PURM
Perspectives on Undergraduate Research & Mentoring

# U-GROW Summer Institute: A Mentoring-Centric Introduction to a Year–Long Cancer Research Education Program for Underrepresented Students

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**Introduction**

In 2020, the COVID-19 pandemic exposed profound healthcare disparities across the United States, including in California. These inequities are especially evident with preventable and manageable diseases, including cancer, for which marginalized communities often face the heaviest burden. In 2021, as a response to the need to identify and address the causes of disparities in cancer, we launched Undergraduates Gaining Research Opportunities for the Cancer Workforce (U-GROW). The product of a cross-institutional partnership between the Cancer Prevention and Control Program at Cedars-Sinai Medical Center in Los Angeles and local California State Universities (CSUs), U-GROW addresses cancer health disparities by preparing a new generation of leaders in cancer control science, drawn from communities disproportionately affected by these inequities.

U-GROW, a year-long education and training program, engages undergraduates in three intertwined components – a preparatory bootcamp, paid cancer research internships, and scientific communications training – while supporting them with a multi-modal network of mentors. The program draws students from the CSU system – "the largest and most diverse public university system in the country" (California State University Office of the Chancellor, 2024) – who often lack access to mentored research opportunities and knowledge about careers in the cancer control field (Manalo-Pedro & Allen, 2023). By providing CSU students with research opportunities and preparing them to excel in graduate-level cancer control science careers, U-GROW attempts to increase diversity in the biomedical workforce. Since its inception, U-GROW has trained 35 undergraduate students across three cohorts ('22, '23, and '24).

While U-GROW was developed to address disparities in cancer research training, the mentoring constellation model applied within the program's curriculum can be adapted across disciplines and institutional contexts. The model's core elements - cultural affirmation, multi-tiered mentoring relationships, and structured support networks - address universal challenges in undergraduate research training, particularly for students from underrepresented backgrounds. Incorporating these research-backed mentoring practices could be especially valuable for programs seeking to bridge gaps between teaching-focused institutions and research centers, regardless of discipline.

The U-GROW program has five main phases: an online internship matching phase, an in-person Summer Institute, a paid in-person summer research experience, online scientific communication workshops, and an alumni participation phase, which has online and in-person opportunities (see Table 1 – Phases of the U-GROW program).

Table 1. *Phases of the U-GROW Program*

| | |
|---|---|
| **Phase 1** | Internship Matching (*online*) |
| **Phase 2** | Summer Institute *(in-person*) |
| **Phase 3** | Paid Summer Research Internship (*in-person*) |
| **Phase 4** | Scientific Communication Workshops (*online*) |
| **Phase 5** | Alumni Participation (*online and in-person*) |

Here, we focus on lessons learned from the Summer Institute (SI), the five-day intensive program at the outset of the U-GROW year, because of its methodical focus on mentoring. Every day of the SI program integrates a variety of mentors who help scholars build skills consistent with the three program goals (i.e., offer a supportive network, paid cancer research internships, and scientific communication training). Each day includes carefully sequenced talks, workshops, panels, and exercises.

While the research internship with Cedars-Sinai Cancer scientists (Phase 3) is the most time-intensive element of our program, we knew that an internship alone would not prepare most students for success in R1 research environments. Especially for students new to research – as many of ours are – and drawing on our experiences as graduates and leaders of similar initiatives, we wanted to offer a comprehensive introduction to the cancer control research field *before* students began their internships. While such placements provide technical training, they often fail to address the unspoken lessons embedded in the hidden curriculum—those crucial aspects of research culture essential for building confidence, skill, and a sense of belonging. These gaps can hinder students' development and limit their potential to thrive in research environments (Hurtado et al., 1996; Seymour and Hewitt, 1997; Jackson et al., 2016; Estrada et al., 2021). To bridge these gaps, U-GROW's mentoring approach weaves together the technical training and the socioemotional support students need to succeed.

Undergraduate research is recognized as a high-impact educational practice (Kuh, 2008), leading to significant benefits for students, such as enhanced research skills, professional development, and academic performance (Healey & Jenkins, 2017; Byars-Winston et al., 2015; Prunuske et al., 2016; Trujillo et al., 2015). Research mentorship at the undergraduate level, particularly in STEM fields, has been shown to play a critical role in shaping students' academic and career trajectories (Estrada et al., 2021; Markle et al., 2022). For students from less educationally resourced backgrounds, mentorship is particularly important, as it not only helps bridge gaps in academic preparation but also provides the social and cultural capital necessary to navigate complex scientific environments. Research has consistently shown that students who receive mentoring are more likely to persist in STEM majors, experience higher levels of engagement, and a stronger sense of belonging in academic and professional communities (Estrada et al., 2018a; Estrada et al., 2018b; Campbell & Campbell, 1997). A combination of high-impact educational practices and constellation mentoring was found to help boost research confidence among upper-division CSU health science students (Valdez-Dadia et al., 2023).

This paper describes the U-GROW program's design, including its mentoring philosophy, mentor characteristics and the structure of both the program and its SI curriculum. We also share insights about preparing underrepresented students for STEM research internships, with particular emphasis on the role of socio-emotional work in fostering the skill development, confidence, and ambition of

students with limited research experience. Through this holistic approach, U-GROW helps to build a diverse cancer control workforce that reflects and serves the communities most affected by health disparities.

**Institutional Background & Considerations**

In response to community needs (Kronenfeld et al., 2021) and national calls from the American Association for Cancer Research (Williams et al., 2024) to address the underrepresentation of researchers and scientific leaders from communities disproportionately affected by cancer disparities, Cedars-Sinai Cancer launched the U-GROW program in collaboration with local and regional CSUs. Championing this effort, co-author Dr. Darrah Kuratani, then a lecturer in the Public Health & Health Sciences Department at CSU Dominguez Hills (CSUDH), recognized the significant gap in research opportunities for CSU students—many of whom are academically accomplished but face barriers to accessing internships and professional networks. She assembled a team (described in the next section) that developed a comprehensive program curriculum to serve CSU undergraduates. Drawing from their experiences in the Minority Training Program in Cancer Control Research (MTPCCR) (Pasick, 2012; Yancey, 2007), a National Institutes of Health R25-funded pipeline program that helped master's students prepare for doctoral programs, Dr. Kuratani and team sought a partnership that would provide CSU students with comprehensive mentorship and hands-on experience in cancer prevention and control science with a strong emphasis in cancer health disparities.

The eight CSU campuses in the greater Los Angeles area — Channel Islands, Dominguez Hills, Fullerton, Long Beach, Los Angeles, Northridge, San Bernardino, and California State Polytechnic University Pomona— collectively serve over 200,000 students, where 58.7% are first-generation college students and 57.4% identify as Hispanic or Latino. These institutions represent a crucial pipeline for recruiting and training the next generation of cancer prevention and control scientists from across Los Angeles. Many of these students, however, lack access to the research opportunities and mentorship available at research-intensive institutions.

The CSU system faces significant obstacles in offering substantive undergraduate research opportunities (Manalo-Pedro & Allen, 2023). Within California's higher education landscape, research funding per student is starkly disproportionate: the University of California (UC) system allocates over $3,600 per student, while the CSU system spends just $37 per student, with the California Community College system receiving even less (Manalo-Pedro & Allen, 2023). For students at the CSUs, access to undergraduate research is further hindered by teaching-heavy expectations on faculty. CSU faculty encounter structural barriers to becoming research mentors, including a workload structure that does not provide or encourage time for undergraduate mentoring; a lack of institutional awards and recognition; and a culture that does not find a place for undergraduate mentoring in the three most common pillars of tenure – research, teaching, and service (Hall et al., 2017; Prunuske et al., 2013).

In contrast to the CSUs, Cedars-Sinai Medical Center is home to over 1,500 active research projects, supported by ~$100 million in NIH funding (Cedars-Sinai Medical Center, 2024a, National Institutes of Health, 2024). Cedars-Sinai Medical Center serves over 1 million patients annually, and as California's largest cancer care provider, Cedars-Sinai Cancer cares for over 30,000 patients yearly, offering extensive research and clinical expertise (Cedars-Sinai Cancer, 2023a).

This strategic partnership between a top-tier research medical center and the undergraduate-focused CSU system not only addresses these students' educational and professional development needs but also enhances the diversity of future leaders in cancer control. More specifically, students from marginalized communities, like many CSU students, face challenges in pursuing biomedical

research careers, especially around research experience, knowledge about research careers, and skills development critical in the early creation of a research scientist identity (Trujillo et al., 2015). Scientist identity is "the degree to which students perceive their science-related pursuits as integral to their sense of self" (Robnett et al., 2018).

**Origins of U-GROW and Program Mentor Team**

In assembling a team to build this program and to serve as program mentors, co-author Kuratani recruited colleagues committed to teaching undergraduates from California's public universities. Each was also a graduate of or a key staff member of MTPCCR, the program that inspired U-GROW, and brought different disciplinary expertise to the team. MTPCCR alumni Annalyn Valdez-Dadia is an assistant professor in Human Services at CSUDH and served as internship coordinator for 4 years at UCLA's MTPCCR site. UCLA MTPCCR program director Sherry M. Kidd (M.Ed. with an emphasis in multicultural counseling) and longtime MTPCCR writing instructor Katherine Isokawa (Ph.D. in English) also helped design the U-GROW program.

The addition of co-author Dr. Patricia Thompson, an accomplished mentor and cancer prevention scientist, who served as Principal Investigator and co-lead of the Cancer Prevention & Control Program at Cedars-Sinai Cancer, was integral to the institutional partnership. Thompson spearheaded the negotiations between the two institutions, establishing the collaborative framework necessary for the program's success. Collectively, these five educators offered U-GROW decades of trans-disciplinary experience mentoring, teaching, and designing curricula for U-GROW's intended audience. More importantly, elements of their backgrounds mirror those of CSU students and motivate each to think critically about how to help underrepresented undergraduates thrive in academia. This combination of experience and motivation, while not unique to these five program mentors, lends a distinguishing texture to the fabric of U-GROW.

**Constellation Mentorship as the Core of U-GROW**

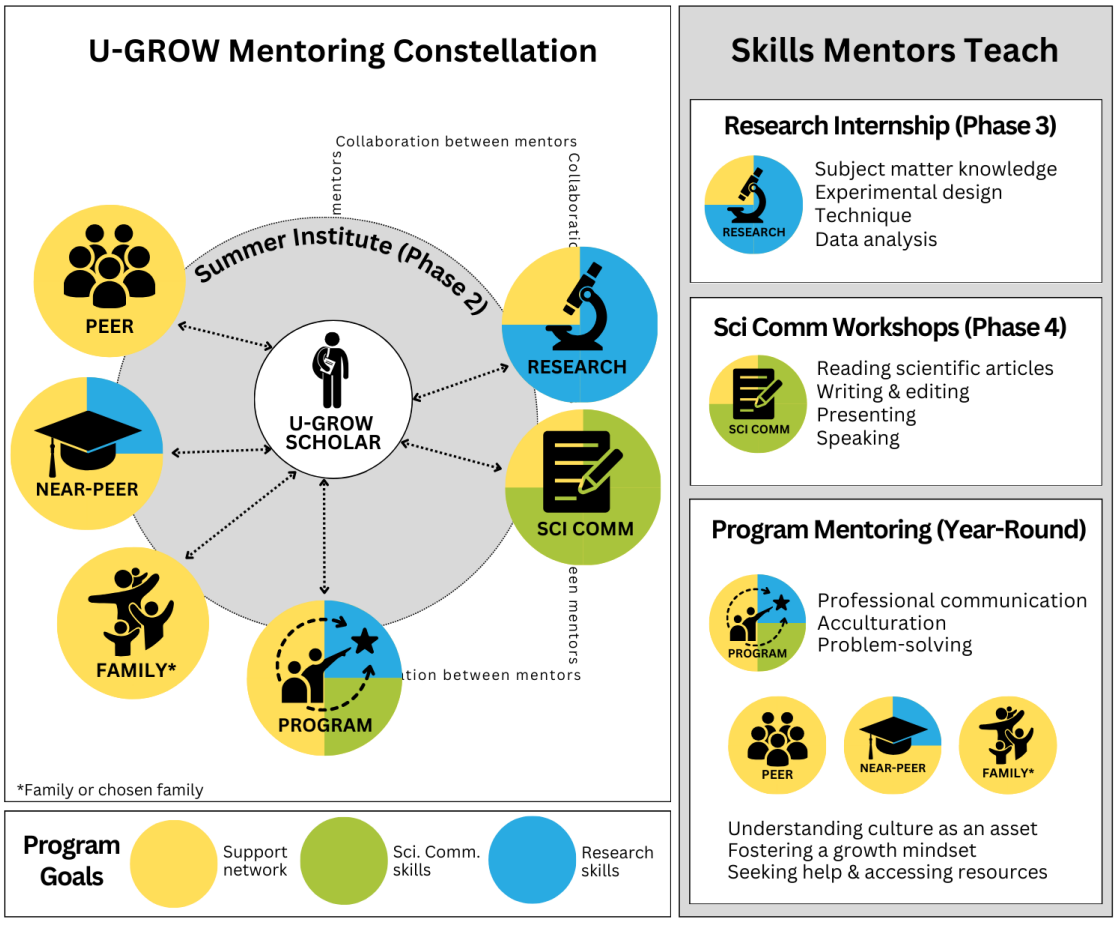
As this brief history of the program's mentoring team suggests, promoting a multiple-mentor model and recruiting mentors, speakers, and panelists from diverse backgrounds is central to U-GROW. As such, we have employed a constellation mentoring model. Constellation mentorship is a dynamic model that emphasizes the value of diverse, interconnected mentoring relationships within a supportive network (Thurman & Vandermaas-Peeler, 2022). Rather than relying on a single mentor to fulfill diverse roles and responsibilities, this approach incorporates multiple mentors—such as senior advisors, peers, and near-peer mentors—who collectively provide tailored guidance and multidirectional support (Thurman & Vandermaas-Peeler, 2022; Vandermaas-Peeler, et al., 2023). By fostering reciprocal relationships and integrating diverse perspectives, mentoring constellations empower individuals to navigate challenges, build confidence, and achieve holistic growth (Estrada et al., 2021).

~~Evaluations from the SI suggest that scholars feel a genuine connection to speakers or mentors who share some life experiences.~~ Mentorship is particularly important for students from marginalized backgrounds, who benefit from having mentors with overlapping identities. In seeking a diverse slate of mentors, speakers, and panelists, however, we encountered the problem we were trying to solve: the disproportionately low representation of marginalized communities among STEM faculty. Culturally insensitive mentors, microaggressions from peers and mentors, stereotype threat, and failures of scientific culture to privilege the cultural wealth of students from marginalized communities are all reasons these students may choose not to pursue or to stop pursuing STEM careers, or why they lack a scientist identity (Jackson et al., 2016; Estrada et al., 2018a; Markle et al., 2022; Robnett at al., 2018). Given these barriers, research shows that effective mentorship is a key factor in the success of underrepresented students in STEM fields, contributing to enhanced research skills, identity formation, and professional growth (Trujillo et al., 2015; Haeger & Fresquez,

2016). Any mentor who engages in culturally relevant support and addresses issues of marginalization can also provide significant benefits (Prunuske et al., 2013; Haeger & Fresquez, 2016). These mentoring relationships help students broaden their career aspirations, solidify their scientist identity, and persist in research careers despite systemic challenges (Estrada et al., 2018a; Estrada et al., 2021).

More importantly, identifying a single mentor with overlapping identities can be difficult due to the low diversity within the professoriate, which perpetuates a cycle of underrepresentation (Thurman & Vandermaas-Peeler, 2022). This lack of representation creates barriers to greater diversity in graduate programs and beyond. U-GROW's constellation mentoring model directly addresses this challenge by surrounding students with multiple diverse sources of support—faculty, peers, alums, and family—creating a sustainable mentoring network that helps break the cycle of underrepresentation (see Figure 1 – U-GROW Mentoring Constellation). In the graphic and explanation that follow, we outline how each member of the mentor constellation supports the U-GROW scholar. The mentors are represented by circles that are color-coded to show their contributions to specific program goals.

Figure 1. *U-GROW Mentoring Constellation***




*NOTE: Figure 1 was designed by Dr. Katherine Isokawa.*

During Phase 1 of the program (not shown in the graphic), the program team matches scholars to research mentors. For U-GROW scholars, their first in-person meeting with mentors begins during the

SI (Phase 2) as they meet their cohort, which consists of peers from different universities and often different majors. In the U-GROW Mentoring Constellation model, the "Peer" node is colored yellow to demonstrate that this mentor cluster grows the students' support network. Similarly, near-peers, such as U-GROW alumni, primarily grow the scholar's research support network (75% yellow) but also provide informal research training by educating scholars about the next steps in a researcher's journey or additional opportunities for mentored research (25% blue).

During the SI week, scholars also interact daily with program mentors (this paper's authors) who not only offer a high level of socioemotional and practical support (50% yellow), an introduction to scientific communication (25% green), and guidance on navigating the forthcoming research experience (25% blue), but who also help scholars build professional development skills through communication, acculturation, and problem-solving activities. Throughout the week and the year, scholars are taught the importance of culture in their personal and professional lives, how to maintain a growth mindset, and how to ask questions.

As scholars progress into research internships (Phase 3), research mentors provide the training to acquire subject matter knowledge, expose scholars to experimental design techniques, and offer an opportunity to learn and practice data analysis in diverse and supportive research settings (75% blue for research skills, 25% yellow for building a supportive network). After the internship ends (Phase 4), Scientific Communication Workshops (SCW) round out the U-GROW program by teaching scholars academic skills associated with reading scientific literature, writing about their research, presenting (i.e., rehearsed speaking), and speaking (e.g., extemporaneously asking a question at a research group meeting) (75% green and 25% yellow, as SCW instruction also addresses the psychological and social aspects of academic writing).

This interwoven approach and the continuous collaboration between mentor clusters help undergraduate students navigate academic and professional challenges, particularly for first-generation college students who may lack family guidance in navigating higher education pathways. U-GROW acknowledges the significance of close relational ties and chosen supportive connections in the mentoring constellation. Recognizing that family networks can significantly influence the pursuit of *or* withdrawal from research endeavors, U-GROW encourages scholars to invite anyone who has supported their academic journey to the SI. This may include faculty mentors from their CSU campus, close friends, grandparents, and others. These guests become part of a robust support network that empowers students throughout their academic paths.

The U-GROW mentoring model highlights how effective mentorship extends beyond developing technical skills. Mentors serve as connectors, helping students overcome challenges, set clear expectations, and foster professional socialization (Prunuske et al., 2016; Shanahan et al., 2015). Within our model, mentors are critical in destigmatizing setbacks, building community, and providing personalized guidance. Students who benefit from this type of mentorship tend to show higher levels of self-efficacy, a stronger sense of belonging, and greater persistence in STEM fields (Byars-Winston et al., 2015; Johnson et al., 2015). These benefits are particularly amplified when mentorship is integrated into structured co-curricular programs like U-GROW, which research shows can significantly increase the likelihood of students pursuing STEM careers (Estrada, 2014).

**U-GROW Program Structure & the Role of the Summer Institute**

To understand the essential role of the SI in the U-GROW curriculum, we provide a more granular breakdown of each phase before outlining the primary goals of the SI. The U-GROW scholars' year begins in the spring of their sophomore or junior year with Phase 1, a research matching phase in which they are paired with internship mentors and work with them to create Learning Contracts that establish clear bi-directional expectations. This preparatory phase leads into Phase 2, the SI, which

prepares students for their research internships. During Phase 3, scholars undertake 180–360-hour paid research internships with Cedars-Sinai cancer prevention researchers. Additionally, they engage in biweekly internship seminars to practice discussing their research informally and designing scientific posters. Phase 3 ends with a poster presentation in the fall. In Phase 4, monthly SCW train students in speaking, presenting, and writing about science. These highly interactive workshops provide opportunities to build on the bonds that began during the SI. In Phase 5, U-GROW offers an evergreen invitation for alumni to return to program events in order to 1) continue receiving mentoring themselves and 2) complete the mentorship cycle by acting as near-peer mentors to current scholars.

Held at Cedars-Sinai in early June, the SI is a five-day intensive program strategically positioned at the beginning of the U-GROW year. Its primary goal is to promote educational equity by 1) establishing a common foundation of knowledge about cancer research and higher education for all students, particularly first-generation college students who are navigating unfamiliar professional and academic environments, and 2) introducing scholars to individuals within the U-GROW mentor constellation, enabling them to build relationships with multiple mentors. In particular, the SI allows scholars to form relationships with program mentors. Forming mentor constellations is consistent with a new model for understanding mentorship that has emerged in recent years, supplanting the old model of the principal investigator as the trainee's sole mentor (Thurman & Vandermaas-Peeler, 2022; Vandermaas-Peeler, et al., 2023).

The small cohort size of 10 to 15 students per year and individualized attention from program mentors during the SI ensure that each student's needs, goals, and challenges are understood from the outset. Drawing from our experiences as university instructors, research mentors, and from NIH-funded mentor training programs (i.e., Advancing Inclusive Mentoring and Scientific Communication Advances Research Excellence), we seek to understand where our students are coming from, as people and researchers. This may involve acknowledging and addressing struggles common to first-generation and minoritized college students, challenges posed by the hidden curriculum, and difficulties asking for help. By candidly sharing our own similar stories, we help students see that the setbacks and uncertainties they will encounter during their internships and beyond are normal parts of the academic journey.

**Summer Institute Curriculum**

The SI curriculum emerged from the team's decades of direct experience teaching and mentoring underrepresented undergraduate students and has evolved based on evaluation data gathered during and between cohorts (see "Results" section below). In analyzing our curriculum, however, we find natural alignment with the remarkably durable framework for undergraduate research mentoring by Shanahan et al (2015), and the eight key elements of High-Impact educational practices (HIPs) enumerated by Kuh and O'Donnell (2013), which have been proven to enhance the education of all undergraduates but particularly undergraduates from underrepresented backgrounds (Kuh et al., 2017).

In Table 2 and the description that follows, we outline our day-by-day curriculum. The scope of each day's activities expands outward, with Days 1 and 2 focusing on the familiar and local (scholars introducing themselves and meeting peers, mentors, and faculty) and Days 3, 4, and 5 addressing three increasingly significant academic milestones: internship, graduate school admission, and graduate program completion. Each day's description will emphasize touchpoints between Shanahan et al (2015) and Kuh and O'Donnell's (2013) frameworks and our SI curriculum, highlighting both the research basis of our curriculum and its adaptability across different institutional contexts and fields of undergraduate research mentoring, from R1 research universities to small liberal arts colleges partnering with research institutions.

Table 2. *Daily Summer Institute Topics & Rationale*

| Day | Topic | Rationale & Connection to Literature |
|---|---|---|
| 1 | *Introductions:* Activities build trust within cohort and with the mentoring team & assess student readiness for this opportunity | • Balance rigorous expectations with emotional support (Shanahan et al. #4)<br>• Expose students to a diversity of people and circumstances (Kuh and O'Donnell #4)<br>• Support professional development by explaining norms of discipline (Shanahan et al. #8) |
| 2 | *Research In Our Field & at Our Institution:* Lectures and panels introduce scholars to research methods, current directions in research, and patient perspectives | • Teach research skills (Shanahan et al. #3)<br>• Enable real-world application of learning (Kuh & O'Donnell #7) |
| 3 | *How to Be an Intern:* Orients interns to institutional protocols and norms. Offers best practices for building mentor relationships. Scholars finalize Learning Contracts | • Set expectations (Shanahan et al. #2)<br>• Teach research skills (Shanahan et al. #3)<br>• Support professional development by explaining norms of discipline (Shanahan et al. #8) |
| 4 | *Graduate School Admissions:* Graduate school applications & funding, connection with near-peer mentors (program alumni) | • Offer chances for peers & near-peers to become mentors (Shanahan et al. #9) |
| 5 | *Graduate School Success:* Faculty & near-peer mentors share graduate school experiences; program mentors and scholars publicly reflect on growth over the week | • Balance rigorous expectations with emotional support (Shanahan et al. #4)<br>• Provide structured opportunities to reflect and integrate learning (Kuh et al. #6) |

## Day 1: Introductions

Day 1 centers on building trust within the cohort and with the program mentor team through two complementary introduction activities that exemplify our mentoring philosophy: "Me and My Culture" and "Writing an Academic Introduction."

In "Me and My Culture," adapted from U-GROW's parent program MTPCCR, scholars and mentors share cultural items and their motivations for joining U-GROW. This activity demonstrates our core principle that cultural wisdom and personal experience are valuable assets in cancer disparities research, eschewing deficit models of social and cultural capital (Jackson et al., 2016; Yosso, 2005). When program mentors participate, sharing their own experiences navigating between their cultures of origin and academic culture, it creates an environment where authentic self-expression becomes normalized in academic spaces. The academic introduction workshop that follows teaches scholars

to navigate professional discourse while maintaining their cultural identities. Scholars learn introduction etiquette, analyze examples, and practice by introducing peers to the cohort.

These paired activities - one cultural, one academic - demonstrate our fundamental mentoring approach: teaching scholars to move fluently between cultural knowledge and scholarly discourse while recognizing the value of both in their development as researchers. This pairing exemplifies Kuh and O'Donnell's high-impact practice key element of engaging with diversity (#4), as participants and mentors learn about each other's cultures, values, and worldviews in an intimate and accepting environment (Kuh & O'Donnell, 2013). "Me and My Culture" sets the stage for encouraging conversations between mentors and mentees that treat both as whole people (Shanahan et al., 2015 - #4). Additionally, the academic introduction workshop lays out the norms of the profession (Shanahan et al., 2015 - #8), offering scaffolded instruction for a ritual that, though familiar to professional academics, is new to many participants. The day sets the foundation for the mentoring relationships and academic identity development that will unfold throughout the SI.

### Day 2: Research in Our Field & at Our Institution

Day 1 of the SI lays the ground for scholars to see themselves as researchers. Day 2 introduces scholars to the research field (in our case, to cancer prevention and health disparities research projects). Morning lectures on cancer biology and social determinants of health begin teaching the specialized language and methods of the field (Shanahan et al., 2015 - #3), while afternoon panels with cancer survivors and community-engaged researchers prompt scholars to see their coursework and internship learning goals as applicable to the real world (Kuh and O'Donnell, 2013 - #7). Additionally, meeting these patient advocates and researchers who come from the same communities as these scholars is an opportunity for scholars to build their mentoring constellations. Day 2's combination of inviting role models to teach technical skills and make real-world connections reinforces our core philosophy that scholars' lived experiences and cultural perspectives enhance rather than detract from scientific rigor.

### Day 3: How to Be an Intern

Day 3's activities prepare scholars for their internships by introducing them to institutional goals and values, finalizing Learning Contracts that set internship objectives and expectations for mentor-mentee relationships (Shanahan et al., 2015 - #2), and explaining the habits of highly successful interns. A highlight is our panel of senior scientists from minoritized backgrounds, who share their journeys from mentee to R01-funded investigator, showing scholars that scientists who may be from the same communities as them can thrive in research careers. The panel exemplifies Shanahan et al.'s (2015) suggested practice of supporting professional development by surfacing and explaining professional norms (#8). The day concludes with workshops on literature review and data analysis, providing concrete skills for success in research environments (Shanahan et al., 2015 - #3).

### Day 4: Graduate School Admissions

Day 4 focuses on the "nuts and bolts" of graduate school preparation, with workshops on when and how to apply, searching for funding opportunities, and preparing admissions documents. The day's highlight is an alumni luncheon, in which program graduates return to Cedars-Sinai to network with current scholars and share recent information about graduate school admissions and practices. This creates opportunities for multi-tiered mentoring (Shanahan et al., 2015 - #9) - current scholars gain practical advice about graduate school, and alumni can deepen their connection to the community by mentoring others. Additionally, alumni who are encountering new challenges in their careers or education can seek stage-appropriate mentoring from program mentors. The day demonstrates how mentoring constellations can offer new possibilities for support beyond those offered by the traditional Principal Investigator-trainee dyad.

### Day 5: Graduate School Success

The final day of the SI emphasizes the importance of mindset and comprehensive support networks for success in graduate school. Workshops address common challenges like imposter feelings (Jackson et al., 2016; Cokley, 2024) and time management.

Recognizing families' crucial role in supporting first-generation students, we invite family members to a closing ceremony that takes up the afternoon of Day 5. During the ceremony, program mentors speak about each scholar's potential and growth individually, affirming the scholar's place in the scientific community while modeling how to balance rigorous expectations with emotional support (Shanahan et al., 2015 - #4). After each scholar is re-introduced to the group by program mentors, they are invited to publicly reflect on their journey to and through the U-GROW program thus far. They describe lessons learned over the week that will guide them towards their future goals, a practice that exemplifies a key element of Kuh and O'Donnell's high-impact practices (Kuh & O'Donnell, 2013 -#6). This celebration of individual development within a supportive community exemplifies our holistic approach to mentoring.

## Methodology

### Evaluation Design

The U-GROW program implemented a comprehensive evaluation framework to assess both implementation quality and outcomes across its year-long training initiative. Primary evaluation questions examined: (1) How effectively does the program recruit and retain diverse scholars? (2) What is the quality and impact of training and mentorship components? (3) To what extent does the program foster scientific identity and research competencies? The evaluation employed mixed methods, primarily using surveys supplemented by performance tracking and academic outcome data. The analysis here focuses on the SI curriculum's impact on mentorship components.

### Participant Selection

Eligible applicants were rising juniors, rising seniors, or recent graduates (within one year) from one of the eight CSU campuses, with a minimum 3.0 GPA and demonstrated interest in cancer disparities research. A completed application would include: short-answer essay questions, a transcript, CV/resume, and a recommendation form (in lieu of a traditional letter). A review committee comprising U-GROW program mentors, research mentors, and faculty advisors evaluated applications based on program alignment, academic potential, writing ability, recommendations, and internship potential.

### Summer Institute Survey Development and Implementation

The SI evaluation instruments included pre, post, and daily surveys, which were modeled after MTPCCR surveys and further developed through an iterative process involving the program team. The pre-SI survey (29 items), administered three days before the 5-day institute, collected demographics, perceived academic preparation, perceived barriers/facilitators, and self-efficacy measures. The post-SI survey (14 items), administered the day after the SI ended, assessed program satisfaction, graduate school intentions, and repeated pre-SI outcome measures for comparison. Daily surveys gathered immediate feedback on speakers, panels, and activities using 5-point Likert scales and open-ended questions (i.e., least/most valuable SI components, areas for improvement, comments to future scholars). At the end of each day, the U-GROW team reviewed the daily surveys to adjust subsequent training activities and to address scholar needs, either the next day or during the remainder of the week.

### Data Collection and Analysis

Data collection (applications and surveys) utilized Alchemer (Cohorts 1-2) and Qualtrics (Cohort 3) survey platforms. Quantitative data from daily surveys were analyzed using descriptive statistics,

including means and standard deviations to measure central tendency and variability in responses. Qualitative data from open-ended questions were analyzed by program team members to identify emerging themes and notable quotes.

**Results**

Scholars from three U-GROW cohorts depicted a representative sample of students from the CSUs within the Cedars-Sinai catchment area (see Table 3 – Participant Demographics). All three cohorts were predominantly individuals who identified as female (63-77%), while over 50% were of Latinx descent for Cohorts 2 and 3. Each year, over a quarter of scholars originated primarily from one CSU campus – Northridge (Cohort 1 at 33.3% and Cohort 2 at 26.7%) and San Bernardino (Cohort 3 at 27.3%). At the time of application, the majority of scholars were either at junior (Cohort 1 at 44.4% and Cohort 3 at 54.5%) or senior standing (Cohort 2 at 53.3%). Although scholars from any academic major participated in U-GROW, there was a higher concentration of Public Health (Cohort 1 at 33.3%, Cohort 2 at 40% and Cohort 3 at 27.3%) and Health Science majors (Cohort 2 at 20% and Cohort 3 at 27.3%).

Table 3. *Participant Demographics by Cohort*

| Demographic category | Cohort 1 (N=9) n (%) | Cohort 2 (N=15) n (%) | Cohort 3 (N=11) n (%) |
|---|---|---|---|
| **Gender** | | | |
| Female | 7 (77.8) | 11 (73.3) | 7 (63.6) |
| Male | 1 (11.1) | 4 (26.7) | 3 (27.3) |
| Non-binary | 1 (11.1) | - | 1 (9.1) |
| **Race** | | | |
| African American | 2 (22.2) | 1 (6.7) | 1 (9.1) |
| American Indian/Alaska Native | - | 1 (6.7) | - |
| Asian | 2 (22.2) | 4 (26.7) | 2 (18.2) |
| Latinx | 2 (22.2) | 8 (53.3) | 6 (54.5) |
| Non-Hispanic White | 3 (33.3) | 1 (6.7) | 2 (18.2) |
| **Campus** | | | |
| Channel Islands | 1 (11.1) | 2 (13.3) | 1 (9.1) |
| Dominguez Hills | 2 (22.2) | 1 (6.7) | 2 (18.2) |
| Fullerton | 1 (11.1) | 2 (13.3) | 1 (9.1) |
| Long Beach | - | 2 (13.3) | 1 (9.1) |
| Los Angeles | 2 (22.2) | 2 (13.3) | 2 (18.2) |
| Northridge | 3 (33.3) | 4 (26.7) | 1 (9.1) |
| Pomona* | - | 2 (13.3) | - |
| San Bernardino | - | - | 3 (27.3) |
| **Academic Year** | | | |
| Junior | 4 (44.4) | 4 (26.7) | 6 (54.5) |
| Senior | 3 (33.3) | 8 (53.3) | 5 (45.5) |
| Recent Alumni | 2 (22.2) | 2 (13.3) | - |
| **Major** | | | |

| | | | |
|---|---|---|---|
| Biology | 1 (11.1) | 1 (6.7) | 1 (9.1) |
| Biotechnology | - | 1 (6.7) | - |
| Business Administration | 1 (11.1) | 1 (6.7) | - |
| Chemistry | - | - | 1 (9.1) |
| Communication | - | - | 1 (9.1) |
| Health Science | - | 3 (20.0) | 3 (27.3) |
| Human Services | 1 (11.1) | 1 (6.7) | - |
| Kinesiology | 1 (11.1) | - | - |
| Performing Arts | 1 (11.1) | - | - |
| Psychology | 1 (11.1) | 2 (13.3) | 2 (18.2) |
| Public Health | 3 (33.3) | 6 (40.0) | 3 (27.3) |

** Recruitment began with Cohort 2*

Quantitative data from the daily surveys provide a snapshot of how each cohort received each SI activity (see Table 4 – Select mentoring-centric Summer Institute activities). However, responses from the open-ended questions offer a more robust illustration of how the speakers, panels, and group activities contributed to the development of the scholars' mentoring constellation.

Table 4. *Averages, by cohort, of select mentoring-centric Summer Institute activities. Values shown are mean ± standard deviation*

| Day | Activities *(Rated on a 5-point scale, where 1 = poor and 5 = excellent)* | Cohort 1 (N=9) | Cohort 2 (N=15) | Cohort 3 (N=11) |
|---|---|---|---|---|
| 1 | *Group:* Me & My Culture | 5.00 ± 0.00 | 4.77 ± 0.44 | 4.80 ± 0.63 |
| | *Sci Comm:* Writing an Academic Introduction | 4.78 ± 0.44 | 4.62 ± 0.65 | 4.70 ± 0.68 |
| 2 | *Panel:* Cancer Survivors/Thrivers | 5.00 ± 0.00 | 4.93 ± 0.27 | 4.91 ± 0.29 |
| | *Panel: Insider Researchers* | 4.94 ± 0.07 | 4.93 ± 0.27 | 5.00 ± 0.00 |
| 3 | *Group:* Internship Orientation | 4.78 ± 0.44 | 4.67 ± 0.49 | 4.70 ± 0.46 |
| 4 | *Panel:* Grad Student/Alumni Perspectives | 5.00 ± 0.00 | 4.58 ± 0.67 | 5.00 ± 0.00 |
| | *Panel:* Mentors' Perspectives | n/a | 4.46 ± 0.96 | 4.80 ± 0.60 |
| | *Speaker:* How to Apply to Graduate School | 5.00 ± 0.00 | 4.50 ± 0.80 | 5.00 ± 0.00 |
| 5 | *Panel*: Faculty of Color in Cancer Research | 4.89 ± 0.33 | 4.85 ± 0.38 | 4.71 ± 0.70 |

Day 1:

Students found both introduction activities meaningful opportunities to become acquainted with their peers, as typified by this Cohort 3 scholar's evaluation comment - "Learning more about my peers showed how everyone comes from different backgrounds and what brings us all together is our drive to do." The introductory workshops helped scholars understand how they, as people from communities underrepresented in research, could connect to other researchers. Far from siloing students in their individual identities, the activities emphasize commonalities between scholars – the "drive to do" mentioned by the Cohort 3 scholar above—without forcing them to abandon important parts of their identities or values. "The issue of losing one's unique culture in a

professional setting is so important – this program is working on that exact topic by encouraging celebration of one's cultures and promot[ing] diversity," wrote a Cohort 1 scholar on an evaluation. They continued: "We also discussed the importance of finding similarities and differences in perspectives, which is crucial in understanding how to meet others in the middle…"

Day 2:
The daily survey highlighted how deeply the scholars were impacted by the panel discussions and interactive sessions with cancer survivors and community-based researchers. A Cohort 2 scholar emphasized their enthusiasm to meet and hear from community-focused researchers: "I loved today. I really enjoy the breakout sessions we have. I enjoyed hearing from everyone on the panels. It was inspiring to hear from passionate advocates and to see the work that is being done to improve health equity."

The survivor panel especially resonated with scholars, as illustrated by a Cohort 1 participant who noted its unique significance: "While all issues/topics discussed today are extremely important, I think that the panel of thrivers was the most important. It provides a new perspective when we learn about cancer from those who lived it rather than doctors. Their experiences bring awareness to some flaws/mistakes that we should be mindful of in the future when we conduct research or converse with patients."

Day 3:
Student evaluation feedback suggested that these personal stories from accomplished scientists were powerfully motivating: "I never considered pursuing a PhD program because it didn't seem possible for me or someone from my background," wrote a Cohort 2 scholar. "This panel taught me that my culture [sic] knowledge and experience is an asset and something of value. I particularly related to [faculty member's] story because it was very similar to my own."

For Cohort 3, we added a live conversation between co-author Thompson and a high-performing program mentor to discuss the habits of successful mentees. The last piece was well-received because of its insights about the upcoming mentored research experience: "It was helpful to hear from a mentor on how they would ideally want to be working with a mentee," wrote a Cohort 3 scholar.

Day 4:
The graduate student/alumni and mentor panels proved particularly impactful for scholars from diverse backgrounds. A Cohort 2 participant highlighted: "The panel with the mentors felt the most crucial to me because I needed to hear about a person of color's experience in research and [how] important it is to be resilient and to believe in yourself and work hard! I loved hearing [the panelist's] story and I appreciated her transparency and willingness to help others."

The Day 4 activities included practical and philosophical lessons for scholars to bring to their mentored research experiences. A Cohort 1 scholar noted the timeliness of the instruction: "The topic of internship roles is crucial to prepare us as we get closer to our start dates." Another Cohort 1 scholar reflected on an idea they would take away from the day's instruction: "[B]e open to the fact that not everyone sees the world (your worldview) the same way, especially when it comes to faith or purpose."

Day 5:
The SI closing ceremony consists of program mentors speaking individually about each scholar's growth to the cohort and their supporters. Scholars' evaluation responses show how meaningful they find this affirmation of their mentored relationships: "I don't think I've ever been in a space where

leaders/mentors share so much positive and supportive feedback. The closing ceremony was truly a gift," a Cohort 1 member shared.

"I think it was essential the way everyone wrote about each scholar individually," wrote a Cohort 3 scholar of the closing ceremony. "[N]ot only did it make me feel cared about, it made me feel like I belong to a community of scientists and therefore am a scientist." This Cohort 3 scholar's words speak to the potential for individualized mentorship that encompasses both professional preparation and socio-emotional support to awaken a stronger scientist identity and sense of belonging.

### Curricular Changes to the SI

In addition to reviewing daily SI surveys before the next day's programming, the program team conducts an annual review and comparison of the feedback between cohorts. Based on pre, post, and daily SI surveys, the program team identified mentoring lessons that required substantial changes and/or a shift in how and when the information was delivered (see Table 5 – Summary of Summer Institute Curriculum Changes 2022-2024).

SI lessons learned from Cohort 1 contributed to the addition of a Cedars-Sinai faculty mentor panel, the inclusion of program alumni as near-peer mentors, and the addition of a session on scientist mindset. Additionally, feedback from research mentors on Cohort 2 highlighted tangible skills that scholars needed to strengthen before beginning their summer internships. In response, for Cohort 3 we incorporated SI sessions focused on literature reviews and data analysis. While these topics were previously covered later in the program during the SCW series, moving them earlier in the program curriculum better prepares our scholars for their internship experiences.

Table 5. *Summary of Summer Institute Curriculum Changes 2022-2024*

| Cohort 2 (SI 2023) | |
|---|---|
| **Curriculum Change** | **Mentoring Lesson** |
| **Day 3:** added mentor panel with Cedars-Sinai Cancer faculty | Mentors "are people too," can be role models for students from underrepresented backgrounds |
| **Day 4:** added Alumni Luncheon with near-peer mentoring | Bi-directional mentoring offers useful tips to current scholars and is a rewarding way for alumni scholars to stay involved |
| **Day 5:** Added presentation on scientist mindset | Trusted mentors can provide honest feedback that helps cultivate growth mindset & eradicate imposter feelings |
| Cohort 3 (SI 2024) | |
| **Curriculum Change** | **Mentoring Lesson** |
| **Day 3:** Added literature review & data analysis workshops | Responds to internship mentors' evaluations of U-GROW scholars |

## Discussion & Implications

Initial findings demonstrate that the SI broadened student perspectives about graduate school and heightened scholars' confidence. A Cohort 2 scholar wrote: "Before this institute, I hadn't thought about grad school seriously. However, the past five days opened my eyes and made me look at grad school as an exciting and achievable goal."

Anecdotal and preliminary evidence suggests the SI succeeds in creating a sense of supportive community. “This program has inspired me to pursue research and graduate school. I feel confident to move forward in my education because of the support from my peers and the U-GROW staff,” a Cohort 2 scholar wrote on their post-SI evaluation. Unpublished focus group results show that, when asked about the SI, Cohorts 1 and 2 scholars felt they benefited from a support system that was with them throughout their professional journeys, not just during their U-GROW years.

As of August 2024, Cohort 3 has yet to complete its research internships, so research mentors’ evaluations of the students trained in SI 2024 are unavailable. These mentor evaluations, the daily student evaluations from the SI, and program team observations from daily SI debriefs will shape the SI for Cohort 4 in Summer 2025. This iterative approach ensures that U-GROW remains responsive to the evolving needs of its scholars and the dynamic field of cancer disparities research. However, preliminary results from SI 2024 suggest continuations of the findings from Cohorts 1 and 2, so the program team intends to make only minor revisions (e.g., timing or sequencing adjustments) to next year’s SI.

In terms of future directions, however, some challenges remain. Access to the Cedars-Sinai campus in central Los Angeles is an ongoing source of difficulty. For most scholars, securing housing to participate in the SI, as well as for the summer internship, poses a financial hardship or interferes with family caretaking duties. With nearly 100 miles separating our farthest west and east member campuses and another 100 miles separating our northern and southernmost member campuses, it is common for scholars to commute 2 hours each way to get to/from Cedars-Sinai. Program leaders have considered two solutions: identifying reasonable accommodations with partner institutions closer to the Cedars-Sinai campus (difficult for sustainability and liability reasons), or piloting online activities or asynchronously delivering program components (scholar evaluations suggest students prefer in-person instruction during the Summer Institute). The program team and Cedars-Sinai Cancer leadership remain committed to finding additional solutions.

### Implications for Other Institutions

Despite the difficulties that our particular environment poses, we have found that our constellation mentorship model helps promote student confidence and sense of belonging. Because our version of constellation mentorship grew out of a unique partnership between a biomedical research center and a large, diverse state university system, we can offer several insights for institutions seeking to develop similar partnerships. First, teaching-focused institutions can leverage research partnerships without requiring extensive infrastructure investment. For example, our online components allow meaningful mentor interactions while minimizing travel demands. Second, while our program focuses on cancer research, the mentoring constellation model can be implemented in any field where underrepresented students need bridges to research careers. Programs could adapt our approach for disciplines ranging from environmental science to engineering, maintaining the emphasis on cultural affirmation while adjusting technical content. Finally, for institutions that serve or want to serve students underrepresented in science, a partnership between institutions can provide an opportunity to pool mentors with diverse expertise or diverse life experiences who can form a mentoring constellation for an aspiring undergraduate researcher.

## Conclusion

The U-GROW Summer Institute is the foundation for a comprehensive research education program that uses research-backed mentoring practices to support underrepresented students. By bringing together mentoring teams with diverse expertise and experiences, the program demonstrates how multiple mentors can collaboratively support scholars’ entry into research. The strategic selection of role model mentors whose stories resonate with students’ experiences helps promote scholars’ sense of belonging within the research community, particularly for students who may otherwise feel

marginalized in academia. This constellation mentorship approach has proven transformative for participants and provides the DNA of the U-GROW program. Over time, this mentorship philosophy has evolved to permeate all aspects of the program, from Scientific Communication workshops that focus on effective mentor communication and developing individualized plans with mentors to comprehensive assessments of mentor-mentee relationships.

The SI's success stems from its systematic approach to building mentoring relationships. Each day strategically expands scholars' support networks while providing concrete tools for navigating research environments. From cultural affirmation activities to near-peer mentoring sessions, the SI creates structured opportunities for scholars to form meaningful connections across the mentoring constellation. This layered approach helps students develop the confidence to engage with multiple mentors throughout their research journey, while also potentially benefiting colleges with limited research resources and those seeking partnerships with research-intensive centers.

The U-GROW program is designed for long-term sustainability through its self-reinforcing structure. Each cohort strengthens the program as students transition from mentees to mentors, creating an expanding network of support. This natural progression is supported by institutional commitment and our engaged mentor community, who model the transition from receiving to providing mentorship. As alumni return to serve as mentors and current participants develop mentoring skills, the program creates expanding cycles of support that ensure its continuation and growth. Ultimately, the U-GROW model provides a blueprint for reimagining how institutions can create more inclusive, accessible, and sustainable pathways into undergraduate training and research experiences across disciplinary boundaries. Through expanded access to research opportunities, the program creates a collaborative community of scholars embedded in a constellation of mentors who understand and support their full potential. By fostering enduring mentor constellations, U-GROW contributes to reshaping the landscape of cancer research by promoting diversity and inclusion in the field for years to come.

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