California State University, Monterey Bay: Undergraduate Research Opportunities Center
William Head and Jessica Brown

> **California State University, Monterey Bay**
> Website: www.csumb.edu or www.uroc.csumb.edu
> Location: Seaside, CA
> Founded: 1994
> Institutional Type: Public
> Carnegie Classification™: Undergraduate instructional program
> Number of Students: 4,795 undergraduates, 197 graduate students, 162 credential students, and 19 post-baccalaureate students
> Number of Faculty: 248
> Degree Programs: 22 bachelor's programs, 8 master's programs, 3 teaching-credential programs
> Founding of UR Office: January 2009

History of Undergraduate Research at California State University, Monterey Bay
Cal State Monterey Bay was established in 1994 as a comprehensive state university campus with a vision to serve "the diverse people of California, especially the working class and historically undereducated and low-income populations." We are a Hispanic-serving institution (HSI) with an enrollment of 4,800 students, 92 percent of whom are undergraduates. More than half of our students live on campus, and 83 percent are under the age of 25. Mirroring the demographics of our region, 34 percent of the undergraduate population comes from historically underrepresented groups, 47 percent are first-generation college students, and 30 percent are low-income. This institutional profile, which presents a unique set of challenges and opportunities, is relatively new to the undergraduate research (UR) dialogue.

The university is dedicated to finding the most effective mechanisms for keeping our students engaged, inspired, and connected to their education. To that end, we have invested heavily in a curriculum that emphasizes active learning, tutoring services, and service-based programs, such as a campus-wide service-learning program. The university also has a track record of supporting UR through senior capstone requirements, grant-sponsored student development programs, and faculty research grants.

Historically, many of our grant-sponsored programs and research projects were funded by federal and state agencies that emphasized science, technology, engineering, and mathematics (STEM) disciplines. In 2004, the university joined the California State University system's Louis Stokes Alliance for Minority Participation (CSU-LSAMP), which is a program of the National Science Foundation that supports students from diverse backgrounds so that they complete undergraduate degrees and enter graduate programs in STEM disciplines. The university also received grants from the National Oceanic and Atmospheric Administration, the U.S. Department of Agriculture, and the U.S. Department of Defense to provide students in STEM fields with scholarships and undergraduate research experiences. These programs laid solid

groundwork for UR opportunities, but their impact on the campus culture was limited because they were restricted to STEM fields.

In the fall of 2007, the U.S. Department of Education awarded the campus a grant from the Ronald E. McNair Postbaccalaureate Achievement Program (McNair Scholars), which enabled us to provide services to students in all disciplines across campus. The goal of the McNair Scholars program is to prepare undergraduates for PhD programs through academic and professional development opportunities such as UR, conference presentations, peer-reviewed publications, and graduate school preparation. As our first cross-campus UR initiative, the McNair Scholars program elevated the campus dialogue about preparing our students for graduate study, created cross-campus collaborations, and highlighted the tremendous value of UR to our students and faculty. Due to the success of our programs and the growing national significance of undergraduate research, the university identified UR as a key initiative in its *2008-2018 Strategic Plan* and in its *2008-2013 Academic Plan*.

Building on the momentum of these programs and the university's commitment to expanding UR, the authors (William Head and Jessica Brown) secured a grant from the U.S. Department of Education's College Cost Reduction and Access Act (CCRAA) program in the fall of 2008. The objective was to institutionalize interventions, such as UR and curricular revision, which increase the graduation rate of underrepresented students in STEM disciplines.

Based on this previous experience and support, the authors proposed creation of a permanent, centralized UR office to consolidate programs and serve students across campus. With strong campus endorsement, we launched the Undergraduate Research Opportunities Center (UROC) in January 2009, making it the first centralized UR office in the 23-campus California State University (CSU) system. UROC now houses our CSU-LSAMP and McNair Scholars programs, two other U.S. Department of Education grants, and privately funded UR programs. Centralization has had a tremendous impact on our campus. It has allowed us to stabilize our services, build efficiencies into our programs, coordinate fundraising, collaborate with faculty on grant proposals, centralize evaluation efforts, and, perhaps most importantly, increase the visibility and importance of UR across our campus and within the CSU system.

In its first two and one-half years, UROC placed 160 students in undergraduate research positions, including a number of students from the community colleges in the region. Of these placements, 137 students were paid stipends through our grants and other UROC funds. More than 100 additional students were served through workshops, research seminars, panels, and one-on-one advising sessions. Each year, the UROC staff also gives presentations on the benefits of UR to more than 250 students. As we grow, our annual goal is to serve a minimum of 300 students through workshops, seminars, and other services, and to place a minimum of 100 students in paid UR experiences.
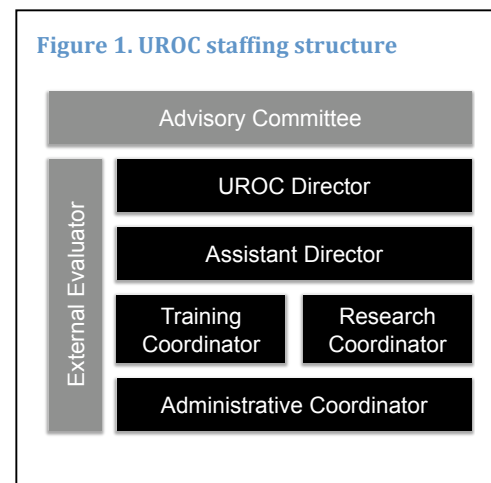
Establishing a UR office this quickly is highly unusual. The combination of a small, young campus; faculty and administration buy-in; a culture of innovation; a founding director with a strong UR record and the trust of faculty and administrators; and initial funding from grants and the campus enabled us to launch UROC quickly and with significant campus support. These factors also allow us to take an entrepreneurial approach to developing and administering UROC

programs. We quickly respond to funding opportunities, pilot new program elements, and forge new partnerships that benefit our students. UROC is also unusual in the high level of support we provide to students, our significant role in curriculum development, and our collaborations with regional research institutions and community colleges, all of which demand a high level of staffing.

UROC's mission is to build students' self-efficacy and educational ownership through scholarship, undergraduate research, and personal achievement. This mission is achieved through mentored undergraduate research and extensive training in reviewing literature, developing a research question, writing research proposals, presenting research results, developing professionalism, and preparing for graduate school. To further prepare for life beyond their undergraduate education, students engage in professional experiences, including presenting their research at conferences and publishing their work in peer-reviewed journals.

Administration and Staffing

UROC's robust services and hands-on approach require a considerable amount of supervision, oversight, and coordination by UROC staff members. Further, given that our small campus lacks traditional offices that support UR students, UROC staff members assume additional responsibilities that would typically fall under the purview of honors colleges or fellowship offices. The UROC team is made up of the director, assistant director, and three coordinators, (Figure 1), all of whom are committed to providing high-quality support for students and faculty. Seventy-five percent of our staff's funding comes from federal grants and the remainder from campus support.

Figure 1. UROC staffing structure

- Advisory Committee
- External Evaluator
- UROC Director
- Assistant Director
- Training Coordinator
- Research Coordinator
- Administrative Coordinator

The director, a faculty member with grant-funded buyout, serves as the lead architect, adviser, and spokesperson for UROC. This is currently a full-time position, but the time commitment will be reduced when the program is more established. The director has a PhD, experience in developing UR programs, and a strong track record in obtaining grant funding for curriculum development and student research. Activities under the director's purview include:
- Overseeing the program's vision, strategic planning, and commitment to excellence.
- Serving as the principal investigator on UROC-initiated grant proposals.
- Working with faculty on collaborative grant proposals.
- Fundraising (public, private, and corporate).
- Initiating relationships with partnering institutions, programs, and individuals.
- Serving as the primary spokesperson for UROC and all affiliated programs.
- Working with staff to provide student and mentoring support.
- Serving on the UROC advisory committee and reporting to the provost and university president.
- Serving on other campus committees to promote and support UROC.

The assistant director is responsible for developing, implementing, and coordinating UROC programs, as well as managing staff, fundraising, budgeting, evaluation, assessment, and marketing. The assistant director has a master's degree, a strong background in training and scientific communication, and a long history of working with academics. The research and training coordinators are responsible for student research support, which includes identifying research opportunities; placing students in research on campus and at partnering institutions; coordinating community college outreach and UR activities; providing support to research mentors; monitoring student progress throughout their involvement with the program; assisting students with their graduate application packages; and developing and teaching the undergraduate research seminar courses (described later) and workshops. While the coordinators work in close collaboration, the research coordinator oversees the research experiences, and the training coordinator develops course and workshop materials and oversees grant reporting. To support the full range of disciplines, one coordinator has a background in STEM fields and the other a background in humanities and social sciences. The backgrounds of our staff members are significant assets to UROC and allow us to build strong alliances with faculty.

The administrative coordinator is responsible for budget tracking and reporting; office management; oversight of two student assistants; website development and maintenance; database development and management; event planning; and maintenance of an efficient and professional front office for UROC clients (students, faculty, partnering institutions, funders, and visitors). UROC staff members also work closely with an external evaluator, who has extensive experience evaluating student and research-support programs, to ensure program effectiveness and gauge results.

The UROC program reports to an advisory committee, which is comprised of the UROC director; the dean of the College of Arts, Humanities and Social Sciences; the dean of the College of Science, Media Arts and Technology; the director of the Center for Teaching, Learning & Assessment; three rotating faculty positions representing a range of academic disciplines; a UROC student; and a representative from an external research partner. The committee, which meets at least twice a year, provides insight and guidance on existing programs; works with UROC to identify gaps in the current programming and establish goals for future work; and, when appropriate, promotes the model of UR to our campus and the broader community. The UROC advisory committee, led by UROC's director, reports to the provost and university president. The committee receives an annual report and regular updates on fundraising, program developments, achievements, and program evaluation.

A Year in the Life of UROC

Fall Semester:
- Conduct the research seminar courses (described below).
- Administer post-research surveys to students and follow-up surveys to alumni to gain feedback on the research experience and the mentoring received.
- Place UROC students in academic-year research positions (develop or revise learning outcomes as needed).

- Work with individual students on graduate school and fellowship applications, and, as needed, assist faculty with letters of support.
- Organize and fund graduate school visits for students.
- Recruit UROC students, including a new cohort of McNair Scholars.
- Review summer research survey reports.
- Convene the fall meeting of the UROC advisory board.
- Present findings from evaluations and summaries of student experiences to departmental, dean, and cabinet meetings.
- Host UROC fall workshops: Graduate School Applications, Statements of Purpose, and Applying for Research Experiences for Undergraduates (REU) programs.
- Conduct review sessions to prepare students for research presentations.
- Take UROC students to student-based conferences, including the Northern California Forum for Diversity in Graduate Education; the national conference of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS); and the Annual Biomedical Research Conference for Minority Students (ABRCMS).
- Prepare UROC students to present at discipline-specific professional conferences.
- Conduct outreach events for first-year seminar classes, regional community colleges, and recent transfer students from community colleges.
- Produce annual reports required by external grants.
- Develop marketing and outreach materials.
- Engage in private fundraising activities.

Winter Break
- Revise the curriculum for the fall research seminar course.
- Prepare for spring research seminar courses.
- Work with faculty on inquiry-based, applied-learning curricula and assessment tools.
- Identify UR grant opportunities and begin proposal writing.
- Draft UROC's annual report.
- Recruit and help students prepare for the CSU system's annual research competition.

Spring Semester
- Conduct research seminar courses.
- Host UROC spring workshops: Graduate School 101, Graduate Record Examination Training, Career Panels, and Preparing for the Summer Research Experience.
- Convene Spring UROC advisory committee meeting.
- Produce annual grant reports.
- Present programmatic awards, such as LSAMP Scholars Awards, Community College Transfer Merit Awards, and UROC Mentor Awards.
- Conduct annual Mentor Training Workshop.
- Conduct review sessions to prepare students for research presentations.
- Prepare UROC students to present at the National Conference on Undergraduate Research (NCUR) and discipline-specific professional conferences.
- Conduct private fundraising activities.
- Write UR grant proposals.
- Celebrate National Undergraduate Research Week by displaying student research posters in the library and highlighting UR on campus.

- Place UROC students in summer research opportunities (identify opportunities, negotiate placements, and place students).
- Work with students to develop their research planning guides (described below).
- Conduct pre-research experience survey and focus groups.
- Work with UROC students on their senior capstone presentations and posters.
- Host year-end UR events.
- Prepare student stories and UR highlights for the president's office, the provost's office, and the deans to use at commencement and other end-of-academic-year events.
- Produce the annual summary of our students' summer research placements and a description of where our UROC seniors will be attending graduate school.

Summer
- Revise curricula for research seminar courses.
- Refine UROC's Research Planning Guide.
- Write UR grant proposals.
- UROC staff present program and research results at CUR and other conferences.
- Conduct mid-summer check-ins with all UROC students and mentors and review students' reflective writing about their summer research experiences.
- Produce new marketing materials and videos.
- Revise and improve UROC website.
- Conduct orientation events for students transferring from community colleges.
- Produce UROC's strategic plan for the coming year.
- Produce materials for advisory committee.
- Expand research opportunities for UROC students at public and private organizations.

Resources
UROC is funded by grants, campus support, and private contributions, with the bulk of the funding coming from federal grants. To maximize the competitiveness of grant applications, we write UROC-specific proposals and collaborate with faculty on discipline-specific proposals that contain UR elements. This model enables us to capitalize on the expertise of faculty and identify funding opportunities in a broad array of disciplines. The campus funds 100 percent of an administrative staff position, plus a portion of all of our staff positions (ranging from 5 percent to 20 percent) that allows us to write grant proposals and participate in campus-based initiatives. We also receive some staff support from grant incentive account funds for discrete UR projects. The remainder of our staff is paid by grants, including course buyout for the director's time.

To build a stable funding structure, we are working toward a UROC financial profile of 55 percent grant funds, 25 percent campus support, and 20 percent donations from private sources, corporate donors, and research partners by 2015.

Physical Layout
UROC is located in the new Tanimura & Antle Family Memorial Library, the hub of campus activities. As a former military base, the campus lacked a centralized location for students to gather, and the library, with its range of study and meeting areas, now provides this. It is a wonderful location that reinforces our cross-campus mission.

The location also allows us to partner with a number of student-based programs that share the same general space (Figure 2). For example, we've worked with the Writing Program to develop writing support and training for our students; we've secured grants that support tutor training and tutoring for our Academic Skills Achievement Program (ASAP). UROC students present to first-year seminar classes on the value of UR and how to connect with UROC, and the office participates in the Center for Student Success's sophomore engagement and retention program.

Figure 2. UROC layout and partners

The 1,600-square-foot UROC office contains a central reception area, where the administrative coordinator's desk is located; three offices (the director and assistant director share an office, and the coordinators of research and training have individual offices to allow for one-on-one student meetings); a printing/utility room; and, most importantly, a dedicated meeting room that holds 35 people. The meeting room is equipped with an LCD projector, ample white boards, and movable chairs and tables. The space is flexible and conducive to hosting classes, seminars, workshops, briefings, and other meetings that allow us to stay connected to our key audiences and recruit new students and faculty into UROC. Just outside of our main office, UROC has two small offices that serve as quiet study rooms for students to take practice GRE tests, complete graduate applications, practice presentations, or simply do homework. UROC also has access to a formal conference room that holds 15 people and a kitchen area adjacent to our main office where we can prepare and store snacks for students, workshops, seminars, and presentations.
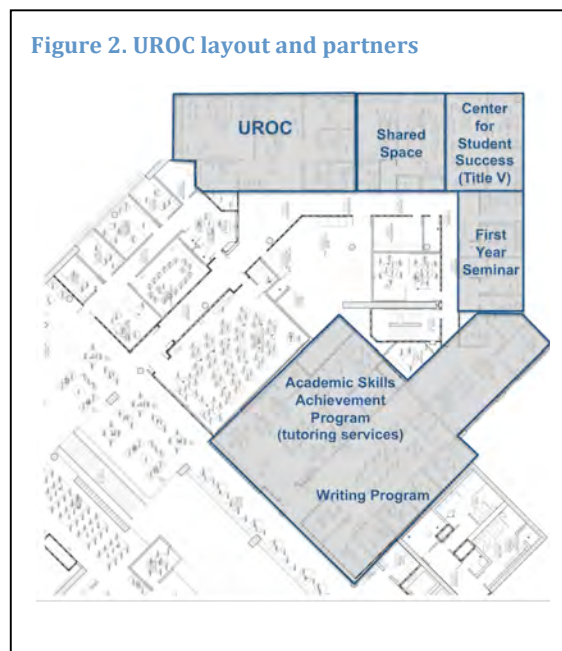
Programs
Grant Programs. UROC is currently home to the McNair Scholars program, the California State University Louis Stokes Alliance for Minority Participation program (CSU-LSAMP), and two recent Department of Education Hispanic-serving institutions (HSI) STEM & Articulation grants. Past awards have included grants from the Department of Education's College Cost Reduction and Access Act (CCRAA) and the U.S. Department of Agriculture's HSI National Program. We also receive funding from the university and private donors to support UR activities. This varied slate of programs demands an agile staff, robust collaborations (both on and off campus), and strong campus support.

UROC capitalizes on similarities among our programs to create, test, and utilize UR materials such as a Research Planning Guide, research seminar curricula, workshop materials, evaluation tools, and mentor training materials (described in later sections). All of our programs maintain a strong emphasis on graduate school preparation and hold all of our students to a high academic performance requirement and code of conduct (Figure 3). Because of our focus on strong academics and scholarly accomplishments, faculty recommend students to UROC who are performing well in their courses or those who may be "on the cusp" and would benefit from a rigorous UR experience.

The number of students supported by UROC depends on our active grants. The McNair Scholars program supports a cohort of 25 students from a broad range of disciplines, the CSU-LSAMP program supports 14 undergraduates in STEM disciplines annually, and the new HSI STEM & Articulation grants from the Department of Education (ED) will provide paid UR experiences to approximately 250 students over five years. The ED grants are designed to increase the transfer, retention, and graduation of students, particularly Hispanic and low-income students, through systematic institutional improvements. One is an individual grant to our campus, and the second is a collaborative grant administered by Hartnell Community College with Cal State Monterey Bay and the University of California, Santa Cruz as partnering institutions. The individual grant is designed to embed extensive curricular improvements along with enhanced undergraduate research experiences into STEM courses. The project will develop 17 new courses and update nine existing ones, with a heavy emphasis on incorporating research and inquiry-based learning into the course curricula. Both grants emphasize paid university and community college UR experiences, community college transfer articulation and outreach, and partnerships with research institutions to expand the range of UR experiences available to our students.

Figure 3. UROC Code of Conduct.

Students are expected to perform well academically and to serve as exemplary members of the scholarly community. In all matters, students will apply themselves to the fullest, work hard, and maintain the highest standards. They will adhere to the rigorous academic standards set by the program, and deliver required products in a timely and professional manner. In their actions they will exhibit maturity, honesty, sound judgment, and respect for others. Students who are unable or unwilling to perform at this level may be dismissed from the program. Mentors and staff will provide guidance to help students achieve their full scholarly and professional potential.

Student Support. The literature shows that undergraduate research increases student persistence and helps prepare students for graduate studies, which is particularly true with underrepresented minorities (Nagda et al. 1998; Kinzie et al. 2008; Malcom et al. 2010). However, our students, and indeed most students in the California State University (CSU) system, come from lower socioeconomic circumstances and simply cannot conduct UR without financial support. Accordingly, a large portion of our budget goes toward paying for student wages and benefits, student travel, and student conference fees. Of course, financial support alone is not enough, and the UROC staff provides significant support to students through one-on-one advising, workshops, and a four-semester UR seminar series (designated RSCH I-IV and described in "Services for Undergraduate Researchers" and "Curriculum and Workshops" below).

Faculty Benefits. Placing undergraduates in research settings also benefits our faculty's research agendas. Faculty members at primarily undergraduate institutions (PUIs) have heavy teaching loads and limited support from graduate students, so our well-trained undergraduate researchers help faculty keep their research projects moving forward. Faculty may also use financial support from UROC as matching funds for external grants, and UROC's structured UR services bolster the competitiveness of faculty research proposals.

Services for Undergraduate Researchers
Students at PUIs often receive a high level of support and guidance, and, in many cases, intensive support is critical for their initial success. However, given that long-term intensive student support does not build independent learners, we focus on building the students' confidence in their ability to conduct research and ability to advocate for their own educational needs, which have lasting and powerful impacts (Astramovich and Harris 2007). By bringing students into UROC early (typically in their sophomore year), we have time to build skill sets, develop their warranted confidence, and help them establish internal measures of quality work. This process takes time and requires careful scaffolding to propel students to a more independent, proactive, and informed approach to their education.

Staff and UROC students introduce incoming freshmen to UR at freshman orientation and in a required seminar for all first-year students. They discuss the value of UR and how to prepare for research (e.g., focus on academics, build relationships with faculty, and explore topics that spark personal interest). UROC begins recruitment efforts in earnest in the students' sophomore year. We focus on sophomores because our freshmen have limited academic preparation, and the campus research groups do not have the staff to train students in basic lab skills and research techniques. In time, we will address these issues and expand the research experience to freshmen by integrating elements of research and inquiry into first-year courses.

New UROC students, typically sophomores, complete an online application that includes a standard information form, their resume/CV, unofficial transcripts, a description of their research interests, previous research experiences (if applicable), relevant coursework, and desired faculty mentor (see Figure 4 for a simplified UROC student timeline). The quality of an application enables program staff to make an initial read of the student's maturity and potential as an undergraduate researcher. Students then meet one-on-one with UROC staff to discuss their career goals and research interests. They also

Figure 4 UROC student timeline

	FALL	SPRING	SUMMER
SOPHOMORE	UROC recruitment and applications.	Identify, apply, and prepare for 1st UR experience through RSCH I and workshops.	Participate in 1st UR experience.
JUNIOR	Apply for and prepare presentations for conferences in RSCH II. Continue academic year UR.	Prepare for 2nd UR through RSCH III and workshops. Identify graduate schools. Continue academic year UR.	Conduct 2nd UR experience. Identify graduate fellowships, draft personal statement, and take GRE.
SENIOR	Apply for graduate programs and fellowships in RSCH IV. Visit grad schools. Continue academic year UR.	Complete manuscripts for publication and present at discipline-specific conferences.	

discuss their current academic status and grades; typically, students aren't formally brought into UROC unless they have a minimum GPA of 3.0, but our official cutoff is 2.75 to allow for extenuating circumstances and to consider students who demonstrate a marked upward academic trajectory. At this initial meeting, UROC staff members determine which program or grant is most appropriate for the student. The student may be asked to submit an auxiliary application or additional materials as required by the program for which they are best suited. If no UROC funding is available for the student (i.e., they are not eligible for any of our grants), the student works with program staff to identify alternative funding or volunteer opportunities. Regardless of funding, the student continues to work with UROC staff and also participates in non-funded activities.

In the spring semester, students work with UROC staff to identify an on-campus research mentor or an off-campus summer research experience, and they complete the appropriate applications for UR programs. They also prepare for their UR experience through a research seminar or workshop series (see "Curriculum and Workshops" for a full description). Although some students begin their research in a limited fashion in the spring semester, the first research experience typically occurs in the summer. About one-third of our students conduct research on campus during the summer, another 15 percent conduct research with our regional research partners, and the remainder attends formal or arranged summer research experiences across the U.S. and abroad. During the summer, about half of our students receive summer funding from UROC, while the remaining students receive funding from federal programs that support UR (e.g., NSF's Research Experiences for Undergraduates) and from campus-specific UR programs (e.g., the CSU Council on Ocean Affairs, Science and Technology; the University of California's Leadership Excellence Through Advanced Degrees). In addition to the Research Planning Guide (described shortly) and regular check-ins with staff and mentors, students also submit written reflections that explore themes such as their responses to setbacks, successes, and relationships with mentors.

When students return in their junior year, they often continue discrete elements of their research (e.g., additional analysis or completion of the research report) or, if they conducted research on or near campus, they may stay fully engaged in the research project. In the fall, we work to elevate the students' professional skills through their completion of a research report, preparation of a poster, and dissemination of their research at professional conferences. Moving to the spring, we prepare them for more independent research projects that are in line with their refined graduate school goals and lead them into an intensive summer UR experience. When students return in the fall of their senior year, they complete graduate school and fellowship applications. They also present their work at discipline-specific conferences and prepare manuscripts for peer-reviewed journals (Figure 4). This model leads to great improvements in our students' scholarly achievements and self-efficacy. For example, when UROC students reflected on their 2010 summer research experience, 90 percent reported large gains in "understanding how researchers think and work," 86 percent in the "ability to do more demanding research," and 83 percent in their "tolerance for obstacles faced in the research process."

Audiences
We provide all of our audiences with services that enable them to effectively engage in and support UR. Two key audiences are reserch mentors and community college students.

Research mentors. UROC relies heavily on faculty and graduate-student mentors to guide students through their research experiences, serve as ambassadors to their particular fields, and help students chart successful paths to graduate school or a profession. To provide our students with a broad range of research experiences, UROC developed a network of mentors on campus and at world-class research institutions in our region (Figure 5). This model has been very successful, and UROC students report high satisfaction with their mentors. Ninety-three percent of students surveyed in the fall of 2010 reported that their mentor "served as a positive role model in his/her profession." Students also reported that their mentors enabled them to gain high-level research skills and helped them plan their work efficiently.

Figure 5. Network of regional research partners.

- Moss Landing Marine Laboratories
- USDA Agricultural Research Service
- University of California, Santa Cruz
- Stanford University's Hopkins Marine Station
- Elkhorn Slough National Estuarine Research Reserve
- Naval Postgraduate School
- National Marine Fisheries Service
- Monterey Bay National Marine Sanctuary
- Monterey Bay Aquarium Research Institute
- The Resource Conservation Districts of Monterey and Santa Cruz counties

We provide a stipend ($1,000 per term) to graduate student mentors at Monterey Bay and at our partnering research institutions. This formalizes their role as mentors and increases graduate students' ownership, commitment, and level of involvement in UR. The high level of attention supplied by the graduate student mentor, who has more research experience but is relatively similar in age to the mentee, forges a strong bond between the mentor and mentee.

To further support effective mentoring activities and create a cohesive network of mentors, UROC developed a mentor training workshop for faculty, researchers, and graduate students. Although the workshop isn't required, we get a large turnout and high enthusiasm for the opportunity to connect with the other mentors and discuss mentoring strategies. Mentors unable to attend receive workshop and follow-up materials. The workshop provides research mentors with proven mentoring techniques, creates a venue for sharing best practices and reflecting on the mentoring experience, and introduces UROC's expectations, tools, and resources to mentors. The full-day workshop covers a spectrum of topics including: the research process, integrating students into research groups, research ethics, learning outcomes and benchmarks, mentoring challenges, creating a personal mentoring philosophy, and assessing student performance and products. Mentors report that they also benefit from interacting and sharing perspectives with mentors from across disciplines (e.g., humanities, music, social sciences, sciences, business).

Caption: Sarah Jeffries, of Cal State Monterey Bay, and her mentors from Moss Landing Marine Laboratories collect native kelp to investigate adaptations to climate change.

Community college students. Community colleges play a critical role in California's higher education pathway. In fact, more than 63 percent of California high school graduates who enroll in the state's colleges and universities as freshmen enroll at a community college (CPEC 2011). Unfortunately, when these students transfer to four-year universities, they often remain off the radar screen for UR opportunities; they are acclimating to a new campus, faculty haven't yet had time to fully evaluate their academic preparation and aptitude, and they often carry additional familial and financial responsibilities (Malcom et al. 2010). These factors cause transfer students to compress their UR opportunities or to miss out on UR altogether, putting them at a distinct disadvantage for graduate school. Despite all of these barriers—or perhaps because of them—the transfer students who do engage in UR perform incredibly well. We discuss our strategies to

engage a broad range of transfer students in UR activities in the "Issues and Challenges" section below.

Curriculum and Workshops

UROC students from across the disciplines participate in a four-semester, graded series of undergraduate research seminars (for a total of 8 credits). Students are selected for the seminar based on their academic record, interest in graduate study, and prior research experience. To sustain an intensive learning environment and an interactive seminar atmosphere, enrollment in each course is presently limited to 25 students.

The first UR seminar (RSCH I) is designed to begin in the spring semester of the student's sophomore year, before the first research experience, and subsequent seminars continue through the fall semester of their senior year (RSCH IV), when students are applying to graduate school. The research seminars do not currently satisfy requirements for credit in students' majors; however, we work closely with faculty to ensure that, where appropriate, the outcomes are complementary to courses within the majors. Following is a breakdown of the content of the seminar series.

> RSCH 200: Undergraduate Research Seminar I (Spring)
> Introduces students to scholarly research and prepares them for UR. Students learn to develop a research question and evaluate literature, and are exposed to research methodologies and other critical research themes. Students build professional skills in public speaking and reviewing literature, and faculty panels help demystify the research environment. Students also complete a "research planning guide" that includes project-specific research objectives, learning outcomes, literature review, and a timeline.

> RSCH 300: Undergraduate Research Seminar II (Fall)
> Builds on the students' summer UR experiences. Students write a research report, participate in structured journal clubs, and engage in activities designed to bolster their capabilities for scholarly research. They explore topics such as plagiarism, bias in data, and research ethics. Students also prepare the results of their research for oral and poster presentations at UR and discipline-specific conferences. Guided activities help students refine their career goals and field of study, and introduce them to graduate programs and admissions requirements. These topics are reinforced through faculty and graduate student panel discussions.

> RSCH 301: Undergraduate Research Seminar III (Spring)
> Prepares students for their second summer UR experiences, with an emphasis on independent research and its application to future graduate work. Students strengthen their ability to communicate their work in written form and in formal presentations. They present research posters and talks at conferences, engage in scholarly peer review, and develop advanced professional skills such as networking and negotiation. Students identify potential graduate faculty advisors, begin their personal statements, and prepare for the Graduate Record Examination (GRE).

RSCH 400: Undergraduate Research Seminar IV (Fall)
Fosters advanced academic skills, such as leadership and academic ownership, which prepare students for a successful transition to graduate school. Students present their research at discipline-specific conferences and develop peer-reviewed publications. Students also develop all of the elements of graduate school and scholarship/fellowship application packages: statement of purpose, research statement, cover letter, curriculum vitae, and letters of recommendation requests. Graduate-student panels explore themes such as "graduate life," the "imposter syndrome," and "work-life" balance.

Workshops. Students who do not enroll in the research seminar courses are invited to participate in UROC's workshop series, where content covered in the seminar courses is included—some of it taught by seminar participants. Fall workshops include Graduate School Applications, Statements of Purpose, and Applying for Research Experiences for Undergraduates (REU) programs. Spring workshops include Graduate School 101, GRE Training, Career Panels, and an intensive four-workshop series to prepare students for their summer research experiences.

We encourage students to apply to summer REU programs because they benefit greatly from leaving the region and spending time on larger, research-based campuses. However, this experience is often out of their comfort zone, and the workshops provide the needed coaching and guidance on how to successfully apply to competitive REU programs. The first REU workshop is preceded by an intensive marketing push, highlighting the value of REUs and students' reflections on their past REU experiences. During the workshops, UROC staff members work closely with students to identify, apply, and broker REU experiences. Although this is time consuming, the experience and insights our students gain justify the staff efforts. Beyond formal REUs, we also work with faculty from other research institutions to create off-campus UR opportunities for our students. The structure provided by UROC, our staff's in-depth knowledge of our participants, and our ability to pay students have opened research doors that would otherwise be closed to our students.

UROC also hosts regular workshop sessions to help students prepare research posters and/or oral presentations for conferences. Upon receiving approval to attend a conference and completing a travel request, students go through a rigorous three-step review process of their conference presentations. First, students work with their mentor and UROC staff to create a storyboard of their presentation and develop a draft research poster or oral presentation. Students review this draft with their mentor and, as needed, UROC staff. Second, once their presentation is in a semi-final form, students present their research as though they were at a conference to an audience of their fellow students, UROC staff, graduate student mentors, and faculty. In addition to catching errors, this is an opportunity for students to learn about each other's work, practice their public speaking skills, and learn how to provide constructive critique. The final step is a dress rehearsal that enables students to polish and fine-tune their presentation.

UROC students often present first at a UR conference such as the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) or the National Conferences on Undergraduate Research (NCUR). This gives students a strong foundation for presenting at subsequent discipline-specific conferences in their field, where they can greatly expand their professional networks. When students return from a conference, they submit a written reflection

of their experience. In addition to the cognitive benefit of reflecting on their conference experience, this is important for tracking individual students and for program evaluation. Conference attendance is funded by grants, conference-specific travel grants, and private donations.

Curriculum. Beyond our research seminar courses and workshops, UROC develops, supports, and promotes the inclusion of UR and inquiry-based learning in the core academic curriculum. For example, using grant funds for curricular reform we revamped a suite of science and math courses with applied, inquiry-based curricula that engages our students in active learning and assists them in formulating their own research questions—providing the perfect training ground for preparing undergraduate researchers. These curricular enhancements have had a profound and positive impact on the way faculty design and deliver their courses and have increased commitment to creating and supporting UR opportunities. The curricular changes also build real-world skill sets that students can transfer to the workforce or graduate studies. For example, when reporting on the curricular improvements in an Environmental Modeling course, the faculty stated: "This engages students, keeps them interested, and helps them see why models are useful. It particularly helps students who might otherwise have difficulty making abstract connections between models and reality. These enhancements also give students more marketable, employable skills, since real-world, paid modeling usually involves a mixture of actual modeling and targeted fieldwork to test the models and collect required input data" (Watson and Guzman 2010).

Through our U.S. Department of Education grant, we will develop 17 new courses and update nine existing courses in our new biology, marine science, and computer science majors, as well as our new minors in chemistry and statistics. The curricula will emphasize research and inquiry-based learning, as well as new technology and transferrable skill sets. We will also restructure our major in Environmental Science, Technology & Policy to utilize experimental field sites to serve as real-world laboratories. Students will develop research skills and use analytical tools to study and model aquatic and terrestrial habitats. We will also develop a program that will bring advanced upper division students into lower division science courses as course assistants to facilitate group work, problem solving, and critical thinking. Further, the grant includes faculty development in science writing instruction and assessment. Given the breadth of these curricular and programmatic improvements, UROC has an unparalleled opportunity to incorporate UR into the STEM curriculum.

Assessment of Student Growth
UROC uses a two-pronged approach to assess student growth during the research process. The first element is an individualized plan for learning outcomes that students develop in close consultation with their mentor. The second is an annual assessment that all mentors complete of their mentees at the end of the research term.

Defining the desired learning outcomes ahead of time is a powerful way to gauge student growth because they require the student and mentor to define success at the outset of the project and provide clear, tangible metrics for student development. In their simplest form, the learning outcomes are an articulation of "what a student can do" as a result of his or her research experience. Each learning outcome has an identified set of activities, products, and criteria by

which the outcome is assessed. Students are required to submit their learning outcomes at the outset of their UR experience as part of UROC's requirement for a research planning guide (RPG) for individual students. Students also include a literature review, timeline, and the mission of the research program in their RPG. At the end of the research term, the mentor evaluates the student's achievement of the learning outcomes, makes note of any adjustments to the criteria and extenuating circumstances for not achieving an outcome, and, if the research relationship is continuing, works with the student to develop a new set of more advanced learning outcomes. In addition to providing a metric for student progress, the outcomes are a mechanism for ensuring that the student and mentor are aligned in their goals for the UR experience. (See Appendix 1 for the learning outcomes portion of the student's RPG, including instructions and a sample outcome.)

The Mentee Assessment form completed by mentors evaluates six overall areas of a student's research competency: understanding of the research project; critical thinking skills; independence, initiative, and adaptability; communication; research methods; and professionalism and laboratory etiquette. Within each area, a more detailed set of criteria is measured on a five-point scale, resulting in a standardized rating for each student. (See Figure 6 for the critical thinking criteria and Appendix 2 for the full Mentee Assessment instrument.) As with the learning outcomes, the assessment form for mentees serves a dual purpose in measuring student progress and articulating to mentors and students the full suite of skills and competencies expected of UROC students.

Figure 6. Example of the Critical Thinking Criteria from UROC's Mentee Assessment
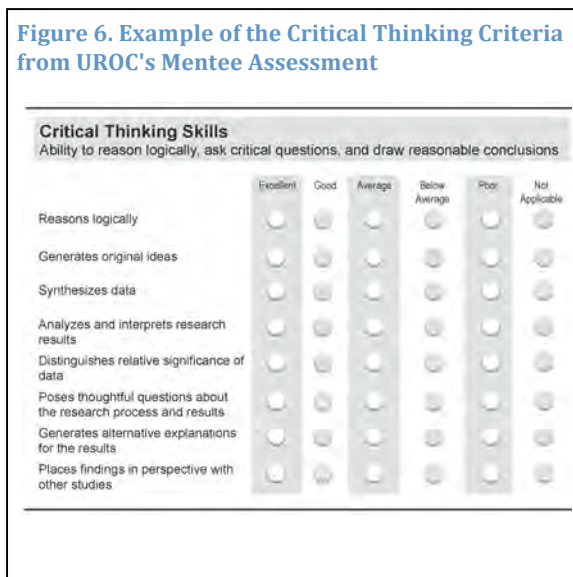
Events and Publications
UROC hosts UR events on campus and produces marketing materials highlighting our students' research projects. UR is also highlighted at the annual senior capstone presentations, which are organized by the majors. However, UROC emphasizes student presentations at professional conferences and publications in peer-reviewed journals because, for our population, it is critical that students calibrate, or norm, their achievements externally against the standards of their discipline. Presenting at an external venue also builds our students' self-confidence and sense of scholarly achievement. In 2010, UROC students presented 25 research posters and talks (see http://uroc.csumb.edu/student-posters?t=citations for a full list of posters and presentations and http://uroc.csumb.edu/student-posters to download the research posters).

A popular spring event is the formal celebration of UROC that highlights graduating seniors. UROC students speak about their undergraduate experiences, plans for graduate school, and future goals. The event is formal, but lively, and always packs a full house of families, university administrators, research partners, and UROC funders. This event is also a draw for local policy makers. At the 2011 event, a trio of regional state senators and assembly members created a joint

certificate of achievement for our graduating UROC students. We also host a spring "Posters-then-Pizza" day to celebrate Undergraduate Research Week. Students present the research posters they have given at regional and national conferences to Monterey Bay students, faculty, and administrators. The event is relatively easy to execute (the posters are already vetted and printed), but it engenders a lot of pride in our students and campus. It is also another opportunity for UROC students to be exposed to the broad scope of research conducted by their peers and to bond as a community of scholars.

Website
Highlights of UROC's website (http://uroc.csumb.edu) include: an online application system; templates and guides for research posters and oral presentations; student research posters (along with citation and downloadable pdf files); and videos and photos that tell UROC and student stories. The online application system and templates are incredible time-savers for staff and students. We proudly post all of our students' posters on the website to provide solid evidence of the quality work our students are producing. The videos and photos take the audience "into the field," introducing them to UROC students and their research. A professional videographer, with strong support from UROC staff, produces the videos. The website is maintained by program staff and student assistants. We also developed a UROC Facebook page where we post student opportunities, photos of our students in the field, and the "GRE Word of the Day."

Branding and Marketing Philosophy
UROC cultivates a brand that embodies high-quality work, innovation, scholarship, and an intellectual community. To implement this, we work closely with the campus Office of Strategic Communications to tell the stories and successes of UROC and its students. We do this through press releases, campus publications, marketing materials, text for speeches by university leaders, and outreach to policy makers. Our marketing efforts are equally divided between external and internal audiences.

UROC's external marketing strategy centers on our students' stories. These stories often include personal elements, highlight the research questions our students are addressing, and describe their career trajectories. Although our marketing materials are customized for each audience, they emphasize the same key messages. (See Figure 7 for a sample UROC messaging document). UROC students often serve as the office's primary spokespeople by speaking to private funders, hosting recruitment events at local community colleges, and engaging with students at regional high schools. The polish, poise, and enthusiasm of the UROC students are infectious and have a lasting impact on audiences.

> **Figure 7. Sample UROC Messaging Document for Outreach Videos.**
>
> - Understanding Student Research
>   - What is the topic of the research?
>   - How was the research conducted?
>   - What is the motivation behind the research?
>   - How will this research be used?
>   - How does this research relate to our region, state, nation, etc.?
>   - What role does the mentor play in the research?
>   - What does the student see as the future of the research?
>   - What project-related and/or personal obstacles did he or she have to overcome?
>   - How is engaging in research preparing the student for graduate school/professional life?
> - How UR Builds a Community of Scholars
>   - Fosters students' belief in themselves as scholars.
>   - Fortifies students' sense of belonging to their field of study and academia as a whole.
>   - Gives students a safe place to share thoughts (and doubts) about research and career paths.
>   - Prepares students to be successful in graduate school.
> - Benefits of Faculty Mentoring
>   - Mentors hold students to a rigorous standard of research.
>   - Mentors guide students in the process of research, critical thinking, and effective question asking.
>   - Mentors engage in a dynamic exchange of knowledge and experience.
>   - Mentors expose students to professional networks and career opportunities.
> - Benefits of Professional Experiences (e.g., conference presentations and peer-reviewed publication)
>   - Calibrates students' academic accomplishments against the norms of their field, thus increasing their sense of self-efficacy.
>   - Builds students' professional and academic networks.
>   - Informs the larger community about the quality research being conducted at Cal State Monterey Bay.

Student researchers' stories are also conveyed in videos, personal reflections, student profiles, and student updates. A popular marketing tool is a printed and online annual summary of our students' summer research (captured in punchy, active descriptions and photos), and a description of where our seniors are going to graduate school and what they will be studying. This document instills a tremendous sense of pride in our students, university, and our external partners and supporters.

Internally, we provide the Office of the President, the Office of the Provost, and the deans of the academic colleges with UR data, UROC highlights, and reports for the purposes of campus strategic planning and accreditation. We also work with the provost's office and the Office of Academic Planning and Institutional Effectiveness on the role of UR in student retention and graduation. These efforts keep university leaders apprised of UROC's efforts and provide them with strong stories to convey to our key constituents.

Fundraising

As described earlier, UROC is working toward a financial profile of 55 percent grant funds, 25 percent campus support, and 20 percent donations from private sources, corporate donors, and research partners by 2015. Currently, UROC's fundraising efforts center on writing grant applications and expanding its endowment. The endowment was first created as part of our

federal curriculum development grant, for which we had to provide matching funds. Although the return on an endowment is initially small, the stability of a fully realized endowment is critical to the long-term viability of UROC. The endowment will help lessen our dependence on external funds and enable us to fill in critical gaps in current funding, including the support of non-STEM students. To date, we have raised $1 million toward our goal of a $10-million endowment.

As a young primarily undergraduate institution, Monterey Bay has a limited pool of alumni; therefore, our development efforts focus on private donors in our region. This requires careful cultivation of funders; in many cases we've had to re-frame funders' knowledge of the university and shift the focus from helping students attain undergraduate degrees to emphasizing students' future post-baccalaureate achievements. Donors have been very generous in their support of UROC's mission.

Relationships with Other Campus Units
One of the many advantages of a small campus is the ease by which we can build partnerships with other campus units. Further, as a primarily undergraduate institution (PUI), every campus unit has at the core of its mission a commitment to support undergraduate education and development. The downside, of course, is that most units are understaffed, and faculty members have high teaching loads. Accordingly, UROC is creative and flexible in building mutually beneficial relationships with a wide range of campus units.

Our most productive and symbiotic relationships are with the cutting edge, faculty-driven research groups on campus. These research groups offer a broad range of dynamic UR opportunities for our students, and, in turn, UROC provides the structure, additional training, and funding for student participation in research. For example, UROC students work with our Spatial Information Visualization and Analysis (SIVA) Technology Center. This center consists of seven campus institutes and labs that use geospatial technology in innovative ways to create data-rich visualizations of California's coastal marine and terrestrial environments to inform policy and management decisions. UROC students are engaged in all facets of the center's work and are receiving training in acoustic and optical remote sensing, telemetry, geospatial analysis, and ecosystem modeling and visualization. UR is also a large element of the Molecular Ecology Lab Group, which combines faculty expertise in biochemistry, molecular biology, and ecology to analyze the presence and toxicity of harmful algal blooms in freshwater environments. Undergraduate researchers in psychology work on projects such as college students' attitudes toward sexuality and how children from varied cultural backgrounds come to understand irony. These intensive UR experiences provide students with a strong platform upon which to build an achievable vision for graduate school.

We recently collaborated with faculty to secure funds from the CSU system's LSAMP for a pilot international UR project. The four-week project took eight students from seven CSU campuses, including Monterey Bay, to Costa Rica for an intensive, field-based research experience led by Monterey Bay faculty. We carefully evaluated student and project outcomes with the goal of expanding the pilot project to a robust, ongoing CSU-wide international UR program. Results from the pilot project showed high student satisfaction. When asked if the experience contributed to the undergraduate experience, one participant reported: "Through this program, I learned the

basis of what makes a good scientist. I developed new ways of looking at my academic course work as a tool and not as something to just get over with. … I confidently believe that my participation in this program very early in my undergraduate career will positively contribute to my academic endeavors in ways I have yet to imagine!"

Beyond the individual research labs, UROC has strong relationships with the departments across campus and also works with such campus programs as the Monterey Bay Regional Academy of Computing Education (MBRACE), which works to diversify the computing workforce. We share resources, identify students for the each other's programs, and coordinate on organizational approaches to increase effectiveness. In addition, UROC collaborates with a number of other campus units:

- *Fundraising.* We work closely with our grants and contracts office on proposals for public funding, and with our advancement office on private fundraising efforts, including building the UR endowment. These activities take substantial time and resources, and a robust campus infrastructure is essential to the long-term stability of UROC.
- *Assessment and training.* We collaborate with the Center for Teaching, Learning & Assessment (TLA) on assessment tools for inquiry and research-based curricula. We are also working with the center and with STEM faculty to develop a series of modules on writing instruction designed to improve students' skills in written communication, critical thinking, and complex reasoning. This will include developing genre-specific criteria (e.g., lab reports, scientific papers, ethical analyses) for assessing writing that can be used across the STEM majors.
- *Strategic communications.* UROC works closely with the communications office to develop press releases, press strategies, and campus speeches.
- *Campus data.* UROC partners with the Office of Institutional Assessment and Research (IAR) to collect campus data such as retention rates and student demographics to be used in proposals, reports, and student recruitment.
- *Recruitment.* UROC informs students about the benefits of UR early in their enrollment at Monterey Bay, be it as first-time freshmen or transfer students. We work with the First Year Seminar program to introduce incoming freshmen to the value of UR and how they can plan for research as they progress through the university. We also work with the Office of Admissions on recruiting transfer students from community colleges and helping them rapidly transition into UR.
- *GRE and preparation for graduate school.* UROC collaborates with the Career Development Office on GRE preparation, graduate school resources, and panels that discuss graduate school and career opportunities.
- *Tutoring.* UROC has grant funding to work with our tutoring program, the Academic Skills Achievement Program, to develop new tutoring materials for science and mathematics courses. The tutors, many of whom are UROC students, gain valuable teaching experience, develop deeper content knowledge in their area of study, and expand their sense of self-efficacy.

Issues and Challenges
Stable and diversified funding. As discussed, the demographics of our campus require that our students be paid for their research endeavors; however, only a few of our faculty have research

grants large enough to fund undergraduates' involvement. Additionally, our McNair Scholars program is the only grant that supports students from all disciplines, but even it has significant eligibility restrictions based on demographics. UROC's goal is to provide undergraduates with paid research experiences across all disciplines. We see this as an ongoing challenge and believe that building UROC's endowment will help us expand and sustain funded UR opportunities.

Another funding challenge is maintaining long-term support for staff. The realities of our campus demand that our staff members be more than grant administrators. They are also mentors and instructors; they provide support to faculty; and they are often the primary contact for our external research partners. We've found that some granting agencies (e.g., NSF) are reluctant to pay for needed staff support and, instead, rely on the institution to cover this cost. We are fortunate to have administrative staff support from the university, and our long-term goal is to expand this support to include, at a minimum, an additional program coordinator position.

These funding issues are brought into tighter focus in times of financial uncertainty at the state and federal levels. If UR is to continue to flourish at our institution, we must diversify our funding, bring more UR into the core curriculum, and continue to make a strong case for the value of UR in our students' academic growth and achievement.

Faculty time. PUIs have higher teaching loads than research institutions, greatly limiting the time faculty members have to engage and mentor students in UR activities. Faculty workload is often allocated by number of units attached to a course, and there is no formal incentive mechanism to support faculty engagement in UR activities. Although our faculty Retention, Tenure, and Promotion policy values the integration of faculty activity (i.e., teaching, research, professional application, university service) and active student learning (e.g., UR, service-learning, course-based projects), providing faculty with incentives to add supervision of UR projects to their workloads remains a challenge.

Scaling up. Although UROC will, over time, provide services to more students on campus, this will be tempered by its commitment to promoting a high-quality experience for every student we work with. We are therefore working to institutionalize research experiences in the undergraduate curriculum (Malcom et al. 2010). We are first focusing on the STEM disciplines and working with the Center for Teaching, Learning, & Assessment to integrate inquiry-based learning and research into the curriculum, and to develop and test rubrics to assess laboratory and field-based courses. In addition to defining levels of achievement, the rubrics will provide an opportunity for faculty to articulate, evaluate, and compare the criteria they use to determine student success. We plan to secure additional funding to apply these UR curriculum revisions and rubrics to other disciplines on campus.

Community college transfers. As mentioned, a high percentage of students attending CSU campuses transfer from community colleges, and all too often they miss the UR experience. We have developed a number of initiatives to ensure that transfer students have access to, and participate in, a robust suite of UR experiences. We have collaborative grants with community colleges to provide their students with paid UR experiences; we developed and deliver regular orientation sessions for transfers; our faculty and UROC students give research talks at regional community colleges to provide insights into UR opportunities and strengthen the networks

among institutions (Malcom et al. 2010); and UROC students lead tours of the Monterey Bay campus for potential transfers, which strengthens the transfer students' connection to our campus, increases their awareness of programs and services, and starts to build their peer networks. As the number of transfer students continues to grow, we must expand and strengthen our outreach, programming, and support of transfer students to ensure that they have equal access to UR.

Program evaluation and assessment of effective UR practices. UROC is committed to evaluating and assessing UR (described below) at Monterey Bay; however, these assessments would be more robust if the findings could be compared with undergraduate research programs on other campuses. Accordingly, the CSU system is developing more compelling and powerful CSU-wide data sets to quantify the impact of UR on student access, retention, graduation, and post-baccalaureate success across institutions in the CSU system.

Assessment of the Program

As a new and growing program, UROC invests heavily in program evaluation and assessment, using grant and university funds. We work with an external evaluator to develop assessment tools that work at multiple levels—from individual students, to grant-funded programs, to the centers—and over the long term.

Our key questions center on self-efficacy, identity as a researcher, development of research skills, career choice, planning for graduate school, and the mentor-student relationship. These questions are evaluated through a mix of surveys, student products, and databases. Our surveys, including extensive pre- and post-summer research surveys that build on existing national surveys, are conducted online using the *StudentVoice* online assessment platform. The online system has greatly eased the distribution process and survey analysis. We also conduct focus groups and one-on-one interviews to gain a deeper understanding of our survey findings. Our external evaluator summarizes the findings, with special emphasis on areas for improvement, in reports for UROC staff. The findings are also packaged for campus administrators and faculty. Moving beyond self-reported indicators, we also track and evaluate student products, student demographics, research placements, professional activities, and academic progress. Taken together, this evaluation work helps us identify gaps in programming, areas for improvement, accomplishment of grant-specific objectives, and program impacts--such as graduate school acceptance rates, the number of external research partners, and the increase in research proposals with funded UR elements.

Moving forward, we will expand our research-based approach to understanding how and why our interventions are having the desired effect. We are particularly interested in investigating the role of goal setting and response to setbacks as they relate to self-efficacy.

The Future

We are proud of what we have accomplished in the early years of UROC, and we have identified five objectives for improving and strengthening our high-quality UR services. First, we will stabilize and diversify our funding, and work toward a funding breakdown, as noted previously, of 55 percent grant funds, 25 percent campus support, and 20 percent from private donations, corporate donors, and research partners. Second, we will expand our mentoring networks and

research opportunities in all disciplines. Specifically, we will expand our network of regional research partners and mentors, and, to bolster on-campus research, we will secure funding for non-STEM disciplines and for graduate student mentors. Third, we will work with our regional community colleges to develop research experiences for their students and create a seamless pathway into UR when they arrive at Monterey Bay. Fourth, we will advocate for the explicit inclusion of mentoring UR as a formal part of the university's faculty retention, tenure, and promotion process. Finally, we will develop a research-based approach to understanding how and why particular interventions have the desired effects so we can broaden our understanding of what works for our students and how we can improve our UR programs.

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Appendix 1. Learning Outcomes

In preparation for your research placement, you will develop **Learning Outcomes** that clearly describe what you will be able to "do" as a result of your experience. Work with your mentor to develop Learning Outcomes that align with the goals of the research project and your personal learning goals. As you develop your outcomes, remember that this is a target for your performance, so aim high and be thoughtful about your desired outcomes.

Each **Learning Outcome** is achieved through the completion of a given set of **activities**, which result in a **product(s)** that is measurable by **criteria** that you and your mentor agree upon. To start off, answer the following questions:

1. What do you want to achieve, or be able to do, as a result of your placement? (Outcome)
2. What activities will you engage in during your placement to accomplish the outcome? (Activity)
3. What product(s) will you produce to demonstrate that you have accomplished your outcome? (Product)
4. What standards will be used to judge the quality of your product(s)? (Criteria)

Now, using active language, hone your answers and convert them into definitive statements. Use strong action verbs to describe your learning outcomes. For example, instead of saying "to learn about," "to participate in," or "to study," use robust action verbs such as "analyze," "assess," "evaluate," (see Table 1). Your activities describe what you will *do* to develop the knowledge and skills to achieve your learning outcomes. Your products are what you will produce to demonstrate that you have accomplished your outcomes. Products can take various forms such as reports, performances, presentations, videos, etc. Finally, your criteria define the quality that is expected of your products.

Table 1: Action Verbs for Outcome Statements.		
Analyze	Apply	Assess
Build	Categorize	Compile
Conduct	Create	Demonstrate
Develop	Establish	Estimate
Experiment	Evaluate	Identify
Operate	Plan	Report
Research	Summarize	Survey

Strive for about three criteria for each product. Start by identifying key words for each criterion and then define them. For example, if you state that your product needs to meet the criteria of being accurate, aesthetically pleasing, and well-organized, you might define them in the following manner:
- **Accurate:** Material is presented without errors or misinterpretation.
- **Aesthetically pleasing:** Products are visually appealing to intended audiences.
- **Well organized:** Material is presented in a logical and easily understood manner.

When well thought out and clearly defined, Learning Outcomes becomes a guide for your development, and communication and checkpoint tools for you and your mentor. As importantly, Learning Outcomes are a way to establish high-reaching goals that are specific and tangible.

Please refer to the sample completed Learning Outcome grid as you develop your Learning Outcomes.

SAMPLE				
	Outcome	Activities	Evidence / Product	Criteria
Prompting Question:	What will I be able to do as a result of this placement?	Which actions or activities do I need to complete to achieve this outcome?	What products will prove that I accomplished this outcome?	How will I know if this product is to par?
Key Words:	Analyze, assess, evaluate, create, survey, etc.	Learn techniques and procedures, practice, etc.	Mentor sign-off, database, reports, presentations, etc.	Accurate, useful, organized, effective, etc.
	Analyze agricultural runoff water quality using the Lachat Autoanalyzer.	1. Read autoanalyzer manual. 2. Practice autoanalyzer procedures. 3. Learn quality assurance procedures. 4. Learn good lab practices. 5. Learn how to dispose of hazardous wastes.	Mentor sign-off of appropriate agriculture water quality analysis skills at the stated criteria.	Independent: Able to use equipment without supervision. Follows lab protocols: Always follows lab safety guidelines and quality assurance procedures. Accurate: Uses lab standards to determine instrument accuracy. Clean and organized: Lab is left clean and organized, and hazardous wastes are properly disposed.
		6. Develop data compilation and analysis skills.	Nutrient data sheets and summaries of all nutrient analyses.	Organized: Data sheets are neat, legible, and well organized. Accurate: All data sheets are presented without error or misinterpretation. Complete: All nutrient samples are processed and compiled into data sheets.
		7. Develop Excel graphing and data display skills.	Excel graphs summarizing raw data results from nutrient analyses.	Accurate: Data are entered into appropriate Excel sections without error. Well organized: Graphs are presented in a logical and easily understood manner. Useful: Staff can use summary graphs for reports and further research.

Appendix 2. Assessment of Mentee Progress

Thank you for taking the time to complete an assessment of your mentee's progress. The assessment includes items related to your mentee's current research competencies, ability to perform research-related tasks, and level of professionalism. You will be asked to complete this assessment online at the end of the mentee's placement or, if this is an ongoing placement, twice annually. However, the assessment can be used as a tool to discuss expectations and progress at any time during the mentee's placement.

Date	
Mentee Name	
Mentor Name	
Mentor Institution	

	Very good	Good	Accept-able	Needs Improve-ment	Poor	N/A
	5	4	3	2	1	N/A
Understanding of the Research Project Displays a firm grasp of the research project, including key concepts, context, and implications.						
1. Appropriate use of discipline-specific language and terminology						
2. Understanding of relevant literature						
3. Ability to describe research project to other researchers						
4. Ability to describe research project to a lay audience						
5. Understanding of the principles and theories underlying the research project						
6. Understanding of the research methodology						
7. Ability to formulate research questions						
Recommendations for improvement: Examples of a job well done:						
Critical Thinking Skills Ability to reason logically, ask critical questions, and draw reasonable conclusions.						
1. Reasons logically						
2. Generates original ideas						
3. Synthesizes data						
4. Analyzes and interprets research results						
5. Distinguishes relative significance of data						
6. Poses thoughtful questions about the research process and results						
7. Generates alternative explanations for the results						
8. Places findings in perspective with other related studies						
Recommendations for improvement: Examples of a job well done:						

	Very good	Good	Accept-able	Needs Improve-ment	Poor	N/A
	5	4	3	2	1	N/A
Independence, Initiative, and Adaptability Demonstrates initiative, creativity, and autonomy in identifying and accomplishing tasks.						
1. Demonstrates appropriate level of independence						
2. Asks for help when appropriate						
3. Flexible and resourceful when confronted with problems and unexpected situations						
4. Mentors more junior students [for senior-level student]						
Recommendations for improvement: Examples of a job well done:						
Communication Expresses ideas clearly orally and in writing.						
1. Expresses ideas clearly in oral communication						
2. Expresses ideas clearly in written communication						
3. Keeps accurate and complete lab notebooks						
4. Accurately articulates lab protocols or standard operating procedures						
5. Understands and utilizes proper citation format						
6. Scientific presentation skills (poster or otherwise)						
7. Keeps mentors and co-workers informed of project status						
8. Receptive to constructive feedback						
9. Listening skills						
Recommendations for improvement: Examples of a job well done:						
Research Methods Demonstrates an ability to function in the research environment.						
1. Understanding of the research process						
2. Ability to plan an experiment or analysis						
3. Performs experiments or analysis accurately and in a timely fashion						
4. Mastery of technology or other research tools						
5. Solves problems and troubleshoots issues						
6. Organizes large groups of data						
7. Follows safe laboratory and field procedures						
8. Responsible maintenance of workspace and tools						
Recommendations for improvement: Examples of a job well done:						

Professionalism and Laboratory Etiquette
Conduct is in accordance with laboratory culture.

1. Punctual						
2. Dependable						
3. Good attitude toward tasks and workload						
4. Enthusiasm for doing research						
5. Functions as a productive team member						
6. Understands the need to maintain accuracy						
7. Takes responsibility for their work						

Recommendations for improvement:

Examples of a job well done:

Learning Outcomes
Reflecting back on the Learning Outcomes developed at the outset of this term, please rate your mentee's level of achievement and provide a rationale for your rating.

	Exceeded	Fully achieved	Partially achieved	Failed to achieve
Outcome 1:_____				
Rationale for rating:				
Outcome 2: _____				
Rationale for rating:				
Outcome 3: _____				
Rationale for rating:				
Outcome 4: _____				
Rationale for rating:				

Additional Comments / Reflections
Please provide any additional comments or reflections: