree in biological sciences and chemistry at Delaware Tech, Bousses earned bachelor's and master's degrees at the University of Delaware where she did research in microbiology and bioinformatics.

The hands-on laboratory skills she learned at Delaware Tech have helped her rise at the other institutions. Bousses said, "The way that the labs incorporated the techniques, and also the way professors would let us figure out and troubleshoot any issues or errors that we might have had, definitely helped me gain an advantage, I would say, to a lot of the people I've had to interact with over the last couple of years outside of Del Tech."

As a graduate student at Penn her responsibilities have included setting up the polymerase chain reaction (PCR) methodology for obtaining genetic information of microbes. It is a skill she learned at Delaware Tech.

Thanks to the lab courses she took for her associate degree, Bousses said, "I already knew how to run and troubleshoot a PCR to obtain sufficient amounts of DNA without contaminating anything and getting pretty good sequences to be able to identify the microbes I isolated the DNA from."

While answering students' questions during an alumni panel at CCURI's 2018 Colloquium, Bousses shared the joy she finds in the challenges that come with research and solving problems. She advised the students to "be patient with the process."

# Meeting Participants

**Beth Ambos, Executive Officer**
Council on Undergraduate Research

**Virginia Balke**
CCURI Co-Principal Investigator

**Heather Bock, Project Director**
CCURI/Finger Lakes Community College

**Avrom J. Caplan, Dean**
The City University of New York

**V. Celeste Carter, Lead Program Director**
Advanced Technological Education
National Science Foundation

**Linnea Fletcher, Biotech Chair**
Austin Community College
Director, InnovATEBIO National Center

**Ashley Hagler, SPARC Director**
Director of Undergraduate Research
Gaston College

**Ian Harwood, Product Manager**
Bio-Rad Laboratories

**Ellen Hause, Program Director**
Academic & Student Affairs
American Association of Community Colleges

**James Hewlett, Professor**
Science and Technology
Director, Biotechnology/Biomanufacturing
Finger Lakes Community College
CCURI Principal Investigator,
Executive Director

**Robin Howard, Senior Director**
Membership Services and Business Operations
Council on Undergraduate Research

**Jonathan Iuzzini, Director**
Teaching & Learning
Achieving the Dream

**Darren Mattone, Life Sciences Chair**
Muskegon Community College
CCURI Co-Principal Investigator

**Russ Read, Executive Director**
National Center for Biotechnology Workforce
Forsyth Tech Community College

**Pushpa Ramakrishna, Program Director**
National Science Foundation

**Diana Spencer, Associate Professor**
George Kaiser Family Foundation
Endowed Chair for Research
Tulsa Community College
CCURI Co-Principal Investigator

**Ellan Spero, Co-Founder**
Lead Instructor
Station1
Lecturer and Historian of Science and Technology
Massachusetts Institute of Technology

**Kal Wysokowski, Director of Grants**
Finger Lakes Community College

# About CCURI

With more than 14 years of experience designing and implementing meaningful and engaging STEM learning at community colleges, The Community College Undergraduate Research Initiative (CCURI) is the go-to organization for guidance when starting and expanding research at community colleges. (For more info see https://www.ccuri.org)

CCURI Executive Director James Hewlett and Project Director Heather Bock share their unique perspective and knowledge to help community colleges create transformative educational programs through research.

CCURI is a national consortium of community colleges, four-year schools, government agencies, and private organizations dedicated to the development, implementation, and assessment of sustainable models for integrating undergraduate research experiences into community college STEM programs.

**James Hewlett**

CCURI Principal Investigator, Executive Director

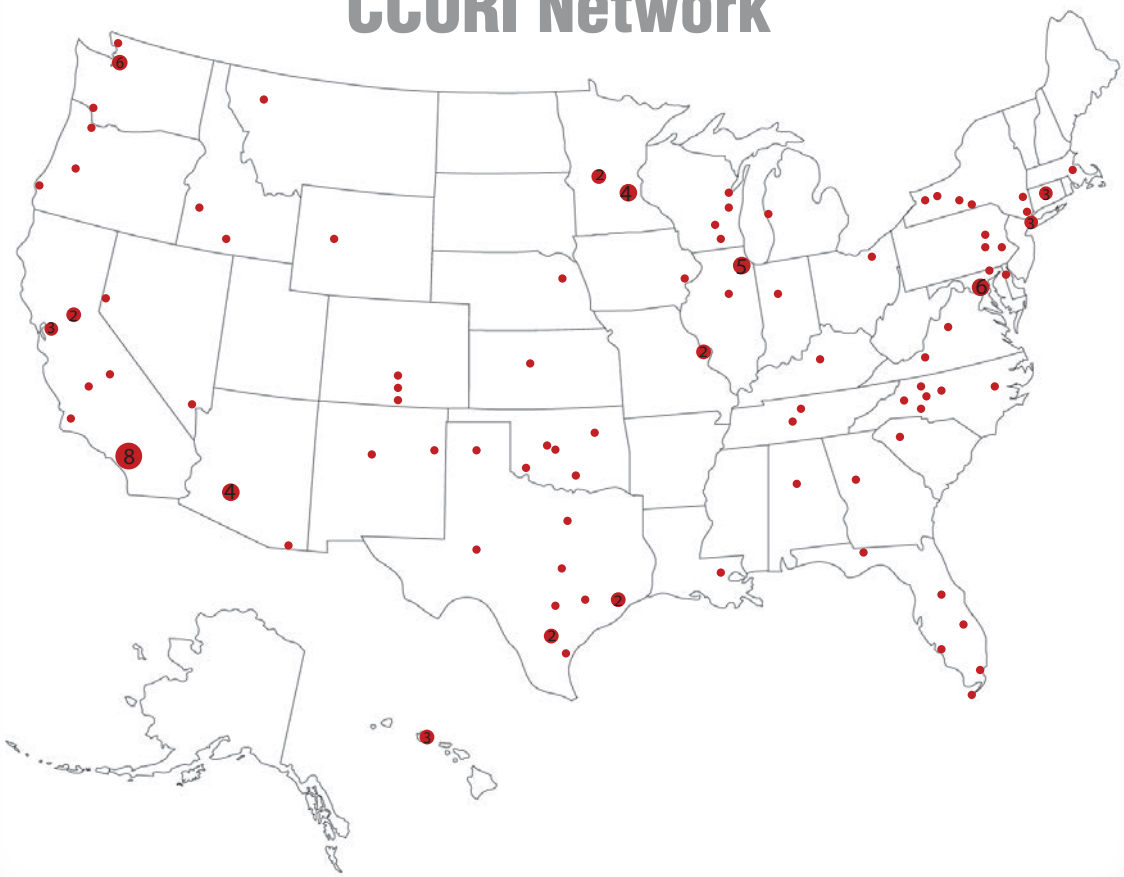
**Heather Bock**

CCURI Project Director

FingerLakes COMMUNITY COLLEGE

CCURI is located at Finger Lakes Community College, 3325 Marvin Sands Drive, Canandaigua, NY 14424

# CCURI Network



CCURI is a national network of more than 100 community colleges in 39 states focused on the development and implementation of undergraduate research programs.

**For more information visit our website:**
**www.ccuri.org**

CCURI
Community College Undergraduate Research Initiative