UCI BioSci
Office of Diversity, Equity & Inclusion

# PROMISE

## PROMOTING INCLUSION IN THE STUDENT EXPERIENCE

FINAL SUMMARY
AND TASK FORCE REPORT

2023

# PROMISE

## Promoting Inclusion in the Student Experience

Final Task Force Report
September 2023

Office of Diversity, Equity, and Inclusion
School of Biological Sciences
University of California, Irvine

## About the Office of Diversity, Equity, and Inclusion (ODEI)

The Office of Diversity, Equity, and Inclusion (ODEI) was created in October 2020 by the School of Biological Sciences Dean, Frank LaFerla. The goal of ODEI is to formalize inclusive excellence as a pillar of success in the School and to advise and support the Dean, as well as the department chairs on issues related to diversity, equity, and inclusion. ODEI is tasked with developing a comprehensive DEI strategic plan for the School; supervising Minority Science Programs; developing new programs and activities to support the success of faculty, staff, and students; and developing and strengthening relationships with academic and training pathway programs that support scholars from minoritized backgrounds. ODEI is led by Associate Dean Michael Yassa. For more information visit http://inclusion.bio.uci.edu.

## About the PROMISE Task Force

The PROMISE Task Force was organized by ODEI with the goal of developing a strategic plan to address the disproportionate success outcomes in the Biological Sciences major for students from disadvantaged backgrounds. The Task Force used an evidence-based approach to tackle this problem, which included examining the pertinent STEM education literature; institutional research on student outcomes; highly granular data from students on their academic experiences, wellness, and sense of belonging; and data of faculty attitudes. The Task Force additionally engaged with STEM equity experts, and with current students and faculty in a town-hall format. Based on the extant data and STEM education literature, as well as Task Force deliberations, ODEI has compiled this report that outlines a new vision for undergraduate biology education that is modern, relevant, engaging, and equitable.

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# Executive Summary

Attrition in the UCI Biological Sciences major disproportionately affects students from racial and ethnic minorities, at-risk students, students with low SAT scores, students with low socioeconomic status, and first-generation college students. Success outcomes, including graduating GPA, core course grades, and four-year graduation rates all reveal 10-20% racial equity gaps. The overarching goal of the PROMISE Task Force is to identify the reasons for these equity gaps and develop ways to promote equity in learning opportunities for a diverse population of biology undergraduates, and to promote an inclusive environment where all students in the major can thrive while maintaining the highest standards of academic rigor.

We propose that a curricular focus on the "New Biology's" grand challenges and real-world applications of biology, and the adoption of active, collaborative, and inclusive teaching strategies that are focused on competencies, rather than didactic knowledge affords us an opportunity to (1) enhance the engagement of students and faculty with the curriculum, (2) consider the lived experiences of students from diverse backgrounds, (3) promote breadth as well as depth, enhancing the preparedness of our students for their future careers, and (4) have an observable impact on equity and inclusion in the major and address the minoritized students' outcomes gap. We also propose that reform cannot be incremental. It must be fundamental, systemic, and firmly grounded in a theory of change. It must focus on the long-term view, rather than short-term solutions.

To meet this vision, we identify six priorities (pillars), each with an evidence-based rationale, a clear and measurable goal, and recommended strategies for consideration. These priorities are (1) re-envisioning the undergraduate biology curriculum, (2) achieving student mastery of competencies and realigning faculty assessment thereof, (3) transforming professional career preparation, (4) strengthening academic advising and student mentoring, (5) providing meaningful and engaging research experiences, and (6) fostering inclusion and belonging.

To ensure accountability, we propose metrics for evaluating success and suggest that transparency—about this report, collected data, and measured outcomes—is key to effective stakeholder engagement. We also discuss limitations of this work and plans for continuous discussion and follow-through. Finally, we recognize that transformation in higher education is not easy and cannot happen overnight. It requires not only careful planning and staged implementation but also an investment of resources and buy-in from campus administration.

We hope that this report sets the stage for the hard work that is truly needed for institutional transformation and suggest that the School of Biological Sciences can play a leading role in transforming the field of biology to become more equitable, and in the process raise our profile of academic excellence and fulfill our campus promise to support the American Dream.

# Problem Statement

Over the last five years, retention for students from underrepresented minorities (URM) (**Box 1**) in Bio Sci was lower than non-URM students by 10-15% in the second year and 15-20% in the third and fourth years. It is believed that many of these students leave the major either due to shifting interests or because they find the program requirements too rigorous. However, this is not supported by data from large national studies on STEM persistence, which have repeatedly demonstrated that URM students are not leaving STEM majors of their own accord. Instead, these students are effectively being pushed out by virtue of pedagogy, advising, and peer engagement that does not foster their interests and promote their intellectual growth. For example, the seminal "Talking about Leaving Revisited" study concludes that problems with students' classroom learning experiences continue to dominate as factors contributing to STEM majors' decisions to switch.[1]

Our current curricular and pedagogical structures may make it more difficult for URM students to thrive as Bio Sci majors. For example, our measures of achievement often assume that our job as educators is one of "gatekeeping", whereby only those who are "worthy" can attain a degree. We must recognize that the educator's responsibility is to provide every student the opportunity to reach their full potential. To this end, we must rethink the culture of our classrooms and mentoring, and "weed out" courses, grading practices, curves, examinations, and other forms of assessment to ensure that our teaching is equitable and inclusive, whilst maintaining the highest academic standards.

We must also recognize that students have complex learning ecologies that influence, challenge, and promote their learning, including family, peers, communities, and society. We cannot teach and mentor equitably by using race- and color-blind approaches. Research on culturally responsive pedagogy has shown that racially minoritized students have fewer opportunities to connect their learning to the topics and themes of personal or cultural interest to them (their lived experience). This set of complexities makes it virtually impossible to solve the problems at hand with incremental or short-term fixes. Transformational change requires reflection, ongoing input from minoritized populations, and a long-term actionable vision.

# Task Force Goal

The overarching goal of the Task Force was to envision and propose ways to promote equity in learning opportunities for a diverse population of Bio Sci undergraduates and to promote an inclusive environment where all students in the major can thrive while maintaining the highest standards of academic rigor. To meet this goal, the Task Force engaged in (1) examination of the extant data on student outcomes, (2) reflection on current pedagogical and advising practices, and (3) identification of challenges and goal-driven strategies to address them.

### Box 1. Race and Ethnicity

Race and ethnicity categories reflect social definitions and are not biological, anthropological, or genetic definitions. Categories used here are based on the US Census Bureau.

- *American Indian or Alaska Native:* A person having origins in any of the original peoples of North and South America (including Central America) and who maintains tribal affiliation or community attachment.
- *Asian:* A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent; for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
- *Black or African American:* A person having origins in any of the Black racial groups of Africa.
- *Hispanic or Latino [Latine]:* A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.
- *Native Hawaiian or Other Pacific Islander:* A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific islands.
- *White:* A person having origins in any of the original peoples of Europe, the
- Middle East, or North Africa.

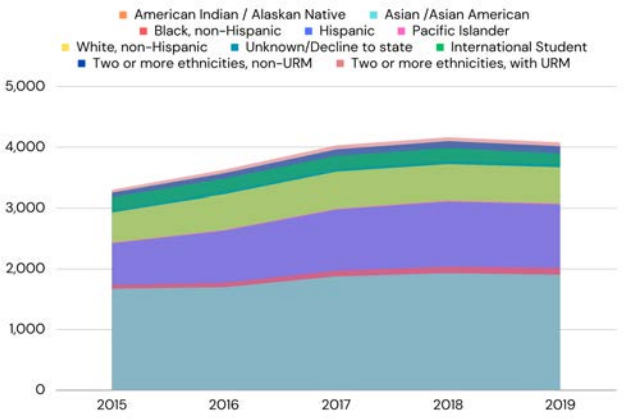
URM is defined as a domestic student who identified their ethnicity or race as at least one of: American Indian / Alaskan Native; Black, non-Hispanic; Hispanic; or Pacific Islander.

# Summary of the Data

## Student Demographics

UCI undergraduate student demographics between 2015 and 2019 have been largely stable with ~2% Black, non-Hispanic; ~25% Hispanic; ~15% White; and ~35% Asian. International student enrollment has decreased slightly from 21% to 17% between 2015 and 2019. In Fall 2019, Black, non-Hispanic students represented 3% of the entire undergraduate school population (both new and continuing students). In comparison to UCI overall, Bio Sci enrolled similar proportions of Black, non-Hispanic, Hispanic, and White students. The major difference is that the proportion of Asian student enrollment in Bio Sci is higher than the overall campus (~47% compared to ~35%) and international student enrollment is substantially lower (~5% compared to ~17%). Total number of Bio Sci students by race/ethnicity is shown in **Fig 1** below.

**Fig 1. Racial and Ethnic Distribution of UCI Bio Sci Students**

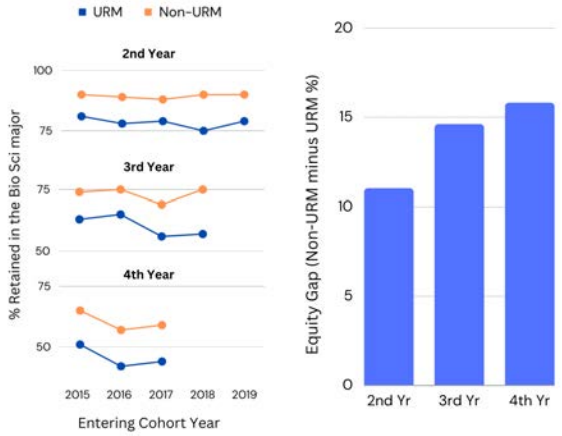



Prospective students can either choose to enter as undeclared at the university level or school level, or select a major (as well as an alternate major) in their application. Therefore, we do not know who intends to major in biomedical fields unless we specifically survey incoming students. There is currently no incoming freshman survey. However, 32% (N = 51) of incoming Black, non-Hispanic undergraduates are enrolled in a STEM-designated major/program. STEM programs at UCI are based on the Classification of Instructional Programs (CIP) code and its NSF designation.

## Student Success Outcomes

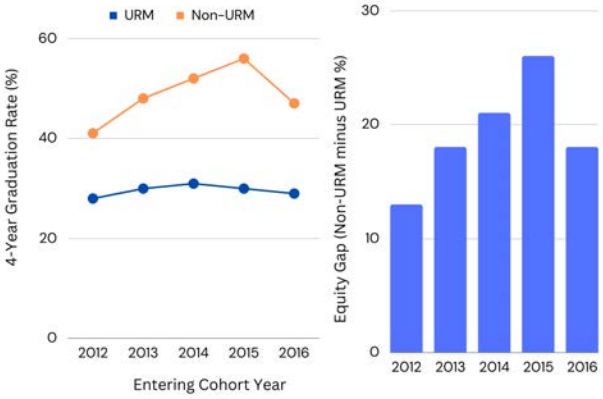
We consider several types of success outcomes over the period from 2013-2019. First is student retention in the major from first to second, third, and fourth years. We observe consistent equity gaps in second-, third-, and fourth-year retention in Bio Sci for URM and non-URM students. Overall, the URM equity gap was 11% in the second year, 14.6% in the third year, and 15.8% in the fourth year (**Fig 2**).

**Fig 2. URM Equity Gaps in Retention in the Bio Sci Major**




The second outcome to examine is four-year graduation rates, which we were only able to examine up to 2016. Here we also observe equity gaps, ranging between 15-25%, in graduation rates between URM and non-URM Bio Sci students (**Fig 3**). Third, we consider GPA and grades in core courses. The graduating GPA, average across 2016-2019 was lower for URM students compared to non-URM students, with an approximate .23 GPA

**Fig 3. URM Equity Gaps in Bio Sci Four Year Graduation Rates**



points difference between URM (~3.12) and non-URM (~3.35). Overall, grades in Bio Sci core courses were also lower for URM students than non-URM students. Finally, one of our most important flagship opportunities in Bio Sci is undergraduate research. While the proportion of URM students in the total Bio Sci population is 28%, the proportion of URM students participating in undergraduate research is substantially lower at ~20%. The same is true for low-income and first-generation students (which have considerable overlap with URM designation). Thus, across all success outcomes considered, there is a clear equity gap whereby students from racial/ethnic minorities are at a disadvantage.

## Summary of the Student Wellness and Climate Survey

To further assess whether student experiences contribute to these equity gaps, ODEI created and deployed the Student Wellness and Climate survey in March-April of 2021 via Qualtrics. It was conducted as an IRB-approved research study (PI: Michael Yassa). The survey was sent via email to the total enrolled undergraduate population in Bio Sci (N=3,646). Response rate was 19%, evenly distributed across the years of the major. Gender and URM distributions were also representative of the overall Bio Sci population. Key findings are:

(1) Bio Sci students are generally satisfied with their academic experience, although there are several areas that could be improved:
    a. Faculty-student communication and engagement;
    b. Quality of academic advising by staff and faculty;
    c. Availability of opportunities for authentic research experiences; and
    d. Access to required courses and small classes.
(2) Bio Sci students are pursuing diverse career options, including health professional and graduate careers. Around half of them are seeking medical degrees, and around 15% are unsure what career to pursue.
(3) A larger proportion (78%) of Black, non-Hispanic students report that preparing for medical school is a chief reason for seeking a Biology degree.
(4) Bio Sci students generally feel that the culture and climate in our School is safe, however, they expressed issues with belonging and closeness to others on campus.
(5) With respect to racial equity gaps, Black, non-Hispanic students were more likely than other races to report (a) feeling unsafe on campus, (b) being concerned about discrimination and campus response to incidents of discrimination, and (c) feeling that staff and administrators are not concerned about their welfare.
(6) An alarming proportion (67%) of Bio Sci students report depressive symptoms that are sufficient to be classified as “at-risk” for clinical depression.
(7) Bio Sci students generally feel that they have adequate social support and healthy social relationships on campus.
(8) Around 30-50% of Bio Sci students experience socioeconomic hardship that is reflected in housing, food, or financial insecurity.
(9) Half of Bio Sci students report one or more disabilities that interfere with their academic life and daily function, but only a small proportion are currently receiving accommodations.

We will deploy this survey every 1-2 years to continue to evaluate these issues and establish trends over time to measure our progress and culture change. We note that this type of data collection is essential for meeting our DEI goals and public dissemination of this information can improve our accountability. We suggest that faculty and academic advising staff be encouraged to utilize the data dashboard to visualize data, test hypotheses, and collaborate with ODEI on disseminating the results. The interactive data dashboard is publicly available to explore at http://inclusion.bio.uci.edu/data.

# Faculty Perspectives

The anonymous Faculty Attitudes Survey assessed research and teaching faculty perspectives and attitudes related to undergraduate education in Bio Sci. Response rate was 25%. Below is a summary of some of the questions and responses.

## What is the spectrum of competencies Bio Sci students need to master?

Respondents cited several crucial skills that require mastery in Bio Sci, including skills in effective study habits, critical thinking/problem solving, experimental design, scientific communication, statistics/

quantitative/computational methods, leadership and teamwork, and equity and inclusion. In addition, both theoretical and practical domain knowledge in Biology were cited as important to master.

## How should we define excellence in our undergraduate program?

Respondents had diverse opinions on this. Some faculty believed that the ultimate measure of success is post-graduate placement and whether students can leverage their Bio Sci education for future jobs. Others indicated that mastery of competencies is most important as a measure of excellence. Yet others cited concrete traditional outcomes such as GPA. Finally, a subset of respondents suggested that we go beyond academic performance to evaluate competencies in problem solving and other skills that prepare students for future careers (holistic evaluation).

## How can we evaluate and recognize contributions to inclusive teaching?

With respect to evaluation, some respondents believed that improving the student feedback process to address elements of equity and inclusion is important. Others suggested a higher weighting of inclusive practices in the evaluation of teaching statements and increasing the utilization of peer-review of classroom teaching to evaluate inclusive teaching practices. Generally, respondents also felt that inclusive teaching could be weighed more heavily in the merit and promotion process.

With respect to recognition, respondents suggested increasing the number of awards and accolades given to inclusive teachers (e.g., Golden Apple), using inclusive teaching as a basis for promotion or accelerated merit, and providing small grants/awards to faculty who demonstrate excellence in inclusive teaching.

## Why do you think students leave Bio Sci for other majors?

This is perhaps the most interesting question asked by the survey and demonstrates deeply held beliefs about causes for student attrition. About half of the respondents suggested that attrition is due to student factors (i.e., students leaving the major), including loss of interest, lack of desire to learn, lack of analytical skills, inability to excel in introductory courses, students finding the major too challenging, and students having unrealistic expectations that set themselves up for failure.

The other half of respondents focused on systemic issues, including teaching practices and climate in Bio Sci (i.e., students being pushed out of the major). The factors cited included the premed required courses not being taught for biologists, weed-out mentality in teaching, lack of meaningful faculty connection, lack of engagement with the curriculum, lack of feeling of community, a focus on memorization and not critical thinking, difficulty in finding research labs, a dated biology curriculum model, and overly stringent regulations and enforcement by academic advising.

## How important is it for Bio Sci undergraduates to participate in research?

Respondents were well aligned in their responses here. Nearly all respondents indicated that research is essential and is one of the best reasons to come to UCI Bio Sci. Some indicated that it should be required of all students in the major. Oth-

ers indicated that it should only be required if we can ensure that the experiences are engaging and that we have enough opportunities and labs.

A related question asked faculty respondents, "What is the best thing about the Bio Sci major as it currently exists?" The undergraduate research program (Bio 199) was mentioned in 85% of the responses.

### What do you think most needs to be changed about the Bio Sci major?

A number of respondents focused on the curriculum, including re-evaluating degree requirements; modernizing the curriculum to reflect contemporary biology; reducing the number of required courses and increasing the number of upper division electives that emphasize critical thinking; expanding computational, statistics, data handling, experimental, and analytical skills; reducing the focus on content knowledge and increasing the focus on transferable skills; and changing how chemistry, physics, and math are taught to Bio Sci students.

Several other respondents focused on teaching practices, including changing the gate-keeper mentality, making the major more collaborative instead of competitive, humanizing the faculty, clarifying expectations for competency mastery, increasing active learning in the classroom, and actively reaching struggling students to provide more direct mentorship and support.

### Summary

The Faculty Attitudes Survey revealed diverse perspectives and attitudes among research and teaching faculty. It demonstrated alignment on some issues (e.g., the importance of research experiences) and divergence on some others (e.g., causes for student attrition from the major).

Overall, this exercise informed the thinking of the Task Force and provided numerous suggestions to consider in the strategic planning process.

We suggest continuing to engage with these questions during departmental faculty meetings and retreats, as they will shape our future teaching goals and inform our practices.

## Challenge Areas

### A Modern Biology Curriculum

We began our discussions by asking the broad question: "What is our job as biology educators?" A formal response to this question was provided by one Task Force member:

> ***"To provide an accurate, topical overview of the field of Biological Sciences in accordance with professional standards."***

Further discussion elucidated numerous other responsibilities we believe the biology educator must fulfill. These are listed below in no particular order:

- Teaching an appropriate curriculum that helps students achieve their goals;
- Modeling cultural guiding principles and core values inside and outside the classroom;
- Helping students develop strategies to overcome obstacles in learning;
- Trying to make the subject matter of biology fun and rewarding by sharing excitement;
- Making the curriculum relevant by discussing ethical, social, and legal issues;
- Providing students with opportunities to apply what they learned;
- Engaging with students beyond the classroom and becoming more involved in advising.

At the heart of these discussions was the notion that we needed to consider student-centered learning and understand that as educators in biology we must give every interested student the opportunity to succeed. The data we collected from students suggested that (1) faculty interest and enthusiasm in the course material could be improved and (2) student engagement with the curriculum could be improved. Our discussions were principally motivated by these findings.

Student and faculty engagement could be enhanced by ensuring that the biology content we teach is fundamentally grounded in the "New Biology", emphasizing integration and collaboration across disciplines, including physics, computational science, mathematics, and engineering. This approach was described in detail in the National Academies' A New Biology for the 21st Century.[2]

The New Biology emphasizes the need to focus on four global "grand challenges" of the 21st century

and the use of modern technological tools and interdisciplinary approaches to address them. The challenges are (1) food, (2) the environment, (3) energy, and (4) health. Aligning our biology education curriculum with the New Biology principles and developing comprehensive solutions to these global challenges is crucial for preparing the next generation of leaders in biological research.

Our core coursework in Bio Sci is a combination of courses that build a fundamental knowledge of biology across all levels of organization, i.e., from DNA to molecules to organisms to ecosystems, and courses that are firmly grounded in disciplinary designations such as Genetics or Biochemistry.

An alternative approach to designing our coursework could be more challenge-focused and promotes interdisciplinary and applied knowledge to address those challenges. Of course, it can be quite difficult to modify existing coursework to fit this approach. The curriculum would need to interweave key concepts that are required fundamental knowledge (expected, for example, of premedical students) with real-world applications. Linking these key concepts to learning objectives that comply to a set of agreed-upon common standards (similar to the K-12 Next Generation Science Standards – NGSS[3]) would also be essential.

An important and relevant resource is the 2011 seminal report "Vision and Change: A Call to Action"[4] produced by AAAS and the National Science Foundation. The report recommended specific actions aimed at improving undergraduate biology education nationwide. These recommendations included the integration of core concepts and competencies throughout the curriculum and focusing on student-centered learning. The report provided a set of principles to guide undergraduate biology education reform. It also provided important guidance for best practices in pedagogy, the input of undergraduate students, and a lens for broadening participation and truly making biology inclusive of all students.

Another essential resource is the 2019 AAAS Report "Levers for Change: An assessment of Progress on Changing STEM Instruction"[5], which provides an evaluation of what helps reduce the

barriers to adoption of effective practices, and the state of instructional reform across STEM fields. The report discusses the use of active and collaborative learning pedagogical approaches and their adoption in STEM fields and concludes that while there has been an increase in using these strategies, their application to diverse student populations is still limited and that assessment has experienced the least reform complared to other teaching practices. The report also stresses that institutional support for the adoption of these practices should be strengthened.

Synthesizing the above, a curricular focus on the grand challenges and real-world applications of biology and the adoption of active and collaborative teaching strategies affords us an an opportunity to (1) enhance the engagement of students and faculty with the curriculum, (2) consider the lived experiences of students from diverse backgrounds, and (3) promote breadth as well as depth, enhancing the preparedness of our students for their future careers. We hypothesize that these curricular and pedagogical changes will have an observable impact on student engagement, which is a key factor in promoting equity and inclusion and could help address the URM outcomes gap we have in the Bio Sci major.

## Core Competencies and Career Preparation

We asked the question, “What do we want our students to know by the time they graduate?” In other words, what skills or competencies do we want to foster in our students to prepare them for the future careers of their choosing?

We recognize that our students are curious about the natural world, and we must endow them with skills to be able to understand and explain science and medicine to others and participate in conversations around important issues (e.g., vaccines, evolution, the impact of climate change, etc.). We aspire to develop informed citizens who are scientifically literate—a generation of problem solvers and critical thinkers. We believe it is crucial for our students to understand the process of scientific inquiry and the value of fundamental research.

The AAAS/NSF report “Vision and Change: A Call to Action” identified the importance for undergraduates to understand not only the process of science, but also the interdisciplinary nature of the New Biology and how science is closely integrated within society. In addition, students should be competent in communication and collaboration, as well as have a certain level of quantitative competency and a basic ability to understand and interpret data. Further, to be current in biology, students should have experience with modeling, simulation, and computational and systems-level approaches to biological discovery and analysis and should be familiar with using large databases. This resulted in a set of competencies:

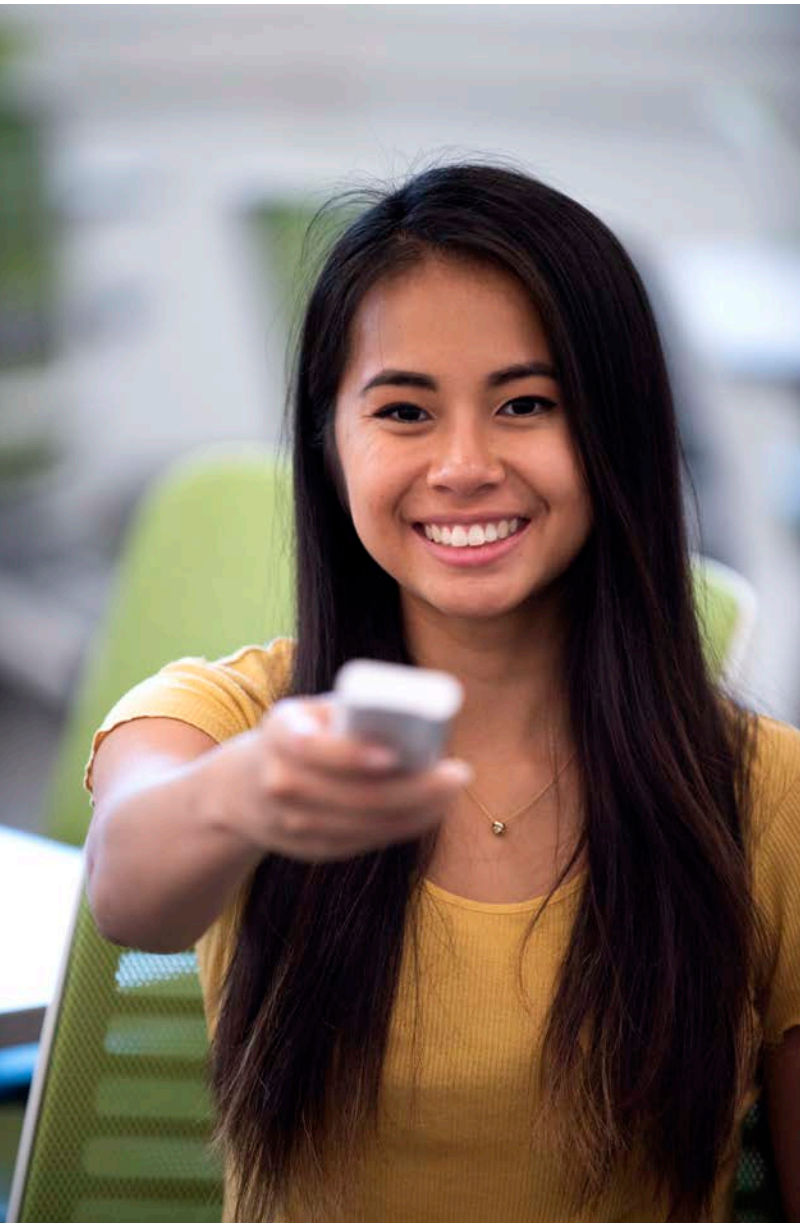
- ability to apply the process of science;
- ability to use quantitative reasoning;
- ability to use modeling and simulation;
- ability to tap into the interdisciplinary nature of science;
- ability to communicate and collaborate with other disciplines; and
- ability to understand the relationship between science and society.

An important take-home message from the report is the need for us to assess how each of these competencies are introduced and evaluated in our undergraduate curriculum.


Further extending the discussion of core competencies for which mastery should be instilled in our students to enhance their career preparation, we considered two other relevant resources. The first is the NIGMS blog Catalyzing the Modernization of Graduate Education by Gammie, Lorsch and Singh[6]. While the focus is on graduate education, many of the skills they identify relate to success in a variety of different scientific careers. These skills range from the hard (e.g., quantitative and com-

putational) to the operational (e.g., experimental design and interpretation of data) to the soft (e.g., communication and teamwork).

The second resource is highly relevant given the number of students in Bio Sci aiming to pursue medical careers. It is a guide by the Association of American Medical Colleges (AAMC) outlining the fifteen core competencies that are required for entering medical students[7]. It is not surprising that those are the capabilities we are asked to evaluate when writing letters of evaluation for medical school applicants[8]. Many of these reinforce and extend the competencies previously discussed as critical for success in scientific careers; they include critical thinking, quantitative reasoning, written and oral communication, scientific inquiry, ethical responsibility, social skills, teamwork, and service orientation. They also include scientific understanding related to human behavior (knowledge of self, others, and social systems) and living systems (knowledge and skills in the natural sciences). Next, we asked the question, "How do we define and measure excellence in Bio Sci?", and the related question, "Can everyone in Bio Sci be excellent?" In other words, can excellence be defined differently for each student, rather than relative to one another? Is it feasible to create an assessment strategy that measures development and improvement of competencies at an individual level? How can this be accomplished without compromising academic rigor? New standards for assessment will be necessary to consider. An example of such a standard is **specifications grading**[9], which can better reflect student learning outcomes, save faculty time, uphold high academic standards, and foster development and creativity.



Synthesizing the above, we suggest that there is a need to explicitly focus on mastery of core competencies across all levels of the biology curriculum. These competencies should be codified into each course's learning objectives with the goal of assessment strategies focusing on skill mastery rather than purely on domain knowledge. They should be at the crux of our faculty and staff advising philosophy and form the basis for measuring our success. They should also always be transparent to the students. Similarly, our assessment and definition of excellence needs to evolve beyond the traditions of academia to focus on more individualized goals and objectives. While we still need to systematically evaluate the post-graduate outcomes of our Bio Sci students, it is highly likely that this type of training will not only improve the student experience but also improve post-graduate outcomes, including success in future careers.

## Inclusive Teaching and Learning

We asked the question, "How can we promote equity and inclusion in teaching and learning?" First, what exactly do we mean by inclusive teaching? Inclusive teaching refers to the range of approaches and strategies to teaching that address the diverse needs, backgrounds, and learning modalities and abilities of all students to create an overall inclusive learning environment where all students feel equally valued and where all students have equal access and opportunity to learn. Students are more motivated to take control of their learning in classroom climates that recognize them, draw relevant connections to their lives, and respond to their unique concerns[10].

To develop this complex climate, we must practice a mixture of intrapersonal and interpersonal awareness, conduct regular curriculum review, and gain knowledge of inclusive practices[11]. The learning environment we create as educators has been directly correlated with learning outcomes: specifically, a student's sense of belonging predicts motivation, engagement, and achievement[12].
As instructors, we can consider a variety of examples and strategies for mastering inclusive teaching pedagogy. Inclusive teaching begins by considering a variety of concerns:

- Why do some types of students seem to participate more frequently and learn more easily than others?
- How might cultural assumptions influence interaction with students?
- How might student identities, ideologies, and backgrounds influence their level of engagement?
- How might course and teaching redesign encourage full participation and provide accessibility to all types of students?

## Box 2. Universal Design for Learning (UDL)

UDL aims to improve and optimize teaching and learning for all people based on scientific insights into how humans learn. UDL uses a variety of teaching methods to remove any barriers to learning to give all learners equal opportunities to succeed. It's about building in flexibility that can be adjusted for every student's strengths and needs. We can use principles of UDL as strategies for inclusive teaching[13] by employing the following:

- Creating a welcoming, respectful learning environment;
- Communicating clear and high expectations to students;
- Providing regular constructive feedback;
- Providing support for learning to enhance opportunities for all learners;
- Considering diverse learning preferences, abilities, and prior experience and knowledge;
- Offering multiple ways for students to demonstrate mastery of the material; and
- Promoting respectful interactions among students and between instructor and students.

Inclusive teaching has numerous benefits for both instructors and students and can directly address several challenges identified by the student survey as well as by the faculty survey. We suggest that it can also directly address the outcomes equity gaps we experience in Bio Sci. Benefits for instructors include a deeper connection and engagement with students from diverse backgrounds, the ability to build meaningful advisory relationships with students, being prepared for discussion of controversial topics in the classroom, and decreasing the potential for conflict. Benefits for students include higher engagement with the curriculum, increased psychological safety to take intellectual risks and feel comfortable voicing ideas, a higher likelihood to be successful through pedagogy that promotes learning across abilities and backgrounds, and enhanced capacity for building supportive social relationships with faculty mentors.

Inclusive teaching, at its core, intends to "level the playing field" such that each student is afforded the opportunity to succeed and thrive. An important and related concept is the idea of Universal Design for Learning (**Box 2**).

The final concept with which we engaged is **Culturally Responsive Pedagogy (CRP)**. CRP is about making changes to the classroom to provide each student with what they need to be successful. The course activities, assessments, assignments and even content used can help promote students' sense of belonging and self-efficacy [14].

Inclusion comes from building relationships with students and knowing who they are. An inclusive pedagogy is one that is relevant to the lives and aspirations of students. It requires that instructors employ equity-minded and culturally affirming teaching practices, including being proactive in reaching out to students and positively reinforcing them with cues of belonging, humanizing relationships to build trust and mutual respect, building culturally relevant and affirming course content by selecting literature and materials that are race and gender inclusive, and being race-conscious and not ignoring race or conversations about race in and out of the classroom.

An extension of CRP would also include the integration of social justice themes in pedagogy. The need for an explicit focus on social justice, cultural humility, and equity issues in biological

sciences research and application allows the curriculum to make contact with students' lived experiences and invites crucial dialogue that benefits both instructors and students. Ideally, these foci would be integrated into each of the core courses and form a key component of learning objectives.

Synthesizing the above, we suggest that there is a need to adopt inclusive teaching practices and culturally responsive pedagogy in our Bio Sci educational philosophy and that doing so will substantially impact the climate for our students in and out of the classroom. It will help build more meaningful, authentic relationships among students and faculty, give every student the best chance to succeed, and connect teaching and learning with students' lived experiences in a way that maximizes their engagement. We recognize that incorporating these practices into our teaching mission is a long-term endeavor. The next section addresses the need for a comprehensive approach to undergraduate education reform. Inclusive teaching becomes one of several interacting pillars.

## Transforming Higher Education

There is no doubt that we are facing numerous challenges in higher education that force us to re-consider many of our standards and practices. These include the changing landscape of biology education, the value of a college education being called into question, the concerted push to modernize pedagogical practices, and the call to address systemic racism and equity gaps that disadvantage individuals from racial/ethnic minorities. With challenges also come opportunities. This is the premise of this report.


Our mission in ODEI is to ensure equity in learning opportunities for a diverse population of Bio Sci undergraduates and to promote an inclusive environment where all students in the major can thrive while maintaining the highest standards of academic rigor. However, achieving this goal is not possible with short term fixes or isolated tactics to modify the curriculum or our teaching philosophy incrementally. It requires a comprehensive re-envisioning of how we educate our students and prepare them for successful careers. Thus, we adopt a broad perspective and consider the question, "What does a 21st century undergraduate education in biology look like?" as not only a guiding question but a central purpose for our work. As such, it is useful to consider the efforts of ODEI as touching every aspect of what we do in Bio Sci and taking a long-term view.

Institutional transformation does not happen overnight and requires a concerted effort across key stakeholder groups. It also requires a Theory of Change to be effective[15]. A Theory of Change is a description of how and why a desired change is expected to happen in a particular context. It focuses on mapping out what a change initiative is trying to achieve and the activities that need to take place to ensure that the desired impact is achieved.
We did not define a particular Theory of Change for the work of the Task Force, as we viewed this work as an early step to identifying the problem areas and the overall desired goals. The next step will be to devise a plan for stakeholder engagement and buy-in. We suggest that creating and empowering Communities of Practice (CoPs)[16] to craft the specific change initiatives and solicit feedback widely may be an effective strategy.

We note that our suggested recommendations should not be viewed as restrictive or exhaustive. They are sample approaches that can be further examined and improved by the CoPs. We urge the CoPs to choose accurate and representative metrics and indicators that inform us on whether the activities produce successful results. We provide some sample metrics in the **Success Metrics** section, however, defining more specific measurable outcomes aligned with program inputs and outputs will be necessary.

# Specific Goals and Recommendations

In the following sections, we detail more refined discussions focusing on six key priorities that we identified as essential for addressing our overall goal. Each section outlines an evidence-based rationale, a clear and measurable goal, and recommended strategies for consideration.

## Re-envisioning the Undergraduate Biology Curriculum

### Rationale

Data from the Student Wellness Survey suggest that Bio Sci students are not sufficiently engaged with the curriculum. The Faculty Attitudes Survey similarly confirmed that the curriculum is dated and does not engage students in modern biology. Students were also dissatisfied with access to small classes as well as classes required for the major. Our large and growing student enrollment has necessitated a very high student to faculty ratio, making it difficult to provide our students with rewarding academic experiences and individualized attention. An examination of course outcomes demonstrates that courses required for the Bio Sci major but taught by other Schools (Math and Chemistry series) pose significant hurdles to our students and disproportionately disadvantage URM students. This set of complex challenges provides an opportunity for a more comprehensive overhaul and modernization of the curriculum so that it better reflects the interdisciplinarity of today's biology and better prepares our students for future careers.

### Goal

To design a Bio Sci undergraduate curriculum that is modern and engaging, emphasizing interdisciplinary themes, and connecting biology with real-world applications.

### Recommended Strategies

- Create a structure (or adapt an existing structure, e.g., the Undergraduate Cabinet) to chart a path for faculty across departments to work collectively to re-design the biology undergraduate curriculum such that it is:
  - grounded in the New Biology and is challenge-focused and interdisciplinary;
  - aligned with professional standards that prepare students for future careers;

  - focused on real-world applications and connections with students' experiences;
  - engaging to both faculty and students and communicates excitement and passion.
- Re-examine requirements for the Bio Sci major to reduce the number of required courses and increase the number of upper division electives that provide small class experiences on important topics interfacing biology with real-world applications.
- Consider new models for faculty teaching in Bio Sci that engages faculty members in basic sciences or in clinical departments at the School of Medicine, who can provide advanced courses on modern and interesting topics.
- Develop mechanisms for engaging more effectively with departments outside of Bio Sci that control required coursework for Bio Sci students (e.g., Mathematics and Chemistry) to redesign coursework to fit better with the re-envisioned biology curriculum.
- Host a workshop, or series of workshops, with transformative biology educators from around the country who have led similar overhauls of the biology curriculum and engage them to consult with our faculty on how to address the challenges that lie ahead. The workshops can also be venues to discuss Vision and Change, A New Biology, and Levers for Change.
- Develop mechanisms to systematically incentivize, support, and recognize faculty adoption of active and collaborative learning and teaching strategies that complement the envisioned new curriculum.
- Recognizing that the biology landscape is constantly evolving, create a mechanism for comprehensively reviewing and updating the curriculum every 3-5 years so that it remains state-of-the-art and serves to prepare our students well for the careers of tomorrow.
- As new faculty are onboarded, we suggest that Vision and Change as well as the New Biology and Levers for Change reports (or their summary briefs) be recommended reading.

## Achieving Mastery and Assessment of Competencies

### Rationale

Data from the Student Wellness Survey suggest that Bio Sci students intend to pursue diverse careers that are not just limited to health professions. The Faculty Attitudes Survey reliably demonstrated the faculty belief that we are not currently training our students to achieve mastery in several core competencies necessary for success, including critical thinking, quantitative and analytical skills, collaboration and teamwork, and communication. There is also a clear need to re-envision how we assess mastery of these competencies. This will involve going beyond traditional assessment that focuses on memorization to include the application of knowledge to real-world situations.

### Goal

To train Bio Sci students to master key competencies that are relevant for their future careers and develop a comprehensive assessment strategy that optimally measures their success.

### Recommended Strategies

- Create a structured process for new course development in Bio Sci and apply the same principles to all existing courses (especially major requirements). This process should involve:
  - Clearly defined and communicated learning objectives for each module;
  - Intentional alignment of learning objectives with core competencies; and
  - Clear assessment strategy that emphasizes skill development over didactic knowledge.
- Reconsider the utility of BIO SCI 2A and 2B and potentially consider those courses as opportunities for faculty to instill passion for the major and begin training students on core competencies such as critical thinking at the earliest stage in the major.
- Given the importance of quantitative and analytical skills, increase offerings of quantitative and computational courses in the major and potentially add at least an introduction to statistics and experimental design as a core requirement that entrains key quantitative and analytical competencies.
- Create a central Bio Sci resource describing the core competencies and match them with learning objectives from each course. This would allow us to evaluate how thorough and balanced our coverage of competencies across the courses offered is, and can help make the curriculum and its goals more transparent to students. Furthermore, students can use an

interactive dashboard to readily see courses they have completed and relevant courses available, and make selections based on the core competencies the courses entrain.

- Consider employing a comprehensive and common strategy for assessment across all core courses to make the process more predictable for students.
- Provide opportunities, resources, and incentives for training all faculty teaching in Bio Sci to align course content with learning objectives and core competencies, with support and coordination with the Division of Teaching Excellence and Innovation (DTEI)[17].
- Continuously engage with colleagues at other institutions, graduate and professional school leadership, and potential employers to stay current on the competencies that are expected of our graduates to thrive in their chosen careers.

## Transforming Professional Career Preparation

### Rationale

Data from the Student Wellness Survey suggest that around half of Bio Sci students intend to pursue careers in health professions (mostly seeking an M.D. degree). About 13% of them intend to seek Ph.D. degrees and 14% were still undecided. Bio Sci has recently started to consider a research track, with a required undergraduate research component, that (if implemented) better prepares students for graduate school. Although the target group is currently only a small proportion of the students in the major, we have an opportunity to educate and raise awareness about the research track and foster additional student interest.

Importantly, while the Minority Science Program (MSP) has demonstrated success in preparing students for graduate studies in biomedical sciences, there is not a comparable process that prepares students for professional health-related careers. Our students may be disadvantaged in medical school applications by having to compete against candidates who have strong pre-health committees and committee letters from their institutions. There are existing models from both private institutions, such as Johns Hopkins University[18], as well as from sister institutions, such as the University of California, Davis[19]. Finally, career preparation and advising within Bio Sci currently remains limited. A dedicated career counselor can be a useful resource to complement faculty and staff advising.

## Goal

To provide Bio Sci students with the highest quality pre-professional guidance and expose them to the diverse careers that can be pursued with a biological sciences degree.

## Recommended Strategies

- Create a new office for pre-professional advising with a focus on pre-health advising. The office should develop a strategy to engage Bio Sci and College of Health Sciences faculty as advisors and committee letter writers. The office's responsibilities, which are distinct from Bio Sci academic advising, include:
  - Helping pre-health students prepare for health professional careers;
  - Helping pre-health students make informed decisions about their course planning;
  - Helping pre-health students secure relevant and meaningful clinical experiences;
  - Helping pre-health students navigate the medical school application process;
  - Helping review and provide feedback on application materials including essays;
  - Helping pre-health students connect with MCAT and other testing resources;
  - Matching each student to a pre-health faculty advisor;
  - Organizing faculty committees to conduct mock interviews with students;
  - Organizing the letter writing and reviewing process, including letter selection; and
  - Organizing application materials and communicating them to medical schools.
  - Increase engagement with clinical faculty in the College of Health Sciences, including the School of Medicine, the School of Pharmacy, and the School of Nursing, by providing teaching opportunities in the major and opportunities to meet and advise students through the pre-professional office (see above).
- Create a new "Medical Tutorial" program that connects qualified pre-health students with medical faculty for credit-based shadowing, internship, and clinical research experiences. This can be coordinated with the Office of Medical Education at the School of Medicine.

Perhaps their existing training, such as the MedAcademy[20] for high school students, can also be leveraged.

- Develop a Bio Sci career fair on an annual basis that focuses on biomedical careers and invites Bio Sci industry partners as well as graduate and professional school admissions staff or faculty to meet and network with students.
- Work with the Division of Career Pathways (DCP) to have a dedicated Bio Sci career advisor provide one-on-one consultations with students in Bio Sci and hold bi-annual workshops to discuss diverse career paths for Bio Sci majors.
- Create mechanisms for outreach and engagement of families, especially of first-generation students, to provide resources and education on the careers available for Bio Sci graduates and discover systems of support and pressure that impact students and their ability to pursue their future goals.
- Scale up the PhD prep training developed by the Minority Science Programs, including assistance with graduate school applications, matching students with faculty for laboratory research (Bio 199), and providing opportunities for scientific communication, such as presenting research. This can build on the new research-intensive track being considered for the Bio Sci major.
- Consider partially re-directing BIO SCI 2A and 2B to provide some exposure to different career tracks and possibilities with a Bio Sci degree. This can involve a series of seminars by diverse faculty and other professionals that discuss their personal journey and career trajectory.
- Consider the marked increase in remote career options in recent years, accelerated by the COVID-19 pandemic, and collect information and attitudes about these types of careers and their relevance to Bio Sci majors. If there is substantial interest, we must address how our training is preparing students for these careers.

## Strengthening Academic Advising and Student Mentoring

### Rationale

Data from the Student Wellness Survey suggest that students were somewhat dissatisfied on average with the quality of advising they received by Bio Sci faculty and staff as well as campus advising staff outside Bio Sci. Discussions of the student advising structure during Task Force meetings led to the impression that Student Affairs staff are overloaded given the large number of students they must advise, leading to much more transactional and less personalized advising.

Further probing also uncovered the issue that once students do not perform as well as expected on the core requirements, they are given the advice to consider other majors. We hypothesized that this could directly influence the URM retention gap observed in the major, as the pushout experienced by students is a function of performance on core courses, which is generally lower for URM than non-URM students. The survey also demonstrated that a significant proportion of our students (20-30%) are not secure in their financial situation, which can weigh substantially on their academic experience and performance. This calls for a more personalized advising approach that considers these factors.

The Student Wellness Survey also demonstrated that as many as 50% of our students do not know any faculty members well enough to ask them for a letter of recommendation. Given how crucial these letters are for successful placement in medical, graduate, and other professional schools, increasing the engagement of students with faculty is crucial. A related issue that was discussed is the lack of faculty involvement in student advising and the need to improve relations and common understanding between faculty and advising staff, who are sometimes viewed by faculty as enforcers of rigid policies. Finally, we note that in recent years, and perhaps as a function of the pandemic and the rising need for flexibility, Student Affairs has begun to employ more holistic evaluation of students and provide more opportunities for students to succeed in core coursework. This, coupled with the recent change in policy to allow for a longer time to graduate with a Bio Sci degree may have begun to address the retention gap, however the direct outcome of these changes in philosophy has yet to be assessed.

### Goal

To provide each Bio Sci student with the highest quality academic advising and individualized, holistic mentorship by Student Affairs staff and mentoring faculty.

## Recommended Strategies

- Develop mechanisms to alleviate the non-advising workload of Student Advising staff so that they can focus on personalizing advising and allocate more time to students in need. Several approaches can be considered, including:
  - Automating certain basic functions like checking requirements, pre-requisites, forms, etc. via the use of a conversational AI/deep learning virtual assistant[21];
  - Providing students with a comprehensive, web-based searchable knowledge base or Frequently Asked Questions (FAQ) and using this as the first level of support before scheduling an advising appointment for more complex cases; and
  - Working with the Division of Undergraduate Education on the centralization and/or automation of non-student focused administrative functions such as data crunching and reporting.
- Continue to offer flexibility in advising modalities (e.g., zoom, chat, or in-person) to accommodate various student schedules, circumstances, and personal preferences.
- Promote more personal interactions between advising staff and students. While assigning each student to a particular advisor may not be feasible or fault-tolerant (e.g., what happens when the advisor leaves or goes on vacation), the scheduling system could track previous interactions and appointments and offer the student the option of speaking with the same advisor if they are available.
- Mitigate the isolation between Student Affairs staff and faculty by educating faculty on requirements and policies employed by Student Affairs, and educating staff on faculty priorities and preferences, to ensure that there is healthy communication and exchange and to promote an environment where the working relationship is more of a partnership.
- Directly involve faculty in mentoring and sponsorship, such that each Bio Sci student has an assigned faculty mentor. Based on the assumption of roughly 4,000 undergraduates and 200-400 involved faculty (including SOM basic sciences faculty) the workload could be quite reasonable. These faculty members can also write letters for their advisees and connect them with research and other opportunities.
- Continue and expand the successful Anteater Parades program with some structured content to help students learn how to get the most out of their degree program, consider career opportunities, develop good study habits and learning skills, and develop supportive mentoring relationships with faculty and a network of peers.
- Encourage and train Student Affairs staff and mentoring faculty to adopt more holistic advising and counseling practices that take into consideration student financial constraints, family circumstances, working schedules, and authentic career goals, with the understanding that these complex ecologies in which students learn can completely shape their experience and their probability of success.
- Consider the application of Individual Development Plans (IDPs) to monitor student goals and progress as they advance in the major. IDPs are frequently used for graduate students at UCI and at other institutions, but it can also be applied to undergraduate students[22].
- Directly address pushout as a fundamental shift in advising philosophy. Advisors should be encouraged to work with students to develop alternative paths to succeeding in the major and only suggest a switch in majors if the student expresses a genuine change in interests.
- Establish strategies to identify and address struggling students and provide them with additional resources early. Examples include:
  - Instructors proactively reaching out to students who have not shown up to class;
  - Advising staff flagging students early on if they fail any of the core requirements to invite them for advising appointments;
  - Meet with every incoming student to define their goals and plans, complete an IDP, and ensure that they feel comfortable enough to reach out at the first sign of struggle;
  - Utilize the Counseling Center to train all faculty and staff on recognizing signs of distress in their students and encourage the use of the “Red Folder” and its resources; and
  - Leverage the use of graduate teaching assistants as “more accessible” instructor figures and empower them with resources to identify and escalate cases of students in distress. This would need to be specified explicitly as one of the responsibilities of the TA.

# Providing Meaningful and Engaging Research Experiences

## Rationale

Enrollment statistics in Bio Sci show that approximately 800-1000 students enroll in BIO 199 undergraduate research for credit each year, 78% of whom are Bio Sci majors. Bio Sci's undergraduate student population is 28% URM, however, the proportion of URM Bio Sci students participating in BIO 199 is considerably smaller (19-20%). The same is true for low-income and first-generation students (which have considerable overlap with URM designation). A subset of students enrolled in BIO 199 also participate in the Undergraduate Research Opportunities Program (UROP) or Summer Undergraduate Research Program (SURP), both of which provide modest financial resources to support the student's independent research project and/or stipend. Importantly, the Division of Undergraduate Education has identified similar equity gaps in the UROP program for URM, first-generation, and low-income students, suggesting that there are barriers to participation for students from disadvantaged backgrounds.

The Faculty Attitudes Survey revealed that Bio Sci faculty believe BIO 199 is the best feature of a Bio Sci education and that it should be required for all Bio Sci students. As we engaged with the question, "What is the role of undergraduate research experience in Bio Sci?", it was clear in Task Force deliberations that we need to (1) expand overall participation in research, (2) provide flexible options for completing laboratory research, and (3) resolve equity gaps in research participation. One Task Force member aptly noted that participation in BIO 199 is what makes a UCI education a top tier R1 institution education. As we further diagnosed the issue of overall participation, several reasons were discussed, including the value of research participation not being effectively communicated to students early in the major and the limited availability of opportunities given the number of labs in the school. We also developed theories for inequitable participation for students from URM backgrounds, including possible lack of interest or knowledge, lack of preparedness, lack of time due to coursework and other commitments, as well as the possibility of faculty bias and stereotypes against students from URM backgrounds.

## Goal

To provide Bio Sci students with meaningful and authentic research experiences that promote mastery of analytic, quantitative, and scientific competencies.

## Recommended Strategies

- Provide more structured and standardized research experiences that focuses on developing understanding of the scientific process, generalizable technical skills, and developing scientific literacy, perhaps through the effective use of Course-Based Undergraduate Research Experiences (CUREs). Importantly, these experiences should emphasize independent research projects and should provide students with similar qualifications as BIO 199 completion.
- Develop mechanisms to systematically incentivize, support, and recognize faculty exceptional efforts in undergraduate mentoring, perhaps by offering new undergraduate mentoring awards to those who demonstrate excellence in this area, and emphasizing these contributions in the merit and promotion process.
- Allocate Bio Sci resources (perhaps through private philanthropy) to complement the campus's central UROP and SURP by offering funds or stipends to students from URM backgrounds to support their independent undergraduate research. This would require a

review and approval process similar to UROP and can leverage existing central structures.

- Consider the introduction of team science experiences, either through courses or through specific lab opportunities. This would foster a key competency that is important for future careers and can be complemented with training in team science through the Team Scholarship Acceleration Lab (TSAL)[23].
- Formalize the process of BIO 199 research by requiring that every opportunity provided by a faculty mentor fulfills specific criteria which include, but are not limited to:
  - ensures that the student is engaged in an authentic and meaningful experience;
  - provides the student with direct mentorship from the PI or from another lab member;
  - ensures that student will gain and apply new skills and knowledge; and
  - ensures that the student will be able to work toward manuscript co-authorship.
- Consider the possibility of installing a central mechanism to apply for BIO 199 before being matched with a lab. A selection committee can then vet students and qualify them before matching them with labs that have open opportunities. This process should not emphasize grades or experience but rather interest and aptitudes. It can also be integrated with advising and IDP use.
- Consider adding a research preparatory course that can be required of all students prior to BIO 199. It can involve training in basic laboratory skills, quantitative and analytical skills, basic coding, and other qualifications that improve student preparation for real lab experience. This can be modeled after the MSP's prep course.
- Ensure that guidance about the importance of research experience, and exposure to the wide array of possible opportunities and topics that may match student interests is presented very early in the major, possibly in BIO SCI 2A/2B.
- Provide training and guidance for faculty to understand the constraints that students from disadvantaged backgrounds must deal with and how this can impact their participation in undergraduate research. Address issues of bias, stereotypes, and microaggressions that may prevent URM students from full participation. This can be a core component of training in culturally aware mentoring, which will be deployed in the school every spring.
- Review the report of the **Inclusion in Undergraduate Research Work Group** for further strategies and recommendations to bridge participation gaps in research, including six key principles that should be considered: (1) accountability and oversight, (2) stakeholder engagement, (3) maximizing flexibility, (4) ensuring equity, (5) holistic evaluation, and (6) building community.

## Fostering Inclusion and Belonging

### Rationale

Data from the Student Wellness Survey suggest a substantial proportion of Bio Sci students do not feel that they are close to people on campus or that they are part of the university, or that university faculty, staff, and administrators are genuinely concerned about their welfare. We learned that Black, non-Hispanic students are at a selective disadvantage when it comes to climate and belonging outcomes, which is a challenge we must address. We also learned that 30-50% of students deal with financial hardship, housing insecurity, or food insecurity, which can affect their experience and their outcomes as a student. Additionally, more than half of our students report one or more disabilities that significantly affect their daily activities and academic functions with only a small proportion indicating that they are currently receiving accommodations. Finally, and perhaps most alarmingly, we learned that most of our undergraduate students are at risk for clinical depression, although this is likely exacerbated by the COVID-19 pandemic.

The Task Force discussions included the need to adopt inclusive teaching practices, including Universal Design for Learning (UDL) principles and culturally responsive pedagogy. We also discussed the need to re-frame our educator role away from gatekeeping or an assessment of who gains access and who advances based on traditional measures of excellence and "worthiness" to focus more on **"groundskeeping"**[24], a more comprehensive role in which the educator tends to the student as well as the ecologies in which they learn to maximize their chance to thrive and succeed. We stressed the importance of understanding the systems and structures that impact a student's success, including financial and family pressures, systemic racism, climate issues in and out of the classroom, and cultural stereotypes

that impact perceptions of communication, preparedness, and likelihood of success. We discussed the need to incorporate social justice themes in the classroom and in the curriculum to ensure that students can connect what they learn with their lived experiences, further fostering belonging and inclusion. Finally, we discussed specific challenges to equity and inclusion that were related to remote teaching and learning, including technology accessibility, impersonal interactions with Student Affairs, the invasive use of test-monitoring software, and the availability of learning-suitable accommodations at home.

### Goal

Transform the climate to be more equitable and inclusive in classrooms and labs and work to promote wellness and belonging for all Bio Sci students.

### Recommended Strategies

- Work with the Counseling Center and the Center for Student Wellness and Health Promotion to provide additional mental health resources for struggling students and develop alternative strategies (e.g., peer counseling) to keep up with the demand for services and activities that promote wellbeing and belonging within the School.
- Encourage faculty to forge strong relationships with students in and out of the classroom by encouraging culturally aware dialogue and mentoring, and providing venues and support for these interactions; e.g., a faculty lunch series, informal student-faculty mixers, and other community-building activities.
- Ensure that all faculty are trained and adept at recognizing signs of distress in their students and encourage the use of the "Red Folder" and its resources. Encourage faculty to be proactive in reaching out to struggling students and providing support. Information about resources in case of struggle, such as the Counseling Center, can also be clearly indicated in the syllabus.
- Ensure that all faculty are familiar with the services provided by the Disability Services Center, and are able and willing to provide the disability accommodations the Center recommends without posing undue burden on the student to provide justification.
- Furthermore, ensure that faculty do not use blanket policies that can selectively disadvantage students with disabilities.
- Provide comprehensive inclusive teaching training and resources for faculty and develop mechanisms to recognize and reward engagement in these trainings; e.g., employing a badging system, accelerated merit and promotions, and inclusive teaching awards.
- Work with faculty during the process of re-designing courses and learning objectives to ensure that they are applying Universal Design for Learning and Culturally Responsive Pedagogy principles (see section on Inclusive Teaching and Learning for details) and are using assessment strategies that focus on competencies rather than memorization.
- Use training and discussion resources from ODEI to build a culture in Bio Sci that moves us away from the gatekeeping mentality; systematically re-examine and modify all courses, teaching practices, academic advising, and research mentoring practices that currently promote gatekeeping or "weeding out" students from the major.
- Build on the model of the recently launched Diversity, Equity and Inclusivity for Teaching Speaker Series[25] to provide a venue for faculty

education and engagement.

- Systematically incorporate social justice themes[26] into the core coursework in Bio Sci by using resources from the Underrepresentation Curriculum Project[27], a flexible curriculum designed to help students in STEM disciplines critically examine scientific fields and take action for equity, inclusion, and justice.
- Develop specific programs and initiatives that focus on the wellbeing and experiences of Black students in Bio Sci to engender community and feelings of belonging. This can also aid with recruitment and building critical mass at UCI.
- Consider a set of strategies to address equity issues in remote teaching and learning including:
    - Dropping the lowest midterm/quiz/assignment grade;
    - Offering flexibility with deadlines;
    - Offering alternatives ways to demonstrate mastery (see specs grading in section on Core Competencies and Career Preparation);
    - Recording lectures with closed captioning to increase accessibility;
    - Allowing more time for taking exams or quizzes, accounting for technical difficulties;
    - Giving students the option to attend in-person lectures or watch recorded lectures without penalty for inability to attend in person.

# Measuring Successful Outcomes

## Measurement Tools

### Student Outcomes

Fortunately, data on student outcomes while at UCI are tracked and available through Institutional Research and Decision Support at several levels, including the School, the campus, and system-wide. These include course enrollment, course completion, grades, and GPA. Additional outcomes include retention in the major (and switches to other programs or Schools), as well as four-year, five-year, and six-year graduation rates. An interesting challenge with respect to outcomes is how to assess retention appropriately. Some students leave the major due to changes in their interests and some are actively "pushed out" of the major. We need a mechanism to disaggregate the collected data based on both objective and subjective measures. GPA could provide an indication, although it may not be causal and may just be an indication of loss of interest. Collecting subjective data from students themselves may be crucial to addressing this issue.

Another challenging set of outcomes to assess relate to post-graduation placement including acceptances to medical or other professional school, graduate school, or postbaccalaureate program, or placement directly in the workforce. Without a mechanism or incentive for students to report back these outcomes, it is difficult for us to evaluate the impact of any change we make on student career preparation. We suggest prioritizing the development of such a tracking mechanism.

### Surveys

We implemented a key survey tool—the Student Wellness and Climate Survey—that has significantly informed our approach and revealed numerous areas to consider in Bio Sci students' academic experiences, career goals and aspirations, wellness and belonging, and financial, housing, and food security. The survey is intended to be administered with regular frequency (every 1-2 years) so that data can be trended over time and be used to assess progress on various initiatives.

The **Wellness and Climate Survey Data Dashboard** is also available online[28] for all faculty, staff, and students to explore and gain insights. Conducting research based on this tool either by analyzing existing data or by adding additional assessments to it is highly encouraged, especially by faculty conducting pedagogical research. Additional targeted surveys focusing on specific change initiatives will also be useful in measuring success.

We also note that the Office of Inclusive Excellence (OIE) regularly conducts unit equity reviews as well as climate surveys. All Bio Sci community members should be strongly encouraged to participate in this process so that the data collected is representative. These data can be used to assess general improvements in our culture and climate.

### Focus Groups

While surveys are objective and generally straightforward to analyze, they can potentially miss important issues if these issues do not fit within the framing of the survey's pre-designed questions. Focus groups can offer an alternative to survey research and can consider new ideas, perspectives, and opinions; clarify issues and potential root causes; identify and understand attitudes and beliefs; and generate a theory or theories for change.

Applying focus groups for qualitative data collection in Bio Sci can have substantial benefit and help further refine the quantitative tools used for measuring outcomes and success.

## Success Metrics

### General Metrics

If change is successful, overall climate and equity metrics should reflect this positive change. These metrics can come from regular evaluations of campus and school climate and culture. For example, OIE assesses climate according to the three pillars of the Office's Action Plan[29]: (1) Wellness, (2) Thriving, and (3) Community.

Another example is OIE's equity review survey, which includes questions addressing satisfaction, attachment, agency, climate comfort, diversity beliefs and practices, DEI leadership, handling of inappropriate behavior, as well as DEI training participation and barriers.

### Specific Metrics

Below we include a preliminary list of specific metrics of success. This list is not intended to be exhaustive but should only serve as a template for more detailed success metrics attached to each change initiative.

- Overall improvement in traditional measures of achievement (grades, GPA)
- Narrowing the racial/ethnic equity gap in grades/GPA
- Improving overall retention in the major
- Improving the racial/ethnic equity gap in retention in the major
- Increasing the percentage of Bio Sci students graduating with a Bio Sci degree
- Narrowing the 4-year graduation rate equity gap
- Improving student satisfaction with academic experiences
- Improving student feelings of attachment and belonging in Bio Sci
- Improving student placement outcomes after graduation
- Improving faculty and advising staff engagement in training
- Improving overall student participation in BIO 199 research
- Narrowing the racial/ethnic equity gap in undergraduate research participation.

# Final Thoughts and Limitations

Academic institutional reform is a challenging long-term endeavor. While many individual issues we identified can potentially be resolved with minor “tweaks”, we suggest that this is not the right approach. To ensure sustainability, change needs to be systemic and needs to engage all stakeholder groups. For example, changing grading schemes without changing the faculty’s long-held attitudes and beliefs about student competencies will not be successful.

A complete transformation of the status quo is not without risk. However, we argue that there is larger inherent risk in maintaining the status quo in the long-term and only applying “band-aid” solutions. Sustainable and meaningful change requires buy-in from various stakeholder groups, an investment of resources from School and Campus leadership, and an alignment of incentives with our equity and inclusion goals.

We suggest that the next stage engages the office of the Associate Dean of Undergraduate Education, Student Affairs staff, the Undergraduate Cabinet, as well as a representative delegation of teaching and research faculty. We also suggest that a version of this report be made widely available to the School’s faculty and advising staff to foster transparency and inclusion.

There are several limitations to this report that are important to note. First, we did not assess the financial risk that is involved in making the recommended changes. This is difficult to assess as several recommendations are interdependent and can be viewed as tactics within a larger strategic overhaul.

We were also limited in terms of data as we still lack comprehensive data on student post-graduation outcomes. A mechanism to collect these data must be an institutional priority if we are to succeed in aligning the correct success metrics with change initiatives.

Finally, the Task Force’s deliberations, meetings, and data collection activities were conducted during the pandemic, which may not be representative of the future. That said, our top consideration was multi-year historic data on student outcomes that did not include the pandemic period. This is clearly both a strength and a limitation. Future data to be considered will more fully examine the impact of the pandemic on student outcomes.

A final note is that the Office of Diversity, Equity, and Inclusion is committed to the continuation of this effort beyond this report. We will support continued engagement and dialogue with stakeholders, regular data collection and analysis, trainings and workshops, and other inclusion efforts with our resources to the extent possible. Questions should be directed to Associate Dean Michael Yassa at michael.yassa@uci.edu.

**Office of Diversity, Equity and Inclusion**
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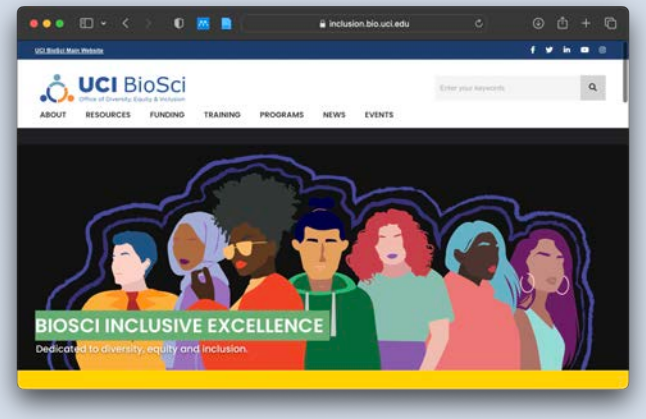
- Strategic Plan
- Funding Opportunities
- Diversity Fellowships
- Resources for Inclusive Teaching
- Inclusive Recruitment
- Assisting Students in Distress
- Diversity Programs
- Training Resources
- Data and Reports
- News and Events



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# Notes

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